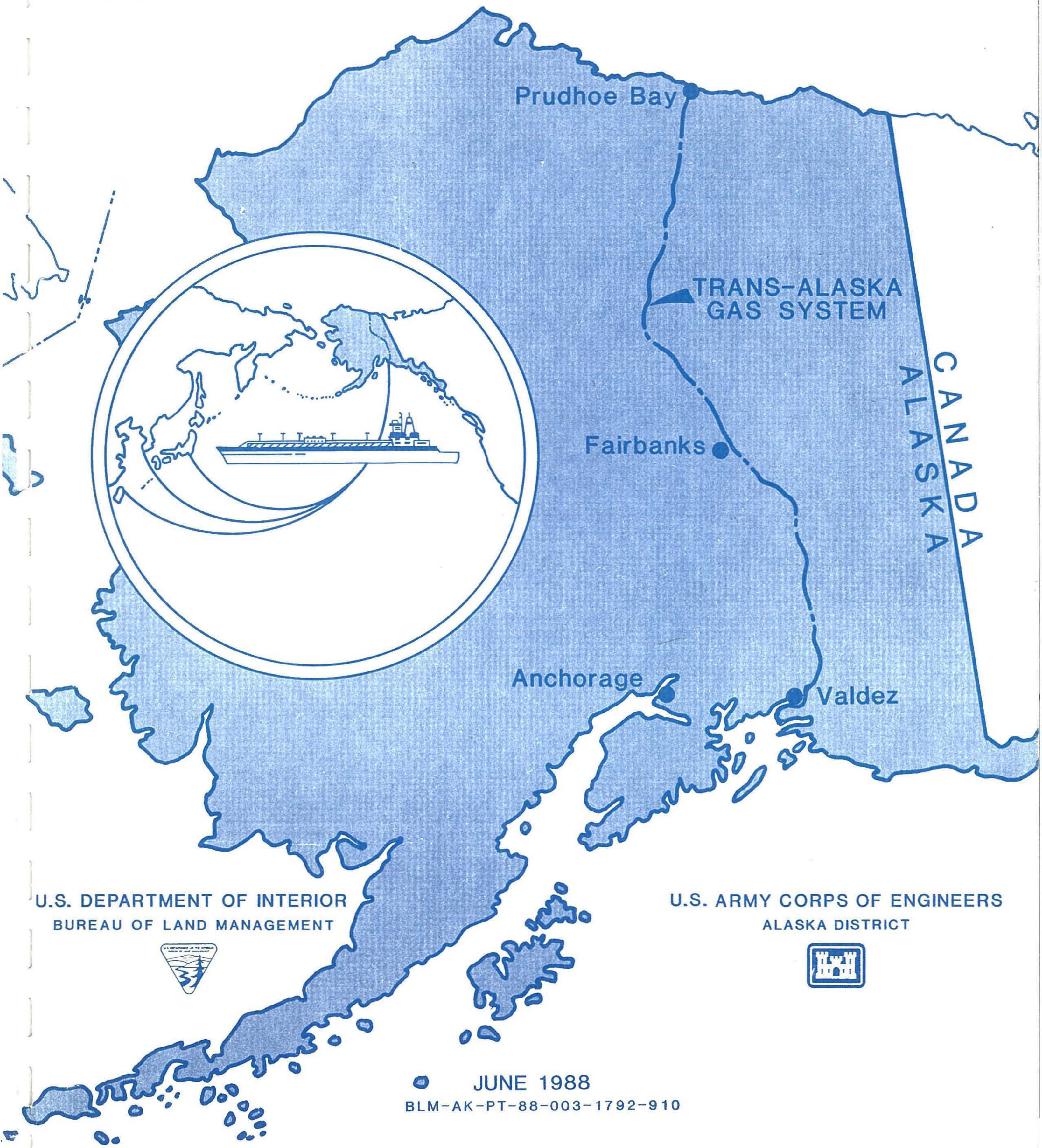
TRANS-ALASKA GAS SYSTEM
FINAL ENVIRONMENTAL IMPACT STATEMENT



U.S. DEPARTMENT OF INTERIOR
BUREAU OF LAND MANAGEMENT

U.S. ARMY CORPS OF ENGINEERS
ALASKA DISTRICT

JUNE 1988

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Bureau of Land Management
Department of the Interior
U.S. Army Corps of Engineers
Department of the Army

FINAL ENVIRONMENTAL IMPACT STATEMENT FOR THE PROPOSED TRANS-ALASKA GAS SYSTEM

Prepared by
Bureau of Land Management
and
U.S. Army Corps of Engineers

Cooperating Agencies

Department of Agriculture

Forest Service

Department of Commerce

National Marine Fisheries Service

Department of Energy

Economic Regulatory Administration

Department of the Interior

Bureau of Indian Affairs

Bureau of Mines

Fish and Wildlife Service

Geological Survey

Minerals Management Service

National Park Service

Department of Transportation

Coast Guard

Federal Highway Administration

Office of Pipeline Safety

Environmental Protection Agency

Federal Energy Regulatory Commission

State of Alaska

Division of Governmental Coordination

Department of Fish and Game

Department of Natural Resources

Department of Transportation and Public Facilities

Department of Environmental Conservation

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COVER SHEET

PROPOSED TRANS-ALASKA GAS SYSTEM

(X) Final

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Bureau of Land Management
Alaska State Office

U.S Army Corps of Engineers
Alaska District, Regulatory Branch

Cooperating Agencies:

Department of Agriculture
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ABSTRACT

YUKON PACIFIC CORPORATION (YPC) PROPOSES TO CONSTRUCT THE TRANS-ALASKA GAS SYSTEM (TAGS) AS A 796.5 MILE LONG, BURIED, CHILLED, HIGH PRESSURE, 36-INCH OUTER DIAMETER NATURAL GAS PIPELINE BETWEEN PRUDHOE BAY AND A TIDEWATER TERMINAL AND LNG PLANT AT ANDERSON BAY. THE ENTIRE PROJECT IS LOCATED IN ALASKA. TEN COMPRESSOR STATIONS WOULD BE BUILT AT REGULAR INTERVALS ALONG THE PIPELINE. OPERATIONS AND CONTROL CENTER FOR THE TAGS PROJECTS WOULD BE IN VALDEZ; HEADQUARTERS AND ADMINISTRATION IN ANCHORAGE, AND MAINTENANCE IN FAIRBANKS. THE PROPOSED TAGS CLOSELY PARALLELS THE EXISTING TRANSALASKA OIL PIPELINE SYSTEM IN ITS ENTIRETY AND A PORTION OF THE AUTHORIZED BUT UNCONSTRUCTED ALASKA NATURAL GAS TRANSPORTATION SYSTEM. UP TO 2.3 BILLION CUBIC FEET OF CONDITIONED NATURAL GAS PER DAY WOULD BE MOVED THROUGH TAGS FOR LIQUIFICATION AND EXPORT BY TANKER TO JAPAN, TAIWAN AND KOREA. YPC ESTIMATES THAT TAGS HAS THE CAPABILITY TO REDUCE THE U.S. BALANCE OF TRADE DEFICIT BY $2.5 BILLION ANNUALLY AT FULL OPERATION.

THE FEIS ANALYZES CONSTRUCTION AND OPERATION OF THE PROPOSED TAGS, AN ALTERNATIVE ROUTING TO COOK INLET, AND THE ALTERNATIVE OF NO-ACTION.

THIS FEIS HAS BEEN PREPARED ACCORDING TO THE REQUIREMENTS OF THE NATIONAL ENVIRONMENTAL POLICY ACT OF 1969 (NEPA) AND REGULATIONS FOR IMPLEMENTING NEPA.

THIS FEIS SERVES AS A NEPA COMPLIANCE DOCUMENT FOR THE U.S. ARMY CORPS OF ENGINEERS, AND BUREAU OF LAND MANAGEMENT, ECONOMIC REGULATORY ADMINISTRATION AND FEDERAL ENERGY REGULATORY COMMISSION.

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1/ Other than Appendix I (supplemental), L (supplemental), N, and O, all others would be identical to those included in the DEIS and are not reproduced again in the FEIS. They are hereby incorporated by reference. Appendix I (supplemental), L (supplemental), N, and O are included in this document.

2/ On June 6, 1988, the Northwest Alaskan Pipeline Company issued a press release about a future potential for modification to the ANGTS project as described in Appendix B of the DEIS. These prospective modifications are summarized as follows: 1) make greater use of snow/ice construction in Alaska where possible; 2) shorten the overall construction schedule by greater use of winter construction; 3) revise the mix of previously approved construction methodology; 4) increase the flow of natural gas throughout from 2.1 BCFD to 2.3 BCFD; 5) decrease pipe diameter in the Alaska segment from 48 inches to 42 inches; 6) increase operating pressure from 1,260 psig to 2,160 psig; 7) reduce the number of compressor stations; 8) reduce the number of other related facilities. On June 8, 1988, a representative of Northwest Alaska Pipeline Company indicated there were no firm plans at this time as to when remobilization of ANGTS would start or when the modifications would be submitted for Federal review/approval. Although detailed technical information is not yet available on the potential June 6, 1988 ANGTS modifications, the overall cumulative effects described in this FEIS are based upon the assumption that ANGTS will be constructed. The FEIS appears to still represent a reasonable estimate of cumulative effects; if anything, the overall thrust of the prospective ANGTS modifications would cause a letter degree of total cumulative effect.

3/ Appendix D has been deleted at the request of EPA since there is substantial uncertainty on the process and design of a gas conditioning facility at Prudhoe Bay needed to provide LNG quality natural gas to TAGS. Prior NEPA evaluations and an expired PSD analysis may not be transferrable or may not be appropriate for TAGS (EPA 1988a).

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SUMMARY

S.1 INTRODUCTION

The Yukon Pacific Corporation (YPC) proposed Trans-Alaska Gas System (TAGS) Environmental Impact Statement (EIS) is a document prepared jointly by the Bureau of Land Management (BLM) of the U.S. Department of the Interior (DOI) and the U.S. Army Corps of Engineers (USACE). It is designed to fulfill requirements of the National Environmental Policy Act (NEPA) for issuance of federal authorizations for a right-of-way from the BLM, for fill placement and activities in wetlands and navigable waters from the USACE, for use of buffer area to operate the ***liquefied natural gas (LNG)*** plant from the U.S. Forest Service (USFS), and for subsequent action by the Economic Regulatory Administration (ERA) and the Federal Energy Regulatory Commission (FERC) under Section 3 of the Natural Gas Act. ***On December 3, 1987 YPC submitted an application for export authorization to the ERA. The application was printed in the Federal Register on February 8, 1988 with the comment period closing on March 9, 1988.***

YPC also filed an application for a place of export with the FERC on December 3, 1987.

On January 12, 1988, the President determined that the effects of export of Alaska North Slope natural gas on American consumers would comply with the market criteria of Section 12 of Alaska Natural Gas Transportation Act (ANGTA) in the context of current and projected future energy markets. The President also stated "I do not believe the finding should hinder completion of ... Alaska Natural Gas Transportation System (ANGTS)."

The proposed TAGS project would transport natural gas from the North Slope of Alaska to tidewater, where it would be liquefied for ocean transport to export markets in the Asian Pacific Rim. As proposed, the project would transport up to 2.3 billion cubic feet per day (BCFD) of natural gas through a 796.5-mile-long, 36-inch outside diameter (OD) buried pipeline.

The proposed TAGS project would be located primarily within the utility corridor developed for planning and subsequent construction of the TransAlaska Pipeline System (TAPS) project from Prudhoe Bay to Port Valdez in the mid-1970's. Northwest Alaskan Pipeline Company (NAPC) ***plans to use this same utility corridor*** for its authorized, but yet-to-be-constructed ANGTS from Prudhoe Bay to Delta Junction. The approved alignment for the ANGTS is reserved, and though work has been suspended, this document is based on the assumption that ANGTS will be built.

The primary components of the proposed TAGS project are:

- Pipeline - The proposed TAGS pipeline would consist of 796.5 miles of a buried, chilled gas pipeline designed to transport gas at a maximum operating pressure of 2220 pounds per square inch (psi) from Prudhoe Bay to a tidewater site at Anderson Bay on Port Valdez.

- Compressor Station - Ten mainline compressor stations would be located along the proposed pipeline route to maintain required system operating pressures (from 1100 to 2220 psi) and the appropriate operating temperatures for system compatibility with ground temperatures. All compressor stations would be manned.

- Liquefied Natural Gas (LNG) Plant - The proposed LNG plant would be located at Anderson Bay and would include four LNG processing units to reduce the temperature to -259°F, condensing it to the liquid state, and four LNG storage tanks.

  The environmental analysis ***in this Final EIS (FEIS)*** must address the decisions of the ERA and the FERC under Section 3 of the Natural Gas Act.

- Marine Terminal - Proposed marine facilities would include a trestle with cryogenic loading lines, two LNG tanker berths, and dock facilities for support vessels adjacent to the LNG plant.

- Maintenance and Operations Locations - The headquarters and administration of TAGS would be in Anchorage. A maintenance facility would be in Fairbanks, which is accessible to rail, air, and road transportation. An operations and control center would be at the LNG marine terminal in Valdez.

In addition to the above facilities proposed for the TAGS project by Yukon Pacific Corporation, a gas conditioning plant, ***a connected action,*** would be required in the Prudhoe Bay area. This gas conditioning plant would deliver ***to TAGS*** a natural gas of a quality suitable for subsequent conversion to LNG at Anderson Bay.

S.2 SCOPING ***AND DEIS REVIEW***

The EIS scoping process ***provided*** the first step ***toward*** public and resource ***agency involvement*** in the environmental review process. The scoping process provides an opportunity for members of the public, special interest groups, and agencies to define environmental issues and concerns related to the project. Six scoping meetings were held in Alaska between December 8 and 13, 1986. Approximately 170 people attended these meetings. Additionally, written comments were received from federal, state, and local entities, industry, and the public. Issues identified during the TAGS scoping process are located in Appendix A.

Copies of the Draft EIS (DEIS) were distributed by mail to various organizations, government agencies, and individuals in mid-September 1987. During the public review period for the DEIS, which ended on November 20, 1987, eight formal public hearings were conducted in Alaska to solicit oral comments on the DEIS and the ANILCA 810 finding on subsistence. Approximately 20 individuals presented oral testimony. Additionally, prior to the close of the public review period, 29 written letters of comment to the DEIS were received. Section 7 of this FEIS presents a summary of the public hearing transcript and copies of each of the letters of comment with responses to all comments received. In addition to BLM and USACE, other cooperating agencies assisted in preparing responses to comments where their authorities or jurisdictions were involved, i.e., ERA, lower-48 states; impacts and end use; DOT, Part 193 of LNG standards, and State of Alaska, subsistence, fisheries, recreation areas, and operation of the Prudhoe Bay field.

S.3 ALTERNATIVES TO THE PROJECT

Alternatives considered but eliminated on the basis of general feasibility included alternative modes for transporting natural gas, regional routes to western and southeastern Alaska, and transportation of natural gas or natural gas liquids in existing TAPS pipeline facilities.

One major regional pipeline route alternative and six alternative LNG plant and marine terminal locations were considered along with the main proposal. The Cook Inlet alternative alignments would deviate from the proposed project near Livengood (Milepost 395) and proceed south to the Cook Inlet area, where three alternative LNG plant and marine terminal locations at Harriet Point, Boulder Point, and Cape Starichkof were considered. Three other alternative LNG plant and marine terminal locations at Gravina, Gold Creek, and Robe Lake in the Prince William Sound-Valdez area were considered. The no-project alternative was also evaluated.

After screening the alternative tidewater sites and pipeline routes, the representative Cook Inlet-Boulder Point alternative emerged as a potentially viable and environmentally acceptable alternative to the proposed TAGS project to Anderson Bay

Detailed comparison of the Cook Inlet-Boulder Point alternative with the proposed Prince William Sound-Anderson Bay project showed the following important differences in the two:

- Land Use/Land Status: The Cook Inlet-***Boulder Point*** alternative requires crossing of Minto Flats, an important subsistence area; transit ***through*** a major national "conservation system unit"--Denali National Park and Preserve; and crossing Susitna Flats. The pipeline for the proposed Prince William Sound-Anderson Bay route follows an existing utility corridor with a pipeline system already in place.

- Constructability: The Cook Inlet-Boulder Point alternative involves a major submarine pipeline crossing of Cook Inlet with concerns for constructability, safety, and environmental considerations.

- Environmental Disturbance: The Cook Inlet-Boulder Point alternative includes 178 miles of pipeline through areas with no current utility corridors or roads. The proposed Anderson Bay site minimizes new construction of access roads and campsites due to the presence of existing infrastructure along the entire route.

- Permit Acquisition: An Act of Congress would be required for the Cook Inlet-Boulder Point alternative to cross the Denali National Park and Preserve under provisions of the Alaska National Interest Lands and Conservation Act (ANILCA), Title XI. This action requires a finding by the National Park Service, the president, and Congress that there is no environmentally acceptable alternative. An existing utility corridor route is available to Anderson Bay.

- ***No-Action Alternative:*** ***The no-action alternative would result from the denial of any of the right-of-ways or permits required for construction and operation. Under this alternative, no construction related to the proposed action would take place. The environmental impacts associated with the project, access roads, work pads, 796.5 miles of pipeline, the LNG plant, and other project components would not occur.***

S.4 ENVIRONMENTAL CONSEQUENCES

The potential environmental consequences of the proposed TAGS project may be characterized as having major, moderate, minor, or negligible on the physical, biological, and socioeconomic features of the existing environment, as defined in Table S-1. Table S-1 analyses assumes that the TAGS project would be in compliance with all applicable laws, regulations, and orders, and that the TAGS applicant would implement all proposed mitigation measures.

The gas conditioning facilities required in the Prudhoe Bay area to deliver pipeline quality gas are not part of the TAGS project as was the case for ANGTS. ***Assumptions used in the preparation of this EIS are*** that a potential site is available and the air quality impacts attendant to such additional facilities at Prudhoe Bay would not significantly affect the air quality of the area. The effects of additional conditioning plant capabilities are similar to those evaluated in the ANGTS conditioning plant prepared by FERC in FERC/EIS 0009, July, 1980. A summary of the environmental consequences for the proposed TAGS Prince William Sound-Anderson Bay preferred route and Cook Inlet-Boulder Point alternative is contained in Table S-2. Table S-2 summarizes and combines several distinct phases of TAGS for each resource category to provide an overview and comparison of impacts for the proposed Anderson Bay route and the representative Cook Inlet-Boulder Point alternative. Impacts associated with specific aspects of a resource within these groups are described in Section 4.0. In all instances "major" impacts can be considered significant. ***An exception is "subsistence" where a "moderate" or "major" impact can be considered significant."***

The Conceptual Gas Conditioning Plant needed to supply LNG quality natural gas is not part of the TAGS project. The environmental effects, especially the air quality aspects, will be evaluated in detail at such time as the technology and plant configuration is more certain. This tiered NEPA evaluation has been coordinated with EPA and recognizes the fact that NEPA air quality evaluations and information in the expired PSD for the ANGTS Sales Gas Conditioning facility are for a plant configuration and technical operation that has been revised significantly.

S.5 FORMAT OF THE EIS

The general format of the EIS follows BLM and USACE regulations implementing NEPA (40 CFR 1502.1). Each section has a specific purpose and is required to include

Table S-1 Definitions of Environmental Impacts

	Major	Moderate	Minor	Negligible
PHYSICAL RESOURCES	Regional change of considerable severity in landforms, surface appearance, availability, or distribution of physical resources lasting for the duration of the project or longer	Localized changes of considerable severity in landform, surface appearance, availability, or contamination of physical resources occurring for the duration of the project, or widespread changes generally limited to the period of construction	Localized change(s) in surface appearance, distribution, availability, or other characteristics of physical resources with no observable residual modification	Little or no change in surface appearance, distribution, availability, or other characteristics occurring as the result of this project, or if any change does occur, it will be extremely localized and temporary
BIOLOGICAL RESOURCES	Regional change in habitat availability or quality that would likely modify the natural abundance or distribution of a species potentially through the life of the project or longer	Regional change in habitat availability or quality that would likely modify the natural abundance or distribution of a species, or localized modification in habitat availability or quality that would likely modify the abundance or distribution of species potentially lasting through the life of the project or longer	Localized change of species abundance, distribution, habitat availability or habitat quality	No measureable change in abundance or distribution, habitat availability, or habitat quality
HUMAN RESOURCES*	The potential to cause regional changes in the economic, cultural, or **sociocultural system** of residents in the area or will require substantial changes in governmental policies, planning, or budgeting	May significantly affect the economic or **sociocultural system** of residents or will require some modification of governmental policies, planning, or budgeting	May marginally affect the economic or **sociocultural system** of residents or will require marginal change in governmental policies, planning, or budgeting	Unlikely to have any measurable effect on the economic or **sociocultural system** of residents or governmental policies, planning, or budgeting

* ANILCA Section 810 requires Federal agencies to evaluate effects of proposed land use decisions on subsistence uses and needs. A proposed action will be considered to significantly restrict subsistence uses if after any stipulations or modifications warranted by consideration of alternatives or conditions, it can be expected to result in a substantial reduction in the opportunity to continue subsistence uses of renewable resources. For the purpose of this EIS, the potential for a significant restriction to subsistence use would occur from major or moderate **impacts** to either biological or human resources as stated in this table.

Table S-2 Summary of Environmental Effects of the Proposed Project to Anderson Bay, the Representative Cook Inlet-Boulder Point Alternative, and the No-Project Alternative 1/

Alaskan Resource Parameter	Proposed Project Anderson Bay			Cook Inlet Boulder Point			No-Project
	Construction	Operation	Cumulative	Construction	Operation	Cumulative	Cumulative
Socioeconomics	Major	Major	Moderate	Major	Major	Moderate	Major
Land-use	Moderate	Minor	Moderate	Major	Moderate	Moderate	Moderate
Transportation	Moderate	Negligible	Minor	Moderate	Minor	Minor	Negligible
Noise	Minor	Minor	Minor	Moderate	Minor	Minor	Negligible
Air quality 2/	Minor	Moderate	Moderate	Minor	Moderate	Moderate	Negligible
Liquid, solid, and hazardous waste	Negligible	Negligible	Negligible	Negligible	Negligible	Negligible	Negligible
Geologic Environment	Moderate	Minor	Minor	Moderate	Minor	Minor	Negligible
Surface & ground water	Moderate	Minor	Minor	Moderate	Minor	Minor	Negligible
Marine environment	Minor	Minor	Minor	Minor	Minor	Minor	Negligible
Fish	Moderate	Minor	Minor	Moderate	Minor	Minor	Negligible
Vegetation/Wetlands	Moderate	Moderate	Moderate	Moderate	Moderate	Moderate	Negligible
Wildlife	Moderate	Minor	Minor	Moderate	Minor	Minor	Negligible
Threatened/Endangered	Minor	Negligible	Negligible	Negligible	Negligible	Negligible	Negligible
Recreation/Aesthetics/ Wilderness	Moderate	Minor	Moderate	Moderate	Moderate	Moderate	Moderate
Cultural	Minor	Negligible	Minor	Moderate	Negligible	Minor	Negligible
Subsistence 3/	Major	Moderate	Minor	Major	Moderate	Minor	Negligible
National Resource Parameters 4/							
Residual effects	N/A	Minor	Minor	N/A	Minor	Minor	Negligible
Socioeconomics	N/A	Major	Major	N/A	Major	Major	Major

1/ The environmental effects may be different for construction, operation, and cumulative aspects. Construction and operations effects vary according to duration and scope of work, whereas cumulative effects evaluate the total TAGS project in combination with TAPS and ANGTS.

2/ The conceptual Gas Conditioning Plant at Prudhoe Bay needed to supply LNG quality natural gas to TAGS is not part of this project. Previous NEPA air quality evaluations and the expired PSD for the ANGTS Sales Gas Conditioning facility may not be transferable to TAGS since the original ANGTS facility has been revised significantly. Accordingly, the gas conditioning facility associated with TAGS will be given detailed NEPA and air quality evaluations at such time as the technology and plant configuration is more certain.

3/ The subsistence was done on a worst case analysis; the impacts after probable mitigation should be moderate to minor.

4/ See discussion in subsection 4.6.19.

N/A - Not applicable

certain information. ***All changes to the DEIS that are incorporated into the FEIS are in bold italic.*** Following is a brief summary of the contents of each major EIS section.

S.5.1 Section 1.0 - Introduction

Section 1.0 provides the necessary background to understand the project, the role of the EIS process for this project, major permits, and other approvals that would be required for the project to proceed. It also summarizes key results of the scoping process and describes initial options considered and eliminated from further consideration. Pipeline, LNG plant, and marine terminal siting evaluation criteria are presented and used to evaluate alternatives and to make comparisons.

S.5.2 Section 2.0 - Description of the Proposed Action and Alternatives

Section 2.0 describes major components of the conditioning plant, pipeline route, LNG plant, and terminal sites. It briefly summarizes development of the project schedule, preconstruction, construction, and operation and maintenance activities, and discusses viable project alternatives.

S.5.3 Section 3.0 - Affected Environment

Section 3.0 describes the existing environment within the area that would be affected by development of the proposed TAGS project and the Cook Inlet-Boulder Point alternative. Disciplines considered included those commented on during the scoping meetings as well as areas of special concern. An effort was made to address only those aspects of the existing environment relevant to environmental impact analysis of the TAGS project.

S.5.4 Section 4.0 - Environmental Consequences

This section ***presents*** the potential environmental impacts ***from implementation of the*** TAGS project or Cook Inlet-Boulder Point alternative. ***All impact analyses assume*** mitigation measures included in the applicant's proposed project (ROW Application, December 5, 1986) are considered an integral part of the project approach.

Environmental consequences of the proposed project are considered for the same disciplines discussed in Section 3.0. This section also describes areas of special concern, public safety, cumulative impacts, ***mitigation measures, quality assurance/quality control,*** unavoidable adverse impacts, irreversible or irretrievable commitments of resources, ***and*** the relationship between local short-term uses of the human environment.

S.5.5 Section 5.0 - Consultation and Coordination

This section describes the process for soliciting input from agencies and the public, the contract with a consulting firm for preparation of the EIS, and other agency participation in the EIS process. It also includes a list of EIS preparers.

Of special importance are issues related to the approved ANGTS and to the ***Trans-Alaska Pipeline System*** (TAPS), as these routes parallel ***those*** proposed for TAGS. These issues include the availability of confidential and proprietary information and the availability of ANGST or TAPS federal rights-of-way for co-use by TAGS. It describes important assumptions upon which the TAGS EIS process is based.

S.5.6 Section 6.0 - Support Material

This section contains the acronyms and abbreviations, the glossary of terms, and the references used throughout the EIS.

S.5.7 Section 7.0 - DEIS Review

This section contains a summary of the public hearing comments and copies of each of the comments received by the DEIS. Responses are provided for each comment identified.

S.6 Permits

YPC has applied for a grant of right-of-way from BLM and the State of Alaska to cross federal and state lands and has applied to the USACE for the required Section 10 (River and Harbors Act, 1899) and Section 404 (Clean Water Act) permits.

The BLM's grant of right-of-way is for federally owned lands, the state grant of right-of-way is for state owned lands, and the USACE permits are for wetlands in all lands along the proposed alignment. The USACE would use a tiered permit process to review and assess environmental protection and project mitigation requirements. The State must determine coastal zone management consistency and the Section 401 water quality compliance to complete the USACE permit process. *The federal Economic Regulatory Administration (ERA) must approve authorization to export liquefied natural gas under Section 3 of the Natural Gas Act (NGA). Under Section 3 of the NGA, application for export authorization must be approved unless, after opportunity for hearing, the proposal is found not to be in the public interest. On December 3, 1987 YPC submitted an application for export authorization to the ERA. That application was noticed in the Federal Register on February 8, 1988 and a comment period was established which was scheduled to close on March 9, 1988. Following the comment period the ERA would review the comments and either establish additional procedures as appropriate, and, then based on the official record, would issue an order granting or denying the requested authorization. In addition, the FERC has been delegated responsibilities under Section 3 of the Natural Gas Act to approve the site of export.*

On December 3, 1987, YPC also submitted an application to the FERC.

S.7 Relationship of TAGS to Other Projects

S.7.1 Pipelines

The proposed TAGS project would be *proximate* to the previously constructed TAPS, the existing *state highway system,* the authorized ANGTS project, *the Haines-Fairbanks military pipeline right-of-way, and the major GVEA and CVEA transmission line right-of-way all located* within the 796.5-mile transportation utility corridor *which also includes the unappropriated BLM lands. At Valdez the proposed TAGS route and plant site/marine terminal would be located* near the Alyeska oil terminal; the proposed Alaska Pacific and Valpetro Petroleum Refinery. Because the TAPS pipeline and Alyeska Marine Terminal are in place, specific details of the projects and impacts of their construction are already known. Construction, operations, and maintenance impacts for TAPS during the past 10 years have been incorporated into the EIS discussion.

Since it was established in 1974, some of the federal lands within the utility corridor have been transferred primarily to state and Native ownership, particularly between the Yukon River and Port Valdez. This is not expected to be a problem for TAGS routing.

S.7.1.1 TAPS

TAPS is an 800-mile-long *hot oil* pipeline system with 12 pump *station sites* along its length from Prudhoe Bay to the Port Valdez oil terminal *for shipment by tanker to the lower-48 states. This crude oil supply accounts for about 20 percent of the total US supply.* A total of approximately 10 miles of the TAGS alignment would be very close to TAPS. The proposed TAGS project is located primarily within the utility corridor *(including the unappropriated BLM lands)* developed for the TAPS project from Prudhoe Bay to Port Valdez.

S.7.1.2 ANGTS

If ANGTS were implemented, the federally approved project would result in construction of 745 miles of 48-inch-diameter pipeline from Prudhoe Bay to the Alaska/Yukon border with a total of 15 compressor stations and a natural gas conditioning facility at Prudhoe Bay. *The ANGTS approval is a federal approval, although application for a state right-of-way lease is pending; it has not been issued for ANGTS.* Of the 745 miles of pipeline alignment in Alaska, approximately 550 miles *of ANGTS* would be adjacent to the proposed TAGS alignment, with 12 of the 15 compressor stations from Prudhoe Bay to Delta Junction *adjacent to the proposed TAGS route.* With the exception of *some* river crossings, the entire authorized ANGTS, like *proposed* TAGS, would be *constructed* totally below ground. A total of about 15 miles of the TAGS alignment is very close to ANGTS.

ANGTS received its initial permit to construct and operate a pipeline system on federal lands in Alaska on December 1, 1980. Substantial detailed engineering design has been completed, but work has been suspended pending more favorable market conditions. Although some federal permits have been issued to ANGTS, the permitting requirements for use of state ownership lands in Alaska have not been completed and no state authorizations have been issued. Work on state permits also is suspended.

From the Alaska/Yukon border the authorized ANGTS would proceed through the Yukon Territory, British Columbia, and Alberta to markets in the western and midwestern states with a total of more than 4,000 miles of pipeline alignment, of which about 2,400 miles in Alaska and Canada remains to be constructed.

At this time there is no firm schedule for remobilization of ANGTS. In October 1987 the NWA office in Fairbanks was closed, and in December ARCO withdrew from the group supporting ANGTS. Active planning on several required preconstruction plans were suspended in October 1984 when the OFI noted that "...early Phase II remobilization was unlikely." (OFI October 29, 1984, 21st Quarterly Report to the President and the Congress.)

S.7.2 Terminal

Although there is no firm commitment to proceed *with* the two proposed Valdez oil refineries, the relative magnitude of the projects and their geographical coincidence with the proposed TAGS pipeline, LNG plant, and terminal *will* be considered.

S.7.2.1 *Proposed* Alaska Pacific Refinery

The proposed Alaska Pacific Refinery is a 100,000-bbl/day crude oil refinery which *was* scheduled to be built beginning in 1988 on the old ALPETCO site just east of the Valdez Airport near Robe Lake. This refinery would produce products ranging from fuel gas to No. 6 bunker fuel. The products are intended to be shipped from Valdez to Pacific Rim countries via tankers. There would be product lines from the refinery site to a marine facility located just beyond the grainery on the north side of Port Valdez. ***This project is on an indefinite hold.***

S.7.2.2 Proposed Valpetro Refinery

The Valpetro Refinery is a proposed small topping plant that would process about 8,000 bbl/day of number 1 and 2 diesel fuel, plus enough fuel gas to operate the plant. The facility is intended to be located on the hillside just east of the Alyeska terminal. Construction ***schedule for this project is uncertain.*** The product line would lead to an offshore loading bulkhead just east of Winnebago Point.

S.7.2.3 Gas Conditioning Facilities

The gas conditioning plant for the TAGS project would be independent of the one evaluated by FERC for ANGTS. Since the FERC conceptual evaluation of the ANGTS Sales Gas Conditioning Plant (ANGTS-SGCF) in 1980, a Central Gas Facility (CGF) has been constructed as part of the Prudhoe Bay oil production operation. ***As a result of the independent construction of the CGF, the ANGTS-SGCF was downsized substantially in 1984.*** The relationship, if any, of TAGS gas conditioning needs and the existing capabilities of the CGF is not known. ***No significant cumulative effects are expected from the construction and operation of the downsized ANGTS-SGCF and a standalone GCF to produce LNG quality pipeline natural gas to TAGS at Prudhoe Bay.***

S.7.3 *Prospective Prudhoe Bay Liquid Petroleum Gas Project*

During the Spring of 1988, the three major Prudhoe Bay Producers (ARCO, BP America and Exxon) announced they are jointly examining the feasibility of recovering additional Natural Gas Liquids (NGLs) from the Prudhoe Bay gas produced with oil. The concept generally consists of modifications to the existing gas handling facilities to recover additional NGLs, modifications to TAPS to transport the

comingled stream, and additional facilities at Valdez for removal of NGLs from the crude stream and separation into commercial grade Liquid Petroleum Gas (LPG) products. If the project is determined to be viable, over 100,000 barrels per day of LPG could be produced starting in 1993-94.

The current phase of the study is examining all aspects including facilities, operations, and product disposition. The examination of operational aspects in particular includes impact on current operations at Prudhoe Bay and along TAPS. The analysis of product disposition includes assessment of possible domestic and Far East markets, logistic requirements and costs. The LPG project, as currently visualized, would add and upgrade facilities on the North Slope, along TAPS, and at Valdez.

The contemplated project is independent of any proposed gas transportation concepts such as ANGTS or TAGS. The facilities would be compatible with conventional natural gas pipeline concepts, since removal of some of these LPG components is necessary before the gas could enter the gas transmission system.

The primary hydrocarbon components of natural gas would continue to be reinjected into the Prudhoe Reservoir and would remain available for a major gas sale when market conditions warrant the development of an appropriate gas transportation system.

S.8 PROPOSED FEDERAL ACTION

The BLM and USACE are proposing to authorize TAGS project-related facilities on a route from Prudhoe Bay that generally parallels TAPS. TAGS would be located on the west side of Galbraith Lake and would follow the highway through Keystone Canyon. The LNG plant and marine terminal would be located on state lands at Anderson Bay. The USFS has identified certain National Forest land at the Anderson Bay LNG plant as suitable for transfer to state ownership. In the event that transfer has not been completed, the USFS proposes to issue appropriate land use authorization on the basis of this *FEIS*.

The TAGS project, as proposed, involves export of North Slope natural gas from Alaska to markets in the Pacific Rim. Export applications *have* been filed with DOE, the ERA *is* required to approve any export of LNG under Section 3 of the Natural Gas Act.

The FERC would also use this FEIS as part of its NEPA requirement.

BLM and USACE proposed action will require submission of detailed information for appropriate review and approval in a manner similar to that used for ANGTS.

SECTION 1
INTRODUCTION

1.0 EIS INTRODUCTION

The proposed Federal actions ***to be considered in this Environmental Impact Statement (EIS) are whether the Bureau of Land Management (BLM) should*** issue a grant of right-of-way for federal lands between Prudhoe Bay and Anderson Bay, ***and/or the U.S. Army Corps of Engineers (USACE) should issue required*** Section 404 and Section 10 authorizations for the proposed ***Trans-Alaska Gas*** (TAGS) project to Anderson Bay. The National Environmental Policy Act (NEPA) of 1969 requires preparation of an EIS whenever a proposed major federal action could significantly affect the quality of the human environment. For the proposed TAGS project the issuance of several major permits and authorizations required before the project could proceed constitutes the major federal actions. These actions include: BLM grant of right-of-way across federal lands; the USACE Section 404 and Section 10 permits authorizing discharge of dredge-and-fill material within the waters of the United States, including structures placed in U.S. navigable waters; U.S. Forest Service (USFS) authorization to use Chugach National Forest lands as a buffer zone; and the Economic Regulatory Administration (ERA) authorization to export liquefied natural gas under Section 3 of the Natural Gas Act (NGA). As part of this NGA analysis, the ***Federal Energy Regulatory Commission*** (FERC) must in part approve the site of export.

The objective of the EIS process is to ensure that ***Federal*** decision-makers and the general public have an opportunity to review available environmental information before ***Federal*** permit decisions are made and actions taken. The environmental process provides for public involvement in major actions which could affect the quality of the human environment.

1.1 PURPOSE AND NEED FOR THE PROJECT

If an export license is granted by ERA, Yukon Pacific Corporation (YPC) has identified a purpose and need for the TAGS project, based on what it believes to be a significant opportunity in the mid-1990's to market Alaska North Slope natural gas in the Asian Pacific Rim nations. To meet this opportunity, YPC proposes to develop the TAGS project, at a cost of approximately $10 billion, which would transport Alaska North Slope gas to a tidewater facility in the Valdez area where it would be liquefied for ocean transport to Asia. Prime markets for the liquefied natural gas (LNG) exist in Japan, South Korea, and Taiwan.

The TAGS project would generate approximately 2.5 billion dollars a year in gas sales, assuming that 14 million tons of gas are sold per year at four dollars per thousand cubic feet (MCF). Although gas sales contracts are not yet complete, a reasonable breakdown of gas volumes by customer could be:

Japan	7 million tons/year
Korea	6 million tons/year
Taiwan	1 million tons/year

Project development could be phased over a period of years to allow controlled integration into the marketplace. When fully operational, the TAGS would export 14 million tons of LNG per year. It is projected that new demand for LNG in Japan, South Korea, and Taiwan would exceed the 14 million-ton capacity of TAGS by the year 2000. In view of this forecast, YPC expects that the total output of the TAGS project would be fully integrated into the Asian market before the turn of the century.

Current State of Alaska estimates show a North Slope natural gas proven reserve of 28.7 trillion cubic feet (TCF). Of that, 27.3 TCF is in Prudhoe Bay. ***The*** U.S. Geological Survey ***(USGS) in 1981 reported that*** estimates of undiscovered, recoverable, ***and*** conventional resources of natural gas on Alaska's North Slope and adjacent offshore areas range from a low of 16.4 TCF to a high of 216.5 TCF with a mean of 76.6 TCF. ***USGS estimates (1981) are being revised by the Geological Survey and Minerals Management Service. That revision is not yet completed.***

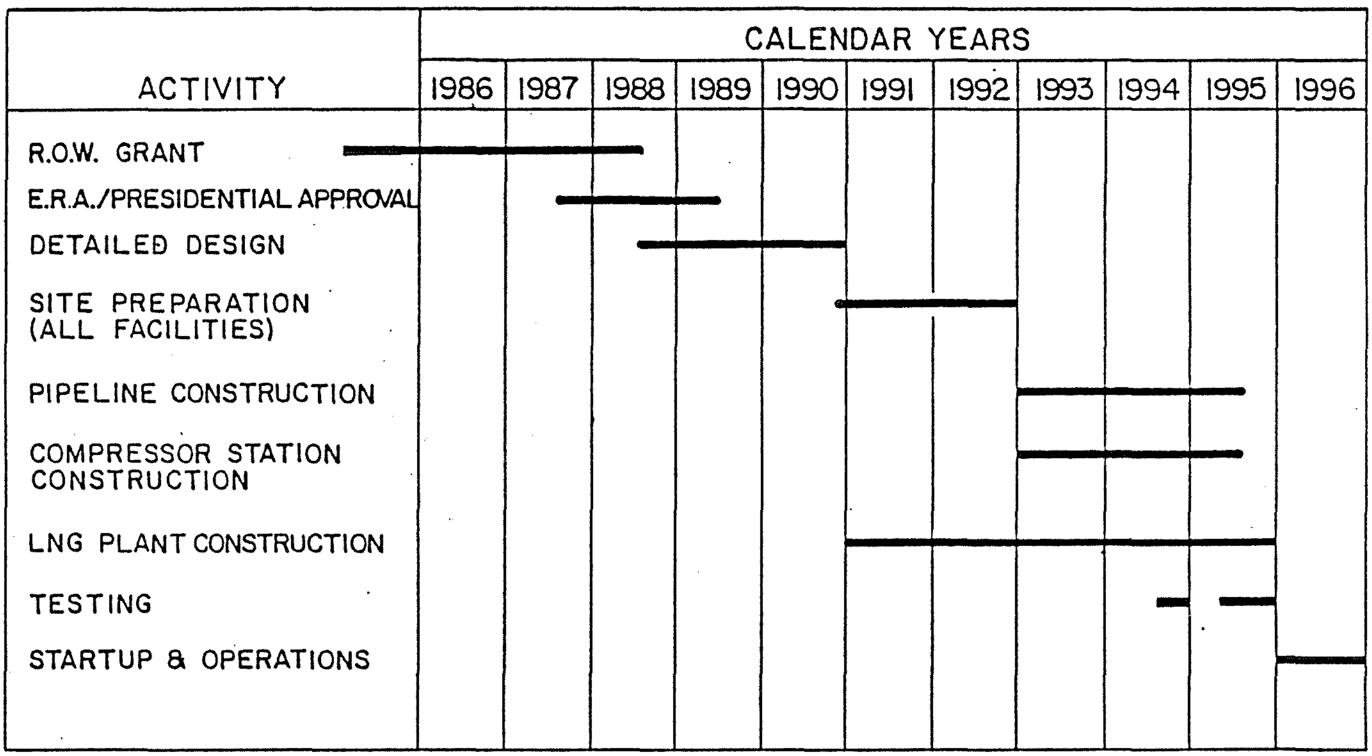
SECTION 1.0 INTRODUCTION

At full development, TAGS would transport 2.3 billion cubic feet per day (BCFD) of raw natural gas. TAGS would use approximately 0.2 BCFD for system fuel use, thereby allowing 2.1 BCFD for export.

Approximately 3.3 BCFD of North Slope natural gas is currently produced during oil extraction. Prior to reinjection, water and some heavier hydrocarbons are removed. Additional gas conditioning would be required to meet pipeline quality specifications. Conditioning at Prudhoe Bay would result in 2.3 BCFD of pipeline-quality gas. A small amount would be used for operation of the TAGS compressor stations and LNG terminal, leaving approximately 2.1 BCFD of pipeline gas for conversion to LNG.

To be able to initiate operations by the mid-1990's, the projected schedule of development for TAGS calls for major permits to be issued by the first quarter of 1988. Detailed design, engineering, and construction permit acquisition would be

Figure 1.1-1 Trans-Alaska Gas System Project Schedule



complete by the last quarter of 1990 or first quarter of 1991. Construction of the project would require four years. Operation would be scheduled to begin the last quarter of 1995. A project schedule is presented in Figure 1.1-1.

Liquefied natural gas from the TAGS project would be marketed in Japan, the Republic of South Korea, and Taiwan. These three Pacific Rim countries depend on imported energy for at least 75 percent of their needs. Each has established reduced dependence on crude oil as a national objective. Natural gas provides approximately one-fifth of the world's energy. Wide use in Asia began only recently but continues to grow quickly.

YPC proposes to sell LNG to all three nations to encourage market diversity. However, need for the TAGS project could be demonstrated in Japan alone, where forecasted increases in total demand for energy in the year 2000 are more than eight times that provided by the TAGS project.

All three nations have substantial trade imbalances with the United States which could be offset to some degree by LNG trade with the TAGS project. According to YPC (1986) a major sale of Alaska LNG could be the largest single U.S. export to help balance the U.S. deficit.

Japan

Infrastructure for the importation of LNG into Japan is already in place. Today, there are 10 LNG importing facilities located near major population and industrial centers (i.e., Tokyo, Osaka, Nagoya, Niigata, and Kita Kyushu), and three new import terminals are under construction. The distribution systems in Tokyo and Osaka obtain more than 75 percent of their natural gas supply from imported LNG. During the 1960's, 80 percent of Japan's primary energy came from petroleum; a large majority of that came from the Middle East. By 1984 Japan's dependency on petroleum was reduced to 58 percent, and there is a national objective to further reduce the dependency on petroleum to about 40 percent by the turn of the century. LNG was first exported to Japan in 1969 (from the Kenai, Alaska, project). By 1984 LNG use had increased to approximately 10 percent of Japan's primary energy requirements.

Today, 110 LNG storage tanks are in operation in Japan with a total capacity of approximately 50 million barrels. Approximately 0.6 million barrels of LNG per day or 14 million tons per annum would be produced by the TAGS project. Japan is currently using approximately 26 million tons of LNG per annum, with 75 percent going to electric power generation and 25 percent into city gas systems. This use is projected to reach 40 million tons per annum by 1995. Until recently, Japan has made little effort to penetrate the industrial gas market. (In 1984 natural gas supplied only 1.4 percent of Japan's industrial market.)

A large potential market exists, particularly if the Japanese government promulgates strong air quality controls, as it did in the late 1960's and early 1970's with electrical power generation. Alaska's ability to play a role in expanding this market depends on its ability to project and limit transportation costs.

Republic of South Korea

Korea Gas Corporation (a wholly owned government corporation) was established in August 1983 under the Korea Gas Corporation Act of December 1982. The prime aim of this corporation is to "promote improvement of the South Korean national lifestyle and to contribute to the rising standard of public welfare by establishing the foundation for supplying a pollution-free and safe gas on a stable and long-term basis."

Korea Gas Corporation (KGC) is in the process of completing an LNG import terminal at Pyong-Taek, south of Inchon, which began operation in late 1986. Future plans call for a second LNG terminal to be located in the Pusan area.

Taiwan

Taiwan has a natural gas distribution system in the Taipei area that handles about 100 million cubic feet per day of local production. Taiwan has agreed to purchase 1.5 million tons of LNG per annum from Indonesia, commencing about 1991.

An LNG import terminal is under construction at Hsingta on the southwest shore of Taiwan. It will be connected to the present gas distribution system near Taipei by a 200-mile gas transmission system, providing gas service to the major population areas of western Taiwan. With a gas system in place by 1991, Taiwan will be in a position to capitalize on these markets once LNG is available and would be able to expand its need for additional supplies of natural gas. Taiwan is a potential market for some additional 2 million tons of LNG per annum.

1.2 BACKGROUND OF THE PROJECT

An application for the proposed TAGS ***project's*** right-of-way across federal lands was initially filed with the BLM and with the USACE for Section 10 and Section 404 permits on May 1, 1984. At that time, YPC considered a joint development with the Northwest Alaskan Pipeline Company (the holder of an approved federal gas pipeline right-of-way from the North Slope to the Alaska/Yukon border) from the Alaska North Slope to Livengood, Alaska. At Livengood the initial YPC route would have proceeded south to an LNG plant and marine terminal located on the Kenai Peninsula. Further analysis by YPC concluded that this was not a feasible or prudent alternative for the development of the TAGS project. YPC amended its original filing with the BLM on December 5, 1986. In addition to the amended filing, YPC filed applications with USACE for Section 10 and Section 404 permits to authorize dredge-and-fill operations within waters of the United States. Those applications triggered the preparation of this EIS.

In March 1987, YPC filed an application with the State of Alaska for approval to use state-owned lands between Prudhoe Bay and Anderson Bay. The EIS process for the two initial federal permits is being coordinated with state evaluations so that a single public involvement process ***on Federal permits*** can be used. ***However, the state has its own public notice and comment requirements that differ from the federal government.***

The ERA must grant an export authorization and the FERC must approve the site of export under Section 3 of the Natural Gas Act before any gas may be exported. ***On December 3, 1987, YPC filed applications with both the ERA and the FERC.*** ERA's decision is also a major federal action and requires compliance with NEPA. ***The Department of Energy*** (DOE), through ERA and the FERC, ***is*** cooperating in the preparation of this EIS.

The proposed TAGS pipeline would be constructed and operated within an existing transportation and utility corridor from Prudhoe Bay to Port Valdez, ***which includes a mixture of unappropriated BLM lands, military reservations, state, Native and other private lands*** generally parallel to the ***entire*** existing ***806-mile-long*** Trans-Alaska Pipeline System (TAPS) and along a ***550-mile*** segment of the approved but unconstructed Alaska Natural Gas Transportation System (ANGTS) from Prudhoe Bay to Delta Junction. Environmental review documents related to this transportation and utility corridor include:

- TAPS Final Environmental Impact Statement (FEIS) completed in 1972 by the BLM with project construction initiated in 1974 and initial operation beginning in 1977.

- Alaska Arctic Gas Pipeline Company proposed to construct a natural gas pipeline from Prudhoe Bay across the North Slope of Alaska to Canada to the domestic market; FEIS completed by BLM in 1976.

- El Paso Alaska Company proposal to construct a natural gas pipeline from Prudhoe Bay to Gravina in Prince William sound; FEIS completed in 1976 by the FPC

- Northwest Alaskan Pipeline Company (formerly ALCAN) proposed to construct a natural gas pipeline from Prudhoe Bay adjacent to TAPS to Delta Junction and on to the Alaska/Yukon Border to serve domestic markets; supplemental FEIS completed by the FPC in 1976.

- Northwest Alaskan Natural Gas Transportation Company proposed to construct and operate a sales gas conditioning facility at Prudhoe Bay, Alaska; FEIS completed by the FERC in 1980.

The proposed LNG plant site and marine terminal would be located approximately 3.5 miles west of the existing TAPS oil terminal on the south shore of Port Valdez.

An inventory of emission and stack parameters for existing sources in the Valdez area has been taken from a PSD permit application for the Alaska Pacific Refinery to ADEC in August, 1986. While this PSD application has been deemed incomplete by EPA and ADEC, the source inventory is a compilation of existing emission sources applicable to the LNG plant and marine terminal for TAGS.

1.3 GENERAL PROJECT LOCATION

The proposed TAGS project would transport natural gas via a pipeline that would extend from Prudhoe Bay to Port Valdez where the LNG plant and marine terminal site would be located at Anderson Bay. The primary components of the proposed TAGS system would be 796.5 miles of buried 36-inch outer diameter (OD) pipeline with 10 compressor stations located along the route. The pipeline would terminate at the Anderson Bay LNG plant site and marine terminal. Project facilities would be located ***primarily*** on lands administered primarily by the BLM and the State of Alaska. Other federal ownerships include portions of several military bases ***and*** a small portion of the Chugach National Forest. ***The breakdown of land ownership is approximately 50 percent federal, 45 percent state, and 5 percent Alaska Native or in other private ownership. Appendix F provides a reference map of ownership.***

1.3.1 Prudhoe Bay to Prince William Sound

The proposed TAGS pipeline route alignment would begin at Prudhoe Bay, immediately downstream of the gas conditioning facilities, and proceed south, paralleling the Sagavanirktok River and traversing the Brooks Range through Atigun Pass. The alignment proceeds south through the Dietrich River and the Middle Fork of the Koyukuk River valleys into the Jim River valley. The route then proceeds southeast towards the Yukon River, with the proposed pipeline crossing the river on its own suspension bridge. The proposed Yukon River crossing location would be approximately 1,000 feet upstream of the existing highway bridge. The pipeline route would continue south, passing east of Fairbanks and Fort Wainwright. Proceeding southeast, parallel to the Tanana River valley, the route crosses the Tanana River near Big Delta. The route passes east of Delta Junction and parallels the Delta River southward, crossing the Alaska Range near Summit Lake. The alignment then traverses the Copper River valley. Upon entering the Chugach Range, the pipeline would parallel the existing Richardson Highway. The route continues to parallel highway alignment through Thompson Pass, entering the Lowe River valley. Through Keystone Canyon it would use the existing Richardson Highway ditch ***in the Lowe River floodplain.*** From the mouth of Keystone Canyon the route follows a westerly course for approximately 21 miles to Anderson Bay, where it would traverse generally north-facing bedrock slopes along the south side of Port Valdez, ***crossing Canyon Slough, an anadromous fish stream.*** The line would follow along Port Valdez behind the TAPS oil terminal. West of the TAPS terminal, the route again follows along the south shore of Port Valdez before terminating just east of Anderson Bay

The Anderson Bay site is located 5.5 miles southwest of the city of Valdez. The TAPS terminal is approximately 3.5 miles east of the site. Valdez is a fishing, ***tourist,*** and industrial community and could offer the industrial, commercial, and residential infrastructure support required by the TAGS project. The city is accessible by road, sea, and air. An airport located approximately 7.5 miles northeast of the site is serviced by several ***instate*** airlines ***and*** a number of smaller charter service and private planes. Many dock and harbor facilities, some industrial, are also located near the east end of Port Valdez.

The Anderson Bay site extends from the east end of Anderson Bay about 7,000 feet to the east and about 2,000 feet south from the shoreline of Port Valdez. The elevations across the site range from water level to about 350 feet. The majority of the site lies below 200 feet.

Generally, the area is comprised of a series of east-west trending bedrock ridges.

mantled with glacial till and infilled with unconsolidated sediments to depths possibly up to 40 feet. Till cover is shallow along ridges. Shallow lakes and wet areas in the grooves suggest a high water table; drainage is good.

The site is in a high seismic area, but no active fault zones are known in the vicinity, though several lineaments are evident. There is no evidence of ground rupturing, subsidence, or uplift at the site. There are 30- to 50-foot bluffs along the coastline of the site. The substrate is coarse (gravel to boulders or bedrock). In the vicinity of the marine terminal, the 60-foot isobath, a water depth suitable for even the largest LNG tankers, lies approximately 500 feet from shore. An offshore anchorage area is available, and there is ample space for maneuvering vessels.

The shape of Valdez Arm suggests it would be susceptible to seiching action. During the 1964 earthquake, submarine landslides at Shoup Bay in fact did trigger large seismic waves within Port Valdez. The configuration and orientation of Port Valdez and Valdez Narrows limits the risk that tsunamis, generated in Prince William Sound, would have in Port Valdez. Earlier bathymetric studies showed no offshore bathymetric features that might amplify a tsunami within the basin. Maximum wave run-up at Anderson Bay was 78 feet (Plafker 1967) during the 1964 earthquake.

Mountains surrounding Port Valdez would shelter the terminal from the severe winds experienced in other parts of Prince William Sound. Prevailing winds are east-westerly and seldom exceed 18 mph; average wind speed is 6 mph. Certain local conditions can intensify winds, and winds can intensify currents. In the absence of meteorological effects, tidal current may be about 1.2 knots but average less.

Wave activity would probably be slight. Waves less than 1 foot occur about 90 percent of the time; waves from 1 to 3 feet occur about 10 percent of the time. Wave action is highest in midwinter and lowest in midsummer. A significant wave is estimated at 5 feet/5 sec; the maximum wave at 9 feet.

Port Valdez is generally ice free year round. Occasionally, shore ice develops in the intertidal zone but poses no serious problems; ice rarely occurs as a sheet. Shoup Glacier has the remote potential of calving icebergs into Shoup Bay that might get into Port Valdez. There is some concern about calved icebergs in the Valdez area from the Columbia Glacier.

1.4 RELATIONSHIP TO OTHER PROJECTS

The proposed TAGS project would be located within the utility corridor developed for the TAPS project in the mid-70's ***which included unappropriated BLM lands.*** Located within this utility corridor are the constructed TAPS pipeline and associated pump stations, the authorized but yet to be constructed ANGTS from Prudhoe Bay to Delta Junction as identified in approved Revision Alignment 4 to the ANGTS project, ***or the existing Golden Valley Electric Authority, the Copper Valley Electric Authority, or the abandoned Haines military oil products pipeline.*** This alignment would be reserved for the ANGTS project. Also within the Port of Valdez is the operational Alyeska Marine Terminal and the proposed Alaska Pacific and the Valpetro ***oil refineries.***

1.5 AVAILABILITY OF ANGTS OR TAPS FEDERAL RIGHTS-OF-WAYS FOR CO-USE BY TAGS

Federal rights-of-way regulation (43 CFR 2881.1-1) " . . . retains a right to use a right-of-way and temporary use permit area or authorize the use in any manner not inconsistent with pipeline construction, operation, maintenance and termination . . . " Later at 43 CFR 2881.1-3(c) the federal government reserves the right on federal lands to " . . . make, issue, or grant right-of-way grants, temporary use permits, easements, leases, licenses, contracts, patents, permits, and other authorizations to or with third parties for compatible uses on, under, or adjacent to the federal lands subject to a right-of-way grant or temporary use permit.'

YPC asserts its intention to keep reasonable distance from the existing TAPS facilities and the authorized but unconstructed ANGTS alignment, as shown by the approved Revision 4 noted to official BLM master title plats. Accordingly, the amended TAGS application dated 12/5/86 proposes to use a 200-foot separation from both TAPS and ANGTS, as appropriate. An exception would be where there is insufficient room due to topographic or environmental constraints. These existing valid Federal rights will be recognized in the processing of the TAGS project.

The Federal Inspector and BLM are preparing a memorandum of understanding to identify circumstances and manner in which BLM and Federal Inspector would exercise their respective responsibilities for the TAGS project.

1.6 FACTORS THE EIS PROCESS IS BUILT UPON

This EIS is built upon the following list of facts:

- Previous EIS's covered environmental issues similar to those associated with the proposed TAGS project, and they are incorporated in appropriate sections of this document by reference.

- The proposed TAGS and authorized ANGTS ***cross through the same environments for a distance of 550 miles*** from Prudhoe Bay to Delta Junction where the two pipelines would bifurcate ***and*** have similar environment, social, and economic features.

- The utility corridor has experienced an actual on-the-ground construction phase and a 10-year operations and maintenance program for the ***806-mile-long*** TAPS project. ***Slightly more than one-half of TAPS was buried. TAPS also had 34 major and 800 other river and stream crossings. The aboveground sections had special construction features at 554 places in wildlife crossings. TAPS facilities have been successfully operated without adverse effect on peregrine falcons.*** TAPS information helps to predict what might happen with the TAGS project under similar construction and operational/maintenance conditions.

- TAPS and authorized ANGTS have been determined to be compatible. Application of similar standards for separation of TAGS and TAPS would result in comparable conditions.

- TAGS and ***authorized*** ANGTS have similar components in that both involve construction and operation of buried, chilled natural gas pipeline systems. There is a question as to what are the best technical standards of compatibility between two chilled, large diameter natural gas pipeline systems. TAGS and ***authorized*** ANGTS are compatible when the standard of a 200 foot separation between the two pipelines is adopted (see Appendix B).

For the purpose of analysis it is assumed that TAGS and the authorized ANGTS would not be constructed concurrently. This assumption is based upon the fact that ***the world economy could not fund two major pipelines in Alaska simultaneously.*** Neither ANGTS nor TAGS have completed sales agreements or arrangements to initiate construction, and neither project has completed permitting (for example, ANGTS does not yet have authorization to use State ***ownerships*** in Alaska ***nor is permitting for its conditioning plant at Prudhoe Bay complete).***

Another assumption is that there would be adequate supplies of Alaskan North Slope natural gas to support economic operation of both ANGTS and TAGS.

It is assumed that necessary air quality authorizations for the TAGS project can be obtained and that emission control measures will not adversely affect the project economics.

It is further assumed that a gas conditioning facility at Prudhoe Bay needed to supply LNG quality natural gas to TAGS will be built and that appropriate air quality authorizations can be obtained.

1.7 CONFIDENTIAL AND PROPRIETARY INFORMATION

During its history Alyeska Pipeline Service Company had collected much confidential and proprietary information on design, construction, operation, and repair of the Trans-Alaska Pipeline System. Northwest Alaskan Pipeline Company assembler similar information during design of the Alaska Natural Gas Transportation System.

At an appropriate time, TAGS may choose to negotiate with one or both of these companies for use of such data.

Under provisions of the Council of Environmental Quality (CEQ) regulations (40 CFR 1502.21) " . . . Material based on proprietary data which is itself not available for review and comment shall not be incorporated by reference." Accordingly, such data, i.e., ANGTS mineral material sources, and frost heave engineering design and biological studies are not available for evaluation of the proposed TAGS during the EIS phases.

1.8 *PUBLIC REVIEW* PROCESS

The ***public review*** process for the ***DEIS for the*** proposed TAGS project identified issues and concerns associated with construction, operations, and socioeconomic issues.

The first step in the federal NEPA ***public review*** process is to publish a Notice of Intent (NOI) for the preparation of an EIS in the Federal Register. The NOI for TAGS was published by the BLM and the USACE on November 17, 1986. The second step in the NEPA process, termed "scoping," determines the significant issues and concerns relating to a proposed action that would be included in the EIS. Six scoping meetings were held in cities and towns in the general vicinity of the proposed pipeline route.

The DEIS was distributed by mail to various organizations, government agencies, and individuals in mid-September 1987. The Notice of Availability of the DEIS for the proposed TAGS project was published in the Federal Register September 18, 1987. This notice identified the availability of the DEIS and identified the locations, dates, and times of the public hearings and identified November 20, 1987 as end of the public review period. Eight public hearings were held in cities, towns, and villages in the general vicinity of the proposed pipeline route to solicit comments on the DEIS and the ANILCA 810 Finding on subsistence. Public hearings were held at:

Location	Date
Peninsula Borough Assembly Room, Soldotna, Alaska	***October 23, 1987***
Anchorage Museum of History and Art Auditorium, Anchorage, Alaska	***October 24, 1987***
Valdez City Hall Council Chambers, Valdez, Alaska	***October 26, 1987***
Glennallen High School Gym, Glennallen, Alaska*	***October 27, 1987***
Hutchinson Career Center Fairbanks, Alaska	***October 28, 1987***
North Slope Borough Assembly Room, Barrow, Alaska	***October 29, 1987***
Stevens Village Community Center, Stevens Village, Alaska*	***October 30, 1987***
Coldfoot Services, Coldfoot, Alaska*	***October 30, 1987***

**** Subsistence hearing also held.***

Approximately 20 people presented oral testimony at the eight public hearings that were held on the proposed TAGS project DEIS and the ANILCA 810 Finding on subsistence. A complete transcript was made for each of these hearings. In addition to the oral comments, twenty-nine written comments were received on or about November 20, 1987, the end of the public comment period. Section 7 of the FEIS contains a summary of the public hearing comments, copies of each of the written responses received and responses to all comments identified. In addition to BLM and USACE, other cooperating agencies assisted in the preparation of responses to comments received on the DEIS where their authority or jurisdiction was involved, i.e., ERA, lower-48 states impacts and end use of gas; DOT, matters involving LNG

safety as per 49 CFR 193; and the State of Alaska, for such issues as subsistence, fisheries, recreational areas, and operational characteristics of the Prudhoe Bay field.

1.9 ALTERNATIVES THAT WERE CONSIDERED BUT REJECTED FROM FURTHER CONSIDERATION

1.9.1 Introduction

Alternatives to the proposed TAGS project that were considered and rejected are discussed in this section. Alternatives considered include several route options to tidewater to supply the export market and a no-project alternative. Transport of Prudhoe Bay natural gas to Lower 48 markets has been addressed in previous proposed projects and will not be addressed here. Information on optional proposals to transport Prudhoe Bay natural gas to the domestic markets is presented in EISs published for three projects: Alaskan Arctic Pipeline Company proposal (*BLM* 1976), El Paso Alaska Company proposal (FPC 1976a), and Northwest Alaskan Pipeline Company (formerly ALCAN) proposal (FPC 1976b). The TAGS EIS assumes that the authorized but unconstructed ANGTS project will be built and does not represent an alternative to the proposed TAGS project.

This section presents information on a broad range of alternatives to the proposed project, describes the process through which alternatives were evaluated, and presents the conclusions of the evaluation. The discussion of these initial alternatives to implement the proposed project includes:

- Consideration of alternative transportation modes and systems
- Consideration of statewide alternative pipeline routes and coastal terminal sites
- Evaluation of specific alternative regional pipeline routes and sites for LNG facilities/terminals
- Comparison of environmental and engineering criteria of potentially feasible routes and sites for the proposed TAGS pipeline and LNG plant and terminal project

1.9.2 Alternative Transportation Modes and Systems Considered

Various alternative modes for transporting Alaska North Slope oil and/or gas to domestic markets were considered in detail *for* the ANGTS in the *BLM's* Final EIS Alternatives Volume of March 1976 (pp. 116-168) and that discussion is adopted by reference. Systems considered were: land routes, including transportation by dense-phase and methanol pipelines, railway, and monorail; marine routes, including ice-breaking tankers and submarines; air routes, including airplanes, helifloats, and dirigibles; conversion of natural gas to other energy sources, including electrical generation and transmission; and possible alternative combinations of various modes. For each system, the ANGTS EIS (FPC 1976**a**) presented a description of the system and its required facilities, its feasibility, and its environmental impact. Since none of these alternative modes of transportation was considered feasible to design or operate, they were eliminated from further consideration. Since there has been no major breakthrough in any of the relevant technologies, ***the prior analyses remain valid.***

1.9.2.1 Natural Gas Comingled with Crude Oil in TAPS

During the scoping process ***and again during review of the DEIS*** the question was raised as to whether natural gas and/or natural gas liquids could be transported in the existing TAPS pipeline system. The answer is that the existing TAPS crude oil pipeline is not designed to handle two-phase flow. The injection of natural gas into crude oil under pressure would result in substantial quantities of the natural gas coming out of solution at points of low pressure along the TAPS route, such as at the Brooks Range, causing serious vapor locks within the system. Additionally, as the natural gas enters the pump stations, serious cavitation problems would occur at some of the pumps. There would be serious jeopardy to continued safe operation of TAPS. ***It should be noted that the Prudhoe Bay LPG Project being considered by the three major Prudhoe Bay producers (ARCO, BP America and Exxon) does not involve natural*** *gas (methane). Should the LPG Project be developed, it is probable that the operating pressures of existing TAPS facilities would be converted to a higher pressure system. The increased operating pressure of TPAS still would not handle two-phase flow.* Therefore, this alternative is not considered a viable option to the proposed action.

1.9.2.2 Convert Natural Gas to a Liquid at Prudhoe Bay and Comingle with Crude Oil in TAPS

During the public scoping process ***and again during review of the DEIS***, a suggestion was made to convert natural gas to a liquid at Prudhoe Bay and then use the existing TAPS to transport both oil and gas to Valdez.

This alternative is possible only to the extent the natural gas, as a liquid, would be compatible with the operating potentials of the TAPS crude oil delivery system.

Natural gas liquids (NGLs) comprise a group of hydrocarbons that occur naturally in gaseous form or in solution with oil in a reservoir. NGLs are recoverable as liquids by condensation or absorption processes.

The average composition of gas reinjected in the Prudhoe Bay reservoir is shown in Table 1.9.2-1.

TAPS was designed to transport large volumes of crude oil. The maximum temperature of the oil when injected into the pipeline is 145°F. The design operating pressure of the pipeline is 1180 psi.

Through addition of long chain polymers ***(which lower the viscosity and reduce the friction factor)*** and project modifications, Alyeska Pipeline Service Company has determined the present 145°F injection temperature for TAPS can be lowered to about 110° to 111°F. At this lowered temperature, and at atmospheric pressure, approximately 40,000 barrels more of NGLs (as a liquid) can be comingled daily with the crude oil in TAPS. Methane, the principal component of the feed gas for the proposed TAGS project, is a gas at these temperatures and pressures; and, therefore, is not compatible with the design of TAPS. At a temperature of -259°F, liquid natural gas (LNG) is not compatible with the TAPS design or operating requirements.

Table 1.9.2-1

Composition of Gases Reinjected in Prudhoe Bay Reservoir Since 1978

Constituent	Average Reinjected Since Percent Volume) 1978[1]
N_2 (nitrogen)	.48
CO_2 (carbon dioxide)	12.77
C_1 (methane)	73.72
C_2 (ethane)	6.97
C_3 (propane)	3.56
iC_4 (iso-butane)	.48
nC_4 (normal butane)	1.15
iC_5 (iso-pentane)	.23
nC_5 (normal-pentane)	.29
C_6+ (hexanes and heavier)	.37
	100.20%[2]

1 (Personal communication - R. Douglass, February 1987).

2 Does not add to 100 percent because of rounding within constituent averages.

Accordingly, the option of converting natural gas to a liquid to be comingled with crude oil in TAPS is not considered a practicable alternative to TAGS.

1.9.3 Regional Pipeline/LNG Plant Alternatives Screening

The initial screening considered alternative pipeline routes and LNG plants in various regions of Alaska. This analysis concluded that only the Cook Inlet and Prince William Sound areas provided feasible alternatives for the pipeline, LNG plant, and marine terminal (see Appendix C). In western Alaska limited tanker access related to sea ice as well as other factors eliminated the region from further consideration. Pipeline distance to Yakutat or other southeast ports and the extensive mountainous terrain that would have to be crossed would be insurmountable obstacles to this project and eliminated the southeast region from further consideration. Figure 1.9.3-1 provides a summary of the criteria evaluation for the statewide route options.

	Western Alaska		Southcentral		Southeast Alaska	
	Norton Sound	Bristol Bay	Cook Inlet	Prince William Sound	Yakutat Bay	Lynn Canal/ Chatham Strait
Continuous Operation of a Marine Terminal	●	⊗	○	○	⊘	○
Minimize Length of Pipeline	○	●	○	○	●	●
Maximize Use of Existing Utility/ Transportation Corridor	●	●	○	○	●	○
Maximize Use of Existing Infra-structure	●	●	○	○	⊗	○
Avoidance of Environmentally Sensitive Area	●	●	⊘	○	●	●
Avoid Permitting Delays	●	●	●	○	●	●

○ = Favorable
⊘ = Moderately Favorable
⊗ = Unfavorable
● = Highly Unfavorable

Figure 1.9.3-1 Summary of Criteria Evaluation for Statewide Route Options

1.9.4 Alternative Sites within Cook Inlet and Prince William Sound Region

Along with the applicant's proposed project and the Cook Inlet-Boulder Point alternative considered in this EIS, two additional Cook Inlet and three Prince William Sound alternative LNG plant/marine terminal sites were evaluated for project feasibility ***by YPC and evaluated in this FEIS***. These include Gold Creek, Robe Lake, and Gravina in Prince William Sound, and Cape Starichkof and Harriet Point in the Cook Inlet region (Figures 1.9.4-1 and 1.9.4-2). Other sites previously considered by FPC for the El Paso proposal as having LNG plant site potential in the Gravina area were Hawkins Island and Bidarka Point. ***Although*** Gravina was used as a representative site for Prince William ***Sound*** sites outside of Port Valdez, ***each of these three Prince William Sound sites had similar access problems as identified in subsection 1.9.4.3 and required difficult marine crossings.*** Eleven pipeline criteria, ten LNG plant site criteria, and seven criteria related to the marine terminal were used to consider the degree of favorability for each of the alternative sites. Results of this analysis are presented in Appendix C and summarized in Figure 1.9.4-3. Evaluation of the applicant's proposed project and the Cook Inlet-Boulder Point alternative are presented for comparison with the other sites on Figure 1.9.4-1 and in Section 2. The other Prince ***William*** Sound and Cook Inlet sites were inferior to the proposed project and Boulder Point sites, respectively, and were eliminated from further consideration. The existing Phillips-Marathon LNG site and the adjacent Nikiski site previously evaluated for the Pacific Alaska LNG Associates Projects (FERC, 1978) cannot accommodate the scale of facilities necessary for TAGS.

1.9.4.1 Cape Starichkof

Cape Starichkof, which shares a common alignment with the Boulder Point site as far as Boulder Point, has one distinct disadvantage--the extra pipeline length and additional compressor station required to transport the gas 59 more miles would have many implications for construction time and associated increase in impacts to the environment and costs. The LNG site characteristics are similar to those for Boulder Point except that land availability would be more of an issue and the environment around Cape Starichkof is more sensitive with respect to fish and shellfish, the fisheries (as economic entity), and recreational use of the area. Marine terminal site characteristics are also similar to those for Boulder Point with the exception that navigational hazards, uncharted submerged boulders and outcrops, and potential sea-ice problems would be less of a factor at Cape Starichkof. The same permitting problems associated with Denali National Park and Preserve exist. Cape Starichkof was rated as less favorable than Boulder Point and eliminated from further consideration.

1.9.4.2 Harriet Point

The pipeline alignment to Harriet Point poses problems over the Boulder Point and Cape ***Starichkof*** alignments. Like Starichkof, Harriet Point would require a longer pipeline and an additional compressor station. Most of the route along the western shore of Cook Inlet is away from available infrastructure to support construction. Few data exist for environmental impact assessment and engineering design analyses. The route also passes through areas of sensitive environments for wildlife and fisheries. The LNG plant site has advantages of land availability and little potential impact to public safety from an accident or spill should one occur. One distinct disadvantage for the LNG plant site is the lack of any infrastructure. Facility construction and operation would be much more difficult and costly since there is no community or commercial base in the immediate vicinity to support the project. The potential for any secondary development would be curtailed. Along with the permitting issue associated with the crossing of Denali National Park and Preserve, Harriet Point would be rated as less favorable than Boulder Point and eliminated from further consideration.

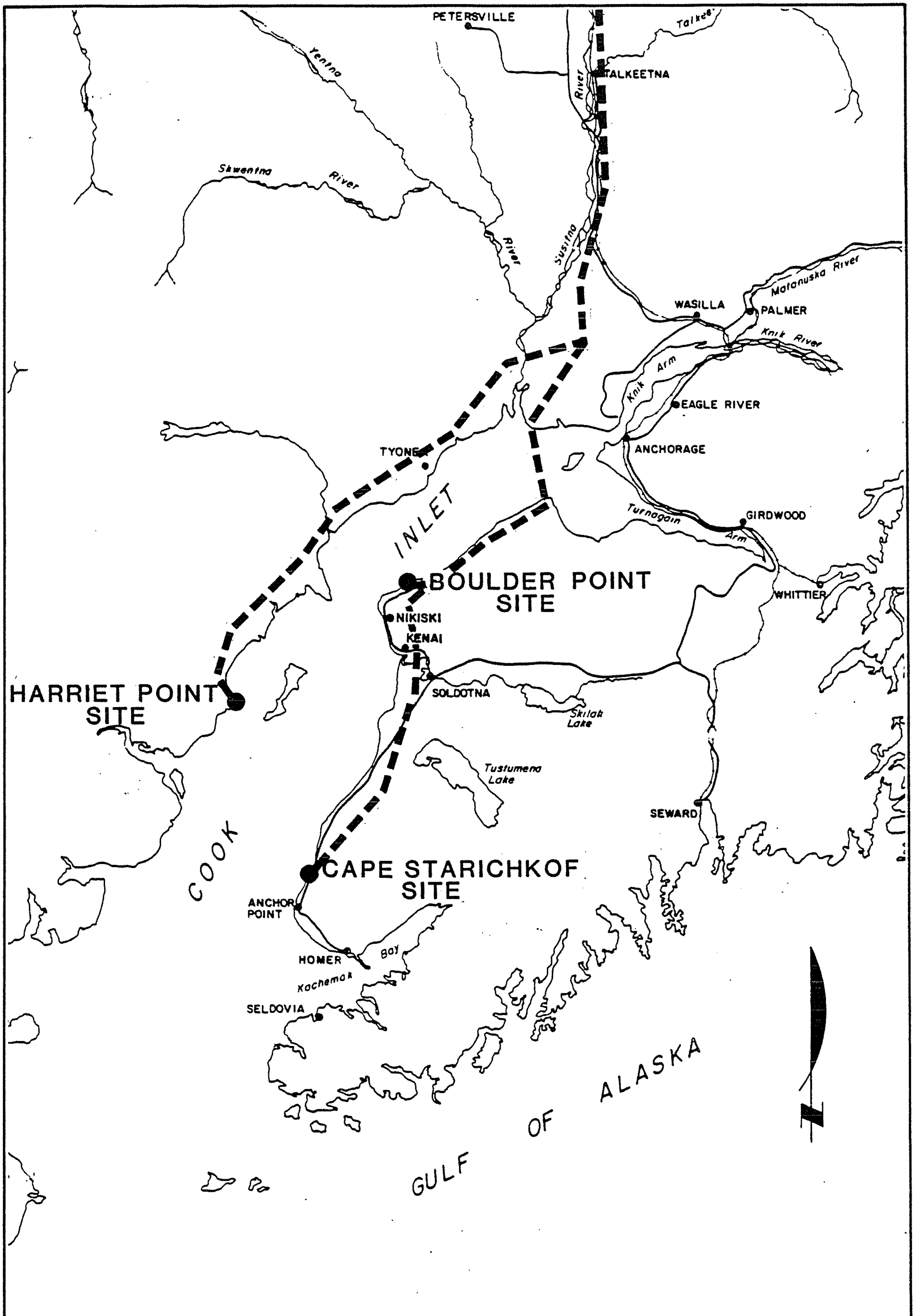


Figure 1.9.4-1. Alternative Cook Inlet Site Locations

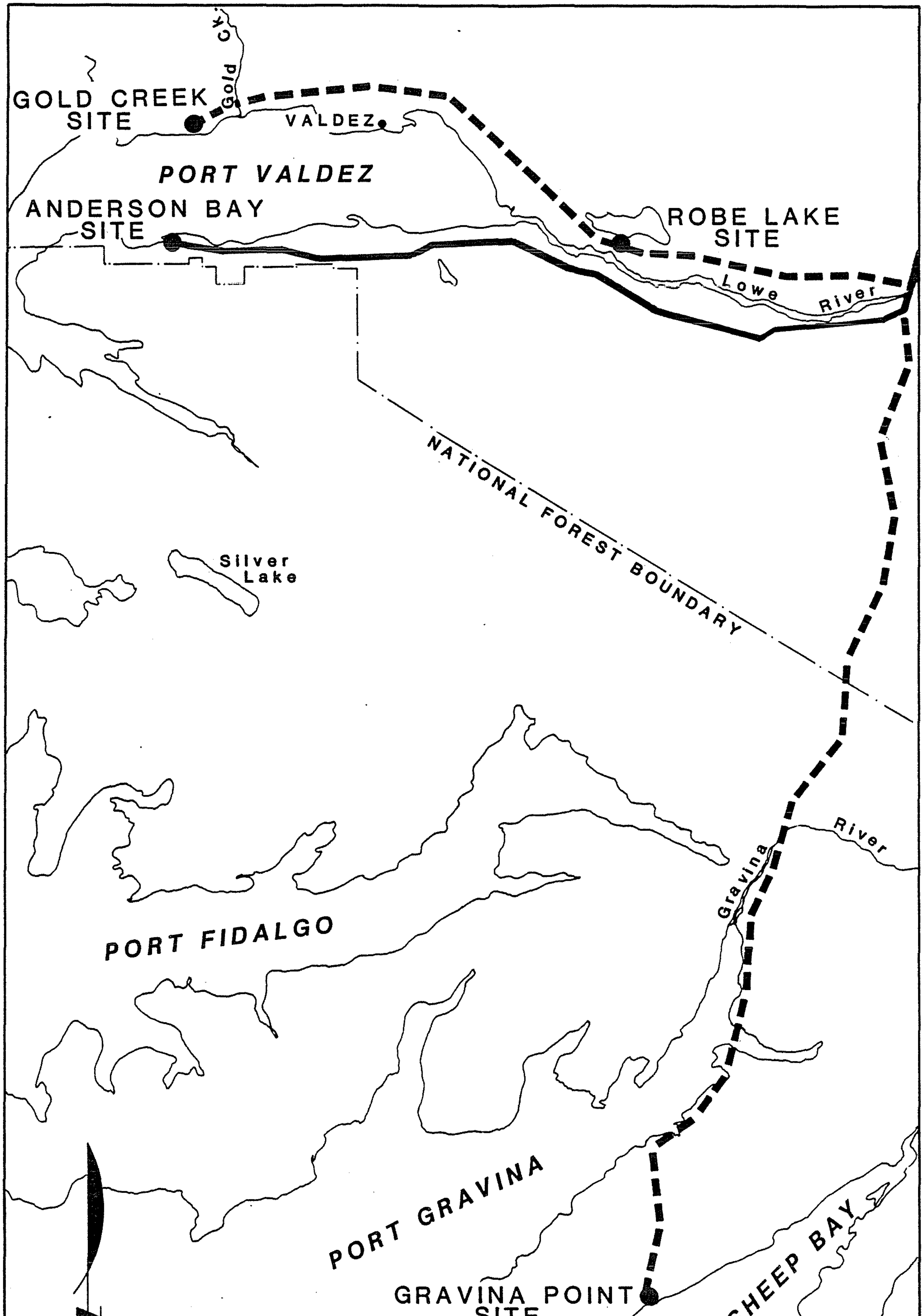


Figure 1.9.4-2. Proposed TAGS Anderson Bay Site Location and Alternative Prince William Sound Site Locations

Figure 1.9.4-3 Criteria Evaluation Matrix for Proposed TAGS Project and Alternative Locations

	Prince William Sound				Cook Inlet		
	Proposed Project to:	Alternatives			Alternatives		
	Anderson Bay	Gravina	Gold Creek	Robe Lake	Boulder Point	Cape Starichkof	Harriet Point
Pipeline Criteria							
- Minimize length of pipeline	○	⊘	○	○	○	⊗	⊗
- Maximize use of existing infrastructure	○	⊗	○	○	⊘	⊘	⊗
- Maximize use of proven construction techniques	○	⊗	⊘	○	⊗	⊗	⊗
- Maximize opportunity for parallel construction techniques	○	⊘	○	○	⊘	⊘	⊘
- Avoid areas of potential geohazards	⊘	⊗	⊘	⊘	⊗	⊗	⊗
- Minimize potential conflicts with sensitive environments	○	⊘	○	○	⊘	⊘	⊗
- Maximize compatibility with current and planned land use	○	⊗	○	○	⊗	⊗	⊗
- Minimize the number of water crossings	○	⊗	○	○	○	○	⊘
- Avoid permitting delays	○	⊘	○	○	●	●	●
- Minimize potential threat to national security	○	⊘	○	○	⊘	⊘	⊘
- Maximize availability of gas to Alaska consumers	⊘	⊗	⊘	⊘	○	○	○
LNG Plant Criteria							
- Adequacy of available land	○	○	○	●	⊘	⊗	○
- Avoid areas with poor foundation characteristics	○	○	○	○	⊘	⊘	⊘
- Avoid areas with faults	⊘	⊘	⊘	⊘	⊘	⊘	⊘
- Avoid sites potentially exposed to seismic sea waves	○	○	○	○	○	○	○
- Minimize length of pipeline to marine terminal	○	○	○	●	⊘	⊘	⊘
- Maximize use of existing community infrastructure	⊘	●	⊘	⊘	○	○	⊗
- Avoid sensitive environmental habitat	⊘	⊗	⊘	⊘	⊘	⊗	⊗
- Public safety considerations	○	○	⊘	●	⊘	⊘	○
- Maximize value added industrial opportunities	⊘	●	⊘	⊘	○	○	⊗
- Minimize site preparation requirements	⊘	⊘	⊗	⊘	○	○	○
Marine Terminal Critieria							
- Minimize exposure to extreme oceanographic conditions	○	○	○	○	⊗	⊗	⊗
- Minimize distance from shore to 60' MLLW depth	○	○	○	⊗	⊘	⊘	⊘
- Maximize suitability of tanker maneuvering and anchorage area	○	○	○	⊗	⊘	⊘	⊘
- Minimize potential hazards to navigation	○	⊘	○	⊗	⊗	⊘	⊘
- Minimize potential problems related to soils and geohazards	○	○	⊗	⊗	○	○	○
- Minimize threat to national security	⊘	⊘	⊘	⊘	⊘	⊘	⊘

○ Favorable
⊘ Moderately Favorable
⊗ Unfavorable
● Highly Unfavorable

1.9.4.3 Gravina

For the pipeline from Livengood to the site, Gravina was rated as unfavorable for use of proven technology, geohazards, land-use compatibility, and permitting. All of these factors were related to the segment of the route from Keystone Canyon through the Chugach Mountains, including 15 miles of routing through the Chugach National Forest. Though operation of a marine terminal at the site had no serious drawbacks for the LNG facility, Gravina was considered to be highly unfavorable with respect to infrastructure for construction and operation of the facility and potential benefits that might be derived from secondary developments in the vicinity of the plant. The Gravina site has numerous distinct disadvantages compared to the proposed Anderson Bay site and ***was*** eliminated from consideration.

1.9.4.4 Gold Creek

The Gold Creek site rated as favorable or moderately favorable for nearly all evaluation criteria. The final segment of the pipeline alignment, near Robe Lake and around the outskirts of the city, was not as favorable as that of the proposed project. The last 3 miles along the west shore of Port Valdez would be in steep side hills, which would result in difficult construction, movement of large volumes of material, and a broad visual scar along the mountainside. The LNG plant site would require extensive excavation and would pose the added problem of disposing of a large volume of spoil from the site. Use of the Gold Creek site would negatively affect potential expansion of the city and recreational use of the Gold Creek area and would require major site work and spoil disposal. Although the rating of the Gold Creek site was similar to the proposed Anderson Bay site, it ***has more difficult access to the site and site preparation was not as favorable as*** the proposed TAGS project and was eliminated from further consideration.

1.9.4.5 Robe Lake

Although the Robe Lake alternative would result in the shortest pipeline among Prince William Sound alternative, consideration of the LNG site and the associated marine terminal facility immediately highlight the major concerns with this alternative. Land that would be needed for the LNG facility is in the midst of residential and recreational use areas. Major site work would be required, resulting ***in*** impacts on aesthetics, interference with recreational use, and even removal of the parcel of land available for residences or recreation. ***Although*** the safety record for LNG plants is excellent, should a catastrophic accident or spill occur, this site would be the worst among the TAGS alternatives in terms of potential impact to public safety. Further, the distance from the LNG plant site to the shoreline and the distance from shore to water deep enough for tanker maneuvering and berthing combine to require a 5-mile cryogenic loading pipeline from the plant to the LNG tanker loading area. The engineering and cost of such a line would make it nearly unfeasible. The location of the berthing and maneuvering area within the harbor has disadvantages with respect to navigational safety, and the submarine soils in this region of the harbor are not favorable for development. Overall, the Robe Lake site should be eliminated from consideration.

1.9.5 Summary

Neither of the Cook Inlet alternatives to Cape Starichkof nor Harriet Point offers engineering, environmental, cost, or safety advantages over location of a facility at Boulder Point. The cost, time, and additional impacted area associated with the Cape Starichkof and Harriet Point sites make them less desirable options and therefore eliminated from further consideration.

Of the three alternatives considered for the Prince William Sound region, Gold Creek is the only one that appears comparable to ***but not better than*** the proposed Anderson Bay site. However, due to the extensive earthwork required for the LNG plant site and the associated spoil disposal requirements, the difficult pipeline constructability for the last 3 miles to the site, and the greater negative impacts on city of Valdez recreational use and potential future expansion, this alternative offered no overriding advantage over the proposed project at Anderson Bay.

Additionally, the no-action alternative was considered. This option would foreclose the potential to market North Slope natural gas in the Pacific Rim markets.

1.10 INTENDED USE AND PURPOSE OF EIS

The TAGS project would proceed in four distinct phases:

- Phase I - Prefeasibility Study
- Phase II - Design *Criteria* and Permitting
- Phase III - Detailed Design and Construction
- Phase IV - Startup and Operations

The Phase I prefeasibility study *will be completed when the BLM and State of Alaska issue right-of-way authorizations and the USACE issue a tiered permit processing procedure.*

Phase II, anticipated to require three years, would focus on the increased level of TAGS project design definition and compliance with the various federal and state regulations to secure permits to proceed with the project. The key evaluations and decisions associated with TAGS are: the preparation of the EIS, federal authorizations based upon the EIS including *BLM and USACE authorizations,* ERA approval of the export of North Slope natural gas, *FERC approval of the place of export, and* state authorizations. *More specific tasks would be tiered in subsequent steps.*

Federal and state authorizations to proceed based on site-specific detailed engineering information *would be* developed by YPC during *Phase III.* YPC would appoint a project management team or project management contractor to manage and perform necessary Phase *III* activities so that permit acquisition could be completed.

This phase is expected to last four to five years. YPC would complete the detailed design and engineering and construct the project. *Thus, the major right-of-way authorizations, the USACE authorization, and the natural gas export approvals would be required by YPC prior to completion of detailed design engineering, design approval, and subsequent authorization to proceed with construction.*

Phase IV, startup and operation, is expected to occur during the fifth construction year. As presently envisioned, operations would be scheduled to begin the last quarter of 1995. Figure 1.1-1 presents the anticipated project schedule.

In accordance with NEPA guidelines, the authorization to construct and operate the proposed TAGS project requires the completion of an EIS which adequately addresses the significant issues raised during the scoping process, alternative means of achieving the proposed project's objectives, *and* adequate assessment of the potential effects of the proposed project. *The DEIS was* circulated for formal review and comments to the public as well as various agencies for a 60-day review period, *which ended November 20, 1987.* Comments to the DEIS *were* submitted in writing. Opportunity to give oral comments *was* provided by public meetings during the review period. All comments, both oral and written, *are* evaluated and individually addressed in the FEIS *in Section 7.0.* The FEIS will be circulated, *followed by* a formal public Record of Decision (ROD) *that* identifies the permit decision made, the alternatives considered, and any mitigation, monitoring, and other means to avoid or minimize environmental impacts *will be prepared following issuance of the FEIS.*

This *FEIS* document will serve as the basis for NEPA compliance by the DOE for ERA's decision under Section 3 of the Natural Gas Act *and for the FERC's approval of the place of export. The FEIS also will serve as a basis for a* land use permit by the U.S. Forest Service for the safety area around the LNG plant at Anderson Bay *should the buffer area not be completely transferred to State ownership.*

The Conceptual Gas Conditioning Facility (CGCF) needed to supply LNG quality natural gas to TAGS has a high level of uncertainty with design and operating characteristics. Prior NEPA and PSD evaluations for the ANGTS Sales Gas Conditioning Facility are not necessarily transferable and may not be appropriate to what may be ultimately constructed for either ANGTS or for TAGS.

Accordingly, the air quality analysis for the CGCF must be deferred to a future NEPA review (EPA, June 1988).

1.11 PROCESSING OF BLM and USACE AUTHORIZATION

Congress reserves a minimum 60-day review period for any BLM decision on a major pipeline right-of-way.

If issued, the BLM's right-of-way grant would contain general and technical stipulations. Should the right-of-way grant be signed, YPC would submit a detailed construction and use plan to the designated federal authorized officer for review by the agency. The construction and use plan would be developed for federal lands in accordance with applicable federal regulations contained in 43 CFR 2882.2-4(c), designed for the management of oil and natural gas pipelines and related facilities. At a minimum the plans would include:

- Schedules for construction of the pipeline and all related facilities and estimated construction costs;

- Plans for protection of the environment during construction, operation, maintenance, and abandonment of the pipeline;

- Plans for emergency repair of any rupture during operation, containment of effluent, and restoration of damage.

Likewise, the USACE would use the FEIS to help in its decision to approve or disapprove the proposed TAGS project. USACE would first deal with the design concept and project alignment alternatives only. Construction work would not be authorized until such time as the second tier of review and approval takes place. This would consist of approval of specific civil engineering design for the proposed TAGS project. See Appendix M for a detailed explanation of the proposed USACE Tiered Processing Procedure. ***The approval for the USACE Tiered Process Procedure would occur prior to the signing of the USACE's Record of Decision.***

The State of Alaska would act on the grant right-of-way lease under state regulations. A FEIS is not a prerequisite to right-of-way grants in the state.

BLM and the USACE in consultation with other state and federal agencies would also conduct an environmental and engineering review of the construction and use plan. Following this review and determination by the authorized officer that preconstruction mitigation measures have been completed, a Notice-to-Proceed (NTP) would be issued. Only then could construction begin. ***In order not to oversimplify the NTP process, it is important to understand that there would be multiple NTPs issued over the period of construction. The review process for the NTPs is based on a technical and environmental review.*** The federal authorized officer would inspect and monitor construction to ensure compliance with the NTP and all stipulations. Additional environmental analysis and NEPA compliance would be performed as necessary.

Subsequent to the requirements covered by the EIS process, but prior to construction of the proposed TAGS project, YPC and TAGS would have to comply with various approval requirements for federal and state permits. To the extent known, authorizing permit actions and responsible agencies are listed in Table 1.11-1. ***Additionally, a series of cooperative agreements have been identified and preliminary discussions on several have been initiated; these include cooperative arrangements between the BLM and OIF, the SHPO and the USACE, BLM, and YPC, and DOT Office of Pipeline Safety, Alaska Department of Natural Resources, and YPC. None of these agreements have been concluded as of yet.***

Table I.II-1 Authorizing Agencies

Agency	Nature of Action	Project Features	TAGS[1/] Project Phase
FEDERAL			
Department of Agriculture			
Forest Service	Special-use permit for construction	Buffer zone for LNG terminal (these lands have been identified as suitable for selection and ownership transfer to the state of Alaska)	II
Department of the Interior			
Bureau of Land Management	Federal right-of-way grant	Pipeline, access roads, materials sites, compressor stations, and communication sites	II
	Temporary use permits	Construction staging areas, material sites, and fly-in and other camps	III
	Special use permits	Materials sites, access roads, solid waste disposal sites, and permanent camps	III
	Cultural and paleontological resource-use permits for survey and excavation	BLM-managed federal land	II & III
	Competitive mineral materials sales contract	Aggregate for project construction and operation and maintenance	III
Fish and Wildife Service	Biological Opinion on threatened or endangered species of fish, wildlife, or plants as part of Section 7, Endangered Species Act, for all federal actions	All project features	II & III
	Implement provisions of Fish and Wildlife Coordination Act	Impacts to marine, aquatic, and terrestrial resources	II, III & IV
Bureau of Indian Affairs	Trust responsibilities for Native allotments	TAGS use of Native allotments	III
Federal Energy Regulatory Commission	Approve place of export	Anderson Bay - LNG Plant	II
Department of Energy			
Economic Regulatory Administration	Authorization to export natural gas under Section 3 of the Natural Gas Act	Foreign sales of LNG	II
Office of Federal Inspector	Reorganization Plan No. 1 of 1979 gave the Federal Inspector "exclusive reponsibility for enforcement of all federal statutes relevant in any manner to the preconstruction, construction, and initial operation" of ANGTS.	Compatibility determination; review and approval of designs, plans, and schedules; and enforcement of provision and requirements of TAGS right-of-way when it is on or adjacent to ANGTS.	II, III & IV
Department of Defense			
Army Corps of Engineers	Permit(s) (Section 404) for placement of dredged or fill material in waters of the United States or adjacent wetlands	Pipelines, material sites, fly-in camps, permanent camps, access roads, lay-down areas, compressor stations, terminal, and solid waste disposal sites	II & III
	Permit(s) (Section 10) for structures or work in or affecting navigable waters of the United States	Water diversion facilities and construction resulting in alterations to water courses; pipeline crossings, Anderson Bay berthing facilities	II & III

1/ Project phase distinction: Phase I - Prefeasibility Study; Phase II - Design Definition and Permitting; Phase III - Detailed Design and Construction; Phase IV - Startup and Operations.

Table I.II-I (continued)

Agency	Nature of Action	Project Features	TAGS[1/] Project Phase
Federal Communications Commission	Issue license to operate industrial radio service	Communications	III
Department of Transportation			
Coast Guard	Approves operations manual	Marine terminal and berthing facilities in Port Valdez	IV
	Permit (Section 9) for bridge crossings of of navigable waters including requirements of Section 4(f) public recreation areas*	Temporary and permanent bridges over navigable waterways	III
Highway Administration	Non-objection to cross federal-aid highways	Pipeline and access roads	III
Office of Pipeline Safety	LNG siting permit, pipeline safety standards	LNG plant site at Anderson Bay, crossings of TAPS and authorized ANGTS	III
Environmental Protection Agency	Issue NPDES permit(s) to discharge wastewater	Any discharge of hydrostatic test water, discharge from tank storage facilities, LNG wastewater discharge, compressor station wastewater discharge, campsite wastewater discharge	III
	Review air quality and water quality screening evaluations	LNG Plant, terminal and compressor station	II
	Review Oil Spill Contingency Plans and Spill Prevention, Containment and Countermeasure Plans	Pipeline, terminal, and berthing facilities	IV
	Establish national PSD increment for NO_2	Air quality authorizations by ADEC	II, III, IV
Department of Commerce			
National Marine Fisheries Service	Biological Opinion on threatened or endangered marine mammals as part of Section 7, Endangered Species Act, for all federal actions; implement provisions of Fish and Wildlife Coordination Act; Marine Mammal Protection Act	Marine terminal at Anderson Bay	II & III
Advisory Council on Historic Preservation	Consultation on cultural sites	All project activities	II & III
STATE OF ALASKA			
Governor's Office of Management and Budget, Division of Governmental Coordination	Coastal Zone Management Consistency Determination	Pipeline and related facilities and the Anderson Bay LNG plant site	III
Department of Natural Resources	Grant right-of-way lease	Pipeline right-of-way, pipeline related facilities, LNG plant site, and marine terminal at Anderson Bay	II
	Right-of-way permit	Access roads to certain use areas	II & III
	Water rights	Pipeline right-of-way, LNG plant site, and marine terminal at Anderson Bay	III
	Tidelands lease	Anderson Bay LNG plant/marine terminal	II & III
	Land-use lease and use of dedicated park lands	Pipeline, LNG terminal site, material sites, campsites, communication sites, and solid waste disposal sites	II & III
	Competitive mineral material sale contracts	Aggregate for project construction and operation	III
	Consistency with state land-use plans - Tanana Valley, Copper River	Pipeline	II
	Material sale contract	Material sites	II & III
	Negotiated or competitive lease	Other permanent facilities	II & III

Table I.II-I (continued)

Agency	Nature of Action	Project Features	TAGS 1/ Project Phase
Department of Natural Resources (continued)			
	Land use permit	Temporary use (up to I year)	II,III & IV
	Water appropriation permit/temporary water use permit	Water use	II,III & IV
	Archaeology permit/cultural resources clearance	Field investigation activities/project authorization	II & III
Department of Fish and Game	Title 16 fish habitat permits	Project activities affecting fish-bearing waters	III & IV
	a. Anadromous fish waters	- Use of any wheeled or tracked equipment; - Placement, excavation, deposition, disposal, or removal of any material; - Use of log-dragging equipment; - Construction of a permanent or temporary crossing including a bridge, ice bridge, culvert, or constructed low water crossing (ford); - Use of rocks, cribbing, sheet piling, or other material to stabilize the bank; - Construction of a river training structure including spur dikes reventment, or guidebank; - Blasting or use of explosives; - Any action which may result in a diversion; withdrawal, alteration, obstruction, impoundment, or pollution of anadromous fish waters;	
	b. Streams frequented by fish	- Construction of a dam or impoundment; - Installation of culverts; - Construction placement, deposition, or removal of any material or structure including instream cross channel structure below ordinary high water; - Diversion or alteration of natural wate-flow;	
	Scientific collection permit	Zoological research programs in which working with animals might result in harassment and/or the need to handle or collect animals	
	Fish and Wildlife Coordination Act Reviews	Placement of fill in waters of the U.S.	II,III & IV
	Special Area Permits	Activities in State refuges, sanctuaries, and critical habitats	III & IV
Department of Environmental Conservation	PSD or other air quality permits	LNG plant and marine terminal; compressor stations	II, III, IV
	Food service permits	Camps and other occupied facilities	II,III & IV
	Drinking water plan review	Camps and other occupied facilities	III
	Solid waste disposal permit	Solid waste disposal sites	III
	Wastewater disposal permit	Hydrostatic test water, test fluids, domestic waste	III
	Spill contingency plan	At locations where fuel is stored	III & IV
	Certificate of Reasonable Assurance (water quality)	Placement of fill in waters and wetlands of the United States; discharge of waste-waters into waters of U.S.	II,III & IV
	Short-term variances	Pipe burial at river crossings; fill placement in Anderson Bay	III

Table I.II-I (continued)

Agency	Nature of Action	Project Features	TAGS[1/] Project Phase
Department of Environmental Conservation (continued)			
	Oil and Hazardous Substances Pollution Control (Permit)	Surface oiling for dust control	III & IV
	Pesticide Control Licensing	Applicator License Applying Pesticides	II,III & IV
	Air Quality Control Permit to Operate	Incinerators greater than 1000 lb/hr fuel burning equipment, greater than 100 MM BUT/hr or greater than 10,000 HP or 9000 KW gravel dryers, rock crushers	II,III & IV
	Water/wastewater Operator Certification	Water/wastewater treatment facilities at camps, terminal, compressor stations	II,III & IV
	Hazardous waste disposal	Radiographic waste, oily water	III & IV
	Open burning permit	Land clearing materials for projects exceeding 40 acres	III & IV
Department of Transportation and Public Facilities	Encroachment permits	Pipeline and facilities located in existing highway rights-of-way	III & IV
	Utility permits	Pipeline crossing of highways including power lines and related TAGS utilities	III & IV
	Traffic operations permits	Heavy and over-sized loads, detours, road closures, and scheduling joint highway/TAGS construction	III & IV
LOCAL GOVERNMENTS			
North Slope Borough	Land-use permits	General project	III
Fairbanks North Star Borough	Land-use, flood hazard, utility and conditional use permits and easements	General project	III
City of Valdez	Land-use permits	General project	III
	Development Permit (for portions of project within coastal zone, but outside port), Federal Consistency Certification, Port Master Plan Amendment, Development Permit, and port development permit appeals	Activities within the coastal zone for development permit and/or Port Master Plan Amendment	II & III

SECTION 2
DESCRIPTION OF THE PROPOSED ACTION AND ALTERNATIVES

SECTION 2.0 DESCRIPTION OF THE PROPOSED ACTION AND ALTERNATIVES

2.1 INTRODUCTION

This section describes the proposed Trans-Alaska Gas System (TAGS) project for the transportation of natural gas from Alaska's North Slope via a 36-inch outside diameter (OD) pipeline to a tidewater facility at Anderson Bay, Port Valdez, Alaska. At Valdez, the natural gas would be converted to liquefied natural gas (LNG) for ocean transport to markets in the Asian Pacific Rim.

The following subsection details the components of the proposed TAGS project and the construction, operation, maintenance, and abandonment phases of the proposed project.

2.2 TAGS PROJECT

Yukon Pacific Corporation (YPC) proposes to construct the TAGS. The system would consist of the following major components: a 796.5-mile, 36-inch OD, buried pipeline system with a design capacity of 2.3 billion cubic feet of natural gas per day (*BCFD*), 10 compressor stations, an LNG plant, and a marine loading terminal. Estimated cost for the TAGS project is $10 billion. The lands that would be directly affected by the construction and operation of the project are primarily under the control of the federal and state governments. A federal right-of-way grant from the Bureau of Land Management (BLM) to traverse federal lands and a state right-of-way *lease* by the Alaska Department of Natural Resources must be approved. An export license also is required from the ERA.

Additional details on the TAGS proposal are available in the right-of-way application that has been filed with the BLM and in the permit applications to the U.S. Army Corps of Engineers (USACE). These documents are available for public review at the BLM's Alaska State Office in Anchorage; BLM's Support Center, Fairbanks; BLM's Washington, D.C. office; and at the USACE, Regulatory Branch, Elmendorf AFB, Anchorage.

2.2.1 Overview of Project Components

The proposed TAGS project components are discussed with reference to the system block flow diagram provided in Figure 2.2.1-1.

Natural gas would be provided to the TAGS pipeline at Prudhoe Bay via existing or a newly authorized gas conditioning facility *(GCF) as conceptually described in subsection 2.2.1. The construction and operation of the conceptual GCF is not part of the TAGS application, but it is a connected action and identified in this EIS.*

YPC conducted an evaluation and located a potential site for the conceptual GCF near Drill Site No. 7 (Figure 2.2.1-2). The conceptual GCF could be located in the several miles south of the area identified for the stand-alone ANGTS Alaska gas conditioning facility (ANGTS-AGCF) evaluated in the FEIS prepared by FERC in July 1980 [construction and operation of a Sales Gas Conditioning Facility (SGCF)[1/] at Prudhoe Bay, Alaska, FERC/EIS 0009] and the existing Central Compression Plant (CCP). The GCF would remove carbon dioxide (CO_2) and a portion of the heavier hydrocarbons from the natural gas. CO_2 would be reinjected into the Prudhoe Bay fields to enhance oil recovery; whereas heavier hydrocarbons might be transported through TAPS as NGLs or reinjected back into the Prudhoe Bay oil field reservoirs.

Support facilities for the conceptual GCF would include gas turbine-driven electric power generators, an emergency diesel-fueled generator, four 1,000-barrel NGL storage tanks, a hydrocarbon waste product system, a fire protection system, and a high-low pressure flare system. Buildings required for the conceptual GCF administration and operation include an administration building, dormitory modules, an office and dining building, an elevator tower, a multistory shop complex, vehicle storage building, a warehouse, and an incinerator building. The conceptual GCF may be able to utilize existing support facilities without requiring new facilities to be constructed.

The ARCO's Central Gas Facility (CGF) is located several miles north of the conceptual GCF site, adjacent to the site approved for the ANGTS-AGCF. It is the world's largest capacity natural gas processing plant and handles all natural gas produced in the Prudhoe Bay complex after it is separated from the oil to be delivered to TAPS. The CGF started operation in late

1/ Later known as the AGCF by ANGTS.

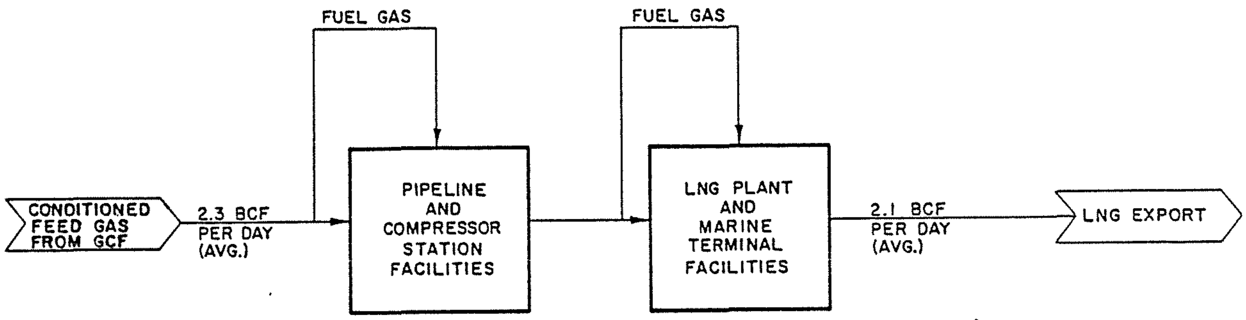


Figure 2.2.1-1 Trans-Alaska Gas System Block Flow Diagram

December 1986 and has slightly exceeded its design capacity to process 3.3 BCFD of natural gas. The CGF performs three jobs: 1) separates natural gas liquids (NGLs) and returns almost all residue natural gas for subsequent reinjection into the gas cap (some of the residue natural gas is used to supply fuel for the operation of the Prudhoe Bay facilities); 2) separates NGL into a stabilized component for addition to the oil transported in TAPS; and 3) ***produces*** a blend of liquids used for enhanced oil recovery. ***All facilities to transport the natural gas to the TAGS pipeline are in place with the exception of the conceptual GCF and associated facilities including a connection to the existing CGF.***

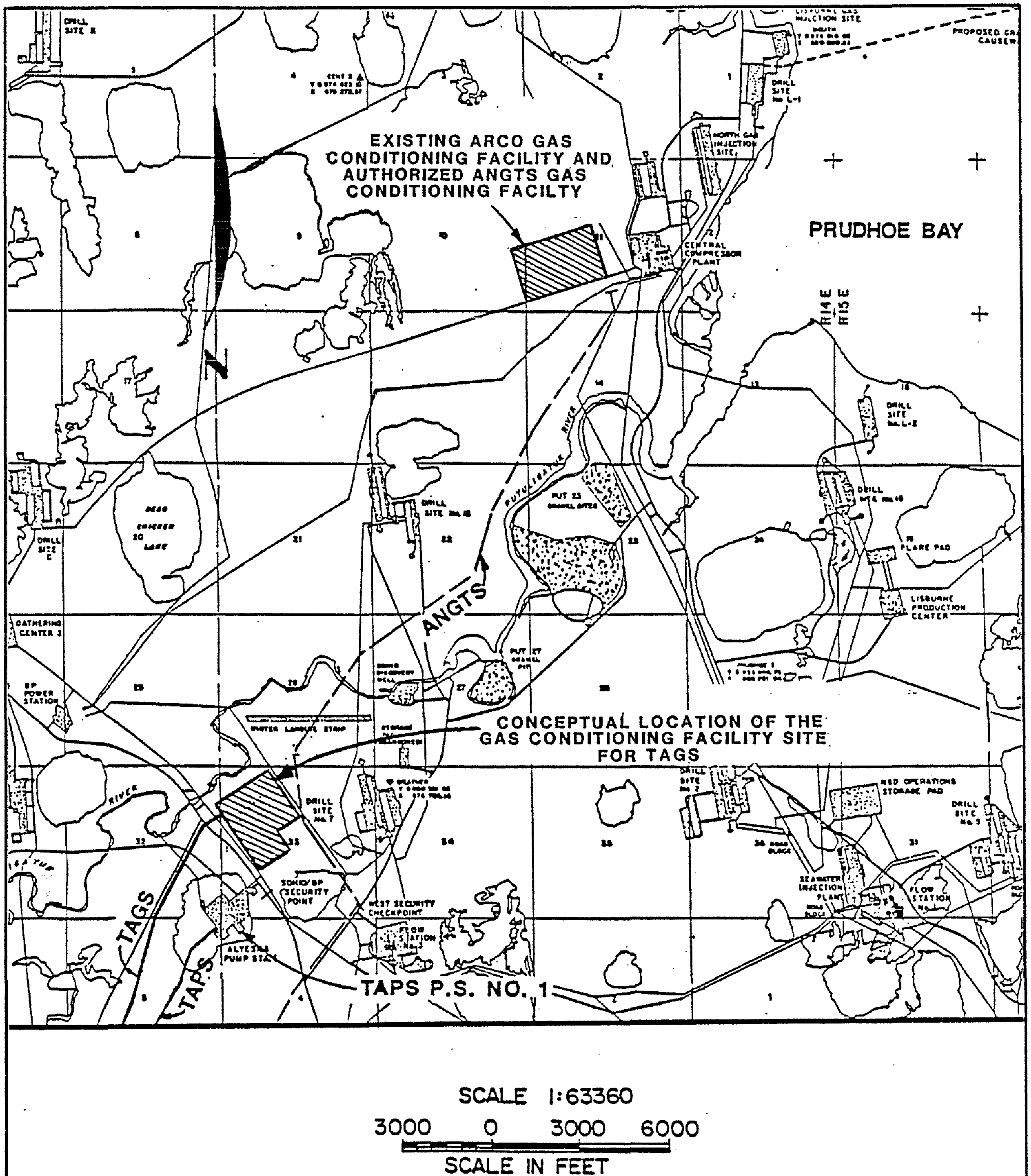
An evaluation considering the cumulative effects of the ANGTS-AGCF and the CGF concluded that a gas conditioning facility could be built and operated with minimal cumulative effects to air quality.

An average of 2.3 BCFD of conditioned natural gas would be proposed for transportation through the pipeline system from Prudhoe Bay to the LNG plant and marine terminal facilities at Anderson Bay near Valdez. Approximately 0.2 BCFD of natural gas would be utilized by the compressor stations along the pipeline and at the LNG plant facilities during the conversion of the natural gas to LNG. Thus, approximately 2.1 BCFD of LNG equivalent would be available to load onto tankers for export to Pacific Rim markets.

In addition to these major components, other temporary and permanent project components are essential for such a major project to be constructed in Alaska. Specifically, construction workpads adjacent to the pipeline ditch, access roads, 26 construction camps at compressor stations and for pipeline construction, material storage yards, and the upgrade of five existing airfields would be required. Table 2.2.1-1 estimates the area of disturbance for construction and operation of the proposed project ***and does not include those already disturbed areas, such as campsites, and airfields, to be used by TAGS. An additional 2,700 acres of undisturbed land would be required in the vicinity of the Anderson Bay LNG Facility for a buffer zone. This buffer zone would remain substantially in its existing natural condition.***

2.2.1.1 ***Conceptual Gas Conditioning Facility - Prudhoe Bay***

Although the conceptual GCF is not part of the TAGS application, it is a connected action and is identified in this EIS. The



NOTE : 1. ANGTS facilities have not received state approvals and all federal authorizations are not complete.

2. New figure in FEIS.

Figure 2.2.1-2. Conceptual Location of the Gas Conditioning Facility at Prudhoe Bay conceptual GCF would condition the natural gas by removing carbon dioxide and a portion of the heavier hydrocarbons. The natural gas would then be delivered to YPC at the proper operating temperature and pressure for transportation through the pipeline to Compressor Station No. 1.

Table 2.2.1-1
Estimate of the New Disturbed Area Required for Facilities

	Construction (Acres)	Operation (Acres)
Gas Conditioning Facility (conceptual)	300 1/	300 1/
Pipeline	14, 473	5,114
Ten Compressor Stations	278	200
Access Roads	430	430
Temporary Camps and Storage Yards	730	255
Air Strips	144	0
River Crossing Extra Work Space	55	20
Communication Sites 2/	6	6
Spoil	700	80
Construction Material Sites and Access Roads	5,800	1,740
LNG Facility	300	280
Total Area Disturbed	23,216	8,425

1/ The 300-acre worst case is based on the information in FERC (1980). Since FERC (1980), ANGTS has scaled down the plant size to less than 200 acres due to their ability to use recently constructed facilities at Prudhoe Bay and a process change.

2/ This includes an estimate of acreage should it not be possible to co-locate communication site at existing TAPS sites.

Two alternative processes are available for the GCF. These include chemical absorbent processes and physical absorbent processes. Both types of processes could be used at the conceptual GCF. Chemical absorbent processes involve the formation of weakly bound chemical reaction products between carbon dioxide and an amine in water solution. The carbon dioxide is desorbed by increasing temperature.

Physical absorbent processes consist of an organic solvent that physically absorbs carbon dioxide. The carbon dioxide is desorbed by reducing the pressure. This method consumes less energy than desorption by heating, as is done in the chemical absorption processes. Several organic solvents are available. These solents were considered for use in the 1980 Prudhoe Bay Project, Final Environmental Impact Statement (FERC/EIS 0009). SELEXOL initially was selected for ANGTS as the most appropriate process. This process was later proposed to be replaced by a BASF Activated MDEA process because of increased efficiency and reduced cost of the facility. To date the ANGTS BASF facility has not completed required federal permitting and no state authorizations have been obtained.

There is substantial uncertainty about the ultimate process and plant configuration for the conceptual GCF. Prior NEPA evaluations and the expired PSD for the ANGTS-AGCF are deemed by EPA as not appropriate for use in this EIS since prior air quality analyses are not necessarily transferable to TAGS. Accordingly, EPA has recommended that air quality analysis for the conceptual GCF be deferred to a future NEPA review (EPA, 1988a).

The conceptual GCF and associated facilities will be designed to condition approximately 2.3 BCDF of natural gas, the design capacity of the proposed pipeline. Assuming a worst case scenario, an area approximately 300 acres in size and 2.7 million cubic yards of gravel would be required to build a stand-alone gas conditioning plant capable of processing the volume of LNG quality natural gas needed for TAGS. With the addition of the CGF of ARCOs, it is reasonable to estimate that a 200-acre site and 2 million cubic yards of gravel would be larger than needed to complete the conceptual GCF necessary for TAGS. For example the size and amount of gravel needed in the ANGTS-AGCF was reduced from 287 to 200 acres and from 2.7 to 1.79 million cubic yards.

The GCF would receive natural gas flowing through the CCP and CGF that is presently being reinjected back into the oil-producing formation. The conceptual GCF would consist of four identical extraction trains consisting of the following elements:

- *a low temperature separator to remove entrained liquid hydrocarbons from the feed gas received from the CCP*

- *A treating unit to remove CO_2*

- *Mechanical refrigeration for precise temperature control of hydrocarbon dewpoint.*

- *A train to reblend liquids to increase BTU value of natural gas for pipeline quality.*

The ownership of the conceptual GCF needed to produce pipeline quality natural gas for TAGS would be determined by the North Slope producers, YPC, and the State of Alaska.

2.2.1.2 Pipeline

The proposed TAGS pipeline would extend from Prudhoe Bay to Anderson Bay near Valdez, Alaska, for a distance of 796.5 miles. The proposed TAGS pipeline is generally aligned with the already constructed TAPS with deviation to the west on the North Slope and in the Galbraith Lake and the Fielding Lake-Summit Lake areas. A single 36-inch OD, welded steel pipeline would be constructed to transport an average of 2.3 *BCFD* of conditioned natural gas at maximum operating pressures of 2220 pounds per square inch (psi). The pipeline would be installed in a buried mode with chilled operation where soil conditions are favorable for long-term operation. At certain river and fault crossings where below-ground construction would not be feasible, the pipeline would be above ground, and special design would be required. Based on preliminary evaluation without site-specific geotechnical data, refrigeration would be assumed to be required at compressor station Nos. 1 through 8. There would be a total of 10 en-route compressor stations. Figure 2.2.1-2 provides an overview of the pipeline route and compressor station locations. (Alignment Maps 1 and 2 at end of document present the route and major facilities.) *As shown in Table 2.2.1-1, approximately 22,910 acres would be disturbed during construction including the 100-foot pipeline construction right-of-way, and 8,119 acres would remain in use during operations including the 50-foot operational right-of-way for the pipeline.*

The proposed TAGS pipeline route alignment would begin at Prudhoe Bay, immediately downstream from the gas conditioning facilities and proceed south, generally within the utility corridor of the Trans-Alaska Pipeline System (TAPS) and the authorized Alaska Natural Gas Transportation System (ANGTS) *which included unappropriated BLM lands and certain military reservations.*

The proposed TAGS pipeline facilities would be designed and constructed in compliance with the Federal Pipeline Safety Regulations, 49 CFR 192, which are the prescribed minimum federal safety standards for the transportation of natural gas by pipeline. Pursuant to these standards, the proposed TAGS pipeline would be fabricated, using high-strength steel pipe designed with sufficient wall thickness and toughness to withstand operating pressures and any external loads that would be imposed after installation. The pipe metallurgical specifications would accommodate the range of temperature conditions that may be encountered over the life of the project. Based upon the proposed conceptual design, high-strength arctic-grade X-70 or X-80 grade pipe with yield strengths equal to or greater than 70,000 psi and 80,000 psi, respectively, and with pipe wall thickness of 0.793 to 1.430 inch or 0.694 to 1.250 inch, respectively, are under consideration. The wall thicknesses for the different pipe grades specified depend on class location and anticipated loads as identified in 49 CFR 192.5.

Using the best available arctic technology, site-specific design factors would be applied during the project design phases. For most of the proposed TAGS route, design factors for Class 1 location would apply. Corresponding pipe wall thickness would then be 0.793 inch or greater for X-70 grade pipe or 0.694 inch or greater for X-80 grade pipe. Heavier wall thickness pipe would be utilized where required for additional safety at road crossings, aerial river crossings, fabrication assemblies (block valves), or where geotechnical conditions (differential settlement, frost heave, seismic ground motion, fault displacement) or other conditions would warrant design for secondary loads.

The joining of line pipe for the proposed TAGS pipeline would be accomplished by welding methods that have been accepted for arctic use by the American Petroleum Institute and the American Society of Mechanical Engineers, as referenced by 49 CFR 192.225. Nondestructive X-ray testing of welds would be performed in accordance with 49 CFR 192.243.

Hydrostatic testing would be performed following the construction of each spread during the final summer. The pipeline would be subdivided into test sections with test manifolds located at each end of the test sections. ***Pipeline river crossings could require pretesting at the time of installation and thus could occur at any time of the year, depending on project scheduling.***

To meet the requirements for corrosion control prescribed in the Federal Pipeline Safety Regulations, the proposed TAGS pipeline would have cathodic protection facilities. Test stations for measuring pipeline electrical potential would be installed at 1-mile intervals along the pipeline route. Test stations would also be installed at all road, foreign pipeline, and river crossings. A test station would consist simply of a post with lead wires and terminal connections encased in a control box and conduit. The test wires would be attached to the pipeline.

In addition, the cited safety regulations also require the use of pipeline valves spaced along the route according to land use as identified in 49 CFR 192. Approximately ***fifty*** 36-inch mainline block valves of the American National Standards Institute 900 ball-types, equipped with gas/hydraulic operators, would be installed. Valve operations would be designed for remote operation and site-specific arctic operating conditions. In addition to those required to comply with the regulations, block valves would be installed upstream and downstream of critical facilities such as meter stations, compressor stations, several river crossings, and fault crossings to provide isolation capability.

2.2.1.3 Compressor Stations

Ten mainline compressor stations would be located along the TAGS route to provide the pressure boosts required for the transportation of conditioned natural gas. (The proposed milepost locations and horsepower sizes are identified in Table 2.2.1-2 and located on the Alignment Maps 1 and 2 at ***the end of the DEIS***.) Between 14 and 40 acres would be required for the construction of each compressor station. Compressor station locations were selected to satisfy both engineering and environmental concerns. Hydraulic studies were conducted to determine the optimal location of each station. A limited area of consideration was then selected for optimal system operating characteristics in regard to gas flow, elevations, temperature, pressure, and throughput. Consideration was also given to the rugged Alaska topography, highly variable geotechnical conditions, active hydrological conditions, and environmental sensitivities.

Table 2.2.1-2
Compressor Station Mileposts and Horsepower Requirements

Station No.	Milepost	Acres	Horsepower
1	66.5	40	18,400
2	125.6	30	20,500
3	213.7	30	18,700
4	280.9	30	16,900
5	357.0	30	20,500
6	421.0	30	18,400
7	486.4	30	14,700
8	562.3	30	20,300
9	639.2	14	21,100
10	720.5	14	16,800
		278	186,300

A plot plan for a typical ***5 or 10 compressor station configuration*** is shown in Figure 2.2.1-3. In addition to the compression equipment, which consists of a single, approximately 20,000-horsepower, turbine-driven, centrifugal compressor at each site, refrigeration equipment for cooling the gas, estimated at between 5,000- and 10,000-horsepower, turbine-driven compressors would be provided where chilled

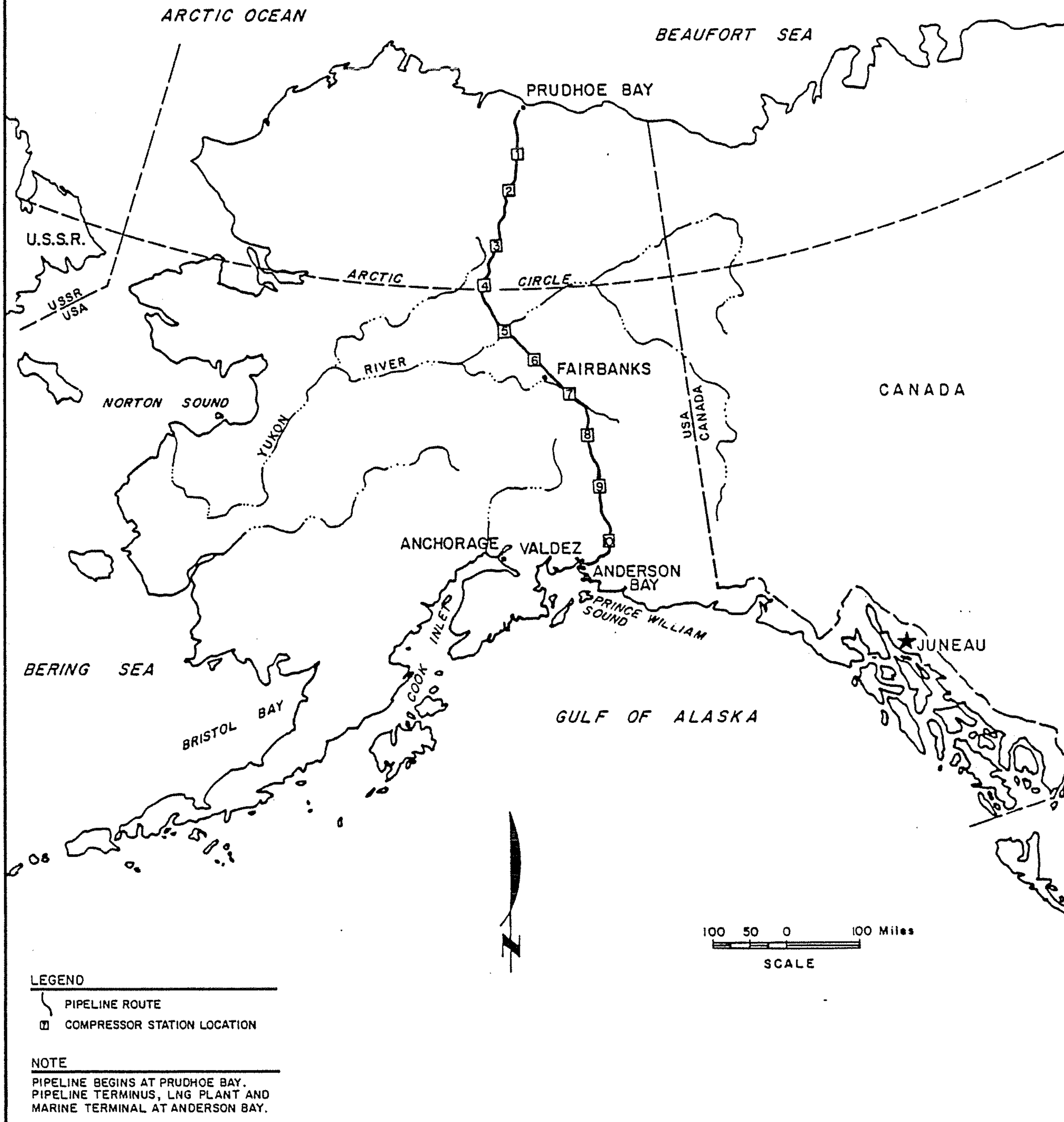


Figure 2.2.1-3 Trans-Alaska Gas System Facilities Location Overview Map

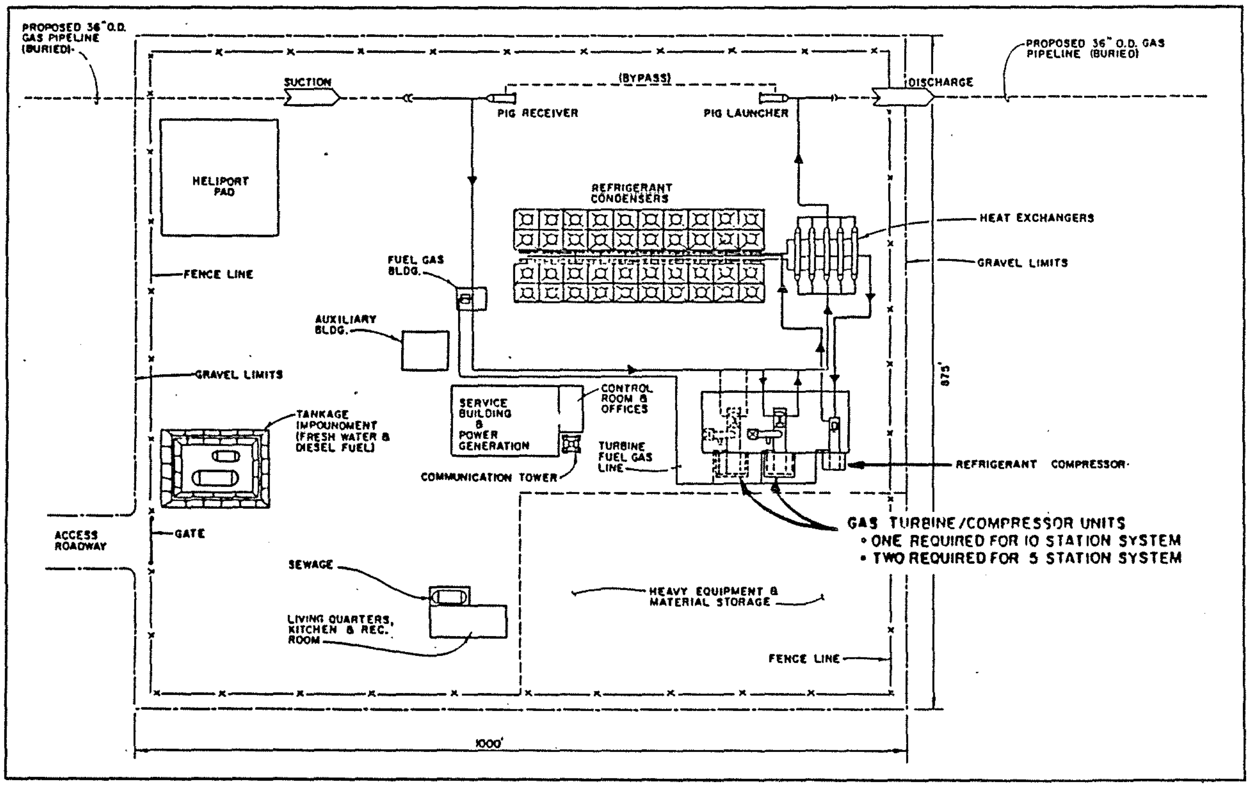


Figure 2.2.1-4
Plot Plan for Typical Compressor Stations Showing
Differences Between 5 and 10 Station Configurations

gas operations were required.[1] Two benefits would be derived from the gas chilling operation: the ground would remain frozen and capacity of the pipeline would increase. Both the gas compressors and refrigerant equipment would be driven by turbines using pipeline gas for fuel.

A five-compressor station optional systems design would be considered during detailed design. Such a design would require more total system horsepower to compensate for the effects of pressure drop over relatively long distances between stations. If it should be determined during final design that a five-station configuration would be feasible, then alternating (even-numbered) sites only would be used for station placement, with an average spacing of approximately 130 miles. Station compression equipment for this design would consist of twin tandem (in series) turbine-driven centrifugal compressor units of an estimated 50,000 horsepower at each site. Refrigeration requirements would vary, depending upon site-specific conditions. Where refrigeration is required, a 15,000- to 20,000-horsepower, turbine-driven compressor would be installed.

Refrigeration would be accomplished by compressing, condensing, and circulating an external refrigerant gas to chill mainline gas flowing through heat exchangers. Refrigerant gas, such as freon or propane,

[1] *Preliminary horsepower requirements for a 5-station option are included in response to Comment 22-6.*

would be supplied to compressor stations in vendor storage canisters.

Compressor stations would be provided with emergency shutdown systems to allow for shutdown, isolation, and venting of all station piping and equipment. Station block valves would be provided to isolate the station and piping from mainline gas while allowing flowing gas to bypass the station.

TAGS compressor stations would include all facilities necessary for stand-alone operation, including on-site utility systems for air supply, water supply, fuel storage, effluent treatment or holding tank as appropriate, electric power, emergency power, and glycol heating; maintenance facilities; communication facilities; living quarters for operations personnel; and a heliport.

2.2.1.4 Liquefied Natural Gas Plant

The LNG plant for the proposed TAGS project would be located at Anderson Bay, along the southern shoreline of Port Valdez at the terminus of the natural gas pipeline, as shown in Figure 2.2.1-4. At the proposed LNG plant, conditioned natural gas from the pipeline would be treated, liquefied, and stored in cryogenic tanks for loading on tankers at the proposed marine terminal for export. The proposed plant site would afford approximately 300 acres of developable land directly adjacent to the proposed marine terminal site, as shown in Figure 2.2.1-5. Topographic and geologic conditions at the site would allow the placement of critical facilities on bedrock foundations, well above the highest historical water level. In addition, ***based upon the LNG safety analysis conducted for the proposed facilities, the site location, 5 miles distant from the City of Valdez and existing infrastructure, would provide for safe operations to the public.***

A plot plan for the proposed LNG plant and marine terminal at Anderson Bay is shown in Figure 2.2.1-6. The major facilities at the proposed LNG plant site include metering facilities, four LNG process trains, four 800,000-barrel cryogenic storage tanks, and the LNG loading lines.

The conditioned pipeline natural gas would enter the LNG plant for initial treatment to remove moisture and impurities ***by passing through a series of driers and scrubbers.*** Feed gas impurities removed by driers and scrubbers would typically include particulates, dust, iron oxide, lubricant oils, and possibly some petroleum liquid condensates. Effluent from the dryer/scrubber system would be collected at a lift station, combined with other oily wastewater and pumped to the LNG plant/marine terminal's oil/water separator. This separator is designed to produce an effluent with less than 10 ppm oil. This effluent then would receive further treatment at the site's wastewater treatment plant. ***Once treated, the gas would proceed through the LNG process.***

The proposed LNG plant would consist of several air-cooled liquefaction trains operating in parallel. Each liquefaction train would produce LNG for transfer to special above-ground cryogenic storage tanks. The proposed total tank volume of 3,200,000 barrels would provide approximately five days of LNG storage at design production rates.

Insulated, double wall, suspended roof, above-ground tanks would be used. A typical LNG storage tank is shown in Figure 2.2.1-7. To store the LNG at -259°F, metallurgy for tank construction would include a nickel alloy steel or aluminum alloy inner tank with a carbon steel outer shell. The complete tank foundation including the ring-wall base would be electrically heated to prevent frost bulb growth. The storage tank area would be surrounded by an impoundment system to contain any accidentally spilled LNG. Basically, the impoundment system would consist of reinforced concrete walls, reinforced earth walls, and excavation of bedrock (or a similar containment structure). Conceptual design has involved the consideration of a combined reinforced earth, reinforced concrete, and rock excavation system.

The LNG loading system would be designed to transfer LNG product from onshore storage tanks to LNG tanker vessels berthed at the marine terminal facility. Transfer piping would be sized for the system to load two tankers simultaneously in a 12-hour period.

Plant utility systems would include storage and distribution systems for fuel gas and diesel fuel, a generation and

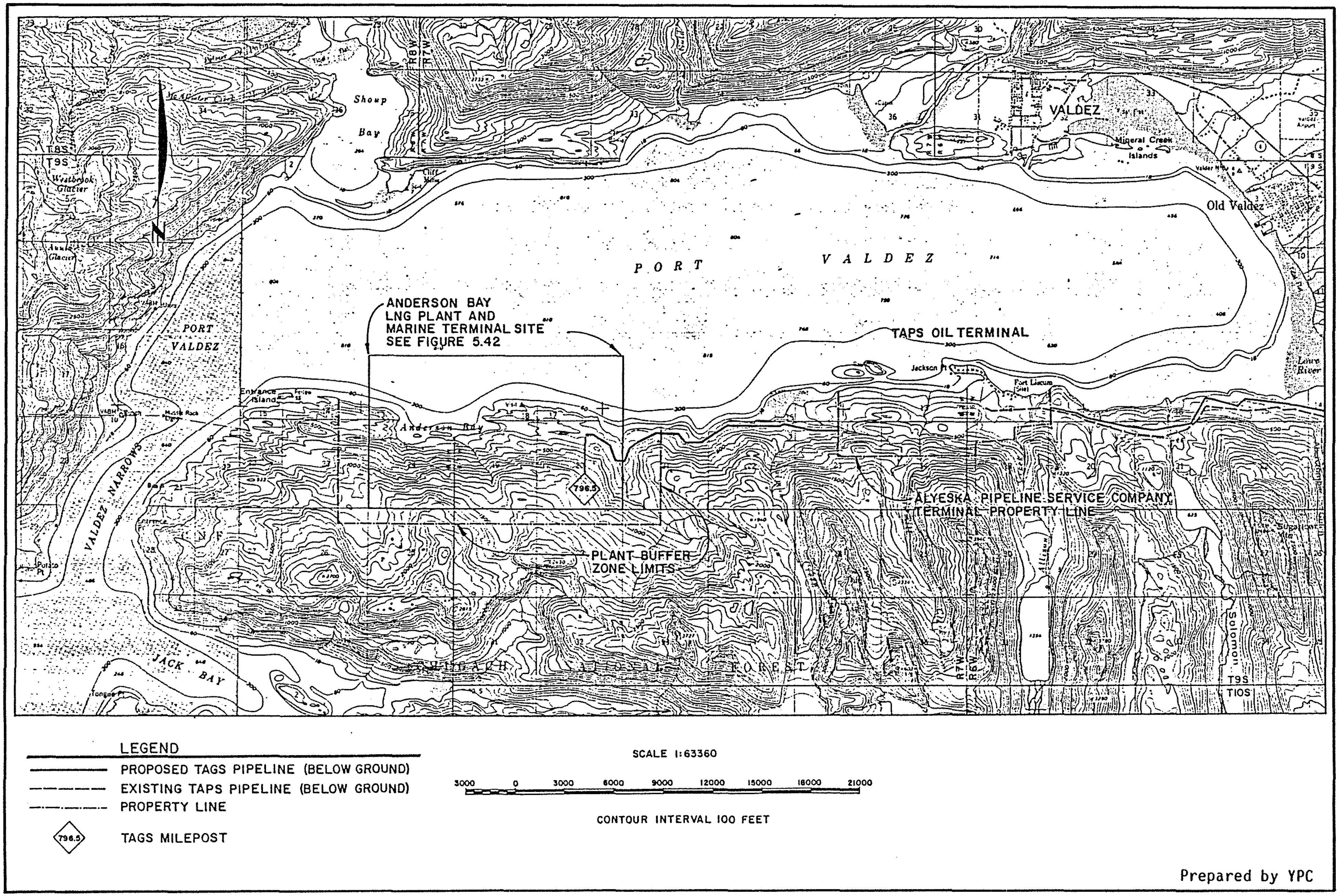


Figure 2.2.1-5. LNG Plant and Terminal Site at Anderson Bay in Port Valdez

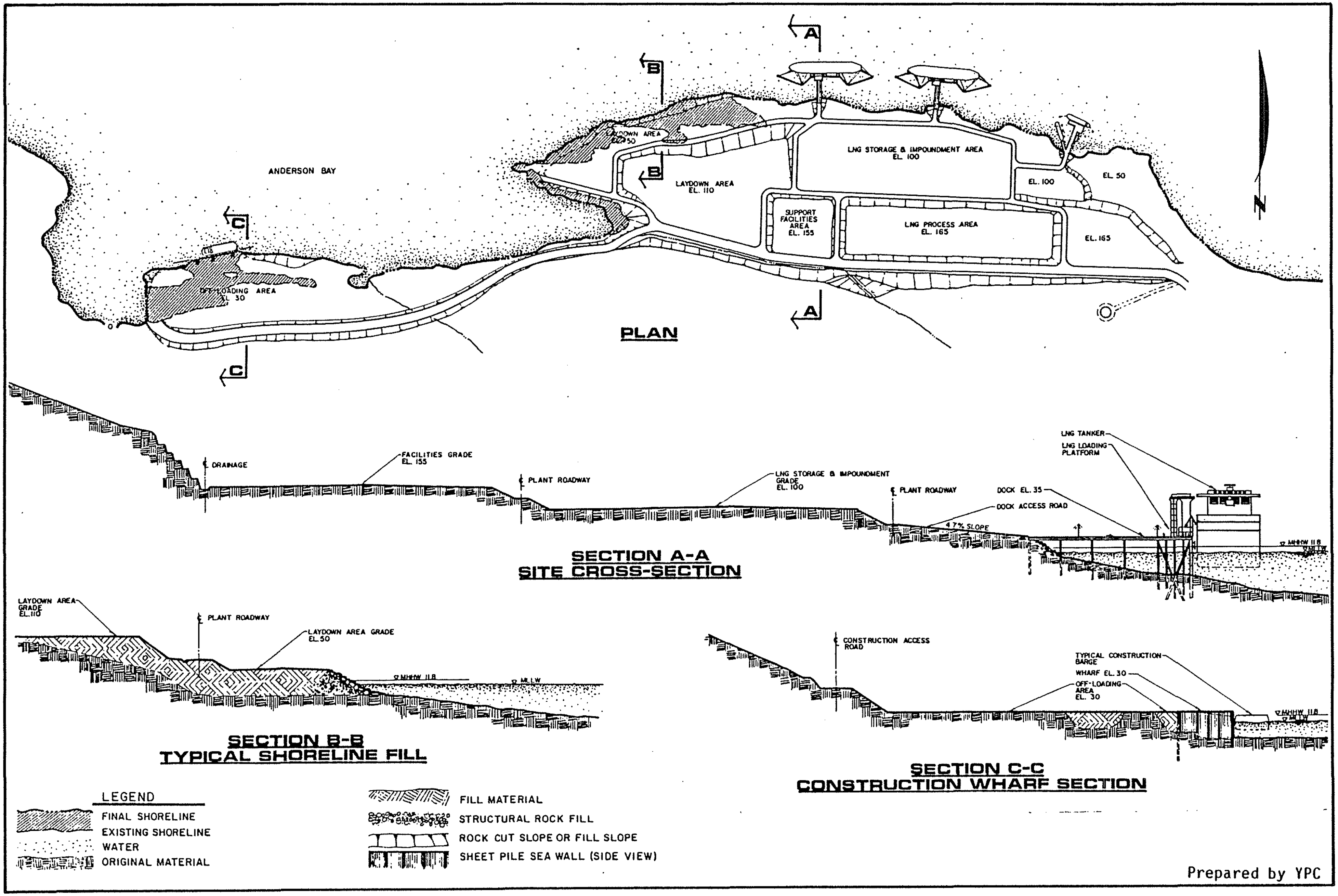


Figure 2.2.1-6 Conceptual Design for LNG Plant and Marine Terminal

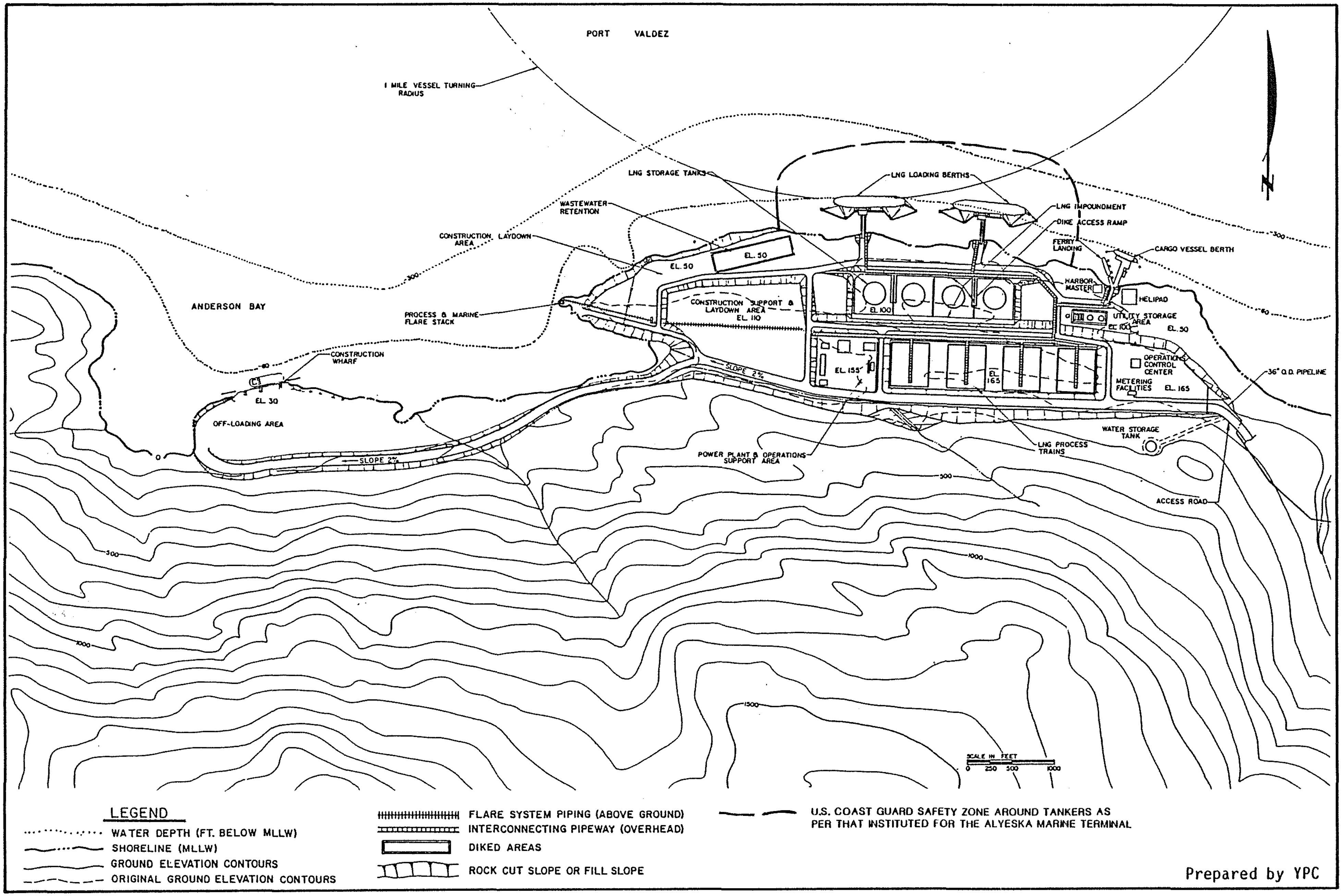
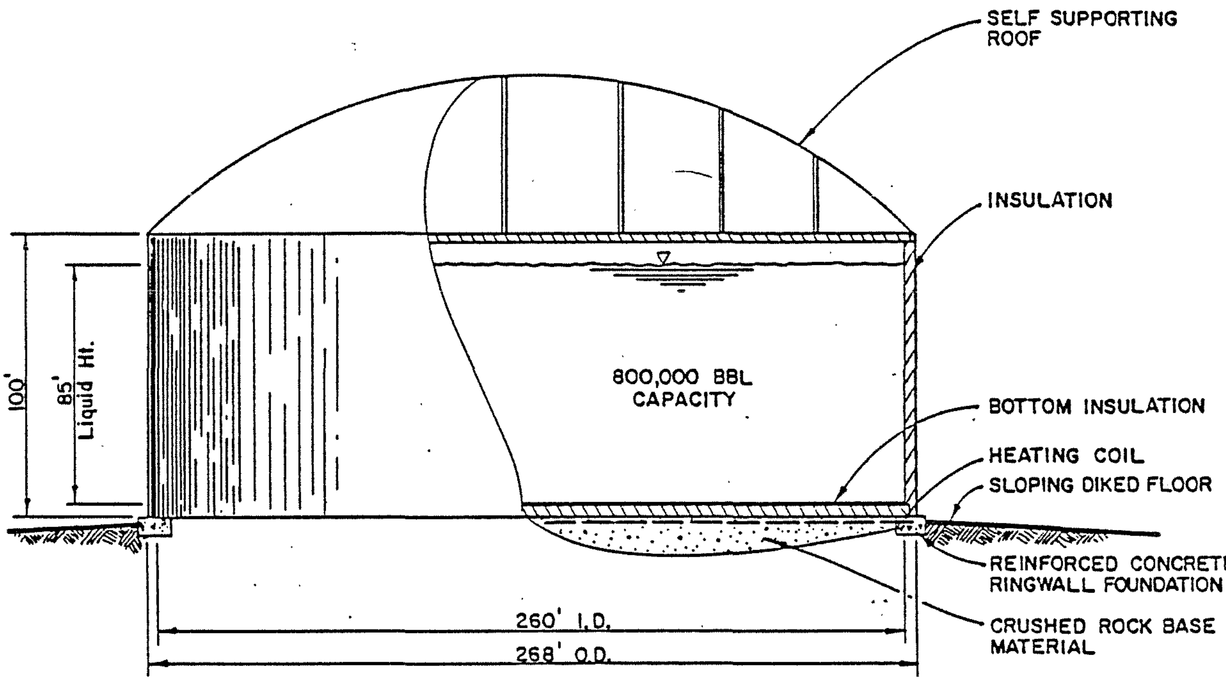


Figure 2.2.1-7. Plot Plan for LNG Plant and Marine Terminal



Prepared by YPC

Figure 2.2.1-8. Typical LNG Storage Tank

distribution system for electric power, storage systems for refrigerants, an air and nitrogen supply system, and a plant effluent treating system.

2.2.1.5 Marine Facilities

The proposed marine facilities would consist of two LNG tanker berths, a cargo vessel berth, a ferry landing for site access, a tug and work boat pier, and the temporary construction off-loading dock. Figure 2.2.1-8 presents conceptual details for each of these facilities.

Two LNG tanker berths would be provided for the mooring and loading of LNG tankers in the size range of 125,000 to 165,000 cubic meter. The tanker berths would consist of loading platforms and berthing and mooring dolphins. The LNG loading platform would be connected to the shore by a causeway, built on piles, carrying roadway and piping.

The tanker berths would be oriented approximately parallel to the shoreline in 50 feet of water (depth below MLLW) and have the capability of mooring a tanker in the aft or forward position. Figures 2.2.1-9 and 2.2.1-10 present designs of typical LNG tankers. Characteristic dimensions are given for two 125,000-cubic meter and two 165,000-cubic meter tanker designs. For additional information on LNG tankers, the reader may refer to the El Paso 1976 FEIS, Vol. II, pages 353-365 (FPC 1976).

During the conceptual design of loading facilities, a design loading rate of 70,000 barrels per hour per tanker was assumed. LNG transfer through the loading system would be by the use of cryogenic pumps and gravity. The loading system would be maintained in a cold condition at all times.

Loading lines supported by trestle structures would connect LNG storage tanks to the loading platform at the end of berth

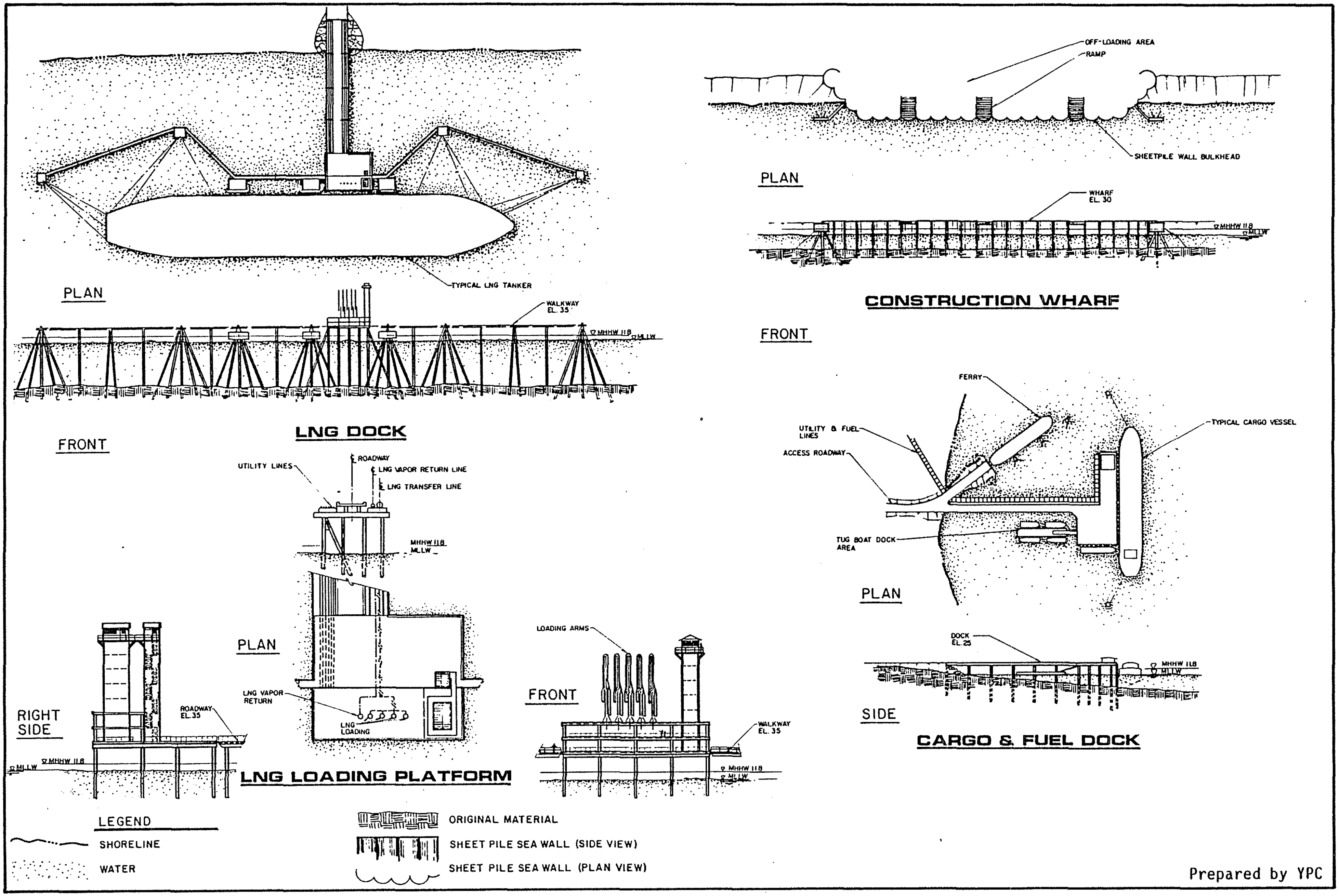
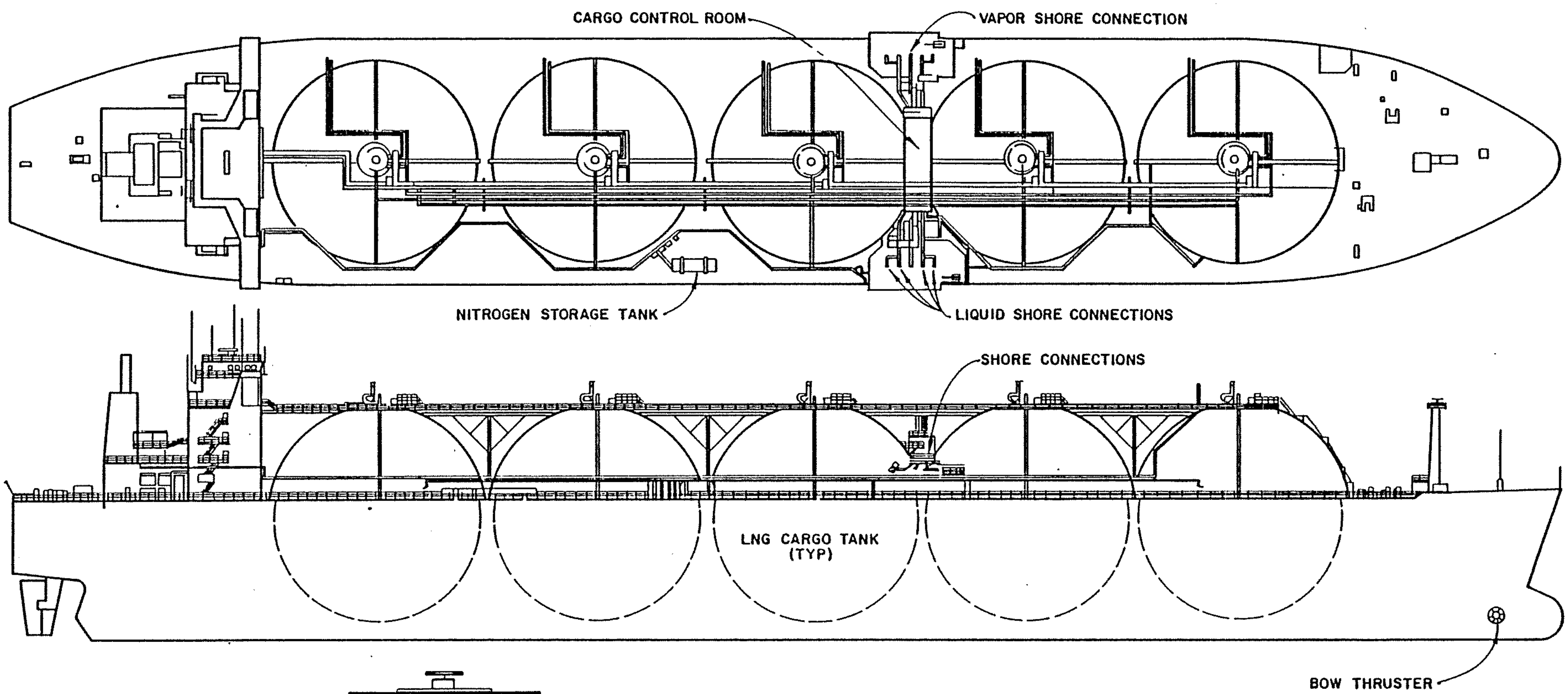
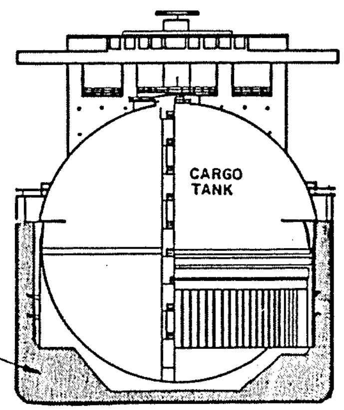


Figure 2.2.1-9 Typical Marine Terminal Facilities



NOTE
TANKER CHARACTERISTICS WILL VARY WITH SPECIFIC MANUFACTURERS AND TANKER TYPES.

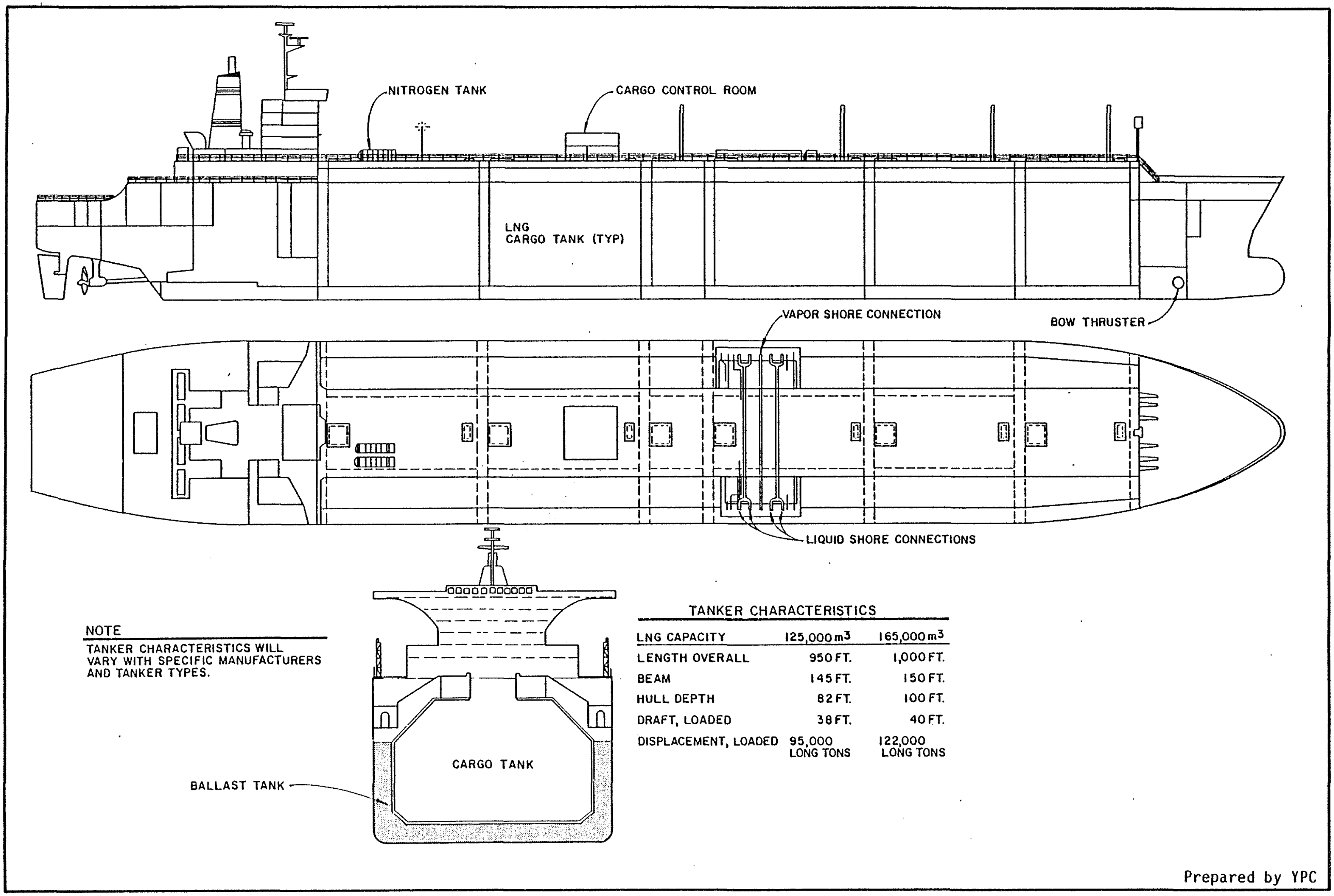


TANKER CHARACTERISTICS

LNG CAPACITY	$125{,}000\ m^3$	$165{,}000\ m^3$
LENGTH OVERALL	950 FT.	1,000 FT.
BEAM	145 FT.	150 FT.
HULL DEPTH	82 FT.	100 FT.
DRAFT, LOADED	38 FT.	40 FT.
DISPLACEMENT, LOADED	95,000 LONG TONS	122,000 LONG TONS

Prepared by YPC

Figure 2.2.1-10. Typical Spherical Design for an LNG Tanker



TANKER CHARACTERISTICS

LNG CAPACITY	125,000 m^3	165,000 m^3
LENGTH OVERALL	950 FT.	1,000 FT.
BEAM	145 FT.	150 FT.
HULL DEPTH	82 FT.	100 FT.
DRAFT, LOADED	38 FT.	40 FT.
DISPLACEMENT, LOADED	95,000 LONG TONS	122,000 LONG TONS

Figure 2.2.1-11. Typical Membrane Design for an LNG Tanker

facilities. Special metallurgy pipe would be used for the loading lines to accommodate the very low LNG temperatures. Loading lines would be insulated between storage tanks and loading platforms to minimize LNG boil-off.

The loading operation at each berth would involve the use of articulated loading arms between the fixed platform facility and the floating vessel. Based upon preliminary design, four loading arms would be sized at 16-inch diameters to accommodate assumed loading rates. In addition, a single vapor-return arm would serve to connect tanker boil-off with onshore vapor recovery facilities. Vapor return lines, also supported by trestle structures, would take LNG vapors back to the plant fuel gas system or to the feed gas stream for reliquefaction. In addition to a main LNG loading line automatic shut-off valve, each loading arm would have an automatic ***fail-safe*** shut-off valve to prevent LNG spillage during emergency conditions.

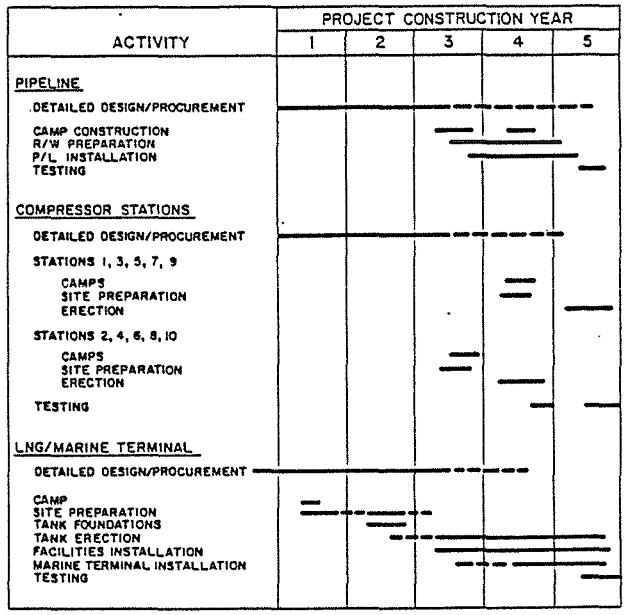


Figure 2.2.2-1
TAGS Overall Construction Schedule

2.2.2 Construction Phasing and Manpower Requirements

Construction planning for the TAGS project focused on practices developed during past arctic pipeline projects, including certain innovative practices that have demonstrated that pipeline construction activities can be carried out in a manner compatible with the unique arctic and subarctic environments. The construction phase of the proposed TAGS project would require five years. Operation is scheduled to begin the last quarter of 1995, as depicted in the project schedule in Figure 1.1-1. The overall project construction schedule for the 14-million-ton LNG annual delivery system is presented in Figure 2.2.2-1. Construction of the LNG plant and marine terminal facilities would determine the overall project construction schedule. LNG plant and marine terminal construction would require five years; pipeline and compressor station construction would occur during years three, four, and five.

Project configuration would be designed and constructed with a design capacity to deliver 14 million tons of LNG to foreign markets. Initial construction and startup could involve smaller delivery capability. In order to accommodate an operationally phased project where initial operation might be on the order of 7 million tons of LNG, facility construction would be incrementally phased to coincide with delivery contract. Initial construction of such a phased project would involve: 1) complete installation of a 36-inch pipeline and all block valves, cathotic protection, metering, communication, and related facilities; 2) partial installation of compressor station facilities; 3) partial installation of LNG plant facilities; and 4) complete installation of the marine terminal.

The pipeline would be identical in all respects to the 2.3 *BCFD* necessary to achieve the design of 14-million-ton LNG delivery. This would include construction of meter stations, block valves, access roads, mineral material site identification, and airfield access as shown for the 14-million-to LNG project. Fewer compressor stations would be needed. The number of compressor stations, compression, and refrigeration horsepower needed would be a function of delivery contracts. The LNG plant at a reduced capacity might involve initial installation of two process trains and three storage tanks. Essentially, complete site development at Anderson Bay would be required under any scenario of less than the design delivery capability to produce 14 million tons of LNG annually. The LNG plant would include the complete relief and blowdown system, potable water system, LNG transfer and boil off piping, air and nitrogen system, wastewater treatment facilities, utilities, all structures, and all communications.

Manpower requirements for the proposed TAGS project would vary throughout the various project phases. During the period of design definition and permit acquisition, YPC would employ or contract with about 375 people. During the design and construction phases, YPC's staff size would average up to approximately 950 people, leveling off to about 550 people throughout operations. During the preconstruction and construction phase, the YPC work force would be based in Anchorage. Following construction, the YPC work force would be located at the Anchorage headquarters, the Fairbanks Maintenance Facility, or operations facilities.

During construction, the work force of contractors, laborers, suppliers, and support services would average 6,355 during the last three years of construction, with a peak of 10,600 during the next to the last year. These figures include all direct construction contractors plus YPC personnel.

2.3 PIPELINE CONSTRUCTION

The construction of the pipeline facilities would involve the best available arctic technology, much of which was successfully developed by Alyeska for the TAPS and further refined by other recent arctic and subarctic construction projects. Pipeline construction activities would be completed in a conventional sequence--material acquisition and stockpiling; camp construction; right-of-way preparation; ditching; pipe stringing, bending, and welding; lowering-in and tie-in; backfilling; cleanup and restoration. Construction activities would be carried out in winter and summer. Consideration would be given to such factors as subsurface conditions, length of line, need for access, type of access required, and winter snow/ice conditions. Stream crossing areas would also be evaluated for winter construction because more favorable flow conditions generally occur in the winter. Site-specific design factors would be determined during the detailed design phase.

Pipeline construction would be accomplished using the six construction segments identified in Table 2.3-1.

Table 2.3-1
TAGS Construction Spreads

Spread	Start (Milepost)	End (Milepost)	Length (Miles)
1	0	160.0	160.0
2	160	275.0	115.0
3	275	430.0	155.0
4	430	563.0	133.0
5	563	696.0	133.0
6	696	796.5	100.5

Dividing the construction project into six segments would limit segment lengths to sizes that can be handled satisfactorily by existing pipeline contractors or groups of contractors. Each spread would require approximately three years to complete. These contractors would be responsible for all construction activities within that segment except when special construction areas are designated, such as the aerial crossings of the Yukon, Tanana, Tazlina, and Gulkana rivers. In addition to these aerial crossings, seven other special construction areas have been identified along the pipeline route.

Each of these special construction areas was identified by YPC because it represents an area with special engineering constraints, environmental sensitivities, or land-use conflicts associated with the siting of two pipelines. Each will be discussed in Section 2.3.4.

2.3.1 Preconstruction

The preconstruction phase would include the following activities: pipeline, compressor station, communication sites, and access roads would be located by survey; construction camps would be made ready for use; airfields would be upgraded; and material sources would be located.

These actions would take place from six camps north of the Yukon River and from existing facilities in communities elsewhere. Material yards would be made ready to hold construction supplies, equipment, and pipe.

Right-of-way acquisition and surveying would entail major field operations prior to construction. The location of the pipeline would be described by a surveyed centerline description of the route through Alaska.

A total of 26 construction camps would be required for the construction of the proposed TAGS project, as shown in Table 2.3.1-1. All of the ***proposed*** pipeline construction camps except Prudhoe Bay and Sourdough Creek would utilize former TAPS construction campsites. There would be a construction camp at each of the 10 compressor stations, as well as the LNG plant/terminal camp. Total bed space for construction camps would be 11,600.

Table 2.3.1-1

TAGS Temporary Construction Camps

Construction Spread	Mile-Post	Location	Bed Spaces: Pipeline P/L	Bed Spaces: Compressor Station
1	0	Prudhoe Bay	200	---
	43*	Franklin Bluffs	400	---
	66	Compressor Station #1	100	300
	84	Happy Valley	500	---
	125	Compressor Station #2	100	300
	140*	Galbraith Lake	500	---
			1,800	500
2	170	Chandalar	500	---
	201	Dietrich	600	---
	213	Compressor Station #3	100	300
	236*	Coldfoot	900	---
			2,100	300
3	281	Compressor Station #4	100	300
	299	Oldman	700	---
	345*	Five Mile	700	---
	358	Compressor Station #5	100	300
	394*	Livengood	700	---
	422	Compressor Station #6	100	300
			2,400	900
4	451	Fairbanks	1,000	---
	487	Compressor Station #7	100	300
	526	Delta	800	---
	563	Compressor Station #8	100	300
			2,000	600
5	600	Isabel Pass	600	---
	639	Compressor Station #9 Sourdough Creek	600	300
	682	Glennallen	700	---
			1,900	300
6	721	Compressor Station #10 Tonsina	700	300
	770	Sheep Creek	500	---
	797	LNG/Marine Terminal	200	1,500
			1,400	1,500
TOTALS			11,600	4,500

* Preconstruction camps plus one at Prospect Airport, Milepost 275.

Access roads would be built to provide necessary access from existing public or private roads to construction areas such as pipeline right-of-way, material/disposal sites, compressor stations, and material storage sites. Selection of access road locations would be based largely on the location of existing public and TAPS access roads, terrain roughness, and haulage distances. Approximately 100 miles of existing access roads, permanent or abandoned, would be repaired for reuse, and approximately 34 miles of new access roads would be constructed to a specification of 30-feet wide at the crown with thickness determined by soil and thermal conditions. Appendix E includes a list of all major access roads required for the project by milepost and length. As an option to structural fill access roads, TAGS would consider the use of snow/ice access roads in areas where all construction activities are scheduled for winter snow/ice roads, on a site-specific basis where conditions are determined to be advantageous, ***and where an adequate winter supply of surface water is available for project use.***

Construction of the pipeline and ancillary facilities work pad would require natural soil or rock borrow material. This would be needed for right-of-way preparation, access roads, temporary and permanent facility foundations, and specialized ditch backfill. Borrow pit and quarry development would probably be accomplished in the first year of pipeline development. Reconnaissance investigations would be conducted during the detailed design phase to identify natural deposits suitable for use as borrow sources for the project. Initially, an inventory of existing sites within the corridor would be assessed. Then, a search for new, suitable borrow sources would be initiated.

Through the use of exploratory borings and geophysical evaluation, potential sites, new or existing, that best meet project needs, would be examined in greater detail to establish site quality and quantity. Detailed development and mining plans would be prepared for required borrow sites. Plans would be in conformance with state and federal requirements and would contain sufficient data to permit development, mining, site protection, and borrow site reclamation.

Seven temporary storage areas for mainline pipe, equipment, and pipeline construction materials would be located along the pipeline route, as shown in Table 2.3.1-2. Initially, the double-jointed pipe sections would be delivered to main pipeline material storage yards to be located in Prudhoe, Fairbanks, and Valdez for mobilization. Distribution to the intermediate construction segment stockpile along the route would be made from these main storage yards. Pipeline construction campsites would also include sufficient area for the staging and storage of pipeline construction material.

Aircraft support services for the transportation of personnel and material during pipeline and compressor station construction would require the use of the seven existing airstrips along the corridor at Deadhorse, Prospect, Five Mile, Fairbanks, Delta, Gulkana, and Valdez, as well as the upgrading of five abandoned TAPS airfields. The airfields identified for upgrade are located at Franklin ***Bluffs***, Happy Valley, Galbraith Lake, Dietrich, and Coldfoot. ***Both Galbraith Lake and Coldfoot are functioning state airports.*** The upgrade runway length would be 5,000 feet.

Table 2.3.1-2
Temporary Material Storage Area

Milepost	Storage Location	Approximate Area (Acres)
0	Prudhoe Bay	30
161	Atigun	20*
275	Prospect	20
370	Old Hess Creek	20*
674	Gulkana	30
700	Willow Lake	20
N/A	Valdez Pipe Storage Yard	30*

* Former TAPS site

2.3.2 Construction

Pipeline construction activities would be confined to a right-of-way width that would vary along the proposed route, depending primarily on topographic conditions. The typical pipeline construction zone which utilizes a gravel or rock workpad is shown in Figure 2.3.2-1. Construction zone width would vary with cross slopes and ditch types; generally, it would be confined to an approximate 100-foot right-of-way width except at temporary staging areas at river crossings and other special points requiring the temporary use of extra widths. Where feasible, the proposed TAGS project would consider the use of ice, snow, or ice and snow workpad as depicted in Figure 2.3.2-2. Preliminary estimates indicate that as much as 33 million cubic yards of borrow material could be required for completion of the proposed TAGS project. A breakdown of the total estimated borrow material by construction spread for all project construction is presented in Table 2.3.2-1.

Figure 2.3.2-3 represents a typical cross-country pipeline spread. Clearing would include the removal of above-ground obstacles such as trees, brush, and boulders. Grading would include the leveling of ground surface, as needed, to change the natural contours to required construction zone geometry. This would involve construction of a workpad embankment where required. Grading requirements would include the handling of temporary spoil, drainage, and erosion control. The proposed TAGS grading design would involve consideration of soils, ground slopes, construction equipment, and procedures and other parameters to ensure that localized stability conditions would not adversely affect the integrity of the pipeline or adjacent facilities and ensure that adequate working width would be provided for construction.

The TAGS criteria for grading design are to ensure:

- Stable cut and fill slopes under normal static conditions;

- Workpad stability under normal conditions;

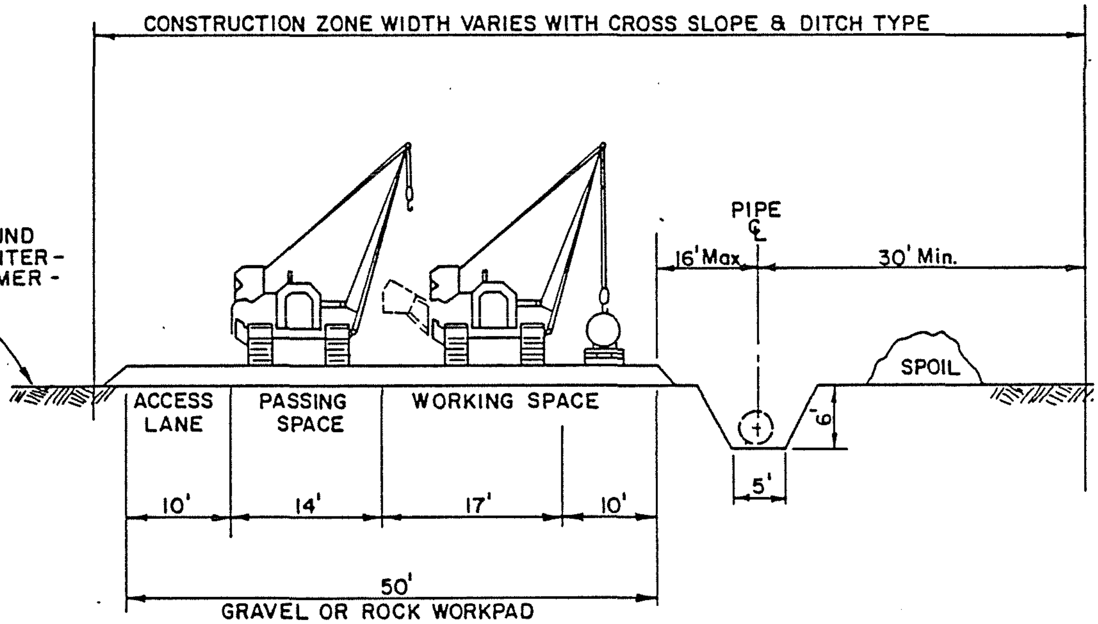


Figure 2.3.2-1. Typical Construction Cross Section with Gravel or Rock Workpad

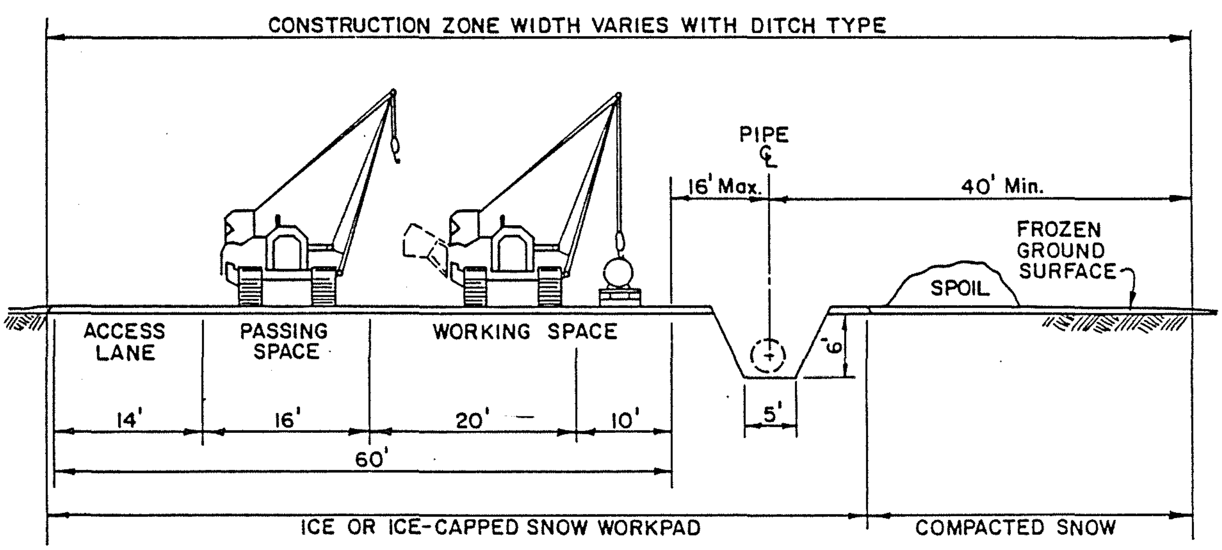
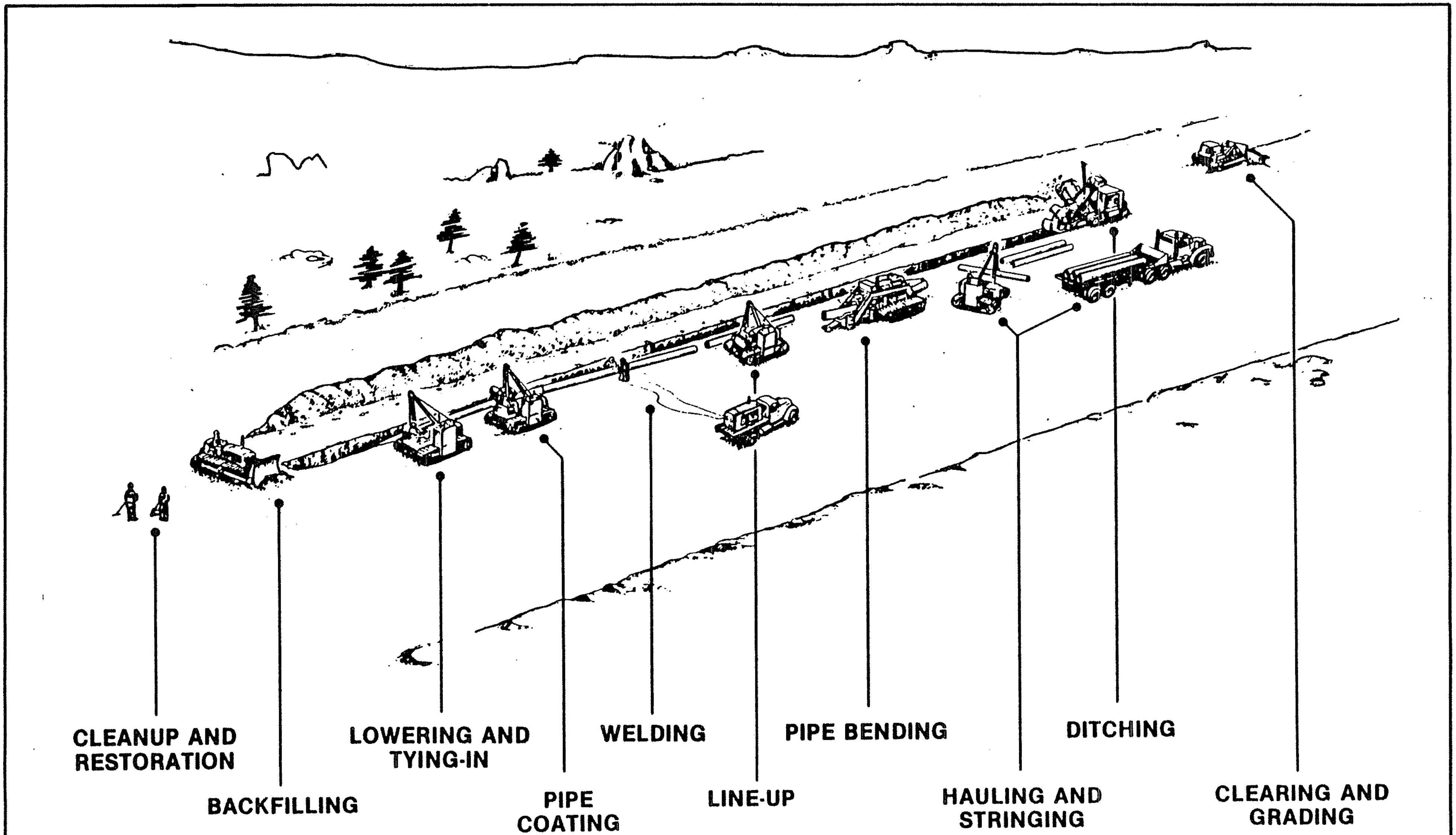


Figure 2.3.2-2. Typical Construction Cross Section with Ice and Snow Workpad



Source: ERT

Figure 2.3.2-3. Typical Cross-Country Construction Pipeline Spread (typical, not to scale) (BLM, 1984)

Table 2.3.2-1
TAGS Estimated Borrow Material Requirements
By Construction Spread

	Construction Section (banked cubic yards x 1000)						
	1	2	3	4	5	6	TOTAL
Workpads	4,200	4,100	3,900	3,600	3,200	2,500	21,500
Access Roads	600	900	60	600	600	300	3,600
Camp Sites/Airfields	400	200	300	100	700	200	1,900
Ditch Backfill	500	500	600	500	700	500	3,300
Compressor Stations	600	300	700	400	200	100	2,300
Other	---	400*	---	---	---	---**	400
TOTALS	6,300	6,400	6,100	5,200	5,400	3,600	33,000

* Roadway fill in Atigun Pass special construction area.
** Adequate borrow material exists on site for LNG plant site, not included in table.

- Stability under seismic loading, including liquefaction, where instability would affect pipeline integrity;

- Control of hydraulic and thermal erosion that could affect pipeline integrity.

Application of these criteria would ensure that no conditions are imposed on the pipe by the construction zone that would affect pipeline integrity or performance.

Temporary construction workpads would be required adjacent to the pipeline ditch to provide a working surface for construction equipment during pipeline construction only. Long-term access for monitoring and maintenance would be achieved with low ground pressure vehicles and light wheel load vehicles; maintenance activities would be scheduled for the winter season in areas sensitive to surface disturbance. The TAGS design philosophy for temporary construction workpads follows:

- Use of gravel or crushed rock workpad for temporary access to pipeline right-of-way.

- Grading and leveling of native ground surface in areas where soil conditions permit, providing adequate surface for pipeline construction.

- Use of public roadway as construction surface only in areas where pipeline is buried in road shoulder.

- Consideration of optional workpad designs to reduce surface disturbance or costs. Optional geofabric, snow/ice, ice-capped snow, ice, and aggregate ice.

The pipeline ditch would be excavated using a combination of conventional excavation techniques to achieve a ditch of specified dimensions and required depth of cover for the pipeline. Pipeline minimum depth of cover would be in accordance with the 49 CFR 192. In normal soils, cover would vary from 30 to 36 inches; in rock conditions, it would vary from 18 to 24 inches. A typical ditch cross section is shown in Figure 2.3.2-4.

TAGS proposed excavation techniques have been used successfully in arctic and subarctic environments. The selected excavation technique would be matched to the soil type, thermal condition, and ground-water conditions.

Ditch excavation techniques for the TAGS project include ditching machines, backhoe, backhoe with blasting, and dragline. Ditching machines would be best suited to the excavation of frozen fine-grained soils, frozen coarse-grained (sandy) soils without significant cobbles or boulders, and thawed, dense, fine-grained soils without ground-water flow. Backhoes, though well-suited for excavating these soil conditions, would have slower advance rate for such conditions than a ditching machine. Therefore, a backhoe would be used primarily in conditions not amenable to the use of ditching machines: to excavate coarse materials with cobbles and boulders and in areas of moderate ground-water flow and high water tables. In addition, backhoes would be used in conjunction with line blasting techniques in frozen soils and bedrock. Spoil piles of backhoes would not be as neat as those produced by ditching machines. Draglines would be used primarily for river crossings and floodplain excavation.

The double-jointed precoated line pipe would be hauled from the temporary material storage yards to stockpile points along the route. The spacing of the stockpiles would be selected to optimize the hauling of pipe

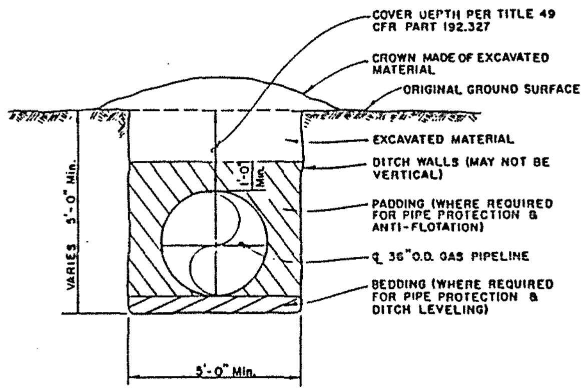


Figure 2.3.2-4
Typical Ditch Cross Section

along the pipeline right-of-way and to minimize backhaul.

The line pipe would be bent by special bending crews to conform to the terrain and fit the vertical and horizontal contours of the ditch. Pipe bending would be performed on the right-of-way using a 36-inch bending machine that would be moved along the right-of-way by tractor. Side-boom tractors would be used to handle the pipe in the bending operation. Following bending, the pipe would be placed on skids for welding. Coating repairs would be completed using patch sticks or shrink sleeves if coating damage due to bending is identified.

The line pipe would be elevated on skids to provide lineup clearance for welding and holding the pipe in alignment during the first welding pass. Mainline welding would be performed manually or by using a mechanical welding system that permits consistent, high-quality welding and produces a desired production rate. Field crews would bevel each joint of pipe to the profile required for automatic welding. Pipe ends would be preheated prior to welding.

Each step of the welding process would be visually inspected by qualified welding inspectors. Alignment and spacing would be inspected for conformance to specifications. Visual inspection of the root pass, filler passes, and cap would be made, and any defects would be removed by grinding. Following welding, radiographic crews would make X-rays of completed welds as required by 49 CFR 192. Welding would conform strictly to the specifications of codes (API 1104). Rejected welds would either be repaired or cut out, depending upon the severity of the defects. Field weld joints would be coated, utilizing thin-film, tape, shrink sleeves, or similar type coating. Pipe coating would be inspected with a "jeep" to detect holidays or other damage to the coating. Repairs would be made using patch sticks.

The welded pipe would then be lifted and lowered into the ditch by a series of side-boom tractors with slings acting in unison and spaced so that the weight of supported pipe would not cause buckling or other damage. Wherever there is a break in the continuous welded pipe, separate tie-in crew would be required to manually weld together the lowered-in pipe strings to complete the pipeline section. Other locations requiring tie-in welds include valves, road crossings, river crossings, compressor stations, and other special crossing areas.

Backfilling procedures would comply with specifications regarding protection of the pipe and coating. Selected granular material would be placed around and under the pipe to protect the pipeline whenever the ditch passes through material that could damage the coating, to mitigate buoyancy problems (outside of floodplain areas), and to protect against excessive loss of pipe cover due to erosion. In all areas where these potential problems do not exist, ditch spoils would be used as backfill and placed in direct contact with the pipe. ***At inactive*** floodplains and stream crossings where buoyancy control is required, concrete bolt-on weights or continuously concrete-coated pipe would be installed. Ditch plugs would be used in areas where potential excessive erosion along the ditch line could affect pipeline integrity. After the completion of the various backfill procedures, the backfill crews would complete the filling of the trench to about 1 foot over the top of the pipe using either ditch spoil or select backfill material. The remaining ditch spoil material would be used to complete ditch backfill and crown the ditch. In sensitive stream and wetland areas, excess ditch backfill could be removed to designated spoil-disposal areas. ***Additionally, to prevent ponding in areas of cross drainage, or to prevent longitudinal erosion, ditch crowns would be broken.***

Cleanup procedures would be performed following pipe laying and backfilling and would include the final grading of the pipeline right-of-way and the shaping of a crown over the pipeline ditch, as required. Restoration procedures, such as seeding and fertilizing, would be performed as required to mitigate erosion, minimize siltation, and encourage the natural revegetation of disturbed areas. In addition to right-of-way restoration, other disturbed construction areas such as material sites, camps, and temporary access roads would be restored to an acceptable condition and revegetated as required. The planned long-term approach to stabilizing disturbed areas involves natural revegetation and reinvasion by native species.

Hydrostatic testing of the pipeline would be conducted during the final summer of construction in each spread. Hydrostatic testing would be performed using water from local sources. Water would be withdrawn from designated surface water sources with the capacity to supply the desired volumes without adversely affecting aquatic habitats and associated biota. Hydrostatic testing would be accomplished using untreated water without the aid of freeze depressant additives. Following testing, water releases would be confined to approved designated areas and diverted to settling basins or to energy dissipators where needed to avoid induced erosion.

2.3.3 Special Pipeline Design

Certain areas along the pipeline construction route, such as river and stream crossings, road crossings, foreign pipeline crossings, and active fault crossings, would require the use of special equipment, materials, and procedures. These requirements would be given special design consideration on a site-specific basis.

2.3.3.1 Buried River and Stream Crossings

The proposed pipeline design has buried crossings at rivers and streams, except at four special river crossings where aerial designs would be used due to site-specific geotechnical, environmental, and/or difficult construction conditions.

The objective of buried pipeline crossing design would be to ensure that the pipe is not exposed to the hydraulic and abrasive forces of water flow and sediment movement. Detailed design would evaluate the potential for pipe exposure to degradation, frost bulb formation, and local scour of the river or in the streambed. In addition, an evaluation would be made of the potential for pipe exposure to bank erosion. Degradation, scour, or erosion would be heavily dependent on the flow regime and morphologic character of the stream or river at the particular location and would be mitigated by site-specific design.

Wherever possible, river or floodplain crossings would be aligned, as near as practical, at right angles to the direction of flow. This orientation would be to prevent channelization along the right-of-way and to minimize the length of the crossing. Where a river or floodplain must be crossed at an angle to the flow, the need for structures to control the river or stream and prevent channelization would be evaluated and designed and utilized where appropriate. In assessing the potential for riverbed scour, floodplain erosion, and the need for pipe buoyancy control, design discharges and corresponding water levels would be evaluated. Such design would be based on:

- Statistical flood frequencies obtained from analyses of local or regional flood data;
- Regional relationships between maximum recorded discharge and drainage area, where regional streamflow records are of sufficient quality and duration; and
- Regional relationships between drainage area and extreme discharges obtained by unit ***hydrographic*** techniques.

Erosion and scour estimates are generally based on hydraulic parameters corresponding to design discharge unless other discharge is considered to be critical

Figure 2.3.3-1 presents three typical configurations for three types of buried river and stream crossings. The unweighted crossing would be used where crossings of minor streams and drainages require only minimum cover depths and where pipe buoyancy would not be a problem. Weighted river crossing designs would be utilized to allow pipeline construction in wet ditch areas or for long-term pipe buoyancy control. Selection of bolt-on weights or continuous concrete coating would be based on site-specific conditions. As previously mentioned, site-specific design would be incorporated to mitigate chilled pipe effects to rivers and streams.

Construction schedules would be developed to minimize impacts at critical water crossings to protect anadromous fish stocks and prevent downstream impacts. Temporary stream diversions could be required for pipeline installation; such diversions would require state approval. To avoid possible conflict with resident and anadromous fish, timing constraints could be required.

Following pipe-laying, trenches would be backfilled with materials equal to or better than the materials excavated. This would minimize changes in channel characteristics with respect to scour and erosive forces. Use of riprap or other bank protection techniques would be required in some locations.

2.3.3.2 Aerial River Crossing

The proposed TAGS conceptual design identified four major river crossings that would require independent aerial suspension bridges due to known environmental and difficult construction conditions. Aerial rather than buried crossings would be used for the Yukon, Tanana, Gulkana, and Tazlina rivers.

Figure 2.3.3-2 is a conceptual sketch of the single-span bridge proposed for the crossing of the Tanana, Gulkana, and Tazlina rivers. Span lengths for the three crossings are estimated to be 1,200 feet, 380 feet, and 700 feet, respectively. The Yukon River crossing would be an independent, twin-span suspension bridge.

2.3.3.3 Road Crossings

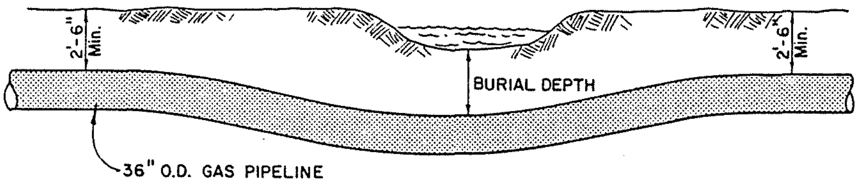
The proposed TAGS pipeline road crossings would be designed and installed with or without casings in accordance with 49 CFR 192. Access roads into material sites, camps, foreign pipelines, service facilities, and private property would be traversed uncased, as shown in Figure 2.3.3-3. The 67 major highway and road crossings would be evaluated on a site-specific basis to determine if an uncased crossing can be used. Where excessive wheel loads are anticipated or concerns for pipeline integrity are identified at road crossings, the advantages and disadvantages of cased crossing would be evaluated during the design phase.

Design and construction would be coordinated with the Alaska Department of Transportation and Public Facilities (DOT/PF) for highway crossings, proper authorizing agents for other public roads, ***telephone cables,*** and private owners for access roads as appropriate. Activities would be coordinated with Alyeska Pipeline Service Company where highway crossings are proximate to its fuel gas line or where its access roads are crossed by TAGS.

2.3.3.4 Crossing of Existing Pipelines

The design and construction of crossings of existing pipelines would require consideration of site-specific conditions and operational characteristics at each crossing. The proposed TAGS route crosses TAPS (above-ground and below-ground sections), the TAPS fuel gas line, the Kuparuk oil line (above-ground section), producer gathering lines, the Haines products pipeline, and the right-of-way for the proposed ANGTS.

Crossings of an existing above-ground ***pipeline*** would be designed for minimal impact to the existing pipeline or respective right-of-way. Although precise angles of crossing would vary based upon site-specific conditions at each crossing location, the angle between the two pipelines at the crossing point would tend toward a right angle (80° to 100°). The TAGS pipeline would be buried a minimum of 2.5 feet below the original ground surface. A crossing point at the midpoint between

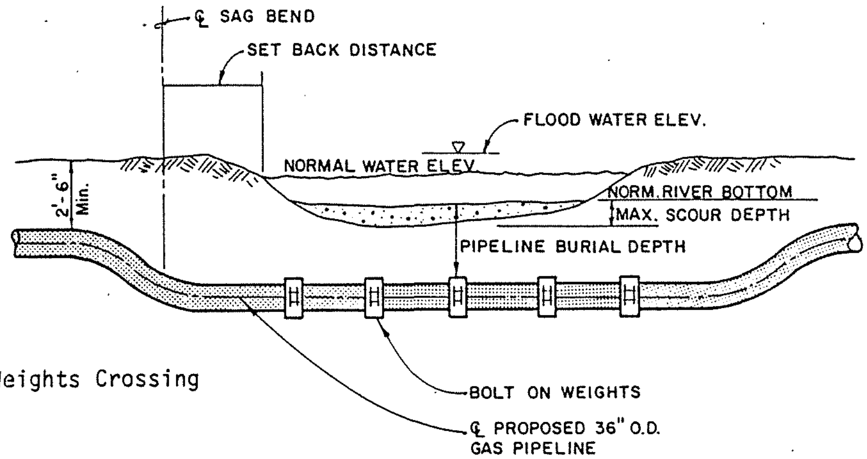


PROFILE

NOTE

PIPELINE BURIAL DEPTH AT STREAM CROSSINGS WILL CONSIDER MAXIMUM SCOUR CONDITIONS ALONG WITH MINIMUM REQUIREMENTS OF FEDERAL PIPELINE SAFETY STANDARDS.

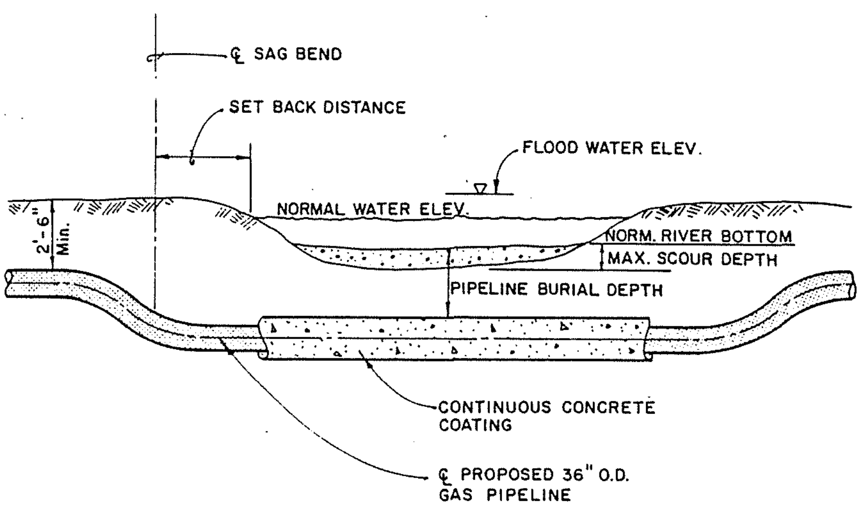
a. Unweighted Stream Crossing



b. Bolt-on Weights Crossing

NOTE

1. PIPELINE BURIAL DEPTH AT RIVER AND STREAM CROSSINGS WILL CONSIDER MAXIMUM SCOUR CONDITIONS ALONG WITH MINIMUM REQUIREMENTS OF FEDERAL PIPELINE SAFETY STANDARDS.
2. BOLT-ON WEIGHTS WILL BE SIZED AND SPACED TO SUFFICIENTLY COUNTERACT BUOYANCY FORCES.



c. Concrete Coastal Crossing

NOTE

1. PIPELINE BURIAL AT RIVER AND STREAM CROSSINGS WILL CONSIDER MAXIMUM SCOUR CONDITIONS ALONG WITH MINIMUM REQUIREMENTS OF FEDERAL PIPELINE SAFETY STANDARDS.
2. CONCRETE COATING WILL BE OF SUFFICIENT THICKNESS TO COUNTERACT BUOYANCY FORCES.

Figure 2.3.3-1
Typical River or Stream Crossing

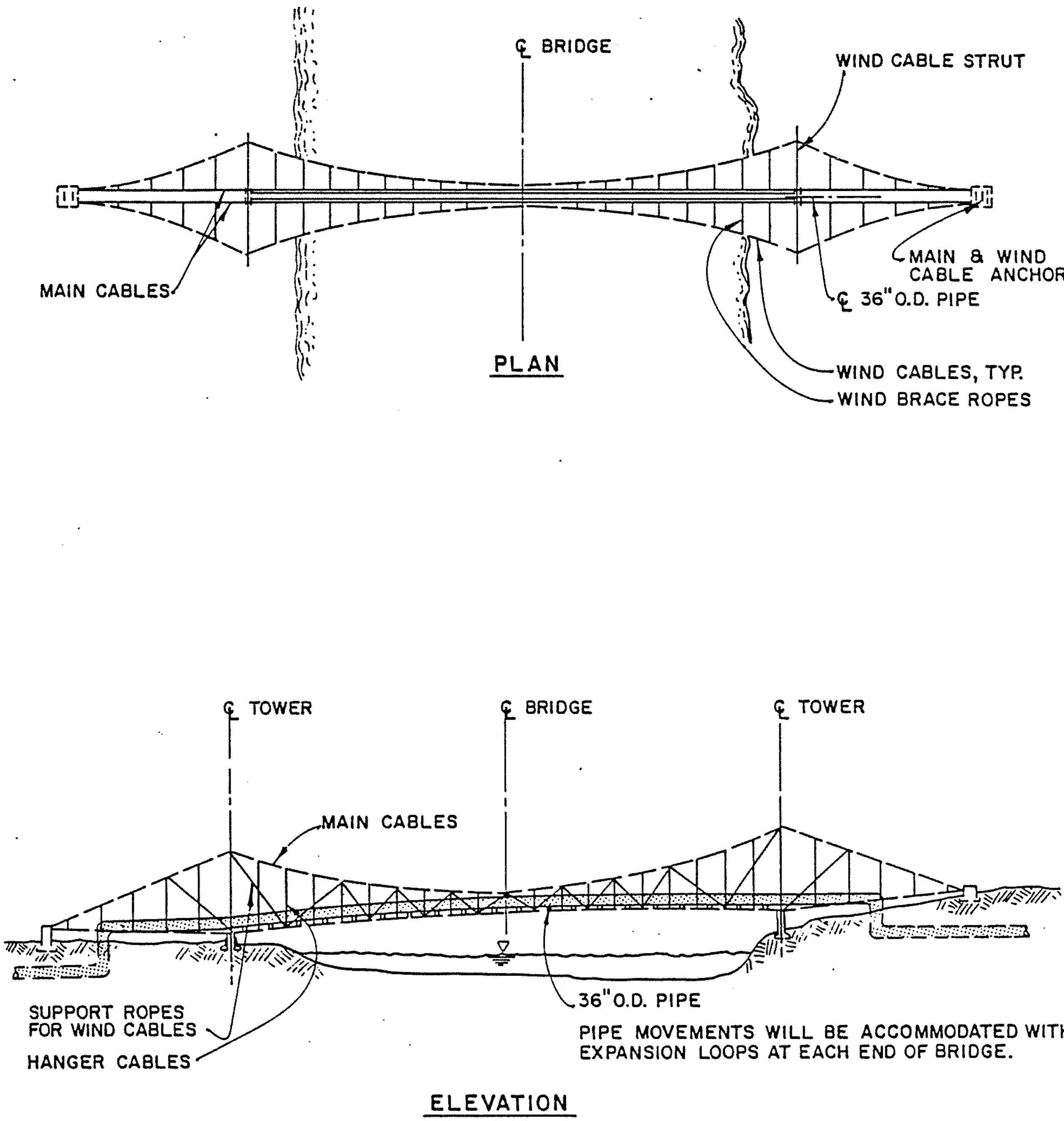
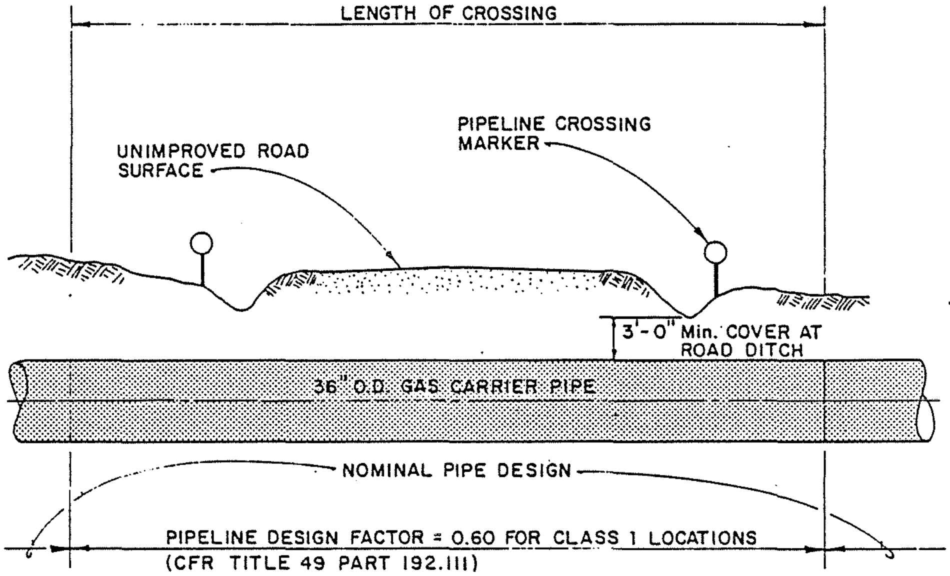
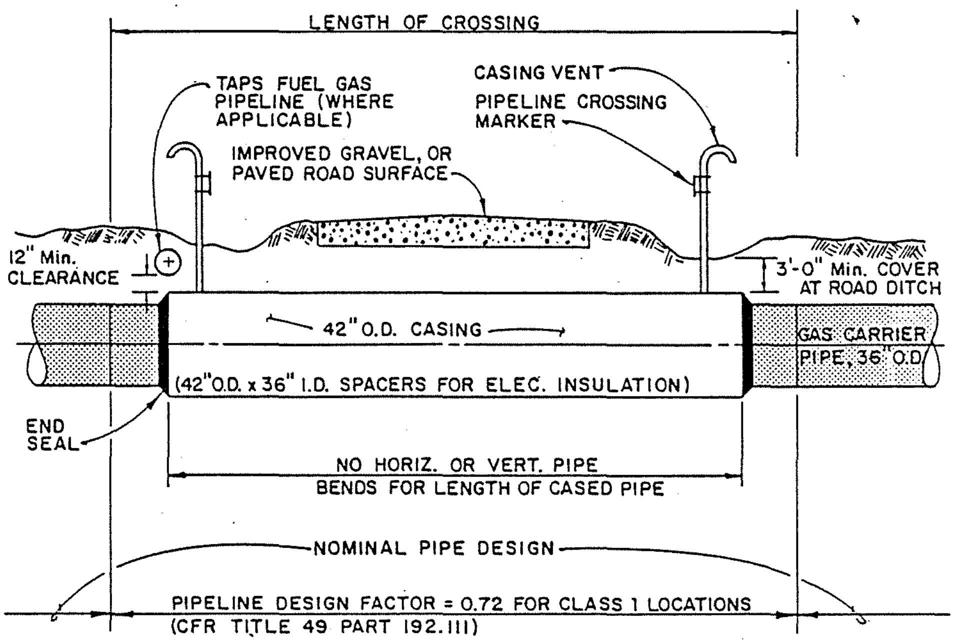


Figure 2.3.3-2. Typical Aerial River Crossing



a. Uncased Road Crossing



b. Cased Road Crossing

NOTES

1. CASING WILL BE EXTENDED 5' BEYOND ALYESKA FUEL GAS LINE WHERE PRESENT.
2. INSULATED OR OTHER THERMAL DESIGNS WILL BE UTILIZED WHERE REQUIRED.

Figure 2.3.3-3. Typical Road Crossing

vertical support *members* of an existing above-ground pipeline would minimize the impacts of construction. Crossings would not be near anchors at valve support locations. For additional safety, TAGS would utilize heavy pipe-wall thicknesses through crossing areas. Figure 2.3.3-4(a) shows a typical crossing scheme for existing above-ground TAPS or Kuparuk oil pipelines. Above-ground producer gathering lines would be crossed by TAGS using a similar scheme.

Crossings of an existing below-ground *pipeline* would also be designed to minimize impact to the existing pipeline and respective right-of-way. Crossing angles for large-diameter, buried, foreign pipelines would also tend toward a right angle. The TAGS pipeline would be buried in an above-ground berm where it crosses another large-diameter buried *pipeline.* Berms would be constructed to allow temporary construction and long-term permanent through-access for TAGS and pipeline activites for existing pipelines. The height of the berms would be such that the TAGS pipeline, elevated a minimum of 6 inches above the existing ground surface, would attain a cover depth of at least 2.5 feet. The TAGS pipeline would be insulated throughout bermed sections and would be constructed with heavy pipe-wall thicknesses. Figure 2.3.3-4(b) shows a typical crossing section for existing below-ground TAPS pipeline sections or proposed below-ground ANGTS pipeline sections should the ANGTS pipeline be constructed prior to TAGS.

Crossings of the below-ground Haines products pipeline would involve burial of the TAGS pipeline beneath the Haines line. A minimum of 1 foot of clearance would be maintained between the TAGS and the Haines pipeline. Select granular backfill would be utilized to replace the original material excavated from the TAGS ditch. Crossing angles would vary, based upon site-specific conditions. Figure 2.3.3-4(c) shows a typical crossing of an existing below-ground pipeline, where the TAGS pipeline is buried beneath the foreign pipeline.

Crossings of the TAPS fuel gas line would be made along with cased Dalton Highway crossings. Road crossing construction would be of the open-trench type with necessary support and protection provided for the fuel gas line during construction. Select backfill material would be utilized throughout the road crossing length, including that area where the fuel gas line would be crossed. Crossings would tend toward right angles to minimize construction impacts. Figure 2.3.3-3(b) shows a typical cased road-crossing scheme, including the fuel gas line.

2.3.3.5 Active Fault Crossings

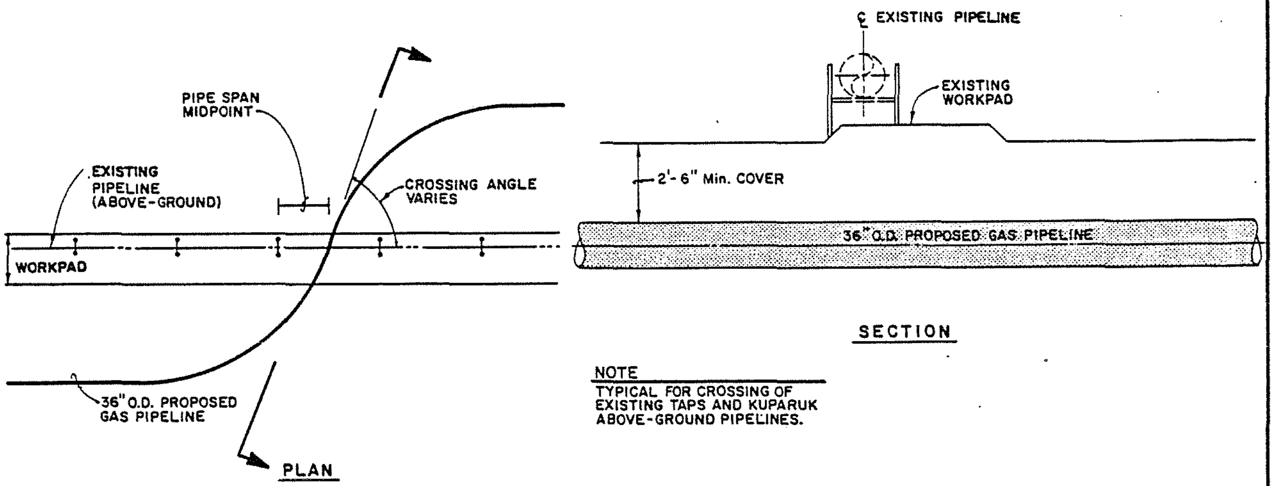
Three major active fault zones would be traversed by the TAGS pipeline--the Donnelly Dome, Denali, and McGinnis faults between Delta and Summit Lake. Crossings over *these* active faults would be elevated on steel beams at grade or elevated on vertical support members (VSM) as shown on Figure 2.3.3-5.

The major hazards affecting pipeline operations in these areas are: 1) differential movement along the fault zone; 2) soil liquefaction; and 3) ground motions. The Denali Fault represents the greatest hazard from differential movement. The McGinnis fault crossing, in the vicinity of the Denali Fault, would cross the active floodplain of both Miller and Castner creeks and would be underlain by extensive deposits of thawed floodplain soils.

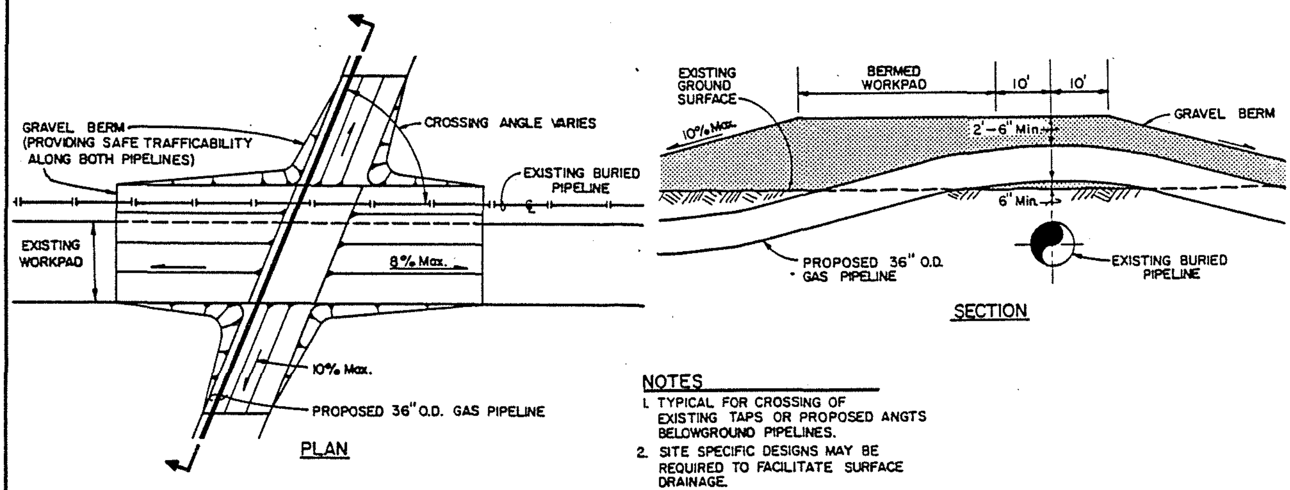
In the Donnelly Dome and Denali fault areas, the pipeline would be elevated on steel cross-beams supported by precast concrete ties at grade, as shown in Figure 2.3.3-5(a). Since the McGinnis fault area falls within an active floodplain, the horizontal support beams would be raised above the highest expected water elevation on steel vertical support members, as depicted in Figure 2.3.3-5(b). In all above-ground areas, the pipeline would be installed with foamglass insulation protected by a metal jacket. Typically, supports would be spaced 60 feet apart and anchors would be provided about every 1,200 feet.

2.3.4 Special Construction Areas

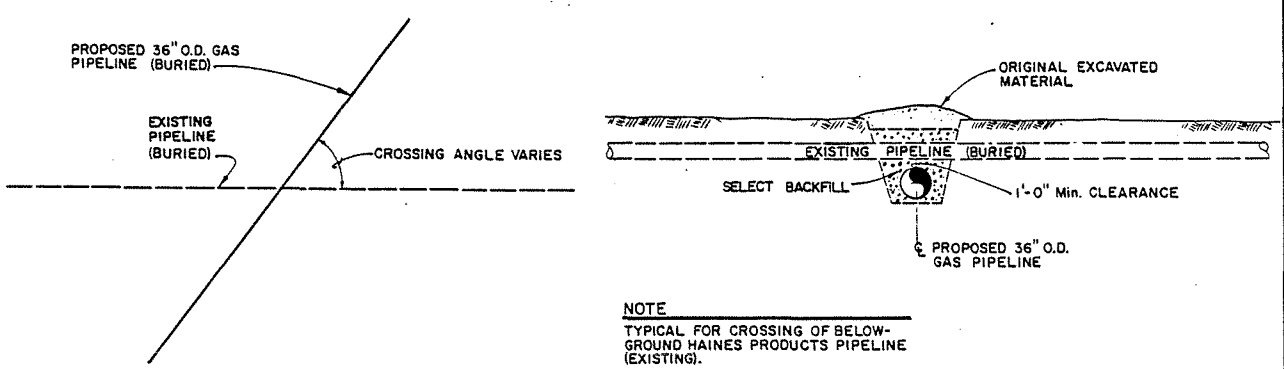
Seven special construction areas have been identified by YPC along the proposed TAGS alignment. Those areas are: Atigun



a. Crossing of Existing Above-Ground Pipelines

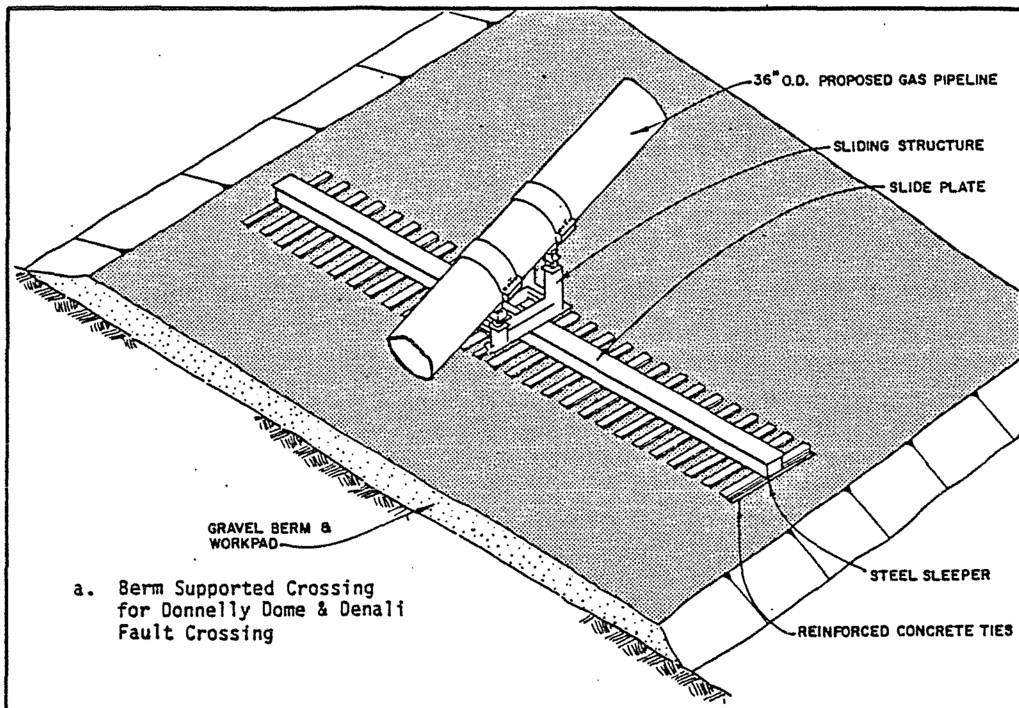


b. Crossing of Existing Below-Ground Pipelines

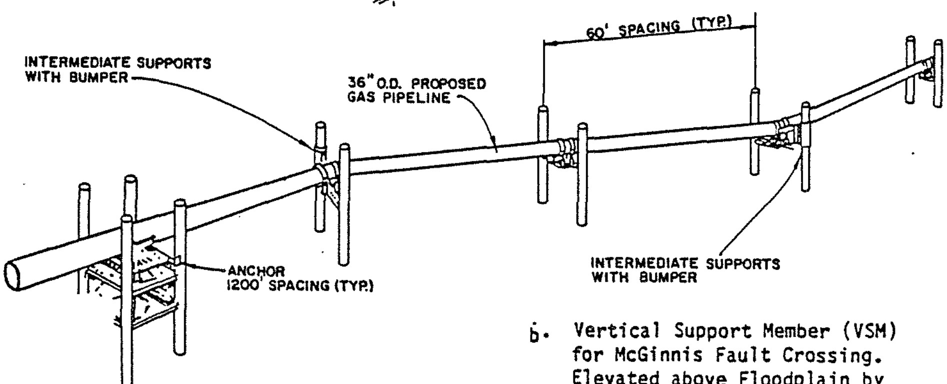


c. Crossing of Existing Below-Ground Haines Product Pipelines

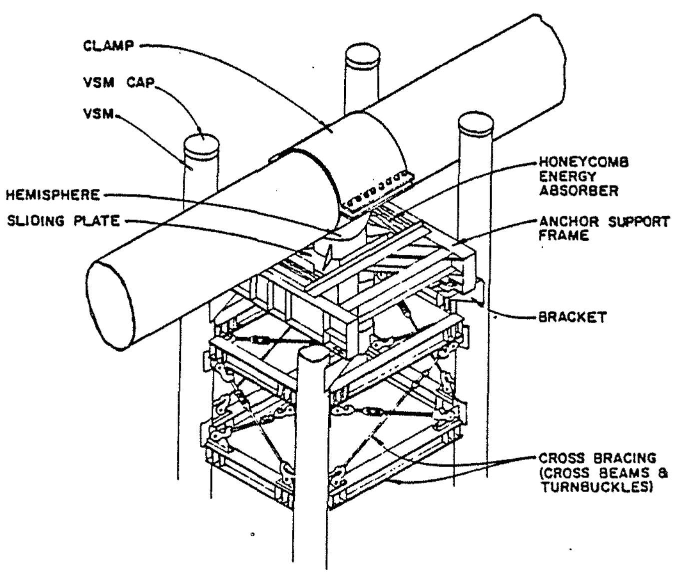
Figure 2.3.3-4. Typical TAGS Crossing of Other Pipelines



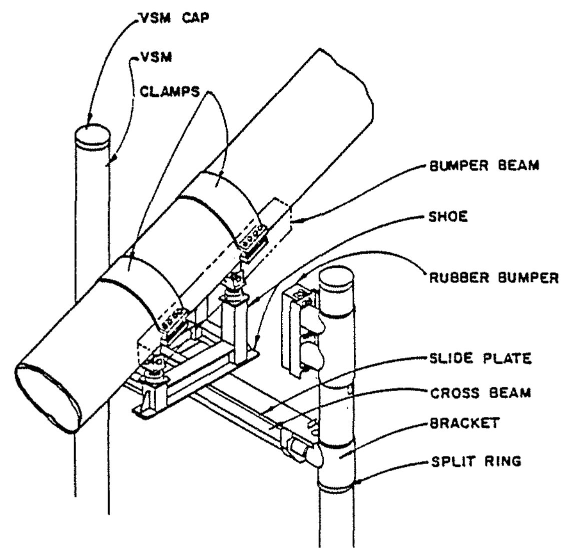
a. Berm Supported Crossing for Donnelly Dome & Denali Fault Crossing



b. Vertical Support Member (VSM) for McGinnis Fault Crossing. Elevated above Floodplain by VSM Structures.



c. Anchor Structure For Donnelly Dome, McGinnis, & Denali Fault Crossing



d. Intermediate Support for McGinnis Fault Crossing. Pipeline is to be Elevated above Floodplain by VSM Structures.

Note: Passive Heat Removal Devices (Thermosyphons) would be Installed in VSM, as Required in Permafrost Areas.

Figure 2.3.3-5. Typical Active Fault Crossing

Pass, the Sukakpak Mountain area, Yukon River, Moose Creek Dam, Phelan Creek, Keystone Canyon, and the TAPS terminal construction area. Each of these locations involves special engineering constraints, environmental sensitivities, or land-use conflicts associated with the siting of two or more pipelines.

2.3.4.1 Atigun Pass

The proposed TAGS pipeline route over Atigun Pass is a narrow "pinch point" intended to accommodate road transportation and pipelines from the North Slope. See Figure 2.3.4-1 for a map of the Atigun Pass construction area.

Atigun Pass is the highest point to be crossed by the TAGS pipeline in the Brooks Range. It is the only feasible route over this section of the Brooks Range. A route through the pass was therefore selected for the state highway and the TAPS project and has also been selected for the authorized ANGTS pipeline and TAGS pipeline.

The TAGS pipeline route would ascend the upper Atigun River valley on the west side of the Dalton Highway and crosses TAPS at the base of Atigun Pass. The route would ascend the north side of Atigun Pass, crossing the state highway, TAPS, and the authorized ANGTS pipeline right-of-way. The TAGS route then ascends roughly parallel to the TAPS route to the continental divide, where a second crossing of the highway and the authorized ANGTS route would be made. The TAGS route would then descend the south side of the pass, proximate to the west side of the authorized ANGTS route and highway, to the base of the pass. At the base of the south side of Atigun Pass, the route crosses the upper Chandalar River and parallels the west side of the highway to the Chandalar shelf. The closest proximity to TAPS would be at the top of Atigun Pass, where TAGS encroaches to within approximately 120 feet of the oil pipeline.

An optional route through an alternative pass 4.5 miles to the west was evaluated but eliminated from further consideration because the approach to the pass was blocked by extensive talus slopes and rock glacier in a steep narrow valley, was remote from existing infrastructure, increased length by 3.5 miles required 21.5 miles of all-weather road, and would require an additional work camp. This option was removed from further consideration.

Construction of the TAGS pipeline is estimated to require two summers of work in the pass area. Civil work to widen the highway would be completed during the first summer and pipeline installation during the second summer. Summer highway traffic would be carefully controlled on a 24-hour basis by radio-equipped flagmen. Travel interruption would be kept to a minimum. Larger vehicles and oversized loads might experience some delay in order to pass the construction area safely.

The second summer construction season would be used entirely for pipeline installation through the pass. Construction would be performed 24 hours per day. The total length of the construction would be limited to approximately 1,700 feet at any one time. Excavated ditch material would be hauled off site to provide sufficient room for pipe-laying operations. Roadway widening would provide sufficient room for pipe stringing (limited to 800-foot sections) and welding operations. The pipe would be laid in 800-foot sections with backfill accomplished as soon as all work is completed on each 800-foot section as shown in Figure 2.3.4-2. Upon completion of pipe-laying operations, the roadway ditch and surface would be restored.

2.3.4.2 Sukakpak Mountain Area

Within the Sukakpak Mountain area, the alignments from Dietrich Camp into the Koyukuk River valley would include ***a route option that has*** the least effects on the existing highway, TAPS, the authorized ANGTS right-of-way, scenic landscapes, and a confluence of the Dietrich and Bettles rivers with the Middle Fork of the Koyukuk River. Routing considerations ***were*** to avoid geotechnical, thermal, and hydrologic conditions that are incompatible with, or detrimental to, construction and operation of a high-pressure, chilled gas pipeline.

The proposed alignment through the approximately 10-mile area in the vicinity of Sukakpak would follow the area already occupied by TAPS, the Dalton Highway, and authorized ANGTS. The engineeringly

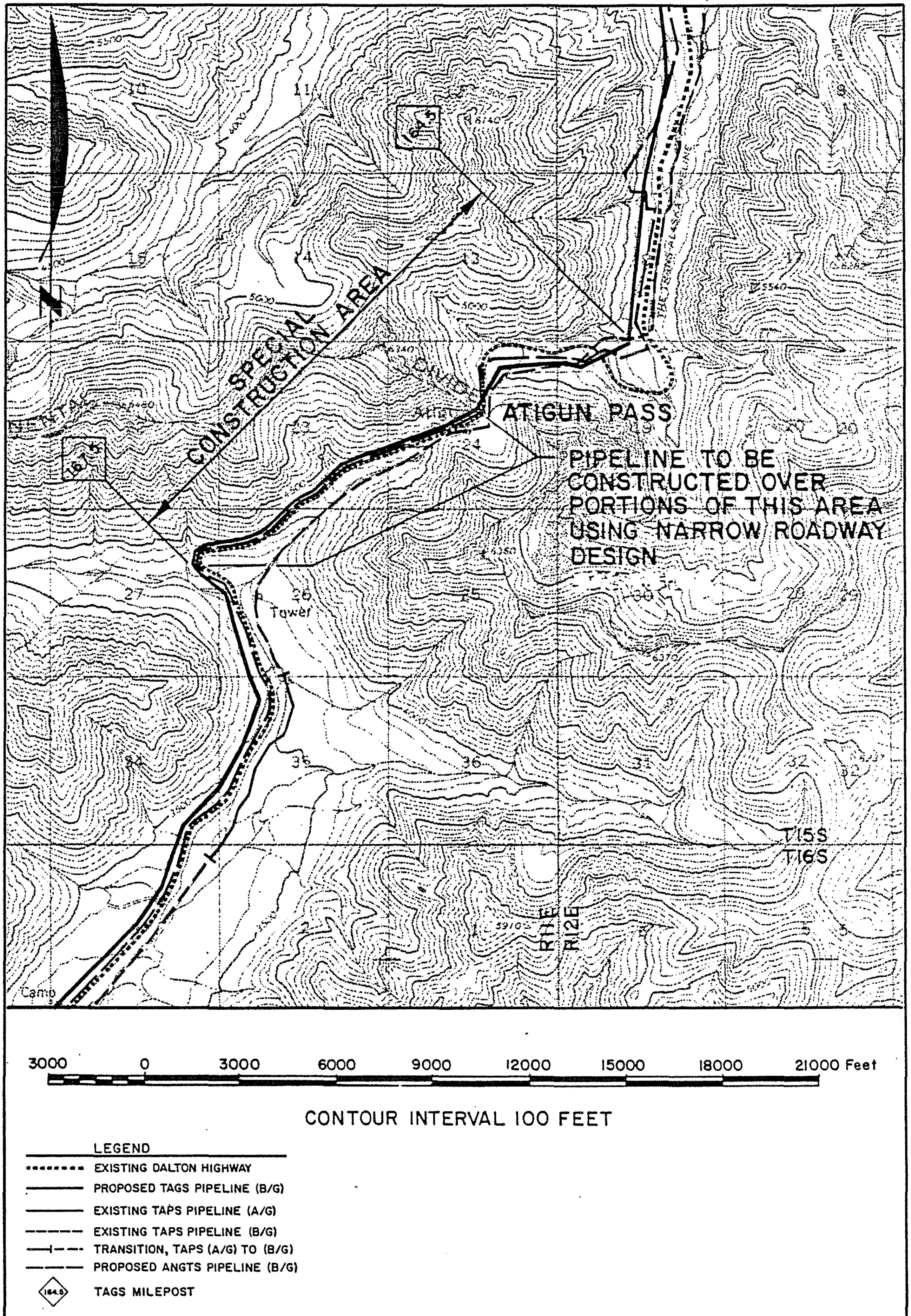


Figure 2.3.4-1. Atigun Pass Construction Area

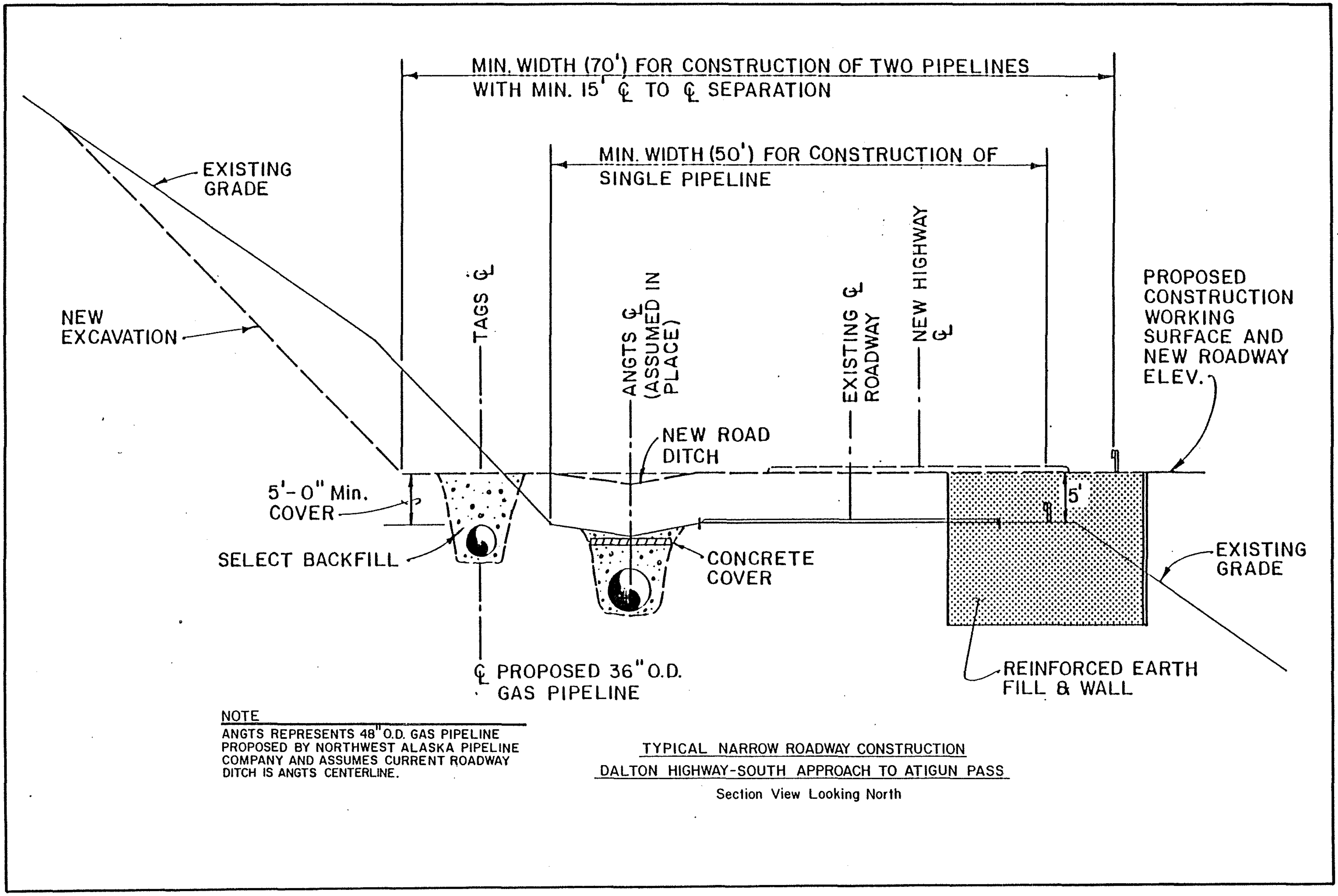


Figure 2.3.4-2. Atigun Pass Construction Area Narrow Roadway Cross Section

preferred route identified by YPC involves crossing the northerly forested saddle of Sukakpak Mountain. This alignment crosses an area having very high scenic value and accordingly BLM has advised YPC that it would not approve the "saddle" route. ***Thus, the route that has been selected for TAGS through the Sukakpak Mountain area, as depicted in Figure 2.3.4-3, does not cross the saddle and is located so that the concerns identified are minimized.***

2.3.4.3 Yukon River

The proposed TAGS pipeline would cross the Yukon River approximately 1,000 feet upstream from the existing Dalton Highway Bridge by way of an independent suspension bridge, as shown in Figure ***2.3.4-4.*** Several criteria limit the number of feasible crossing points for the new bridge: relatively narrow straight river section would be needed for bridge piers; suitable foundation conditions should exist for the support of bridge piers and anchor structures; suitable geotechnical conditions should exist in the surrounding area for the construction of pipeline approach segments; access from existing infrastructures should be reasonable; and the location should not affect existing river structures.

Conceptual design of a suspension structure for the TAGS project is shown in Figure ***2.3.4-5.*** A twin-span bridge would be designed for pipeline loading only***, e.g., no new public vehicular or foot traffic would be permitted.*** Each span would be approximately 1,000 feet long. Of the three piers required for this structure, the central pier would be constructed near the middle of the river on a bedrock anchor. Three 120-foot-high steel towers would support the main cables and pipeline load. Wind struts, 120 feet wide, would provide support for laterally strung wind cables and wind loads.

Design of the proposed bridge would involve consideration of river flood levels, ice scour conditions, high wind loads characteristic of the Yukon Valley, atmospheric icing loads, a wide range of temperature variation, navigation, and seismic loading. A site-specific geotechnical investigation would be necessary to determine the actual pier location.

The TAGS above-ground pipeline crossing of the Yukon River would be located approximately 800 feet upstream of the existing Yukon River bridge. Both bank abutments are on or close to Native allotments. Because of security reasons, public access to these private lands would be restricted. Due to the need to secure the above-ground portion of the pipeline from transition to transition, the security zone for the TAGS Yukon River crossing would be of greater size than the TAPS security zone.

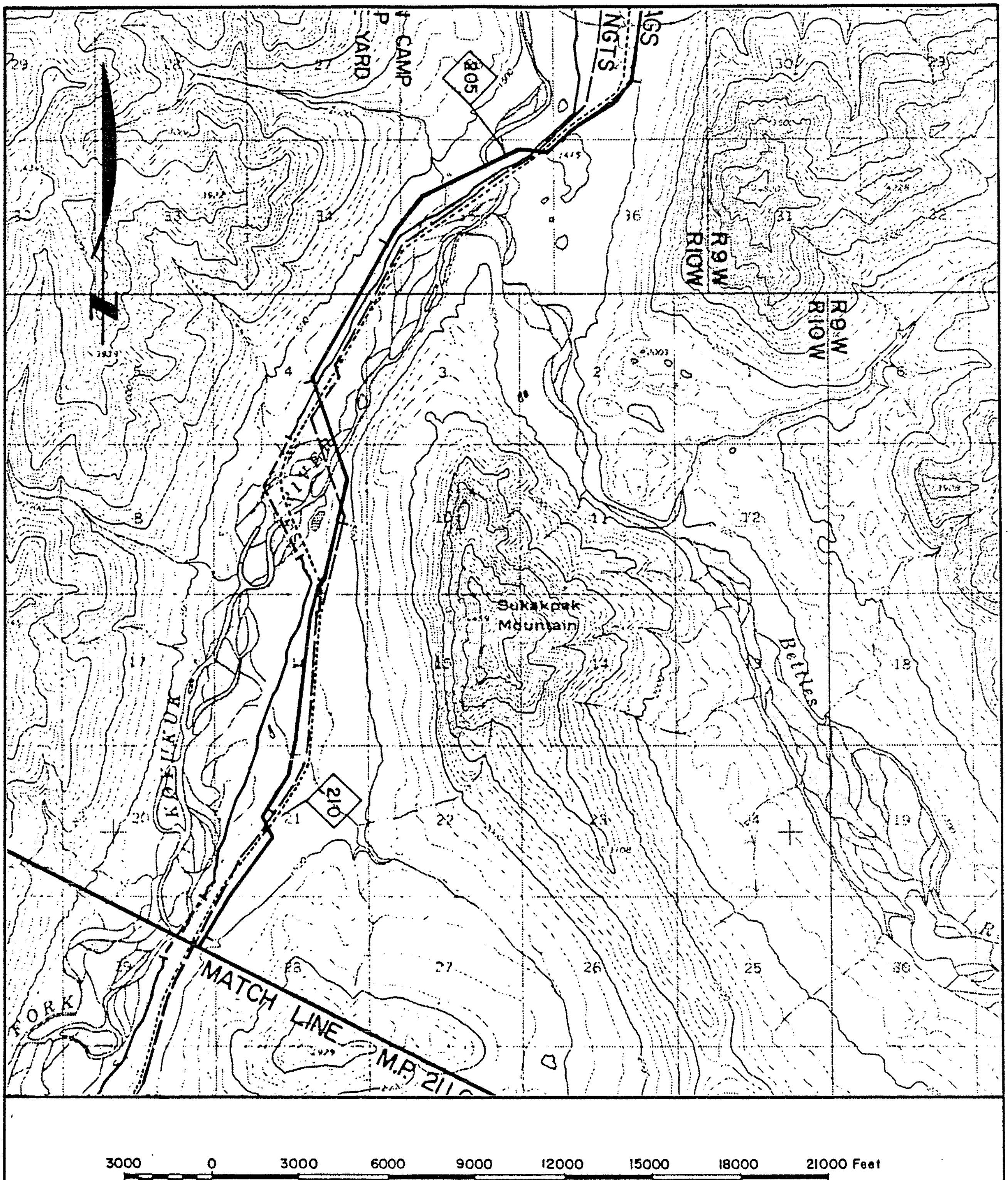
2.3.4.4 Moose Creek Dam

The TAGS pipeline crosses the Chena River Flood Control Project (Moose Creek Dam) southeast of the Fairbanks area. Moose Creek Dam, ***as shown in Figure 2.3.4-6*** is approximately 6.5 miles long and is oriented perpendicular to the TAGS route. The TAGS route would cross the dam on a flat floodplain 1.8 miles south of the main channel of the Chena River. At the point of pipeline crossing the dam height is approximately 40 feet, with 2.5:1 dam slopes. A special crossing over the top of the dam would be planned to prevent disturbance to the earthen structure of the dam.

Construction of the Moose Creek Dam crossing would occur in two phases during the first year of pipeline construction. The first phase, which would involve civil work only, would be conducted during the summer to ensure proper compaction of fill. Riprap protection would be placed on the upstream side of the structure except at the 80-foot-wide construction zone needed for pipeline installation. The second phase would involve the installation of the pipeline, which would commence in the fall. After completion of backfill, required riprap protection would be placed on the pipeline right-of-way. ***Construction of the pipeline across the Moose Creek Dam*** area ***is depicted in Figure 2.3.4-7.***

2.3.4.5 Phelan Creek

The proposed TAGS alignment between the mouth of Phelan Creek and the subsequent



CONTOUR INTERVAL 100 FEET

LEGEND

- EXISTING DALTON HIGHWAY
- PROPOSED TAGS PIPELINE
- EXISTING TAPS PIPELINE (A/G)
- EXISTING TAPS PIPELINE (B/G)
- TRANSITION, TAPS (A/G) TO (B/G)
- PROPOSED ANGTS PIPELINE (B/G)
- TAGS MILEPOST

Figure 2.3.4-3. Sukakpak Mountain Construction Area

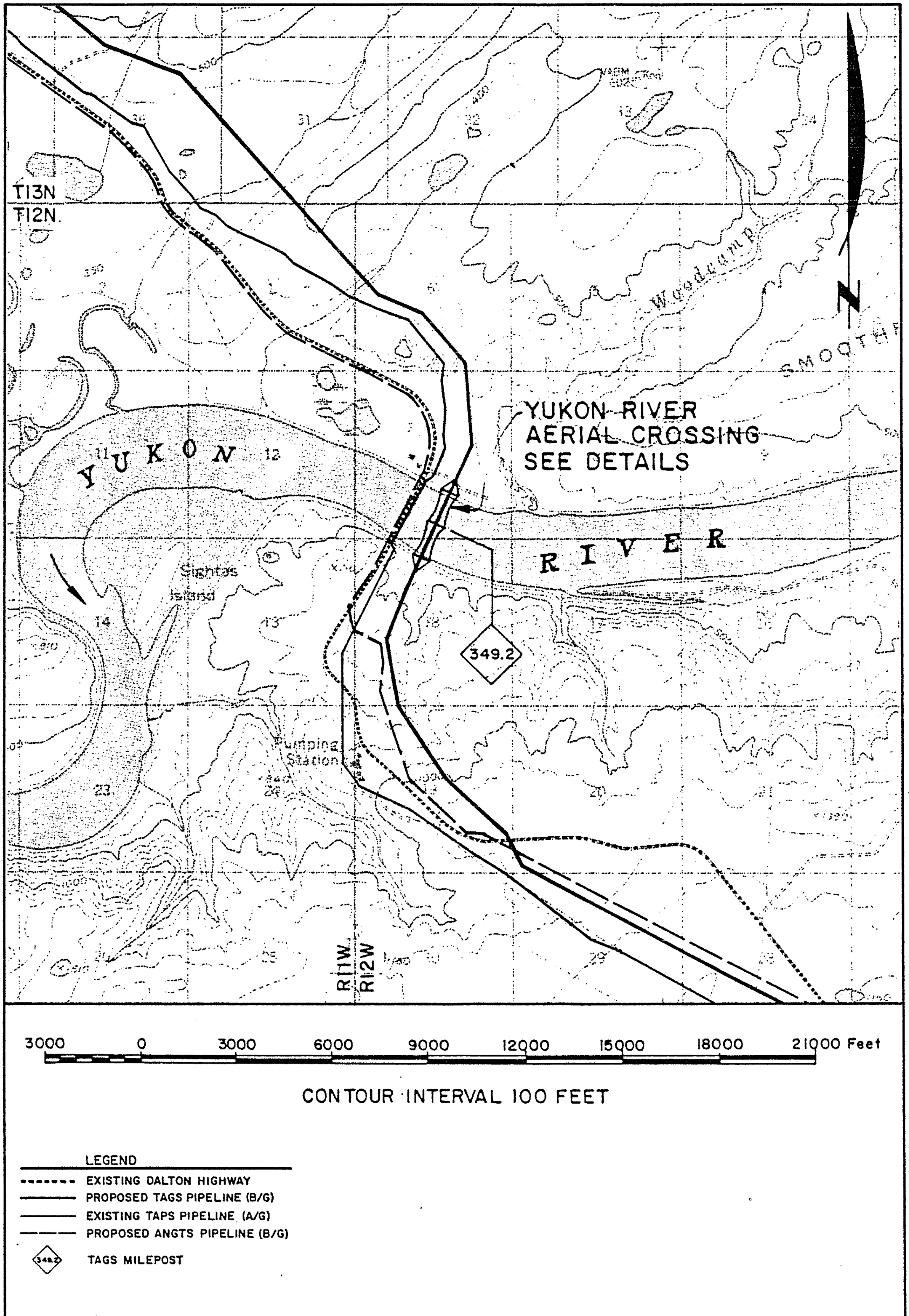


Figure 2.3.4-4. Yukon River Construction Area

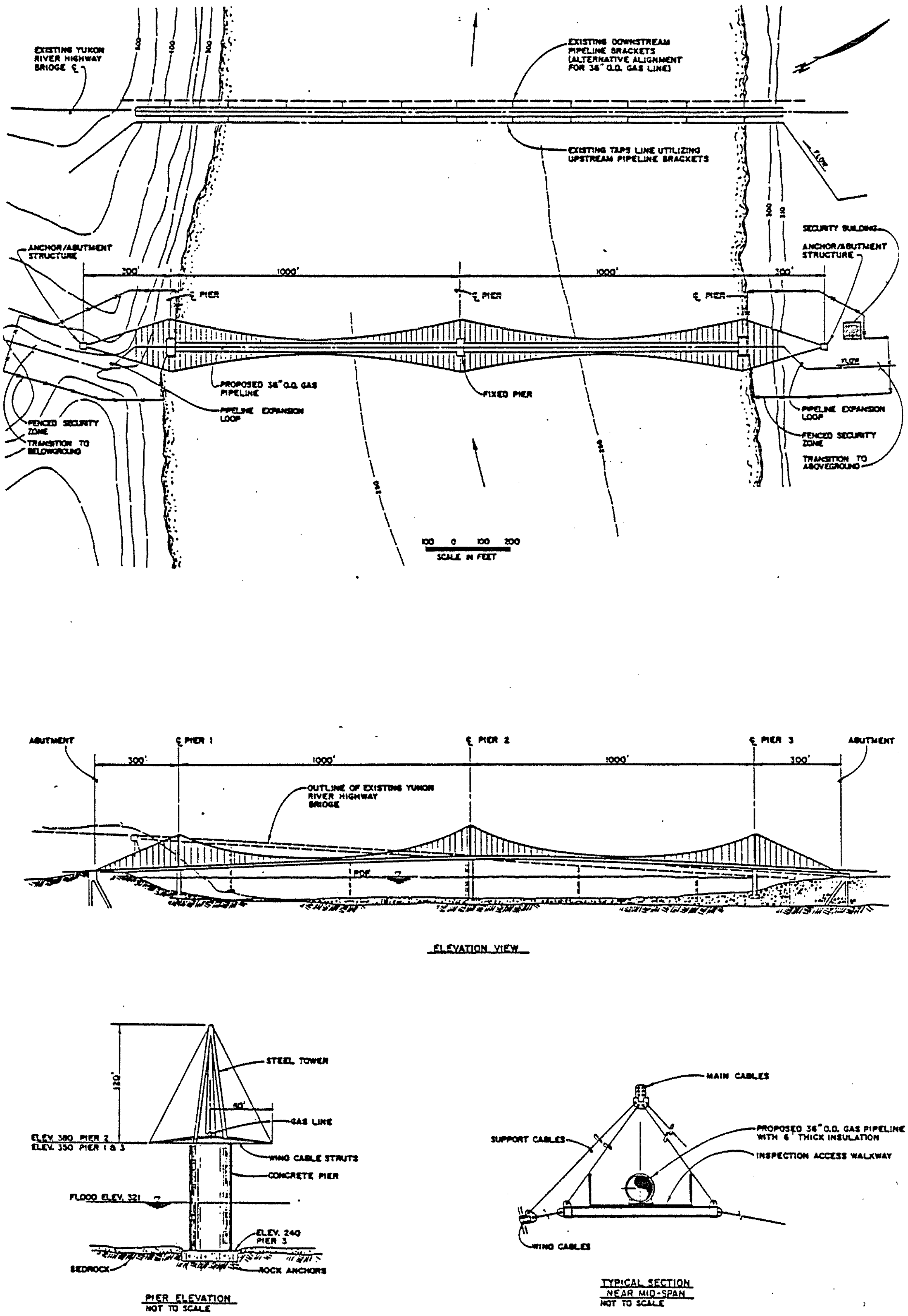
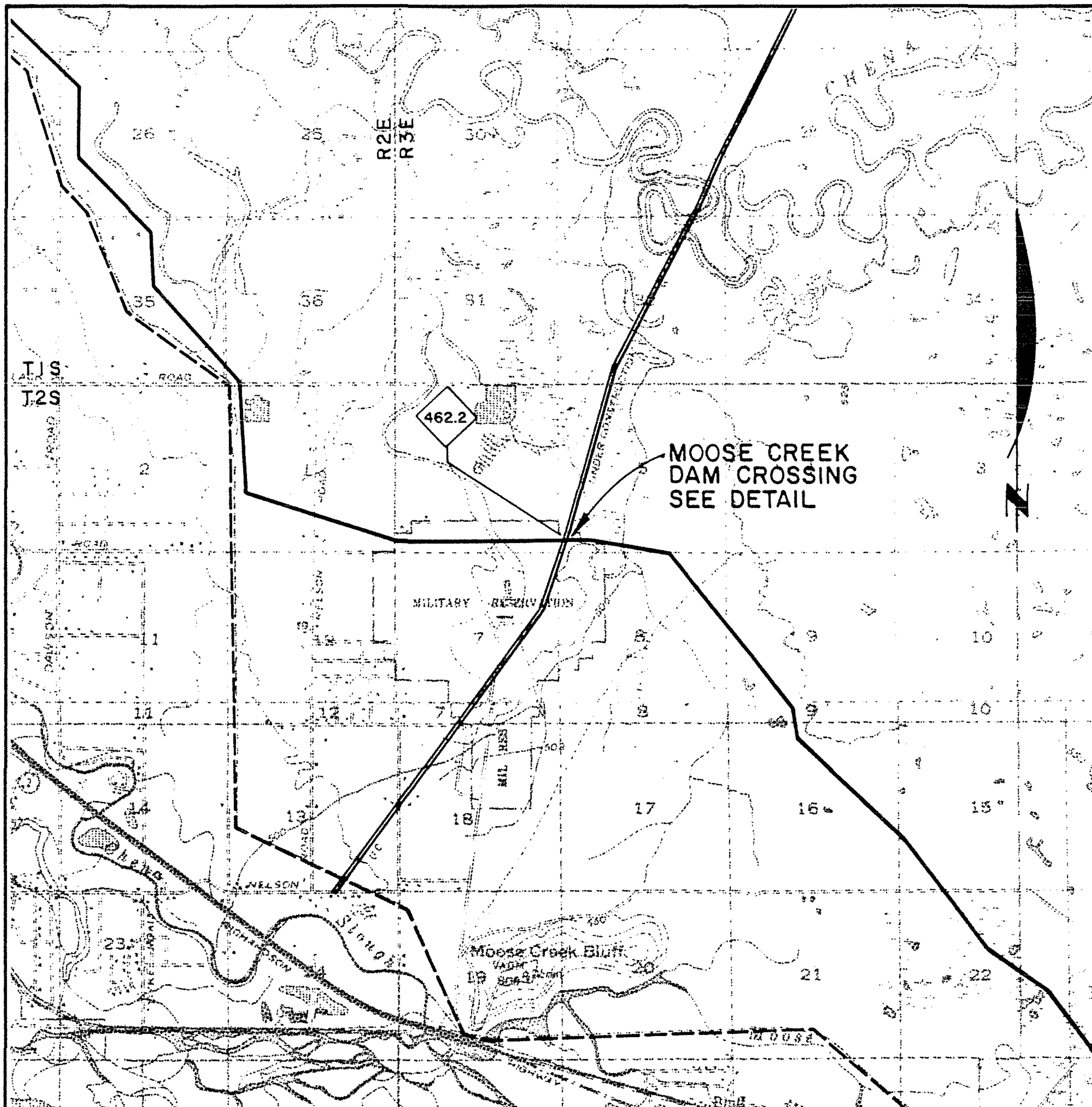


Figure 2.3.4-5. Yukon River Aerial Crossing



SCALE 1:63360

3000 0 3000 6000 9000 12000 15000 18000 21000 Feet

CONTOUR INTERVAL 50 FEET

LEGEND

PROPOSED TAGS PIPELINE (B/G)

EXISTING TAPS PIPELINE (B/G)

APPROXIMATE LIMITS OF MOOSE CREEK DAM

462.2 TAGS MILEPOST

Figure 2.3.4-6. Moose Creek Dam Construction Area

NOTE : New Figure in FEIS

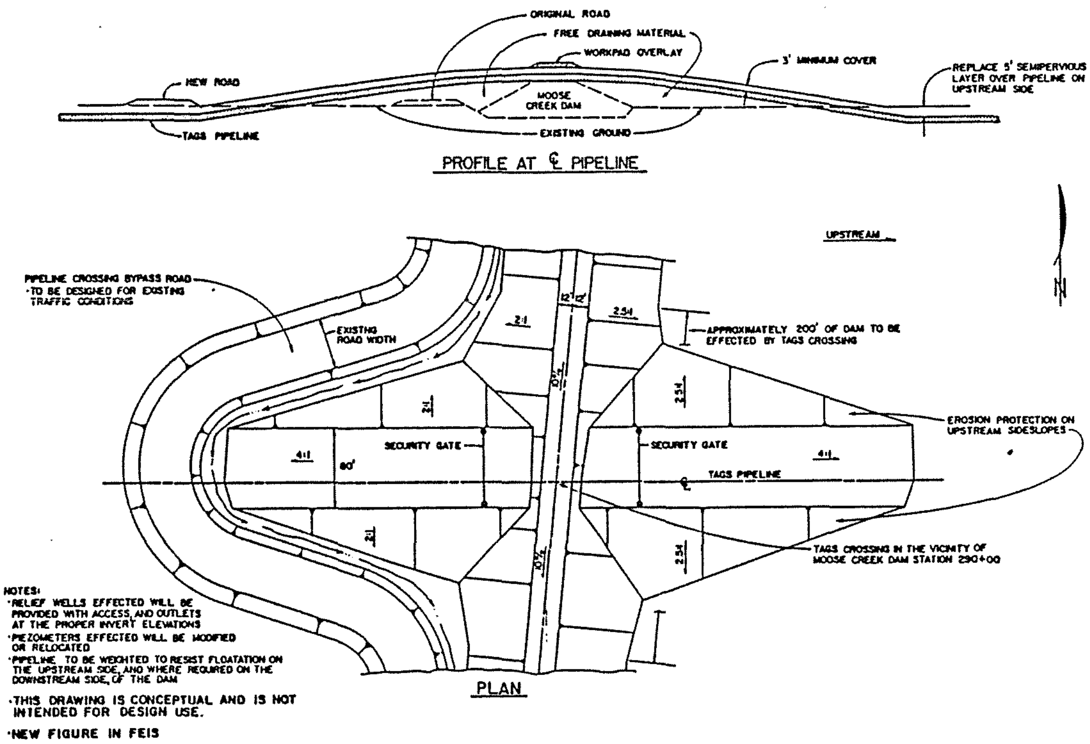


Figure 2.3.4-7. Moose Creek Dam Construction Area Cross Sections

crossing of Phelan Creek would include co-use of the Richardson Highway areas. Figure *2.3.4-8* is an area map of Phelan Creek. The total length of special construction would be approximately 10,500 feet, with three co-use areas totalling 7,800 feet. The Richardson Highway throughout this area follows the break in slope between the steep valley wall and the wide braided floodplain of Phelan Creek. In two areas, totalling approximately 2,700 feet in length, the highway has been relocated farther from the valley wall to straighten the alignment. The TAGS pipeline would be routed along the toe of the slope of the valley wall, encroaching on the highway ditch only where the highway is located close to the valley wall. Pipeline construction for these areas of encroachment is depicted in Figure *2.3.4-9*.

A site-specific investigation and an evaluation of the potential for the creation of aufeis and heave in the paved highway surface would be conducted during final design. Where applicable, insulation would be utilized to limit frost-bulb growth and the blockage of ground-water flow.

2.3.4.6 Keystone Canyon

The proposed TAGS route through Keystone Canyon would involve Richardson Highway co-use for most of its 19,500-foot length, as shown in Figure *2.3.4-10*. The special construction area starts near the south end of the Richardson Highway bridge crossing of the Lowe River, near Bear Creek, and ends at the TAGS pipeline crossing of the highway at the mouth of Keystone Canyon.

Through this section the Richardson Highway is routed near the Lowe River in Keystone Canyon. The Lowe River is severely constricted in the canyon, and the Richardson Highway is closely flanked by the steep canyon walls and the river. In the upper canyon area, the highway is located on the east side of the river. In the lower canyon area, the highway is located on the west side. The Richardson Highway crosses three bridges within the canyon.

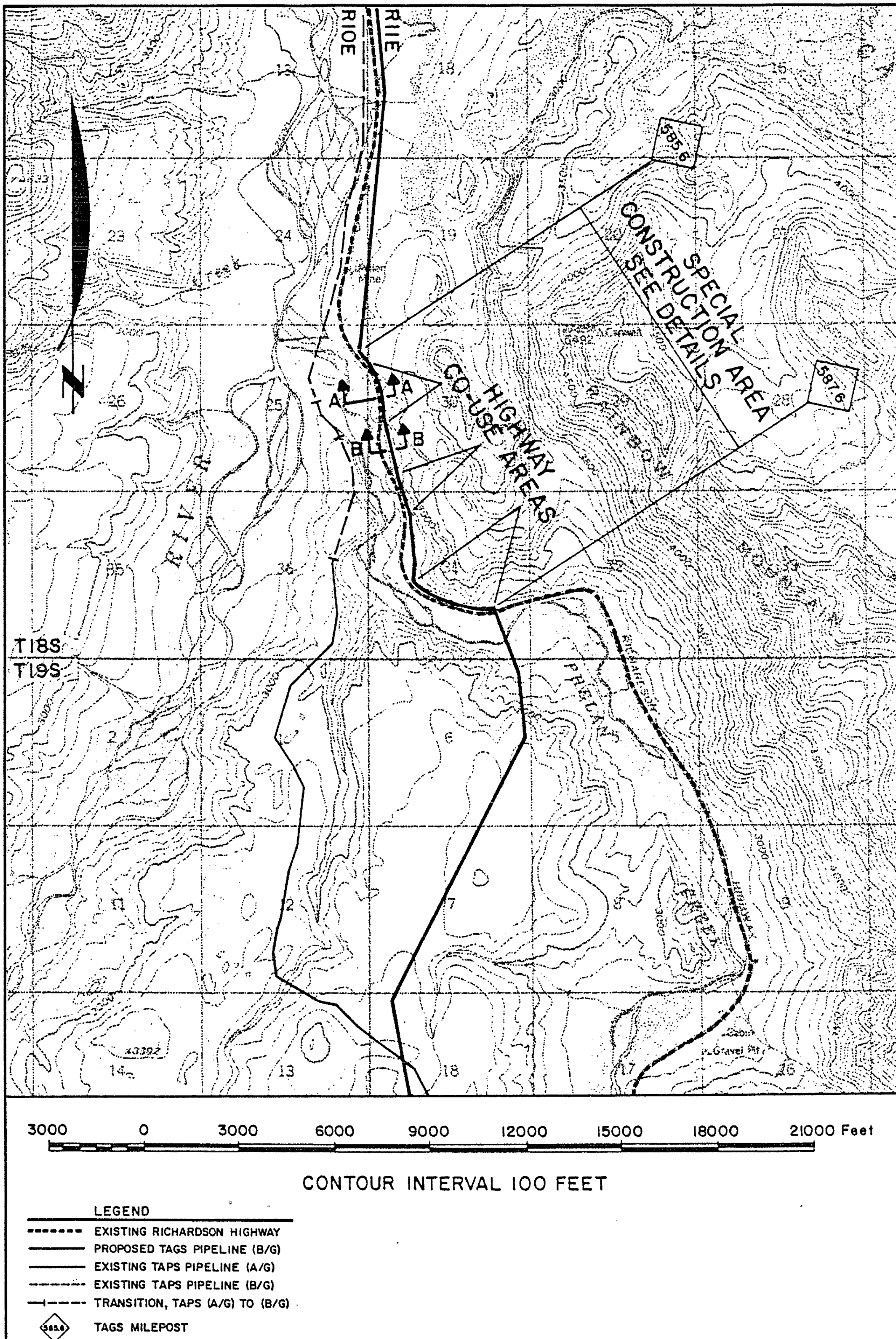


Figure 2.3.4-8. Phelan Creek Construction Area

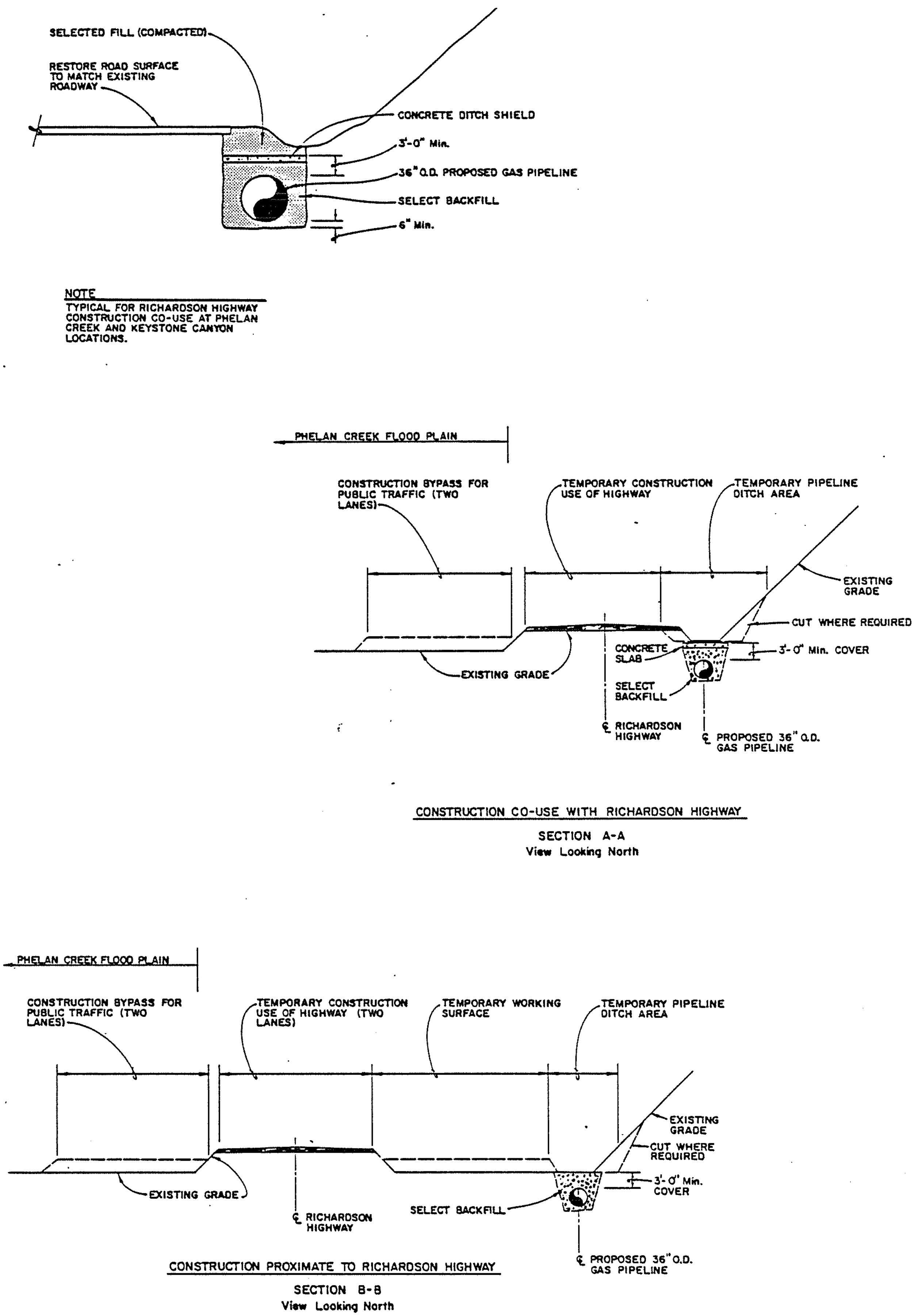


Figure 2.3.4-9. Phelan Creek Construction Area Cross Section

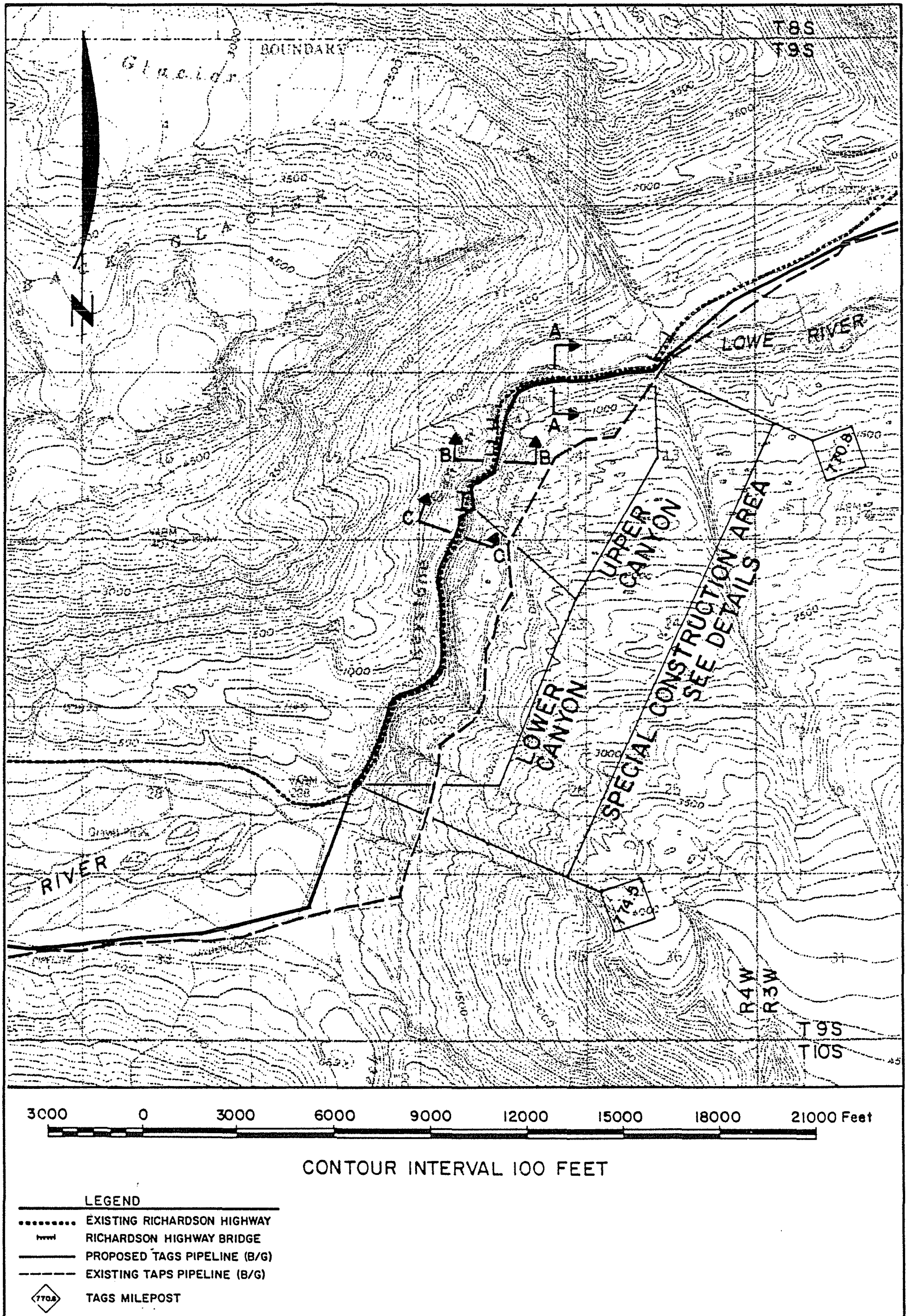


Figure 2.3.4-10. Keystone Canyon Construction Area

The proposed TAGS pipeline would be routed primarily in the highway ditch next to the canyon wall and would deviate only to avoid conflicts with highway bridges and to cross the Lowe River. To avoid conflict with the two highway bridges in the upper canyon area (near Snowslide Gulch), the TAGS pipeline would use the abandoned railroad/ Richardson Highway tunnel.

Installation of TAGS in this area would be completed in a single summer season during the second year of pipeline construction. ***Timing and construction constraints would be stipulated by the state for the stream crossing to avoid anadromous fish migration.*** Typical construction sections for the area are shown in Figure ***2.3.4-11.*** Except for construction through the old highway tunnel and in the limited areas where sufficient space exists for pipeline construction from a separate work surface, construction would take place off of the highway with the pipeline near the roadway ditch. A protective cover would be utilized over the pipeline where it is located immediately adjacent to the roadway.

Pipeline installation would be conducted on a 24-hour-per-day basis to reduce construction time through this section, thus allowing a return to natural traffic flow as soon as possible. Ditch spoil would not be stored on-site since no area exists next to the ditch for stockpile.

A temporary bypass would be constructed in the Lowe River floodplain for the section north and east of the old Richardson Highway tunnel. Traffic through this section would be allowed to pass without delay except during blasting and material handling; minor delays could be required for public safety.

Construction activity would be limited to a length of approximately 1,200 feet. The critical point in the Keystone Canyon construction section would be the roadway crossing required at Ruddleston Falls. This crossing and the Lowe River crossing immediately to the north would be installed concurrently. Since no room exists for a bypass, the highway crossing would be cut and temporarily bridged to maintain trafficability. The river crossing would be excavated, then the road crossing and river crossing would be installed. After completing pipe installation, the temporary bypass on the north end of the section would be removed and the roadway through the section would be restored.

2.3.4.7 TAPS Terminal Construction Area

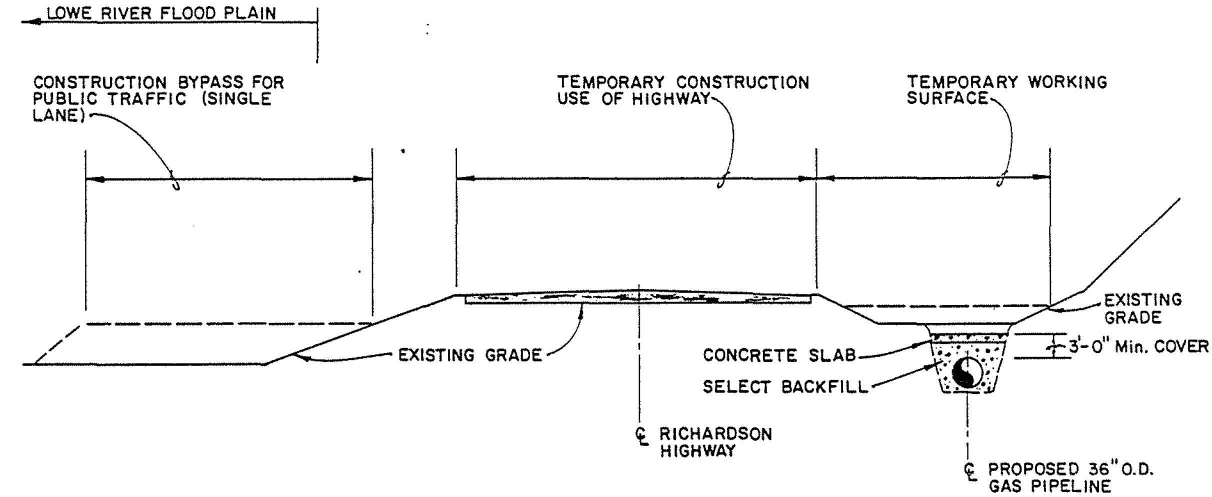
The proposed TAGS alignment between the Fort Liscum slide area and the mouth of Sawmill Creek requires routing in the area of the TAPS oil terminal site owned by the Alyeska Pipeline Service Company. This special construction section would be approximately 18,500 feet and routed south and above the TAPS oil terminal site. Two construction seasons would be required, the first would be for workpad and site preparation and the second for pipeline installation, as shown in Figure ***2.3.4-12.***

The feasibility of this route and alignment design in this area would involve coordination with Alyeska Pipeline Service Company. Selection of a specific route in the area of the terminal would be the result of detailed evaluation of available alternatives, design requirements, and construction procedures. Proposed TAGS operating and maintenance requirements would also affect specific route selection.

2.4 COMPRESSOR STATION CONSTRUCTION

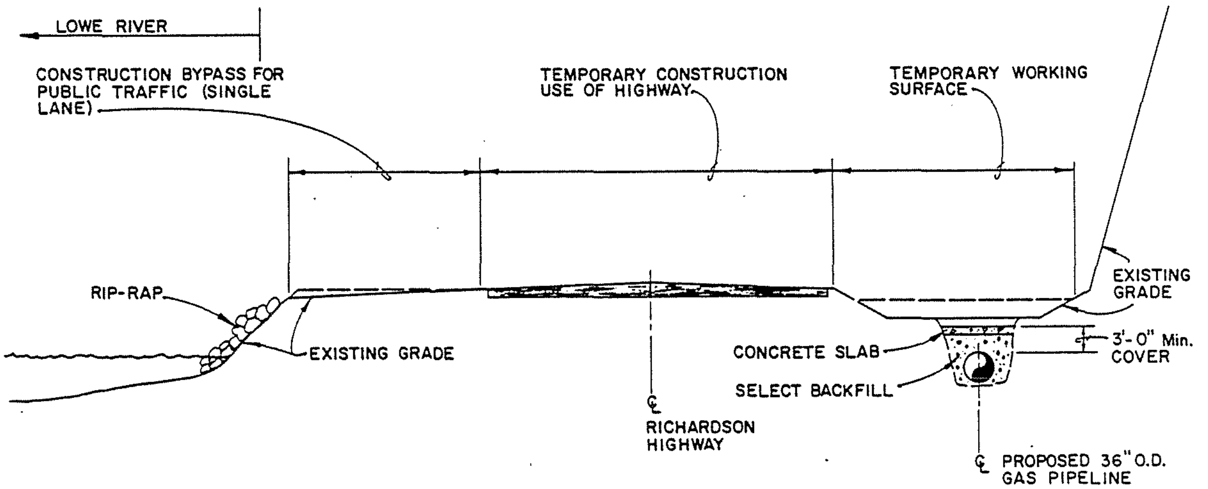
YPC has proposed a 10 compressor station configuration, but also has recognized there is possibility of a 5-station option. The EIS focuses on the 10-station system because it involves more construction effort and more sites. It should be noted that air quality evaluations have used the 5-unit system. This exception was made in recognition that the 5-unit system has greater emission capability at each of the sites. The final selection of a 10- or 5-unit system would be determined during Phase II. In addition to locational factors, overall system integrity and the effect of colder operating temperatures with the 5-unit system in the areas of discontinuous permafrost would be evaluated.

The conceptual system design of 10 compressor stations ***would*** provide the necessary pressure boosts to efficiently transport 2.3 ***BCFD*** of natural gas from Prudhoe Bay to Anderson Bay. These stations would be located along the pipeline by the mileposts ***as*** identified in Table 2.4-1 and shown on the pipeline route map in Alignment Maps 1 and 2. ***Conditioned natural gas would enter the pipeline at***



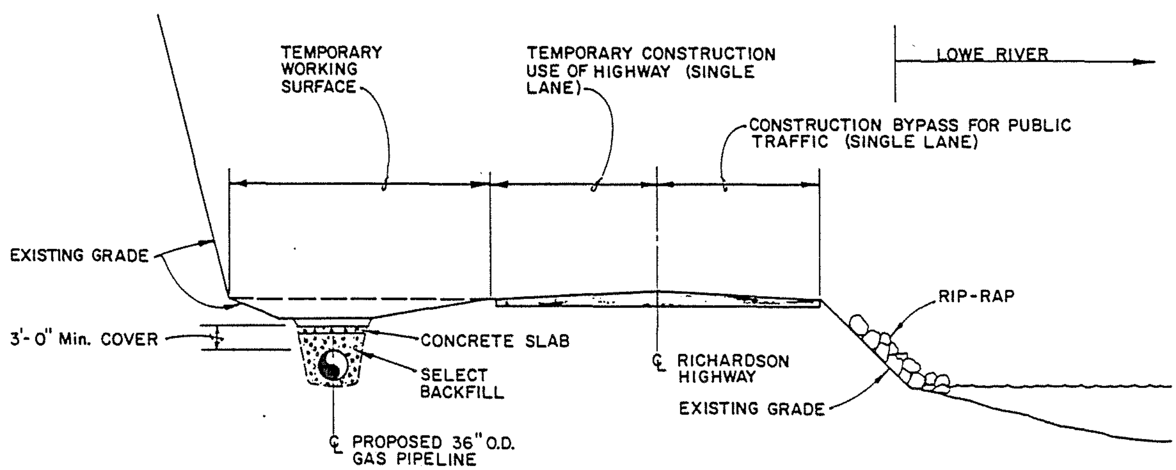
CONSTRUCTION CO-USE WITH RICHARDSON HIGHWAY

SECTION A-A
View Looking North



CONSTRUCTION CO-USE WITH RICHARDSON HIGHWAY

SECTION B-B
View Looking North



CONSTRUCTION CO-USE WITH RICHARDSON HIGHWAY

SECTION C-C
View Looking North

Figure 2.3.4-11. Keystone Canyon Construction Area Cross Sections

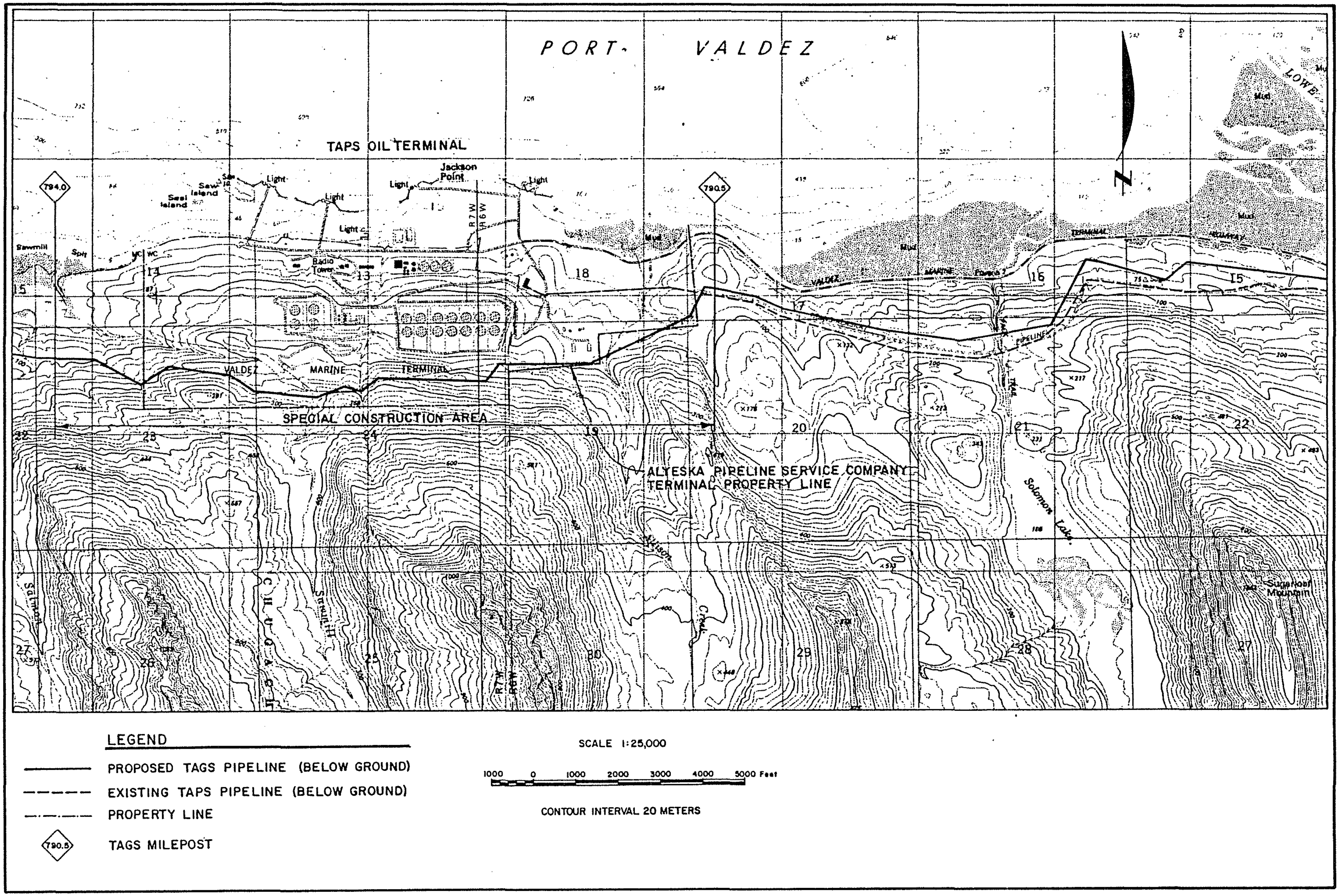


Figure 2.3.4-12. TAGS Pipeline Route through Alyeska Terminal Areas

the outlet of the conceptual GCF at a temperature and pressure to reach the first compressor station at MP 66.5.

Location of proposed TAGS compressor stations is based upon consideration of ***overall*** system operating requirements and physical siting constraints. Ideally, station locations would allow equal horsepower to be installed and operated at all compressor stations. Siting constraints include the rugged Alaska topography, highly variable geotechnical and highly active hydrological conditions, environmental sensitivities, and restricted access. Compressor station locations provide acceptable system operating characteristics while satisfying environmental and engineering concerns.

Construction of each compressor station would require two construction seasons. The first season would be used for site preparation, camp and temporary facility installation, and foundation construction. The second season would be used for equipment and material receipt, installation, erection, and startup.

The compressor stations would be constructed in two groups. The first group (stations 2, 4, 6, 8, and 10) would be built in construction years three and four. The second group (stations 1, 3, 5, 7, and 9) would be built in construction years four and five. An overall schedule for compressor station construction is shown on Figure 2.2.2-1.

Conventional techniques and procedures would generally be used to construct the compressor stations. All construction activities would be carried out on the station gravel pad and would not affect the surrounding environment.

Compressor station sites first would be cleared of brush and timber. Where appropriate, pads would be installed at each site over a geofabric to reduce gravel volume and to ensure the long-term performance of the pad. The pads at Compressor Stations 1 and 2 would be located in cold permafrost areas; they would consist of gravel placed over high-density polystyrene insulation. Compressor Station 10, to be located on the existing Tonsina Camp pad, would require the addition of 1 foot of gravel only to level the pad for construction.

Based on the conceptual design, it is estimated that 2,300,000 ***bank*** cubic yards (BCY) of borrow material would be required for the construction of 10 compressor stations and related temporary camp and storage yard areas. The following Table 2.4-1 provides estimates of borrow requirements for each site:

Table 2.4-1
Compressor Station Sites
Borrow Requirements

Compressor Station	Milepost	Acreage Required	(BCY)
1*	66.5	40	340,000
2	125.6	30	260,000
3*	213.7	30	300,000
4	280.9	30	175,000
5*	357.0	30	350,000
6	421.0	30	175,000
7*	486.4	30	150,000
8	562.3	30	250,000
9*	639.2	14	200,000
10	720.5	14	100,000

**** Would not be constructed under a 5-station configuration.***

Buildings and structures at compressor station sites in permafrost areas would be supported on artificially refrigerated or steel pipe foundations. In nonpermafrost areas, conventional concrete foundations would be used.

The compressor station installation plan would maximize the use of offsite fabrication and assembly in order to minimize field installation man-hours, reduce overall cost, and improve completion schedules. However, because of size restrictions on key Alaska highways leading to the compressor station sites, prefabrication would be limited to equipment assemblies rather than complete facility modules. The packaged equipment to be shipped to each site would include the main gas compressors, the refrigeration compressors, the fired heater packages, the gas turbine-driven generator packages, and the air compressor packages.

All compressor station piping would be prefabricated to the maximum extent practical in spools and pieces marked for installation at each site. Preassembly of piping, such as valve assemblies and launcher and receiver assemblies, would be performed in the manufacturer's shop. These preassembled units would be insulated in the shop to minimize field construction work. The majority of the gas and refrigeration piping would require field welding. Long straight runs of exterior piping would be preinsulated to the extent practical.

2.5 LNG PLANT AND MARINE TERMINAL CONSTRUCTION

The proposed TAGS LNG plant and marine terminal would be located at Anderson Bay, along the southern shoreline of Port Valdez. Anderson Bay is approximately 3 miles inside the Valdez Narrows, 3.5 miles west of the existing TAPS oil terminal, and 5.5 miles west-southwest of the city of Valdez, as shown in Figure 2.2.1-4.

Construction of the LNG plant and marine terminal at Anderson Bay would require conventional construction procedures and techniques. Detailed design and construction activities would be completed over a five-year period. A general schedule outlining the overall construction program is provided in Figure 2.5-1. The critical path schedule consists of site preparation, LNG tank foundation installation, and tank erection. Detailed engineering for the site layout and the site preparation design and contract packages would have to be completed during the last six months of the project development activities prior to the initiation of construction in order to complete the LNG plant and marine terminal at the end of year five.

Development of the LNG plant and marine terminal site would be completed by subcontractors. Scope of work would include completion of all earthwork, foundations (except LNG tank foundations), retaining structures, subsurface lines, rock reinforcement and rock drainage, site drainage, and roadways. Site development activities would begin as early as possible in the first construction year to ensure completion of the LNG tank areas early in the second construction season. Site development activities mostly would be carried out in three consecutive summer seasons.

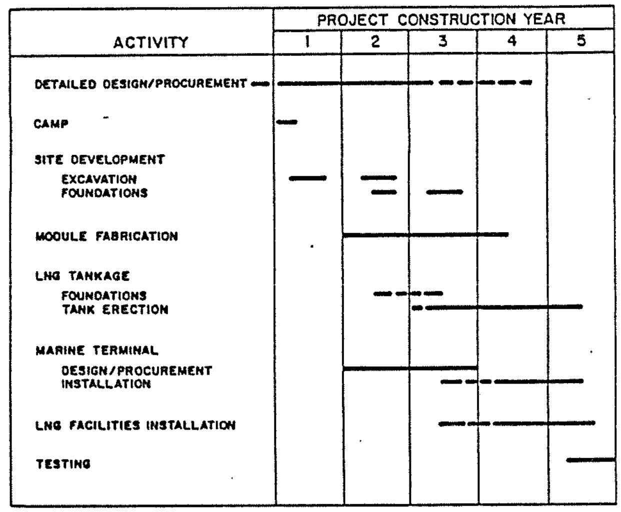


Figure 2.5-1
LNG Plant and Marine Terminal
Construction Schedule

Site excavation would involve removal of overburden soils, within design limits, down to bedrock and placement of these soils in planned *fill and* disposal areas *(as shown in Figure 2.2.1-5*; the removal of rock down to design grade elevations; and the placement of compacted rock fill in low areas up to design grade elevations. Overburden removal would be done using conventional shovels, loaders, and haul trucks. Rock excavation would be done using conventional drilling and blasting techniques. Rock would be moved and placed by dozers, loaders, haul trucks, and compactors.

Based on the layout developed during conceptual design, bedrock foundations for all critical facilities would be provided using the following site grades:

Facility	Elevatio
LNG process trains	165'
Metering facilities, feed gas preparation, and control area	165'
Power plant and operations support area	155'
LNG storage tank area	100'

Utility storage area	100'
Harbormaster and helipad area	50'
Wastewater retention area	50'
Construction wharf and off-loading area	30'

Site excavation quantities would be approximately 12 million cubic yards, of which 75 percent is expected to be rock. After bulking, this volume would be approximately 10 million cubic yards of the excavation quantity which would be used for on-site fill, including earthwork for the construction wharf and off-loading area in Anderson Bay. Approximately 5 million cubic yards of excavated material would not be needed and would require disposal.

Conventional concrete foundations would be used almost exclusively. Major foundations would be located on bedrock, and minor foundations would be located on bedrock or engineered rock fill.

Trenches for subsurface lines (electrical, instrument, water, and sewer) and drainage facilities would be excavated using drilling and blasting in bedrock areas and backhoes in rock-fill areas. Rock cut-slope reinforcement and drainage would be installed as required using conventional drilling and anchoring techniques and standard casing material. Site roadways would be constructed from blasted rock material generated during site excavation activities.

A construction off-loading dock area would be located in Anderson Bay. Constructed of rock fill from site excavation, the off-loading area would be designed to stage maximum 1,200-ton module loads. Steel sheet-pile cells would be utilized to construct the pier front. The dock would be designed for loaded-barge drafts.

Upon completion of site development for the LNG tank area, the LNG tanks subcontractor would mobilize and begin construction of the ring foundations for the first two LNG tanks as early as possible in the second construction season, continuing until all four tank foundations are complete. Tank materials would be received on-site early in the second construction season. LNG tank erection would begin in late summer of the second construction season and would continue until all four tanks are constructed. Expected completion would be in midsummer of the fifth construction year. The tanks constructed would be using a nickel alloy steel or aluminum alloy inner tank and a carbon steel outer shell. The complete tank foundation including ring-wall base would be electrically heated to prevent frost-bulb growth.

The storage tank area would be surrounded by an impoundment system constructed to contain any accidentally spilled LNG. The impoundment system would be formed with reinforced concrete walls, reinforced earth walls, by excavating bedrock, or by using a combination of these structures. During conceptual design a combined reinforced earth, reinforced concrete, and rock excavation system was considered. Individual cells 450' x 450' x 35' high were evaluated during the conceptual phase of impoundment design as being adequate for ***necessary exclusion zone as specified by DOT siting requirements.***

The installation of the remaining LNG shoreside facilities would be handled by an erection subcontractor. The erection subcontractor would mobilize to the site in the third quarter of the third construction year. Completed modules would be shipped via barge to Alaska, unloaded at the construction dock facility in Anderson Bay, and moved to the site by way of the dock access roadway. LNG process trains would be delivered and installed in sequence until all four process trains were completed.

The remaining yard pipe would be installed, tested, and tied in. All systems would go through a transfer of care, custody, and control procedure prior to final commissioning and operations.

The design and construction of all marine terminal facilities would be handled by a specialty subcontractor. A contract for this work would be awarded in the fourth quarter of the first construction year. Marine terminal design and procurement activities would begin at the start of the second construction year and continue for about two years.

The marine terminal subcontractor would begin construction of the two LNG mooring and loading berths late in the third construction year and continue until all marine terminal facilities were completed in midsummer of the fifth construction year.

The two fixed berths would be constructed approximately parallel to the shoreline in 50 feet of water. Each would be capable of mooring a 125,000- to 165,000-cubic meter LNG tanker. Mooring and breasting dolphins would be driven into the harbor bed. Fenders would absorb tanker movement impacts at the berths. A platform to support the marine cryogenic loading arms would be set back from the breasting line. Cryogenic loading lines supported by trestle structures on piles would connect the LNG storage tanks to the loading platform at the end of the berth facilities.

The conceptual design for each berthing facility would consist of three breasting dolphins, a transfer platform for the four marine loading arms and a vapor return arm, and four mooring dolphins located outboard of the vessel. Both the mooring and breasting dolphins would be accessible by catwalks.

A cargo vessel berth and dock would be constructed to handle general cargo shipments to the site and for refrigerant and liquid-fuel loading. The berth would be located in water deep enough for a vessel with 20 feet of draft. Conceptually, this facility would be designed for a 5,000-deadweight-ton vessel. A ferry landing would be constructed to allow marine access to the site from the city of Valdez and would be the primary means for site access during operations. A front-loading ferry capable of transporting cars and light trucks (5 tons per vehicle) would be constructed. The landing would consist of either a fixed ramp structure, a floating dock, or a combination of both. Conceptual design ***located on Figure 2.2.1-6 shows*** the tug and work boat pier adjacent to the cargo berth causeway. Space would be provided for three tugs and a pilot launch. This facility would be a floating dock with swing-type access ramps.

Other facilities to be constructed at the LNG plant and marine terminal site would include meter stations, communications systems, operations support facilities, and maintenance facilities.

The proposed TAGS LNG plant facility would be developed in accordance with the Pipeline Safety Regulations of the U.S. Department of Transportation. The Code of Federal Regulations Title 49, Subchapter D, Part 193 (49 CFR 193) prescribes Federal Pipeline Safety Standards for liquefied natural gas facilities. The proposed LNG plant reflects technical comments received from DOT. All facilities constructed at the LNG plant site would meet the requirements ***of 49 CFR 193 and, where prescribed by 49 CFR 193,*** prescribed by the current National Fire Protection Association 59A LNG standards. ***Where not conflicting with 49 CFR 193, NFPA 59A LNG standards would be implemented.*** Analysis conducted by YPC indicates that the Anderson Bay site could be developed in compliance with 49 CFR 193. Recognizing the commitment to safety embodied in this code, it has been used as the basis for evaluation of the proposed LNG plant site, for development of a conceptual definition of the LNG plant, and for LNG plant safety planning. These regulations would be used as the ***contolling*** standard for specific siting requirements, design, construction, equipment, operations, maintenance, personnel qualifications and training, fire protection, and security of the proposed LNG facilities.

The marine cargo transfer system and associated facilities and any matter (other than siting) pertaining to the system or facilities between the marine vessel and the last manifold (or valve) located immediately downstream of a storage tank must comply with 33 USC 1221 and Executive Order 10173 developed in accordance with the U.S. Coast Guard procedures.

2.6 OPERATIONS AND MAINTENANCE

Operation of the proposed TAGS pipeline, LNG plant, and marine terminal facilities would be in compliance with all applicable federal, state, and local regulations and standards. In addition, optimal system operating characteristics would be a goal in the design phases of the project as related to pipe structural requirements, geotechnical requirements, and thermal requirements and in site-specific evaluations.

The proposed TAGS pipeline system would be designed to transport 2.3 ***BCFD*** of conditioned natural gas from Prudhoe Bay. Beginning at a Prudhoe Bay gas measurement facility, the pipeline would extend 796.5 miles south to the proposed Anderson Bay LNG plant and marine terminal facility. Maximum operating pressures would be 2220 psig to a low of 1100 psig. YPC would consider gas takeoffs along the route on a business basis.

At the terminus of the pipeline, LNG plant facilities would receive gas throughput at a pressure of approximately 1300 psig. Operating temperatures below 32°F would be maintained through northern and interior permafrost areas. Conventional warm gas operation would be utilized in southern areas where essentially permafrost-free soil conditions exist. The single transition point from chilled to warm gas flow would be determined based on geotechnical and pipe constraints during later detailed design.

Gas entering the TAGS pipeline at Prudhoe Bay and gas delivered by the pipeline for liquefaction at Anderson Bay would be measured for flow volumes, composition, and BTU content. Table 2.6-1 identifies the feed gas composition used for conceptual design for the proposed TAGS project.

An integrated communication system would provide for the exchange of voice and data information along the entire pipeline route. A Private Automatic Branch Exchange (PABX) key system and public telephone network would be located at the Anchorage headquarters, the Fairbanks maintenance facility (FMF), all compressor stations, the LNG plant/marine terminal, and the operations control center (OCC). A mobile radio system would link the entire pipeline, the OCC, the FMF, and the headquarters. A supervisory control and data acquisition communication (SCADA) system at the OCC would monitor metering stations, valves, and compressor stations. A microwave radio system would link all telephone system locations, PABX, SCADA, Telex, and mobile radio repeater equipment.

Sites for communication facilities would be selected during the detailed design phase. These would be located on ridges or mountaintops in a manner similar to communication facilities developed for TAPS. Figure 2.6-1 shows a conceptual layout of a typical communication facility should it be possible not to have co-use of existing communication sites.

Table 2.6-1
Anticipated Feed Gas Composition

Constituent	Molecular Percent
N_2 Nitrogen	0.75
CO_2 Carbon Dioxide	0.00*
C_1 Methane	91.60
C_2 Ethane	2.67
C_3 Propane	3.40
iC_4 Iso-Butane	0.35
nC_4 Normal Butane	1.12
iC_5 Iso-Pentane	0.06
nC_5 Normal Pentane	0.04
C_6+ Hexanes and heavier	0.01
	100.00%

* All CO_2 will be removed on the North Slope during conditioning.

Additionally, TAGS facility communications could involve the use of fiber-optic technologies. Fiber-optic systems could provide communications and data transmission capabilities throughout the TAGS system. The fiber optic cable would be comprised of groups of glass fibers which are wrapped together and sheathed for protection, fiber-optic cables allow low loss, noise free transmission of digitally encoded (light) communication signals. Typically, fiber-optic cables are continuous between receptor locations, several inches in diameter, and flexible.

Fiber-optic cables would be installed along with construction of the pipeline. Reels of fiber-optic cable would be utilized to lay cable in the pipeline ditch parallel to the gas pipeline. Laying the fiber-optic cable would be coordinated with pipeline backfill activities such that the cable would lay above the pipeline, and on an initial layer of backfill material. Intermittent splicing of the cable would be required, and coordinated with pipeline tie-in activities. Fiber optic systems are low maintenance communication facilities, and require low power consumption during operations. Maintenance typically involves splicing in the event of cable damage due to excavation.

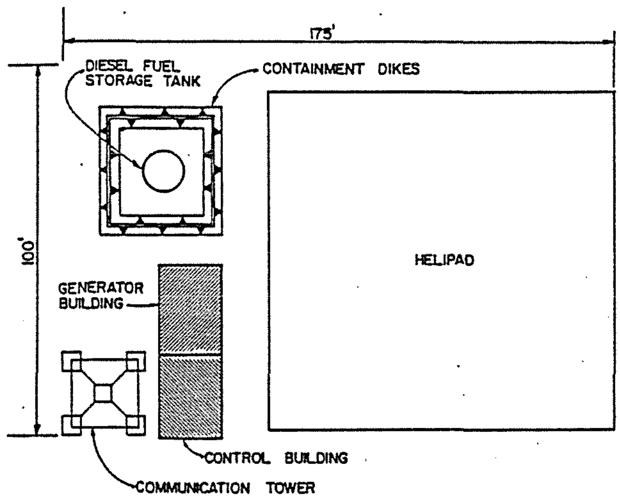


Figure 2.6-1
Typical Communication Facility

At each compressor station, a remote terminal unit would coordinate the control functions, activities, and communication of signals and data to the SCADA system at the OCC. In addition to instrumentation at each compressor station, meter station, and mainline valve station, other remote monitoring units would also transmit data to the SCADA computer at Anderson Bay. These units may include earthquake detection accelerometers, ground displacement sensors for sensitive slopes, or discrete pipeline monitoring devices for localized areas affected by frost heave, should they become necessary during pipeline operations. Remote monitoring units would be connected to microprocessors that would collect and transmit the data to the OCC.

Auxiliary facilities along the pipeline system would be required to support operation and maintenance efforts. Block valves spaced regularly along the pipeline route would provide for sectional system isolation. Corrosion control facilities would be spaced regularly along the pipeline route to provide system cathodic protection and measurement capabilities. Gas metering facilities would be required at each end of the pipeline system to account for gas deliveries at Prudhoe Bay, gas deliveries to the liquefaction plant, and pipeline/ compressor station fuel and to account for any system losses. A major maintenance facility would be located near Fairbanks. Material and equipment storage areas would be maintained along the pipeline to allow for responsive pipeline maintenance.

The proposed TAGS LNG plant and marine terminal would provide treatment, liquefaction, storage, and loading capabilities for natural gas to be liquefied and exported by tanker. Of the initial 2.3 *BCFD* (average stream) of pipeline gas received at Prudhoe Bay, the equivalent natural gas product would be approximately 2.1 *BCFD* for export at Anderson Bay.

The proposed LNG plant would liquefy natural gas utilizing cryogenic processes. Pipeline gas would first be prepared for liquefaction by passing through a series of driers and scrubbers to remove any moisture and impurities. After preparation, gas fed to liquefaction trains would be dry and clean.

Liquefaction of the natural gas would be accomplished by refrigerating the feed gas to a temperature of approximately -259°F. The refrigeration plant would consist of four liquefaction trains (units) operating in parallel. Each liquefaction train would produce LNG for transfer to a common storage facility. Unlike most LNG facilities that use water for cooling, the TAGS Anderson Bay facility would use air-cooling as the sole heat exchanger for the four liquefaction trains. No liquid thermal effluent would be produced.

The refrigeration requirements for liquefaction would be supplied by a series of closed-loop systems in each train. Each closed-loop system circulates refrigerant through a heat exchanger. Feed gas, also flowing through the exchanger, though confined to through-flow piping, would be chilled by the refrigerant. Resulting chilled natural gas would become LNG product. Refrigerant that became warm in the thermal exchange would be returned to the beginning of its closed-loop for recompression and cooling. Process designs that use various refrigerant gases and closed-loop refrigerant schemes are available. Designs for using a mixed gas refrigerant system or single gas refrigerant systems in series are available. Either system would provide the desired LNG product

Refrigerants for the closed-loop systems would consist of propane, ethylene, methane, and possibly some nitrogen. Propane and ethylene would be from off-site sources; methane would come from the feed-gas stream. Nitrogen from the air separation unit would provide purge and utility nitrogen for the LNG plant. Storage for liquid nitrogen from the air separation plant would also be provided.

After feed gas is chilled and condensed into liquid by exchangers, it would flow into an LNG flash drum where LNG could be pumped to storage and vapor could be recovered for use as fuel gas. All refrigeration and power generation gas turbines would be fueled by feed gas, boil-off gas, and flash gas. During LNG tanker loading, feed gas make-up to fuel would be reduced to compensate for the vent gas from the tanker, which would be collected, compressed, and sent to the fuel system. A block flow diagram of LNG plant facilities is presented in Figure 2.6-2.

Exhaust emmission sources at the LNG plant would include the following.

4 LNG liquefaction trains, each using five natural gas-fired turbines

3 vaporizers

4 25-megawatt gas-fired generators

1 solid waste incinerator

1 reactivation heater

1 process flare

Additionally, minor emissions would originate from other small pieces of equiment and vehicles.

Emissions from all of the sources itemized above (except for vehicles and the solid waste incinerator) would be generated from the combustion of boil-off natural gas as plant fuel. Prior to liquefaction, this gas had passed through driers and scrubbers for removal of particulate matter, lubricant oils, hydrogen sulfides, and mercury. Therefore, combustion of this natural gas would result in minimal emissions of all contaminants, such as sulfur dioxide, nitrogen dioxide, particulate matter, and carbon monoxide.

Water supply for the LNG facility would come from multiple sources and would be used for domestic purposes (drinking, sanitary facilities, and washdown) and fire protection as shown in Figure 2.6-3. The primary water source would be wells, supplying up to 200 gpm. Domestic water would be stored in a 3,500,000-gallon water storage tank, 3,000,000 gallons of which would be reserved for fire protection.

Wastewater from LNG plant facilities would be comprised of potentially oily wastewater from washdown and marine facilities and sanitary wastewater from personnel facilities as shown in Figure 2.6-3. Oily wastewater could contain significant amounts of soil and grease, grit and other settleable solids, as well as various suspended solids composed of organics and inorganics. Proposed treatment for such wastewater is a two-stage process. Initially, a pretreatment oil/water separator will be used to remove floatable oils and greases and readily settleable solids. Pretreated oily wastewater would then be combined with domestic wastewater for biological secondary treatment to remove organics, some trace metals, and remaining settleable and suspended solids. Sludges and skimmings from the oil/water separator would be incinerated. Ash would be handled as a solid waste.

Domestic wastewater from personnel facilities is anticipated to be of standard sewage strength. Collection systems would be relatively short and well controlled; no excessive infiltration or inflow sources of wastewater are anticipated. Treated water from the oily wastewater treatment facility would be combined with domestic wastewater for treatment.

Secondary treatment of combined wastewater would be required before discharge into the receiving waters of Port Valdez, according to State and EPA requirement. The EPA would issue a National Pollution Discharge Elimination System (NPDES) permit that covers the LNG facility discharge. Secondary treatment typically involves biological removal of dissolved organic and inorgnic wastes, followed by settling to remove the biologically formed solids as well as other organic and inorganic solids in the wastewater. Secondary treatment also removes some

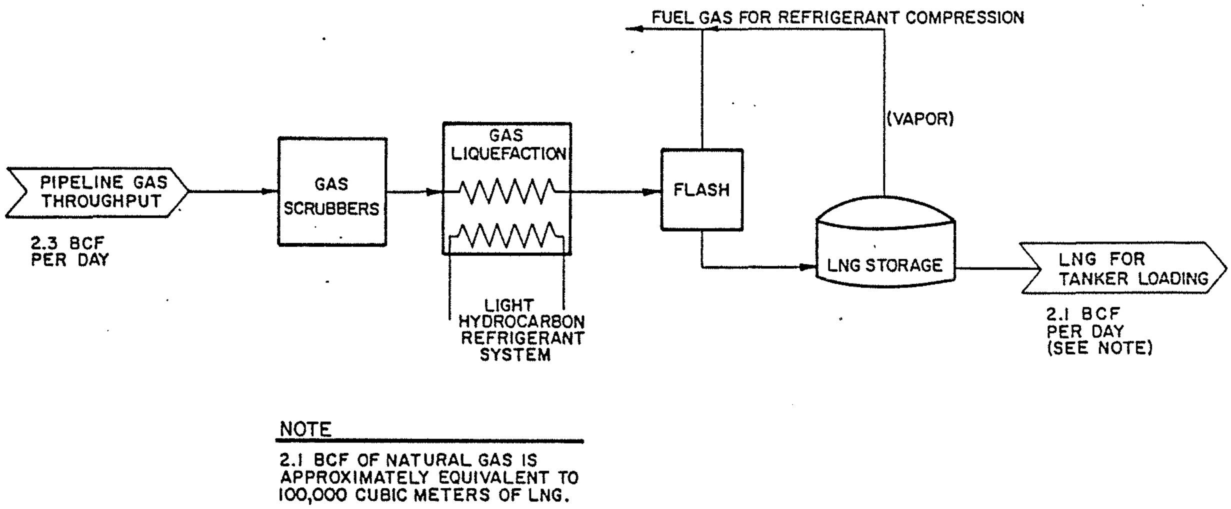


Figure 2.6-2 LNG Block Flow Diagram

metals, trace oils and greases, and some organics which could be in industrial effluents. Secondary treatment would be accomplished using a packaged aerobic treatment unit. The system would include a complete mixed aeration tank for biological treatment followed by a settling tank (clarifier) for solids removal. Solids would be recycled into the aeration process to provide a fresh supply of bacteria for the aerobic treatment. Sludge from the secondary treatment process would be combined with the oily waste sludge and incinerated on site.

During conceptual design, liquefaction facility would be sized for pipeline throughput to the LNG plant at 2.3 ***BCFD*** (average stream). At this rate, 2.1 ***BCFD,*** or approximately 100,000 cubic meters per day of LNG, could be produced. An estimated 680,000 horsepower of refrigerant gas compression would be required to meet ***this*** preliminary design figure. According to preliminary design, an estimated total cooling load released to the atmosphere would be about 2.6 billion BTU per hour.

LNG product would be pumped from the final flash drum in each liquefaction train through a common header to the LNG tankage area. Storage would be provided by four tanks with 800,000-barrel capacity, which would operate at near or slightly above atmospheric pressure. The proposed total tank volume of 3,200,000 barrels would provide approximately five days of LNG storage at design production rates.

The tanks would be individually pressure controlled to avoid boil-off fluctuations with changing atmospheric conditions. Safety pressure and vacuum valves, sized for emergency conditions, would protect the tanks. Boil-off from LNG storage tanks would be compressed and returned to the process trains for reliquefaction or for fuel gas. The storage tank area would be surrounded by an impoundment system to contain any accidentally spilled LNG.

The LNG product from onshore storage tanks would be transferred through the LNG loading system. LNG tanker vessels would be berthed at the marine terminal facility to receive LNG for export to the Asian Pacific Rim. Transfer piping would be sized that the system would be capable of loading two tankers simultaneously in a 12-hour period.

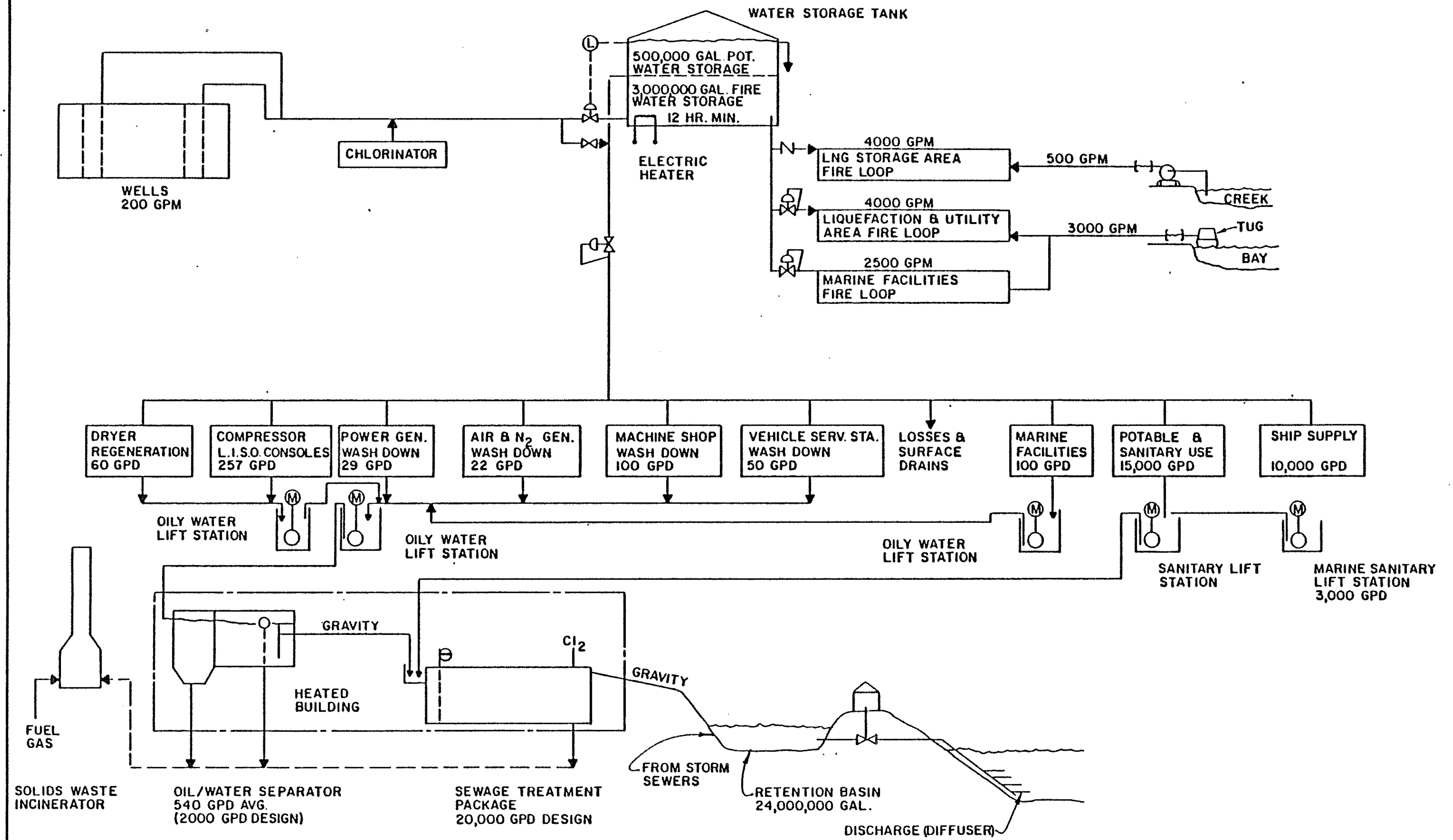


Figure 2.6-3 LNG Plant Water Supply and Wastewater Systems

Conceptual design of loading facilities would involve a design loading rate of 70,000 barrels per hour (bph) per tanker. LNG would be transferred through the loading system by cryogenic pumps and gravity. The loading system would be maintained in a cold condition at all times.

Loading lines supported by trestle structures connect LNG storage tanks to the loading platform at the end of berth facilities. Special metallurgy pipe would be used for loading lines, to accommodate the very low LNG temperatures. Loading lines would be insulated between storage tanks and loading platforms to minimize LNG boil-off.

The two LNG tankers would be oriented approximately parallel to the shoreline in 50 feet of water (depth below MLLW) and have the capability of mooring in either the forward or aft position. Figures 2.2.1-8 and 2.2.1-9 present sketches for typical spherial and membrane LNG tankers with dimensions for both 125,000 and 165,000 cubic meter tanker designs.

A typical 125,000 cubic meter tanker would require approximately 66,000 ton of ballast under normal operating conditions. Sea water would be used for ballast. ***Should*** ballast water be taken on in any port areas, it would be exchanged for sea water on the open ocean. Polluted ballast water would not be disposed of in Prince William Sound. There would be no oily ballast water from LNG tankers due to the nature of the LNG containment vessels.

The loading operation at each berth would involve using articulated loading arms to span between the fixed platform facility and the floating vessel. Based on preliminary design, four loading arms would be sized at a 16-inch diameter for assumed loading rates of 70,000 bph. In addition, a single vapor return arm would serve to connect tanker boil-off with onshore vapor recovery facilities. Vapor return lines, also supported by trestle structures, would take LNG vapors back to the plant fuel-gas system or to the feed-gas stream for reliquefaction. In addition to a main LNG loading line automatic shut-off valve, each loading arm would have an automatic shut-off valve to prevent LNG spillage during emergency conditions.

The proposed onshore TAGS LNG plant facility would be developed in accordance with the Pipeline Safety Regulations of the U.S. Department of Transportation. The Code of Federal Regulations Title 49, Subchapter D, Part 193 (49 CFR 193) prescribes Federal Pipeline Safety Standards for liquefied natural gas facilities.

The waterfront LNG facilities adjoining navigable waters of the United States which include marine cargo facilities, the transfer system, and associated facilities between the vessel and last manifold (or valve) immediately before the receiving tank(s) would be developed in accordance with the U.S. Coast Guard regulations by authority of United States Code 33 (33 USC 1221) and Executive Order 10173 (see Appendix G).

Analysis indicates that the Anderson Bay site could be developed in compliance with 49 CFR 193 as well as with 33 USC 1221. Recognizing the commitment to safety embodied in this code, ***YPC has identified these requirements as*** the basis for ***its initial*** evaluation of the proposed LNG plant site, for development of a conceptual definition of the LNG plant, and for LNG plant safety planning. These regulations would be used as the primary standard for specific siting requirements, design, construction, equipment, operations, maintenance, personnel qualifications and training, fire protection, and security of the proposed LNG facilities.

2.7 TERMINATION

The project life of TAGS would depend on the availability of natural gas. If additional supplies should become available, the life of the facilities could be extended beyond the projected 30-year life of the project. The termination procedures to be implemented would be subject to appropriate existing federal, state, and local regulations in effect at that time. A full review of these procedures would be submitted by YPC during the "Authorization to Proceed With Construction" phase of the project.

2.8 MITIGATIVE ASPECTS OF THE PROPOSED PROJECT

2.8.1 Introduction

YPC, during its initial phases of developing its proposed alignment and facility placement for TAGS, took into account social, environmental, and land-use issues raised during authorization of TAPS, the Dalton Highway, and ANGTS. These included scheduling construction sessions to avoid sensitive life cycle periods of wildlife, moving Compressor ***Station*** No. 9 to avoid a caribou migration use area, ***and locating pipeline construction to avoid highly valuable salmon habitats wherever possible.***

Mitigation measures developed by YPC to prevent and/or mitigate major adverse impacts ***are shown in subsection 4.7 - Mitigation Measures. These YPC measures have been incorporated in the evaluation of effects throughout the EIS.***

In addition to the mitigation measures ***proposed by YPC*** the BLM and USACE would ***require*** standard and special stipulations. These stipulations would contain generic measures applied to all ***BLM rights-of-way and USACE's Section 404 and Section 10 permits*** as well as site-specific measures which ***would*** be evaluated at the time the ***detailed engineering plans are developed.*** For example, required surveys for cultural resources and protected animals could identify the need ***and extent of*** site-specific stipulations.

Federal and state agencies can enforce mitigation measures and stipulations on federal, state, and private lands that are affected as a federal action.

Mitigation measures presented in this ***EIS*** are those proposed by YPC as part of its application to BLM and USACE. These measures have been committed to by YPC; others are reasonably expected to be permit requirements of at least one or more permitting agencies.

The mitigation measures proposed by YPC were designed to accomplish the following goals:

- Assure that the pipeline is structurally sound to minimize the potential for damaging accidents or leaks.
- Minimize the potential impacts to soils integrity and permafrost including considerations of hydrology and vegetation.
- Conserve limited resources, including water and gravel, along the entire route.
- Minimize impacts to ***fish,*** wildlife, ***and*** marine and aquatic habitat.
- Minimize environmental impacts due to spills, discharges, and waste disposal.
- Minimize potential for damage to other structures, facilities, and operations.

These purposes, if accomplished by the mitigation activities and techniques, described in ***subsection 4.7 of this EIS,*** would fulfill YPC's stated purpose of constructing the pipeline in a cost-effective yet environmentally acceptable manner.

2.9 REPRESENTATIVE COOK INLET-BOULDER POINT ALTERNATIVE

2.9.1 Introduction

An evaluation of criteria developed to identify and appraise environmentally acceptable and environmentally feasible routes to transport Prudhoe Bay natural gas to tidewater for liquefaction and transportation to Asian Pacific Rim markets is presented in Appendix C. The results of this evaluation identified that none of the three Prince William Sound alternatives was ranked as superior to the YPC proposed TAGS project to Anderson Bay. This evaluation also identified that the Cook Inlet-Boulder Point alternative has been selected as the most representative of the Cook Inlet alternatives. The no-project alternative is also discussed in this subsection.

2.9.2 Route and Site Description

The Cook Inlet alternative pipeline route would originate in the vicinity of

Livengood (Milepost 395 of the proposed TAGS pipeline alignment) and proceed in a southerly direction to Cook Inlet, as shown in Alignment Map 3 at the end of this document.

The project description presented in Subsections 2.2 through 2.7 would be the same for a project to the Cook Inlet-Boulder Point alternative. This alternative would require a 15-mile subsea pipeline across Cook Inlet from near Figure Eight Lake on the north side of Cook Inlet across to Point Possession and two additional elevated river crossings.

From Livengood the alternative Cook Inlet regional pipeline route would diverge from the proposed pipeline route proceeding southward, following along the eastern margin of Minto Flats before crossing the Minto Fault. The route continues southward through Nenana with an elevated crossing at the Tanana River. A route option to avoid the Minto Flats area proceeding from Livengood to Fairbanks along the proposed TAGS alignment, and then from Fairbanks to Nenana along the Parks Highway was evaluated. This option was discarded due primarily to the increase of approximately 50 miles of pipeline length.

From Nenana the route follows the Alaska Railroad, with an elevated crossing of the Nenana River near Liaho. The route then generally follows the Parks Highway to a point just south of Healy, where it parallels the Alaska Railroad for several miles before again joining the Parks Highway, traversing a portion of the Denali National Park and Preserve and using two elevated crossings of the Nenana River.

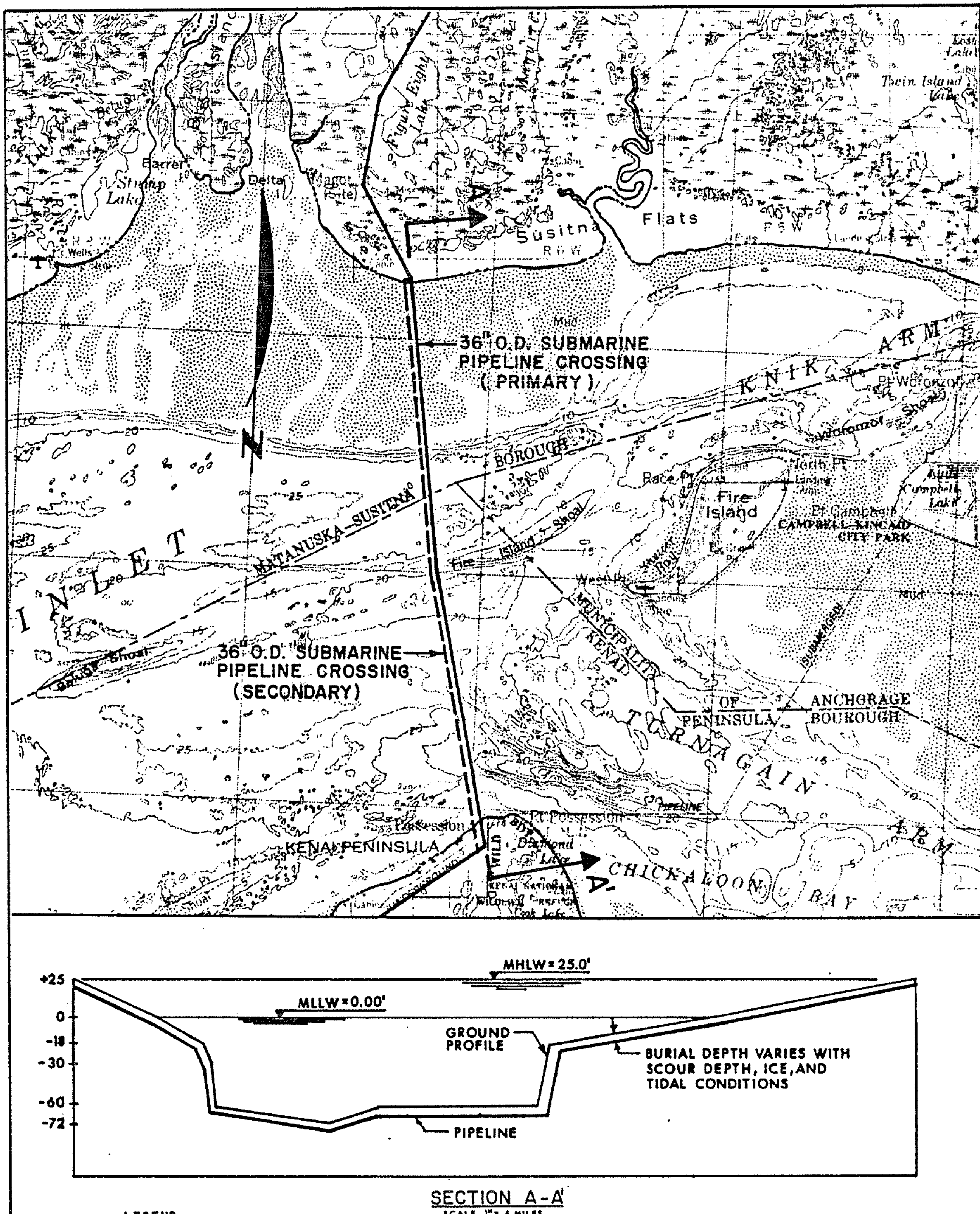
The route continues south, paralleling the highway just inside the park boundary before leaving the park near McKinley Village. As the route proceeds south, it again crosses the Nenana River with an elevated crossing. It passes through Cantwell and Summit and enters into Broad Pass. In this area the route crosses the McKinley strand of the Denali Fault system, also thought to be active.

Several route options to avoid Denali National Park and Preserve were evaluated. These options focus on the existing Intertie alignment in the valley on the east side of the Nenana River. These were discarded because of engineering constraints due to the very rough terrain and potential severe environmental impacts.

In the Nenana River valley between Healy and McKinley Village, two route options to avoid crossing Denali National Park and Preserve were identified. These included the east side of the Nenana River and the Anchorage-Fairbanks Intertie powerline in the next valley east of the Nenana River.

Once through Broad Pass the route traverses the upper Chulitna River valley, requiring an aerial crossing at Hurricane Gulch as it continues to follow the Parks Highway through Denali State Park and into the Susitna River valley south of Talkeetna. Following the highway south, this pipeline route crosses the Susitna River near Sunshine and Montana creeks in an elevated mode. Between Kashwitna and Willow the pipeline route departs the highway right-of-way, proceeding south around Nancy Lake State Recreation area toward Flat Horn Lake near the mouth of the Susitna River and traverses the Susitna Flats State Game Refuge.

To reach Boulder Point on the Kenai Peninsula, a dual 15-mile subsea pipeline, as depicted in Figure 2.9.2-1, would be required to cross beneath Cook Inlet to Point Possession on the Kenai Peninsula. Although several route options that avoided the length subsea crossing of Cook Inlet were evaluated, all were discarded because of increases in pipeline length, the need to cross both Knik and Turnagain arms, and greater length of pipeline in industrial and population areas. Construction of the Cook Inlet subsea pipeline crossing would require the use of a large-pipeline lay barge capable of handling the concrete-coated 36-inch diameter pipe. Both primary and secondary pipelines would be subject to the extreme conditions of the Cook Inlet crossing. Welding of pipe joints and completion of the coating process at the joints would be accomplished on the lay barge, and the completed section would then be lowered to the sea floor. Next, the pipe would be buried using a jet sled equipped with high-capacity airlift pumps. Provisions for excavating and removing occasional boulder-size material from the pipe alignment and trench would be incorporated in the construction plan.



SECTION A-A'
SCALE 1" = 4 MILES

LEGEND

TAGS PRIMARY LINE

TAGS SECONDARY LINE

SHORELINE, MLLW

Figure 2.9.2-1 Cook Inlet Crossing for the Cook Inlet-Boulder Point Alternative

Due to the extreme tidal fluctuations and currents found in Cook Inlet, a multipoint anchoring system would be required to hold the lay barge in position. The presence of the lay barge and its multipoint anchor system would result in the need for a traffic control system for vessels bound to and from the Port of Anchorage during the construction phase. Additionally, pipe burial depth for both pipelines should be sufficiently deep to provide adequate protection from anchor dragging or protection from scour.

From the Point Possession area the pipeline would parallel an existing gasoline pipeline right-of-way southwesterly for about 50 miles along the coast, terminating at Boulder Point just north of Nikiski, one of the Cook Inlet sites previously considered for location of the LNG plant and marine terminal as shown in Figure 2.9.2-2. This route avoids the Kenai National Moose Range but traverses the Susitna Flats State Wildlife Refuge and the Captain Cook State Recreation Area for about 1.5 miles.

The Boulder Point site is located on the east side of Cook Inlet on the Kenai Peninsula approximately 17 road miles north of the city of Kenai and 6 miles north of an existing petroleum, petrochemical, refining, and LNG industrial complex at Nikiski. Boulder Point is located northeast of East Forelands, a designated reserve for navigational purposes.

Commercial and residential development is not common, particularly near the site. Good infrastructure is in place for supporting construction and operations, but land availability could be a problem. Possible conflicts with nearby shipping and docking operations at Nikiski might exist (***BLM*** 1976).

The north Kenai Road passes within 1.5 miles of the Boulder Point site, ending at Captain Cook State Recreation Area. The Nikiski airstrip is approximately 1.5 miles inland from Boulder Point; a regional airport at Kenai approximately 14 miles south.

The Boulder Point site has fair proximity to deep water, coastal bluffs of moderate height, and stable shoreline. It is the northernmost feasible industrial site with deepwater marine acccess on the east side of Cook Inlet and the closest site to Anchorage (ESL 1980b).

Soils are suitable for development (loess over glacial outwash), and terrain above the cliffs is gently sloping to hilly (SCS 1962). Bedrock foundation may be lacking. Faults, volcanoes, and glacial floods should not be a problem. The water table is low, and liquefaction potential is low (OIW 1975; SCS 1962).

Site terrain and topography would allow construction of the LNG plant a safe distance from the marine terminal. Distance from the 60-foot isobath to shore is approximately 4,000 feet. Earlier studies (OIW 1975) indicated acceptable anchoring at depths less than 200 feet and an adequate maneuvering area (2,000 feet minimum). Navigation aids are present and the state requires a licensed coastal pilot for vessels moving up Cook Inlet above Kachemak Bay.

A number of prominent rock outcrops occur along the shoreline of Boulder Point, particularly on the north side. ***The National Oceanic and Atmospheric Administration's*** (NOAA) National Ocean Survey charts warn of numerous uncharted and dangerous submerged boulders in the eastern portion of Cook Inlet, and some shoaling also exists along the east side of the inlet. Projected dangers from tsunamis are minimal due primarily to low predicted wave height, historical resistance of central Cook Inlet to earthquake-caused tsunamis, and existence of the Alaska Regional Tsunami Warning System (OIW 1975).

Floating ice and icing conditions can be severe problems in this area, and extreme tidal exchanges are generally strong in this area (BLM 1976; OIW 1975). Ice in Cook Inlet would be an inherent winter hazard, requiring ice strengthening of LNG tankers, advance scheduling, and two berths. Six out of 13 accidents recorded in Cook Inlet during a four-year study period (1971-1974) were due to ice. The ice problem is most severe in the upper inlet, particularly north of the forelands, a constriction shown in Figure 2.9.2-2. LNG shipments to/from the existing Nikiski facility have been delayed due to ice or strong winds, though only for short periods of time (OIW 1975). Increased LNG tanker traffic due to the TAGS project might, however, increase the incidence of such delays.

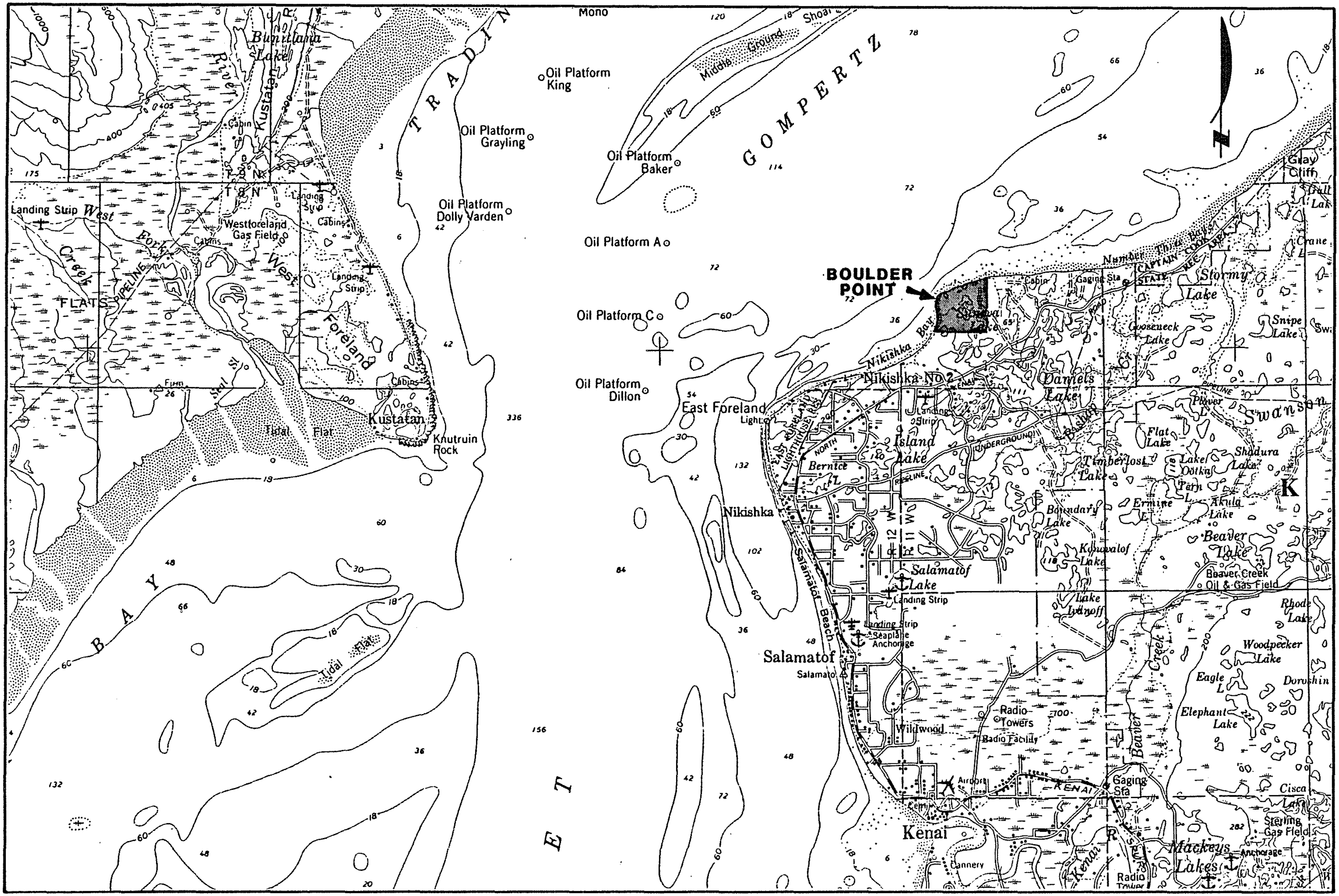


Figure 2.9.2-2 Boulder Point Location Adjacent to the East Foreland Area of Cook Inlet.

2.9.3 System Components for the Cook Inlet-Boulder Point Alternative

The Cook Inlet-Boulder Point alternative would require construction of approximately 791 miles of pipeline and 10 compressor stations.

The basic project components for the Cook Inlet-Boulder Point alternative would be similar to the proposed TAGS project. The pipeline route from Prudhoe Bay to near Livengood for the proposed project and the Cook Inlet-Boulder Point alternative would be the same. Likewise, the proposed project's approach to road crossings, elevated and below-ground river and stream crossings, fault crossings, and other basic construction techniques would be the same for the remainder of the route.

The major differences in construction would be for those conditions specific to the Cook Inlet alternative route that would require different construction techniques, such as the subsea pipeline under Cook Inlet, the approach to the pinch point near Denali National Park and Preserve, and the major access roads required for access to the compressor stations located in Minto and Susitna flats.

Table 2.9.3-1 summarizes the major facility components that would be required for the Cook Inlet alternatives compared to those for the proposed project.

In addition to the 15 construction camps which would be required from Prudhoe Bay to Livengood (see Subsection 2.3.1), 13 additional new construction campsites would be required from Livengood to Boulder Point. The locations of these sites are shown in Alignment Map 3 and the sizes identified in Table 2.9.3-2. Unlike the proposed route, which would use existing camp pads, except at Anderson Bay, all sites would require the construction of a gravel pad. Total bed space would be similar to that proposed for the proposed project.

It is assumed that the amount of mineral materials needed for the construction spreads for the Cook Inlet-Boulder Point alternative from Livengood to Boulder Point would be similar to that shown in Table 2.3.2-1 for the proposed TAGS project except that increased amounts of material would be required for permanent access roads to the Minto and Susitna Compressor Station and the new construction camp pads.

Table 2.9.3-1
Summary of Major Facility Components for the Proposed Project and Alternatives

	Proposed Project-Anderson Bay	Cook Inlet-Boulder Point Alternative
Pipeline to LNG Site (miles)	797	791
Compressor Stations	10	10
Elevated River Crossings	4	6
Subsea Pipeline (miles)	None	15
Length of Loading Line (miles)	*less than 1*	*greater than 1*
Ferry Loading	Yes	No
Construction Camp at LNG Plant/ Terminal Site	Yes	Yes
Construction Camps at New Sites	1	13

Table 2.9.3-2

Temporary Construction Camps and Storage Pads
Livengood to Boulder Point

Location	Bed Spaces Pipeline P/L	Bed Spaces Compressor Station	Pipeline Storage Pad
Compressor Station 6A	200	300	Yes
Dunbar	800	--	Yes
Compressor Station 7A	--	300	No
Rex	600	--	Yes
Healy/Compressor Station 8A	500	300	Yes
Cantwell	600	--	Yes
Chulitna/Compressor Station 9A	500	300	Yes
Talkeetna	600	--	Yes
Kashwitna	600	--	Yes
Compressor Station 10A	100	300	Yes
Beaver Lake	600	--	Yes
Otter Creek	400	--	Yes
Boulder Point	100	1500*	No
TOTALS	5600	3000	

* LNG Plant/Marine Terminal

Six elevated crossings would be required for the Cook Inlet alternative at the Yukon, Tanana, and Nenana (two crossings) rivers and at Hurricane Gulch and Montana Creek. These crossing techniques are discussed in Subsection 2.3.4 for the Yukon River and Subsection 2.3.3 for the remaining river crossings shown in Figures 2.3.3-2 and 2.3.4-4.

A 15-mile subsea pipeline would cross beneath Cook Inlet. Its construction would require the use of a large pipeline lay barge capable of handling the concrete-coated, 36-inch diameter pipe. Welding of pipe joints and completion of the coating process at the joints would be accomplished on the lay barge. Completed sections would next be lowered to the sea floor. The pipe would then be buried using a jet sled equipped with high-capacity airlift pumps. Provisions for excavating and removing occasional boulder-size material from the pipe alignment and trench would be incorporated in the construction plan.

Due to the extreme tidal fluctuations and currents found in Cook Inlet, a multipoint anchoring system would be required to hold the lay barge in position. The presence of the lay barge and its multipoint anchor system would result in the need for a traffic control system for vessels bound to and from the port of Anchorage during the construction phase. Additionally, pipe burial depth should be sufficiently deep to provide adequate protection from anchor dragging and protection from scour.

The Cook Inlet-Boulder Point alternative would require a loading line greater than 1 mile in length from the LNG storage tanks to the loading berth, as described in Subsection 2.5

No ferry landing would be required for the Cook Inlet-Boulder Point alternative because of the availability of road access to the site.

Due to the lack of road access to the proposed Anderson Bay Site, a 1,700-bed temporary camp would be required. Although the Boulder Point site is reasonably accessible to existing infrastructure by roadways, it would require a construction camp, though somewhat smaller than that for the Anderson Bay site.

Along the Cook Inlet-Boulder Point alternative, aerial crossings of the Tanana River, two crossings of the Nenana River, Hurricane Gulch, and Montana Creek would be required. These aerial crossings would be similar to those discussed in Subsection 2.3.3 and depicted in Figure 2.3.3-2. The exception would probably be the Tanana River crossing, which because of the width at the crossing point, would either require a fixed pier in the center of the river similar to that which would be used for the Yukon River (see Figure 2.3.4-4) or a span with pier abutments on an island in the river.

The alternative LNG site located at Boulder Point would be along the eastern shoreline of Cook Inlet just north of the constriction known as the East Foreland, as shown in Figure 2.9.2-2. The LNG plant site and marine terminal configuration for this alternative site are shown in Figure 2.9.3-1. The facilities depicted for this site are described in Subsection 2.5.

2.9.4 Prince William Sound LNG Plant Site Alternative

Several LNG plant sites have been identified and discussed in Appendix C. Information currently available indicate a low probability that subsequent detailed engineering and site design data would cause rejection of the Anderson Bay site. Should the preferred Anderson Bay LNG plant site subsequently prove unacceptable, any alternative LNG plant siting in the Prince William Sound area would require further analysis to meet NEPA requirements.

2.9.5 No-Action Alternative

Under a no-action alternative the construction of facilities to transport natural gas to tidewater for conversion into LNG for export to the Asian Pacific Rim markets would not occur. This alternative avoids all environmental effects associated with the construction and operations of the project. ***The no-action alternative would result from denial of any of the right-of-ways (ROWs) or permits required for construction and operation of the project (e.g., denial of the BLM to grant a ROW or denial of the USACE Section 404 or Section 10 permits) or the ERA export license or***

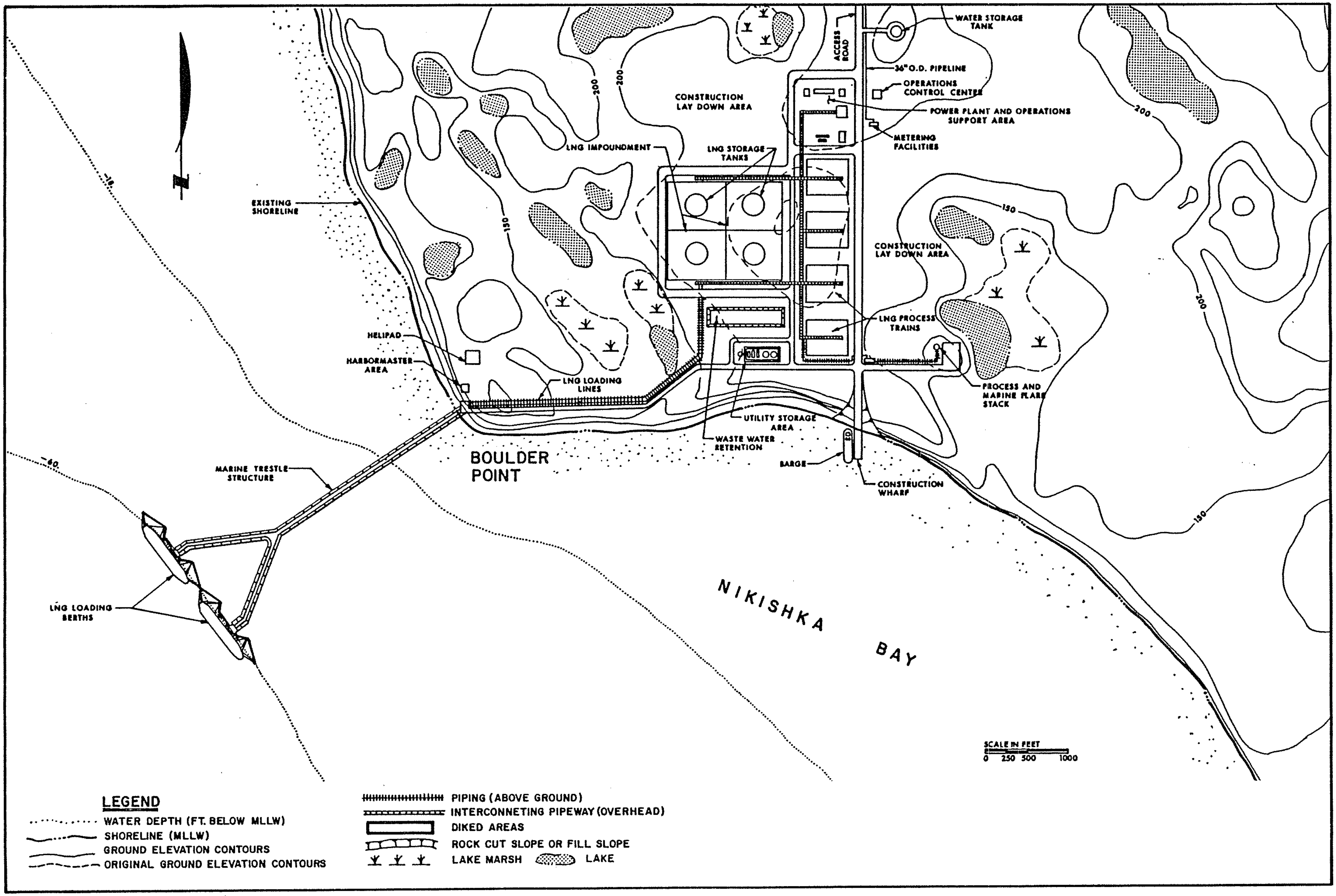


Figure 2.9.3-1 LNG Plant Site and Marine Terminal Layout for the Boulder Point Alternative Site

FERC approval of the place of export. Under this alternative, no construction related to the proposed action would take place. The environmental impacts associated with the construction of project roads, workpads, 796.5 miles of pipeline, the LNG facility, and related project components would not occur.

This alternative would not provide a pipeline project for transport of Alaska's Prudhoe Bay natural gas to tidewaters for transport to foreign markets, (i.e., Pacific Rim countries). The no-action alternative continues to assume that the authorized ANGTS project would be constructed. That pipeline, as proposed, would be capable of transporting 3.2 BCFD of conditioned natural gas from the Prudhoe Bay field to the contiguous United States.

The no-action alternative would forego the economic effects of employment and revenue to the state and local jurisdictions of Alaska. Nationally, the opportunities for improving the balance-of-trade imbalance would be lost.

2.9.6 Summary

The applicant's proposed project involves the transport and sale of natural gas from Alaska's North Slope to the Asian Pacific Rim markets. The potentially feasible alternatives for the project include construction and operation of a natural gas pipeline to a tidewater port in either the Prince William Sound or Cook Inlet region of Alaska and shipment of LNG by tanker. Evaluation criteria were developed to consider the feasibility and preferability of various alternative ports and project configurations in both the Prince William Sound and Cook Inlet regions. The applicant's proposed Anderson Bay project was identified as the preferred site in Prince William Sound, and Boulder Point was determined to be the best Cook Inlet alternative.

The potential environmental consequences of constructing and operating a pipeline from Livengood to the Cook Inlet-Boulder Point were analyzed and compared with the consequences on the various disciplines for the proposed project.

The Cook Inlet-Boulder Point alternative pipeline alignment with an LNG plant and marine terminal at the Boulder Point site represents an alternative to the proposed project that is feasible and would be environmentally acceptable, though not environmentally preferred over the applicant's proposed project.

Criteria for consideration of the applicant's project and the proposed alternative are summarized in Figure 2.9.5-1. This analysis was part of a more detailed evaluation of potential alternatives presented in Appendix C. The analysis points out the numerous factors that favor the proposed project over the Cook Inlet-Boulder Point alternative.

The no-action alternative was considered. The national, international, and statewide impacts of this alternative revolve around the continued lack of development of Alaskan North Slope natural gas and improvement to the balance of payments and the absence of the positive economic benefits to the state. The no-action alternative would mean that none of the impacts to the natural or human environment of Alaska described in this document would occur.

2.9.7 Proposed Federal Action

The BLM and USACE ***have accepted the respective applications for YPC preferred route from Prudhoe Bay to Valdez that generally parallels TAPS and*** are proposing to authorize TAGS project-related facilities. TAGS would be located on the west side of Galbraith Lake and would follow the highway through Keystone Canyon. The LNG plant and marine terminal would be located on state lands at Anderson Bay. The USFS has identified certain National Forest land at the Anderson Bay LNG plant as suitable for transfer to state ownership ***and the state has filed for transfer of these lands***. In the event that transfer has not been completed, the USFS proposes to issue appropriate land use authorization on the basis of this ***EIS. No units of the National Park, National Refuge or National Wild and Scenic Rivers would be crossed.***

The ERA must grant an export authorization under Section 3 of the Natural Gas Act before any gas may be exported. ERA has decided that this export is a major federal action requiring compliance with

NEPA. An export application ***was*** filed ***with ERA on December 3, 1987.*** ERA is cooperating in the preparation of the EIS.

Section 3 of the Natural Gas Act, as delegated by the Secretary of DOE, provides FERC with authority, in part, to approve the place at which the natural gas will be exported. ***Application to FERC on this approval was made by YPC on December 3, 1987. FERC is cooperating in the preparation of the EIS.***

	Proposed Project Anderson Bay	Cook Inlet-Boulder Point Alternative
Pipeline Criteria		
- Minimize length of pipeline	○	○
- Maximize use of existing infrastructure	○	⊘
- Maximize use of proven construction techniques	○	⊗
- Maximize opportunity for parallel construction techniques	○	⊘
- Avoid areas of potential geohazards	⊘	⊗
- Minimize potential conflicts with sensitive environments	○	⊘
- Maximize compatibility with current and planned land use	○	⊗
- Minimize the number of water crossings	○	○
- Avoid permitting conflicts	○	●
- Minimize potential threat to national security	○	⊘
- Maximize availability of gas to Alaska consumers	⊘	○
LNG Plant Criteria		
- Adequacy of available land	○	⊘
- Avoid areas with poor foundation characteristics	○	⊘
- Avoid areas with faults	⊘	⊘
- Avoid sites potentially exposed to seismic sea waves	○	○
- Minimize length of pipeline to marine terminal	○	⊘
- Maximize use of existing community infrastructure	⊘	○
- Avoid sensitive environmental habitat	⊘	⊘
- Public safety considerations	○	⊘
- Maximize value added industrial opportunities	⊘	⊘
- Minimize site preparation requirements	⊘	○
Marine Terminal Criteria		
- Minimize exposure to extreme oceanographic conditions	○	⊗
- Minimize distance from shore to 60' MLLW depth	○	⊘
- Maximize suitability of tanker maneuvering and anchorage area	○	⊘
- Minimize potential hazards to navigation	○	⊗
- Minimize potential problems related to soils and geohazards	○	○
- Minimize threat to national security	⊘	⊘

NOTE: Individual criteria cannot be weighted on an equal basis.

○ Favorable
⊘ Moderately Favorable
⊗ Unfavorable
● Highly Unfavorable

Figure 2.9.5-1
Criteria Evaluation Matrix for Proposed TAGS Project
and Cook Inlet-Boulder Point Alternative

SECTION 3
AFFECTED ENVIRONMENT OF THE PROPOSED ACTION AND ALTERNATIVES

SECTION 3.0 AFFECTED ENVIRONMENT OF THE PROPOSED ACTION AND ALTERNATIVES

3.1 INTRODUCTION

This section analyzes the environment that would be affected by the proposed Trans-Alaska Gas System (TAGS) from Prudhoe Bay to the Prince William Sound-Anderson Bay LNG plant site and terminal facilities and the Cook Inlet-Boulder Point alternative. Even though the authorized ANGTS has an approved right-of-way, no construction has occurred; therefore, it is not part of the existing environment. Appendix B provides a complete description of the authorized ANGTS project. Appendix B *also* describes the ANGTS stand-alone conditioning plant at Prudhoe Bay evaluated by FERC in 1980. As with the authorized ANGTS pipeline sytem, construction of the ANGTS conditioning plant has not started.

The affected environment discussions for the proposed project varies with *the* type of resources considered--for some, the discussion is confined to the immediate area of the anticipated disturbance; for others, a more regional approach is used. Impacts to these areas are generally considered by discipline in appropriate sections of this document. Subsections summarize the important environmental impacts in each of these areas.

The area that would be occupied by the proposed TAGS project has been the subject of detailed study and analysis since the decision was made to develop the Prudhoe Bay area for the production of oil and natural gas. Initial environmental studies began in the early 1970s, culminating with the publication of a Final EIS for the TAPS project in 1972 and construction of the TAPS project from 1974 through 1977.

During the period of TAPS construction, three natural gas projects were proposed for the construction of a system to transport North Slope natural gas to U.S. markets by the Alaskan Arctic Gas Pipeline Company, the El Paso Alaska Company, and the Alcan Pipeline Company (subsequently Northwest Alaskan Pipeline Company). Two of these proposals were for an all-pipeline route and one was for a pipeline-LNG tanker system. EISs were published for all three of these projects by the Department of the Interior (DOI) *and* the Federal Power Commission (FPC). Additionally, the Federal Energy Regulatory Commission (FERC) completed an FEIS for the Western LNG Cook Inlet proposal. Thus, the environmental description and assessment for consideration of the TAGS project include FEISs for the:

- Proposed Trans-Alaska Pipeline, DOI, 1972, volume III (pp. 1 to 449).

- Alaska Natural Gas Transportation System, Proposed Alaska Arctic Gas Project, BLM, 1976, Alternatives pp. 194 to 302 and 570 to 614.

- Alaska Natural Gas Transportation System, Proposed El Paso LNG Project, FPC, 1976a, pp. II-67 to II-252 and II-376 to II-503.

- Supplement, Alaska Natural Gas Transportation System, Proposed Northwest Alaskan Project (Alcan Project), FPC, 1976b, pp. 37 to 208 and 368 to 372.

- Cook Inlet LNG project, Proposed Western LNG Project, FERC, 1978, pp. 29 to 135 and 233 to 296.

- Northwest Alaskan Natural Gas Transportation Company proposed to construct and operate a sales gas conditioning facility at Prudhoe Bay, Alaska; FEIS completed by the FERC in 1980.

The Affected Environment sections of these previously prepared EISs are adopted herein by reference and updated with more recent information. Since socioeconomics appeared to be the key issue during the scoping process for the proposed action, it is the first subsection presented. Several discussions, such as noise, are covered because they were raised during scoping or were perceived by the public to be of major concern, even through the assessed impacts were negligible.

3.2 PROPOSED TAGS PROJECT TO ANDERSON BAY

3.2.1 Introduction

The following subsections describe the existing environment and ambient conditions for the proposed route from Prudhoe to

Anderson Bay. The topics result from issues derived at scoping meetings and agency comments. In all cases the description begins at the northern end of the route and proceeds southward unless there is a statewide description. The technical sections are grouped into similar or related topics whenever possible.

3.2.2 Socioeconomics

3.2.2.1 Statewide Socioeconomic Conditions

Oil and gas development is the dominant force in the Alaska economy because the industry supplies more than 90 percent of the state government's revenues. Table 3.2.2-1, which summarizes statewide population since 1960, shows that the most dramatic period of population increase occurred from 1974 to 1977--the TAPS construction era. In only three years, Alaska's population rose from 348,100 to 481,000, an increase of 38 percent. However, the end of the pipeline boom was followed by an economic slump, high unemployment, and a 16 percent population decline. By 1980 Alaska's population had dropped to 401,900.

Alaska's economic downturn ended abruptly as skyrocketing oil prices quickly pushed the state's annual oil revenues (which had been only $500 million in 1977) past the $2.2 billion mark in 1980. These burgeoning state revenues were accompanied by an enormous increase in state government spending for operating expenses, low-interest loan programs, and capital construction projects. The state's population began a rapid increase in 1981 in response to construction employment and infrastructure development. That same year oil prices hit a record $37 per barrel, and in 1982 state oil revenues peaked at nearly $3.6 billion (See Table 3.2.2-1).

Between 1970 and 1985 Alaska's population grew an average of four percent annually, compared to less than one percent annually for the nation as a whole during the same period. In the decade between 1970 and 1980 Alaska's population increased by nearly 100,000 persons, but in the five years between 1980 and 1985 the state population grew by nearly 138,000.

These population trends are mirrored in Alaska's employment statistics. Total average annual statewide employment peaked in 1985 at 231,400. As shown in Table 3.2.2-2, the 150 percent increase in state employment between 1970 and 1985 was accompanied by significant shifts in the relative importance of various sectors. In 1970 government employment accounted for nearly 40 percent of the Alaska's wage and salary employment. By 1985 government represented less than 30 percent of the total employment. The most notable change was the declining role of federal employment in the state's economy. There were 17,600 federal workers in 1985, virtually the same number as in 1970 when one Alaska worker in five was employed by the federal government. By 1985 that figure had dropped to 1 in 12. State and local government employment grew at roughly the same rate as overall employment.

Between 1970 and 1985 more than two-thirds of Alaska's 140,000 new jobs were in the state/local government, trade, and service sectors. In 1985 there were more construction workers than federal employees. Finance, insurance, and real estate employment, which tripled between 1970 and 1985, exhibited the largest percentage increase but accounted for less than six percent of total employment. Transportation, communications, and public utilities employment growth was somewhat lower than the overall rate of increase. Only 14 percent of the new jobs created since 1970 were in basic industries such as mining (which includes petroleum development) and manufacturing (primarily timber and seafood processing).

Since statehood in 1959, most of Alaska's population growth has been concentrated in urban and suburban areas of the state. In 1985 about 44 percent of the state's residents lived in the municipality of Anchorage. Alaska Natives, who constitute 16 percent of the statewide population, are Alaska's largest minority group. The remainder of the statewide population is 77 percent white, 3 percent black, and 4 percent other races. Nationally, 83 percent of the population is white, 12 percent black, and 5 percent other races.

Table 3.2.2-1 Alaska Statewide Socioeconomic Indicators
1960 to 1987

	Population		Employment		Oil Revenue[1]	
Year	Number	Percent[2] Change	Number	Percent[2] Change	Number ($)	Percent[2] Change
1960	230,400	--	N/A	--	N/A	--
1961	236,700	2.7	N/A	--	N/A	--
1962	242,800	2.6	N/A	--	N/A	--
1963	249,900	2.9	62,090	--	N/A	--
1964	253,200	1.3	65,380	5.3	N/A	--
1965	265,200	4.7	70,530	7.9	N/A	--
1966	271,500	2.4	73,127	3.7	N/A	--
1967	277,900	2.4	76,784	5.0	N/A	--
1968	284,900	2.5	79,803	3.9	N/A	--
1969	294,600	3.4	86,565	8.5	N/A	--
1970	302,583	2.7	92,467	6.8	N/A	--
1971	319,600	5.6	97,584	5.5	47.0	--
1972	329,800	3.2	104,243	6.8	48.4	3.0
1973	336,400	2.0	109,851	5.4	50.3	3.9
1974	348,100	3.5	127,200	15.8	80.2	59.4
1975	384,100	10.3	160,900	26.5	90.4	12.7
1976	409,800	6.7	173,100	7.6	391.5	333.1
1977	481,000	17.4	164,200	-5.1	477.6	22.0
1978	411,600	-14.4	166,900	1.6	441.5	-7.6
1979	413,700	0.5	166,600	-0.2	821.6	86.1
1980	401,851	-2.9	171,100	2.7	2,256.5	174.6
1981	435,200	8.3	186,500	9.0	3,304.3	46.4
1982	460,837	5.9	201,000	7.8	3,574.8	8.2
1983	495,290	7.5	214,300	6.6	3,026.6	-15.3
1984	523,048	5.6	225,000	5.0	2,861.6	-5.5
1985	539,600	3.2	231,400	2.8	2,743.5	-4.1
1986[3]	545,299	1.0	N/A	--	2,657.9	-3.1
1987[3]	543,900	-0.2	N/A	--	1,011.0	-62.0

(1) Total unrestricted petroleum revenue in millions of dollars
(2) Percent change from prior year
(3) Figures for 1986 and 1987 are projected estimates

Sources: Alaska Department of Labor, Research and Analysis Section; "Revenue Sources," Alaska Department of Revenue, Division of Petroleum Revenue, December 1986.

Table 3.2.2-2 Distribution of Employment, by Sector
Statewide, Fairbanks, and Anchorage
1970 and 1985 Comparisons

Industrial Sector	1970 Number	1970 Percent	1985 Number	1985 Percent	Percent Increase 1970-1985
STATEWIDE					
Mining	2,994	3.3	9,400	4.1	214
Construction	5,400	5.9	18,600	8.0	244
Manufacturing	7,838	8.6	11,800	5.1	51
Tran/Com/Utility	9,109	10.0	19,100	8.3	110
Trade (wholesale & retail)	15,357	16.9	46,300	20.0	201
Service & Miscellaneous	11,627	12.7	45,499	18.6	289
F.I.R.E.*	3,098	3.4	12,800	5.5	313
Government-Federal	17,100	18.8	17,600	7.6	3
Government-State & Local	18,450	20.3	50,400	21.8	173
TOTAL	90,974	100.0	231,400	100.0	154
FAIRBANKS					
Mining	86	0.6	200	0.7	133
Construction	1,255	8.7	3,100	10.6	147
Manufacturing	249	1.7	600	2.0	141
Tran/Com/Utility	1,646	11.4	2,900	9.9	76
Trade (wholesale & retail)	2,614	18.1	6,200	21.2	137
Service & Miscellaneous	1,725	11.9	5,800	19.8	236
F.I.R.E.*	518	3.6	1,000	3.4	93
Government-Federal	2,533	17.5	2,700	9.2	7
Government-State & Local	3,825	26.5	6,800	23.2	78
TOTAL	14,451	100.0	29,300	100.0	103
ANCHORAGE					
Mining	958	2.3	4,200	3.7	338
Construction	3,514	8.4	8,900	7.7	153
Manufacturing	1,018	2.4	2,800	2.4	175
Tran/Com/Utility	3,907	9.3	10,000	8.7	156
Trade (wholesale & Retail)	8,617	20.5	27,700	24.1	221
Service & Miscellaneous	6,455	15.4	26,400	23.0	309
F.I.R.E.*	1,980	4.7	8,700	7.6	339
Government-Federal	9,509	22.6	9,800	8.5	3
Government-State & Local	6,037	14.4	16,400	14.3	172
TOTAL	41,995	100.0	114,900	100.0	174

* Finance, Insurance, and Real Estate

Source: Alaska Department of Labor, Research, and Analysis, Statistical Quarterly, various issues.

Another difference between Alaska's population and the nation's is age--Alaskans are younger. In 1980 the median age of Alaska residents was 26.1, compared to the national average of 30. Alaska also consistently has had fertility rates above the national average. Between 1980 and 1985 the age group that experienced the highest growth rate was the 25 to 34 years old segment--young adults in the prime ages for family and household formation. Alaska males outnumber females 53 percent to 47 percent, compared to the U.S. as a whole where females outnumber males 51 percent to 49 percent.

Alaska has traditionally had a young, mobile work force due to the preponderance of highly seasonal jobs in construction, fishing and fish processing, recreation and tourism, and mining. Peak unemployment normally occurs during winter.

Between 1985 and 1986 Alaska's population grew only one percent, which is less than the rate of natural increase and which indicates net outmigration from the state.

Alaska has a ***well-developed,*** modern infrastructure of public and private facilities such as roads, schools, shopping centers, airports, housing, ports, receation facilities, utilities, and office buildings. These developments have reshaped the skylines of Alaska's cities, but major housing, transportation, school, and utility improvements have also been made in virtually every rural village. ***Most of this infrastructure was built with oil revenues which the state received after the completion of TAPS.***

3.2.2.2 Regional Socioeconomic Conditions

The following section gives an overview of existing socioeconomic conditions in regions and communities which would be affected by the construction and operation of TAGS. The location of communities within 50 miles of the TAGS corridor are shown on the maps in Figure 3.2.2-1.

The TAPS (pipeline and related facilities) has provided an increased tax base to those incorporated jurisdictions where such facilities are located. For tax purposes the system facilities are amortized over a 20-year-period, during which they will provide tax revenue to these jurisidictions. ***Due to substantial additions to the tax base in*** the North Slope and Fairbanks North Star ***Boroughs,*** TAPS ***presently*** represents less than 15 percent of the total assessed valuation. ***By comparison*** in Valdez, ***which has experienced minimal growth over the last decade,*** TAPS represents approximately 90 percent of the tax base.

3.2.2.2.1 North Slope Borough

The North Slope Borough (NSB), created in 1972, includes eight Native villages and a number of military and industrial sites--most notably the Prudhoe Bay oil field. Although none of the borough's villages is located within 50 miles of the pipeline corridor, the first 180 miles of the proposed TAGS pipeline route and two compressor stations would be located within the borough and subject to local property taxes.

Table 3.2.2-3 summarizes population trends for four NSB villages--Anaktuvuk Pass, Barrow, Kaktovik, and Nuiqsut. These communities have all experienced substantial growth since 1970, particularly in the 1980-85 period when they grew at an average rate of more than 37 percent. This growth is attributable to several factors including: 1) high inmigration and low outmigration by Natives due to the availability of a larger number of relatively high-paying NSB jobs, 2) the construction of new housing and other amenities, 3) new elementary and high schools in the villages so students ***would*** not have to be sent to distant boarding schools, and 4) a high birth rate.

Statistics on the oil industry and construction workers based at Prudhoe Bay and other locations are difficult to collect and maintain because of high seasonal variation in employment. Since 1980 the number of workers based at Prudhoe Bay and adjacent fields has typically exceeded the population of all NSB villages. In 1983 estimates of the Prudhoe Bay work force ranged from 5,300 to 7,000.

The dominant force in the North Slope economy is NSB tax revenues from the Prudhoe Bay and adjacent developments.
Table 3.2.2-4, which summarizes North Slope

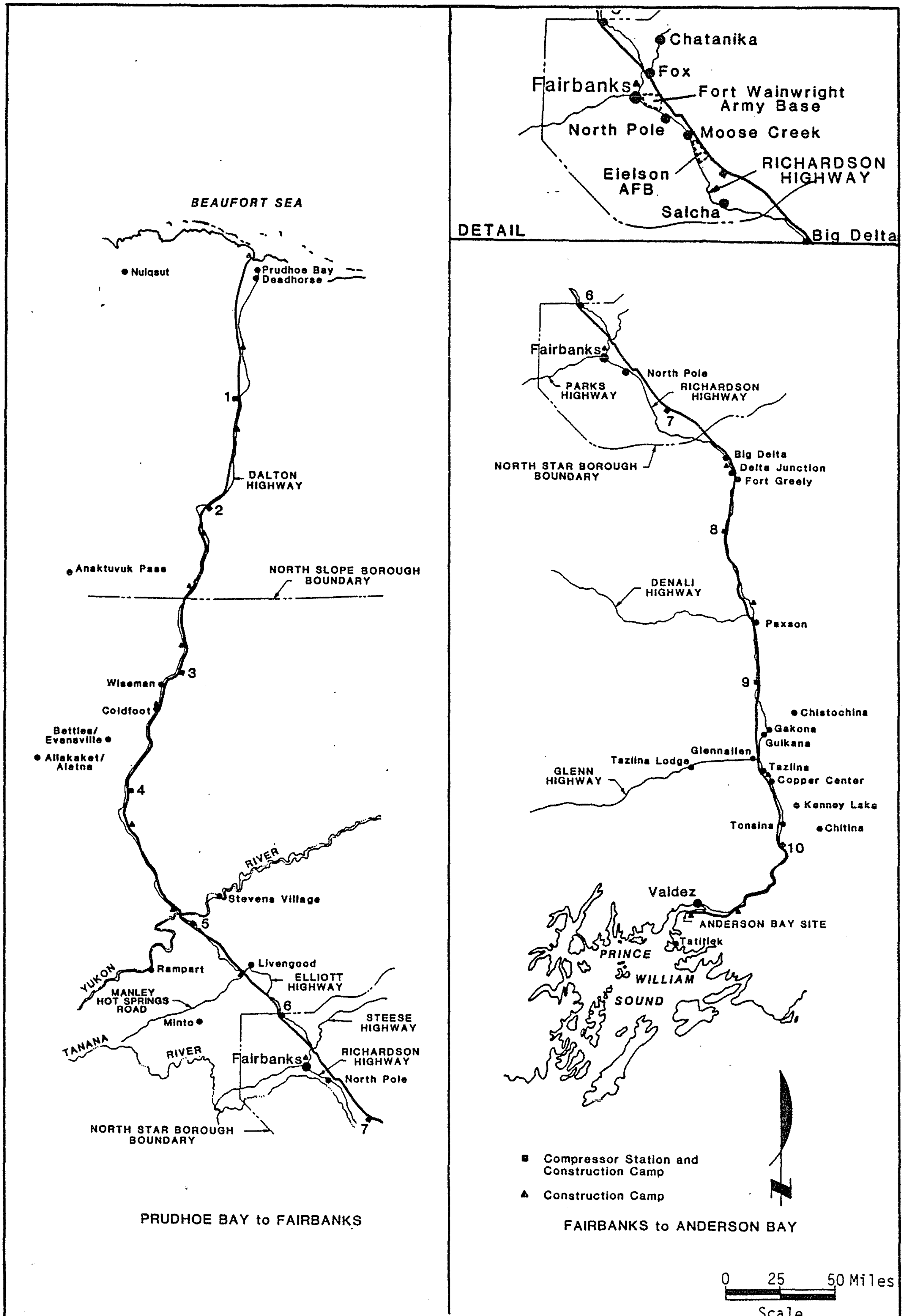


Figure 3.2.2-1 Location of Communities within 50 Miles of the Proposed TAGS Project

Table 3.2.2-3 Proposed TAGS Corridor Population Statistics
1970, 1980, and 1985 Comparisons

Location	1970	1980	1985	Percent Change 1980-1985
North Slope Borough (NSB) - Villages				
Anaktuvuk Pass	99	203	278	36.9
Barrow	2,104	2,267	3,075	35.6
Kaktovik	123	165	220	33.3
Nuiqsut	*	208	332	59.6
TOTAL	2,326	2,843	3,905	37.4
NSB - Other				
Prudhoe Bay	N/A	N/A	N/A	--
Pump Stations #1 thru 4	*	N/A	80	--
TOTAL	N/A	N/A	N/A	--
Between NSB and FNSB - Villages				
Wiseman	N/A	N/A	30	--
Bettles/Evansville	57	94	88	-6.4
Allakaket/Alatna	174	163	188	15.3
Stevens Village	74	96	110	14.6
Rampart	36	50	48	-4.0
Minto	168	153	231	51.0
Livengood				
TOTAL	509	556	695	25.0
Between NSB and FNSB - Other				
7-Mile DOT	*	N/A	10	--
Yukon Crossing	*	B/A	9	--
Nolan/Linda/Emma/Tamway	*	N/A	26	--
Coldfoot	*	N/A	15	--
Pump Stations #5 thru 7	*	N/A	60	--
TOTAL	*	N/A	120	--
Fairbanks North Star Borough (FNSB)				
City of Fairbanks	14,771	22,645	27,099	19.7
City of North Pole	265	724	1,640	126.5
Other	30,828	30,614	46,340	51.4
TOTAL	45,864	53,983	75,079	39.1
Delta Area				
Delta Junction	703	945	1,207	27.7
Fort Greely	1,820	1,635	1,832	12.0
Other (including Pump Station #9	609	1,797	1,846	2.7
TOTAL	3,132	4,377	4,885	11.6
Glennallen/Copper Center Area	N/A	2,721	2,943	8.1
TOTAL	N/A	2,721	2,943	8.1
Valdez	1,005	3,079	3,687	19.7

* Information not available

Sources: 1970 and 1980 Census; Alaska Department of Community and Regional Affairs; 1985 estimates for the area between the North Slope Borough and the Fairbanks North Star Borough were taken from the Utility Corridor Draft RMF/EIS.

Table 3.2.2-4 Full Taxable Property Value
Municipality of Anchorage, Fairbanks North Star Borough,
North Slope Borough, and the City of Valdez
1970 to 1986

	Value in Millions of Dollars			
Year	Anchorage	Fairbanks	North Slope	Valdez
1970	1,106	305	--	35
1971	1,399	341	--	61
1972	1,661	391	250	47
1973	2,010	476	203	50
1974	2,302	567	256	94
1975	2,935	795	561	228
1976	3,740	1,237	1,794	545
1977	4,538	1,589	3,570	1,212
1978	5,269	1,905	4,716	1,670
1979	6,543	2,305	5,111	1,653
1980	7,495	2,312	5,818	1,748
1981	8,003	2,607	6,705	1,743
1982	10,612	2,996	8,269	1,701
1983	10,867	3,357	10,076	1,697
1984	13,199	3,628	12,355	1,720
1985	15,755	4,211	12,877	1,740
1986	19,343	4,727	13,571	1,693

Note: Collection of these statistics is required under AS 14.17.140, "Determination of Full and True Value by Department of Community and Regional Affairs."

Source: Alaska Department of Community and Regional Affairs, Division of Municipal and Regional Assistance, Office of the State Assessor.

property values from 1972 to 1986, shows that taxable property in the NSB rose from only $250 million in 1972 to $3.6 billion in 1977 when the oil pipeline was completed. In 1986 the taxable property in the NSB totalled $13.6 billion. By comparison, taxable property in Anchorage totals $19 billion. In ***Fiscal Year*** (FY) 1974 the NSB collected only $3.5 million in property taxes. By FY 1986 the NSB's tax revenues totalled $236 million. More than 95 percent of the assessed valuation is oil industry-related property.

These property tax revenues have enabled the local government to collect hundreds of millions of dollars and to borrow more than $1 billion to fund a vast capital improvement program. NSB employment statistics for 1985 showed a total of 9,392 jobs within the borough, most at Prudhoe Bay. Nearly all employment in Barrow and other borough villages, however, was with the government--132 federal workers, 35 state employees and 1,402 local government workers. Much of the local government employment in this period was actually construction work on local capital improvement projects.

3.2.2.2.2 Corridor Villages (Between North Slope Borough and Fairbanks North Star Borough

The discussion that follows gives an overview of the small communities, villages, and industrial sites located south of the NSB and north of the Fairbanks North Star Borough (FNSB) and within 50 miles of the proposed TAGS ***right-of-way***. As summarized in Table 3.2.2-4, in 1985 this area had a population of more than 800 ***persons***, 80 percent Alaska Native.

Wiseman, an historic mining community, is located 200 miles northwest of Fairbanks, very close to the TAPS pipeline. In 1985 Wiseman had about six families for a total of 30 permanent residents. The Wiseman economy is tied to mining and Dalton Highway transportation. Two guiding services are based there.

Bettles/Evansville is located on the south bank of the Koyukuk River 180 air miles northwest of Fairbanks. During winter residents maintain an ice road between the community and the Dalton Highway. The 1980 Census enumerated 94 residents, and the 1985 population was about the same. Bettles Field is the major airstrip in this region, and air support services are an important part of the local economy. The Gates of the Arctic National Park headquarters and several guiding services are based in Bettles. The community has a lodge, two general stores, fuel service, and an FAA flight service station.

In addition to Evansville there are five other small Native villages in the area with a combined population of nearly 600, more than 90 percent of which is Native. These villages have subsistence-based economies with only a few cash employment opportunities, usually with the school or village council programs. BLM firefighting and local construction projects furnish opportunities for cash employment during summer. Allakaket and Alatna, population 188, are located across from one another on the Koyukuk River. Alatna was originally settled by Eskimos from the Kobuk River area and Allakaket is an Athapaskan Indian village. Stevens Village, population 95, is located on the north bank of the Yukon River and is the closest community to the Yukon River bridge. Rampart, population 48, is located on the south bank of the Yukon River. Minto, population 231, is located on the Tolovana River. Minto is the only Native village in this region with road access to Fairbanks. Road access combined with a high birth rate, new housing, new water and sewer system, new school, and other amenitites have contributed to the community's growth.

Livengood is located near the junction of the Elliott and Dalton Highways. No population figures are available. Livengood provides a rest stop for travelers along the highways. During construction of the TAPS a construction camp was located there.

TAPS Pump Stations No. 5 through 7 are located in this region. Each pump station has a full-time staff of about 20. Coldfoot was the site of one of Alyeska's camps during construction of TAPS. Later, a small portion of the campsite was taken over by the Alaska Department of Transportation and Public Facilities (DOT/PF) as a state camp. In about 1980 BLM issued a lease to an individual who established a service center there for traffic along the Dalton Highway.

In 1985 this center had a population of 45 including 31 adults and 14 children. DOT/PF has a transportation center and the Alaska State Troopers maintain a station at Coldfoot.

DOT/PF employs eight people ***near*** the Yukon River crossing ***at Seven Mile Camp*** during summer. The transportation center has a gas station, restroom facilities, and staff housing. There are more than 26 people living at several scattered mine sites on Linda Creek, Emma Creek, and Tramway Bar.

The Jim River Camp, near the former Alyeska Prospect Creek construction camp, is currently occupied by about seven households. The settlement is near Pump Station 5. Most residents are DOT/PF employees who maintain the Dalton Highway.

During the summer, the number of part-time residency north of Fairbanks increases primarily due to road maintenance, tourism, and mining activities. For example, there is temporary residency during the summer by the DOT/PF contractor manning the highway checkpoint at the end of the public access northward on the Dalton Highway at the Chandalar Shelf.

3.2.2.2.3 Fairbanks North Star Borough

The ***Fairbanks North Star Borough*** (FNSB) is Alaska's second largest population center. It is located approximately midway between Prudhoe Bay and Valdez. Fairbanks is the transportation, trade, and service center for the vast interior of the state ***and serves other local communities such as Fox, Moose Creek, Chatanika, Fort Wainright Army Base, Eielson Air Force Base, North Pole, and Salcha. Fairbanks has a modern international airport, and road and rail links with the State's other population centers and is the trans-shipment point for all overland cargo to the North Slope.*** In 1985 the FNSB had an estimated population of about 75,000, a 39 percent increase over its 1980 population of 53,983 persons. In 1976, during construction of TAPS, Fairbanks' population reached more than 70,000, but it fell sharply in the postpipeline period. From 1980 to 1985 the Fairbanks ***area*** experienced an economic boom fueled by increased state spending. In 1985 the economy began to level off, but this was offset somewhat in 1986 by additional military personnel.

Between 1970 and 1985 Fairbanks' average monthly employment more than doubled, from 14,451 to 29,300. During the peak of pipeline construction (1974-77) Fairbanks employment reached 30,407. As shown in Table 3.2.2-2, the two major changes in the Fairbanks economy since 1970 have been the decreasing importance of federal government employment and the increasing role of service employment. Employment in construction, transportation, communications, and utilities has grown faster than overall employment. Pump Station No. 8, near Salcha, employs about 25 local residents, most of whom live in the North Pole area. Alyeska has about 16 other employees in Fairbanks.

One of the most significant legacies of the TAPS has been the increased tax base for pipeline and compressor stations located within the FNSB. In 1977 the oil and gas property constituted about 37 percent of the FNSB's total assessed valuation. In FY 1986 it accounted for only 18 percent of the FNSB tax base. The value of taxable property in the FNSB rose from $305 million in 1970, 2.3 billion in 1980, ***and*** $4.7 billion in 1985.

3.2.2.2.4 Delta Area

The Delta area, located about 100 miles southeast of Fairbanks at the junction of the Alaska and Richardson highways, includes the communities of Delta Junction and Big Delta and Fort Greely (an Army post). None ***assess*** municipal sales or property taxes.

The most current population information available for Delta Junction comes from a local survey made in 1984, which estimated the area had 5,458 residents--1,175 within the city of Delta Junction, and 4,284 outside the city, ***including Big Delta, Fort Greely Army Base, and Summit Lake.*** This represents an increase of 25 percent over the 1980 population of 4,377.

Most private employment in the Delta area is in highway-related services and small retail businesses. In 1978 the state began the Delta Agricultural Project to grow cereal and feed grains for state and export markets. Although nearly 85,000 acres have been cleared for agriculture, in 1986 only about 17,000 were under cultivation. The project has not been an economic success. Falling world grain prices, lack of processing and export facilities, and a small herd of foraging bison have all had negative effects on the experiment.

Except during construction of the oil pipeline, Fort Greely has been the area's major employer. A TAPS construction camp 8 miles north of the city had 1,550 workers in 1975. In January 1987 only about 20 persons were employed at TAPS Pump Station No. 9 located about 8 miles south of Delta Junction. Alaska Department of Labor statistics for 1985 show average annual civilian wage and salary employment for the area at 776--353 federal government workers, 15 state employees, 151 local government employees (primarily school district personnel), and 257 workers employed by private businesses. However, due to the number of farmers and other self-employed people, private sector employment is somewhat underestimated in these figures. Problems with the agricultural development, combined with a statewide downturn in economic conditions, have caused a serious slump in the local economy. There is presently a high vacancy rate in rental housing and a large number of homes are for sale.

3.2.2.2.5 Glennallen/Copper Center Area

The Copper Center-Glennallen region, with a total population of *nearly 3,000* persons, is located about midway between Delta Junction and Valdez. Most of the support services for the area are located in Glennallen, which had a 1985 population of 929. The largest Native community in the region is Copper Center with its population of 174.

Seven other small communities (Chitina, Sourdough, Gakona, Gulkana, Upper Tonsina, Kenney Lake, and Paxson) are in the region. All of these communities are located adjacent to the proposed TAGS *route* except Kenney Lake, which is situated 8 highway miles away, and Chitina, which is 30 highway miles from the corridor. None *are* incorporated. Their only regional governmental organization is a rural school advisory board. Native residents are also represented by AHTNA, the Native regional corporation, and Copper River Native Association, a regional nonprofit corporation. Some Native communities also have traditional tribal councils.

Two TAPS camps, Glennallen and Tonsina, were located in this region during pipeline construction. The total number of workers here peaked at nearly 2,300 in October 1975.

The recent employment information for this area is for 1984, when there was a total of 701 jobs, including 32 federal employees, 127 state workers, 93 local government employees, and 449 private employees. The local economy is depressed. One indicator in the area is that the Copper River School District filed bankruptcy in December 1986. Numerous local businesses have closed, and most others have reduced their work force.

3.2.2.2.6 Valdez

Valdez originated as part of a major transportation route to interior Alaska. That role ended in 1923 during gold rush days with completion of the Alaska Railroad between Seward and Fairbanks. Valdez briefly became a busy port again during World War II. When Alaska became a state, Valdez had only 555 residents. During 1964 the city was relocated 4 miles southwest to a new townsite after much of the community was destroyed by an earthquake tsunami.

The role of Valdez as a major port was revived when it was chosen as the southern terminus for the TAPS. By 1970 the population of Valdez was 1,005. During peak pipeline construction in 1976, the population of Valdez swelled to more than 8,000 but by 1980 had declined to 3,079. In 1985 Valdez had a population of 3,687, a 360 percent increase since 1970 and a modest growth of 20 percent since 1980.

Prior to construction of the pipeline, government accounted for more than 60 percent of the employment in Valdez. The largest employer was Haborview Development Center, a state facility for the mentally and physically handicapped. In 1968 state and local government accounted for 69 percent of the jobs in Valdez. In 1976, during the peak of pipeline construction, total employment rose to 4,584, with more than 25 percent of the jobs in government employment.

In 1985 the total employment in Valdez was 1,850--15 federal government workers, 399 state employees, 311 local government workers, and 1,125 employees of private companies. About 200 people are employed by Alyeska.

Table 3.2.2-4 summarizes the enormous increase in the Valdez tax base which occurred due to construction of TAPS. In 1970 Valdez had an assessed valuation of only $35 million. In 1978 the assessed valuation was $1.7 billion and has remained fairly constant at that level. The oil and gas property within the city limits accounts for more than 90 percent of the community's assessed valuation. Depreciation in the value of TAPS is expected to seriously erode the community's tax base over the next two decades.

3.2.3 Land Use and Ownership

3.2.3.1 Introduction

The proposed pipeline with its associated compressor stations and LNG plant and terminal have the potential to alter the present land use of the existing pipeline *route* to a certain extent. The following subsection discusses the existing land use of the *route* and the nearby area in order to establish a framework for the discussion of potential TAGS project impacts to land use.

3.2.3.2 General Land Use Patterns

The proposed TAGS project would be built primarily on federal and state land within an existing utility corridor that contains a public/private road, a major oil pipeline, and Federal lands that have been authorized to contain chilled gas ANGTS pipeline. Therefore, the corridor area and its vicinity is already partially industrialized, even though it may be surrounded in many areas by undeveloped, essentially inaccessible country.

Throughout the corridor area, there are numerous existing land use plans and programs, and the TAGS project must be consistent with them or prior to construction, secure a variance. The following plans and programs are identified for the proposed TAGS corridor: the North Slope Borough Comprehensive Land Use Plan, the North Slope Borough Coastal Management Program, Utility Corridor Draft Resource Management Plan (Federal--BLM), Fairbanks North Star Borough Comprehensive Land Use Plan, Tanana Basin Area Plan (State--DNR), Tanana Valley State Forest Management Plan, Delta-Salcha Area Plan, Copper River Basin Area Plan (State--DNR), Delta and Gulkana Wild and Scenic Rivers Plans (Federal--BLM), Draft Prince William Sound Area Plan (State--DNR), City of Valdez Comprehensive Land Use Plan, and Valdez Coastal Management Program. Other approved plans or studies include: Corridor Management Framework Land Use Plan, and Denali Scenic Highway Study (Federal--Alaska Land Use Council).

Since the utility corridor was established by the federal government in 1971, portions have been transferred to state and Native ownerships. This is especially true between the Yukon River and Fairbanks and in the Copper River drainage ***where in three instances federal lands within the Utility Corridor, withdrawn by PLO 5150, as amended, transferred to the State of Alaska the segment Yukon River to Washington Creek; to ATHNA Region and/or several villages scattered acreage between Sourdough and Pippin Lake areas; and to Chugach Natives small acreage in the vicinity of Tonsina south of Pippin Lake area.*** Appendix F shows the generalized land-ownership along the route TAGS proposes. Presently land ownership along this route is approximately 45 percent state (either patented, tentatively approved, or pending), 50 percent federal (under BLM, military, or USFS jurisdiction), 5 percent Alaska Native or in other private ownership.

In the Prudhoe Bay area the land is primarily state-owned industrial (oilfield development and production), with some sport and subsistence hunting occurring outside the lease area and pipeline corridor and fishing along the coast and the Sagavanirktok River. ***Subsistence and commercial fisheries for whitefish exist in the Colville River Delta.***

Federal lands located north of the 68-degree parallel close to TAGS have been initially screened for wilderness opportunities. Lands determined to possess wilderness characteristics are not available for any use until such time as Congress releases them. Small portions of the preferred TAGS routing near TAPS Pump Station No. 3 have been relocated to less desirable sites pending Congressional decisions.

From Prudhoe to Fairbanks, the primary use of the area near the corridor is mineral extraction, including gravel and gold mining, hunting and fishing, and as an entryway for recreationists. Hunting, both sport and subsistence, is a primary land use along this section but is greatly inhibited by the restriction on discharge of firearms within 5 miles of the Dalton Highway ***as well as the State's off-road vehicle restrictions under Alaska Statute, AS-19.40.*** Gold mining occurs primarily from the Chandalar Shelf to Fairbanks, mostly on small streams and tributaries. Gravel mining occurs along the entire route. TAPS construction alone opened 270 borrow pits (FPC 1976a). Considerable gravel resources would be required for the proposed construction.

Generally, mineral material resources appear adequate to meet the estimated volumes needed for the TAGS project. Whether they are located in the quantities and qualities desired is unknown.

There are two areas where existing developed mineral resources appear limited in abilities to expand beyond immediate requirements for TAPS and the state highway ***needs***: Construction Spread 1 (North Slope), and Construction Spread 5 (in the Copper River basin). In both cases ***some of the*** TAGS ***alignment*** would be located beyond areas previously explored for mineral material resources. In Construction Spread 1 the initial focus for TAPS and Dalton Highway sources was in the Sagavanirktok River and adjacent uplands. ***In*** this area, ***DOT/PF*** is no longer using the active floodplains of rivers ***as*** material ***sources.*** In Construction Spread 5 it is unlikely that snow and/or ice workpad construction techniques would reduce significantly the mineral material requirements for TAGS ***even if adequate surface water supplies were available.***

The TAGS route from Fairbanks to Valdez passes through lands developed primarily adjacent to the peripheral roads and highways. Prevailing land use is typical of a major transportation route through a thinly populated region. Fishing and hunting are still very important uses, but there are many small towns and lodges along the route which depend on travelers for cash income. Wilderness recreation, such as hunting, fishing, sightseeing, and ***camping***, is also an important use in this area. ***Eielson Military Reservation and Fort Greely Military Reservation are traversed by the proposed TAGS project.***

The proposed route passes through some farming areas, primarily near Fairbanks and the Delta Junction area. The primary crop is barley for feeding livestock.

Valdez area land uses are primarily recreation, transportation, and light industrial. Those activities include sightseeing and tourism, the state marine transportation system and the Richardson Highway, and the TAPS terminal, respectively.

The forestry potential along the route is only slight to moderate. Much of the commercial-grade timber involves pure stands of white spruce, birch, and balsam poplar along the floodplains. Present timber usage includes logs for homes, outbuildings, mining, and other miscellaneous local construction. Additionally, many residences along the route heat their homes with wood cut from their local area. Permits must be acquired to cut logs on public lands.

Two government installations are crossed by the pipeline at Eielson AFB and portions of Fort Greely. This evaluation reflects conclusions and recommendations contained in the Utility Corridor Draft Resource Management Plan and Environmental Impact Statement (August 1987) now being prepared by the BLM for public lands north of Fairbanks. The Draft Plan and EIS addresses broad land use decisions including the need for transportation and utility projects such as TAGS. The project would comply with all existing land-use plans since most of those plans already incorporate the existing utility corridor as ***an area with recognized utility and energy transportation values.***

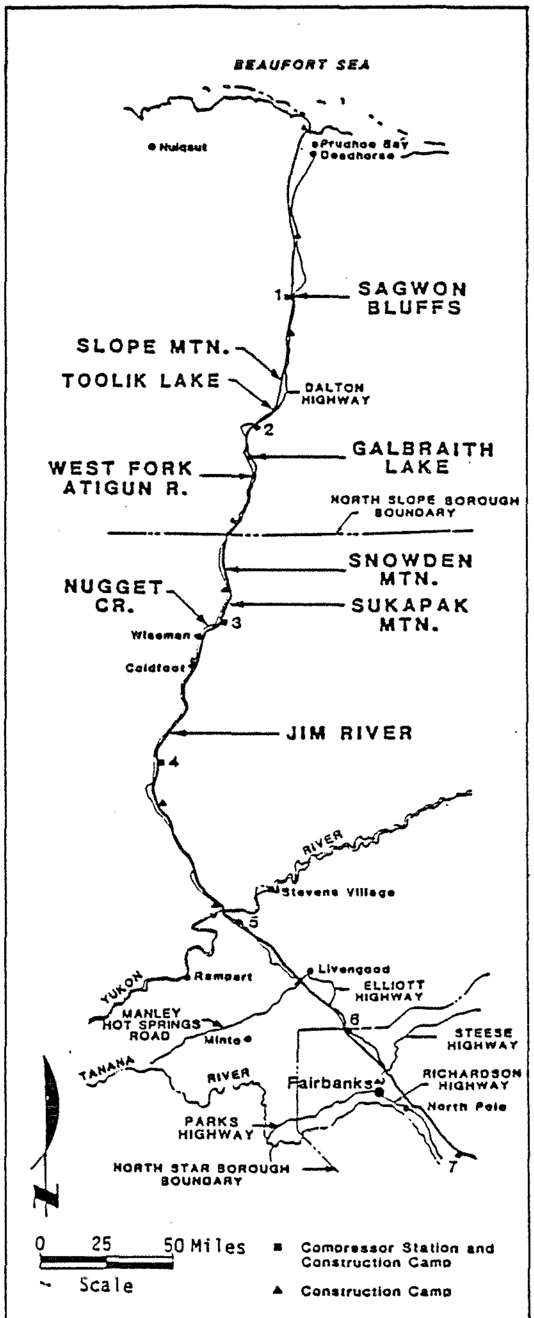
3.2.3.3 Potential Areas of Critical Environmental Concern

The Federal Land Policy and Management Act of 1976 (FLPMA) directs the BLM to identify, evaluate, and as appropriate, *gives* special attention to Areas of Critical Environmental Concern (ACECs). Congress defined an ACEC as an area ". . . within public lands where special management attention to protect and prevent irreparable damage to important historic, cultural or scenic values, fish and wildlife resources or other natural systems or processes . . ."

The BLM, in its Utility Corridor-Draft Resource Management Plan and EIS (August 1987) has identified several areas of public lands associated with the TAGS project north of the Yukon River that have prospective ACEC value. These designations take into the account the primary purpose of the utility corridor, which is for transportation and utility systems, and the occurrences of other superlative public values that need special management attention. ACEC designations are proposed by BLM for the following nine areas that have some relationship to the proposed TAGS project: Sagwon Bluffs, Toolik Lake, Slope Mountain, Galbraith Lake, Westfork Atigun, Snowden Mountain, Sukakpak Mountain, Nugget Creek, and Jim River (Figure 3.2.3-1). Management objectives in several of these prospective ACEC's formalize earlier management decisions made to protect special resource values during the planning, construction, operation, and maintenance of TAPS and the Dalton Highway and for planning the ANGTS.

In addition to the above nine areas, three other prospective ACEC areas that are in the general region of TAGS, including the Ivishak River, Poss Mountain, and Kanuti Hot Springs, are believed to be sufficiently distant or separated by topographic features from the proposed TAGS route *so* that they will not be directly affected by TAGS construction or operation. The following discussions summarize values for which the nine potential ACECs that are proximate to the TAGS route would be managed.

Figure 3.2.3-1
General Location of Potential Areas of Critical Environmental Concern (ACEC) Having Close Proximity to the TAGS Alignment



Source: BLM Utility Corridor Draft Resource Management Plan and EIS (Aug. 1987)

3.2.3.3.1 Sagwon Bluffs ACEC (Potential)

This prospective ACEC involves 42,240 acres. Its western boundary is the Dalton Highway in the general vicinity of TAGS Compressor Station No. 1 (Milepost 66.5). It extends eastward to the Ivishak River ACEC. It contains approximately 20 percent of the known nesting pairs of peregrine falcons along the Sagavanirktok River. This proposed ACEC also contains habitat for gyrfalcons and rough-legged hawks. Riparian zones are important for caribou, moose, and brown bear. The northernmost archaeologic sites associated with the Athapaskan culture are in this unit ***as identified in the "Utility Corridor Draft Resource Management Plan and EIS," BLM, PE-17.*** A sensitive plant species Erigeron muirii is also found in the area. A Habitat Management Plan focusing on peregrine falcon habitat was developed by BLM in 1979 for portions of this proposed ACEC.

Special management practices proposed by BLM are to assure peregrine falcon habitat and sensitive plants are not adversely affected and to incorporate protection measures such as spatial restrictions identified in the Peregrine Falcon Recovery Plan (FWS 1982).

3.2.3.3.2 Toolik Lake ACEC (Potential)

This prospective ACEC involves 34,560 acres, ***which*** surrounds Toolik Lake and several drainages. A university research station is located in the vicinity of the area of a former TAPS construction camp. A large number of arctic research projects focusing on an arctic natural lake and tundra biome are based in and around Toolik Lake. These research efforts provide extremely important information pertinent to public land management on the Alaska North Slope.

3.2.3.3.3 Slope Mountain ACEC (Potential)

This prospective ACEC is 2,600 acres in extent. It is bounded on the east roughly by TAPS in the vicinity of material site near TAGS Milepost 115. This unit contains known lambing habitat and mineral licks for Dall sheep and contains raptor nesting habitat. The vertical faces of the TAPS material site have become raptor nesting habitat. Dall sheep are frequently observed in this material site using the revegetated areas as a food source and the steep material pit slopes as escape habitat.

Because a growing number of sport hunters are using the Dalton Highway to hunt sheep, critical sheep habitats require special protection.

BLM proposes that the mineral lick be withdrawn from mineral entry to protect its existing natural values.

3.2.3.3.4 Galbraith Lake ACEC (Potential)

This prospective ACEC encompasses 115,000 acres--generally public lands between the Arctic National Wildlife Refuge and the Gates of the Arctic National Park and Preserve. The land is essentially between TAGS Mileposts 135 and 145. This unit contains critical wildlife and fisheries habitat, historical and archaeological sites, paleontological and geologic sites, and scenic values.

Erigeron ***muirii***, a candidate plant species, has ***not*** been observed in this area.

This area has the highest concentration of historic and prehistoric cultural resources of any region along TAGS. It includes three sites nominated to the National Register of Historic Places. The area has been recommended as an Ecological Reserve by the Joint Federal-State Land Use Commission and has been recommended for entry into the Register of Natural Landmarks by the U.S. Geological Survey and the National Park Service. Scenic values are rated by BLM as "outstanding."

This area provides walking access to the nearby Gates of the Arctic National Park and Preserve from the former TAPS construction camp area on the west side of Galbraith Lake. The lake serves as a base for air transportation for floatplanes both to the Arctic National Wildlife Refuge and to the Gates of the Arctic National Park and Preserve. The nearby state-owned airstrip also serves as a major focal point for resource users and visitors to North Slope areas to the east and west. The general area at Galbraith Lake has served as a temporary summer base for federal and state resource evaluation teams and for BLM management of the area. It also acts as a base for commercial guiding operations.

BLM management practices propose that new uses be authorized only after special care to ensure that existing public values are not unreasonably threatened.

3.2.3.3.5 Westfork Atigun River ACEC (Potential)

This area covers 4,700 acres to the west of the proposed TAGS alignment near Milepost 155. Its primary value is for Dall sheep lambing habitat and as a sheep mineral lick. As such it has habitat values similar to those described for the Slope Mountain ACEC area (Subsection 4.2.3.3.2). Management objectives by BLM for Westfork Atigun River ACEC are similar to those for the proposed Slope Mountain ACEC.

3.2.3.3.6 Snowden Mountain ACEC (Potential)

This area involves 19,520 acres along the western side of the Dietrich River between TAGS Milepost 188 and 198. It contains areas of unusual geologic and paleontologic values associated with the Devonian and lower Paleozic epochs. It contains formations with Devonian corals and Cambrian trilobites. In addition, there are two Dall sheep mineral licks on Snowden Mountain.

Proximity to public access allows for scientific research. Dall sheep habitat is also important for wildlife viewing and ***sport*** hunting. Overall management objectives by BLM for this area are similar to those described for the Galbraith Lake ACEC. Areas containing sheep mineral licks would be withdrawn from mineral entry.

3.2.3.3.7 Sukakpak Mountain ACEC (Potential)

This unit involves 2,944 acres containing Sukakpak Mountain. It is bounded on the west by the lower slopes of the eastern mountain at the 1,500-foot counter levels and on the east by the western bank of the Bettles River. It is closely associated with TAPS in the vicinity of Milepost 208. The area has unique, picturesque, colorful ***geological*** structures, folds, and faults representing mountain-building processes of the Brooks Range. It contains a sensitive plant species, Orthotrichum diminutivum. Scenic values are rated as "outstanding" by BLM.

The primary area values lie in the excellent opportunities to view the basic geologic processes responsible for the Brooks Range.

Even though applications for mineral material removal sites along the talus slopes were denied, BLM will continue the special management practices initiated with TAPS construction.

3.2.3.3.8 Nugget Creek ACEC (Potential)

This unit contains 3,300 acres on the west side of the middle fork of the Koyukuk River near Milepost 215 of TAGS. Its primary values are Dall sheep lambing habitat and mineral licks. As such, it has values similar to those described for the Slope Mountain and Westfork Atigun River ACECs (Subsection 4.2.3.3.2).

BLM management practices for this area would be similar to those for Slope Mountain.

3.2.3.3.9 Jim River ACEC (Potential)

This unit involves 200,320 acres in the headwaters of the Jim River, and Prospect Creek encompasses an area adjacent to the inner corridor in the vicinity of TAGS Milepost 260 to 275. This potential ACEC is not crossed by the TAGS project. Its principal resource values are: chum and king salmon spawning habitat, overwintering habitat for both resident and anadromous fish species, sportfishing use, raptor habitat, scenic and recreation values, and archaeology.

Chum and king salmon fisheries of the Jim River are very important to runs in the upper Koyukuk drainage. Fish produced here are suspected to have important subsistence and commercial value. The river is one of the most heavily used recreational streams north of the Yukon River along the TAGS alignment.

Archaeological values are high for prehistoric Athapaskan sites; several are of National Register quality. Most present knowledge is related to studies done when

TAPS and the Dalton Highway were built. Several large sites that were identified have only been examined for occupation in specific areas by TAPS or the Dalton Highway.

Scenic values are rated as outstanding by BLM. This general area also contains one of the few peregrine falcon nesting areas between the Yukon River and the Brooks Range.

In addition to standard cultural and raptor management practices, BLM recommends that no disturbances be permitted to active waterways having fishery values. Special evaluations would be required of upland mineral material sites that have potential for adverse effect on existing fishery values.

3.2.4 Transportation

3.2.4.1 Introduction

Alaska presents a unique transportation system, integrating air, highway, marine, and railway transport. This transportation system must overcome the inherent characteristics of a small population, tremendous geographical size, difficult terrain, dramatic climate *ranges*, and, outside the few major population centers, lack of specific infrastructure.

Alaska presently is served by approximately 7,000 miles of highway connecting its major cities. This is augmented by a "marine highway" system connecting various southeastern and southcentral ports by passenger and car ferry. The Alaska Railroad, operated by the state, carries passengers and freight from Seward to Fairbanks. Barges operate seasonally on the Yukon and Tanana rivers. An annual late summer marine transport system (Sealift) carries materials to Prudhoe Bay.

The TAGS project would result in increased highway traffic due to transport of the 80-foot, double-jointed pipe sections by truck during the 15-month construction period and would affect all regions along the corridor.

Scheduled and charter air transport play major roles in both passenger and cargo transportation.

3.2.4.2 Prudhoe Bay Area

The Prudhoe Bay and the Kuparuk development areas are serviced by the Spine Road and a series of gravel roads which originated from and surround Lake Colleen at Deadhorse. Marine freight is brought in by a single annual large sealift and off-loaded by lighter and barge to one of four operating dockheads (Oliktok, West Dock, East Dock, Endicott) during the ice-free seasonal window of August and early September. The State of Alaska operates Deadhorse Airport for commerical and charter aviation. The airport has a Federal Aviation Administration flight service station and a full range of navigational aids.

3.2.4.3 Dalton-Elliott Highways

The Dalton Highway is a gravel road which extends south from Prudhoe Bay to Livengood where it joins the Elliott Highway. It was originally built and maintained by Alyeska as a private road. It is now maintained by the state and has been resurfaced with 6 inches of crushed gravel. Highest observed daily count on this highway was 465 vehicles in March 1977 (DOT/PF 1980). By 1980 daily traffic had stabilized to approximately 154 vehicles per day during August, the busiest month (Eakland 1982). In 1982 the route from Fairbanks to Prudhoe was traveled by a record 42,000 trucks transporting cargo north in support of petroleum development at Kuparuk. DOT/PF sets daily capacity of the Dalton Highway at about 600 vehicles.

During the summer of 1986, only 74 vehicles per day total, north- and south-bound included, used the Dalton Highway, compared with a total of 465 vehicles during the peak of TAPS construction.

Beginning in the summer of 1981, the Dalton Highway from the Yukon River to the vicinity of Deitrich Camp was open to public use from June 1 to September 1. Other months, and north of Deitrich Camp, travel is by state permit only. Permits are usually issued only to local residents and industrial/commercial users. There is virtually no alternative form of transportation other than charter aircraft between Prudhoe Bay and Fairbanks, but there are several small airstrips. ***Coldfoot airstrip is maintained by DOT/PF on a year-round basis. Although both Galbraith and Prospect Creek airstrips are state airports, both are maintained by Alyeska Pipeline Service Company (APSC) under an agreement with DOT/PF. The Five-Mile airstrip is a private, Alyeska Pipeline Service Company (APSC) strip on lands leased from BLM. Except for Five-Mile,*** they are heavily used by hunters during August and September ***but maintained year round.***

3.2.4.4 Fairbanks Area

Fairbanks occupies an important position in central Alaska transportation. It is considered the jumping-off place for Prudhoe-bound air and truck freight. The northern terminus of the Alaska Railroad at Fairbanks deposits freight to be trucked or flown to Prudhoe.

Fairbanks also acts as the origin or northern terminus for both north-south state highways, including the major artery south to Anchorage (Parks Highway) and the Alaska Highway. Fairbanks receives some goods by barge from the Yukon River and barges goods up the Tanana River to the south. Fairbanks is served by several major airlines and has full-charter air service.

3.2.4.5 Richardson Highway and Valdez Area

Paralleling the Tanana River south of Fairbanks, the proposed TAGS line would follow the Richardson Highway. This highway is intersected by the Alaska Highway at Delta Junction and the Glenn Highway at Glennallen. From Glennallen the Richardson parallels the Copper River, the Tonsina River, ***the Little Tonsina River, the Tiekel River, the Tsina River,*** and Ptarmigan ***Creek*** to Thompson Pass in the Chugach Mountains and along the Lowe River to Valdez. There are several small fixed-wing charter services along the Richardson Highway between Fairbanks and Valdez. ***Additionally, there is a paved airport at Delta Junction (military, but with scheduled civilian flights during TAPS) and near Glennallen (Gulkana Airport with scheduled air service during TAPS). Both could be used during TAGS.***

Valdez is a transportation hub on northern Prince William Sound. There is scheduled and charter air service available. Valdez is a deep-water seaport and has considerable marine vessel traffic, including private, charter, commercial fishing, sightseeing, and tanker vessels. The TAPS marine export system is located on Port Valdez across from the city of Valdez. Approximately three supertankers per day call at this facility, which is located in this deep, natural, sheltered harbor. There is a great increase in private and commercial marine vessels during the summer. Most commercial traffic is related to the state ferry service and fishing/crabbing vessels. Outside Port Valdez, in Prince William Sound and the Gulf of Alaska, severe storms can last for several days. In 1986, ***when adverse*** weather prevented vessels from reaching the TAPS terminal for a ***few days, pipeline throughput was lowered and storage tanks allowed to fill up past normal limits.***

3.2.4.6 Anchorage Area

The Anchorage transportation system consists of an international airport, a major railroad center, and a major highway system, and it is the hub of small-plane traffic in the state. Merril Field and the Lake Hood floatplane facility are two of the busiest small-plane airports in the United States.

Whittier and Seward are both ice-free ports and are potential sources or terminals for marine shipping related to the TAGS project. ***The Alaska Railroad connects these ports to Anchorage and interior Alaska.***

3.2.5 Noise

The proposed TAGS project would be built almost entirely in the designated utility and transportation corridor. It would be within or near the Prudhoe Bay industrial complex and would parallel the TAPS and ancillary facilities corridor and public highways. For most of the route the proposed TAGS would be within earshot of the

Dalton, Richardson, or Elliott highway. Each of these constitutes a source of localized background noise, as does boat traffic and commercial and light aircraft overflights. Although the corridor itself is developed, most of the area adjacent to the route is undeveloped and sparsely populated, and ambient noise levels are generally low. Most ambient noise is generated by the wind and moving water.

Data for similar locations indicate that typical natural noise levels usually range from 15 to 45 dBA (the dBA scale represents how the human ear hears the various sound frequencies) which is considered quiet. Natural noise levels up to 65 dBA may be associated with storms and wildlife (EPA-DOI 1984). An automobile moving at 62 miles per hour at 50 feet is about 71 dBA, a bulldozer operating at 50 feet is about 87 dBA, while machines, outboard motors, and floatplanes generate noise levels up to 85 dBAs at 50 feet (EPA-DOI 1984).

Along the utility corridor, noise is presently generated at the Alyeska pump stations. At a distance of 600 feet, the noise level from these facilities has been estimated at 74 dBA (DOI 1972). Sound levels measured in the Prudhoe Bay area in 1979 identified sound levels from the central compressor plant of 74 dBAs at 15 meters from the turbine air intake and 60 dBAs at 120 meters from flare operation (FERC 1980). These ambient levels are affected by wind and other atmospheric conditions. Noise carries considerable distances during calm, cold conditions due to increased air density (DOI ***1986a***).

Background noise in the Valdez area is quite low, with road traffic and aircraft the most significant sources. Valdez is typical of many small Alaska cities with moderate traffic and limited sources of noise. There is some ambient noise from the Alyeska terminal which lies about 3.5 miles east of the proposed TAGS terminal at Anderson Bay. Anderson Bay has no road access and is virtually undeveloped. Natural background noise levels are low except when transient boats and aircraft pass by.

3.2.6 Meteorology and Air Quality

3.2.6.1 Introduction

The climate along the proposed TAGS route, which includes some of the most extreme temperature ranges in North America, is classified in four major zones (FPC 1976a): Arctic, Continental Interior, Transition, and Maritime. The Arctic Zone extends south from the Beaufort Sea coast through the northern part of the Brooks Range. The southern portion of the Brooks Range down through the upper Copper River basin to the crest of the Chugach Mountains comprises the Continental Zone. The Transition Zone (from continental to maritime climate) includes primarily the Chugach Mountains. Generally, lands south of the Chugach Mountains are in the Maritime Zone, although there is some modification in the Port Valdez area due to the mountain barrier surrounding the basin.

Air quality along most of the route is generally considered to be very good due to minimal human habitation and industrial development. Localized sources of emissions include vehicles, traffic, and wind-generated dust and forest fires, which contribute to temporary increases in air pollution. Seasonal and annual weather variability greatly influences ambient concentrations. ***No Class I airsheds are directly related to the proposed TAGS project.***

3.2.6.2 North Slope and Brooks Range

Temperature and wind conditions north of the Brooks Range are among the most severe in the state. It is not the coldest area, but since temperatures are quite low and the area invariably experiences moderate to severe winds, chill factors are often below zero. From the Beaufort Sea coast to the Brooks Range, surface winds are predominantly from the east during summer and westerly in winter. The annual average speed is 12 to 13 miles per hour (mph) along the coast and slightly lower inland. Wind speeds of 35 to 50 mph primarily are associated with fall and winter storms (Ruffier and Bair 1977).

Minimum winter temperatures in (°F) average between -15° and -30°. Wind speeds average about 10 to 15 mph. These conditions result in an equivalent chill factor of -40° to -80°. During periods of extreme cold the temperature may drop to -40° or -50°, but winds are usually much lighter during such extreme cold conditions. Daily summer temperatures warm to the 40s and occasionally the 50s, with temperatures up to 60° common near the foothills (USACE 1984). Extremes of +85° and -66° have been recorded at Umiat about ***110*** miles ***south***west of Prudhoe on the Colville River.

The area averages 4 to 6 inches of precipitation annually, including 30 to 50 inches of dry snowfall in winter (USACE 1984). Drifting snow is common due to strong surface winds and dry snow conditions, producing whiteouts that often last for several days but only include the vertical area within 50 feet of the ground. Whiteouts typically restrict driving, flying, and outside work due to lack of visibility and the danger of getting lost (BLM 1976).

In 1953 the National Weather Service established a climate station in Anaktuvuk Pass, about ***170*** miles ***south***-southwest of Prudhoe Bay, that has provided much of the meteorological data collected for the Brooks Range. Records show an average annual snowfall of about 63 inches, which makes up a large portion of the total annual precipitation of about 10 inches.

Present air quality emissions occur primarily from sources associated with the Prudhoe Bay facilities, including oil-production facilities, electric generators, two petroleum refineries, and an industrial incinerator. Other sources include vehicle exhaust, road and pipeline maintenance operations, and buildings' heat systems. Air quality monitoring was performed during 1979-80 (USACE 1984) and again in 1986 in the Prudhoe Bay-Kuparuk area. Results indicate that concentrations for all air pollutants are presently below those allowed by the National Ambient Air Quality Standards (NAAQS), and the area is currently designated as an "attainment zone."

Recent studies by National Oceanic and Administrative Administration (NOAA) have shown that the air quality of the North Slope and nearshore Beaufort Sea has been somewhat affected by pollution from northern Europe and Siberian industrial effluents (USACE 1984).

Although ***a GCF is considered a connecting action,*** YPC is not proposing to construct a gas conditioning facility at Prudhoe Bay ***as discussed in subsection 2.2.1. However, YPC*** had conducted a screening analysis to determine if the ***conceptual GCF*** site could meet the necessary air quality emission requirements ***for this connected action.*** Appendix D presents the potential effects of the ***conceptual GCF*** on the Prudhoe Bay airshed.

3.2.6.3 Fairbanks Area

Temperature extremes are even greater near Fairbanks and in the Interior. Although the climate is considerably milder in summer, it is somewhat colder in winter. There are fewer occurrences and durations of strong winds, and maximum velocities are less except in mountain passes. Some drifting of snow occurs but not nearly as much as on the North Slope.

Temperatures (in °F) during summer are commonly in the upper 60s and 70s, with extremes in the 90s. Average winter lows range from -5°F to -25°F, with extremes between -50° and -65°.

Annual precipitation in the Fairbanks area is 10 to 13 inches. Heaviest amounts occur in summer from thunderstorms. Snow accumulations average from 50 to 70 inches in the Fairbanks area. Outside the Fairbanks bowl area, precipitation can exceed 26 inches per year.

Periods of cold temperatures and low wind speeds in northern and central regions of Alaska can lead to long-lasting atmospheric temperature inversions. During severe winter cold periods, the relatively large volume of water vapor and other material emitted by vehicles, space heating systems, power generating stations, and industries in Fairbanks is kept near the ground by these extremely high-gradient inversions, often for long periods of time. This produces severe air pollution in the form of ice fog, which hinders vehicular travel and air traffic and poses a health hazard. ***According to ADEC's (1983) Air Quality Control Regulations, subsection 18 AAC 50.012, identifies both the Fairbanks and North Pole urban areas as areas of nonattainment for carbon monoxide.***

3.2.6.4 Fairbanks to Valdez

From Fairbanks south to the Chugach Mountains there is considerable variation in elevation and type of terrain. At Gulkana surface winds are primarily southeasterly during all months except November through February, when wind direction is northerly (FPC 1976a). On either side of the Alaska Range surface winds average 5 to 8 mph annually, and the monthly range is 3 to 10 mph. The strongest winds generally occur during spring and summer. In and near the mountains, however, especially through high passes and narrow valleys, strong winds up to 50 to 60 mph are common, most often in the winter. Snow drift in some areas, especially around Delta Junction, makes it difficult to keep major highways open at times.

Summer temperatures (°F) usually range between 60° and 75° during the day, with night temperatures dropping into the low 50s and upper 40s. Maximum values would be in the 80s and occasionally near 90°. Winter daytime temperatures vary between 5° and 15, dropping to -10° to -25° at night. Extreme winter lows range from -45° to -60°, usually with at least one prolonged period of cold weather each winter. There is little fluctuation of temperature between day and night during these cold snaps, and temperatures average -40° or colder. Winds are usually lighter during these periods, but wind chill is still of concern to those outdoors.

Precipitation is typically 10 to 12 inches annually in this region, with an annual snowfall of about 35 to 70 inches, although certain areas get much more.

The area from Fairbanks to Valdez is sparsely populated and nonindustrialized except for the pipeline corridor; ***therefore, it*** has good to excellent air quality. There are several small villages along the route, with Glennallen and Delta Junction the major population centers. Very few effluents are of any concern.

The proposed TAGS route would pass through a section of the Chugach Mountains that holds the record for snowfall in Alaska (DOI 1972). An annual average of approximately 400 inches of snowfall was recorded between the years 1952 through 1987. A total of 974.5 inches was recorded during the winter of 1952-53 by the Cooperative Weather Station at Thompson Pass and February 1964 remains as the highest monthly snowfall record was set at 346.1 inches. Surface winds and drifting snow cause considerable trouble for highway crews in the passes, and winds of 30 to 70 mph occur several times each month during the snow season, often causing severe whiteouts.

Because Thompson Pass is affected by the warmer air of the Gulf of Alaska, winter temperatures are much warmer than those to the north. During the coldest part of winter, Fahrenheit readings are usually between 0° and 15°; the coldest temperature recorded was -39°.

Climatic conditions on the southern slopes of the Chugach Mountains reflect a gradual moderation of temperatures. The annual temperature extremes are +87° and -28°. Summer days warm into the 50s and 60s; nights during the coldest months typically have temperatures between 5° and 25°.

Precipitation is heavy compared to most other areas described. Annual snowfall ranges from 250 to 400 inches and is usually "wet," contributing substantially to the total annual precipitation of 60 to 90 inches. Most precipitation occurs from August through November.

The complex terrain surrounding Valdez greatly influences local climate. The high mountain ridges to the north protect Valdez from extreme cold in winter and prevent warmer air originating in the Interior from reaching there in summer. Mountains to the south provide a barrier to the warm, moist air from the Gulf of Alaska in winter, but any protection they provide in summer is offset by cool drainage winds off nearby glaciers. Temperatures (°F) average about 18° during the coldest month (January) and about 53°F during July, the warmest month (EPA 1979).

In Valdez rainfall is abundant, averaging more than 59 inches per year (EPA 1979). September, the wettest month, averages 7 inches. June, the driest month, averages 2.7 inches. Snowfall is heavy, averaging almost 294 inches annually, with an average of more than 39 inches each month from December through March (EPA 1979). There is considerable cloudiness and low ground fog during the year.

Surface winds in the Valdez area, although strong on occasion, are generally light and northeasterly during the winter and southwesterly during the summer (EPA 1979) and not nearly as strong as through Thompson Pass.

Light winds with surface inversions and above-surface stable layers can lead to high air pollution potential. However, surface inversions are typically short term. Overall, dispersion conditions in the area are considered fairly good (EPA 1979).

Alyeska Marine Terminal facilities were designed to meet National Primary Air Quality Standards and/or State of Alaska emission standards (DOI 1972). ***The ADEC is reviewing information on the TAPS Marine Terminal at Valdez to determine if the current facilities are subject to PSD review.***

3.2.7 Liquid, Solid, and Hazardous Wastes

Solid waste disposal is presently handled in a variety of ways by the different communities along the corridor, primarily through landfill. Due to the low population and small quantity of solid wastes, disposal is not a problem in most areas. During TAPS construction many approved sites in abandoned mineral material sites were developed along the corridor that functioned effectively. ***An example of the quantities produced by TAPS include approximately 500 destroyed vehicles, 3,000 batteries, 9,000 to 10,000 tires, 15,000 to 20,000 tons of scrap construction material, 4,000 to 6,000 tons of equipment components, thousands of used drums, thousands of tons of camp-related wastes, dozens of prefabricated buildings, and quantities of unused pipe. Short-term*** disposal sites north of Fairbanks ***were used by TAPS for disposal.***

Hazardous materials are presently generated by several entities along the route including TAPS, the highway department, schools, and small generators such as service stations and cleaners. Currently there is no mechanism for storage or disposal of toxic or hazardous material in Alaska, and all such materials must be disposed of by transport to the Lower 48 states.

Sanitary wastes are generated all along the proposed route by the people and industrial facilities present. Due to the low population density, disposal of sanitary wastes is not a problem except on a local level in areas which are wetlands or have a high water table. There ***are*** virtually no common sewage disposal sites along the proposed route except at Fairbanks and Valdez. Therefore, most dwellings, businesses, or small shopping centers are left with the problem of disposing of their own liquid wastes. Most do so by leach fields or use of individual package sewage treatment plants. In some areas, contamination levels in surface waters are high in the spring due to a winter's accumulation of waste, but generally water levels are sufficiently high to dilute this contamination to acceptable levels.

Liquid wastes generated by the project would include domestic wastewater and filter backwash; equipment washdown; storm water runoff; and industrial wastewater. Domestic wastes and filter backwash water produced at the 26 campsites and compressor stations would be treated by package treatment plant systems which are designed to meet ADEC and EPA water quality criteria at the discharge point. These treatment plants would be sized and operated to accept wastes from camp facilities as well as waste from field toilets. Wastewater would average about 100 gallons per person per day.

The TAPS construction used individual package sewage treatment along the route at construction camps and at pump station sites, and the same type of disposal is planned for the TAGS project.

3.2.8 Physiography, Geology, Soils, Seismicity, and Permafrost

3.2.8.1 Introduction

The topography, geology, and soils along the proposed TAGS pipeline corridor are highly variable. The route crosses the arctic coastal plain, three mountain ranges and intervening uplands, and alluvial basins and is generally oriented perpendicular to major structural trends (FPC 1976a). Igneous, sedimentary, and metamorphic bedrock are found along the proposed route. Structurally, these rocks are varied and complex.

Geomorphic processes, including erosion, mass wasting, and deposition, have resulted in a wide range of ***unconsolidated materials*** overlying bedrock. ***Surficial unconsolidated materials along the proposed pipeline route range from fine-textured and poorly drained to coarse-textured and well drained and exhibit a wide range of engineering characteristics. Soil moisture content and drainage are affected by the presence and distribution of permafrost.***

Permafrost, or perennially frozen ground, is encountered along much of the proposed route. Major engineering problems can arise where warming of permafrost occurs in poorly drained, fine-grained sediments. These materials generally contain large amounts of interstitial ***and/or separated*** ice. ***The segregated ice may take the form of irregular blobs or lenses, or horizontal layers that range in thickness from fractions of an inch to many feet.*** As the permafrost warms, the interstitial ice melts, resulting in a volumetric reduction of the soil mass and excessive wetting of the thawed, fine-grained soils. These effects can result in subsidence of the ground surface and downslope movement of the entire thawed mass. ***Coarse-grained sand and gravel soils can also contain large amounts of ice. Generally, however, the ice content of coarse-grained soil is lower than than for fine-grained soil. Ice most commonly occurs in coarse-grained soils as small segregated masses and coatings on individual grains. As these permafrost soils thaw, they generally undergo less volumetric reduction and subsidence than do fine-grained soils. The better drainage afforded melt water in coarse-grained soils also makes these materials less likely to undergo downslope movement.***

Engineers classify permafrost soils on the basis of their tendency to undergo significant volumetric changes upon thawing. "Thaw stable" soils are those which do not undergo significant volumetric changes and as a result do not produce significant engineering impacts upon thawing. Thaw stable soils are typically sands and gravels containing minor amounts of fine soil and interstitial ice. Conversely, "thaw unstable" soils do undergo significant volumetric changes and can create major engineering problems upon thawing. Ice-rich silts and clays are typical thaw unstable soils. Experience along the TAPS route has shown that soils originally thought to be thaw stable can cause significant engineering problems and that care must be taken in assessing the thawed behavior of permafrost soils.

Permafrost is continuous north of Atigun Pass and discontinuous throughout much of Interior Alaska, including areas within valleys south of the Continental Divide in the Brooks Range. The term "continuous permafrost" implies permafrost underlies nearly all the landscape, including small ponds and streams, and has a temperature lower than 32°F at the depth of zero annual seasonal change (about 15 feet). In the zone of "discontinuous permafrost," ground temperatures are higher than 32°F and most north facing slopes and low areas are underlain by permafrost. South facing slopes and ground beneath large bodies of water may be permafrost free (Brown and Kreig 1983). The southern limit of discontinuous permafrost along the proposed alignment occurs in the Chugach Mountains at the Little Tonsina River.

Even in the coldest parts of Alaska, a thin layer of ground, the "active layer," thaws every summer and separates the top of the frozen permafrost from the ground surface. The thickness of the active layer depends upon the capacity of the surface material to protect the underlying permafrost from summer heat. Active layer thickness can vary from .5 to 5 or more feet and can change dramatically when the surface is disturbed (DOI 1972).

Based on topographic and geologic similarities, seven primary physiographic units have been identified along the project corridor. The physiographic units discussed in this document are based on the system described by Wahrhaftig (1965). Some of the Wahrhaftig province have been combined into more general physiographic units with more common descriptors to emphasize terrain, geology, and soil conditions along the proposed route. The seven units described herein are as follows: North Slope, Brooks Range, Yukon-Tanana Uplands, Tanana Valley, Alaska Range, Copper River Basin, and Chugach Mountains. These units will provide an organizational framework for the following sections. The boundaries of the physiographic provinces are shown on Figure 3.2.8-1 and in cross section on Figure 3.2.8-2.

Three major active fault zones are traversed by the TAPS route between Delta Junction (Milepost 533) and Summit Lake (Milepost 600). Specifically, these are the Donnelly Dome, Denali, and McGinnis Glacier faults. The Denali Fault displayed significant evidence of offset in the last 10,000 years (Richter and Matson 1971).

3.2.8.2 North Slope

The North Slope physiographic unit encompasses the coastal plain and foothills provinces. This unit is bounded on the north by the Beaufort Sea and by Slope Mountain (near Galbraith Lake) on the south.

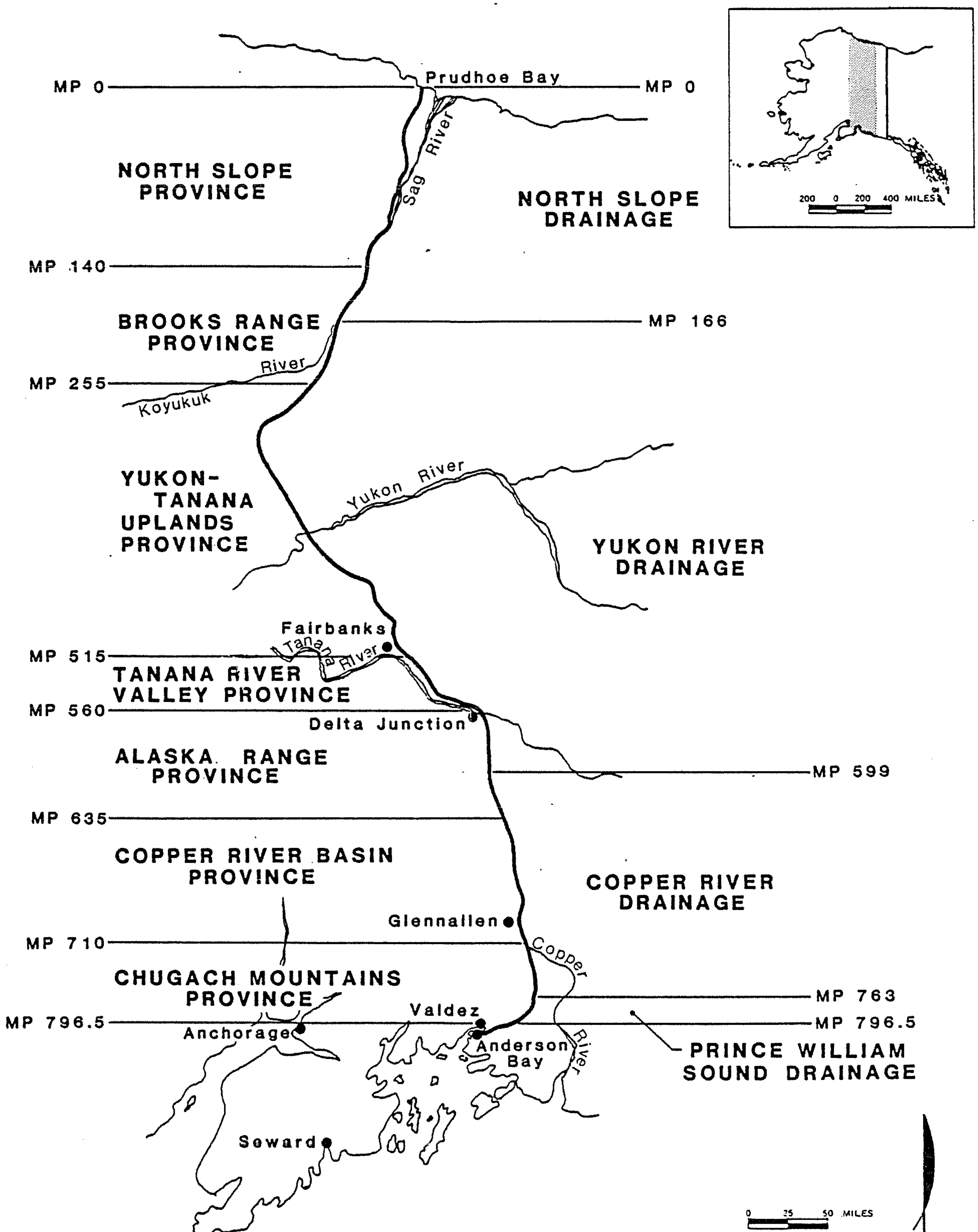
The coastal plain has low relief and rises gently from the sea to an elevation of about 600 feet. The average slope of the land surface in most areas is less than 10 feet per mile toward the north (FPC 1976a). Coastal bluffs, sand dunes, lake and river banks, and pingos (ice-cored hills) provide occasional breaks in the landscape.

The flat terrain results in very poor drainage and marshy conditions in summer. Thousands of shallow, wind-oriented thaw lakes dot the landscape. These lakes range in depth from 2 to 20 feet and, as spring thaw continues, they expand. When they intersect a gully or a streambed, they drain, leaving a depression in the land surface. A network of ice-wedge polygons form patterned ground between the thaw lakes *and under most thaw lakes unless they are deep.*

Rivers from the Brooks Range flow northward across the coastal plain. The Sagavanirktok River, which is typical of major streams in this province, traverses the coastal plain through a series of interconnected braided channels which form a broad floodplain. Spring flooding typically occurs in May and June. Open water occurs in the active channels from June through September. Erosion has resulted in exposed bluffs along the margins of the floodplain. Oxbow lakes and flood channels are common along major rivers such as the Sagavanirktok. Aufeis (sheet icing) conditions are common in such areas during the winter.

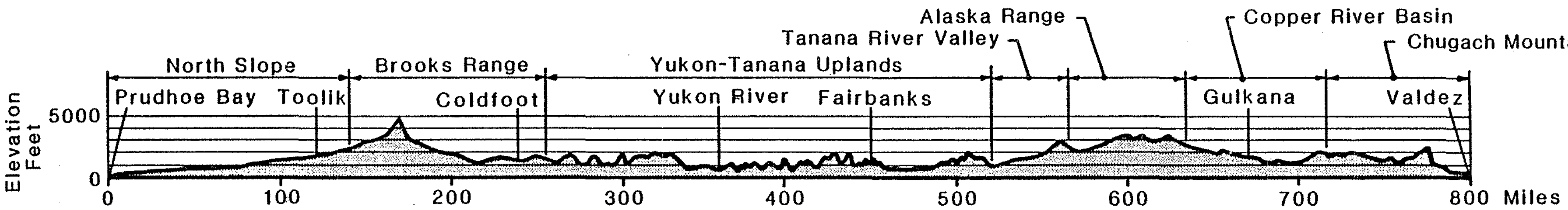
The coastal plain is underlain by 10 to 150 feet of unconsolidated Quarternary sediments resting on nearly flat-lying Cretaceous and, in some areas, lower Tertiary sedimentary rocks. The northern foothills are underlain by Cretaceous sedimentary rocks, folded into long anticlines and synclines. The east to west-trending ridge topography was produced by unequal erosion of layers of rock differing in hardness. The southern part of the foothills is underlain by diverse sedimentary rocks and igneous intrusions of Devonian to Cretaceous age.

On the plain, soils are poorly drained and generally do not thaw to depths of more than 20 inches and are susceptible to slides in steeper areas. Soils encountered between the northern terminus of the proposed TAGS route and the Sagavanirktok River floodplain are extremely ice-rich silt and fine sand overlying frozen sand and gravel. *Areas with high potential for sand and gravel extraction exist along the coastal plain in active floodplains and in upland and abandoned floodplain deposits. Extensive areas of seasonally thawed gravels exist in*



NOTE : MP Refers to Mileposts along the Proposed TAGS Pipeline Route
Physiographic Provinces after Wahrhaftig, 1965

Figure 3.2.8-1 Physiographic Provinces and Major Drainage Basins Along the Proposed TAGS Pipeline Route



SOURCE: Brown and Kreig, 1983

Figure 3.2.8-2 Cross Section Along Proposed TAGS Route

the active floodplain of the Sagavanirktok River. However, seasonal deposition of alluvium in arctic rivers is limited and any thawed gravel (relatively inexpensive to obtain) would not be replenished rapidly. For this reason, gravel extraction would probably be limited to frozen upland and abandoned floodplain deposits. Most soils of the foothills are poorly drained, occurring on long slopes and in microtopography. A few moderately well-drained to well-drained gravelly soils occur on ridges and large river terraces. Organic soils are uncommon and occur mostly in polygonal ground of old drained lake basins (Brown and Kreig 1983).

The coastal plain and foothills are underlain by thick permafrost that reaches a maximum depth of approximately 1,800 feet at Prudhoe Bay. Thickness of the active layer is generally less than 1.5 feet in predominantly fine-grained soils. Unfrozen zones are generally limited to deep river channels, some of which are underlain by unfrozen gravel and deep lake basins (Brown and Kreig 1983).

3.2.8.3 Brooks Range

This physiographic unit encompasses the Brooks Range mountains through the Ambler-Chandalar ridge and lowland province. The TAGS route enters the Brooks Range unit at Slope Mountain north of the continental divide which extends to the South Fork Koyukuk River on the south.

The Brooks Range rises abruptly from the arctic foothills to an elevation of 8,000 feet. Glaciation has sculpted the mountain ridges into ragged forms dominated by cliffs and benches. The east-west trend of ridges was caused by alternating bands of hard and soft rocks of sedimentary and volcanic origin.

Rivers flow in glacially eroded valleys 0.5 to 2 miles wide. Minor tributaries flow east-west, parallel to the structure of the bedrock.

The proposed route crosses the Brooks Range through Atigun Pass, which is narrow and steep-sided. It then descends to the broad valley of the upper Chandalar River. Descending the Chandalar Shelf, the route follows a valley system formed by the Dietrich River and Middle Fork Koyukuk River.

Landslides are present along the proposed route. Presence of steeper slopes and occurrence of up to 30 freeze-thaw cycles a year decrease the resistance of rock fragments and soil to downslope movement.

The Brooks mountains in this area are composed chiefly of folded and thrusted Paleozoic limestone, shale, quartzite, slate, and schist with some sandstone and conglomerates. The north front of the range is light colored, cliff-forming limestone. Bedrock south of 68 degrees north latitude is metamorphosed (FPC 1976a).

Hills in the Ambler-Chandalar ridge and lowland area are mainly metamorphosed basalt. Lowlands are underlain largely by sedimentary rocks folded into anticlines and synclines.

Higher parts of the Brooks Range are mostly steep, exposed bedrock and coarse, unstable colluvial deposits with local areas of poorly drained, gravelly soils.

North of the continental divide, shallow permafrost retards internal drainage, consequently most soils are wet, poorly differentiated, and contain significant organic material. In the foothills and mountain areas south of the treeline, mass movement results in poorly drained, silty or gravelly soils with thin organic horizons. Seasonal thaw is generally less than 20 inches (Brown and Kreig 1983).

The Atigun River valley is underlain by silt, sand, gravel, and locally by bedrock. In the divide area it is underlain by talus and rubble mantling bedrock. South of the divide, the route is underlain by a veneer of generally frozen glacial silt, sand, and gravel over bedrock.

In the southern foothills, the area is underlain by unconsolidated deposits of frozen glacial silt, sand and gravel, colluvial silts, alluvial deposits, and bedrock (DOI 1972).

Permafrost is continuous north of the continental divide and discontinuous south of the divide. Bedrock and unconsolidated deposits on slopes are generally perennially frozen. South of the divide, permafrost is probably absent in most areas beneath active channels of large rivers. Thaw bulbs occur beneath smaller drainages. Fine-grained deposits of the Brooks Range usually contain massive ice as ice wedges. Coarse-grained materials contain ice between particles.

3.2.8.4 Yukon-Tanana Uplands

The Yukon-Tanana Uplands physiographic unit encompasses the Kokrine-Hodzana Highlands province, the intervening Rampart Trough province, and the Yukon-Tanana Uplands province. TAGS enters the Yukon-Tanana Uplands unit at the South Fork Koyukuk River on the north and extends to Shaw Creek on the south.

The northernmost section of the unit is comprised of the Kokrine-Hodzana Highlands. Even-topped, rounded ridges from 2,000 to 4,000 feet elevation characterize the northernmost section of the unit. Isolated areas of rugged mountains stretch above the ridges. The divide separating the Yukon and Koyukuk river drainage systems wanders through the highlands. The Hodzana, Tozitna, Melozitna, and Dall rivers drain into the Yukon. The Kanuti and South Fork Koyukuk rivers drain the uplands into the Koyukuk.

The proposed route crosses the Jim River and a series of colluvial fans before leaving the valley at Prospect Creek. The terrain between the Jim and Ray rivers consists of a series of lightly·forested, east-west trending foothills and narrow ridges.

The Rampart Trough separates the Kokrine-Hodzana Highlands provinces from the Yukon-Tanana Uplands province. The Rampart Trough is a narrow depression with gently rolling topography 500 to 1,500 feet in elevation. The proposed route crosses the trough south of the Yukon River in the vicinity of Hess Creek. The Rampart Trough was eroded along a tightly folded belt of soft continental coal-bearing rock of Tertiary age. Hard rock hills and the surrounding uplands are partly metamorphosed sedimentary and volcanic rocks of Mississippian age that are cut by granitic intrusions.

From the Rampart Trough to the Fairbanks area, the route crosses the Yukon-Tanana Uplands primarily along ridge crests. The route follows natural ridge crests and saddles and crosses valleys of major east to west-trending drainages before descending into the Tanana River valley (FPC 1976a).

The Kokrine-Hodzana Highlands are underlain chiefly by Paleozoic and Precambrian (possibly) schist and gneiss cut by several granitic intrusions.

Rocks along the north side of the Yukon-Tanana Uplands province are comprised of highly deformed Paleozoic sedimentary and volcanic rocks containing limestone units. The rest of the upland province is chiefly Precambrian schist and gneiss. Small elliptical granitic intrusions are found in the northwestern part. ***On the uplands, coarse gravelly soils derived from the granitic intrusions are common. Organic soils occur in tussock meadows associated with drainages (Brown and Kreig, 1983). A thick mantle of windborne silt lies on the lower slopes of hills and thick accumulations of muck (a mixture of frozen organic matter and silt) overlie deep stream gravels in the valleys.***

North of the Yukon River in the Kokrine-Hodzana Highlands, the proposed TAGS route is underlain by a wide range of unconsolidated deposits and bedrock. The broad, open Jim River valley is an area of discontinuous permafrost, and limited zones of thawed gravel are found in the Jim River floodplain. Soils in the Rampart Trough include frozen colluvial silt, sand, rock ***fragment***, gravel, and ice-rich, reworked, wind-blown silt (DOI 1972; FPC 1976a).

Between the Yukon River and Livengood the area is mantled by loess. Well-drained soils over a deep permafrost table are common on steep slopes, alpine ridges, and summits. Organic soils are common in poorly drained sites.

South of Livengood much of the proposed TAGS route is underlain by reworked wind-blown silt, colluvial silt, alluvial silt, sand and rock fragments, sand and gravel, and dune sand.

Alluvial soils that lack permafrost or are perennially frozen below 4.5 feet tend to be well drained, while those with permafrost shallower than 4.5 feet are not. Upland soils on south-facing slopes are generally well drained and free of permafrost. Soils on both north-facing slopes and long, flat slopes and valleys are poorly drained, usually with a shallow permafrost table (Brown and Kreig 1983).

South of the Brooks Range the presence of permafrost and thickness of the active layer are closely related to slope angle, aspect, vegetation, thermal properties of parent material, and drainage (Brown and Kreig 1983). Generally, permafrost is discontinuous and locally depressed. In the Fairbanks area perennially frozen ground is widespread, and the relatively warm, sensitive permafrost degrades if the surface is disturbed.

South of Fairbanks much of the area is thawed, but large accumulations of ice are locally present in reworked silts.

3.2.8.5 Tanana Valley

The proposed route crosses this unit beginning at Shaw Creek, runs through the Tanana River drainage area, and crosses the river at Big Delta to a point near Donnelly Dome south of Fort Greely, which is the southern boundary of the unit.

Rivers from the Alaska Range flow for a few miles at the heads of the fans in broad terraced valleys 50 to 200 feet deep. Thaw lakes occur in areas of fine-grained alluvium; thaw sinks are abundant in areas of thick loess cover (FPC 1976a).

The Tanana Valley is covered with surficial deposits, including outwash fan deposits from the Alaska Range. Scattered low hills of granite, ultramafic rocks, and schist rise above the outwash. Tertiary conglomerate in the foothills of the Alaska Range dips beneath the valley in a monocline (DOI 1972).

Soils along this portion of the alignment include frozen, ice-rich silts over alluvial gravels from Shaw Creek and across the Shaw Creek flats, frozen loess over bedrock from the southern end of Shaw Creek flats to the Tanana River, and generally thawed alluvial gravel and sand from the Tanana River to south of Fort Greely along the Delta River. Areas north of major streams are underlain by thick deposits of muck. Parts of the southwestern section have a thick loess cover, but central and eastern parts are free of loess south of the Tanana River (DOI 1972).

Permafrost is essentially continuous from Shaw Creek to the Tanana River and discontinuous from the Tanana River to south of Fort Greely. Interstitial ice includes massive lenses and ice wedges in silts overlying alluvial gravel or bedrock.

3.2.8.6 Alaska Range

The Alaska Range physiographic unit encompasses the Northern Foothills province as well as the Alaska Range mountains. The point at which the TAGS route enters the Alaska Range unit is Donnelly Dome on the north and the route crosses at Isabel Pass (near Paxson) on the south.

The northern foothills of the Alaska Range are flat-topped, east-west ridges, 2,000 to 4,500 feet high and 5 to 20 miles long that are separated by rolling lowlands. The lowlands average 700 to 1,500 feet in elevation and 2 to 10 miles wide. The foothills are largely unglaciated, but some valleys have been widened by glacial action.

The Alaska Range consists of rugged, glaciated ridges 6,000 to 9,000 feet high. These ridges run parallel and trend east-west, broken at intervals of 10 to 50 miles by low passes.

Mountains in the vicinity of the route reach 8,500 feet, but the route avoids these rugged peaks by passing through the Delta River gorge.

Ridges of the northern foothills are mostly crystalline schist and granitic intrusions. The lowlands are underlain by poorly consolidated Tertiary nonmarine sedimentary coal-bearing rocks.

The Alaska Range is a complex synclinorium with Cretaceous rocks in the center and Paleozoic and Precambrian rocks on the flanks. High mountains are underlain by granitic stocks and batholiths. The synclinorium is cut by great longitudinal faults that approximately parallel the length of the range. These faults are marked by lines of valleys and low passes running parallel to the range.

Three active faults associated with the Denali fault system cross the proposed TAGS route. The Donnelly Dome fault crosses the Richardson Highway near the proposed route, just north of Donnelly Dome. Near Lower Miller Creek, just south of Castner Glacier, the McGinnis fault crosses the proposed route (coinciding with the Hines Creek fault). Between Lower Millers Creek and Millers Creek to the south, the Denali fault crosses the proposed route.

The Denali fault is the longest, most conspicuous in Alaska. It is a major

arcuate crustal break extending across southcentral Alaska, into southeastern Alaska for 840 mi (1,352 km). The fault runs essentially east-west through the Alaska Range unit. It branches, crossing the proposed TAGS route near Black Rapids Glacier and again near Paxson.

There is abundant evidence of right-lateral displacement and a long history of movement along Denali fault. Offset drainage systems, scarps, and sag ponds indicate Holocene (relatively recent) movement along the fault. Lateral fault slips were reported at the Richardson Highway, although survey results differed in the amount of measured slip. A number of shallow earthquakes on the fault trace were primarily located about 100 mi (161 km) west of the proposed route (near 149°W longitude); several deeper earthquakes have also been located in or close to this area.

The proposed TAGS route follows along the east side of the Delta River valley, crossing an area underlain generally by glacial deposits, including till and stratified drift, though limited areas of bedrock are encountered in some places.

Terraces along the route through the mountains consist of generally unfrozen coarse sand and gravel, mantled in places with organic-rich silts. In short sections where the route leaves the terraces, subsurface materials are dense glacial till over bedrock (DOI 1972; FPC 1976a).

Permafrost is essentially discontinuous through the range. Frozen zone ice forms include interstitial ice, massive lenses, and ice wedges in surficial deposits overlying either bedrock or alluvial gravel (FPC 1976a).

3.2.8.7 Copper River Basin

The Copper River Basin physiographic unit encompasses the Gulkana Uplands as well as the Copper River Lowlands provinces. The proposed TAGS route enters the Copper River Basin unit at Isabel Pass on the north and exits near the *settlement* of Tonsina on the south.

The Gulkana Uplands are characterized by subtle east-west ridges varying in elevation from 3,500 to 5,500 feet, separated by lowlands ranging 2 to 10 miles wide. The ridges are cut every 5 to 15 miles by notches which were eroded by glaciers or glacial meltwaters. At Hogan Hill the proposed TAGS route enters the Copper River Lowlands. The eastern part of the lowlands is a relatively flat to gently rolling plain 1,000 to 2,000 feet high. The smooth plain has been eroded by the Copper River and many of its tributaries. Resultant river valleys have steep walls 100 to 500 feet high.

The Copper River and most of its tributaries are braided glacial streams in their upper courses.

Bedrock in the Gulkana Uplands is chiefly metamorphosed basalt with interbedded sediments. Both rock types have been cut by large granitic intrusions. Bedrock beneath the southern part of the Copper River is primarily easily eroded sandstone and shale of Mesozoic age. Bedrock beneath the northern part is chiefly resistant late Paleozoic and Mesozoic metamorphosed volcanic rock with granitic intrusions.

Soil conditions are highly variable along the Gulkana Uplands, consisting of glacial till, ice-content deposits, colluvial deposits, and talus. However, stream gravel and sand are common. Soils in the Copper River Lowlands include glaciolacustrine clay, silt and sand, fluvial silt, sand and gravel, colluvium, and deposits of peat, and organic silt.

North of the Klutina River, permafrost is essentially continuous except in major river valleys. South of the Klutina, permafrost is discontinuous with the permafrost table often depressed as much as 25 feet below ground. In the vicinity of Summit Lake permafrost occurs in isolated zones 5 to 25 feet thick, *the surfaces of which vary in depth from 0.5 to over 10 feet. In general, the plastic glaciolacustrine clay soils of the Copper River Lowlands are dense and contain segregated ice in veins and veinlets. This condition is common throughout the basin. Massive ground ice is also present. Test drilling in these fine-grained soils has shown that the distribution of ice-rich permafrost is difficult to predict.* Segregated ice is generally absent except in silty materials where it takes the form of lenses and seams. Where the upper Gulkana River would be crossed just *south* of

Summit Lake, the floodplain is underlain by gravelly, silty sand which tends to liquefy when disturbed (DOI 1972; FPC 1976a).

3.2.8.8 Chugach Mountains Prince William Sound

The Chugach Mountains form a rugged barrier along the north coast of the Gulf of Alaska. Extremely rugged east-west trending ridges ranging from 7,000 to 13,000 feet dominate the high areas. The low areas are comprised of discrete massive mountains 5 to 10 miles wide and 3,000 to 6,000 feet high, separated by a system of valleys and passes 0.5 to 1 mile wide.

The entire range has been heavily glaciated, and topography is marked by horns, aretes, cirques, U-shaped valleys, and rock basin lakes. The coast is indented by fjords and sounds with ridges extending southward as chains of islands. The range is drained by short, swift streams, most of which originate at glaciers. All higher areas are buried in great ice fields from which glaciers radiate. Most glaciers on the south side of mountains end in or near tidewater.

The proposed TAGS route enters the Chugach Mountain unit south of Willow Lake and runs along glacially scoured valleys of the Tonsina, Tiekel, and Tsina rivers. It follows the Richardson Highway, crossing out of the Copper River basin as it goes through Thompson Pass. Steep rocky slopes are encountered south of the pass, particularly in Keystone Canyon. After passing through Keystone Canyon the route descends into the broad floodplain of the Lowe River and continues along the southern margin of Port Valdez to Anderson Bay.

Tectonically, this physiographic unit and most of the Prince William Sound coastline is composed of accreted terrane emplaced as the Pacific plate (and earlier plates) subducted beneath the North American margin. During this process, relatively small "platelets" of crust are moved into the subduction zone trench, but rather than entering the trench they are thrust against the continental margin and become part of the overriding plate. Folding, thrusting, and faulting along with some metamorphism commonly occur in such terrane (Dames and Moore, 1987).

The Valdez region is located within one of these platelets--called the Chugach terrane. This terrane is composed of a metamorphic rock sequence that was formed in the Cretaceous (135 to 150 million years) and was accreted onto the North American continent in the late Cretaceous (Page et al., 1986). It is estimated that the Chugach terrane underthrust its leading edge approximately 25 miles beneath the Alaskan mainland to the north. Recent crustal studies indicate the currently active Aleutian megathrust lies at a depth greater than 6 miles. Below this depth the Pacific plate is subducting beneath mainland Alaska (Dames and Moore, 1987).

The accretion process results in the presence of many faults. However, accretion was completed over 50 million years ago and the faults generated should no longer be active (Dames & Moore, 1987).

The proposed TAGS LNG plant site at Anderson Bay would be located within an area designated Seismic Zone 4 by the Uniform Building Code (UBC) (UBC, 1985). The UBC classifies seismic risk within the United States on the basis of five zones (Zone 0 through 4) of increasing seismic intensity. In an area designated Seismic Zone 0, no damage to structures as a result of seismic activity is expected to occur. Conversely, a Seismic zone 4 area is one in which heavy seismically induced structural damage could occur. The proposed Anderson Bay TAGS LNG site has been classified a Seismic Zone 4 area on the basis of damage caused in Valdez by the 1964 great Alaskan earthquake and the areas proximity to its epicenter. The epicenter of the 1964 great Alaskan earthquake was located at the north end of Prince William Sound about *40* miles west of the Anderson Bay site. The 1964 event resulted from movement along the Aleutian megathrust. Although this major shock occurred beneath mainland Alaska, no surface fault rupture has been observed on the mainland that could correlate with the earthquake. The scarcity of surface fault rupture during the 1964 earthquake is thought to reflect the fact that slippage is taking place on the Aleutian megathrust at a depth below 6 miles and that involvement of the crust above this depth is quite limited (Dames and Moore August 1987).

Studies by YPC show that fault lineaments at the Anderson Bay site support the concept of limited shallow coastal involvement. No evidence of active slippage was found during a geological reconnaissance along the traces of Anderson Bay fault lineaments.

The extreme damage experienced at the old site of the town of Valdez in the 1964 earthquake was the result of a massive submarine landslide and ground cracking due to amplicifaction of ground motion in the saturated, fine-grained deposits of the Valdez delta on which the town was then located. Surface rupture of faults was not involved. By contrast, the proposed Anderson Bay site is located on bedrock which is not subject to the types of liquefaction effects that result from strong motion in saturated, poorly consolidated, fine-grained sediments such as Valdez delta (Dames and Moore August 1987).

One particular aspect of the regional tectonics which must be examined in the context of the Anderson Bay site is the significance of the Yakataga seismic gap. It is well established in the geologic and seismic record that most movement between North America and the subducting Pacific plate in the Aleutian/Alaska region takes place during great earthquakes (Ms greater than 7.8). The Yakataga seismic gap is a section of the subduction zone that has not experienced a great earthquake since 1899/1900. Its western edge is located about 50 miles east of Valdez--approximately the easternmost edge of rupture associated with the 1964 great Alaskan earthquake.

If the Yakataga is a zone where stresses induced by subduction are building up for another major slip, the site-relevant question is whether or not a great earthquake event within the Yakataga Gap would have a potentially greater impact on the site than the 1964 event did. On two counts, the evidence appears to be negative:

- The edge of the gap is farther away from the site--about 57 miles versus the distance between the 1964 epicenter and the site, which is about *40* miles.

- The estimated magnitude for the expected gap-filling event is a Mw equals 8.3, nearly a magnitude less than the Mw of 9.2 for the 1964 earthquake.

It is therefore implied that the 1964 earthquake imposed greater impact on the site area than a potential event in the Yakataga Gap would (Dames and Moore August 1987).

In summary, the available evidence indicates:

- There has been no Holocene activity on faults at the Anderson Bay site.

- Tectonic subduction is the driving mechanism for ongoing seismicity in the Valdez area.

- The subduction process is characterized by slip events which rarely involve surface rupture.

3.2.8.9 Mineral Materials

Construction, operation, and maintenance of transportation and utility systems in arctic and subarctic environments require large amounts of mineral materials (sand, gravel, and crushed rock) to insulate sensitive permafrost regimes. Much has been learned as new successful designs and concepts were tested and used during TAPS construction (1974-77) and in the subsequent development of the Prudhoe Bay and adjacent oil fields. A concept used in the Kuparuk River oil field development in the 1980s was to use a temporary ice road, eliminating the need for a gravel construction pad. Small segments of TAPS also were constructed from snow and ice workpads without damage to the environment.

Most, if not all, TAGS mineral material sites would be uplands. Table 2.3.2-1 shows the estimated mineral material requirements by construction spread. Construction Spreads 1 (North Slope) and 5 (Copper Valley) have limited proven sources of mineral materials. In Construction Spread 1 design criteria will emphasize construction and maintenance procedures that make maximum use of winter period snow/ice work pad. In Construction Spread 5, it is unlikely that snow and/or ice work pad construction techniques would reduce significantly the mineral material requirements for TAGS. This area also is one where the TAGS operation/design criteria may be either at a chilled or ambient operating temperature.

Overall TAPS construction required approximately 41 million cubic yards of mineral materials. An additional 24 million cubic yards of mineral materials were granted the State of Alaska for construction of the Dalton Highway. ***TAPS has an annual need of approximately 100,000 cubic yards per year or 2 million yards over the next 20 years (D. Prendeville, ASPC, January 1988, pers. comm.).***

The need for mineral materials from federal lands for ANGTS is estimated to be in excess of 20 million cubic yards.

The Alaska Department of Transportation and Public Facilities estimates highway maintenance for annual needs, periodic resurfacing, and reconstruction during the 30-year life of TAGS to be 60,800 cubic yards per mile on unpaved highways and 47,300 cubic yards per mile on paved highways. Overall this translates to about 48.3 million cubic yards (M. Tinker, 1987, pers. comm.).

3.2.9 Surface and Ground Water

3.2.9.1 Introduction

The TAGS pipeline route encompasses four separate river route drainage systems: North Slope, Yukon River, Copper River, and Prince William Sound drainages.

The pipeline crosses more than 200 streams. Twenty-nine have drainage areas greater than 100 square miles within the proposed TAGS corridor. Many small drainages are ephemeral and flow only during breakup or during heavy rains.

The relationship of those drainage systems with the physiographic provinces upon which TAGS route geology was based can be seen in Figure 3.2.8-1.

3.2.9.2 North Slope Drainage

The North Slope Drainage, from TAGS Mileposts 0 to approximately 174, is bounded on the north by the Beaufort Sea and on the south by the Brooks Range. Within this area, the pipeline is located almost entirely within the drainages of the Putuligayuk, Sagavanirktok, or Kuparuk rivers. The Arctic Slope Drainage is composed of three distinct physiographic divisions, each with its own distinct hydrologic characteristics. These divisions are: the Arctic Coastal Plain, Arctic Foothills, and the Brooks Range (Wahrhaftig 1965). All hydrologic processes in this drainage are dominated by the dry arctic environment and by the shallow seasonal thaw depth. There are no large active glaciers along the TAGS route that could affect the system.

3.2.9.2.1 Surface-water Hydrology

Numerous studies related to North Slope development as well as USGS studies and stream gauging for TAPS provide a major base of hydrologic data and information for planning, design, and construction of TAGS. The hydrologic year in the Arctic can be divided into four major periods of unequal length (Mortensen ***and Cannon*** 1982). The longest is the winter period beginning in early November. During this period surface-water flow recedes slowly until, in late winter, all surface stream flow ceases, except in local zones of ground-water discharge (USGS ***1976***). The second period, breakup, begins in late ***May*** in the foothills and may extend to mid-July on the coastal plain. During the early stage of breakup, the first flow is ***common*** over the ice and flood diversions around channels blocked by icings or snow drifts. Almost all flow during breakup results from melting of snow and ice. During most years the maximum discharge occurs during late breakup in late May to mid-June.

The ice-free summer period follows breakup. Occasionally very large floods result from infrequent summer storms, particularly on streams in the Brooks Range and the foothills. In general, however, flow rates for coastal plain streams recede, and in smaller streams sometimes cease, during the summer. Runoff from larger streams passing through the coastal plain, results from storms in the Brooks Range. The presence of impervious permafrost causes wide fluctuations in discharge because runoff is not appreciably modified by ground-water recharge or storage. Freezeup is the shortest period, taking three to five weeks, and is accompanied by rapid flow recession.

There are two basic causes of floods in arctic streams. The first is the breakup flood. Staging resulting from this flood may be increased by icing or ice jams. The second type is the summer or fall rainfall flood. This is caused by infrequent intense rainstorms. Rain floods are frequent on small Brooks Range streams and rarely observed on small coastal plain streams.

Average runoff rates are poorly defined but seem to range from about 3 inches per square mile on the coastal plain to 12 or more inches in the Brooks Range. For small coastal plain streams, three-fourths of the years runoff occurs during June. For large rivers and small Brooks Range streams the runoff is more evenly distributed over June, July, and August.

3.2.9.2.2 Surface Water Quality

In the arctic region, water temperature is a dominant factor and varies, as does air temperature, with elevation, latitude, and exposure to sunlight. The range of temperatures varies more in the tundra area and least in the spring-fed streams. Summer temperatures of arctic streams seldom exceed 60°F, although the surface temperature of shallow, clear lakes may sometimes be 68°F.

The quantity, size, and nature of sediment depends on the waters origin and various other factors such as recent heavy rains. Most of the surface waters in this area of the TAGS route are not affected by glacier runoff. Major nutrients such as nitrates and phosphates are generally in low concentrations in arctic streams. ***Hood et al.*** (1973) reports phosphate concentrations to be quite low in arctic streams and lakes throughout the year. Nitrates are typically low in the deeper lakes and higher in ponds and rivers.

Tundra streams have natural color imparted by the high level of organic material dissolved from the peat.

Arctic lakes are normally at or near saturation levels for dissolved oxygen (DO) during the open-water season; however, severe oxygen depletion may occur under the ice during the winter.

Tundra ponds typically have low dissolved solids during breakup, increasing to very high levels later in the summer and during/after freezeup due to solids rejection during freezing.

3.2.9.2.3 Ground-water Hydrology

Permafrost soils have an extremely low permeability, several orders of magnitude lower than the same soils in their unfrozen state and prevent recharge of ground water. In areas of continuous permafrost such as the Arctic Slope, ground water occurs only in unfrozen sands and gravels below major rivers, in large alluvial fans, and as outflow from bedrock springs. Water in alluvium below rivers and in fans is limited in volume and can be easily depleted (Williams ***and Everdingen*** 1973).

Springs and related icings are the most conspicuous active hydrologic feature of the Arctic Slope during the winter season. During the winter, water from springs freezes downstream from its source to form icings. The extent and thickness of these icings depend primarily on the rate of spring flow (USGS ***1976***). Icings tend to occur at the same locations each year. The location of major springs and icings are described by the USGS (1976). Icings can, and often do, fill stream channels to above normal open water flood levels and cause diversions of flow during breakup.

On the coastal plain, permafrost is thick and subpermafrost water is brackish or saline. The best quality ground water on the coastal plain occurs in the alluvium below major rivers. Springs in the Brooks Range that flow all year-round are of excellent quality *(USGS, 1977)*. For bedrock springs, the discharge and quality remain nearly constant year-round.

3.2.9.2.4 Hydrologic Hazards

Hydrologic hazards include floods, channel scour, and lateral erosion. Flood hazard evaluations are complicated by potential diversions of breakup floods by icings and ice jams. Hazards also include the impact and uplift forces of floating ice on structures such as bridge piers. Snow avalanches are a minor hazard in Atigun Pass. Additional hazards occur because of the possibility of creating new icings because of construction.

3.2.9.2.5 Present Water Use

At the present time only a small amount of surface water is used as a source of domestic water, primarily for existing oil industry and government camps. However, due to the limited amount of fresh water available, a significant amount is actually being used for present needs. An additional amount of surface water is used during the summer months for industrial purposes such as road watering and hydrotesting.

3.2.9.3 Yukon River Drainage

The Yukon River drains all of the 433 miles of the TAGS route lying between the Brooks Range and the Alaska Range (TAGS Mile 174 to 615) with the pipeline crossing 127 identified streams. The pipeline route generally follows the highway, and for much of its way is located on the terraces of the Dietrich, Middle Fork Koyukuk, and Delta rivers and Phelan Creek. The physiographic environment is diverse, ranging from alpine brooks in the Alaska Range to thaw lakes of the Tanana-Kuskokwim Lowlands. The hydrologic environment is equally diverse, with mean annual precipitation ranging from 10 inches at the Yukon River to 80 inches or more on the active glaciers of the Alaska Range (USGS 1971a).

3.2.9.3.1 Surface Water Hydrology

As is discussed in 4.2.9.1, the hydrologic year can be divided into four parts: the longest is the winter period followed by a short very active breakup period, a summer ice-free period, and an early winter freezeup period. The winter period begins after the ice cover is formed, usually by early December. During the winter, flow recedes in response to diminishing ground-water inflow until by early April, flow is diminished to nearly nothing. Small streams are dry except in the immediate area of springs. Breakup occurs in May. During many years the largest flood of the year occurs during breakup. The early summer period lasts to mid-July and is characterized by recession of snowmelt flow. After mid-July, summer storms become frequent and runoff increases and decreases rapidly in response to variations in rainfall. The largest flood discharges on all but the Yukon River occur as a result of summer storms. Summer flow in streams draining the Alaska Range are substantially increased by glacial melt.

Runoff rates are substantially modified by ground-water storage and discharge. Flow recession rates tend to be slower than in the Arctic. Average annual runoff rates vary widely. Typical values are about 1 cfs per square mile in the Brooks Range, 0.5 cfs per square mile near the Yukon River, and about 4 cfs per square mile in the uplands of the Alaska Range. Average rates in a given year tend to vary widely from the long-term average.

Glaciers are a common feature of the Alaska Range and impact all major streams. Streams draining the Brooks Range, as well as the north bank tributaries of the Tanana River, are not affected by glaciers. For most large streams, glacier impacts are limited to an increase in flow during warm weather and an increase in turbidity. For headwater streams, the impacts are more pronounced. The suspended sediment load is close to the maximum conveyance capacity of the stream, and a large diurnal variation in flow rate responds to daily temperature fluctuation. A few of these glacial streams may be affected by outburst floods from glacial dammed lakes, should the glacial regime change enough to form a lake. There is no history of glacial outburst flooding of these minor streams nor are any significant changes in the present glacial regime anticipated. Larger rivers may be affected by changes in glaciers. The Black Rapids glacier has surged several times, blocking the Delta River and creating outburst floods downstream (USGS 1971a). Phelan Creek has flooded from releases at Gulkana Glacier in the past.

3.2.9.3.2 Surface Water Quality

Water resources of this region are as varied as the topography, which consists of low river valleys, foothills, plateaus, and high mountains.

Water quality of streams for which data are available was generally good.

There is wide variation in color and turbidity concentrations in these surface waters due to glacial or spring origin and passage of slow-moving streams through peat bogs where the highly organic substrate imparts a tea color to the water. Many streams originate from glaciers and are highly turbid.

Lakes in this drainage have relatively abundant nutrients and DO is typically high in the surface waters except during late winter. Surface waters range from 32°F to 65°F during late summer.

3.2.9.3.3 Ground-water Hydrology

There is more ground water available in the Yukon drainage basin than in any other part of Alaska. Within the Yukon River drainage the largest sources of ground water are in the alluvial deposits of the major river valleys and their larger tributaries. These are the lower and middle Koyukuk, Yukon, Tanana, and Delta river valleys. Smaller, but not less important, sources are alluvial fans in mountain valleys. Ground water also exists in fractured bedrock (Williams *et al.* 1973).

Near Fairbanks, water-bearing alluvium is 820 feet thick and wells 200 feet deep yield 1,000 to 3,000 gallons per minute yields *(USGS, 1971a)*. Wells finished in bedrock in the same area usually yield less than 50 gallons per minute. In general, ground water is abundant along the route in the area. Ground water does not recharge through permafrost (USGS 1953), therefore it may not be available at specific sites.

Ground-water discharges to the surface as springs as well as directly to rivers and lakes and provides all of the late winter flow in streams. In many areas ground-water discharge from the toe of alluvial fans provides areas of open water in the winter that are critical to fish overwintering. These open water areas along the toes of fans are particularly prevalent along the Dietrich, Koyukuk, and Delta river systems. Springs discharging in winter create icing downstream. In some cases the ice levels can be well above open-water flood levels and at times cause diversions of breakup flow *(USGS, 1953)*. Icing along the TAPS is well described; the method of formation *of icings* and their locations *are described by* USGS (1976).

3.2.9.3.4 Hydrologic Hazards

Hydrologic hazards include floods, channel scour, and lateral erosion. Flood hazards are compounded by the possibility of diversions by ice jams and icing. Hazards also include impact and uplift forces of floating ice on structures such as bridge piers. Diversion of channels in aggrading streams is a possibility. A particular flood risk in the Delta River drainage is associated with glacier outburst. Avalanches are a hazard in the *Chandalar* River valley and in the upper Delta River and Phelan Creek valleys.

3.2.9.3.5 Present Water Use

Water is used at many separate locations in the Yukon River drainage for domestic, military, mining, petroleum refining, and other industrial purposes. The total use is believed to be in excess of 20 mgd; however, this is a small fraction of the available resource. Along the pipeline route, ground water is the source of virtually all of the water used. Within the basin, but not close to the pipeline, thermal springs are used for domestic heating and for small farming operations (USGS 1978).

3.2.9.4 Copper River Drainage

The Copper River drainage is bounded by the Alaska Range on the north and by the Chugach Mountains on the south (TAGS Mile 598 to 775). Within this basin the route generally follows the Gulkana River to its confluence with the Copper River, the Copper River to the Tonsina River. From there it follows the valleys of the Tonsina, Tiekel, and Tsina rivers to the summit of the Chugach Mountains at Thompson Pass. The hydrologic environment is diverse; streams range from low-gradient lake- and spring-fed streams to precipitous glacial streams.

3.2.9.4.1 Surface-water Hydrology

As with the two areas previously described, the hydrologic year is divided into four parts. The winter period begins after the ice cover is formed, usually by early December. Flow recedes during winter in response to diminishing ground-water inflow until by late March; flow is at its annual minimum. Small streams are dry except in the immediate area of springs. Breakup occurs in May in response to seasonally warming weather and rapid melt of snow and ice. Breakup flood stages are often increased dramatically by ice jams on the larger streams. The early summer period lasts to mid-July. After mid-July summer storms become frequent, and runoff increases and decreases rapidly in response to variations in rainfall. The largest flood discharges on all streams without glacier-dammed lakes occurs as a result of summer storms augmented in some cases by glacier lake dumps. Summer flow in streams draining the Chugach Mountains are substantially increased by glacier melt, but the Alaska Range provides little glacier melt.

Average annual runoff rates *vary* widely. Typical values are about 1 cfs per square mile near Copper Center and about 8 cfs per square mile at the southern extremity. Typical winter runoff rates vary *linearly* along the pipeline route from 0.2 cfs per square mile in the Alaska Range to 0.5 cfs near Thompson Pass (USGS 1971).

Most large streams south of Glennallen, with the exception of Squirrel Creek and the Little Tonsina River are influenced to some degree by glaciers. The most severely impacted stream, the Tazlina River, is subject to frequent, severe lake outbursts from both Tazlina and Nelchena glaciers. Flood discharges from outbursts have been 10 times as high as the highest discharge from nonoutburst floods (USGS 1971). The Klutina, Tonsina, and Tsina rivers are also subject to infrequent outburst flooding. It is conceivable, but not likely, that an outburst lake could form on any glacier.

3.2.9.4.2 Surface Water Quality

This drainage extends from the south slopes of the Alaska Range to Thompson Pass and includes mountainous areas of moderate rainfall and glacially originated streams. Except for the Gulkana, most large streams in the region are heavily sedimented in the spring and summer and clear during the fall and winter. Concentrations ***of suspended sediments*** reach 2,000 mg/l on glacial headwater streams in the summer.

There are several large, deep lakes along the route, including Paxson and Summit lakes. Water quality of these lakes is good.

There is only limited domestic and industrial use of surface water in this area. There are only a few small communities along the route and most do not have a water system; houses typically have a well and a leach field.

3.2.9.4.3 Ground-water Hydrology

The Copper River basin is located within the discontinuous permafrost zone, although permafrost is sporadic in the southern portion. Infiltration rates to ground water is limited by this permafrost and occurs mainly through the beds of larger rivers and lakes and other unfrozen zones (USGS 1978). Consequently, ground-water supplies are difficult to locate in the central part of the basin and quality tends to be poor.

Springs draining the alluvial deposits on the south flank of the Alaska Range and the north flank of the Chugach Mountains are common. Springs provide a major component of surface water flow in several streams (Sourdough and Squirrel creeks). Hillside springs near Squirrel Creek and near the Little Tonsina River create icings on the hillside, particularly in disturbed areas. Well yields, in bedrock wells, are about 10 to 20 gallons per minute (USGS 1978).

3.2.9.4.4 Hydrologic Hazards

Hydrologic hazards include floods, channel scour, lateral erosion, and meander cutoffs. Hazards also include the uplift forces of floating ice on structures such as bridge piers during spring breakup. Diversions by icings or by aggrading streams is also a possibility. Streambeds may scour rapidly as the result of periodic meander cutoffs. A particular flood risk is associated with glacier outburst floods. Large slab avalanches are a hazard in the Chugach Mountains. Ground icings from springs near Squirrel Creek and the Little Tonsina River are likely.

3.2.9.4.5 Present Water Use

There is very little water use in the Copper River basin. Domestic use is limited to a few small communities and construction camps. There would be limited use by TAPS and DOT/PF maintenance camps.

3.2.9.5 Prince William Sound Drainage

The Prince William Sound drainage is the smallest basin crossed and is bounded by the Chugach Mountains on the north and Prince William Sound on the south. The proposed TAGS pipeline follows the Lowe River to Port Valdez then goes along the south side of the arm to the terminal (TAGS Mile 775 to 796). With the exception of the Lowe River, streams are short and swift; most head in glaciers. The climate is considerably warmer in winter and wetter. Most streams do not freeze in winter. Annual precipitation rates range to 160 inches.

3.2.9.5.1 Surface-water Hydrology

Runoff rates are unusually high; up to 12 ***cfs per square mile*** per year ***(USGS, 1971a)***. Rates vary less from season to season than for any other portion of the pipeline. Runoff is rapid, infiltration and evaporation rates are low; and streams respond rapidly to changes in precipitation rates. The largest floods occur in late summer or fall as the result of general rainstorms. Floods are sometimes augmented by melt of snow or ice by rain. Winter floods caused by rain are not unknown. Mean annual low flow occurs in the winter (about one cfs per square mile) and results largely from return of ground water infiltrated into bedrock.

Glaciers are a dominant feature of the Chugach Mountains. All major streams are impacted by glaciers. Outburst floods have occurred on Sheep Creek, most recently in 1945. Glacier melt augments summer flow and is responsible for the turbidity of streams.

With the exception of the Lowe River, all streams in the basin are controlled by bedrock and have limited alluvium. The Lowe River's braided channels within the floodplain are unstable and subject to rapid change. Outburst floods, as well as any other large flood, tend to wash sediment from the floors of the rock stream channels and deposit this material as fans in receiving streams. The most recent Sheep Creek outburst deposited 25 feet of debris as a fan in the Lowe River (USGS 1971). Streams southerly of the mouth of the Lowe River discharge directly into tidewater.

3.2.9.5.2 Surface Water Quality

Water quality is generally good with the exception of summer and early fall when suspended solids increase due to glacial runoff.

Water quality data shows less fluctuation in most parameters for streams in this area. Dissolved oxygen values appear to be uniformly high, with low phosphates and fairly high nitrates present. Low human use is presently being made of surface waters except for the private fish hatchery at Solomon Creek.

3.2.9.5.3 Ground-water Hydrology

The Prince William Sound drainage is free of permafrost at lower elevations. The principal aquifers in alluvium recharge easily, and wells yield about 200 gallons per minute of good-quality water. Additional aquifers are found in the joints and fractures of bedrock. Yields vary widely.

Ground-water discharges occur as springs from bedrock and at the base of alluvial fans. These discharges tend to form icings, principally in the Lowe River floodplain. These icings, however, tend to be of short duration because of the warm temperatures in this region.

Water from deeper wells sometimes exceeds the U.S. Public Health Service limits for chloride, sulfate, and magnesium (USGS 1971).

3.2.9.5.4 Hydrologic Hazards

Hydrologic hazards include floods and the channel scour, lateral erosion, and meander cutoffs associated with them. Hazards also include the impact and uplift forces of floating ice on structures such as bridge piers. Diversions by icings or by aggrading streams is a possibility in the Lowe River. A particular flood risk is associated with glacier outburst floods on Sheep Creek as well as other similar streams. A unique hazard in this area is the possibility of extremely large flood discharges on Solomon Gulch Creek should the upstream dam fail. Large slab avalanches are a hazard to much of the route.

3.2.9.5.5 Present Water Use

Present domestic use of water is limited to the municipal supply for the city of Valdez and a very limited number of individual wells. There is a limited industrial water use by the TAPS at their terminal. The Solomon Gulch Hydroelectric Project is essentially a run-of-the-river plant which does not alter the seasonal runoff pattern but will alter short-term runoff rate. A second hydrologic project, Allison Lake, is authorized for construction by the USACE. Its potential regulation of stream flow is not known at this time.

3.2.10 Marine Environment

3.2.10.1 Physical Oceanography

3.2.10.1.1 Introduction

The main affected environments of the proposed TAGS project are the nearshore environment in the vicinity of the LNG and terminal facilities and the route of LNG tankers through Prince William Sound and the central Gulf of Alaska. ***Once outside Prince William Sound, LNG tankers would move over the high areas to destination ports in Pacific Rim nations.***

The proposed LNG plant and tanker terminal are located on the western shore of Port Valdez, ***and*** east to west-trending fjord about 3 miles wide by 12 miles long. The bottom is notably flat and approximately 750 feet deep (Figure 3.2.10-1). Steep mountain walls extend along the northern and southern sides of Port Valdez up to altitudes of 3,000 to 5,000 feet. The seafloor of Port Valdez slopes more gradually in the eastern end of the port into the outwash plain of the Lowe River, the Robe River, and Valdez Glacier streams. At the far western end of Port Valdez, and typical of a glaciated fjord, lies a narrow double-silled entrance, Valdez Narrows, which connects with the Valdez Arm into Prince William Sound and the Gulf of Alaska. Water depth in the constricted area is in the range of 350 to 500 feet. The shore of Port Valdez is rocky everywhere except where deltas and moraines have been built into the fjord by streams and glaciers.

The physical oceanography of Port Valdez has been described in a number of documents, including Hood et al., 1973; DOI, 1972; and Colonell (ed.), 1980.

3.2.10.1.2 Circulation, Currents, Tides

Circulation within Port Valdez is determined by interactions of tidal currents, wind-driven currents, and freshwater input from both glacial and nonglacial streams. Tides, which normally provide the primary driving force for Port Valdez circulation, are mixed semidiurnal with a mean tidal height of approximately 10 feet and an extreme range of approximately 22 feet. Tidal currents are predominantly east-west in conformance with the configuration of the bay.

Concern for potential adverse impacts is lessened by the favorable hydrographic conditions in Port Valdez. The receiving water body is large and deep and has a relatively high estimated flushing rate as represented by the large tidal prism (approximately 26 percent) and short residence time (about four to six weeks). ***Furthermore,*** the requirement for specific federal and state regulatory review and approval for any discharges ensures that full analysis would be given to specific design features of a later stage in the project.

Local wind conditions have a major influence on near-surface currents. Because of the channeling effect of the mountains surrounding Port Valdez, prevailing winds in the general vicinity and thus, wind-driven currents, are also directed into an east-west direction. Highest currents that have been observed near Jackson Point, just ***east*** of Anderson Bay, were approximately 1.7 feet per second but are most often below 0.6 feet per second. Currents below 50 feet are generally quite low, less than 0.05 feet/second. Finally, prevailing winds in the Gulf of Alaska have also been shown to drive coastal upwelling and downwelling in the Gulf of Alaska and to cause intrusions of bottom waters into Port Valdez from Prince William Sound between March and July.

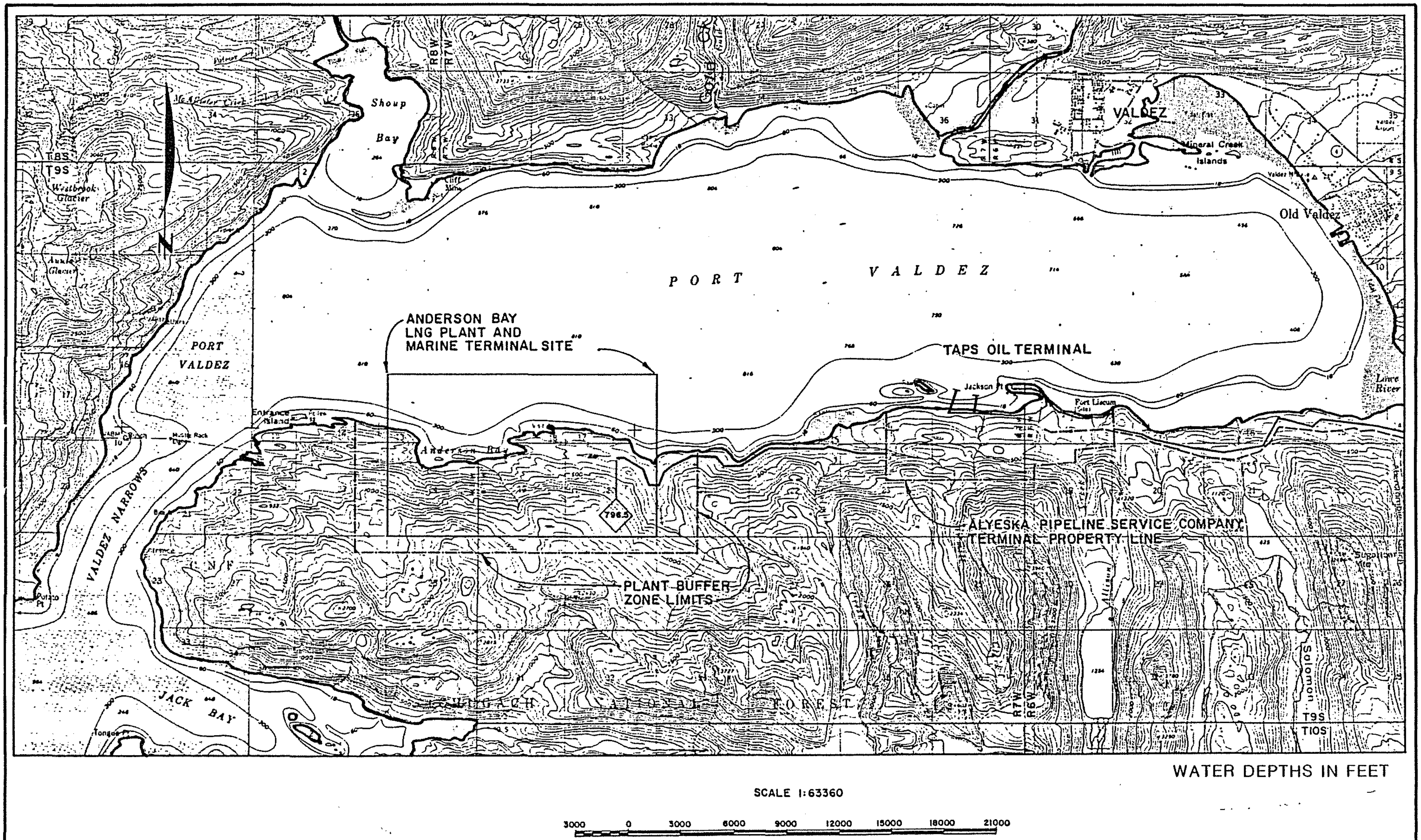


Figure 3.2.10-1 Port Valdez and Vicinity

During summer a strongly stratified two-layered system results from increased freshwater input and higher surface temperatures. Warmer, less saline water has a net movement seaward, while colder, more saline water flows in through Valdez Narrows at depth. Late fall to early spring conditions generate uniform water column salinity and temperature, and flow due to tidal current is generally more restricted to the near surface waters (upper 50 feet). Studies in published reports have detected shifts in flow directions under both stratified and unstratified conditions but have not been fully able to correlate such occurrences with climatic factors. The net effect of tides, wind-driven currents, and storm-induced flows is a "residence time," or period of full exchange of Port Valdez water in the range of a few weeks to a conservative 40 days (Niebauer & Nebert 1983).

3.2.10.1.3 Waves

Waves in Port Valdez are locally generated by winds. Wave height and period is a function of wind, speed, duration, and fetch. An estimated maximum one-hour average wind speed of 62 knots from the east, building up over a 12-mile fetch, was used to calculate an estimated maximum significant wave height of over 10 feet (Dames & Moore 1979). This wind speed and direction often occurs in winter. Wave heights in the vicinity of Anderson Bay would be expected to be substantially less. More commonly, wind speeds are such that significant wave heights are less than 1 foot, with a significant period under two seconds, 90 percent of the time during winter months and 98 percent of the time during the summer (Dames & Moore 1979).

3.2.10.1.4 Sedimentation

Annual input of suspended material into Port Valdez from the three largest sediment sources, the Lowe River, Mineral Creek, and Valdez Glacier Stream, was estimated to be more than 2.76×10^6 metric tons, with virtually all of the sediment retained within the port (Sharma & Burbank 1973). Sedimentation rates were estimated to range from 5 inches/year 1.5 miles west of the Lowe River mouth to less than 0.4 inches/year in the western portions of the port. In addition to sediment transport by typical processes of ***flocculation*** of suspended sediments, resuspension, and redeposition, processes that are generally prevalent in spring through early fall, atypical processes, submarine slides, and subsequent turbidity currents have also been described for Port Valdez as the result of tectonic activities. These have generally occurred on the steep slopes of unconsolidated sediments that form the submerged river deltas and glacial terminal moraines.

3.2.10.1.5 Ice

One of the primary features of Port Valdez for use as a port is that it is ice-free year-round. Even during the most severe winters, oceanographic conditions preclude free formation of sea ice in the Gulf of Alaska (DOI 1984). Though ice discharged by Columbia Glacier is sometimes driven into Prince William Sound by north winds, and sea ice sometimes forms in the arms of the sound, the only ice generally found in Port Valdez is the occasional floating Shoup Glacier ice that has escaped from Shoup Bay (AEIDC 1983). Large Columbia Glacier icebergs may occupy vessel traffic lanes into and out of Valdez Arm, especially during summer and fall.

3.2.10.1.6 Water Quality

Temperatures in Port Valdez range from 36 to 59°F. Highest temperatures occur near the surface during summer. Observed salinities range from 0 to 32 ppt with lowest values found in surface waters flowing out from rivers and creeks draining into the port during late spring to early fall. Lowest salinities found in central portions of the port below the uppermost 5 feet were rarely below 24 ppt.

Various aspects of chemical oceanography, nutrient concentration, and hydrocarbon levels for the waters of Port Valdez have been discussed in detail in Hood et al. (1973, pp. 199 to 248 and 395 to 410), trace metals were studied by Gosink (1980), and general findings updated in Shaw (1984, pp. 33 to 52). Comparisons of Port

Valdez waters with EPA criteria and/or "normal" open ocean values have generally confirmed the high quality of the waters prior to and since the initiation of TAPS terminal operations. Some elevated trace metal and hydrocarbon levels have been found subsequent to operations of the TAPS terminal and are the subject of ongoing studies and facility treatment modifications. Naturally occurring elevations in trace metals occur emanating from the eastern end of Port Valdez in association with sediment input from the Lowe and Robe rivers (Gosink 1980).

- Dissolved oxygen (DO) - observed values were 6 to 7 mg/l;

- pH - water column values from 7.9 to 8.9;

- Concentrations of arsenic, chromium, copper, mercury, nickel, and selenium were generally all within the range for "clean" open ocean waters;

- Hydrocarbon concentrations *(HC)* have nearly all been below 1.0 ppb and are never greater than 10 ppb. ***However, some recent reports have documented HC in Port Valdez to be in excess of 10 ppb (Woodward Clyde/Entrix, 1986).***

3.2.10.2 Marine Biology

3.2.10.2.1 Introduction

The LNG facility, the port and its associated facilities, and the marine transportation system have the potential to affect the nearshore marine life in Port Valdez and the shipping route of the TAGS system through Valdez Arm and Prince William Sound. The existing marine resources for these areas are described for Port Valdez and the sound as far as Hinchinbrook Entrance, which opens into the Gulf of Alaska about 60 miles southeast of the Anderson Bay marine terminus.

These resources are important as a part of the local and nearshore ecosystem and support subsistence, commercial, and sport fishing; and some marine mammal harvesting. Since many species in the area migrate over vast distances, they are of international significance.

3.2.10.2.2 Benthos

The shoreline of Port Valdez is steep and rocky on the western half but extends into boulder-cobble beaches and extensive mudflats to the east where the Lowe and Robe rivers enter.

The intertidal zone supports a biota characteristic of southcentral Alaska coastal areas, including a fairly sparse plant community but a relatively large animal biomass. The most important animals appear to be clams, blue mussels, barnacles, harpacticoid copepods, and several species of polychaete worms (Feder 1983, pp. 77 to 90). Intertidal algae species include the fucoids and eelgrass important for the herring egg fishery. Species abundance and diversity are generally greater in the upper part of the intertidal zone (Dames & Moore 1979).

A strong seasonal cycle in both species composition and population deviation along the rocky shores is evident in data from numerous years of ***study*** (Feder and ***Matheke*** 1980).

The subtidal infauna of Port Valdez is dominated by bottom-feeding organisms typical of soft substrates, including polychaete annelids and bivalve molluscs. Total number of species, species diversity, and biomass are relatively low, probably symptomatic of an environment with repeated seasonal disturbance associated with high sedimentation rates (Feder 1983, pp. 77 to 90).

Benthic studies of the deeper areas of Port Valdez indicate that polychaetous annelids were the most important group of benthic organism. More than a hundred species of annelids were identified, making them the most diverse taxa in the Port Valdez benthic communities. Molluscs were second in importance with approximately 60 species present. Echinoderms were the only other significant group present (Feder and Matheke 1980).

Data from the three benthic subtidal sampling stations nearest to Anderson Bay had general composition, total species, numbers of organisms, and species diversity that showed them to be generally similar to other benthic sampling stations throughout the western Port Valdez (Feder and Matheke 1980).

In the shallow subtidal zone adjacent to the proposed construction area both rocky and soft habitats occur. Where present, the shallow rocky areas contain rich kelp bed communities with a diverse group of marine invertebrates. This type of community is important to some species of fish and is also important in the kelp-herring roe fishery.

3.2.10.2.3 Fish

Four species of Pacific salmon (pink, chum, ***coho***, and red) inhabit Port Valdez during some portion of their life history. King salmon are occasionally present but are not known to spawn in local streams and are therefore excluded from the following discussion. Commercial values of these and other important species are discussed in Subsection 3.2.10.2.6.

During summer adult salmon enter Port Valdez and spend from a few hours to six weeks in the area before entering their natal spawning streams. ***Red salmon usually arrive in early to mid-June; pink salmon arrive later, usually in mid-July,*** spawning in July and early August. The other species arrive somewhat later. ***Coho***, for example, arrive in August and spawn as late as October. Pink salmon may spawn in the intertidal area, with the emerging fry immediately entering the saltwater environment.

Another period of importance occurs when pink salmon fry emerge from the gravels of their home streams in the spring and shortly thereafter proceed downstream into the estuarine environment. This migration occurs somewhat more slowly for chum salmon, and may take two to three years for silver and red salmon, the latter usually spending two years in a lake before entering the marine environment.

Fish egg incubation occurs during the winter. This period is also important for salmonoid production.

The anadromous Dolly Varden inhabit Port Valdez area during a portion of their life cycle and generally spawning occurs during the October and November time period.

Marine species in the deep, offshore area appear to be present in low numbers, but the equipment used in previous surveys may have been inefficient at capturing larger, more mobile fish. Studies report the presence of 23 species, including five species of flounder, one skate, and several types of cod and sculpin. Pacific perch and yellow-eyed rockfish, pollock, and halibut have also been observed. Shallow regions are more diverse and include large numbers of black rockfish, Pacific cod, ling cod, and greenling. Herring utilize the shallow subtidal algae beds of Jack Bay and Valdez Arm for spawning during April and May (Valdez CDD 1982).

3.2.10.2.4 Birds

Port Valdez is classified as a "high use area" for ***seabirds*** and waterfowl and there are seabird and shorebird colonies in Shoup Bay and vicinity ***and*** in the shallow, ***western*** end of Port Valdez (MMS 1984).

A specific discussion of birds in the Port Valdez area can be found in the EIS prepared for the proposed ALPETCO project (EPA 1979). A summary of that report is presented in the following paragraphs.

Approximately 113 species of birds typically occur in the Port Valdez and Valdez Arm areas each year. The highest diversity and abundance is found in the nearby deciduous forest community during the summer. The marine littoral waters and intertidal zone support the greatest densities during winter months.

Seasonal migration patterns are similar to other areas of Prince William Sound, but relative abundance within each species appears to be quite low.

The Robe Lake freshwater marsh is perhaps the most important wildlife habitat in the study area, followed by salt marshes at Dayville Flats, Island Flats, Mineral Creek delta, and Shoup Bay. All support waterfowl nesting sites ***that*** are scarce in Port Valdez. During spring and fall migration, salt marshes at Island Flats and Shoup Bay are often used as staging or resting areas by several hundred migrating Canada geese. The small Dayville Flats marsh also receives some use by migrating waterfowl.

In winter, diving and sea ducks are relatively abundant. Barrow's golden-eyes, common golden-eyes, buffleheads, harlequin ducks, and white-winged scoters typically move onto intertidal flats to feed on pink-shelled clams during high tide. Nearshore waters are clearer during winter and feeding conditions better than during the summer. Primary feeding areas are located near Solomon Gulch Creek and Island Flats.

The entire Prince William Sound area, including the Valdez Arm and the Lowe River drainage support nesting and migrating populations of the bald eagle.

3.2.10.2.5 Marine Mammals

Whales use the offshore marine habitats much more than other marine mammals, which are associated with various shoreline features. The three species of endangered whales ***which*** may be present in Valdez Arm and Port Valdez according to the National Marine Fisheries Service include the humpback whale, (Megaptera novaeangliae), fin whale (Balaenoptera physalus), and gray whale (Eschrichtius robustus). ***These species*** are likely to occur in the project area during some portion of each year. ***Killer whales (Orcinus orca) and minke whales (Balaenoptera acutorostrata) occur regularly in the project area of Valdez Arm.*** Humpback whales are most likely to be found in Prince William Sound from April through October in small foraging groups composed of both adults and calves. Fin whales also may be found foraging in Prince William Sound in groups containing both adults and calves from April through July. Gray whales migrate past Prince William Sound from March through June and again from November through January with individuals or small groups entering the Sound during those months. No critical habitat has been designated for any of the above-listed species in the Prince William Sound area.

Two species of porpoise occur occasionally in the area--the harbor and the Dall. Other marine mammals common in the area include the Steller sea lion, the sea otter, and the harbor seal (Valdez CDD 1982; EPA 1979).

3.2.10.2.6 Commercial and Sport Fisheries

The fish resources of the Gulf of Alaska play an important part in the Alaska and the international commercial fishing industry. Of commercial importance are salmon, halibut, herring, ocean perch, black cod, pollock, Pacific cod, turbot, and other bottomfish. Commercial shrimp and crab and other shellfish operations are also very productive in the gulf. In 1980 the Gulf of Alaska provided 8.2 percent of the total domestic and foreign fisheries harvest in U.S. waters (MMS 1984).

Commercial value of Prince William Sound fisheries for the most recent years that published data were available (1984) includes: salmon, $41 million; other finfish, $4 million; and shellfish, $2 million--totalling $47 million (ADF&G ***1986d***). During 1985 the commercial purse seine catch in pounds for Port Valdez and Valdez Narrows (statistical area 221-60) was 0.35 million and for Valdez Arm (statistical area 221-50) was 10.1 million. These represented 1.2 percent and 35.0 percent of the record 28.9 million pound Prince William Sound catch for 1985. For both commercial and sportfishing salmon activity in the general project area fishing is heaviest through Valdez Narrows and into Port Valdez as far as a fishing closure line running north/south across the port near the eastern end of the proposed LNG site (146°30'30"W). Port Valdez is closed to commercial salmon fishing east of this point. ***However, special fishing openings for salmon have occurred east of this line near the Solomon Gulch hatchery.***

For Confusion Creek, which empties into Anderson Bay, peak observed salmon escapement during the occasional years when observations were made, has been on the order of 40 to 550 pinks. No chum observations have been made since 1963 (J. Brady, pers. comm.).

The Lowe River and Robe Lake systems have been principal producers of sockeye and coho salmon, though the quality of the Robe Lake run has declined in recent decades due to natural changes in sedimentation in Corbin Creek eutrophication after a 1950s diversion of Corbin Creek away from Robe Lake. Previously, the Robe Lake system supported ***a significant run of*** sockeye ***salmon. In*** 1982 the average run was ***reduced to*** approximately 5,000 ***sockeye salmon*** (Valdez CDD 1986).

The Valdez Fisheries Development Association's Solomon Gulch Hatchery, about 8 miles east along the shoreline from Anderson Bay, had a forecast return of 294,000 pink salmon from the 1984 fry release of 8.4 million (Randall et al., 1985). A return of two million pinks was expected in 1986. Chum and coho salmon are also spawned at the Solomon Gulch Hatchery, and coho are being pen-raised just offshore of the hatchery. The first coho returns occurred in 1986. Beginning in 1984 chinook salmon fry ***reared in a state*** hatchery were held and released in Anderson Bay. The first return of three-year-old kings is expected in 1987.

The International Pacific Halibut Commission reported 168,298 halibut landed in the Valdez area in 1984 (ADF&G ***1986d***).

Since 1964, herring roe has been commercially harvested in Prince William Sound. In 1969 Prince William Sound became Alaska's main herring-eggs-on-kelp harvest area with an annual production of nearly a quarter-million dollars worth of export product (NOAA and BLM 1980). Though herring do not return to the same spawning area each year, they generally utilize shallow subtidal (intertidal to 60 feet) algae beds for spawning in April and May. The nearshore area in the vicinity of Anderson Bay is among the areas that have historically been utilized (J. Brady, pers. comm.).

The 1984 Prince William shellfish harvest consisted of: clams, 168,000 pounds; Dungeness crab, 824,000 pounds; king crab, 34,000 pounds; shrimp, 1,411,000 pounds (ADF&G ***1986d***).

There are two major fish processing plants in Valdez, which has a fleet of more than 40 commercial fishing boats (Alexiev 1983).

In addition to the significant commercial fishery in Valdez, the sport fishery is a major attraction. Numerous recreational charter and private boats ply throughout the Prince William Sound area, including Valdez Arm to take advantage of the excellent sport fishery. Valdez annually hosts the Silver Salmon Derby sponsored by the Valdez Chamber of Commerce in August 1 through Labor Day. Additionally, they are sponsoring a Halibut and Pink Salmon Derby in June and July.

3.2.11 Fish

3.2.11.1 Introduction

The fisheries resources of Alaska are among the most abundant and valued in the world. They are an essential part of the livelihood of many Alaskans and a highly important industry for Alaska's present and future economy. Fish also comprise a component of the environment vulnerable to both local and general population levels throughout their range. More than 200 rivers and streams inhabited by fish would be crossed by the TAGS project. ***Table 3.2.11-1 identifies only the 104 exceptionally productive streams crossed by the TAGS project, and it should not be interpreted as a comprehensive listing of all the streams crossed. The State of Alaska, in its comments on the DEIS, identified additional streams crossed by the proposed project; these streams are adopted by reference to the State's comments located in Section 7.0 Comment 22-183.***

Of the 104 exceptionally productive fish streams listed in Table 3.2.11-1, 27 are highly sensitive fish stream crossings. 37 ***of the fish stream crossings are within an environmentally sensitive drainage, and 61 were identified as restrictive fish streams for TAPS. TAPS crossed 34 major rivers and streams and a total of 800 rivers and streams along its 800-mile route.***

This section adopts previously prepared EIS sections by reference wherever applicable but includes a discussion on the physical aspects of the drainage and brief life history of the important species. Limiting factors, where understood, are also discussed as well as updated information on present stress to these organisms. Table 3.2.11-1 summarizes life history information for the key species found along the entire TAGS route. No threatened or endangered fish species are known to live in waters traversed by the TAGS project.

3.2.11.2 Arctic Slope Drainage

The arctic drainage is that area from the Beaufort Sea coast to the south end of Atigun Valley. It includes the nearshore Beaufort Sea coast.

Table 3.2.11-1 Exceptionally Productive Fish Streams
Along the Prudhoe Bay to Valdez Route of TAGS

	Stream	Milepost*	Fish Species	Most Critical Time	Least Critical Time
1.	Putuligayuk River	3.1	GR, SB	May-Sept.	Oct.-Apr.
2.	Sagavanirktok River**//	20.8-37.0[1/][2/]	GR, WF, BB NP, AC, CD	Jan.-Dec.	--
3.	Happy Valley Creek	84.5	BB, GR, CD WF	May-Sept. 15	Oct.-Apr.
4.	Toolik River**//	124.6	GR, WF, BB, AC	May-Oct.	Nov.-Apr.
5.	Kuparuk, East Fork**//	125.3	GR, CD	May-Oct.	Nov.-Apr.
6.	Kuparuk River**//	126.9[2/]	GR, WF, BB, AC, CD	May-Oct.	Nov. Apr.
7.	Oksrukuyik Creek**//	115/117.6[2/]	AC, GR, CD, BB, WF	May-Oct.	Nov.-Apr.
8.	Galbraith Lake Inlet	137.3[2/]	BB, GR, LT	May-Oct.	Nov.-Apr.
9.	Atigun River**//	154.8/162.2	AC, LT, CD GR, WF, BB	May-Oct.	Nov.-Apr.
10.	Chandalar River**//	167.9[1/]	DV, GR, CD NP, WF	May-Oct.	Nov.-Apr.
11.	Dietrich River**//	174.3/178[2/][1/]	WF, DV, GR, BB, CD	May-Oct.	Nov.-Apr.
12.	Nutirwik River//	183.5	GR	May-Oct.	Nov.-Apr.
13.	Snowden Creek**//	197.5	GR, CD, DV	May-Oct.	Nov.-Apr.
14.	Linda Creek//	214.0	CD, GR	Apr.-Oct.	Nov.-Mar.
15.	Sheep Creek	215.4	GR, CD	Apr.-Aug.	Nov.-Mar.
16.	Wolf Pup Creek//	215.8	CD	Apr.-Oct.	Nov.-Mar.
17.	Nugget Creek	216.4	GR	Apr.-Oct.	Nov.-Mar.
18.	Over Creek//	217.7	BB, GR	Apr.-Oct.	Nov.-Mar.
19.	Coon Gulch//	220.1	GR	Apr.-Oct.	Nov.-Mar.
20.	Minnie Creek//	224.0	WF, GR, BB, CD, DV	Apr.-Oct.	Nov.-Mar.
21.	Marion Creek**//	231.4	WF, GR, BB, CD, DV	Apr.-June	Nov.-Mar.
22.	Clara Creek**//	234.7	GR	Apr.-Oct.	Nov.-Mar.
23.	Slate Creek**//	236.0	KS, GR, DV WF, CD	Apr.-Oct.	Nov.-Mar.
24.	Rosie Creek//	241.4	GR, WF, CD, DV	Apr.-Oct.	Nov.-Mar.
25.	Windy Arm Creek//	246.5	CD, GR	Apr.-Oct.	Nov.-Mar.
26.	Chapman Creek//	248.9	GR, NP, CD	Apr.-June	Aug.-Mar.
27.	Koyukuk River, South Fork**//	255.0[2/]	GR, KS, CD, DS, WF, SK	Jan.-Dec.	--
28.	Grayling Creek	261.9	GR	Apr.-Oct.	Nov.-Mar.
29.	Jim River**//	265.8[2/]	GR, KS, DS, WF, DS, SK	Jan.-Dec.	--
30.	Douglas Creek	268.6	GR, CD	Apr.-Oct.	Nov.-Mar.
31.	Prospect Creek**//	275.3[2/]	DS, KS, GR, WF, CD, SK NP	Jan.-Dec.	--
32.	Bonanza Creek, North Fork**//	282.1	GR, WF, CD, SK, NP	Apr.-Oct. Sept.-Oct.	Nov.-Mar. Jan.-Mar.
33.	Bonanza Creek, South Fork**//	284.0	GR, WF, NP, CD	Jan.-Dec.	--
34.	Fish Creek**//	292.0/293.7/294.8	CD, GR, WF	Apr.-Oct.	Aug.-Mar.
35.	Kanuti River**//	300.2[2/]	SRNP, RW, BBWF, SS, GR,CD, DS	Apr.-Oct.	Jan.-Mar.
36.	Dall River, West Fork//	312.7/315.0	WF, IN, GR, NP	Apr.-Oct.	Nov.-Mar.
37.	Unnamed Stream**// (tributary to Ray River)	326.7/346.5	CD, IN, WF NP, GR, BB	Apr.-Nov.	Dec.-Mar.

Note: Most Critical Time reflects periods of time identified as critical or sensitive by BLM. Least Critical Time is the period not identified as either critical or sensitive by BLM.

Table 3.2.11-1 Exceptionally Productive Fish Streams
Along the Prudhoe Bay to Valdez Route of TAGS (continued)

	Stream	Milepost*	Fish Species	Most Critical Time	Least Critical Time
38.	Yukon River**//	349.2 2/ 3/	PS, RS, DS, KS, WF, GR, SS, IN, NP, BB, CD, SK, TP	Jan.-Dec.	--
39.	Isom Creek//	358.9	GR	May-Oct.	Nov.-Apr.
40.	Fish Creek//	373.3	GR	May-Oct.	Nov.-Apr.
41.	Hess Creek**//	373.6 2/	CD, WF, IN, DS, SK, NP, GR, BC, CD	Apr.-Oct.	Nov.-Mar.
42.	Erickson Creek//	379.6/383.0	GR, SK	May-Oct.	Nov.-Apr.
43.	Lost Creek//	387.3	GR, WF, CD	May-Oct.	Nov.-Apr.
44.	Tolovana River**//	393.6 2/	NP, WF, BB, KS, IN, DS, GR	Apr.-Dec.	Jan.-Apr.
45.	Slate Creek//	402.8	GR	May-Oct.	Nov.-Apr.
46.	Tatalina River**//	407.2 2/	IN, WF, GR, BB, NP	May-Nov.	Dec.-Apr.
47.	Globe Creek	412.4	GR	May-Oct.	Nov.-Apr.
48.	Aggie Creek//	418.0/418.8	GR	May-July	Aug.-Apr.
49.	Washington Creek//	426.0	GR, WF, CD	Jan.-Dec.	--
50.	Chatanika River**	432.3 2/	WF, IN, NP, BB, SS, KS DS, GR	Jan.-Dec.	--
51.	Treasure Creek//	436.1	CD	May-Oct.	Nov.-Apr.
52.	Goldstream Creek	442.1	GR, WF, NP, BB	May-Oct.	Nov.-Apr.
53.	Little Chena River	452.5	--	--	--
54.	Chena River**	452.9 2/	IN, WF, NP, BB, KS, SS, DS, GR, CD, SK	Jan.-Dec.	--
55.	Moose Creek//	467.7	GR, NP, SK,	Jan.-Dec.	--
56.	French Creek//	469.7/470.4	GR, WF, BB, NP	Apr.-Nov.	Dec.-Mar.
57.	Little Salcha River**	483.0 2/	GR, WF, KS, CD	Jan.-Dec.	--
58.	Salcha River	488.1 2/	WF, BU, NP GR, KS, SS, CD	Jan.-Dec.	--
59.	Redmond Creek**	492.1 2/	KS, GR, DS, WF, BB, CD	May-Oct.	Nov.-Apr.
60.	Gold Run Creek	499.0	GR	May-Oct.	Nov.-Apr.
61.	Rosa Creek	506.1/511.2	GR	Mar.-Oct.	Nov.-Feb.
62.	Shaw Creek**	512.1	BB, GR, WF, CD, SC, DS, NP	Jan.-Dec.	--
63.	Tanana River**	524.0/2/ 1/	KS, SS, WF, GR, NP, DS, BB, IN, CD, SK	Jan.-Dec.	--
64.	Ruby Creek	563.0	GR, WF	--	Jan.-Dec.
65.	Bear Creek	564.3	GR, WF	--	Jan.-Dec.
66.	Darling Creek	566.4	GR, WF	--	Jan.-Dec.
67.	One Mile Creek	569.8	--	--	--
68.	Gunnysack Creek	570.6	GR, WF	--	Jan.-Dec.
69.	Boulder Creek	573.9	GR, WF	--	Jan.-Dec.
70.	Whistler Creek	574.6	GR, WF	--	Jan.-Dec.
71.	Floyd Creek	576.8	GR, WF	--	Jan.-Dec.
72.	Michael Creek	577.8	GR, WF	--	Jan.-Dec.
73.	Castner Creek	580.6	GR, WF	--	Jan.-Dec.
74.	Lower Miller Creek	581.3	GR, WF	--	Jan.-Dec.
75.	Phelan Creek//	587.8	BB, DV, CD, GR, WF	Jan.-Dec.	--
76.	Upper Gulkana	610 2/	CD, GR, RS, DV	May-Sept.	Nov.-Apr.

Table 3.2.11-1 Exceptionally Productive Fish Streams
Along the Prudhoe Bay to Valdez Route of TAGS (continued)

	Stream	Milepost*	Fish Species	Most Critical Time	Least Critical Time
77.	Gillespie Creek//	627.8	BB, GR, CD, KR, RS	Sept.-June	July-Aug.
78.	Haggard Creek//	634.82/	GR, SK	May-Oct.	Nov.-Apr.
79.	Gulkana River**//	649.12/1/	BB, DV, GR, KS, LT, RS, SH, CD SK, WF	Jan.-Dec.	--
80.	Tazlina River**//	678.42/	BB, DV, GR, KS, LT, SK, RS, SH WF	Apr.-Dec.	Jan.-Mar.
81.	Yetna Creek//	683.4/681.8	GR, KS, SS	May-Aug.	Sept.-Apr.
82.	Klutina River**	688.92/	KS, RS, SS, SH, GR	Apr.-Nov.	Dec.-Mar.
83.	Willow Creek	698.1	GR, DV	May-Aug.	Sept.-Apr.
84.	Rock Creek//	703.1	GR, DV	May-Aug.	Sept.-Apr.
85.	Squirrel Creek//	707.9	DV, SS,	May-Nov.	Apr.
86.	Tonsina River**//	714.2/	SB, WF, SH, BB, DV, GR, KS, LT, RS, SS	Apr.-Nov.	Dec.-Mar.
87.	Little Tonsina River**//	2/715.82/	BB, DV, CD, GR, LT, DS, RS, SS. WF	Jan.-Dec.	--
88.	Little Tonsina Tributary (Little Tonsina Flats)//	716.2/725.12/	DV, KS, SS, CD, GR	Aug.-Sept.	Oct.-July
89.	59-Mile Creek//	730.9	DV	Aug.-Mar.	Apr.-July
90.	Squaw Creek//	734.7	DV	Aug.-Mar.	Apr.-July
91.	Boulder Creek//	737.5	DV	Aug.-Mar.	Apr.-July
92.	Stuart Creek//	743.2	DV	Aug.-Mar.	Apr.-July
93.	Tsina River//	748.2/755.3/757.1	DV	Apr.-Mar.	Apr.-July
94.	Ptarmigan Creek	761.5	DV, RB	Aug.-Sept.	Nov.-July
95.	Sheep Creek	768.8	SS	Aug.-Nov.	Dec.-July
96.	Lowe River**	770.6/774.61/	DS, DV, PS, RS, SS	Jan.-Dec.	--
97.	Clear Stream	2/778.2	DV, PS, SS	Jan.-Dec.	--
98.	Abercrombie Gulch	787.1	DS, DV, PS, SS	July-May	June-July
99.	Solomon Creek	789.1	PS, DS	July-Feb.	Mar.-June
100.	Dayville Flats Creek	790.1	CD, DV, PS	July-May	June
101.	Allison Creek	791.0	CD, DV, DS, PS	July-May	June
102.	Sawmill Creek	2/792.4	PS, DS	July-Feb.	June-July
103.	Unnamed (Terminal Site)	2/793.8	PS, DS	July-Feb.	June-July
104.	Unnamed (Terminal Site	2/796.1	PS, DS	July-Feb.	June-July

KEY

Arctic Char	AC	Dolly Varden	DV	Pink Salmon	PS	Sockeye (Red) Salmon	RS
Burbot	BB	Grayling	GR	Rainbow Trout	RB	Suckers	SK
Chinook (King) Salmon	KS	Inconnu	IN	Sculpin	CD	Trout Perch	TP
Chum (Dog) Salmon	DS	Lake Trout	LT	Steelhead Trout	SH	Whitefish and/or Cisco	WF
Coho (Silver) Salmon	SS	Northern Pike	NP	Stickleback	SB		

1/ Encroachment onto floodplain
2/ Denotes highly sensitive fish stream crossing of TAPS
3/ Aerial crossing
* Milepost indicators to be provided when preferred route is selected
** Within an environmentally sensitive drainage
// Restricted fish stream for TAPS
— Not crossed by TAPS

Source: Alaska Department of Fish and Game, 1980, Fish Resources of ANGTS.
BLM, 1986, Fish Streams along TAPS
BLM, 1987, Open File Report--TAPS Fish Streams, Second Edition
BLM, 1987, Zones of Restricted Activity for Protection of Key Fish Areas along TAPS on Federally Administered Lands. (Also see response to Comment 22-183.)

NOTE : Changes in Bold Print

Marine and anadromous fish are important to the North Slope Eskimo (Inupiat) subsistence fishery as well as a limited but valuable sports fishery and a small commercial fishery. The affected environment of fish on the coastal plains and the nearshore Beaufort Sea area of the North Slope is discussed in the FEIS on the Northwest Pipeline Gas Conditioning Plant (FERC 1980) and in the Endicott EIS (USACE 1984) and is incorporated by reference. However, some discussion of critical habitat and updated life history information is included.

Perennial springs, larger lakes, and deep pools (greater than 7 feet) in rivers and major tributaries may provide the only source of flowing or unfrozen water during the long winter freezeup period and are therefore critical to the survival of overwintering populations of freshwater and anadromous fish and their eggs in the arctic drainage (DOI *1986b*). The integrity of the riparian habitat is also very important for maintenance of fish stocks in coastal plain water bodies.

The life histories of most arctic region fish are complex and not completely understood. It is known that these fish grow and develop slowly and have life spans of up to 40 years. These characteristics are probably the result of low primary and secondary productivity of the waters, the short growing season, and low water temperature.

Arctic char are found ***in a number of drainages in the Central Beaufort including*** the Sagavanirktok River and its major tributaries entering from the east. Both the strictly freshwater and the anadromous populations of char are present. Most of the char in the Sagavanirktok River are anadromous and migrate upstream from the Beaufort Sea in late July or August of each year. ***Also, arctic cisco and broad whitefish are found in the Sagavanirktok River (see various Endicott reports).***

Arctic grayling are widely distributed in the arctic drainage and are found in the clear waters of most streams and lakes. Overwintering occurs in the deep pools of the lower rivers and tributaries and the deeper lakes.

Round whitefish are one of the most widespread and common species in northern waters, inhabiting both lakes and streams. They are an important subsistence species, taken primarily with gillnets. They occur in most major North Slope drainages and in coastal lagoons. The Sagavanirktok River appears to be a major whitefish spawning area (McCart ***and Craig*** 1973).

Other species such as Arctic cisco, broad whitefish, and salmon are not typically found in the Sagavanirktok River. ***Pink and chum salmon occur in the Sagavanirktok River below the Lupine River.***

Inupiat use all species found in these arctic drainages to some extent for subsistence, both along the coast and in the Sagavanirktok River and larger lakes.

Sport fishing pressure has increased in recent years due to the haul road (Dalton Highway), which has greatly increased accessibility and the number of people using the area. Although grayling and char can still be caught by anglers near the highway, these fish are typically much smaller and less numerous than before road access. The potential of these populations to support a larger fishing effort and still maintain a high degree of quality is unknown (DOI 1986).

At present there is no commerical fishing in, and little subsistence use of, the upper Sagavanirktok River drainage. The only commercial fishery in the arctic drainage is on the Colville River, 50 miles to the west.

3.2.11.3 <u>Yukon River Drainage</u>

The Yukon River drainage extends from Atigun Pass in the north to the Tanana River drainage in the south. The affected fish resources found in the Yukon drainage are discussed in the TAPS/ANGTS and El Paso EISs which are incorporated by reference in this section. However, some aspects of critical habitat and updated information on fish resources is presented below.

The Yukon River drainage is a huge area and includes many large lakes and rivers and a highly variable set of primary and secondary tributaries; therefore, its fisheries resources are more diverse than the arctic drainage. Salmon are present in large numbers and are especially important because they are commercial, subsistence, and sport fishing resources. The Yukon's major tributaries from the Brooks Range and those to be crossed by the TAGS pipeline include the Dietrich, the South and Middle Forks of the Koyukuk, and the Jim rivers. All are relatively clear with gravel- to cobble-size material comprising their streambeds.

There are nearly 50 rivers and streams inhabited by fish to be crossed by the TAGS pipeline in this region. These flowing waters contain a diverse variety of habitat. Rivers contain grayling, sculpins, suckers, whitefish, chum salmon, and a few king salmon which migrate up the Koyukuk as far as Coldfoot. Dolly Varden are found in some mountain streams, and burbot, lake trout, suckers, inconnu, and northern pike are found in many lakes or streams from the Brooks Range south.

The route parallels the Delta River for a considerable distance. The Delta River mainstem is turbid and highly braided, although its headwaters are clear. Many tributaries of the Delta River crossed by the proposed TAGS route further downstream are fed directly by glaciers, have a steep gradient, and contain few fish. Most species ***of fish*** use the highly turbid mainstem mostly for migration, preferring the larger, clear tributaries for spawning. ***However, salmon spawn at the mouth of the Delta River but do not migrate up the main stem.***

The Tanana River is fed by glaciers from the Alaska Range and is heavily laden with silt during the warmer months, although several of its major tributaries are clear. Subpermafrost springs in certain locations, particularly sloughs and side channels of the Tanana and Delta rivers, provide spawning habitat for coho and chum salmon when these waters become clearer in the fall.

All of the lakes, rivers, and streams of this region freeze over to a depth of up to 5 feet during the long, cold winters. Deep pools (10 feet or more) in the larger rivers and lakes are highly valuable as overwintering habitat, which may be the limiting factor for nonsalmonid fish populations in these waters. Subsurface springs and intergravel flow keep the maturing eggs from freezing during the winter. The tributaries of the Yukon serve as important migratory corridors for most of the species of fish present in the systems.

Many of the Yukon drainage rivers and streams are fairly accessible and accommodate a significant amount of sport fishing. The Chena River near Fairbanks has burbot, northern pike, grayling, and several species of forage fish and is representative of slow-moving, deeper rivers of the Yukon drainage.

The lower Chena River supports burbot fishing, and the headwaters support excellent grayling fishing. Many of the lakes near the proposed TAGS route support abundant populations of lake trout and northern pike, and most are heavily used by fly-in fishermen during the summer months.

3.2.11.4 Copper River Drainage

The Copper River drainage includes some of the most valuable fish-producing waters crossed by the proposed route. Extending from Isabel Pass in the Alaska Range to Thompson Pass in the Chugach Mountains, the river systems along the proposed route are fairly accessible to fishermen by road and boat. This, coupled with the high fishing quality of many streams and lakes, has resulted in an intensive and valuable sport fishery in much of this area. The Copper River system ***which drains into the Gulf of Alaska*** is the spawning grounds for millions of commercially caught salmon, especially king, ***silver,*** and red salmon.

There are many large lakes in the drainage. Paxson and Summit lakes in the the alpine country of the Alaska Range are large, clear, and deep. Both are accessible by road and support considerable sport fishing for grayling and lake trout and some whitefish, burbot, and rainbow trout. They are also important rearing areas for sockeye salmon hatched in the upper Gulkana River and Fish lakes. Their accessibility can be a problem. During the winter of 1986-87 these lakes were closed to burbot and lake trout fishing due to severe reductions in breeding stock.

The Gulkana River is clear and accessible by road for ***part*** of its length and is the most important sports fishing stream in the Copper River system. Large numbers of red and king salmon and some steelhead trout annually migrate up this stream to traditional spawning areas. Additionally, there are significant resident populations of rainbow trout and grayling. There is a salmon egg-taking and spawning facility on the upper Gulkana in this area.

Major tributaries of the Copper River include the Tazlina, Klutina, and Tonsina rivers. These large streams characteristically have a milky color due to glacial silt, yet support sizeable runs of red, king, coho salmon and some steelhead trout which spawn in smaller clearwater tributaries. Important personal use and subsistence fisheries exist on the *upper* Copper River, where dipnetting and fish wheels have traditionally been allowed. Personal use fishing pressure is primarily for red and king salmon *and occurs only on the main stem.*

Ice is not as thick on these rivers and lakes, usually from 2 to 4 feet. Overwintering habitat is therefore more plentiful.

3.2.11.5 Prince William Sound Drainage

The five species of Pacific salmon (chum, king, coho, pink, and red), comprise the major anadromous fish present in coastal area streams and rivers. During *summer and* fall adult salmon migrate from northern Prince William Sound up freshwater streams to spawn. Many are caught by commercial fishermen offshore and many more by sports fishermen closer to shore and in the lower rivers.

Depending on the species, eggs of salmon are generally laid in the *summer and* fall and hatch in the spring. Fry may migrate directly to sea or remain in fresh water for a year *or two (or sometimes* longer) *before migration. Salmon then spend one to five years in the North Pacific, again depending on the species, before returning to their parent streams to spawn and die.*

Each salmon species and life stage has its own food preferences, which change seasonally and during growth. Juvenile salmon typically feed on plankton. Pink, red, and chum salmon continue to eat primarily plankton as adults, although they may also eat larger food items such as squid and shrimp. King and coho salmon juveniles and smolts subsist largely on insects and small fish when in fresh water. They switch to herring and other small marine fish as well as some planktonic organisms when in the ocean. With few exceptions, salmon do not feed after entering spawning streams.

The Lowe River, which is paralleled by the proposed route for *about 15* miles, is representative of most area rivers and is typically turbid in the summer due to silt from melting glaciers. In fall and winter these rivers are typically clear. Some rivers do not freeze over completely whereas others may form ice up to 2 feet thick. Overwintering habitat is not critical. Resident *and anadromous* populations of Dolly Varden are present, and the Lowe River is an important production area for *coho,* sockeye, pink, and chum salmon. Much of the salmon spawning occurs in the tributaries, sloughs, and side channels to the Lowe.

Other streams flowing directly into Prince William Sound crossed by the proposed TAGS route are typically smaller, but the lower reaches of most streams, frequently in intertidal zones, are spawning areas for pink and chum salmon. Many of these streams have impassable fish barriers a short distance upstream, and movement of fish upstream from the sound is limited. Streams that do not have natural barriers typically support runs of coho salmon.

3.2.11.6 Summary of Fisheries Harvest Information

The fisheries harvest data in Table 3.2.11-2 represents the magnitude of the fisheries resources potentially subject to project related impacts. It is not intended to present a comprehensive overview of the fisheries harvest along the pipeline route.

The TAGS project parallels or crosses a number of streams in the Yukon River Drainage where chum, chinook, and coho salmon are the most heavily utilized commercial and subsistence species in the system. The Salsha, Chena, and Chatanika Rivers are among the most important in the Yukon drainage. The mouth of the Delta River, above its confluence with the Tanana River, is an area of upwelling springs where fall run chum salmon spawn. Recreational harvest data for grayling, whitefish, northern pike, and burbot are presented in Table 3.2.11.2 for selected water bodies in

Table 3.2.11-2 Fisheries Harvest Data Along the Proposed TAGS Pipeline Route

Location	Species	1975-1984 Average	1985	1986
Yukon River Drainage	Salmon	1,577,200	1,773,600	1,627,000
Commercial	Salmon	1,162,300	1,237,300	1,280,700
Subsistence	Salmon	413,600	532,000	351,300
Recreational	Salmon	1,352	2,918	--
Cooper River Basin				
Cooper/Bering River	Salmon	1,044,000	2,115,400	1,332,900
Commercial	Salmon	984,700	2,042,400	1,273,300
Recreational	Salmon	6,800	10,600	--
Subsistence/ Personal Use	Salmon	48,000	52,700	59,600
Gulkana Drainage (1)	BB, GR, WF, LT, SH, RB	14,483*	23,017	--
Glennallen Area (1)				
Klutina River	AC	--	2,480	--
Other Waters	AC	--	3,521	--
Tanana Drainage (1)				
Chena River	GR, NP, BB	30,745*	10,277	9,166
Salcha River	GR	7,570*	5,826	7,540
Chatanika River	GR, WF, NP	11,313*	21,754	26,012
Shaw River	GR	2,570*	2,584	505
Fielding Lake	GR	1,982*	1,023	--
Tanana River	BB	1,921*	1,365	2,948
Other Waters	WF	1,946*	5,880	--
Port Valdez (1)	DV	602*	1,266	--
	SS	5,600**	--	6,000
Prince William Sound	Salmon	13,276,800	26,899,800	13,592,200
Commercial	Salmon	13,247,500	26,850,900	13,592,200
Recreational	Salmon	29,200	48,800	--
Subsistence	Salmon	--	--	--

*	1977-1984 Average	AC	Arctic Char
**	1982-1986 Average	BB	Burbot
(1)	Recreational Fishery	SS	Coho (Silver) Salmon
--	Not Available	DV	Dolly Varden
SH	Steelhead Trout	GR	Grayling
WF	Whitefish	LT	Lake Trout
RB	Rainbow Trout	NP	Northern Pike

Source: Published and unpublished data from ADF&G files.

NOTE : New Table in FEIS

the Tanana Drainage likely to be affected by TAGS construction.

Harvest data for the Copper River Basin include the Gulkana River and the Bering River. In the salmon commerical fishery, all five species of Pacific salmon are taken, but sockeye, coho, and chinook predominate. The Gulkana Drainage supports the major sport fishery and recreational harvest of salmon in the area. Several other species are also harvested in the recreational fishery in the Gulkana Drainage (including Summit and Paxson lakes). The Gulkana River has supported the second highest harvest of grayling in Alaska since 1977, and in 1985, the Gulkana River was the top producer of Arctic grayling in the state.

Port Valdez supports the largest sport fishery in Prince William Sound and the largest pink salmon sport fishery in the state. Chum are also important, with coho salmon less abundant then pinks and chums. Anderson Bay is a release and return site for a program to establish a hatchery based chinook fishery in the area. Other species in the Port Valdez recreational catch include halibut, rockfish, and Dolly Varden char.

Prince William Sound supports a large salmon fishery. Production of pink salmon has increased dramatically in the past 10 years with record harvests occurring in 1979, 1981, 1984, and 1985. Much of Port Valdez is closed to commercial fishing, with the exception of a "terminal fishery" near the Soloman Gulch hatchery site. The 1987 catch of salmon (pinks and chums) for Valdez Narrows and the "terminal" catch of hatchery fish was 1,764,500.

3.2.12 Vegetation and Wetlands

3.2.12.1 Introduction

The vegetation along the proposed TAGS pipeline corridor is exceedingly variable, responding to differences in regional and local climates, surficial geology, and soils. The distribution of vegetation is further influenced by disturbances such as fire, flooding, and human alterations that have affected plant succession.
Table 3.2.12-1 provides a summary of the major vegetative types along the proposed TAGS route.

The major vegetation types in Alaska have been classified in numerous ways since the earliest work by Spetzman (1963), but classifications are very similar (see Table 3.2.12-2). Later descriptions by Viereck and Little (1972), the Joint Federal-State Land Use Planning Commission for Alaska (1973), and in the Alaska Regional Profiles (Selkregg et al. 1975a,b) added to the geographic information. The Joint State/Federal Fish and Wildlife Advisory Team (Pamplin 1979) modified these classification schemes to emphasize wildlife habitat types. These broad classification schemes are supported by the more detailed hierarchical vegetation classifications especially designed for mapping in northern Alaska (Walker 1983) and the Alaska Vegetation Classification (Viereck et al. 1982). The major vegetation types, as they occur in the tundra, taiga, and coastal biomes are described below.

Wetlands perform important physical and ecological functions that deserve special consideration (OCM 1981). Wetlands play a major role in maintaining hydrologic systems and the quality and quantity of surface and ground waters. Some wetlands can absorb large quantities of water and act as natural flood control systems for rivers by gradually releasing floodwaters and reducing the magnitude of high flows. Wetlands may slow the rate of runoff during periods of normal rainfall and help recharge aquifers. In some places, sediments and pollutants may be filtered out of water draining through wetlands, and water quality may thus be improved. Wetlands are extremely important to resident and migratory birds for resting, feeding, and nesting, and can be important foraging grounds for large mammals such as caribou, moose, and bear.

A wetlands classification has also been developed to emphasize the hydrologic and wildlife habitat characteristics of vegetation. An earlier wetlands classification was used by Bergman et al. (1977) for waterbird habitat studies. Wetlands have been defined by the USACE (33 CFR 328) as "those areas that are inundated or saturated by surface or ground water at a frequency and duration sufficient to support, and that under normal circumstances do support, a prevalence of vegetation, typically adapted for life in saturated soil conditions." The wetlands classification of each major vegetation type is included with the following descriptions based on the USACE description and as identified in Table 3.2.12-1 would be approximately 51 percent of the proposed route. This value includes habitat types not specifically classified as "wetlands" by Pamplin (1979) but which are considered by others to meet the definition set forth above for 33 CFR 328.

The classification used here is that of Selkregg et al. (*1975a*) because it provides a broad framework for describing the major ecosystems along the route. A comparison of these classes with those of the Alaska Vegetation Classification (Viereck, et al. 1982) is presented in Table 3.2.12-2. The Selkregg classification is useful for a general description of the route because it provides discrete classes of vegetation that are related to landscape characteristics. The Alaska Vegetation Classification, which has been commonly accepted for detailed surveys, has been used for vegetation mapping (Levels III and IV) of the Copper River basin and Tanana River basin by the Alaska Department of Natural Resources but has not been used for mapping other land areas along the route. The disadvantages of using the Alaska Vegetation Classification for general descriptions are that at finer levels of resolution (Levels III through V) require information that is not generally available until the design phases of a project.

3.2.12.2 Arctic Tundra

The arctic tundra region, characterized by low-growing vegetation of mosses, lichens, grasses and sedges, and dwarf shrubs, is divided into three major physiographic provinces: the coastal plain, the foothills, and the mountains of the Brooks Range. The coastal plain generally supports wet tundra vegetation due to the shallow, saturated active layer above the permafrost. The foothills generally support moist tundra on the slopes, wet tundra in the swales, and alpine tundra on the more exposed, drier sites. In the Brooks Range, alpine tundra predominates as a result of the higher elevation and the coarser soils of mountain slopes. High shrub thickets develop on floodplains in less exposed areas or where enough snow accumulates to protect vegetation against harsh winter winds. In the active channel of the braided floodplains the surface is frequently barren.

Wet tundra consists of an almost continuous cover of sedges and grasses. Mosses and dwarf shrubs are frequently present in better drained sites; in standing water, rooted aquatic plants predominate. This wetland vegetation type (palustrine; emergent; or permanently, semipermanently, or seasonally flooded) provides important habitat for waterfowl.

Moist tundra in upland terrain varies from stands where cottongrass tussocks predominate to stands where dwarf shrubs, sedges, and mosses dominate. Diamond-leaf willow and dwarf birch are important shrubs. This wetland vegetation type (palustrine, emergent, persistent/ scrub-shrub, broad-leaved deciduous, saturated) is important habitat for tundra birds and caribou.

Alpine tundra occurs in mountainous areas within both the tundra and taiga and on well-drained gravel ridges in the Arctic. It generally consists of prostrate shrub and lichen with occasional forbs, sedges, and mosses. This vegetation type is not classified as a wetland.

High shrub thickets of willow grow in protected sites on the floodplains of the Sagavanirktok and Atigun rivers and are common in small drainages in the foothills. These riparian shrublands (palustrine, scrub-shrub, broad-leaved deciduous, temporarily flooded) are very productive and are important habitat for songbirds, moose, and caribou.

3.2.12.3 Interior Taiga

Most of the proposed TAGS corridor passes through the subarctic forests of the interior region. The interior route passes primarily through forested areas, interrupted occasionally by treeless bogs in the lowlands and high shrub thickets near timberline and along floodplains. The major vegetation types found in the interior are the bottomland spruce-poplar forest, upland spruce-hardwood forest, lowland spruce-hardwood forest, high shrub and low shrub

Table 3.2.12-1 Estimates of Major Vegetative Types Crossed by the Proposed TAGS Route

		Percent of Route
Arctic Tundra	Total	22
Wet Tundra		4*
Moist Tundra		13*
Alpine Tundra		1
Shrub Thicket		2*
Unvegetated Areas (floodplain and barren)		2**
Interior Taiga	Total	75
Upland Spruce-Hardwood Forest		26
Lowland Spruce		14*
Bottomland Spruce-Poplar Forest		3
Bogs		4*
Shrub Thicket		23***
Moist Tundra		5*
Unvegetated Floodplain		Trace*
Coastal Forest	Total	3
Spruce-Hemlock Forest		2***
Shrub Thicket		1
Bottomland Spruce-Poplar Forest		Trace

* Designated as wetlands
** May be regulated as wetlands
*** A portion of this figure may be wetlands

Note: 51 percent of the total shown in this table is assumed to be wetlands.

Table 3.2.12-2 Comparable Vegetation Types Used in the Classification System of Selkregg et al. (1975a) and Viereck et al. (1982)

Selkregg et al. (1975)	Viereck et al. (1982) - Level II
Wet Tundra	Graminoid Herbaceous (wet graminoid herbaceous - Level III)
Moist Tundra	Graminoid Herbaceous (moist graminoid herbaceous - Level III)
Alpine Tundra	Dwarf Scrub, Low Scrub, Forb Herbaceous, Bryoid Herbaceous
High Shrub Thickets	Tall Shrub Scrub
Low Shrub Bog and Muskeg	Dwarf Tree Scrub, Low Shrub Scrub, Dwarf Shrub, Graminoid Herbaceous, Forb Herbaceous, Bryoid Herbaceous, Aquatic (nonemergent) Herbaceous
Upland Spruce-Hardwood Forest	Needleleaf Forest, Broadleaf Forest, Mixed Forest
Lowland Spruce-Hardwood Forest	Needleleaf Forest, Broadleaf Forest, Mixed Forest
Bottomland Spruce-Poplar Forest	Needleleaf Forest, Broadleaf Forest, Mixed Forest
Coastal Spruce	Needleleaf Forest

bogs and marshes, which are briefly described as follows.

The bottomland spruce-poplar forest type is a tall, relatively dense forest along actively meandering rivers and streams and is one of the most productive interior forest types. The forest generally occurs as a narrow, permafrost-free band along the rivers as a result of a succession on freshly deposited alluvium.

Upland spruce-hardwood is the most extensive forest type along the route. Interior forest are greatly affected by fire, which leads to a patchwork of vegetation types throughout the region because of the many local areas in different stages of succession. On moderate south-facing slopes the forest is composed of white spruce, paper birch, or aspen in either pure stands or in combinations. This forest type along the Yukon-Tanana Uplands is an important source of sawtimber and firewood for interior residents. Black spruce, often with scattered paper birch, grows on northern exposures or on shallow, nutrient-poor soils. Black spruce stands are by far the predominant subtype in the upland spruce-hardwood forests, especially along the route alignment between Coldfoot and Fairbanks. On well-drained soils in upland areas, black spruce stands are not considered wetlands; however, on saturated soils underlain by permafrost (primarily on north-facing slopes) this type is classified as wetlands.

Lowland spruce-hardwood forest is characterized by extensive pure stands of black spruce or by stands of black spruce mixed with paper birch, balsam poplar, and aspen. Treeless bogs occur in depressions throughout this forest type. Large areas burned since 1900 are covered by willow scrub and by dense stands of small black spruce. Where permafrost is present or the soils are saturated, this forest type is classified as a wetland.

High shrub thickets in the Interior occur along floodplains and near treeline, in a transition zone between upland spruce-hardwood forests and alpine tundra. Along floodplains, shrubs develop quickly on freshly formed alluvium that is subject to periodic flooding. Tall willows and alder dominate the canopy. The riparian shrub thickets (riverine unconsolidated shore, temporarily flooded) are very productive and are important wetland habitats for wildlife.

Low shrub bogs and marshes occur where conditions are too wet for tree growth, primarily in lowland unglaciated areas, old abandoned floodplains, in partly filled ponds and abandoned stream channels, and occasionally on gentle north-facing slopes. Some areas contain a nearly continuous cover of low shrubs; others are characterized by a cover of sedges and moss. These vegetation types are classified as wetlands (palustrine, emergent and scrub-shrub, saturated to semipermanently flooded). The major occurrences of these wetlands are along the Chatanika Flats, Chena River flats, Shaw Creek flats, and portions of the Copper River drainage.

3.2.12.4 Coastal Forests

The vegetation in the Chugach Mountains south of Thompson Pass is influenced by the warmer and wetter maritime climate. At higher elevations in Keystone Canyon nearly continous high shrub thickets occur. Coastal spruce and hemlock forest occur at lower elevations. The broad floodplain of the Lowe River supports productive bottomland spruce-poplar forests and high shrub thickets on gravel bars next to the braided channels. Low shrub bogs and marshes are common in poorly drained areas at low elevations.

Coastal spruce and hemlock forests are dominated by Sitka spruce and western hemlock, with a scattering of mountain hemlock and Alaska cedar.

Bottomland spruce-poplar forests along the floodplains of the Lowe River are dominated by black cottonwood and Sitka spruce.

High shrubs, dominated by Sitka alder, form extensive thickets on the mountain slopes near treeline and often have a well-developed grass and fern layer below. Willow and alder are also prominent on the floodplain forming riparian wetlands.

Low shrub bogs and marshes in the coastal region vary in species composition, but commonly have thick moss mats with some sedges and low shrubs and would be considered wetlands. A few slow-growing western hemlock or Alaska cedar are scattered on drier sites. Ponds containing aquatic plants are often present in low-lying areas. This vegetation type is classified as a wetland by the USACE.

3.2.13 Wildlife

3.2.13.1 Introduction

The route of the proposed TAGS project transects a broad spectrum of wildlife habitats and resources. Of the 67 species of terrestrial mammals (both native and introduced) recorded in Alaska (MacDonald 1980), at least 48 of them occur along the TAGS route. Similarly, of the 417 species of birds recorded in Alaska (Gibson 1986), at least 225 species inhabit areas along or adjacent to the TAGS route. Most birds along the corridor are migratory. Peak use of terrestrial habitats occurs during the summer breeding season (May-August), and a number of species occur in seasonal concentrations during the spring (March-May) and fall (August-October) migration periods.

Wildlife resources are discussed within the context of the four major drainage divisions used in subsection 3.2.9. In biogeographic terms, however, these divisions are not necessarily distinct. In this sense the fauna of the Yukon and Copper river drainages are quite similar, although arctic influences dominate in the northern part of the Yukon River drainage and coastal in the southern Copper River drainage.

The information presented in the following sections has been drawn largely from previous EISs (DOI 1972, FPC 1976a, BLM 1976) and the Utility Corridor - Draft Resource Management Plan and EIS, August 1987, and has been corrected and updated where appropriate. More complete discussions of birds in Alaska were prepared by Gabrielson and Lincoln (1959) and Kessel and Gibson (1978). No comprehensive, authoritative reference has yet been compiled for Alaska mammals, but useful information can be found in several regional treatments, including Bee and Hall (1956) and Buckley and Libby (1957). General distribution maps for mammals were presented by Mannville and Young (1965) and Hall (1981). Konkel et al. (1981) prepared synopses of habitat-use data for mammals and birds. Specific information on wildlife habitats along the proposed route is delineated in map atlases prepared by the Alaska Department of Fish and Game (1973; 1978; 1985; 1986a,b) and by Hemming and Morehouse (1976). A summary of sensitive wildlife habitat from Prudhoe Bay to Anderson Bay is presented in Table 3.2.13-1 for large mammals and Table 3.2.13-2 for birds.

3.2.13.2 Arctic Slope Drainage

3.2.13.2.1 Large Mammals

Caribou are by far the most abundant large mammals in the Arctic Slope drainage and have been the focal point of a substantial amount of research regarding the effects of petroleum development. The Central Arctic Herd (CAH) resides year-round in the region between the Colville and Canning rivers from the Beaufort Sea coast inland to the Brooks Range as shown in Figure 3.2.13-1. Herd size was estimated at about 16,000 animals in the summer of 1986 (R. Cameron, ADF&G, pers. comm.) and is increasing. Calving occurs from late May to mid-June on the coastal plain, usually within 15 to 25 miles of the coast and mostly in the Kuparuk oil field and Bullen Point/Canning River delta areas, although in years of extensive snow cover calving occurs farther inland (Shideler 1986). After calving, the majority of the herd spends the summer on the coastal plain, traveling to the coast during periods of mosquito harassment and moving inland during mosquito-free periods. The herd disperses inland in late summer and fall and winters mainly in the northern foothills and valleys of the Brooks Range. Migration routes between winter and summer ranges are oriented along major rivers, including the Sagavanirktok.

The CAH is flanked on the west by the Western Arctic Herd (WAH), estimated at more than 224,000 caribou in 1986 (J. Davis, ADF&G, pers. comm.), and on the east by the Porcupine Herd (PH), estimated at 181,000 caribou in 1986 (K. Whitten, ADF&G, pers. comm.). In some years caribou from the WAH may winter as far east as the CAH range, which is transected by the proposed route. Although some interchange of individuals occurs between adjacent herds, it is

Table 3.2.13-1 Sensitive Areas for Mammals Along the Proposed TAGS Route

Species	Area	Primary Use	Period
Caribou	Prudhoe Bay to Franklin Bluffs	Calving	Late May to mid-June
Caribou	Prudhoe Bay to Galbraith Lake	Spring migration	March to June
Moose	Upper Sagavanirktok River	Wintering	October to May
Dall Sheep	Slope Mountain, Atigun Canyon, Dietrich River area	Lambing, mineral licks	May to August
Brown Bear	Dietrich River and Middle Fork Koyutuk River Valleys	Feeding concentrations	Spring, Fall
Moose	Jim River, Prospect Creek, Fish Creek, Bonanza Creek	Wintering	October to May
Moose	Hess Creek	Wintering	October to May
Moose	Tolovana River and Tatalina River	Wintering, calving	October to May, May to June
Moose	Chatanika River to Salcha River	Wintering, calving	October to May, May to June
Moose	Shaw Creek Flats	Calving, wintering	May to June, October to May
Bison	Donnelly Dome to Big Delta	Wintering	September to March
Bison	Delta River (Donnelly Dome to Black Rapids)	Calving	April to June
Dall Sheep	Delta River area (Ruby Creek to Castner Glacier)	Lambing, mineral licks	May to August
Brown Bear	Delta River (Donelly Dome to Black Rapids)	Feeding concentrations	Spring, Fall
Brown Bear	Summit Lake to Paxson Lake	Feeding concentrations	Spring, Fall
Caribou	Paxson Lake to Tazlina River	Migration, wintering	October to May
Moose	Paxson Lake to Sourdough	Calving	May to June
Moose	Hogan Hill to Copper Center	Wintering	October to May
Moose	Tonsina River	Calving	May to June
Moose	Tonsina River, Tiekel River	Wintering	October to May
Dall Sheep	Unnamed mountain just west of Tonsina	Lambing	May to June
Moose	Lowe River	Restricted Range	All year

Source: Hemming & Morehouse, 1976; ADF&G 1985, 1986a, 1986b; FPC 1976a

Table 3.2.13-2 Sensitive Areas for Birds Along the Proposed TAGS Route

Species	Area	Primary Use	Period[1/]
Waterfowl	Prudhoe Bay to Ivishak River	Nesting	June to August
Raptors	Franklin Bluffs	Nesting	April to August
Raptors	Sagwon Bluffs	Nesting	April to August
Raptors	Saganavirktok River Bluffs near Lupine River mouth	Nesting	April to August
Raptors	Slope Mountain	Nesting	April to August
Raptors	Atigun River Valley area	Nesting	April to August
Waterfowl	Galbraith Lake	Spring migration	May to June
Raptors	Upper Dietrich River Valley	Nesting	April to August
Waterfowl	Cathedral Lakes	Migration	May
Waterfowl	Jim River	Nesting	May to August
Waterfowl	Kanuti River	Nesting	May to August
Waterfowl	Ray River	Migration, nesting	May to August
Raptor [2/]	Yukon River to Delta River	Nesting	April to August
Waterfowl	Hess Creek	Nesting	May to August
Waterfowl	Tolovana River	Nesting	May to August
Waterfowl	Chatanika River	Nesting	May to August
Waterfowl	Chena River to Salcha River	Nesting	May to August
Waterfowl	Harding Lake	Fall concentration	September to October
Waterfowl	Shaw Creek Flats	Nesting	May to August
Waterfowl	Delta/Tanana River Junction	Wintering	October to April
Sandhill Cranes	Delta Junction area	Spring and fall migration	Late April to mid-May, September
Waterfowl	Paxson Lake to Tazlina River	Nesting	May to August
Waterfowl	Willow Lake	Nesting	May to August
Waterfowl	Robe Lake/Lowe River mouth	Spring and fall concentrations	April to May. September to October
Raptors	Lowe River/Anderson Bay	Nesting	April to August

Source: Hemming & Morehouse. 1976; ADF&G 1985, 1986a, 1986b; FPC 1976a

1/ The sensitive period for some areas may be expanded (March through August) if gyrfalcons or eagles are present.

2/ Scattered raptor nests (see Table 4.2.14-1).

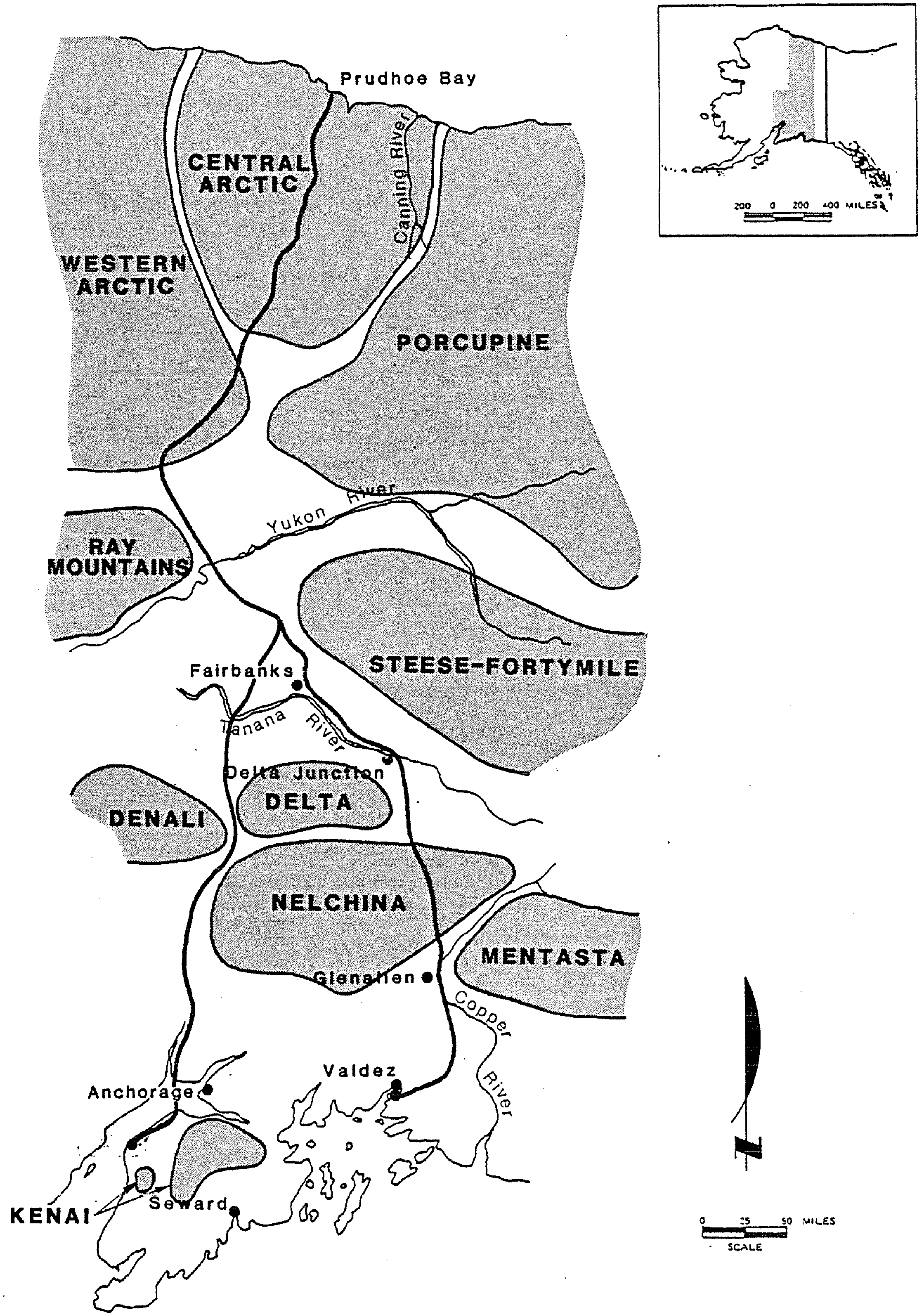


Figure 3.2.13-1 Main Caribou Herds of Alaska Along the Proposed TAGS Pipeline Route and Cook Inlet-Boulder Point Alternative

considered to be very limited at present population levels.

Musk oxen are found primarily to the east of the proposed TAGS route in the Arctic National Wildlife Refuge (ANWR), but individuals (usually bulls) and small groups have been seen in recent years as far west as the Kuparuk and Prudhoe Bay oil fields and as far south as Galbraith Lake (Reynolds et al. 1985). From June to at least October 1986, as many as 18 musk oxen were observed repeatedly along the Sagavanirktok River north of Franklin Bluffs near where the TAGS line would pass. Musk oxen generally prefer riparian habitats during summer and fall, shifting to windblown ridges and bluffs during winter and early spring and to upland tussock areas during calving season.

Moose reach the northern limit of their range on the Arctic Slope, having populated the region only during the last century. Coady (1980) estimated that about 2,000 moose inhabited the Arctic Slope and considered the population to be stable or increasing slowly. Moose occur in highest density along the Colville River, but "sizable numbers" occur along some rivers east of the Colville (Coady 1980), including the upper Sagavanirktok, which is a winter concentration area (ADF&G 1986a). The proposed TAGS route would parallel this concentration area. Moose inhabit most arctic drainages wherever adequate stands of willow occur. The population is probably limited primarily by winter food supply and predation (BLM 1976).

Dall sheep are found along the proposed TAGS route in the mountains of the Brooks Range north to Slope Mountain. The Atigun River valley is bounded on both sides by sheep winter range (ADF&G 1986a), and the Atigun Canyon below Galbraith Lake contains an important lambing area (BLM 1976). More than 300 sheep have been reported to use the Atigun River drainage from early winter to early summer. Lambing occurs from mid-May to mid-June (BLM 1976). In addition, two mineral licks are located near the floor at Atigun Canyon and are used by sheep in spring and early summer (DOI 1972); another lick is located on Slope Mountain (ADF&G 1986a).

Brown bears (also called grizzlies) are distributed sparsely across the coastal plain, becoming more numerous in the foothills and valleys of the Brooks Range. Bears emerge from winter dormancy in April and May and spend considerable amounts of time during summer foraging and resting in river valleys and on hillsides. The Sagavanirktok and Atigun river valleys are concentration areas (ADF&G 1973). Bears enter winter dormancy in October and November (DOI 1972). Dens are usually dug in south-facing slopes in the foothills and mountains through which the proposed TAGS route passes.

Wolves are present in very low densities in the arctic drainage area, probably due to illegal hunting (DOI 1972). They can occur anywhere along the TAGS route, as dictated by the availability of their primary prey (caribou and moose) but are more numerous in the foothills and mountains. Suitable natal den sites are very limited on the coastal plain, essentially restricting denning to well-drained south slopes farther inland in the foothills and mountains (Stephenson 1974) through which the proposed TAGS route passes.

3.2.13.2.2 Birds

More than 200 species of birds have been reported north of the Brooks Range divide (Pitelka 1974, Troy 1985). Nearly half probably frequent the coastal plain and Sagavanirktok River valley. Information in this section has been drawn from a number of references (DOI 1972; Pitelka 1974; Sage 1974; FPC 1976a; Kessel and Gibson 1978; USACE 1984; Troy 1985).

The avifauna of the coastal plain habitats crossed by the TAGS route is dominated by waterbirds, including loons, ducks, geese, swans, and shorebirds. The greatest species diversity occurs in wetlands between the Canning and Colville rivers (USACE 1980), the region in which the TAGS route is located.

The Sagavanirktok River and Delta are among the first waters to open in spring and consequently are occupied by bird groups until other waters are free of ice. Existing road and pipeline systems in the Prudhoe Bay area have altered surface water patterns and snowmelt in some areas, also influencing the distribution of birds (USACE 1980).

Four species of geese regularly breed along the TAGS route in this region. The only breeding colony of snow geese in the United States is found on Howe Island, on the Sagavanirktok River delta (USACE 1984). These snow geese use the area crossed by the TAGS route near the Sagavanirktok River valley and adjacent habitats along the Dalton Highway in spring, arriving in the latter half of May (Burgess and Ritchie 1986). Brant nest in small colonies near the coast. Canada and white-fronted geese are more widespread and are also found nesting inland. Common duck species include northern pintail, American wigeon, old squaw, greater scaup, and common eider.

Gulls and shorebird species are conspicuous in all arctic habitats crossed by TAGS. Coastal areas such as mudflats and beaches are used by staging dunlin, semipalmated sandpipers, and stilt sandpipers (USACE 1984). The most abundant breeding species on the coastal plain are the red phalarope, red-necked phalarope, semipalmated sandpiper, dunlin, and pectoral sandpiper (Truett et al. 1982). The density and diversity of shorebirds and waterfowl decreases considerably as the TAGS route enters upland tundra to the south.

Seven species of raptors regularly occur along the TAGS route, as do ravens. Cliff-nesting raptors and ravens are concentrated along the Sagavanirktok River, especially on Franklin Bluffs, Sagwon Bluffs, and in the Atigun River valley. Rough-legged hawks are the most abundant species, but their numbers fluctuate markedly with numbers of microtine rodents, their primary prey. Nesting in the same areas are gyrfalcons and peregrine falcons. A few golden eagles nests are found on cliffs in the upper Sagavanirktok and Atigun river valleys (Roseneau et al. 1981).

The threatened <u>tundrius</u> subspecies of the peregrine falcon traditionally nests on cliffs ***and foothills near*** the Sagavanirktok River. Prior to declines in the 1970s, six or seven sites probably were active annually along the Sagavanirktok (FWS 1982). At least nine pairs were present in 1986. Most peregrines arrive by mid-May and leave the region by late September.

Two owl species, the snowy owl and the short-eared owl, occur along the TAGS route. Snowy owls nest primarily on the coastal plain. Short-eared owls probably breed along the TAGS route.

3.2.13.3 Yukon River Drainage

3.2.13.3.1 Large Mammals

Moose are distributed throughout the region, occurring in a wide variety of habitats ranging from upland shrubs to lowland spruce bogs, old burns, and riparian areas (ADF&G 1976a). Riparian habitats are often used intensively, especially during winter (FPC 1976a). The TAGS route crosses a number of lowland and riparian areas considered part of general concentration areas during calving season, rutting season, or winter (ADF&G 1973, 1986b; FPC 1976a).

The proposed route largely avoids caribou ranges in this region. The Dietrich River has been used as a migration route in the past, and the route crosses the eastern portion of the WAH winter range from the Kanuti River north (DOI 1972; ADF&G 1986b). The area east of the Middle Fork of the Koyukuk River has been used as winter range by the Porcupine Herd in former years (FPC 1976a). The Ray Mountain caribou herd is located west of the pipeline route just north of the Yukon River. This herd has been recognized by ADF&G (***Valkenburg,*** pers. comm.). It consists of between 500 to 1,000 animals. The route touches the western portion of the historic winter range of the Steese-Fortymile Herd (estimated at 15,000 caribou in 1986 [J. Davis, ADF&G, pers. comm.]), although that portion of the range has not been used since at least 1970 (FPC 1976a). Along the Delta River the route parallels the eastern edge of the calving grounds of the Delta Herd (estimated at 7,500 caribou in 1986 [J. Davis, ADF&G, pers. comm.]); the Delta Herd winters west of the Delta River (ADF&G 1986b).

Dall sheep occur near the proposed TAGS route along both sides of the Dietrich and upper Delta River valleys. In the former area at least five mineral licks have been located (ADF&G 1986b), and the route passes near lambing cliffs near Kuyuktuvuk and Nutirwik creeks (FPC 1976a). Movements of sheep down to and across the valley bottoms have been noted. Sheep are not known to cross the proposed route along the Delta River. At least one mineral lick is located east of the proposed route (ADF&G 1973). Windblown ridges and slopes, usually at the mouths of tributaries along major drainages, constitute important winter range for sheep in the mountains of interior Alaska (ADF&G 1976a); the TAGS route passes through several such areas. Sheep are highly traditional in their use of summer and winter ranges and mineral licks.

Bison were introduced near Delta in 1928 and have become a popular, intensively managed game species. Herd size is maintained at about 275 (Townsend 1985). The proposed route would cross fall and winter range near Delta Junction, pass through summer range, and parallel the eastern edge of the calving area along the Delta River south of Donnelly (ADF&G 1973). Most bison calves are born during May.

Brown bears are relatively common along the Dietrich River and the Middle Fork of the Koyukuk, which are concentration areas during spring and fall (ADF&G 1973, 1986b; FPC 1976a). The upper Delta River in the Donnelly area has been identified as a spring and fall concentration area as well (ADF&G 1986b). Brown bears occur only rarely in the lowland spruce forests near the Yukon and Tanana rivers.

Black bears would occur along the TAGS route because they are widely distributed throughout the forested portions of the Interior and may reach densities up to one per 10 to 20 square miles (DOI 1972). Black bears concentrate near berry patches, particularly in alpine and subalpine habitats. In late summer they tend to avoid extensive open tundra (ADF&G 1976a). Moist lowlands are commonly used in spring.

During TAPS construction many carnivores, especially bears, interacted with camp and field-related activities to create a major human-carnivore problem. Direct feeding by workers, scavenging at dumpsites, and break-in within camps became serious problems.

Wolves occur throughout the interior region in higher densities than in the Arctic. Moose is major prey species, and caribou and Dall sheep are taken opportunistically. Snowshoe hares are an important supplemental food in some years. Active dens of adjacent wolf packs are usually established 15 to 25 miles apart. Wolves may range as widely as 20 miles from their dens during summer (ADF&G 1976a). The overall density of wolves in interior regions ranges from about one per 40 to one per 100 square miles (ADF&G 1976a).

3.2.13.3.2 Birds

Approximately 225 species of birds have been reported in interior Alaska; however, only 75 percent occur regularly (Kessel 1986). Information for this region has been derived mainly from the DOI (1972), FPC (1976a), and Kessel and Gibson (1978).

More than 30 species of loons, grebes, and waterfowl summer in interior Alaska (Kessel 1986). Dabbling ducks, including mallard, northern pintail, green-winged teal, American wigeon, and northern shoveler, are common nesting species. Diving ducks include lesser scaup, bufflehead, and goldeneyes. Drought-displacement of ducks from prairie and parkland potholes to northern wetlands, including interior Alaska, increases the number and variety of ducks in some years (Hansen and McKnight 1964).

The principal goose species are Canada and greater white-fronted geese (King and Lensink 1971), which together probably number in the low tens of thousands throughout the Interior (FPC 1976a). Trumpeter swans nest in lowland lakes throughout the region; more than 300 of these swans, once considered an endangered species, have used the lower Koyukuk River valley in the spring (DOI 1972).

The proposed TAGS route would cross productive waterfowl nesting habitat in the Kanuti Flats; the Ray, Tolovana, and Chatanika rivers; oxbows and ponds along the Chena and Salcha rivers; and morainal ponds near Donnelly Dome (DOI 1972). The route would also traverse several drainages that enter Minto Flats and the lower Koyukuk River, which are important waterfowl nesting areas. Besides these wetlands, the TAGS route crosses several agricultural fields near Delta Junction used by thousands of migrating waterfowl (Ritchie 1980). Many of these areas are heavily used by recreational and subsistence hunters.

Approximately half of the world population of lesser sandhill cranes passes through the upper Tanana River valley during spring and fall migrations (Kessel 1984). Daily counts in excess of 40,000 birds have been recorded near the TAGS alignment between Delta Junction and Donnelly Dome. Some of these birds nest in lowlands in interior Alaska, but most migrate to or from more important breeding grounds in western Alaska and Siberia.

More than 20 species of shorebirds and gulls commonly nest in or migrate through the Interior. Lesser yellowlegs, solitary sandpipers, and common snipe are typically found in summer in wetlands interspersed in woodland habitats. Spotted sandpipers, mew gulls, and herring gulls are common along rivers. The upland sandpiper and lesser golden-plover are breeders in upland tundra areas near the Alaska Range. Other shorebirds, such as pectoral and semipalmated sandpipers and long-billed dowitchers, migrate through spring and fall.

Nineteen species of raptors can be found on cliffs and in woodland habitats crossed by the proposed TAGS route. Cliff-nesting species include the gyrfalcon, golden eagle, and peregrine falcon. Gyrfalcons and golden eagles are relatively common nesters in the Brooks Range and Alaska Range. Suitable cliff habitat for these species occurs along the upper Koyukuk and Delta rivers.

The federally endangered anatum subspecies of the peregrine falcon has nested traditionally near the proposed TAGS route on the Yukon and Tanana rivers and on small tributaries of these rivers, such as the Salcha (USFWS 1982). Peregrines arrive in mid- to late April and depart by September. Active or formerly active aeries occur near the proposed TAGS crossings of the Yukon, Tanana, and Salcha rivers. Potential habitat occurs on the Jim and Koyukuk rivers (Roseneau et al. 1981). At least seven active aeries were reported on the Tanana River in 1970. In the same period seven aeries had been identified on the middle Yukon from Fort Hamlin to Tanana (*FWS* 1982). Significant declines in numbers of peregrines occurred after about 1968, especially on the Tanana River. However, numbers and productivity have increased substantially; seven pairs were recorded along the Tanana between Tanacross and Fairbanks in 1986 (R. Ambrose, USFWS, pers. comm.) several of which are in the vicinity of the proposed TAGS route.

Bald eagles nest throughout the Interior but are especially common on the Tanana River upstream from Fairbanks. Most nests are in spruce and poplar trees along the river and the shorelines of floodplain lakes. Bald eagles attend nests by mid-May. A few birds regularly winter in the Big Delta area (Ritchie 1982).

Four owl species are ***in residence,*** nesting in woodland habitats along the TAGS route: Great horned owl, northern hawk-owl, great gray owl, and boreal owl. Short-eared owls are common during migration and occasionally breed in the Interior, whereas snowy owls have been reported only during winter.

3.2.13.4 Copper River Drainage

3.2.13.4.1 Large Mammals

Caribou in the Copper River basin are distributed in the Nelchina Herd, currently estimated at about 30,000 animals, and the Mentasta Herd, estimated at about 3,000 animals in 1983 (J. Davis, ADF&G, pers. comm.). Both herds are increasing. The TAGS route transects the eastern portion of the Nelchina Herd's winter range, and some spring and fall migration occurs across the route. The Mentasta Herd is distributed to the east of the TAGS route on the northern flanks of the Wrangell Mountains but may winter as far west as the TAGS route. The calving grounds of both herds are located well away from the route (ADF&G 1985).

Moose are common in this region, and the proposed route passes through calving and winter concentration areas in the lowlands of the Gulkana River drainage (ADF&G 1973, 1985). Seasonal migrations occur across the proposed TAGS route (Van Ballenberghe 1977). This population, like that of the Yukon River region, is important for both subsistence and sport hunting.

Dall sheep inhabit the southern Alaska Range and the northern portions of the Chugach Range near the proposed TAGS route as well as the Wrangell Mountains to the east. The route approaches sheep habitat most closely in the Tonsina area near two mineral licks (ADF&G 1985). Dall sheep are found primarily on the northern flanks of the Chugach Mountains due to heavy accumulations of snow on the south side of the range (ADF&G 1976b).

Brown bears occur in relatively high densities in the region, primarily in upland tundra areas and river valleys in the foothills and mountains of the Alaska and Chugach ranges. Concentration areas have been identified near Paxson, used for denning, intensive spring activities, and feeding salmon spawning streams (primarily the upper Gulkana River) in late summer and early fall (ADF&G 1973). Intensive spring use by both species of bears has been noted in the Klutina and Copper river valleys south of Copper Center, and brown bears probably den in the area just east of and parallel to the Copper River in that vicinity (ADF&G 1973).

The bison populations along the proposed route consist of small groups that have become established in several localized areas as a result of transplants from elsewhere. The proposed TAGS route would transect the range used by bison in the Delta area, and ***possibly*** in the Chitina and Copper River areas; ***however, these bison populations range primarily on the east side of the Copper River and TAGS would be located on the west side.***

Black bears are uncommon to rare in northern portions of the Copper River drainage but are quite common in the southern portion, particularly in the foothills of the Chugach Mountains (ADF&G 1976b).

Wolves are distributed throughout this region from lowland spruce forests to mountain valleys and slopes. Densities are comparable with those in the Yukon River drainage, although hunting and trapping pressure (both legal and illegal) currently exerts a limiting effect on numbers in the region.

3.2.13.4.2 Birds

The Copper River drainage contains many species of birds common to either the Yukon River drainage or the Lowe River drainage (DOI 1976). The habitats are typical of interior taiga (Kessel and Gibson 1978). About 120 species occur along the proposed TAGS route in this region. Kessel et al. (1967) described birds and habitats found along the Richardson Highway from Delta Junction to Valdez.

Areas of good waterfowl habitat are found along the Gulkana River between and including Summit and Paxson lakes, thaw lakes between Hogan Hill and Glennallen, Willow, and Pippin lakes, and ponds adjacent to the Tonsina and Little Tonsina rivers (DOI 1972). Greater scaup, green-winged teal, American wigeon, and mallard are the principal duck species nesting in this area (King and Lensink 1971). Lakes in the Gulkana River-Glennallen area and the Tazlina-Klutina area also constitute important trumpeter swan nesting habitat. In 1968 nearly 600 adult and immature swans were observed in late summer surveys in the lowlands of the Copper River-Nelchina Basin region (DOI 1972). Spring concentrations of swans have been identified in several areas, most notably along the Copper River east of Gulkana (ADF&G 1985).

Bald eagles are common nesting raptors along the Gulkana and Copper rivers.

3.2.13.5 Prince William Sound Drainage

3.2.13.5.1 Large Mammals

The only three species of hooved mammals that occur along this portion of the TAGS route are moose, mountain goat, and Sitka black-tailed deer in the Lowe River-Valdez Arm vicinity (Roberson 1986). Black bears, brown bears, and wolves are present, although wolf density is quite low due to the relative scarcity of ungulate prey.

Moose in this region are limited to the lower 25 miles of the Lowe River valley. The population is small and will likely remain so because of the restricted amount of habitat available (Gusey 1978).

Mountain goats occur throughout the coastal mountains ringing northern Prince William Sound and are found as far north as the southern Wrangell Mountains. Although they are present from the Tonsina area south along the TAGS route, they are considered abundant only in the mountains to the east of Valdez Arm (ADF&G 1976b). Goats summer high in steep alpine habitats, moving to lower elevations and wind-blown areas as snow accumulates during winter. Young are born in late May and early June in alpine cliff habitat.

Brown and black bears are considered to be the most important large mammals along the proposed corridor, concentrating in lowlands and tidal flats in spring, moving up mountain slopes as new-growth vegetation becomes available later in the season. Bears tend to concentrate along salmon spawning streams, such as Robe Lake, in late summer (ADF&G 1973). Berries are important foods late in the season, and *at that time* bears concentrate in the vicinity of berry patches.

3.2.13.5.2 Birds

More than 200 species of birds have been recorded in the North Gulf Coast-Prince William Sound region (Isleib and Kessel 1973), which includes coastal forest, alpine, subalpine, and marine environments. Many of these species however, are uncommon, or are most abundant in the area of the Copper River delta. Nearly 150 species of birds can be found in the Lowe River area (DOI 1972).

Bald eagles congregate along the Lowe River in large numbers in fall and winter during salmon spawning. The species nests regularly in the Lowe River-Valdez area (DOI 1972); one nest is located near the proposed LNG terminal site (YPC 1986).

At least 15 species of seabirds commonly occur in Prince William Sound (Isleib and Kessel 1973). Four small seabird colonies, including a black-legged kittiwake and Arctic tern colony at Shoup Bay, occur in Valdez Arm (Sowls et al. 1978); Anderson Bay is within the foraging range of birds nesting at those colonies.

Other waterbirds, including ducks, loons, and gulls, also use the area, especially during the winter months, when large numbers of sea ducks and dabbling ducks concentrate to feed in nearshore areas. Major feeding areas include Solomon Creek, Allison Point, and Island Flats (EPA 1979).

Migrating geese, ducks, and shorebirds stop at tidal and marsh areas in and near Anderson Bay during spring and fall migration (EPA 1979). However, the major staging grounds for millions of shorebirds and waterfowl on the Pacific Flyway occur farther to the east, on the Copper River Delta (Isleib and Kessel 1973). Thus, the regional importance of Anderson Bay as a migration stop.

3.2.14 Threatened, Endangered, and Other Protected Species

Several species listed as threatened or endangered inhabit areas near the TAGS route or right-of-way during some part of the year. All threatened, endangered, protected, or candidate species which might occur near the route, including the marine nearshore areas of the Beaufort Sea and northern Prince William Sound are listed in Table 3.2.14-1, along with other species of significant interest.

Of the endangered marine species, the gray whale is present in the Beaufort Sea in such small numbers that they are considered rare. Bowhead whales are common in the Beaufort Sea, but they typically pass the Prudhoe Bay area farther offshore. Bowhead whales have been recorded inshore of the 30-foot contour west of Barter Island ***during the fall migration (Ljungbead 1987)***. Whales are discussed more fully in Subsection 3.2.10, Marine Environment.

The Eskimo curlew is listed as an endangered species but is probably extinct in Alaska, having not been sighted in Alaska since the late 1880s. Therefore, there is little likelihood any will occur along the Sagavanirktok River, part of its former range.

The threatened Arctic peregrine falcon nests and feeds along the cliffs and foothills near the Sagavanirktok River. As many as *9* nesting pairs have been recorded in the area from Prudhoe Bay to the foothills of the Brooks Range, with concentrations being recorded from the Franklin ***and Sagwon*** Bluffs area on the east side of the Sagavanirktok River. General nesting areas of peregrines present along the route are discussed in Subsection 3.2.13, Wildlife.

The endangered American *(anatum)* peregrine *is* a different subspecies than the Arctic *(tundrius)* peregrine. ***The American peregrine nests in interior Alaska, primarily*** along the Yukon and Tanana rivers and ***their tributaries. The anatum race of peregrines may also occur as a migrant or breeding bird in the Copper River region.***

Gray, fin, and humpback whales ***may be present*** in and around northern Prince William Sound and use the Valdez Arm area as a summer feeding grounds, eating marine phytoplankton, zooplankton, squid, and small fish. Humpback and fin whales forage in the northern sound in small groups containing both calves and cows. Gray whales migrate past the area in March through June and again ***from*** November ***through January.***

The Aleutian Canada goose is an endangered species and may migrate along the coast in the area near and just offshore of Valdez. They are not expected to occur in the project area and are therefore not listed in Table 3.2.14-1.

Bald eagles are not threatened or endangered in Alaska, but they and their nests are protected by several federal statutes. Bald eagles and their nests are common in the Valdez area. There are known nest sites along the Lowe River floodplain and the Anderson Bay area of Valdez Arm. ***Bald eagles nest at low to moderate densities in the interior and Copper River basin as well.***

There are no threatened or endangered plant species along the proposed TAGS route. However, several plant species are limited in their distribution, and to avoid becoming listed as endangered, are given special consideration (Murray ***1987***) along the route and are identified in Table 3.2.14-1. These species are not formally designated as threatened, but due to their scarcity BLM has adopted a policy to provide special consideration.

3.2.15 Recreation, Aesthetics, and Wilderness

3.2.15.1 Recreation

The proposed TAGS project to Anderson Bay involves no federal lands within national conservation system units.

Recreational opportunities along the proposed TAGS route include such seasonal and year-round activities as hiking, hunting, sport fishing, camping, sightseeing, climbing, boating, floating, kayaking, skiing, snow machining, dog mushing, flying, cycling, swimming, photography, wildlife viewing, ice-skating, berry-picking, and recreational mining. Outdoor activities depend on weather, time of year, and access. Since the route parallels year-round highways (Richardson, Dalton, Elliott), access to the corridor area is generally good. The area away from the existing Dalton Highway and TAPS facilities is a vast wilderness stretching from the Canadian Border on the east to the Chuchki Sea more than 300 miles away on the west. Lack of roads and developed trails, private land, and difficult terrain may hinder more extensive use. Aircraft, boats, and all-terrain vehicles offer considerable off-road access during certain times of the year. Such use is very heavy all along the route during the September hunting season.

The North Slope and Brooks Range are most used during summer for wilderness-type recreation. Lakes within the area have been popular for fishing for many years. Guides operate out of Prudhoe Bay, Galbraith Lake, and Sagwon airstrip during the fall. Gates of the Arctic National Park and Preserve is within hiking distance of the Dalton Highway; the Arctic National Wildlife Refuge (ANWR) also provides recreational hiking, fishing and wilderness opportunities, mostly for fly-in hunters and campers from Deadhorse. The gold towns of Wiseman and Coldfoot are of historical interest. The Dalton Highway has limited public facilities, and state access permits are required for all private or commercial traffic above the Dietrich River. ***There is a small camping area where the Arctic Circle crosses the Dalton Highway.*** The caribou season in this area (Unit 26) is liberal, allowing hunting nine months of the year, although with firearms shooting is not permitted within 5 miles of the Dalton Highway, hunting with a bow is allowed with certain restrictions.

The Yukon River area provides access to Kanuti and Yukon Flats National Wildlife refuges. The Yukon River and its tributaries provide popular water recreation use, especially for moose hunters during September. ***A public boat-launching facility is present in the vicinity of the Yukon River bridge.*** Berry-picking and hunting are common activities all along the Dalton Highway during fall.

Recreational use of the area south of the Yukon River to Fairbanks is heavy.

Table 3.2.14-1 Threatened, Endangered or Candidate Species, and Bald Eagles

Species	Status	Location/Comment
MARINE MAMMALS		
Bowhead whale	Endangered	Common in nearshore Beaufort Sea during fall migration.
Gray whale	Endangered	Occasional in Prince William Sound and Rare in Beaufort Sea
Fin whale	Endangered	Occasional in summer in northern Prince William Sound
Humpback whale	Endangered	Fairly common in spring and summer in Prince William Sound
BIRDS		
Eskimo curlew	Endangered	Probably extinct in Alaska
Arctic peregrine falcon	Threatened	Present north of the Brooks Range and nest in the Sagavanirktok River during the summer
American peregrine falcon	Endangered	Nest along the Yukon and Tanana Rivers and tributaries and possibly in Prince William Sound
Bald eagle	Federally protected	Common near Valdez and occurs in areas along rivers in the Copper and Tanana River drainages
PLANTS		
Yukon Aster (*Aster yukonensis*)	Category 2 Candidate	Found along the upper Koyukuk River
Arctic Pennycress (*Thalspi arcticum*)	Category 2 Candidate	Well-drained alpine slopes and gravel inactive river-beds on North Slope
Erigeron muirii	Category 3 Candidate	Well-drained gravel foot-hills north of Brooks Range

Livengood, a gold mining center, offers historical interest. The Tolovana River is popular for canoeing. The area is also popular for road hunters, fishermen, river floating, and berry-picking in the fall.

A popular, undeveloped rock-climbing area known as Grapefruit Rocks exists along the Elliot Highway ***and has been recommended for future legislative designation as a public reserve in the Tanana Basin Area Plan.*** The area is also used to some extent for picnicking, overnight camping, and cross-country skiing. Other popular outdoor use areas are the Wickersham Dome ***within the White Mountains National Recreation Area,*** the Chena Lakes Recreation Area ***managed by the FNSB and the Chena River State Recreation Area managed by the DNR/DOPOR.***

The Chatanika River State Recreation Area is in the vicinity of the TAGS project, and the Chatanika State Recreation River (proposed) is crossed by the TAGS route.

Fairbanks offers most urban amenities and necessities as well as tourist points of interest. Along the Richardson Highway south of Fairbanks the Tanana and Salcha rivers are important for recreation, as are several large lakes (Quartz, Birch, and Harding). ***Public camping areas are available at Harding Lake, Quartz Lake, Lost Lake, and at Delta Junction.***

Donnelly Dome, a low, rounded hill not far south of Delta Junction, receives considerable use by hikers. ***A public camping facility is available at Donnelly Creek.*** The ***State*** campground on Fielding Lake is heavily used ***because*** it is close to the highway. ***Additionally,*** on the Richardson Highway, Black Rapids Glacier and the Isabel Pass area offer scenic views.

Fishing is a popular recreation all over the region, principally because several high-large lakes (e.g., Paxson and Summit) offer quality fishing opportunities. ***Public camping is available on Paxson Lake and at the Gulkana River; both are used heavily by salmon sport fishers.*** There is also considerable fly-in fishing to nearby lakes. ***There is increased recreational use at Fielding Lake-Summit Lake areas. There is a state-owned campground at Fielding Lake and the Fielding Lake area is recommended for future legislative designation as a State Recreation Area in the Tanana Basin Area Plan.*** Portions of the Nelchina Caribou Herd cross the Richardson Highway in the Sourdough area south of Delta during fall migration, and hunters often congregate there in September.

The Gulkana and Delta rivers are designated under the Wild and Scenic Rivers Act but not in the area of the proposed TAGS crossings. ***Public camping is available at Sourdough Creek on the Gulkana, a popular area for grayling fishing. Camping is also available near the Gulkana airport.***

The Tazlina River is used by canoeists who put into the Little Nelchina River from the Glenn Highway and float down the Tazlina River to the Richardson Highway bridge. The ***Klutina,*** Tonsina, and Little Tonsina rivers are also used recreationally for fishing and floating. The Tiekel is also a popular fishing stream, but its flow is usually too low for floating. ***Public camping is available on the Little Tonsina and Tiekel rivers.***

Squirrel Creek Campground, a state recreation site, is found near the junction of the Richardson and Edgerton highways. Numerous other camping and scenic viewpoints are available between Glennallen and Worthington Glacier National Landmark. The Wrangell-St. Elias National Park and Preserve lies immediately east of the highway in this area. The Worthington Glacier State Recreation site, within walking distance of the road, has more visitor days than any other site in the Copper River basin.

Nineteen miles east of Valdez on the Richardson Highway and in the Chugach National Forest is Keystone Canyon, a scenic 2.6-mile-long, deep gorge by the Lowe River. The Lowe River through Keystone Canyon is popular with experienced white-water kayakers when the river is high in May, June, and July. Below the canyon, the river becomes a wide, ***braided*** stream.

A whitewater raft and kayak guiding service operates out of Valdez, providing regular runs in the 5-mile section of the Lowe River running through the Keystone Canyon. The peak season is July through August.

Recreational services available in Valdez include charter fishing boats, tours of the Solomon Gulch Hatchery and TAPS

Marine Terminal, and sightseeing by charter airplanes and boats to Columbia Glacier. There are the major fishing contests in Valdez during the summer. ***All of Prince William Sound, and a portion of Port Valdez including Anderson Bay receive heavy use by salmon anglers.***

The Prince William Sound and Port Valdez areas are highly significant outdoor recreation sites, not only because of the availability of numerous scenic and recreational resources, but also due to their proximity to the railbelt area with more than half the state's population. Outstanding natural resources, accessibility from the Anchorage metropolitan area, and availability of high-quality recreation lands within the Chugach National Forest provide a setting favoring continued rapid growth of recreational use.

State parks, forests, game refuges, and recreational sites/areas crossed by or within 5 miles of the proposed TAGS route to Anderson Bay are identified in Table 3.2.15-1. This table includes 17 existing and 8 proposed facilities. Table 3.2.15-2 identifies existing federal recreational areas.

Valdez is continuing to expand and exploit the areas natural beauty and natural deep ship harbor and is on several commercial tour routes that utilize bussing from Anchorage, two large tour boat operators based in Valdez, luxury cruise lines scheduling stops in Valdez, many one-day cruise boats and ferries depart daily, and numerous private boats and rental, including the popular barefoot cruises originate in Valdez harbor. Sites such as the Alyeska Marine Terminal, Columbia Glacier, and beautiful Prince William Sound are located in the vicinity of Valdez.

3.2.15.2 Aesthetics

North of the Yukon River, Alaska is a vast wilderness except for the presence of oil production and related transportation facilities and a few isolated communities. Although man's impact has not been totally absent, it has been localized. The area is typically pristine and natural. South of the Yukon, populated areas, the highway, and the pipeline share the same corridor space. Over the entire route, background views, except for the TAPS and the highway, are relatively untouched by human activity.

Visual resources along the route are outstanding, including vistas of North Slope tundra, limestone hills, and vast river floodplains, the Brooks Range, including Atigun Pass, Sukakpak Mountain, Castle Mountain, and Galbraith Lake. The Alaska Range, including Summit and Paxson lakes, and the Chugach Range, including Thompson Pass, Blueberry Lake SRS, Worthington Glacier, Keystone Canyon, and Prince William Sound, with its infinite variety of fiords, recreation, and wildlife viewing, offer first-class aesthetic resources.

In 1973 Alyeska prepared a comprehensive report on the aesthetics of the TAPS project (APSC 1973). The report presents major aesthetic criteria that have been used to identify aesthetically sensitive areas and discussed how the criteria are applied to prevent and mitigate disturbance of sensitive viewsheds along the route.

Since the proposed TAGS route essentially parallels the TAPS route and also involves large-diameter pipeline construction, the TAPS criteria and aesthetics plan should be generally applicable to both projects. This plan (ASPC 1973) is hereby referenced for a more comprehensive discussion on aesthetics of the proposed route.

Several of the recreational sites mentioned are formally designated recreation areas and are eligible for special protection. Possible disturbance to one of these sites is covered in the environmental consequences section.

3.2.15.3 Wilderness

Public lands north of the 68th parallel associated with the general route of TAGS have been designated by congress as an area that BLM is to evaluate existing wilderness values and to recommend to congress which areas, if any, should be included in the National Wilderness Preservation System. The overall report on this area is being prepared by BLM and will be available for public review and comments during the late spring or early summer 1987.

Table 3.2.15-1 State Parks, Forests, Game Refuges, and Recreational Sites/Areas Along Anderson Bay Route

Name of Area	TAGS Milepost	Existing/ Proposed	Land Use Plan Needs Modification to Authorize TAGS Project
Tanana Valley State Forest	397-404 (crosses) 497-512 (crosses)	Existing	No
Grapefruit Rocks	413 (crosses)	Proposed	Yes
Chatanika River State Recreation Area	434 (w/in 5 mi-east)	Existing	NA
Chatanika Stae Recreation River	433-434 (crosses)	Proposed	No
Chena Hot Springs Winter Trail	451 (crosses)	Proposed	No
Quartz Lake State Recreation Site	522 (w/in 5 mi-east)	Existing	NA
Big Delta State Historic Site	525 (w/in 5 mi-west)	Existing	NA
Delta State Recreation Site	533 (w/in 5 mi-west)	Existing	NA
Donnelly State Recreation Site	561 (w/in 5 mi-west)	Existing	NA
Fielding Lake Recreation Site	597-600 (w/in 5 mi-west)	Proposed	NA
Dry Creek State Recreation Site	673 (w/in 5 mi-east)	Existing	NA
Squirrel Creek State Recreation Site	710 (w/in 5 mi-east)	Existing	NA
Little Tonsina State Recreation Site	724 (w/in 5 mi-west)	Existing	NA
Worthington Glacier State Recreation Site	759 (w/in 5-mi west)	Existing	NA
Blueberry Lake	736 (crosses)	Existing	No
Shoup Bay State Marine Park	796 (w/in 5 mi-north)	Existing	NA

NOTE : New Table in FEIS

Table 3.2.15-2 Existing Federal Recreation Areas along the Anderson Bay Route

Name of Area	TAGS Milepost
Arctic National Wildlife Refuge (FWS)	137-162 within 5 miles W
Gates of the Arctic National Park and Preserve (NPS)	150-160 within 5 miles E
Gates of the Arctic National Park and Preserve (NPS)	174-250 within 5 miles E
White Mountains National Recreation Area (BLM)	355-360 within 5 miles W
Delta National Wild and Scenic River (BLM)	270-595 within 5 miles E
Gulkana National Wild and Scenic River (BLM)	630-635 within 5 miles E
Gulkana National Wild and Scenic River (BLM)	645-647 within 5 miles E

NOTE : New Table in FEIS

During 1980, the BLM made a special non-wilderness assessment of 4.7 million acres associated with the proposed ANGST route and .2 million acres associated with a proposed high voltage electric power line south of Delta Junction. BLM subsequently determined, after public involvement and notice in the Federal Register, that 1.5 million acres of the 2.5 million acres of federal ownership under BLM management in the special assessment area no longer contained wilderness value. This non-wilderness determination reflected their proximity to the existing TAPS facilities, existing Dalton, Elliott, Steese and Richardson Highways and the various settlements, mining areas and other related intensive land uses (BLM, 1980). TAGS is located within these previously classified non-wilderness areas between Prudhoe Bay and Miller Creek south of Delta Junction.

The preferred routing of TAGS in the vicinity of TAPS Pump Station No. 3 (TAGS mileposts 95 and 110) involve lands where BLM is prohibited from authorization any change to existing wilderness values until Congress takes final action. Accordingly, YPC has identified an optional routing that avoids these lands.

3.2.16 Cultural Resources

The following discussion provides a brief historical perspective on the territory of the different Alaska Native groups and some of the cultural history of the TAGS *route.*

The proposed TAGS pipeline would pass through the traditional territory of several Alaska Native peoples. In the Valdez Area the coastal fringe and adjacent mountains were home to the Chugachmiut, the southernmost Eskimo group in Alaska. Farther north, across the Copper River basin between Thompson Pass and Isabel Pass, the proposed pipeline route traverses the ancestral territory of the Ahtna, an Athapaskan group. The lands from Isabel Pass north to a point a few miles beyond the Yukon River belonged to the Tanana, another Athapaskan group. *The Koyukan Athapaskan's traditional territory, in the 19th century extended eastward to the Wiseman and Stevens Village area (Clark, 1981). While the distant Athapaskan* liguistic neighbors, the Kutchin, occupied the territory north of them to at least the Brooks Range divide. Though the Kutchin also hunted and camped beyond the divide in prehistoric and early historic times, the territory from the mountains to the arctic coast was home to the Inupiat (northern Eskimo).

The proposed TAGS route would not only pass by cultural resource sites reflecting the activities of these peoples, but also sites created by their immediate and more distant ancestors and those representing the presence of earlier people who may not have been culturally or genetically related to them. Cultural resources sites located as a result of archaeological surveys testify to at least 11,000 years of human activity in the area to be traversed by the proposed pipeline.

Many archaeological investigations have been conducted in the general vicinity of the pipeline to answer specific research questions, for example, Alexander's (1969) work in the Galbraith Lake region. The results were a relatively intensive survey of an area to be crossed by the pipeline. The primary cultural resource site survey of the pipeline route, however, was that associated with construction of TAPS. This route roughly parallels and is very close to the route proposed for TAGS. Investigations along the TAPS route began in the summer of 1970 and extended through the 1971 field season, at which point legal and technical difficulties delayed further work until 1974. The early effort focused on surveying the entire pipeline corridor and excavation of cultural resource sites discovered in locations where disturbance by construction activities seemed certain (Cook 1971). Field activities in 1974 and 1975 concentrated on clearance of construction areas, which involved additional surveys and in some cases excavation (Cook 1977).

The other major survey for cultural resource sites in the vicinity of the proposed TAGS route was that conducted in preparation for construction of the ANGTS (Shinkwin and Aigner 1979). The first field season (1978) was spent on that portion of the proposed route from Delta Junction to the Yukon border, but from 1979 through 1981 archaeological survey efforts were expanded on the portion of the proposed pipeline route paralleling both the TAGS and TAPS routes from Delta Junction north to Prudhoe Bay. Other than TAPS and ANGTS surveys, relatively little archaeological work has been done along the proposed TAGS corridor, except small-scale surveys have been conducted in some localities. (See, for example, (Lobdell *1987*) for citations of work in the Prudhoe Bay area) and site-specific clearances have been conducted ***by DNR*** for DOT/PF.

Table 3.2.16-1 summarizes the results of the various cultural resource site surveys conducted in the vicinity of the corridor. It lists the number of known sites (both prehistoric and historic), as entered in the Alaska Heritage Resource Survey site

Table 3.2.16-1
Cultural Resource Sites Listed on the AHRS Site Inventory for the USGS Quadrangles Traversed by the Proposed TAGS Pipeline

	SITES			
	Total	TAPS	ANGTS	10-Mile Corridor
Beechey Point	36	3	0	2
Sagavanirktok	59	8	3	13
Philip Smith Mountains	325	50	38	94
Chandalar	22	2	11	13
Wiseman	207	9	11	42
Bettles	101	48	15	79
Livengood	171	12	26	112
Fairbanks	225	0	5	11
Big Delta	95	0	2	41
Mount Hayes	329	3	N/A	130
Gulkana	99	5	N/A	32
Valdez	233	28	N/A	75

inventory, by USGS 1:250,000 quadrangle and the total sites known to be present within a 10-mile-wide corridor centering on the TAPS pipeline as constructed. The totals shown must be considered strictly provisional as a wide range of factors affects the accuracy of the actual number listed for this area on the AHRS roster. For example, Cook (1977) reported that 323 sites were located in the northern four construction sections of the TAPS pipeline, but for various reasons only 132 were entered into the AHRS inventory.

The great majority of sites discovered during these surveys are shallow scatterings of lithic debris derived from stone tool-manufacturing activities by ancient people. Many did not contain culturally or temporally diagnostic artifacts, but even these sites can provide significant data on land and resource utilization patterns. Stratified sites, sites with culturally and/or temporally identifiable artifacts, sites with good preservation of organic materials, and sites with features (hearths, tent rings, cache pits, etc.) are also known from the corridor. Such sites possess even greater potential for helping to explain the past human history of Alaska.

Several sites either listed or proposed for the National Register are found along or adjacent to the proposed TAGS route. These include the following:

- Gallagher Flint Station - a national historic landmark ***that is a 12-acre site located*** in the Upper Sagavanirktok River Valley near the TAGS route.

- Mosquito Lake Site - Proposed as a national historic register site on the east side of Galbraith Lake.

- Sourdough Lodge - a national historic landmark in the vicinity of Gulkana.

- Gakona Roadhouse - a national historic register site at approximately ***milepost 135*** of the Glen Highway ***on the Tok cutoff.***

- Keystone Canyon ***Railroad*** Tunnel - a proposed national historic landmark in Keystone Canyon.

It is difficult to formulate an acceptable cultural historical sequence for the entire corridor or even for specific areas. However, the BLM's Draft RMP/EIS for the utility corridor has given special consideration because of the high significance of these national register properties for the following areas (see Table 3.2.16-2). Broad-scale treatments such as that by Dumond (1977) dealing with Eskimo and Aleut prehistory are far too generalized to allow understanding of the specific cultural events characterizing the human history of the corridor area.

Table 3.2.16-2
Potential National Register Sites in the General Vicinity of TAGS North of the Yukon River

Site	Name	Sign	Size	Report
BET-022	Island	High	3,500	71:354
BET-026	Grayling	High	(?)	70:13;
BET-052	Pio Point	High		Gal pc
PSM-027	Putu	High	500	70:112;
PSM-042	ML-13	High	(?)	71:214
PSM-058	No Name Knob	High	(?)	Slaughter, notes
PSM-060	Ribdon	High	(?)	Slaughter, notes
PSM-072	1629	High	200	field notes
PSM-073	Blip	High	150	Slaughter, notes
PSM-074	Atigun #1	High	(?)	Wilson; jsa 81:12
PSM-075	Atigun #3	High	(?)	Wilson
PSM-076	Atigun #2	High	(?)	Wilson
PSM-092	MS 113-2	High	(?)	field notes
PSM-096	Atigun gorge	High	(?)	Kunz, notes
SAG-004	Sag-Ivishak	High	10,000	70:137
SAG-005	Sag-1; S-28	High	15	70:123

Source: Utility Corridor - Draft Resource Management Plan and EIS (August 1987)

Regional syntheses are invariably based upon the individual researcher's interpretation of the uneven archaeological record.

In northern Alaska the proposed pipeline corridor passes through territory occupied for at least the past 1,500 years, and perhaps as many as 4,500 years, depending on how one reads the archaeological record, by peoples ancestral to the modern Inupiat (Gal and Hall 1982). The more recent representatives of this sequence would be those people exhibiting the complex of cultural characteristics archaeologists refer to as Western Thule (or Late Prehistoric Eskimo) and Birnirk. Moving back in time the Ipiutak, Norton, Choris, and Denbigh complexes also are represented by sites in the area. In late prehistoric times ancestors of the modern Kutchin Athapaskans ranged over the northern flanks of the central Brooks Range. Their distant ancestors may have occupied the region in much earlier times. People represented by the Tuktu complex, and at other sites spanning several thousand years in time where the tool inventory includes lancelolate as well as notched projectile points, have tentatively been identified as Indian (under the rubric "Northern Archaic Tradition") by some archaeologists. The earliest human occupation of northern Alaska, possibly as early as 11,000 years ago, was by people (American Paleoarctic Tradition and perhaps other complexes) utilizing a tool technology based on the manufacture of lithic blades.

The prehistory of the Interior, from the Brooks Range crest south to Ahtna country, is also poorly understood, primarily because relatively few sites have been located and tested or excavated. Based on the data available in the mid-1970s, Cook (1975) placed known sites from this area into three broad occupational categories: 1) historic or late prehistoric occupations (spanning the Christian Era), definitely Athapaskan in nature; 2) an older cultural stratum (dating roughly between the time of Christ and 7000 to 8000 B.C.) which might or might not be early or ancestral Athapaskan but had strong affinities to cultural expressions found further north; and 3) a vaguely defined earlier period about which there was little agreement on the part of archaeologists. Recently Aigner (1986), reviewing the prehistory Interior from the viewpoint of 10 more years data acquisition and a slightly different theoretical perspective, reached substantially the same conclusions. She believes that ancestral Athapaskans arrived in Alaska sometime between 14,000 and 9,000 years ago sustained by a prominent microblade technology, and the subsequent cultural history of the Interior was marked by gradual adaptation to changing climatic conditions and local circumstances. Humans may have entered Alaska earlier, perhaps between 35,000 and 25,000 years ago, but evidence of their presence in the Interior has yet to be found.

Evidence of prehistoric human occupation in the area of the proposed pipeline's southern terminus, in what was historic Chugachmiut country, is even scantier. The few excavations undertaken at sites in the general area suggest that ancestors of the historic Chugachmiut have inhabited the region for at least 2,000 years (de Laguna 1956; Workman 1977).

Thus, the known cultural resource sites in the vicinity of the proposed TAGS pipeline corridor offer a glimpse of the human past across a tremendous span of time and space, allowing tentative understanding of the nature of human adaptation over time to the challenges posed by the Alaska environment.

3.2.17 Subsistence

3.2.17.1 Introduction

Subsistence is the harvest of fish, wildlife, vegetation, and other natural resources for noncommercial purposes. ANILCA Section 803 defines "subsistence uses" as the customary and traditional uses by rural Alaskan residents of wild, renewable resources for direct personal or family consumption as food, shelter, fuel, clothing, tools, or transportation; for the making and selling of handicraft articles out of non-edible byproducts of fish and wildlife resources taken for personal or family consumption; ***for barter, or sharing for personal or family or family consumption;*** and for "customary trade." It includes activities associated with the harvesting, processing, consumption, and distribution of these resources. Alaska Natives and many non-Native rural residents have traditionally participated in subsistence activities. Subsistence use of fish and wildlife and the regulations governing it are determined on an area-by-area basis by the State Boards of Fish and Game using specific criteria. The major considerations are whether or not a particular area is rural and has a history of subsistence use of specific fish and wildlife species.

The statutory definition of subsistence is as follows: Alaska Statute 16.05.940(28) defines "subsistence fishing" as "the taking of, fishing for, or possession of fish, shellfish, or other fisheries resources by a resident domiciled in a rural area of the state for subsistence uses with gill net, seine, fish wheel, long line, or other means defined by the Board of Fisheries." Alaska Statute 16.05.940(29) defines "subsistence hunting" as "the taking of, hunting for, or possession of game by a resident domiciled in a rural area of the state for subsistence uses by means defined by the Board of Game."

Alaska Statute 16.05.940(24) defines "resident" as "a person who for the preceding 12 consecutive months has maintained a permanent place of abode in the state and who has continually maintained a voting residence in the state...."

Alaska Statute 16.05.940(9) defines "domicile" as "the true and permanent home of a person from which the person has no present intention of moving and to which the person intends to return whenever the person is away; domicile may be proved by presenting evidence acceptable to the boards of fisheries and game."

Alaska Statute 16.05.940(25) defines "rural area" as "a community or area of the state in which the noncommercial, customary, and traditional use of fish or game for personal or family consumption is a principal characteristic of the economy of the community or area." The Boards of Fisheries and Game have made and will continue to make, decisions about which areas of the state are rural.

Taken together, it is clear that these definitions preclude nonresidents from engaging in subsistence hunting or fishing under state law. Likewise, Alaska residents living in temporary construction camps almost certainly could not show that such camps were their domiciles. Alaska residents legitimately domiciled in rural communities would be qualified to hunt and fish under state subsistence regulations; however, large population increases or shifts in the economies of rural communities might cause such communities to lose their "rural area" status.

The Native peoples of Alaska have pursued subsistence as a way of life for generations. Subsistence contributes to the economy, social structure, cultural traditions, nutrition, and identity of those who participate in it. The foundation of their sociocultural systems is the utilization of the natural environment and its biological resources. Subsistence foods constitute a significant portion of the diet of Native communities, particularly in smaller villages where imported foods are not readily available or are very expensive. Subsistence and employment contribute to the overall village economy.

Subsistence harvest patterns are seasonal, responding to biological cycles, proximity of resources, environmental conditions, and ease of travel and access. These patterns have a historical basis and have been modified with the establishment of permanent settlements. Most rural communities rely on specific subsistence resources to varying degrees, depending on their abundance, seasonal distribution, and proximity.

The area affected by the proposed TAGS project has been divided into five subregions for the purpose of discussing the distribution of subsistence resources and community harvest activities: 1) the North Slope Borough; 2) the Northern Corridor; 3) the Fairbanks-Delta Junction area; 4) the Glennallen-Copper Center; and 5) Valdez-Tatitlek (Figure 3.2.2-1).

A concept somewhat related to subsistence is "personal use" of fish and wildlife resources, primarily fish. Under state fish and game regulations, certain specific fisheries are opened for "personal use" harvest of fish, usually by dipnet, fishwheel, or set gill net. Harvest is limited to a specific number of fish per family member. Some of these popular fisheries are located along the proposed route.

3.2.17.2 North Slope Borough

The portion of the route within the North Slope Borough lies approximately between TAGS MP 0 and 160. Three NSB communities use this area of the route for subsistence activities--Nuiqsut, Kaktovik, and Anaktuvuk Pass. The Natives in this area are primarily Inupiat Eskimo, and their uses of the region's resources coincides with traditional Eskimo uses.

A brief discussion of the general subsistence activity patterns of Nuiqsut, Kaktovik, and Anaktuvik Pass are provided below:

Nuiqsut

Caribou represents both the single most available food source and the greatest harvest from one source. However, its availability is not stable and fluctuates with changes in population and migration patterns. Caribou are hunted when available year round, although major harvest activities center around spring and the early fall. Moose are harvested during the fall months, and furbearers are harvested during the winter and spring months. Marine mammals are also a significant component of subsistence. The fall harvest of bowhead whales has great cultural significance; seal and polar bear are harvested during the fall, winter, and spring. Other important resources utilized include freshwater fish (exploited during the entire year) and birds.

Hunting for caribou and moose occurs by snowmobile during fall, winter, and spring months. Traditional harvest areas include portions of the project route. Fish harvests are concentrated at traditional fish camps during the summer months; ice fishing occurs closer to the village.

Kaktovik

Kaktovik is located approximately 70 miles east of Prudhoe Bay. Kaktovik residents depend primarily on caribou, sheep, bowhead whale, seal, polar bear, fish, furbearers, waterfowl and other birds. For the most part primary harvest areas are located east of the Yukon Pacific project, although hunting for caribou, seal, and sheep can bring residents into areas potentially affected by the project. Caribou are hunted summer, fall, and winter; sheep primarily during the winter; bowhead whale during the fall; seal year around; polar bear during the fall, winter, and spring; furbearers during the winter; and waterfowl primarily during spring and summer.

Anaktuvik Pass

The subsistence emphasis for Anaktuvik Pass is on caribou; like Nuiqsut, caribou availability is not stable and fluctuates with changes in population and migration patterns. Caribou are hunted when available, although hunting occurs in spring and fall peaks coinciding with migration. Sheep is also a seasonally important component of diet, hunted more intensively during the fall but available year around. Other important resources include moose (year-round with a fall peak), grizzly bear (spring through fall), furbearers/small mammals (year round), and birds and fish (year round).

Resources are harvested in a broad area of the Brooks Range, including a portion of

the Yukon Pacific route. Access to resources is provided primarily by snow machine, when snow cover permits. ATVs are also used.

3.2.17.2.1 Availability of Subsistence Resources

Because the area around these three North Slope communities encompasses a diverse range of terrain that ranges from marine waters to the Brooks Range, residents utilize a variety of subsistence resources (Woodward-Clyde 1984).

Marine mammals are important NSB subsistence resources and include seal (ringed, bearded, and spotted), walrus, polar bear, and beluga and bowhead whale. Seals are hunted by boat during the summer and on the ice during the winter and spring. Polar bears are usually taken opportunistically, although they can be the specific object of hunting on the ice during the winter and spring. Bowhead whales are hunted by boat with shoulder gun "harpoons" during their spring and fall migrations; belugas are taken opportunistically in conjunction with other activities.

Terrestrial mammals hunted for subsistence include caribou, black bear, moose, brown bear, Dall sheep, and ***hare***. Caribou are hunted when present, primarily in the late spring through early winter. Moose are primarily taken in the fall near Nuiqsut and in winter in Kaktovik. Dall sheep are hunted in both spring and fall. Furbearers are hunted and trapped during winter. Access to hunting areas is by boat during open water and snow machine when snow cover permits.

Hunting for seabirds, ***game birds, small mammals,*** waterfowl, and gathering bird eggs occurs during the late spring, summer, and early fall.

A variety of fish contribute to the subsistence diet, including salmon, char, cisco, grayling, ***whitefish, lake trout,*** and some species of marine fish. Fish are taken year-round, both in coastal waters by boat and at traditional campsites on rivers and the coast. Gill nets are used both in open water and under the ice; rod and reel is also a popular method.

Various plant resources for food and other needs, including berries, roots, seeds, fuel wood, and construction materials make up the last category of subsistence resources. Harvest of these resources is frequently done in conjunction with other subsistence activities.

The distribution and proximity to villages of many of these resources is seasonally limited. In particular, caribou, bowhead whales, and specific waterfowl are present only during certain phases of migration. The location of other resources, such as polar bear and fish, depends on seasonal utilization of habitat (e.g., summer ice pack, overwintering areas).

3.2.17.3 Northern Corridor Communities

The northern corridor area runs from TAGS MP 160 to 420 and is used for subsistence activities by seven communities: Nolan/Wiseman, ***Coldfoot,*** Livengood, Bettles/Evansville, Allakaket/Alatna, Stevens Village, Rampart, and to a lesser extent Minto. Several of these communities are traditionally Northern Athapaskan; the others are the result of mining activities or highway and TAPS maintenance activities. ***The following descriptions of community subsistence are general in nature and summarize more complex harvest patterns.***

3.2.17.3.1 Availability of Subsistence Resources

Five major types of subsistence resources are utilized by northern corridor communities along the proposed route (BLM 1987):

- Hunting for moose, caribou, bear, Dall sheep, ***hare, porcupine, game birds, muskrats,*** and a variety of waterfowl;

- Fishing for salmon, char, cisco, grayling, ***several species of whitefish, burbot, sheefish, and pike;*** and other varieties of fish;

- Trapping various furbearers, including beaver, ***marten, lynx,*** fox, wolf, wolverine, marmot, and others;

- Collecting various plant resources for food and other needs, including berries, roots, seeds, fuel wood, and construction materials;

- Utilization of water resources for drinking or food processing needs.

Caribou have been historically important to residents of the subregion, although relatively recent shifts in caribou migration patterns have altered use somewhat (ADF&G 1986). They are harvested from fall through spring, depending on distribution. Access to harvest areas is provided by boat during open water and snow machine when snow cover permits.

A high percentage of households in the region participate in moose hunting (ADF&G 1986), harvested from September through March. Access to harvest areas is by boat along rivers, sloughs, and lakes; snow machine; all-terrain vehicle; and on foot.

Black bear are hunted during ***April***, May, and ***the*** late summer ***and fall months***, usually opportunistically in conjunction with other activities. Up to half the households in some communities participate in bear hunting (ADF&G 1986).

While Dall sheep are still a culturally preferred food, harvests have been reduced in recent years, partly due to the difficulty of access and time and effort involved. Some Bettles and Allakaket/Alatna residents travel between 130 and 150 miles by riverboat to hunt sheep (ADF&G 1986).

A high percentage of households in the region participate in fishing activities, depending on specific location. Chinook, chum, and coho salmon are the most important subsistence fish in this region. They are harvested from June through ***September***, primarily with set gill nets ***and fish wheels***. Fishing is a group activity that takes place at traditional fishing campsites. Whitefish are also a major fish resource, taken in the summer incidentally to salmon, early spring and late fall with small-mesh gill nets, ***and*** winter under the ice. Inconnu (sheefish), pike, burbot, and grayling are also harvested. Access to fishing sites is by boat ***during the open-water months*** and ***by*** snow machine during the winter.

Waterfowl and small game make an important contribution to subsistence resource consumption. Ducks, geese, grouse, and snowshoe hare are most commonly harvested, often in conjunction with other activities. Waterfowl are harvested in May ***through June*** and September, and hare are hunted year-round.

Nolan/Wiseman

Located on the Koyukuk River along the proposed TAGS route, Nolan/Wiseman is a historic mining community. Subsistence uses in the area include trapping along the Koyukuk River and its tributaries and moose hunting, fishing, and wood gathering (BLM 1987).

Livengood

Livengood is a historic mining community located just east of the TAGS route at Milepost 395. Subsistence uses are probably similar to Nolan/Wiseman, and include ***trapping,*** moose hunting, fishing, and wood gathering.

Bettles/Evansville

The Bettles/Evansville community (actually two adjacent communities) is a regional transportation and service hub located 30 miles west of the TAGS route; Evansville is predominantly Native, and the majority of Bettles residents are non-Native (Marcotte and Haynes 1985). Participation in employment is greater than in more traditional Native communities. Moose are the largest single source of protein in household diets. Though the availability of caribou has been low in recent years, harvest levels should increase with greater availability. Waterfowl, snowshoe hare, and black bear are also harvested. Fish provide a relatively small, though still important, component of diet than ***in*** other communities in the subregion. Hunting and trapping activities are common along the Middle and North Forks of the Koyukuk River and its tributaries.

Allakaket/Alatna

Located 190 miles northwest of Fairbanks and west of the TAGS route Allakaket and Alatna are on opposite banks of the Koyukuk River. Fishing is an important subsistence activity. Fish comprise a substantial portion of the diet. Salmon is the major species harvested. As in Bettles/-Evansville, moose is an extremely important source of protein. Sheep hunting is culturally important to residents, despite the distance and effort involved. Caribou and bear are often taken in conjunction with this activity. Near the TAGS route, residents hunt and trap along the Kanuti River and the South Fork of the Koyukuk River. Fishing and hunting also occurs on portions of Fish and Bonanza creeks (BLM 1987).

Stevens Village

Stevens Village is a traditional Athapaskan community located 20 miles up the Yukon River from the TAGS crossing. Important subsistence activities include fishing; hunting of moose, waterfowl, and small game; trapping; and berry picking. Fishing occurs primarily at traditional fish camps. Salmon is an important component of diet, and chinnok, chum, and coho salmon harvested. Portions of the pipeline corridor are used for all of these activities, particularly the Ray River drainage (R. King, pers. com., 1987).

Rampart

Rampart is a traditional Athapaskan community located approximately 30 miles down the Yukon River from the TAGS crossing. Subsistence patterns are similar to those of Stevens Village. The majority of subsistence uses by residents occur outside the utility corridor area (BLM 1987). Some trapping and moose hunting use may take place along Hess Creek, portions of Isom Creek, and the Yukon River in the vicinity of the crossing.

Minto

Located off the highway to Manley Hot Springs, ***the traditional Athapaskan community of*** Minto is somewhat more distant from the TAGS route than other communities discussed. The harvest of subsistence resources, including northern pike, sheefish, ***and*** black bear, ***occur along the Yukon River, which*** is heavily used by Fairbanks area residents. Moose, salmon, waterfowl, and small game are an important component of the diet. ***In addition to portions of the utility corridor,*** residents utilize the Tanana River and its tributaries and the area between the community and the Elliott Highway for subsistence activities.

3.2.17.4 Fairbanks-Delta Junction Communities

This subregion is located between MP 420 and 560 of the TAGS route. Unlike the areas to the north, the Fairbanks-Delta Junction communities are more urban in their orientation, with greater participation in wage employment and the cash economy. They are not classified as a rural subsistence use area by the ***Joint*** Board of ***Fisheries*** and Game and are not economically or culturally tied to pursuit of subsistence activites, although some residents participate in subsistencelike activities and personal use fisheries. This portion of the TAGS route contains three major communities: Fairbanks, North Pole, and Delta Junction. Smaller communities such as Fox, ***Salcha*** and Big Delta are also included in the area discussed.

3.2.17.4.1 Availability of Subsistence Resources and Community Use Patterns

Particular subgroups within the Fairbanks area participate in subsistence activities. In 1980 approximately 3,000 Alaska Natives resided in the Fairbanks North Star Borough (ADF&G 1986). Subsistence salmon fisheries at the Yukon River Bridge and on the Tanana River near Fairbanks ***are*** heavily utilized; ***however, they are scheduled to be reclassified as personal use fisheries later this year.*** In 1984 there were 308 subsistence permits issued for this fishery and a harvest of 8,632 fish.

3.2.17.5 Glennallen-Copper Center Communities

Located between TAGS MP 560 and 760, this subregion contains six communities: Paxson/Sourdough, Gakona, Gulkana, Glennallen, Copper Center, and Upper Tonsina. Similar to the northern corridor subregion, this area is a mix of traditional Athapaskan communities, regional service centers, and highway/pipeline maintenance camps. Subsistence patterns are further influenced by readily available road access.

In addition to subsistence activities, several of the rivers in the subregion support popular personal use fisheries.

3.2.17.5.1 Availability of Subsistence Resources

Fish harvests are the most important subsistence activity in the subregion. Sockeye salmon constitute the majority of the harvest (ADF&G 1985). Salmon are harvested from June through September using fishwheels, dipnets, and rod and reel. Fishwheels are by far the predominant method, particularly in the southern two-thirds of the subregion. Five major fishwheel sites involving 42 fishwheels are located on the Copper River in the vicinity of the proposed TAGS pipeline (Stratton 1982). Fishwheel sites have been traditional, and entire households participate in the effort, although participation has been increasing in recent years. Grayling, trout, and burbot are also harvested. Access to subsistence sites is by road and boat.

Moose are highly valued subsistence resources. They are hunted during fall months using highway vehicles, off-road vehicles, airplanes, and boats. Due to ease of highway access there has been significant competition for moose between subsistence and sport hunters. Over the past few years subsistence hunting allocations have been changed to help ensure an adequate subsistence harvest (ADF&G 1985).

Caribou have been a historically important subsistence resource, but population declines in both the Nelchina and Mentasta herds over the last two decades have restricted hunting to allow for an increase in herd size. Recent increases in caribou populations and changes in subsistence hunting seasons have allowed a fall caribou subsistence hunt. Access to hunting areas is similar to that discussed above for moose.

Other subsistence resources include small game, furbearers, waterfowl, grouse, and berries. Spruce and birch are used for firewood and home construction.

3.2.17.5.2 Personal Use Fishery

The Copper River is a very popular personal use dipnet fishery for sockeye, chinook, and coho salmon. Nearly 4,000 permits were issued for this fishery in 1987. Individuals are allocated up to 20 fish, and households up to 40 fish (ADF&G 1985). Many nonlocals participate in the fishery. Approximately 35 percent of the permits issued in 1983 went to Anchorage residents. Currently, the most popular location for dipnetting is just outside of Chitina to the east of the TAGS route.

3.2.17.5.3 Community Use Patterns

Paxson/Sourdough

Located at approximately MP 647 of the TAGS route, Paxson/Sourdough is a non-Native community with a predominantly wage employment and cash economy. Primary subsistence activities include hunting for moose, caribou, black bear, and sheep; fishing for salmon and other fish; hunting small game and waterfowl; and harvesting plants and berries. Based on surveys in 1982-83, the harvest of big game contributed 58 percent of the mean household harvest of wild resources, followed by fish (37 percent), small game (8 percent) and plants and berries (5 percent) (ADF&G 1985). Mean household harvest was about 441 pounds.

Gakona

Gakona is located on the Tok Cutoff at the conjunction of the Gakona and Copper rivers. Primary subsistence activities are generally similar to those of Paxson/Sourdough but with greater participation in the subsistence salmon fishery. Based on surveys in 1982-83, the harvest of fish contributed 69 percent of the mean household harvest of wild resources, followed by big game (24 percent), small game (4 percent), and plants and berries (3 percent) (ADF&G 1985). Mean household harvest was 614 pounds.

Gulkana

Gulkana is located on the Richardson Highway, just south of the Tok Cutoff. It has a mix of the traditional subsistence and cash economy. Primary subsistence activities are similar to those of Paxson/Sourdough. Overall household participation in subsistence is lower than many of the other communities in the subregion. Based on Alaska Department of Fish and Game surveys in 1982-83, the harvest of fish contributed 62 percent of the mean household harvest of wild resources, followed by big game (29 percent), small game (5 percent), and plants and berries (5 percent) (ADF&G 1985). Mean household harvest was about 320 pounds.

Glennallen

Glennallen is the regional service and transportation hub and is predominantly non-Native with a employment and cash economy. Per-household participation in subsistence activities is among the lowest in the subregion. Primary subsistence activities are similar to those in Gulkana. Based on surveys in 1982-83, the harvest of fish contributed 54 percent of the mean household harvest of wild resources, followed by big game (40 percent), small game (5 percent), and plants and berries (5 percent) (ADF&G 1985). Mean household harvest was about 305 pounds.

Copper Center

Copper Center is the Native regional center and exhibits a mix of the traditional subsistence and cash economy. Primary subsistence activities are similar to those Gakona but with a higher household participation in the subsistence salmon fishwheel fishery. The 1983 harvest of fish contributed 83 percent of the mean household harvest of wild resources, followed by big game (11 percent), plants and berries (5 percent), and small game (2 percent) (ADF&G 1985). Mean household harvest was about 383 pounds.

Upper Tonsina

The Upper Tonsina area includes the community of Tonsina and some scattered residences in its vicinity around Chitina ***(30 miles from Tonsina)*** and Kenney Lake ***(12 miles from Tonsina)***. Primary subsistence activities are similar to those of Gulkana. According to ADF&G the 1983 harvest of fish contributed 58 percent of the mean household harvest of wild resources, followed by big game (31 percent), plants and berries (6 percent) and small game (5 percent) (ADF&G 1985). Mean household harvest was about 305 pounds.

Valdez-Tatitlek Communities

South of MP 760 ***to*** the proposed LNG terminal at Anderson Bay (MP 796.5), ***the area is*** sparsely populated and contains only two communities: Valdez and Tatitlek. Valdez has a wage employment and cash economy. Subsistence activities by residents are minimal. Tatitlek, ***located on Prince William Sound,*** is a traditional Chugach Eskimo community that is oriented towards coastal subsistence activities.

3.2.17.5.4 Availability of Subsistence Resources and Community Use Patterns

Tatitlek

Tatitlek is not located on the TAGS route, but could be affected by related tanker traffic. Though no detailed subsistence surveys of Tatitlek have been completed, reliance on subsistence resources is similar to those of other corridor areas. A wide variety of subsistence resources is available throughout the year, unlike interior locations. Harvest activities of residents tend to be oriented to use of relatively nearby marine and coastal areas. Access to resources is primarily by boat.

Major subsistence resources include fish, marine mammals, deer, and waterfowl and bird eggs. Salmon are harvested from May through September; marine fish such as herring, halibut, and rockfish are harvested year-round. Invertebrates such as crab and clams are generally available throughout most of the year. Deer are hunted from September through December, and ducks and geese are hunted during the same time period. Seal and sea lions are hunted year-round.

3.3 REPRESENTATIVE COOK INLET-BOULDER POINT ALTERNATIVE

3.3.1 Introduction

The following subsections describe the existing environment of the representative Cook Inlet-Boulder Point alternative to the proposed TAGS project from a point just south of Livengood to the Boulder Point site on the east side of Cook Inlet. The discussion of disciplines is in the same order as found in Subsection 3.2 for the proposed action.

3.3.2 Socioeconomics

3.3.2.1 Regional Socioeconomic Conditions

About 20,000 people live along the Cook Inlet-Boulder Point alternative route from Livengood to Boulder Point. North of Cook Inlet the only major developments in this area since 1970 have been: (1) expansion of the highway-oriented business due to the completion of the George Parks Highway between Anchorage and Fairbanks; and (2) expansion of coal-mining activity at the Usibelli Mine near Healy. Most residents live in small rural settlements along the main transportation corridors.

The following section gives a brief overview of existing socioeconomic conditions in three designated regions in the Cook Inlet-Boulder Point alternative corridor: (1) Parks Highway area north of the Matanuska-Susitna Borough, (2) corridor communities in the Matanuska-Susitna Borough, and (3) corridor communities in the Kenai area. Table 3.3.2-1 gives population summaries for each area. Section 3.5.17 describes the environment between Livengood and Nenana.

3.3.2.2 Parks Highway Area

In 1986 the George Parks Highway area between Nenana and Cantwell had a population of about 1,900 persons--about the same as in 1970. During TAPS construction the only significant impact in this area was increased highway and railroad traffic. Nearly all of the inhabitants in this area live on or within a few miles of the highway or rail line. Nenana and Anderson are the only incorporated municipalities in this area.

Nenana is on the Parks Highway about 55 road miles southwest of Fairbanks. With an estimated 552 residents in 1986, Nenana functions primarily as a transportation and service center for the area south of Fairbanks. Nenana is about 40 percent Native and is the only corridor community with a high percentage of Native residents.

Nenana has a small retail and service sector. Residents rely on Fairbanks for most goods and services. A 1981 study found that Nenana residents drove to Fairbanks an average of five times per month during summer and about twice per month during winter.

In addition to highway connections to the state's primary population centers, Nenana also has rail and barge service. Most rail freight to Nenana is petroleum products, which are barged from Nenana to interior villages along the Yukon and Tanana rivers. Nenana is one of only four permanent dry cargo loading and unloading facilities on the Yukon/Tanana rivers system. The Interior's largest barge operator is located in Nenana, and approximately 32,000 tons of freight crosses the Nenana dock annually bound for villages. The community's major employers are the barge company and the Yukon-Koyukuk School District headquarters, which administers schools in 10 interior communities.

Anderson, 21 miles south of Nenana, is adjacent to the Clear Air Force Station (AFS)--an early warning missile site. A 1986 city census enumerated 397 residents in the community and 378 at Clear AFS for a total population of 775. In 1986 Clear AFS accounted for nearly 75 percent of the community's employment.

Table 3.3.2-1 Population Summary Cook Inlet-Boulder Point Alternative

Location Within Alternative Corridor	1970	1980	1986
Parks Highway Area			
Nenana	497	470	552
Anderson	362	517	397
Clear Air Force Station	426	400	378
Healy, Suntrana, Usibelli	469	443	434
McKinley Park	26	60	59
Cantwell	98	89	87
Subtotal	1,878	1,979	1,907
Matanuska-Susitna Borough			
Talkeetna area	216	708	1,100
Montana Creek area	927	1,023	1,700
Willow	38	139	232
Subtotal	1,181	1,870	3,032
Kenai-Peninsula Borough			
Kenai	3,533	4,324	6,546
Soldotna	1,202	2,320	3,668
Nikishka area	2,997	3,747	4,885
Subtotal	7,732	10,391	15,099
TOTAL	10,791	14,240	20,038

Sources: 1970 and 1980 U.S. Census, Alaska Department of Community and Regional Affairs, City of Nenana, City of Anderson, Kenai-Peninsula Borough.

The Healy area, about 56 miles south of Nenana, estimated 434 residents in 1986, residing in Healy, Suntrana, or Usibelli. The mainstay of the local economy is the Usibelli Coal Mine, which ships coal on the Alaska Railroad to Fairbanks and to Seward for export to South Korea. Other major employers in the Healy area are the Golden Valley Electric Association coal-fired generating plant and the Railbelt School District.

About 60 persons, primarily National Park Service employees and their families, live at Denali National Park and Preserve. Most of the others living along the corridor depend on tourism for their cash income. Cantwell, a highway service community with a 1986 population of 87, is located about 30 miles south of Denali Park near the juncture of the Denali and Parks highways.

3.3.2.3 Matanuska-Susitna Borough

About 3,000 people live along the alternative route in the northern Matanuska-Susitna Borough. There are no incorporated cities in this area, but there are numerous small settlements. The largest is Talkeetna, which had an estimated 441 residents in 1986. The Talkeetna area population is estimated at 1,100. About 1,700 people live south of Talkeetna near Montana Creek, and about 232 people live in Willow.

3.3.2.4 Kenai Area

The last 50 miles of the corridor is in the Kenai Peninsula Borough. There are three governments in the Kenai area portion of the corridor--the Kenai Peninsula Borough, the City of Soldotna, and the City of Kenai. In 1986 an estimated 15,099 persons lived in the Kenai/Soldotna/Nikiski area, which accounts for about a third of the population within the borough.

In contrast to other portions of the corridor the Kenai area has a diversified economic base with a well-developed retail and service sector. As shown in Table 3.3.2-2, between 1980 and 1986 total employment in the borough rose from 8,550 to 11,141, an increase of 30 percent.

In addition to petroleum, the major employers in the Kenai area are local government, retail trade, and service businesses. All sectors have grown more than 60 percent since 1980. The Kenai area economy is very oriented toward the oil and gas industry, not only because of Cook Inlet petroleum exploration and development, but also because a significant percentage of the local labor force have worked on Alyeska pipeline and North Slope petroleum projects. Many oil field services businesses are also located in Kenai.

Tourism and fishing-related businesses are also important contributors to the local economy during the summer months from May to September. The Kenai River and several other rivers on the peninsula are extremely heavily used by sport fishermen and recreationists from all over the world. They fish for salmon, steelhead, and halibut offshore and use the locally accessible beaches for some of the finest clamming in the world. Some weekends as many as 10,000 people may pass through Soldotna pursuing recreation on the peninsula.

Commercial set-net operations on the eastern side of the inlet also contribute millions of dollars to the local economy.

3.3.3 Land Use and Ownership

The pipeline route to Cook Inlet would be constructed primarily on federal and state lands in the more remote areas such as from Livengood to Nenana and Willow to Boulder Point. However, along much of the Parks Highway, regional, borough, and private landholdings are interspersed among the federal and state holdings. Clear Air Force Station would be traversed adjacent to the highway. Homesteading and numerous state land sales to Alaska residents have occurred in this area. Some of these would be crossed or closely approached by the pipeline and the compressor stations.

In the Minto Flats area south of Livengood, ***sport and*** subsistence hunting and fishing are the primary land uses. ***Minto Flats has been proposed as a State Game Refuge, and the enabling legislation is in the Legislature. Along the Tanana River the route traverses the Tanana Valley State Forest.*** From Nenana to Willow the route would be adjacent to the Parks Highway and the Alaska Railroad corridor, the primary

Table 3.3.2-2 Kenai Peninsula Borough Employment by Industry
1980 and 1986 Comparisons

Industry	1980	1986*	% Change 1980-86
Mining	800	1,001	25
Construction	600	762	27
Manufacturing	1,800	1,095	-39*
Trans., Comm. & Utilities	700	761	9
Wholesale Trade	250	376	50
Retail Trade	1,100	1,846	68
Finance, Ins. & RE	200	394	97
Services & Misc.	1,200	1,959	63
Federal Government	200	217	9
State Government	550	825	50
Local Government	1,150	1,905	66
TOTAL	8,550	11,141	30

* Based on the first six months of 1986. Thus, it is likely that average annual employment in manufacturing, which is primarily fish processing during the summer, will be somewhat higher.

Source: Alaska Department of Labor, Statistical Quarterly, various issues.

transportation arteries to the Interior of Alaska. This route borders the most highly developed industrial lands in the state. Known as the Alaska Railbelt, the corridor from Fairbanks to the Anchorage area has three major existing facilities within it. These are the Alaska Railroad, the Parks Highway, and the Anchorage-Fairbanks electrical intertie.

The route traverses sparsely developed lands with a number of peripheral roads and other developments, including several gold mining and gravel extraction operations. Just north of the Alaska Range, the route would pass near Alaska's only operating coal mine, owned by the Usibelli Company. This strip mine provides the fuel for coal-fired electric generating ***plants*** in Fairbanks, ***Healy,*** and Clear AFS and is the only coal exporting operation in Alaska.

South of the Alaska Range the volume of oil and gas produced in fields in Cook Inlet and the Swanson River fields far exceeds other minerals in value. Coal is present near tidewater in the Matanuska, Beluga, and Kenai fields. The total coal resource is estimated to be approximately 2.5 billion short tons, but none of this is presently mined. An EIS for strip mining in this area is in its final stages of completion. ***Additionally, gravel mining is an important activity in the southern portion of the Railbelt Corridor.***

The prevailing land uses typify those of a major transportation route through a thinly populated region. Fishing and hunting are still important uses in this region, but many towns and highway stops depend on visitors to Denali National Park and Preserve for the majority of their cash income. Many are closed in the winter. In addition to Denali attractions, there are numerous other recreational areas, including the huge Denali State Park, as well as activities such as hunting, fishing, boating, and trapping throughout the corridor.

Forestry potential exists along the route but is presently of limited value and only locally important. Present usage includes logs for homes, outbuildings, corrals, and heating, plus some applications in mining. ***Dimensional lumber is produced from local timber in Fairbanks.*** The heavier stands of commercial forest surround the Cook Inlet area. The prime timber species in the Susitna lowlands and Cook Inlet areas include cottonwood and white spruce. There are extensive stands of cottonwood and paper birch in the middle Susitna Valley.

ADNR regularly conducts timber sales for harvest of these renewable resources in areas adjacent to the route. Principal sale areas are between Fairbanks and Nenana, in the Susitna River valley, and on the Kenai Peninsula.

The USFS timber harvest program is primarily in areas away from the route. FWS occasionally burns or sells timber from the Kenai National Wildlife Refuge as a result of habitat enhancement programs.

Land use and management plans exist for much of the region, including a Nenana Comprehensive Planning study, the General Management Plan, Land Protection Plan, and Wilderness Suitability Review for Denali National Park and Preserve, Matanuska-Susitna Borough Comprehensive Development Plan, and the Kenai Borough Comprehensive Plan. There is also an ADNR Land Use and Resource Report published in 1978. These plans would have to be complied with or modified in areas where a gas pipeline would conflict with presently specified uses.

The primary industry of the Cook Inlet area is oil and gas production. The petroleum products industry has produced billions of dollars worth of oil and gas since 1959. There are four major petroleum facilities at Nikiski just south of the Boulder Point site.

The Susitna River mouth and delta is a part of the Susitna Flats State ***Game*** Refuge and is set aside for wildlife. The entire region traversed by the route is the primary center for the state's third largest industry--tourism and recreation. This is especially true of the Parks Highway near the Denali National Park and Preserve, Denali State Park, Nancy Lake State Recreation Area, and Captain Cook State Park

Agriculture is a dominant commercial land use of the eastern side of the Susitna lowlands near Cook Inlet. Hay farms and dairies are the primary activities.

Fish resources in Cook Inlet include anadromous species such as salmon and smelt and resident species such as flounder and halibut. Species such as halibut, while not anadromous, may be considered migratory, coming into shallower water at certain times of the year. All five species of Pacific salmon, including sockeye, chum, pink coho, and chinook, inhabit upper Cook Inlet in that order of abundance. Of these, the pink and chum contribute most of the commerical catch. ***Commercial salmon fishing is a very large industry in Cook Inlet with a 1987 value (ex-vessel) of approximately $95 million with a total of 10.2 million salmon caught.*** Sockeye, halibut, and coho are also important.

3.3.4 Transportation

The region traversed by the alternative route has a relatively complex transportation system in comparison with other parts of Alaska. It has a relatively good paved road network, most of the railroad infrastructure in the state, several large seaports and airports, and existing oil and gas pipelines in the Cook Inlet area. This area is one of the few parts of Alaska with significant competition among the various kinds of transportation. These factors result in an effective network for public transportation and commerce in the Railbelt, which the Cook Inlet-Boulder Point alternative route parallels for much of its distance.

The Parks Highway extends from Anchorage to Fairbanks and provides commercial and public vehicular access to the Interior of Alaska. Daily traffic on the highway varies, depending on the number of tourists visiting the Denali National Park and Preserve and recreational traffic traveling to fishing, hunting, and boating sites along the route. Denali National Park and Preserve recorded a daily average of about 25,000 visitors during the 1986 summer season. During the June fishing season and the September hunting season, traffic is often stop-and-go on Sunday afternoons from Wasilla to Anchorage, a distance of about 50 miles.

The Alaska Railroad, with approximately 650 miles of track connecting Fairbanks to Anchorage and Anchorage to Seward, carried more than 8 million tons of cargo during fiscal year 1984 (***ADOT/PF 1984a***) and numerous passengers between Anchorage, Denali Park, and Fairbanks. The railroad also serves as a unique supply, passenger, and mail delivery service for residents of otherwise inaccessible areas between Anchorage and Fairbanks.

There are four major ports in the region: Anchorage, Nikiski/Drift River, Homer, and Kenai on Cook Inlet and Seward and Whittier. There is considerable small-boat traffic along the Susitna River and its major tributaries, and the area is heavily used by small planes, especially during hunting and fishing season. Since North Kenai/Nikiski Road is a dead end, it is seldom used at or near its capacity.

3.3.5 Noise

Since the Cook Inlet-Boulder Point alternative route would be built along or near an existing transportation system, i.e., the Parks Highway and the Alaska Railroad, there would be considerable ambient noise derived from train and vehicular traffic, small aircraft, jet and air boats, and shooting, as described in Subsection 3.2.5. However, several sections, i.e. Livengood to Minto pass, through areas of little development, the noise level is correspondingly low.

3.3.6 Meteorology and Air Quality

The climate along the regional Cook Inlet-Boulder Point alternative route is classified in the four major climatic zones as discussed: the Arctic, the Continental Interior, the Transition, and the Maritime. The Arctic Zone extends south from the Beaufort Sea coast through the northern part of the Brooks Range. The southern portion of the Brooks Range down through the middle Susitna River basin (near Talkeetna) comprises the Continental Zone. The Transition zone (from continental to maritime climate) includes primarily the lower Susitna River basin. Generally, the area around Cook Inlet is in the Maritime Zone, although there is some modification due to the mountain barrier surrounding the inlet.

The climatic condition for most of the route to the area north of the Alaska Range is similar to that discussed in Subsection 3.2.6. The mean annual Fahrenheit temperatures in the area north of the Alaska

Range is from about 24° to 29°. South of the Alaska Range the mean annual temperature is about 29° in the more northerly part and 38° in the Cook Inlet area.

Extremes range from lower than -60° to nearly 100° north of the Alaska Range. South of the range extremes range from about -40° to 85°.

Precipitation in the area north of the Alaska Range has an annual range of from about 8 to nearly 24 inches per year. South of the Alaska Range the average annual precipitation is from 12 to 24 inches per year at lower elevations.

Winds are generally calm in the area north of the Alaska Range with high winds usually less than 50 miles per hour. South of the Alaska Range winds are generally light, although winds in excess of 50 miles per hour have been noted at several places along the route.

In the area north of the Alaska Range, ice fog, other fog, and blowing snow cause hazardous conditions along portions of the route at certain times of the year. South of the Alaska Range ice fog is less common and less persistent. Blowing snow and severe wind conditions in some of the passes through the Alaska Range, such as Broad Pass, constitute a hazard at certain times of the year, especially in late winter.

Air quality along most of the route is generally considered to be very good and characteristic of rural areas due to minimal human habitation and industrial development. A coal-fired generating facility at Healy burns 180,000 tons of coal per year, and another coal-fired plant at Clear AFS burns about 85,000 tons of coal per year. Natural, localized sources of emissions include traffic, wind-generated dust, and forest fires which contribute to temporary increases in air pollution.

Denali National Park has been classified by ADEC in 1983 as a Class I airshed under 18AAC50.020(b); whereas the Anchorage urban area has been designated under 18AAC50.021 as a nonattainment airshed.

3.3.7 Liquid, Solid, and Hazardous Wastes

Railbelt communities dispose of solid waste in a variety of ways. The primary disposal means are through landfill and both legal and illegal dumping. Due to the low population and small quantity of solid wastes, disposal is not a problem in most areas.

Hazardous materials are presently generated by several entities along the route, the major sources being the railroad, highway department, schools, and small generators such as filling stations and cleaners. Currently there is no mechanism for storage or disposal of toxic or hazardous material in Alaska, and all such materials must be transported and disposed of in the Lower 48. ***Several years ago a fire in a gas compressor plant on the Kenai Peninsula resulted in soils contaminated with PCB. Disposal of that material remains a problem.***

Sanitary wastes are generated all along the proposed route by the people and facilities there. Due to the fairly low population, disposal of sanitary wastes is not a problem except on a local level. Problems occur especially in areas which are wetlands or have a high water table.

There are virtually no common sewage disposal sites or systems along the Cook Inlet-Boulder Point alternative route. Therefore, each dwelling, business, or shopping center is left with the problem of disposing of their own liquid wastes. Most use leach fields or package sewage treatment plants. Waste concentrations in surface waters ***can be*** high in the spring due to a ***winter's*** accumulation of wastes, but generally water levels are sufficiently high during breakup to dilute waste concentrations down to acceptable levels.

3.3.8 Physiography, Geology, Soils, Seismicity, and Permafrost

3.3.8.1 Introduction

Between Livengood and Boulder Point the Cook Inlet-Boulder Point alternative route passes through six physiographic provinces as shown on Figure 3.3.8-1:

- Yukon-Tanana Uplands
- Tanana River Valley
- Northern Foothills
- Alaska Range
- Broad Pass Depression
- Susitna Lowlands

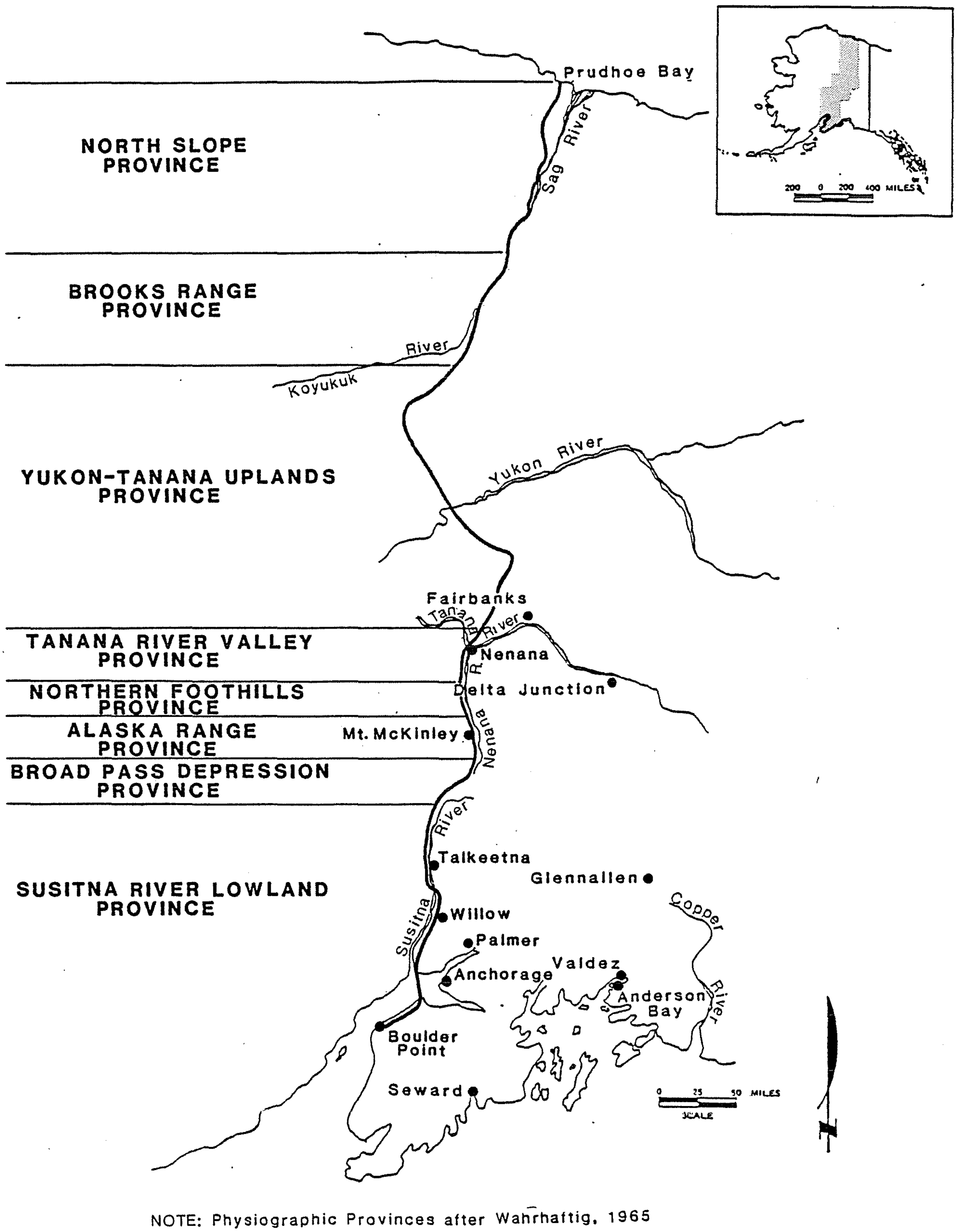


Figure 3.3.8-1 Physiographic Provinces Along the Cook Inlet-Boulder Point Alternative

Bedrock underlying the Cook Inlet-Boulder Point alternative route is generally covered by surficial deposits. The route consists chiefly of schist, claystone, siltstone, sandstone, conglomerate, shale, slate, argillite, graywacke, greenstone, and andesite. The sedimentary rocks vary from poorly to well-indurated, from thinly bedded to massive and have joint systems with spacing of from a few inches to several feet.

Deposits of surface material underlying the corridor are extremely varied. The northern section of the route is underlain by ice-rich silt, sand, gravel, and colluvium. In the Nenana-Clear area, unconsolidated sediments consist of silt, sand and gravel, dune sand, and muskeg *(peat)* deposits.

From Nenana to Talkeetna the route is generally composed by glacial outwash gravel, glacial moraine, clay, silt, and gravel.

The segment of the Cook Inlet-Boulder Point alternative route from near Talkeetna south is underlain by glacial outwash consisting of ground moraine, floodplain silt, sand and gravel, muskeg, and shallow lakes.

In the area south of Livengood in the highlands adjacent to the Tanana River continuous permafrost is encountered. The Tanana Valley contains isolated ice masses in silty alluvium. Intermittent permafrost is encountered through the Alaska Range, including the foothills both north and south. The Susitna River valley is generally free of permafrost but frozen soil may be found under patches of muskeg. The Cook Inlet-Boulder Point alternative route is seismically active and associated with the northeast extension of the Aleutian seismic belt. In addition to the 1964 earthquake (magnitude 8.5), epicenters of several shocks of magnitude 7.0 and larger have occurred within 100 miles of the route during this century.

The earthquake potential along the alternative route may be specified in terms of maximum expectable earthquakes, as shown in Table 3.3.8-1. The maximum expected earthquake is the largest earthquake that can reasonably be expected to occur, based on existing knowledge. It exceeds the largest known historic earthquake. The zonation of the route might be refined if more complete geologic and geophysical data were available.

Table 3.3.8-1
Maximum Expectable Earthquakes

Segment	Magnitude
Livengood to Clear	7.5
Clear to Broad Pass	8.0
Broad Pass to Willow	7.5
Willow to Boulder Point	8.5

Source: FPC 1976a

Depths of earthquakes along the alternative range from shallow crustal to subcrustal depths in excess of 75 miles. Two major active faults which intersect the corridor include the McKinley strand of the Denali Fault near Cantwell and the Castle Mountain Fault just west of Wasilla. An earthquake of magnitude 8 accompanied by ground breaking of at least 20 feet may occur near the McKinley strand of the Denali Fault whereas the magnitude and vertical offset on the Castle Mountain Fault would be about 7.5 and 10 feet, respectively. A delineation of earthquake epicenters (Gedney et al., 1969) indicates a seismically active fault that intersects the alternative in the vicinity of Healy.

The discussion for the Yukon-Tanana Uplands, Tanana River Valley, and the Alaska Range are similar to that found in Subsection 3.2.8 - Affected Environment. Discussion for the remaining three provinces follows.

3.3.8.2 Northern Foothills

This region of the Alaska Range includes east to west-trending ridges 2,000 to 4,000 feet in elevation with wide intervening valleys. The foothills are largely unglaciated.

The Cook Inlet-Boulder Point alternative pipeline alternative route enters the foothills on the north via the Nenana River and parallels the Parks Highway to Healy. Bedrock exposures in this section of the route should allow construction due to the solid foundation.

3.3.8.3 Broad Pass Depression

The Broad Pass Depression, 1,000 to 2,500 feet in altitude and 5 miles wide, is a trough with a glacially deposited floor. It opens on the east to a broad glaciated lowland with rolling morainal topography and central outwash flats. The bounding mountain walls of the trough are several thousand feet high. Long, narrow hills in the trough trend parallel to its axis, and the main streams in Broad Pass are in deep gorges. The trough opens to the south toward the Susitna Lowlands.

Most of the bedrock in the Broad Pass area consists of deformed, slightly metamorphosed Paleozoic and Mesozoic rocks that are also exposed in the surrounding mountains. Moraine covers the floor of the depression.

The divide between the Bering Sea and Pacific Ocean drainages crosses this depression in two places and is marked by nearly imperceptible passes. The southwestern part of the depression drains from the Chulitna River into the Susitna; the central part through the Nenana River north to the Yukon; and the eastern part by the headwaters of the Susitna. Most streams which head in Broad Pass and in the surrounding mountains are of glacial origin and are swift, turbid, and have braided beds.

Near Summit, several long, narrow lakes lie in the central parts of the trough. Moraine and thaw lakes are common in the eastern part of the depression. Most of the depression is underlain by permafrost.

3.3.8.4 Susitna Lowlands

The Susitna Lowlands are a glaciated area containing ground moraine and stagnant ice topography, drumlins, eskers, and outwash plains. Most of the area is less than 500 feet above sea level and has low local relief. Rolling uplands near the bordering Talkeetna Mountains and the Alaska Range rise to about 3,000 feet. Isolated mountains, such as Mount Susitna, rise from the central part of the lowland. The Susitna Lowlands contain a major population center and most of the developed agricultural land in Alaska.

The lowlands are drained by the Susitna River and other streams that flow directly into Cook Inlet. Most of these streams on the east side head in glaciers in the surrounding Talkeetna Mountains.

The Cook Inlet-Susitna Lowlands consist mainly of poorly consolidated, coal-bearing rocks of Tertiary age comprising the bedrock. This rock is covered by glacial moraine and outwash and deposits from former lakes and oceans. The boundaries of the lowlands consist of: a) abrupt mountain fronts that are probably fault lines and b) rolling hills of hard pre-Tertiary rocks that slope gently toward the lowlands. The uplands are probably uplifted parts of the surface on which the Tertiary rocks were deposited. The edge of the lowland generally marks the edge of the Tertiary cover, which dips gently away from the mountains. The individual mountains in the center of the Susitna Lowlands are made up of metamorphic and granitic rocks of Mesozoic age.

Dozens of irregular-shaped shallow lakes and ponds occur, primarily in morainal areas. Muskeg ponds are common in poorly drained areas.

3.3.8.5 Mineral Resources

Large deposits of subbituminous and lignite coals occur both north and south of the Alaska Range, particularly along the west side of Cook Inlet in the Beluga River area and to a lesser extent on the east side

The only active coal mine currently in Alaska is at Healy along this route. Prior to discovery of Cook Inlet oil and gas supplies, large amounts of coal for the Anchorage area were mined near Palmer.

The route also traverses numerous mineralized zones. Though the route crosses little unexplored areas, the potential for new discoveries of gold, copper, zinc, and lead along the route is only fair.

3.3.9 Surface and Ground Water

3.3.9.1 Livengood to the Nenana River

The Cook Inlet-Boulder Point alternative route departs the preferred route south of the Tolovana River crossing and follows the Tolovana Valley downstream to Minto Flats and then along the edge of the flats to the Tanana River.

The alternative route crosses many small clear-water, gravel-bed streams draining into Minto Flats. Minto Flats is a low, poorly drained area consisting of muskeg lakes and marsh connected by sluggish meandering streams.

Major floods on small streams occur mainly as the result of late summer rainstorms. Icing occurs on most stream valleys in winter as the result of groundwater discharge from fractured bedrock sources and from shallow alluvium. There are no glaciers tributary to the route in this area, and water quality is good.

The route crosses the Tanana River about 3 miles downstream of Nenana, which provides a terminal connecting the Alaska Railroad to the barge traffic of the Tanana and Yukon rivers. The Tanana River is a large, silty, braided-channel glacial river that tends toward rapid channel changes during floods. The Nenana, also a large, silty, braided-channel river, splits into several distributaries at its junction with the Tanana. The primary distributary of the Nenana River is crossed about 2 miles upstream from Nenana. Streambeds and banks of both rivers are extremely low and unstable in this area. The area floods frequently, and the main channel of the Nenana River could easily divert through another of the existing distributaries to the Tanana.

3.3.9.2 Nenana River to Summit

This 95-mile portion of the route follows the broad Nenana River valley, paralleling ***both*** the Alaska Railroad ***and*** the Parks Highway to the summit of the Alaska Range. The Nenana and its major tributaries are braided, glacial rivers which drain the northern flank of the Alaska Range. Although the Nenana and its major tributaries are glacial, there are no known glacier-dammed lakes. Major floods can result from fall rainstorms combined with glacier melt. Occasionally the Parks Highway is blocked. Soils in the northern portion of this section tend to be easily eroded. Moderately hard water of the calcium-carbonate type is readily available.

3.3.9.3 Summit to Cook Inlet

From Summit the route follows ***both*** the Alaska Railroad ***and*** the Parks Highway through Broad Pass and down the wide glaciated valleys of the Chulitna and Susitna rivers. The northern 50 miles of this section is located on a high terrace in the 5-mile-wide glaciated floor of the Chulitna River valley. Tributaries crossed drain the Talkeetna Mountains and the southern slopes of the Alaska Range and tend to be small and incised deeply into bedrock. Most of these streams are clear, and floodplains are narrow.

The lower 75 miles of this portion follows the Parks Highway through the Susitna Lowlands to Willow. This is glaciated lowland containing many small lakes separated by drumlins and eskers. In this section there are crossings of the Chulitna and several other significant streams. The Chulitna is a steep, gravel-bed river affected by large glacial outburst floods.

The streams the route crosses south of where it transects the Susitna River are less active and tend to be meandering or split channel with gravel beds. ***Generally*** water quality is excellent. Those draining the Talkeetna Mountains tend to be slightly glacial. There is no permafrost in this area, and erosion potential is minimal. Ground water is readily available and is of the calcium bicarbonate type.

This 55-mile portion of the route leaves the highway north of the village of Willow and follows a route more or less on the divide between the Susitna and Little Susitna rivers to the north shore of Cook Inlet. Only one major stream, Willow Creek, is crossed; however, the route crosses many small streams and wetlands for much of the distance. All streams crossed are relatively clear, meandering, and have gravel beds. Water quality is good and ground water is readily available, although there are few springs in that area.

3.3.9.4 Cook Inlet to Boulder Point

At the point it would be crossed, Cook Inlet is a 15-mile-wide, shallow estuary. During winter, ice floes drift with the tide. The bed consists of silts and clays over glacial gravel deposits. The bed scours easily to the gravel in response to tidal currents.

From the Cook Inlet crossing the route follows an existing gas pipeline southwesterly for about 50 miles along the coast to the terminal site at Boulder Point. Six small, low-gradient, clear-water streams draining lake basins are crossed, as well as the Swanson River, a coastal stream of some significance. Water quality of these streams is good, and ground water is readily available.

3.3.10 Marine Environment

3.3.10.1 Physical Oceanography

The affected marine environment would consist of the area of upper Cook Inlet near the LNG facilities, the marine terminal, and the marine pipeline crossing. The proposed pipeline across Cook Inlet to Boulder Point would be in an area of variable and constantly changing bathymetry, strong currents, very high tidal exchange, and floating ice during much of the winter. Currents in this area are driven more by tides than wind, and bore tides form in the area near the proposed crossing. Winds are more severe here than in the surrounding terrestrial area due to the funneling effect of the mountains on either side of Turnagain Arm. Strong glacial winds occur during summer.

Sedimentation is highly variable, and changes occur constantly in the area's shoals and bathymetry. Major rivers entering the inlet are all highly turbid from glacial flour, and the 3 to 6 m/sec currents generated by extreme tidal exchanges scour the shallow bottom and constantly redeposit the clay/silt sediments.

Ice from the tidal rivers in the area sometimes covers 10 to 80 percent of the inlet during severe cold spells. This pan ice, though usually only 1 or 2 feet thick, is dangerous to ships without reinforced hulls and to any structures placed in the water. Upper Cook Inlet freezes completely during brief periods of extreme cold and calm winds.

Water quality is good with respect to most parameters except for turbidity, which is very high. Waste discharge sources which could be exacerbated by the TAGS project include Point Woronzof, the primary municipal waste discharge point where treated sewage from Anchorage enters upper Cook Inlet, the mouth of the Kenai River where the City of Kenai discharges wastes, and from several industrial sources near Nikiski.

3.3.10.2 Marine Biology

A variety of seabirds, fish, and marine mammals such as seals and sea lions, are present in upper Cook Inlet but usually in low numbers, probably due to the extreme tides, turbid water, and low primary and secondary biological production in the upper inlet.

A large school of beluga whales uses the upper inlet as a feeding ground during summer when salmon mill at the mouth of the 20 Mile and Susitna rivers, Portage Creek, and many other west inlet streams.

Fish species of interest in the upper inlet include all five species of Pacific salmon, which are present when returning to spawn in tributaries, rivers, and streams or during outmigration of young smolt. Pacific cod, halibut, and sole, plus a few smelt and hooligan (candlefish) are also present but in small numbers and only during periods of migration or seasonal movement. Excellent razor clam beaches lie just south of the proposed terminal area.

3.3.11 Fish

The fish resources of the proposed route were discussed in Subsection 3.2.11. Most of that discussion holds true for the Cook Inlet-Boulder Point alternative route. Physical characteristics of surface waters in both areas, including glacially turbid major rivers fed by clear tributaries, are similar, and the species typically present also vary little. Approximately 100 rivers and streams, ***as identified on the 7-1/2 minute UGSG topographic maps,*** are crossed by the Cook Inlet-Boulder Point alternative route (see Table 3.3.11-1). All five species of Pacific salmon ***as well as other fish species*** are present in ***many*** of them, as discussed in Subsection 3.2.11. The fish resources are under more fishing

Table 3.3.11-1
River and Stream Crossings from
Livengood to Boulder Point

Winter Creek
Eagle Creek
No Name Creek
No Name Creek
No Name Lake Tributary
No Name Lake Tributary
No Name Tolovana Tributary
No Name Tolovana Tributary
Tatalina River (2 crossings)
Washington Creek
Chatanika River
No Name Tributaries to Minto Lake and Flats
Gold Stream Creek
Little Gold Stream Creek
Tanana River
East Middle River
Little Nenana
Nenana River
Julius Creek and 2 Tributaries
Glacier Creek
Nenana River
No Name Tributary to Nenana
Birch Creek
Bear Creek
2 No Name Tributaries to Nenana
Rock Creek
Perry Creek
Little Panguingue Creek
Panguingue Creek
Dry Creek
6 No Name Creeks
Riley Creek
Nenana River
Carlo Creek
Slime Creek
Nenana River
Jack River
Cantwell Creek
Fourth of July Creek
East Fork of the Chulitna River
Hardage Creek
Antimony Creek
Honolulu Creek
Hurricane Gulch
Granite Creek
Pass Creek
Little Coal Creek
No Name Tributary to Chilitna
Byers Creek
No Name Tributary to Chulitna
Troublesome Creek
Chulitna River
5 No Name Tributaries to Chulitna
Trapper Creek
Rabideux Creek and Slough
Susitna River
No Name Tributary to House Lake
Montana Creek
Goose Creek
Sheep Creek
Caswell Creek
Kashwitna River
196-Mile Creek
Little Willow Creek
Willow Creek
Polly Creek
No Name Tributary to Red Shirt Lake
Fish Creek
Tributary to Flathorn Lake
Miller Creek
Seven Egg Creek
Otter Creek
No Name Tributary from Scamp Lake
Swanson River
No Name Tributary from Gooseneck Lake

Table 3.3.11-2 Fisheries Harvest Data Along the Cook Inlet-Boulder Point Alternative Route

Location	Species	1975-1984 Average	1985	1986
Minto Flats (1)	NP	3,377*	--	4,903
Susitna Drainage (1)	AC, GR, WF, BB, LT, RB, NT	46,472*	41,404	--
Upper Cook Inlet	Salmon	4,380,100	5,640,000	7,956,600
Commercial	Salmon	4,079,200	5,292,800	7,942,700
Recreational	Salmon	283,500	317,900	--
Personal Use	Salmon	14,900	27,300	12,200
Subsistence	Salmon	2,500	2,000	1,700

*	1977-1984 Average	AC	Arctic Char
**	1982-1986 Average	BB	Burbot
(1)	Recreational Fishery	SS	Coho (Silver) Salmon
--	Not Available	DV	Dolly Varden
SH	Steelhead Trout	GR	Grayling
WF	Whitefish	LT	Lake Trout
RB	Rainbow Trout	NP	Northern Pike

Source: Published and unpublished data from ADF&G files.

NOTE : New Table in FEIS

pressure along the alternative route. Several primarily saltwater species are present in the lower Susitna, including hooligan (candlefish), smelt, and coast range sculpin. Also, there is little personal-use fish netting on streams crossed by the Cook Inlet-Boulder Point alternative route.

The pipeline would be buried at most river and stream crossings but would be elevated at some along the Cook Inlet-Boulder Point alternative route, including Tanana, Nenana, Hurricane Gulch, and Montana Creek. The route would parallel existing facilities, and a major highway, a railroad, and a high-voltage transmission line would parallel the Cook Inlet-Boulder Point alternative route for most of the way. There are very few streams crossed after the Cook Inlet-Boulder Point alternative route leaves the highway system near Willow.

Among the more important streams to be crossed would be Willow Creek, which has all five species of salmon present and is heavily used by sport fishermen; the Swanson River, which has a highly vulnerable run of silver salmon; and Montana Creek, which has large runs of pink and chum and a major rainbow trout population. Montana Creek receives very heavy fishing pressure because of its accessibility. Due to the lack of existing infrastructure in the lower Susitna River part of the route, access road construction would be substantial all the way to the mouth of the Susitna River. ***The Susitna River is a significant anadromous fish producing river.***

Table 3.3.11-2 presents fisheries harvest data for the Cook Inlet-Boulder Point, alternative route. It represents the mangitude of the fisheries resources potentially subject to project related impacts, and is not intended to present a comprehensive overview of the fisheries harvest along the pipeline route.

The major fishery occurring in Minto Flats is the recreational and subsistence harvest of northern pike, although burbot, grayling, and sheefish are also taken by sport fishermen. Minto Flats supports the largest recreational harvest of northern pike in interior Alaska, and although the total subsistence harvest is unknown, it could be significantly greater than the sport harvest.

Table 3.2.11-2 identifies the salmon harvest in Upper Cook Inlet, but the salmon harvest in the Susitna River drainage is not available. The Susitna River drainage is an important salmon producer with a total escapement objective of 1,360,000 fish, the majority of which are pinks. Sockeye, chum, and chinook make up smaller portions of this goal. The total recreational harvest of other species (trout, char, grayling, whitefish, and burbot) in the Susitna River drainage is also included in the table.

3.3.12 Vegetation and Wetlands

The vegetation and wetlands traversed by the proposed TAGS route south to the point of divergence (TAGS Milepost 395 near Livengood) has already been described in Subsection 3.2.12. Except for coastal sedge marsh in the Susitna Flats, no new vegetation types would be transected by the Cook Inlet-Boulder Point alternative route. However, the relative proportions of vegetation types traversed would differ from those along the Prince William Sound alternative. Vegetation types occurring along the proposed Cook Inlet-Boulder Point alternative route are described under Interior Taiga (Subsection *4.2.12*). Even in the lower Susitna River valley and Kenai Peninsula portions of the route, vegetation types more closely resemble those of the interior region than of the south coastal region.

Five broad vegetation types would be affected by the Cook Inlet-Boulder Point alternative south of Livengood. In order of estimated occurrence these types are: lowland *spruce*-hardwood forest (approximately 39 percent); upland spruce-hardwood forest (35 percent); bottomland spruce-poplar forest (15 percent); alpine tundra (7 percent); and high shrub thickets (4 percent) (BLM 1976). Although coastal sedge marsh was not specifically treated by the BLM (1976), the proportion of this type along the proposed alternative route would be on the order of one to two percent.

Lowland spruce-hardwood forest is found along the route in the Minto Flats and Tanana Flats north of the Alaska Range, along the lower Susitna River, and on the Kenai Peninsula portions of the route.

Upland spruce-hardwood forest occurs primarily in the upper Nenana and Chulitna river valleys along the route and is locally interspersed in the lowland forest type on better-drained sites. Bottomland spruce-poplar forest is found immediately adjacent to major rivers, most notably the Tanana, Chulitna, and lower Susitna. Alpine tundra is found in the passes through the Alaska Range and locally along floodplains. Coastal sedge marsh borders upper Cook Inlet, mostly in the Susitna Flats.

The major wetland areas crossed by the proposed alternative route are lowland spruce-hardwood forest and lowland bogs and marshes in the Minto Flats, Tanana Flats, lower Susitna River valley, and northwestern Kenai Peninsula. Additional minor wetland areas include shrub thickets and moist tundra above treeline in the Alaska Range, and shrub thickets on floodplains and coastal marshes in upper Cook Inlet, especially the Susitna Flats.

3.3.13 Wildlife

The species of large terrestrial mammals found along the proposed Cook Inlet-Boulder Point alternative route south of Livengood are the same as those described in Subsection 3.2.13, with two exceptions--bison and mountain goats do not occur along this route.

The proposed route passes through important winter concentration areas for moose, including major riparian habitats in a number of sections along its length (ADF&G 1973, 1985). Most moose populations of southcentral Alaska are subjected to heavy hunting pressure, both legal and illegal, as a result of the proximity of major centers of human population. The route skirts the western edges of the ranges of the Delta, Yanert, and Nelchina caribou herds and the eastern edge of the range of the Denali Caribou Herd, as shown in Figure 3.2.13-1. Only a very small portion of the Nelchina Herd would be expected to come into contact with the route, primarily in fall and winter. Dall sheep inhabit areas adjacent to the route in the Alaska Range, most notably in the Windy Pass area. Compressor Station No. 8A would be only a few miles from winter sheep range on Mount Healy but should have negligible noise impact due to the distance.

Black bears are abundant along much of the proposed alternative, especially in the Tolovana River/Minto Flats area, the Chulitna and lower Susitna river valleys, and the Kenai Peninsula lowlands. Brown bears occur in moderate densities in the Alaska Range and Kenai Peninsula portions of the proposed route and in lower densities elsewhere along the route (ADF&G 1976a, b). Wolves occur along the entire proposed route and are subjected to heavy trapping and hunting pressure in areas near human population centers, particularly on the Kenai Peninsula.

The species composition of the avifauna along the proposed Cook Inlet-Boulder Point alternative route south of Livengood is essentially ***similar to that*** described for the Yukon and Copper river drainages under Subsection 3.2.13, with the addition of a number of marine-oriented species in the upper Cook Inlet region.

The most important habitats that would be affected by the proposed alternative route are the prime waterfowl nesting and staging areas along the eastern Minto Flats, lower Susitna River valley (especially the Susitna Flats), and the Kenai Peninsula lowlands. Coastal sedge-marsh habitat in the upper Cook Inlet region hosts breeding densities of up to 60 ducks/square mile, and the Susitna Flats and Minto Flats are considered to be "especially sensitive and important from the standpoint of maintaining undisturbed habitat" (ADF&G 1976b). ***Large concentrations of geese, including snow and crackling Canada geese, use portions of this corridor as a flyway in the spring and fall. The only known nesting and rearing areas for the limited population of the Tule white-fronted geese occur along the eastern area of the Susitna Flats State Game Refuge. Minto Flats supports duck-nesting densities that are among the highest in North America. The area is also an important nesting habitat for the trumpeter swan.*** The impacts would be considered moderate.

The proposed alternative route would traverse nesting habitats of several raptor species. Bald eagles nest in lowland areas and river valleys (except in the Alaska Range); the species is a common nester along the lower Susitna River. Low numbers of golden eagles nest near the route in the

Alaska Range, but the amount of habitat for cliff-nesting raptors is very limited elsewhere along the route. There are records of peregrine falcons nesting near the proposed route south of Livengood (FWS 1982). Low to moderate nesting densities of several hawk and owl species occur in forested habitats along the route.

3.3.14 Threatened, Endangered, and other Protected Species

The threatened or endangered species of concern for either route are listed in Table 3.2.14-1. Peregrine falcon have been sighted along the Nenana and Susitna rivers, but no nest sites have been reported in this area. There are reports of historic peregrine falcon nesting near the proposed route just south of Livengood (***Alaska Peregrine Flacon Recovery Plan, 1982***).

Seasonably large concentrations of bald eagles gather along the lower Susitna River, and there are several nest sites along the Tanana and Susitna rivers and the coast of the Kenai Peninsula. Eagles gather to feed on hooligan in the lower Susitna in May and June and may occur in concentrations of 50 or more in one small stretch of the river. Eagles also congregate at the mouths of upper Cook Inlet rivers to feed on fish scraps, especially at locations where fish are cleaned by sports fishermen.

There are no threatened or endangered plants. However, there are two ***sensitive*** plant species along the Cook Inlet-Boulder Point alternative route--the Smelowskia pyriformis and the pink dandelion (Taraxacum carneocoloratum) (Murray 1980). Both are found in high passes in the Alaska Range.

3.3.15 Recreation, Aesthetics, and Wilderness

3.3.15.1 Recreation

Recreational use of much of this region is high, and there are many high-quality recreation areas available. Most of the state's population is concentrated near the route, and requirements for recreation are intensive.

Recreational opportunities in the vicinity of the Cook Inlet-Boulder Point alternative route include seasonal and year-round activities such as hiking, hunting, sport fishing, camping, sight-seeing, boating, cross-country skiing, snowmobiling, dog mushing, cycling, wildlife viewing, ice-skating, berry picking, and recreational mining. Outdoor activities depend on weather, time of year, and access. Since the route parallels a year-round highway and railroad system most of the way, access to the area is generally good. However, lack of roads and developed infrastructure, private land, and extensive muskeg hinder more extensive use, especially in summer. Aircraft, boats, and all-terrain vehicles provide off-road access during certain times of the year. Such use is very heavy all along the route during the September hunting season and in certain locations during the winter.

The Denali National Park and Preserve lies roughly midway between Anchorage and Fairbanks adjacent to the proposed TAGS. This scenic area is of national and international importance. Mount McKinley, the highest North American peak, surrounding mountains nearly as high, rolling alpine tundra vistas, and wildlife resources such as grizzly bear and caribou are available to viewers nearly every day of the summer.

In ***1982*** approximately ***580,000*** recreational visits were recorded in Denali National Park and Preserve, accounting for a total of almost ***125,000*** overnight stays (***Shives, 1988***). This number of visitors ***almost tripled*** over the previous 10-year period. Visitors engage in wildlife viewing, photography, camping, hiking, and mountain climbing. Facilities in the park are available for motorhomes, trailers, and tents at specific locations along the park road. Shuttle busses are available during the summer to take visitors along the park road to Eielson Visitor Center and to Wonder Lake on an hourly basis. The busses operate as wildlife tours also. Visitors can drive personal vehicles into the park before June and after the first of September each year.

State parks, forests, game refuges, and recreational sites/areas crossed by or within 5 miles of the proposed Cook Inlet-Boulder Point alternate route are listed in Table 3.3.15-1. This table identifies 5 proposed and 6 existing facilities.

Table 3.3.15-1 State Parks, Forests, Game Refuges, and Recreational Sites/Areas Along the Cook Inlet-Boulder Point Alternative Route

Name of Area	TAGS Milepost	Existing/ Proposed	Land Use Plan Needs Modification to Authorize TAGS Project
Minto Flats State Game Refuge	(5 crossings)	Proposed-legislation passed Senate 1987 and is now in House Resources Committee	Yes-currently covered by Tanana Basin Area Plan
Tanana Valley State Forest	395-460 (2 crossings)	Existing	No
Nenana State Recreation River	508-560 (crosses or w/in 5 mi)	Proposed	Yes
Denali State Park	593-634 (crosses)	Existing	Yes
Montana Creek State Recreation Site	666 (crosses or w/in 5 mi)	Existing	No
Willow Creek State Recreation Site	690 (w/in 5 mi-east)	Existing	NA
Susitna Valley State Forest	678-702 (w/in 5 mi-west)	Proposed	NA
Kroto Creek-Moose Creek State Recreation River Corridor	696-700 (w/in 5 mi-west)	Proposed	NA
Lower Susitna-Yentna Wildlife Habitat and Recreation Area	710-720 (w/in 5 mi-west)	Proposed	NA
Susitna Flats State Game Refuge	717-739 (crosses)	Existing	No-refuge plan in development
Captain Cook State Recreation Site	719 (w/in 5 mi-north)	Existing	NA

NOTE : New Table in FEIS

Table 3.3.15-2 Existing Federal Recreation Areas along the Anderson Bay Route

Name of Area	TAGS Milepost
Denali National Park and Preserve (NPS)1/	Crosses about 13 miles
Denali National Park and Preserve (NPS)	Within 5 miles E about 15 miles
Kenai National Wildlife Refuge	Within 5 miles W about 15 miles

1/ Crossing a National Park-Preserve requires specific authorization of Congress (see 43 CFR 36).

NOTE : New Table in FEIS

The state has developed several high-quality recreational areas along the Parks Highway. Following is a list of important recreational areas administered by the Alaska Department of Natural Resources, Division of Parks, near the Cook Inlet corridor. Recreational uses, size, and locations are given.

- Denali State Park - Cantwell, 282,000 acres, various acccess points for camping, canoeing, fishing; Byers Lake is the largest and most heavily used campground

- Nancy Lake Recreation Area - Willow, 22,685 acres camping, picnicking, canoeing, and fishing

- ***Montana Creek Wayside - Talkeetna, 82 acres, camping and fishing***

- Willow Creek Wayside - Willow, 40 acres camping and fishing

- Little Susitna Wayside - Houston, 25 acres, camping, picnicking, swimming, fishing, and boating

- Bernice Lake Wayside - Kenai, 7 acres camping, boating, canoeing, fishing, and swimming

- Captain Cook Recreation Area - Kenai, 3,620 acres camping, boating, canoeing, fishing, and swimming

The Cook Inlet-Boulder Point alternative route traverses several state and ***federal*** wildlife areas. These include the Susitna Flats State Game Refuge, the Kenai National Wildlife Refuge, ***and the proposed Minto Flats State Game Refuge (currently in the legislative process). A Conservation Management Plan for the Kenai National Wildlife Refuge was implemented in 1985. The State is in the process of developing a management plan for the Susitna Flats State Game Refuge; the draft plan was released in October 1987. The Minto Flats State Game Refuge was proposed in 1987, and although it is not yet a designated state game refuge, it is covered by the Tanana Basin Area Plan.***

Northern Cook Inlet salmon are an important recreational resource. Most sport fishing for salmon in the area is in freshwater streams.

Chinook, sockeye, pink, chum, and coho salmon are found in varying combinations and abundances in major tributaries of the Susitna River and most other streams which enter Cook Inlet.

Hooligan spawn in the early spring in several of the rivers on the east side of Cook Inlet, including 20 Mile River and the Susitna and Kenai rivers, providing sport and subsistence fishing opportunities at that time.

A major sport fishery has developed for salmon during the summer in many of the Susitna tributaries. Those streams flowing into the Susitna River from the east, such as the Willow and Kantishna and Sheep, Goose, and Montana creeks, would be crossed by this pipeline right-of-way. These rivers are major recreational resources during the summer months and receive heavy usage on weekends in June and July.

Hunting is an extremely popular activity ***in the Minto Flats, the Tanana Flats, the northern foothills of the Alaska Range, and the Susitna Flats and*** on or near the Susitna and Swanson rivers and the Parks Highway during ***the fall. Sport waterfowl would be in the Minto and Susitna Flats area, moose in the Tanana and Susitna Flats and caribou in the foothills of the Alaska Range..*** There is also considerable spring bear hunting along the Susitna River.

3.3.15.2 Aesthetics

There are areas of considerable aesthetic value in the region between Livengood and Nenana, especially in the Minto Flats area. There are scenic vistas of low hills and large valleys adjacent to the enormous wetlands area that comprises Minto Flats. This area is essentially roadless but is used by Fairbanks and interior community residents during certain periods, such as hunting season and for fishing during the summer. The area near and just south of Denali National Park and Preserve is of major scenic and aesthetic value. This route includes ever-changing views of the Alaska Range and the peaks of McKinley, Deborah, and Kerr.

The lower route is generally obscured from any large vistas or viewsheds by the presence of tall spruce, birch, and poplar along the route. Most of the route also has existing disturbance due to the railroad, the George Parks Highway, and/or the Anchorage to Fairbanks *transmission line*.

3.3.15.3 Wilderness

Along the Cook Inlet-Boulder Point alternative, the only formal wilderness area that exists is that associated with Denali National Park and Preserve. Several areas of the route have been identified as *roadless state* wildlife refuges. The route traverses both Minto *and Susitna flats*, an area which still retains wilderness character.

3.3.16 Cultural Resources

Subsection 3.2.16 summarizes the affected environment for cultural resources for the Cook Inlet-Boulder Point alternative route north of the Alaska Range.

In southcentral Alaska the relationship between the early Athapaskans and the people known to have occupied southcentral Alaska at an earlier date is not well understood (Cook 1975). At the time of European contact, Cook Inlet was occupied by the Tanaina Indians (Osgood *1966*). The Tanaina probably moved into the area in late prehistoric times, having been preceded by the Pacific Eskimo (Dumond and Mace 1968:19). There is evidence of at least seasonal use by the Pacific Eskimo of the Cook Inlet area, including the upper and middle reaches, until late prehistoric times (Dumond and Mace 1968; Reger 1977; NPS April 1987). The middle region of the inlet has shown a pattern of coastal occupation by the Eskimo and coastal and interior occupation by the Indians (Reger 1977:37). It is known that by 500 A.D. Athapaskans occupied interior Alaska and utilized a subsistence strategy similar to that assumed for the people of earlier periods.

Linguistic studies by Kari (*n.d.*) indicate that the Cook Inlet-Boulder Point alternative route area was occupied in recent history by Athapaskan-speaking people. In general the southern portion of the project near Cook Inlet was occupied by Tanaina and the northern portion of the route was dominated by the Ahtna Indians. The origin of either group is not well understood, but it appears the Ahtna may have occupied the interior area for a considerable time (Workman 1977). The Tanaina probably are recent arrivals to the upper Cook Inlet area (Osgood 1966, Reger 1977).

The prehistoric cultural resources of the Alaska Range in the vicinity of Denali National Park and Preserve include some of the oldest sites found to date in Alaska. Representations of the earliest known culture in the area are found at the Dry Creek Site, west of Healy just outside the park boundaries. This site, which is a National Historic Landmark, has been dated to 10,500 years before the present (NPS April 1987).

The area between the inner and outer mountains of the Alaska Range within Denali National Park and Preserve was a relatively marginal resource area for prehistoric populations. However, this condition of marginality probably varied over time because there are significant site concentrations in select river valleys. The Teklanika River valley contains the densest as well as the most important concentration of sites, including the Teklanika Archaeological District which is listed in the National Register. Other, less spectacular concentrations of sites occur in the adjacent Savage and Sanctuary river valleys (Davis 1980; NPS April 1987).

The Teklanika sites include a major campsite, a lithic material quarry, and assorted hunting lookouts. Many of these sites may be related to one another and are possibly contemporaneous (Davis 1980). Remains from the main Teklanika sites have been described as representative of the Denali Complex (Paleoarctic Tradition) (West 1975). This complex may date to 10,000 years before the present. Material at the remaining sites suggests affinities to the Northern Archaic Tradition and later phases of the Arctic Small Tool Tradition (Davis 1980). A large amount of the material found to date probably represents the several different Athapaskan Indian groups who frequented the area (NPS April 1987).

Archaeological studies have been performed along or near the proposed Cook

Inlet-Boulder Point alternative route by the Susitna Hydroelectric Project and the Anchorage-Fairbanks Intertie Project. The studies suggest this alternative route passes near a potentially important archaeological site, and the possibility is high for further significant finds in the area. The Dry Creek Archaeological Site, entered on the National Register in 1974, is thus far the oldest reliably dated site of human occupation in Alaska. Artifacts from the site show certain similarities to the later Upper Pleistocene Diuktai culture of northeastern Siberia. The site is also capable of yielding important paleoecological information. It is located about 100 miles south of Fairbanks near Healy.

The first recorded European contacts were related to the exploration of Captain James Cook, who sailed into the inlet in 1778. A Russian trader with the Zaikov expedition had established trade links with the Ahtna Indians by trading through the coastal Chugach Eskimos in the early 1700s (de Laguna 1972).

Trading camps established by 1783 along Cook Inlet later became staging areas from which military and geological survey parties explored and mapped interior Alaska during the late nineteenth century. By the late 1800s, gold prospectors were searching much of the Susitna River basin. In 1903 gold was discovered on Galina Creek, later renamed Valdez Creek, which became the center of Susitna basin gold mining. Overland trails and supply routes developed. Most of these routes utilized the Richardson Trail, which originates in Valdez, since there was no convenient unloading facility on Cook Inlet. Consequently, the movement of men, supplies, gold, and furs to and from the Alaska Interior was primarily east of the Talkeetna Mountains.

It was not until around 1915 that there was renewed interest in transportation routes to the middle and lower reaches of the Susitna Valley. Congress authorized construction of the Alaska Railroad, and a northern route was selected which eventually paralleled the Susitna River for much of the way to Fairbanks. The railroad was completed in 1923. Roadhouses were built simultaneously with construction of the railroad, at one time numbering about 50 along this route. Of these, only the Wasilla Roadhouse near Knik is on the National Register. It ***was not*** until 1973 that the Parks Highway between Fairbanks and Anchorage was completed. Until then, the only access to the Fairbanks area and to Cantwell and the Mount McKinley area park was via the Richardson and the Denali highways. The Denali Highway between Paxson and Cantwell is still a gravel road.

3.3.17 Subsistence

The area affected by the proposed Cook Inlet-Boulder Point alternative route has been divided into three subregions for the purpose of discussing the distribution of subsistence resources and community harvest activities. These communities are: Nenana, upper Cook Inlet, and the Anchorage/Kenai Peninsula.

3.3.17.1 Nenana Corridor Communities

The Nenana Corridor begins approximately at Livengood and ends at Denali National Park and Preserve. Five potentially affected communities are located in the corridor--Minto, Nenana, Anderson-Clear, Healy-***Suntrana***, and McKinley Village. Of these communities, Minto is a predominantly traditional Athapaskan village; Nenana has a mixed population of Native and non-Native residents; and the remainder have small non-Native communities with economics that revolve around the military, mining, and service-tourism.

3.3.17.1.1 Availability of Subsistence Resources

Four major types of subsistence resources are utilized by Nenana Corridor communities.

- Hunting for moose, caribou, bear, sheep, ***hares***, and a variety of birds and waterfowl.

- Fishing for salmon, char, cisco, grayling, and other species.

- Trapping various furbearers, including beaver, martin, fox, muskrat, wolf, wolverine, marmot, and lynx.

- Collecting various plant resources for food and other needs, including berries, roots, seeds, fuel wood, and construction materials.

Moose are the most important subsistence resource of this area. In Nenana, 95 percent of surveyed households reported participating in moose hunting during a 12-month period of 1981-82 (ADF&G 1986). Moose hunting takes place along rivers and off-the-road systems, primarily in the fall, but it may continue into the winter months. Important use areas include the Minto Flats; the Tanana, ***Teklanika***, Tolovana, Chatanika, and Wood rivers; and along the Parks Highway as far south as Cantwell. Boats and all-terrain and highway vehicles are commonly used during the fall for hunting access; snowmobiles are used in winter when snow cover permits.

Compared to moose, the subsistence resources of caribou, bear, fish, and Dall sheep are less important. Increased expense and effort, competition with sport hunters, and concerns about depleting the ***resources*** are mentioned as reasons for low subsistence hunting effort for species identified (Shinkwin and Case 1984). Hunting for these animals mostly takes place in the fall, although bear are also hunted in spring. The hunting of Dall sheep is more likely to take place away from the TAGS corridor. Though they may not represent a large portion of subsistence harvest, many households participate in hunting for small game, birds, and waterfowl. In Nenana a recent survey showed that household participation was 82 percent for hare, 77 percent for waterfowl, and 73 percent for ptarmigan and grouse (Shinkwin and Case 1984). Peak waterfowl hunting occurs in September along rivers, lakes, and sloughs, particularly in the Minto Flats and the Linden Lakes areas. Upland game birds and ***hares*** are harvested throughout the year.

Fish are another important subsistence resource, particularly for the community of Nenana, which harvests chinook, chum, and other salmon on the Nenana and Tanana rivers. Fishwheels and set nets are used to harvest salmon. Most fishwheel and set net sites are concentrated along the Tanana River within 6 miles up and downstream from Nenana. Communities to the south of these river systems tend to be less dependent on salmon and also harvest other fish resources. Salmon fishing takes place in summer ***and fall.*** Fishing for other species, such as cisco, grayling, and char, occurs during winter using set gill nets deployed under the ice.

Game Management Unit (GMU) 20, which includes this segment of the TAGS alternative route, is one of the most heavily used trapping areas in the Interior (ADF&G 1986). The area's population and road access contribute to this high use. Activities are concentrated along the Parks Highway and side roads and along the river systems. Trapping provides an important supplementary source of cash and products for local handicrafts. Snow machines are the most commonly used means of access to trapping areas, although dog sleds and aircraft are also used.

3.3.17.1.2 Community Use Patterns

Minto is a traditional Native ***Athapaskan*** community with road access to the Elliott Highway. Moose, salmon, ***whitefish, pike,*** waterfowl, and small game are important components of the diet. Residents utilize the Tanana River and its tributaries, ***the Minto Flats*** and the area ***south of the*** Elliott Highway ***to the Tanana River*** for subsistence activities. Additional information on subsistence characteristics of Minto is presented in Subsection 3.2.17.

Of the other communities in this area, Nenana is the only one with a significant Native population; 46 percent in 1980 (ADF&G 1986). The economy is a mix of traditional subsistence and wage employment. Moose and salmon are among the most important subsistence resources, and household participation in hunting for waterfowl, upland game birds, and small game animals is also high. Harvest activities are concentrated along the waterways accessed by boat (rivers, sloughs, and lakes) and along the Parks Highway and secondary roads.

The remaining three communities are predominantly non-Native and are wage-employment oriented, although subsistence contributes to their economies. ***They are not classified as rural by the Joint Boards of Fisheries and Game.*** Subsistence***like*** activities are oriented towards hunting of moose, waterfowl, upland game birds, sheep, and small game animals and trapping. Subsistence*like* activities are focused along the Parks Highway and adjacent areas where access is available.

3.3.17.2 Upper Cook Inlet Communities

The upper Cook Inlet section of the route stretches from just south of Denali Park and Preserve along the Parks Highway to Houston. The area includes six communities: Cantwell, Summit, Talkeetna, Montana Creek, Willow, and Houston. These communities are primarily non-Native and have wage-based economies with some contributions by subsistence. The National Park Service considers Cantwell a fish and game subsistence resident zones for Denali National Park and Preserve. This means that residents of these communities are allowed to subsistence hunt and fish in the park.

Considered part of the Railbelt area, the nature of subsistence activities of these communities is a mix of rural and urban, unlike traditional Native communities. ***Of these communities, only Cantwell and Summit are classified as rural by the Joint Boards of Fisheries and Game.*** Because of their location and road access, they do not meet the present state definition for subsistence users, and their harvest of fish and wildlife is considered to be recreational. In addition, several more communities located off the Parks Highway may use the proposed route area for subsistence*like* purposes, including Petersville, Peters Creek, and Trapper Creek.

3.3.17.2.1 Availability of Subsistence Resources

Resources used for subsistence by these communities are similar to those of the Nenana Corridor and include moose, caribou, bear, Dall sheep, salmon and other fish, waterfowl and upland game birds, small mammals, furbearers, berries, and edible plants. Harvest periods are also similar to that of the Nenana Corridor. Moose are hunted during the fall months along the Parks and Denali highways and the various systems connected to them by boat along the Susitna and Chulitna rivers and their tributaries. Access is sometimes by airplane. Salmon are harvested by rod and reel from June through September. Access is usually by boat and the road systems. Harvest of nonsalmonids occurs year-round. Waterfowl are also harvested during fall, along with small game into the winter. Trapping begins in November and continues into April and May except during warm springs. Access is along the road system, by boat, and by snow machine.

3.3.17.2.2 Community Use Patterns

The small and rural communities along the Cook Inlet-Boulder Point alternative route in upper Cook Inlet area have wage employment economies, but harvest of fish and wildlife and trapping contribute to the economy. Though specific data are not readily available on household participation in fish and wildlife harvest, it appears that moose is the most important subsistence resource, followed by salmon. Many households are likely to participate in hunting for waterfowl and small game and to a lesser extent sheep and caribou, which are less accessible and require greater effort. Trapping contributes to cash income in most of the smaller communities.

3.3.17.3 Anchorage-Kenai Peninsula Communities

This segment of the alternative route runs from Wasilla to the Boulder Point LNG terminal site on the Kenai Peninsula. The affected communities include Big Lake, Anchorage, Nikiski, Kenai, and Soldotna. As was the case for the upper Cook Inlet communities, they are connected to Anchorage by the Railbelt transportation system, and residents of this area generally do not qualify for subsistence harvesting as classified under state policy as rural residents. Specific subgroups in all of these communities participate in subsistence activities, particularly Natives on the Kenai Peninsula.

3.3.17.3.1 Availability of Subsistence Resources and Community Participation

For the upper Cook Inlet communities, fishing and moose hunting are popular subsistence and recreation activities. Salmon fishing occurs from May to October in streams in the Mat-Su Valley and in streams along the coast of the Kenai Peninsula. The Susitna and Little Susitna rivers, located near the alternative route, are popular rivers for salmon fishing. Rod and reel is the primary method of harvest, although a personal use set-net salmon fishery is often opened in certain areas along the route. Access to fishing areas is by road, boat, and airplane. A random sample of households in the Anchorage and Palmer/Wasilla showed that 1978-79 household participation ranged from 28.6 to 39.9 percent for freshwater fishing (ADF&G 1985). Fishing for rainbow trout, grayling, burbot, and other freshwater species occurs throughout the year along the area's rivers, lakes, and streams.

Though not quite as popular as fishing, the Alaska Public Survey of Anchorage and Palmer/Wasilla showed that 1978-79 household participation in moose hunting ranged from 13.2 to 21.4 percent. Popular moose hunting areas include GMU's 16 A and B along the Susitna River, 14 A-C to the east, and 15 B and C on the northern Kenai Peninsula. Hunting takes place primarily during the month of September. Access is by road, boat, snowmobile, and airplane.

Other important subsistence/recreation activities include hunting for waterfowl along coastal flats and wetlands (with seven percent household participation) during September and October and hunting for small game (8 to 11 percent household participation). Popular waterfowl hunting areas along the alternative route include the Susitna Flats and the Chickaloon Flats on the Kenai Peninsula.

3.4 CONCEPTUAL GAS CONDITIONING FACILITY - PRUDHOE BAY

3.4.1 Introduction

Although the conceptual gas conditioning facility (GCF) is not a part of the TAGS application, it is a connected action. The following section describes the existing environment and ambient conditions for the proposed GCF located at Prudhoe Bay adjacent to the central gas facility (CGF). The technical sections are grouped into similar or related topics whenever possible.

3.4.2 Affected Environment

Socioeconomics

Socioeconomic factors existing in the North Slope Borough (NSB) are discussed in detail in Subsection 3.2.2.2.1. The Prudhoe Bay/Deadhorse complex is located primarily on state-owned land within the NSB. The NSB has eight Native villages and several military and industrial sites. None of the borough's villages are located within 50 miles of the conceptual GCF. However, the conceptual GCF would be located within the borough and subject to local property taxes.

NSB villages have experienced substantial population growth since 1970 due to high immigration by Natives due to availability of high-paying NSB jobs, construction of new housing and other amenities, new schools in villages, and a high birth rate. Oil industry and construction workers based at Prudhoe Bay and other locations typically exceed the population of all NSB villages. The Prudhoe Bay work force ranged from 5,200 to 7,000 in 1983.

NSB tax revenues from Prudhoe Bay and adjacent developments are the major force in the North Slope economy. NSB employment statistics show a total of 9,392 jobs within the borough in 1985. Most of the jobs were located at Prudhoe Bay. The majority of employment in the villages was with the government.

Land Use and Ownership

The conceptual GCF site is located several miles south of the CGF. This site is owned by the State of Alaska. The primary land use in the area is industrial.

Transportation

A detailed discussion of transportation is presented in Subsection 3.2.4.2. The Prudhoe Bay area is serviced by Spine Road and a series of gravel roads, annual sealifts and barges during the ice-free seasonal window of August and early September, and the Deadhorse Airport.

Noise

Noise carries considerable distances during calm, cold conditions due to increased air density. The major noise sources in the Prudhoe Bay area, identified by personnel, were the central compressor plant, the central power plant, drilling sites, flow stations, and gathering centers (FERC, 1980). Sound levels generated at the central compressor plant have been identified at 74 dBAs at 15 meters from the turbine air intake and 60 dBAs at 120 meters from flare operation (FERC, 1980). These ambient levels are affected by wind and other atmospheric conditions. Noise is discussed in detail in Subsection 3.2.5.

Meteorology and Air Quality

A detailed discussion of meteorology and air quality of the North Slope is presented in Subsection 3.2.6.2. Prudhoe Bay experiences some of the most severe temperature and wind conditions in the state. Minimum winter temperatures average between -15 and -30 degrees F with extremes of -40 to -80 degrees F. Winter winds average 10 to 15 mph. Summer temperatures warm to the 40s with temperatures in the 60s common near the foothills (USACE, 1984).

This area is semiarid with an average 4 to 6 inches of precipitation annually. Average snowfall is approximately 63 inches. Whiteout conditions can occur restricting driving, flying, and outside work due to a lack of visibility (BLM, 1976).

Ice fog, a phenomenon peculiar to arctic and subarctic regions, is minimal at Prudhoe Bay because of the constant wind. The Beaufort Sea, pickup and diesel trucks, fossil fuel space heaters, sewage treatment plant, and animal respiration are the major contributors to ice fog at Prudhoe Bay (FERC, July 1980).

Liquid, Solid, and Hazardous Waste

Waste generation and disposal are discussed in detail in Subsection 3.2.7. Solid waste is primarily disposed of in approved landfills. An existing solid waste landfill is used by the oil industry on the North Slope. Incinerators are also used for solid waste disposal.

Liquid wastes generated by the construction and operation of the conceptual GCF include domestic wastewater, equipment washdown, storm water runoff, and industrial wastewater. Domestic wastes would be treated by wastewater treatment plants.

There are no facilities in Alaska for the storage or disposal of hazardous waste. All such materials must be disposed of by transport to the Lower 48 states.

Physiography, Geology, Soils, Permafrost and Seismicity

These topics are discussed in detail in Subsection 3.2.8.1. Much of the information in this subsection was obtained from Section B2 of the FEIS for the Prudhoe Bay Project (FERC, July 1980). The GCF would be located within the Arctic Coastal Plain in the North Slope physiographic unit. This relatively flat region extends north from the Arctic Foothills to the Arctic Ocean with few variations in its overall gentle slope to the sea. Its low relief and the presence of widespread shallow permafrost has lead to the formation of thousands of shallow lakes and extensive marshy or boggy areas (FERC, July 1980).

The site of the conceptual GCF generally consists of 400 meters of stratified sandy gravels with interbedded lenses of gravelly sand, sand, and silty sand. The bedrock is formed by generally flat-lying Cretaceous and Tertiary mudstones and siltstones. The proposed GCF would be located on upland tundra deposits approximately 8 meters higher than the various lacustrine deposits which occupy the numerous shallow depressions on the adjacent coastal plain (FERC, July 1980).

Soils on the coastal plain are generally level and poorly drained. Soils associated with floodplains near active or abandoned stream channels, coastal deposits, or sand dunes may have good drainage. Well drained soils do not appear in the immediate area of the conceptual GCF site (FERC, July 1980).

The permafrost is continuous in this area of Alaska and may extend to depths of 1800 feet. The active layer within the on-site tundra deposits is generally less than 1.5 feet. The moisture content may be 50 to 200 percent in silts and sands and 5 to 20 percent in sandy gravels (FERC, July 1980).

The conceptual GCF site is located within Seismic Risk Zone 1 of the Uniform Building Code, and the maximum Modified Mercalli Intensity for this area is III. Therefore, seismicity is not a significant hazard to the proposed GCF (FERC, July 1980).

Surface and Ground Water

North Slope surface and ground water hydrology, quality, and use are discussed in Subsection 3.2.9.2. Much of the following information was obtained from Section B3 of the FEIS for the Prudhoe Bay Project (FERC, July 1980). There are three main watersheds in the Prudhoe Bay region. They include the Put River basin, Kuparuk River basin, and the Sagavanirktok River basin. The Arctic Coastal Plain contains thousands of shallow lakes and ponds, a number of braided rivers, and many small streams. Coastal lakes are near or open to the ocean and account for 80 percent of the total surface area. These lakes generally range from 0.6 to 6 meters in depth. Lakes or ponds on the North Slope generally freeze over by mid to late September and remain frozen until late June or July (FERC, July 1980).

Precipitation and existing surface water bodies are the primary sources for ground water recharge. Water reaches aquifers only through unfrozen areas that perforate the permafrost. Ground water that flows between the vegetative mat and the permafrost migrates along the permafrost table until it discharges at the surface or reaches an unfrozen zone. In areas where the permafrost table is close to the surface, marshy or swampy conditions are dominant. Deep ground water recharge, storage, and outflow is virtually eliminated by the thick permafrost layers found on the North Slope.

Marine Environment

The following subsection was summarized from Section B3 of the FEIS of the Prudhoe Bay Project (FERC, July 1980).

The astronomic tides in the Beaufort Sea are considerably smaller than the meteorologic tides and are generally mixed semidiurnal with mean ranges from 10 to 30 cm. The tide appears to approach the shelf from the north.

From November to May, there is no significant wave activity along the Beaufort Sea coast because the sea is frozen. As the ice begins to break up in June, the predominantly northeastern winds generate waves of less than 1 meter. Some waves have been recorded as high as 1-3 meters during severe storms in July and August. Wave activity declines in October, and virtually all waves are less than 1 meter.

The maximum recorded wave height for Prudhoe Bay is 0.3 meter (FERC, July 1980).

Throughout the nearshore Beaufort Sea, currents are caused primarily by the wind. Circulation during the summer is related closely to local wind patterns.

The currents and circulation patterns of Prudhoe Bay are very complex because of the variability of the bottom topography and absence of barrier islands. Gyres, counter currents, and null areas occur frequently within the bay and are influenced markedly by wind direction and velocity. The Arco causeway influences the circulation of the western part of the bay to some extent. Computer simulation of a variety of wind conditions demonstrated that the Arco causeway separated the bay into two different but related wind-responsive circulation patterns.

Circulation patterns and current velocities are determined principally by wind because of the relative weakness of tidal forces and small tidal amplitudes. These wind-generated currents usually are strong enough to mix waters of different salinities or temperatures, preventing persistent stratification of water layers. The effect of the wind on currents appears to persist through a large portion of the water column (3-5 meters in depth) (FERC, July 1980).

The coast erodes at a rate of 1.4 meters per year. Mildly severe windstorms, expected to occur every 5 to 6 years, will generate waves of 0.6 to 1.2 meters and will accelerate this "normal" erosion rate. The character and depositional pattern of sediments in Prudhoe Bay are influenced primarily by the Sagavanirktok and Put rivers. The very fine materials are found in water deeper than 1.8 meters because of their movement offshore in response to nearshore wave energy. Gravel is present, although not prevalent, in a few areas west of the Arco causeway.

The sands, sandy silts, and silty sands contain little organic carbon (average 0.37 percent of weight). This is because of the relatively low biological productivity of the bay. It has been reported that total organic carbon values are 2.95 percent of weight from the deeper bottom samples of Prudhoe Bay (FERC, July 1980).

Prudhoe Bay generally is frozen over from September to June. The ice can reach 2 meters in thickness. Most of Prudhoe Bay is frozen to the bottom, except in the deepest part of the bay, where approximately 0.5 meter of water remains.

The ice begins to weaken and melt in May and breaks free of the beach in June, but the area is not clear of ice until July. In May and June, river water flows out onto shorefast ice. As channels melt in this ice, the river water drains through it and may scour the bottom sediments. This "strudel" scour can excavate depressions several meters deep. These depressions are filled with sediments entering from the rivers following break-up (FERC, July 1980).

Fish

Marine and anadromous fish are important to the Inupiat Eskimos for subsistence as well as limited sports and commercial fishing. Perennial springs, larger lakes, and deep pools (greater than 7 feet in depth) in rivers and major tributaries may provide the only source of flowing or unfrozen water during the winter period. These waters are critical to the survival of overwintering freshwater and anadromous fish and their eggs. Fishery resources of Alaska are discussed in detail in Subsection 3.2.11 of this EIS.

Vegetation and Wetlands

Vegetation and wetlands are discussed in detail in Subsection 3.2.12. The site of the conceptual GCF is located in the Arctic Coastal Plain in the arctic tundra region described in Subsection 2.3.12.2. The coastal plain generally supports wet tundra vegetation due to the shallow, saturated active layer above the permafrost. Wet tundra consists of almost continuous coverage of sedges and grasses. Mosses and dwarf shrubs are frequently present in better drained sites. Rooted aquatic plants predominate in areas of standing water. This wetland vegetation type provides an important waterfowl habitat.

Wildlife

A detailed discussion of wildlife, discussed by drainage area, is presented in Subsection 3.2.12. Several large mammal species are located in the Arctic Slope drainage area including caribou, musk oxen, moose, dall sheep, bison, brown bears, and wolves. Caribou are most likely to be found in areas directly adjacent to the conceptual GCF site. The affected environment of large mammals is discussed in detail in Subsection 3.2.13.2.1.

The Arctic Slope drainage is home to more than 200 bird species. Many of these species frequent the Arctic Coastal Plain. Bird populations and their affected environment are discussed in Subsection 3.2.13.2.2.

Threatened, Endangered, and Other Protected Species

A detailed discussion of threatened, endangered, and other protected species is presented in Subsection 3.2.14. The threatened, endangered, or protected species located on the Arctic Coastal Plain and in the Beaufort Sea include: bowhead whale (endangered), gray whale (endangered), Eskimo curlew (endangered), and Arctic peregrine falcon (threatened). No threatened or endangered plant species are located on the Arctic Coastal Plain. However, several species have been given special consideration by the BLM. These species include: Astes yukonensis; Thalspi arcticom and Erigeron muirii.

Recreation, Aesthetics, and Wilderness

Present recreation uses in the vicinity of the conceptual site of the GCF is by guided tours traveling from the airport and various facilities within the Prudhoe Bay industrial complex. Travel is by vehicle on the existing road net.

The Prudhoe Bay Airport is also a place where recreationists intending to visit other areas such as ANWR shift to smaller *aircraft. Recreation is also discussed in Subsection 3.2.15.1.*

The conceptual GCF is located within an area of intense industrial development associated with the Prudhoe Bay oil and gas field complex. No federal lands are involved with the GCF. State lands have been classified for industrial uses. Aesthetics are discussed in detail in Subsection 3.2.15.2. Visual resources of the North Slope area include vast river plains, limestone hills, and tundra.

A detailed discussion of wilderness is presented in Section 3.2.15.3.

Cultural Resources

Cultural resources are discussed in detail in Subsection 3.2.16. Much of the following information was obtained from Section B11 of the FEIS for the Prudhoe Bay Project (FERC, July 1980). The arctic coast has been home to the Inupiat (northern Eskimo) since prehistoric and early historic times. The Kutchin have also hunted and camped on the arctic coast. Although there are currently no permanent Native population living within the immediate Prudhoe Bay area, the land has been the site of numerous temporary settlements and seasonal hunting and fishing camps. Numerous old grave sites, sod hut and ice cellar outlines, and a variety of artifacts indicating the historical and cultural significance of the land have been identified by the NSB and the Federal government. These sites are heavily concentrated along the entire coast, the barrier islands, and the river valleys, particularly the Colville River. Prudhoe Bay has all the ecological prerequisites attractive to prehistoric and historic Eskimo banks (FERC, July 1980).

Subsistence

The conceptual GCF is located in an area already disturbed by intensive industrial development on the operation of the Prudhoe Bay complex. Several Native communities use the *general*Prudhoe Bay area for subsistence including Nuiqsut, Kaktovik, and Anaktuvuk Pass. The Natives in this area are primarily Inupiat Eskimo. Their uses of the region's resources coincide with traditional Eskimo uses. Important marine subsistence animals include seal, walrus, polar bear, and beluga and bowhead whale. Important terrestrial subsistence animals include: caribou, black bear, moose, brown bear, Dall sheep, and rabbit. Seabirds, waterfowl, and fish also contribute to the subsistence diet. Berries, roots, seeds, fuel wood, and construction materials are also subsistence resources. The distribution and proximity to villages of many of these resources is seasonally limited or depends on seasonal utilization of habitat (i.e., summer ice pack, overwintering areas). A detailed discussion of subsistence is presented in Section 3.2.17.

SECTION 4
ENVIRONMENTAL CONSEQUENCES OF THE PROPOSED ACTION AND ALTERNATIVES

SECTION 4.0 ENVIRONMENTAL CONSEQUENCES OF THE PROPOSED ACTION AND ALTERNATIVES

4.1 INTRODUCTION

This section analyzes and discusses potential environmental consequences as they presently exist for activities associated with the proposed TAGS project and the Cook Inlet-Boulder Point alternative. Even though the authorized ANGTS has an approved right-of-way, no construction has occurred; therefore, it is not part of the existing environment. Appendix B provides a complete description of the authorized ANGTS pipeline project. Appendix B also provides a summary of the Sales Gas Conditioning Facility as evaluated by FERC in 1980. The alternative representative Cook Inlet-Boulder Point route is discussed in Section 2.0. The actual project might differ somewhat from the scenario presented in Section 2.0 in that minor changes in routing, compressor station locations, stream crossings, and other modifications would be expected; however, the types and magnitude of the potential effects of such modifications should be reasonably comparable. Concurrent construction of both ANGTS and TAGS in Alaska is assumed not to be viable; therefore, it is not incorporated in this analysis. It is, however, assumed that both authorized ANGTS and proposed TAGS would be built.

Required permit applications such as those for stream crossings, air and water emission discharges, and land use would require considerable additional site-specific information and discussion of impacts. As discussed in Subsection 1.10, the proposed TAGS discussed herein would proceed in four distinct phases. The preparation of this DEIS is the initial step in the second phase which is "Design Definition and Permitting."

The consequences section for consideration of the TAGS project tiers on the following FEISs:

- Proposed Trans-Alaska Pipeline, DOI, 1972, Volume 4, pp. 1 to 637.
- Alaska Natural Gas Transportation System, Proposed Alaska Arctic Gas Project, DOI, 1976, Alternative, pp. 457 to 508 and 614 to 622.
- Alaska Natural Gas Transportation System, Proposed El Paso LNG Project, FPC, 1976a, pp. II-253 to II-320 and II-376 to II-503.1/
- Supplement, Alaska Natural Gas Transportation, Proposed Northwest Alaskan Project (Alcan Project), FPC, 1976b, pp. 209 to 328 and 368 to 372.
- Cook Inlet LNG project, Proposed Western LNG Project, FERC, 1978, pp. 137 to 197 and 233 to 296
- Northwest Alaskan Natural Gas, proposed construction and operation of the Sales Gas Conditioning Facility at Prudhoe Bay, FERC, 1980, pp. 70 to 109.

The consequences sections of these previously proposed projects are incorporated herein by reference wherever applicable and include appropriate discussions as well as updated information in each subsection.

Discussion considers the applicant's proposed mitigation measures, described in Section 4.8 as project features that would be implemented. In addition, the impact assessment section considers environmental, social, and engineering stipulations included in the TAPS Grant of Right-of-Way dated January 23, 1974, the ANGTS Grant of Right-of-Way dated December 1, 1980, and the USACE's ANGTS Permit dated December 2, 1982. Table 4.1-1 defines the significance level of environmental effects terminology used throughout this section.

1/ The FEIS incorporated the DEIS of November 1975. The FEIS identifies the impact and alternative discussion and changes only. A significant amount of support information is contained in the DEIS.

Table 4.1-1 Definitions of Environmental Impacts

	Major	Moderate	Minor	Negligible
PHYSICAL RESOURCES	Regional change of considerable severity in landforms, surface appearance, availability, or distribution of physical resources lasting for the duration of the project or longer	Localized changes of considerable severity in landform, surface appearance, availability, or contamination of physical resources occurring for the duration of the project, or widespread changes generally limited to the period of construction	Localized change(s) in surface appearance, distribution, availability, or other characteristics of physical resources with no observable residual modification	Little or no change in surface appearance, distribution, availability, or other characteristics occurring as the result of this project, or if any change does occur, it will be extremely localized and temporary
BIOLOGICAL RESOURCES	Regional change in habitat availability or quality that would likely modify the natural abundance or distribution of a species potentially through the life of the project or longer	Regional change in habitat availability or quality that would likely modify the natural abundance or distribution of a species or localized modification in habitat availability or quality that would likely modify the abundance or distribution of species potentially lasting through the life of the project or longer	Localized change of species abundance, distribution, habitat availability or habitat quality	No measureable change in abundance or distribution, habitat availability, or habitat quality
HUMAN RESOURCES*	The potential to cause regional changes in the economic, cultural, or **socio-cultural system of residents in** the area or will require substantial changes in governmental policies, planning or budgeting	May significantly affect the economic or **sociocultural** system of residents or will require some modification of governmental policies, planning, or budgeting	May marginally affect the economic or **sociocultural system** of residents or will require marginal change in governmental policies, planning, or budgeting	Unlikely to have any measurable effect on the economic or **sociocultural system** of residents or governmental policies, planning, or budgeting

* ANILCA Section 810 requires Federal agencies to evaluate effects of proposed land use decisions on subsistence uses and needs. A proposed action will be considered to significantly restrict subsistence uses if after any stipulations or modifications warranted by consideration of alternatives or conditions, it can be expected to result in a substantial reduction in the opportunity to continue subsistence uses of renewable resources. For the purpose of this EIS, the potential for a significant restriction to subsistence use would occur from major or moderate impacts to either biological or human resources as stated in this table.

NOTE : Changes in Bold Print

There is the possibility that the TAGS project would be constructed on a phased basis as discussed in subsection 2.2.2 on page 2-15. For the purposes of this impact analysis, it is assumed the worst case effect would result from construction of all facilities needed to deliver 14 million tons of LNG to market. Phasing to a smaller scale project for initial startup would lessen some effects and redistribute some of the identitifed impacts. Any elements of the TAGS project, as defined, would be evaluated to assure that they are adequately addressed as required by NEPA.

4.2 PROPOSED *TAGS* PROJECT TO ANDERSON BAY

4.2.1 Introduction

The following subsections describe the environmental consequences of the proposed route from Prudhoe to Anderson Bay. The topics result from issues raised at scoping meetings and from agency comments. In all cases the identification of consequences begins at the northern end of the route and proceeds southward unless there is a statewide description. The technical sections are grouped into similar or related topics whenever possible.

4.2.2 Socioeconomics

4.2.2.1 Statewide TAGS Impacts

4.2.2.1.1 Population and Employment

The major socioeconomic impact of the TAGS project during preconstruction and construction phases would be increased population and employment. The preconstruction phase would last about three years and require about 375 personnel in Anchorage to work on design definition and permitting. During the five-year detailed design and construction phase, average annual TAGS employment would peak at more than 7,200 people (Table 4.2.2-1). By comparison, employment on the TAPS pipeline peaked at an annual average of nearly 22,000 people.

During the five-year construction phase an average 950 project management, administration, and related support staff would be based in Anchorage. During the first two years of the construction period there would be very little construction craft employment along the pipeline corridor. One exception is that about 1,500 personnel would be working on the LNG plant and marine terminal facilities in Valdez.

During peak construction about 80 percent of the direct project employment would be in craft positions. However, a major problem during the TAPS project was a shortage of skilled, experienced workers in certain crafts. To evaluate the potential availability of craft workers, TAGS construction craft requirements were compared with peak TAPS employment, union membership, and union unemployment. The results of this analysis, summarized in Table 4.2.2-2, show that the number of current unemployed in most crafts exceeds the number of workers in that craft who might be needed during construction of TAGS.

During the construction of TAPS, nearly all the welders were imported because there had been little or no prior need for this skill in Alaska. Due to the TAPS construction and subsequent North Slope development, there are presently about 120 pipeline welders union members who are Alaska residents. The TAGS project would require a peak of less than 200 welders compared to nearly 1,400 on the TAPS project.

Much of the socioeconomic impacts associated with the TAPS project resulted from the need to import workers with pipeline-related construction experience. At that time most of the contractors were also new to Alaska. Today, most of the major contractors who would likely bid on the TAGS project have extensive Alaska experience and have developed a cadre of Alaska workers who have the skills and experience to work on the TAGS project. Certain management and technical personnel and some highly skilled crafts personnel would still have to be brought in, but most positions probably could be filled from within the state. It should be noted, however, that the state labor market, particularly the availability of craft workers, could decrease dramatically between now and when TAGS is built due to outmigration and shifts to other employment.

Table 4.2.2-1 TAGS Project Employment by Job Type Construction Phase

JOB TYPE	YEAR 1	YEAR 2	YEAR 3	YEAR 4	YEAR 5
Construction Managers	18	29	162	167	134
Admin. Managers	4	7	40	50	46
Purchase Agents	4	6	33	31	31
Accountants	6	9	49	47	38
Computers Techs/Progs	6	9	49	47	38
Engineers	28	46	253	241	172
Attorneys	1	1	8	-9	11
Life & Physical Scientist	1	2	12	12	8
Public Relations	1	1	7	9	6
Personnell/Labor Relation	3	4	24	30	31
Engineering Techs.	45	72	396	504	459
Secretaries	5	8	46	47	42
Bookkeepers	5	8	46	47	42
Office Machine Opers	5	8	46	47	42
Clerks	14	23	125	132	107
Carpenters	3	5	26	43	34
Caterers	19	31	171	201	191
Concrete Workers	0	0	0	3	2
Electricians	6	10	54	127	266
Sheet Metal Workers	8	13	73	67	44
Laborers	74	119	661	1395	1187
Operating Engineers	148	237	1310	1887	1606
Painters	0	1	3	6	48
Pipe Fitters	10	17	93	638	457
Welders	6	10	55	139	186
Teamsters	98	158	872	1276	674
Subtotal 1/	**520**	**834**	**4612**	**7202**	**5902**
Federal/State 2/	**100**	**110**	**120**	**120**	**120**
TOTAL	**620**	**944**	**4732**	**7322**	**6022**

Source: **1/ Yukon Pacific Corporation**
2/ Joint Federal/State Approval and Monitoring Team including Technical Contractor for Design Review (BLM Estimate)

NOTE : Changes in Bold Print

Table 4.2.2-2 TAGS Peak Craft Employment Compared to TAPS and to Current Employment by Union Members

Craft	TAGS (1) Peak Employment	1985 (2) Union Members	1985 (2) Union Unemployment	TAPS (3) Peak Employment
Carpenters	43	2,547	724	509
Caterers	201	2,811	979	1,254
Electricians	266	570	380	761
Laborers	1,395	1,981	1,169	3,323
Operating Engineers	1,887	2,800	924	4,593
Plumbing/Pipe Fitters	638	1,560	208	946
Welders	186	NA	NA	1,379
Teamsters	1,276	8,776	2,721	3,224
Other	118	NA	NA	1,533
Sub Total	5,782	21,045	7,105	17,522

Source: (1) Yukon Pacific Corporation

(2) Alaska Department of Labor, Research and Analysis Section "Union Membership and Percent Out-of-Work," Juneau, Alaska, 1980-1985

(3) "Community Information Quarterly," Fairbanks North Star Borough, Volume I, No. 1, February 1978

In addition to direct peak employment of about 7,200 people the TAGS project would create about 3,400 indirect jobs during construction (Table 4.2.2-3). These statistics do not include the conditioning plant, additional North Slope field development, or state and local government employment.

During the operations phase TAGS would employ about 550 people in Alaska: 100 in Valdez, 150 in Anchorage, 100 in Fairbanks, and 200 at the 10 compressor stations ***(in two-weeks-on/one-week-off shifts).*** As shown in Tables 4.2.2-4 and 4.2.2-5, the project would also generate indirect employment of about 1,250 jobs during the operation phase.

Table 4.2.2-6 estimates the overall population gain (workers and families) during the five-year TAGS construction period at about 10,600 persons. During construction most population impacts would be concentrated in the communities along the corridor. In the two years following project completion, however, most of this population gain would be lost. As Table 4.2.2-4 shows, by the fifth year of TAGS operation the total statewide population gain as a result of the TAGS project would be about 2,000.

4.2.2.1.2 Infrastructure and Social Impacts

The long lead time available to plan for the TAGS project and the surplus of facilities and services currently available should help relieve infrastructure impacts of the project. For the most part Anchorage, ***Fairbanks***, and the communities along the proposed TAGS route could accommodate most anticipated impacts without building new facilities. During the TAPS project housing shortages were the primary cause of the rapid inflation. Today, however, housing surpluses are the rule in Anchorage, ***Fairbanks,*** and nearly all the communities along the proposed TAGS route. In fact, surplus capacity exists throughout the public and private sectors due to the billions of dollars that has since been spent in state-funded construction for new schools, airports, highways, hospitals, roads, fire departments, government offices, libraries, community centers, and other public facilities.

This growth was matched by vast expansion of the state's banking industry, retail trade, service sectors, and other infrastructure. Most of the state's utility providers have substantial excess capacity, and vacancy rates are high for all types of retail, commercial, and industrial space. Services such as trucking would need to expand, but this can readily be accomplished without negatively affecting existing customers. The extent to which the state's infrastructure would still have a surplus when TAGS is constructed depends on future Alaska economic trends and when construction begins.

Concern about the social and economic effects of the TAPS pipeline was second only to environmental concerns. The project caused a flood of jobseekers to come to the state, and in some communities along the corridor the supply of housing, facilities, and services were totally inadequate to meet the demand. Many that do not find employment would be dependent on state social services and would strain existing social support programs. All the communities in the TAGS corridor experienced the effects of the TAPS project, which should greatly help them to anticipate and plan for potential TAGS impacts. These communities have also experienced postconstruction economic downturns and should be better able to differentiate between short-term impacts and long-term community and economic development needs.

4.2.2.1.3 Government Revenues and Expenditures

During the operations phase the TAGS project would add an estimated $188 million annually in property taxes, $64 million in state severance taxes, and $125 million in royalty payments. In addition, approximately $100 million in corporate income tax would be realized. In 1986 dollars TAGS would add nearly $1.4 billion to the assessed value of the North Slope Borough, $800 million to the Fairbanks North Star Borough and $2 billion to the City of Valdez. The revenue from these increases in the property tax base would greatly exceed any imaginable costs state and local governments would incur dealing with socioeconomic impacts of the project.

Table 4.2.2-3 TAGS Indirect Employment Increases
Construction Phase

	Year 1	Year 2	Year 3	Year 4	Year 5
Mining	80	79	84	10	7
Oil & Gas	0	0	0	0	0
Other Mining	84	79	84	10	7
Construction.	716	1221	5150	8063	6758
TAGS	520	834	4612	7202	5902
Other	196	387	538	861	856
Manufacturing	10	14	64	99	82
Logging	0	0	0	0	0
Sawmills	0	0	0	0	0
Pulp & Paper	0	0	0	0	0
Seafood Processing	0	0	0	0	0
Other Manufacturing	10	14	64	99	82
Transportation, Comm., & Public Utilities	189	189	310	515	638
Trucking	60	52	80	112	118
Water Transportation	114	94	91	111	121
Air Transportation	11	20	78	134	133
Other Transportation	1	6	18	46	87
Communications	2	13	32	84	141
Public Utilities	1	5	11	28	39
Wholesale Trade	28	56	294	506	480
Motor Vehs. & Parts	1	4	9	23	27
Constr. Mtls., Elec. & H'Ware	2	5	15	32	30
Building Mtls. & H'Ware	3	9	21	51	59
Other Retail Trade	7	38	91	242	368
Services	147	198	422	719	849
Health, Legal & Membership Orgs.	6	28	78	188	308
Other Services	141	169	344	531	541
Finance, Insur. & Real Estate	7	39	97	252	408
Banking	2	13	33	86	142
Other	5	26	64	166	266
Government 1/	**40**	**40**	**60**	**75**	**70**
TOTAL	**1143**	**1804**	**6487**	**10512**	**9732**

1/ State and local law enforcement, highway maintenance community coordination and related support activities. (HLA estimate)

Source: All other estimates like Yukon Pacific Corporation

NOTE : Changes in Bold Print

Table 4.2.2-4 TAGS Indirect Employment Increases
Operation Phase

	Year 1	Year 2	Year 3	Year 4	Year 5
Mining	0	0	0	0	0
Oil & Gas	0	0	0	0	0
Other Mining	0	0	0	0	0
Construction	8	27	31	29	26
Manufacturing	7	7	7	7	7
Logging	0	0	0	0	0
Sawmills	0	0	0	0	0
Pulp & Paper	0	0	0	0	0
Seafood Processing	0	0	0	0	0
Other Manufacturing	7	7	7	7	7
Transportation, Comm., & Public Utilities	703	739	762	773	778
Trucking	2	5	8	9	9
Water Transportation	2	7	7	7	7
Air Transportation	2	7	9	10	10
Other Transportation	551	558	566	570	572
Communications	3	16	25	29	32
Public Utilities	142	146	147	147	147
Wholesale Trade	63	73	78	79	79
Motor Vehs. & Parts	1	3	3	3	3
Constr. Mtls., Elec. & H'Ware	0	2	2	2	2
Other Wholesale Trade	62	68	72	74	74
Retail Trade	12	48	61	64	65
Motor Vhs. & Parts	2	7	12	14	14
Building Mtls. & H'Ware	3	8	6	6	6
Other Retail Trade	8	32	42	44	45
Services	700	741	765	770	773
Health, Legal & Membership Orgs.	9	36	57	62	65
Other Services	691	705	708	709	709
Finance, Insur. & Real Estate	35	75	97	106	110
Banking	3	17	24	27	29
Other	32	59	73	79	82
Government	0	0	0	0	0
Federal	0	0	0	0	0
State	0	0	0	0	0
Local	0	0	0	0	0
Miscellaneous	0	0	0	0	0
Total	1528	1711	1799	1828	1838

Source: Yukon Pacific Corporation

Table 4.2.2-5 TAGS Selected Local Area Economics
Operation Phase

Local Area	Year 1	Year 2	Year 3	Year 4	Year 5
Direct and Indirect Employment (Jobs)					
Statewide	1528	1711	1799	1828	1838
Anchorage	743	832	874	889	893
N'Slope Borough	79	88	93	94	95
F'Banks Borough	291	325	342	348	350
Valdez City	25	28	29	30	30
G'Allen/Copper Center	60	67	71	72	72
Direct and Indirect Resident Personal Income (Millions 1986$)					
Statewide	71.3	84.7	91.8	95.9	100.0
Anchorage	35.9	42.6	46.2	48.2	50.3
N'Slope Borough	1.0	1.2	1.3	1.3	1.4
F'Banks Borough	12.5	14.9	16.1	16.8	17.6
Valdez City	1.2	1.4	1.6	1.6	1.7
G'Allen/Copper Center	1.0	1.0	1.0	1.0	1.0
Retail Sales (Millions 1986$)					
Statewide	29.9	35.5	38.5	40.2	42.0
Anchorage	15.0	17.8	19.4	20.2	21.1
N'Slope Borough	.4	.5	.5	.5	.5
F'Banks Borough	5.2	6.2	6.7	7.0	7.3
Valdez City	.5	.5	.6	.6	.7
G'Allen/Copper Center	.4	.4	.4	.4	.4

TAGS Property (Millions 1986$)	
Statewide	$ 9,400
Anchorage (Offices and Storage Facilities)	$ 25
N'Slope Borough (2 Comp. Stations; 175 miles pipe)	$ 1,380
F'Banks Borough (2 Comp. Stations; 85 miles pipe; office/storage)	$ 810
Valdez City (20 miles pipe and LNG plant/marine terminal)	$ 2,030
G'Allen/Copper Center (1 Comp. Station; 22 mile pipe)	$ 165

Other Property Value Increases (Millions 1986$)	
Statewide	$ 22
Anchorage	$ 11
N'Slope Borough	(small)
F'Banks Borough	$ 4
Valdez City	$ 1
G'Allen/Copper Center	(small)

Notes:

(1) Compressor Stations in North Slope Borough (2), Fairbanks Borough (2), and Glennallen/ Copper Center Area (1). Two other compressor stations located outside localities listed here.

(2) Employment is on a place of work basis. These are jobs in the local area that may or may not be filled by residents.

(3) Personal income and retail sales are on a resident basis in the case of personal income, regardless of where earned.

Source: Yukon Pacific Corporation

Table 4.2.2-6 TAGS Selected Alaska Economic Changes - Construction Phase

	Year 1	Year 2	Year 3	Year 4	Year 5
Cumulative Population Gain 1/	651	1,526	4,578	9,045	10,570
Employment Due to Construction	1,103	1,764	6,427	10,437	9,662
Resident Personal Income Due to 2/	43.7	68.9	273.0	468.8	445.2
Cumulative Housing Units Auth. 3/	71	183	563	1,279	1,728
Bank Deposits Due to 2/	3.8	17.1	45.3	118.4	177.7

1/ Population gain includes TAGS workers in camps.
2/ Personal income and bank deposits in millions of constant 1986 dollars.
3/ Housing units excludes TAGS workcamps.

Source: Yukon Pacific Corporation

Additionally, TAGS revenues would help to supplant declines in state petroleum revenues due to the depreciation of TAPS and potential reductions of Prudhoe Bay oil production. The State of Alaska owns 12.5 percent of the total volume of natural gas to be produced at Prudhoe Bay.

The major communities (Fairbanks, Delta Junction and Valdez) have elected officials and staffs to work with YPC and the state to plan for socioeconomic impacts. However, about two-thirds of the proposed TAGS right-of-way would be located in areas without local governments. Although these are relatively small communities, the lack of elected officials makes it difficult to determine who really represents the community. YPC would coordinate with residents along the proposed right-of-way to assess potential problems and develop mitigation strategies, whether or not they have formal governments. Areas which do not assess local property taxes would need to rely on state funding to meet local impacts.

4.2.2.2 Regional TAGS Employment Impacts

Interest in construction employment would undoubtedly be high among corridor residents. All except those living in Anchorage or Fairbanks would have to travel to Anchorage or Fairbanks to seek employment. *Additionally, most out-of-state job seekers would likely go to Anchorage or Fairbanks.* During construction some corridor residents would work on the pipeline, since many village and urban residents now have construction experience. One consequence of falling construction employment opportunities in recent years is that many workers, especially village residents, have not maintained their union status and would not be eligible for hire.

In rural areas pipeline employment could conflict with some subsistence pursuits and BLM fire-fighting jobs. A more serious concern would be that highly skilled workers now maintaining village utility systems and other facilities might be attracted to higher-paying pipeline jobs. The loss of such workers could jeopardize village facilities if adequately trained personnel were not available to replace them.

During the operations phase the only employment opportunities along the corridor would be 20 workers at each compressor station, 100 at the Fairbanks maintenance facility, and 100 at the Valdez terminal and LNG plant. The following sections detail specific impacts from construction in six regions along the proposed corridor.

4.2.2.2.1 North Slope Borough

TAGS construction in the North Slope Borough (NSB) would include 175 miles of pipeline and two compressor stations. About 200 personnel would be housed in existing facilities at Prudhoe Bay and a total of 2,200 additional beds would be available (although not all at the same time) at construction camps to be located at Franklin Bluffs, Happy Valley, Galbraith Lake, and Compressor Stations No. 1 and No. 2.

Since none of the NSB Native villages are located near the proposed TAGS right-of-way, no direct impacts on village populations or community services are anticipated. Average annual TAGS employment in the region would peak at nearly 600 (Table 4.2.2-7).

The most significant effect of the project to the NSB would be increased property tax revenues from the pipeline and compressor stations in the borough, which would have a combined value of $1.4 billion. This figure does not include an estimated $1.5 billion for the Prudhoe Bay conditioning plant and millions of dollars in field development required to deliver gas to the conditioning plant. The TAGS project and conditioning plant would add $2.9 billion to the NSB's assessed valuation, which stood at $13.6 billion in 1986.

4.2.2.2.2 Southern Dalton Highway Area

In the Dalton Highway area south of the NSB, the TAGS project would have construction camps at Chandalar, Dietrich, Coldfoot, Oldman, Five Mile, Livengood, and Compressor Stations Nos. 3, 4, 5, and 6, which would have a total bed capacity of 5,700. (Note: Not all these camps would be operated simultaneously or at full capacity.) The pipeline construction worker population would exceed the entire resident population along the corridor and adjacent villages several times over.

During construction of the oil pipeline the only two inhabited settlements ***within 15 miles of the TAPS pipeline route*** were Wiseman and Livengood, both historical mining towns with only a handful of inhabitants. Although no municipalities or large settlements have arisen along the corridor, there has been a substantial amount of settlement, particularly along the Elliott Highway near Fairbanks.

Beginning in 1980, DOT/PF established highway maintenance camps at seven locations along the highway. The northernmost of these camps ***in the southern Dalton Highway area*** is located at the Chandalar Shelf. The Chandalar Shelf and Sagavanirktok River maintenance camps are staffed by two rotating (one-week-on/one-week-off) six-person crews of DOT/PF personnel who live in a dormitory. There are four other DOT/PF maintenance stations between the Sagavanirktok River and Livengood staffed by five to eight personnel each. Most state workers at these latter sites are accompanied by their families. The construction of TAGS would result in an expansion of services provided by DOT/PF at these locations on a temporary basis. In addition to the DOT/PF camps there are "truck stops" at the Yukon River Crossing and Coldfoot that include workers and their families, and they would be affected by increased use of the Dalton Highway.

Along with additional road maintenance, increased traffic also creates potential for more accidents and state trooper patrols. Most pipeline construction personnel would likely be transported to remote camps in this area by air, which would also increase the requirement for airport maintenance at some airports in the region.

Table 4.2.2-7 TAGS Selected Local Area Changes
Construction Phase

Local Areas	Year 1	Year 2	Year 3	Year 4	Year 5
Direct and Indirect Employment (Jobs)					
Statewide	1103	1764	6427	10437	9662
Anchorage	412	659	2400	3898	3609
N'Slope Borough	92	147	595	483	268
F'banks Borough	216	345	1258	2044	1892
Valdez City	20	125	455	830	854
Glennallen/Copper Center	25	41	165	134	74
Direct and Indirect Resident Personal Income (Millions 1986$)					
Statewide	43.7	68.9	273.0	468.8	445.2
Anchorage	20.3	32.1	127.2	218.5	207.5
N'Slope Borough	0.3	0.5	2.4	2.0	1.1
F'banks Borough	9.4	14.8	58.9	101.2	96.1
Valdez City	0.4	3.0	12.1	23.4	24.7
Glennallen/Copper Center	(small)	(small)	1.0	1.0	(small)
Retail Sales (Millions 1986$)					
Statewide	18.3	28.9	114.9	196.8	186.9
Anchorage	8.5	13.4	53.4	91.7	87.1
N'Slope Borough	0.1	0.2	1.0	0.8	0.4
F'banks Borough	3.9	6.2	24.7	42.7	40.3
Valdez City	0.1	1.2	5.0	9.8	10.3
Glennallen/Copper Center	(small)	(small)	0.4	0.4	(small)

Notes:

(1) Employment is on a place-of-work basis. These are jobs in the local area and may or may not be filled by local residents.

(2) Personal Income and Retail Sales are on a resident basis. Thus income earned by local area residents working elsewhere is included in local area resident personal income.

Source: Yukon Pacific Corporation

With the exception of Minto, most of the villagers (Allakaket/Alatna, Bettles/Evansville, Stevens Village, and Rampart) in the Dalton Highway region travel by air. However, some Stevens Village and Rampart residents travel by boat to the Yukon River crossing and then by vehicle to Fairbanks. There is a 29-mile winter road from Bettles/Evansville to the Dalton Highway, which local residents use to travel to Fairbanks. Thus, to some degree, village residents and others living along the highway could be affected by increased traffic along the road. A DOT/PF worker noted that during construction of TAPS the increased traffic caused highway dust in the settlement of Wiseman, creating a nuisance impact. Minto residents probably would be the most affected by increased highway traffic since villagers frequently travel to Fairbanks.

Since there are no local governments with jurisdiction over any part of the proposed TAGS corridor between the NSB and the Fairbanks North Star Borough (FNSB), no local taxes would be levied or available to local residents to directly offset any impacts which might occur. Therefore, the direct socioeconomic impact would be major during construction for the communities directly along the corridor, and minor to negligible for those communities more removed from the construction activity.

4.2.2.2.3 - Fairbanks North Star Borough

During TAGS construction a 1,000-bed construction camp and a 400-bed construction camp adjacent to Compressor Station No. 7 would be located within the FNSB. Fairbanks would also be the primary storage site for pipe to be shipped north and south along the highway. During the TAPS project, pipe was double-jointed and coated in Fairbanks; however, on the TAGS project the coating and double-jointing would be done at the factory.

Impacts of TAGS would be of lesser magnitude than those generated by the TAPS project because:

- Peak average annual direct and indirect Fairbanks employment on TAGS line would be 7,500, compared to 15,000 during the TAPS project.

- *The impacts on the Fairbanks housing market for TAGS would be less than TAPS because a much greater proportion of the resident labor force would likely work on the project, non-resident workers would live in construction camps, and management personnel would live in Anchorage.*

- *Hiring would take place in both Anchorage and Fairbanks.*

- In contrast to a housing shortage, overloaded utilities, and an underdeveloped commercial sector which preceded the TAPS project, Fairbanks now has a surplus of housing, excess utility capacity, and an oversupply of retail and service businesses. *Additionally there are numerous light industrial facilities and land zoned for light industrial which should be able to accommodate project needs. The only new heavy industrial sites will be the Prudhoe Bay conditioning plant, the compressor stations located along the route, and the Valdez LNG Plant/marine terminal.* Some of this surplus will likely be absorbed due to the expected increase of several thousand military personnel over the next two years. However, if the state's economic problems persist, as discussed in Subsection 3.2.2, much of the surplus will probably not be absorbed.

- Much of the local work force has construction and oil industry experience, both working on the TAPS project and on other North Slope petroleum developments.

- *The FNSB Planning Department's Community Research Center, which was originally established in 1974 as the Pipeline Impact Information Center, has the information and staff to help the community plan for pipeline impacts. An example of the type of expertise they could provide is their effort to help Fairbanks plan for the addition of the Light Infantry Division at Fort Wainwright. The Borough's Planning Department can also play an important role in helping the community plan for the gas pipeline.*

Although Fairbanks would likely experience some negative impacts during TAGS construction, they would be largely offset by the positive aspects of employment, economic development, and increases in local tax revenues. ***Detailed project plans and requirements, which would be developed during the five-year detailed design and planning phase, should allow Fairbanks adequate time to plan for potential impacts if this infrastructure has been absorbed.***

During the operations phase of the project, about 100 workers would be employed at the Fairbanks maintenance center and 20 workers at Compressor Station No. 7. Additionally, the 85 miles of pipeline and Compressor Station Nos. 6 and 7 would add an estimated $810 million to the FNSB's tax base, which totalled $4.7 billion in 1986. The addition of TAGS to the Fairbanks tax base would help to offset the anticipated decline in the value of the TAPS pipeline due to depreciation. ANGTS would provide similar benefits. ***Although many of these workers may leave the state before the TAGS project begins, it is likely that many of them would return to work on the project.***

4.2.2.2.4 Delta Area

During construction, an 800-bed construction camp would be located ***at Big Delta, about 10 miles west of*** the city of Delta Junction, and a 400-bed construction camp would be located adjacent to Compressor Station No. 8, about ***30*** miles south of ***Delta Junction.*** Given that the area population is about 5,000 people, the project would temporarily increase the local population by about 20 percent.

The local infrastructure of facilities and services developed since the TAPS project has greatly enhanced the community's ability to meet potential impacts of the TAGS project. Additionally, Delta Junction is only about ***90*** highway miles from Fairbanks, which would be available to meet any impact demands which Delta cannot accommodate.

Due to the present slump in the local economy, Delta Junction officials predicted that most residents would welcome the increased employment and economic opportunities another pipeline construction project could provide. During the operations phase the only potential ***for some local project-related*** employment in the area would be about 20 jobs at the Compressor Station No. 8. Delta Junction, which has the only government in the area, does not assess any local sales or property taxes. Thus, the local residents would not be able to benefit directly from TAGS tax revenues.

4.2.2.2.5 Glennallen/Copper Center Area

Of all the regions along the TAGS corridor, the Glennallen/Copper Center area would likely experience the highest relative socioeconomic impacts and the lowest relative benefits. The 2,000 bed spaces in the construction and compressor station camps ***would increase*** area's population ***by more than 60 percent.*** About half the residents live in Glennallen; the remainder are scattered in several small communities. Most of the area's communities are adjacent to the proposed TAGS corridor and would directly experience increased traffic and other strains on the limited local facilities and services such as banks, hospitals, and police.

Although employment and population impacts were greater during the TAPS project than they would be during TAGS, the local infrastructure is similar to that existing during the oil pipeline period. Since there is good highway access to Anchorage, the Glennallen/Copper Center area might attract pipeline worker families requiring such services as schools, medical, and public safety. During the TAPS project numerous families lived in motor homes and small trailers in the Glennallen area, overloading the area's ability to provide needed services. One indicator of the transportation and population impacts the region experienced during TAPS was that 21 Alaska State Troopers were stationed in Glennallen in 1976, compared to only three in 1986.

Despite potential socioeconomic impacts, many if not most Glennallen/Copper Center area residents probably would welcome the large, though short-lived boost the TAGS project would give to the local economy. One indicator of the depressed economic conditions in the area is that the Copper River School District filed for bankruptcy in December 1986. Numerous local businesses have closed, and most have cut employees.

A significant problem in the Glennallen/Copper Center area is that there are no local municipalities or regional government, although some villages have Native councils. As a result, it could be difficult for the communities to plan for socioeconomic impacts, even though existing facilities are available to provide needed services. The lack of local governments also means that area residents cannot receive direct property tax or other revenues from the TAGS project. The State may require YPC to enter into some sort of agreement to repair or pay for repairs for the portion of the existing highway system adversely impacted. This would tend to reduce construction impacts and costs to the state government. In the operations phase the only direct local employment opportunities would be 20 persons each at Compressor Station Nos. 9 and 10.

4.2.2.2.6 Valdez

Valdez would likely experience the largest per-capita impacts of any region along the proposed TAGS corridor during both construction and operation phases. In Valdez the construction period would last five years, compared to only three years for the remainder of the corridor. During the peak year of TAGS construction the project would create an estimated 830 additional direct and indirect jobs in Valdez. Most of this employment would be associated with construction of the LNG plant and the marine terminal. Other employment would be related to the pipeline storage yard, pipeline construction, and other facilities.

TAGS employment would represent a 45 percent increase over the 1985 average of 1,850 jobs in the community (ADLS 1985). However, even at the peak of TAGS construction, Valdez employment would be substantially below the record 4,600 peak employment experienced during the TAPS construction period.

Due to the current slump in the Valdez economy there is presently a housing surplus, excess capacity in community facilities such as schools and hospitals, and an abundance of retail and service businesses (Valdez Planning Department, pers. comm.). Much of this excess capacity would be absorbed if a proposed $900 million refinery is built in Valdez. Refinery construction, which would peak at 1,500 workers. Construction is expected to take two years, and when completed the refinery would employ approximately 250 persons.

Today the population of Valdez is three times the size it was prior to the TAPS project. Thus, the local infrastructure of facilities and services would be much better able to accommodate the needs of the TAGS project with this expanded population. Planning would be required to ensure that the community does not overbuild to accommodate construction phase employment since during the operation phase TAGS employment would be reduced to 100 workers.

Although there would be a construction camp at Anderson Bay for construction workers, there would be families and associated construction contractors that would rent vacant houses, stay in hotels, and use campgrounds in the vicinity of Valdez. During the construction period there could be competition for bed space especially during the summer tourist season.

In addition to long-term employment, the 20 miles of pipeline and the LNG plant and terminal facilities would add about $2 billion to the Valdez tax base, which in 1986 totalled $1.7 billion. By the time of TAGS completion the present Valdez tax base is expected to have eroded substantially due to depreciation in the value of the TAPS facilities and TAGS would make up for the tax loss, although this decline might be offset if the proposed $900 million refinery is built.

4.2.2.3 Summary

The most significant socioeconomic impact of the TAGS project during preconstruction and construction phases would be increased population and employment. Direct employment on the project, however, would be only about a third of that experienced during TAPS construction. If the project were being built now, most of the required work force could be drawn from a large pool of unemployed construction craft workers in the state. Unfortunately, by the time TAGS would be built, these workers might not be available because they left the state or found other employment.

Interest in construction employment would undoubtedly be high statewide, particularly among corridor community residents; however, unless the hiring practice is changed, those seeking employment would have to travel to Anchorage or Fairbanks to be hired. Pipeline employment could create some labor shortages in both rural and urban areas, as was the case with TAPS. In rural areas pipeline employment could conflict with some subsistence pursuits, but a more serious concern would be that highly skilled workers now maintaining village utility systems and other facilities would be attracted to higher-paying pipeline jobs, creating employment voids in necessary daily activities where such conditions could be tolerated.

At the present time Fairbanks would be able to accommodate TAGS-induced growth. However, the community's surplus housing and other infrastructure could be absorbed by the time the project would be built due to an influx of military personnel expected in the next two years. The Glennallen/Copper Center area, where the construction work force could outnumber local residents, would likely experience the greater negative impacts with minimal benefits. The five-year construction period in Valdez would strain the local housing supply and the infrastructure of community services, especially if a proposed $900 million refinery is built prior to or during TAGS construction. ***During construction of TAGS adverse impacts would occur in the summer tourist season when there would be a greater demand for bed space. This competition for available hotel accommodations was acute in 1987 during much of the peak tourist periods.*** Otherwise, Valdez impacts would be minor.

During the operations phase, statewide employment would total 550 people. The largest relative long-term employment impact would be in Valdez, where 100 people would be employed at the marine terminal and LNG plant. The largest socioeconomic impact of the TAGS project would be increased state government revenues from property taxes, severance taxes, and royalties. There would be no direct tax benefits in the Dalton Highway, Delta Junction, or Glennallen/Copper Center areas because they do not assess local property taxes. TAGS would provide a substantial boost to NSB, FNSB, and City of Valdez property tax revenues, which would largely or wholly supplant the decline in TAPS tax revenues.

The socioeconomic impacts for TAGS are ***major and*** similar to those indentified for both ANGTS and the El Paso project; FPC, 1976a, pp. 2-374 and 2-375 and FPC, 1976b, p. 264, states that influx of construction workers would cause short-term impacts to water supply and waste, crime, and inflating strain on the supply of goods and services in Alaska.

4.2.3 Land Use

4.2.3.1 Introduction

The TAGS project starts in the Prudhoe Bay area within the oil development and transportation zone, follows the ***existing transportation and*** utility corridor from its point of origin to an area south of Thompson Pass in the Chugach Mountains, passes through Keystone Canyon, and then proceeds to an LNG plant at Anderson Bay in Port Valdez.

The route of the proposed project would change unimproved land to pipeline right-of-way for the duration of the project. It would cross the alignment of the TAPS, authorized ANGTS, and various highway rights-of-way in a number of places. Table 2.2.1-1 provides an estimate of the area disturbed by the combined TAGS facilities.

4.2.3.2 Project Impacts

Initial pipeline construction would require approximately *23,216* acres of land, of which *8,425* acres would be required for the life of the project. ***Table 2.2.1-1 shows the acreage required by project component. The inventory of project use acres includes only those acres disturbed by project facilities; it does not include existing access roads, material sites, construction camps, airstrips, material storage yards, and other facilities. The disturbed acres identified***

do reflect expansion at any of these already disturbed areas. Within the boundary of the Chugach National Forest, the approximately 1,300 acres for the terminal and LNG facility buffer zone would require a special use permit for long-term duration of project operations.

Most of the route passes through relatively undeveloped areas on federal or state lands along the TAPS ***route*** and existing road system. There are a few towns and villages located on public and private lands along the route and only four incorporated cities--Fairbanks, North Pole, Delta Junction, and Valdez. Access to or use of private lands for project use would require direct negotiations between the property owner and TAGS. ***Due to these changes, some revisions could be required to the FNSB's Comprehensive Plan.*** Within a mile or so on either side of the proposed ***route*** the area is virtually inaccessible except by walking, horseback, or all-terrain vehicle. Access is easier in winter, and cross-country skiers and snowmobilers use the existing access road system and the frozen major river systems as transportation corridors for hunting, trapping, access to winter cabins, and ice fishing. Impacts to these uses would be moderate but short term.

The major temporary land requirements necessary for project construction would include the 100-foot-wide right-of-way strip 796.5 miles long, new or extended access roads, material sites, and construction camps (see Table 2.2.1-1). Upon completion of construction, a 53-foot-wide permanent right-of-way would be required. The remainder would revert back to the present landowner. ***In addition to the location of the pipeline in the 53-foot permanent right-of-way, TAGS is considering the installation of a fiber-optic cable which would be installed along with the pipeline during construction. The fiber-optic cable system would be used for TAGS communication and could potentially reduce the redundancy requirements of an aboveground communication system. There would be negligible environmental impact with the installation of a fiber-optic cable.***

The 53-foot permanent right-of-way for pipeline (5,114 acres) plus ***a small number of*** the material sites and compressor stations would remain cleared and ***unavailable for other noncompatible uses.*** Impacts to the corridor would be minor.

Much of the area would naturally revegetate with grasses and low-growing shrubs which would be allowed to remain on the right-of-way. This regrowth would prevent erosion and provide some wildlife habitat. Materials sites would include reopening some of the existing TAPS borrow pits. Except for those sites required for maintenance, all material sites would be restored and allowed to revegetate; other land uses would then occur. The TAGS project gravel requirements would result in removal of about 4,000 acres from other uses temporarily and the removal of 33 million cubic yards of mineral material for construction. The impact of the total amount of borrow pit acres would be moderate since most of these areas would eventually be returned to preconstruction use after restoration. The other major land use changes would consist of new access roads, dump sites, compressor stations, surplus equipment disposal areas, and construction camps, occupying a total of about 7,938 acres.

Pipeline construction camps would be closed upon completion of construction and facilities removed. Since ***all of the proposed pipeline construction camp, except Prudhoe Bay and Sourdough Creek, are located at*** existing ***unused*** campsites. There would be ***minimal*** additional loss due to these pads. ***Approximately 78 of the 278 acres used for compressor station facility construction, primarily the temporary camp areas, would be revegetated.*** Construction pads, even after revegetation, would be of limited value to wildlife for many years. The compressor stations and most access roads would be maintained and withdrawn from other ***incompatible*** land uses for the life of the project.

Indirect impacts possibly would include increased public access and use through new access roads and greater use of the existing highway system, which would result in increasing demand on lands adjacent to the corridor for such activities as mining, homesites, trapping, hunting, fishing, and sightseeing during both winter and the warmer months. Construction of a below-ground natural gas pipeline would restrict access across the pipeline to those areas where ramps or other appropriate access roads have been built. Movement of heavy equipment or other vehicles indiscriminately across the pipeline would be prohibited. Due to the nature of most of the area of Alaska this restriction would create minor impacts to official access.

The influx of workers into the larger communities of Fairbanks and Valdez also would result in changes of present land uses. Workers would purchase land, use it more for recreational pursuits, and require development of presently undeveloped property.

Presently the airstrip at Franklin Bluffs is under state lease for nonairport use. This land use would be precluded during preconstruction and construction activities if TAGS secures rights to use the the airstrip. Material presently stored at airfield would be relocated to another area.

The State has assumed management and maintenance of the Dalton Highway, and pressure is increasing to allow full public access on this highway. Access is already open all the way to the Dietrich check point at the Chandalar Shelf area. If unrestricted access were allowed, the pressure on lands adjacent to the TAGS corridor would increase, and existing land uses would change, perhaps dramatically. TAGS construction or operation would result in a minor change to the existing conditions inconveniencing tour buses, present commerical traffic, and noncommercial vehicles.

All of these potential changes in land use would have to conform with requirements of land-use planning documents presently in effect. Land-use plans have been developed by the NSB, FNSB, and the Valdez City Planning Commission. Project design criteria and location of the various facilities would also have to conform with various existing state and federal land-use restrictions, including:

- U.S. Coast Guard must review construction of facilities seaward of the last manifold of the marine terminal.

- Compliance with 49 CFR 193 regarding exclusion zones for thermal radiation and vapor-gas dispersion zones for the LNG plant.

- Crossing of military reservations would mean that present land use of the construction area and possibly the pipeline route could change.

- Moose Creek Dam across the Chena River in Fairbanks is a USACE structure, and federal stipulations for its use would have to be met.

- ADF&G requirements would be met for wildlife refuges, stream crossings, drainage structures in fish streams, sensitive habitats, or wildlife sanctuaries.

- ADNR requirements for use of any state parks or state land leasing, including tidelands, would have to be met.

The direct impacts to present land uses along the corridor would involve clearing and brushing along construction areas; grading around compressor stations, drainage structures in fish streams, and communications sites; and excavation and refilling the pipeline trench. Other direct impacts would result in habitat loss from the construction appurtenances and habitat modification due to the development of mineral material sites, disposal sites, storage yards, and access roads. Some of the land to be cleared contains potentially marketable timber stands. This is especially true in the area just south of Fairbanks, the Glennallen area, and in the area from Thompson Pass nearly to Valdez. Though the potential for some timber harvest is there, the area has slow regrowth potential and the timber is relatively small. Therefore, it is not presently competitive with West Coast timber in either quality or price, and there seems to be little likelihood of the timber being marketed in the foreseeable future. Increased access could result in establishment of new local logging enterprises. Impacts would be negligible.

The proposed route also passes through some presently used and potential agriculture land. This farming, ranching, and dairy land is located around and north of the Fairbanks area and near Delta Junction. Some of this land would be temporarily lost to production during construction, but overall impacts would be minor.

Future pipeline options would be substantially reduced in some areas, notably Atigun Pass, Sukakpak Mountain, and Keystone Canyon, where there would not be enough room for a new pipeline. Likewise at Phelan Creek once the TAGS pipeline was installed, any future pipeline options would be foreclosed.

The proposed route would start at Prudhoe Bay and pass near industrial development centers at Fairbanks, and Valdez. The pipeline would increase industrial development on the North Slope due to development of known gas fields and exploration for new fields. It is anticipated that any secondary industrial development associated with the gasline, e.g., petrochemical development, would occur at tidewater in the Valdez area. The route also crosses military reservations. There are no known restrictions that would result in location in TAGS on military land uses that would offset military missions in Alaska.

Mineral extraction patterns might be changed somewhat. Some gold claims might be crossed, the surface water flow pattern changed, or ice bulb formation might cause the loss of some marginal mineral claims. On the other hand the increased number of access roads might allow better access and increase mining in some of areas. In any event the impacts to mining, with the exception of gravel, are expected to be minor.

The presence of the TAGS LNG facility and marine terminal would change the present use of Anderson Bay for the life of the project. The buffer zone around the LNG plant would include restrictions that prohibit public use of 1,300 acres of Chugach National Forest lands administered by USFS. Access to surrounding areas to the forest from Anderson Bay and other shoreline areas would be reduced due to the access restrictions around the LNG plant.

4.2.3.3 Potential Areas of Critical Environmental Concern (ACEC)

Discussion of prospective ACEC's have been grouped with other special areas associated with the proposed TAGS project in Subsection 4.2.19.

4.2.3.4 Summary

The pipeline route, LNG plant, and marine terminal would change or influence land uses on 22,910 acres. Other land use changes would be on a local basis, mostly very near the existing TAPS corridor. Land use of the corridor itself would be relatively unchanged. Although the route crosses two military reservations, this would not compromise the military's mission on these lands. Total impacts to existing land use would be moderate to minor. This would be similar to that described for El Paso (FPC, 1976a, p. II-367).

4.2.4 Transportation

4.2.4.1 Introduction

The discussion of transportation impacts is divided into marine, air, and land transportation and considers both long- and short-term changes and the significance of potential impacts.

4.2.4.2 Marine Transportation System

In the Prudhoe Bay area, marine transportation or sealift is confined to a brief period, usually August, when the pack ice recedes enough to allow non-ice-breaking ships to pass along the Beaufort Sea nearshore area. Typically during this period a sealift of tugs and barges carrying large component sections of equipment and buildings arrives at Prudhoe and is unloaded on one of the four causeway docks. The TAGS project would add a considerable number of barges to one or two years of sealift. This would increase the traffic from associated marine vessels, including workboats, lightering vessels, and possibly dredging operations.

Increased marine traffic would cause localized traffic conflicts and perhaps increase the incidence of minor collisions, but since the Prudhoe Bay, Kuparuk, and Endicott sealifts would be essentially completed prior to TAGS project startup, the net result would probably be a continuation of similar traffic to what has occurred in recent years. Such an increase would, of course, provide a boost to Alaska and Seattle/Portland barge operators since it would extend their involvement in sealifts to Alaska for a few years.

Prince William Sound marine traffic proceeds year-round and includes TAPS supertankers, fishing vessels, ferries, and charter and sports boats. This traffic is controlled by the U.S. Coast Guard in Valdez by use of a Vessel Traffic Service (VTS) designed for constricted areas to lessen the probability of collisions. The major control points to Anderson Bay are the Hinchenbrook Entrance and the Valdez Narrows.

The additional five or six tankers per week from TAGS, plus the terminal support vessels and the ferry from Valdez to the marine terminal, would have to be integrated into the VTS. The U.S. Coast Guard has indicated the additional TAPS project tankers would not have any impact on the VTS since existing vessel traffic movement is low (McCall, pers. comm.). The chance of collisions and major or minor oil spills would increase. Weather in Prince William Sound can be severe and has caused tankers to be delayed in getting to the Alyeska terminal. In 10 years of operations experience at the Alyeska Marine Terminal, no tanker incidents have occurred. Overall, the impacts from marine traffic would be negligible due to the VTS.

Marine terminals at Anchorage, Whittier, and Seward would also experience increased usage but all can handle greater shipping volumes without more development but with higher employment.

LNG tanker traffic on the high seas between Prince William Sound and destination ports in Pacific Rim nations is expected to have no effect on transportation.

4.2.4.3 Air Transportation

Potential impacts on air transportation would primarily be evidenced in Prudhoe Bay and Valdez during the construction phase of the project, although some increase in scheduled airline and charter service would occur throughout the operation of the project. In the Prudhoe to Fairbanks area there would be an increase in scheduled airline traffic and both fixed- and rotary-wing charter service during the major construction phase and some increase during the preconstruction permitting ***phases.*** Such increases would result from movement of personnel and construction-related materials. This would have significant positive effects on the airlines and the air-charter services in these regions. Additional air traffic would be a moderate impact to existing guided hunts in the Galbraith or Sagwon areas. Overall impacts would most likely be minor during construction and negligible during operations phases.

Several primary airports--Anchorage International, Fairbanks International, and Valdez--would experience some increase in traffic but with negligible impacts. Each of the three major airports has recently undergone expansion and would be capable of accommodating increased passenger and cargo loads.

Construction of the proposed route between Fairbanks and Valdez also would be affected to a lesser extent. Mostly, the need for charter air service for fixed- and rotary-wing aircraft would be increased. The spinoff effects on the aircraft charter business would be more people in the area and increased demand for charter services. The latter impacts would be positive to this industry. Some restrictions as to altitude and zones might be instituted during project construction. It is also possible that some traffic control might be added at the two state airports, ***along the route of Galbraith and Prospect,*** and public use might be temporarily affected. Overall impacts on air transportation for this region would most likely be minor during construction and negligible during operational phases of the project.

4.2.4.4 Land Transportation

The Prudhoe Bay area would be moderately affected by increased car and truck traffic during construction of the proposed project. The result would be longer waits at crossroads, security checkpoints, and during sealift; increased dust loading from many associated roads in the area; and a greater chance of accidents and minor oil spills. Even with the high volume of construction-related vehicles, the daily allowable limits of 600 per day would not be exceeded. Traffic delays could be kept to a minimum--probably no more than four hours. Greater use of the gravel road system would mean increased maintenance of affected sections. Overall impacts would most likely be moderate during construction and negligible during operation.

The primary impact of the TAGS project in this region would be increased traffic on the Elliott and Dalton highways. In summer 1986 northbound and southbound traffic on the Dalton Highway averaged only 74 vehicles daily, compared to 275 vehicles per day in 1976 during the peak of Alyeska construction. The Dalton Highway was originally built and maintained by Alyeska as a private road. It is now maintained by the State.

Since October 1978, when the State assumed ownership and maintenance of the highway, the roadway has been resurfaced and topped by 6 inches of crushed gravel. This provides an excellent driving surface, which would be damaged by the up to 10,000 truckloads of double-jointed pipe that would have to be transported from Fairbanks over the Elliott and Dalton highways.

Since construction would include crossing the Dalton and Richardson highways in several places, and connecting access roads to the existing structures, there would be isolated instances of delay, probably not more than several hours, to all traffic using the highway system. Delays or short-term interruptions of access could occur to such activities as mining, sports hunting, and fishing across the construction area. In such instances traffic control would be maintained for the short term of such activities. Again, YPC does not intend to delay traffic. Other possible impacts would increase collisions with moose and other wildlife. More extensive road repair would be required, especially during construction when some of the vehicles carrying TAGS equipment would be oversized. During TAPS there ***were*** dust settlement problems in the Wiseman area ***even though water and other dust control material was used as would be the case with TAGS.*** This minor construction impact would occur along the entire route where communities are adjacent to gravel roads.

There could be serious delays should there be the necessity for extensive highway repairs during TAGS construction. It could also be a problem if such construction changed the existing highway alignment. Areas subject to change lie between Delta and Summit and in the Paxson, Gakona, and Copper Center area. The Phelan Creek construction area would probably be the only location where traffic delay impacts would occur. No impacts would be evident from operation of the pipeline.

The overall roadway and highway traffic and repair impacts to the more populated interior areas along the Richardson Highway from Fairbanks to Glennallen would probably be moderate during construction and negligible during operations since traffic would return to a more normal pattern. ***However, there would be increased traffic generated during construction at the Eielson AFB. Traffic impacts during construction would be minimal if a traffic schedule is developed to reduce TAGS through base traffic to off-peak periods. Due to the nonmilitary construction personnel using the base for entry, TAGS would need to coordinate with base security staff to develop a program for entry.***

A good highway system exists in the Valdez area, but in some places it is quite constricted, such as in Keystone Canyon. In these areas delays would be necessitated by blasting and excavation of the pipeline trench near the existing highways. The increase in project-related traffic, especially by oversized loads, would also slow down traffic, particularly in the summer during the tourist season. These delays would be coordinated with the DOT/PF. Because of the tremendous volume of tourists and visitors to this area, highway travelers, especially those making connections with the Alaska Ferry System, must be apprised of activities so as not to miss scheduled departures. Unexpected delays in meeting scheduled departures would cause major inconvenience to any individual who could not reschedule. There would be some increased possibility of accidents and oil spills in sensitive habitats and a need to increase the number of state trooper patrols.

A raft and kayak guide service operates out of Valdez in the 5-mile section of the Lowe River running through Keystone Canyon. Both traffic delays during their peak summer season and road construction in the river-bank could adversely impact their operations during the one construction season in Keystone Canyon.

The present capacity of 1,700 vehicles per day on the lower Richardson Highway would probably not be exceeded, but project traffic would result in increased damage to the highway, especially during freeze/thaw periods. The overall impacts would probably be moderate during construction. The impacts would be primarily to the local residents and seasonal tourists. There would be considerable economic benefit to local trucking and shipping firms during construction, given the expected demand for transportation services.

The existing and planned improvements to the Alaska Railroad should be able to accommodate increased demand for rail service. A secondary impact of increased rail traffic, especially in the winter, is the associated moose kill. ***Moose kills associated with operation of the State owned Alaska Railroad take place in winter when heavy snows cause moose to use the cleared train tracks as travel routes within moose winter range. The majority of the moose-train incidents are concentrated along 70 miles of train track between Wassila and Talkeetna. The Alaska Railroad and Alaska Department of Fish and Game have been and are continuing to seek ways to reduce the number of moose killed by trains. Already investigated and found ineffective were sound emitting devices placed on the trains. Current investigations are focusing on clearing the snow further away from the tracks as there is greater opportunity for the moose to move to the side. Also being studied is the effect of train speed (C. Granvogel, ADFG, pers. comm., January 1988).***

Statewide, there would be an increase to rail and highway traffic in the Railbelt and Fairbanks area during construction. This impact would be minor during construction and negligible during operation. The state may require YPC to enter into some sort of agreement to repair or pay for repair of portions of the existing highway adversely impacted. This would reduce construction impacts.

4.2.4.5 Summary

Overall, the existing transportation system could handle the increased traffic in all areas quite well with some project-related improvements which would be long-lasting and beneficial to the more remote areas, such as airport improvements and increased use of air charter services to remote areas. There would be delays along the entire highway system during the construction period which would affect tourist, commerical, and local traffic. Since such delays would be of short duration, no interruption in the flow of deliveries to Prudhoe Bay, to miners, or to other commercial enterprises would be expected. These impacts would be moderate during construction and negligible during operation of the project. The impacts discussed for ANGTS (FPC, 1976b, pp. 298-299) reflect the same impacts.

4.2.5 Noise

4.2.5.1 Introduction

This subsection presents a discussion of the interaction between the proposed project and the noise consequences to the environment. Construction noise would be considered short term and transient, but operations noise would be long term and continuous.

4.2.5.2 Construction Phase

Construction of the proposed TAGS would result in indirect noise due to additional road traffic and aircraft and direct construction site noise from heavy equipment. Noise effects to the environment from construction of the project are a function of the noise generated by construction equipment, the location and sensitivity of nearby land uses, and the timing and duration of the noise-generating activity. ***They*** would all be of short duration. Road traffic due to hauling operations, personnel transporation, and aircraft flights to airfields located along the route would be expected to create the largest indirect impacts during the construction, which would be minor.

Construction of a project of this magnitude involves various types of earth-moving and other heavy equipment--most of it noisy--working in tandem to get the job done as quickly as possible. Typical decibel levels (in dBA at 50 feet) of noisiest construction equipment are: front-end loaders, 72 to 85 dBA; backhoes 72 to 94 dBA; tractors, 72 to 95 dBA; scrapers and graders, 76 to 94 dBA; and trucks, 68 to 96 dBA. Welding equipment noise would be between 75 and 86 dBA. These ranges represent typical equipment used on pipeline construction sites, most of which is diesel powered. Noise decays at a rate of 6 dBA per doubling of distance, which is a worst-case assumption that does not include additional attenuation caused by atmospheric absorption, terrain, and meteorological conditions. If higher attenuation rates were assumed, the estimated impacts would be less.

All construction noise has the potential to temporarily affect wildlife near construction activity. When an activity begins in an area, wildlife initially react adversely but over a period of time begin to habituate to constant noise levels. Sudden changes in sound, such as during blasting, would create a startled response and, depending on the timing, could result in significant impacts to wildlife. Normally, the TAGS proposed timing mitigation constraints and those expected from the FWS for the more sensitive species should eliminate any major impacts Studies indicate that the most probable effect of noise would be to reduce utilization of affected habitat areas. This effect should be short term and likely varies between species. The bald eagle nesting site at Anderson Bay could be affected by the several years of construction activity and the noise created by such activities, as identified in Subsection 4.2.14.

Blasting operations during the construction phase would produce direct impacts. Drilling and blasting would be required where trenching through rock could not be accomplished by ripping and removing the loose material with a backhoe. The detonation of explosive materials induces transient motion in the rock which is then transmitted through transient motion into the surrounding rock and through any overlying or underlying strata. It is this motion, referred to as ground motion, that produces noise and stress levels. In some areas the impact would result in a startled response from wildlife for greater distances than during typical construction activities.

Construction of the compressor stations would require only small amounts of grading; most of the activity would entail hauling of materials and construction of the buildings. Those activities should be of short duration, including installing the compressors. Little impact would be predicted since no residences would be located within audibility of the proposed compressor station locations.

At Anderson Bay the pile driver used in offshore construction would be the noisiest piece of construction equipment on the project, producing an average level of about 65 dBA at 1,000 feet during its use. At the closest receptors to this noise source, almost 3.5 miles to the east at the Alyeska terminal, pile-driving levels would be about 45 dBA, which would not be disturbing. Noise levels from other sources, including construction of LNG plant, berth, and metering facilities, would generally not exceed 61 dBA at a distance of 1,000 feet. Noise levels at 2 miles would be well below ambient conditions and would not be disturbing.

All construction noise has the potential to temporarily affect wildlife near construction activity. See Subsection 4.2.13 for more detailed discussion of effects on wildlife.

4.2.5.3 Operations Phase

Noise potentials of significance during the operational phase of the project would be due to the compressor stations, which are long-term, continuous, and fixed sources. The estimated distance at which stations would affect residences with normalized day-night sound levels is 6,000 to 7,000 feet (FPC 1976a). YPC estimates the expected noise levels from a single turbine/compressor unit for gas compression would produce levels less than 59 dBA at a distance of 400 feet from the equipment. The proposed TAGS turbine/compressor units would be fully enclosed and would be equipped with exhaust silencers. Applying the generalization that when the distance between point noise sources and a receptor in the far field is doubled, the sound level decreases by 6 dBAs, sound levels are expected to be below background noise levels at a distance of 3,000 to 4,000 feet from the compressor station for normal operating conditions. As identified in Subsection 4.5, outdoor ambient noise levels range from 15 to 45 dBAs.

Periodic venting (blowdown) of high-pressure gas from the pipeline and at compressor stations would cause temporary but severe increases in sound levels. Maintenance checks on the emergency blowdown system normally occur annually unless an emergency triggers a blowdown, which could last for as long as 45 minutes at the pipeline relief valves and five minutes at the compressor stations. Noise from such blowdowns would be estimated to be a maximum of 140 dBA at a distance of 100 feet from the stack (without silencers).

Compressor Station No. 1 is located within 2 miles of several peregrine falcon nests and two historically used sites. Noise levels at the nesting sites would be close to ambient but would increase as the falcons approached the station during feeding. The primary concern would be human activity in and around the compressor station ***and the periodic maintenance venting which could be timed so as not to occur during those time periods sensitive to peregrines. However, in the event of an emergency, triggered blowdown, there would be a risk that such an event could occur during the nesting period. The worst situation would be a temporary or permanent abandonment of one or more nests. Although there would be a startle response by mature adults no permanent impacts are expected to adults.*** Section 7 consultations have been completed; there are satisfactory mitigation measures which have been identified (see Appendix H). ***Property owners in the Salcha River area were concerned about the noise that would be emitted by Compressor Station Number 7. Except for the periodic venting or blowdown, no residences should be affected by the location of the station. Some noise, above ambient, could reach the river, but with most travelers using motor driven boats, potential noise impacts would be masked.***

Compressor Station No. 9, located on the south side of Hogan's Hill (Milepost 639.2), was relocated to be outside the migration route of a portion of the Nelchina Caribou Herd. Some noise impacts would be detectable to about 5,000 to 6,000 feet from the station. Such noise impacts could cause minor changes to the caribou migration pattern. ***Moderate*** impact to migration could occur as a result of increased noise levels.

Noise-generating activities from project operations in the harbor area include tanker/tug traffic, dock machinery, and material and maintenance truck and vehicle traffic to and from Anderson Bay. Marine vessel tanker traffic to and from the port would be increased about 20 percent as a result of the TAGS project, and, relative to present marine vessel traffic noise levels, would cause negligible impacts. The noise levels generated by machinery connecting to and disconnecting from the tankers in the process of loading LNG would not be expected to exceed ambient conditions in the harbor area beyond 1,000 feet from the source. Barges and commuter traffic to and from Anderson Bay would not noticeably add to the noise because of the low decible levels involved.

4.2.5.4 Summary

The construction impacts of noise would be minor and of short duration along the entire length of the pipeline system. Operational impacts would be negligible. The noise impacts would be similar to those identified for El Paso (FPC, 1976a, p. II-366) and ANGTS (FPC, 1976b, pp. 322-323).

4.2.6 Air Quality

4.2.6.1 Introduction

This subsection presents information concerning the emissions and impacts of air pollutants resulting from the construction and operation of the TAGS pipeline system, LNG plant, and marine terminal. (See Subsection 2.2 for a description of project components.) YPC is not proposing to construct a ***GCF*** at Prudhoe Bay. ***(See Subsection 3.2.6). Prior NEPA evaluations and the expired PSD for the ANGTS-AGCF may not be transferrable to TAGS and may not be appropriate since there have been significant modifications to the original ANGTS facility. Accordingly, detailed air quality evaluations for the conceptual GCF for TAGS is deferred to a future NEPA evaluation that reflects ultimate process and plant configuration for the GCF (EPA, 1988a). For a discussion of the GCF, see Subsection 4.4.***

The total air quality impact of existing and proposed sources would be evaluated for compliance with state and national ambient air quality standards (NAAQS). Only those pollutants and areas where TAGS emission

impacts exceed significant impact levels (SIL) have been included in the analysis. State and NAAQS evaluated are 3-hour, 24-hour and annual SO_2; 24-hour and annual TSP/PM_{10}; 1-hour and 8-hour CO; and annual NO_2 (Dames and Moore, 1988a). Documentation of emission calculations and emission factors used for the air quality evaluations and modeling were submitted to EPA for review and approval (EPA, 1988). Revisions incorporated in the FEIS have been determined to adequately evaluate expected air quality impacts from the TAGS project alone and adequately evaluate compliance with NAAQS. With regard to increments, however, caution should be used in interpreting air quality effects at Anderson Bay from modeling due to inherent uncertainty in modeling and the highly complex air quality issues in the Valdez area (EPA, 1988b).

4.2.6.2 Construction Emissions

Construction of the TAGS pipeline system would cause temporary deterioration of air quality, primarily resulting from exhaust emission from construction equipment, ***camp treating and waste incineration emissions,*** dust created in transportation of materials and personnel, and impacts resulting from gravel crushing. The major significant emission sources during construction of the proposed project would be fugitive dust and construction equipment exhaust emissions associated with excavation activities (i.e., grading, filling, and clearing of land). Exhaust emissions would include carbon monoxide (CO), sulfur oxides (SO_x), nitrogen oxides (NO_x), hydrocarbons (HC), and suspended particulates (TSP). Emissions would result from the following activities during construction.

- Clearing and Grading ROW. Emissions from clearing and grading operations would include combustion exhaust from heavy-duty construction equipment and particulate matter from earth-moving activities and burning of slash.

- Hauling and Stringing Line Pipe. Emissions from pipe-stringing trucks and dust from rock blasting would occur during this activity.

- Ditching. Significant combustion emissions from operation of backhoes, power shovels, and fugitive dust generated from blasting and moving soils would result from these activities.

- Lowering and Tying-in. Exhaust emissions from the tractors would be expected from this activity.

- Backfilling. Significant fugitive emissions from earth moving and filling and exhaust from the motor graders, etc., would occur during this activity. Fugitive dust emissions for the abovementioned construction activities for aggregate fugitive dust emission would be a factor of 1.2 tons per acre of construction per month of activity using EPA estimates (EPA *1977*).

- ***General Construction Traffic. Construction traffic on the general work pad, on access roads, and on unpaved highways would generate dust (particulates) even with the use of dust-control procedures.***

- ***Camp Heating and Waste Incineration. Fuel oil used for camp heating and to fire the waste incinerators would result in combustion emissions.***

- Burning. The burning of cleared slash, the daily incineration of putrescibles, and the burning of construction wood and paper waste would result during construction.

These emissions would not have a major air quality effect along the route due to the temporary nature of construction. The vehicles and fuels would be similar to those used at more densely populated urban sites, where such emissions are normally of minor concern.

Figure 2.3.2.3 shows a typical construction spread and types of heavy equipment. Their activities are transient, with any one activity, such as trenching or welding, not being in one area for more than a matter of days.

Vehicular emission along the mostly remote route would not be noticeable with the exception of the Fairbanks area, where unique and acute air pollution problems are created by both surface air inversions and ice fog conditions during the winter. Construction-related emissions could worsen this situation during the construction phase, especially during December, January, and February when Fairbanks often experiences carbon monoxide levels which exceed state and national ambient air quality standards by as much as 200 percent.

Appropriate mitigation measures would be implemented when possible to reduce emissions from increased vehicle traffic. These measures could include plug-ins at work and campsites, use of diesel (compression ignition) rather than gasoline, propane and natural gas (spark ignition) engines, and use of buses rather than individual vehicles wherever possible.

Identified sources of emissions during construction of the LNG plant and terminal would include construction equipment exhaust emissions (i.e., grading, filling, and clearing), service boats used for transport of personnel and equipment to the construction site, and earth-moving activities which result in fugitive dust emissions.

Exhaust emissions from construction equipment would include carbon monoxide (CO), sulfur oxides (SO_x), nitrogen oxides (NO_x), hydrocarbons (HC), and suspended particulates from diesel-powered and gasoline-powered equipment. The extent of these emissions is not expected to be major. The vehicles and fuel for these vehicles would be similar to that used at more densely populated urban sites where such vehicle emissions are of minor concern. Vehicular emission at this remote site are expected to be minor. These emission levels are similar to those found acceptable for ANGTS and less than those for TAPS.

Gasoline-fueled and diesel-fueled tugs, barges, and personnel transport boats would travel to the construction site from Valdez. Emissions from these sources are not expected to be major because of the small ship sizes and few trips involved.

Particulate (dust) emissions would be generated during various construction activities, such as grading, filling, and clearing of land at the 300-acre plant and terminal site. Assuming that construction activities would be limited to 75 acres during any one month, and using the emission factor (1.2 tons per acre per month) (EPA 1985), particulate emissions are estimated at 90 tons per month. The particle size distribution of fugitive dust from construction activities generally indicates larger-diameter particles than from many industrial sources, including particles greater than those captured by a high-volume sampler (30 microns) and particles greater than the respirable fraction (less than approximately 10 microns). These larger particles from earth-moving activities settle to the ground quickly; therefore, excessive particulate concentrations are more common at locations close to construction activity.

The likelihood that fugitive particles from construction activities at this site would have a potentially major impact on the city of Valdez would be slight. The extent of the impact would be major only if (1) soil moisture content were low, (2) winds were blowing from the west-southwest, (3) wind speed greater than 12 miles per hour (this results in greater entrainment of particles at the source and reduced settling), or (4) wind stability classification were neutral (D wind Classification - Note that more stable wind classes E and F do not occur at elevated wind speeds).

Open burning of land clearing materials and other burnable construction material must under certain circumstances be permitted by the ADEC or other local agencies. Although certain time constraints could prohibit open burning during specific time windows, the burning of construction slash and other construction materials would cause localized air pollution and visual problems, particularly near residential areas. Due to the remote nature of the construction project, such impact would be negligible.

4.2.6.3 Operation Emissions

4.2.6.3.1 Compressor Station

Gaseous pollutants from compressor stations along the route consist of combustion products from the gas-fired engines, mainly nitrogen oxide and hydrocarbons. Intermittent emissions of hydrocarbons could be expected occasionally, particularly methane as a result of leaks, venting, and other accidental emissions.

Compressor stations for the TAGS Project will be located at various points between Prudhoe Bay and Valdez (see Appendix P for a discussion of locational factors). Both a 5-unit and a 10-unit compressor station system are under consideration for the TAGS Project. The worst-case scenario from a site specific air quality standpoint is the 5-unit system since each unit requires more compression horsepower (see Table 2.2.1-2 and Figure 2.2.1-4). Conceptual design information affecting air emissions is presented in Table 4.2.6-1.

Modeling results for NO_2, SO_2, CO and TSP/PM_{10} are presented in Table 4.2.6-2. Maximum predicted 3-hour and 24-hour SO_2 impacts were both well below their respective SIL, federal standards and PSD increments. The maximum annual SO_2 average (less than 0.1 ug/m^3) was much less than its federal standard, PSD increment and SIL. Short-term (1-hour and 8-hour) maximum CO impacts of 250.7 ug/m^3 and 175.5 ug/m^3, respectively, were both well below their SIL and federal standards. The predicted 24-hour TSP/PM_{10} impact of 4.7 ug/m^3 is below the PSD TSP increment of 37 ug/m^3 and the PM_{10} federal standard of 150 ug/m^3, as well as the 24-hour TSP SIL of 5 ug/m^3. The annual TSP/PM_{10} impact of 0.2 ug/m^3 also was well below the federal standard of 100 ug/m^3; however, the 1 ug/m^3 SIL was exceeded. Annual NO_2 impact is well below the proposed PSD increment of 25 ug/m^3 (Dames and Moore, 1988b). Since all but the predicted maximum NO_2 are within required federal, state, PS and NAAQS standards, no significant long-term air quality impacts would result from the operation of the compressor stations. These emission levels are similar to those for the authorized ANGTS and the previously proposed El Paso (p. II-316). Additionally, the first four TAPS pump stations are operated by natural gas and have not created *known* adverse impacts.

4.2.6.3.2 LNG Plant

The location of the LNG plant near Valdez is advantageous with respect to minimizing the operational air quality impacts of the plant on human receptors. The city is normally upwind of the proposed plant location, as winds are generally easterly. Additionally, the plant is 5.5 miles away from the townsite, a distance which allows much more dispersion of any source emissions than would normally be encountered in a more urban setting.

Exhaust emission sources at the LNG plant would include the following.

4 LNG liquefaction trains, each using five natural gas-fired turbines

3 vaporizers

4 25-megawatt gas-fired generators

1 solid waste incinerator

1 reactivation heater

1 process flare

Additional minor emissions would originate from other small pieces of equipment and vehicles. Emissions from all of the sources itemized above (except for vehicles and the solid waste incinerator) would be generated from the combustion of boil-off natural gas as plant fuel. Prior to liquefaction, this gas had passed through driers and scrubbers for removal of particulate matter, lubricant oils, hydrogen sulfides, and mercury. Therefore, combustion of this natural gas would result in minimal emissions of all contaminants, such as sulfur dioxide.

The 20 gas turbines used in the four LNG liquefaction trains and the four gas-fired generators were judged to represent the greatest potential source of air contamination. This is due to the greater consumption of natural gas by these sources and the combustion in internal combustion engines, which inherently results in greater emission of nitrogen oxides and carbon monoxide compared with emissions from external combustion sources.

In order to quantify representative background air quality levels in the Valdez airshed a survey of available ambient air monitoring was conducted. Data sources used were those in the public domain and included the TAPS marine terminal, proposed Valpetro refinery and the Alaska Pacific Refinery PSD application. These data were also verified by ADEC and EPA as being the most current having applicability to the TAGS LNG plant and marine terminal. Monitoring for TAPS

Table 4.2.6-1 Stack Parameters of Compressor Station[1/]

Source	UTM (East km)	UTM (North km)	Height (m)	Diameter (m)	Temperature (k)	Velocity (m/s)	Building Dimensions (meters) Length	Width	Height
Main Line Compressor	555.50	7056.71	12.5	3.0	786	20.3	57.9	24.4	7.9
Refrigeration	555.50	7056.67	12.5	1.8	700	27.8	57.9	24.4	7.9
Power Generation	555.51	7056.82	10.0	1.1	644	24.0	57.9	24.4	7.9
Fire Heater	555.50	7056.82	8.5	0.9	500	9.0	57.9	24.4	7.9

1/ 5-unit configuration.

Source: Dames and Moore, 1988a.

Table 4.2.6-2 Modeling Results for Compressor Stations
(5-Station Scenario)
(Concentrations in ug/m^3)

Pollutant	Averaging Time	Predicted Maximum	Significant Impact Level	PSD Increment	NAAQS
NO_2 1/	Annual	11.7	1	N/A	100
SO_2	3-hour	0.8	25	512	1,300
	24-hour	0.4	5	91	365
	Annual	<0.1	1	20	80
CO	1-hour	250.7	2,000	N/A	40,000
	8-hour	175.5	500	N/A	10,000
PM	24-hour	4.7	5	37	150
	Annual	0.2	1	19	50

1/ NO_2 increment has not yet been promulgated by EPA which is under a court-ordered schedule to promulgate a NO_2 increment not later than October 1988. The value of 25 ug/m^3 has been suggested by EPA Region 10 as a proposed increment.

Source: Dames and Moore, 1988b.

facilities at Valdez encompassed several stations with the closest being approximately five miles from the proposed TAGS LNG plant and marine terminal. The Alaska Pacific Refinery facility site is more than ten miles from Anderson Bay and did not include sampling for ozone or CO (Dames and Moore, 1988a).

Atmospheric dispersion models require meteorological data for a one-year period. Mandatory parameters include: wind speed, wind direction, temperature, stability class and mixing heights. During the period 1978-1980, meteorological data was collected at several locations in the Valdez area. These data sources were used for the modeling for the LNG plant and marine terminal. In general, the Jackson Point data is considered as most representative for Anderson Bay since both locations are characterized by east-west shorelines with water to the north and mountainous terrain immediately to the south (Dames and Moore, 1988a).

Stack parameters of the LNG plant and marine terminal used for air quality modeling are presented in Table 4.2.6-3. Modeling results for NO_2, SO_2, CO and TSP/PM_{10} are presented in Table 4.2.6-4. These data show the predicted maximum short-term (3-hour and 24-hour) SO_2 impacts of 12.5 ug/m^3 and 6.9 ug/m^3, respectively, fall below the PSD increment and federal standards. The 24-hour SO_2 predicted impact exceeds the SIL of 5 ug/m^3, but the annual SO_2 impact of 0.9 ug/m^3 was below all quantifiable levels. Maximum 1-hour and 8-hour CO impacts of 1080.7 ug/m^3 and 286.7 ug/m^3, respectively, are well below the 1-hour and 8-hour SIL for each and federal standards. The maximum 24-hour TSP/PM_{10} impact of 13.4 ug/m^3 was well below the PSD TSP increment of 37 ug/m^3 and federal PM_{10} standard of 150 ug/m^3. The annual 24-hour federal TSP SIL of 5 ug/m^3 was exceeded and the annual TSP/PM_{10} impact of 1.2 ug/m^3 was slightly above the 1 ug/m^3 SIL. The predicted annual NO_2 impact of 18.0 ug/m^3 was well below the federal standard of 100 ug/m^3; however, the 1 ug/m^3 SIL was exceeded. Note that the annual NO_2 impact also was predicted to be well below the proposed PSD increment of 25 ug/m^3 (Dames and Moore, 1988b).

YPC is aware of the ADEC's air quality monitoring requirements, which could be accomplished within the currently projected project schedule.

The Port Valdez area naturally experiences fog especially during winter months in morning hours when moist air masses from the southwest result in overcast skies and neutral or stable vertical mixing conditions. The introduction of additional water vapor to such an atmosphere could increase fog.

The LNG plant includes several previously identified sources that emit water vapor as a product of natural gas combustion. Typically, the moisture content of such exhaust gases is less than 20 percent by volume.

The emission of water vapor to the atmosphere from the LNG plant would be elevated by exhaust gas temperatures from the combustion of fuel (stack gas temperatures from turbine engines are 891°F) and the air-cooled condensor coils used in the gas liquefaction system. A synergistic effect from the various exhaust points and from the released cooling load would yield a greater plume rise, longer transport, and greater dispersion of the moist exhaust gases placing water vapors higher into the atmosphere.

The air quality analysis presented in Subsections 4.2.6.3.1 and 4.2.6.3.2 were based on conservative control design and model approach assumptions. Refinements of these assumptions would occur during the PSD permitting process when the best available control technology (BACT) would be defined by specific equipment and representative meteorological and air quality data would become available. The project would meet all BACT requirements dictated by PSD regulations.

NOx emission control for gas turbines would include stage air/fuel introduction and/or combustion modification. Heater NOx emission control would probably include NOx burners. The BACT for SO_2 and PM_{10} would consist of the use of low sulfur and particulate fuel.

The emissions at the LNG plant and marine terminal would not exceed NAAQS; however they would exceed SIL for 24-hour SO_2, 24-hour TSP, annual TSP/PM_{10} and NO_2. Therefore, the air quality impacts from the proposed TAGS facilities at Anderson Bay are considered to have

Table 4.2.6-3 Stack Parameters of LNG Plant and Marine Terminal

Source	UTM (East km)	UTM (North km)	Height (m)	Diameter (m)	Temperature (k)	Velocity (m/s)	Building Dimensions (meters)		
							Length	Width	Height
LNG Train #1	525.90	6771.30	12.50	6.0	711.0	32.7	100.6	28.0	7.9
LNG Train #2	526.10	6771.30	12.50	6.0	711.0	32.7	100.6	28.0	7.9
LNG Train #3	526.30	6771.30	12.50	6.0	711.0	32.7	100.6	28.0	7.9
LNG Train #4	526.50	6771.30	12.50	6.0	711.0	32.7	100.6	28.0	7.9
Power Generator	526.60	6771.50	12.50	5.0	711.0	32.7	39.6	21.3	7.9
Fired Heater	526.60	6771.20	12.50	2.0	466.0	5.4	30.5	18.3	4.9
Tanker #1	525.70	6771.90	38.10	1.7	450.0	5.8	300.5	45.7	13.7
Tanker #2	526.10	6771.00	38.10	1.7	450.0	5.8	300.5	45.7	13.7
Tugboat #1	525.20	6772.40	9.10	0.5	730.0	15.2		NA	
Tugboat #2	525.70	6772.10	9.10	0.5	730.0	15.2		NA	
Tugboat #3	526.20	6772.40	9.10	0.5	730.0	15.2		NA	
Tugboat #4	526.70	6772.30	9.10	0.5	730.0	15.2		NA	

Source: Dames and Moore, 1988a

Table 4.2.6-4 Modeling Results for LNG Plant and Marine Terminal Facilities (Concentrations in ug/m^3) 1/

Pollutant	Averaging Time	Predicted Maximum	Modeled Background	Total Concentration	Significant Impact Level	PSD Increment	NAAQS
NO_2 2/	Annual	18.0 3/	16.1	34.1	1	N/A	100
SO_2	3-hour	12.5	N/A	12.5	25	512	1,300
	24-hour	6.9	61.5	68.4	5	91	365
	Annual	0.9	N/A	0.9	1	20	80
CO	1-hour	1080.7	N/A	1080.7	2,000	N/A	40,000
	8-hour	286.7	N/A	286.7	500	N/A	10,000
PM_{10}	24-hour	13.4	32.8	46.2	5	37	150
	Annual	1.2	4.3	5.5	1	19	50

1/ Caution should be used in interpreting air quality effects from modeling, due to the inherent uncertainty in modeling and the highly complex air quality issues in the Valdez area (EPA, 1988b).

2/ NO_2 increment has yet to be promulgated by EPA which is under a court-ordered schedule to promulgate NO_2 increment by no later than October 1988. The value of 25 ug/m^3 has been suggested by EPA Region 10 as a proposed increment.

3/ NO_2 concentration based upon assumed 50% NO_x control of LNG trains and power generation emissions.

Source: Dames and Moore, 1988b.

potential for causing moderate impacts. EPA (1988b) cautions that interpreting air quality modeling has inherent uncertainty due to modeling and the highly complex air quality issues in the Valdez area.

4.2.6.3.3 LNG Terminal

Identified sources of emission to the atmosphere from the operation of the LNG terminal would include: 1) tanker engine emission, and 2) fugitive leaks in the LNG marine tanks and loading lines. Although the engines may have an option to operate on bunker fuel, tanker engines are assumed to operate on natural gas fuel which is boil-off from the LNG tanks while in port. ***Tanker emissions were included in the LNG modeling presented in Table 4.2.6-4.***

The capacity of the LNG loading lines would allow simultaneous loading of two tankers in a 12-hour period. Due to the time required for idling and docking, limited worst-case 24-hour emissions would occur when the terminal services three LNG tankers of 125,000-cubic meter capacity in one day.

Emission of nitrogen oxides, particulate, hydrocarbons, and sulfur oxides are expected from the tankers' internal combustion engines. Nitrogen oxide emissions from these natural-gas-fired engines are expected to be greater than emissions of sulfur oxides, particulate, or hydrocarbons. The extent of these emissions is expected to be of minor concern at receptors at the Alyeska Terminal and in Valdez.

Should the engines operate with the optional bunker fuel, or a combination of natural gas boil-off and bunker fuel as is occurring in Cook Inlet, emissions of nitrogen oxides, particulate, and carbon monoxide would be similar to those outlined above. Emission of sulfur dioxide would be greater than with natural gas fuel. At the Cook Inlet facility, LNG tankers normally use a mix of 94 percent LNG boil-off and 6 percent bunker fuel (McCall, pers. comm.). The extent of sulfur dioxide emission with this fuel mix would not be expected to exceed national standards.

Fugitive leaks of LNG or of natural gas from storage tanks on the tankers and from loading lines represent emissions of nonmethane hydrocarbons as well as emission of methane. The anticipated feed gas composition includes 17.86 percent by weight of nonmethane hydrocarbons. Unlike the emission of methane, the emission of nonmethane hydrocarbons to the atmosphere contributes to the formation of ozone and photochemical smog. The extent of these emissions to the atmosphere, however, would be carefully controlled to reduce fire hazard and product losses as well as to reduce emissions to the atmosphere. Mitigative measures proposed by YPC should ensure that nonmethane hydrocarbon emissions are of minor concern and impacts negligible.

As discussed above, the BACT would be developed during the PSD permitting process, resulting in additional mitigative measures.

4.2.6.3.4 Summary

Construction and operation of the compressor stations, LNG plant, and marine terminal would result in degradation of air quality. Various sources of emission would occur during both construction and/or operation of the facilities. The sources judged to have the greatest potential impact ***are located at Anderson Bay. A dispersion modeling analysis of the emissions indicated that the LNG plant and marine terminal would not exceed NAAQS; however emissions would exceed existing SIL for the 24-hour SO_2, 24-hour TSP, annual TSP/PM_{10} and NO_2. Additionally, the SIL for NO_2 is exceeded at compressor stations. Overall these impacts are minor to moderate. Final design and use of BACT has potential to provide substantial reduction in these predicted emissions. EPA (1988b) futher cautions that there is inherent uncertainty in the modeling results and care should be used in interpreting predicted air quality impacts in the Valdez area due to the modeling and highly complex air quality issues.***

4.2.7 Liquid, Solid, and Hazardous Wastes

4.2.7.1 Introduction

Three categories of wastes would be generated by the proposed TAGS project facilities during construction and operations--all of which are strictly controlled by Alaska Department of Environmental Conservation (ADEC) or EPA.

These wastes, including their source and their disposition, are the subjects of the following subsections.

4.2.7.2 Liquid Wastes

Wastes from all facilities would not significantly degrade the surface and subsurface water quality beyond the approved mixing zone. During operations the compressor station resident staff would number about 10. Accommodations for up to 20 additional maintenance personnel would be available. Using a per-capita rate of 100 gallons per capita per day, the average daily quantity of wastewater generated would be 1,000 gallons with a maximum of 3,000 gallons. Wastes from compressor stations would be collected and emptied at offsite approved treatment plants. Impacts of wastewater discharge would be minor unless an unexpected condition were to arise that would require special mediation unique to each individual situation.

Liquid wastes from hydrostatic testing may or may not contain contaminants which would require a state discharge permit prior to release. In any case, applicant would adhere to ADEC regulations.

Equipment washdown at construction camps and compressor stations would occur as necessary and would constitute about 15 percent of the volume of wastewater generated. These wastes would be collected in a sump or other device run through an oil-water separator. The remaining water would be routed through a settling basin to remove sediment. This water would then be discharged along with the wastewater to dilute waste concentration. Wastes from the settling basin would be disposed of in an approved solid waste disposal site. If operated properly, negligible impacts would result.

Surface water runoff from each workpad, construction laydown area, and full storage area would depend on local precipitation, but each site would be designed to retain a large runoff in a short period of time. The retention facilities would be installed to collect the runoff, which could then be run through an oil-water separator and/or a settling basin.

Industrial liquid wastes would be generated primarily by vehicle maintenance and repair. Oily waste would be collected in sumps. Mixing would be avoided whenever possible. Wastes would be stored in approved containers until they could be properly disposed of either at a recycling center or a hazardous waste facility if they are classified as toxic or hazardous. Impacts should be negligible unless an accident occurred during transport of the material, particularly aboard ship. The resulting environmental impacts would depend on the location of the occurrence and the sensitivity of the area.

Risk of serious secondary environmental harm as a result of accidents during transshipment is considered minor due to the type and amounts of liquid waste to be generated by the TAGS project.

4.2.7.3 Solid Wastes

Solid wastes would be generated primarily at the construction camps at the rate of about 8 pounds per person per day. Table 4.2.7-1 provides a summary by construction camp. This waste would consist of paper, cans, bottles, cooking scraps and wastes, repair scraps, and used pallets and broken lumber. Estimated quantities of solid wastes generated at each camp are listed in Table 4.2.7-1. Combustible wastes would be burned as permitted by the ADEC, and the remaining materials plus noncombustibles would be placed in an approved landfill or at a local solid waste facility. Solid wastes generated at compressor stations should range from approximately 50 to 150 pounds/day. These wastes would be managed the same as construction camp wastes. Wastes from operation of the LNG plant/marine terminal should average approximately 500 pounds/day and would be disposed of at a properly developed and approved landfill on-site, or at local solid waste management facilities. Incineration rather than storing food scraps and wastes would avoid attracting bears and other wildlife and reduce creation and destruction of nuisance animals. ***Fencing would be used at camps to preclude the development of an attractive nuisance and unwanted human/carnivore interaction.*** Proper landfilling would result in negligible impacts.

4.2.7.4 Hazardous Wastes

Hazardous and toxic materials would be used on site at all work camps, compressor stations, and along the pipeline route and would include at least the following: pressurized gases; solvents; chlorinated hydrocarbons; explosive gases; flammables such as gasoline and diesel; and corrosive materials, pesticides, herbicides, and paints. During construction, hazardous materials to be stored, handled, and used at TAGS temporary construction facility locations and for the construction of the pipeline system include various fuel oils, lubricants, electrical materials, corrosion inhibitors, acids, paints, pesticides, solvents, glycols, water treatment chemicals, and reproduction equipment chemicals.

The following tables present hazardous substances to be stored, handled, and consumed during operations: Table 4.2.7-2 estimates the total quantities for the TAGS compressor stations, Table 4.2.7-3 estimates the total quantity for the TAGS LNG plant site and marine terminal, and Table 4.2.7-4 for the Fairbanks Maintenance Facility. These materials identified in Tables 4.2.7-2, 4.2.7-3, and 4.2.7-4 would not become hazardous wastes until there is a need to dispose of them after use. When that occurs, YPC would have 90 days to collect, consolidate (not mix), properly package, place into approved DOT/PF overpack containers, and to ship them to an approved incinerator or landfill facility in accordance with applicable state and federal regulations. Any special permits required for transportation of hazardous substances would be obtained from the proper authorities.

If properly handled, accidental spills and contamination could be avoided, and impacts due to these wastes would be negligible. The major potential for impact would be during shipment to a disposal site. As with liquid waste, the risk of secondary environmental impacts during transshipment is considered minor due to the amounts of hazardous materials to be generated by TAGS.

4.2.7.5 Summary

Construction and operation of the TAGS project would result in production of several types of waste products, most being construction waste that can be handled with no impacts to the environment, ***as identified in Subsection 3.2.7. The example used for TAPS would be of a lesser volume since the construction methods and the magnitude of effort is less with fewer workers.*** Minor quantities of more sensitive waste products would result from both construction and operation. These would be handled and treated as specified by existing regulations and would, therefore, create negligable impacts. The ANGTS SFEIS considered this issue and determined it to be minimal, (FPC, 1976b, p. 364).

4.2.8 Geologic Environment

4.2.8.1 Introduction

The proposed TAGS system would interact with the geologic environment in a number of ways during construction and operation. Impacts arising from construction and operation could result in modifications to the topography, physiography, resources, and permafrost along the proposed route. Geologic processes at work in the natural environment include frost heave, thaw degradation, erosion, and mass wasting. Conversely, the geologic environment could directly affect the pipeline. For example, the pipeline would not affect the seismicity along the route; however, ground displacement along an active fault as a result of an earthquake could cause the pipeline to rupture if undetected and not considered in design.

YPC has proposed mitigation, as identified in Subsection 2.8, which should ameliorate most of the concerns regarding pipeline-geologic environment interaction. Many of the measures proposed by YPC were used successfully during construction and operation of TAPS and were considered in the EISs for ANGTS, El Paso, and AAGPC and found to result in minor impacts.

The potential interactions between the pipeline and the geologic environment are discussed in Subsections 4.2.8.2 to 4.2.8.7. Section 4.2.8.8 presents a

Table 4.2.7-1 Construction Camp Waste Quantities

Mile Post	Camp	Bed Spaces	Average Daily Wastewater Quantities (gallons)	Average Daily Solid Waste Quantities (pounds)
0	Prudhoe Bay	200	20,000	1,580
43	Franklin Bluffs	400	40,000	3,160
66	Compressor Station #1	400	40,000	3,160
84	Happy Valley	500	50,000	3,950
125	Compressor Station #2	400	40,000	3,160
140	Galbraith Lake	500	50,000	3,950
170	Chandalar	500	50,000	3,950
201	Dietrich	600	60,000	4,740
213	Compressor Station #3	400	40,000	3,160
236	Coldfoot	900	90,000	7,110
281	Compressor Station #4	400	40,000	3,160
299	Oldman	700	70,000	5,530
345	Five Mile	700	70,000	5,530
358	Compressor Station #5	400	40,000	3,160
394	Livengood	700	70,000	5,530
422	Compressor Station #6	400	40,000	3,160
451	Fairbanks	1,000	100,000	7,900
487	Compressor Station #7	400	40,000	3,160
526	Delta	800	80,000	6,320
563	Compressor Station #8	400	40,000	3,160
600	Isabel Pass	600	60,000	4,740
629	Compressor Station #9 Sourdough Creek	900	90,000	7,110
682	Glennallen	700	70,000	5,530
721	Compressor Station #10 Tonsina	1,000	100,000	7,900
770	Sheep Creek	500	50,000	3,950
797	LNG Plant/ Marine Terminal	1,700	170,000	13,430

NOTE : Changes in Bold Print

Table 4.2.7-2 Estimated Quantities of Hazardous Substances Stored, Handled, or Consumed for the Proposed TAGS Compressor Stations

Description	Monthly Consumption	Storage	Remarks
Nitrogen	3,750 scf*	7,500 scf	250 scf bottles at 2,200 psig, 6 bottles/station
Gas turbine/ compressor oil	-0-	1,200 gallons	Synthetic oil
Seal oil	550 gallons	5,500 gallons	Stored in 55-gallon drums
Halon (or other inert gas)	-0-	3,000 pounds	Stored in 300-pound cylinders
Glycol	20 gallons	2,200 gallons	Stored in 55-gallon drums
Freon (or other refrigerant gas)	-0-	10,000 pounds	Stored in 1-ton containers; make-up storage of 2 percent
Diesel	11,500 gallons	200,000 gallons	40,000-gallon tank at station
Gasoline	3,000 gallons	25,000 gallons	5,000-gallon tank at station

* Standard cubic feet

Table 4.2.7-3 Estimated Quantitites of Hazardous Substances Stored, Handled, or Consumed for the Proposed TAGS LNG Plant Site and Marine Terminal

Description	Monthly Consumption	Storage	Remarks
Ethylene	55,440 pounds	1,200,000 pounds	6,000 barrels refrigerated storage sphere
Propane	484,440 pounds	4,532,000 pounds	4 high-pressure 16,230-foot^3 bullets
Nitrogen	684,000 scf*	5,121,050 scf	55,000-gallon liquid nitrogen tank
Gas turbine/ compressor oil	-0-	150 barrels	Stored in 55-gallon drums
Seal oil	25 barrels	50 barrels	Stored in 55-gallon drums
Glycol	2 barrels	80 barrels	Stored in 55-gallon drums
Chlorine	350 pounds	2,000 pounds	Stored in 2,000-pound cyliners
Halon (or other inert gas)	-0-	3,000 pounds	Stored in 300-pound cyliners (one system replacement)
Methanol	-0-	10 barrels	Stored in 55-gallon drums
Diesel	1,845 barrels	40,000 barrels	Two 20,000-barrel tanks
Molecular sieve	-0-	10,000 pounds	Stored in barrels (one trap replacement)
Activated carbon	-0-	10,000 pounds	Stored in barrels (one trap replacement)

* Standard cubic feet

Table 4.2.7-4 Storage of the Following Refrigerants and Chemicals for the Proposed TAGS Fairbanks Maintenance Facility

Lube oil	8,600 gallons (two reservoir replacements)
Seal oil	1,200 gallons
Halon	8,800 pounds (one total system replacement)
Freon	18,000 pounds (5 percent volume/year)

systematic description of pipeline/geologic environment interaction.

4.2.8.2 Topography and Physiography

Topographic and physiographic impacts resulting from the development of the TAGS pipeline would be primarily the result of excavation necessary for the construction of the pipeline. Clearing and grading of the working surface, including filling and cutting and the development of new or expansion of existing borrow sites, would modify existing landforms over the short-term construction phase and would leave permanent scars in the terrain in areas where the pipeline route traverses bedrock or where borrow pits, spoil disposal, or quarry sites have been developed. These impacts are principally visual changes of the landforms. Alterations of existing drainage features might also cause minor but permanent changes.

Maintenance of the pipeline could result in local changes in terrain similar to those during initial construction. These impacts would probably be localized and of minor importance, similar to those experienced by TAPS.

At Anderson Bay, site excavation would involve removal of overburden soils down to bedrock to facility elevations as described in Subsection 2.5. Approximately 10 million yards of excavated quantities (after bulking) would be utilized for on-site fill placement and 5 million yards would require disposal. The features of the LNG plant site would be considerably modified creating a visual impact similar to that of the TAPS terminal site.

4.2.8.3 Mineral and Petroleum Resources

4.2.8.3.1 General Statement

The primary resources that could be affected by construction and operation of the proposed TAGS pipeline are petroleum and aggregate (sand, gravel, and quarry rock). Potential impacts to these resources are discussed in more detail in the following sections.

The impact of the proposed pipeline on coal and heavy metal resources would be negligible.

4.2.8.3.2 Petroleum Resources

Experience in petroleum-producing provinces elsewhere in the world indicates that construction and operation of the infrastructure required to support a large oil/gas field often leads to extension of the field and possibly to discovery of additional fields nearby. To date, the development of the Prudhoe Bay field has led to the discovery and development of the Kuparuk, Lisburne, and Endicott fields. Continuing expansion of oil-producing operations on the North Slope and the continental shelf underlying the Arctic Ocean is to be expected except as curtailed by economic factors or restricted by governmental regulation, classification, or other policies. Operation of the TAGS pipeline, providing additional access for Alaska North Slope natural gas to markets, would be expected to lead to discovery, extraction, transportation, and use of additional quantities of oil and gas on the North Slope in excess of presently proven reserves. This is the identical effect as identified in ANGTS (FPC 1976b, p. 365).

Secondary effects of this enhanced development is addressed as part of the federal and state leasing project, as an example, the Beaufort Sea Sale 97, ***FEIS, June 6, 1987.***

Operation of the LNG plant/marine terminal at the southern end of the pipeline would provide a processing and export facility for natural gas from the offshore area in the Gulf of Alaska and from the onshore areas along the pipeline route. The extent of new exploration and discovering new energy resources is proportional to the amount of transportation and marketing capabilities between supply sources and markets. The impact of TAGS with its diversified market would have a major effect on the development of petroleum resources.

4.2.8.3.3 Mineral Materials

Construction of the TAGS pipeline and its associated work pad would require large quantities of aggregate for right-of-way preparation, access roads, foundations, and specialized ditch backfill. Preliminary estimates indicate 33 million cubic yards of aggregate may be required for completion of the TAGS project. The applicant proposes, wherever possible, to reuse construction areas where gravel pads remain after TAPS construction uses were finished, such as construction camps, and to use some existing TAPS access roads where joint use is feasible. This accounts for an estimate for TAGS of some 8 million cubic yards of mineral materials less than used for TAPS construction.

Most, if not all, TAGS mineral material sites would be uplands. Table 2.3.2-1 shows the estimated mineral material requirements by construction spread. Construction Spreads 1 (North Slope) and 5 (Copper Valley) have limited proven sources of mineral materials. In Construction Spread 1 design criteria will emphasize construction and maintenance procedures that make maximum use of winter period snow/ice work pad. In Construction Spread 5, it is unlikely that snow and/or ice work pad construction techniques would reduce significantly the mineral material requirements for TAGS. This area also is one where the TAGS operation/design criteria may be either at a chilled or ambient operating temperature. Due to the complex soil/permafrost interactions in much of this spread, it is probable that long-term, regular surface access to and along the pipeline route would be required. Therefore, amounts of mineral materials needed are not likely to be reduced.

Overall no major environmental adverse impacts are expected at any upland mineral material site as the adjacent forest provides scenic screening and standard erosion mitigations protect fishery habitats. Where these deposits are incorporated in or underlain by permafrost, their excavation would cause the permafrost to thaw. Impacts from permafrost thawing are considered minor since standard mitigations for slope stability in arctic environments have succeeded in keeping erosion localized to the mineral material site.

Upland material sources used for construction would be visible for a substantial number of years. The exact duration would depend upon whether permafrost is present, length of growing season, extent and type of soil terrain, and vegetation in the surrounding area. Upland sites would have more fine soils included within the gravel, and therefore screening or washing procedures would be necessary. The applicant would investigate prospective mineral material sources in Phase II of project development and develop detailed mining plans showing how the site would be mined, the access, and stabilization-revegetation proposals. This would be similar to the process successfully used for TAPS and would be submitted to appropriate interagency review and comment prior to approval.

Material extraction from river gravel bars, above water levels, leaves no permanent scars; if taken during the winter the extraction provides no sedimentation and does not harm fish eggs, which cannot tolerate subzero temperatures. However, there are other factors such as fuel spills and material storage to be considered. In floodplain sites, adherence to biologically accepted practices, including those summarized in FWS, 1980 study.

Moderate impacts would result from extraction of 33 million cubic yards of mineral materials for TAGS and would be similar to those for TAPS and for the state highway system. A major exception is that the applicant has not proposed to use active river- or streambed sources. Impacts to supplies of mineral materials in all but Construction Spreads 1 and 5 would be negligible to moderate. In some cases, available supplies would be used faster and have a potentially moderate effect; conversely, actions associated with exploring mineral sources in areas not now available would create moderate effects to the extent new supplies exceed TAGS needs and there is access to existing and authorized transportation utility systems.

The El Paso, ANGTS, and Sales Gas Conditioning Plant FEIS focused on the significant impacts of mineral extraction from water bodies, this would not be the case with TAGS. Therefore, the impacts would be less since TAGS plans to remain out of water bodies whenever possible.

4.2.8.4 Seismicity

The applicant recognizes that a major design criterion for TAGS would be the ability of the system to withstand the anticipated effects of a major earthquake. The earthquake potential along the various segments of the route has been expressed in terms of the maximum credible earthquake (DOI 1974). The applicant, like TAPS, has proposed specific designs for fault crossings and has proposed to develop additional data to evaluate slope stability, liquefaction, and strains in buried pipe. The collection of data and their use would be similar to that required of TAPS. Developing and applying these criteria correctly would result in a pipeline system capable of withstanding earthquake effects while producing no major impacts to the environment.

The following four distinct but interrelated seismic phenomena constitute potential impacts to the proposed pipeline.

- Soil liquefaction and ground breakage
- Ground motion, including potential slope failure
- Differential movement along a fault
- Water inundation by earthquake-generated waves (tsunamis)

Liquefaction, the earthquake-induced transformation of stable granular materials such as silt and sands into a fluidlike state, can occur during long-duration and significant seismic events. Due to a general lack of cohesion, the relatively common deposits of uniform silts and fine sandy silts found in and beneath some stream valleys in Alaska are susceptible to seismic liquefaction. In addition, zones of other fine-grained sediments in these valleys may be susceptible to liquefaction.

YPC recognizes that liquefaction and strong ground motion are significant geotechnical constraints to siting and designing the proposed system. The potential impacts of these phenomena can be reduced by avoiding potentially liquefiable areas or, in areas where alignment changes are not feasible, by applying construction techniques to mitigate potential liquefaction-related problems.

Consolidation of loose alluvial sediments under seismic shaking occurs in both the horizontal and vertical dimensions, resulting in settlement, ground cracking, or breakage.

The occurrence of large earthquakes is a potentially serious hazard to the integrity of the pipeline system. Seismic shaking or surface faulting accompanying a large shock could deform the pipeline directly or cause failure in the foundation material that could lead to deformation. Excessive pipeline deformation could result in rupture where the route crosses active faults. The applicant has proposed to traverse the faults in the above-ground mode on steel beams at grade or on vertical support members (VSM) similar to TAPS. Proper design of the above-ground fault crossings would result in a system that would accommodate differential pipeline movement from earthquake-induced horizontal and/or vertical displacement. Large earthquakes could trigger landslides and sea waves that could affect the integrity of the loading dock and tankers.

The immediate environmental impact of a pipeline failure resulting from an earthquake would depend on specific circumstances. The most serious direct impacts from such a failure would result from ignition of escaping gas and a resulting fire. Destruction of the vegetative cover could result in disruption of the thermal regime and initiation of erosion. Use of heavy equipment in suppressing the fire and making repairs could have further impacts on surface geological features and vegetative cover.

The pipeline and LNG plant are located at an elevation higher than that of the highest recorded tsunami run-up wave, and no major impacts to these onshore structures would be anticipated.

Overall seismic issues associated with TAGS are comparable to those associated with TAPS and as identified in the EIS for the El Paso pipeline and LNG plant (FPC, 1976a).

4.2.8.5 Permafrost

Impacts to permafrost occur where there are changes to its existing delicate heat balance. The *YPC* proposes to maintain mean pipeline operating temperatures between 0°F and 32°F in permafrost areas. Compression and refrigeration of the gas would take place at regular intervals along the pipeline in order to reduce the likelihood of large-scale and long-term degradation of the permafrost. As proposed, the pipeline operation would have minor impacts on the permafrost regime, during operation when a subfreezing condition would produce a minor net increase in permafrost occurence. During the period between initial construction and ***operation*** stability, there are opportunities where permafrost regimes would be thawed. Pipeline and system design criteria are intended to prevent permafrost degration because such an event could threaten pipeline system operation in sensitive environments through increased erosion. Since these latter environment effects would be specifically reduced through arctic design/construction techniques, the overall impact on permafrost is minor. This is the same design approach used in the evaluation and subsequent approvals of authorized ANGTS.

The most significant impacts on permafrost would be realized as a result of disturbing the natural ground surface during construction. Changes could result from any activity that reduces the surficial material or changes surficial heating characteristics. Reducing the insulating qualities of the surface material through compaction or removal of material would increase surface heat input to permafrost during summer and could cause degradation.

All disturbances in permafrost areas would have long-term, perhaps irreversible effects on the permafrost regime. Construction activities that could affect the permafrost include the placement of gravel workpads and structures and ditch excavation. The thickness and general insulating qualities of the organic layer and the ice content of the uppermost permafrost layers are probably most critical in determining specific impacts. The applicant has proposed thermal modeling as a means to assess the effects of thermal disturbance caused by clearing, placement of workpads, and ditching. Mineral material sites would have specific approved plans to ensure that the disturbance to the permafrost environment does not cause major impacts to other resources.

Removal of the present ground surface materials or change in their thermal properties by in situ use would have impacts ranging from negligible to moderate during construction and operation, with greatest impacts occurring if the underlying soil is ice rich. Exposure of the ice-rich soil to solar radiation results in melting. If the exposed ice-rich soil is brought into contact with running water, thermal erosion takes place as the water not only melts the interstitial ice, but also carries away the soil particles. If a high-ice content area is involved, subsidence of the soil surface, gullying, and establishment of new drainage patterns could occur. Depending on the topography, characteristics of the permafrost, and type of disturbance, impacts would vary from negligible to major.

Mitigative measures proposed by the applicant to minimize permafrost melting and erosion would include construction scheduling, specialized construction zone grading, and use of erosion control techniques. Construction of TAPS has shown that if these measures are properly applied, construction impacts would be reduced to localized impacts on the permafrost regime.

Portions of the pipeline would be buried as long as ***two-and-one-half*** years before the introduction of chilled gas. Impacts of the pipeline construction on the permafrost would occur in the time period from the initial disturbance until the startup of chilled operation. Pipe backfill materials could become saturated, increasing the bouyancy of the pipe. Thaw of the permafrost may occur in a number of areas, and there may be some thaw settlement and risk of instability of the backfill and work pad area. This would be considered and mitigated in the design process. Impacts would be minor.

In sloping terrain the pipeline ditch could divert and capture local surface drainage, causing erosion of natural surface soils and removal of pipe supporting materials by becoming a channel of reduced resistance to water flow (FPC 1976a). The use of ditch plugs, surface protection, select pipe ditch backfill, and erosion control monitoring could mitigate impacts occurring as a result of local drainage capture and modification. Erosion-control monitoring would be a continual mitigation effort to reduce the potential occurrences prior to and during operation. Impacts would be minor.

Numerous studies, field data, and full-scale tests conducted by government and industry indicate that the operation of a chilled gas pipeline would result in creation of a frost bulb. The direct impact of decreasing the temperature of existing permafrost is negligible. However, the creation of a frost bulb in formerly unfrozen zones could have major impacts on the integrity of the pipeline and on the surrounding environment and nearby facilities. Frost bulb growth beneath streams and across subsurface drainage zones could result in lowered water temperatures for overwintering fish and an increase in the occurrence and severity of aufeis development.

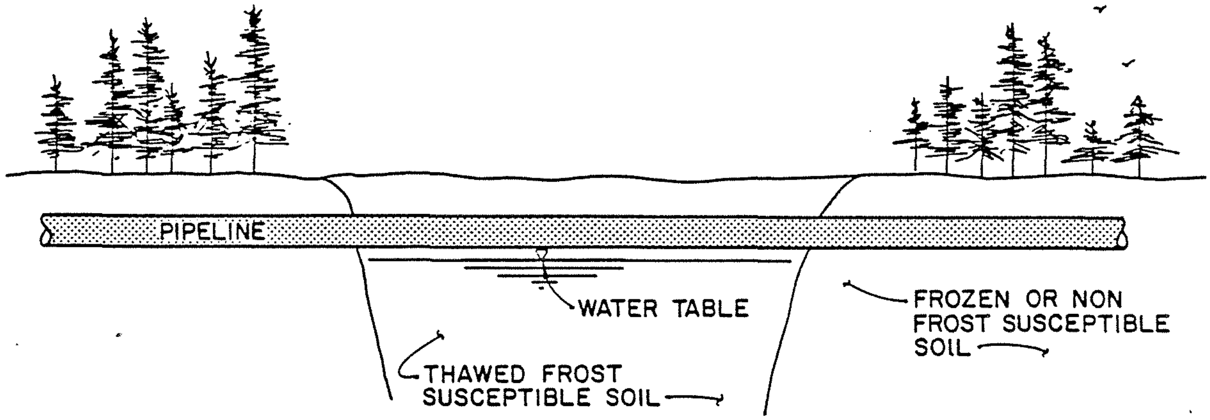
The applicant understands these impacts could be major and has proposed to investigate design measures to mitigate the impact of frost bulb growth on subsurface flow and to adjacent facilities, as discussed in FPC (1976a), p. II-273. Additionally, an unavoidable adverse impact identified for ANGTS (FPC 1976b, p. 363) confirms that although quantification is impossible, the construction and operation of ANGTS would cause long-term disturbance to permafrost areas. Where differential thawing and erosion would occur, it would be difficult to control.

4.2.8.6 Frost Heave

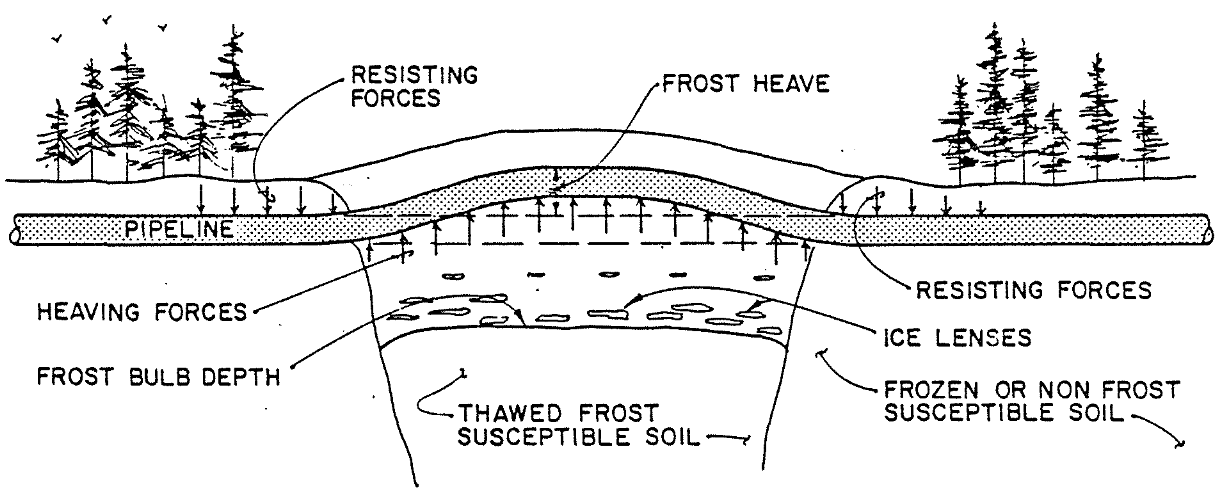
Much research has been devoted to developing an understanding of the mechanism of frost heave and to developing models for qualification and quantification of frost heave. In addition, large amounts of laboratory and full-scale frost heave data have been developed and reported by public and private institutions such as the USACE Cold Regions Research and Engineering Laboratory ***and others. See comment 27 and response to comment 12-17.*** The applicant recognizes frost heave as a major design consideration for the proposed system and intends to obtain additional field and laboratory data in order to predict the behavior of frost-susceptible soils as they affect the pipeline and related facilities.

Frost heave, or upward movement of the soil mass, results primarily from the development of segregated ice lenses due to freezing of soil water migrating to the freezing front and to a lesser extent due to freezing of some of the pore water in a "bulb". A chilled gas pipeline passing through initially thawed soils would cause a bulb of frozen soil to develop over time. Frost heave is possible anywhere with freezing temperatures, a source of water, and frost-susceptible soils ***as shown in Figure 4.2.8-1.***

The impact of frost heave upon the pipeline would depend on the severity of the heaving. If it occurs over long lengths of the pipe, heave of the pipe (and its associated frost bulb) would not affect its integrity adversely. If it occurs in an area subject to flooding and stream erosion, however, the pipe could become exposed and subject to damage. Differential heave of the pipeline, particularly over short spans, would increase stress on the pipe and is one of the most important geotechnical concerns, especially in transition zones with adjacent areas of frost-susceptible and nonfrost-susceptible soils ***as shown in Figure 4.2.8-2.*** The applicant proposes to mitigate the effects of pipe stress caused by frost heave primarily by incorporating thicker-walled pipe in those areas where frost heave forces are anticipated. ***Other***



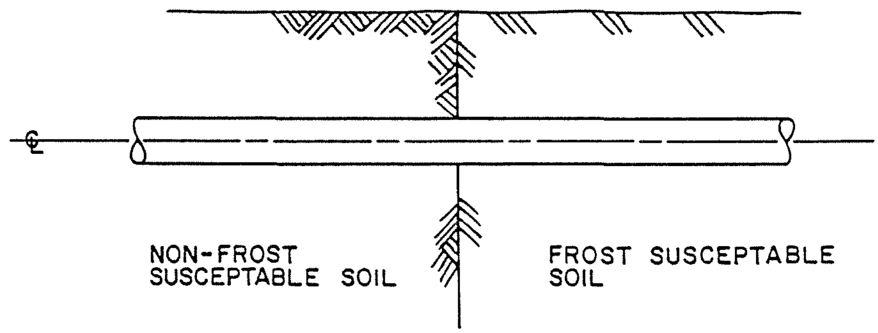
GENERAL CONDITION BEFORE COOLING



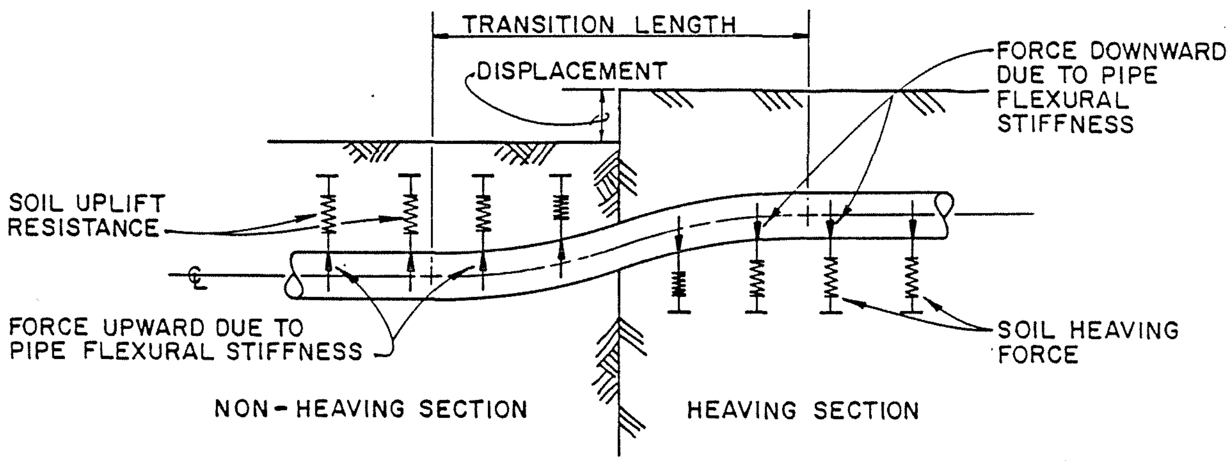
GENERAL CONDITION AFTER COOLING

Figure 4.2.8-1 General Representation Frost Heave Phenomenon

NOTE : New Figure in FEIS



A. ABRUPT THERMAL INTERFACE - INITIAL STATE



B. ABRUPT THERMAL INTERFACE - DURING OPERATION

Figure 4.2.8-2 Frost Heave Effect on Pipeline

NOTE : New Figure in FEIS

potential solutions to reducing local frost heave problems that also will be considered as final site-specific designs developed by YPC are: pipe-wall insulation, excavation and replacement of frost-susceptible soil, ditch-wall insulation, and insulated pipe-berm burial (Figure 4.2.8-3). Additional options include the use of passive, surface-thawing techniques, special operation and maintenance procedures (such as gas temperature cycling or deep thawing with probes), and use of thermosyphons at valve locations. The primary environmental impacts would be the effects on the soils and vegetation caused by the need to repair or replace the pipe. Impacts from these activities would normally be minor unless the action occurs in an environmentally sensitive area or during a time period when weather conditions are not optimal. In those cases impacts would be more severe.

Secondary impacts to other resources associated with TAGS would be directly related to the frequency of repair or maintenance. In a worst case the impacts would be similar to those for initial construction except effects would be confined to the localized area requiring extensive repair or maintenance. The frequency and probability of worst-case situations could be substantially reduced once design criteria have been proposed, evaluated, and approved.

Uplifting of the pipe due to frost heave could cause ponding of surface water on the upstream side of the pipeline and redirection of surface water flow. Impacts on surface water flow could be moderate where uplift occurs over long distances across the preexisting drainage direction. The intercepted surface water would be led along the uphill side of the pipe until a natural drainage is reached where it would be permitted to cross the pipe via a low-water crossing or culvert. Diversion of surface water could result in increased erosion of surface soils. This impact would tend to be localized and minor. Erosion control monitoring and use of surface protection as proposed by the applicant would greatly reduce the severity and occurrence of those conditions.

The effects of frost ***heave*** on surface and ground water and fish are treated in greater detail in Section 4.2.9 - Surface Water and Ground Water, and in Section 4.2.11 - Fish Impacts.

4.2.8.7 Erosion and Mass Wasting

Erosion and mass movement consist of geological processes associated with the force of gravity--the former with water or wind as the principal medium and the latter with the entire body of soil and rock debris as the medium. Consequently, the severity of these processes increases as the slope of the land surface increases. The proposed pipeline route passes through some of the most rugged topography in Alaska, traversing many steep slopes along the route in the Brooks Range, the Alaska Range, and the Chugach Mountains as well as in some foothills and plateau regions.

The construction of TAPS and the Dalton Highway ***on the north, and the Steese, Richardson, and Glenn highways to the south*** has provided an understanding of how the slopes along the proposed TAGS alignment might be expected to react to construction disturbance. YPC proposes to use knowledge gained in constructing these projects and in conjunction with more recent advances that have been made in understanding potential slope instability to perform the initial route evaluation and preliminary design to reduce the level of potential negative impacts.

The planned TAGS route to Anderson Bay has avoided areas marked by surface indicators of naturally occurring active slope instabilities. These include extensive deposits of colluvial and talus materials, slopes patterned with solifluction lobes, bimodal failure scars on permafrost slopes, conventional landslide and rockslide areas, and progressive failures of river- or streambank cut slopes. Routing and design would be used to minimize or avoid the potential.

Solifluction is a shallow, downslope movement of water-saturated unfrozen sediments usually over a surface of frozen material. Such a shallow, downslope movement of soil and tundra vegetation probably would not affect the buried portion of the pipeline system. It could, however,

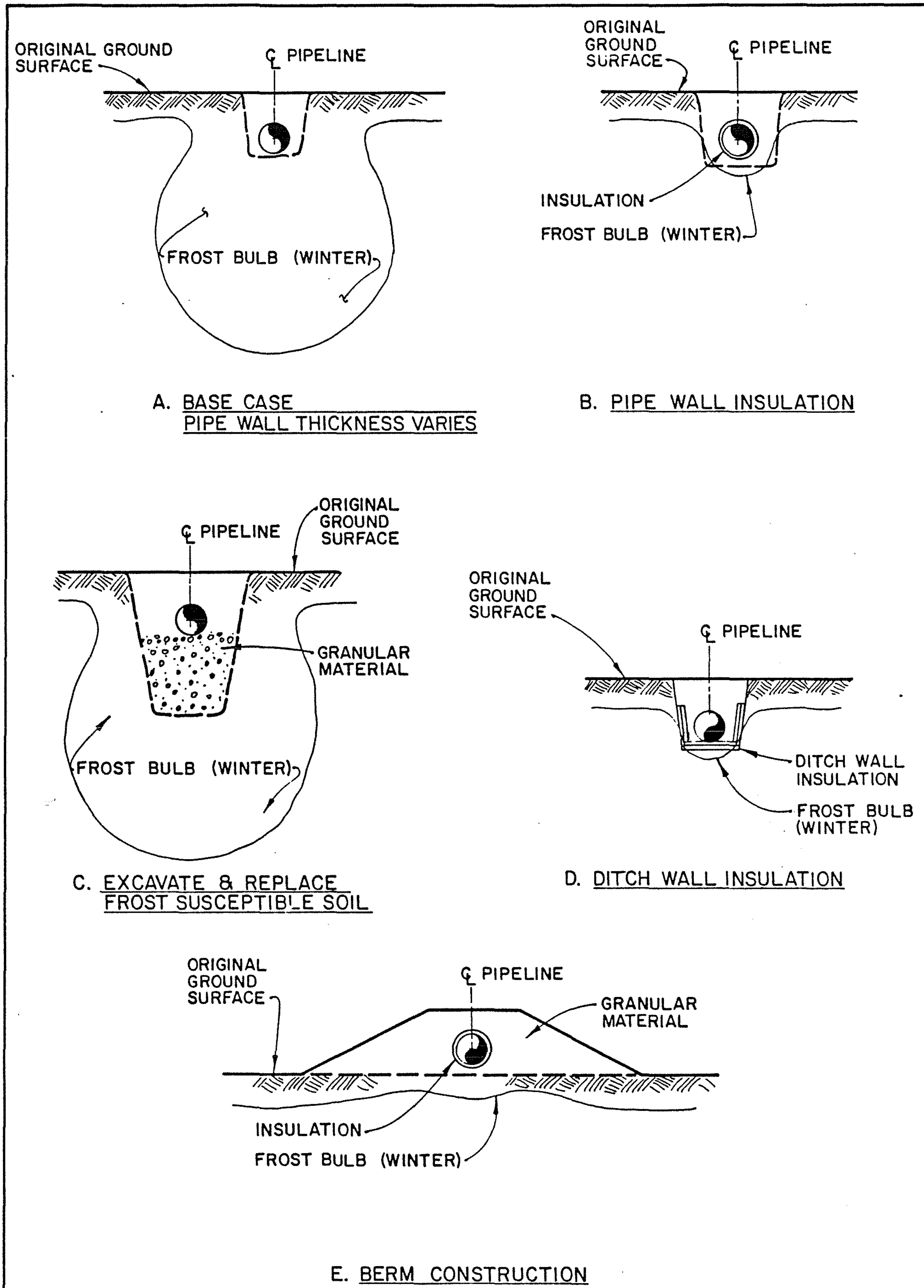


Figure 4.2.8-3 Potential Frost Heave Mitigative Measures

NOTE : New Figure in FEIS

redirect surface drainage, causing accelerated erosion and thawing of permafrost.

Avoiding areas of sloping, ice-rich permafrost would minimize impacts to these areas where slope failure might occur if ice-rich permafrost was disturbed by construction of TAGS. Mitigation techniques available to the applicant in ice-rich areas include avoidance, winter construction insulated work pad, and a properly designed gravel work pad. These techniques were used successfully in constructing TAPS, were determined as adequate for authorized ANGTS, and could minimize adverse impacts to the environment as a consequence of TAGS.

4.2.8.8 Pipeline/Geology Interaction

The route from Prudhoe Bay to near Galbraith Lake parallels and would normally be located 1 to 4.5 miles from the Dalton Highway. Moderate impacts along this segment would be the result of surface disturbance during construction.

During the period between pipeline installation and startup of chilled gas operation, thermal degradation and subsequent erosion and mass wasting could cause loss of cover and backfill. These impacts would occur primarily in the northern foothills of the Brooks Range and between the Yukon River to Delta Junction where the route crosses ice-rich soils underlying moderate slopes.

From Galbraith Lake to the South Fork Koyukuk River, the route closely parallels TAPS and the Dalton Highway. Construction activities would cause minor local stream siltation and thawing of the ice-rich layers and lenses in permafrost resulting in thaw settlement and thermal erosion. After startup of the chilled gas pipeline, frost heave of the pipeline in the lower valley unfrozen soils would occur. The South Fork Koyukuk River to the Yukon River could develop some localized thawing of the ice-rich frozen soils during construction, which would have long-term effects.

South of the Yukon through the Tanana Uplands, the route crosses a wide range of soil types and permafrost conditions. Impacts would occur from preparing construction pads, trenching, and borrow pits. Terrain modification from these activities would be moderate.

The potential for minor impacts due to thermal degradation of the relatively warm permafrost south of the Yukon River exists during the construction-to-chilled-gas-operation period. Frost heave impacts to the pipeline after chilled gas startup would probably be a significant consideration for pipeline design and modeling. The fine-grained soils exposed as a result of surface disturbance would be susceptible to erosion from surface runoff, resulting in gullying and minor water quality impacts.

Surface erosion and its subsequent impact on water quality could be controlled with techniques proposed by the applicant.

The main potential impact within the Tanana Valley would be from degradation of locally ice-rich frozen silts and alluvial gravels underlying the Shaw Creek Flats and the frozen loess overlying bedrock in the upland areas south of Quartz Lake. Alluvial gravels along the Delta River from Big Delta to the southern end of this segment are generally permafrost free.

From Donnelly Dome to Summit Lake the route closely parallels the existing TAPS pipeline and the Richardson Highway. Along this segment there would be minor terrain modification from trenching across discontinuously frozen glacial deposits. Degradation of locally ice-rich soil could develop as a result of construction activity.

Between Donnelly Dome and Paxson the route crosses the Donnelly Dome, McGinnis Glacier, and Denali faults. A damaging earthquake as large as magnitude 8, accompanied by fault offsets of at least 20 feet, could be expected along this fault zone (FPC 1976a). Damage to pipeline support structures due to strong ground motion would be moderate. YPC would design earthquake monitoring systems and procedures which would include system shutdown for inspection of affected areas and possible maintenance after a major seismic event.

The most significant impact consideration for this segment of the pipeline route is differential movement along any of the three fault zones. Loss of pipeline integrity due to fault displacement and subsequent pipeline deformation is of primary concern. Consequently, a special elevated construction mode to accommodate potential fault displacement would be installed at the crossings of these three fault zones, thus reducing the potential impact to the pipeline from fault displacement.

Other impact considerations are ground motions and subsequent liquefaction of saturated alluvial material in the active floodplains of both Miller and Castner creeks along the McGinnis Glacier Fault.

An important impact consideration for the route south of Summit Lake is the differential settlement that could develop if the fine-grained permafrost soils in the Copper River basin are allowed to thaw. Erosion at major stream crossings and mass wasting along the steep river bluffs could result in minor impacts to surface water quality. Frost heave effects on the pipeline due to freezing of any unfrozen glaciolacustrine deposits could create major impacts.

The most significant potential impact of the segment through the Chugach Mountains is related to earthquake hazards. Damaging earthquakes, as demonstrated by the 1964 earthquake (magnitude 8.5), can and do occur. Impacts to the pipeline as a result of seismic activity could include impacts to pipeline integrity as a result of ground failure in the saturated alluvial soils found in the floodplains of the numerous stream crossings and, along the Lowe River, due to strong ground motion. No major impacts to pipeline integrity would be anticipated if structures are designed using proper seismic criteria.

Frost bulb development and its effects on surface and ground-water flows is treated in Section 4.2.9.

4.2.8.9 Summary

Construction of TAGS would cause a wide range of impacts to the geologic environment along the route. Conversely, the geologic environment could directly impact pipeline integrity. Impacts to the geologic environment would occur mainly during construction and would consist of changes in topography, thermal effects on permafrost, and increased erosion. Impacts to the pipeline system would be realized primarily during operation as a result of the differential heave, erosion, and seismicity of the proposed route. All of these potential conditions would be reduced to overall minor impacts by application of the mitigating measures described in the Project Description (Subsection 4.8) and by special conditions which may be contained in various required permits issued by regulatory agencies.

Impacts caused by TAGS construction would be very similar to those created during TAPS construction and authorized ANGTS. Overall, impacts for TAGS would be moderate during construction and minor during operation.

4.2.9 Surface Water and Ground Water

4.2.9.1 Introduction

Construction and operation of TAGS would involve construction in and across the floodplains of rivers and streams along the route. These activities have potential for causing both long- and short-term impacts on the riparian habitat and upon property both up- and downstream of the route. Additionally, thermal effects of construction, both in and out of the floodplain, can affect ground-water movement and alter surface drainage. The impact of the pipeline on the existing water resources and on the fluvial environment depends on specific design, construction and maintenance procedures used, and scheduling of activities. These activities are largely controlled by stipulations and conditions of the various specific permits and the mitigation efforts described in the Project Description, Section 4.8.

Subsection 4.2.9.2 describes the general types of surface-water processes which would be affected as a result of pipeline construction and operation and identifies resulting impacts to the hydrologic environment. Subsection 4.2.9.3 describes impacts to ground water. These general processes may occur at any point on the pipeline route. Specific processes which are of concern for particular pipeline segments are described in Subsection 4.2.9.4.

4.2.9.2 General Surface Water Impacts

Hydrologic processes are systematically interrelated--an impact to one process would in time effect change in other processes (Curry 1972). If sufficient care is exercised during design, construction, and operation of the TAGS pipeline, these impacts could be reduced. They are described in the following subsections.

Alteration of stream hydraulics includes changes in existing velocity, stage, or water-quality patterns directly by TAGS construction of instream works or by inducing natural changes such as icings or deposition of sediment. Flow alterations could be caused by the construction of project-related roads, pads, river training works, bridges, and culverts, or naturally by ice. Effects on stream hydraulics could in turn affect other resource values, such as the deposition of sediment in an existing channel might cause modifications or diversion of a stream, creating moderate impacts.

Scour, the lowering of a streambed, occurs naturally in response to passage of a flood. Long-lasting TAGS construction-related increases in scour could be caused by a constriction or impingement of flow in either the channel or floodplain. Scour could expose the foundation of hydraulic structures and cause them to fail. Scour would also *cause* a short-term local increase in suspended sediment downstream of the scouring area and creates deep holes in the streambed, thus increasing stream-bottom diversity.

Bank erosion is the lateral migration of riverbanks in response to erosion by impinging flow during construction of TAGS. Bank erosion is the chief source of suspended sediment in most nonglacial streams. If allowed to continue, bank erosion could undermine and destroy riparian property and create a moderate impact. Migration is a natural ongoing process on the outside of bends in any alluvial river; however, it can be accelerated by either natural or man-made changes in stream geometry or an increase in flow intensity. Icings or depositions of sediment change flow patterns. Erosion might also be accelerated by instream activities such as gravel mining, which disrupt the natural supply of sediment from upstream.

Diversion is the removing of water from one drainage channel to another (ASCE 1962). Diversion is a natural process occurring frequently in braided river channels, in deltas, and on alluvial fans and less frequently in meandering rivers. The usual natural cause of diversion in rivers is blockage of an existing active channel by deposited sediment, icings, or ice jams. Diversions may be temporary, resulting in minor impacts as usually occurs with icings, or long lasting, resulting in moderate impacts as occurs with sediment blockages. Although diversions are a natural occurrence, their frequency and severity could be increased by any activity which increases erosion or sediment deposition, restricts channels, or creates new channels. Particular concerns created by the TAGS in cold regions would be the creation of icings by thermal or ground-water discharge changes and creation of new channels by thermal degradation of ice-rich soils. Diversions could cause rapid destruction of property and could destroy road access to facilities. Diversions could also disturb or isolate sensitive habitat areas. ***Temporary diversions to facilitate installation of buried pipe in flood plains could occur. Pipe is most apt to be installed in flood plains during the winter low-flow season. These diversions could, if not controlled, dewater fish overwintering areas or create icings which could divert flow at breakup. However, diversions could be controlled by ditch plugs and other standard measures.*** The potential for diversion would be minimized by application of the mitigating measures provided by YPC.

Aggradation is the rise in bed level of a stream at a specific site in response to deposition of sediment (ASCE 1962). During construction, aggradation could be caused by a downstream flow constriction, such as a culvert, or by increased production of sediment upstream, such as from a disturbed area. Aggradation could also cause diversion. Aggradation could permanently alter the character of the streambed in the aggrading area to a finer, less permeable bed because the finer material deposited clogs the interstitial spaces in the original bed, causing moderate impacts where it occurs. Aggradation at one point in a stream could remove sediment and would result in cleaner flow and possible degradation of the downstream bed. A source of aggradation, unique to cold regions, is raising of the ground level because of the creation and expansion of subsurface ice, such as might occur around a cold pipe. To minimize this process, TAGS would insulate where necessary.

Icings, sometimes called aufeis, naleds, or glaciers, ***are formed*** by successive freezing of sheets of water that seep from the ground, a river, or a spring (USGS 1976). Icings may form naturally in thick sheets on floodplains, as the result of surfacing streamflow, or as hillside icings formed below springs. Icings often occur because local thermal characteristics are altered by construction, allowing frost to penetrate blocking aquifers and stream channels and causing water to surface.

The TAGS pipeline could alter surface thermal characteristics because of construction of roads or pads. The buried pipeline could alter subsurface temperatures by freezing areas normally thawed or by thawing areas normally frozen. Either process could create icings by altering ground-water flow patterns and causing water to surface. Although the impact of the icing itself is minor, the resulting diversion could be moderate. Icings could divert streamflow during breakup, or they could inundate roads, TAPS facilities, or those to be constructed for authorized ANGTS. TAGS proposes to avoid areas of regular formation of icings, or to control icings that are not avoided using standard techniques such as ice fences.

Erosion is wearing away of lands or structures by running water or wind (ASCE 1962). Erosion would be caused by construction activities which concentrate water flow or which loosen soil surfaces. Erosion rates would be accelerated when ice-rich soils are ***thermally*** disturbed. Erosion could cause moderate impacts ***when silt and sand size soil particles are deposited on the spawning beds of fish. Clay size particles tend not to deposit and will cause minor impact to the stream by reducing light transmission and thus impacting growth of basal food chain organisms.*** Secondary minor impacts to streams would be increases in turbidity and sedimentation of beds, ***which could smother spawning beds, result in loss of eggs and/or fry, the disruption of the food chain by displacement of organisms, and the change in the stream flora.*** Erosion, particularly in ice-rich sands and silts, could rapidly concentrate streamflow and create new drainages.

Surface water resources could be contaminated by improperly treated wastewater from camps, from accidental spills of fuels or lubricants, by chemicals used during construction or operation activities, by release of contaminated hydrostatic test water, by fertilizer used for rehabilitation, as a by-product of gas conditioning, or by sediment from erosion. Impacts created by such incidents would cause negligible to major impacts, depending on where they occur and what is spilled.

Available winter surface water supply could be seriously depleted by use at camps, for fire supression, or for other use along some portions of the pipeline route. This occurred occasionally during the TAPS construction, especially in the northern areas. During construction winter surface water supply could also be depleted by diversion of either surface or ground water, or by creation of icings. ***Water use is a critical issue related to fish habitat, especially as it relates to over-wintering habitat for fish, believed to be a population-limiting factor on the North Slope, even in the absence of industrial or domestic withdrawals. Present water sources within economical haul distances of existing facilities are already fully committed. Water withdrawals from Arctic rivers during the winter season would not be permitted by state policy. If withdrawals are planned, alternatives need to be identified and evaluated in the detail design stage, and authorizations must be received from the State. TAGS would not remove water during the winter from areas upstream of fish overwintering areas.*** Depletion of winter water supply could affect aquatic resources, causing minor to moderate impacts, even though such uses are regulated by the ADNR water use permit system.

4.2.9.3 General Ground-water Impacts

Impacts on ground water ultimately result in impacts to surface water. The most common influence to ground water in frozen soil results from disturbance of flow in the shallow active zone overlaying permafrost. This zone can be rendered impermeable by either compaction penetration of frost from the surface, or by growth of a frost bulb around the chilled pipe. Frost can penetrate because of alteration of surface thermal characteristics or because of operation of the pipe at below-freezing temperatures. Diversion of an aquifer would create a new ground-water flow pattern, which could surface and result in an icing, accelerated erosion, or diversion of surface flow. These alterations may in turn further affect the thermal regime and initiate more thermal degradation, causing negligible to moderate impacts, depending on the area affected.

Impact caused by frost bulbs would be most noticeable on small, near surface aquifers which could become completely blocked, causing water to surface and *create* icings in winter and new channel development in summer. Impacts would be negligible to moderate.

Excavation for ditches and material sites could intercept shallow ground-water flow and permeate bedding material in pipe ditches. These activities could create new subsurface drainage paths and dewater existing springs. They could also contribute to formation of surface icings. These same pipeline features could intercept surface flow and recharge ground-water aquifers in unfrozen areas which could cause depletion of surface water entering streams.

Along much of the route, winter ground-water availability would be nonexistent or limited to unfrozen alluvium underlying major streams. Volume in the alluvium would be low, and there is no recharge during winter.

Shallow ground water could be contaminated by accidental spills or leaks of fuel oils and other chemicals. Water quality could also be *lessened* by leakage from sewage collection and treatment facilities. Ground-water contamination during TAPS construction occurred often. For example, when the heating fuel oil lines at Prospect leaked, resulting in ground-water contamination which later surfaced in a stream, the BLM required lining of storage areas. Also, there were reported spills of hydraulic oil, (highly toxic) and leaky sewage treatment plants at Cold Foot and Prospect. These and other incidents caused ground-water contamination. Contamination would be long term because ground-water movement is slow. If ground-water contamination occurred, impacts would be minor to moderate.

4.2.9.4 Other Direct Impacts

Between Prudhoe Bay and Slope Mountain the major potential effect on surface water would be disruption of natural drainage paths in the Putuligayuk and Little Putuligayuk river basins by the work pad. Gravel mines proposed for the Sagavanirktok River terraces could, in concert with existing works, adversely alter surface waterflow and endanger TAPS river crossings and river training structures if not carefully located. Impacts include increased risk of failure of existing pipelines, the need for more extensive maintenance of existing river training works, and possibly the need to construct new works. Each of these events could impact water quality and lead to further stream changes.

Relatively small hillside icings occur along Slope Mountain, and small stream icings occur on many of the streams crossed by the pipeline route. Icing sizes are limited by availability of ground water. Thermal disturbances could alter present icing patterns. Minor impacts to roads and pads might occur in the vicinity of Slope Mountain.

Pad and pipeline design must be carefully coordinated with adjacent structures to prevent either excessive erosion or deposition. A steep-sided slope of active alluvial fans runs from the West Fork Atigun River to the base of Chandalar Shelf. Such fans are subject to frequent channel diversions during floods as a result of rapid aggradation. Channels on the fan scour as they adjust their bed to new grade as the result of erosion of the toe of the fan by receiving waters. Relatively small snow avalanches and debris flows could occasionally block roads and pads and might damage above-ground structures. Avalanche releases could be aggravated by construction activities and could endanger personnel and other properties. Alluvial fans and the thawed gravels below Atigun Pass and the Chandalar River provide limited sources of ground water that do surface to form massive icings. Creation of new or larger icings in streams near the 13 miles proximate to the authorized ANGTS right-of-way on both sides of Atigun Pass could divert streams and has the potential to impact TAPS, the Dalton Highway, authorized ANGTS, and proposed TAGS. Depending on volume and location, impacts could range from negligible to moderate.

From the base of Chandalar Shelf to South Fork of the Koyukuk River the alignment would be located adjacent to the floodplains of the Dietrich and Middle Fork Koyukuk rivers. These streams are braided, are generally aggrading, ice severely, and are subject to rapid diversion. Winter icing levels frequently exceed normal open-water flood levels. Diversions could be caused by instream works that alter flow patterns, such as construction of river training structures, roads, or by disruption of winter flow patterns which causes icings. Impacts would be those discussed above. Much of the remaining alignment would be located on active alluvial fans tributary to the Dietrich and Koyukuk rivers. Channels on these fans are unstable and subject to rapid diversion and scour. Alteration of these minor streams by TAGS could cause minor impacts to adjacent pipelines and the highway. The crossings of the two forks of Bonanza Creek present a risk of causing a diversion. Most of the streams crossed tend to ice severely in the winter. Creation of new icings could cause diversions or inundate existing facilities. Limited supplies of shallow ground water tend to exist in the unfrozen valleys. Alteration of the thermal regime could create new icings or relocate existing icings and thus affect the existing pipeline or roads.

The Yukon River bridge would span the entire river with only one instream pier. When completed the bridge would have minimal permanent impact on the stream. Construction of the instream pier would introduce some silt into the stream and would present a risk of contamination from construction-related oil spills. When completed, the bridge should reduce existing tendencies for ice jams at the downstream highway bridge because it would presplit the ice sheet.

Unanticipated geotechnical conditions such as occurred in construction of the TAPS/Dalton Highway bridge across the Yukon River could be encountered during the construction of the pier four foundation of the Yukon River Bridge. These conditions did not pose a fatal flaw for the TAPS/Dalton Highway bridge, and only required modification of the pier foundation in order to accommodate the fracture bedrock. YPC intends to conduct a detailed field investigation that includes core drilling and testing at the pipeline bridge pier location. Design of the TAGS pier foundation would then be based on evaluation of the site specific conditions found by the field investigation.

From the Yukon River to the Elliott Highway near Fairbanks the streams tend to be clear and free from suspended sediment. Slopes along the alignment tend to be steep, and soils are more erodible than in most areas. Ground water exists in valley alluvium and fractured bedrock. Icings are common in valleys and hillsides. The location and size of icings could change as the result of construction or as the result of operating a cold TAGS pipeline. These changed icings could affect the TAPS and authorized ANGTS or the highway, creating more surface flow which could develop into new or expand typical icing formation with the potential to adversely affect any structures in its path. Such impacts would be moderate.

From the Elliott Highway near Fairbanks to Fort Greely the route lies in areas of soils that erode easily. Throughout this portion of the route, impacts to water quality would be minor, and changes in drainage paths caused by erosion would be of particular concern.

From Fort Greely to Paxson Lake most streams crossed or paralleled by the pipeline route are glacial. Almost all of the tributaries of the Delta River are crossed on rapidly aggrading alluvial fans which could shift channels rapidly. Maintaining channels in existing locations at highway crossings requires extensive maintenance. The stability of an existing channel on a fan could be easily disrupted by construction, and resulting channel changes could impact TAPS and the state highway. The Delta River and Phelan Creek are rapidly aggrading braided rivers that tend to ice to high levels. Diversions are frequent. Icing levels sometimes exceed highway grades. These streams are subject to glacial outburst floods from the Gulkana Glacier.

All of these facts combine to make this area particularly sensitive and difficult for pipeline construction. TAPS is protected by an extensive series of river training structures. Because of the proximity of proposed TAGS, impacts to adjoining property construction easily could occur. Effects from operating the pipline would be negligible. Because of the large natural bed load carried by streams in the area, effects from erosion on water quality would be minimal. The chief potential impact to ground water would be in altering icing patterns. Ground water from alluvial fans apparently surfaces as springs along the toe in the Delta River and Phelan Creek.

Throughout much of the section between Paxson Lake and the Tonsina River the soils are ice rich, relatively warm, fine grained, and easily eroded. Sourdough, Willow, and Rock creeks tend to develop icings. There would, therefore, be a potential for diversion and accelerated erosion and consequent degradation of the existing high-quality water as a result of accelerated icings caused by TAGS.

From the Tonsina River to the mouth of Keystone Canyon the alignment generally follows the valleys of the Little Tonsina, Tiekel, Tsina, and Lowe rivers through the Chugach Mountains. Stream valleys tend to have narrow floodplains and in many places are constricted by the existing highway or TAPS pipeline. Construction of the TAGS pipeline would further constrict the floodplains and could create changes in the stream that might affect existing facilities. This would be a particular concern in the Tsina and Lowe river valleys. The route crosses several very active alluvial fans which could aggrade rapidly during large floods.

From Keystone Canyon to Anderson Bay, the route crosses several very steep active streams with beds of shallow alluvium over bedrock except on active fans near tidewater. Diversions on fans, caused either by constructed works or by deposition of sediment, are possible. These diversions could damage existing facilities.

4.2.9.5 <u>Summary</u>

Construction of TAGS would cause a wide range of impacts to both the surface and subsurface waters along the route. All of these impacts would be minimized by application of the mitigating measures described in the Project Description and by special conditions in various required permits issued by regulatory agencies. Due to these mitigation measures, the *impacts* for TAGS would be reduced from that identified for El Paso (FPC 1976a, p. II-371) and ANGTS (FPC 1976b, p. 362). Impacts consist of changes in stream geometry, introduction of sediment and pollutants, diversions of subsurface water flow, formation of frost bulb, aufeis formation, and depletion of water supplies. These impacts to water resources would, depending on the locations and nature of existing conditions, cause minor to moderate impacts and in turn affect other resource values and possibly property and habitat value both up- and downstream of the TAGS. Impacts caused by TAGS would be very similar to and frequently cumulative with those created by TAPS and the state highway system or postulated for authorized ANGTS and El Paso.

4.2.10 <u>Marine Environment</u>

4.2.10.1 <u>Introduction</u>

Six general causes of impacts on the marine environment and potentially on marine biota that could be expected to result from the TAGS project:

- Construction and presence of the LNG terminal and appurtenant structures;

- Liquid effluent discharges to marine waters;

- LNG and oil lost during storage, transfer, or shipping;

- Facility operations and ***the effects of*** increased tanker traffic on marine mammals and birds related to disturbance;
- Increased use of the area by recreational and commercial fishermen;
- Increased human population and ancillary developments on the marine and adjacent terrestrial habitats.

4.2.10.2 Impacts from Construction of LNG Terminal Facilities

Impacts from construction of the LNG plant, terminal, and appurtenant facilities would be largely those from fill operations (see Figure 2.2.1-5). The LNG plant and terminal property site would occupy approximately 5 percent of the Port Valdez shoreline. This area would be modified or occupied for the life of the project. The most significant physical change to the nearshore area would be the placement of fill on approximately 100 acres of littoral or sublittoral sea floor in the area immediately offshore of Anderson Bay and the adjacent plant site.

There would be a small net loss of subtidal benthic habitat and an even smaller loss of intertidal habitat. Data from available studies (Feder and Matheke 1980; Feder 1983; ***Valdez CDD, 1986)*** indicate that dominant forms to be lost would be invertebrates, mainly small polychaete worms and bivalve molluscs, living in the substrate. The species composition, numbers of species, and organism densities at sampling stations close to Anderson Bay were similar to most other sample stations in western Port Valdez.

These data suggest that soft substrate benthic habitat that would be covered by TAGS project fill contains no unique organisms or unusually high population densities and is, in fact, characteristic of more than 30 percent of the subtidal habitat of Port Valdez. The Port Valdez shallow subtidal benthos has not been considered to be a limiting factor as a food source to higher organisms such as fish, birds, or marine mammals. The loss of 100 acres of benthic habitat would be a ***minor*** project impact since it would have minimal effect to higher forms that feed on benthic invertebrates. Any hard substrates that might be covered would reduce the amount of algal substrate available for deposition of eggs by spawning herring. In the context of the low total amount of substrate that might be affected, impacts would be moderate.

During construction of the plant and terminal facilities, there would be localized increases in sediment suspended in the water column and rates of sedimentation in nearshore area. In the context of excessively high sedimentation rates from river and stream discharges during the summer months when construction would be taking place, the localized increase would probably be negligible. Because, in general, the sediments of Port Valdez are uncontaminated from industrial wastes and low in organic matter (Feder et al. 1973; Hood et al. 1973; Shaw 1980), problems such as toxicity, chemical oxygen demand, or hydrogen sulfide release would not be anticipated, and overall dredging impact would be minor.

The presence of the terminal facilities and associated fill material would not be expected to cause any appreciable alteration in tidal flow, circulation, or deposition patterns.

4.2.10.3 Effluent Discharges

The proposed LNG plant and marine terminal facility would include both primary and secondary treatment of wastes prior to their discharge into Port Valdez ***as shown in Figure 2.6.3***. An oil/water separator would be used to remove floatable oils and grease and potentially settleable solids. Sludges and skimmings would be incinerated and the water effluent piped into a secondary treatment system, probably incorporating biological removal of dissolved organic and inorganic wastes, followed by settling of solids. A disinfectant treatment, such as ozonation, chlorination, or ultraviolet light, could also be incorporated into the treatment process if necessary. Total volumes have not been estimated but are low relative to industrial and port facilities that include process wastewaters and/or treated oily ballast water.

Specific aspects of system design and discharge location would be developed as the project proceeds into design and would be subject to federal and state regulations through National Pollution Discharge Elimination System (NPDES) permitting and state water quality certification processes. The possible discharges of petroleum hydrocarbons to the marine environment from the Alyeska Marine Terminal, currently under study by the EPA, has been associated with the effluent from the facility's oily ballast treatment system. LNG tankers serving the TAGS terminal would have ballast water separated from the LNG storage compartments and, thus, do not have the potential for a similar discharge problem.

Treated combined wastewater would be expected to have parameters with the general maximum concentrations shown in Table 4.2.10-1.

Table 4.2.10-1
Anticipated Combined[a] Waste-Water Treated Effluent Quality

BOD	30 mg/l
COD	80 mg/l
Suspended Solids	30 mg/l
Metals	Trace
Nitrogen (as total N)	30 mg/l
Phosphorus (as total P)	8 mg/l
Chlorides[b]	50 - 80 mg/l
Oil and Grease	Low enough to not cause a sheen upon discharge
Bacteria	Less than 200 *fecal coliform colonies per 100 ml*

(Source - YPC)

a Secondary treatment of combined domestic wastewater and treated oily wastewater.
b Increase in chlorides with treatment if chlorination disinfection is used.

Receiving waters are large and deep and have a relatively high estimated flushing rate, as represented by the large tidal prism (approximately 26 percent) and short residence time (about four to six weeks). *Furthermore,* the requirement for specific federal and state regulatory review and approval for any discharges ensures that full analysis would be given to specific design features of a later stage in the project. Accordingly, potential impacts from a permitted, treated wastewater discharge are expected to be negligible.

A major concern for the El Paso Gravina terminal focused on the 658,000 gallons per minute of heated waste water that would be discharged into the marine environment. That waste water would have created a major impact in Prince William Sound (FPC 1976b, p. II-373). The Anderson Bay LNG facility for TAGS uses a different LNG process. That process requires no heated waste water discharge. Accordingly, the effect of the TAGS LNG plant is significantly less than that identified for the El Paso project.

LNG tankers would process sanitary and other liquid wastes (including bilge wastes) at sea in accordance with U.S. Coast Guard standards. Because LNG tankers do not co-mingle LNG and ballast water, there would be no potential problem with discharge of oily ballast water. Ballast water discharged into the marine waters of Alaska would be clean sea water and have negligible impact on marine water quality.

4.2.10.4 Impacts from LNG or Oil Released into the Marine Environment

The natural gas and liquefied natural gas would be the primary fuels used to power the LNG plants and LNG tankers. Hydrocarbon spills other than LNG or natural gas would come from minor or chronic spills of lubricating oil and grease, fuel for tugs or other machinery, or during bunkering. The facility would operate with a *fuel* Spill Prevention Control and Countermeasure Plan and other discharge contingency plans as would be required. Such spills would be minimal and would most likely be contained within spill containment devices, such as diked walls or booms, specifically designed for that purpose. Impacts from such small spills are expected to be negligible.

A spill of LNG such as from a tanker or pipeline rupture would be followed by freezing of virtually any material encountered by the LNG, as it draws heat from the environment, volatilizes, and disperses into the air. Organisms on or near the surface of water or land that were in the direct path of the dispersing and vaporizing LNG would be expected to be killed due to freezing or asphyxia. No impact would be expected much below the water surface, and the gas would completely vaporize and disperse. Unless a major aggregation of birds of marine mammals happened to be in the path of the dispersing LNG, marine impacts generally would be expected to be localized and short-lived or minor.

4.2.10.5 Impacts to Use of the Anderson Bay Nearshore Area by Commercial and Recreational Fishermen

Both commercial and sport fishing for salmon occur in Valdez Narrows and into Port Valdez through the vicinity of Anderson Bay (J. Brady, pers. comm.). The Solomon Gulch hatchery releases pink, coho and chum for commercial fisheries, and chinook in Anderson Bay for commercial fishing purposes. Construction timing and procedures could interfere with salmon return migration.

The operation of the TAGS marine terminal would restrict use of the nearshore area by recreational and commercial fishermen by excluding from use a restricted zone in the immediate vicinity of the docks, tankers, and ***mooring*** dolphins as well as a larger area during docking and berthing operations. The TAPS marine terminal had established by law a safety zone area within 200 yards of TAPS facilities and within 200 yards of tankers in transit or in port. Assuming that the U.S. Coast Guard establishes a similar restricted safety zone for the TAGS facilities as was done for TAPS, a nearshore area on the order of 200 acres would be restricted from use by fishing vessels. Vessels are required to notify the Coast Guard Vessel Traffic Center (VTC) for permission to enter the safety zone. Construction activities would exclude both commercial and sport fishing in the immediate vicinity of offshore construction due to safety considerations. With the proposed configuration of facilities, there would be a limited area that is currently available to fishing that would become unavailable for the life of the facility. Due to the small size of this area relative to the total fishing area, this impact would be considered moderate.

4.2.10.6 Impacts of Disturbance to Marine Mammals and Birds

The proposed facility would be located in an area with minimal direct use by marine or shorebirds or marine mammals ***(including seals, sea otters, and sea lions)*** and would cause little displacement or disturbance to bird or marine mammal populations. The single bald eagle nesting area on the western shore of Anderson Bay would be well outside of the proposed 330-foot buffer zone for developments (Valdez CDD 1986) and should not be affected. Tanker passage through Hinchinbrook Entrance and on into Port Valdez would be via existing vessel traffic corridors, and because the operations would represent only an incremental increase over existing operating facilities, negligible impact disturbance to birds or marine mammals would be anticipated.

4.2.10.7 Marine Impacts from Increased Human Population and Ancillary Development

The potential for increased disturbance of marine mammals and birds with increased human population exists but is not quantifiable. Should the project result in increased population and increased recreational uses, an incremental increase of port use for pleasure boating and fishing probably would not create a disturbance problem with existing marine-associated wildlife because Port Valdez is so large. ***Marine mammals are protected under the Marine Mammals Act of 1972, as amended.***

4.2.10.8 Summary

Impacts of the TAGS project on the marine environment would result from fill operations, construction, operation of the marine terminal, and aquatic discharges from the LNG plant. There would be direct loss of subtidal soft-substrate habitat and any hard substrate habitat that would be in the immediate project area. Organisms living on the sea floor in areas dredged or filled would be destroyed. Subtidal sediments in the vicinity of Anderson Bay are generally characteristic of those for the entire western Port Valdez, so organisms and habitat loss would not be unique or particularly important to the system. Impact would be minor to soft-substrate habitat and moderate if hard-substrate habitat were present.

The LNG plant and marine terminal facility would have minimal impacts on recreational or commercial fishing in Valdez Narrows and Port Valdez. There would be some area near Anderson Bay closed to recreational and commercial fishing during operation due to public safety zones, similar to that for the TAPS marine terminal. Permanent restricted safety zones would remove some portion of the nearshore area around the marine terminal from use for commercial or recreational fishing. Impact to fishing would be minor.

Effluent discharges would be required to meet state and federal water quality requirements and would be subject to the NPDES permitting process. Treatment requirements, discharge characteristics, and contaminant levels would be considered and controlled through this process. In addition, Port Valdez has a good flushing rate, and there should be very limited potential for long- or short-term pollutant buildup. LNG tankers have segregated ballast tanks and do not have an oily water ballast discharge, so no impact is expected.

Overall, project activities are not expected to greatly increase disturbance to marine mammals or birds, and impacts would be negligible.

4.2.11 Fish Impacts

4.2.11.1 Introduction

Studies related to the construction and monitoring of impacts related to the TAPS pipeline and authorized ANGTS have led to a fairly good understanding of the streams and lakes along the TAGS route, including fish species present, their life history and habitat use patterns, and construction and operation effects of a major pipelines along this corridor. Much more is known about anadromous fish streams than the others. Nevertheless, there is the potential for damage to occur to the fish resources along the proposed route during construction and operation. The following discussion presents information on impacts to fish resources by major sources of those impacts and covers special circumstances.

4.2.11.2 Stream Crossings

The major potential impact to fish resources would be due to the more than 200 ***fish*** stream crossings for burying the gas pipeline ***and associated work pad construction.*** Primary impacts would include ***temporary diversions, fluming, pumping, or working in flowing water*** of the stream and resultant turbidity. ***Since ADF&G regulations require authorization for stream crossings, fish passage should be maintained unless specifically authorized by ADF&G.*** Erosion, turbidity, and siltation are part of the natural cycle of physical changes occurring in both running waters and lakes along the route. Most streams and lakes and the organisms therein adjust ***to short-term increases in the*** level of silt and turbidity; however, there would be problems when there is an abnormally high silt load, its duration is longer than normal, it occurs at an unusual time of the year (particularly winter in fish overwintering areas), or it is of a different type of sediment than the watershed is accustomed. Many project activities, ***including work pad construction,*** also have the potential to increase the sediment load, thereby producing a variety of possible effects, including reduction of primary production, reduction in numbers and variety of benthic organisms, mortality to fish eggs or larvae, or interference with sight feeding (Hynes 1970). Increased turbidity or siltation is seldom lethal to adult fish.

Since there is so much variety in the chemical, physical, and biological characteristics of the streams and lakes along the route, each stream would be considered separately in regard to final engineering design of stream crossings, which would include environmental stipulations concerning those crossings. Table 3.2.11-1 presents a list of ***the most exceptionally productive fish streams*** crossed by TAGS, along with the species present and the most and least sensitive times for crossing. Prior to construction each ***stream frequented by fish*** would require a specific stream crossing permit from ADF&G and would conform with state water quality standards as pertaining to sediment discharge. There are no direct lake crossings anticipated, although some lakes would be affected by turbidity due to nearby access roads, stream crossings, or other construction activities.

Streams have the capacity to recover from moderate amounts of siltation, both natural and man-induced. This recovery depends on velocity of flow, ambient clarity, and size of introduced particles. ***Sediments deposited into low-gradient stream reaches would produce long-term impacts.*** One of the worst effects of heavy siltation is the creation of a sill at the mouth of tributary streams that might last for years and dramatically reduce fish entry to the tributary. Temporary blockage or rerouting of the stream during construction has considerable impact potential but would be averted by selecting the construction period properly. As identified in Table 3.2.11-1, the critical periods in fish streams is identified and varies considerably along the length of the pipeline route. Impacts to fish overwintering areas would be moderate during construction and minor during operations.

Siltation would not normally affect anadromous fish in the migratory streams but would greatly affect salmonids in their spawning and rearing areas. The increased turbidity and disturbance during construction of crossings would be extreme but typically local and temporary in nature with moderate impacts in the immediate vicinity of activity and as particulates settle out. There is some possibility of long-term siltation near unstable road cuts and thermokarsting areas. The impacts due to this type of erosion and siltation would be moderate for short periods until stabilization occurs; then it would be minor. Impacts during operation would also be minor.

4.2.11.3 Access Road Construction

The construction of new gravel access roads to the construction area, borrow pits, and construction camps, would entail crossing many small streams. The primary potential for impacts at stream crossings would be temporary blockage or channeling during construction and placing of culverts. Temporary bridges would be used over some water crossings. Blocking and changing of streams channels is virtually unavoidable but would typically occur during the least sensitive period and would be quite brief in most instances.

Recent improvements, including steel culverts, heating and insulation of culverts, and deeper placement have greatly improved drainage and fish passage. Culvert placement and design have been poor in the past, especially on the North Slope with its shallow active layer and disperal of surface drainage patterns. Mitigation, which includes use of these improvements, would be utilized whenever necessary to ensure fish passage, and impacts would be moderate.

Culverts can also change stream flow patterns. These conditions can impede fish passage. As proposed by YPC, design criteria that can mitigate this situation would be used to ensure that flow gradient in the culvert does not impede passage of small fish and that the bottom lip of the culvert is always below the water surface at the downstream end. With appropriate designs, impacts to fish passage would be minor.

4.2.11.4 Borrow Sites

Some dewatering and disruption of subsurface flow would affect stream hydrology, especially during overwintering and in dry periods. Normally, borrow pits would be located on the terrace above and berms constructed between the borrow pit and the active streambed, resulting in only minor impacts during construction.

Construction in the larger river floodplains or access roads to the construction site or borrow pits has some impact potential and might result in washouts, increased sedimentation, and stream channelization. This would most likely occur on the upper Sagavanirktok River and in the Atigun, Dietrich, Delta, and Koyukuk river floodplains and the west side Galbraith Lake route. Construction would typically occur in these areas during periods when they are frozen, which would reduce but not eliminate the potential impact. However, where fish overwintering areas occur, these activities could increase stress on fish and result in localized fish kill and possible loss of overwintering population. Impact would be severe to any fish populations impacted in this manner, and overall impact would depend on the size of affected populations and number of other overwintering areas in the vicinity. Impacts from borrow sites would be moderate during construction and minor during the postconstruction period.

4.2.11.5 Other Impacts

The potential for the spill of fuel from tanker trucks, diesel storage tanks, or large equipment into surface water bodies always exists. Such spills are usually small but common on construction sites. Due to the large number of streams crossed by access roads and the buried pipeline, there would very likely be some spills into watersheds during construction. Such spills would be immediately controlled and cleaned up, but there may be local impacts, especially to bottom fauna and sensitive fish life stages. Based upon the general operational plans in force for the past several years in Alaska, it is probable that impacts resulting from equipment or oil tank spills would be moderate in the immediate vicinity of spill containment.

Buried stream crossings of chilled gas pipelines would possibly cause frost bulbs to form. These frost bulbs could result in downstream aufeis formation, possible blockage of flow for long periods of time, unusually severe flooding during breakup, and loss of critical fish overwintering and spawning habitat. Fish migration routes could be affected as well as springs which maintain spawning beds and produce essential overwintering habitat. To prevent those impacts, TAGS has proposed mitigation, such as temperature controls of the pipeline or the pipe buried deep enough so that the chance of frost bulb formation is minimal. Proper placement of buried pipelines and timing of construction in sensitive fish streams would minimize impacts to sensitive areas. Accordingly, impacts would be minor.

The presence of more people and better access would result in increased pressure on catchable fish resources by sport, subsistence, and personal use fishermen. For indigenous species this would result in selective removal of the larger fish and loss of the more desirable species from accessible locations. In areas such as the North Slope, where fish are slow growing and have reduced reproductive capacity, this would be a significant local effect. Reduced size and numbers of desirable species has already occurred in accessible areas near the haul road system, and recently (1987) Paxson and Summit lakes near the Richardson Highway have been closed to winter fishing due to reduced spawning populations of burbot and lake trout.

River training structures would be installed at some crossings to prevent washouts or excessive siltation. These structures would channel the stream and increase the flow velocity in these sections, possibly resulting in reduction of rearing habitat, impeding upstream migration, and accelerating downstream movement by semiplanktonic life stages of fish. This might result in reduced survival rates for young salmonids. Location of these structures would be carefully considered before emplacement. Both USACE and ADF&G must permit such structures, and they would typically not be installed in highly productive and sensitive fish streams. The impacts would be minor.

Other possible sources of impacts include water withdrawal from overwintering areas in lakes and deep pools in rivers, ***for*** winter ice road construction, and various types of activities in watersheds and floodplains such as airstrips, disposal pits ***in conjunction with mineral material operations***, camps for construction personnel, and compressor stations. None of these would have high impact potential, given appropriate design and construction techniques ***proposed by TAGS***, the adherence to state and federal regulations regarding construction in floodplains, ***and the State restriction on the withdrawal of water from anadromous fish overwintering areas which would result in fish mortality.***

Several especially sensitive streams must be crossed or otherwise disturbed (e.g., the Galbraith Lake ACEC overwintering fish habitat, and the Jim River area near Milepost 270 where fish overwinter, salmon spawn and rear, and there is excellent grayling fishing). Other sensitive areas include an elevated crossing at Solomon Gulch Creek, with its private salmon hatchery, several pristine salmon and steelhead streams such as the Gulkana, Little and upper Little Tonsina rivers, and major fish-producing rivers or recreation areas such as the South Fork Koyukuk, Yukon, Chatanika, Chena, and Salcha rivers. These areas would be moderately impacted. The existing and planned egg-taking and spawning facilities near the Gulkana River crossing would also be potentially affected. Canyon Slough is one of the many clearwater salmon spawning areas on the Lowe River system which could be moderately impacted during construction.

Highly sensitive fish overwintering areas potentially would be affected by all the previously mentioned activities. These areas would be avoided and protected to the extent necessary. Most important overwintering areas are known, and stream crossings would be planned and engineered according to state-of-the-art technology. Water would not be withdrawn from fish overwintering areas. Water withdrawal from all fish streams would be designed to prevent impingement or entrainment of larval fish. Impacts to these sensitive areas would probably be moderate during construction and minor during operation.

4.2.11.6 Summary

Most impacts to local and regional fish populations could be prevented or avoided using state-of-the-art arctic pipeline engineering and construction techniques and by constructing during the least sensitive period. Other possible effects could be reduced by utilizing appropriate resource management techniques, such as restricting access and fish catch size and limits and providing for permanent catch and release fisheries near popular access points. This would be up to state agencies to implement.

Construction and operation would result in localized and moderate short-term effects to the fish populations. There is no indication that anadromous fish populations would be significantly decreased. The construction impacts for TAGS would be less than those identified for El Paso, ANGTS and the Sales Gas Conditioning Plant since generally the mineral extraction would not be from active water bodies (FPC 1976a, p. II-371).

There are no threatened or endangered fish species in Alaska.

4.2.12 Vegetation and Wetlands

4.2.12.1 Introduction

The impacts of the proposed TAGS project on vegetation and wetlands would be diverse and vary considerably in extent, severity, and duration throughout and, to some extent, beyond the life of the project. Although it is difficult to quantify such impacts, experience gained during TAPS construction and operation would prove invaluable in anticipating and preventing or mitigating many TAGS impacts. In this regard, useful discussions and recommendations concerning problems encountered during pipeline construction and operation have been presented by FPC (1976a), Burger and Swenson (1977), Pamplin (1979), Brown and Berg (1980), Markon (1980), the U.S. General Accounting Office (1981), and Woodward-Clyde Consultants (1980) among others, and are incorporated by reference in this subsection.

The USACE developed a strategy for processing the TAGS authorization for the discharge of dredging or fill material as described in Subsection 1.11. This strategy identifies a tiered approach to the permit application process. The first tier for which the initial approval/disapproval would be received, would be satisfied by the generic information contained in this EIS. This would come in the form of special conditions that YPC would have to address during the second tier. A proposed list of special conditions is found in Appendix M. However, for the site-specific approval during the second tier, detailed identification and characterization would be required for disposal of fill into wetlands and other USACE regulated water bodies so that site-specific mitigation could be applied. Mitigation would be determined by the value and importance of wetlands impacted or lost. With this approach, the USACE and resource agencies would focus their review and evaluation on the design and major alignment alternatives in the first tier and later address the localized impacts to specific wetlands in the second tier. No authorizations to begin work would be granted until the second tier.

The activities associated with the proposed project would be categorized as follows: construction, rehabilitation and revegetation, *and* operation.

The impacts anticipated from the project are considered under combinations of these headings.

4.2.12.2 Construction Impacts

The preconstruction and construction phases of the proposed project are considered together because of the similarity of activities involved, although most of the impacts discussed would occur during construction. Due to the magnitude of the construction effort and the number of people involved, this phase would have the greatest impact on vegetation along and adjacent to the proposed route. The total area directly disturbed would be approximately 22,910 acres for the entire TAGS project. Although detailed estimates of the magnitude of direct impacts on specific habitat types are not yet available for TAGS, the areas affected would be similar to those affected by TAPS. Approximately 59 percent (about 16,200 acres) of the total TAPS area directly affected by that project (excluding the Dalton Highway) consisted of wetland habitats, including wet-meadow tundra, tussock tundra, bogs, marshes (Pamplin 1979), riparian willow, approximately one-half of spruce woodlands, and unvegetated floodplains.

The primary impact would be the direct removal of vegetation during preparation of the right-of-way through clearing, grading, and gravel placement. The total amount of ground area disturbed just along the pipeline working right-of-way during this phase is estimated at 14,473 acres. Based on the area affected by the TAPS work pad (Pamplin 1979), approximately 47 percent of the area of the TAGS right-of-way would be expected to directly affect wetlands. Wetlands were affected more by TAPS workpad and Dalton Highway construction than by any other activities (Pamplin 1979). Disruption and compaction of the organic surface layers of vegetation would lead to increases in the depth of the active (seasonal thaw) layer.

The extent of active-layer increase would depend on vegetation type, soil characteristics, intensity of disturbance, and season (FPC 1976a). In areas of ice-rich permafrost, destruction or disruption of the insulating vegetative layer would lead to thaw settlement, slumping on slopes, and ponding (How 1974), making reestablishment of vegetation difficult. Removal of the forest canopy would also lead to moderate increases in active-layer thickness and in changes in species composition due to elevated levels of *insulation* of the forest floor.

Vegetation killed, injured, or weakened in forested areas by construction activities could provide favorable breeding conditions for insects, such as the spruce bark beetle, and disease organisms that could spread to adjacent unaffected vegetation (FPC 1976b), although this impact is expected to be minor. Appropriate disposal of slash piles through immediate mulching or controlled burning would further reduce this potential impact.

Where conditions favor the use of snow/ice work pads and roads, impacts on vegetation would be less severe than elsewhere because no grading or gravel placement would be necessary. Nevertheless, negative impacts would occur, primarily in arctic tundra wetlands. Those impacts would include compaction of the organic layer, reduction of microtopography, reduction in cover of vascular plants, and increases in thaw depth (Hernandez 1974; Brown and Berg 1980). Brown and Berg (1980) indicated that the reduction in vascular species cover and increase in thaw depth might be relatively short-lived. Additional damage would be likely if low snowfall necessitated the collection of snow from large areas or the hauling of snow or water from distant sources (BLM 1976). This impact is expected to be negligible to moderate depending on the terrain, snowfall, and amount of traffic.

In addition to direct removal of vegetation along the right-of-way, the extraction of 33 million BCY of gravel and rock from material sites and the subsequent use of those materials in the construction of work pads, access roads, construction camps, compressor stations, storage yards, and airstrips would result in substantial direct losses of vegetation. In this regard it is noteworthy that the area disturbed in developing material sites during the TAPS project construction (including the Dalton Highway) was significantly greater than was initially estimated (12,200 acres versus 5,760 acres) (Pamplin 1979). Approximately 29 percent of the surface area directly disturbed by TAPS material sites involved wetlands. This proportion would be lower during TAGS construction because of lower demand for gravel *and* greater attention to site selection to minimize destruction of wildlife habitat and wetlands in the arctic drainage area.

Construction of the TAPS material sites, Dalton Highway, and work pad accounted for the majority of damage to terrestrial habitats by that project (Pamplin 1979). The extensive use to be made of existing gravel pads for the proposed TAGS facilities would mitigate a substantial portion of the adverse impacts expected from material extraction and placement. Adherence to recommended guidelines for gravel mining (Burger and Swenson 1977; ***Woodward-Clyde Consultants*** 1980) would further mitigate adverse impacts. Nevertheless, the additional losses of vegetated habitats through these activities would constitute a major component of the expected impacts. Any loss of riparian willow habitat in arctic floodplains would potentially be disruptive in view of its high value as wildlife habitat and its limited occurrence (Hernandez 1974; Pamplin 1979). Impacts are expected to be moderate.

The impoundment of water caused by the disruption and alteration of surface drainage patterns due soil compression; permafrost degradation; trenching; erosion-control measures; grading; and gravel pad, access road, and pipeline mound construction would constitute major, though generally localized, impacts on vegetation and wetlands (FPC 1976b). Inhibition of cross-drainage would cause ponding and thermal erosion on the upslope side of linear gravel structures and gradual drying of habitats on the downslope side.

Both types of impact would result in changes in species composition over the long term and in direct mortality of some plants in the short term (Hernandez 1974). Gully erosion downslope, induced by the concentration of flow through culverts onto ice-rich soils not previously subjected to such flow, would also occur in some areas (Brown and Berg 1980). Ponding problems would be exacerbated by clogging of culverts through icing and road-maintenance activities. Careful attention to terrain and drainage features in the placement of culverts and low-water crossings, coupled with proper maintenance, would mitigate some of these impacts. However, alteration of drainage patterns would constitute a principal construction-related impact on the vegetation communities and wetlands along the proposed route, particularly on the coastal plain. The overall impact is expected to be minor to moderate, depending on topography.

Dust fallout from vehicular traffic on gravel roads would occur throughout the life of the proposed project but would undoubtedly peak during the construction phase. This impact would be most noticeable along the Dalton Highway. Studies along the Dalton Highway have demonstrated that some plant species, especially certain mosses and lichens, are sensitive to road dust, and a few species appear to respond positively to it (Everett 1980; Alexander and Van Cleve 1983). Thus, some changes in species composition near gravel roads would be anticipated. In addition, the accumulation of dust on the snow within 100 to 300 feet of heavily traveled roads causes early snow melt (Everett 1980), which accelerates the chronology of growth of plants near the road by perhaps as much as two to three weeks. On the other hand, the chronology of plant growth would be delayed in areas where snowdrifts persist in spring as a result of snow accumulation along access roads and near project structures.

Accidental spills and leaks of toxic fluids such as fuels and antifreezes would occur throughout the life of the project but would be most likely during construction. The direct impact on vegetation would be considerable in localized areas and would vary according to the amount spilled, the terrain, and the season of the year (EEI 1977). Such spills would be especially serious in riparian zones and wetlands. Careful construction practices would reduce the frequency and size of spills, and appropriate cleanup would reduce the impacts on vegetation. This impact is expected to be minor for the occurrence of small spills and moderate to major in the unlikely event that a large spill should occur.

Fire would increase along the proposed route as a result of the operation of construction and incineration equipment, the use of flammable materials, and the carelessness of smokers (FPC 1976b). Although management agencies no longer view fire as being necessarily detrimental to wildlife habitat values and often increases habitat value by regrowth of forage species, it would constitute a direct, dramatic impact on vegetation along the route that would add to the incidence of naturally occurring wildfires. On the other hand, the cleared right-of-way would function as a firebreak and would allow access for fire-fighting equipment if suppression was deemed necessary. The incidence of fires related to the TAPS project was negligible. Likewise, this impact is expected to be negligible for the TAGS project.

4.2.12.3 Rehabilitation and Revegetation

After construction, disturbed areas would be rehabilitated in accordance with an approved plan. This would include the stabilization of bare soil by mechanical means or physical structures and the reestablishment of vegetation. The primary goals of such efforts are the reduction of both hydraulic and thermal erosion and the maintenance of slope stability (Hernandez 1974). A related goal is reduction of the aesthetic impacts of such a large-scale project. Rehabilitation and revegetation of disturbed areas are thus important measures for mitigating the major impacts to scenic quality and the minor loss of available foraging habitat.

Although revegetation in past projects has primarily involved the use of "domesticated" species of grasses, emphasis is now being placed on the use of native species. The use of species developed from indigenous stocks is preferred because they are better adapted to the environmental conditions along the route and would not create the potential problems associated with introducing exotic species into adjacent ecosystems. The species selected should be compatible with the climatic conditions prevailing along those portions of the route in which they are to be seeded (Johnson 1980, 1981; Alexander and Van Cleve 1983). In areas not prone to wind or water erosion, YPC proposes to encourage native revegetation through appropriate soil preparation, thus allowing the areas to return to near-preconstruction conditions. This approach, which relies heavily upon the 10 year results of TAPS construction and operation, *and* would result in slow initial revegetation, was approved for use by authorized ANGTS so that there would be less modification to the natural ecosystems.

4.2.12.4 Impacts of Project Operation

The transition from construction to operation and maintenance of the proposed project would cause a substantial decrease in the amount of area disturbed directly and in the amount of project-associated activity affecting vegetation along the route. It is estimated that the total area taken out of production for the life of the project following mitigation of temporary use construction areas would be 8,119 acres, of which 5,114 acres would be along the operational right-of-way, and 1,740 acres would involve material sites and site-access roads for maintenance purposes. The proportion of wetland areas affected would be approximately the same as that affected during the construction phase.

Continuing alteration of drainage patterns would constitute the major impact on vegetation communities, particularly wetlands, during the operational phase of the proposed project. In addition to the impacts from disruption of surface drainage already described, frost-bulb formation and freezing of granular fill around the chilled pipeline would impede subsurface drainage across the proposed route. The specific impacts of this phenomenon would vary among vegetation communities, but the general effects would include saturation and flooding of substrates upslope from the pipeline, causing drowning of some plants and increased drainage and drying of substrates downslope. These impacts would be greatest in wetlands and would cause changes in species composition and abundance (Hernandez 1974; FPC 1976a), effects similar to those described for impoundments (Subsection 4.2.12.2). Cooling of the soils directly above the chilled pipe would lead to a decrease in thaw depth, affecting root penetration and growing-season length, and possibly interfering with revegetation efforts.

Gas flowing through the proposed pipeline would be chilled only through Compressor Station 8. Thus, permafrost degradation could potentially be accelerated in boggy wetlands of the Copper River basin where pipeline temperatures rise above 32 degrees through the combined effects of thermal and hydraulic erosion along the pipeline route. Subsequent disuption of both surface and subsurface drainage would cause the impacts on vegetation already described (upslope flooding, downslope drying, altered species composition).

A direct impact on vegetation during the operational life of the project would result from maintenance of the right-of-way, albeit at reduced width. The removal of invading shrubs and trees to permit pipeline surveillance, maintenance, and repair would maintain the vegetation on the right-of-way in a stage of early succession except in tundra (FPC 1976a). The infrequent occurrence of this type of maintenance is expected to have a minor impact.

Emergency repairs to the pipeline system would have the potential to cause significant local impacts, depending on community type and season of the year. The need to use all-terrain vehicles (even low-ground-pressure varieties) during summer in permafrost-rich areas would cause the greatest impacts, primarily through compaction of the vegetation and organic layer and corresponding increases in thaw depth (FPC 1976a).

Operation of compressor stations are unlikely to affect adjacent aquatic vegetation and wetlands through discharge of effluents or leaching of toxic substances from landfills or disposal sites. TAPS pump stations have been issued permits by ADEC to discharge sewage effluent, and past practice has been to both vaporize the effluent and to discharge offsite (***Dietrick***, pers. comm., *1987*). ADEC has also issued permits for the disposal of ash and residue for the incineration of sewage sludge ***and*** refuge at the pump stations. Toxic or ***eutrophying*** effects of such practices on adjacent terrestrial or aquatic ecosystems have not been monitored or documented. Impacts from such practices would likely be negligible or minor. Appropriate sewage treatment and sludge-disposal techniques as proposed by YPC would reduce impacts to a negligible or minor level.

Emissions, particularly of sulfur oxides from compressor station operations, have been identified as having the potential to reduce lichen growth in localized areas where air stagnation is common in winter, such as in the Yukon River drainage area (BLM 1976, p. 485). Effects of such impacts have not been documented in Alaska. Emission levels at the compressor stations are expected to be low and to have minor impact on adjacent lichens.

4.2.12.5 Summary

The primary impact on vegetation and wetlands during construction of the proposed project would be the direct mortality of vegetation on the estimated 22,910 acres that would be affected by material extraction, pipeline placement, and related structures. Natural revegetation would ultimately reduce impacts to some extent, and the amount of area directly disturbed during the operation phase would decrease to an estimated 8,119 acres. This loss represents an adverse impact that cannot be avoided. The severity would be moderate to minor in the area of the right-of-way, material sites, and facilities, and of short- or long-term duration, depending on the vegetation communities traversed and the success of postconstruction rehabilitation.

Disruption and alteration of local drainage patterns during both construction and operation would cause upslope flooding and downslope drying, in some areas resulting in the direct mortality of some plants in the short-term and in changes in species composition over the long-term period. Impoundments would in most cases change the character of the existing wetland in which they occur, but in some instances create new wetlands.

A variety of other impacts would occur from the use of winter roads and work pads, accidental spills and fires, dust fallout, revegetation and right-of-way maintenance, emergency repairs, effluents, and emissions, but those impacts would primarily be minor to negligible in severity. In some cases, however, the impacts of spills, fires, and dust fallout could cause moderate (long-term) local changes in species composition. There would be some positive impacts due to clearing of mature timber, fire, and natural revegetation by shrubs such as willows. In many areas of the southern part of the route, this would improve moose forage.

The effects for the ANGTS also showed that reinvasion of natural species would require many years and there would be areas of wet and dry vegetation (FPC 1976b, p. 362).

4.2.13 Wildlife

4.2.13.1 Introduction

In general the range and magnitude of specific impacts would be proportional to the diversity of wildlife habitats traversed by the proposed route. Because the TAGS route would parallel the TAPS and approved ANGTS routes and involve a similar level of construction effort and associated effects, adverse impacts on wildlife due to habitat loss and human activity would be expected. Note, however, that the proposed buried pipeline would avoid a major impact issue that resulted from elevating much of the TAPS pipeline, namely, the need for special large-mammal crossing structures during the operational phase of that project.

Based on the knowledge gained from developments in Alaska and Canada, including TAPS, the predicted impacts of the proposed project on wildlife can be grouped into six interrelated categories:

- Direct mortality from collisions with vehicles and facilities, shooting (hunting and destruction of nuisance animals), and stress (exhaustion) from deliberate harassment;
- Passive or active disturbance caused by human activities, especially during critical periods or seasons (calving, denning, nesting, breeding, winter);
- Indirect loss of habitat through displacement of animals or disruption of movements and migrations;
- Direct habitat loss through physical alteration;
- Attraction to artificial food sources; and
- Contact with and contamination of food by pollutants, especially fuel and oil spills.

These impacts would occur during both the construction and operation phases of the proposed project. However, for all categories, the magnitude of impacts would be greater during construction than during operation due to the much higher levels of human activity and the amount of area disturbed during the former phase.

More detailed discussions of these impacts are presented by Calef (1974), Jacobson (1974), Kucera (1976), Klein and Hemming (1977), Klein (1979), Douglass et al. (1980), Bliss and Klein (1981), and Hanley et al. (1981). The following discussions focus specifically on the predicted impacts on large mammals and bird species during both the construction and operational phases of the proposed project. Table 3.2.13-1 presents a list of specific areas considered to be sensitive for these species.

4.2.13.2 Large Mammals

4.2.13.2.1 Caribou

The proposed TAGS route would traverse the ranges and affect several different caribou herds in various ways, depending on the season and geographic area. The greatest impacts would be experienced by caribou of the Central Arctic Herd (CAH), whose year-round range is transected by the route, and the Nelchina Herd, whose winter range would be crossed by the route. The Nelchina Herd migrates across the proposed route in both spring and fall. Minor to negligible effects would be experienced by caribou from the Western Arctic, Porcupine, Steese-Fortymile, Delta, and Mentasta herds. The proposed route crosses or contacts only small portions of their winter ranges.

Direct mortality of caribou during both the construction and operation phases would occur primarily from increased pressure by hunters, both legal and illegal. Construction of the Dalton Highway opened a large area of previously inaccessible caribou range to road access. Despite regulations governing highway access and use of off-road vehicles and closing areas along the Dalton Highway to shooting, hunting mortality has increased in recent years on CAH caribou (K. Whitten, pers. comm.). Legal bow hunting along portions of the Dalton Highway on the coastal plain contributes to this mortality. Hunting pressure has the potential to cause a major decrease in caribou numbers.

To the extent that the proposed TAGS project would bring more humans into contact with caribou in remote areas, any mortality would contribute to impacts on that herd. Increased traffic levels associated with the project would add to mortality from collisions with vehicles, although overall effect would be minor. Intentional harassment of caribou, especially by aircraft, could cause mortality through exhaustion or abortion of fetuses, particularly in late winter when energy reserves are low. Preventive and mitigative measures for these impacts include the prohibition of hunting by project workers, controlled access to project roads and facilities, aircraft altitude restrictions, and worker education programs dealing with the effects of disturbance.

Disturbance resulting from normal construction and operation activities would have moderate to minor impacts. Caribou cows are very sensitive to disturbance during the calving season ***(Cameron, 1983)***, and localized avoidance of development activities has been documented (Shideler 1986). The proposed route ***traverses an area of limited calving use by*** the CAH; ***however,*** some caribou would be displaced by project activities during the calving season***, although the route crosses a low-density portion of the calving ground***. This impact would be minor because few cows calve in the vicinity of the route. The sensitivity of caribou to human disturbance decreases during the summer when harassment by insects causes movements to insect-relief habitat along the coast. Some contact and disturbance would occur during that season, although it would not be extensive.

An issue that has received much attention is the disproportionately low representation of CAH cows and calves in the vicinity of the TAPS corridor. This phenomenon is generally considered to be an avoidance response to human activity along the corridor, although different habitat preferences have also been mentioned as a possible reason (Shideler 1986). This impact would be minor ***to moderate*** in terms of the overall TAGS project and it would be most noticeable during construction. Normal activities associated with operation of the pipeline would likely have a negligible impact with the exception of surveillance helicopters and traffic on the Dalton Highway. However, impacts from these activities are not expected to ***add significantly the present*** situation.

Noise from Compressor Stations 1 and 2 would cause minor local impacts through avoidance of the immediate vicinities of the stations although habituation would be expected to diminish the impacts over the long term with noise and activities ***at TAGS compressor station similar to those*** associated with existing TAPS Pump Station Nos. 3 and 4. ***Because of its proximity to documented migratory-crossing zones along the Richardson Highway and TAPS (Carruthers et al. 1984), Compressor Station 9 potentially could cause minor to moderate impacts during construction when movements of portions of the Nelchina Herd to and from winter range east of the proposed route occurs.***

The temporary disruption of migrations and local movements ***would occur*** during the construction phase, resulting from high levels of human activity and the presence of the open pipeline ditch and associated material stockpiles. Groups attempting to cross the route would be deflected by the open ditch and would parallel the route until they could cross, or ***would*** turn back. Such disruption would be greater for the Nelchina Herd because the primary migratory routes have an east-west orientation rather than north-south, as for the CAH ***and because a substantial portion of the Nelchina Herd can be expected to*** cross the proposed route during spring and fall migrations (Pitcher 1987, Carruthers and Jakimchuk 1987). Therefore, the impact would be moderate for the Nelchina Herd during seasonal migrations and minor for CAH. *Increased traffic levels on roads would also delay or deflect movements. The results of these impacts include indirect habitat loss through restriction of access and increased energy expenditure caused by detouring from chosen travel routes. Such impacts could be reduced through careful scheduling of construction activities and traffic and* through *restriction of the length of open ditch and time the ditch is open in specific construction segments. The underground mode of the pipeline and the much lower levels of activity during the operational phase of the project would reduce these impacts to negligible to minor levels.*

Direct loss of habitat from the placement of project facilities, borrow pits, and accidental oil spills would occur, causing slight reductions in the amount of forage available. Through revegetation, however, some additional forage plants would become available and compensate for the lost forage production. Some material sites, access roads, and gravel pads would be used as relief habitat during periods of harassment by parasitic flies. *In any event the overall impact* of direct habitat loss *would be negligible to minor due to the relatively small area affected.*

4.2.13.2.2 Moose

As with caribou, increased access by humans would result in increased direct mortality of moose through legal hunting, poaching, and collisions with vehicles during both the construction and the operational phases. The tendency of moose to concentrate in riparian and shrub habitats along transportation corridors would make them more susceptible to these mortality factors during winter.

Disturbance by activities in or near concentration areas would cause some avoidance by moose, potentially displacing them from preferred habitats. Generally, however, moose tend to tolerate human activities better than caribou, and such impacts would likely be local, short-term changes during the construction phase of the project. Avoidance of the immediate vicinity of compressor stations would probably occur during the operational phase. Local displacement from calving habitats (see Table 3.2.13-1) by disturbance would probably occur in some areas, although moose are generally more dispersed at that season than in winter. Disturbance of aggregations in the fall would have the potential to disrupt breeding behavior.

The presence of the open ditch and high levels of construction activity would temporarily interfere with the local movements of moose. Of more consequence would be the disruption of migratory movements undertaken by some moose between summer and winter ranges (Van Ballenberghe 1977; Douglass et al. 1980). The magnitude of these movements varies greatly among individuals. Distances between seasonal ranges may be as little as a few miles or may exceed 50 miles, depending on snow levels (Van Ballenberghe 1977). Thus, the energetic costs of deflection would be proportionately greater in a year with deep snow. Therefore, the impacts from disruptions of movement would be minor to moderate depending on snow levels. Disruption of migratory movements would not be likely to occur during pipeline operation.

Direct habitat loss would potentially constitute a major impact on moose at their northern range limit on the North Slope, where suitable winter habitat is restricted to riparian willow flats. The development of material sites during TAPS construction caused major impacts on arctic riparian habitats (Klein 1979; Pamplin 1979), and such activities during TAGS construction could cause adverse impacts on moose. A review of the TAPS experience by Burger and Swenson (1977), Pamplin (1979), and *Woodward-Clyde Consultants* (1980) resulted in the preparation of guidelines which could reduce gravel-mining impacts. Intensive site selection assessments to avoid vegetative gravel bars in floodplains, especially in the Arctic, and the use of upland sites, which usually have fewer long-term impacts on fish and wildlife populations, would reduce habitat losses. Moose browse would be increased in forested areas in which habitat alteration resulted in early successional stages of vegetation (shrub habitats).

4.2.13.2.3 Dall Sheep and Mountain Goats

The potential impacts of the proposed project on Dall sheep and mountain goats are considered together because of similarities in habitat use and behavior. As described earlier, Dall sheep occur in all of the mountain ranges crossed by the proposed route, whereas mountain goats occur near the route only in the Chugach Mountains.

Due to the rugged nature of the terrain inhabited by sheep and goats, impacts from direct mortality and habitat loss would likely be negligible, although a few sheep have been killed by vehicles in the Atigun Valley. Primary impacts would involve disturbance of, and increased energy expenditure (due to stress) by, animals near the route during construction. Sheep are sensitive to disturbance from aircraft, construction activities (especially blasting), and simulated compressor-station noise (Kucera 1974; Douglass et al. 1980). They are particularly susceptible to such disturbances when at mineral licks, lambing cliffs, and winter habitats. Temporary displacement of sheep from areas within a mile of noise sources such as construction equipment, generators, and simulated gas compressors has been documented (Kucera 1974).

Very little is known regarding the reactions of mountain goats to development activities, ***but temporary habitat abandonment and interference with movement of rutting males are potential local impacts especially during construction (Smith and Raedeke, 1982).*** Thus, moderate to minor construction-related impacts would be expected in areas where the proposed route closely approaches sheep and goat habitat, such as along the Atigun, Dietrich, Delta, Little Tonsina, Tiekel, Tsina, and Lowe river valleys. Some of these impacts could be reduced through restriction of aircraft traffic to specific corridors and altitudes and through implementation of noise-attenuation measures. No significant habitat displacement has been documented for the TAPS project; such impacts by the TAGS project would likely be negligible. It is probable that some degree of habituation to continuous noise from Compressor Stations 3, 8, and 10 would occur during pipeline operation.

In mountain valleys crossed by sheep and goats traveling to and from mineral licks and between seasonal ranges, temporary disruption and deflection of movements during construction would constitute a minor impact. Attraction of sheep to some revegetated areas has occurred during TAPS operation and would be likely during TAGS operation. Overall impacts to sheep and goats would be minor during construction and negligible during operation.

4.2.13.2.4 Bison and Musk Ox

The bison and musk ox populations along the proposed route consist of small groups that have become established in several localized areas as a result of transplants from elsewhere. The proposed TAGS route would transect the range used by bison in the Delta area and would contact the western extremities of the ranges of musk oxen on the arctic coastal plain and of bison in the Chitina and Copper River areas.

The Delta bison herd would experience several types of impacts from the proposed project. Direct mortality from highway traffic has been documented at existing levels of traffic and would increase as pipeline activities increased during construction (Douglass et al. 1980), although the impact would likely be minor. The TAGS project would cause the direct loss of very little habitat used by bison, which during winter includes agricultural fields in the Delta Junction area. The principal impacts of the project would result from increased disturbance levels, primarily by aircraft, and from temporary disruption of migratory movements during pipeline construction. These impacts would be minor to negligible. Bison cross the route while traveling between winter range near Delta Junction and calving and summer ranges along the Delta River floodplain. ***The TAGS revegetation program would emphasize natural seeding and fertilizing methods; thus, Delta Herd bison would not be attracted to revegetated areas north of Donnelly Dome, as they were to areas revegetated following TAPS construction (H. Hoskins, pers.***

comm., 1987). The proposed project would have negligible impact on the Copper River and Chitina bison herds *because the route skirts the extreme western edge of their range*.

Musk oxen on the coastal plain are distributed mostly to the east of the proposed route, but the population is expanding in numbers and in the size of the range used. Small numbers of musk oxen would probably encounter proposed project facilities during the life of the project. The short-term impacts during construction would be minor to negligible, consisting of some disturbance by aircraft and increased traffic on the Dalton Highway and possibly deflection of dispersal movements if any animals attempted to cross the route. Operational impacts would be negligible, consisting primarily of overflights by surveillance aircraft.

4.2.13.2.5 Carnivores

The projected impacts of the TAGS project would be similar among the species of carnivores considered in this section: brown bear, black bear, wolf, red fox, and *arctic* fox.

Based on experience from the TAPS project, attraction of carnivores to areas of human activity would be a major impact during both phases of the proposed project (Klein and Hemming 1977; Douglass et al. 1980). This attraction stems from the presence of artificial food sources at project facilities, including feeding by project personnel, improper food storage, and inadequate disposal of garbage (Milke 1977; Follmann et al. 1980).

Such artifical feeding disrupts natural foraging behavior. For instance, some bears might delay entry into winter dens. More importantly, the animals would become habituated to humans, and direct mortality would increase. Habituated bears may cause extensive property damage and pose serious threats to the safety of project personnel, resulting in conflicts that end in the destruction of "nuisance" animals. Habituated foxes and wolves would be easy targets for poachers and would also increase the risks of disease transmission to other animals and to humans, most notably rabies and hydatid disease. Habituated animals seeking food along roads would also be much more likely to be killed by vehicles. *Some mortality of habituated carnivores also could occur through attraction to and ingestion of spilled antifreeze* (H. Hoskins, pers. comm., 1987), *such morality would be negligible*. An additional negligible to minor impact would result from construction-related disturbance and destruction of natal den sites of wolves and foxes and of winter den sites of bears, although the numbers are expected to be very low in the project areas.

4.2.13.3 Birds

4.2.13.3.1 Raptors

Disturbance associated with human activity and noise would be the most likely impact on nesting raptors near the proposed TAGS corridor (Roseneau et al. 1981). The degree of impact, however, would vary dramatically with species and individual behavior, stage of nesting, degree of nest seclusion, age of the birds, and prey abundance. Types of disturbance would include fixed-wing aircraft and helicopters, explosions, machinery and vehicle activity, and pedestrians. Disturbance could cause adults to abandon nests; interrupt incubation, brooding, or other important activities (e.g., hunting, feeding); injure nestlings during sudden departures; cause premature fledging; and attract predators to the nests (Fyfe and Olendorff 1976; Roseneau et al. 1981).

Many raptors are considered sensitive to aircraft disturbance during nesting. Substantive behavioral studies that might lend support to actual impacts, however, are limited. Windsor (1977) and Platt (1977) showed that peregrines and gyrfalcons visibly reacted less to aircraft at higher altitudes (more than 1,000 feet) than at lower ones. No significant difference in reproductive success for either species was recorded between disturbed and undisturbed pairs. Use of aircraft during raptor nesting surveys, which might be considered severe disturbances due to close approaches to nests, has not revealed more than short-term changes in the behavior of nesting birds (Roseneau et al. 1981). Conservative flight zoning and restrictions to reduce disturbance during the arrival, incubation, and nestling stages of raptors would lessen the impacts of aircraft-related disturbance to minor to negligible levels.

Disturbance from human activities on the ground near nests would cause moderate impacts on nesting raptors, including abandonment of some nest sites (Roseneau et al. 1981). In general, most raptors are more tolerant of activities: (1) below their nests than above; (2) during the nestling period than during incubation and courtship; (3) at higher, more secluded nest sites than at lower, accessible sites; and (4) where stimuli do not appear harmful (for instance, distant, tangential road traffic vs. visits to the nest).

TAGS construction activities would include ground survey crews, machinery, and human activity near work pads and compressor stations. In addition, minor impacts would occur if off-duty field workers inadvertently disturbed nesting birds. Restricting human access in some areas, educating personnel regarding disturbance impacts on raptors, and locating facilities outside of prime raptor habitats would eliminate impacts as required or identified by the Bald Eagle Protection Act and the Peregrine Falcon Recovery Plan.

Other types of disturbance to raptors associated with TAGS would include construction-related blasting. Although some species have shown adaptability to loud noise, scheduling of blasting activities should consider the breeding season and nesting territories to reduce impacts during these sensitive periods.

TAGS Compressor Station No. 1 is located within the 2-mile radius of existing peregrine falcon nests. Even though it is located on the opposite side of the Dalton Highway from the nests and the noise levels would be at ambient between 5,000 to 7,000 feet from the station, it is not sited in compliance with accepted requirements ***(see Appendix H). According to FWS,*** this compressor station location could cause the loss of productivity of up to three peregrine nest sites at the Sagwon Bluff ***and*** this loss of productivity could lead to a long-term decline in the total Arctic peregrine falcon population if appropriate mitigation measures and conservation practices are not implemented ***(H. Hoskins, pers. comm., 1987). Existing peregrine falcon restrictions are presently under review. Appendix H provides the more detailed information on the Biological Consultation which includes conservation and mitigation measures and the conclusions from the USFWS that concluded that if the TAGS project was constructed and operated in accordance with the guidelines of the Peregrine Falcon Recovery Plan, Alaska Population (1982) and the other protective stipulations that would be included in the BLM grant right-of-way, no long-term cumulative effects are expected. The compressor station location and associated human activity could increase the potential for disturbance to peregrine nest sites located on Sagwon Bluffs. However, activities near TAPS Pump Station No. 2 apparently have not influenced the occupation or productivity of peregrine nest sites within 2 miles of that facility. The BLM in their review of "TAPS Peregrine Falcon Protective Restrictions" such as those used for TAPS indicate that routine pipeline activities present litle danger to the continued existence of the peregrine falcon.***

Direct mortality of raptors should be of negligible to minor significance. Because of their perching, scavenging, and hunting behaviors, raptors would inadvertently collide with vehicles and stationary objects such as guy wires and poles. They might also collide with aircraft or as a result of their attack instinct--a reaction exhibited by individual raptors (Nelson 1979).

Intentional destructive acts such as illegal shooting and nest destruction are possible. Such behavior during TAPS construction was not suspected, however, and should not be a major concern (Roseneau et al. 1981). Restricting access and firearms and educating personnel would reduce this potential.

Other impacts on raptors would include changes in numbers, composition, or availability of prey, habitat alteration and loss, increased populations of competitors (e.g., ravens), and the presence of environmental contaminants. Based on experience gained from TAPS, the potential for more than minor impacts from these causes is limited. Furthermore, no demonstrable negative impacts to raptor populations were attributable to TAPS activity (White et al. 1977, p. 226).

4.2.13.3.2 Waterfowl

Moderate impacts on waterfowl could result from TAGS development in some areas (see Table 3.2.13-1). The most obvious impact would be the construction disturbance of nesting, feeding, or staging habitats as a result of pipeline and facility siting. Specific components of the construction phase that could modify habitat include right-of-way clearing, gravel road and pad placement, and pipeline ditching. Impairment of surface drainage would be avoided since this could cause thermal surface erosion. ***Attempts would be made to avoid thermal erosion caused by the impairment of surface drainage. However, some drainage problems would occur nonetheless.*** Brink (1978, p. 47) described this phenomenon as a major impact on nesting birds, including waterfowl, along the TAPS corridor; however, the total amount of waterfowl nesting habitat that would be affected would be small and the overall impact minor. The severity of flooding and drainage problems would be greatest in permafrost terrain (Hanley et al. 1981). On the other hand, impoundments are used during spring migration, at least until other habitats become snow free. In addition, earlier snowmelt and emergence of vegetation in the "dust shadows" of some roads and facilities associated with TAGS would induce waterfowl use of some habitats for a limited period in spring. This habitat selection occurs presently along the Dalton Highway, primarily north of the Brooks Range and is apparent in the Prudhoe Bay area (Murphy et al. 1986, p. 29). At this time, there has been no quantification of the impacts created by "dust shadows". A five-year study at Prudhoe Bay is under way to assess impacts.

Indirect loss of habitat by disturbing waterfowl and effectively limiting the use of other habitats is also possible during TAGS construction and operation. Aircraft disturbance of staging waterfowl, especially geese, has been shown to cause short-term changes in behavior and distribution. The actual physiological consequences of these disturbances have not been determined, but frequent disruptions during staging could potentially result in increased mortality during migration, constituting a moderate impact. Traffic and human activity associated with TAGS access roads and facilities would also influence waterfowl behavior and the use of wetland habitats. The impact would be minor.

Incidents involving land and water pollution would undoubtedly accompany TAGS construction and operation. Potential pollutants include small amounts of spilled fuel, domestic solid and liquid wastes, and some hazardous chemicals associated with pipeline construction (Hanley et al. 1981). The degree and longevity of these impacts would be increased if the contaminants entered aquatic environments. Waterfowl would be the most vulnerable to these contaminants, and spilled fuel would have adverse effects on the insulative qualities of their plumage (FPC 1976b). The degree of vulnerability would depend on the breeding stage, stage of molt, food habits, and behavior of the species present (Albers 1977). The impact from the numerous small spills would be minor; however, the impacts from unpredictable large spills, if they should occur, could be moderate to major depending on size and time of year.

Direct mortality due to increased hunting, illegal shooting, and intentionally destructive acts would likely be minor to negligible. Mortality due to collisions with vehicles and permanent structures such as buildings, fences, and towers would generally be minor. However, the severity of these impacts could increase if structures, particularly communication towers with guywires, were located within or near major migration routes (FPC 1976b, p. 272). In addition, losses due to collisions might be greater in areas where foggy weather predominates, as on the coastal plain and the Prince William Sound region. Such effects would be negligible.

Finally, an indirect effect of TAGS would be increased numbers of predators of waterfowl (foxes, gulls, ravens), especially near camps. Feeding of predators, consciously or inadvertantly, would contribute to population growth of the predators and increase predation.

4.2.13.3.3 Other Birds

A variety of other bird species would be influenced by TAGS construction and operation. Other waterbirds, especially loons, shorebirds, and gulls, would be affected by a set of potential impacts similar to those described for waterfowl. Chief among these would be displacement by disturbance and direct habitat loss and alteration.

Tundra-nesting bird densities could be reduced locally not only by direct habitat loss, but also by indirect loss through a "road effect," extending laterally several times the actual width of the road (Hanley et al. 1981). This road effect on birds would be caused by the combined impacts of noise, activity, dust, and persistent water or snow. The same effect could also occur near work pads and permanent camps.

Sandhill cranes migrate in spring and fall in the tens of thousands across the TAGS corridor in the Delta Junction area of the lower Delta River. Some direct mortality due to collisions with aircraft, towers, wires, and facilities would be possible, but these impacts would be negligible to minor. Disturbance by some TAGS activities, such as air traffic ***or material excavation near roosting sites on floodplains***, could affect ***local*** movements and distribution of cranes ***Kessel, 1979). Floodplain material site activities in roosting areas could adversely affect the cranes (Kessel 1979).*** The timing of crane migrations is very restricted, and appropriate scheduling of pipeline activities could reduce potential impacts.

Ptarmigan and grouse are particularly vulnerable to collisions with vehicles, and direct mortality would rise with increased traffic. Improved access and increased human presence would cause greater hunting pressure on these species.

Raven and gull populations could rise locally due to the introduction of artificial food sources, thereby increasing their predation on other birds nesting nearby since they are effective predators and nest robbers. Careful disposal of camp wastes and control of artificial feeding would reduce this impact.

4.2.13.4 Summary

The impacts of the proposed project on large mammals and birds are broadly divisible into several categories. Direct loss of habitats would occur during construction and the operational phase, although rehabilitation and artificial and natural revegetation would restore some habitat values by providing early successional plants for ungulate forage. The impacts of direct habitat loss due to TAGS would be minor.

Of more consequence are those impacts that result in direct mortality or energetic stress to wildlife or in indirect loss of additional habitat through avoidance and displacement. Direct mortality due to collisions with vehicles and structures, increased poaching, more hunting, destruction of "nuisance" animals (***habituated carnivores***), and stress/exhaustion from deliberate harassment would occur to some extent during the life of the project. Proposed mitigative measures would reduce direct mortality to minor or negligible ***impacts.*** Vehicle collisions would probably result in moderate impacts to wildlife during construction.

Disturbance by humans could increase energetic stress on wildlife populations, especially during critical life-history periods or seasons. Such disturbance would be greatest during construction but would be mitigated by careful scheduling of activities. The overall impacts from disturbance during construction would be moderate to minor ***if proposed mitigative measures are followed closely. Minor to moderate indirect losses of habitat would result from local avoidance of project facilities and human activities, primarily during construction.*** Reduced human activity and habituation by wildlife would reduce indirect impacts to minor or negligible during project operation.

Attraction of carnivores to artificial food sources would cause moderate impacts during construction, leading to direct mortality of some animals. These impacts typically occur despite preventive measures but would be reduced to minor or negligible levels during operation. Minor to negligible impacts would occur to carnivores throughout the life of the project. ***The***

impacts on carnivores are similar to ANGTS (FPC 1976b, p. 363), but less than that identified for El Paso (FPC 1976a, p. II-372).

4.2.14 *Threatened, Endangered and Other Protected Species*

4.2.14.1 Introduction

Threatened and endangered species are of paramount importance at certain localities (see Table 3.2.13-1) in considering the impacts of an 800-mile pipeline and associated tidewater and marine transportation facilities. The following subsection also considers candidate plant species and threatened and endangered raptors and whales. Table 4.2.14-1 lists the threatened, endangered, or protected raptors. BLM initiated required consultative procedures with the Fish and Wildlife Service (FWS) and the National Marine Fisheries Service (NMFS) on January 29, 1987. Appendix H summarizes the BLM evaluation of effects on peregrine falcons and other threatened or endangered animal species and provides mitigation measures and conservation practices being developed during the Section 7 Consultation Process. Responses from U.S. Fish and Wildlife Service and National Marine Fisheries Service are included in Appendix H which concur with the BLM conclusion that the TAGS project is not likely to effect threatened or endangered species.

4.2.14.2 Terrestrial Species

The terrestrial threatened or endangered species of most concern during construction and operation of the pipeline and its associated facilities would be the peregrine falcon. There are several peregrine nesting sites near the proposed route and compressor station location. Each of these areas is specified in Table 4.2.14-1. Of similar importance are the nesting sites of gyrfalcon and bald and golden eagles. Although neither ***bald nor golden eagle are*** threatened nor endangered in Alaska, nesting sites are protected by federal law.

Types of impacts which might affect raptors would include accidental shooting, blasting, rock crushing, vehicle traffic, aircraft noise, oil spills, collision at high structures such as towers and buildings, and general human activities such as walking. Impacts would include but not be limited to the possibility of ingesting oil soaked prey, premature flight by fledglings, and abandoning or deserting their nests or nesting areas. Other possible consequences would involve collisions with vehicles and aircraft and project structures and reduced use of traditional breeding or feeding habitat during construction. Peregrine falcon have continued to nest successfully near TAPS Pump Station 2. That existing facility has activity and noise characteristics similar to those expected of a TAGS compressor station.

Compressor Station No. 1 is located within the vicinity of several peregrine falcon nest sites at Sagwon Bluffs. YPC would implement construction and operating policies which would restrict employees from approaching the Sagwon Bluffs and install noise reducing equipment at the compressor station, if the need for such equipment can be demonstrated. Disturbance by humans could increase energetic stress on the peregrine falcons, especially during mating, nesting, and feeding activities. Such disturbance would be greatest during construction and could not be mitigated by scheduling during the sensitive periods due to the labor intensive nature of constructing such a facility.

Impacts on nesting or breeding sites of these raptors would be prevented to the extent possible by a combination of careful route selection, winter construction in these sensitive areas, proper environmental education of construction workers, preparation of adequate responses to stipulations, and agency monitoring during project construction and operation.

Biological consultation for the TAGS project has been completed (see Appendix H). The FWS has determined that should the conservation and mitigation measures identified by BLM be incorporated into the right-of-way grant, the TAGS project would not have any long-term or cumulative negative effects on the peregrine falcon (see Appendix H, June 30, 1987).

Table 4.2.14-1 Sensitive Areas for Falcons and Eagles

Species	Area	Sensitive Period[1/]
Arctic Peregrine Falcon	Franklin Bluffs Area	April through August
Arctic Peregrine Falcon and Gyrfalcon	Sagwon Bluffs	April through August
Arctic Peregrine Falcon, Gyrfalcon and Golden Eagle	Slope Mountain	April through August
Golden Eagle and Gyrfalcon	Atigun and Upper Dietrich Valleys	April through August
American Peregrine Falcon	Yukon River	April through August
American Peregrine Falcon	Grapefruit Rocks	April through August
Bald Eagle	Chatanika River	April through August
American Peregrine Falcon	Chena River	April through August
American Peregrine Falcon	Salcha River	April through August
American Bald Eagle	Tanana River[2/]	April through August
American Peregrine Falcon	Delta/Tanana River Junction	April through August
Bald Eagle	Delta/Tanana River Junction	October through April
Bald and Golden Eagles	Little Tonsina River	April through August
Bald and Golden Eagles	Tiekel River	April through August
Golden Eagle	Tsina River	April through August
Bald Eagle	Lowe River	April through August
Bald Eagle	Abercrombie Gulch	April through August
Bald Eagle	Anderson Bay	April through August

1/ The sensitive period in some areas may be extended (March through August) if gyrfalcon or eagles are present.

2/ Shaw Creek to Delta-Tanana River Junction, including Quartz Lake.

NOTE : Changes in Bold Print

Compressor Station No. 1 has been identified by BLM and other federal and state agencies as an area of special concern due to peregrine falcon habitat. BLM has had special land management practices in this area for a number of years. Final placement of TAPS facilities in this area was selected on the basis of the concerns to peregrine falcons. Likewise special attention has been given by BLM to operation and maintenance actions of TAPS in this area.

The BLM Biological Assessment of June 3, 1987 (Appendix H in the DEIS) specifically identified Sagwon Bluffs as an area where peregrine falcons may be affected. Six next sites are reported in this area, two are between five and six miles from the proposed TAPS alignment but near TAPS Pump Station No. 2. Four nest sites are within three miles of the proposed TAGS alignment; two of which are within two miles of TAGS Compressor Station No. 1. One of the nest sites is within one mile of TAGS and this next has been productive consistently and active since at least 1979. The Sagwon Bluffs area is contained in the "Utility Corridor Draft Resource Management Plan and EIS" as an area meriting designation as an Area of Critical Environmental Concern (ACEC) - see 3.2.3.3.1. Sagwon Bluffs also is discussed at 4.2.19.2 as an area of special concern. It is important to note that all TAGS facilities and the buried pipeline in the Sagwon Bluffs area are separated from the peregrine falcon nest habitat by the existing Dalton Highway.

Compressor station siting has been identified by BLM as an element of the TAGS project where development of comprehensive plans and/or programs will be required in the next tier of planning by YPC (see Table 4.8-1). These compressor station plans and/or programs will consider: overall system operating reliability, frost heave, noise, air quality, and fish and wildlife (see Table 4.8-2). An additional mitigation measure is the requirement that TAGS final route selection, facility placement and construction in environmentally sensitive areas discussed in 4.2.19 (see Table 4.8-2). Areas involving peregrine falcon nesting habitats are: 4.2.19.2 - Sagwon Bluffs; 4.2.19.4 - Slope Mountain; 4.2.19.13 - Yukon River Bridge; and 4.2.19.14 - Grapefruit Rocks.

Consultation by BLM with FWS under Section 7 of the Endangered Species Act have resulted in the conclusion that the proposed TAGS project can be constructed and operated without long-term or cumulative negative effects on peregrine populations.

The next tier of planning by YPC would be to evaluate whether a TAGS facility such as Compressor Station No. 1, or a construction, operation or maintenance activity would be in accord with the Peregrine Recovery Plan for Alaska. If not, the BLM or other appropriate agency would reinitiate the consultative requirements of Section 7 to determine the extent there are options for relocation, design or operation of the specific TAGS project component. Also considered at that time would be the option of site specific waiver of the general guidelines to reflect the particular biological facts of the affected peregrine population as presently provided in the existing Peregrine Falcon Recovery Plan for Alaska (1982).

The project would comply with the requirements of the Bald Eagle Protection Act and the Peregrine Falcon Recovery Plan.

Golden eagle nest sites are also protected under the Bald Eagle Protection Act. Although the Bald Eagle Protection Act has been amended to allow taking of golden eagle nests (not the eagles themselves) when conflicts with resource development or recovery projects occur, this amendment does not provide blanket authorization to take nests. Permits must be acquired for each nest and cannot be issued for nest sites that are occupied or under construction. Some of the other criteria for determining whether permits would be issued include whether the taking is compatible with preservation of the regional golden eagle population, whether the applicant can reasonably conduct the resource development or recovery operation in a manner that would avoid the taking of a golden eagle nest, and whether mitigation measures compatible with the resource development or recovery operation are available. Thus, although taking of golden eagle nests <u>may</u> be permitted if conflicts with the TAGS pipeline occur, it should not be assumed that such taking would be permitted until permits have actually been issued. At this time, no relocation of nests would be anticipated; however, should relocation be required, it would be performed as identified to minimize impacts to the golden eagle.

4.2.14.3 Marine Species

There are several endangered whale species in the Beaufort Sea and northern Prince William Sound (see Table 4.2.14-1). These cetaceans could be affected by collisions with project-related ship traffic, noise from ships or marine construction activities, or by oil spills from project-related accidental spills . All of these impacts are preventable to a large degree and even under the worst scenario would not be detrimental to the population. Noise from tankers, blasting or pile-driving might cause increased but temporary avoidance of the area. Overall, impacts to endangered whales are expected to be negligible, and no critical habitat has been designated for any of the listed marine species.

The National Marine Fisheries Service has reviewed the BLM's biological assessment and has concluded that there would be no identified critical habitat in Prince William Sound for any of the three species of whales identified and that construction and operation of the TAGS terminal would "not likely adversely affect" any of the three whale species (see Appendix H, July 8,1987).

4.2.14.4 Summary

The proposed route and LNG plant facility site are, in some cases, quite near peregrine falcon or bald eagle nesting areas. Also, the marine transportation routes pass through areas with endangered whale species. In both the terrestrial and marine environments, similar facilities and transportation routes already exist in these areas with no signficant impacts noted as identified in Appendix H. By using proposed mitigation and timing and compliance to the extent possible with the conditions established by the FWS under the Bald Eagle Protection Act and the Peregrine Falcon Recovery Plan, the impacts to these species would be expected to be ***minor during construction and negligible during operation.*** The impacts identified for TAGS would be similar to ANGTS and El Paso since all federal actions must comply with the same regulations.

4.2.15 Recreation, Aesthetics, and Wilderness

4.2.15.1 Introduction

As with many other aspects of the project, there would be both positive and negative impacts pertaining to recreation, wilderness, and aesthetics. Generally, the negative impacts would emanate from construction noise, dust, and visual scars on otherwise undisturbed and natural areas. New recreation access points would be created by the project. Greater numbers of people would reside in the state.

Recreational use along roads associated with this route from Livengood south to the Valdez area is heavy and would be impacted primarily during construction by competing uses between tourists and construction workers, since most popular recreation facilities are highway oriented. From Fairbanks to the Chandalar Shelf area, recreation use has been increasing rapidly because a major portion of the Dalton Highway is now open to public traffic.

4.2.15.2 Recreation

The area from Chandalar Shelf north to Prudhoe Bay at present has only light recreation use, consisting mainly of fly-in hunting and fishing. Several hunting guides operate from airstrips near the TAPS, especially the Galbraith Lake and Sagwon airstrips. Due to increasingly relaxed state highway access permit procedures, recreational use is expected to continue to increase along the Dalton Highway. A concession to drive tourists one way along the Dalton Highway between Prudhoe Bay to Fairbanks was recently issued by the state for the summer of 1987. Recreational use along this scenic route would also increase due to the number of construction workers. Impacts to recreation would be expected to be moderate.

The proposed TAGS pipeline route runs parallel to, or a few miles from, a highway system along its entire route. Lateral access roads from the existing highway to the proposed route would, if open to the public, very likely be used by recreationists. This access would extend the area and amount of use that already exists and could significantly increase the recreational opportunities.

Examples of potential openings of new access to presently roadless areas would include: the west side of Atigun River above Galbraith Lake, Summit Lake, and Grayling Lake. Impacts would be moderate on these areas. The Galbraith Lake and the Sukakpak Mountain areas are well-known entrance points to the nearby Brooks Range ***federal conservation units***, including Gates of the Arctic and the Arctic National Wildlife Refuge.

During construction there would be moderate recreational use of areas along the pipeline by construction workers. Recreation opportunities for travelers and vacationers on highways along the route would be temporarily altered during the construction period. However, there would be moderate, increased use by construction workers and others in the winter months where roads are kept open and maintained, resulting in minor impacts to recreation.

Unless steps are taken to provide adequate recreation facilities, campgrounds, picnic areas, overlooks, boat access sites, trail leads, parking areas, turnouts, and rest stops, damage to the vegetation and trash from uncontrolled recreation use and a general degradation of recreation and aesthetics would result. ***Additionally, due to the typical influx of tourists to Alaska and the presence of the construction workers and their families, the increased use of public campgrounds could cause an increased potential for human/carnivore interaction due to feeding by the visitors and poor handling of garbage and other attractants. An example of a closing of a public campground occurred during the construction of TAPS when the campground on the Upper, Little Tonsina, near Pump Station Number 12 where marauding bears became habituated to humans.***

Boaters on and hikers near rivers might be disturbed by construction noise or by visual obstructions such as elevated crossings. Salcha River recreational experience should not be affected except where the right-of-way traverses the river, creating a visual scar. The raft and kayak use of the 5 miles of Keystone Canyon area would be restricted during construction within the Lowe River.

Odors from engine exhaust, fuel areas, and camps would be evident near recreational areas during construction.

Wildlife populations near the corridor would be temporarily affected by the construction of the proposed project and possibly by increased pressure from hunting and harassment by workers. If the present restrictions on discharging firearms within 5 miles of the Dalton Highway and prohibited use of access roads associated with and maintained by TAPS north of the Yukon River are continued, the total numbers of wildlife available near the corridor and the recreational viewing potential of the area would not be decreased.

Unregulated use by all-terrain vehicles, trail bikes, snowmobiles, and other off-road vehicles could have a significant adverse impact on recreation and aesthetics by permanently scarring the landscape, damaging the vegetation, compacting the soil, causing erosion, and harassing the wildlife. These activities would probably continue to be restricted by the State as they presently are along the Dalton Highway. Therefore, the impacts would be minor. The impacts to recreation for TAGS would be less than those identified for El Paso because the southern terminal of El Paso involved undeveloped areas of the Chugach National Forest, which would not be the case with TAGS.

A discussion of designated state recreation areas has been grouped with other special areas associated with the proposed TAGS project in Subsection 4.2.19.

Project-related recreational needs would increase potential for recreational use of the area because more people would become aware of such opportunities through publicity and personal association with employees. More use would inevitably bring more control; thus, present recreationists might experience such things as reservation systems, reduced options for types of experiences, and restrictions on places they might go and their length of stay. An example would be the January 1987 reduction of catch limit at Summit and Paxson lakes for burbot and lake trout due to the large number of ice fishermen and resultant fishing pressure. Impacts such as those could further restrict or result in increased pressures to other areas. Additionally, the tourism industry expansion would be curtailed in certain areas during construction, especially at major interest points such as Keystone Canyon and Worthington Glacier.

4.2.15.3 Aesthetics

Aesthetics is a value judgement; everyone interprets and experiences it differently. ***Some would view the project's*** increased availability of a unique area to more people ***to be a benefit while others would say it is an intrusion.***

A more direct impact of construction on recreation resource would be the visual scars resulting from buried pipeline construction and the visual impacts of aerial stream crossings. In all cases this gas pipeline would be at least a third utility and perhaps a fourth to be located in the corridor area; consequently, it would not be the same as building a new pipeline across an undisturbed area. As was the case with ANGTS, there would be minor impacts to aesthetic values.

Facilites such as communications towers, buildings at compressor sites, block valves, and the LNG site, would be visible from the air and highway for great distances in some cases. At times, the linear pipeline berm would also be visible to those hiking in the nearby mountains. Lights on communications towers and at compressor stations would be visible over long distances, especially at night. Impacts would be minor to moderate along the corridor. Co-use of existing facilities such as communications facilities would result in no impact.

Nearly all of the proposed right-of-way south of the Brooks Range would require the clearing of brush and forest cover. This would significantly alter the natural environment and in these areas would degrade existing aesthetic values, particularly where long straight clearings are visible from the road. These impacts would be moderate during construction and minor during operation.

Recreationists within several miles of the line would have their experiences affected by construction and operation activities. When the route passes within a mile or so of presently used recreational areas, the impacts would typically be minor, especially during construction. Noise, traffic, additional dust, and the scars from clearing and ditching would decrease the experience, sometimes to a considerable degree. Impacts in the vicinity of TAPS during construction would be moderate and negligible thereafter.

Many of the aesthetic impacts have already been discussed under recreation. The major impact to many people would be the viewshed as seen during hiking, driving on the main roads, and boating on rivers as well as from the air. For those people whose appreciation of aesthetic quality is related to beauty, sensations, or to the congruity of the environmental features, the proposed project would have a major adverse effect on the resource. Visual impacts in forested areas were identified as particularly severe and long-term in areas of high relief or low vegetation. The pipeline right-of-way, borrow sites, cut and fills, and access roads would remain landscape features indefinitely causing long-term aesthetically adverse impacts (FPC 1976b, p. 362). But for others, long tangents might add interest to otherwise repetitive, though natural views.

4.2.15.4 Wilderness

The preferred TAGS routing involves two small areas where existing wilderness studies and recommendations to Congress have not been completed and are identified in Subsection 3.2.3.3. Until BLM makes its recommendations on wilderness to Congress ***as part of the ANILCA 1001 report*** and Congress takes specific action, the preferred TAGS route will not be approved. ***YPC has identified optional routing at MP 95 and MP 110 that would avoid areas "having wilderness values." These optional routings are specifically incorporated into this EIS.*** There are several ***federally designated*** wilderness areas near the route, including the Arctic National Wildlife Refuge, the Gates of the Arctic National Park and Preserve, and the Wrangell-Saint Elias National Park and Preserve, which are primarily roadless and wilderness areas. None of these areas would be directly disturbed by the proposed project. Impacts should be minor. There would be some increased use of wilderness areas in Alaska as a result of construction and operational employment opportunities created by TAGS.

4.2.15.5 ***Wild Rivers and Chugach National Forest***

There would be no direct impacts to the Gulkana and Delta Wild and Scenic River areas since the route would not cross the designated portions of these rivers. Units of national park and refuge systems authorized by ANILCA are not involved. The portion of the LNG terminal buffer area within the Chugach National Forest is classified as a general multiple-use forest area. Secondary impacts to these recreation areas would occur due to construction workers using recreation areas. ***Also the buffer area for the LNG terminal that is in the Chugach National Forest has been determined by the USFS to be suitable to transfer to State ownership under the Alaska Statehood Act.***

4.2.15.6 Valdez Area

Most recreation in the Valdez area is centered around fishing; sightseeing by car, boat, and by foot; and some hunting. These recreational pursuits would be stressed considerably during construction due to the large influx of people to an area with limited accessibility. The aesthetic experience of fishing for anadromous species such as salmon would be impacted, but there are other factors which affect these activities more than crowded stream access points.

Hiking opportunities should be increased after construction, especially in such areas as Keystone Canyon where accessibility to trailheads would be somewhat improved. The locally popular Goat Trail and Riddleston Falls would be affected only during the construction period. Aesthetics of this region would be only moderately affected once construction was completed since the pipeline would be buried along the roadway right-of-way.

The Copper River Railroad Historic Area would be disturbed and less accessible during construction of the tunnel. Some present forest uses, such as fishing, overnight stays, and access to the Chugach National Forest across the buffer zone, would be prohibited in order to protect the LNG plant in Anderson Bay. These impacts would be moderate.

4.2.15.7 Summary

The impacts to recreation and aesthetics would be widespread due to the length of the area disturbed, but the band of disturbance would be quite narrow.

Primary disturbance would occur during construction and would involve impacts to present uses and users of the area, especially by tourists, sightseers, and wilderness enthusiasts. ***During construction we anticipate the following short-term impacts on tourism:***

- ***Increased highway traffic.***
- ***Increased air passenger activity.***
- ***Shortage of hotel and other visitor accommodations.***
- ***Problems hiring and retaining tourism service employees due to the attraction of higher paying pipeline jobs.***

However, these impacts should be offset by the following:

- ***The airlines will likely add more flights; the airline terminal facilities built in recent years should be able to accommodate any foreseeable increase in demand.***
- ***The year-round occupancy rates should be significantly higher, thus increasing bed tax revenues which are used primarily to support tourism promotion and development efforts.***
- ***Today Prudhoe Bay, the TAPS pipeline, and Valdez Marine Terminal are major tourist attractions.***

- *Improvements in the transportation infrastructure will be of long-term benefit to the tourism industry.*

- *Increased state and local government revenues from the TAGS project can be used to advertise tourism and finance development projects.*

Impacts to aesthetics would be more long-lasting. The visual impacts would include long stretches of linear clearing of vegetation, many new borrow sites where vegetation has been removed, and the linear scar from the berm over the pipeline. Their impacts would be moderate.

There would be negligible impact on wilderness value since the band of increased disturbance is quite narrow and would not change the existing character of a majority of the route. The TAGS impacts would be less than for El Paso since the pipeline route and LNG site are not located in roadless wilderness areas of the Chugach National Forest.

4.2.16 Cultural Resources Sites

4.2.16.1 Introduction

Adverse impacts to cultural resource sites as a consequence of a large-scale project such as TAGS would be either primary or secondary in nature. Primary or direct adverse impacts would be those resulting from activities directly associated with the construction and operation of the proposed gas line. Beginning with the Federal Antiquities Act of 1906, a suite of federal and state laws has been enacted to protect significant cultural and paleontological sites.

Any activity that causes the alteration of a cultural resource site, ranging from total destruction to only slight damage, can substantially diminish the potential value of the site to contribute to understanding of the human past. Secondary or indirect impacts, which also can result in the loss of significant data, include alteration of the local site environment (topography, ground cover, etc.) in such a way as to increase the possibility of future erosion, unauthorized artifact collection by individuals associated with the project, and an increase in human utilization of the region because of maintenance activities and generally improved access.

4.2.16.2 Potential Primary Impacts

Formal consultation between BLM and the State Historical Preservation Office has been initiated to develop a Memorandum of Agreement to protect cultural resources during the construction of TAGS. Without an appropriate cultural resource site protection plan, the potential for direct adverse impacts on cultural resource sites as a result of TAGS varies with the location of construction areas.

In Keystone Canyon the proposed TAGS pipeline would be routed through the Keystone Canyon Railroad Tunnel, a proposed National Historic Landmark. In addition to this tunnel being used for the Copper River Railroad, it was previously used as a highway tunnel. In 1976 a cave-in occurred; its present historic values are not known.

4.2.16.2.1 Construction Areas Previously Surveyed for TAPS or ANGTS

Presumably, pipeline construction in areas previously surveyed for TAPS or in anticipation of ANGTS holds relatively little potential for damaging cultural resource sites because most, if not all, sites in such areas have been identified and evaluated and many have been excavated. Those remaining sites deemed to be significant cultural resources, according to National Register of Historic Places criteria, should be protected by extant federal and state laws. However, it is always possible that some cultural resource sites, particularly those that are deeply buried, may have escaped the notice of earlier investigators and would be found. Also, though potential danger to sites identified during the TAPS project as well as for ANGTS preconstruction reconnaissance (not public information) may have been mitigated by avoidance, it might be necessary, because of routing changes or the need for additional borrow material, to disturb these sites during construction of TAGS. Any archaeological sites which were partially excavated during the TAPS project that could not be protected by avoidance, may be at considerable risk of major impact if TAGS construction proceeds because they are concentrated on material source sites which were previously mined to the perimeter of the archaeological site. Implementation of an appropriate cultural resource protection plan would ensure that potential impacts are minor or negligible.

4.2.16.2.2 Construction Areas Not Previously Surveyed for TAPS or ANGTS

In the absence of an appropriate cultural resource site protection program, the potential exists for major adverse effects during TAGS construction on sites not previously studied. Earlier surveys have demonstrated the considerable potential for archaeological remains in the unsurveyed portions of the proposed TAGS alignment. Cultural resource sites situated along the actual pipeline, on material sources, and in other areas that would be disturbed by construction may be subject to severe damage or even destruction. Location of such sites and employment of appropriate mitigation measures as part of a cultural resource protection plan would reduce the potential impact to negligible levels.

4.2.16.3 Potential Secondary Impacts

The potential for indirect adverse impacts on cultural resource sites as a result of TAGS construction is potentially major and of special concern because of difficulty in mitigating such effects. Unsalvaged sites within and adjacent to the proposed TAGS alignment would be at risk in terms of secondary impact regardless of whether or not a previous archaeological survey has been conducted in a specific area. The only difference is that without knowledge of the sites in unsurveyed areas it would be impossible to make an estimate of the extent that secondary impacts diminished the data base.

Many types of secondary impacts are possible, including unauthorized collection of cultural materials by construction or operational personnel or by individuals who simply have greater access to the region because of improved transportation. Unfortunately, the last has been common in Alaska. Though control of erosion and other measures designed to provide general environmental protection in construction areas could also protect cultural deposits, there would be the possibility that adverse secondary impact which could alter thermal regimes (which might accelerate deterioration of organic materials) could occur. Site disturbance might result from erosion attributable to postconstruction phase activities, such as increased use of areas adjacent to the pipeline by off-road vehicles.

4.2.16.4 Summary

Any disturbance to a cultural resource site, including scientific excavation, could result in adverse impact. However, an appropriate cultural resource protection program, such as that now being planned in conjunction with the proposed construction of TAGS, has the capacity to reduce risk to a minor or negligible level. Impacts for TAPS, TAGS, ANGTS, and El Paso would be considered similar for overall cultural values since such values are given special consideration by federal and state laws. Furthermore, the execution of such a program has the potential to make major contributions to our knowledge of the past.

4.2.17 Subsistence

4.2.17.1 Introduction

The potential effects of the proposed project on subsistence uses are primarily a function of the impacts on fish and wildlife used for subsistence, access to subsistence resources (including forest products), and potential interference with or disruption of harvest activities.

Potential direct effects of the proposed project on subsistence uses include the following.

- Reduction in the availability of subsistence resources due to various aspects of project construction and operation

- Interference with or preclusion of access to subsistence resources and harvest methods

- Competition for subsistence resources by project personnel

- New or greater use of subsistence resources in areas made more accessible by new or improved roads or trails

Potential indirect impacts are adverse effects on communities and individuals from a loss of traditional harvest activities, including loss of traditional supply of foods, increased outlay of cash for substitute foods, reduction in time available for subsistence activities due to employment commitments, and sociocultural impacts from reduced participation in the harvest, processing, and distribution of subsistence resources.

Following are some criteria that determine significance of potential effects.

- Relative abundance and distribution of the subsistence resource and harvest activities compared to that affected by the project

- Duration of the impact

- Relative importance to the communities/individuals of the affected resources and uses

- Availability of other sources of affected resources or acceptable replacement resources

4.2.17.2 Impacts to Fish and Wildlife

Construction and operation of the project could affect fish and wildlife resources used for subsistence activities in three ways, all resulting in their reduced availability for subsistence harvest. First, mortality could occur from project construction or accidental events such as an oil spill. Fish would be most at risk due to the potential for siltation or fuel spills into a watercourse. Second, fish and wildlife might avoid the project area due to construction activities, or in the case of poorly placed drainage and fish passage structures, be unable to physically migrate through the project area. Animals that can avoid the area during construction activities, such as moose and caribou, are likely to do so. Finally, construction and operation of project-related facilities could result in habitat loss and a reduced level of utilization of the project area by fish and wildlife. Here the level of impact depends on the particular habitat disturbed by pipeline, road, borrow pit, and facility construction. Fish spawning and overwintering areas and loss of riparian vegetation that supports moose populations are among the habitats most sensitive to disruption. The duration of impacts would be generally limited to construction activities on any of the six construction spreads, none of which would not exceed two years. Specific activities include clearing the right-of-way work pad construction (four to 11 months), and pipe ditching and laying (six to seven months).

North Slope Borough

The potential for impacts to fish and wildlife resources used for subsistence purposes varies along the TAGS route. In the North Slope Borough some fish resources would be affected by mortality, obstructions to migration, and loss of critical habitat. Other important areas used by village residents for fishing would still be available, and impacts to fish would be minimized through proper design and construction procedures proposed for the TAGS project. Moderate impacts to moose, sheep, and caribou are potentially more significant on a short-term basis. Avoidance of construction areas and induced changes to distribution or migration patterns would cause temporary hardship to individuals who utilize areas along the route for the subsistence harvest of moose and caribou, requiring increased harvest effort elsewhere. Loss of riparian habitat could reduce the availability of moose. Because the area along the TAGS route is not a primary subsistence use area of Kaktovik, Nuiqsut, and Anaktuvuk Pass, impacts to fish and wildlife in this area would be minor and are not significant in terms of subsistence.

Northern Corridor

Along the northern corridor, caribou, moose, and fish would also be sensitive to TAGS-related impacts. Communities close to the TAGS route would more likely be affected, such as Nolan/Wiseman and Livengood. Fish and wildlife avoidance would temporarily require a greater level of harvest effort in areas more remote from construction activities. This would result in a temporary significant restriction of subsistence use of these resources (see Figure 4.2.17-1). The communities of Allakaket/Alatna, Bettles/Evansville, Rampart, and Stevens Village use many areas other than the TAGS route for subsistence activities and would not be as affected by impact to fish and wildlife.

Fairbanks-Delta Junction Communities

The Fairbanks-Delta Junction communities area is not classified as a rural subsistence use area by the *Joint* Boards of ***Fisheries*** and Game, and participation in subsistence-like activities is lower in that area. Since no construction activities occur in the vicinity of personal-use fisheries, impacts would be limited to the unlikely occurrence of a catastrophic fuel spill event.

Glennallen/Copper Center Corridor

Potential impacts in the Glennallen/ Copper Center corridor would be moderate and similar to those in the northern corridor, with fish, moose, and caribou being the most sensitive subsistence species. There would be no migration impacts to the Nelchina Caribou Herd. Because there are no activities in major rivers used for subsistence or personal-use fisheries, impacts to subsistence fisheries would be minimal except in the unlikely event of a catastrophic fuel spill.

Some avoidance of the construction area by moose and caribou would occur. Communities adjacent to the TAGS route would be affected and include Paxson/Sourdough, Gulkana, Glennallen, Copper Center, and the Upper Tonsina communities. This would result in temporary significant restriction of subsistence uses of these resources (see Figure 4.2.17-1).

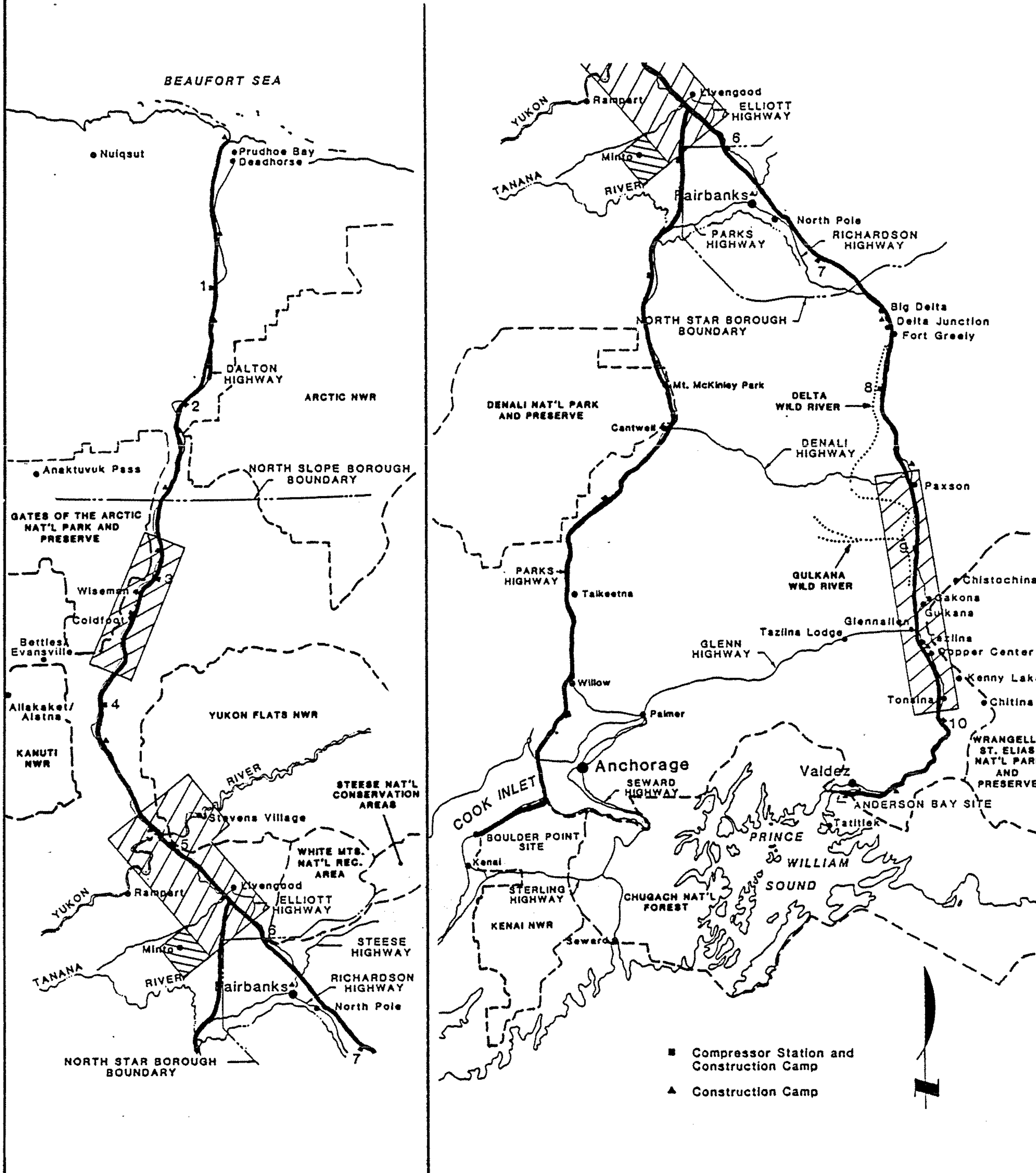
Valdez/Tatitlek

Like other areas of the TAGS route, moose and fish in the Valdez area are the subsistence species most sensitive to impact. However, because subsistence hunting and fishing by Valdez residents is minimal, subsistence impacts would not be significant. Valdez is not presently classified as rural by the State Boards of Fish and Game. Tatitlek relies on marine subsistence species and primary harvest areas are located outside Valdez Arm (City of Valdez 1986). Marine mammals used for subsistence might be sensitive to increased levels of tanker traffic. Other subsistence fish and wildlife species are unlikely to be affected.

Adverse impacts to fish and wildlife used for subsistence purposes could result in some increased effort for adequate subsistence harvest and economic and social impacts. Again, communities adjacent to the TAGS route would be moderately affected.

4.2.17.3 Interference/Access Impacts

TAGS project construction and operation has the potential to interfere with subsistence activities. The primary causes of interference are restriction of access to traditional subsistence use areas and restriction on hunting and fishing in the vicinity of the TAGS project. Construction activities and placement of facilities, roads, and borrow pits throughout the project area would eliminate or restrict some access to areas traditionally used for subsistence activities. In the Glennallen-Copper Center area, access restrictions associated with the TAPS pipeline have affected firewood and household log harvesting (R. King, pers. comm.). Work pad construction and pipeline ditching and laying activities would last for periods of up to 11 months (although the pipeline ditch would not likely be open for more than 30 days in any given location). Construction camps, access roads, and borrow pits could be operational for the period of construction. The potential for these impacts would be significant, but temporary, and limited to the length of construction activities in a given area.



Prudhoe Bay to Anderson Bay

Livengood to Cook Inlet

Reference: U.S. Department of Interior Geological Survey, Alaska National Interest Lands Conservation Act, December 2, 1980

Figure 4.2.17-1 Area of Significant Restriction of Subsistence Use During Pipeline Construction Proposed TAGS Project

Regulations regarding hunting and trespassing in the vicinity of the completed TAGS line can also have the effect of restricting subsistence use of traditional sites. Loss of hunting access due to restrictions around oil and gas facilities is a common complaint of NSB residents (Woodward-Clyde Consultants 1984). Unlike an oil or gas field, the TAGS corridor is a narrow linear feature, and hunting restrictions would be less likely to result in the extensive elimination of subsistence activities in traditional use areas. Any closure of the TAGS right-of-way to public access would also affect access to traditional subsistence use areas. Because the TAGS pipeline would be buried for most of its length, the necessity for hunting and access closures after completion of construction would be minimized, and impacts would be minor.

Communities located adjacent to the TAGS route, such as those in the northern corridor (Nolan/Wiseman and Livengood) and Glennallen/Copper Center area (Paxson/Sourdough, Gulkana, Glennallen, Copper Center, and the Upper Tonsina), are more sensitive to interference impacts than those which are further away or have broad subsistence use areas. Interference with subsistence activities would result in some increased effort for adequate subsistence harvest and economic and social impacts, particularly in communities adjacent to the TAGS route. This would cause a temporary but significant restriction of subsistence use in these areas (see Figure 4.2.17-1).

4.2.17.4 Increased Sport Hunting, Fishing, and Trapping Competition

Increased levels of sport hunting, fishing, and trapping would be associated with TAGS construction and operation. The project would introduce large numbers of direct and indirect employees into the area and would likely result in improved access into many places with fish and wildlife resources. This ***mobile*** work force and its dependents would participate in sport hunting, fishing, and trapping activities. Left unregulated, such participation would compete with subsistence users for fish and wildlife resources, which would threaten maintenance of the populations of fish and wildlife used for subsistence purposes. Sport hunting, fishing, and trapping activities by employees would be concentrated around the locations of construction camps. During TAPS construction many participating companies prohibited employees from sport hunting and fishing while on the project. In addition, a 5-mile-wide corridor on each side of the pipeline was closed to sport hunting and fishing by the State of Alaska ***north of the Yukon River***. If a similar action is taken by the State Boards of Fish and Game, it might be necessary to exempt traditional subsistence users from closures.

Although not within a unit of the national park system, current actions by the state to manage the Nelchina Caribou Herd provide a likely example of what might happen should the TAGS project produce competition for fish and wildlife resources above that prudent for good management. The harvests of Nelchina Caribou Herd presently is controlled by a permit system. Only Alaskan residents are eligible for these permits and a certain number of permits are set aside for the local rural subsistence residents. The season for subsistence harbest is significantly longer than that for sports hunting.

Due to the availability of ***existing*** public access to hunting and fishing areas and the subsistence reliance on the area in the immediate vicinity of the TAGS project, the northern corridor (Nolan/Wiseman, ***Stevens Village,*** and Livengood) and Glennallen/Copper Center area (Paxson/Sourdough, Gulkana, and Upper Tonsina communities would be more vulnerable to increased competition from sport hunting, fishing, and trapping than those which are further away or have broad subsistence use areas. Fish (salmon, grayling, burbot, and whitefish), moose, and caribou are important dietary components to communities of these areas and are also popular sport hunting and fishing species. Small and medium-size furbearers are trapped to provide materials for local handicrafts and pelts which are an important source of cash for some families. Increased competition from sport hunting, fishing, and trapping would result in moderate impacts and increased effort for adequate subsistence harvest, and economic and social impacts.

Currently, there are restrictions on hunting with firearms in the 5-mile-wide corridor on each side of the Dalton Highway, which also applies to subsistence hunting. However, because fishing is not restricted and both sport and subsistence hunters will likely go outside the corridor to hunt, competition will remain a likely impact.

Historically, the ***Joint*** Boards of ***Fisheries*** and Game have acted to protect subsistence harvest of fish and wildlife when such harvest levels have been deemed to be in jeopardy or inadequate to maintain traditional subsistence use of fish and wildlife. Such protection measures have taken the form of special subsistence hunting and fishing openings (e.g., moose and caribou hunts in the Glennallen area and king salmon fishing in Tyonek), or restrictions on sport and commercial harvest. Specific actions by the ***Joint*** Boards of ***Fisheries*** and Game to reduce the effects of TAGS on subsistence resources in the Glennallen and Livengood-Wiseman areas ***depends*** upon the actual extent of TAGS workers establishing residency in these two areas.

Pipeline ***construction*** employees could conceivably qualify as rural subsistence users and compete with area residents for subsistence resources. To qualify as rural subsistence users, a non-Alaska resident would have to reside ***in Alaska*** for one year ***and establish a primary domicile*** in a rural area classified for subsistence. An Alaska resident from outside the area in question would have to legally change his ***primary*** residence to the rural area classified for subsistence. Because the period of pipeline construction is relatively short and pipeline crews will be moving regularly from camp to camp along the pipeline spread, this is not likely to happen. ***It also is possible that operations employees might qualify for subsistence in the area of unemployment. As a general rule employees associated with the operation of TAPS have not changed their primary domicile to remote, rural locations. This same pattern is expected to be representative of TAGS operational workers.***

There is a possibility that some increased sport fishing competition may occur in national parks and sport hunting and fishing in national park preserves along the project route. However, the State of Alaska is empowered to exercise a subsistence harvest preference over sport harvest if a scarcity is determined to exist, and this would apply to fish and game resources on park lands. Such an action could be taken to minimize this impact. Similarly, there is a potential for non-resident project employees to become rural residents and increase the number of qualified subsistence users eligible to hunt and fish on park lands. However, as described in Section 3.2.17.1, the requirements for one-year residency and legal change of address would make it unlikely that non-resident construction workers would qualify as subsistence users. In the case of Alaskan residents employed by TAGS, they would also need to have resided in Alaska for a year and would need to change their primary domicile to the local rural area where they are employed. This is considered unlikely.

The National Park Service (NPS) has specific regulations covering subsistence use (36 CFR 13 Subpart B.13.43 and 1344). These regulations establish a procedure for designating zones wherein Alaskan rural residents having their primary permanent residence adjacent to or in the vicinity of the National Park may use it for subsistence. Alaskan rural residents having a personal or family history of customary and traditional use (without aid of aircraft) of the National Park also may apply to the manager of the National Park for a subsistence permit.

Pipeline workers residing in TAGS construction camps would be unlikely to quality for subsistence use in an adjacent National Park unless the employee established "primary permanent residence" within an area already designated as a "Resident Zone" or had a personal or family history of subsistence use meeting NPS standards. Accordingly, TAGS would have negligible effect on existing subsistence use in a National Park.

The duration of competitive impacts would be limited to the period of construction, although the operational work force could continue to compete with subsistence users on a smaller scale. These impacts would not result in a significant restriction of subsistence uses.

4.2.17.5 Impacts From Employment

Even in those Alaska communities oriented towards a traditional subsistence way of life, most residents desire some level of employment. Employment provides cash, which is used to support subsistence activities (i.e., purchase of boats, snowmobiles, supplies) and is often distributed along the same kinship lines used for distribution of subsistence resources. Project employment opportunities are very important to local residents, and wage income would offset loss of subsistence resources to some degree. However, employment also presents some disadvantages to participating in the traditional subsistence way of life (A. Lane, pers. comm.). ***These disadvantages include loss of time available to prepare for and pursue subsistence activities. Decreased participation due to employment would have some economic impact which would be partially offset by wages.***

Subsistence harvest patterns follow the seasonal availability of resources, but they also require flexibility to take advantage of unexpected harvest opportunities as they arise. Full-time employment is not conducive to participation in subsistence activities, particularly those that cannot be scheduled in advance. In many predominantly Native communities, full-time jobs such as those in school districts and government provide flexibility for subsistence activities (such as subsistence leave or school closures). During construction of the TAPS project, employers often reported that Native employees would request leave or quit to participate in subsistence activities. Likewise, many Native employees thought full-time employment too restrictive. Because the majority of local employment opportunities would be during project construction, minor impacts from employment would generally be temporary and are not considered a significant restriction of subsistence uses.

The communities most sensitive to employment-created subsistence impacts are those that are predominantly Native and which have a social structure and community identity that revolves around participation in subsistence activities. These include Kaktovik, Nuiqsut, Anaktuvuk Pass, Evansville, Allakaket/Alatna, Stevens Village, Rampart, Minto, Copper Center, and Tatitlek. The effects of an employment-induced reduction in subsistence participation are primarily social and cultural.

4.2.17.6 Relocation/Increased Harvest Effort

An indirect impact of the TAGS project, resulting from the primary impacts ***to subsistence*** described above, is increased harvest effort required to offset loss of subsistence resources in the vicinity of the project. Any reduction in harvest levels attributable to the project would result in this increased effort to make up the loss taking place in other areas unaffected by the project (relocation). In addition to the time involved with extra travel, increased harvest effort usually requires additional outlays of cash for fuel and supplies.

Communities located adjacent to the TAGS route, such as those in the Northern Corridor (Nolan/Wiseman and Livengood) and Glennallen/Copper Center (Sourdough/Paxson, Gulkana, Glennallen, Copper Center, and the Upper Tonsina communities) area, are more sensitive to impacts from relocated or increased effort than those which are further away or have broad subsistence use areas. Because of greatly reduced levels of activity and construction facility closure/rehabilitation after construction, relocation and increased effort impacts would ***result*** in a temporary but significant restriction of subsistence uses (see Figure 4.2.17-1) during construction but would be negligible during project operation. ***(Residents of Nolan do not quality as living in a "resident zone" for purposes of subsistence in the nearby GAAR [L. Waller, NPS, pers. comm., 3/88]).***

4.2.17.7 Economic Impacts

A second indirect effect of TAGS construction and operation would be adverse economic impact on communities that are oriented towards a subsistence way of life. This could partially be offset by any local hire/employment opportunities. Economic impacts result from increased outlays of cash to replace reductions in subsistence harvests and to support increased harvest efforts to make up for reductions in resources. Where a reduction of harvest in traditional use areas occurs, a resulting increase in or relocation of harvest effort may require additional cash outlays for supplies such as food and fuel for boats and snow machines.

Harvest replacement with store-bought foods is often expensive, and cash used for these purposes may be diverted from other needs, such as heating fuel, clothing, and equipment.

In communities where employment opportunities are few, additional cash outlays are a hardship since no ready sources of cash are available. This would be ***partially*** offset by local hire employment opportunities provided by the project. Communities with limited employment opportunities and located adjacent to the TAGS route, such as Native communties in the northern corridor and Glennallen/Copper Center area, are more sensitive to competition impacts than those which are further away or have broad subsistence use areas. The level of economic impacts would be moderate during construction activities (the major source of fish and wildlife interference/access and relocation/increased effort impacts) but negligible during project operation.

An additional economic impact could result from a decision by the Joint Boards of Fisheries and Game to redesignate a community from rural to non-rural. This could occur if a project induced changes to population growth and employment characteristics resulted in the Joint Boards of Fisheries and Game reevaluating the communities rural subsistence status. Loss of this designation would prevent residents of an affected community from receiving subsistence preference in the harvest of fish and wildlife, and participate in subsistence hunting and fishing seasons. This in turn would create associated economic impacts. The greatest likelihood would occur during the construction phase in communities like Glennallen, which could become a regional supply center for pipeline activities. Housing non-resident employees of Yukon Pacific and its contractors in camp facilities would minimize this impact. After project construction, operation-related employment would not be significant enough to result in redesignation. Although this is possible, it is believed that it is unlikely that TAGS induced population growth of permanent residents to areas such as Glenallen will not be so large as to cause a redesignation. This possibility is even more unlikely for smaller communities like Wiseman.

4.2.17.8 Social/Cultural Impacts

The social impacts from the loss of participation in subsistence activities are complex and include loss of cultural identity and status in the affected community, dietary impacts, and aggravation of social problems such as depression and substance abuse (Woodward-Clyde Consultants 1984). As indicated earlier, the foundation of sociocultural systems of many rural communities is the subsistence utilization of the natural environment and its fish, wildlife, and vegetation resources. A reduction in the ability to participate in subsistence activities would result in community and individual identity loss through being unable to provide and distribute subsistence resources at traditional levels. Subsistence foods are a physically and psychologically important source of nutrition to Alaska Natives. A moderate reduction in such foods and their replacement with a limited range of store-bought foods can also lead to dietary problems and a loss in sense of well-being.

The communities that are most likely to be sensitive to social impacts from reduced subsistence activities are those that are predominantly Native and which have a social structure and personal identity that revolves around participation in subsistence activities. These include the North Slope communities, Evansville, Allakaket/Alatna, Stevens Village, Rampart, Minto, Copper Center, and Tatitlek. Proximity to the TAGS route, severity of harvest opportunity reduction, and limited alternatives for relocation of harvest effort would also aggravate social impacts. Duration of social impacts are likely to be limited to the period of project construction.

4.2.17.9 Summary

The TAGS project would result in several categories of impacts to subsistence uses and activities: impacts to fish and wildlife used for subsistence; interference and access impacts; increased competition from sport hunting, fishing, and trapping; impacts from project employment; relocation of and/or increased harvest effort; economic impacts; and social impacts. With few exceptions, these impacts would be minor to moderate and temporary, limited to construction activities that occur over a 34-month period in any given construction spread. Minor levels of impact--permanent or "life-of-the-project"--would result from habitat loss (due to borrow activities and placement of facilities), interference with or restrictions by ADF&G for hunting adjacent to the right-of-way, and limited hunting/fishing/trapping competition from the operations work force. These impacts do not constitute a "significant restriction" of subsistence uses or activities. Some temporary impacts such as fish and wildlife avoidance of the project area, interference with or restrictions to access to hunting on the ROW, and associated relocation of and/or increased harvest effort, economic impacts, and social impacts would result in a major but temporary restriction in subsistence uses and activities by communities located adjacent to the TAGS route. Affected communities and resources include the following: Nolan/Wiseman, Livengood, ***Stevens Village,*** and Minto (hunting for moose and caribou and fishing); and Paxson/Sourdough, Gakona, Copper Center, and Upper Tonsina (hunting for moose and caribou, and fishing).

4.2.17.10 ANILCA Section 810(a) Evaluations and Findings.

Appendix L contains evaluations and findings as required by ANILCA for all alternatives.

4.2.18 Public Safety

4.2.18.1 Introduction

This discussion describes the risks and consequences of possible upset conditions and hazards associated with the proposed project which could affect public safety. The safety system analysis is based on a review of routing and siting, criteria, design and construction requirements, operations and maintenance requirements, and proposed mitigation. Safety elements that would be incorporated in project design include gas detection, fire detection and protection, high-pressure relief and emergency venting, containment, and control of LNG spills or leaks, shutdown systems, geologic and seismic consideration, noise control, adherence to applicable design codes and regulations, personnel training, and quality assurance/quality control.

4.2.18.2 Pipeline

As discussed in Section 2, the pipeline system was designed to minimum federal safety standards for the transporation of natural gas as prescribed in 49 CFR 192. These regulations outline the minimum requirements for materials, design, fabrication, assembly, construction, operation, inspection, testing, and maintenance of pipelines transporting natural gas. Noncompliance with any of these requirements could result in adverse safety conditions.

The proposed TAGS would be constructed near TAPS and/or the authorized ANGTS at Atigun Pass, Sukapak Mountain, Yukon River, at several pipeline and road crossing locations, and near the TAPS oil terminal in Valdez. Although a preliminary determination of compatibility has been identified (see Appendix B), both public safety and national security concerns could result should a system failure occur at these "pinch points."

Specific designs have been developed by YPC to accommodate the expected seismic areas crossed by the pipeline. Seismic criteria would consider two levels of earthquakes--a design-contingency earthquake and a design-operating earthquake. All elements of the pipeline system, including the compressor stations, would be designed to withstand the loading of a design-operating earthquake in accordance with conventional engineering practices and criteria and remain operational during and after such an event. In the event a design-contingency earthquake, the pipeline system would be shut down for inspection to determine if any repairs would be necessary.

The pipeline system would be equipped with an emergency pressure relief system and mainline block valves to handle emergency shutdowns along the system. Such a system would be remotely operated with block valve spacing between 5 and 20 miles and at critical locations such as at meter stations, compressor stations, aerial river crossing, and fault crossings. At these locations, block valves would be located immediately upstream and downstream to provide isolation capability.

Consideration would be given to using block valves during the detailed design phase where TAGS is near either TAPS or ANGTS (see Appendix B for a listing of such locations).

Cathodic protection facilities would be installed along the entire pipeline route for external corrosion control to prevent pitting due to chemical reaction between the soil and the carbon steel pipe. If pitting were not controlled, it could reduce the wall thickness of the pipe sufficiently to cause a break.

The security for the pipeline would be provided by both aerial and ground reconnaissance. Frequent overflights would be conducted along the entire length of the pipeline system. All above-ground facilities would be fenced to prevent unauthorized entry. The aerial crossings of the pipeline would be provided with a security area on either bank of the river crossings or at the aboveground fault crossings.

An integrated communication system would provide for the exchange of voice and data information along the entire pipeline route. In addition to the traditional microwave radio system which would link all telephone system locations, PABX, SCADA, Telex and mobile repeater equipment, YPC is considering the installation of a fiber-optic cable in the pipeline trench. This system would provide a redundant communication and data transmission capabilities with no additional environmental impacts.

4.2.18.3 Compressor Stations

Each of the proposed TAGS compressor stations would be manned full time for station operations and maintenance. The stations would be equipped with gas detection, fire detection, communications facilities, and utility systems sufficient for stand-alone operations. The TAGS compressor station would be equipped to handle and control emergency situations with emergency shutdown systems to allow for isolation and venting of all station piping and equipment. Station block valves would be provided to isolate the station and pipeline from the mainline gas while allowing flowing gas to bypass the stations. Since each of the 10 compressor stations is located in remote areas, no adverse impacts to public safety should result from emergency operations.

4.2.18.4 LNG Safety

4.2.18.4.1 LNG Safety Regulations

The U.S. Department of Transportation Office of Pipeline Safety, certified the "Liquefied Natural Gas Facilities, Federal Safety Standards" (49 CFR 193), which prescribe safety regulations for LNG facilities (see Appendix G). Additionally, the U.S. Coast Guard under authority of 33 USC 1221 and Executive Order 10173 is responsible for establishing regulatory requirements for facility site selection as it relates to management of vessel traffic in and around a facility and for all matters pertaining to structures or equipment located on navigable waters and facilities located between the vessel and the last manifold (or valve) immediately before the receiving tank(s). These regulations govern and standardize criteria for the siting, design, installation, or construction of an LNG facility and prescribe requirements for the maintenance and operation of the facility, personnel qualifications and training, fire protection, and security. Under these regulations, an LNG facility must be designed to minimize the hazards to persons and off-site properties resulting from leaks and spills of LNG and other hazardous fluids at site.

The LNG system safety and reliability for a project as large and complex as TAGS must balance the risks and consequences associated with the construction and operation of the system with the technical and economic feasibility of system design criteria and operational procedures.

All system safety and reliability design criteria, operational procedures, and other mitigating measures as specified in 49 CFR 193 would be implemented and are intended to reduce the possibility of system failures and to reduce risk to public safety.

4.2.18.4.2 Public Risk of LNG

The risk to the public from the proposed LNG liquefaction and marine terminal at Anderson Bay would result from the effects of a catastrophic leak or spill of LNG. LNG is an extremely cold (-259°F), volatile, ***liquid*** which readily vaporizes when exposed to external heat sources such as water, soil, or air ***and when warmed to a temperature of -160°F becomes lighter than air.*** LNG produces ***about 600*** cubic feet of natural gas for every cubic foot of liquid at ambient temperature. Pure LNG vapors, if confined, are not explosive, but a mixture of 5 to 15 percent vapor to air is flammable. Should such a mixture of LNG vapors be allowed to disperse in the presence of an ignition source, an explosion could occur.

The major concern of a large-scale LNG spill would be ***the dispersion of flammable vapor and subsequent ignition at the site or over a larger area.*** Once the air-vapor mixture has been ignited, the fire would probably propagate back to the fuel source (FERC 1978). Although there is little actual experience with such a catastrophe from this type of facility, impacts to the public would be highly variable and would depend on the following.

- Location of the spill and the population of the areas adjacent to this location.
- Presence of an ignition source within the dispersion limits of the vapor cloud and whether the cloud became ignited.
- Flammability of the structures and materials encompassed by the vapor cloud or exposed to radiation from a large LNG pool source.
- Repairability of the leak source and the time it takes to accomplish shutdown.
- Time required to notify the public and take appropriate mitigation actions (FERC 1978).

4.2.18.4.3 Anderson Bay LNG Plant and Marine Terminal Safety Considerations

The site at Anderson Bay was selected for location of the proposed TAGS LNG plant and marine terminal facilities based on specific analyses conducted by YPC with respect to the compliance with the requirements of 49 CFR 193. Anderson Bay is a relatively remote location within Port Valdez. The distances which separate Anderson Bay from existing developments contribute to the inherent safety of the site. Alyeska Pipeline Service Company operates the TAPS terminal at Jackson Point in Port Valdez. This terminal is located approximately 3.5 miles to the east and is the only existing industrial activity near Anderson Bay. The existence and operations of the TAPS terminal would not adversely affect the operation of the TAGS facility. Valdez Narrows, located more than 3 miles west of Anderson Bay, is used by vessel traffic to enter and depart Port Valdez, including tankers which carry TAPS crude oil. Shipping use of the Valdez Narrows or Port Valdez would not be adversely affected by the operation of the TAGS facility. The city of Valdez is located more than 5 miles east-northeast of Anderson Bay on the opposite (north) shore of Port Valdez.

The proposed TAGS LNG plant site at Anderson Bay would be located within a Uniform Building Code designated seismic risk zone 4. An on-site geologic reconnaissance and preliminary site seismic evaluation have been completed by YPC in order to develop confidence that the Anderson Bay site would be capable of complying with 49 CFR 193 siting requirements. Specifically, the limiting criteria listed in 49 CFR 193.2061(f) have been evaluated by YPC as follows:

- Most Critical Ground Motion

  Deterministic and probabilistic calculations have been performed. The predominant feature which controls seismic hazard in the Valdez area is the gently dipping "Benioff-Wadati zone" that marks the boundary between the Pacific and the Alaskan tectonic plates. A major seismic event could occur on the Benioff-Wadati zone, which lies 13 to 19 miles beneath Port Valdez. Peak ground acceleration estimates are based on data relating to seismic events associated with the Benioff-Wadati zone. A maximum seismic event directly beneath the site at a depth of 13 miles was considered for the deterministic evaluation of a peak acceleration attenuation equation ***would result in*** a maximum deterministic ground acceleration peak value of 0.4g.

  Preliminary probabilistic estimates of ground motion have been evaluated using tectonic models from prior studies in the region. These models were used with conservative attenuation relationships for the bedrock site conditions know to occur at Anderson Bay. Based upon an annual probability of exceedance less than 0.0001, a probabilistic peak ground acceleration value of 0.55g has been estimated for the Anderson Bay site.

- Quaternary Fault Displacement

  A survey of geologic and seismological professionals ***who are*** active in the Valdez region and literature review of geological and seismological references indicate that no evidence of Quaternary faulting has been identified within the site region. The closest faults with demonstrable Quaternary displacement are greater than 50 miles from the site. There is no evidence that any faults within the Valdez region were active during the great earthquake of 1964, even though the epicenter of this event was only 30 miles to the west.

- Differential Surface Displacement and/or Soil Liquefaction Due to Dynamic Properties of Materials Beneath the Site

  A preliminary site geological reconnaissance indicates that most of the site is underlain by near-surface bedrock. The Anderson Bay site appears to be geologically similar to the nearby TAPS terminal. Experience on the TAPS terminal site indicates that bedrock foundations within the site would be possible. Therefore, differential subsurface displacement and liquefaction during a seismic event due to dynamic properties of soils should not be a concern.

The Anderson Bay site would be developed at three major graded bench elevations. An upper bench graded to elevations of approximately 155 to 165 feet would be constructed to accommodate placement of pipeline gas receiving facilities, process units, power plant, operational control and maintenance facilities, and process flare stack. A middle bench graded to an approximate elevation of 100 feet would be constructed to accommodate placement of LNG storage tanks and an impoundment. A lower bench graded to elevations of approximately 50 to 60 feet would be constructed to accommodate harbormaster facilities, shoreline berths, dock entrances, wastewater treatment facilities, and an isolated area for the marine flare stack.

Conceptual layouts call for 1:1 cut slopes in rock. This angle would result in slopes less steep than both the rock bedding and foliation providing a relatively stable configuration for rock cut slopes. YPC has proposed to evaluate potential slope difficulties in detail during the design stage. Based on experience gained at the

TAPS terminal, rock slope stability could be achieved at the Anderson Bay site through the use of proper design and construction techniques.

The LNG storage tanks and impoundment area would be based on the use of four 800,000-barrel storage tanks, a four-cell system of 450-foot by 450-foot by 35-foot-high reinforced earth and concrete wall dikes and requiring approximately 50 acres. The cells would be sized for isolated containment of 150 percent of the contents of each storage tank. A 100-foot-wide perimeter roadway would provide access to the storage tank and impoundment area.

The results of on-site geologic reconnaissance and preliminary seismic evaluation performed by the applicant indicate that the Anderson Bay site would be capable of meeting seismic siting requirements of 49 CFR 193.2061(f). No site conditions have been identified that would preclude location of LNG storage tanks at Anderson Bay pursuant to 49 CFR 193.2061(f). YPC's discussions with cryogenic tank manufacturers verify that 800,000-barrel storage tanks could be designed for maximum estimated seismic loads identified.

Based upon conceptual definition of the plant relief system, approximately 40 acres of surrounding fenced or over-water security area is required for the process flare stack. This area was determined as the radiation zone exceeding 2000 Btu/hr-ft^2 around the flare.

For safety and access the proposed TAGS LNG plant facilities would have proper facilities separation to allow multiple points of access and egress between all site areas and to allow personnel and equipment to move around the facility during an emergency. At minimum, the distances specified in the National Fire Protection Association Code 59-A for LNG would be adopted.

The Anderson Bay site is located on the south shore of Port Valdez, Alaska. It is an ice-free, weather-protected fjord with established navigational facilities and procedures for large vessels. Water depths are 50 feet, within 300 feet of the shoreline, an area suitable for a tanker-turning basin of more than a mile in radius. The subbottom is known to be bedrock. Marine access to the city of Valdez is relatively easy.

The Anderson Bay site would be of suitable size, topography, and configuration to safely accommodate the proposed LNG facility. All area, distances, separations, impoundments, and access-ways developed by YPC during conceptual definition of the LNG plant facility could be accommodated in a plant layout configuration at Anderson Bay. The resulting LNG plant/marine terminal site layout as identified in Figure 2.2.1-5 appears constructable with a design that minimizes hazards. LNG tanker berths could be safely located along the Port Valdez shoreline east of Anderson Bay (Figure 2.2.1-4).

YPC's layout of the Anderson Bay site has considered emergency access. Cargo vessel berth and ferry landing facilities at the extreme east end of the site and an alternative off-loading dock area at the extreme west end of the site would provide emergency access for personnel, equipment, and materials. Multiple access routes would be available from either dock area to facilitate fire-fighting, spill control, or personnel evacuation.

Available information indicates the Anderson Bay site can be designed to meet the prescribed siting requirements of Subpart B of 49 CFR 193 at an appropriate conceptual level, including the general requirements for site size, topography and configuration, thermal radiation protection, and flammable vapor-gas dispersion, seismic investigation and design, flooding, soil conditions, wind, severe weather and natural occurrences, adjacent facilities, and requirements for separation of facilities.

The risk to the public from the proposed LNG plant and marine terminal facility would be the effects of thermal radiation and flammable vapor gas dispersion of a catastrophic leak or spill of LNG. Within the vicinity of the proposed Anderson Bay facilities, several areas of public or private land uses were identified, as shown in Table 4.2.18-1.

Table 4.2.18-1
Private and Public Land-use Areas Near the Anderson Bay LNG Plant and Marine Terminal

	Distance From Site/Ft.
North shoreline of Port Valdez	14,300
Entrance Island	14,800
Shoup Bay spit	15,000
TAPS terminal	16,500
City of Valdez	31,400
Old Valdez	44,000
Alaska Pacific Refinery	58,000
Valdez Airport	52,800

YPC performed an analysis of the thermal radiation and flammable vapor-gas dispersion for an LNG spill. The results of its analysis are attached as Appendix I and are summarized below. These calculations were independently verified for BLM and USACE by ***Harding Lawson Associates (HLA)*** during preparation of the DEIS ***and this FEIS. In addition, they have been closely coordinated with DOT. See Subsection 5.11.***

The thermal exclusion zone evaluation conducted by YPC for the proposed Anderson Bay site was for a postulated LNG pool fire for the content of an 800,000-barrel LNG storage tank spilled and burning within the dike. The results of the thermal radiation calculations worst case, using the American Gas Association thermal radiation methodology, was for an unattenuated incident radiant flux level of 1,600 Btu/hr-ft^2 (prescribed by 49 CFR 193.2057) extended for a maximum distance of 1,725 feet from the center of a tank dike. All public and private land-use areas, as identified above would be located outside the thermal exclusion zone.

A flammable gas-vapor dispersion exclusion zone associated with an average gas concentration in air equal to 2.5 percent (prescribed by 43 CFR 193.2059) for a postulated LNG spill. YPC performed these calculations using the conservative American Gas Association Model and the U.S. Coast Guard "Development of an Atmospheric Dispersion Model for Heavier-Than-Air Gas Mixtures." The greatest flammable vapor-gas dispersion distances was for the 800,000-barrel storage tank spill into the dike area and for a 10-minute loading arm spill onto water at the rate of 12,000 gallons per minute. Results of the conservative model indicated the maximum dispersion distance would extend 11,700 feet from the dike wall for the storage tank spill and 11,920 feet for the 10-minute loading arm spill onto water while for the U.S. Coast Guard model the results were 6,854 feet and 6,243 feet, respectively. The results for the model evaluations indicate that all public and private land-use area identified above would be located outside the maximum dispersion exclusion zone.

In summary, results for both the thermal exclusion zones and vapor dispersion analysis indicate that the proposed facility could be safely located at the Anderson Bay site and meet the thermal radiation protection and flammable vapor-gas dispersion protection requirements of 49 CFR 193. Review of the study indicated that this analysis was a reasonable and prudent application of 49 CFR 193 and that no readily apparent fatal flaws that would prohibit use of the proposed Anderson Bay site for the TAGS project exists.

4.2.18.5 LNG Tanker

LNG tankers traversing Prince William Sound to and from the proposed Anderson Bay marine terminal would be subject to the U.S. Coast Guard Vessel Traffic Service (VTS) which consists of four basic components:

- Traffic Separation Scheme
- Vessel Movement Reporting System
- Radar Surveillance
- Regulations

The purpose of the VTS is to prevent collisions and groundings and to protect the navigable waters of the area from environmental harm resulting from collisions and groundings. The users of the VTS are not only the tankers transiting to and from the TAPS Marine Terminal, but also ferries, cargo vessels, tugs, tour boats, and other vessels. ***The U.S. Coast Guard also monitors large, potentially dangerous icebergs in Prince William Sound which calf from Columbia Glacier and present a hazard to ships that transit to and from Port Valdez.***

The U.S. Coast Guard has indicated in a letter of February 20, 1987 to the BLM that the additional tanker traffic which would result from the proposed TAGS project would not have any adverse affect on the VTS system since the existing VTS would be capable of handling a significant increase in vessel traffic without changing the present operations.

For further public safety protection, especially in the vicinity of critical port areas, the U.S. Coast Guard normally identifies safety zone regulations. The waters within 200 yards of any waterfront facility at the TAPS complex or vessels moored or anchored at the terminal complex and the area within 200 yards of any tanker vessel maneuvering to approach, moor, unmoor, or depart the TAPS marine terminal complex are safety zones. It would be anticipated that for public safety a similar safety zone would be identified for the TAGS project facilities and tankers (*USCG* 1984).

The LNG tanker fleet transporting LNG to the Pacific Rim would be of two sizes, 125,000 and 165,000 cubic meters, with the LNG cargo combined in independent cargo tanks of either the spherical or membrane stainless steel design. The inner hull of these double hulled ships would bear the weight and dynamic forces of the LNG cargo. Boil-off of the LNG during transit would be consumed as fuel in the ship's boilers. No boil-off vapors would be vented to the atmosphere from the tankers. Typically, boil-off vapors would supply about 70 percent (FERC, 1978) of ship's fuel during transit, bunker-C fuel oil would make up the remaining fuel requirement.

A fleet of 15 LNG tankers would make the 3,300 to 4,550 nautical mile voyage from Valdez to the Pacific Rim (Japan 3,300, South Korea 4,040 and Taiwan 4,550) in approximately 12 to 15 days depending on the point of destination, weather conditions and ship's speed. Once the tanker enters the sea lanes outside Prince William Sound, the tanker is in international waters and away from any populated areas until it nears its point of destination. A total of 220 to 280 tankers would be loaded annually at Anderson Bay which equates to one ship arrival and departure every 1.25 to 1.5 days. The maximum fill rate during loading of the LNG tankers would be 70,000 barrels per hour per tanker or 12 to 15 hours to fully load a tanker.

The various events which could cause casualties among the general public must be considered as a risk. Normally the LNG tankers marine transit is considered the single element of an LNG project that has the greatest potential for large releases of LNG. The most likely hazard with a large LNG tanker would be a collision with another large ship, a grounding, a ramming with a fixed object or a breakdown of a major tanker component which could leave the tanker without propulsion or controls. The safety features proposed by YPC for the LNG plant and marine terminal operation facilities would normally be such that the consequences from an on-site LNG release would be restricted to the vicinity of the plant. Whereas, a major spill on water from an LNG tanker casualty could form a potentially flammable vapor cloud which could drift to land areas or, if ignited at the spill site, could generate an intense pool fire and cause fatalities (FERC, 1978).

According to the FERC staff (1978) there is no actual at sea experience with the extent of hazards to the public from LNG tanker transportation of LNG. The FERC staff, in various proposed LNG project EISs indicate that data concerning experiments involving LNG spills, analytical techniques for calculating vapor dispersion, and past experience involving the transportation and storage of LNG and other liquefied flammable gases. Such data and techniques were used by the FERC staff to analyze the potential hazards associated with the operations and transportation for LNG.

The transportation of LNG in tankers would threaten the public if an accident resulted in LNG spills onto water from a damaged LNG tanker. The escaping LNG could endanger any populated areas within the dispersion limits of the cloud, although once the tanker is outside Valdez Arm, no areas of population would be within this limit except for other transiting ships. The direction of movement and the extent of travel of the vapor cloud would depend on the magnitude of the LNG spill, the prevailing meteorological conditions and potential ignition sources.

In its August 7, 1987 response, FERC indicated that the need for detailed risk analysis for LNG tanker (as was done in past FERC EISs) is not warranted because of the extremely low population associated with tanker traffic and the existance of an established VTS. For more detail on LNG tankers, see (FPC 1976a, pp. II-573 through II-581).

4.2.18.6 Summary

TAGS would be designed, constructed, and operated in accordance with all applicable codes, standards, and regulations to reduce the possibility and consequences of system failures such as fires, explosions, LNG spills, and other impacts to public safety.

Design criteria for such site-variable parameters as seismic hazards, wave run-up, or corrosion potential would be based on existing information, supplemental studies, as required, and the technical and economic feasibility of specific design criteria. Operating procedures and mitigation measures would be in accordance with a variety of regulatory agency requirements, as well as good engineering practice. Proper training of operations staff further ensures system safety by reducing the probability and severity of accidents. All system safety and reliability design criteria, operations procedures, and mitigation measures are intended to reduce the possibility of system failures and to reduce the adverse public safety impacts associated with such failures.

Overall, it appears that YPC location and conceptual design reflects consideration of the excellent safety record experienced by the LNG industry in general during the last 10 years, as well as the safety record for LNG facilities which have operated safely in Alaska for more than 15 years.

4.2.19 Areas of Special Concern Along the TAGS Alignment

4.2.19.1 Introduction

The applicant identified seven areas along the route where special construction considerations are necessary. These are due to unusual engineering constraints, environmental sensitivity, or land-use conflicts. In addition to these seven areas, other issues of special concern were raised through the EIS scoping process ***and subsequently during review of the DEIS.*** Impacts to these areas are generally considered by discipline in the appropriate sections of this document. This subsection ***pulls together into one place and*** summarizes the important environmental impacts in each of these areas. Each of these areas would receive special attention during the stages of development of design criteria, design, ***final location,*** construction, operation, and maintenance.

4.2.19.2 Sagwon Bluffs ACEC (Proposed - Milepost 65.5)

The initially proposed location of Compressor Station No. 1 was changed from the east side of the Dalton Highway where there are active Arctic peregrine falcon nests and historically used peregrine nests near Sagwon Bluffs to the west side of the highway just outside of the Sagwon Bluffs proposed ACEC ***where the existing Dalton Highway and its traffic separates the proposed compressor station location from nesting areas along the river to the east.***

Compressors are normally audible to humans from distances of 6,000 to 7,000 feet (FPC 1976a) and would perhaps be audible to peregrine falcons for greater distances. Gas blowdowns occur infrequently but even using stack silencers would be in the range of 80 dBAs at 100 feet (FPC 1976a). Blowdown, if timed properly, would not affect the peregrine falcons; however, in an emergency situation such as unscheduled venting during the critical breeding or nesting season, some impacts, including disorientation and nest abandonment, could occur.

Under routine operations compressor operations would probably be less disturbing than normal highway noise. Overall, potential disturbance would be less than if the compressor were located on the east side of the highway.

Overall impacts to raptors by the project would be minor in this area except during emergencies; impacts could then be moderate should the emergency occur during the nesting period, April to August.

4.2.19.3 Toolik Lake ACEC

None of the TAGS project facilities are directly associated with the Toolik Lake area. However, the ACEC does adjoin the Dalton Highway. Truck traffic and construction impacts are expected to be negligible.

4.2.19.4 Slope Mountain ACEC (*Proposed*)- Milepost 115)

The TAGS pipeline route crosses near the toe of Slope Mountain where TAPS has a material site. Habitat created by the mineral material site provides important Dall sheep use areas. TAGS proposes that much of the pipeline work in this area take place during the early winter. Overall impacts to Dall sheep and to raptors would be similar to that experienced with TAPS construction.

Slope Mountain also contains a mineral lick. This mineral lick would not be available for a mineral material source to sheep during the TAGS construction period.

Overall, the effects of TAGS on the sheep and raptors of the Slope Mountain ACEC would be minor during construction and negligible thereafter. Commercial guiding opportunities would be displaced to the extent they now use the ***ANGTS fly*** camp pad.

4.2.19.5 Galbraith Lake Area *ACEC (Proposed)* (Milepost 137 to 164)

4.2.19.5.1 TAGS Proposed Route

The proposed TAGS pipeline route is on the west side of the Galbraith Lake while the Dalton Highway, TAPS, and the authorized ANGTS corridors are on the east side. As proposed, the pipeline might affect a relatively undeveloped area which was identified for special consideration in the BLM's Utility Corridor Resource Management Plan (RMP). Galbraith Lake, along with the TAPS access road, airstrip, and construction camp pad, would be totally enclosed by the TAGS pipeline and the Dalton Highway.

The buried pipeline might also close, reduce, or increase the cost of future options for access westward toward National Petroleum Reserve - Alaska and to federal, state, and private Native-owned resources unless special construction techniques were utilized at specific points to allow crossings. These special buried pipeline crossings techniques could be installed during construction should future road alignments be known or subsequent to pipeline construction. Impacts to future access should be minor.

Permanent access roads and the construction work pad would potentially open approximately 20 miles of new access along the west side of Atigun River valley upstream from Galbraith Lake to off-road traffic. There would be an additional visual impact to those driving along the Dalton Highway since the construction related scars would be visible. There also is a concern about effects upon overwintering fish habitats upstream of Galbraith Lake.

On the east side of the highway near Mosquito Lake, TAPS and the authorized ANGTS traverse several sites of cultural significance. Though no new surveys have been conducted along the TAGS alignment, it is likely that several additional sites could be affected by construction.

Although the impacts to the streams entering Galbraith Lake would be similar to those crossed in other areas, there is a growing pingo next to one of the streams (Dean 1987) which has the potential to disrupt the local water regime should the construction and/or operation affect the pingo. There is substantial concern about the icings that occur at pipeline crossings in drainage on the west side of Galbraith Lake. Access to the proposed TAGS alignment from the Dalton Highway would also intercept water areas just upstream of winter fish habitat (see Section 4.2.11).

Golden eagle and gyrfalcon nests are present on the bluffs west of the road and could be disturbed during construction by high noise levels and aircraft as discussed in Subsection 5.14.

Other than the major short-term construction effects, the long-term effects primarily would be associated with increased access and moderate visual changes along the highway.

4.2.19.5.2 East Side Galbraith Route Option

At BLM's request YPC developed an optional alignment on the east side of the highway adjacent to TAPS and authorized ANGTS. This optional route has construction difficulties such as insufficient space between TAPS and the mouth of Atigun Gorge for both TAGS and authorized ANGTS; fine-grained, ice-rich soils and massive ice beneath the active floodplain; major pinch points upslope of TAPS Remote Valve No. 26, a joint highway/below-ground TAPS crossing in the upper Atigun River active floodplain; and to accommodate both TAPS and authorized ANGTS, the TAGS route would be located upslope on terrain with steeper cross slopes. Visual intrusion of this route from the Dalton Highway would be major due to construction on the upslope canyon wall where deep cuts would be required.

4.2.19.5.3 Summary

During the construction of TAPS, geotechnical conditions at the Atigun River crossings indicated the need for large separation distances between existing and future pipelines in order to minimize adverse impacts and to ensure compatibility between pipelines. Areas suitable for pipeline construction on the east side of Galbraith Lake are already committed to the existing Dalton Highway and TAPS and authorized ANGTS.

The existing TAPS Remote Valve No. 26 creates a pinch point for two additional pipelines and would require TAGS to be on steep cross slopes uphill of above-ground TAPS and the buried fuel gas line. Again, sufficient space for authorized ANGTS and TAGS would be questionable due to the boundary of the Arctic National Wildlife Refuge on the west-facing toe of Atigun Canyon. Resident Dall sheep habitat of similar value are associated with either route.

An evaluation of the preferred TAGS alignment on the west side of Galbraith Lake and the route option to the east of the Dalton Highway demonstrates preference for the west side option primarily due to the increased visual intrusion created by the route on steeper canyon slopes with the easterly alignment option. The west side is generally rolling terrain similar to what the highway is built on and would create less visual impact, although creating a new scar 1 to 4.5 miles from all other existing activities.

The preferred TAGS route, if located on the west side of Galbraith Lake, would open this area to easier access. The impacts to aesthetics and to the Dall sheep habitat would probably be moderate. The impact to cultural resources would not be known until a detailed survey was conducted. Therefore, careful location of access would be required to avoid sensitive overwintering fish habitats in the upstream area of Galbraith Lake.

The westerly alignment would avoid difficult proximity, engineering, construction, and maintenance issues with the Dalton Highway, TAPS, and the authorized ANGTS alignment.

4.2.19.6 West Fork Atigun River ACEC (*Proposed*) - Milepost 155

The wildlife and aesthetics values of the West Fork Atigun River area near TAGS are similar to those described for Slope Mountain (Subsection 4.2.19.3) except there is no known raptor nesting. This area is not readily accessible at the present time. The proposed TAGS alignment along the west side of Galbraith Lake opens this area to easier access. Accordingly, the impacts on Dall sheep habitat, especially the existing mineral licks, would be minor. The area of the mineral licks would not be available for a TAGS mineral material site. Accordingly impacts to Dall sheep using the licks would be minor.

4.2.19.7 Atigun Pass (Milepost 164.5 to 167.5)

Atigun Pass is identified as a pinch point, where up to three major pipelines and the Dalton Highway need to be accommodated in a narrow pass. Route options to avoid Atigun Pass were evaluated and determined to not be viable due to difficult geotechnical problems (see Subsection 2.3.4.1).

Construction at Atigun Pass would occur in two summer work seasons and would be coordinated with the DOT/PF. The major potential impact in this area is the interruption of normal traffic by construction operations. With minor exceptions, traffic delays would be on the order of several hours or less at a time during the two construction seasons. Construction would be timed to coordinate with existing traffic patterns and traffic controlled to keep delays to a minimum. The effect of delay on the proposed new tourist bus business starting in 1987 is unknown. There would also be some potential short-term impacts of construction to Dall sheep lambing on the south-facing slopes of the pass as occurred during TAPS. During construction sheep avoided the areas closest to the noise source; following construction the sheep returned to their traditional lambing areas.

Of particular concern to DOT/PF would be the potential impacts that could result from a landslide during construction or operations. Such a landslide could close the only access to Prudhoe Bay for the entire time required to remove the slide material and restabilize the altered slopes. The impact would be that the highway supply route to and from Prudhoe Bay would be interrupted until the road was reopened. Such an impact would be short term and delay both north and southbound traffic, including the tourist bus traffic.

4.2.19.8 Snowden Mountain ACEC (*Proposed*) - Milepost 188 to 198)

The proposed TAGS alignment runs along the western lower slopes of Snowden Mountain in close to the Dalton Highway, TAPS, and the authorized ANGTS. Site-specific locations of mineral material sites would take into account the special geologic, paleontologic, and wildlife habitat values of this area. Available information indicates TAGS would have impacts similar to those for the Dalton Highway and TAPS. Accordingly, impacts would be considered minor during construction in that sheep may not come as close to the construction area and the Dalton Highway as they now do. Impacts on geology and paleontology would be negligible.

4.2.19.9 Sukakpak Mountain *ACEC (Proposed)* (Milepost 200 to 210)

The TAGS pipeline route to the north of Sukakpak Mountain involves another pinch point, where the highway, TAPS, and authorized ANGTS meet. The route would avoid geotechnical, thermal, and hydrologic conditions that are incompatible with the construction and operation of a high-pressure gas line. YPC is evaluating special routing, design, construction, and mitigation techniques with respect to pipeline routing along the highway adjacent to Sukakpak Mountain. This alignment avoids new impacts to the superlative visual quality of the area.

There are proximity constraints related to construction near TAPS, authorized ANGTS, and the Dalton Highway. Other constraints are related to placement of the pipe in the *Koyukuk* River and the slope of Sukakpak Mountain. Construction of the Dalton Highway along the bench below the flanks of Sukakpak Mountain has revealed there are geotechnical issues that would need careful attention in the design and maintenance plans for TAGS. Foremost is the dramatic incidence of subsurface water flow above the highway as expressed by frost bulb and small pingo-type formations.

The preferred TAGS route would have crossed the forested saddle on the northwest edge of Sukakpak Mountain and then across its western-facing lower forested flanks in an area very visible to travelers that has high aesthetic value along the Dalton Highway. The preferred route would have crossed through an area where BLM denied mineral material extraction for TAPS construction because of scenic values. Accordingly YPC was told by BLM that a saddle crossing would not be approved. Impacts would be negligible.

4.2.19.10 Nugget Creek ACEC (*Proposed* - Milepost 215)

Values in this unit are similar to those at Slope Mountain (Subsection 4.2.19.3) except there appears to be no raptor nesting. The ACEC unit is located on the west side of the Middle Fork Koyukuk River from the present Dalton Highway, TAPS, authorized ANGTS, and the proposed TAGS near Milepost 215. No access requirements to the area have been identified for TAGS. Accordingly, negligible impacts would result.

4.2.19.11 Grayling Lake (Milepost 260)

The proposed route is located on the east side of Grayling Lake on the bench above the lake and the riparian zone and crosses Grayling Lake Creek approximately one-half mile south of the lake. The highway, TAPS, and authorized ANGTS are on the west side of the lake crossing a pinch point. The TAGS work pad would potentially improve access, creating increased fishing and hunting pressure and offroad vehicle use. Impacts in this area would be moderate.

4.2.19.12 Jim River ACEC (***Proposed*** - Milepost 260-275)

The proposed ACEC and adjacent area near the proposed TAGS alignment contain an array of special values ranging from cultural to biological.

The proposed TAGS alignment is close to the Dalton Highway, TAPS, and authorized ANGTS. Impacts for TAGS would be similar to those from construction, operation, and maintenance of the Dalton Highway and TAPS and would be quite similar to impacts from the authorized ANGTS. Special measures to protect existing resources in the Jim River area were successful during TAPS construction. Similar protective measures would be used for TAGS. Accordingly, the overall impact of TAGS on the Jim River area is considered minor except for the indigenous fish population such as grayling. Greater accessibility and more people would probably result in moderate impacts to this resource.

4.2.19.13 Yukon River Bridge (Milepost 349)

TAGS would construct an independent suspension bridge approximately 1,000 feet upstream from the existing highway. It has been determined that the existing Dalton Highway bridge over the Yukon River was designed to support a highway and three large-diameter pipelines. Alyeska Pipeline Service Company occupies the upstream side of the bridge ***for TAPS and also reserved*** the downstream side. The center crossing of the bridge ***supports below the Dalton Highway*** is reserved for ANGTS ***leaving no unreserved space for the TAGS pipeline.***

A ***TAGS*** bridge would result in the substantial reduction of use or complete loss of an informal boat-launching ramp and recreation area located on private land due to construction and security requirements for the bridge abutments and for the above-ground pipeline on both bridge approaches. This structure is shown in Figure 2.3.4-4. The present small-boat launching ramp and recreation use is at a private access point on the north bank upstream from the existing Yukon River bridge where an air-cushion barge landing was established for moving equipment and supplies across the Yukon River before and during construction of the highway bridge.

The river is used both for boat/barge navigation and by low-level flights by light aircraft during marginal flying conditions. The bridge piers would extend upstream ***creating a*** hazard for water traffic, while the high steel towers on top of the concrete piers would create an additional hazard to pilots using the river for navigation during low ceilings. Appropriate safety devices such as strobe lights would be installed. The bridge pier at the TAGS bridge would reduce ice hazards to the existing bridge in that the TAGS bridge pier would also be the first ice breakpoint before ice reaches the highway bridge.

The security requirements would be a major impact throughout the life of the project to those who now informally use private land adjacent to the bridge for use as a public boat-launching ramp and recreation area. Due to the good access to the Yukon River from the existing bridge, another area in the vicinity of the north bridge ramp would probably be used for access. ***Peregrine falcon nesting habitat also is located downstream of the existing Dalton Highway Bridge. The primary concern is that aircraft uses not impact this nesting area. Since the closer Dalton Highway Bridge was constructed without significant effect to the peregrine falcon nesting habitat.***

4.2.19.14 Grapefruit Rocks (Milepost 410)

The *TAGS pipeline route would cross state land near* Grapefruit Rocks north of Fairbanks *via* a steep promontory west of the *Elliott* Highway. *The TAGS routing* would require drilling and blasting through rock, as was done for construction of the highway. The route alignment is within 2 miles of a peregrine falcon aerie located on the east side of the highway. Blasting could affect the birds should it occur when they are present. *However, major summertime highway reconstruction, through the Grapefruit Rocks area did not appear to cause any significant long-term effect to nesting peregrine falcons.* Such activities *by YPC* would be restricted during specific periods critical to the peregrine falcons. Additionally, the area is used by local rock climbers and has been recommended for administrative designation as a public reserve in the Tanana Basin Area Plan.

4.2.19.15 Chatanika State Recreation Area (Milepost 434)

The TAGS pipeline alignment crosses the Chatanika River about four river miles downstream of the existing Dalton Highway bridge. The TAGS crossing is about one-half mile upstream from the existing TAPS crossing. The authorized ANGTS crossing of the Chatanika River would be midway between TAPS and proposed TAGS crossings. The river is a popular canoe and small power boat and fishing area. The three pipeline crossings are near the existing Chatanika River State Recreation Area. The three pipelines also cross in an area that has been proposed for designation by the State Legislature as the Chatanika State Recreation River.

Of particular concern would be the visual aspects created by the three pipeline crossings and timing of construction in terms of existing boating and fishing uses. Impacts are considered minor during construction and negligible during operation.

4.2.19.16 Salcha River Area (Milepost 486 to 490)

Compressor Station No. 7 is located on state land approximately 1.5 miles northwest of the proposed TAGS pipeline crossing of the Salcha River. As one travels along the Salcha River, it would be possible to occasionally view Compressor Station No. 7 located on a wooded ridge above the river. Depending on atmospheric conditions and wind direction, it might be possible to hear the compressor station during operation. The location of the compressor station could affect the existing recreational value of the river and wilderness homesites in this area. Additionally, a permanent 5-mile access would be required from Johnson Road to the compressor station. No access would be provided from the Richardson Highway to the compressor station site or to the pipeline alignment. Construction access would be along the existing TAPS corridor. No discharges would occur into the Salcha River.

The pipeline crossing of the river would create another cut through the vegetation, resulting in loss of riparian habitat and creating a visual scar for those using the river for recreation.

4.2.19.17 Phelan Creek (Milepost 585.6 to 587.6)

Pipeline construction in the Phelan Creek area, another pinch point, would require co-use with the Richardson Highway for approximately 1.5 miles. A road bypass around the entire area would be constructed on the Phelan Creek floodplain to facilitate normal traffic. Traffic delays would occur during blasting and material hauling. The primary impact to this area, however, would be the potential for the chilled gas pipeline to increase occasionally serious existing aufeis conditions.

The Phelan Creek co-use area, because the existing highway is located immediately above a widebraided floodplain area, affords considerable latitude in providing bypass for traffic around the construction zone, hence construction-related traffic delays would be minor.

Of concern to DOT/PF would be the potential impacts created during construction should a landslide close this pinch point or should a catastrophic accident occur during operation and result in road closure. Impacts of a catastrophic accident would be major. *The State has identified an option that would follow the existing TAPS alignment more closely. This alignment could involve construction in the Delta Wild River therefore is not favored by BLM.*

4.2.19.18 Summit Lake/Upper Gulkana River Area (Milepost 595 to 610)

The proposed pipeline would be located on state land west of Summit Lake and the upper Gulkana River, whereas all other facilities, including the Richardson Highway and TAPS, are located east of Summit Lake. The construction work pad has the potential to open the *state owned* area on the west side of the lake. This would include increased hunting and fishing and winter snow machine travel. Summit and Paxson lakes are presently restricted as to burbot and lake trout fishing due to overfishing of the breeding stock.

A revised location for crossing the Gulkana River immediately downstream of the Denali Highway bridge was selected after a field trip by YPC and state and federal agencies including ADF&G where concerns about high-value salmon fishing resources were discussed. The Gulkana/Denali crossing provides good access for construction, pipeline maintenance, and concentration of disturbance to an area of the Gulkana already affected by prior highway construction. The confined river channel downstream of the existing highway bridge structure minimizes the buried crossing length and disturbance to adjacent riparian habitats.

In this area the Gulkana River contains major salmon resources that could be affected by construction. There are proposed fishery enhancement programs planned for this area, one of which is in place upstream of the crossing. Construction impacts would be moderate. *This portion of the Gulkana River is not within the Gulkana National Wild and Scenic River.*

4.2.19.19 Hogan Hill Area (Milepost 627 to 640)

Hogan Hill is the site of TAGS Compressor Station No. 9. Hogan Hill is the southernmost tip of a series of north-south trending hills separating the upper drainages of the Gakona and Gulkan River basins.

Comments on the DEIS focused on two aspects of the TAGS alignment in the Hogan Hill area: caribou migration, and mineral material supply.

The Nelchina caribou herd migrates through the Hogan Hill area in the spring and early winter in its movement from winter range to summer range, to the north and west. Generally, migration movements are in an easterly or westerly direction through a 60-mile-wide corridor extending from Paxson to Glenallen. In most years the primary migration routes tend to concentrate in Round Top Mountain and Sourdough (Mileposts 627 to 647, respectively). Comments in the DEIS focused upon construction activities associated with the TAGS project and with noise generated from equipment and blowdowns at Compressor Station No. 9. By scheduling construction activities in the entire 60-mile-wide migration corridor on the basis of seasonal caribou movements, keeping construction activity at any one time to short distances and by keeping short sections of open pipeline trench, construction impacts of TAGS on caribou would be minor to moderate. Upon completion of construction, overall impacts to the Nelchina caribou herd would be negligible.

The second concern in the Hogan Hill Area is availability of mineral materials. Hogan Hill (Milepost 640) is the principal source of mineral materials for both TAPS and the Richardson Highway road maintenance for a 50-mile area to the south.

Impacts of TAGS on the availability of mineral material supplies at Hogan Hill are deemed to be minor to moderate. The extent of the impact would depend upon selection of a final design and the extent that design requires construction of all-weather access roads and the extent that existing geologic conditions would require extensive backfill with select mineral materials and not the material removed from the pipeline trench.

4.2.19.20 Blueberry Lake State Recreation Site (SRS) (Milepost 765)

The Blueberry Lake SRS is a 192-acre scenic area established on state lands in 1972 by the State of Alaska as a day-use area in a scenic alpine high country setting, located on the south side of Thompson Pass adjacent to the Richardson Highway. Use is primarily during the summer tourist season.

The proposed TAGS pipeline crosses the Blueberry Lake SRS along the western part of the property. Route options to the east of the *SRS* boundary are precluded by a rugged terrain immediately adjacent to the east *SRS* boundary that leads to Heiden Canyon. An optional route along the abandoned state highway was rejected because it involved more impact directly to the *SRS* property and use areas. During summer construction the typical impacts related to the construction of a pipeline would occur, which would exclude use of part or all of the area during the single construction season with moderate impacts. Once construction is completed, the right-of-way would be revegetated to a manner similar to the nearby TAPS. Overall impacts are considered minor.

4.2.19.21 Keystone Canyon (Milepost 770.8 to 774.5)

The proposed TAGS route traverses Keystone Canyon for approximately 4 miles along the Richardson Highway. Both are routed near the Lowe River which is incised in a steep-walled canyon. Except where TAGS proposes to route the pipeline through the Old Richardson Highway tunnel, pipeline/highway co-use is proposed. The Keystone Canyon Railroad Tunnel has been proposed as a National Historical Landmark, see Subsection 4.2.16.2.1.

For the sections north and east of the tunnel, a temporary bypass would be constructed in the Lowe River floodplain to allow traffic to pass without significant delay during normal construction operations. The TAGS pipeline would be routed through the tunnel. Construction would be coordinated with DOT/PF to keep summer highway traffic delays to a minimum. Traffic would be carefully controlled on a 24-hour-per-day basis by means of radio-equipped flagmen and a pilot car to reduce traffic impacts. Construction through the canyon should not impact Ruddleston Falls or the Goat Trail located on the rock cliffs above the highway.

DOT/PF is concerned about the potential impact during construction or operations should a landslide occur, closing this pinch point. This is the only land route from Valdez to other areas of the state. Completion of the new state highway through Keystone Canyon and Thompson Pass and the construction of TAPS have provided a baseline of data and experience for the proposed TAGS project. No evidence of rock failure was observed in Keystone Canyon during the 1964 earthquake, and there has been an excellent record of highway performance. There is a concern about the potential for creating localized unstable rock slopes by the undercutting or day-lighting of discontinuities in the bedrock during construction of the pipeline. The failure of a locally undercut or day-lighted bedrock section would create additional traffic delays and increased requirements for rock reinforcement. Since construction through the canyon would be limited to short 200- to 400-foot sections, the extent of a potential problem area and its potential impact would be limited to relatively short and manageable durations.

YPC would conduct detailed field investigations to accomplish geologic mapping, core and soil borings and testing, ground-water investigations, surface water hydrology, and rock slope stability evaluations. The detailed design and construction plan for TAGS would be based on the results of the field investigation and evaluation and would be coordinated with the DOT/PF during the final design phase. Coordination of blasting and excavation procedures, rock reinforcement requirements, traffic control, and safety are considered to be a necessary part of a successful design by YPC.

4.2.19.22 *Canyon Slough Area (Milepost 780)*

Canyon Slough is located within a portion of a highly productive salmon habitat area along the south side of the

Lowe River. Principal concern is with the effect of the TAGS pipeline on existing aquatic habitats. The TAGS alignment through this area generally is along the outer limits of the Lowe River floodplain. The toe of adjacent slopes is already occupied by TAPS, which in this area is buried. Accordingly, since TAPS already occupies the most favorable site for a buried pipeline, TAGS could not avoid or limit a floodplain location.

The Prince William Sound Area Plan (Public Review Draft, November, 1987) on p. 3-153 states "a corridor is reserved for the proposed Trans Alaska Gas System (TAGS) pipeline." The Lowe River in that plan is rated as "Crucial Rated Habitat" for bald eagles. Subunit 21-M "Lowe River Floodplain" on p. 3-155, pertains to the lower Canyon Slough area. The proposed management intent for this unit is to retain existing state ownerships and manage resources to emphasize protection of salmon habitat and eagle nesting. The adjacent unit 21-N "Lowe River Bench" is described as being the location of both TAPS and TAGS. This area also contains the highest volume timber resources near Valdez and has winter moose habitats. State ownership under the proposed plan would continue to emphasize existing uses, with forestry and transportation the primary land designation.

Options for relocation of TAGS out of the floodplain in the Canyon Slough area are largely controlled by the existing buried TAPS oil pipeline. It should be noted that the TAGS system in this area will be operated at ambient temperature. Therefore, drainage disruptions by frost bulb formation are not a factor; therefore, overall effects for construction and operation of TAGS should be similar to those of TAPS in the Canyon Slough area. Use of ditch plugs to reduce the effect of wetland drainage would reduce overall effects on salmon habitat. Impacts to salmon habitat are considered to be locally moderate.

4.3 COOK INLET-BOULDER POINT ALTERNATIVE

4.3.1 Introduction

Basic construction and mitigation techniques described for the proposed action were used as a baseline for evaluating the Cook Inlet-Boulder Point alternative.

4.3.2 Socioeconomics

The Cook Inlet-Boulder Point alternative route would have similar statewide impacts to population, employment, infrastructure, social systems, and government revenues and expenditures, as described in subsection 4.2.2.1 for the proposed project. Regional impacts for the Cook Inlet-Boulder Point alternative route would be similar in nature to those for proposed project (see Subsection 4.2.2.2). Specific regional impacts for the Cook Inlet-Boulder Point route are described below.

Unlike the proposed project routing, the Cook Inlet-Boulder Point alternative route has not already experienced a major pipeline project. Since nearly all of the communities and settlements north of Cook Inlet are located along the Parks Highway, they would be impacted by a major increase in traffic during construction.

Potential construction camp locations have been determined for the Cook Inlet-Boulder Point alternative corridor (see Subsection 2.9). During peak construction, camp populations could easily exceed those resident in many areas. Although most workers would live in camps, they would likely have moderate construction impact on local settlements, particularly those with bars since the construction camps would prohibit alcohol.

In 1986 the unemployment rate along the Cook Inlet-Boulder Point route was at least 15 percent. Residents in all portions of the corridor have experience in construction and petroleum-related projects and would be interested in employment.

Summer construction and transport of pipe and other materials would conflict with the summer tourist season and could be a major problem for visitors to Denali National Park and Preserve, which is one of the state's major tourist attractions. Impacts to the summer tourists along the alternative corridor would be major during the construction phase and return to normal during operations.

During the construction and operations phases the Kenai area would experience moderate short-term impacts such as shortage of housing, increased employment, and increase demand for services. The construction period in Kenai would be five years compared to three years in the corridor north of Cook Inlet. During the peak year of TAGS construction, the project would create an estimated 850 additional direct and indirect jobs in the Kenai area. Most of this employment would be associated with the LNG plant and the marine terminal at Boulder Point. This increase would represent a 15 to 20 percent increase in employment in the Kenai area, a short-term major benefit.

Due to the current slump in the Kenai economy, local officials noted that most residents would probably welcome the employment and economic development opportunities the TAGS project could provide. During scoping, local officials stated that the community's infrastructure could accommodate the growth during the construction period; however, there still would be increased pressure on existing facilities, and it is unknown now what surplus would exist at that time.

Careful planning would be required to prevent the community from overbuilding to accommodate the relatively short-term growth during the construction period. The Boulder Point LNG plant and marine terminal would have an operation work force of 100 compared to 850 during construction. However, the operations employment would still be a significant increase in local long-term economic base and would help to offset recent decreases in Cook Inlet petroleum development employment. A major positive impact of the project would be an estimated $2 billion addition to the tax base for the Kenai Peninsula Borough. Similarly, the local area along the railbelt corridor would experience increase in local employment and an increased tax structure similar to that identified for the proposed TAGS project on Tables 4.2.2.5 and 4.2.2.7.

Overall, consequences of a project such as TAGS would have major impacts during both construction and operation in a state with a population and community infrastructure such as that found in Alaska.

The impact discussion from Subsection 4.2.2.3 for national effects would be the same for the Cook Inlet-Boulder Point alternative.

4.3.3 Land Use

Impacts to present land uses of the area along the Cook Inlet-Boulder Point alternative route would be quite similar to those described in Subsection 4.2.3 this document. Major differences are:

- The route passes through or very near ***six*** important and sensitive areas for wildlife and people, including Minto Flats ***(currently in the legislative process for designation as State Game Range)***, Denali National Park and Preserve, Denali State Park, the Susitna Flats State Wildlife Refuge, ***Captain Cook State Recreation Area,*** and the Kenai National Moose Range.

- More land is in private hands along the Cook Inlet-Boulder Point alternative route, and there would be many different landowners to deal with.

- An existing transportation corridor occurs along this route just as along the primary route, but the Cook Inlet transportation systems is much more heavily used. Therefore, the potential for impacts to this system are more pronounced.

- Much higher levels of recreational use occur in the Cook Inlet area. Impacts to these land uses could be absorbed in some areas and would create problems in others.

- Pipeline construction would require the development of material sites and the construction of access roads, work pads, and compressor stations in the presently roadless Minto and Susitna flats areas. A total of more than 100 miles of these two areas would be traversed. Permanent access to compressor stations in each area would be required.

For these reasons the impacts to land use during both construction and operation would probably be classified as major during construction and moderate during operation.

4.3.4 Transportation

Impacts to the transportation system would be similar to but more severe than the those impacts discussed in Subsection 4.2.4 for the proposed route. The greater severity would be due to additional vehicle and air traffic in an already crowded system. Construction on the Susitna Flats and the North Kenai area would require some air support in areas with existing heavy use by small aircraft traffic. There are hundreds of small aircraft flights per day across the lower Susitna area during the summer. Increased flights would add noise disturbance to an already noisy area. Railroad traffic would be increased during construction of the Cook Inlet-Boulder Point alternative, but overall impacts of increased commercial rail traffic would be positive. Pipe and material storage areas could be located close to the rail network to alleviate double haul to storage sites.

Construction of access roads, highway crossings, and movement of vehicles carrying equipment and gravel would cause traffic delays, sometimes for several hours. These delays would be coordinated with DOT/PF and would be timed to occur when low traffic counts were present.

Increased vehicle traffic due to construction personnel and supply vehicles also has the potential to increase existing traffic problems, especially at peak periods such as early morning, late afternoon, on Saturday mornings, and late Sunday afternoons. ***Increased LNG tanker traffic in the lower Cook Inlet area may require installation of a Vessel Traffic System simular to that now existing at Port Valdez. At present the LNG and oil tanker volumes in combination with other commercial and recreational traffic have not been sufficient to require the stringent system used at Port Valdez.***

Selection of the Cook Inlet-Boulder Point alternative would increase the air traffic at area airports, including Anchorage, Seward, Homer, and especially Kenai. Likewise, the ports of Whittier, Seward, Homer, Anchorage and especially Nikiski Point would be heavily used, creating a positive economic benefit for the port areas. The port facilities and the larger airports could handle increased TAGS traffic without any problem ***other than for the potential need for VTS in lower Cook Inlet.*** The impacts to the existing transportation systems would likely be moderate during construction and minor during operation because it would involve Denali National Park and Preserve. ***The VTS would provide enhanced vessel control.***

4.3.5 Noise

Overall noise impacts would be similar to those described for the proposed project in Subsection 4.2.5.

The Cook Inlet-Boulder Point alternative project would add to the ambient noise through construction equipment, large trucks, increased vehicle and small aircraft traffic, possible blasting at material sites, blowdown at the compressor stations, and block valve venting.

Certain operational functions such as blowdown of the gas lines would affect local residents and perhaps wildlife.

Minto Flats and the Lower Susitna Valley are not within a developed corridor, and both would have a compressor station in their vicinity. Noise during construction and operation would have moderate impacts in these areas.

Unless unforeseen amounts of blasting at materials sites, pipeline trenching, or other unusual noise-producing activities were required, a short-term noise increase for one or two seasons would be evident, primarily by aircraft and vehicles associated with construction. Impact would be moderate. An increase in noise during the operation phase by surveillance aircraft and compressor stations during blowdown would likely produce minor impacts.

4.3.6 Meteorology and Air Quality

Air emissions for the Cook Inlet-Boulder Point alternative route would be the same as for the proposed project and impacts similar to these described in Subsection 4.2.6 for the proposed Anderson Bay project. Important differences in regional atmospheric conditions and population and use patterns that affect air quality impacts are discussed below.

Along the section from Livengood to Nenana, meteorological conditions, including generally calm winds and very strong temperature inversions near the surface, favor the potential for atmospheric pollution. Such conditions are more pronounced in open valleys with gentle slopes, especially at lower elevations. The effluents from construction or compressor station operation between Livengood and Nenana would not be sufficient to produce severe ice fog conditions in this area. Impacts would be negligible.

The present pollutant load from the two existing coal-fired generating stations near Clear AFS and Healy might experience some addition to their pollutant emissions, but since atmospheric conditions are not as conducive to inversions in this area, impacts from Compressor Station No. 8A probably would be moderate.

Air effluents that would degrade the Class I area of Denali National Park and Preserve are prohibited. Therefore, compressor stations would have to be located as far north and south of the park as possible. Dust and effluents from construction would have to be suppressed to avoid degradation.

In the area between Denali Park and Preserve and Cook Inlet, the major source of ambient emissions is vehicular traffic along the Parks Highway; effluents from the Beluga gas-fired generating facility; and slash burning from the agricultural area near the east side of the mouth of the Susitna River. Existing pollution levels can be high in this area under certain atmospheric conditions, and impacts could be moderate at these times during construction. ***The Anchorage urban area has been classified by ADEC as a nonattainment area for carbon monoxide under 18AAC 50.02 (1983).***

Several sources of emissions already exist near the proposed Boulder Point LNG Plant facility and marine terminal. They include the large Tesoro refinery, the Chevron refinery, the Phillips LNG facility, and the nitrate fertilizer plant. The air quality problems would most likely be minor during construction and ***moderate during*** operation in this area, depending on prevalent atmospheric conditions.

4.3.7 Liquid, Solid, and Hazardous Wastes

Impacts of waste generation and handling would be similar for the proposed Cook Inlet-Boulder Point alternative route as described for the proposed project in Subsection 4.2.7. Impacts from solid waste burning and disposal should be minor, even during construction since state permit requirements are conservative and would protect the local water and air quality.

If hazardous wastes are properly stored, secured, transported, and disposed of out of state according to strict state and federal criteria, impacts of hazardous wastes would be negligible both during construction and operation.

State and federal permits must be obtained prior to any disposal of sanitary wastes or sludge, and these wastes and their disposal would be strictly regulated. Therefore, it can be anticipated that impacts to surface waters from sanitary wastes would be minor.

4.3.8 Geologic Environment

This section presents a discussion of the potential impacts and interactions between the Cook Inlet-Boulder Point alternative route and the geologic environment. The potential interactions between the pipeline and the geologic environment for the proposed project to Anderson Bay were presented in Subsections 4.2.8.

In the Cook Inlet-Boulder Point alternative route segment from near Livengood to Compressor Station ***No.*** 9A near Summit, continuous permafrost would be encountered. Degradation of ice-rich permafrost on side slopes and in valley bottoms could develop as a result of construction activities. The potential for surface modification due to thermal degradation of the relatively warm permafrost along this segment would be especially high during the construction and prior to startup operations. Mass wasting could occur locally where areas of highly developed solifluction lobes were disturbed by construction activity. This problem would be of concern along the moderate to steep slopes bordering the Tanana River valley. The fine-grained soils exposed as a result of mass wasting would be susceptible to erosion and gullying. As with the proposed project, impacts would range between moderate to negligible depending on conditions at time of construction.

An important concern within the Tanana River valley would be the degradation of locally ice-rich frozen silts and alluvial gravels underlying its many small tributary streams. Alluvial gravels along the Nenana River to Clear Creek are generally free of permafrost; however, liquefaction of these saturated, alluvial materials as a result of a severe earthquake could moderately impact the pipeline and associated support structures.

Within the Alaska Range, the Cook Inlet-Boulder Point route is characterized by a potentially high level of seismicity. The greatest potential impact for this segment of the alternative route would be differential movement along the Denali Fault. An earthquake of magnitude 8 accompanied by fault offset of at least 20 feet along the McKinley strand of the Denali fault system would have similar consequences for a pipeline constructed along either the proposed primary or alternative route. Loss of pipeline integrity due to fault rupture is of primary concern; however, construction techniques as described for the fault crossings in Section 2 should reduce potential impacts. A delineation of earthquake epicenters indicates the alternative corridor also crosses a seismically active fault in the vicinity of Healy (Gedney et al. 1969). The seismic zonation of the alternative route is not well known due to a lack of detailed geologic and geophysical data. Other impact considerations for this section are ground motions and subsequent liquefaction of alluvial silts and sands along the floodplain of the Nenana River with a range of potential impacts depending on specific conditions that exist.

Most of the Broad Pass Depression is underlain by permafrost. The potential impacts within the Broad Pass Depression would be from degradation of locally ice-rich frozen silts and alluvial gravels underlying the abandoned floodplain and benches bordering the Chulitna River. Impacts to these areas would be minor except for locally induced mass wasting on valley slopes where a range from negligible to moderate impacts could occur.

The Broad Pass Depression opens on its south end to the Cook Inlet-Susitna Lowlands. The Castle Mountain Fault lies close to the alternate route in the vicinity of Houston. Along this section of the route, the seismic risk is major. Primary impacts to the pipeline would occur as a result of ground cracking and liquefaction of thawed soils.

Isolated local pockets of permafrost may occur under muskeg in lowlands along the Susitna River. Clearing and trenching in these areas could result in localized thaw settlement of these materials. Thaw settlement could affect pipeline integrity due to loss of bedding material and subsequently, local pipe support. With periodic maintenance, impacts would be minor.

From Knik Arm to Boulder Point, the route is permafrost free. Principal impacts would be from minor terrain modification as a result of clearing and trenching. These impacts would be primarily visual in nature and would be of secondary importance and minor over the operational life of the pipeline. The most important considerations for this segment of the alternate route are those related to earthquake hazards. The potential for a damaging earthquake is major, as demonstrated by destruction of structures in the Anchorage area as a result of the 1964 earthquake (magnitude 8.5). Impacts to the pipeline as a result of seismic activity and ground failure or saturated soils on the bluffs of Knik Arm and Cook Inlet or damage to pipeline support structures due to strong ground motion would be minor.

Overall, impacts due to construction and operation along the alternative route would be moderate.

The overall evaluations presented in 4.2.8.3.3 apply to the Cook Inlet-Boulder Point alternative. The main difference is that there is a shortage of good-quality mineral materials in the immediate vicinity of Anchorage due to existing land use and large-scale development patterns. Most mineral material sources for TAGS will be from new sources. Improved access to TAGS areas will have a moderate effect on increasing the availability of mineral materials to the Anchorage area.

4.3.9 Surface and Ground Water

General types of hydrologic impacts that may arise along the Cook Inlet-Boulder Point alternative route are the same as those for the primary route described in Subsection 4.2.9. The following paragraphs identify specific impacts most applicable to various segments of this alternative route.

4.3.9.1 Livengood to the Nenana River

Permanent effects would accrue from the need to provide permanent access along the 50-mile portion of this route that is not connected to the existing road or railroad system. To ensure year-round access, the TAGS access road would have permanent bridges and culverts. The route would also require development of material sites to supply gravel for both the work pad and access road. This would possibly cause major and long-lasting disturbances to an undisturbed area. Hydrologic impacts would result from the introduction of sediment and pollutants into Minto Flats. Erosion control would be particularly difficult due to the instability of the ice-rich silts on the hill slopes and because of the tendency of the streams to ice. A compensating effect would be improved access for TAGS oil spill control and cleanup activities should they be necessary. Overall, impacts would be expected to be moderate for this area.

The Tanana and Nenana river crossings are in a very unstable area. As a result of pipeline construction, or due to natural activities which constrict the river, ice jams could divert the Nenana River through any one of the existing distributaries forming its junction with the Tanana. This could breach the alternative route between the crossings, endanger the pipeline, and alter the existing geometry of both the Tanana and Nenana rivers. These changes in geometry could affect navigation on the Tanana and conceivably increase risks of flooding. Impacts would be expected to be moderate.

4.3.9.2 Nenana River to Summit

Through this area the primary challenge would be to coordinate the drainage design with that existing for the railroad and the highway so as to not accelerate erosion for either of the existing systems. Impacts would be major should such acceleration occur.

4.3.9.3 Summit to Cook Inlet

Through both the Chulitna and Susitna portions of section, the prime hydrologic impacts of the pipeline would be the potential for affecting the water quality of the existing streams or altering hydraulics of the adjoining highway or railroad drainage structures.

Primary hydrologic impacts in the Willow to Cook Inlet section would be construction-related pollution and erosion. Additional long-term impacts to water quality might arise because of improved access to an otherwise inaccessible area. Impacts would probably be minor in this section.

4.3.9.4 Cook Inlet to Boulder Point

Impacts are primarily from construction-related erosion and would most likely be minor.

4.3.10 Marine Environment

The marine environment could affect or be affected by project construction or operation in ways similar to those described for the proposed project (Subsection 4.2.10.1). The Cook Inlet-Boulder Point alternative is notably different from the proposed project in its additional requirement for a 15-mile subsea pipeline. This introduces a major construction activity into the marine environment and subjects the project to an additional potential impact from accidents and pipeline maintenance or repair. There are several major differences in the characteristics of the marine environment for the Cook Inlet-Boulder Point alternative that influence potential environmental impacts. The presence of tidal extremes in excess of 30 feet vertical height and accompanying currents reaching as high as 6 to 7 knots present major problems to marine construction, facility design, and routine operations and would also increase the potential for accidents. Extreme winter icing conditions would increase the probability that operations would have to be curtailed at times and would also increase the potential for accidents. Extensive shoaling areas off the East Forelands just south of Boulder Point would require some dredging and pose potential navigational hazards, while sedimentation, scour, and the presence of mobile submarine bedforms would affect engineering design suitability for marine terminal facility offshore components.

Burial of the pipe crossing Cook Inlet deeply enough to ensure it would not be exposed by scour or endangered by ships anchors would be difficult. Winter construction or repair would be practically impossible because of floating ice and the extreme tidal current. To ensure dependable service, two crossings might be necessary. The crossings would need to be widely separated so that in the event one fails, flow could be maintained by diverting gas to the other crossing. Impacts in this area would likely be minor related mainly to potential to increased silt loading and interference with ship traffic. All these factors make construction of the pipeline crossing and construction and maintenance of the marine terminal more difficult and possibly make the entire systems more susceptible to accidents during operations.

There is less deepwater turning room for tanker maneuvering and anchoring in Cook Inlet, which has a narrow channel and major potential problems with ice in the winter season. There is the additional possibility that a vessel could anchor in the vicinity of the pipeline crossing and perhaps drag its anchor across the pipe. The subsea transmission line from the west side of Cook Inlet has been broken in this manner, causing electrical outages in Anchorage. Even though the pipeline would be jetted into the bottom, much of the jetted silt would not settle back over the line due to the currents. *Eventually*, the pipeline trench would be filled in with silt.

The marine terminal pilings could cause sediment to accumulate or erode due to changes in current patterns, resulting in sills being created or producing a deeper channel which could impact marine operation.

The potential effect of the facility or resultant tanker traffic on marine birds, fish, or mammals would be negligible. There is an increased possibility of an oil spill due to increased ship traffic in the area; and such a spill could cause damage to the local clam beds or affect bald eagle populations which gather each summer at the mouths of most Cook Inlet rivers. Spills would be difficult to control or clean up in the area during high winds and/or broken ice conditions.

The possibility also exists for collision of a beluga whale with a ship.

Once out of Cook Inlet and on the high seas, LNG tanker traffic would follow the general route of LNG tankers that have been successfully delivering Cook Inlet LNG to Tokoyo for the past 17 years. No new impacts are expected to the high seas marine environment.

4.3.11 Fish Impacts

Since construction techniques, mitigation procedures, and types of streams involved are similar, impacts to fish along the Cook Inlet-Boulder Point alternative route would be similar to those described for the proposed route in Subsection 4.2.11. Those areas where impacts would be different are discussed below.

More fishing pressure, resulting from fishing by construction workers, and, possibly, from improved access for recreational fishermen would result in increased stress to fish populations during TAGS construction and possibly operation along the Cook Inlet-Boulder Point alternative route. There is also a chance that some existing, heavily used areas would have restricted access after construction due to creation of an exclusion or security zone around some TAGS-related facilities, resulting in a shift of existing fishing pressure to other Cook Inlet fish resources. Much of this can be regulated. A number of access roads, work pads, and culverts crossing many streams could result in temporary blockage or erosion with resultant turbidity of small streams and cross drainages along the Cook Inlet-Boulder Point alternative route. Excavation of a greater number of new materials sites would have the potential for similar impacts. Impacts would probably be moderate during construction and minor during operation.

There would be minor impacts from the compressor stations, LNG plant, or marine terminal to freshwater or anadromous fish resources along the Cook Inlet-Boulder Point alternative route.

It is not known whether construction would occur on active floodplains or whether any training structures would be required at major river crossings along the Cook Inlet alternative route, so these impacts would range from negligible to moderate, depending on the location.

4.3.12 Vegetation and Wetlands

The impacts on vegetation and wetlands along and adjacent to the proposed alternative route to Cook Inlet-Boulder Point would essentially be the same as those described in detail in Subsection 4.2.12 for the proposed project. No quantitative estimates of the amounts of specific vegetation types directly affected by the proposed project activities are available other than the approximate proportions from the *FPC* (1976b).

The wetlands directly affected by this alternative would constitute a relatively large proportion of the route, primarily involving lowland spruce-hardwood forests, bogs and marshes along the eastern Minto Flats, lowlands between Nenana and the Alaska Range, the lower Susitna River valley, and the coastal marshes of the Susitna Flats. Overall impacts to vegetation and wetlands would be moderate during construction and operation.

4.3.13 Wildlife

The general impacts of the proposed Cook Inlet-Boulder Point alternative route would be the same as those described in Subsection 4.2.13 for the proposed project. Of primary concern would be disturbance and local disruption of movements of large mammals during the construction phase. No important caribou migration routes would be crossed, and effects would therefore be negligible. Disturbance of wintering Dall sheep in the area of Compressor Station No. 8A would constitute a minor impact. Increased human activity and access and the probability of increased direct mortality through hunting and poaching of animals, especially moose, would cause minor to moderate impacts. The abundance of black bears would be greater along the Cook Inlet-Boulder Point alternative route could possibly result in problems caused by attraction to artificial food sources; other carnivore species (brown bear, wolf, red fox) would be affected as well. Impacts would likely be minor.

The primary impacts on birds from the proposed Cook Inlet alternative route would involve disturbance of and increased access to important nesting and staging habitats of waterfowl, mainly in the Minto and Susitna flats. These impacts would be moderate for the Minto Flats area and are considered to be moderate overall. Other potential impacts on birds are discussed in Subsection 4.2.13.

4.3.14 Threatened, Endangered, or Candidate Species

No known nesting areas occur along the route for peregrine falcons. The Cook Inlet-Boulder Point alternative route would pass close to one or more occupied bald eagle nests. Construction during the fall and winter would prevent significant disturbance to these species. Oil spills from construction activities has the likelihood of causing minor to moderate impacts to eagles or other raptors which might feed on oiled birds and ingest toxic petroleum in that manner.

No impacts would be expected to marine mammals except for those discussed in Subsection 4.2.14 for tanker transit. Impacts would be minor.

There is a possibility that the two candidate plant species could be disturbed during pipeline construction in high passes in the Alaska Range, but ground searches would be made before construction to identify and allow avoidance of any extremely important areas.

Overall, impacts to threatened or endangered animal species and sensitive plants would be minor *during construction* to negligible *during operation.*

4.3.15 Recreation, Aesthetics, and Wilderness

The environmental consequences of the Cook Inlet-Boulder Point alternative route on recreational resources would be of a similar nature to those described for the proposed route in Subsection 4.2.15. Major differences would occur because of the much larger population in the Railbelt area and the corresponding higher demand on all recreational resources as nearly half of Alaska's population lives in or near Anchorage, which is only about 30 miles across the inlet from the mouth of the Susitna River.

The two major transportation routes from Anchorage lead to the Railbelt area or to the Kenai Peninsula, both of which are near the proposed Cook Inlet-Boulder Point alternative route. This causes seasonal crowding in accessible recreational sites. Fishing, clamming, hunting, and other pursuits occur primarily along the Kenai Peninsula beaches and rivers. The addition of several thousand workers during project construction would put a significant strain on existing, already crowded recreational access points and facilities.

Especially susceptible to impacts would be the highway-accessible fishing streams such as Sheep Creek, Montana Creek, and Willow Creek. Access points to the major rivers in the area (Kashwitna Landing, the Little Susitna, and Talkeetna) would be stressed, as would air charter services to such highly popular areas as the Theodore River near the mouth of the Susitna, the Deshka, or Lake Creek.

Hunting pressures, already heavy, would also increase in accessible areas near the road system and the major riverways such as the Susitna and the Swanson. Use of all recreational areas would increase, but many are presently underused and would not be stressed. Among those presently underused would be the Nancy Lake Recreation Area, the Little Susitna Campground, and Denali State Park. Air traffic would increase moderately, resulting in more noise and a less enjoyable outdoor and wilderness experience for many present users.

Overall, impacts to recreational resources would probably be moderate for this area during construction and moderate to minor during operation due primarily to seasonal crowding.

4.3.16 Cultural Resources Sites

The potential for cultural resources impact is similar to that for the proposed route (Subsection 4.2.16). This alternative route passes near a potentially important archaeological site, and the possibility is high for further significant finds in the area. The Dry Creek Archaeological Site, entered on the National Register in 1974, is thus far the oldest reliably dated site of human occupation in Alaska. Artifacts from the site show certain similarities to the later Upper Pleistocene Diuktai culture of northeastern Siberia. The site is also capable of yielding important paleoecological information. It is located about 100 miles south of Fairbanks near Healy.

Only general archaeological surveys have been conducted on the east side of the lower Susitna River. Prehistoric occupation did occur in this area, and further archaeological investigations in areas such as the Beluga coal field are expected to yield positive results.

Insufficient data exist to estimate the paleontological potential along the route. These areas were occupied in prehistoric time, and investigation is expected to yield archaeological finds.

The Cook Inlet alternative route through the Railbelt lies near the most heavily populated and most developed region in Alaska. As a consequence, several archaeological surveys and investigations have been accomplished, but the possibility of damage to yet unknown sites is still quite high. This potential damage could be quite major in light of the importance of the Dry Creek *site in the vicinity of* Healy.

Although extensive archaeological surveys would be completed prior to construction along this route, and those sites would be excavated or avoided to the extent possible, there is still the possibility of disturbance of sites without proper investigation, vandalism of sites, and/or removal of surface artifacts which might be of great significance.

Because it involves several segments where there are presently little disturbance, impacts to archaeological sites would be moderate along the Cook Inlet route during construction and negligible during operation.

4.3.17 Subsistence

The general impacts of the TAGS project activities on subsistence are discussed in Subsection 3.2.17. The impacts along the Cook Inlet-Boulder Point alternative are similar to those along the proposed route. There are several types of impacts on fish and wildlife used for subsistence resources--harvest and access interference; impacts from project employment; relocation and/or increased harvest effort; reduced levels of subsistence harvest; and economic and social effects. These are discussed in the following paragraphs.

The Cook Inlet-Boulder Point alternative route would affect fish and wildlife resources through mortality, avoidance, and habitat loss. See Subsection 4.2.17 for further information.

4.3.17.1 Impact to Fish and Wildlife

Along the Nenana Corridor, caribou, moose, and fish would be the most susceptible to impact, although proposed construction and mitigation measures would minimize impacts to all three. Communities close to the alternative route would be more likely to be affected. These include Minto, Nenana, ***and Cantwell, which are classified as rural. Non-rural communities where subsistencelike activities could be affected include*** Anderson/Clear, Healy/Suntrana, and McKinley Village. Wildlife avoidance of the construction zone would temporarily require harvest in areas more remote from construction activities, resulting in temporary but significant restrictions to subsistence uses.

Impacts to Cook Inlet and Anchorage/Kenai communities would be similar to those in the Nenana Corridor except that these areas are not classified as rural subsistence areas under game management regulations, and participation in subsistence is relatively lower.

4.3.17.2 Interference/Access Impacts

As described in Subsection 4.2.17.3, proposed TAGS project construction and operation have the potential to interfere with subsistence activities. The primary causes of interference would be restriction of access to traditional subsistence use areas and restrictions on hunting and fishing in the vicinity of the TAGS project. Rural subsistence communities located adjacent to the Cook Inlet-Boulder Point alternative route (Nenana ***and Cantwell), and the non-rural communities*** Anderson/Clear, Healy/Suntrana, and McKinley Village) would be more sensitive to interference and access impacts than those which have a broad subsistence use area or are less dependent on subsistence resources.

4.3.17.3 Increased Sport Hunting, Fishing, and Trapping Competition

Like the proposed action, the Cook Inlet-Boulder Point alternative route would be subject to increased levels of sport hunting, fishing, and trapping during construction and operation of the project (see Subsection 4.2.17.4). The availability of public access along the alternative route already supports high levels of subsistence, sports hunting, fishing, and trapping activities. Introduction of direct and indirect employees would increase these activities. Rural subsistence communities located adjacent to the alternative route, such as Nenana, ***and Cantwell, and non-rural communities such as*** Anderson/Clear, Healy/Suntrana, and McKinley Village, would be more sensitive to interference impacts than those which are farther away from the route and have broad subsistence use areas or are less dependent on subsistence resources.

If the ***Joint Board of Fisheries*** and Game determine that increased levels of sport hunting and fishing associated with a population influx attributed to the TAGS project threaten maintenance of traditional levels of subsistence harvest, measures to maintain subsistence harvest levels, such as sport hunting and fishing closures or special subsistence hunts, are likely to be enacted.

Some of the pipeline work force could potentially meet residency requirements and become rural subsistence users and compete with current rural subsistence users. However, because the period of pipeline construction is relatively short and pipeline crews will be moving regularly from camp to camp along the pipeline spread, this is unlikely.

4.3.17.4 Impacts from Employment

Local employment on the alternative project would be highly desirable, and income provided would temporarily offset subsistence-related economic impacts. However, as mentioned in Subsection 4.2.17.5, employment also presents some disadvantages to participating in the traditional subsistence way of life by reducing the flexibility to pursue seasonal subsistence activities. The communities that are most likely to be affected by employment-created subsistence impacts are those that are predominantly Native with a social structure and personal identity that revolve around participation in subsistence activities. This would include Minto and part of the population of Nenana. These impacts would not result in a significant restriction of subsistence uses.

4.3.17.5 Relocation/Increased Harvest Effort

Any reduction in subsistence harvest caused by the project would result in relocation of and/or increased harvest effort (Subsection 4.2.17.6). Communities located adjacent to the alternative route, such as those in the Nenana Corridor and upper Cook Inlet area, are more sensitive to impacts from relocated or increased effort than those which are further away or have broad subsistence use areas. Because of greatly reduced levels of activity and construction facility closure/rehabilitation after construction, relocation and increased effort impacts would be minor during project operation. In the Nenana and Minto areas, a temporary but significant restriction of subsistence uses would occur.

4.3.17.6 Economic Impacts

Economic impacts result from increased outlays of cash to replace reductions in subsistence harvests and to support increased harvest efforts to make up for reductions in resources (see Subsection 4.2.17.7). Communities with limited employment opportunities located adjacent to the alternative route, such as Native communities in the Nenana Corridor (Minto and Nenana), would be more sensitive to competition impacts than those which are farther away or have broad subsistence use areas. These impacts would be partially offset by local employment opportunities.

4.3.17.7 Social Impacts

The social impacts from the loss of participation in subsistence activities include loss of cultural identity and status in the affected community, dietary impacts, and aggravation of social problems such as depression and substance abuse (Subsection 4.2.17.8)

The communities that would most likely be sensitive to social impacts from reduced subsistence activities would be those that are predominantly Native with a social structure and personal identity that revolve around participation in subsistence activities such as Minto and Nenana. Proximity to the alternative route severity of harvest opportunity reduction, and limited alternatives for relocation of effort would also aggravate social impacts.

4.3.17.8 Summary

Overall impacts to subsistence communities would be moderate to some villages along the northern section of the route during construction and minor during operation. Impacts to subsistence uses would likely be negligible to communities along the southern part of the route during both construction and operation.

4.3.17.9 ANILCA Section 810(a) Evaluations and Findings

Appendix L comprises the Section 810(a) evaluations and findings as required by ANILCA for all alternatives.

4.3.18 Public Safety

The risks and the consequences associated with the construction of a representative Cook Inlet-Boulder Point alternative would be similar to that described in Subsection 4.2.18. There would be local variations in public safety associated with the overall TAGS system; for example, there is a VTS for LNG tanker traffic at Anderson Bay, whereas at Boulder Point there is none. Since each of these must meet established state and federal safety standards, the overall effect would be the same.

4.4 *CONCEPTUAL GAS CONDITIONING FACILITY - PRUDHOE BAY*

4.4.1 Introduction

Although the conceptual gas conditioning facility (GCF) is not a part of the TAGS application, it is a connected action and requires some discussion in this EIS in a conceptual approach. The following subsection analyzes and discusses the potential environmental consequences as they presently exist for the construction and operation of the proposed GCF. The technical sections are grouped into similar or related topics whenever possible. Some of the information in the following subsection was extracted from the FEIS for the Prudhoe Bay Project (FERC, July 1980).

4.4.2 Effects

Socioeconomics

The socioeconomic impacts of the TAGS project are discussed in Subsection 4.2.2. No direct impacts on North Slope Borough villages would occur due to the construction of the GCF because the villages are not located near the conceptual GCF site. The most significant effect of the conceptual GCF would be increased property tax revenues from the estimated to be between $3 and $4 billion facility and million of dollars in field development required to deliver gas to the conceptual GCF. The cumulative effect of additional industrial facilities in the area would probably:

- *Spur increased oil and gas development producing future socioeconomic impacts*
- *Provide additional taxable property for the North Slope Borough which would increase tax revenues for the borough.*

Land Use and Ownership

The construction of the conceptual GCF within the existing Prudhoe Bay development complex would probably have little additional impact on the land use as it currently exists. An adjacent site has already been authorized to contain the proposed ANGTS SGCF. Little additional land use impacts would occur because the modification from subsistence and undisturbed wilderness to a petroleum complex has already taken place. However, there are some potential impacts from the conceptual GCF. These impacts include the following:

- *Increase in further gas and oil development may increase impacts to traditional land uses*
- *Increased gas and oil development may increase the possibility of opening the haul road to increased public use, possibly resulting in extreme pressure on the fish and wildlife and land resources of the area.*

Transportation

Transportation related impacts are discussed in Subsection 4.2.4. Overall the existing transportation system could handle the increased traffic resulting from the construction of the conceptual GCF. Potential impacts include the following:

- *Increased marine traffic may cause localized traffic conflicts and may increase the incident of minor collisions*
- *The increase in sealifts would benefit the Alaska and Seattle/Portland barge operators since it would extend their involvement in sealifts to Alaska for a few years*
- *Increase in air traffic during the permitting and construction phase would benefit the airlines and air charter services in the Prudhoe Bay area;*
- *The Prudhoe Bay area and the haul road would be moderately impacted from increased truck traffic during the construction phase of the conceptual GCF resulting in longer waits at crossroads, security checkpoints and during sealift, increased dust loading from roads, increased risk of accidents, and minor oil spills*

- *Project-related improvements would be long-lasting and beneficial to adjacent communities.*

Noise

A detailed discussion of noise-related impacts is presented in Subsection 4.2.5. Assuming a worst case condition of simultaneous operation of construction equipment, the resulting noise level during gravel placement and grading would be 98 dBA at 15 meters. The noise levels from all construction activities would depend on the duration and number of work shifts and the use of construction equipment each day. Noise levels from conceptual GCF operation are estimated to be 63 dBA at 0.8 km, an increase of 6 decibels above existing noise levels (FERC, July 1980). Possible impacts resulting from increased noise include:

- *Significant effects of wildlife in the area, possible reducing the use of marine and/or terrestrial habitat areas impacted by the noise.*

Air Quality

Air quality is discussed in detail in Subsection 4.2.6. During construction of the conceptual GCF, pollutant emissions would depend on the type and amount of equipment used and the extent of equipment use. Pollutant concentrations would also vary with the relative locations of the construction activities. Generally, the emissions would include hydrocarbons, nitrogen oxides, carbon monoxide, sulfur oxides, particulates, and water vapor. Major activities that would produce emissions include gravel extraction and placement, transportation of modules from the barges to the pads, and other support functions. Construction of the GCF would cause temporary and minimal deterioration of the ambient air quality in the vicinity of the project site (FERC, July 1980).

Possible impacts due to air pollution may include:

- *Soiled surfaces of facilities adjacent to the conceptual GCF from particles*
- *Particulates may act as catalyst, increasing corrosive reactions between metals and gases*
- *Inorganic gases (SO_2 and NO_2) may tarnish and corrode metals.*

Cleaning and/or replacement of components will minimize potential impacts. Cumulative impacts of the conceptual GCF on air quality are discussed in Subsection 4.5.6.

The DEIS in Appendix D (Air Quality Impact Screening Analysis, Gas Conditioning Facility, Prudhoe Bay Unit) described the potential effects of a conceptual gas conditioning plant as a connected action with the proposed TAGS project. After careful review EPA has concluded that since a gas conditioning plant is not part of the immediate proposal and since such a plant would need to be subject to subsequent NEPA analysis, that Appendix D be deleted from the EIS (EPA, 1988a).

The recommendation to delete Appendix D is further based upon the fact that information in the public record available for NEPA evaluation does not reflect neither current technology for gas conditioning nor does it reflect the fact that significant modifications have been made to the air quality requirements and standards since the FERC 1980 analysis of the ANGTS gas conditioning plant and its expired PSD permit. Accordingly, EPA concluded that because of the high level of uncertainty with design aspects of a gas conditioning plant associated with TAGS, the air quality analysis must be deferred to a future NEPA review as prior air quality conclusions are not necessarily transferrable and may not be appropriate to what may be constructed ultimately to provide LNG quality pipeline gas for TAGS. EPA further concluded that with this revision for the GCF and more detailed analysis of air quality effects included in this FEIS has resulted in an acceptable approach to addressing EPA's concerns.

Liquid, Solid, and Hazardous Waste

The exact amount of liquid and solid wastes produced at the proposed GCF is dependent on the number of construction *workers and operators. The exact amount of wastewater to be generated during construction and operation of the conceptual GCF is unknown. The wastes would be collected and treated in off-site treatment plants. Other liquid wastes would be collected and disposed of by treatment, recycling, or by disposal at a hazardous waste facility if they are identified as toxic or hazardous.*

The solid waste generation rate would be approximately 8 pounds per person per day. The waste would consist of paper, cans, bottles, cooking scraps and waste, repair scraps, and used pallets and broken lumber. Combustible wastes would be incinerated at existing facilities. Noncombustible wastes would be placed in landfills or at a local solid waste facility. Incineration would avoid attracting wildlife, thus reducing the need to destroy nuisance animals. Proper landfilling would result in negligible impacts.

No known hazardous wastes are expected to be generated by the conceptual GCF (FERC, July 1980).

Geologic Environment

The conceptual GCF would impact topography, geologic resources, erosion, siltation, and permafrost. Potential impacts are as follows:

- *Gravel pad emplacement, excavation, and permafrost degradation, should it occur, would result in topographic impacts*
- *Cut and fill could create excessive permafrost degradation and consequent engineering hazards*
- *The conceptual GCF would facilitate the depletion of natural gas from Prudhoe Bay*
- *The conceptual GCF would require from 2 to 2.7 million cubic yards of gravel and an area of 200 to 287 acres impacting available gravel and land resources*
- *Excavation and extraction of gravel and construction of the gravel foundation mats would increase turbidity and siltation, although most of the impact would be limited to the existing area of extraction and excavation*
- *Water erosion should not be a serious problem because of the relatively low slope and low rainfall in the proposed project area*
- *Wind erosion could occur if the organic layer overlying the soil is removed; however, disturbance of the organic mat would be minimal because of engineering and environmental constraints related to permafrost*
- *Most construction affects the thermal regime resulting in (1) decreased insulation between the surface and the permafrost and (2) degradation of the permafrost*

Potential impacts to permafrost may be minimized by construction scheduling, specialized construction zone grading, and use of erosion control techniques. Geologic impacts are also discussed in Subsection 4.2.8.

Surface Water and Ground Water

Surface water impacts are discussed in detail in Subsection 4.2.9.2. Possible impacts due to the construction and operation of the GCF on surface water include the following:

- *Construction of the conceptual GCF would alter local surface drainage patterns, and redirected or concentrated surface drainage may create both thermal and surface erosion*
- *Road embankments, gravel pads, and berms would be sufficiently thick to prevent thaw of underlying permafrost*
- *The permafrost table could rise under the gravel emplacement and dam lateral movement of water above the permafrost, creating new areas of wet and dry conditions.*

A detailed discussion of potential impacts to ground water is presented in Subsection 4.2.9.3. Impacts to ground water ultimately impact the surface water. Potential impacts to ground water include the following:

- *Icing, accelerated erosion, or diversion of surface flow could result from diversion of an aquifer and creation of a new ground-water flow pattern*

- *Thermal degradation may result from the creation of new ground-water flow patterns*

- *Frost bulbs may cause ground water to surface and create icings in the winter and new channel development in the summer*

- *Excavation could create new ground-water drainage paths and dewater existing springs*

- *Ground-water contamination could occur from accidental spills or leaks of fuel oils and other chemicals.*

Marine Environment

Minimal impacts to the marine environment would be expected. Potential impacts include the following:

- *Whales may be disturbed along their entire migration route and their summering grounds in the Beaufort Sea due to ship traffic to Prudhoe Bay using the same access route as the whales*

- *Human onshore and offshore activities could disturb whales using shallow waters for migrating, breeding, or feeding*

- *Human activity and concomitant noises may cause certain seals to abandon traditional hauling rounds, breeding rookeries and foraging areas, and may cause the seals to alter their migratory routes (FERC, July 1980).*

Fish

Potential impacts to fish would result from mortality, obstructions to migration, and loss of critical habitat. Construction of the conceptual GCF would require gravel from beaches, streams, riverbeds, and the Beaufort Sea. Gravel removal from streams or rivers could alter stream morphology, resulting in impacts to aquatic biology. Fish impacts are discussed in detail in Subsection 4.2.11. Potential impacts to fish are as follows:

- *Gravel removal and other construction activities in a stream during fall freezeup, when fish are beginning to inhabit an overwintering area, could block fish passage*

- *Siltation caused by gravel removal operations may cause a reduction in the escape cover of young fry and a reduction of the available food supply needed by the fry*

- *Withdrawal of water from an area may cause the mortality of some species due to waste buildup or decreased dissolved oxygen concentration.*

Vegetation and Wetlands

The proposed construction would destroy wet tundra vegetation in the immediate vicinity of the proposed facilities. A detailed discussion of vegetation and wetland impacts is presented in Subsection 4.2.12. This destruction could potentially result in the following impacts:

- *New roads, collecting pipelines, facility pad which covers several hundred acres, and permafrost degradation may alter water levels and form new wetlands influencing vegetative growth and succession*

- *Permafrost degradation could result in thermokarst subsidence, slumping, rutting, and other types of permafrost degradation*

- *Air pollution could impair plant functions increasing susceptibility to microbial infection and reducing plant growth.*

Wildlife

Wildlife impacts are discussed in detail in Subsection 4.2.13. Wildlife may be affected by noise, human activity, loss of habitat, and other factors. The kind and *severity of the impact would vary by season, species, and probably life stage. Potential impacts to wildlife include:*

- *Wildlife, including polar bears, caribou, birds, and others, would probably restrict use of habitat areas impacted by noise and human activity*

- *Primary and secondary pollutant effects on wildlife are expected to be minimal; the primary effect would likely be on the lichen community, the food source for most indigenous wildlife communities (FERC, July 1980).*

Threatened, Endangered, and Other Protected Species

Impacts to threatened, endangered, and other protected species are discussed in detail in Subsection 4.2.14. Endangered and threatened species within the affected area of the conceptual GCF include the bowhead (Balaena mysticetus), the gray whale (Eschrictius robustus), and the peregrine falcon (Falco peregrinus tundrius). The FERC staff performed biological assessments for each of these species. The FERC concluded that "there are no scientific data which would allow us to conclude that vessel harassment problems would result such as were observed for gray whales near California and Mexico or for humpback whales in Alaska and Hawaii." In further response in a December 26, 1979 letter to FERC, the National Marine Fisheries Service (NMFS) concluded that the "proposed activities would not adversely impact either gray or bowhead whales" and that "the proposed activities are unlikely to jeopardize the continued existence of gray or bowhead whales or their habitat." (FERC, July 1980).

The FERC staff concluded that no impact to the peregrine falcon would be expected from the SGCF at Prudhoe Bay because no nesting sites were located within 35 km of the proposed site. The U.S. Fish and Wildlife Service stated that the proposed ANGTS project would have no effect on the peregrine falcon if the FERC stipulates mitigating terms and conditions in the certificate authorizing the project (FERC, July 1980).

Recreation, Aesthetics, and Wilderness

Few impacts to recreation, aesthetics, and wilderness are expected. Additional wilderness would not be impacted because the immediate Prudhoe Bay area has already been affected by facilities installed there for the TAPS project. The conceptual GCF would add only incrementally to this existing impact. This type of impact is considered less harmful to the aesthetics of the area than placing the new facility in as yet an unimpacted area on the North Slope (FERC, July 1980).

The conceptual GCF would have little direct effect on the recreational resources of the area. Construction workers will probably engage in limited sport fishing in the Prudhoe Bay area, although the companies in the area generally discourage it. Tourism into the Prudhoe Bay coastal area is not expected to increase because of the proposed GCF. The construction and operation would not provide tourists with new embarkation points, and existing tourist attractions have very limited as well as costly transportation approaches and accommodations (FEC, July 1980). A detailed discussion of recreation, aesthetics, and wilderness impacts is presented in Subsection 4.2.15.

Cultural Resources

The land in the area of Prudhoe Bay has been the site of numerous temporary settlements and seasonal hunting and fishing camps of the Alaskan Natives. Associated with this activity are various grave sites, sod huts, and ice cellar outlines which still exist today. Although these types of historical landmarks have been found in the area, it is not known at this time if any exist on the Prudhoe Bay industrial complex or on the immediate site. Installation of the proposed facilities would cause irreversible impact to these resources.

This impact could be minimized, however, if a thorough historical and archaeological survey of the site were carried out before construction was allowed to proceed and any historical or archaeological finds were salvaged.

Subsistence

A detailed discussion of subsistence impacts is presented in Subsection 4.2.17.2. Impacts to fish resources could occur from mortality, obstructions to migration, and loss of critical habitat. Alternative fishing sites used by village residents for fishing would still be available for use. Impacts would be minimized by proper design and construction procedures.

Impacts to moose, sheep, and caribou are potentially more significant on a short-term basis. Construction and operation of the conceptual GCF would result in loss of habitat, and changes in distribution or migration patterns. Because this area is not used for primary subsistence use area of Kaktovik, Nuiqsut, and Anaktuvuk Pass, impacts to fish and wildlife in this area would be minor in terms of subsistence (FERC, July 1980). Increased development spurred by the construction of the conceptual GCF could affect the future of subsistence hunting and fishing areas. This effect is considered to not cause as significant restriction to existing subsistence use or to subsistence resources.

4.5 NO-ACTION ALTERNATIVE

4.5.1 Introduction

The following section is a discussion of the environmental consequences of a no-action alternative. This alternative would result from denial of any of the permits required for construction or operation of the proposed 796.5-mile TAGS pipeline. Under this scenario, no construction of facilities to transport natural gas from Alaska's North Slope to tidewater for conversion into LNG and export to Pacific Rim markets would occur.

The impacts resulting from a pipeline project would not occur under a no-action alternative. The primary impacts avoided are briefly described by topic in the following section. It should be noted that not only are negative environmental impacts avoided, but so are any positive impacts resulting from a project such as TAGS.

4.5.2 Socioeconomics

The no-action alternative would not have statewide impacts of the same nature regarding population, employment, infrastructure, social systems, and government resources as the preferred or alternative pipeline projects.

Population and employment growth within the state resulting from the project would not occur. The population gain of an estimated 10,600 people, the creation of 7,200 direct and 3,400 indirect jobs during the 5-year TAGS construction period would not occur. Project denial would forego the use of skilled/experienced personnel currently unemployed, but remaining in the state. If continued to be unused, this experienced resource may diminish and may not be available for future projects. The permanent gain of 550 direct and 1,250 indirect jobs created by project operation would not be realized.

The short-term impacts to local population centers near the pipeline alignment resulting from the influx of construction workers would not take advantage of the existing unused or underused infrastructure (both public and private) and housing, most of which resulted from the previous TAPS construction.

Revenue gains that would result from the project would not be available to the state, local jurisdictions, or citizens. The expected revenues generated from property, state severance, corporate taxes, and royalty payments estimated to be $477 million annually would be lost. Any supplement in declining petroleum revenues generated by the project would not be gained.

4.5.3 Land Use

Impacts to land use resulting from implementation of the proposed action would not occur under the no-action alternative. The use/disturbance of an estimated 22,910 acres during the construction period and permanent use of 8,119 acres for project operation would not take place. Most of the land to be used for the construction and operation of the project is located on state and federal land along the existing TAPS corridor and established road system.

New access road construction and extensions to existing roads would not occur. The estimated 33 million cubic yards of mineral aggregate proposed for use along the pipeline corridor would remain in place for use by others. The establishment of a 53-foot-wide permanent right-of-way for the pipeline along its 796.5-mile route would not occur. Options for future construction of a major pipeline through topographically restricted areas such as Atigan Pass, Phalen Creek and Keystone Canyon would remain.

4.5.4 Transportation

The no-action alternative would not add any additional air, rail, road, or marine traffic to the existing transportation networks. Existing transportation facilities would not need upgrading. The short-term congestion problems that may be experienced during the construction period would be avoided.

4.5.5 Noise

The minor noise impacts associated with the project construction (e.g., heavy equipment operation) would not occur along the proposed pipeline route under the no-action alternative. The most intense short-term impacts avoided would be those resulting from rock drilling and blasting. Thus, the intermittent exposure of increased noise levels to wildlife along the route would be avoided.

Operational impacts determined to be negligible such as turbine and compressor operation and periodic venting of high-pressure gas along the pipeline route would not occur.

4.5.6 Air Quality

Impacts to air quality resulting from the proposed project would not occur under the no-action alternative. These impacts would be short-term impacts from construction equipment exhaust emissions and fugitive dust generated along the pipeline route.

The emissions associated with operation of the turbine-powered compressor stations along the route and the release of gas (primarily methane) from leaks and venting of the pipeline would not be generated. The air quality impacts associated with construction and operation of the gas conditioning facility at Prudhoe Bay (a connected action) and LNG facility and marine terminal in Port Valdez would be avoided.

4.5.7 Liquid, Solid, and Hazardous Wastes

Impacts associated with waste handling and disposal were determined to be negligible, resulting in little impact on disposal facilities or air quality (from burning of combustible waste) along the proposed route. Under the no-action alternative, these negligible impacts would be avoided. There would be no need for new solid waste disposal sites along the TAGS route. Existing sites would have a longer life-span.

4.5.8 Geologic Environment

The no-action alternative would avoid the minor geologic impacts associated with project construction. Topographic impacts resulting from excavation, filling and grading within the 100-foot right-of-way would not take place. The mineral aggregate required for construction of the proposed project's roadways, workpads, and other fill activities would remain in place.

Any potential impact to petroleum resources (i.e., induced development) on the Alaska North Slope resulting from project operation would not occur. The primary geologic impacts associated with geologic conditions along the pipeline route would include frost heave, seismic hazards, and increased erosion potential. These impacts would be avoided under this alternative.

4.5.9 Surface and Ground Water

Under the no-action alternative the minor to moderate impacts associated with pipeline construction would be avoided. These impacts result largely from construction activities and stream crossings. The potential impacts relating to surface waters, including streambed erosion or aggradation, thermal characteristics or supply (i.e., quantity of flow) would be avoided. Any potential to *affect the integrity of other structures (i.e., bridges and other pipeline crossings) from modification of stream channel crossings would not result.*

Impacts to the shallow ground-water resources along the proposed route, resulting from vehicle traffic, filling and trenching, and accidental spills of fuels and lubricants would not occur.

4.5.10 Marine Environment

Impacts to the marine environment from construction of the proposed LNG plant in Port Valdez would include fill of subtidal and intertidal habitat and subsequent destruction of marine organisms occupying these areas. The no-action alternative would avoid these minor impacts, as well as expected minor impacts associated with LNG plant effluent discharges to the bay.

4.5.11 Fish

Potential impacts to fishery resources avoided by the no-action alternative include crossing of more than 200 fish streams and the resultant increases in sediment loads and turbidity. These impacts could affect fish populations by reducing reproductive and feeding potentials. Crossings would be made by the pipeline (usually buried) and access roads (culverts and bridges). Dewatering activities and potential for spills of fuel and lubricants into drainage courses would not occur.

4.5.12 Vegetation and Wetlands

Impacts that would be avoided by the no-action alternative would include disturbance of wetland areas estimated to occur along approximately 47 percent of the 795.6-mile TAGS alignment and disruption of the upper insulating vegetative layer in permafrost areas, both of which are included in the estimated 14,473 acres of vegetation disturbance along the proposed corridor. Changes in drainage that may cause local modifications of wetland characteristics and impacts from spills, dust, and other construction and operational activities would not occur.

4.5.13 Wildlife

The no-action alternative would avoid impacts to wildlife habitat along the proposed route. Impacts to wildlife habitat and the resulting impact on populations that would not occur include habitat destruction, habitat degradation (increased noise levels and human activities), and mortality of or avoidance of the pipeline corridor by wildlife.

4.5.14 Threatened, Protected, or Candidate Endangered Species

Under the no-action alternative, any potential impact to threatened, protected or candidate endangered species would not occur. The only species identified to be near the proposed route for the TAGS project are the bald eagle and peregrine falcon. Nesting areas for these species are near the proposed pipeline corridor; however, impact to these areas is considered to be negligible since other pipeline and/or transmission line projects exist along the corridor and have resulted in no observable effects on these species. Marine species of endangered animals would not be affected.

4.5.4.15 Recreation, Aesthetics, and Wilderness

Impacts to recreation, aesthetics, and wilderness from the proposed TAGS project would be avoided under the no-action alternative.

Project impacts to recreation include restriction of access during construction which when combined with a lack of hotel/motel accommodations could cause a lower rate of annual tourism growth. This temporary lower growth rate would be avoided under the no action alternative. There would also be less competition for sport hunting and fishing.

The no-action alternative would prevent impact to the visual quality of the proposed pipeline corridor. The natural viewshed would not be modified by addition of a linear scar and associated work pads and access roads.

Wilderness areas anticipated to suffer minor impacts from the proposed TAGS project include the Arctic National Wildlife Refuge, *Gates of the Arctic National Park and Preserve, and the Wrangell-Saint Elias National Park and Preserve. Any potential impact to these areas and other wildland areas along the TAGS route would be avoided.*

4.5.16 *Cultural Resources*

Potential impacts to cultural resources from construction of the TAGS project would be avoided under the no-action alternative. The potential for positive impacts resulting from archaeological discoveries also would not occur under this alternative.

4.5.17 *Subsistence*

Subsistence impacts avoided by the no-action alternative are directly related to other impacts avoided by this alternative including those associated with fisheries, wildlife and recreational access. Increased pressure on fishery and wildlife resources from construction activities and human intrusion could impact these resources by direct mortality, avoidance of affected areas, and habitat loss. Communities and individuals depending on these resources, primarily fish, moose and caribou, located along the corridor would not be impacted under this alternative.

4.5.18 *Public Safety*

Any impacts related to public safety that may occur from the proposed TAGS project would be avoided by the no-action alternative. Any potential for fire, explosion or release of natural gas would be avoided along the pipeline route and at the LNG facility in Port Valdez. The majority of potential impacts would result from a catastrophic event most likely related to seismic activity.

4.6 COMPARISON OF ENVIRONMENTAL EFFECTS OF THE COOK INLET-BOULDER POINT ALTERNATIVE WITH THE PROPOSED PROJECT

4.6.1 Introduction

Table 4.6.1-1 presents a comparative summary of the environmental effects of the proposed TAGS project versus the Cook Inlet-Boulder Point alternative. The affected environment and environmental consequences of the proposed project to Anderson Bay are fully developed in Subsections 3.2 and 4.2, respectively. The affected environment and potential consequences of the Cook Inlet-Boulder Point alternative were described in Subsections 3.3 and 4.3, respectively. For each of the environmental disciplines addressed in this EIS, an evaluation was conducted to determine whether either the proposed project or the Cook Inlet-Boulder Point alternative presented a clear difference in the overall level of impact for the specific environmental disciplines. For most disciplines a variety of potential impacts emerged that had to be qualitatively considered and weighed and a judgment made on whether a distinctly preferable advantage existed for one route over the other. When advantages and disadvantages essentially balanced, the routes were considered to be similar in level of impact.

For 10 of the 16 categories considered, no clearly preferred route (Table *4.6.1-1*) emerged. These included socioeconomics; noise; air quality; liquid, solid, and hazardous wastes; geology; water resources; marine environment; fish; vegetation and wetlands; wildlife; and subsistence.

The Cook Inlet-Boulder Point alignment was considered to have the least potential for adverse impacts to threatened and endangered species. The proposed project to Anderson Bay was considered to have the least potential for adverse impacts to land use, transportation, recreation and aesthetics, and cultural resources.

4.6.2 Disciplines Favoring the Cook Inlet-Boulder Point Alternative

4.6.2.1 Threatened and Endangered Species

The presence of peregrine falcon and bald eagle feeding, nesting, and roosting areas would be more prevalent along the proposed Anderson Bay Route. Construction of the proposed TAGS would cause more impacts along this alignment. Impacts would be *acceptable* as identified in Appendix *H*.

Table 4.6.1-1 Comparison of Proposed Action with Cook Inlet-Boulder Point Alternative

Environmental Factor	Best Route
Socioeconomics	Both routes similar
Land Use	Anderson Bay route
Transportation	Anderson Bay route
Noise	Anderson Bay route
Air Quality	Both routes similar
Liquid, Solid, and Hazardous Wastes	Both routes similar
Geology, Soils, and Permafrost	Both routes similar
Surface and Ground Water	Both routes similar
Marine Environment	Both routes similar
Fish	Both routes similar
Vegetation and Wetlands	Both routes similar
Wildlife (including birds)	Both routes similar
Threatened and Endangered Species	Cook Inlet-Boulder Point route
Recreation and Aesthetics	Anderson Bay route
Cultural Resources	Anderson Bay route
Subsistence	Both routes similar

4.6.3 Disciplines Favoring the Proposed Project

4.6.3.1 Land Use

The proposed TAGS route would parallel an existing pipeline/utility corridor, though it would cross or disturb ***one*** state recreational area at Blueberry Lake. The Cook Inlet-Boulder Point alternative would cross a number of parks and subsistence and recreation areas, including ***proposed*** Minto Flats ***State Game Refuge***, Denali National Park and Preserve, Denali State Park, the Susitna Flats State Game Refuge, Nancy Lake State Recreational Areas, and Captain Cook State Park. The presence of a larger number of very sensitive areas and the larger amount of private land along the alignment and at the proposed LNG plant site favor the proposed project.

4.6.3.2 Transportation

Construction of the proposed TAGS project would very likely cause vehicular traffic delays at several points along the alignment such as Phelan Creek, Atigun Pass, and Keystone Canyon. There would also be a major increase in traffic along highways paralleling the alignment. For the Cook Inlet-Boulder Point alternative, however, there is a much larger base of existing traffic, and there are several key places for which major traffic delays due to construction would be likely to occur during certain periods. These include the George Parks Highway in the general area of Denali National Park and Preserve, the area between Wasilla and Anchorage in the Matanuska-Susitna Borough, and on the Sterling Highway on the Kenai Peninsula. Both on the basis of affecting a larger existing volume of traffic and the additional locations likely to be affected, the proposed project would be expected to have the least impact on transportation. ***A VTS for tanker traffic is in place and can handle anticipated vessel traffic at Anderson Bay.***

4.6.3.3 Recreation and Aesthetics

Outdoor recreational pursuits are popular throughout the area of the proposed project as well as along the Cook Inlet-Boulder Point alternative. Recreational use would be affected by the number of recreational users, impacts to recreational resources, access, traffic, and aesthetics and would relate both to construction and to operations. Though the most popular types of recreation vary somewhat among the two alignments, the number of recreational users is substantially greater in the Cook Inlet-Boulder Point alternative project area, and recreational and aesthetic impacts would be expected to have a greater effect with the proposed project.

4.6.3.4 Cultural Resources

There are numerous small archaeological sites of minor importance along both the proposed Anderson Bay alignment and the Cook Inlet-Boulder Point alternative. Those areas along the proposed project are better known and documented due to the TAPS and authorized ANGTS siting work. Along the Cook Inlet-Boulder Point alternative alignment, one very important site has been identified, the Dry Creek site near Healy, and most of the route has not been surveyed. On the basis of this one important identified site and possibility that other sites may exist along the Cook Inlet-Boulder Point alternative route, there is a greater potential for impact to cultural resources along this route than for the proposed project.

4.6.4 Summary

The potential environmental consequences of constructing and operating a pipeline from Livengood, where the system would diverge from the applicant's proposed alignment, to an LNG plant and marine terminal at Boulder Point on Cook Inlet were analyzed and compared with environmental consequences anticipated for the proposed project. It was determined that, on balance, the impacts anticipated from either the proposed project or from the Cook Inlet-Boulder Point alternative would be similar in scope and range. The proposed project would be expected to have the greater potential to affect threatened or endangered species because of their greater occurrence in the vicinity of the project, whereas the Cook Inlet alternative to Boulder Point would have greater potential impacts in several areas, notably land use, transportation, recreation and aesthetics, and cultural resources. Since disturbance to threatened or endangered species would not occur, the applicant's proposed project was determined by the agency to be the preferred alternative.

4.7 CUMULATIVE IMPACTS

4.7.1 Introduction - Anderson Bay

The cumulative impacts for the proposed TAGS project considers TAPS, the existing highway, and the authorized ANGTS project within the 796.5-mile transportation utility corridor, along with the Alyeska oil terminal, the proposed Alaska Pacific Refinery and the Valpetro Petroleum Refinery in Port Valdez. Because the TAPS pipeline and Alyeska Marine Terminal are in place, specific details of the projects and impacts of their construction and operation are already documented. Subsection ***4.7.19*** presents a summary of the Cook Inlet-Boulder Point alternative cumulative impacts.

The Office of the Federal Inspector on October 3, 1986 noted that Northwest Alaskan Pipeline Company was considering the merits of shifting from a system designed around a 48-inch pipeline to a smaller, higher-pressure delivery system. Informal discussion by BLM with representatives of Northwest Alaskan Pipeline Company in January 1987 led to a decision to prepare this evaluation on the basis of the existing, approved 48-inch pipeline. On February 18, 1987, the Office of the Federal Inspector, in its annual report on ANGTS, concluded that although action was suspended, "the project continues to offer great promise in making available to Americans abundant supplies of Alaskan natural gas." Accordingly, this section evaluates the effects of TAGS, assuming ANGTS is built as authorized. Concurrent construction is considered very unlikely.

The determination of when TAGS and ANGTS would initiate actual construction of their respective projects is a factor to be decided in the marketplace after a realistic consideration of various options concerning Alaska North Slope natural gas resources, both proven and professionally expected to be recovered. Operation of market forces is the best guarantee that Alaska natural gas resources are developed efficiently and that there are incentives to find additional proven reserves. The FEIS has been revised to more clearly reflect the absence of a definitive time frame for ANGTS to resume planning and design development suspended in 1985. This uncertainty was further emphasized in November 1987 when ANGTS announced closure of its office in Fairbanks, and in December 1987 when ARCO withdrew from the consortium proposing construction of ANGTS because there were inadequate economic incentives to deliver Alaskan North Slope natural gas to domestic markets in the conterminous United States. World economic conditions could not support two major projects in Alaska simultaneously. It was for these economic and marketplace considerations that the DEIS did not consider concurrent construction of ANGTS and TAGS.

Although there is no firm commitment to proceed for the two proposed Valdez refineries, the relative magnitude of the projects and their geographical coincidence with the proposed TAGS pipeline, LNG plant, and terminal necessitates consideration of potential cumulative impacts. The cumulative impact discussions, by discipline, are general and qualitative and based on the supposition that none of these projects would be constructed concurrently. Key aspects of the authorized ANGTS and the proposed Valdez TAPS refineries are summarized below.

4.7.1.1 TAPS

The TAPS is composed of an 800-mile-long ***hot oil*** pipeline system with 12 pump station ***sites*** along its length from Prudhoe Bay to the Port Valdez oil terminal. ***Currently TAPS is transporting about 20 percent of the daily supply of oil to the United States.*** The proposed TAGS project is located primarily within the utility corridor developed for the TAPS project from Prudhoe Bay to Port Valdez. Since its initial establishment in 1974, ***some of*** the federal lands within the utility corridor have been transferred primarily to state and Native ownership, ***particularly south of the Yukon River. The major exception is along the Delta Wild River, Gulkana Wild River, and Tonsina River area.***

4.7.1.2 ANGTS

The approved ANGTS project would result in the construction of 745 miles of 48-inch-diameter pipeline from Prudhoe Bay to the Alaska/Yukon border with a total of 15 compressor stations (as described in Appendix B). Of the 745 miles of pipeline alignment, approximately 550 miles would be adjacent to the proposed TAGS alignment, along with 12 of the 15 compressor stations from Prudhoe Bay to Delta Junction. With the exception of several river crossings, the entire authorized ANGTS, like TAGS, would be totally below ground. This discussion assumes that ANGTS would be built according to the approved Revision 4 alignment and that the construction of TAGS and ANGTS would not be concurrent.

A Memorandum of Understanding ***(MOU)*** between the Federal Inspector and BLM is being prepared to identify roles needed to protect prior existing rights of ANGTS should TAGS be ***constructed*** first or concurrently, or in the event that the authorized ANGTS project should be proposed for modification in a manner that would threaten operational aspects of TAGS. ***That MOU is*** not yet completed.

4.7.1.3 ***Proposed*** Alaska Pacific Refinery

The proposed Alaska Pacific Refinery is a 100,000-bbl/day crude oil refinery which is ***planned*** to be built on the old ALPETCO site just east of the Valdez Airport near Robe Lake. This refinery would produce products ranging from fuel gas to No. 6 bunker fuel. The products are intended to be shipped from Valdez to Pacific Rim countries via tankers. There would be product lines from the refinery site to a marine facility located just off the grainery on the north side of Port Valdez. ***This project is on an indefinite hold.***

4.7.1.4 Proposed Valpetro Refinery

The Valpetro Refinery is a proposed small topping plant that would process about 8,000 bbl/day of number 1 and 2 diesel, plus enough fuel gas to operate the plant. The facility is intended to be located on the hillside just east of the Alyeska terminal. ***During the winter of 1986-87,*** Valpetro was actively pursuing permits and various other authorizations. ***However, at this time the construction schedule for this project is uncertain.*** The product line would lead to an offshore loading bulkhead just east of Winnebago Point.

4.7.1.5 ***Prospective Prudhoe Bay Liquid Petroleum Gas Project***

During the Spring of 1988, the three major Prudhoe Bay Producers (ARCO, BP America and Exxon) announced they are jointly examining the feasibility of recovering additional Natural Gas Liquids (NGLs) from the Prudhoe Bay gas produced with oil. The concept generally consists of modifications to the existing gas handling facilities to recover additional NGLs, modifications to TAPS to transport the comingled stream, and additional facilities at Valdez for removal of NGLs from the crude stream and separation into commercial grade Liquid Petroleum Gas (LPG) products. If the project is determined to be viable, over 100,000 barrels per day of LPG could be produced starting in 1993-94.

The current phase of the study is examining all aspects including facilities, operations, and product disposition. The examination of operational aspects in particular includes impact on current operations at Prudhoe Bay and along TAPS. The analysis of product disposition includes assessment of possible domestic and Far East markets, logistic requirements and costs. The LPG project, as currently visualized, would add and upgrade facilities on the North Slope, along TAPS, and at Valdez.

The contemplated project is independent of any proposed gas transportation concepts such as ANGTS or TAGS. The facilities would be compatible with conventional natural gas

pipeline concepts, since removal of some of these LPG components is necessary before the gas could enter the gas transmission system.

The primary hydrocarbon components of natural gas would continue to be reinjected into the Prudhoe Reservoir and would remain available for a major gas sale when market conditions warrant the development of an appropriate gas transportation system.

4.7.1.6 Natural Gas Conditioning Plant at Prudhoe Bay

The operators of the Prudhoe Bay fields have constructed and are operating the largest natural gas conditioning facility in the world to process natural gas for use as field fuel, fuel for Pump Station 1 through 4, and for reinjection. In ***1983***, FERC and the USACE authorized construction of a natural gas conditioning plant near this existing facility to condition natural gas for the ANGTS pipeline. ***The USACE in 1984 issued authorization to ARCO to construct the CGF on a portion of the previously authorized ANGTS-AGCF site.***

Additional facilities to provide LNG pipeline quality natural gas for TAGS ***are*** required. The extent of facilities needed could vary from modification of the existing new facility to a stand-alone facility. Although not specifically part of the TAGS project, this ***FEIS*** evaluated prospective sites within the Prudhoe Bay area and the airshed (see Appendix D). The cumulative effects of the needed facility for TAGS would not cause an adverse cumulative effect on the airshed. This analysis assumes that the ***partially*** authorized ANGTS sales gas facility would be built (see Appendix B).

4.7.2 Socioeconomics

Cumulative construction and operational impacts of the project area would be positive in that the proposed TAGS project would take advantage of presently unused infrastructure and labor throughout the corridor and around the state. ***However, by the time TAGS is constructed, some of the existing infrastructure could have been absorbed.*** Construction would result in temporary need for housing and other services in Fairbanks, Delta Junction, Glennallen/Copper Center, and Valdez, with minimal new infrastructure requirements due to the expansion during and following TAPS. The same would be true of the authorized ANGTS. Likewise, following construction, this greater magnitude would cause more employment and population declines after the projects were completed.

The proposed TAGS would be in competition with TAPS, DOT/PF authorized ANGTS, and others for access and use of mineral materials along the route. Competition for mining-related material such as heavy equipment, fuel, personnel and wages, and the impact of withdrawing acreage for mineral entry.

The cumulative impacts of the TAGS and approved ANGTS projects during the operating phase would be a slightly higher level of employment but would not affect housing and other services significantly. The major long-term impact of the two projects would be higher property tax revenues for the North Slope Borough, Fairbanks North Star Borough and the City of Valdez, and higher property tax, severence tax, and royalty income to the State.

Valdez would likely experience the largest relative cumulative socioeconomic impacts, but Valdez would be adequately prepared to accommodate the construction related impacts. Due to the present oversupply of all infrastructure, no major construction or operational cumulative impacts would be expected. Most beneficial to the economy of the State of Alaska would be the stretching out of each of these projects to make more efficient use of the existing infrastructure, labor force, and economic benefits.

4.7.3 Land Use

Cumulative impacts to present land uses would be minor since the route is primarily within the utility corridor created by TAPS and the highway system. ***However, there could be a greater demand for light industrial and residential land in the Fairbanks area.*** Impacts to present hunting, fishing, recreation, subsistence, mineral resources, timber resources, and logging activity would be additive but minor due to the present usage. Impacts to agriculture and agricultural lands would be negligible since the area involved would be small, and the reuse of any disturbed areas could be accommodated after construction was completed.

Moderate impacts would likely occur from combined project gravel extraction on the North Slope and in the Copper River Valley where such resources may be limited. The extent the supply would exceed the demand in these two areas is not known. These resources are limited along the corridor and combined demand could exceed the supply that exists without crushing rocks from the talus slopes and exposed outcropping. Cumulative impacts, which would be additive, would include visual scars, increased erosion, and moderate wildlife habitat loss. Additional impacts due to gravel extraction would involve the cost to the developer of the less accessible gravel resources.

The construction of both the TAGS and authorized ANGTS, along with the presence of TAPS and the highway, would prohibit further pipeline or major north/south highway expansion at Atigun Pass, the Middle Fork of Koyukuk River near Sukakpak, Phelan Creek, and Keystone Canyon. Cumulative impacts would be major should the need for another pipeline or utility system be required, otherwise the impact would be minor.

4.7.4 Transportation

Cumulative impacts of construction of the proposed TAGS facilities would be interactive with existing transportation systems and, except for the requirement for long-term availability of low-cost mineral material for highway maintenance, of short duration. Minor impacts would include traffic delays, dust accumulations during dry periods, stress on the integrity of the existing highway maintenance program, and increased potential for accidents. During construction, truck traffic would not exceed DOT/PF's maximum highway capacities; following construction, impacts would be minor. ***The potential for increased simultaneous usage of the highways by both construction equipment and recreational vehicles would increase the potential for accidents and/or personal injury during the period of pipeline construction unless traffic control measures are instituted. Following construction these impacts should be negligible.*** Individual construction impacts would be nonadditive for shipping and commercial transportation systems throughout the state. Coordinated scheduling would alleviate part of the problem, but impacts during construction would be moderate for all highway users and minor thereafter.

Future new transportation routes that might be established in a easterly or westerly direction from existing highways needing to cross TAPS in addition to ANGTS and TAGS would realize special design and construction costs. ***TAGS*** would have special access design features where such features were required of TAPS and authorized ANGTS. Accordingly, there would be minor cumulative impact on future transportation.

There would be some minor impacts to the marine transportation system, especially at Valdez Narrows and within Port Valdez. This would be alleviated to some extent by the strict U.S. Coast Guard controls, but there would still be the increased likelihood of minor and major oil spills and ship collisions, as well as competition for sea lanes between petroleum ships, fishing vessels, and other marine traffic.

Improvements to existing transportation facilities such as increasing the runway length by TAGS probably would be unnecessary if ANGTS were constructed first. Should TAGS be built first then ANGTS would not need to expand co-used transportation facilities. There would be no net cumulative effect in the same way that facilities constructed for TAPS reduce the need for completely new facilities for either TAGS or ANGTS.

4.7.5 Noise

Noise impacts of the project would mainly involve disturbance to humans and wildlife. Construction noise would increase either in duration or location with each project. Because all construction activities are short term, inconvenience to humans or dislocation of some wildlife would be temporary. Noise from long-term facility operations (including compressor stations, LNG plant and terminal), from transportation along land, air, and marine corridors and from other activities associated with increased human populations and ancillary structures would be interactive with existing noise levels plus that of other potential projects.

Cumulative noise impacts in the Hogan Hill and Sagwon Bluffs areas could be moderate during construction, but would diminish to minor following completion of the TAGS project. In the Hogan Hill area, key noise concerns center on the Nelchina Caribou Herd. Here the increased noise traffic associated with a construction crew of approximately 900 will dwindle to that associated with an operations crew of about 20 personnel. During TAGS operations the most significant noise impacts would be the result of emergency compressor station blowdowns. However, should such an emergency event occur, these noise impacts would still be limited to a small area adjacent to the affected compressor station. Maintenance blowdowns would be scheduled during non-migratory periods.

There would be minimal cumulative increases in noise mainly along the pipeline corridors and in Port Valdez resulting in minor impacts.

4.7.6 Air Quality

Air quality impacts are generally additive along the route. Cumulative effects on air quality within the entire project area would likely be important only in Port Valdez. Particulates, *NO_2*, and SO_2 would likely increase slightly due to additional equipment, traffic, and on-site construction. Impacts along the right-of-way during construction would be short lived and minor.

Operation of proposed TAGS facilities are of concern for NO_2 at compressor stations where the SIL is exceeded; however, the greatest concern is in the Port Valdez airshed where the TAGS facilities at Anderson Bay are predicted to exceed standards for 24-hour SO_2, 24-hour TSP SIL, annual TSP/PM_{10} and NO_2 SIL.

The ADEC is reviewing information on the TAPS marine terminal at Valdez to determine if current facilities are subject to PSD review. In addition, the sponsors of the Alaska Pacific Refinery have submitted a PSD application to ADEC. Emissions from these two sources, and other growth since the baseline year 1979 could limit the amount of increment available for TAGS facilities at Anderson Bay. This in turn could affect the amount of air pollution controls for TAGS facilities and ultimately permittability of the project (EPA, 1988a). Should all proposed or prospective projects in the Valdez area be implemented, it is possible that all emission sources would be required to meet BACT standards. This could include scrubbers and bag houses, use of low sulphur fuels for oil tankers while in Port Valdez and other various control technologies.

The extent that existing air emissions would be modified by the propsective Prudhoe Bay LPG Project is unknown.

The conceptual GCF needed at Prudhoe Bay to provide LNG quality natural gas to TAGS is not part of the immediate TAGS project proposal. Careful consideration has been given to non-confidential and non-proprietary data currently available for the ANGTS SGCF (FERC 1980) and the expired PSD for a stand-alone SELEXOL process conditioning plant. The sponsors of ANGTS have modified the initial proposal in several substantial ways and other natural gas liquids/natural gas processing facilities have been built as part of the Prudhoe Bay field operations. Accordingly there is a high level of uncertainty with the design of a conditioning plant and previous air quality evaluations for ANGTS may not necessarily be transferrable and may not be appropriate to what ultimately may be constructed (EPA, 1988a).

While natural gas take-off for Fairbanks, provided by ANGTS, TAGS or ENSTAR, is desirable from most points-of-view, combustion of natural gas does produce more water vapor that combustion of natural gas does produce more water vapor than combination of fuel oil or gasoline. At temperatures colder than -25°F, the additional water vapors would exacerbate the ice fog problem in the Fairbanks area.

4.7.7 Solid Waste, Hazardous Materials, and Sanitation

There would be *some* cumulative impacts due to solid and hazardous wastes.

These would be primarily in shortened useful life of existing disposal sites. Disposal ***would be*** done in the manner prescribed by current EPA and ADEC requirements.

ANGTS and TAPS together would create approximately the same amount of solid waste as the TAPS project. TAPS produced approximately 500 destroyed vehicles, 3,000 batteries, 9,000 to 10,000 tires, 15,000 to 20,000 tons of scrap construction material, 4,000 to 6,000 tons of equipment components, thousands of used drums, thousands of tons of camp-related wastes, dozens of prefabricated buildings, and quantities of unused pipe. Existing landfills located at Prudhoe Bay would be used to dispose of solid waste produced in the North Slope Borough. The existing Fairbanks North Star Borough landfill, expected to reach capacity as soon as the year 2005, would not be significantly impacted by the TAGS project. Alternative landfills, new and/or existing, would be used to minimize impacts to the North Star Borough landfill. The Valdez landfill, located approximately 2 miles from the city of Valdez, has no established date of closure. This facility could be used by TAGS with minimal impact to its life expectancy. Additional new and existing landfills would also be used by TAGS along its route. These landfills would meet EPA and ADEC requirements.

There might be some additive impacts due to liquid waste disposal if more than one discharge entered the same water body within a short distance or period of time. Since care would be taken to see that that would not occur, there would most likely be only minor or negligible impacts. Should multiple discharges occur, impacts would only be minor and local due to compliance with strict state and federal regulations.

4.7.8 Geology

4.7.8.1 Geology Environment

Construction of proposed TAGS and authorized ANGTS along with associated access roads, construction camps, and compressor stations requires large amounts of borrow material. This resource is already greatly depleted in certain areas along the route, especially on the North Slope. Development of new borrow sources or additional extraction from existing sites could affect the supply available for highway and TAPS maintenance and for the construction of both authorized ANGTS and the proposed TAGS project. The use of more expensive techniques such as rock crushing or longer haul distance from conventional fluvial gravel sources might be required. Use of geofabrics to reduce the amount of gravel needed to protect sensitive permafrost environments is another option as is use of snow/ice work pad construction that would reduce the amounts of mineral materials required for TAGS in areas where gravel is, or would be, in short supply where both TAGS and ANGTS would have common locations ***and where summer maintenance or operational access is not required.*** Detailed information on mineral material sources for TAGS is of a generic nature at this time, as it was during the EIS process for both El Paso and ANGTS. However, the EIS process cannot use the more detailed information developed for ANGTS during its detailed design and engineering phase because the information has been classified as confidential and proprietary or copyrighted.

The proposed routing of several pipelines through Atigun Pass and the relatively confined valleys of the Atigun and South Fork Koyukuk rivers, Phelan Creek, and Keystone Canyon could affect stability of the steep slopes. ***Cumulative impacts at Atigun Pass would be significantly less should TAGS be built before ANGTS because rock cuts and road location for TAGS would create a substantially prepared burial section for ANGTS.*** Cumulative impacts along the Yukon-Tanana Uplands could result from several pipelines passing through thermal degradation areas of relatively warm, ice-rich permafrost. There would be moderate impacts during construction and for that period prior to startup. Likewise, mass wasting and subsequent erosion and gullying could occur locally where more than one pipeline crosses highly developed solifluction slopes. Both of these situations would be localized to the construction area and would be mitigated once operation in the chilled mode occurred, with minor impacts.

Cumulative effects could also result from thermal degradation of fine-grained, discontinuously frozen soils at pipeline crossings and where permanent TAGS access roads would cross TAPS in the Copper River basin.

Along the Chugach Mountains segment, increased rates of erosion at the numerous stream crossings and mass wasting and instability of the steep slopes found in this segment could affect the structural integrity of other facilities and interact to yield major impacts. Careful design, use of proven techniques, and effective quality control would minimize the likelihood that any such impacts would occur.

4.7.8.2 Petroleum Resources

The TAGS project would enhance exploration and development of Alaskan North Slope natural gas. This effect is similar to those evaluated for the El Paso proposal (FPC 1976a) and for ANGTS (FPC 1976b). The cumulative effect of the TAGS project would most likely be for future leases rather than existing leases by the State, Natives, or Federal government. Federal oil and gas leasing status is summarized below.

Onshore

- National Petroleum Reserve - Alaska; 23 million acres evaluated by the U.S. Department of Navy and by the Department of the Interior (BLM 1983). All development scenarios envision petroleum transportation systems going ***from National Petroleum Reserve Alaska to TAPS at points at or between Prudhoe Bay and Galbraith Lake.***

Offshore 1/

- Beaufort Sea Joint Federal/State Sale; FEIS prepared by MMS in 1979 and 1980 covering 514,192 acres. Commercial supplies of natural gas would go to Prudhoe Bay. Assumes the ALCAN (ANGTS) project would be built.

- ***Diapir*** Field (Beaufort Sea Sale 71); FEIS prepared by MMS in 1982 covering 1.83 million acres. Commercial supplies of natural gas would go to Prudhoe Bay. Assumes ANGTS would be built.

- ***Diapir*** Field (Beaufort Sea Sale 87); FEIS prepared by MMS in 1984 for 7.7 million acres. Commercial supplies of natural gas would go to Prudhoe Bay. Primary focus of the evaluation was for oil production.

- Beaufort Sea (Sale 97); FEIS prepared by MMS in 1987 for 19.37 million acres. Commercial supplies of natural gas would go to Prudhoe Bay. Assumes ANGTS or TAGS would be built.

- Chukchi Sea (Sale 109) DEIS prepared by MMS in 1987 for 29.5 million acres. No economic supplies of natural gas are expected to be discovered.

State leases are for a patchwork on state ownerships on the Alaskan North Slope. Most outstanding onshore leases are concentrated in the Prudhoe Bay and Kuparuk River areas. Offshore leases are concentrated between Camden Bay on the east to Smith Bay on the west. The State does not identify development scenarios as part of its petroleum leasing program (ADNR, ***personal communication***). For the purposes of this evaluation, it is assumed that development of commercial supplies of natural gas ***on*** State ownership also would go to Prudhoe Bay or the nearest point on a gas pipeline such as ANGTS or TAGS.

The cumulative impact of TAGS on petroleum resources would focus primarily on future State, Federal, or Native leasing, as decisions to date have assumed there would be an operational natural gas delivery system between the Alaskan North Slope and markets. Therefore, TAGS would have an cumulative effect only to the extent ANGTS was not operating. TAGS would have a cumulative long-term minor to major impact on exploration and production of Alaskan North Slope natural gas and a minor impact on oil exploration or production. The specific cumulative impacts on petroleum resources are not quantifiable at this time because such an effect is a function of a

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1/ ***Minerals Management Service, Anchorage,*** August 19, 1987.

particular petroleum reservoir (heavy or light oil, field pressure, gas content amounts, etc.), distance to Prudhoe Bay, TAPS or TAGS, and the overall economics.

4.7.9 Surface and Ground Water

Most potential impacts to ground or surface water resulting from the TAGS, TAPS, and authorized ANGTS projects are independent and additive. For surface water these would include such considerations as scour and erosion. For ground water, disturbance of flow, thermal degradation, and interference with recharge are the major concerns.

Major potential interactive impacts are those that would affect the thermal regime, aquifer flow, or the water supply for other projects. Critical areas would include those for which the pipeline projects are close to each other and areas for which water resources might be scarce.

Areas of potential concern include the Sagavanirktok River terraces, where gravel mining operations could adversely alter surface water flow near the TAPS river crossings and river training structures. Alluvial fans and thawed gravels below the Atigun and Chandalar rivers are areas where project activities could cause new or enlarged icings in streams near the 13 miles proximate to the authorized ANGTS, causing stream diversion and other possible problems. Finally, stream crossings between the Yukon River and the Elliott Highway may exhibit increased erosion and sedimentation due to icings which could impact TAPS, ANGTS, or the highway. These impacts would be moderate.

Cumulative impacts related to use of surface and ground water in the Valdez area would be minimal.

4.7.10 Marine Environment

Cumulative impacts of TAGS to the marine environment could develop from:

- Construction activities from all proposed projects that resulted in increased turbidity, loss of intertidal and subtidal benthic habitat, and loss of nearshore habitat from use by marine mammals and birds.

- Additional pollutants from facility discharges.

- Increased potential for impacts via hydrocarbons or toxic or hazardous substance spills.

- Increased disturbance from combined facility operations and associated vessel traffic.

- Impacts from increased human population and ancillary developments. Construction of the proposed refineries would cause additive impacts in all areas.

Operations of the TAPS and TAGS terminal, along with the two proposed refineries, would increase tanker traffic in the Port of Valdez. This increase would be additive and would not preclude additional increases in tanker traffic.

Several factors concerning existing conditions in Port Valdez and characteristics of the proposed facility are particularly important in considering cumulative impacts of the TAGS project with existing and proposed projects. Of great importance is oceanographic information concerning the harbor. Its size, circulation patterns, and flushing rate minimize the residence time of discharges into the western half of the port. Existing pollutant loading appears to be negligible, and the capacity of Port Valdez to dilute and remove additional pollutants in low concentration would probably not be exceeded with planned projects. The high existing sediment load in the eastern end of the port minimizes the likelihood that temporary dredging-related increases would have any significant negative impact. The location of the TAGS project in the western half of the port, away from important fisheries streams and seabird concentration areas, suggests that ***cumulative impacts associated with*** this project ***would be minor, particularly as they relate to the more sensitive eastern reaches of the port.***

4.7.11 Fish

Cumulative impacts to local fish populations would be attributable to factors such as erosion, training walls, culvert placement, and washouts of buried crossings. ***Multiple drainage structures may impede fish migration, an important cumulative effect that must be considered during design of these facilities.*** The applicant's proposed mitigation measures related to timing of construction and use of appropriate stream crossing techniques should minimize the possibility of major cumulative impacts due to physical changes. ***Nonetheless, cumulative impacts to fisheries resources and short-term habitat losses would occur.***

One of the most important types of cumulative impacts would occur from additional fishing pressure due to the TAGS project at stream access point along the entire corridor. Slow-growing indigenous fish populations can't withstand heavy fishing pressure, and the size and number of catchable fish declines. This has already occurred along the TAPS corridor and unless controlled, would result in additional impacts during TAGS construction. The addition of two buried pipelines to areas where there is already a single buried pipeline and perhaps a road culvert could cause moderate cumulative impacts.

The most probable cause of cumulative impacts would be changes to streamflow ***induced by the presence of river-crossing structures*** and sedimentation due to dredging for buried stream crossings. Site-specific stream crossing stipulations would be prepared. Adherence to those stipulations would reduce or eliminate most cumulative impacts. ***However, care must be taken to design river and stream crossings so that they do not induce long-term erosion and increased downstream sedimentation. Induced river sedimentation, as well as additional drainage and culvert structures, may cause long-term habitat loss or loss of spawning beds particularly in areas where multiple pipeline and road crossings impact a particular river or stream. These impacts may be particularly important upon small streams since the cumulative length of disturbed channel area could represent a proportionately greater area of habitat loss or disturbance than that associated with similar structures over a larger stream or river. Stream-specific mitigation measures would, therefore, be designed to minimize impacts to critical fish habitat.*** Frequent inspection during construction and operations should identify potential erosion, siltation, or hydrological problems before they affect fish habitat.

Some impacts to sensitive fish habitat such as spawning areas and overwintering locations already exist due to the highway system and ***TAPS***. The approved ANGTS would add to these impacts, and eventually the TAGS project would increase disturbance to these areas. ***However, water withdrawal from fish-bearing waters, particularly in overwintering areas, would not be allowed unless further site-specific studies determine that sufficient water is available to ensure survival of these sensitive habitats and that approval was received from ADF&G.***

The potential for cumulative impacts to fish resources would be moderate during construction and minor after construction.

4.7.12 Vegetation and Wetlands

Cumulative impacts to vegetation would be related primarily to the additive effects of habitat temporarily or permanently lost. Since there are no endangered plant species, and the total area of vegetation lost to all projects combined would not be large, the impacts would be moderate. The areas disturbed during pipeline construction would be regraded, contoured, and fertilized to encourage natural replacement of the vegetative cover. These impacts would be additive for the disturbed areas and should not affect TAPS or authorized ANGTS.

Wetland impacts would be similar to those which occurred as a result of the TAPS and highway construction. Wetland impacts would include the drying up of some areas due to restriction of sheet drainage flow volume or duration and possibly flooding of some wetlands, resulting in loss of some vegetation species and wildlife habitat. Cumulative impacts due to TAGS and authorized ANGTS would be prevented by disturbance of the smallest area possible, careful attention to drainage patterns, proper grading and culverting, and prompt revegetation to prevent erosion and maintain natural flows as nearly as possible.

A variety of secondary impacts that could increase the cumulative impacts to *wetlands included new drill pads and associated access roads since existing drill sites tend to be located for the optimal recovery of oil and not necessarily natural gas. These new gravel works would all be located in wetlands and could adversely affect a significant number of acres, especially when impacts from created impoundments, gravel spray and dust are considered. This new work will place additional demands for water and gravel. New drill sites (and new drilling at existing ones) would generate significant quantities of drilling muds and cuttings, as well as other wastes and process fluids all of which require careful handling. There would be risk that emergency conditions could cause discharges into wetlands and other waters of the United States. In addition, new collecting pipelines may have to be constructed to transport natural gas from new wells to existing field pipelines. Additional roads and pipelines could affect wildlife use of wetlands and would increase human disturbance and fragmentation of wildlife habitat (EPA, 1988a). These impacts have been given initial consideration in federal leasing decisions on the Alaskan North Slope (see 4.7.8.2). It should be noted that well spacing is a function of reservoir dynamics, cost and state regulation. Accordingly, any wetland impacts associated with the TAGS project would be the result of sequence and timing of disturbance rather than creation of significant new disturbances. In any case, features involving wetland disturbance would require project specific NEPA evaluations as part of the USACE authorization process.*

The cumulative impacts would be *moderate*.

4.7.13 Wildlife

Potential cumulative impacts to birds would be primarily derived from construction-related activity, including noise from heavy equipment and aircraft. The amount of total wildlife habitat lost after construction would be minor. Seasonal restrictions would likely be imposed, preventing certain construction activities during summer months. This would alleviate most of the potential impacts that could occur to raptors and other birds during the nesting season.

Cumulative wildlife impacts to mammals would typically be additive. In most cases, there would be few direct effects leading to loss of animals except for collision with vehicles. Impacts could be absorbed without decrease to the local or regional population. Heightened stress would be expected on local wildlife populations by construction-related activities such as machinery operations and aircraft and vehicular traffic during sensitive periods such as lambing or calving. *The combined impacts of TAGS construction-related disturbance (noise, traffic, clearing) and operational impacts associated with TAPS and the Richardson Highway taken together could affect migration of the Nelchina Caribou Herd in the Hogan Hill area unless construction is limited to non-migratory periods. Following construction of TAGS the operational impacts would be minor and generally limited to a small area adjacent to Compressor Station No. 9. Studies indicate that the pipelines themselves pose negligible interference with the migration and overwintering of caribou (Carruthers et al., 1984; and see Subsection 4.2.13.2.1).* Sheep might be prevented from using certain mineral licks for a few months. These impacts would be shortlived and localized, therefore minor.

Postconstruction cumulative impacts of the buried pipelines would be negligible.

There would be some cumulative impacts to birds due to collisions with additional structures such as towers and buildings and due to additional vehicular traffic. These impacts would likely be minor.

4.7.14 Threatened, Endangered, or Candidate Species

All proposed projects emphasize avoidance of the nesting sites of endangered and threatened peregrine falcons, as well as bald eagles, gyrfalcons, and golden eagles. Little direct cumulative impact is anticipated since ANGTS and TAGS construction would not occur simultaneous. Increased access and increases in construction personnel along the pipeline corridor and in Valdez would result in a greater potential for disturbance to nesting raptors through recreational activities. The amount of disturbance would be negligible; increased recreation and construction activities would not result in the loss of individuals of any endangered or threatened species. ***There would be additional loss of vegetation habitat during construction. Although much of the habitat area would be restored, the land required for the permanent aboveground facilities would be unavailable habitat for the life of the project. Although some feeding areas would be lost, and there would be noise disturbance associated with the permanent facilities, the cumulative impact would be negligible.***

The addition of LNG tankers to the northern Prince William Sound area increases the chance for accidental collisions between ships and endangered whale species. Such occurrences are unavoidable but extremely rare.

Section 7 consultation on endangered species has been completed, and correspondence from NMFS and FWS indicate there would be no critical habitats involving endangered species if agency guidelines are complied with. FWS has stated that the TAGS project "would not have any long-term or cumulative negative effects on the peregrine falcons" while the NMFS states that "the TAGS LNG terminal project is not likely to adversely affect" the three whale species (see Appendix H).

4.7.15 Recreation, Aesthetics, and Wilderness

Along the northern portion of the TAGS route, cumulative impacts to aesthetics would in many cases be increased due to the overall space occupied by four separated, cleared rights-of-way in a single corridor. Construction activities and associated noise, traffic, and visual impacts would be greater in magnitude and duration given both the TAGS and ANGTS pipelines. There would be approximately twice the present number of surface facilities such as compressor stations along the corridor, as well as increased visual scars on the landscape from borrow pits and access roads. Cumulative impacts to aesthetics along the corridor would be moderate.

Increased access to lands for recreation would probably occur with both projects, and increased numbers of people employed along the pipeline routes would probably translate into some increased recreational use to resources, resulting in minor impacts. ***Traffic impacts associated with the joint use of highways by construction equipment and recreationists during construction would require traffic control measures to ensure negligible impacts.***

Cumulative impacts to recreation and aesthetics in the Valdez area would result in considerably stressed recreational areas during construction periods, considering the major influx of workers. Over time, a permanent increase in the population of Valdez to support operation of the TAGS LNG facility and two refineries could ***lead to*** moderate increases in recreational use and pressure on limited recreational resources. Aesthetically, with the completion of the three facilities in addition to the Alyeska terminal, the appearance and character of Valdez would be changed further in the direction of a modern industrialized port, resulting in moderate impacts.

4.7.16 Cultural Resources

In assessing the potential effects of TAGS construction on the cultural resources along the pipeline corridor, the possible adverse cumulative effects of three pipelines, TAPS, TAGS and authorized ANGTS and a major highway being constructed in the same general corridor must be considered. Increasing the width of the impacted corridor obviously would increase the chances that more archaeological sites would be affected.

The construction of two additional pipelines would increase the necessity to mine material source sites, or portions of such sites, which were not utilized during TAPS construction because of the presence of potentially significant cultural remains. Though acceptable alternate material sources might be found, some of them might also contain archaeological sites. Cumulative impacts to cultural sites, if all projects were constructed, would probably be minor.

4.7.17 Subsistence

Since construction of the Dalton Highway, use of the area around Galbraith Lake and Atigun Gorge for fishing, hunting, trapping, and camping activities by Natives has become more infrequent ***in the utility corridor north of the Yukon River*** (BLM 1987). Oil and gas development on the North Slope has impacted traditional subsistence use of the Prudhoe Bay area primarily due to access hunting restrictions. Increased access in the northern utility corridor and the Glennallen/Copper Center areas has resulted in increased sport hunting and fishing competition for subsistence resources. In the latter case, promulgation of new subsistence regulations were necessary to ensure the continuation of moose and caribou hunting opportunities and protect the animal populations (ADF&G 1985).

Construction of the TAGS project would create additive impacts on subsistence existing activities. These additive impacts would occur primarily during construction, the period of greatest competition from the increased number of workers along the TAGS alignment. Some access problems could occur due to restrictions placed on crossing or shooting near the TAGS pipeline. Because the TAGS project would not involve major expansion of the existing Prudhoe Bay oil and gas complex, would follow a linear right-of-way adjacent to the existing TAPS line, and would use an LNG terminal near the existing Alyeska oil terminal, long-term cumulative impacts on subsistence activities from TAGS would be only minor.

4.7.18 Public Safety

The cumulative risk to public safety during construction of TAGS would be derived from the increased traffic in the air and on the highways of the state and from the intense construction activity within the highway and utility corridors. A cumulative interactive impact would result should TAGS construction activity disrupt or rupture the TAPS or the authorized ANGTS ***or the impacts of TAPS and authorized ANGTS on TAGS***. The probability of this occurring is remote because of the required separation distance of TAGS from both TAPS and authorized ANGTS. The increased probability reflects the general increase in transportation levels. ***See Appendix B which discusses the compatibility of TAGS to these other pipeline systems.***

During operations there is the additive, though remote potential of a pipeline rupture or leak on the TAGS system which could impact TAPS or the authorized ANGTS. TAGS operational procedures would be designed to respond to various types of potential accidents and include safety features such as emergency shutdowns, valve closures, block valves on either side of river crossings and fault lines, corrosion control, and inspection procedures.

Cumulative increases in tanker traffic through Port Valdez and Valdez Arm and construction activities in the Valdez area would increase the potential for accidents, including some that could result in oil spills.

The cumulative impact of LNG tanker traffic on the high seas between Prince William Sound and destination ports in Pacific Tim nations is considered negligible.

The Anderson Bay LNG plant site and marine terminal sites were selected to provide the greatest capacity to comply with the federal DOT regulations 49 CFR 193. An evaluation of the LNG plant thermal and vapor exclusion zones indicates that the Anderson Bay site provides an ample buffer zone and safe conditions outside of the site boundary at all times. The cumulative risk to public safety would be considered minor.

National security considerations include the requirement for a continuous supply of energy, enhanced by the TAGS project independent of the authorized ANGTS or the proposed Valdez refineries. The common source of petroleum for TAPS, TAGS, and ANGTS; the proximity of pipelines at pinch points; and the proximity of TAPS and TAGS marine terminals means that a single terrorist incident could conceivably interrupt multiple facilities. Measures to protect against this are balanced by the fact that there would be some measure of security due to their proximity as well.

4.7.19 Potential Impacts in the Conterminous States Arising from Alaskan ***North Slope*** Natural Gas Exports

As proposed, the Trans Alaska Gas System (TAGS) would gather, transport, process and liquefy about 2 billion cubic feet per day (BCFD) of North Slope natural gas for export to Pacific Rim countries. ***To the extent*** *there is a cause and effect relationship between such exports and the non-consumption of natural gas in the lower 48 staes, there may be environmental consequences in the lower 48 states. The analysis in Appendix K addresses the environmental residuals associated with using other fossil fuels such as coal to meet this demand. Two scenarios are considered--one where there is no additional gas available, and the second where the natural gas is available from domestic sources in the conterminous states, but not from the North Slope of Alaska.*

This EIS assumes ANGTS would be built. Currently there is no means to transport North Slope natural gas for consumption in conterminous states. Therefore, no reasonable or logical nexus could be drawn between exports of North Slope gas and the environmental residuals associated with the assumed incremental demand. Within the 25 years covered by the analysis in Appendix K, this situation could change since a means to supply this gas to the conterminous states could arise. In any event, the existence of a transportation system to the lower 48 states does not necessarily mean TAGS exports would have environmental consequences in the lower 48 states since it is not unreasonable to assume there are sufficient natural gas reserves in Alaska to serve both the export and the domestic markets for the foreseeable future.

For analytical purposes, it was assumed that TAGS would be completed by *year* 1995 and operate at capacity for 25 years, or until 2020. Net capacity of TAGS after subtracting pipeline and gas plant fuel would be 2 billion cubic feet (BCF) per day, or 730 BCF per year exported as liquefied natural gas (LNG). This amount of energy would be equivalent to .73 Quad/year, less than 1 *percent* of domestic energy consumption during the 25 years of TAGS operation.

To understand the importance of the proposed natural gas exports, reference case projections of energy consumption are shown on Table *4.7.20-1*. Energy consumption in transportation and residential sectors would be excluded in this analysis because of the limited substitutability of coal and natural gas for transportation fuels and the very small amount of coal consumed in residential home heating. Total energy consumption by utilities and industry *is* projected by Data Resources Inc. (see Appendix K) to increase from 36.2 to 57.4 Quadrillion BTU (Quads) from *the year* 1995 to 2020, an increase of almost 60 *percent* spread over 25 years. However, total natural gas consumption would be expected to fall, in absolute and relative terms, as coal use doubles. Almost the entire increase in projected energy consumption occurs in the utility sector, which has the greater ability to use coal cleanly. Coal would be the fuel of choice by utilities because of the relative costs of other alternatives.

Table *4.7.20-1*
Reference Case Projection
of Energy Consumption by Sector,
1995 to 2020 (Quadrillion BTU)

Year	Electric	Industrial	Combined
1995	22.7	13.5	36.2
2000	26.1	13.7	39.8
2005	28.4	13.7	42.1
2010	32.7	13.6	46.3
2015	37.3	13.7	51.0
2020	43.4	14.1	57.4

Source: Tables 2.1.1 through 2.1.6.

Nationally aggregated SO_2 and NOx emissions associated with each scenario (reference, intermediate and maximum residuals cases) are identified in Table *4.7.20-2*. Regional residuals would not be inconsistent with the national residuals *while* other environmental residuals would not be detailed because few models are available to analyze these residuals without major subjective assumptions and considerable expense.

Table 4.7.20-2
Emissions by Scenario for Utility and Industrial Sectors 1995 to 2020, Million Tons

	SO_2			NO_x		
Year	Ref	Int	Max	Ref	Int	Max
1995	19.9	20.1	20.2	10.7	10.9	10.9
2000	20.9	21.1	21.2	11.2	11.4	11.5
2005	20.7	20.9	21.0	11.7	11.8	11.9
2010	20.5	20.6	20.8	12.2	12.4	12.5
2015	21.1	21.3	21.4	13.0	13.2	13.2
2020	20.6	20.8	20.8	14.0	14.2	14.3

Source: Compiled from Tables 3.1.1 and 3.2.1.

Tables ***4.7.20-2 and 4.7.20-3*** show small increases in SO_2, within each case (less than 4 ***percent***), smaller increases from the intermediate residuals case relative to the reference case and smaller increases when comparing the intermediate to maximum residuals case. SO_2 emissions would not be projected to increase substantially in the reference case due to assumptions in the models which project enforcement of current clean air regulations, and the application of current control technology as new boilers would be built to replace existing capacity and meet new demands. Increases in SO_2 from the reference case to the intermediate case would be due principally to the assumed incremental demand, 0.73 Quad/yr. The very small difference between SO_2 emissions in the maximum residuals case relative to emissions in the intermediate case would be due to greater coal use in the maximum residuals case.

NOx emissions show similar relationships among cases. Within the reference case, however, total emissions increase only 31 ***percent*** over the period compared to a projected increase in total fuel use of 59 ***percent***. This would be explained by the increase in total market share by coal over time.

In summary, the analysis shows small differences among the reference, intermediate and maximum residuals cases modeled for SO_2 and NOx emissions. In addition, ash, particulate matter, and sludge emissions would also be forecasted to vary minimally between the cases. Given the potential for errors inherent in all forecasts, the wide variance in energy market conditions in the last 10 years and the long term of the period covered by this analysis, the environmental consequences of the cases modeled here would not be substantially different.

4.7.20 Summary of Cumulative Impacts of the Cook Inlet-Boulder Point Alternative

The first 395 miles of the proposed project and the Cook Inlet-Boulder Point alternative routes south from Prudhoe Bay are the same. Cumulative impacts ***in Alaska*** have been discussed for that segment in Sections 4.5.2 through ***4.7.18***. Cumulative impacts considered for the alternative route from Livengood to Boulder Point are discussed in the paragraphs below. In many instances the cumulative effects are similar to the proposed TAGS route; in those cases only the effects specific to the Cook Inlet-Boulder Point alternative are described.

For purposes of cumulative impact evaluation, this discussion considered the existing towns and villages along the route, with the existing transportation infrastructure, reasonable future construction, and major projects along or near the proposed alternative route. ***The ENSTAR Natural Gas Company has recently proposed a small diameter natural gas pipeline from Big Lake to Fairbanks. Some upgrades to the existing power transmission intertie system between Anchorage and Fairbanks are under consideration. There are the*** preparations for the 1994 Winter

Table 4.7.20-3

Percentage Change in Emissions 1995-2020

	Percentage Change from Reference				Percentage Increase Max Over Int. Case	
	SO_2		NO_x			
Year	Int	Max	Int	Max	SO_2	NO_x
1995	0.95	1.54	1.53	1.79	0.59	0.26
2000	0.97	1.55	1.71	2.12	0.58	0.41
2005	0.79	1.45	1.45	1.97	0.65	0.51
2010	0.83	1.47	1.40	1.84	0.64	0.43
2015	0.77	1.35	1.28	1.65	0.57	0.36
2020	1.15	1.26	1.19	1.82	0.11	0.61

Source: Tables 3.1.2, 3.2.2, and 4.0.

Olympics, should Anchorage be selected, and a few other significant potential developments such as the Hatcher Pass Recreational Area, the Eagle River ski area, and the City of Anchorage port and marina facility. These potential activities were included in the evaluation of cumulative impacts.

As with the proposed project to Anderson Bay, most of the area along the Cook Inlet-Boulder Point alternative route is economically depressed and would probably absorb the project construction and operation effects with minimum detrimental social impacts. Along the Parks Highway portion of the route, the communities deal with thousands of tourists per day during the peak summer months, and that highway is heavily used as the main transportation corridor between Anchorage and Fairbanks. The Kenai Peninsula has accommodated major energy developments and related employment booms in the past. Existing infrastructure of the northern part of the route, including housing, schools and shopping centers, could not accommodate project needs within the Parks Highway Corridor and would require expansion. On the other hand, the Kenai Peninsula could easily accommodate this project with existing resources and infrastructure. Both the Matanuska-Susitna and the Kenai Peninsula Boroughs, as well as the state as a whole, would benefit significantly from the cumulative benefits of severance and property tax revenues derived from the project and its facilities and royalties associated with the sale of state-owned natural gas. Such impacts would be moderate.

Though no pipeline facilities would be located within the bounds of the Municipality of Anchorage, the city does have the infrastructure to support pipeline construction activities. The city presently has a major surplus of existing residential and commercial space and under present circumstances should have not difficulty supporting preparation for the 1994 Olympics or any of the other identified potential developments.

There is considerably more private land along the alternative route, and recreational uses are more intense on a local basis. Cumulative impacts to land use would, therefore, be moderate in these areas. A pinch point would include the Nenana River Canyon near Denali Park where future development would likely be precluded. The TAGS Cook Inlet-Boulder Point alternative would probably be beneficial for proposed expansion of recreational facilities except in competing for personnel use and commercial fish resources.

Cumulative impacts to transportation would be minor during construction due to the proximity of construction to the Parks Highway and the Alaska Railroad for much of the route and the present heavy use of this highway and railroad, especially during the summer. There would be some impacts of the TAGS construction on transportation. Impacts would be due mostly to traffic delays and damage to the existing roadways, plus the creation of new access roads from the highway to the work pads. Commercial air transportation would be able to accommodate the increase, although current air traffic for small planes is quite heavy along the lower part of the proposed route. Cumulative impacts would be minor. Some restrictions might need to be implemented during construction for increased safety. Marine transportation is quite reduced, presently due to the poor economic conditions, and would be able to handle increased volumes of materials and equipment necessary for construction. ***Increased vessel traffic in Cook Inlet as a result of the Cook Inlet-Boulder Point alternative could cause establishment of a VTS program by the Coast Guard. An EIS is currently being developed to address the proposed development of a port facility at Point McKenzie in Upper Cook Inlet. The project is being planned by the Matanuska-Susitna Borough.***

Noise impacts along the Cook Inlet-Boulder Point alternative route would probably affect more people and fewer wildlife than the proposed route. Local noise levels are quite evident near the highway and rail system and along the major flight paths for light planes in the Lower Susitna area. For some parts of the Cook Inlet-Boulder Point alternative noise levels would increase over time in areas where they are currently low. Noise impacts would be minor along most of the route during both construction and operation.

Air quality cumulative impacts along most of the alternative route would be minor. An exception would ***be*** the area near Denali Park and Preserve, which is one of the few Class I air quality areas in Alaska. There could be a compliance problem during construction; also, if a compressor station were located nearby, the Lower Matanuska-Susitna Valley, especially the area near Cook Inlet, is presently a nonattainment zone ***for CO. Any additional incremental*** emissions would ***be prohibited. There are provisions for tradeoffs which suggests that appropriate air emission authorizations could be given by ADEC.***

Assuming compliance with present state and federal laws and permit stipulations, there should be no cumulative impacts due to the proposed increases in solid, liquid, or hazardous waste production.

There would be some potential for cumulative impacts to soils along the route where the pipeline was placed close to the existing highway and railroad beds. Overall impacts would likely be the same as for the proposed TAGS project.

The cumulative impacts to ground and surface waters would be similar but less than those impacts described for the proposed route in Section ***4.7.9***. There are a few areas where surface runoff patterns would be altered by constructing a buried pipeline adjacent to the existing highway and railroad beds. These impacts would be minor. There should be negligible impacts to ground-water resources.

Cumulative impacts to the marine environment would be similar to those for the proposed route, but somewhat less, primarily because no filling is necessary. Impacts would include increased vessel traffic in Cook Inlet, an increase in potential for collisions and resultant oil and gas spills, and additional structures near salmon migratory pathways. Overall cumulative impacts to the marine environment of Cook Inlet would be minor.

Impacts to fish resources along the Parks Highway and the Alaska Railroad would be somewhat similar to those for the proposed TAGS. The proximity of Cook Inlet-Boulder Point alternative to extremely productive fish holding, spawning, and *sports fishing areas along the route* would result in minor to moderately impacts. *Construction period impacts to sports fishermen would be moderately severe and difficult to reduce. Operations impacts would be minor.*

The area disturbed by cover removal is very similar for both the proposed and alternative routes, as are the vegetation types; therefore, the cumulative impacts would be similar. The Cook Inlet-Boulder Point alternative passes through extensive wetland areas near Minto Flats and along the lower Susitna River. A considerable amount of wetlands is already disturbed along the alternative route by the Parks Highway, the power transmission lines, the railroad bed, and the existing Beluga, gas pipeline. The impacts to vegetation on wetlands would be similar to those for the proposed TAGS except for the two roadless areas near Minto and Susitna Flats. Impacts there would be termed moderate.

Impacts to the important big game species may vary as to their cumulative impacts along the Cook Inlet-Boulder Point alternative. Large numbers of moose use much of the area for winter habitat. An increase in rail and highway traffic, plus an increase in hunting pressure due to construction workers would result in increased winter kills by train and road traffic and by more hunting pressure on moose along much of the route. There would be little or no cumulative impacts to caribou along the route due to the increased traffic. Hunting is already restricted to permit only and there should be little uncontrolled additional impact.

There should be little additional or cumulative impact to the bird populations except in the area of Minto Flats and the Susitna State Wildlife Refuge. In these areas, there would be minor additional impacts due to the project and potential additional projects.

There will be no direct impact to threatened or endangered species, therefore no cumulative impacts.

There are significant and extensive recreation resources along the alternative route, including the Denali Park and Preserve, Minto Flats, Denali State Park, the streams along the Lower Susitna River, and the Susitna Flats area. There are some impacts to these areas at present, and cumulative impacts would be moderate to these resources during construction and operation.

Primary impacts would result from traffic delays, dust, construction noise, torn up roads and increased competition for all recreational resources.

The aesthetic quality of the areas along the Cook Inlet-Boulder Point alternative route would be considered superior at present. Cumulative impacts to aesthetics would likely be moderate along the route. The Cook Inlet-Boulder Point alternative has several scenic areas, including *proposed* Minto Flats *State Game Refuge*, the Denali National Park and Preserve, and the Broad Pass areas. These areas would be affected most during construction. Impacts should be minor thereafter.

Wilderness value and potential is high high along the Cook Inlet-Boulder Point route which crosses a designated wilderness area in Denali National Park and Preserve. Impacts to the route would be considered moderate for this category as to cumulative impacts due to increased activity near the park, traffic delays, and possibly reduced or restricted access.

The potential for cumulative impacts to cultural resources such as archaeological sites would be moderate along the Cook Inlet-Boulder Point alternative route due to the importance of some of the sites known and suspected to exist since the area was used as the entry by Alaska Natives to the interior Alaska. Cumulative impacts to this route would be greatest during construction and negligible thereafter.

Cumulative impacts to subsistence would be increased with heavy use areas near Minto Flats, *the Nenana Corridor, and the Upper Cook Inlet communities. These impacts would be similar to those discussed for the proposed TAGS project, with Minto, Nenana, and Cantwell being the most likely to be affected.*

4.8 MITIGATION MEASURES

YPC, during its initial phase of developing the proposed TAGS project alignment and facility location, took into account: 1) special engineering requirements needed to successfully build *and operate a buried, chilled, large diameter natural gas pipeline in arctic and subarctic conditions; 2) environmental issues associated with Alaskan use and enjoyment of fish and wildlife for viewing, subsistence, commercial, and sport purposes; and 3) social factors such as local employment, availability of local and state infrastructures, housing, air and water quality, access to public lands, and the relationship of TAGS to TAPS, ANGTS, highways, and other utility transportation systems. Mitigation measures identified by YPC were summarized in Chapter 2.8, Mitigative Aspects of the Proposed Project, in the DEIS. These YPC proposed mitigation measures have been used in the EIS to evaluate how the proposed TAGS project might change the existing social, environmental, and economic fabric of Alaska.*

In addition to mitigation measures developed by YPC and submitted to BLM and USACE as part of its formal applications, the BLM and USACE evaluated prior mitigative requirements used in federal authorizations in 1974 for the construction, operation, maintenance, and termination of TAPS, an existing 806-mile hot oil pipeline system generally paralleling the proposed TAGS alignment. Special consideration was given to those mitigation measures which were proven effective during the 10-plus years of operation. A similar evaluation was made of the 1980 federal authorization to build, operate, repair, and terminate a 745-mile-long buried, chilled, large diameter natural gas pipeline system in Alaska. Special attention was given those mitigation measures for ANGTS directed to the 550-mile segment in the vicinity of the proposed TAGS alignment.

BLM and the USACE discussed potential mitigation measures for the proposed TAGS project with federal and state authorizing entities also cooperating in the preparation of this EIS. This interagency consultation by BLM and USACE had a primary intent to develop comparable mitigation requirements and, to the maximum extent possible, common wording for issues also of concern to other agencies (e.g. revegetation of disturbed areas). Mitigation measures used in the 1974 and 1980 Alaska pipeline federal authorizations were reviewed to assure those mitigative approaches still reflected environmental, social, and technical concerns in the light of current law, policy, and technology. Included in these consultations were FWS, OFI, DOT-OPS, FERC, EPA, ADNR, ADFG, ADOT/PF, and ADEC. Alyeska Pipeline Service Company, Northwest Alaskan Pipeline Company, and YPC also were consulted.

YPC has used a tiered concept for development of detailed information. Accordingly, BLM and USACE would use a tiered approval system that requires YPC to prepare detailed information and submit it for review and approval before proceeding to the next phase. For example, BLM will not approve the start of project construction before the place of export has been approved by FERC and ERA has issued an export license. The fundamental approach used in the tiered mitigation process is: the development and approval of Design Criteria, Final Design, and issuance of a "Notice to Proceed." The start of construction would be preceded by approval of a final design that included analysis of environmental and social issues; analysis demonstrating BLM and USACE requirements had been met; maps and engineering scale drawings showing exactly what would be done and where; schedule; and relation, if any, to TAPS, ANGTS, state highways, and other transportation-utility systems. Table 4.8-1 lists the proposed requirements for development of comprehensive plans and/or programs for the next tier.

Mitigation measures to minimize negative effects and promote positive effects proposed by YPC included the following guidelines :

- *Ensure TAGS is structurally sound; reduce potential for accidents or leaks.*
- *Minimize soil and vegetation disturbance; reduce frost heave; maintain permafrost regime, and, minimize disturbance to surface/subsurface hydrology.*
- *Conserve limited resources, including water supplies and gravel.*
- *Prevent undue and unneccessary disturbance to fish, wildlife, and marine ecosystems.*

- *Minimize potential damage to existing structures, facilities, and operations.*

- *Give priority to Alaskan hire and equal opportunity hiring.*

- *Minimize disturbance of, or access to, local rural subsistence resources.*

Table 4.8-1. Summary of Comprehensive Plans and/or Programs Required by BLM and USACE Proposed Authorization for TAGS

Access Roads
Air Quality
Blasting
Camps
Clearing
Compressor Station Siting
Cultural Resource Protection
Environmental Briefings
Erosion and Sedimentation Control
Fire Control
Human Carnivore Interaction
Liquid Waste Treatment
Mineral Material Exploration and Removal
Oil and Hazardous Sustances Reporting Control, Cleanup, and Disposal
Overburden and Excess Material Disposal
Pesticides, Herbicides, Chemicals
Quality Assurance and Quality Control
Restoration and Revegetation
River Training Structures
Seismic
Snow and Ice Work pads and Snow and Ice Access Roads
Solid Waste Management
Stream, River, and Floodplain Crossings
Surveillance and Maintenance
Visual Resources
Wetland Construction

Table 4.8-2 summarizes major mitigation concepts applicable to the proposed action. Mitigation measures identified by YPC as part of its formal application to BLM and USACE have been used in predicting the probable environmental and social effects of TAGS. Additional mitigation has been identified by BLM and USACE that could further reduce bad effects or increase good effects. Comments on the DEIS showed both confusion and concern on specifically what mitigation measures would be used if the TAGS project were authorized. Accordingly, mitigative aspects proposed by YPC discussed in Chapter 2.8 of the DEIS have been consolidated in this subsection and are presented in Table 4.8-2.

4.9 QUALITY ASSURANCE/QUALITY CONTROL (MONITORING)

The key to ensuring compliance with the mitigation measures proposed by YPC would be developed through the NEPA process and various federal, state, and local laws and regulations, ***and an*** effective monitoring program. The monitoring task generally would be divided into the design review phase and the field monitoring phase. A variety of institutional arrangements have been used to monitor other large projects like this one.

The government could assemble a staff of people with appropriate expertise within its organization to perform both the design review and the field compliance monitoring or it could contract for these services. ***Department of Interior*** (DOI) included detailed environmental and technical pipeline engineering stipulations requiring design review and field monitoring in the grant of right-of-way for TAPS. To enforce the grant, DOI established the Alaska Pipeline Office (APO) with expertise in construction management; civil, structural, electrical, and soils engineering; geology; and hydrology. The staff also included specialists in the natural resource and environmental fields. Mechanics Research Incorporated, the APO technical support contractor, provided additional expertise in welding, corrosion, seismic design, pipe engineering, and other disciplines. At the peak of TAPS construction, APO had approximately 150 federal and contract personnel monitoring the project. Initially, the APO reported directly to the Secretary of the Interior. Two years after pipeline startup the responsibility was delegated to BLM's Alaska state director, where it remains.

A formal cooperative agreement was signed between the State of Alaska and DOI

Table 4.8-2. Summary of Major Mitigation Concepts Applicable to the TAGS Project 1/

- Design, construct, operate, and maintain TAGS so there is minimum risk of system failure (YPC)a/ c/.
- Develop a project control system to give rapid detection of leaks and to provide rapid system shutdown (YPC)a/ c/.
- Install remote block valves upstream and downstream of meter stations, compressor stations, aerial river crossings, and active fault crossings (YPC)a/ c/.
- Maintain at least a minimum separation of 200 feet between TAGS and TAPS facilities and with the ANGTS alignment (YPC)a/ c/.
- Develop criteria, and design TAGS to continue safe operation during a design contingency earthquake. Develop and use design operating earthquake plans and procedures (YPC)a/ c/.
- Use above-ground mode for active fault crossings. Use of elevated on-steel beams on vertical support members or on steel beams at grade similar to those used for TAPS (YPC)a/ c/.
- Incorporate an automatic fail-safe shut-off valve at each loading area at the marine terminal to prevent LNG spillage during emergency conditions (YPC)a/.
- Design LNG plant to withstand snow loads that exceed the average annual snowfall of 300 inches at Valdez a/.
- Conduct intensive, site-specific geologic studies at Anderson Bay LNG Plant and marine terminal with special attention to:
  - Foundation materials;
  - Spoil removal, use, and disposal;
  - Earthquakes;
  - Failure of cut slopes (YPC)a/ b/.
- Avoid areas where icing regularly occurs. If cannot avoid, use special designs or operational/maintenance programs to maintain existing surface and subsurface hydrology (YPC)a/ b/.
- Limit amount of vegetation disturbance to the construction area to the maximum extent possible (YPC)a/ b/.
- Provide negative buoyancy at buried water crossings and in saturated, unfrozen soils by use of granular backfill material, bolt-on concrete weights or concrete sleeves (YPC)a/ b/.
- Schedule ditching operations to minimize the time the ditch is open (YPC)a/ b/.
- Develop design criteria for a 5- and a 10-unit compressor station system that considers:
  - Overall system operating reliability;
  - Frost heave;
  - Noise;
  - Air quality;
  - Fish and wildlife (BLM)a/ b/.
- Reduce channel or shoreline modification by scour or erosion by backfilling the pipeline ditch in water bodies with material equal to or better than the original bed material (YPC)a/ b/ c/.
- Design stream, river, and flood plain crossings at right angles if at all possible (YPC)a/ b/ c/.
- Design temporary drainage structures to withstand at least a 5Q discharge. Permanent drainage structures would be designed to withstand at least a 50Q discharge (USACE)a/ b/ c/.
- Authorizations to proceed would be given on the basis of system-wide status. For example, the place of export and export license would be granted before BLM and USACE approved pipeline construction.
  - Field work would be approved on the basis of final design; compliance with BLM and USACE permit conditions; maps showing what and where on a construction level detail; completion of any needed supplemental environmental or subsistence evaluations; and a determination that final design does not threaten TAPS, highways, ANGTS, or other transportation-utility systems (BLM, USACE)a/ b/ c/.
- Prepare detailed reclamation plans which considers methods such as:
  - Priority to stabilization and revegetation of disturbed areas;
  - Use of native plant species;
  - Segregation of topsoil and organics, and stockpiling where reclamation would be enhanced (USACE, BLM)b/.
- Locate final alignment and facility location to avoid:
  - Sensitive wildlife habitats and sensitive fish habitats; if cannot avoid, schedule construction, operation, and maintenance work and/or use special designs to prevent undue or unnecessary effects (YPC);
  - Jeopardy to endangered and threatened animals and any candidate plants (BLM, USACE);
  - Cultural and historic sites; if cannot avoid, take appropriate action to collect scientific information on the site before it is changed (YPC);
  - Designated federal, state, or local recreation areas. If there is no reasonable alternative, use special designs and operation-maintenance programs to minimize undesirable effects (BLM, USACE)b/.
- Give special attention to final route selection, facility placement, and schedules for construciton, operation, and maintenance at:
  - Environmentally sensitive areas listed in Subsection 4.2.19 of the FEIS;
  - Military bases;
  - Poker Flats NASA facilities;
  - Backscatter facilities (BLM, USACE)b/.
- Avoid new disturbance by using:
  - Minimum length of pipeline;
  - Use of previously disturbed areas developed for TAPS, such as camp sites, mineral material sites, access roads, and communication;
  - Effective erosion and sediment control (YPC)b/.
- Water taken from fish streams and lakes would follow accepted ADF&G practices. This includes designing intake structures to prevent impingement or entrainment of fish (YPC)b/.
- Develop ways to reduce or eliminate any significant restrictions to subsistence use by local rural Alaskan residents during construction as discussed in Subsection 4.2.17 of the FEIS. This would include:
  - Prohibition of TAGS construction workers from hunting while domiciled at TAGS construction camps;
  - Environmental briefing all TAGS employees when appropriate to their work location;
  - Keeping new access open only if needed for operation and maintenance of TAGS or for other uses of public lands;
  - Blocking and stabilizing all temporary access roads used in TAGS construction (YPC)b/.
- Mobile ground equipment would be operated in wetlands or water bodies only when specifically approved in advance (BLM, USACE)b/.
- Conduct open burning of slash and construction wood/paper in accordance with State and local requirements (YPC)b/.
- Incorporate all appropriate permit stipulations into all contracts issued by YPC (YPC)b/.
- Give priority to employment of Alaskan residents in addition to Equal Opportunity hiring (YPC)b/.
- Provide natural gas take off points for in-state use of Alaskan North Slope natural gas as directed by APUC (YPC)b/ c/.
- Maintain existing traffic patterns on state highways and local access roads to the maximum extent possible. This would include:
  - Providing bypasses;
  - Scheduling road closures with ADOT/PF to coincide with the period of minimum traffic;
  - Use of short construction spreads in key areas along existing highways such as Keystone Canyon, Phalen Creek, and Atigun Pass (YPC)b/ c/.
- Minimize environmental impacts during gravel extraction through:
  - Use of existing mineral material sites (YPC);
  - Selecting new sites that minimize the biological significance of habitat alteration (YPC);
  - Designing and developing upland sites to maximize potential for revegetation and minimize potential for erosion and adverse visual impact (YPC);
  - In flood plain sites, adherence to biologically accepted practices, including those summarized in the FWS, 1980 study (YPC);
  - Maintain at least a 500-foot buffer of undisturbed vegetation between mineral material sites and state highways unless specifically approved. Blend layout of material sites with surrounding terrain BLM)b/ c/.

- Inspection of 100 percent, where practicable, but nor less than 90 percent of the main line girth welds using non-destructive inspection techniques (BLM)a/b/
- Develop and use a testing and monitoring program to ensure structural integrity of the pipeline system and LNG plant that meet DOT standards as a minimum (YPC)a/ b/ c/.
- Avoid slopes having inherent instability. Where such slopes cannot be avoided, use most favorable location, taking into account:
  - Liquefaction;
  - Erosion and sediment control;
  - Operation and maintenance programs;
  - System integrity (YPC)a/ b/ c/.
- Develop and incorporate erosion control practices in all elements of the TAGS system for the control of erosion, sedimentation, production, and transporation-deposition of eroded materials. This includes:
  - Energy dissipators;
  - Riprap or other bank protection measures;
  - Culverts, dikes, or berms;
  - Overburden and spoil storage, use, and disposal;
  - Buffer areas;
  - Ditch plugs (YPC)a/ b/ c/.
- Develop frost heave design appropriate to the final alignment. Localized situations would consider chilled pipe/soil thermal interaction and surface and subsurface hydrology. Primary attention would be given to use of thicker-walled pipe, but localized conditions could include such measures as insulated pipe, insulated ditch, removal and replacement of frost-susceptible material in the pipe trench, above-ground berms around insulated pipe, or varying the operational temperature of the gas (YPC)a/ b/ c/.
- Where soil-water-pipe interactions are believed to create thermal conditions favorable to significant frost heave, specific designs to maintain hydrologic regimes would be developed. These measures may include:
  - Reduction of pipe cover over very short lengths;
  - Deeper burial of pipe;
  - Removal of some or all uplifted soil (YPC)a/ b/ c/.
- Create minimum disturbance in wetlands and limit the number of river, stream, lake, and wetland crossings (BLM, USACE)b/.
- Avoid water pollution by:
  - Effective use of an approved erosion control plan (YPC);
  - Use of containment dikes or other suitable impervious means around fuel or other hazardous substance storage areas (YPC);
  - Construction camp fuel distribution system located in utilidors, welded joints, metering, or other suitable means to monitor fuel distribution (YPC);
  - Collect all waste oil from TAGS equipment and take to an approved disposal site (YPC);
  - Secondary treatment of combined waste water from LNG plant and marine terminal (YPC);
  - Use medium energy outfall diffuser to mix fresh water effluent with sea water over short distance at LNG secondary treatment discharge point (YPC);
  - Confine test water releases to approved places, including, as necessary, settling basins (YPC);
  - Keeping snow bladed from road or facility surfaces from entering wetlands or water bodies (USACE);
  - Have an approved Spill Prevention Control and Countermeasure Plan before fuel or hazardous substances are moved to a site (YPC);
  - Use special design when a frost bulb might adversely affect existing water quality to an overwinter fish area (BLM, USACE);
  - Reballast empty LNG tankers with open ocean water before entering Prince William Sound (YPC);
  - Incinerate sludges and skimmings from the oil/water separator in an approved incinerator (YPC).
- Avoid wildlife harassment by use of:
  - Environmental briefings;
  - Fencing facility areas and use methods for disposing of putrescible wastes that do not attract carnivores;
  - Schedule construction, operations, and maintenance programs at times to avoid undue stress during sensitive life cycle periods (YPC)b/.
- Minimize gravel usage as much as possible through use of workpad designs utilizing thinner gravel overlay and winter construction (YPC)b/ c/.
- Where feasible, consider use of ice, snow, or ice and snow workpad to minimize potential disturbance and reduce use of mineral material volumes (YPC)b/ c/.
- Draw water for hydrostatic testing and for snowpads only from designated surface water sources with the capacity to supply required volumes without adverse affects in the aquatic environment (YPC)b/.
- Protect existing telephone and electric transmission lines, roads, other pipelines, and other improvements during construction, operation, and maintenance of the TAGS system (YPC)c/.
- Locate downslope of existing roads and other pipelines to the maximum extent possible (YPC)b/ c/.
- Minimize number of crossings of TAPS pipeline, ANGTS alignment, and state highways (YPC)c/.
- Coordinate design and construction for highway, private roadways, access roads, or highways, Alyeska Pipeline Service Company, ANGTS, or private landowner (YPC)c/.
- Ensure that the integrity of the TAPS pipeline would be protected during the construction, operation, and maintenance of the TAGS project (YPC)c/.
- Incorporate policies and procedures to ensure that existing federal authorizations for ANGTS are reasonably protected (BLM)c/.
- Utilize blasting control measures when blasting near existing facilities to avoid damage to them (YPC)c/.

:FOOTNOTES:

1/ The applicant (Yukon Pacific Corporation) has formally submitted to the Bureau of Land Management (BLM) and the U.S. Army Corps of Engineers (USACE) mitigation measures that range from engineering to social and environmental. These applicant-proposed (YPC) measures are deemed to be part of its application and are reflected throughout the EIS as measures that would be implemented. Conceptual mitigation measures shown in Chapter 2.8 of the DEIS are incorporated in this table. Many measures that can be identified as "engineering" design concepts to improve pipeline system integrity also have a direct and positive effect on fish and wildlife, e.g., maintenance or operational measures are reduced or can be scheduled at non-disruptive times to fish and wildlife populations. Additional mitigation measures have been identified by BLM and/or USACE that could further reduce adverse effects or enhance desirable results.

a/ Mitigation measure associated with TAGS system integrity.
b/ Mitigation measure associated with environmental or social effects from TAGS.
c/ Mitigation measure associated with protection of adjacent transporation or utility systems.

for the construction phase of the TAPS project. The three primary features of this agreement dealt with (1) making the DOI and State of Alaska pipeline right-of-way and lease stipulations as similar as possible, (2) enforcing fish and wildlife stipulations, and (3) design review and field monitoring of technical pipeline engineering aspects of the project to ensure pipeline integrity. USACE has utilized contractors to perform its permit compliance monitoring on the North Slope of Alaska.

The Joint Federal/State Fish and Wildlife Advisory Team was formed to monitor compliance with environmental stipulations in the field irrespective of landownership. Though ADF&G issued Title 16 fish habitat permits under its own authority, federal and state biologists provided advice to both the federal authorized officer and the state pipeline coordinator.

DOI provided design review and field monitoring of the project for pipeline integrity irrespective of landownership. The *DOI's* authorized officer did not enforce environmental provisions on state land.

The Alaska Natural Gas Transportation Act established OFI to coordinate and monitor Federal activity concerning ANGTS. Reorganization Plan No. 1 of 1979 transferred to Office of the Federal Inspector (OFI) exclusive responsibility for enforcing all Federal statutes relevant to ANGTS. OFI coordinates its activities with those of other Federal agencies in order to provide "one-window" service for obtaining necessary Federal permits and authorizations for ANGTS and to eliminate unnecessary duplication and administrative burden in the enforcement of those permits and authorizations. OFI mobilized and attained its statutory purposes successfully during the construction of the Eastern and the Western Legs (the prebuild portions) of ANGTS. In this effort, OFI utilized employees of other Federal agencies and technical support contractors to supplement its staff. OFI reduced its staff following completion of the Eastern and Western Legs. OFI currently monitors events relevant to ANGTS and exercises its coordination and enforcement responsibilities where appropriate. OFI is prepared to remobilize fully when work begins to complete ANGTS.

Government used a self-monitoring concept in connection with the Exxon LaBarge Gas Field Project in western Wyoming. This project involved development of a deep gas field located primarily on lands administered by BLM and USFS. The concept agreed to by Exxon, BLM, and the USFS for monitoring construction consisted of a comprehensive industry quality assurance/quality control (QA/QC) program with federal oversight. Exxon contracted for its QA/QC from two different companies and monitored itself for compliance with all permit and regulatory requirements. To interact with the Exxon AQ/QC staff, BLM and the USFS jointly appointed two authorized officer's representatives (AOR), one from each agency. The AOR's jurisdiction covered the entire project without regard for the administrative boundary between BLM and USFS lands. The primary role of the AOR team was to oversee the effectiveness of the Exxon QA/QC program.

For purposes of this EIS, the joint federal and state monitoring team has been assumed to be not more than 120 people including contract support (see Table 4.2.2-1). Inclusion of this 120-person figure is for evaluation purposes and should not be construed that an APO or OFI type of organization has been selected as the preferred federal or state approach to TAGS monitoring. There is, however, a firm commitment by both federal and state entities that there be an effective and appropriate level of monitoring of the TAGS project.

The type and size of organizations doing the design review and field monitoring of the proposed TAGS project would vary depending on a number of factors. Among them are construction schedules, level of new environmental concerns, and creation of new technical engineering solutions to construct and operate a buried gas pipeline in arctic and subarctic conditions. BLM has initiated preliminary discussions with YPC and federal and state agencies having approval/monitoring authorities over projects such as TAGS to identify agency roles and responsibilities. These roles in turn will be used to evaluate the various federal/state institutional arrangements to select one that provides efficient, proper environmental protection.

For example, the BLM, USACE, and OFI have initiated discussions to clarify respective roles where these areas overlap between YPC, TAPS, and ANGTS. ***As a result of these discussions, the right-of-way for TAGS would set forth the responsibilities of the Federal Inspector under Reorganization Plan No. 1 of 1979 and would contain specific provisions to facilitate the exercise of these responsibilities. In addition, BLM and OFI are working on a Memorandum of Agreement that would specify the way in thich BLM and OFI would exercise and coordinate their respective roles in areas where ANGTS and TAGS could interact.***

4.10 UNAVOIDABLE ADVERSE IMPACTS

The construction and operation of the previously proposed El Paso pipeline system, LNG plant site, and marine terminal would result in certain unavoidable adverse environmental impacts like those for TAGS. These impacts are similar to those discussed for the El Paso project and are therefore adopted by reference where applicable for the TAGS project. (See FPC 1976a, pages II-365 and II-367.)

Impacts during the construction phase would be, for the most part, of short-term duration and mitigatable. Most impacts associated with the operational life of the project would be less severe but of long-term duration. The following paragraphs discuss the adverse effects remaining after appropriate mitigative measures such as those identified in Section ***4.8*** are applied.

The proposed TAGS project, with fewer employees than TAPS, would create an employment pattern similar to TAPS in that both resident Alaskans and jobseekers from outside Alaska would vie for construction and operations employment. Jobseekers coming to Alaska who do not find employment would have to rely on state social services. ***Since most of the unemployed job seekers coming to Alaska would likely be single (or not bring families until they have a job), they would probably leave the state relatively quickly if they do not find employment.*** Large numbers of workers would be employed during the peak construction period. Once construction is completed, the existing job market would not be able to absorb those unemployed, and there would be an increase in unemployment.

Land-use impacts would include the temporary use of approximately 23,000 acres of directly disturbed area which would be cleared. This loss would be minimized since the proposed TAGS project would be constructed within an existing designated utility corridor, and this disturbance would not significantly modify local land use. Most existing land-use plans would apply to the TAGS project and would not have to be changed to accommodate the proposed action. ***However, the plan might need to be updated after construction of the TAGS project to reflect changes.***

Moderate but long-term land-use impacts would occur to the approximately 8,000 acres which occur in the pipeline right-of-way and area occupied by the associated facilities, including the LNG plant and terminal. The work pad, material sites, access roads, and right-of-way would be removed from present uses for the life of the project.

Construction activities, increased highway travel, construction equipment, compressor stations, the LNG tankers, and the LNG plant would all add incremental amounts of dust, nitrogen oxides, sulfur oxides, carbon monoxide, and particulates to the air. These emissions would typically be diluted over a very large area. Air quality degradation would be negligible except in the Valdez area, where more concentrated emissions would occur in an area already impacted by air emission from Alyeska Marine Terminal operations, including oil tankers.

Some surface and ground water would be used during the project. This amount would not constitute a serious loss to available supplies. Care would be taken to prevent dewatering of sensitive areas such as fish overwinter areas. Silts would enter the surface water from several sources, including melting of soil-rich ice in spoils deposits, erosion from access roads and camp/construction pads, and placement of culverts. Excavating streambeds for pipeline burial would temporarily result in possibly high levels of turbidity. These factors would lower water quality, at least on a temporary basis.

Frost bulb formation in streams, should it occur, could result in modification of springs and could change subsurface flow and flow regimes of surface waters.

Unavoidable spills of fuel and other contaminants would also result in some local water quality degradation. Discharge of wastewater effluents would result in a local decrease of dissolved oxygen and locally heavy nitrate and phosphate loading, thereby changing surface water quality.

Ground water would probably not be affected except by depletion, given the applicant's mitigating proposals.

Construction of the marine terminal and dock would result in the loss of under 100 acres of benthic habitat. The LNG plant wastewater discharge would decrease marine water quality, at least in the mixing zone.

An undetermined amount of loss of seabird and waterfowl resting habitat would occur in Anderson Bay. The exclusion zone around the dock and facilities would result in loss of the some nearshore area to be used by commercial and sports fishermen. Monetary loss is possible but would probably be negligible. Existing uses of the upland ridge top areas of the Chugach National Forest at the LNG plant site is light and unquantified. For safety reasons, firearm discharge would be prohibited on about 1,500 acres of public land.

There would be a direct loss of about 23,000 acres of vegetation along the right-of-way and around related facilities. Some of this area would be allowed to revegetate to low-growing species. This will be accomplished by both natural and artificial revegetation.

There would be a permanent or temporary loss or disturbance to approximately 3,200 acres of wetlands. Some changes to surrounding vegetation due to construction would be unavoidable. Disturbance of the vegetation cover would result in soil erosion and thermokarsting, which would eventually stabilize. Vegetation near access roads would be affected by dust and thermal degradation of permafrost near the gravel. Spill of diesel, methanol, and lubricants would kill some vegetation and might sterilize the soil locally for years. Changes in surface sheet drainage patterns would result in the loss of some existing wetlands vegetation and change in species composition in other areas.

Some Dall sheep winter range and lambing habitat would be disturbed during construction, resulting in temporary avoidance of these areas. If satisfactory alternative habitat is available, no losses should occur, but winter range and lambing grounds are limited on the north slope of the Brooks Range.

Some direct displacement loss of riparian moose habitat would occur. Noise and human activity during construction would cause avoidance of certain areas, especially during calving. Traffic increases would result in increased moose fatalities due to collisions, especially during severe winters.

Additional project-related traffic during construction would also result in direct mortalities to large game animals in the Delta Junction area. Some direct loss of bison habitat and farmland would also occur in this area.

Human presence is essentially incompatible with wolf, brown bear, lynx, and wolverine populations. The TAGS project, as would any major construction project, could result in legal and illegal shooting and collisions with vehicles. Other animals such as bear and fox are more tolerant of human intrusion and can become habituated to camps and work sites due to the presence of garbage and food handouts by employees. Such occurrences would result in human/carnivore interaction. The outcome would normally be the destruction of the problem animal. Animals were destroyed during the construction of TAPS. The Arctic National Wildlife Refuge, Alaska Coastal Plain Resource Assessment (1986*a* and *b*) predicted the loss of one brown bear per year due to human/carnivore conflicts or accidents. It appears to be a reasonable number for the TAGS project as well.

Swans and loons are very sensitive to disturbance, especially by low-flying aircraft, during breeding and nesting periods. The project would result in some displacement loss of habitat for these birds during construction.

There would also be some loss of waterfowl nesting habitat during construction. Some species are very sensitive to and would possibly abandon the corridor during construction and possibly operation, resulting in some loss to these populations.

There would be some displacement habitat loss for tundra-nesting shorebirds during construction. Many shorebirds avoid heavily traveled roads and dusty areas, and this would reduce breeding and nesting habitat. There might be small losses to hawks and owls due to collisions with vehicles and structures.

Disturbance or displacement of endangered Arctic peregrine falcons and/or their prey could result from construction near occupied nesting sites. Several such sites are fairly close to the route.

Disturbance to protected bald eagle nests would be avoided.

Wilderness and recreational opportunities and values would be lost or reduced in the area of the pipeline especially during construction. There is no way to avoid these impacts. Though they are difficult to quantify, losses would occur essentially along the entire route of the pipeline and would be relatively short term. Some state 4(f) lands would be temporarily altered.

Aesthetic and wilderness values would be reduced for the area near the pipeline or its related facilities. There would be scars visible due to the buried pipeline berm, borrow pits, access roads, and compressor stations. These impacts are also unquantifiable but long term along the relatively narrow utility corridor.

There would be unavoidable impacts to subsistence resources during construction. Regulations governing use and crossing of the area during construction or operation could result in restriction of access to traditional subsistence areas. The short-term access to a cash economy would change subsistence use patterns for a short period for some Native communities.

In summary, there would be some unavoidable adverse impacts due to the projects. These impacts are similar to those incurred in construction of the TAPS project and those anticipated with the authorized ANGTS project. Impacts from TAGS ***will be*** somewhat less in severity ***than those observed for TAPS and evaluated for ANGTS*** due to the use of an already disturbed, designated industrial corridor and an existing infrastructure.

4.11 RELATIONSHIP BETWEEN SHORT-TERM USES AND LONG-TERM PRODUCTIVITY

In general, "short term" has been used throughout this EIS to mean the construction period and an operations duration of up to 20 years. "Long term" has been used to refer to that time beyond 20 years. However, for this subsection, the definition of long term relates to the life of the project, which is expected to be between 20 and 40 years.

Changes to the environment in the vicinity of the TAGS project and most impacts would be considered short term, with many of the greatest impacts occurring during the construction and early operational phases of the project. If these impacts were properly mitigated, the overall loss of productivity would be short term. These effects include removal and disturbance to wildlife and vegetation, increased turbidity in surface waters, habitat loss in the marine system, disruption to local land traffic patterns, and increased local populations centered around TAGS construction camp locations. The length of time for which these impacts would persist at a given point along the pipeline alignment would be minimal. Small oil spills from construction equipment and ensuing cleanup activities would also have short-term effects on productivity.

Short-term employment, especially for Alaskans, could result in long-term benefits to the state economy and work force and would increase the pool of highly trained instate workers. Use of state royalty gas would have a short-term effect on productivity but would have a long-term benefit to the state's Permanent Fund. In a similar manner, the increased economic activity would mean an influx of new residents and in the short term could impact the existing economic and social structure.

Biological productivity would be lost in the short term for almost 23,000 acres of vegetation and wetlands, but with proper management most of these areas directly disturbed could be returned to varying degrees of productivity levels. Though restoration efforts might not be entirely successful the overall loss would be minor.

There would be a long-term commitment of ***up to a total of*** 33 million cubic yards of gravel material necessary for construction. This would be a significant long-term commitment since limited supplies of gravel exist within and near several portions of the corridor, and most of the gravel used for this project would not be available for reuse. ***Additionally, the potential exists for using certain air quality increments in the Valdez area which could restrict certain types of future development.***

There would be a loss of the nonrenewable natural gas resources from Alaska's North Slope. This would be offset by a net reduction of the U.S. balance of payments deficit for the life of the TAGS project. There is a reasonable probability that this project would encourage exploration for and development of additional North Slope natural gas reserves in the future which could prolong the life of the project.

4.12 IRREVERSIBLE AND IRRETRIEVABLE COMMITMENTS OF RESOURCES

A decision to approve the construction and operation of the TAGS project would irreversibly and irretrievably commit several types of resources. An irreversible commitment of a resource is one that could not change once it has occurred, while an irretrievable commitment of resource is one that could not be recovered or reused. Table *4.12-1* summarizes irreversible and irretrievable impacts for the disciplines discussed.

Construction of the project would result in irretrievable use of fuels and lubricants as well as other construction-related materials. During operation, there would be the irretrievable commitment of a daily average of 2.3 BCF of natural gas to Asian Pacific Rim markets.

Table 4.12-1 Commitment of Resources Resulting from the TAGS Project

Environmental Discipline	Irreversible	Irretrievable	Comments
Alaska Socioeconomics	No	No	No significant long-term commitment except at Valdez where the LNG plant/marine terminal would require more stringent VTS by the U.S. Coast Guard.
Land Use	Yes	Yes	A commitment for long-term use of approximtely 8,000 acres of land area along the pipeline alignment, compressor station, and at the LNG plant site.
Transportation	No	No	No significant long-term commitment.
Noise	No	No	No significant long-term commitment.
Meteorology/Air Quality	No	No	In the Valdez area certain types of future projects could be restricted.
Solid Waste/Hazardous Materials and Sanitation	Yes	No	None is expected except in the unlikely event of a major fuel spill at camps during construction or along roadways, some irreversible effects on soils, surface water, vegetation, and wildlife could result. Although most waste disposal sites would be located in remote areas, some use of existing
Physiography, Geology, Soils, and Permafrost	No	Yes	The construction of TAGS would require 33 million cubic yards of gravel. Some of this material might be retrievable, but most would be irretrievably committed. Differential heave during the life of the project would be irreversible.
Surface and Ground Water	No	No	No significant long-term commitment
Marine Biology and Oceanography	Yes	Yes	The 50 acres of subtidal habitat lands within Port Valdez would be lost.
Fish	No	No	No significant long-term commitment.
Vegetation and Wetlands	Yes	Yes	Some long-term commitment.
Wildlife	No	Yes	No significant long-term commitment.
Threatened and Endangered	No	No	No significant long-term commitment.
Recreation and Aesthetics	Yes	No	Construction of the project would affect aesthetics, resulting in irreversible commitment of resources.
Cultural	Yes	Yes	For those sites located and salvaged, there would be an irreversible commitment of resources, while for those that could be accidently destroyed, there would be an irretrievable commitment of resources.
Subsistence	No	No	No significant long-term commitment; increased competition for limited subsistence resources from construction workers at Glennallen and north of the Yukon River would cause short-term commitments.
Alaska North Slope Natural Gas	Yes	Yes	Although not all North Slope gas gas would be committed to the TAGS project, that gas committed to export would not be available for use in domestic U.S. markets and the President has determined that adequate energy supplies exist for domestic markets.

SECTION 5
CONSULTATION AND COORDINATION

5.0 CONSULTATION AND COORDINATION

5.1 INTRODUCTION

Yukon Pacific Corporation (YPC) initiated the environmental review process for the proposed Trans-Alaska Gas System (TAGS) by filing application for the right-of-way permit with the U.S. Bureau of Land Management (BLM) and an application for permits to dredge and fill with the U.S. Army Corps of Engineers (USACE). As joint lead federal agencies, the BLM and USACE received cooperation and assistance from many organizations and individuals, both public and private, in developing and coordinating the ***Final*** Environmental Impact Statement ***(FEIS)*** for the project.

5.2 ENVIRONMENTAL REVIEW PROCESS

The BLM, Alaska state office, and the USACE, Alaska District, were designated to be responsible for EIS preparation under the National Environmental Policy Act (NEPA). The Governor's Office of Management and Budget, Division of Governmental Coordination, coordinated state input into the document.

The first step in the federal process was for BLM and USACE to publish in the Federal Register on November 17, 1986, a Notice of Intent (NOI) to prepare an EIS. The second step was to identify pertinent environmental issues and concerns related to the proposed action. This "scoping" process, as it is called, included a series of public meetings to solicit comments of concerned citizens and public and private organizations. Appendix A of ***the DEIS*** summarizes the issues raised by the 170 people who attended the scoping meetings. The DEIS addresses their concerns as well as those of the cooperating agencies.

ERA elected to participate rather than prepare a parallel NEPA compliance document since ERA decided that this export authorization under Section 3 of the Natural Gas Act was a major federal action and required NEPA compliance. The FERC in its Declaratory Order issued May 27, 1987 stated than "in exercising its own statutory responsibilities under Section 3 of the Natural Gas Act, the Commission will also need to comply with NEPA, with access to an appropriate EIS."

The DEIS ***was circulated*** to federal, state, and local agencies and to the general public for a 60-day review period ***which ended November 20, 1987***. A public hearing ***was*** held during this time within the project area, as identified in ***Section 7.0 of*** this document. Agency and public comments received ***are*** incorporated ***in the FEIS in Section 7.0***.

5.3 CONTRACTS WITH OUTSIDE CONSULTING FIRMS

A contract for the preparation of a third-party EIS was executed with Harding Lawson Associates of Anchorage, Alaska (HLA). Working under the direction of the BLM, HLA was directed to collect, summarize, and synthesize relevant information and data, prepare analyses, and prepare the required documents. HLA attended scoping meetings and ***hearings on the DEIS and hearings on susistende at Glenallen.*** HLA subcontractors include: Jon Isaacs and Associates of Anchorage, Alaska, Edwin S. Hall and Associates of Stony Brook, New York, and Alaska Biological Research of Fairbanks, Alaska. Other subconsultants and HLA staff with important project responsibilities are listed along with their qualifications and specific project responsibilities in Table 5.3-1.

Additionally, the ERA subcontracted with the Argonne National Laboratory to prepare "An Assessment of the Potential Environmental Residuals in the Lower 48 States Arising from Alaskan Natural Gas Exports" (see Appendix K ***of the DEIS***).

5.4 OTHER AGENCY PARTICIPATION IN PREPARATION OF THE DEIS

The U.S. Fish and Wildlife Service has jurisdiction by law and special expertise related to the project and was designated as a cooperating agency (40 CFR 1501.6). Such an agency is to cooperate with and assist the lead agency in preparation of the document.

The following agencies ***were requested by BLM and USACE to be*** cooperating agencies:

Table 5.3-1 List of EIS Preparers

Name	Responsibility/Discipline
U.S. BUREAU OF LAND MANAGEMENT	
Jules V. Tileston	TAGS EIS project officer
Craig Altop	*Endangered Species Consultation and Biological Assessments*
U.S. ARMY CORPS OF ENGINEERS	
William M. Fowler	TAGS EIS project officer
ARGONNE NATIONAL LABORATORY	
A. J. Dvorak	Environmental scientist
S. J. Flaim	Economic analyst
R. C. Hemphill	Economic analyst
R. Neenan	Economic analyst
T. D. Veselka	Environmental scientist
A. P. S. Teotia	Economic analyst
C. Hoffstetter	Computer analyst
A. F. Longhe	Computer analyst
R. J. Love	Computer analyst
S. Ryan-Schoen	Word processor
S. Rogowski	Word processor
HARDING LAWSON ASSOCIATES (Third-party TAGS EIS Consultant)	
Michael J. Sotak, M.S.	Project manager
Andrew J. McCusker, M.S. //	Marine environment/asst. project mgr.
Gary G. Lawley, Ph.D. **//	Terrestrial/aquatic ecology
Steven A. Johnson, M.S.	Geology
Giles N. McDonald, B.A., P.E. **	Hydrology
Jon Isaacs, M.S. **	Subsistence
Edwin S. Hall, Ph.D. **//	Cultural resources
Susan R. Fison, B.A. **	Socioeconomics
Jay M. England, P.E. //	Geological, geotechnical, permafrost
Robert L. Baldwin, M.E., P.E. **//	Climate, air quality, noise
Ralph M. Isaacs, Ph.D., P.E. //	Permafrost engineering
Frederick I. Cooper, B.S. //	Air quality
Scott R. Briggs, Ph.D.	Coastal processes
Robert J. Ritchie, M.S. *	Birds
Brian E. Lawhead, M.S. *	Wildlife
M. Torre Jorgenson, M.S. *	Vegetation, wetlands
Judith A. Brogan **//	Technical editing
Sara A. Reading	Word processing
Patty L. Martin	Word processing
Janet E. Tandy	Word processing
Cristal A. Fosbrook //	Engineering technician
Joseph A. Przeczewski	Drafting

* *Alaska Biological Research*
** *Independent Consultant*
// *DEIS only*

- Department of the Interior
  - Bureau of Indian Affairs
  - Bureau of Mines
  - Geological Survey
  - Fish and Wildlife Service
  - National Park Service
  - Minerals Management Service

- Department of Agriculture
  - U.S. Forest Service

- *Department of Commerce*
  - *National Oceanic and Atmospheric Administration*

- Department of Energy
  - Economic Regulatory Administration

- Department of Transportation
  - Federal Highway Administration
  - Office of Pipeline Safety
  - U.S. Coast Guard

- Environmental Protection Agency

- Federal Energy Regulatory Commission

- Office of the Federal Inspector

- State of Alaska
  - Division of Governmental Coordination
  - Department of Fish and Game
  - Department of Natural Resources
  - Department of Transportation and Public Facilities
  - Department of Environmental Conservation

As previously stated, the Governor's Office of Management and Budget, Division of Governmental Coordination, provided liaison with the State of Alaska. Other federal, state, and local agencies, organizations, and individuals were called upon to contribute their specific areas of expertise (see Subsections 5.5 to 5.7, as appropriate.

5.5 ARCHAEOLOGICAL COORDINATION

BLM by letter of February 10, 1987 initiated action to develop a memorandum of agreement with the Alaska State Historic Preservation Office should the project be approved.

5.6 ENDANGERED SPECIES CONSULTATION

BLM, by letter of May 19, 1987 to National Marine Fisheries Service and by letter of June 3, 1987 to U.S. Fish and Wildlife Service, provided the Biological Assessment of the BLM for the TAGS project pursuant to Section 7 of the Endangered Species Act of 1973, as amended. These letters of consultation identified conservation and mitigation measures which would be included as conditions to the right-of-way grant.

By letter of June 30, 1987, the U.S. Fish and Wildlife Service concurred with the conclusion that the proposed TAGS project would not have any long-term or cumulative negative effects on the peregrine falcons should the Peregrine Falcon Recovery Plan and other protective stipulations for peregrine falcons be included in the right-of-way grant.

The National Marine Fisheries Service, by letter of July 8, 1987, also concurred with BLM that there would be no identified critical habitat in Prince William Sound for any of the three species of whales identified and that use of the construction and use of the TAGS terminal is "not likely to adversely affect" any of these species (see Appendix H).

5.7 OFFICE OF THE FEDERAL INSPECTOR

Reorganization Plan No. 1 of 1979 placed in the Federal Inspector "exclusive responsibility for enforcement of all Federal statutes relevant in any manner to pre-construction, construction, and initial operation" of ANGTS. The Federal Inspector and BLM are working on a Memorandum of Agreement (MOA) to coordinate their activities to ensure both agencies can carry out their respective roles efficiently and responsibly without imposing any unnecessary burden on the TAGS project.

5.8 TECHNICAL CONSULTATION WITH THE U.S. DEPARTMENT OF TRANSPORTATION

Consultation with the U.S. Department of Transportation (DOT), Office of Pipeline Safety (OPS) has occurred at several stages in the development of this Environmental Impact Statement (EIS). OPS is charged with *enforcement of 49 CFR 193, Liquefied Natural Gas Facilities: Federal Safety Standards. The Anderson Bay LNG Terminal must comply with 49 CFR 193 to obtain an operating permit. The FEIS incorporates information and recommendations obtained in consultation with OPS. As well, OPS has provided guidance applicable to design of the LNG terminal and key safety items addressed by 49 CFR 193. There is no precedent on how the 49 CFR regulations will be implemented since no LNG plant has been approved under these 1980 requirements. Accordingly, special consultation was initiated by BLM with OPS early in the NEPA process to assure the FEIS reflected the best available understanding on how the Anderson Bay LNG facility for TAGS would be approved.*

In addition to pipeline safety requirements, OPS assisted BLM in the technical evaluation of TAGS insofar as its compatibility with TAPS and with ANGTS where TAGS would be on or adjacent to those alignments.

The issues addressed by OPS with respect to the DEIS include the following: NEPA scope, implementation of 49 CFR 193, historic environmental data for terminal design, distances for safety, trade-offs between safety and economy, and editorial clarifications. During the review of the application modifications in 1986 by YPC, OPS also discussed the importance of LNG storage tank and impoundment design to project safety. The issues raised by OPS are discussed below.

Development of the TAGS project is proceeding within the framework of a tiered approval procedure, described in Sections 1.10 and 1.11 of this document. The FEIS is for the first of four project approval phases. Formal compliance with 49 CFR 193 will, of necessity, take place during the design, construction, and operating phases of the project.

The DEIS provided the highest historic water level recorded in the vicinity of Anderson Bay (78 ft). Referring to seismically induced sea wave data, this information was obtained from State of Alaska hazard maps. The available data indicate that it is technically feasible to construct and operate a LNG plant and provide proper protection against a seismically induced sea wave at the Anderson Bay site.

Detailed environmental data required for design of the TAGS project, including wind, rain, snow, and flood, will be collected in subsequent project phases, and utilized in accordance with 49 CFR 193. The available environmental data and the operating experiences of the TAPS oil terminal provide reasonable assurance that an LNG terminal can be built at Anderson Bay for all environmental conditions of concern.

Potential thermal radiation and LNG vapor cloud hazard zones have been computed, based on the conceptual LNG terminal. The supplement to Appendix I, contained in the FEIS, provides supporting information for Appendix I of the DEIS. For the EIS purposes, sufficient analysis has been conducted to provide reasonable assurance that the Anderson Bay site can be designed to 49 CFR 193 thermal radiation and vapor cloud hazard requirements. During terminal design, the hazard zone distances will be recomputed to reflect actual plant layout and plant equipment sizing in conformance with 49 CFR 193.

Section 4.2.18.4.1 of the FEIS states the relationship between the TAGS project and 49 CFR 193. OPS has cited that 49 CFR 193 uses performance language to the maximum extent possible. Usually, there are a number of design alternatives available to achieve the performance levels required by 49 CFR 193. Such options, all of which meet 49 CFR 193, will be subsequently evaluated during design phases in terms of reliability, safety, cost, and other factors to define the optimum configuration for the LNG terminal.

OPS noted various sections of the DEIS where editorial changes would be helpful. The FEIS contains most of the suggested changes. A few expanded editorial clarifications are provided below.

YPC will develop the Anderson Bay LNG plant in accordance with the requirements of 49 CFR 193, including applicable sections of NFPA 59A, Standard for the Storage and Handling of Liquefied Natural Gas (LNG). Over 90 percent of the LNG facilities built in the United States were built to NFPA 59A standards (prior to promulgation of 49 CFR 193 by DOT in 1980). The facilities built in accordance with NFPA 59A have enhanced *the public and worker safety record. Further, around the world NFPA 59A has been widely used as the standard for LNG facilities. These facilities have also had an exceptional safety record. As an example, the Phillips-Marathon LNG Plant at Kenai has been operating continuously for almost 20 years, without an incident.*

Frequently, process facilities are designed to meet more than one design standard. This is done by assuring that every section of the standards being utilized are met or exceeded. At an LNG plant, the net effect of meeting both 49 CFR 193 and NFPA 59A is that, in some situations, the minimum requirements of NFPA 59A will be exceeded.

Section 4.2.18.4.2 of the FEIS describes the general characteristics of LNG. LNG vapor at -259°F is about 1.58 times as dense as air. LNG vapor, when sufficiently warmed, becomes lighter than air.

The DEIS incorporated language from previous FERC Environmental Impact Statements in Section 4.2.18.4.2 with regard to a major spill concern. The intent of these cites is to identify that the probability of occurrence of a large-scale fire when compared to the probability of occurrence of a very large vapor cloud that travels well outside the plant and not the potential impact of either a fire or ignited vapor cloud.

LNG storage tanks must comply with API 620, Appendix Q, Low-pressure Storage Tanks for Liquefied Hydrocarbon Gases, to comply with 49 CFR 193, and must be tested in accordance with the strict standards of 49 CFR 193. There are about 225 double-metal-shell LNG tanks similar to those proposed by YPC in service, and some have been in service for over 20 years. There has not been a single LNG storage tank failure resulting in LNG being released into the air from tanks designed, constructed, and tested in accordance with API 620, Appendix Q.

Many of the above storage tanks are equipped with electric-powered foundation heaters. Based on information available to YPC, there are no significant problems with foundation heaters other than in hot, damp, tropical environments. Foundation heater systems for tanks in tropical locations have been replaced with minimum difficulty. Newer foundation heater designs are now being used in tropical locations to reduce the potential for foundation heater failure.

Storage tank pressure/vacuum relief design is a well-established technology. Over 275 LNG storage tanks of all design types are in successful operation around the world, and not a single tank has sustained structural damage due to pressure, vacuum, or roll-over conditions. 49 CFR 193 notes the most common method used to prevent roll-over conditions: "selective filling at the top and bottom of the tank." Tank pressure/vacuum relief valves will be sized in accordance with 49 CFR 193 during detailed design of the project.

Impoundment systems will be developed in accordance with 49 CFR 193 during detailed design of the project. Several candidate dike side wall material systems have been identified in the DEIS and FEIS. Both earthen dikes and reinforced earth dikes have been used extensively in the LNG industry. Further, both systems have been successfully tested for integrity when exposed to unignited and ignited LNG spills. Other possible dike materials, including concrete, are noted in the DEIS and FEIS. Insulation and pre-stressing might be necessary for concrete designs. The diking system selected for installation will be designed to prevent LNG spills beyond the impoundment limits.

5.9 TECHNICAL CONSULTATION WITH THE U.S. ENVIRONMENTAL PROTECTION AGENCY

Coordination and consultation with Region 10 of the Environmental Protection Agency (EPA) has occurred at several steps in the NEPA process. As a Cooperating Agency under the CEQ Regulations, EPA has made technical comments on air quality, water quality, and wetland issues associated with the proposed TAGS project. However, the primary area of technical input to this FEIS is in the area of air quality emissions. As a result of air quality comments raised by EPA during the DEIS review process (see Comment Letter 25), Yukon Pacific Corporation arranged for a detailed Work Plan for a Supplemental Air Quality Impact Analysis (Dames and Moore, 1988a) to be submitted for review and approval of EPA (EPA, 1988a). Modeling

results outlined in the approved Work Plan, including computer data runs, were submitted to EPA (Dames and Moore, 1988b) and subsequently approved (EPA, 1988b). These technical air quality modeling results are reflected in this FEIS.

5.10 INDIVIDUALS

A detailed list of individuals who received the ***FEIS*** is available on request from Mr. Jules Tileston, BLM, Alaska State Office, 701 "C" Street, Box 30, Anchorage, Alaska 99513.

5.11 *FEIS* AVAILABILITY

Copies of the ***FEIS*** are available for inspection at the following locations:

BLM's Alaska State Office in Anchorage; BLM's Support Center, Fairbanks; BLM's Washington, D.C. office; and at the USACE, Regulatory Branch, Elmendorf AFB, Anchorage; ***Economic Regulatory Administration, Washington, D.C.; Federal Energy Regulatory Commission, Washington, D.C.; and Office of Pipeline Safety, Washington, D.C.*** Additionally, copies will be available in public libraries in Anchorage, Fairbanks, Valdez, Juneau, Soldotna, and the Federal Depository Library System.

5.12 LEVEL OF INFORMATION REQUIRED TO PROCESS THE ENVIRONMENTAL IMPACT STATEMENT AND, IF WARRANTED, ISSUE A GRANT OF RIGHT-OF-WAY UNDER THE DEPARTMENT OF THE INTERIOR REGULATIONS (43 CFR 2800)

The level of information required to assess reasonable options and the probable environmental consequences thereof varies according to the specific decision ripe for action.

CEQ Regulations (40 CFR 1502.20 and 1508.28) provide a mechanism to encourage federal agencies to tier their evaluations under NEPA " . . . to eliminate repetitive discussions of the same issues and to focus on the actual issues ripe for decision . . . " The NEPA evaluations and the federal decisions associated with the proposed TAGS would be tiered.

SECTION 6
SUPPORT INFORMATION AND REFERENCES

SECTION 6.0 SUPPORT MATERIAL

6.1 ACRONYMS AND ABBREVIATIONS

ACEC	Area of critical environmental concern
ADF&G	Alaska Department of Fish and Game
ANGTS	Alaska Natural Gas Transportation System
ANILCA	Alaska National Interest Lands Conservation Act of 1980
ANWR	Arctic National Wildlife Refuge
BCF/D	Billion cubic feet/day
BCY	Banked cubic yards
BIA	U.S. Bureau of Indian Affairs
BLM	U.S. Bureau of Land Management
BPD	Barrels per day
BPH	Barrels per hour
CEQ	Council on Environmental Quality
CFR	Code of Federal Regulations
CO	Carbon monoxide
DEC	Alaska Department of Environmental Conservation
DEIS	Draft Environmental Impact Statement
dBA	Decibel A-weighted
DNR	Alaska Department of Natural Resources
DOE	Department of Energy
DOI	U.S. Department of Interior
DOT	U.S. Department of Transportation
DOT/PF	Alaska Department of Transportation and Public Facilities
EIS	Environmental Impact Statement
EPA	U.S. Environmental Protection Agency
ERA	U.S. Economic Regulatory Administration
FEIS	Final Environmental Impact Statement
FERC	Federal Energy Regulatory Commission
FLPMA	Federal Land Policy and Management Act
FMF	Fairbanks Maintenance Facility
FNSB	Fairbanks North Star Borough
FPC	Federal Power Commission
FWS	U.S. Fish and Wildlife Service
hp	Horsepower
K°	Degree Kelvin
LNG	Liquefied natural gas
LPG	Liquid petroleum gas
m	Million
MCF	Thousand cubic feet
MLLW	Mean lower low water
NAAQS	National Ambient Air Quality Standards
NEPA	National Environmental Policy Act of 1969
NGL	Natural gas liquids
NMFS	National Marine Fisheries Services
NO_2	Nitrogen dioxide
NO_x	Oxides of nitrogen
NOAA	National Oceanographic and Atmospheric Administration
NPDES	National Pollutant Discharge Elimination System
NPS	National Park Service
NRHP	National Register of Historic Places
NSB	North Slope Borough
NTP	Notice to proceed
OCC	Operations control center
OD	Outside diameter
OFI	Office of Federal Inspector
OIW	Oceanographic Institute of Washington
PABX	Private automatic branch exchange
PM_{10}	Particulate matter
PSD	Prevention of Significant Deterioration
psi	Pounds per square inch
psig	Pounds per square inch gauge
RMP	Resource Management Plan
ROD	Record of Decision
ROW	Right-of-way
SCADA	Supervisory control and data acquisition
SHPO	State Historic Preservation Office
SIL	Significant impact level
SO_2	Sulfur dioxide
SO_x	Oxides of sulfur
SRA	State recreational area
SRS	State recreational site
TAGS	Trans-Alaska Gas System
TAPS	TransAlaska Pipeline System
TCF	Trillion cubic feet
TSP	Total suspended particulates
USACE	U.S. Army Corps of Engineers
USC	U.S. Code
USFS	U.S. Forest Service
USGS	U.S. Geological Survey
VSM	Vertical support member
VTS	Vessel Traffic Service
YPC	Yukon Pacific Corporation

6.2 GLOSSARY

active layer	The top layer of ground above the permafrost table that thaws each summer and refreezes each winter.
aerie	Nest of a bird on a cliff or mountaintop; a brood of birds of prey.
aggregate (concrete)	Hard, fragmentary material (usually rock) mixed with cement to make concrete.
Alaska Native	Indian, Eskimo, and Aleut, as defined in Section 3, Alaska Native Claims Settlement Act, December 18, 1971.
alluvial fan	A low, relatively flat to gently sloping deposit of alluvium shaped at the surface like an open fan (but actually a segment of a cone) and laid down by a stream at the place where it issues from a narrow mountain valley on a plain or broad valley.
alluvium	Unconsolidated geologic materials deposited by the running water in which they were transported.
ambient temperature	The temperature of the surrounding air in which an activity takes place.
anadromous	Referring to sea-going fish which spawn in the fresh waters of rivers and lakes.
aquifer	A rock formation, bed, or zone containing water that is available to wells. An aquifer may be referred to as a water-bearing formation or water-bearing bed.
archaeological	Of or pertaining to the study of prehistoric peoples--their dwellings, artifacts, and way of life.
Area of Critical Environmental Concern (ACEC)	Area of national or international significance threatened by adverse change or reduction or loss of values unless special management attention is applied. ACEC status indicates public land managed to prevent irreparable damage to important historic, cultural, or scenic values; fish and wildlife resources; or other natural systems or processes.
authorized officer	Federal employee assigned the responsibility of overseeing compliance with right-of-way stipulations during pipeline construction and operation.
attainment zone	Area that meets the federal air quality standards.
aufeis	A mass of surface ice formed by successive freezing of sheets of water that seep from the ground, a river, or spring.

A-weighting	A weighting scheme applied to sound level measurements; corresponds approximately to human hearing sensitivity. Expressed as decibels, A-weighted (dBA).
backfill	Material used to replace material removed during construction.
basin, drainage	The area from which all water flows to a common body (ocean, lake, or stream).
bathymetry	Submarine topography.
bcf	Billion cubic feet.
bedding	Selected fill material placed under an object to provide uniform bearing. Stratification in sedimentary or volcanic rocks.
bedrock	Rock that has undergone no major change through the effects of weathering and erosion at the surface of the earth; commonly overlain by surficial material.
benthic	Pertaining to the bottom of a body of water.
berm	An embankment of fill.
bifurcation	Point at which a linear feature (stream, highway, etc.) divides or forks into two branches.
block valve	A valve capable of completely, closing off gas flow in a pipeline.
bog	An acidic, mineral-deficient, peat-filled or peat-covered wetland, usually having vegetation of peat moss (<u>Sphagnum</u> spp.), sedges, heath shrubs, and scattered black spruce and tamarack.
bolt-on weights	Concrete weights that are bolted in place around pipes traversing rivers and streams to provide negative buoyancy.
borrow	Any earthen, granular, or rock material taken from one area for use in another.
borrow sites	Site from which road construction materials (gravel) would be extracted.
breakup	In general, the time or year when snow, ice, and nonpermanently frozen ground melt. Specifically, the ice cover on rivers thaws, i.e., the time when the solid sheet of ice on rivers breaks into pieces that move with the current. Breakup connotes the end of winter to residents of the North.
breasting dolphin	A pile or other structure against which a moored ship rests.

cathodic protection	A method of preventing corrosion of steel pipe and components by causing an electrical current to flow from the soil to the pipe.
cavitation	When a pump pulls air instead of liquid.
compressor station	A facility which supplies the energy to move gas in transmission lines or into storage by increasing the pressure.
construction spread	A portion of the pipeline system that constitutes a complete physical entity that can be constructed independently of any other portion of the pipeline system in a designated area or between two proximate geographical points.
continuous permafrost	The occurrence of permanently frozen ground everywhere beneath the exposed land surface throughout a geographic regional zone with the exception of widely scattered sites, such as newly deposited unconsolidated sediments where the climate has just begun to impose its influence on the ground thermal regime.
creep	The slow, gradual, more-or-less continous, non-recoverable deformation sustained by ice, soil, and rock materials under gravitational body stresses.
cryogenics	The science of low-temperature phenomena.
dBA	A unit for measuring sound which takes into account the frequency of a sound as well as the intensity. See also decibel.
decibel	A unit for measuring the relative loudness of sounds, equal approximately to the smallest degree of differenece of loudness ordinarily detectable by the human ear, the range of which includes about 130 decibels on a scale beginning with 1 for the faintest audible sound.
discontinuous permafrost	Permafrost occurring in some areas beneath the ground surface throughout a geographic regional zone where other areas have none.
ditch	The excavation in which a pipeline is buried. .
ditch plug	An impervious barrier placed across the pipeline ditch to prevent subsurface axial water flow in the ditch.
drainage basin	A part of the surface of the Earth occupied by a drainage system which consists of a surface stream or a body of impounded surface water together with all tributary surface streams and bodies of impounded surface water.
drumlin	A low, rounded, elongated hill, mound, or ridge of compact till formed under a glacier and shaped by its flow or carved out of older drift by readvancing ice.

emergent	An aquatic plant with any of its parts extending above the water surface.
endangered species	Any species in danger of extinction throughout all or a significant portion of its range. This definition excludes species of insects that the secretary of the interior department determines to be pests and whose protection under the Endangered Species Act of 1973 would present an overwhelming and overriding risk to man.
erosion	The process whereby materials are loosened or dissolved and removed from a part of the Earth's surface by running water, waves, ice, and winds. Causes include weather, corrosion, and man's activities.
esker	A long, low, narrow, sinuous, steep-sided ridge or mound composed of irregularly stratified sand and gravel that was deposited by a subglacial or englacial stream.
estuary	The seaward end or widened tidal mouth of a river valley where fresh and salt water mix and where tidal effects are evident.
fault	A surface or zone of rock fracture along which there has been movement, which may range from microscopic to many miles.
fault zone	A relatively long and narrow band on the surface of the earth comprising numerous faults and fractures expressed by a single fault or fault system at depth.
floodplain	A strip of relatively smooth land bordering a stream, built of sediment carried by the stream and dropped in the slack water beyond the influence of the swiftest current.
freezeup	The time of year when temperatures generally stay below freezing long enough so that ice covers form on rivers. Freezup connotes the beginning of winter to residents of the North.
frost bulb	A mass of frozen soil which often develops from temperature differentials, such as occurs surrounding a pipe containing gas at a temperature below 32°F.
frost heaving	The lifting of the ground surface caused by the freezing of internal moisture.
frost susceptible	A soil condition capable of producing frost heave from the convergence of freezing temperatures, available water, and certain finely-graded soils.
geofabric	Man-made material, usually consisting of cross-linked polymer fibers, generally designed to prevent fines from mixing with material supported or contained by the geofabric so that drainage or support of overlying material is not adversely affected.
gravel	Unconsolidated deposits of rounded rock fragments larger than sand; more than 0.83 inch in diameter.

ground heaving	Upward movement of the ground surface as a result of the formation of ground ice in excess of pore space.
ground water	Water in the ground that is in the zone of saturation from which come wells, springs, and ground-water runoff.
habitat	The place and its total environmental complex where a plant, animal, or community of organisms lives.
holiday	A gap or defect in pipe coating.
hydrostatic test	The application of a predetermined fluid pressure to the interior of a pipe to test its ability to withstand the specified test pressure over a prescribed time period.
ice bulb	A ring of frozen soil surrounding a chilled pipeline in unfrozen ground.
ice fog	A dense foglike composition of minute ice crystals that forms because of temperature inversions during times when (a) temperatures are below -25°F*, (b) there is a source of moisture, such as cars or a power plant, and (c) particulates in the air form a nuclei for droplet and ice particle condensation.
ice-rich permafrost	Perennially frozen ground that contains ice in excess of that required to fill pore spaces.
ice wedge	A massive, generally wedge-shaped body with its apex pointing downward and composed of foliated or layered, vertically oriented, usually white ice.
icing	A mass of surface ice formed by successive freezing of sheets of water that seep from the ground, a river, or spring. River icings are formed from waters of the river itself building up over the existing river ice and sometimes extending beyond the river channel onto the floodplain. Ground icings are formed on the ground surface when an obstruction blocks normal ground-water flow. Spring icings are formed by water flowing from a spring.
impact	In this environmental statement any change in existing physical, biological, or cultural conditions that would ensue if the proposed gas pipeline system were built, operated, and abandoned.
infrastructure	The basic, underlying framework or features of something.
inversion (temperature)	The condition which exists in the atmosphere when warm air is above cooler air. Ground-based inversions caused by radiative cooling and cold air drainage are common in the Arctic and sub-Arctic in winter.

* Ice fog reportedly forming in Fairbanks at temperatures above -25°F.

isobath	A line on a map or chart that connects points of equal water depth.
jeep	A machine for detecting gaps or defects in pipe coating.
lineament	A linear topographic feature of regional extent that is believed to reflect crustal structure.
liquefied natural gas (LNG)	A clear, flammable liquid principally composed of methane. Natural gas must be cooled to -259° to produce LNG, and its volume occupies 1/600 of the volume of gas.
liquid petroleum gas	Primarily the propane, butane, and pentane fractions of the natural gas liquids.
loess	A widespread, homogeneous, commonly nonstratified, unconsolidated, but slightly coherent deposit generally laid down by the wind, and consisting predominantly of silt with subordinate grain sizes ranging from clay to fine sand.
mass wasting; mass movement	Movement of material down a slope by the force of gravity.
mineral deposit	A naturally occurring concentration of potentially valuable minerals or rocks; need not be economically minable under current economic conditions.
moraine	A mound, ridge, or other distinct accumulation of generally unsorted, unstratified glacial drift deposited chiefly by direct action of glacier ice in a variety of topographic landforms that are independent of control by the surface on which the drift lies.
muskeg	A bog, usually a sphagnum bog frequently with tussocks of deep accumulation of organic material, growing in wet, poorly drained, boreal regions, often areas of permafrost.
natural gas liquids	A group of hydrocarbons that occur naturally in gaseous form or in solution with oil in reservoir.
overburden	Barren rock material, usually unconsolidated and often overlying a deposit of useful materials so it must be removed prior to mining.
particulate matter (PM_{10})	Minute separate particles in which air pollution are airborne. (PM_{10} refers to particles with an aerodynamic diameter less than or equal to a nominal 10 micrometers as measured by a reference method based upon Appendix J, 40 CFR 60.)
permafrost	Soil, rock, or any other earth material whose temperature remains below 32°F (0°C) continuously for two or more years.
pinch point	A narrow area where construction is limited.
pingo	A conical, more-or-less asymmetrical mound or hill with a circular or oval base, a commonly fissured summit, and a core of massive ground ice covered with soil and vegetation. Occurs in the continuous and discontinuous permafrost zones and exists for at least two winters.
ponding	Forming ponds by the blocking of natural drainage courses.

population	The total individuals of a species or of a mixture of species in an area.
proven reserves	Mineral reserves, especially of crude oil, natural gas liquids, and natural gas, for which reliable quantity and quality estimates have been made.
Prevention of Significant Deterioration (PSD)	A set of EPA regulations at 40 CFR 51, Subpart I, Paragraph 51.116 which outlines air quality emission discharge permitting requirements for new and for modified sources located in areas which attain NAAQS in order to prevent significant deterioration of the ambient air.
raptor	Bird of prey, e.g., falcon, hawk, eagle.
Reach	The length of a stream channel uniform with respect to discharge, depth, area, and slope.
reserves	Identified deposits known to be recoverable with current technology under present economic conditions.
riparian	Situated on or pertaining to the bank of a river, stream, or other body of water. Often used to describe plants of all types that grow near bodies of water.
riprap	Blocks of rock, commonly of irregular shape, used to buttress parts of streambanks, shorelines, and artificial embankments against erosion.
route	The path of the proposed pipeline.
salmonid	A fish of the salmon family (Salmonidae), including salmon, trout, char, and whitefish.
scour	Erosion, especially by moving ice or water.
seiche	A free-or standing-wave oscillation of the surface water of an enclosed or semienclosed body of water that varies in duration and height and can be caused by changes in atmospheric pressure, wind, tidal current, and earthquakes.
significant impact level (SIL)	Ambient air concentration of criteria pollutants contributed by a proposed source above which the source is considered to contribute significantly to NAAQS.
slash	Tree limbs and brush debris cut down to clear a right-of-way.
slump	A mass of earth material that has moved down a slope.
snow/road pad	A temporary access road or activity area constructed by leveling and packing snow to the required depth and density to support traffic or other human endeavor.
soil liquefaction	A situation in which soil strength is greatly reduced because of excessive pore water pressure buildup, especially in saturated sandy soils that are subject to compaction and remolding triggered by earthquake vibrations.
solifluction	The process of slow, gravitational, downslope movement of saturated, nonfrozen earth material behaving apparently as a viscous mass over a surface of frozen material.

sound attenuation	A reduction in sound level.
spoil	Any earth or rock material that has been excavated.
subsistence uses	The customary and traditional uses by rural Alaska residents of wild, renewable resources for direct personal or family consumption as food, shelter, fuel, clothing, tools, or transportation; for the making and selling of handicraft articles out of nonedible byproducts of fish and wildlife resources taken for personal or family consumption; for barter, or sharing for personal or family consumption; and for customary trade.
suprapermafrost layer	The layer of ground above the permafrost, consisting of the active layer and, wherever present, taliks.
taiga	The boreal forest of coniferous, mostly evergreen, needle-leaved trees.
talus	Rock fragments of any size and shape lying at the base of the cliff or very steep slope from which they were derived. Movement of fragments is by gravity.
terrestrial	Consisting of or pertaining to the land.
thaw-stable	Frozen soils that upon thawing do not show loss of strength below normal long-time thawed values, nor produce detrimental settlement.
thaw-unstable	Frozen soils that upon thawing show significant loss of strength below normal long-time thawed values and/or significant settlement as a direct result of the meeting of the excess ice in the soil.
thermokarst	The irregular topography resulting from differential thaw settlement or caving of the ground because of the melting of ground ice in thaw-unstable permafrost.
threatened species	Any species likely to become endangered within the foreseeable future throughout all or a significant part of its range.
Title XI	Part of the Alaska National Interest Lands Conservation Act (ANILCA) of 1980 that provides a mechanism for the secretary of the interior department to grant access through certain reserved lands in Alaska.
tsunami	A sea wave caused by submarine seismic or volcanic activity. Though totally unrelated to tides, it is frequently called a "tidal wave."
tundra	A treeless, level or gently undulating plain characteristic of arctic and subarctic regions. It usually has a marshy surface which supports a growth of mosses, lichens, grasses and sedges, and dwarf shrubs underlain by a dark, mucky soil and permafrost.
unconsolidated material	A sediment whose particles are not cemented together.
ungulate	Hoofed mammal, such as caribou, deer, and moose.
water table	The upper surface of a zone of saturation. No water table exists where that surface is formed by an impermeable body.

wetlands	Those areas that are inundated or saturated by surface or ground water at a frequency and duration sufficient to support a prevalence of vegetation, typically adapted for life in saturated soil conditions.
wilderness	An uncultivated, uninhabited, and usually roadless area set aside for preservation of natural conditions according to Section 2(c) of the Wilderness Act of 1964.
working land	The area along side a pipeline right-of-way used for most activities.
workpad	A longitudinal gravel pad used to support construction equipment during installation of the pipeline and for access to areas during the pipeline construction period.
zooplankton	Passively drifting to weakly swimming, mainly microscopic animals of marine and fresh waters.

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SECTION 7
DEIS REVIEW

SECTION 7.0 DEIS REVIEW

7.1 INTRODUCTION

Throughout the preparation of the Trans-Alaska Gas System Project EIS, the BLM and USACE (joint federal lead agencies), communicated with and received input from many federal, state, and local agencies, elected representatives, environmental and citizens organizations, industries, and individuals. Many of these individuals and organizations who were contacted participated in the public scoping meetings that were held at the following six locations in Alaska:

- North Slope Borough Assembly Room, Barrow, December 8, 1986
- Glennallen High School, Glennallen, December 10, 1986
- Valdez City Hall Council Chambers, Valdez, December 11, 1986
- Peninsula Borough Assembly Room, Soldotna, December 12, 1986
- BLM Anchorage District Office, Anchorage, December 13, 1986

Approximately 500 copies of the DEIS were distributed by mail to various organizations, goverment agencies, and individuals including the Alaska delegation to Congress and state legislators. Supplemental distribution was made to the Federal Depository Library System through the Government Printing Office. During the public review period, which ended on November 20, 1987, eight formal public hearings were conducted in Alaska to solicit comments on the DEIS and the ANILCA 810 finding on subsistance. These hearings were held in the following locations:

- Peninsula Borough Assembly Room, Soldotna, October 23, 1987
- Anchorage Museum of History and Art, Anchorage, October 23, 1987
- Valdez City Hall Council Chambers, Valdez, October 26, 1987
- Glennallen High School, Glennallen, October 27, 1987*
- Hutchinson Career Center, Fairbanks, October 28, 1987
- North Slope Borough Assembly Room, Barrow, October 29, 1987
- Stevens Village Community Center, Stevens Village, October 30, 1987*
- Coldfoot Services, Coldfoot, October 30, 1987*

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* Subsistence hearings.

7.2 PUBLIC HEARING DISCUSSION

A list of persons presenting oral comments at the public hearing is presented in Table 7.2-1. Although the primary focus of these public hearings was the DEIS, as required by NEPA for the TAGS project, the hearings at Glennallen, Stevens Village and Coldfoot were the locations for the subsistence hearings required by Section 810, Alaska National Interest Lands Conservation Act.

The public hearing comments are summarized and responded to in the FEIS Subsection 7.4. The full public hearing transcripts have not been reprinted in the FEIS because they are a part of the public record. Copies of the full hearing transcripts are available for public review at the following locations:

7.2-1 List of Persons Presenting Oral Comments at the Public Hearings

Location	Testimony at Public Hearings	
Soldotna	October 23, 1987.	No testimony was presented.
Anchorage	October 24, 1987.	Mr. Clayton Morteboy (citizen)
Valdez	October 26, 1987.	Mrs. Nancy Lethcoe (citizen) Mr. David Hammock (local agency)
Glennallen	October 27, 1987.	Mr. Nick Zorbinis (citizen)
Fairbanks	October 28, 1987.	Mr. David Lacey (citizen) Mr. Thomas Duncan (local agency) Ms. Eva Heffle (citizen) Mr. Oscar Frank (citizen) Mr. Kelly McMullen (local agency)
Barrow	October 29, 1987	Mr. Benjamin P. Nageak (local agency)
Stevens Village	October 30, 1987.	Mr. David Lacey (citizen) Mr. Robert Joseph (citizen) Mr. Stevens (citizen) Unidentified Speaker 1 (citizen) Unidentified Speaker 2 (citizen) Unidentified Speaker 3 (citizen) Mr. Sam Pitka (citizen)
Coldfoot	October 30, 1987.	Mr. Woodward (citizen) Mr. Jack Reakoff (citizen) Mr. Paul Dionne (citizen) Mr. David Lacey (citizen) Mr. Dick Mackey (citizen)

- BLM State Office, Branch of Pipeline Monitoring, Anchorage, Alaska

- U.S. Army Corps of Engineers, Alaska District Office, Anchorage, Alaska

The public hearing comments provided on the left side of each page are summaries of the official transcripts for each hearing. Responses to each comment are provided to the right side of each page. Special corrections or modifications to the DEIS, made in response to comments, can be identified in the body of the FEIS in italic print.

7.3 COMMENT LETTER DISCUSSION

The BLM and USACE received 29 letters of commentary during the public review period on the DEIS for the proposed TAGS project. All letters of comment were reviewed and are reprinted in this Subsection 7.5. All substantive comments are identified by the comment number and have received a response. In addition to BLM and USACE, other cooperating agencies assisted in the preparation of responses to comments received on the DEIS where their authoirty or jurisdiction was involved, i.e., ERA, Lower 48 states impacts and use of gas; DOT, matters involving LNG safety as per 49 CFR 193; and the State of Alaska, for such issues as subsistence, fisheries, recreational areas and operational characteristics of the Prudhoe Bay Field. Frequently DEIS subsections are modified to reflect the comment and response and can be found in the body of the FEIS in italic print. Individual substantive comments within each letter and the corresponding responses accompanying these comments are assigned the same reference number. Letters that did not address the environmental issues were acknowledged.

7.3-1 List of Written Comments Received During the Public Comment Period

Reference Number	Source of Letter
1	Department of Transportation, United States Coast Guard, Juneau, Alaska (Federal agency)
2	Unified Fairbanks (organization)
3	Donald C. Chesebro, Box 972, Valdez, Alaska (citizen)
4	J.B. Jacks, S. 10 W 31357 Irwin Court, Wales, Wisconsin (citizen)
5	Greater Fairbanks Chamber of Commerce, P.O. Box 74446, Fairbanks, Alaska (organization)
6	National Parks and Conservation Association, Washington, D.C. (organization)
7	United States Department of the Interior, Minerals Management Services, 949 E. 36th Ave., Rm. 110, Anchorage, Alaska (Federal agency)
8	Department of the Air Force, Regional Civil Engineer, Western Region (AFESC), 630 Sansome St., Rm. 1316, San Francisco, California (Federal agency)
9	Dinyee, P.O. Box 1372, Fairbanks, Alaska (organization)
10	Alyeska Pipeline, 1835 S. Bragaw St., Anchorage, Alaska (business)
11	United States Department of the Interior, National Park Service, 2525 Gambell St., Rm. 107, Anchorage, Alaska (Federal agency)
12	Northwest Alaskan Pipeline Company, 3111 C Street, Ste. 200, Anchorage, Alaska (business)
13	Fairbanks North Star Borough, P.O. Box 1267, Fairbanks, Alaska (local agency)
14	United States Department of Commerce, National Oceanic and Atmospheric Administration, P.O. Box 21668, Juneau, Alaska (Federal agency)
15	Sierra Club, 241 E. Fifth Ave., Ste. 205, Anchorage, Alaska (organization)

7.3-1 List of Written Comments Received During the Public Comment Period (Contd)

Reference Number	Source of Letter
16	ARCO Alaska, Inc., P.O. Box 100360, Anchorage, Alaska (business)
17	Tanana Chiefs Conference, Inc., 201 First Ave., Fairbanks, Alaska (organization)
18	Federal Energy Regulatory Commission, Washington (Federal agency)
19	The Wilderness Society, 519 West 8th Ave., Ste. 205, Anchorage, Alaska (organization)
20	Jerry McCutcheon, 8541 East 4th Ave., Apt. B, Anchorage, Alaska (citizen)
21	McHenry & Staffier, P.C., 1300 19th St. N.W., Washington, D.C. (business)
22	State of Alaska, Department of Natural Resources, 4420 Airport Way, Fairbanks, Alaska (State agency)
23	United States Department of the Interior, Fish and Wildlife Service, 1011 E. Tudor Road, Anchorage, Alaska (Federal agency)
24	Office of the Federal Inspector, Alaska Natural Gas Transportation System, 1000 Independence Ave. S.W., Washington, D.C. (Federal agency)
25	U.S. Environmental Protection Agency, Region 10, 1200 Sixth Ave., Seattle, Washington (Federal agency)
26	Department of Energy, Washington, D.C. (Federal agency)
27	United States Department of the Interior, Geological Survey, 4200 University Drive, Anchorage, Alaska (Federal agency)
28	State of Alaska, Department of Natural Resources, 4420 Airport Drive, Fairbanks, Alaska (State agency)
29	United States Department of Commerce, National Oceanic and Atmospheric Administration, Washington, D.C. (Federal agency)

SECTION 7.4
PUBLIC HEARING COMMENTS

PUBLIC HEARING COMMENT PH1

RESPONSE

October 23, 1987 - Soldotna

PH1 No testimony presented.

PUBLIC HEARING COMMENT PH2

October 24, 1987 - Anchorage

Mr. Clayton N. Morteboy

PH2-1 How far would TAGS be from the oil pipeline because of safety and environmental problems, especially through swamp areas?

PH2-2 The oil pipeline's pipe was made in Japan, and my concern is would it be possible that pipe could be made in the United States?

PH2-3 Could the gas line be used by the people of the State of Alaska before this gas could be exported out of Alaska to Korea, Japan, China? Is it possible that the in-state users would have first priority on this gas and not be charged extra for the gas?

RESPONSE

PH2-1 As stated in the Subsection 1.5 and throughout the EIS, the TAGS pipeline alignment would be generally within the existing utility corridor normally no closer than 200 feet from the TAPS or authorized ANGTS.

PH2-2 No commitments have been made for pipe at this time. As stated in the EIS, YPC would provide detailed pipe specification to potential suppliers both domestic and foreign. General pipe specifications are identified in Subsection 2.2.1.2.

PH2-3 At the present time, the ANGTS project has stated that a natural gas takeoff valve would be placed in Fairbanks for city-wide use. Therefore, if ANGTS is constructed before TAGS then a gas tap would be already available to the city. In the event that ANGTS is not constructed before TAGS, then the TAGS project would provide a gas tap in the Fairbanks area.

The State Right-of-Way Leasing Act, AS 38.35 et seq., requires TAGS to provide connections, as determined by the Alaska Public Utilities Commission under AS 4206.340, for persons contracting for wholesale purchases of natural gas when required by the public interest. Further, the State of Alaska can require connections anywhere along a pipeline if it is deemed necessary to transport royalty natural gas taken in kind.

The Alaska Public Utilities Commission can require that during construction of a pipeline appropriate hardware be installed for future connections. The Commissioner of the Department of Natural Resources, local governments, individuals or corporations may request such special connections. The cost for connections or special hardware for future connections, are borne first by the State, which is then reimbursed by the municipality, individual or company utilizing the connections. The applicant is required to comply with state law with regard to gas takeoff connections and interconnections.

Insofar as "pricing" of gas transported through the Trans-Alaska Gas System, the pipeline would be operated as a common carrier pipeline pursuant to AS 38.35. As such, any intrastate sales would be at a rate approved by the Alaska Public Utilities Commission. Pipeline rates would be determined using a rate base methodology, and, obviously, cannot be calculated until after the pipeline is completed. However, provisions of the Alaska Public Utilites Act will insure ample public participation in setting that rate.

PUBLIC HEARING COMMENT PH3

October 26, 1987 - Valdez

Mrs. Nancy Lethcoe

PH3-1 Is there any reason to proceed beyond this stage with the TAGS project?

PH3-2 I have some serious reservations about the tiered approach, since you asked for feedback on that. It is very difficult to give an informed opinion when the data is lacking on design specifications, the exact data on emissions aren't available, and the scientific documentation on the actual LNG plant and on it's socioeconomic impact is woefully lacking. (Major decisions haven't been made yet.)

PH3-3 The DEIS contain inaccuracies and statements that are very general. For example, on page 1-5, it states, "An airport located approximately 7.5 miles northeast of the site is serviced by several major airlines." The EIS would have been much more useful as a planning document if accurate, specific statements had been made instead of loose generalities that are false. The EIS is fraught with statements like that, and I don't think it's of any use to go through and point every single one of them out because it would mean reading virtually every paragraph in the document. The information is incomplete and difficult to find.

PH3-4 I attended the scoping process, so I was very interested in how input that came to you through the scoping process was incorporated into the Draft EIS. The Valdez-area scoping was in Appendix A, on page A-3, and it is divided down to seven remarks. I believe there were somewhat more than seven remarks made during the scoping process in Valdez, but the general outline seems to be pretty much as I remember it. There is then a treatment of remarks number given. A two means that it will be treated in the EIS. There is no reference to a page number in the DEIS that can be related to scoping issues.

PH3-5 Anderson Bay is a traditional anchorage for boaters. It is an extremely important anchorage during adverse weather conditions and icing conditions, for small boaters who may hole up in there rather than risk coming in to Valdez and icing up badly in the wintertime. This was raised during the scoping process. There is a two, implying that this discussed in the DEIS. I find no discussion of it anywhere in the DEIS.

PH3-6 I would like to recommend that consideration be given to placing a mooring buoy some place in the lower part of Port Valdez that could be used by small boaters in the wintertime or other times of the year when they can't make it into Valdez. This is a serious safety problem that should be addressed and mitigation measures proposed for it.

RESPONSE

PH3-1 The TAGS project is a tiered decision process with each succeeding stage requiring more detailed engineering information. The initial question addressed in this EIS is what are the anticipated effects if the TAGS project is authorized.

The EIS process is one of the initial steps for any major project. It is a necessary process to solicit public input on a project which has been identified as a major federal action which could significantly affect the quality of the human environment. Once the EIS process has been completed, the project proponent would proceed into the more detail planning and design phases of the project as summarized in Figure 1.1-1 and in Subsection 1.10.

As stated by the Council on Environmental Quality (CEQ, 1977) to the President on the environmental impacts of proposed Alaska Gas Transportation Corridor, "the sufficiency of any environmental impact statement is necessarily tied to the nature and scope of the federal action concerned...for this limited purpose that is considered here--not their sufficiency for determining precise alignments, facility locations and other site-specific data." (p. 14).

CEQ (1977) further states that "federal agencies may not bypass further environmental analysis of the authorized system simply because broad program statements have been prepared and found sufficient under NEPA. Rather, they must weigh important environmental concerns at all subsequent stages...to ensure... environmental policy receives...attention on the ground in Alaska." (p. 19)

PH3-2 As discussed in the EIS, detailed design specifications would be developed in later project phases. The tiered approach is the only practical approach to evaluate the viability of a major project such as TAGS, the EIS is the first opportunity for major projects to identify potential environmental concerns.

PH3-3 The DEIS was reveiwed for the types of inaccuracies that were identified, however, since the EIS process is part of a tiered process many of the statements remain general. Specifics were incorporated when possible. The FEIS has incorported the noted revision.

PH3-4 As stated in Subsection 5.2 and in Appendix A, the issues raised during scoping were identified in that appendix and would be treated in the EIS. The issues identified as a "two" were considered in the DEIS. No specific reference was cited for the treatment of them as scoping issues.

PH3-5 As stated in Subsections 4.2.3.1 and 4.2.15.6 of the DEIS, most recreation in the Valdez area centers around fishing, sightseeing, boating and hunting. Specific reference to Anderson Bay is that access to the shoreline would be prohibited due to the buffer zone. Figure 2.2.1-6 has been revised to show there would be opportunity for adverse weather anchorage at Anderson Bay. The specifics of how emergency or other mooring for small boats at Anderson Bay would be developed as part of the LNG and marine terminal designs.

PH3-6 At the present time, the preliminary design for the LNG plant site and marine terminal would not preclude the safe harbor anchorages in Anderson Bay.

PUBLIC HEARING COMMENT PH3 (Contd)

PH3-7 The other issues that were raised during scoping were concern for the historical resources at Anderson Bay, the Goat Trail, and historical importance of Keystone Canyon.

PH3-8 Tourism is an important part of the Valdez economy, no concrete information was presented that I could find in the document as to what was going to be lost, what was going to be saved, and what the company might do to mitigate these impacts, such as the possible loss of the Goat Trail.

PH3-9 When people do an EIS on a community, they should come and spend some time in the community and make a serious effort to understand what's important to us here, what will have an impact on us, and what we may hope for in terms of trying to mitigate these impacts.

PH3-10 Tourism is an important part of the economy. It is of course not the only part of the economy. But it would have been nice in the Draft EIS if some knowledge of the importance of tourism to this community had been made. For example, on page 1-5, it says, "Valdez is both a fishing and an industrial community." There is no mention of tourism. There is no mention of cruise ships, there is no mention of tour boats, there is no mention of campgrounds, there is no mention of hikings, there is no mention of the restaurants, gift shops, and the large number of people who make all or a portion of their income from tourism. Before a Final EIS is done, I would really appreciate if the preparer of the EIS comes down and looks at tourism in the Valdez community, asks such basic questions as what really would be the impact of bringing, and again it's hard to tell from the DEIS, whether it's 750 people a year for five years in here, or 1500 people for two years and 750 people for three years. Where are they going to stay? Are they going to be in the campgrounds all summer long? If they are in the campgrounds all summer long, where are the people who are the highway traffic for the tour boats going to stay? And quoting the loose statement in the DEIS to the effect that the effect that the increased number of people working in Valdez will enhance the recreation and tourism. If they are taking the spaces in the hotels and the spaces in the campgrounds where tourists would come to stay and go out to Columbia Glacier, to Shoup Bay, or on a fishing trip. There could be a serious adverse impact on tourism here. It is important that these questions are looked at before you get too much farther down the line.

PH3-11 Another area that I found somewhat disappointing was in air quality. As people in a tourism related community, people do not pay to come up and look at air pollution. If they find out that they have a chance to look at a lot of air pollution, it really doesn't enhance our opportunities for getting them to come to Valdez. Air pollution as a health hazard should be considered. I see no discussion of the negative impact of the visual detraction of air pollution on the tourism industry. What is being emitted, how much is being emitted, and what would be the impact on what is already

RESPONSE

PH3-7 These resources are discussed in Subsection 3.2.15.1 and the impacts during construction are identified in Subsection 4.2.15.1.

PH3-8 We agree that tourism is a significant economic resource for the City of Valdez. Valdez is graced with many natural wonders within easy reach of the tourists. The DEIS discussed tourism in Subsections 3.2.5 and 3.2.15 and potential impacts in Subsection 4.2.5 and 4.2.15.

The discussion of environmental effects for Valdez identifies that there would be competition for available hotel rooms, apartments, houses, trailers and camping spaces during the several years of construction of the LNG terminal. This in lieu of the fact that YPC would have a construction camp at Anderson Bay. As identified both during the scoping meetings and at the public hearings, during the peak of the summer tourist season in 1986 and 1987 hotel rooms were in short supply or not available, this impact would be present during the construction of the LNG plant and marine terminal.

We do not think that there would be anything lost, some tourists, who don't have reservations would be upset if they could not find hotel or camping space. There would be no loss to the natural beauty of Keystone Canyon or the goat trail. The LNG terminal and the marine teminal would most likely become another tourist attraction as the Alyeska Marine Terminal has become as referenced in the <u>Industrial Siting Evaluation</u>, 1987.

Since pipeline construction would be limited to the Richardson Highway area in the Keystone Canyon, no impact would result to the Goat Trail or to any of the natural wonders of the canyon. Except for the two river crossings adjacent to the existing bridges, the pipeline would be placed in the ditch adjacent to the highway. The only impact to tourism in Keystone Canyon would be the potential for traffic delays. ADOT/PF and YPC, along with input from local officials, especially those involved with the tourist industry, would develop a program to restrict road closures to a minimum, especially during the summer early morning and late afternoon peak traffic periods.

PH3-9 The DEIS identifies environmental impacts and other discussions for the Valdez area throughout the document. These discussions incorporate information from various published, unpublished and personal communication sources.

The staff that prepared the EIS are indeed familiar with the Valdez area, but the purpose of the EIS is to be a generic document as identified in Comment PH3-3, and not a focused document on any specific area along the approximately 800 mile route.

PH3-10 We fully concur with the statement that tourism is an important part of the Valdez economy. Subsections 3.2.2, 3.2.5, 3.2.15, 4.2.2, 4.2.5 and 4.2.15 have been revised accordingly. Subsection 3.2.15.1 identifies the various types of activities raised in this comment.

PH3-11 The LNG plant would not produce air pollution that would in any way discolor the sky. As identified in Subsection 4.2.6.3.2, all air emissions would not be within all standards.

PUBLIC HEARING COMMENT PH3 (Contd)

available, was not contained in the DEIS. This may be because you are not yet at the design stage. It would be good to have the data now, before a decision is made on an environmental impact statement. For example, page 3-23, "Alyeska Marine Terminal facilities were designed to meet national primary air quality standards and our State of Alaska emission standards." That is eight years out of date. Alyeska has changed its operation. We have cruise ships coming in here that put air pollutants in the air. A lot of things have changed. There should be some monitoring being done by Yukon Pacific to see what the actual conditions are and what their impact is going to be.

PH3-12 Mitigating efforts identified, page 2-57, state that sludges and skimmings from the oil-water separators would be incinerated in an approved incinerator. An approved incinerator may not be the best technologically available one. The approved technology may be well below the best available standards that can be met.

PH3-13 The ballast water, page 2-57, as I understand it, would be in separate compartments, separated from the LNG tanks. When LNG tankers return from the Orient they will pick up ballast water at a harbor in the Orient, proceed out into the north Pacific, empty the ballast water in the north Pacific, take on new ballast water in the north Pacific, and proceed into Port Valdez. Could ships arrive in Prince William Sound with ballast water picked up in Tokyo harbor, which would have pollutants far worse than anything that we have here? I have not found, and maybe I just overlooked it, that there is no testing facility of the ballast water that these tankers would be bringing into the LNG terminal. And I would hope that there would be testing to determine that exchange of ballast water occurred at sea. I think we're just asking for trouble to allow tankers to come and unload ballast water here without first testing what it is that they are unloading.

PH3-14 In the final EIS, more specific statements should be used to replace generalities, and more attention should be paid to when, if not at this point, in the process there is going to be a real discussion of mitigation measures.

Mr. David Hammock

PH3-15 The Convention and Visitors Bureau feels that what the tourism industry has to sell in Valdez is our environment. Assuming that the project proceeds with full environmental safeguards and meets the approvals and requirements of your agencies, we see no basic conflict with the proposed development and our long-term tourism prospects. As a matter of fact, tourism has been enhanced in Valdez by the presence of the Valdez facility of Alyeska Pipeline Service Company. Similarly, in the long term, we see no basic conflict, again assuming environmental safeguards are met with the

RESPONSE

PH3-11 The Table 4.2.6-4 of the DEIS contained preliminary estimates of emission data for the LNG process. More recent calculations for the emission rates can be found in the FEIS in Table 4.2.6-4.

We agree that there has been an increase in the types and amounts of emissions in the Valdez environs as a result of construction and operation of the Alyeska Facilities and the City of Valdez's desire to encourage further industrial development, and expansion of the tourism industry and fishing operations.

YPC would comply with accepted PSD permit requirements to perform air quality monitoring.

PH3-12 This is a matter of semantics, YPC would be required to comply with approved ADEC requirements for incineration which could involve the best available control technology (BACT) requirements. BACT would also be used with other TAGS facilities at Anderson Bay.

PH3-13 All ships would be directed to exchange ballast water once out at sea. The ships log could be used to verify that such operations occurred and each ballast tank was exchanged.

PH3-14 The TAGS project is not yet at the stage where such details are acceptable for the FEIS. This information is more appropriate for detailed design review, site specific permit applications, submission of comprehensive plans to be reviewed by BLM and other federal and state agencies, and for notices to proceed.

PH3-15 The EIS identifies the Valdez area as truly unique and one which should be safeguarded. We also concur with the tenor of the comment that impacts to traffic must be mitigated. As previously indicated, YPC would coordinate with appropriate officials to ensure minimal impacts to the Valdez tourist industry during the summer peak season.

PUBLIC HEARING COMMENT PH3 (Contd)

two: tourism development, and the TAGS system development. Our concerns really are directed at the construction period impact. The Prince William Sound Tourism Coalition was just formed to begin to market this area as a tour destination. And Valdez is a key gateway in that area. The biggest concern we have is that construction in the Keystone Canyon area and any situation where the proposed TAGS route would interact with the highway system so that it is compatible with the traffic demands that the tourism industry requires. Between the 15th of May and the 15th of September, there are daily motor coach operations in and out of Valdez that connect with marine operations. Most of the traffic is concentrated in two windows throughout the day. We feel it would be possible to develop a schedule that meets the needs of the major tour operators, and yet allows adequate time for the construction to proceed in the Keystone Canyon. But we think there should be a requirement that coordination be made with these tour operators.

PH3-16 The independent travelers in motor homes or RVs must also be accommodated. It is important that during the construction period along the highway or in the Canyon, that right-of-way passages be maintained, not only adequate for motor coaches, which can handle pretty rough roads, but the RVs and motor homes that are used by the independent travelers as well. So, specifically, in order to maintain our connection with the marine-highway system, and with the day boats, or boats that travel daily back and forth from Whittier to Prince William Sound, we need to make sure Keystone Canyon stays open daily so that the daily schedule in that peak summer period would be maintained for tourism operations.

PH3-17 Highway closure information and schedules should be available at such junctions as Tok and Glennallen to reassure travelers that the roads will be opened and they can make it into Valdez despite any rumors to the contrary.

PH3-18 We do share her concern about Anderson Bay. We're just curious if there is going to be any impact. We'd like someone to think about it.

PH3-19 Could the traffic flow within Port Valdez, during the construction of the marine terminal proposed by the TAGS project, be impacted? From the middle of May to the middle of September, there are as many as four or five boats, 60 to 120 feet in length, carrying passengers from Valdez to Whittier past Columbia Glacier. We also have fishing charters and private sport fishing. We're going from about 40 sailings to almost 50. We anticipate a 15 to 25 percent increase in sailings in Valdez every year for the next three to five years.

PH3-20 There's increasing demand, because of our success in developing the tourism potential, for access to the same transportation corridor. Our concern at the Bureau is that tourism needs be taken into consideration as an economic environmental impact. In conclusion, we feel that the long-term prospect of the TAGS project does not interfere with the long-term prospect of tourism, as long as the environmental safeguards are adequate.

RESPONSE

PH3-16 In response to Comment PH3-8, it is indicated that YPC would coordinate with ADOT/PF and local authorities to limit road closures to a minimum.

PH3-17 Comment noted.

PH3-18 See response to public hearing Comment PH3-5.

PH3-19 Although there would be increased shipments of cargo into Valdez Arm during the several year construction period for the LNG plant and mariner terminal at Anderson Bay, the USCG has stated that the VTS system in place for ships entering Valdez Arm could handle a much greater volume of traffic than is presently entering Port Valdez. Other than the present restriction of one way traffic through Valdez Narrows, no disruption to ship transits would be expected.

Contrary to the other EIS's cited throughout this EIS which pertain to LNG tanker traffic in the near coastal areas between Alaska and California (or other U.S. ports), tanker traffic resulting from the TAGS project would remain in coastal waters only in Prince William Sound. The EIS only discusses issues as they relate to the Prince William Sound area in relation to such issues as air quality, traffic, ballast water, collisions with endangered species and so forth.

PH3-20 There would be some impacts during construction. The impacts would be minimal but YPC would coordinate their efforts to keep these impacts to an acceptable level. YPC would coordinate with all appropriate federal, state and local governments to minimize these impacts.

PUBLIC HEARING COMMENT PH4

RESPONSE

October 27, 1987 - Glennallen

Mr. Nick Zorbinis

PH4-1 When we have an influx of people who will be here for a short duration during construction, I'd like to find out if there are any regulations to control the subsistence. Could this be done by the local Alaska Department of Fish and Game (ADF&G) since they would be more aware of who is in need of subsistence or who has been here long enough to utilize subsistence? Are those people, here for a short time, entitled to the same benefits? The ADF&G would have better judgment of that situation than anybody else. I'd like to propose that for the record that ADF&G regulate subsistence during construction.

PH4-1 The state regulations that govern eligibility for subsistence hunting and fishing are determined by the State Boards of Fisheries and Game. These regulations are explained in Subsections 4.2.17.4 of the FEIS.

PUBLIC HEARING COMMENT PH5

October 28, 1987 - Fairbanks

Mr. David Lacey

PH5-1 I oppose and don't believe that we need another bridge on the Yukon River at the Yukon crossing; that there is room on the existing bridge for another pipeline (gas line) using the present structure; and that the respective agencies with jurisdiction should work it out so that there is not a need to construct another bridge at the Yukon River.

PH5-2 There hasn't been any mention of the way that the subsistence was affected originally by the oil line and the resulting Haul Road, particularly north of the Yukon River. On page 4-11 in the DEIS it says that during construction of the oil pipeline the only two inhabited settlements on the route directly affected were Wiseman and Livengood in the southern Dalton Highway area. There were some other villages along the route north of the Yukon River there that were directly affected. The Stevens Village subsistence economy was directly affected. I question that statement as not complete or as inadequate on page 4-11 in Section 4.2.2.2.2.

PH5-3 In the DEIS it is stated that there is going to be an attempt to restore surficial features to preconstruction status. My concern is that such restoration was supposed to have been done with the oil line but in reality it didn't happen. Now we have a situation where at Coldfoot and at the Yukon crossing the BLM is in the process of attempting to stimulate community development in an area that was supposed to been restored to its original state. The people constructing the gas line should be held to their word and actually return things to their natural state as opposed to what happened in the past.

PH5-4 I'm concerned about construction of access roads. I felt that there were too many access roads constructed on the TAPS pipeline. The TAGS access roads could seriously impact the area. Creating more access is really going to impact subsistence and the natural integrity of the area. I'm concerned about some of the streams that are being impacted as a result of the increased access due to the Haul Road. With construction and increased population, the streams are going to be further impacted to maybe a point of no return. Specifically, the Dall River has been seriously impacted near the Haul Road crossing. The Department of Fish and Game should severely restrict the sport fishing and access on the Dall River. It is an important subsistence fishery.

PH5-5 The project effects on subsistence, particularly in the communities north of the Yukon River along the Dalton High, was that impacts on communities subsistence uses has been understated by BLM in this document. Stevens Village should be added to those communities that would suffer

RESPONSE

PH5-1 We concur that there is room on the existing Yukon River bridge. The problem is that TAPS is located in the upriver set of pipe support brackets and Alyeska installed another set of pipe support brackets on the down river side of the bridge which has been reserved by Alyeska for a future oil line crossing. The bridge was further designed to accomodate another pipeline below the road grade. This area has been reserved for authorized ANGTS.

The bridge proposed for the TAGS project, as discussed in Subsection 2.3.4.3 of the EIS would be a suspension bridge. The bridge would be constructed to support only the TAGS pipeline, similar to TAPS Tanana River bridge southeast of Fairbanks.

PH5-2 The purpose of this analysis is to address the impacts of the proposed Yukon Pacific project. The cumulative impacts of opening up the Dalton Highway are referred to in Subsections 4.7.17. Subsistence patterns and effects on several villages north of the Yukon River were addressed in Subsections 3.2.17.3, and 4.2.17. The latter section states that communities directly adjacent to the pipeline would be more directly affected.

PH5-3 YPC has stated that as project mitigation they would perform such restoration. What occurred previously is not what is proposed.

PH5-4 Existing access would be used as much as possible so that the total number of access roads would be significantly reduced for the TAGS project. During construction, use of project access roads would be tightly controlled to allow only project-related traffic. After construction is completed, roads required for access would be tightly controlled to allow only project-related traffic. Otherwise, temporary access roads would be bermed to prevent access or the road material would be removed.

It would be up to the ADF&G to establish any restriction that may be necessary to protect the resources of the Dall River.

PH5-5 Stevens Village was initially not considered to be subject to a short-term Significant Restriction of Subsistence Use because it is not directly adjacent to the proposed project ROW and has access to other harvest areas away from the project. However, due to the presence of increased population in the area, and the availability of boat access up the Yukon River to areas used by Stevens Village for subsistence activities, changes have been incorporated into the FEIS that state Stevens Village would suffer short-term Significant Restriction of Subsistance Use from the proposed project. The proposed mitigation measures by YPC and its contractors to prohibit camp employees from sport fishing, hunting and trapping, and State enforcement of subsistence harvest preference regulations would affect Stevens Village.

PUBLIC HEARING COMMENT PH5 (Contd)

RESPONSE

severe restrictions because of the construction and Stevens Village should be referred to as having a significant restriction.

Mr. Thomas Duncan

PH5-6 The report seems to overall gloss over negative impacts, particularly the impacts of job seekers flocking to Anchorage and Fairbanks. The socio-economic impacts are really given a short change. There's several misleading and exaggerated statements, we note some of those specifically in our written comments. Something of great concern that received no mention is a take-off valve for Fairbanks. Many of the statements in the EIS lead one to believe that none is planned.

PH5-6 See responses to specific comments raised in Comment Letter 13.

PH5-7 The availability of natural gas as an alternate energy source has been desired in Fairbanks for a long time and is a very important side benefit of any project such as TAGS.

PH5-7 See response to public hearing, Comment PH2-3.

PH5-8 On page 4-16, Section 4.2.2.3, makes an important statement regarding the present excess infrastructure that Fairbanks has right now as possibly being absorbed by the influx of military personnel in the coming years. It's an important point that was not reflected in other parts of the documents where it just mentioned that Fairbanks had an excess of infrastructure and that this would somehow buffer the coming projects.

PH5-8 The DEIS (page 4-13) acknowledged that some of the surplus in the Fairbanks North Star Borough would likely be absorbed.

PH5-9 On page 4-131 makes a very important statement about the job seekers coming to Alaska who do not find employment and would have to rely on state social services. This impact isn't reflected in an earlier statement that identifies Anchorage and Fairbanks as the sole hiring locations for people seeking employment.

PH5-9 Such job seekers were not a major burden on the social services in Fairbanks during the oil pipeline. In fact, participation in most public assistance programs dropped dramatically. For example, the number of persons in Fairbanks receiving Food Stamps dropped from 700 prior to the pipeline to only 99 during the peak of construction.

Ms. Eva Heffle

PH5-10 Arctic John Etalook has been in court over trespass and damages done by Alyeska and the State of Alaska. Because there's a lack of concern and protection of native lands, he was vandalized and his personal things broken, stolen, and destroyed. What were the monitors doing when this happened? Promises were made but not kept. Is this going to happen again to our native lands when this gas pipeline gets built? What assurance do we have that you will really protect our interest? Who will benefit by the line's construction other than businessmen and large corporations? Is this meeting really going to protect us as native people and our environment against damages or is it just another way of pacifying the people?

PH5-10 It was an unfortunate situation that Arctic John Etalook's property was trespassed and vandalism occurred. The Dalton Highway is presently patrolled by Alaska State Troopers, this was not the case when these events occurred. YPC, the TAGS project sponsor, would be required to negotiate rights-of-way across all land traversed by the pipeline or used for project related facilities, both temporary and permanent. This would include all Alaskan Native or privately held lands. A right-of-way agreement with each property owner is necessary.

Mr. Oscar Frank

PH5-11 Is the proposed Yukon River bridge necessary? I oppose it. It could impact subsistence to Stevens Village located about 27 miles up river

PH5-11 See response to Comment PH5-1.

PUBLIC HEARING COMMENT PH5 (Contd)

from the current bridge. We see it as an impact to our subsistence hunting and fishing because of the increased number of people that will be in these areas from construction camps, tourists, and visitors. I'm also wondering if they'll be able to hunt under subsistence regulations.

Mr. Kelly McMullen

PH5-12 Accelerated growth due to construction over the past five years in the Fairbanks area has substantially reduced our progress towards reaching Clean Air Act standards for carbon monoxide. We are in a nonattainment status at this time and do not have a projected date to reach attainment. The additional traffic generated by this project may delay our reaching attainment. And significantly, traffic impacts in congested areas may create hazardous levels of carbon monoxide in localized areas.

PH5-13 The document also does not address open burning within the Fairbanks North Star Borough for which an ordinance was substantially strengthened in the last year to prohibit large scale open burning within the urban and industrial areas of the Borough and during the winter months of November through February.

PH5-14 Another issue is the generation of ice fog, particularly if natural gas is made available for use in the Fairbanks area. I believe that natural gas would be beneficial in general to the area to reduce energy costs. Natural gas combustion does generate more water vapor when burned for either mobile vehicles or stationary sources than liquid petroleum products; therefore, more ice fog would be generated for the same amount of energy consumed.

PH5-15 The Fairbanks landfill currently has an expected life in the neighborhood of 20 to 30 years. The wastes generated by this project could substantially reduce the life of the landfill. And at this time no new landfill sites have been identified or approved within the Borough.

PH5-16 Hazardous waste is likely to be generated by the project, it cannot be accepted at the Fairbanks landfill nor any other landfill within the State of Alaska at this time. The document, as far as I was able to review it, does not address that.

PH5-17 At this time the document does not appear to address mitigating any of these impacts to Fairbanks.

RESPONSE

PH5-12 See response to FNSB Comment 13-43 and 13-44.

PH5-13 See response to FNSB Comments 13-45 through 13-47.

PH5-14 See response to FNSB Comment 13-48.

PH5-15 See response to FNSB Comment 13-52.

PH5-16 See response to FNSB Comment 13-50.

PH5-17 The purpose of an EIS is to review the proposed project, identify effects of the project, suggest mitigation if known, and to provide the decision maker with a document that provides sufficient information to make an informed decision on a proposed project. The EIS cannot be a document that answers every question. The specific details of most major projects including specific mitigations, would be defined during the detailed design and engineering phase. The TAGS project is not at this phase. See Subsection 1.10 of the FEIS.

PUBLIC HEARING COMMENT PH6

RESPONSE

October 29, 1987 - Barrow

Mr. Benjamin P. Nageak

PH6-1 If the Trans-Alaska Gas Line is built, you're touching on some very important hunting areas which are used not only by residents of the North Slope Borough but our Interior brothers. A lot of people depend on different wildlife in the area. We have had problems in the past with hunters coming from the urban areas and hunting along the Haul Road. I don't know if this situation would intensify if the gas line is built. Human activity diverts a lot of the game from where traditional hunting has occurred and from those villages who use them for their sustenance. A lot of traffic going along the pipeline would probably displace game.

PH6-1 See response to Comments PH4-1, PH5-4, and PH5-5.

PUBLIC HEARING COMMENT PH7

October 30, 1987 - Stevens Village

Mr. David Lacey

PH7-1 The EIS says that there will be a significant restriction of subsistence, that communities close to the TAGS route, such as Nolan, Wiseman, and Livengood, would more likely be affected by a greater level of harvest efforts. And then it goes on to say the communities of Allakaket, Bettles, Rampart, and Stevens Village use many areas, other than TAGS route, for subsistence activities and would not be as affected by impacts to fish and wildlife. Are these areas, as identified, considered significantly restricted?

Mr. Robert Joseph

PH7-2 Our main concern is subsistence: hunting, fishing, trapping, and our way of life here. We depend on a subsistence way of life. What subsistence impacts would occur to us? What types of restriction would be placed on workers? How will it be controlled? Will subsistence be monitored as heavily or more so than during the TAPS pipeline? How much monitoring would occur prior to and during the pipeline?

PH7-3 At another hearing recently, agencies were exploring the possibility of developing the Yukon Crossing. We've always been concerned about our land and our place where we have grown up. And we have lived off this land most of our lives. And what assurance do we have before and during the construction of the gas line that there is going to be a plan to have people there monitoring prior to and during construction?

PH7-4 Is the pipeline going to parallel with the existing oil line?

Mr. Don Stevens

PH7-5 Our main concern is subsistence and we've been subsistence village for a long time. And we had a lot of problems when that oil line came through; people getting off the right-of-way, coming in, and fishing. I would like to see that the right-of-way, instead of the existing five miles, all be closed off and for any kind of vehicle--off road or Sno-Go--during the construction.

PH7-6 Stevens Village would like to benefit from projects and work on it. We would like the opportunity to get training early.

PH7-7 Previously, we didn't have time to sit down and really work out how the village wanted to benefit. We were against TAPS for subsistence purposes. We're still against any kind of development adjacent to our land in

RESPONSE

PH7-1 See response to Comment PH5-5.

PH7-2 Subsection 4.2.17, has been strengthened to show the subsistence impacts on Stevens Village. Subsection 2.8, describes impact mitigation measures proposed by YPC to address subsistence impacts, which include public access restrictions and employee fishing, hunting and trapping restrictions. Also see response to Comments PH5-4 and PH5-5 for further information. With regard to monitoring subsistence activities, monitoring and the enforcement of subsistence preference regulations are the responsibility of the State of Alaska.

Various State of Alaska statutes provide the definitions for subsistence: Alaska Statute 16.05.940 (28) defines "subsistence fishing" as "the taking of, fishing for, or possession of fish, shellfish, or other fisheries resources by a resident domiciled in a rural area of the state for subsistance uses with gill net, seine, fish wheel, long line, or other means defined by the Board of Fisheries." Alaskas Statute 16.05.940 (29) defines "subsistence hunting" as "the taking of, hunting for, or possession of game by a resident domiciled in a rural area of the state for subsistence uses by means defined by the Board of Game."

Alaska Statute 16.05.940 (24) define "resident" as "a person who for the preceding 12 consecutive months has maintained a permanent place of abode in the state and who has continually maintained a voting residence in th state ..."

Alaska Statute 16.05.940 (9) defines "domicile" as "the true and permanent home of a person from which the person has no present intention of moving and to which the person intends to return whenever the person is away; domicile may be proved by presenting evidence acceptable to the boards of fisheries and game."

Alaska Statute 16.05.940 (25) defines "rural area" as "a community or area of the state in which the noncommercial, customary, and traditional use of fish or game for personal or family consumption is a principal characteristic of the economy of the community or area." The Boards of Fisheries and Game have made and will continue, to make, decisions about which areas of the state are rural.

Taken together, it is clear that these definitions preclude nonresidents from engaging in subsistence hunting or fishing under state law. Likewise, Alaska residents living in temporary construction camps almost certainly could not show that such camps were their domiciles. Alaska residents legitimately domiciled in rural communities would be qualified to hunt and fish under state subsistence regulations; however, large population increases or shifts in the economies of rural communities might cause such communities to lose their "rural area" status.

PUBLIC HEARING COMMENT PH7 (Contd)

RESPONSE

PH7-3 See response to Comments PH5-5 and PH7-2.

PH7-4 Yes, as indicated at the public hearing and throughout the EIS, the pipeline would be within the right-of-way corridor of TAPS for the greatest part of the alignment. Thus, many of those areas already impacted for support systems, such as camps, airfields, access roads and so forth, would be reused by TAGS thus reducing the need to impact new areas.

PH7-5 For information regarding public access and mitigation measures, see response to Comments PH5-4 and PH5-5. Restrictions on vehicular access on lands adjacent to the ROW are up to the landowners, which include the State of Alaska and the Bureau of Land Management.

PH7-6 YPC has stated it will give priority to Alaskan resident hire, in addition to Equal Opportunity Hire priority. YPC intends to identify during the detailed design phase how employment needs would be met. The level and extent of training required will be analyzed during Phase II and III of the project.

PH7-7 See response to Comment PH7-6.

PUBLIC HEARING COMMENT PH7 (Contd)

Stevens Village. We would like 100 percent protection, for subsistence purposes, in place adjacent along the gas line.

Unidentified Voice 1

PH7-8 Is there not enough room in the oil pipeline corridor to put gas line on the existing Yukon River bridge? Would there be another five-mile utilidor or corridor with access around the new bridge?

Mr. Robert Joseph

PH7-9 The option is for another pipeline to go on the existing bridge?

Mr. Don Stevens

PH7-10 Is TAGS going to be asking for any more acres of land, i.e., increasing the size of the existing corridor?

Mr. David Lacey

PH7-11 If Yukon Pacific builds their gas line, would the Northwest Gas Line be built. If Northwest isn't built, could TAGS be placed on the existing bridge? Could TAGS also use the Northwest right-of-way? That would eliminate the need for the new bridge.

PH7-12 Continue to keep everybody informed about the TAGS project.

PH7-13 The rural Alaska areas had negative impacts from the oil line development. The Dall River is being overrun now with a lot of waste and vandalism, over-fishing, and trespass problems. There are hunters coming up here competing for subsistence and jobs. The rural communities must be given an opportunity to share in some positive impact and try to offset any negative impacts to the subsistence economy. Economic opportunities for residents not only during the construction but also the operation of the gas line, such as at the compressor stations.

PH7-14 Stevens Village has energy needs. Can gas taps be installed for take-off by Stevens Village?

PH7-15 Could an impact fund be set up to offset some of the negative impacts and help the communities work with the situation and try to protect their resources and way of life?

Mr. Robert Joseph

PH7-16 How many compressor stations are you going to have along the line? Would each one be manned? Would you increase the corridor? It doesn't go

RESPONSE

PH7-8 See response to public hearing, Comment PH5-1. The proposed TAGS Yukon River pipeline suspension bridge would be located 1,000 feet upriver from the present Dalton Highway bridge. Should the state decide that the 5-mile corridor around TAPS where the use of firearms is prohibited should be expanded when TAGS construction is initiated, the prohibition would extend upriver an additional 800 feet. Since the TAGS bridge is not intended to provide for new public access, there is only remote likelihood for expanding the existing closure further upstream.

PH7-9 See response to public hearing Comment PH5-1.

PH7-10 Yes, as stated in the EIS in Table 2.2.1-1, an additional 23,216 acres would be impacted along the 796.5 mile pipeline corridor during construction. Additionally, 8,425 acres would be dedicated to the TAGS project for the project life.

PH7-11 At this time, ANGTS is a project authorized by the federal government and has an identified specific alignment known as Rev 4, as amended. The TAGS project sponsors have recognized this authorization, and have defined the TAGS project as if authorized ANGTS were in place. Thus, the authorized ANGTS right-of-way has been reserved for use by ANGTS. Under this scenario, TAGS could not use space identified for ANGTS on the Yukon River bridge.

PH7-12 The BLM and the USACE, as well as other federal and state agencies would continue to keep the public informed about the project and major project milestones.

PH7-13 Comments on mitigation to minimize sport harvest competition with subsistence users are presented in response to Comment PH5-5, and addressed in Subsection 2.8. Employment opportunities for rural communities are addressed in response to Comment PH7-6.

PH7-14 See response to public hearing Comment PH5-7. Although that response addresses Fairbanks, it applies equally to Stevens Village.

PH7-15 The establishment of any impact funds to offset negative impacts to local communities is a matter that would be determined during detailed planning preceeding construction (for additional discussion, see response to Comment 13-30).

PH7-16 There would be 10 compressor stations along the pipeline length. Table 2.2.1-2 identifies the location, acres involved and the amount of horsepower. Each compressor staton would be manned with a staff of approximately 20 people.

In several limited areas TAGS could be located outside what is generally known as the utility corridor. TAGS deviates more than several miles from TAPS near Prudhoe Bay, at Galbraith Lake and at Fielding Lake-Summit Lake. It does not appear that the TAGS deviates more than 5 miles from TAPS at any location. The TAGS pipeline route deviations would take advantage of more favorable soil, thermal conditions, wind and, where possible, areas of congestion. The only area where TAGS is appreciably outside an established corridor is at Fielding Lake and Summit Lake.

PUBLIC HEARING COMMENT PH7 (Contd)

outside the corridor? Is there anywhere along the line that you may have to deviate more than 5, 6, 7 to 10 miles along the route?

PH7-17 Our main concern is our subsistence. What impacts would there be during and after construction? How much development will be created after the pipeline is constructed at the Yukon crossing?

Mr. Don Stevens

PH7-18 Is it too early to talk about construction and training? What kind of jobs there would be for rural residences?

Unidentified Voice 2

PH7-19 Is this gas line a sure thing, or is it just another proposal like the Northwest Gas Line?

PH7-20 Are Northwest and Yukon Pacific two different companies?

Unidentified Voice 1

PH7-21 Training should be starting about now, by the time the pipeline construction begins, people would be trained to secure a job.

Unidentified Voice 3

PH7-22 I'd like to see 100 percent protection of subsistence resources.

Mr. Sam Pitka

PH7-23 We have a fish camp located on the Yukon River right below the pipeline crossing. Traditionally, we rely heavily on our trapping and fishing resources. Now we have to apply for trapping permits. Now we have to apply for wood cutting permits. Our livelihood is what's holding us together. We are a proud people. We respect our animals, our wildlife, our fish and game. Native people were here first. It is time that people start recognizing us as a people of the land and to respect us.

Mr. Robert Joseph

PH7-24 It seems like our main concern is subsistence.

Mr. David Lacey

PH7-25 I would hope that BLM and the State and also Yukon Pacific combine their efforts to protect subsistence in the area, and make a major effort to educate and orient not only the workers but also the general public about

RESPONSE

PH7-17 Impacts to subsistence are addressed in Subsection 4.2.17. Also see response to Comments, PH5-5 and PH7-2. The pipeline bridge across the Yukon River would create no additional development; the bridge is a suspension bridge designed for carrying the pipeline only, and not vehicular traffic. Response to Comment PH5-4 addresses access restrictions.

PH7-18 This information would be developed during the five-year detailed design and planning phase with adequate lead-time to allow communities to plan for potential impacts and training program.

PH7-19 The TAGS project is proceeding in a phased approach as discussed in Subsection 1.10. Nothing is a sure thing, especially multibillion dollar projects.

PH7-20 They are different companies.

PH7-21 See response to public hearing Comment PH7-18.

PH7-22 Protection of subsistence resources is partially addressed by proposed mitigation measures regarding access restrictions, sport fishing/hunting/trapping, and by State enforcement of subsistence harvest priority regulations. See responses to Comments PH5-4, PH5-5, and PH7-2.

PH7-23 The importance of subsistence to rural Alaskan residents is addressed in Subsection 4.2.17. See response to Comment PH7-22.

PH7-24 See response to Comments PH5-4, PH5-5 and PH7-2.

PH7-25 See response to Comments PH5-4, PH5-5 and PH7-2. In addition, the Bureau of Land Management would require YPC to provide an education program for all the employees of YPC and its contractors. This program would contain an orientation to the importance of subsistence activities and other Native Alaskan concerns.

PUBLIC HEARING COMMENT PH7 (Contd)

the subsistence economy. The basic human rights of indigenous people are their land, the self-government, and the right to make a living off that land.

Mr. Sam Pitka

PH7-26 Develop an educational program to train Alaskans to qualify them for jobs on the TAGS pipeline. The educational process should be continuous.

RESPONSE

PH7-26 Detailed project plans and requirement, which would be developed during the five-year detailed design and planning phase, should allow adequate time to plan for necessary programs. YPC would encourage use of trained Alaskans on the project.

PUBLIC HEARING COMMENT PH8

October 30, 1987 - Coldfoot

Mr. Woodward

PH8-1 During the construction of TAGS, are there going to be restrictions put on subsistence hunting, fishing, and trapping by the local people?

PH8-2 Will the pipeline companies place restriction on any weapons in camp and not allow workers to trap, hunt, or fish during construction?

Mr. Jack Reakoff

PH8-3 When the last pipeline was built there were no provisions for subsistence. We didn't have a state subsistence law. We weren't given any hearing such as this to state our views. We were closed down. We had to pack our moose five miles back to Wiseman. The regulations that applied during the last pipeline should not be implemented. We have a subsistence law that provides that when fish and game resources are in a limited supply, as would be with a vast influx of construction workers, that subsistence users would be allowed preference over nonrural users.

PH8-4 There are regulations in effect right now that the people in Wiseman are not in agreement with; restrictions to ATV use and restrictions to firearms.

PH8-5 I'm in favor of limiting the workers on this TAGS project to using the old Alyeska's policy of not allowing their workers to have rifles or firearms to compete with the subsistence users.

PH8-6 Proposed TAGS Compressor Sation No. 3 is sited in the Gold Creek gravel pit region in basically an undisturbed area. I am not in favor of this location. If they move the proposed compressor station to old Dietrich Camp area this would be compatible with our subsistence uses. The compressor station in Gold Creek supposedly would require a year-round maintained runway which is not compatible with use in the vicinity. There are sensitive game areas at the Gold Creek compressor station site. It is in immediate proximity to a sheep crossing, to a lambing area, and to an area where game travels between the Bettles River, Big Lake, Upper South Fork area, and the Middle Fork. This is basically a traveling zone for game animals. To put a permanent installation such as a compressor station in that area is not appropriate.

Mr. Paul Dionne

PH8-7 And trapping and hunting, especially trapping, is a means of income to me in the wintertime, so it's a subsistence. The TAGS impacts should be

RESPONSE

PH8-1 The rural preference of State Fish and Game subsistence regulations is discussed in Subsection 4.2.17.4. Mitigation measures are addressed in the responses to Comment PH5-5 and in Subsection 4.8. If local people are hired by YPC and live in the pipeline camps as compared to their residences, they would be prohibited from fishing, hunting, and trapping in the vicinity of the camps. Hunting may be prohibited in the vicinity of construction activities and facilities due to safety concerns (see Subsection 4.2.17).

PH8-2 YPC would probably have a prohibition to firearms in camp similar to that used by Alyeska during the construction of TAPS. However, YPC could not enforce any regulations on trapping, hunting and fishing by construction workers. That authority resides with the State.

PH8-3 As implied in the comment, current law provides for subsistence user preference over sport harvest activities if circumstances make it necessary. Also, see responses to Comment PH8-2 for other potential restrictions on subsistence activities.

PH8-4 The authority for such regulations resides with the state.

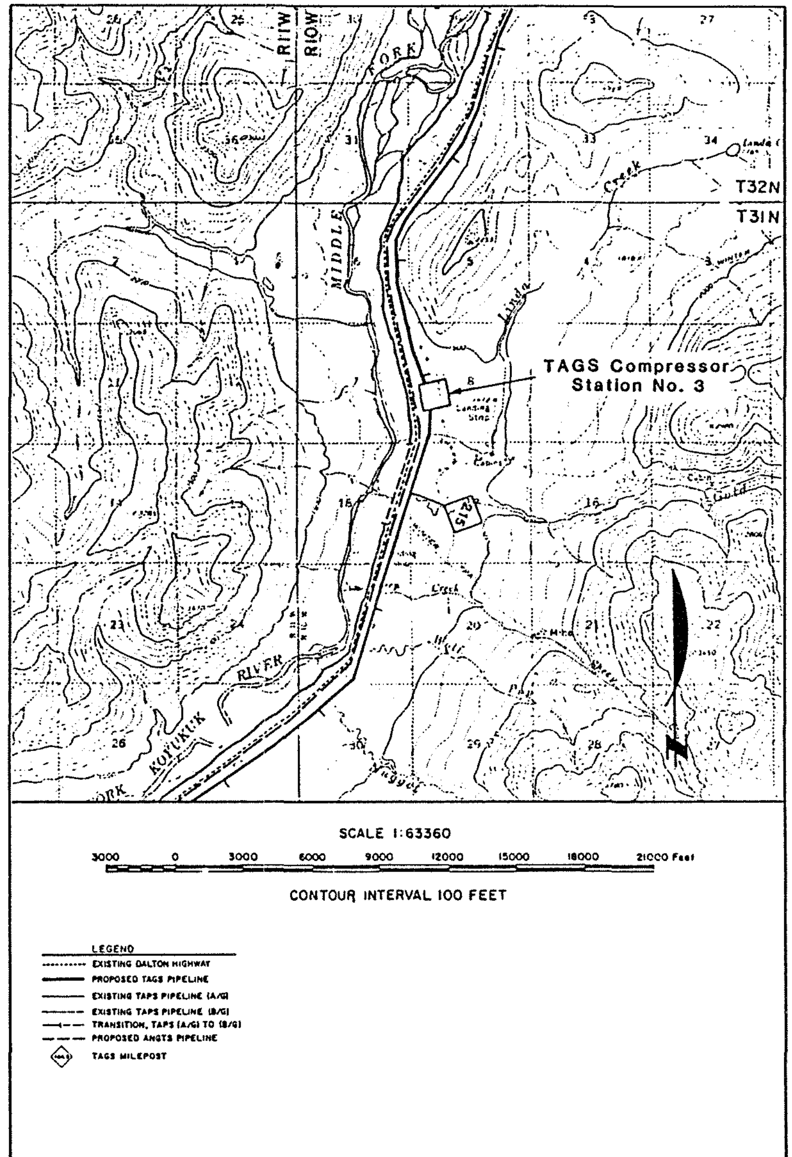
PH8-5 See response to Comments PH8-1, PH8-2, and PH8-3.

PH8-6 The proposed TAGS Compressor Station No. 3 is located in or adjacent to an existing gravel pit, a highly disturbed area and is in the general vicinity of several placer gold mine operations. The attached map more specifically identifies the station location. Although this map does not identify the extent of the existing gravel pit, the site is located adjacent to the Dalton Highway and an access road previously used to haul out gravel. This station location, in an already disturbed area, appears to create minimal additional environmental impacts. Compressor stations are sited along the pipeline route to optimize the flow of the natural gas. Such a change to Dietrich Camp area if it were possible would reduce the optimum flow of gas and require the relocation of other stations throughout the pipeline system. Specific wildlife studies would be conducted during preconstruction to determine the proximity and importance of the identified sheep crossings, lambing areas and other game animals in the vicinity. YPC would coordinate such studies with the ADFG. The project facility locations would conform to the guidelines or conditions placed upon YPC.

PH8-7 See response to comments PH5-5, PH7-2, and PH8-1.

PUBLIC HEARING COMMENT PH8 (Contd)

RESPONSE



Compressor Station No. 3 Location Map

PUBLIC HEARING COMMENT PH8 (Contd)

restricted to the construction zone and shouldn't be allowed to affect my income. Workers should be restricted from hunting and trapping.

Mr. Dave Lacey

PH8-8 On page 4-85 of the DEIS, where it mentions significant restriction of subsistence uses or activities, the affected communities and resources include Nolan, Wiseman, Livengood, and Minto. There is no mention of Stevens Village. I think that is an oversight. Appendix L on page L-17, Section 3.1, mentions that in the northern corridor and Glennallen, Copper Center communities, there would be some short-term but significant restriction of subsistence uses. And then it goes on to say communities significantly affected are those adjacent to or in the immediate vicinity of TAGS route, include Nolan, Wiseman, and Livengood. I don't understand why Stevens Village isn't included in that list.

Mr. Dick Mackey

PH8-9 BLM is contemplating developing or opening up for development a sizeable area in the vicinity of Coldfoot. The runway is already there, communications are here, and various state and federal agencies are putting their complexes in. It would seem that this would be the logical area to locate Compressor Station No. 3, if it is technically feasible, versus 30 miles up the road in what is now an undisturbed area.

PH8-10 Would the comment dealing with Gold Creek be considered as part of the DEIS and subsistence?

RESPONSE

PH8-8 See response to Comment PH5-5.

PH8-9 Compressor stations are located along the pipeline system to optimize the flow of the natural gas as efficiently as possible. The site at Gold Creek, is close to a previously disturbed area. To relocate Compressor Station Number 3 twenty-five to thirty miles further south to Coldfoot would probably require the relocation of all other stations and the use of additional energy to move the natural gas through the system. All compressor station locations will be given intensive review as the TAGS project proceeds.

PH8-10 Yes, see response to public hearing Comment PH8-6.

SECTION 7.5
COMMENT LETTERS

COMMENT LETTER 1

DEPARTMENT OF TRANSPORTATION

UNITED STATES COAST GUARD

Commander, (oan)
17th Coast Guard
District
P. O. Box 3-5000
Juneau, AK
99802-1217
(907)586-7368

16590
22 OCT 1987

USDI Bureau of Land Management
Attn: Mr. Jules Tileston, TAGS Program Officer
701 C Street, Box 30
Anchorage, AK 99513

Re: TAGS DEIS

Dear Mr. Tileston:

This office has reviewed the TAGS DEIS.

The last paragraph of Section 3.2.15.1 mentions that the proposed route traverses one 4(f) land area, Blueberry Lake State Recreation Area.

1-1 The proposed route traverses more than one. My letter of 1 December 1986 mentioned several known or possible 4(f) areas north of Delta Junction. Several parks and similar areas south of Delta Junction are mentioned in the DEIS as being crossed by the proposed route. These, too, would probably be 4(f) traverses.

It would seem appropriate that if 4(f) is to be mentioned in Section 3.2.15.1 at all, it should not be implied that there is only one area involved. All such areas should be listed.

1-2 The 4(f) factor may be largely academic, however. The bridge permitting function is in the process of being transferred from the Coast Guard to the Corps of Engineers, and 4(f) does not apply to Corps permits.

Sincerely,

J. S. MERRILL
Commander, U. S. Coast Guard
Chief, Aids to Navigation Branch
Seventeenth Coast Guard District
By direction of the District Commander

Copy: CDR McCall, MSO Valdez

RECEIVE
NOV 1987

RESPONSE

1-1 Subsequent to Commander Merrill's letter of 1 December, 1986, Yukon Pacific Corporation reviewed its proposed pipeline route alignment and was able to relocate the route and associated construction to remain outside three of the four areas you identified. Blueberry Lake State Recreation Site is the only remaining 4(f) land area traversed by the TAGS project. Quartz Lake State Recreation Area, Dry Creek State Recreation Area, and Worthington Glacier State Recreation Area would no longer be traversed. See Tables 3.2.15-1, 3.2.15-2, 3.3.15-1, and 3.3.15-2.

1-2 Comment acknowledged, discussion of 4(f) reflects this future transfer of permitting function. The exact date for the transfer has not been established, but it is expected to occur during 1989. Until such transfer is effected, the authority for 4(f) continues to remain with the U.S. Coast Guard.

COMMENT LETTER 2

RESPONSE

UNIFIED FAIRBANKS

October 30, 1987

Mr. Jules V. Tileston
Department of the Interior
Bureau of Land Management
TAGS Project Officer
701 C Street, Box 30
Anchorage, AK 99513

SUBJECT: · Testimony for DEIS on TAGS Project

Dear Mr. Tileston:

Enclosed please find a Resolution on the TransAlaska Gas System Project that was passed at the regular meeting of Unified Fairbanks on October 21, 1987.

The Resolution is self-explanatory and detailed on the five areas of concern that we have with this project.

2-1 [We would be pleased to have our areas of concern addressed in your next draft for public hearing.

Sincerely,

UNIFIED FAIRBANKS

Charles P. Rees

CPR:jal:NS2

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NOV 1987

P.O. Box 60389 Fairbanks, Alaska 99706 • (907) 456-7986

2-1 Your concerns are addressed in this FEIS. No further public hearings will be held on this FEIS.

COMMENT LETTER 2 (Contd)

RESOLUTION ON THE TRANSALASKA GAS SYSTEM

WHEREAS Fairbanks, Alaska, is centrally located to this proposed construction effort, and;

WHEREAS Fairbanks, Alaska, is the terminus of the Alaska Railroad that would be the vehicle for major equipment and supply shipments for the construction effort of the pipeline, and;

WHEREAS Fairbanks, Alaska, is the terminus of the Dalton Highway, the supply road leading to the North Slope, and;

WHEREAS Fairbanks is a major supply point for both labor and services and goods that would be used on the proposed pipeline project, and;

WHEREAS the present application and summary is silent as to the role of Fairbanks, other than a maintenance facility will be located in the Fairbanks area, and;

WHEREAS the 63rd parallel has been the traditional separation point in Alaska for union jurisdictional work north of the Alaska Range and that work was the prerogative of Fairbanks, and;

WHEREAS Fairbanks is now looking at a 20" gasline to connect to the Beluga Gas Fields in Anchorage and Kenai, and;

WHEREAS Fairbanks has consistently maintained there should be a take-off in any gas pipeline that comes through the Fairbanks North Star Borough to benefit the citizens of this area with low cost fuel and to promote industrial and petrochemical development.

NOW THEREFORE be it resolved that:

2-2 1) Yukon Pacific be required to detail its intentions for Fairbanks, Alaska, concerning the construction effort of the pipeline and its use of the labor and facilities and services of Fairbanks, Alaska.

2-3 2) That Yukon Pacific be required to detail their plans for the M and O of the pipeline and the hiring of maintenance workers from Anchorage or Fairbanks, and

2-4 3) that the Yukon Pacific applications clearly state that a take-off valve will be in place for Fairbanks, Alaska, as a part of their construction effort, and

2-5 4) that detail will be given Fairbanks by Yukon Pacific prior to final approval of their drawings of what gas flow can be anticipated from that take-off valve, and

2-6 5) what price will be charged for the gas and how will it be calculated.

This resolution was passed by UNIFIED FAIRBANKS on October 21, 1987 at a regular meeting of this body.

UNIFIED FAIRBANKS

Charles P. Rees, President

RESPONSE

2-2 Detailed project plans and requirements will be developed during the five-year detailed design and planning phase. At the present time, YPC intends to site the pipeline and compressor station maintenance facilities in Fairbanks. However, the specific determination as to what facilities would be sited in Fairbanks would be based on the community's interest in having some facilities in the borough, restrictions imposed by zoning and health standards, and the economics of placing such a facility in the area.

2-3 See response to Comment 2-2.

2-4 At the present time, the ANGTS project has stated that a natural gas takeoff valve would be placed in Fairbanks for city-wide use. It is also noted that Enstar has proposed construction of a natural gas line between Anchorage and Fairbanks. The purpose of the Enstar proposal is to transport Cook Inlet natural gas northward to Fairbanks for city-wide use. Therefore, if ANGTS is constructed before TAGS, then a gas tap would be already available to the city. In the event that ANGTS is not constructed before TAGS, and the Enstar proposal has not been built, then the TAGS project would provide a gas tap in the Fairbanks area.

The State Right-of-Way Leasing Act, AS 38.35 et seq., requires TAGS to provide connections, as determined by the Alaska Public Utilities Commission under AS 4206.340, for persons contracting for wholesale purchases of natural gas when required by the public interest. Further, the State of Alaska can require connections anywhere along a pipeline if it is deemed necessary to transport royalty natural gas taken in kind.

The Alaska Public Utilities Commission can require that during construction of a pipeline, appropriate hardware be installed for future connections. The Commissioner of the Department of Natural Resources, local governments, individuals, or corporations may request such special connections. The cost for connections or special hardware for future connections are borne first by the State, which is then reimbursed by the municipality, individual or company utilizing the connections. The applicant is required to comply with state law with regard to gas takeoff connections and interconnections.

2-5 See response to Comment 2-4. The quantity and quality of gas potentially available to the Fairbanks area can be discussed after detailed design is completed and at such time as details of any prospective gas taps are complete.

2-6 Insofar as "pricing" of gas transported through the Trans-Alaska Gas System, the pipeline would be operated as a common carrier pipeline pursuant to AS 38.35. As such, any intrastate sales would be at a rate approved by the Alaska Public Utilities Commission. Pipeline rates would be determined using a rate base methodology and, obviously, cannot be calculated until after the pipeline is completed. Nonetheless, provisions of the Alaska Public Utilities Act will insure ample public participation in setting that rate.

COMMENT LETTER 3

1 November 1987

Donald C. Chesebro
Box 972
Valdez, Alaska 99686

Jules V. Tileston
Bureau of Land Management
701 C Street, Box 30
Anchorage, Alaska 99513-0099

Dear Mr. Tileston,

After having reviewed the DEIS for the TAGS, I favor construction of the TAGS to Anderson Bay. Construction of the TAGS in the TAPS utility corridor should minimize nearly all environmental impacts.

3-1 I do not find in the DEIS exactly how close or distant the TAGS would be from the TAPS. In my view the closer the two systems are, the less the impact of the TAGS.

3-2 The DEIS states that in the Keystone Canyon area the TAGS will not follow the TAPS but instead will follow the Richardson Highway. No reason is given for this choice of location. I object to TAGS being placed adjacent to the Richardson Highway. It would be aesthetically objectionable and probably less safe for the public than a route which follows the TAPS around the Keystone Canyon area.

Sincerely,

Donald C. Chesebro

Donald C. Chesebro

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RESPONSE

3-1 In the Introduction, Subsection 1.5 it states that TAGS "proposes to use a 200-foot separation from both TAPS and ANGTS."

3-2 Routing of TAGS proximate to the TAPS route around Keystone Canyon was evaluated early in the project and was found not to be feasible or desirable for several reasons. Construction of the TAPS line above the canyon to the east required extensive earthwork grading and large cuts and fills to develop construction access. The resulting configuration of graded sections allows room for only the TAPS pipeline, with no provision for additional alignments in this area. There appears to be insufficient space for placement of the TAGS pipeline upslope of the TAPS. Routing of TAGS downslope of TAPS was determined to be not feasible due to the extensive required disturbance of fill sections, potential soil instability, and the potential for affecting TAPS.

An on-site field evaluation of the proposed TAGS route and alternatives through the Keystone Canyon area was conducted by YPC during the summer of 1987 to collect additional information pertaining to the feasibility of the TAGS co-use routing with the Richardson Highway and to identify potential geotechnical and construction concerns within the canyon. Various potential routing options, which avoided co-use with the Richardson Highway and potential construction conflicts were evaluated. The alternative for routing the line out of the canyon is the "Goat Trail" on the west wall of Keystone Canyon approximately 100 to 300 feet above the highway starting near the old road alignment at Bear Creek and following an old trail to join with the current routing near Bridal Veil Falls. This alternate route, which is the same length as the current route, avoids approximately 2.3 miles of co-use with the Richardson Highway in Keystone Canyon.

This "Goat Trail" route is a narrow graded ROW which was apparently utilized before construction of the highway along the Lowe River. The "Goat Trail" option has several potential concerns regarding its use as a pipeline route, including extensive grading on cross slopes up to 80 percent, deep burial of the pipeline at Snowslide Gulch to reduce erosion concerns, and a cut through a small ridge.

Slope stability concerns on the current route between Ruddleson Falls and Bridal Veil Falls would not be eliminated by the "Goat Trail" option. Through much of this area, the "Goat Trail" route is located at the top of the Richardson Highway rock cuts. Stability of these rock cuts is therefore important to this route option since instability has the potential to destroy the access road and undermine the pipeline. Additionally, alteration of drainage could affect the hydrostatic conditions and stability of the highway cuts.

The "Goat Trail" option and a routing paralleling the TAPS alignment have serious problems with constructability. The stability of the rock cuts through Keystone Canyon could be affected by "Goat Trail" construction, and TAPS stability could be affected by downslope TAGS construction. TAGS construction in Keystone Canyon would be confined to existing disturbed areas, and would result in minimal visual impact after completion of construction. The extensive grading required for either the "Goat Trail" or TAPS alternatives could result in major visual disturbances. Finally, the "Goat Trail" has an identified historic and recreational value which would be significantly diminished should construction of TAGS occur on this optional alignment.

Once the TAGS pipeline is buried, predominantly in the highway ditch next to the canyon wall, it deviates only to avoid conflict with the highway bridges and to cross the Lowe River in the canyon, and would not be visible except for the river crossing.

COMMENT LETTER 4

RESPONSE

J. B. JACKS
S.10 W 31357 IRWIN CT.
WALES, WI 53183

11-1-87

Jules Tileston, TAGS Officer
BLM - 701 C St.
Box 30
Anchorage, AK 99513

Dear Mr. Tileston:

I am writing in support of the Trans-Alaska Gas System. We need such systems if we are ever to achieve highest and best use of Alaskan lands.

As things stand now, it seems that all we will ever have in Alaska is nature preserves with very little room for people.

There is already too much Alaskan lands off limits to developments... lets push this project through!

Sincerely,

JB Jacks

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NOV 5 1987

Comment noted.

COMMENT LETTER 5

RESPONSE

Greater Fairbanks **Chamber** of Commerce

First National Center
100 Cushman Street
(907) 452-1105
P.O. Box 74446
Fairbanks, Alaska 99707

FAIRBANKS HUB OF THE INTERIOR

November 2, 1987

Mr. Jules Tileston
U.S. Department of Interior
Bureau of Land Management
Alaska State Office
701 C Street, Box 30
Anchorage, Alaska 99513

Dear Mr. Tileston:

Enclosed, please find a copy of the position taken by the Greater Fairbanks Chamber of Commerce regarding the Trans Alaska Gasline System project.

Sincerely,

W.R. Cox
W.R. Cox
President

WRC/rmt

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NOV 12 1987

COMMENT LETTER 5 (Contd)

RESPONSE

Greater Fairbanks **Chamber** of Commerce

First National Center P.O. Box 74446
100 Cushman Street (907) 452-1105 Fairbanks, Alaska 99707

The Greater Fairbanks Chamber of Commerce supports the Trans Alaska Gasline System project. Our members welcome progress, the positive economic impact from both construction and operational phases, as well as enhanced quality of life for affected Alaskans.

Fairbanks and Alaska is home to a major labor force skilled in pipeline construction and operation. Fairbanks has been a service center for Alyeska since it began operation and the community has developed around this role. Opportunities resulting from the TAGS project will be necessary for the community to maintain a diverse and viable spectrum of businesses, especially as oil field production begins to decline.

Our community has upgraded its utility infrastructure and is well prepared and experienced in meeting the service demands for construction and operational activities. There is adequate housing, office, and warehouse space available for economic growth. Our hospital, one of the most modern available, is under-utilized as are many of our other socio-economic facilities. Consequently, we encourage TAGS to consider our community when locating their operational and administrative headquarters.

In summary, we believe the economical opportunities accompanying this project outweigh any adverse impacts that have been identified to date. The availibility of natural gas as a heating/cooking fuel will help mitigate existing carbon monoxide polution. We endorse this project for the economic opportunities it affords our community and members.

Dated this 20th day of October, 1987.

Mike Kelly - Chairman W.R. Cox - President

Your comments are noted.

COMMENT LETTER 6

National Parks and Conservation Association Est 1919

November 10,1987

Jules V. Tileston
TAGS Program Officer
Bureau of land Management
701 C Street, PO Box 30
Anchorage, AK 99513

Dear Mr. Tileston,

Here are our comments on the Trans-Alaska Gas System (TAGS) Draft Environmental Impact Statement, dtd. September 1987. The National Parks and Conservation Association, founded in 1919, is the only non-profit, organization devoted to protecting and improving all of our Nations National Parks. At present the Association has about 60,000 members (300 in Alaska). While the association is primarily concerned with the management of National Parks, it has concerns for the health and welfare of the environment nation-wide.

We are pleased that the proposed route does not go through Denali National Park as one of the alternatives in the scopping document suggested. It appears that the proposed route beginning a Prudhoe Bay and terminating at Anderson Bay in Prince William Sound is the most feasible and prudent route for TAGS. We feel that the DEIS does a good job of analyzing the alternative routes and the preferred route seems to meet the criteria identified through scopping and is the most environmentally sound.

6-1 We do however, feel that the DEIS is lacking in its treatment of economic factors relating to the economic feasibility of such a project. The DEIS does identify the primary market as being the "Pacific Rim", but the document does not address weather or not the gas will be competitive in the world market. Nor does the DEIS consider any market test, project financing, or any evaluation of

6-2 the projects feasibility under various economic conditions. As we pointed out in our previous comments, NEPA requires the agency to considers the relationship between local, short-term uses of man's environment and long-term productivity, including the relationship between the short-term benefits to be derived from the project and the long term environmental degradation that will result. We find the economic portion of the process to be lacking in this DEIS. As a minimum you need to make visible you considerations of economic feasibility, minimum gas price structures, realistic markets, and cost/benefit of construction.

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NOV 13 1987

National Parks and Conservation Association
1015 Thirty-First Street, N.W., Washington, D.C. 20007
Telephone (202) 944-8530

RESPONSE

6-1 This comment suggests that an analysis be provided of economic issues for which there would be no environmental consequences in terms of physical or biological impacts. Such an analysis would exceed the scope of an EIS. The Council of Environmental Quality's (CEQ) regulations for implementing NEPA suggests the conclusion that it is not an appropriate or obligatory part of the NEPA process to analyze the economic issues identified in the comments, such as the economic feasibility of the project, potential gas prices in the world market, or the cost/benefit of construction.

On the latter issue, the CEQ regulations are quite clear. Only if a cost/benefit analysis relevant to the choice between alternatives is being done, shall it be incorporated by reference or appended to the statement (40 CFR 1502.23). For purposes of NEPA compliance, the weighing of alternatives need not be displayed in a monetary cost/benefit analysis, and should not be so displayed when, as in this EIS, there are important qualitative considerations to address.

The EIS fulfills its NEPA requirement with regard to the economic issues raised in these comments by indicating those considerations, including factors not related to environmental quality, which may be relevant.

Since the proposal is for a commercial (non-government) project, the applicant, YPC, would be the final judge of the economic feasibility of this project. However, the Department of the Interior will consider economic and other non-environmental issues during its decision process following publication of the final FEIS.

6-2 Subsection 4.9 of the DEIS addressed the local short-term economic benefits of the TAGS project and the minimal long-term environmental effects. The socioeconomic Subsection 4.2.2 further discusses the environmental effects of the TAGS project.

COMMENT LETTER 6 (Contd)

2.

6-3 We still question the need for a separate pipeline, because we understand that gas may be injected into the present line and transported in that manor. The DEIS does not consider this option.

6-4 In addition we do mot understand why we must continue to consider export of the energy when the administration is so determined to open up the Arctic Refuge to full leasing sot that the country is energy self sufficient. The DEIS addresses the issue of balancing the trade deficit with this gas, but does not address the issue of substitution of an unknown quantity of energy from the Arctic Refuge at great cost to the nation and the environment, with a known quantity of gas at minimum cost and risk to the environment. We would like to see this analyzed prior to any further work on this project by the federal government.

If you have any questions please contact me.

Sincerely,

William J. Holman

William J. Holman
Alaska Regional Representative
4300 Rendezvous Circle
Anchorage, AK 99504
(907) 337-9454

RESPONSE

6-3 Natural gas cannot be injected into the TAPS oil pipeline. To efficiently and effectively transport natural gas, it must be compressed to flow at high pressure in a gaseous state. To effectively transport oil, it must be pumped in a liquid state. The systems for performing such functions are totally different. Further, the TAPS pipeline was not designed to accommodate the high pressures required for the transportation of natural gas.

6-4 The TAGS DEIS assumed that the authorized ANGTS would be constructed in order to assure that the cumulative environmental consequences of the proposed TAGS project were evaluated in accordance with the requirements of the National Environmental Policy Act. (See responses to Comments 12-1 and 12-3 for a discussion of natural gas supply estimates for the Alaska North Slope.) On January 12, 1988, the President of the United States concluded that there was an adequate supply of secure, reasonably priced supplies of natural gas to meet the demand of American consumers for the foreseeable future. The authorized, but unconstructed, ANGTS project would be capable of also transporting any future proven reserves of natural gas on the Alaska North Slope including those that might be discovered in the coastal plain area of the Arctic National Wildlife Refuge; therefore, authorization of the TAGS project to export Alaska North Slope natural gas does not effect the results identified in the TAGS DEIS. Congress will make the decision on ANWR.

COMMENT LETTER 7

United States Department of the Interior

MINERALS MANAGEMENT SERVICE

ALASKA OUTER CONTINENTAL SHELF REGION
949 E. 36TH AVENUE, ROOM 110 ANCHORAGE, AK 99508-4302

NOV 12 1987

Memorandum

To: TAGS Project Officer

From: Regional Director, Alaska OCS Region

Subject: Review of Trans-Alaska Gas System (TAGS) Draft Environmental Impact Statement (EIS)

The following comments are the result of our review of the TAGS draft EIS. We have organized our comments by page references.

7-1 Page S-4, Table S-1: The term "social well-being" in the human resources definition is confusing. Section 4 discusses "Social/Cultural Impacts" as they relate to cultural identity and sociocultural systems. The definition would be clearer if the focus were on these "systems" opposed to "well-being." This comment would also apply to Table 4.1-1.

7-2 Page S-4, Table S-1: The word "imports" in the last sentence of the footnote should be "impacts" (see Table 4.1-1).

7-3 Page S-5, Table S-2: From the analysis provided in Section 4, the major/moderate impacts given to subsistence resources seem unjustified.

7-4 Page 2-2, Table 2.2.1-1: The reason that helicopter facilities were not referenced during the operation phase should be explained.

7-5 Page 2-8 through 2-14, Figures: Sources were not cited for Figures 2.2.1-4 through 1-6 and Figures 2.2.1-8 through 1-10.

7-6 Page 3-47 through 3-49, Table 3.2.11-1: This table shows that 27 of the 104 streams are "denoted highly sensitive fish stream crossings." This seems significant and should be discussed more in-depth than presented on page 3-94/95.

7-7 Page 3-50, 3.2.11.2: This section states that "Arctic char are found primarily in the Sagavanirktok River and its major tributaries . . . ." Arctic char are found in a number of drainages in the central Beaufort (see Craig, 1984). Also, arctic cisco and broad whitefish are found in the Sagavanirktok River (see Endicott reports).

7-8 Page 3-68, 3.2.14: This section does not agree with former discussions by area (3.2.13) for the peregrine falcon.

7-9 Page 3-68, 3.2.14: Include Salmon Bluffs in paragraph four as a concentration area.

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NOV 16 1987

RESPONSE

7-1 Tables S-1 and 4.1-4 have been modified to reflect this comment.

7-2 Table S-1 have been modified to reflect this comment.

7-3 We have carefully reevaluated the major and moderate impacts given for subsistence in the light of other comments on the DEIS including results of formal subsistence hearings in Glenallen, Stevens Village, and Coldfoot. At this time, we still conclude that there would be, under a worst-case scenario, a "significant restriction" to subsistence uses to the areas identified in Figure 4.2.17-1 during the 36-month construction period that TAPS was built. It is probable that cooperative efforts by YPC, and the local, state, and federal governments can result in mitigation measures that will offset or preclude any long-term adverse effects on existing subsistence in these two regions.

7-4 As can be seen on Figure 2.2.1-3, a heliport pad is included for each of the 10 compressor stations. Additionally, eacn of the construction camp sites, material storage yards, and LNG facilities would be equipped to accommodate helicopters. No additional disturbed area for each facility should be identified.

7-5 The figures located on pages 2-8 through 2-14 were prepared by Yukon Pacific Corporation.

7-6 The rivers and streams identified on pages 3-94 and 3-95 are not the only pages on which the highly sensitive fish stream crossings are discussed. These pages constitute the discussion for the Cook Inlet-Boulder Point alternative from a point just south of Livengood to the Boulder Point site on the east side of Cook Inlet. The discussion on pages 3-46 and 3-50 through 52 describes the fishery resources and fish stream crossings for the Anderson Bay alternative. Additionally, fishery impacts and impacts on stream crossings are addressed in Section 4.2.11 (pages 4-52 and 4-53).

7-7 Subsection 3.2.11.2 has been modified to reflect this comment.

7-8 Subsections 3.2.13 and 3.2.14 have been modified to reflect this comment.

7-9 Sagwon Bluffs or "Salmon Bluffs" is added to the discussion in Subsection 3.2.14.

COMMENT LETTER 7 (Contd)

2

7-10 Page 3-68, 3.2.14: Not only does the American peregrine falcon migrate along the Tanana and Yukon Rivers (paragraph five), but both rivers are significant nesting areas.

7-11 Page 3-69, Table 3.2.14-1: The location/comment column for the American and arctic peregrine falcon is inconsistent with Section 3.2.13.

7-12 Page 3-76, 3.2.17.1: Subsistence is stated to be the "foundation" of the sociocultural system, yet sociocultural systems are given minimal discussion in this document. This section should be expanded.

7-13 Page 3-76, 3.2.17.2.1: The reader would not know from the text the tremendous importance of the bowhead whale to the Inupiat. In addition, virtually no information describing the differences between community (i.e., harvest locations, quantities, or timing) can be found in this section. The moose harvest data noted on page 3-101 should appear in this section. A good analysis of subsistence harvest is presented for the Nenana corridor and farther south. This type of analysis should also be presented for North Slope communities.

7-14 Page 4-19 through 4-22, 4.2.4: It would be useful to incorporate a logistic flow scheme (i.e., where materials enter Alaska, how much enters, and what enters) into the transportation discussion. From this, the author could logically assess the series of impacts on ports, roads, and airports.

7-15 Page 4-19 through 4-22, 4.2.4: A personnel travel scenario in regards to personnel location and movement to and from the workplace does not appear in this document. This would be necessary to justify the conclusion regarding impacts of personnel travel patterns.

7-16 Page 4-27, Table 4.2.6.1: For particulate matter (PM), the new PM_{10} particles should be included. Also, include Prevention of Significant Deterioration Class II air quality limits, which apply to most of Alaska.

7-17 Page 4-28, Table 4.2.6-2: This table illustrates the calculated concentration for Nitrogen Dioxide is greater than significant impact level (not lower as stated in the text at top of the second column).

7-18 Page 4-29, 4.2.6.3.3: The measures discussed are not mitigative. They are standard and would not reduce expected emissions.

7-19 Page 4-31, Table 4.2.7-1: There appears to be a label error in this table. The last two columns have the same label.

7-20 Page 4-35, 4.2.8.2: Excavation for the LNG terminal should be included.

7-21 Page 4-36, 4.2.8.3.2: The EIS for the Beaufort Sea Sale 97 has been finalized.

7-22 Page 4-62, 4.2.13.2.1: As stated in the fifth paragraph, "Caribou cows are very sensitive to disturbance during the calving season, and localized avoidance of development activities has been documented (Shideler, 1986)." Cite the original author and investigator of this finding and the primary publication from which this conclusion is derived, i.e., Cameron, R. D. 1983. Caribou and petroleum development in Arctic Alaska. Arctic 36(3):227-231).

RESPONSE

7-10 Subsection 3.2.14 has been modified to reflect this comment.

7-11 Table 3.2.14-1 has been modified to reflect this comment.

7-12 We have reviewed the evaluations on subsistence and have concluded the description is adequate.

7-13 The purpose of this analysis is to address aspects of subsistence that could potentially be affected by the proposed project. The YPC project would have no impacts on bowhead whales and related subsistence activities. With regard to information on difference in harvest patterns between communities, the comment is accepted. See modifications in the FEIS in Subsection 3.2.17.1.

7-14 A detailed logistic flow plan would be developed for the TAGS project at a later project stage. Due to the upgrade of the state's infrastructure during and since TAPS, it does not appear that there would be any necessary expansion of ports, roads, and airports for the TAGS. Expansions during the last 10 years can accommodate many more flights than present use. All major Alaskan highways have been upgraded in recent years and are significantly below capacity, and all ports in Alaska have excess capacity for transfer of project related cargo.

7-15 As stated in the previous comment, this is a detail which must await further project definition.

7-16 See response to Comment 25-4.

7-17 See response to Comment 25-6.

7-18 Comment accepted and the FEIS incorporates recommendation in Subsection 4.2.6.3.3.

7-19 Table 4.2.7-1 modified to reflect comment.

7-20 Comment accepted and FEIS incorporates recommendation in Subsection 4.2.8.2.

7-21 Cite for DEIS changed to FEIS in Subsection 4.2.8.3.2.

7-22 Cameron replaces Shideler for cite, since the primary conclusion was derived from this original publication, and incorporated into his 1986 literature review.

COMMENT LETTER 7 (Contd)

7-23 Page 4-63, 4.2.13.2.1: The assessment of impacts on caribou is a brief and general analysis with little explanation of how impact levels (minor to negligible) were derived. For example, in the first paragraph, the analyst states that caribou avoidance of the pipeline corridor due to human activity would be a minor effect because construction would occur during the winter. Explain the significance of why winter construction activities are less disturbing to the caribou.

7-24 Page 4-69, 4.2.14: "Endangered" should be included in the title.

7-25 Page 4-70, Table 4.2.14-1: This table does not list whales or plants as referenced in the text on the previous page. This table should also distinguish between Arctic and American peregrine falcons.

7-26 Page 4-78 through 4-85, Subsistence: The areas used for subsistence activities were not described and the analysis leading to the impact assessment is not thorough. In the first paragraph under 4.2.17.5, list what the "disadvantages" are that employment presents to the traditional subsistence way of life.

7-27 Page 4-121, 4.5.13: This analysis should include the effects of other ongoing and proposed projects such as the Endicott development and ANWR oil exploration. All potential oil and gas development projects in the Arctic are interrelated in their transportation infrastructure and this will have an effect on wildlife populations.

We appreciate the opportunity to comment on this document. Please address any questions you have regarding our response to Michael Baffrey at 261-4679.

Alan D. Powers

RESPONSE

7-23 The brief, general analysis of impacts is consistent with the "generic" nature of the EIS as identified in Section 1. The impact levels described were based on the original impact definitions identified in Table S-1. Reference to winter construction was deleted in the FEIS.

7-24 The title for Subsection 4.2.14 has been modified.

7-25 Subsection 4.2.14.1 and Table 4.2.14-1 has been modified to reflect this comment.

7-26 Considerably more information was reviewed and analysed than presented in EIS. The EIS does not present an encyclopedic description of subsistence activities; it provides a description necessary to understand the significant impacts of the project and alternatives. The comment related to disadvantages in reference to employment has been added to 4.2.17.5. In general, the sections on subsistence have been modified to reflect similar comments.

7-27 The Endicott development project is an offshore project which recently became operational. The primary concerns of this project were marine in nature, relating to fish movement and migration, impacts to whale migration, and impacts to various coastal processes which could affect marine organisms. Marine environment from TAGS are primarily in Valdez Arm, not the Beaufort Sea.

It is uncertain as to what type of development would occur in ANWR should it be opened for oil development. The TAGS pipeline would be totally below ground and should not, except during construction, impact wildlife on the North Slope. ANWR is more than 50 miles from where TAGS development would occur. Further, the Porcupine Caribou herd does not use areas where TAGS facilities would be located. Most oil and gas sale/lease decisions by the state and federal governments on the Alaska North Slope have presumed that a gas transportation system to markets would be developed. Accordingly, the overall interrelationships on wildlife populations have been considered in those prior decisions. We do not view TAGS as having a significant effect on the conclusions leading to those earlier oil and gas sale/lease decisions.

COMMENT LETTER 8

DEPARTMENT OF THE AIR FORCE
REGIONAL CIVIL ENGINEER, WESTERN REGION (AFESC)
630 SANSOME STREET - ROOM 1316
SAN FRANCISCO, CALIFORNIA 94111-2278

NOV 16 1987

REPLY TO ATTN OF: ROVP (Tye/556-0887)

SUBJECT: Review Comments - Proposed Trans-Alaska Gas System Draft EIS

TO: U.S. Department of the Interior
Bureau of Land Management
Alaska State Office
701 C Street, Box 30
Anchorage, Alaska 99513-0099
ATTN: Jules V. Tileston

1. This office has reviewed the subject document and has the following comments:

a) Appendix Map F-2 indicated the TAGS pipeline route crossing is in the proximity of Eielson AFB. [8-1] Does the proposed pipeline enter Air Force property? [8-2] Will a new easement be required and what environmental and security impacts will the project have on AF property? Recommend that Alaska Air Command and Eielson AFB be included on the mailing list for future reviews or meetings.

[8-3] b) The Air Force should be provided with assurances that the centrifugal compressors at the Compressor Stations along the TAGS pipeline route will not introduce electronic interference for Air Force communication and electronic systems.

[8-4] c) Will the road construction and increased traffic generated by the TAGS project disrupt access to Air Force installations?

[8-5] d) An alternative pipeline route as described on Page 3-84 indicates that the pipeline will cross Clear AFS property. Please insure proper coordination with HQ Space Command and Clear AFS representatives.

[8-6] 2. Inasmuch as this DEIS does not specifically address potential impacts to either of the Air Force Installations noted above, request that an updated DEIS be issued to include discussion of said impacts. Also request that additional time be provided for the purpose of reviewing and commenting on subsequent DEIS.

3. Please direct any inquiries or future correspondence to Mr. Michael Tye of this office at 415-556-0887.

Phillip E. Lammi
PHILLIP E. LAMMI, Chief
Environmental Planning Division

cc: HQ USAF/LEEVN
HQ AAC/DERA
HQ AF SPACE COM/DEPV
343 CSG/DEEV

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NOV 23 1987

RESPONSE

8-1 Like TAPS and authorized ANGTS, TAGS enters U.S. Air Force property at Eielson Air Force Base.

8-2 Yes, easements similar to those issued to TAPS would be negotiated. the environmental impacts to Eielson would be similar to those which occurred with TAPS construction and operation. YPC would coordinate with the Air Force on matters of security.

8-3 TAGS compressor stations are not expected to introduce any electronic interference to existing or proposed (OTH-B Radar) Air Force communication or electronic systems. All compressors and power generators would be driven by turbines which do not utilize electronic ignition systems. No TAGS facilities would be providers of radio frequency noise. Supervisory control and data acquisition and communications facilities needed to operate TAGS would, however, use radio frequencies.

8-4 There would be increased traffic generated by construction of TAGS since the only access to that portion of the right-of-way is through the base. This impact would be controlled access, similar to that used during the construction of TAPS. Since there would be a construction work pad along the pipeline alignment, there would be minimal heavy equipment traffic on the existing base road system. To reduce impacts to the base peak traffic flow, schedules could be coordinated utilizing off-peak periods.

8-5 If the Cook Inlet alternative was initiated, coordination with the HQ Space Command and Clear AFS representatives would be conducted.

8-6 The FEIS has been strengthened and advance copies of the FEIS were provided to the military for review and comment. The conditions in the proposed BLM right-of-way also provides for coordination and consultation, see Table 4.8-2. Increased traffic at Eielson is identified in Subsection 4.2.4.4.

COMMENT LETTER 9

Dinyee
P.O. Box 1372
Fairbanks, AK 99707-1372

November 16, 1987

BLM
Alaska State Office
701 C Street, Box 30
Anchorage, AK 99513-0099
Attention: Jules V. Tileston

Dear Mr. Tileston:

Dinyee is sending comments on the TAGS Draft Envioronmental Impact Statement. First off, we want to compliment you for the plan and the public hearings that you conducted. You did a good job from our perspective. We do have a few comments on the plan itself. We are concerned that the Stevens Village area was not considered as an area that would have significant restriction of subsistence uses during the construction and operation of the gasline due to impacts to fish and wildlife. According to ADF&G, the lowest moose population in the state is in unit 25D. Stevens Village residents believe that that is a result of the oil pipeline. Stevens Village has probably seen more negative impacts
9-1 from the oil pipeline with less positive benefits than any area in the state. Alyeska personnel from the nearby pump station still fish the Dall Rivers quite extensively. It is ongoing. There has been an inverse relationship between the millions of dollars in economic activity in the Stevens Village traditional lands and the negative impacts from it that the village has suffered. Look at how the haul road has affected Stevens Village in the past. Please correct this oversight in the plan.

We are concerned about the planned building of another bridge at the Yukon River. When the time comes the state can condemn the right of way and
9-2 use the current structure. The Yukon River does not need to undergo any unnecessary impacts from this project.

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NOV 25 1987

RESPONSE

9-1 The purpose of this analysis is to address the impacts of the proposed TAGS project. The cumulative impacts of opening up the Dalton Highway are referred to in Section 4.7.17. The TAGS project would do little to create additional access over that which already exists (see response to Comment PH5-4). A second major difference between construction of the TAPS line and opening of Dalton Highway and the proposed TAGS project is the enactment of State regulations regarding subsistence user preference of fish and game resources. The State of Alaska has primary responsibility for overseeing these regulations but under certain circumstances under ANILCA, the Secretary of Interior could have enforcement responsibilities.

9-2 Whether the state would exercise eminent domain for private enterprise is a matter beyond the scope of this document.

The Yukon River bridge crossing proposed for this project would be located approximately 1,000 feet upriver from the present highway bridge. The bridge for the TAGS project would be constructed solely as a pipeline bridge; no roadway would be constructed. This bridge would be similar to, but longer than, the existing TAPS crossing of the Tanana River southeast of Fairbanks along the Richardson Highway. Except for the restriction of some existing public access at the north bridge abutment, for security reasons, there are no significant environmental consequences identified. See subsection 4.2.9.13.

COMMENT LETTER 9 (Contd)

9-3 On page 4-11 the statement, "during construction of the oil pipeline the only two inhabited settlements on the route directly affected were Wiseman and Livengood". This is not true. Stevens Village was directly affected.

9-4 On page 4-17 it states that, "construction camps would be closed upon completion of construction and facilities removed". This was supposed to happen after the oil pipeline was constructed but as we see at Coldfoot it did not and we see the mess that is there now.

9-5 We are concerned that the gas line construction should involve less access roads being created. There were far too many constructed for the oil pipeline. This impacts subsistence and the country greatly.

9-6 We are concerned about impacts from overfishing and trespass problems at the Dall Rivers. The Dall Rivers should be off-limits to the construction and operations personnel. Steps should be taken to mitigate impacts to these culturally and economically important rivers to Stevens Village. There is a conservation problem there now as a result of the oil pipeline according to the local people who know their rivers intimately.

9-7 To try to offset the many negative impacts to the local people, BLM needs to insure that the economic opportunies are maximized for them. Local, local hire needs to be a priority. J/Vs with the local village corporations need to be promoted and mandated during construction and operation of the line. Impact funds should be made available for the local communities in order for them to train workers and deal with the social impacts.

9-8 The workers and public need to be kept informed and educated about the subsistence economy, Athabascan culture, and the special relationship that Native Americans have with the federal government. This will help to mitigate some of the impacts.

Finally, we appreciate the fact that we are being kept informed. Please keep it up.

Cordially,

Cheryl Mayo

Cheryl Mayo
President
Dinyee

RESPONSE

9-3 Wiseman and Livengood were the only two inhabited settlements within 15 miles of the TAPS pipeline route. Subsection 4.2.2.2.2 has been modified to reflect this comment. (Residents of Nolan are not generally eligible for subsistence harvests in the nearby Gates of the Arctic National Park and Preserve.)

9-4 As stated in Subsection 4.2.3.2, Yukon Pacific Corporation, sponsors of the proposed TAGS project, plan to close each pipeline construction camp and remove facilities. The facilities that remained at Coldfoot Camp after completion of TAPS were approved by the BLM to provide public facilities for use by the public in conjunction with the State decision to open the Dalton Highway to public travel north of the Yukon River. An office complex is also located in this area for NPS, along with State highway maintenance facilities, a public airport, a BLM temporary office, and a public safety office.

9-5 The proposed TAGS project would utilize as many of the existing access roads constructed for the TAPS project as possible to reduce the impacts identified in this comment. The location and design of access roads would be determined during final design based on engineering and environmental constraints, and project construction requirements. Temporary access roads required for construction would be blocked and reclaimed to prevent further use. Appendix E of the DEIS contained a list of the access roads by milepost and length. There are indeed many fewer access roads for the proposed TAGS project.

9-6 As a mitigation measure proposed for this project, the employees of YPC and its contractors will be prohibited from sport hunting while they reside in the TAGS construction camps. Furthermore, the BLM would require YPC to provide an education program for all the employees of YPC and its contractors. This program will contain an orientation to the importance of subsistence activities and other Native Alaskan concerns. In regard to current problems with over-fishing and trespass, enforcement is the responsibility of tne ADFG and the affected landowners.

9-7 Yukon Pacific Corporation has stated that Alaskan hire would be a priority both during construction and operation of the TAGS project. This statement is made also with the knowledge that YPC must adhere to Federal Equal Opportunity laws in the hiring of workers. YPC intends to identify during the detailed design phase how employment needs would be met. The level and extent of training would be analyzed during Phases II and III of the TAGS project.

9-8 An employee information program would be conducted by the project sponsors to provide each employee with information concerning various aspects of arctic safety, environmental protection, and specific project restrictions. Such information, as suggested in this comment, could be incorporated into this training program.

COMMENT LETTER 10

Alyeska pipeline
SERVICE COMPANY

1835 SOUTH BRAGAW STREET ANCHORAGE ALASKA 99512 TELEPHONE (907) 278-16·· TELEX 090-25-127

November 17, 1987 Letter No. 87-3685

Jules V. Tileston
U.S. Department of the Interior
Bureau of Land Management
Branch of Pipeline Monitoring
701 C Street, Box 13
Anchorage, Alaska 99513

Re: Draft Environmental Impact Statement for The Trans Alaska Gas System

Dear Mr. Tileston:

This letter constitutes the written testimony of Alyeska Pipeline Service Company as Agent for the below listed Permittees of the Trans-Alaska Pipeline System (TAPS), submitted in response to the Notice of Availability and Public Hearings published in the Federal Register September 11, 1987 by the Bureau of Land Management, Alaska State Office, and U.S. Army Corps of Engineers, Alaska District, with respect to the Draft Environmental Impact Statement (DEIS) for the Trans Alaska Gas System (TAGS). In submitting this testimony Alyeska recognizes that the DEIS is not intended to be a description of TAGS as that proposed system directly impacts upon the existing TAPS crude oil pipeline system including the Valdez Marine Terminal. Alyeska understands that before any proposed transportation system for natural gas is constructed in proximity to TAPS, Alyeska and the TAPS Permittees will be given full and adequate opportunity to comment upon and object to any proposed construction on a site-specific basis. In view of that right, we limit present comment to the following points:

10-1 1. Continued coordination between TAGS, ANGTS and TAPS throughout the project is essential, especially during the planning and design stage.

10-2 2. Any TAGS facilities which are planned possibly to cross or be adjacent to the Valdez Marine Terminal must be coordinated with and approved in advance by Alyeska and the TAPS Permittees.

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RESPONSE

10-1 BLM and the USACE plan to continue the coordination which has been ongoing since the inception of the TAGS project. Good management and safety dictates that during planning and design all present and approved lease holders be fully informed of all aspects of TAGS. See response to Comment 10-2.

10-2 Alyeska Pipeline Service Company will continue to be consulted about proposals for the planning, construction, operation and maintenance of TAGS facilities across or near the Alyeska oil pipeline marine terminal at Valdez. The oil pipeline marine terminal at Valdez is located on land owned by Alyeska. That private ownership is in turn adjoined by lands and waters in State ownership. The Agreement and Grant of Right-of-Way for TAGS would expressly require TAGS not to interfere with operations of the Trans-Alaska Pipeline System or other federal authorization thereto. To achieve this objective, the proposed Grant for TAGS requires the applicant to coordinate any aspect of TAGS plans, programs, and design criteria with Alyeska Pipeline Service Company during the time such plans, programs, and criteria are being developed. Prior to federal approval, the applicant will have to provide evidence that such coordination occurred. Federal approvals would consider the results of these coordination efforts (for additional information see Subsection 4.8 and Table 4.8-2).

COMMENT LETTER 10
(Contd)

Bureau of Land Management
Letter No. 87-3685
November 17, 1987
Page 2

10-3 3. TAPS present and long-term requirements for mineral materials must be recognized and provided for.

10-4 4. Access roads and pipeline rights-of-way must be kept open without interruption for TAPS operations and oil spill response.

10-5 5. Above and below ground crossings of TAPS by TAGS must be approved by and coordinated with Alyeska.

10-6 6. All areas where TAGS is within 200 feet of TAPS must require detailed review and coordination of construction design and activities with Alyeska.

10-7 7. To the extent joint use may appear appropriate for TAPS Related Facilities, such as Access Roads, or for mineral material sites, Alyeska will require advance agreement as to uses and sharing of costs.

Alyeska and the TAPS Permittees appreciate this opportunity to provide comments on the DEIS. Further, we look forward to receiving detailed information as required by the Federal Agreement and Grant of Right-of-Way for the Trans-Alaska Pipeline System in order that Alyeska and the TAPS Permittees may continue to review the plans for TAGS as this project proceeds.

Very truly yours,

ALYESKA PIPELINE SERVICE COMPANY

Alfred T. Smith
Associate General Counsel

sks

cc: G.M. Nelson
T.L. Polasek
S.D. Dietrich

RESPONSE

10-3 Information on mineral material for TAPS has been included in Subsecton 3.2.8.9.

10-4 The proposed TAGS project plans to utilize existing access roads where possible to reduce environmental impacts to areas where such roads are available for access to mineral material or construction access. During construction, while access roads are in use for TAGS, procedures would have been developed by YPC during the planning and design criteria development to assure that TAPS could continue full uninterrupted system operations of these access roads and that they be available for oil spill response. See response to Comment 10-2.

10-5 See response to Comment 10-2.

10-6 The proposed Agreement and Grant of Right-of-Way for TAGS uses the same 200-foot separation standard between TAPS and TAGS that was developed for TAPS and ANGTS. See response to Comment 10-2.

10-7 The proposed Agreement and Grant of Right-of-Way for TAGS would address these issues. However, it has been Yukon Pacific Corporation's position that before construction of the project could begin, an agreement relative to potential effects of TAGS on TAPS would have to be in place.

COMMENT LETTER 11

United States Department of the Interior
NATIONAL PARK SERVICE

ALASKA REGIONAL OFFICE
2525 Gambell Street, Room 107
Anchorage, Alaska 99503 - 2892

IN REPLY REFER TO:
L7619(ARO-REC)

17 NOV 1987

Memorandum

To: State Director, Bureau of Land Management

From: Acting Regional Director, Alaska Region

Subject: NPS comments on the Draft Environmental Impact Statement for the Proposed Trans-Alaska Gas System.

We have reviewed the subject document and have the following comments.

11-1 While no units of the National Park System will actually be crossed by the proposed pipeline, both Gates of the Arctic National Park and Preserve (GAAR) and Wrangell-St. Elias National Park and Preserve (WRST) will be directly affected by sport and subsistence hunters and fishermen using park resources during pipeline construction, and possibly post construction. Potentially, the new users will compete with local rural residents who now rely on park and preserve resources. These resources are important to local rural residents for subsistence activities such as hunting, fishing, trapping, heating and homebuilding.

11-2 The final EIS should specify that all other users may sport hunt in the preserves and sport fish in both parks and preserves in

11-3 accordance with federal and state regulations. As such, the final EIS should evaluate the effects on park and preserve resources and associated subsistence users that will result from both increased sport hunting and fishing in the preserves and increased subsistence use in the parks and preserves by construction and operations employees that become local rural residents.

11-4 The final EIS should also address the potential for the project to cause a redesignation of a community from rural to non-rural because of the effect of the project on the local cash/

11-5 subsistence economy. Should a community or area status be redesignated from rural to non-rural, every resident of that community or area would be ineligible to participate in designated subsistence hunting and fishing seasons anywhere in the state.

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RESPONSE

11-1 Figure 4.2.17-1 has been modified to reflect boundaries of the noted National Parks and Preserves along with the Wild Rivers and/or Wildlife Refuges. Subsections 3.2.17 and 4.2.17 and the ANILCA 810 finding (Appendix L) have been modified to reflect this comment.

11-2 The FEIS incorporates this recommendation in Subsection 4.2.17.4.

11-3 Comment is accepted and the FEIS incorporates recommendation in Subsections 4.2.17.4 and 4.7.17.

11-4 The FEIS incorporates this recommendation in Subsection 4.2.17.7.

11-5 The FEIS incorporates this recommendation in Subsection 4.2.17.7.

COMMENT LETTER 11
(Contd)

11-6 In addition, the location of the Alaska National Interest Lands Conservation Act Section 810(a) finding must be highlighted in the table of contents of the final EIS.

11-7 NPS is concerned about unregulated public access to park/preserve lands associated with the project and the potential resultant

11-8 effect on resources of GAAR. Section 4.2.15.2 (page 4-73) of the draft EIS describes the potential for increased recreation use of areas that are now roadless. This would occur because of improved public access via lateral access roads from the Dalton Highway to the proposed Trans-Alaska Gas System route. We therefore request that the final EIS evaluate the feasibility and effect of regulating public access from project lands during and after project construction.

11-9 The mitigation measures identified in Section 4.6 (page 4-128) do not address project related impacts to recreation and subsistence use in either GAAR or WRST. We recommend the following actions be considered for implementation to reduce potential impacts on park/preserve resources:

1. During project construction, regulate access from the Dalton Highway to exclude other than industrial uses:

2. Prohibit Trans-Alaska Gas System aircraft access to GAAR.

3. Apply hunting restrictions on Trans-Alaska Gas System employees which are consistent with those established by the Alyeska Company.

11-10 Concerning cultural resources, the size of the Gallagher Flint Station National Historic Landmark, described on page 3-74, is incorrect. The landmark is 12 acres in size. The final environmental statement should reflect this correction.

Questions concerning our comments may be directed to Larry Wright, Environmental Compliance Division, telephone (907) 271-2636.

Richard J. Stenmark

RESPONSE

11-6 The FEIS incorporates this recommendation in Appendix L, and Tables 3.2.15-2 and Figure 4.2.17.1.

11-7 It is unlikely that the TAGS project will cause any unregulated public access to park/preserve lands associated with the project. Existing public access would be maintained. During the construction period, <u>new</u> access constructed for TAGS would not be available for <u>public use</u>. At the close of the construction phase, all <u>new</u> access would be restored and stabilized unless a specific decision to the contrary is made by the appropriate state or federal agency.

11-8 The discussion in Subsection 4.2.15.2 relates specifically to access roads in the vicinity of Galbraith Lake, Summit Lake, and Grayling Lake. Access to other areas of concern to the National Park Service would not be increased.

11-9 It is not comtemplated that the TAGS project would result in additional significant impacts to recreation and subsistence use in either GAAR or WRST. The definition of subsistence provided by the State of Alaska, and incorporated into the response to Comment PH5-11, basically prohibits construction workers, other than rural Alaskan employees, from participating in subsistence within the areas identified. The NPS regulations governing subsistence uses in either GAAR or WRST would further reduce the number of people otherwise qualifying under state regulations for subsistence use in either nation park system unit.

With respect to the three specific mitigation measures identified in this comment our response is as follows: 1) Prohibition of non-industrial use from the Dalton Highway is not practical because local rural residents and recreationalists are now using existing access. New access is discussed in the response to Comment 11-7. 2) Air access to units of the National Park Systems are issues that will be resolved by YPC and NPS on a case-by-case basis during subsequent phases of the TAGS project. It is noted however, that complete prohibition of TAGS air access to GAAR would unreasonably restrict standard aircraft practices now in use. For example, air access to the TAPS communication site near the boundary of FAAR requires low-level overflight to approach the helipad. Aircraft also are used to conduct aerial population surveys of Dall Sheep and other wildlife species in the western part of the Utility Corridor. 3) This mitigation measure has been proposed by YPC is part of its application to BLM and USACE. See Table 4.8-2.

11-10 The acreage for the Gallagher Flint Station National Historic Landmark is modified pursuant to this comment in Subsection 3.2.16.

COMMENT LETTER 12

NORTHWEST ALASKAN PIPELINE COMPANY
ONE OF THE WILLIAMS COMPANIES

WILLIAM J. MOSES
GENERAL COUNSEL AND
CORPORATE SECRETARY

3111 C Street, Suite 200
Anchorage, Alaska 99503
907-561-8040

November 18, 1987

U.S. Department of the Interior
Bureau of Land Management
Alaska State Office
701 "C" Street, Box 30
Anchorage, Alaska 99513-0099

Attention: Jules V. Tileston

Re: Written Comments of the Alaskan Northwest Natural Gas Transportation Company regarding the Trans-Alaska Gas System (TAGS) Draft Environmental Impact Statement (DEIS) dated September 1987

Gentlemen:

Northwest Alaskan Pipeline Company (NWA), as Agent and Operator for the Alaskan Northwest Natural Gas Transportation Company (ANNGTC), a partnership, hereby submits the enclosed written comments on the TAGS DEIS. We request that these written comments be included in the official record of proceedings in accordance with the Notice of Availability of the DEIS and Public Hearings and Comment Period commencing September 21, 1987.

12-1 In summary of the comments herein, the TAGS DEIS is a fatally flawed document that does not withstand the test of reasonableness in dealing with the major issues involved. It is founded on assumptions, critical for the proposed TAGS Project, that clearly have no basis in reality. To adopt such assumptions (e.g., adequate proven gas reserves for two major pipeline projects in the early 1990's) is an unconvincing, irresponsible act. The DEIS, moreover, fails to comply with CEQ regulations for the preparation of environmental impact statements. It clearly obfuscates such key issues as the need for a major additional industrial facility at the North Slope, namely a gas conditioning plant for TAGS. Accordingly, the DEIS, as it stands, cannot serve as an acceptable basis for decision making.

NWA has already submitted detailed written comments on the TAGS Project Description which were made part of the record of the scoping meetings for the TAGS DEIS. Rather than repeat each of these earlier comments which are equally applicable to the DEIS, the earlier written comments of NWA which are cited below and attached hereto as Enclosure A, are incorporated herein by reference.

The earlier written comments of NWA which are enclosed herewith are identified as follows:

1) Letter dated November 25, 1986 (Subject: Preliminary Comments on Draft Project Description of the Trans-Alaska Gas System) from NWA to A. H. Kohl, and its enclosures:

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RESPONSE

12-1 This comment confuses a prediction of gas availability and an assumption necessary to conduct an analysis of the maximum potential for environmental impact. The FEIS, for purposes of assuring a representative analysis under cumulative effects of the proposed TAGS project assumes ANGTS will be expeditiously constructed and operated as envisioned in the 1976 FEIS for that project and as subsequently authorized on December 1, 1980 in the Agreement and Grant of Right-of-Way for ANGTS.

The DEIS does not make any assessment as to the quantity of natural gas reserves on the North Slope. However, for the DEIS to be able to assess the cumulative impacts of both the ANGTS and TAGS projects, it was necessary to assume that there were sufficient reserves available for both projects. The Geological Survey and Minerals Management Service are completing a revision of national oil and gas existing and projected supplies shown in G. S. Circular 680. Proven natural gas reserves in the Prudhoe Bay area of the Alaska North Slope represent approximately 15 percent of the total natural gas reserves of the United States. In addition, undiscovered, recoverable supplies of natural gas from the Alaska North Slope may exceed 100 trillion cubic feet. It is further noted in Comment 12-21 that Northwest Alaskan Pipeline Company states "We are not suggesting that at no point in the future would there be sufficient proven reserves for both ANGTS and TAGS." The President's finding of January 12, 1988 (see Appendix N) concluded that current and projected future energy markets are adequate and that export of Alaska North Slope natural gas met the requirements of Section 12 of the Alaska Natural Gas Transportation Act (15 U.S.C. 719j) and that TAGS should not hinder completion of ANGTS.

No data has been presented which would allow the conclusion to be drawn that the existing and potentially recoverable gas is insufficient to supply both systems. Without substantial certainty that adequate reserves do not exist, the cumulative impact analysis of the DEIS must assume that there are sufficient reserves for both projects, so that the potential for environmental impact is not understated.

As stated in the DEIS, the gas conditioning facility is not a part of this application, but is a connected action. Accordingly, the DEIS evaluated the anticipated environmental effects of a conceptual gas conditioning plant separate from that needed for ANGTS. This was the approach taken by ANGTS where the gas conditioning facility was not a part of the ANGTS pipeline project, though identified as a connecting action since it was uncertain who would construct it or what would be the specific requirements due to field needs and so forth. The FEIS for the Sales Gas Conditioning Facility at Prudhoe Bay, Alaska, FERC/EIS 0009, was issued four years after the FEIS for the ANGTS pipeline alignment was approved. To make this point clearer, the TAGS FEIS has pulled together information in the DEIS relative to conceptual gas conditioning plant and placed these in distinct subsections (see Subsection 2.2.1.1, 3.4, and 4.4). Also, the gas conditioning facility is carried through in the cumulative impacts discussion. An exception has been made for air quality analysis at Prudhoe Bay because there is a high level of uncertainty on the final design for the conceptual GCF. Accordingly, the 1980 FERC NEPA evaluation and expired PSD permit for the ANGTS SGCF contain conclusions that may not necessarily be transferrable and may not be appropriate to what might ultimately be constructed to provide LNG quality natural gas to TAGS. Therefore, air quality analysis at Prudhoe Bay must be deferred to a future NEPA review (EPA 1988a). Other air quality analysis has been determined to adequately evaluate expected impacts from TAGS alone and adequately evaluates compliance with NAAQS (EPA 1988b).

COMMENT LETTER 12 (Contd)

J. V. Tileston . -2- November 18, 1987

a) Letter dated July 24, 1984 from Bureau of Land Management to Yukon Pacific Corporation;
b) Letter dated September 2, 1986 from NWA to Yukon Pacific Corporation;
c) Letter dated October 14, 1986 from NWA to Yukon Pacific Corporation;
d) Letter dated March 20, 1984 from Secretary of the Interior to Yukon Pacific Corporation.

2) Letter dated December 1, 1986 (Subject: Preliminary Comments on Draft Project Description of the Proposed Trans-Alaska Gas System) from NWA to Honorable Theodore J. Garrish, Federal Inspector, Alaska Natural Gas Transportation System.

3) Letter dated December 9, 1986 (Subject: Written Comments of the Alaskan Northwest Natural Gas Transportation Company regarding Scoping Meetings for proposed Trans-Alaska Gas System Environmental Impact Statement) from NWA to J. V. Tileston, BLM, and W. M. Fowler, U.S. COE.

4) Letter dated December 22, 1986 (Subject: Additional comments on Project Description of the Trans-Alaska Gas System) from NWA to A. H. Kohl, BLM.

Approximately a year ago, NWA pointed out in its November 25, 1986 Preliminary Comments on the Draft Project Description for TAGS that the document suffered from two basic and fundamental categories of deficiencies, namely, a fundamental lack of sufficient meaningful information and detail, and, second, a series of basic misconceptions regarding a number of highly significant aspects of the proposed TAGS project and the already Presidentially and Congressionally approved Alaskan Natural Gas Transportation System project (ANGTS). As will be seen below, the TAGS DEIS suffers from the same basic deficiencies, perhaps understandably so, since the DEIS necessarily had to be based in large part upon the TAGS Project Description. Therefore, rather than repeating each of the comments made in previous submittals regarding these deficiencies, we will merely highlight the most glaring examples found in the TAGS DEIS.

Failure to Address the "No Action Alternative" as required by 40 C.F.R. 1508.25(b).

12-2 As pointed out in our earlier submittal of November 25, 1986, the draft TAGS Project description failed to address the "no action alternative," and this basic deficiency still exists in the TAGS DEIS. The Council on Environmental Quality's (CEQ) regulations under the National Environmental Policy Act (NEPA), 40 CFR 1508, applicable both to the Bureau of Land Management (BLM) and the U.S. Corps of Engineers (U.S. COE), mandate in 40 CFR 1508.25(b) that agencies must consider the "no action alternative" in the EIS process. In the present TAGS DEIS, the agencies simply make a bald assertion that a "no-project alternative was also evaluated" (see, for example, paragraph S-4, paragraph 2), but then only discuss the "no action alternative" in fleeting references (see, page 2-6, Section 2.9.5 and Section 2.9.6; page 4-13L, Section 4.9) in a context of the assumed downside of no action. It is clear, however, that an agency must also adequately address the benefits of "no

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12-2 Comment accepted and the FEIS incorporates recommendation in Subsection 2.9.5 and 4.5.4. Also, a cumulative summary of the "no action alternative" is included in Table S-2.

It was in no way suggested in the DEIS that "if TAGS is not built, there will be no development of Alaska North Slope gas." For example, p. 4-119, while discussing the cumulative effects of TAGS on petroleum resources, states: "The cumulative impact of TAGS on petroleum resources would focus primarily on future State, Federal, or Native leasing, as decisions to data have assumed there would be an operational natural gas delivery system between the Alaskan North Slope and markets." We believe that when the marketplace demonstrates a need for natural gas, federally authorized ANGTS would be constructed to transport Alaska North Slope gas to the market in the lower 48 state's markets.

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12-2 (Contd) action" under the mandate of the regulations. In other words, the CEQ regulations require agencies to address in the EIS the benefits which will result if the "no action alternative" is chosen. Thus, for example, since BLM and U.S. COE both state in the DEIS that the ANGTS project is assumed to proceed regardless of whether or not TAGS is approved, it is fatuous to suggest that if TAGS is not built there will be no development of Alaska North Slope gas or that there will be no economic benefits to the state and local jurisdictions of Alaska. The TAGS project purports to be in addition to the already approved and permitted ANGTS gas line project, the benefits of which are already a matter of record in proceedings before the Federal Energy Regulatory Commission (FERC). As testified to in those proceedings, the benefits of the ANGTS project range into the billions of dollars for state and local jurisdictions, as well as employees, contractors, subcontractors and suppliers, whether or not TAGS is ever approved. As to specific benefits resulting from "no-action" on TAGS, they include, among others, avoiding the disruption and cumulative environmental impact of a third major pipeline system, avoiding an inefficient, wasteful use of gas resources (by LNG conversion), and obtaining the economic and national security benefits of an enlarged energy supply through ANGTS for all of the United States. Since, as already stated, TAGS does not purport to constitute a substitute for ANGTS but merely an additional project, failure to address the overall benefits of the "no action alternative" is a fundamental deficiency in the DEIS.

Misconceptions and Contradictory Statements Regarding the Nature of TAGS as an Additional and Sequential Project Rather than an Alternative Project to ANGTS

These comments fall into three principal areas: 1) Use of ANGTS-permitted facilities, 2) availability of adequate proven gas reserves for two major pipeline projects in the early 1990's, and 3) analysis of certain environmental impacts by Argonne National Laboratory.

12-3 In earlier comments it has been pointed out that the various drafts of the TAGS Project Description contained misconceptions regarding the availability of various facilities along the ANGTS route for use by TAGS. Thus, TAGS has described as "critical" to its needs certain camp sites, airfields and the like, and completely overlooked the fact that such facilities were already permitted to ANGTS and would not be available to TAGS during the construction phase of ANGTS. We pointed out that since TAGS is an additional project to ANGTS, unless the DEIS can adequately address the problem of simultaneous construction, the TAGS DEIS must unequivocally acknowledge the fact that TAGS is only even conceptually feasible as an additional project sequentially following ANGTS.

12-4 Rather than squarely addressing this basic deficiency, the DEIS merely confuses the matter further. Illustrating the contradiction and confusion in the DEIS are, on the one hand, statements in the document that unequivocally state that TAGS and ANGTS are assumed not to be constructed concurrently (see, for example page 1-7, Section 1.6, penultimate paragraph) "...it is assumed that TAGS and the authorized ANGTS would not be constructed concurrently..."), and the agencies go so far as to state that "concurrent construction...is assumed not to be viable..." (page 4-1, paragraph 1; see also Section 4.5.1.2). On the other hand, apparently unmindful of the fact that it has concluded elsewhere in the text of the DEIS that concurrent construction of TAGS with ANGTS is simply not viable, in its introductory overview and summary

RESPONSE

12-3 This comment addresses several issues: some federal areas are needed by both TAGS and ANGTS; TAGS can be approved only as an additional project "sequentially following ANGTS," and; the FEIS must consider "simultaneous construction" of TAGS and ANGTS.

Federal authorizations for ANGTS temporary use such as construction camps, airfields and the like are non-exclusive and may be used for other compatible uses (see response to Comment 12-38 for additional discussion). State authorizations for ANGTS have not been completed (see Comment 22-71). These facts have been considered in the FEIS.

The FEIS has assumed for the evaluation of cumulative environmental consequences that ANGTS would be built. The Supplemental FEIS prepared by FPC in 1976 outlined the anticipated environmental consequences associated with construction and operation of ANGTS. This FEIS has incorporated by references the environmental consequences of ANGTS (pp. 209-328) and then evaluated the cumulative effects of TAGS combined with those of both ANGTS and TAPS and other pertinent transportation/utilities such as the Dalton Highway. At this time, there is no clear evidence as to whether ANGTS or TAGS would be built second. The FEIS has been revised to more clearly reflect the absence of a definitive final design schedule or construction schedule for ANGTS or when planning and design development suspended in 1985 would be restarted. This uncertainty was further emphasized in November 1987 when ANGTS announced closure of its office in Fairbanks and subsequently in December 1987 when ARCO announced it was withdrawing from the ANGTS group because there were inadequate economic incentives to deliver Alaskan North Slope natural markets to domestic markets in the conterminous United States.

Simultaneous construction requires all federal and state permitting to be completed, all financing in place and all necessary supplies needed for construction, e.g., 48-inch pipe for ANGTS and 36-inch pipe for TAGS, compressors and chilling equipment for both ANGTS and TAGS compressors, skilled workforce and necessary construction equipment. The likelihood of this happening in the light of world financial markets and the fact that ANGTS would need to have concurrent construction in both Alaska and in Canada make the probability of "simultaneous construction" very remote. 40 CFR 1502.14 of the CEQ Regulations requires an EIS to examine all reasonable alternatives. In determining the scope of alternatives to be considered, the alternative must be practical or feasible from the standpoint of technical and economic factors when tempered by common sense. The BLM and USACE carefully have reconsidered the potential for simultaneous construction of both ANGTS and TAGS as discussed on p. 1-7 of the DEIS and have determined that simultaneous construction of both gas pipeline projects remains unlikely.

12-4 See response to Comment 12-3.

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12-4 (Contd) we find the government agencies assuming, for purposes of the DEIS, that ANGTS would be started in 1990 (page 5-7, Section 5.5.7.1.2, paragraph 2), and only a few pages later showing TAGS assumed to start its own field work also in 1990 (see figure 1.1-1, on page 1-2).

12-5 Since the DEIS simply fails to address the cumulative impact of TAGS being constructed concurrently with ANGTS, and goes so far as to say it would not even be viable as a concurrent project, then BLM and U.S. COE need to clarify the contradictory statements in the document by clearly pointing out that the only circumstance in which a proposed TAGS project is even considered viable is as an additional project to ANGTS which sequentially follows construction of the already approved and permitted ANGTS project.

12-6 Similarly, and of more fundamental importance, BLM and U.S. COE need to clarify their assumptions in the DEIS that there would be adequate supplies of North Slope gas to support economic operation of both ANGTS and TAGS by pointing out that they are merely assuming the development of future proven reserves of gas based upon a sequential construction of TAGS after ANGTS, since a simple mathematical computation of the volumes of proven existing supply necessary to meet the throughput of ANGTS set forth in the Congressionally approved President's Decision of 1977, demonstrates that present proven North Slope gas supplies are insufficient for both ANGTS and TAGS in the timeframe discussed in the DEIS. To blithely assume that adequate proven gas reserves exist for two major gas pipeline projects, both to be constructed in the early 1990's, is an incredibly facetious, irresponsible act that cannot withstand objective examination of the facts. To persist in such an assumption in the face of expert testimony on the record to the contrary, is arbitrary, capricious and unsupported by the record.

12-7 As was true of the earlier TAGS Project Descriptions, the DEIS is also replete with additional examples of contradictory statements or assumptions regarding whether TAGS is purportedly an additional project to ANGTS or an alternative. For example, the entire assessment by the Argonne National Laboratory attached as Appendix K and the narrative text related thereto suffers from this deficiency. Keeping in mind the asserted basic assumption of BLM and U.S. COE that ANGTS is already approved and will be built during the time frame considered in the DEIS -- in other words, that TAGS is an additional project to ANGTS and not an alternative, and that concurrent construction of TAGS and ANGTS simply is not viable -- then the fundamental premise of the entire Argonne National Laboratory study stands in stark contradiction to the body of the DEIS. Argonne, according to its own introduction, assumes only two scenarios in its study (see Appendix K, page K-3). First, only a TAGS export project and no additional gas available to the Lower 48 states; and second, additional domestic gas available to the Lower 48 states but no gas from the North Slope. It is ludicrous that Argonne never even addressed the one scenario involving a project already approved by Congress and permitted by the Federal Government, ANGTS, nor did it address the most obvious "no action" alternative, namely, no TAGS project and only the approved ANGTS project.

12-8 Even setting aside the peculiar aspect of Argonne proceeding in the opposite direction of BLM and U.S. COE, the interpretation of statistical data in the study is suspect. For example, national percentage averages are used to reach a summary conclusion that loss of Alaskan gas to the Lower 48 market

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12-5 See response to Comment 12-3. We further agree that cumulative impacts are an important element of the required evaluations under the National Environmental Policy Act and have strengthened the FEIS accordingly. Although ANGTS and TAGS are not "interchangeable," the overall cumulative effects identified and available in the public record for ANGTS reasonably can be used to predict the cumulative environmental consequences of construction and operation of the proposed TAGS project.

The FEIS does not assume that TAGS would be constructed after ANGTS. Whether TAGS or ANGTS comes first is a marketplace decision (see response to Comment 12-3). Proposed federal authorizations of the TAGS project recognize prior federal authorizations for ANGTS. The proposed Agreement and Grant of Right-of-Way includes specific requirements that the applicant consult with the holder of the ANGTS Agreement and Grant. As noted in the response to Comment 10-2, the applicant would be required to provide evidence of coordination with Alyeska and ANGTS prior to federal approvals. The President's finding of January 12, 1988 concluded that export of Alaskan North Slope natural gas complies with the requirements of Federal law that led to subsequent authorization of expeditious construction of ANGTS in 1980. For further discussion, see response to Comments 12-1 and 12-38.

12-6 See Comment 12-1 for discussion on gas reserves.

12-7 The comment reveals a lack of understanding of the purpose for which the analysis was conducted. The analysis examined the potential for environmental impacts in the lower 48 states if the exportation of natural gas via TAGS results in a domestic supply shortfall. Thus, the scenarios were drawn in a way to simulate the manner in which such a shortfall could be made up without the use of North Slope gas. A scenario developed to include North Slope gas, as supported by the comment, would be irrelevant to the question being examined, i.e., what is the environmental effect of exporting the gas instead of using it domestically. To develop such a scenario, it would be necessary to postulate that no shortfall occurs as a result of the TAGS export, in which case no environmental impact would occur. Therefore, to develop such an alternate scenario serves no useful purpose from the standpoint of environmental impact analysis under NEPA.

In a broader sense, it is important to note that nowhere does the EIS stipulate, or even predict, that ANGTS would or would not be built, e.g., TAGS and ANGTS are not connected actions. Nor does it present an opinion as to the viability of both projects existing together. Such speculations are inappropriate for an EIS and are not necessary in order to conduct an analysis of the potential environmental impacts. The viability of both projects would ultimately be tested in the marketplace. Rather, the document makes appropriate analytical assumptions consistent with the issues being examined in order to predict the environmental consequences. When examining the issues surrounding the cumulative construction impacts, of course both TAGS and ANGTS must be included. Likewise, when examining the issue of the lower 48 impacts resulting from a shortfall, no North Slope gas can be included. In short, the scenarios developed must match the issues being examined.

12-8 Northwest Alaska claims that ANL's finding that a 3 to 6 percent increase in SO_2 residuals in some western areas is a significant environmental impact. Given the long lead times for development and the disparity among energy forecasts over the 20-year period covered by the analysis, a 6 percent difference is well within the error tolerances of the models. Hence, a 6 percent difference from the base case is not statistically significant.

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12-8 (Contd) has "minimal" environmental effect (see page 4-125), but Argonne's own tables of impacts on a regional basis raise a warning flag. For example, Table 3.1.2, page K-20 shows a 5.45 percent increase in SO_2 emissions in Mountain Region 2 compared to the reference case. Again, for NO_x (Table 3.2.2) the South Atlantic Region and Mountain Region 2 have increases of 3.06 percent and 6.85 percent respectively. At a time when a major national effort is underway to achieve absolute reduction in harmful emissions to the atmosphere, it is disingenuous to label such increases as "minimal." In summary, the Argonne study reaches a manifestly erroneous conclusion, is based on erroneous assumptions and fails to even address the fact that TAGS supposedly is being considered by the Government as an additional, non-concurrent project to ANGTS.

<u>Obfuscation Regarding Gas Conditioning Facilities</u>

12-9 The treatment of gas conditioning facilities for the TAGS project in the DEIS is a classic example of obfuscation. Yukon Pacific has presented different versions of the "facts" regarding the conditioning facility necessary to process and deliver the pipeline quality gas required for its proposed TAGS project. Thus, in one earlier version of the "facts" Yukon Pacific stated that "existing and authorized gas conditioning facilities in Prudhoe Bay can provide the quality of pipeline gas needed to operate TAGS" (see NWA comments of November 25, 1986), and asserted that it would discuss responsibility for construction and operation of such facilities with the North Slope gas producers and NWA. When NWA pointed out that the only "existing or authorized" facilities at Prudhoe Bay were the ANGTS Alaska Gas Conditioning Facility (AGCF) and the Miscible Gas Facility (MGF) used to process gas for enhanced recovery of oil, and further pointed out that the AGCF was a FERC-regulated jurisdictional facility, TAGS attempted to change its story. Thus, Yukon Pacific in statements to the FERC contradicted its own right-of-way application and Project Description already pending before BLM and U.S. COE, and asserted that the conditioning facility would not be the existing AGCF, but rather a separate, stand-alone gas conditioning facility. As you are aware, the problem of flatly contradictory filings by Yukon Pacific before FERC and BLM/U.S. COE is an issue, among others, now pending in an appeal to the U.S. Court of Appeals for the District of Columbia Circuit, No. 87-1540.

12-10 The DEIS reflects the confusion and contradictions evident in Yukon Pacific's own filings to date; however, as will be seen, BLM and U.S. COE compound the confusion by failing to review their own records regarding the ANGTS AGCF.

12-11 A necessary starting point in attempting to sort out the confusion of the DEIS regarding the gas conditioning facilities is a recognition of the requirement in the C.E.Q. regulations that an impact statement must address "connected actions" (40 CFR 1508.25(a)). The regulation defines a "connected action" as one which automatically triggers other actions which may require environmental impact statements; or actions that cannot or will not proceed unless other actions are taken previously or simultaneously; or are independent parts of a larger action and depend on the larger action for their justification. Based on the regulatory definition, there can be no rational argument that construction of the TAGS pipeline system and a gas conditioning facility to produce pipeline quality gas for that system are not "connected actions," and under N.E.P.A. <u>both</u> must be addressed in the DEIS.

12-9 The FEIS considers the gas conditioning facility as a separate, stand-alone facility which is a "connected action" to the TAGS project. The North Slope conceptual gas conditioning facility discussed in the FEIS, however, is not part of the proposed federal action described in the FEIS. No applications have been filed for State or federal approval of such a facility. As stated in the response to Comment 12-1, it was several years following the completion of the ANGTS FEIS that an FEIS for the Sales Gas Conditioning Facility at Prudhoe Bay, Alaska was approved. This was due to the fact that an agreement had to be coordinated with the North Slope gas producers, the State of Alaska and NWA. As stated in Subsection 2.2.1, the same scenario must be followed with TAGS.

12-10 Much of the information about the ANGTS AGCF is proprietary and not in the public domain. References in the TAGS DEIS to the ANGTS AGCF relied upon the FERC FEIS information which was in the public domain. It is recognized that the conceptual gas conditioning plant evaluated as a connected action with TAGS is a "worst-case" and that the initial SELEXOL design has been discarded for a more efficient design and that the producers have recently completed a major gas plant in the Prudhoe Bay area. As noted in Subsection 4.7.6, air quality analysis for a facility at Prudhoe Bay needed to provide LNG quality natural gas to TAGS must be deferred to a future NEPA review. However, if Northwest Alaskan Pipeline Company wishes to place their information in the public domain, we would be pleased to use it.

12-11 As stated in the response to Comment 12-1, and evident in the DEIS, and more specifically stated in the FEIS, the conceptual gas conditioning facility is a "connected action." The Council on Environmental Quality (CEQ) stated in July 1976 that although the generic FEIS's prepared for the various pipeline proposals was adequate under the National Environmental Policy Act (NEPA) additional EIS's or more site-specific environmental data must be presented, with sufficient analysis to weigh important environmental concerns. It was several years after this decision that NWA filed an application with the FERC for a certificate of public convenience and necessity for the gas conditioning facility. This process ultimately culminated with the FEIS cited in the response to Comment 12-1 and incorporated by reference in the TAGS EIS process.

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12-12 The DEIS assumes that ANGTS will be built (page S-1, paragraph 3); that is to say, it assumes that the ANGTS pipeline and AGCF will be built, but then ignores the required review and analysis of a separate, stand-alone TAGS gas conditioning facility as a "connected action" to the TAGS pipeline proposal. Thus, the DEIS asserts that gas conditioning facilities are not part of the TAGS project (page 5-3, Section S-4, paragraph 2) and tries to obfuscate the issue by claiming that the effects of a gas conditioning facility for TAGS are "similar to those evaluated in the ANGTS" (page S-3, Section S-4, paragraph 2), while at the same time totally ignoring any discussion of the cumulative effects of a second gas conditioning facility on the North Slope (page 5-7, Section S.5.7.3, the DEIS asserts that the TAGS facility would be independent of the one evaluated by FERC for ANGTS).

12-13 There is even a more glaring example of the confusion regarding a TAGS gas conditioning facility and its relationship to the government-approved AGCF in the compatibility evaluation attached as Appendix B to the DEIS. At page 50 of Appendix B, the DEIS describes a Selexol-based AGCF and incorporates by reference into the TAGS DEIS the impact statement for the ANGTS AGCF. Let us set the record straight.

1. The ANGTS AGCF uses a BASF-based design, not a Selexol-based design. BLM and U.S. COE have apparently overlooked their own records which will show that in a Federal Register Notice of Design Approval published in Federal Register Vol. 48, No. 241 at pages 55596 and 55597 on December 14, 1983 the Federal Inspector for ANGTS approved a BASF Activated MDEA process for the AGCF which results in an increase in efficiency and reduction in cost of the facility. Thus, the DEIS in late 1987 is still discussing a conditioning facility based upon a process (Selexol) which four years ago was replaced by a more efficient reduced cost facility that the government itself approved in a formal Federal Register notice of final agency action under Reorganization Plan No. 1 of 1979.

12-14

2. Since the DEIS asserts that the latest version of the TAGS proposal for conditioning gas does not involve the AGCF for ANGTS, and that the TAGS will use a separate gas conditioning facility, obviously merely incorporating into the TAGS DEIS the FEIS for ANGTS does not meet the statutory and regulatory requirement for discussion, review and analysis of the proposed TAGS gas conditioning facility as a "connected action" to the TAGS proposed pipeline. Common sense indicates that a discussion of someone else's facility doesn't solve the problem of describing and reviewing and analyzing one's own proposed facility which purports to be a separate stand-alone facility.

12-15

3. The proposed gas conditioning facility for TAGS will be an enormous industrial facility under any circumstance, as discussed below, and not just a minor modular add-on to an existing facility.

12-16 The DEIS, rather than addressing the issue of a gas conditioning facility for TAGS, speculates on use of the Central Gas Facility at Prudhoe Bay (formerly referred to as the Miscible Gas Facility (MGF)). Once again, the government has overlooked its own records and has just compounded the confusion. As the U.S. COE records will clearly indicate, the location of the CGF/MGF and the co-location of the AGCF was carefully coordinated by the sponsors of ANGTS and the owners of the CGF/MGF. As a matter of fact, an

RESPONSE

12-12 The cumulative effect discussion of the TAGS DEIS evaluated the authorized ANGTS in Subsection 4.5.1.5 and reflected through the cumulative effects discussion.

12-13 The use of confidential and proprietary information in evaluations under the National Environmental Policy Act is prohibited. The only available information in the public arena dealing with the environmental consequences of construction, operation, and maintenance of a gas conditioning facility in the Prudhoe Bay area is found in the 1980 FEIS prepared by the Federal Power Commission entitled "Prudhoe Bay Project" (Sales Gas Conditioning Facility for the ANGTS project). It is public record that ANGTS requested revision of the proposal described in the 1980 FEIS. However, as noted in the enclosures to this comment, certain information provided the U.S. Army Corps of Engineers on October 23, 1984 was classified by the Northwest Alaskan Pipeline Company as "CONFIDENTIAL/PROPRIETARY INFORMATION ENCLOSED." The USACE granted the ANGTS a permit for the Alaska Gas Conditioning Facility, Permit Number 4-820121, on July 25, 1983. This permit was modified by the USACE at the request of ANGTS on May 7, 1985, Permit Number M-820121, to reduce the size of the fill due to plant redesign and a new process to condition the gas. It also is pertinent to note that the required air quality permits from ADEC for the BASF-based design for the ANGTS Sales Gas Conditioning Facility have not been issued by EPA or DEC, nor have authorizations to use state ownerships needed for the ANGTS facility been given by the state.

12-14 See response to Comments 12-1, 12-9, 12-11, 12-12, 12-13, 12-15, and 12-16.

12-15 As stated in Comment 12-16, NWA originally estimated their gas conditioning facility (GCF) to cover an area of approximately 300 acres with a stand-alone gas conditioning facility. Due to the construction by ARCO of the CGF/MGF (the GCF would be co-located with this facility) and a process change, the ANGTS GCF would require about 200 acres. To use a worst-case scenario, as discussed in the FEIS, a conceptual GCF for the TAGS project would require approximately 300 acres.

12-16 The DEIS adopted by reference a worst-case scenario for a conceptual gas conditioning facility like that evaluated in the Sales Gas Conditioning Facility at Prudhoe Bay, Alaska, FERC/EIS 1980. This FEIS reviews and analyzes the potential impacts in Subsection 4.4.

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overlapping of the areas for the CGF/MGF and AGCF was specifically designed to allow the AGCF to potentially share usage of the CGF/MGF flare facilities and pits. In fact, the ANGTS project sponsors and the CGF/MGF owners have contemplated fully integrating the CGF/MGF and the future AGCF, which would result in additional substantial cost and environmental benefits. The AGCF plant layout was specifically redesigned, in coordination with the North Slope Producers in 1984/85, to permit this to occur. Under this redesign, the CGF/MGF would potentially provide hydrocarbon dew point control and supply the AGCF with gas requiring only CO_2 removal, compression and chilling. (See letter of April 3, 1985 to U.S. COE and letter of February 27, 1984 to Alaska State Pipeline Officer for ANGTS; U.S. COE was also directly informed of this by NWA letter of October 23, 1984; copies of letters attached as Enclosure B.)

12-16 (Contd) So as to place in perspective the relative size of the CGF/MGF and AGCF, let us examine the U.S. COE's own records. The U.S. COE's 404 permit for the CGF/MGF authorized the placement of over 600,000 cubic yards of gravel into 85+ acres of wet tundra for purposes of constructing that facility. The original AGCF 404 permit covered an area of approximately 287 acres and authorized over 2.7 million cubic yards of gravel. After the redesign and co-location of the AGCF with the CGF/MGF, the area required for the AGCF was reduced to approximately 186 acres and 1.79 million cubic yards of gravel. Thus, a TAGS stand-alone gas facility, which under the basic assumption of the DEIS, is additional, unconnected, and stands separate from the AGCF/CGF/MGF co-located facilities, will be an enormous industrial plant covering about 200 acres of wet tundra and is expected to use over two million cubic yards of gravel. With the possible exception of the proposed LNG terminal facility for TAGS, the required North Slope gas facility is the largest and most expensive single component in its entire system. Yet, the DEIS fails to review and analyze its potential environmental impact.

Use of ANGTS Proprietary and Confidential Data

12-17 This subject has be covered at length in earlier NWA comments, and we will therefore merely reiterate our earlier position: such data was developed at great expense by the sponsors of ANGTS, belongs to the sponsors of ANGTS, is proprietary and confidential, and with few exceptions, is protected specifically under the Copyright Law of the United States. The statement at page 4-40, Section 4.2.8.6 that large amounts of laboratory and full-scale frost heave data "have been developed and reported by...Northwest Alaskan Pipeline Company..." is misleading. NWA has, in fact, "developed" such data for the ANGTS sponsors, but the date is not "reported," that is to say, it has not been placed in the public domain, and therefore is not available to TAGS.

Proximity - Related Problems

12-18 NWA in its comments of December 22, 1987, pointed out that the TAGS Project Description raised several fundamental proximity-related issues: 1) Pipeline crossings, 2) Compatibility of three large diameter pipelines in close proximity; and 3) Atigun Pass. The TAGS Project Description was vague on each of these issues and lacked meaningful detail. Neither Yukon Pacific nor the agencies preparing the DEIS have done any field work or engineering regarding these issues and therefore the DEIS remains vague, sketchy and essentially lacking in meaningful engineering or technical data, review or analysis.

12-17 The reference to NWA has been deleted. Confidential and proprietary information cannot be used in the EIS process. TAGS is "not a substitute" or "alternative" project to ANGTS. Although ANGTS and TAGS are not "interchangeable," the overall effects identified and available in the public record for ANGTS reasonably can be used to predict the environmental consequences of construction and operation of the proposed TAGS project. The details of engineering requirements to successfully place a buried chilled 48-inch natural gas pipeline in sensitive environments in Alaska is confidential and proprietary. However, there is a public record by the Federal Inspector in the 23rd quarterly report of May 8, 1985 to the Vice President of the United States on the status of ANGTS that there are in fact satisfactory solutions to many unsolved issues identified in the ANGTS Agreement and Grant of Right-of-Way. Therefore, it is logical that unanswered technical questions that confronted ANGTS at the time of its Agreement and Grant of Right-of-Way on December 1, 1980 also can be satisfactorily answered for TAGS and that TAGS has similar environmental consequences to those of ANGTS.

12-18 It has been determined that the proposed TAGS project meets the requirements that subsequent federal approvals under the Mineral Leasing Act, as amended, be compatible with prior federal authorizations under the provisions of 43 CFR 2881.1-1 and 2881.1-3. This determination is based upon the information available in the public sector and has been evaluated in the light of confidential and proprietary information available to such agencies of the federal government. (Also see response to Comment 12-39.) The Federal Inspector was consulted about the determination of compatibility in so far as ANGTS and TAGS are involved (see DEIS Appendix B at p. B-8 and B-9). A draft Memorandum of Agreement between the Federal Inspector and BLM outlines how the respective authorities for ANGTS and TAGS would be discharged to expedite federal decisions for TAGS. Further, provisions similar to that developed between TAPS and ANGTS have been proposed for inclusion in the Agreement and Grant of Right-of-Way for TAGS (responses to Comments 10-2, 10-4, 10-6, and 12-6).

This comment addresses issues also raised in Comments 12-23 (Crossings), 12-24, 12-30, 12-46 and 12-48 (Compatibility), and 12-20, 12-22, 12-43 (Atigan Pass). Accordingly, please see responses to these comments as well.

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1) Pipeline Crossings: We pointed out the problem of unnecessary pipeline crossings in our earlier letter, indicating that the TAGS chart showed 41 crossings. However, the DEIS does not address this issue. In fact, by omitting the earlier chart, the issue has been ignored entirely. Merely dropping the chart doesn't solve the problem.

2) Compatibility of three large-diameter pipelines in close proximity: Since the TAGS project sponsors readily admit that they have not performed any engineering or field work of any significance and don't intend to until after obtaining a Federal right-of-way, the DEIS simply fails to address this threshold issue in any meaningful way, and leaves a solution, or lack thereof, to some vague future time frame.

3) Atigun Pass: Our earlier comments on pages 2-4 of our December 22,1986 letter still apply. The DEIS doesn't even bother to correct the sequence of crossings in the route description (page 2-32) to reconcile with the sequence of crossings on maps (Figure 2.3.4-1 on page 2-33). The typical roadway cross section (Figures 2.3.4-2, page 34) is an improvement over the earlier erroneous one, but lacks meaningful detail and does little more than show the relative positions of ANGTS and TAGS.

12-18 (Contd)

The fact that the DEIS simply fails to address the major concern we expressed regarding the proposed method of installation of a second gas pipeline and the protection to be provided for an existing gas pipeline appears to be the inevitable result of a lack of any meaningful field engineering work by the TAGS project sponsors or by the preparers of the DEIS. In the narrow confines of Atigun Pass, with an operating oil pipeline and a state highway already in place, these unaddressed questions related to the construction and operation of two closely adjacent, high pressure, chilled gas pipelines are, indeed, critical. The mere assertion that Atigun is the only feasible route, without any demonstrated engineering and technical review and analysis of the alternatives, is not enough. A substantial percentage of the energy needs of this nation will be passing through a geologically unstable arctic mountain pass in a "pinch-point" with pipelines only a few feet apart. To cavalierly assume that future engineering solutions will be reached does not do justice to the seriousness of the technical concerns.

For all the foregoing reasons, the TAGS DEIS is fatally flawed, and cannot serve as an acceptable basis for decision making under existing law.

Very truly yours,

William J. Moses
General Counsel

COMMENT LETTER 12 (Contd)

RESPONSE

J. V. Tileston -9- November 18, 1987

cc: Mr. William M. Fowler
TAGS Project Manager, U.S. COE, Alaska District

Michael J. Penfold, Alaska State Director
Bureau of Land Management, Anchorage

Earl N. Kari, Director, Alaska Office
Office of the Federal Inspector, Anchorage

Jerry Brossia, State Pipeline Officer for ANGTS
Alaska Department of Natural Resources, Fairbanks

Col. Wilbur T. Gregory, Jr., District Engineer,
U.S. COE, Alaska District

Harry G. Brelsford, General Counsel
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Alyeska Pipeline Service Company, Alaska

Harry A. Noah, Mgr., Environmental Permitting
Yukon Pacific Corporation, Anchorage

Howard Griffith, Jr., President and Chief Executive Officer
Yukon Pacific Corporation, Anchorage

Honorable Theodore J. Garrish, Federal Inspector
Alaska Natural Gas Transportation System

Honorable Donald P. Hodel
Secretary of the Interior

Honorable Ralph W. Tarr, Solicitor
U.S. DOI

Honorable J. Stephen Griles, Assistant Secretary of Interior
U.S. DOI

Robert H. Burford, Director
BLM

Lloyd W. Ulrich, Office of Pipeline Safety
U.S. DOT

Enclosures

COMMENT LETTER 12 (Contd)

NORTHWEST ALASKAN PIPELINE COMPANY
ONE OF THE WILLIAMS COMPANIES

HAROLD W. MOLES
VICE PRESIDENT, OPERATIONS

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(907) 456 8700

ALO-86-4099

December 22, 1986

Mr. Arlan H. Kohl, Chief
Branch of Pipeline Monitoring
Bureau of Land Management
701 C Street Box 30
Anchorage, Alaska 99513

RE: Additional Comments on Project Description of the Trans-Alaska Gas System

Dear Mr. Kohl:

This letter supplements our comments on the Trans-Alaska Gas System ("TAGS") Project Description which we submitted to you in our letter dated November 25, 1986 (Moles to Kohl; Re: Preliminary Comments on Draft Project Description of the Trans-Alaska Gas System).

Northwest Alaskan Pipeline Company ("NWA") has reviewed the amended TAGS Project Description, dated December 1986, which we received from your office on December 9, 1986. The basic deficiencies in the draft project description which we detailed in our November 25, 1986 letter unfortunately still exist in the latest version, and our earlier comments are therefore equally applicable to the December 1986 document. Indeed, some of the minor changes from the earlier draft simply reemphasize its overall deficiencies. For example, while the
12-19 November 1986 draft omitted the critical section on "Mitigation," the new version covers all "Mitigation" measures in just three sparse pages. Yet this is a vital concern of all parties who would be affected by TAGS, including the sponsors of the Alaska Natural Gas Transportation System ("ANGTS"). Clearly the latest version of the Project Description is still fundamentally deficient.

12-20 We preface our additional comments by noting that we are addressing the Atigun Pass issue in this letter, rather than separately with Yukon Pacific, as suggested in your letter of December 4, 1986. As NWA stated in its letter of October 14, 1986 (Moles to Noah), which was attached to our letter to you of November 25, 1986, the issues of compatibility and proximity are not merely private matters to be resolved by NWA and TAGS separate from the environmental review process. Issues related to compatibility and proximity are inherent in the EIS process of the Federal Government, particularly so in a critical area such as Atigun Pass where TAGS is proposing that it be a mere fifteen feet away from the ANGTS.

ENCLOSURE A

RESPONSE

12-19 Discussions under Subsection 4.8 in the FEIS have been expanded to include recommendations from federal and state permitting agencies cooperating in the preparation of the FEIS, YPC's mitigation from Subsection 2.8 of the DEIS, and comments received during review of the DEIS. The substance of this comment, however, deals with mitigation measures proposed by the applicant, and its application to the BLM and USACE. As such, these applicant proposed mitigation measures as discussed in Chapter 2 of the DEIS are relocated in Subsection 4.8 of the FEIS as an integral part of the proposed action by the applicant. The FEIS has consolidated YPC proposed mitigations identified in its applications to BLM and USACE and together with BLM and/or USACE additional measures, which if implemented would further reduce adverse effects and/or enhance beneficial effects of the proposed TAGS project. These are discussed in Chapter 4.8.

12-20 The federal decision process encourages private enterprises to identify and resolve concerns of mutual interest. To the extent private enterprise cannot resolve mutual concerns and there is an overriding federal responsibility to assure appropriate protection of the environment, protection of public health and protection of public safety, we agree that the final determination of compatibility between TAGS and ANGTS is a federal responsibility. This responsibility is reflected in the FEIS by indicating the Federal Inspector and the BLM intend to coordinate their respective authorities to expedite federal decisions for the proposed TAGS project. Also noted in responses to other comments, the proposed Agreement and Grant of Right-of-Way for TAGS requires evidence of coordination between TAGS and ANGTS. Final federal approvals would take into account the results of the coordination.

COMMENT LETTER 12
(Contd)

Mr. Arlan H. Kohl
ALO-86-4099
Page two

Availability of Proven North Slope Gas Reserves for both ANGTS and TAGS

At the Fairbanks scoping meeting on Tuesday, December 9, 1986, a representative of Yukon Pacific made the statement that there are approximately 31 trillion cubic feet ("tcf") of "existing proven reserves" on the North Slope of Alaska and that such reserves are available for the proposed TAGS project. Although we touched upon this issue on page 5 of our letter of November 25, we believe a response to the Yukon Pacific assertion is warranted.

We are not aware of any factual basis for such a statement, either as to the correct, current figure for "existing proven reserves" or their adequacy for two large diameter pipeline systems. Congressional testimony on this subject by the three principal North Slope producers (Exxon, ARCO, Standard Oil) made it clear that "proven North Slope reserves" at that time (on the order of 25 tcf)
12-21 were adequate for only a single large diameter gas pipeline. (See transcript of the November 16, 1983, Senate Hearings on "Marketing Alternatives for Alaska North Slope Natural Gas" as discussed in the October 3, 1986, letter from the Federal Inspector for the ANGTS, addressed to the Alaska State BLM Director.)

We are not suggesting that at no point in the future would there be sufficient proven reserves for both ANGTS and TAGS. Rather, we simply make the following points: (1) the factual basis for the Yukon Pacific spokesman's assertion regarding "existing proven reserves" on the North Slope of 31 tcf should be reviewed, recognizing that "proven reserves" are quite different from mere estimates of "resources," (2) present proven North Slope gas reserves appear sufficient for only a single major pipeline project, and (3) there is an existing commitment to the ANGTS of North Slope reserves sufficient for that project. We are, of course, prepared to document the legal basis for this commitment at the appropriate time and place.

Atigun Pass

There is a fundamental issue regarding the feasibility of the TAGS routing through Atigun Pass. The limited amount of detail provided for the routing of TAGS through this critical special construction area has hampered our evaluation.

To start with, as we read it, the route description on Page 5-129 does not accurately describe the sequence of crossings depicted by the TAGS routing shown
12-22 on Figure 5.2.3. Simply put: the written description and small scale plot (Figure 5.2.3) do not match up.

Moreover, the typical roadway section (Figure 5.24 on Page 5-132) affords inadequate detail for the critical segment from the summit down the south side of the pass. This section shows little more than the relative position of the two gas pipelines, i.e., the TAGS pipeline to the west of ANGTS and the Dalton

RESPONSE

12-21 See response to Comment 12-1.

12-22 This comment addresses preliminary review information developed by YPC for BLM and USACE. Subsequently, the BLM distributed that information to cooperating federal and state agencies at a meeting in Anchorage on November 11, 1986. The commentator and representatives of Alyeska Pipeline Service Company were invited and did attend that meeting. As a result of this comment and other comments from cooperating federal and state agencies, YPC amended its applications to the BLM and USACE in December 1986. The DEIS accurately depicted the general relationship of the proposed TAGS alignment through Atigan Pass and with the Dalton Highway, TAPS and the authorized ANGTS as shown in Revision 4. Further, this alignment has been fully coordinated with the state which has formed an interagency team to process the state authorizations for the proposed TAGS project. The Alaska Department of Highways and Public Facilities is an active member of that group.

COMMENT LETTER 12 (Contd)

RESPONSE

Mr. Arlan H. Kohl
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Highway. This relative relationship is also confirmed on Page 5-129 of the Project Description -- "The TAGS route then descends the south side of the pass proximate to the west side of the ANGTS right-of-way and highway...." Figure 5.24, however, is misleading in depicting the ANGTS pipeline <u>in</u> the roadway. The approved location for ANGTS is proximate to the west shoulder and ditchline of the existing roadway.

Of major concern is the proposed method of installation of a second gas pipeline and the protection to be provided for an existing gas pipeline. Section 12.3, Construction Impact Issues, of the Project Description does not provide much more than an outline of issues and problems. Something much more substantial than "Possible Design Solutions" is needed.

Considering the restrictions in working space along the roadway, and extensive rock work required for a second gas pipeline in Atigun Pass, the danger to an existing gas pipeline would be immense. Even if blasting were prohibited, all construction activities, especially hillside and trench excavation, would require careful planning, expert craftsmen and very close supervision. Such construction activities could cause landslides or shearing of the roadway which would jeopardize an existing pipeline. Moreover, the use of heavy construction equipment above a high pressure pipeline in operation would be a very risky business.

12-22 (Contd)

From the standpoint of safety and practicality, we question the feasibility of constructing a second gas pipeline subsequent to the installation and commencement of operation of the first gas pipeline through Atigun. All factors considered, the laying of a second gas pipeline would be exceedingly difficult, if not virtually impossible.

This view concerning a second gas pipeline is reinforced by the difficulty encountered in selecting a suitable location for the ANGTS route. Not only was extensive engineering field work required, but numerous discussions were held with State, Federal and Alyeska representatives, including a review of the route in the field with engineering representatives from the Alaska Department of Transportation and Public Facilities.

Construction difficulties aside, TAGS has not addressed the potential problems involved in operating and maintaining two adjacent high pressure, chilled gas pipelines. At a fifteen foot (15') centerline-to-centerline offset, two large diameter pipelines are essentially in the same ditch. TAGS has said nothing about the thermal effects on the roadway, or of one pipeline on the other.

As currently proposed, we question the prudence of the TAGS routing across Atigun Pass. The engineering problems associated with a third pipeline are

Mr. Arlan H. Kohl
ALO-86-4099
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12-22 (Contd) enormous if not insurmountable. In summary, this issue is so fundamental to the integrity of ANGTS, the Trans-Alaska Pipeline System ("TAPS") and the Dalton Highway that it is premature to be suggesting that a third pipeline can be accommodated in Atigun Pass without first undertaking extensive engineering field work. Thus, at this early conceptual stage of the EIS process, alternative routing should be studied and developed before assuming, as Yukon Pacific does, that "the only feasible and logical route over this section of the Brooks Range" for a third pipeline is Atigun Pass.

<u>Crossings of the ANGTS Pipeline by the TAGS Pipeline</u>

12-23 Table 5.5, on Pages 5-82/83, indicates an inordinate number of crossings of the ANGTS pipeline by TAGS; forty-one to be exact.

Once again the degree of detail provided by the small scale maps does not permit a meaningful determination of whether all of these crossings are necessary or not. For example, TAGS Sheet 9 of 12 (1:250,000) covers the routing from approximately TAGS MP473 to MP536. In this sixty-three mile length, Table 5.5 shows six crossings of ANGTS, and yet it is difficult to discern all of these crossings on Sheet 9.

Without adequate information, the actual need for so many crossings cannot be evaluated; however, NWA does not believe that a total of forty-one crossings is compatible with the TAGS objective to "minimize number of crossings of existing or proposed TAPS, ANGTS, and highway facilities," as stated on Page 5-7 of the Project Description.

<u>Specific Requirements Regarding Proximity To And Compatibility With The ANGTS Pipeline</u>

12-24 The basic issue of environmental and technical acceptability of three large-diameter pipeline systems in relatively close proximity to each other must first be addressed, as noted in our November 25 preliminary comments.

Presuming that this prerequisite issue is satisfactorily resolved to the reasonable satisfaction of all concerned parties, there will remain a number of key questions regarding the criteria for proximity and the compatibility of the TAGS and ANGTS pipelines. Similar questions were extensively addressed by relevant government officials and by both the TAPS and ANGTS sponsors in issuing the Federal right-of-way grant for the ANGTS project. The basic guidelines developed in that case for the reasonable protection of TAPS are equally applicable to the TAGS-ANGTS case and they must be modified as appropriate and then adopted as fundamental planning assumptions for the proposed TAGS project.

RESPONSE

12-23 Maps at a scale of 1:63,360 showing the proposed TAGS alignment in relation to ANGTS and TAPS have been provided to the commentator. Additionally, since publication of the DEIS, the BLM has noted on the official Master Title Plats (MTP) the location of TAGS facilities described in the FEIS. The MTP also shows all the other prior federal authorizations such as ANGTS, TAPS, land ownership and related land matters. As indicated in response to Comment 12-20, it is expected that the sponsors of ANGTS and TAGS would take the initiative to propose solutions to issues of common concern. See response to Comment 15-6.

12-24 The proposed project has been determined to meet the requirements of 43 CFR 2881.1-1 and 2881.1-3. The preliminary determination was provided the Federal Inspector and was included in the DEIS as a means to fully inform the public of BLM's proposed action insofar as the relationship of TAGS to TAPS and to ANGTS.

COMMENT LETTER 12 (Contd)

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Specific guidelines that we propose, which we have adapted from ANGTS' Federal Right-of-Way Grant F-24538, are as follows:

12-25

(1) Physical Proximity

The TAGS Pipeline shall be separated by 200 feet or more from facilities or planned facilities of the ANGTS (except access roads, airfields or other facilities which are not either gas containing or civil works or structures which protect or physically support gas containing facilities). The Federal Inspector for the ANGTS ("Federal Inspector") will designate the points on the facilities or planned facilities from which the 200 feet shall be measured. Separations of less than 200 feet requested by Yukon Pacific may be approved by the Federal Inspector at crossings of the ANGTS and at other locations agreed upon by Yukon Pacific and the ANGTS Sponsors. At other locations where required to avoid environmental damage or terrain constraints, requests by Yukon Pacific for separation of less than 200 feet may be approved by the Federal Inspector, provided that the Federal Inspector has first determined that the following criteria have been met:

(1) The construction and initial operation of the ANGTS will not be impaired;

(2) Stability of foundation and other earth materials will be protected and maintained;

(3) The integrity of the TAGS Pipeline will be reasonably protected and maintained;

(4) Significant damage to the environment (including but not limited to fish and wildlife populations and their habitats) will not be caused;

(5) Hazards to public health and safety will not be created;

(6) The ANGTS will be reasonably protected from adverse effects of Yukon Pacific's activities including the activities of its agents, employees and contractors (including subcontractors) and the employees of each of them; and

(7) Provided that in no case will reducing the cost of construction be the sole consideration upon which such approval is based.

RESPONSE

12-25 The applicant also has proposed, as noted in Comment 12-32, the 200-foot separation developed for ANGTS and TAPS be used for TAGS and ANGTS. This criteria is discussed in the FEIS and has been included in the proposed Agreement and Grant of Right-of-Way for TAGS.

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12-26 (2) Insurance

As a prerequisite for the issuance of a Federal Right-of-Way for the TAGS, the sponsors of that system shall enter into a hold harmless and indemnification agreement with the sponsors of the ANGTS that will also reasonably ensure Yukon Pacific's liabilities to the owners of the ANGTS. Such an agreement shall be similar to that entered into by the ANGTS sponsors and the TAPS owners dated November 16, 1980 and referenced in the ANGTS right-of-way grant, in the Insurance paragraph, on pages 6 and 7 thereof.

12-27 (3) Coordination of Plans

Any aspects of any plans, programs, and Design Criteria for TAGS prepared by Yukon Pacific that are likely to have a significant impact upon the facilities or planned facilities of the ANGTS will be coordinated by Yukon Pacific with the sponsors of the ANGTS during their development and shall be submitted to the Federal Inspector for his approval. Coordination means providing the sponsors of the ANGTS an opportunity to review and comment upon relevant parts of the plans, programs, and Design Criteria. Yukon Pacific will reasonably take these comments into consideration. Coordination does not necessarily mean concurrence. Evidence of such coordination must be provided the Federal Inspector, and his approval must be obtained prior to commencement of any activity pursuant to any such plans, programs or Design Criteria. In determining the acceptability of the plans, programs, and Design Criteria, the Federal Inspector will consider suggestions or objections submitted by sponsors of the ANGTS.

Prior to undertaking any activity proximate to the ANGTS or its right-of-way or, in any event, when such activities could pose a threat to the integrity of the ANGTS, Yukon Pacific shall provide the Federal Inspector and the sponsors of the ANGTS with a written analysis of the situation. Such analysis shall address the effects, if any, of TAGS design and proposed activities on the ANGTS and, where necessary, describe systems designed to ensure protection of the ANGTS and its right-of-way against damage arising from the construction operation, maintenance and termination of TAGS.

12-26 Insurance is not an issue germane to the FEIS.

12-27 The BLM and Federal Inspector are preparing a Memorandum of Understanding that establishes a procedure for efficient coordination where TAGS and ANGTS are in close proximity. Additionally the BLM will require YPC to provide evidence of coordination with NWA whenever TAGS would be on or adjacent to the previously authorized alignment for ANGTS.

COMMENT LETTER 12 (Contd)

Mr. Arlan H. Kohl
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(4) Damage to ANGTS and Its Right-of-Way

12-28 Yukon Pacific shall provide reasonable protection to the ANGTS right-of-way from the adverse effects of its activities or those of its agents, employees, contractors (including subcontractors) and the employees of each of them during construction, operation, maintenance and termination of the TAGS. This protection shall specifically be provided to the ANGTS and its right-of-way as shown in the ANGTS Rev. 4 Alignment Sheets or subsequent amendments thereof. If it is determined by the Federal Inspector that Yukon Pacific has caused damage to the ANGTS or to its right-of-way, and if the ANGTS sponsors so require, then Yukon Pacific shall promptly repair, or reimburse said sponsors for reasonable costs in repairing the property to a condition which is satisfactory to them, but need not exceed its condition prior to damage.

The above guidelines are by no means a complete list of stipulations or other requirements that necessarily must be imposed upon Yukon Pacific Corporation in order to protect the integrity of the ANGTS. Rather, as stated previously, they are certain key, fundamental planning assumptions that need to be explicitly adopted by all concerned parties at this early point in planning for the TAGS.

In conclusion, although as noted above, we believe that the December 1986 amended TAGS Project Description suffers from the same basic deficiencies detailed in our earlier letter of November 25, 1986, we do appreciate being afforded the opportunity to review the document, and will be pleased to review further TAGS project documents as they become available. We will also be glad to discuss any comments herein with the Bureau of Land Management's Ad Hoc Compatibility Review Team in January 1987.

Sincerely,

Harold W. Moles by [illegible]

Harold W. Moles
Vice President, Operations

WJM/HWM/DA

cc: Michael J. Penfold, Alaska State Director
Bureau of Land Management, Anchorage
Mr. Jules V. Tileston, Project Manager - TAGS
Bureau of Land Management, Anchorage

RESPONSE

12-28 Reasonable protection of prior federal authorizations is required. YPC has identified this and proposed mitigation measures, see Subsection 4.8 and Table 4.8-2. As noted, elsewhere, YPC has invited NWA to make a joint field evaluation where there are matters of interest to NWA. To date that joint on-the-ground examination has not happened.

COMMENT LETTER 12 (Contd)

RESPONSE

Mr. Arlan H. Kohl
ALO-86-4099
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cc: (continued)
Earl N. Kari, Director, Alaska Office
Office of the Federal Inspector, Anchorage
J. Richard Berman, Deputy Federal Inspector
Office of the Federal Inspector, Washington DC
James C. Harle, Alaska Manager, ANGTS Relations
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Jerry Brossia, State Pipeline Officer for ANGTS
Alaska Department of Natural Resources, Fairbanks
Harry A. Noah, Manager Environmental Permitting
Yukon Pacific Corporation, Anchorage
Howard Griffith, Jr., President and Chief Executive Officer
Yukon Pacific Corporation, Anchorage

COMMENT LETTER 12 (Contd)

RESPONSE

NORTHWEST ALASKAN PIPELINE COMPANY
ONE OF THE WILLIAMS COMPANIES

HAROLD W. MOLES
VICE PRESIDENT, OPERATIONS

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ALO-86-4098
December 9, 1986

Mr. Jules V. Tileston
TAGS Program Officer
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Mr. William M. Fowler
TAGS Project Manager
Alaska District
U. S. Army Corps of Engineers
P. O. Box 898
Anchorage, Alaska 99506-0898

RE: Written Comments of the Alaskan Northwest Natural Gas Transportation Company Regarding Scoping Meetings for Proposed Trans-Alaska Gas System Environmental Impact Statement

Dear Sirs:

Northwest Alaskan Pipeline Company (NWA), as agent and operator for the Alaskan Northwest Natural Gas Transportation Company, a partnership, hereby submits the enclosed written comments, identified below. NWA requests that such written comments be included in the official record of proceedings of the public scoping meetings held pursuant to the Special Public Notice dated November 19, 1986.

The written comments of NWA which are enclosed herewith are identified as follows:

1) Letter dated November 25, 1986 (Subject: Preliminary Comments on Draft Project Description of the Trans-Alaska Gas System) from Harold W. Moles to Mr. Arlan H. Kohl, and its enclosures:

   a) Letter dated July 24, 1984 from Bureau of Land Management to Yukon Pacific Corporation

   b) Letter dated September 2, 1986 from Harold W. Moles, NWA, to Yukon Pacific Corporation

   c) Letter dated October 14, 1986 from Harold W. Moles, NWA, to Yukon Pacific Corporation

   d) Letter dated March 20, 1984 from The Secretary of the Interior to Yukon Pacific Corporation

COMMENT LETTER 12 (Contd)

RESPONSE

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December 9, 1986
Page two

2) Letter dated December 1, 1986 (Subject: Preliminary Comments on Draft Project Description of the Proposed Trans-Alaska Gas System) from Edwin A. Kuhn, NWA, to Honorable Theodore J. Garrish, Federal Inspector, Alaska Natural Gas Transportation System.

Sincerely yours,

Harold W Moles

Harold W. Moles
Vice President, Operations

HWM:da

Enclosures

cc: E. Kari, OFI, Anchorage
D. Berman, OFI, Washington

COMMENT LETTER 12 (Contd)

RESPONSE

NORTHWEST ALASKAN PIPELINE COMPANY
ONE OF THE WILLIAMS COMPANIES

EDWIN (AL) KUHN
VICE PRESIDENT
GOVERNMENT AFFAIRS

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(202) 872-0280

GOA-86-1048

December 1,1986

Honorable Theodore J. Garrish, Federal Inspector
Alaska Natural Gas Transportation System
U.S. Department of Energy (FA-1)
1000 Independence Avenue, S.W., Room 3G064

Re: Preliminary Comments on Draft Project Description of the Proposed Trans-Alaska Gas System

Dear Mr. Garrish:

The Bureau of Land Management, on November 6, 1986, provided us with a document entitled "DRAFT Trans-Alaska Gas System Project Description November 1986" and requested comments. Our preliminary observations are enclosed for your information and appropriate action.

Yours truly,

Edwin A. Kuhn

Encl: NWA letter of 11/25/86, (Moles to Kohl)

cc: Honorable Donald P. Hodel, Secretary of the Interior
Honorable Ralph W. Tarr, Solicitor, DOI
Honorable J. Steven Griles, Assistant Secretary of the Interior, Land and Minerals Management
Richard Berman, Deputy Federal Inspector
Robert F. Burford, Director, BLM
E. Allan Wendt, Deputy Assistant Secretary of State, International Energy and Resources Policy
Lloyd W. Ulrich, Office of Pipeline Safety, DOT

295 CHIPETA WAY SALT LAKE CITY, UTAH 84108

COMMENT LETTER 12 (Contd)

RESPONSE

NORTHWEST ALASKAN PIPELINE COMPANY
ONE OF THE WILLIAMS COMPANIES

HAROLD W. MOLES
VICE PRESIDENT, OPERATIONS

1001 NOBLE STREET, SUITE 240
FAIRBANKS, ALASKA 99701
(907) 456-8700

November 25, 1986

Mr. Arlan H. Kohl, Program Manager
BLM, Branch of Pipeline Monitoring
Box 30
701 "C" Street
Anchorage, Alaska 99513

Re: Preliminary Comments on Draft Project Description of the Trans-Alaska Gas System

Dear Mr. Kohl:

On November 6, 1986, the Alaska State Office of the Bureau of Land Management (BLM) provided Northwest Alaskan Pipeline Company (NWA) a single copy of a document entitled "DRAFT Trans-Alaska Gas System Project Description November 1986" together with a single set of route maps of the proposed Trans-Alaska Gas System (TAGS). NWA, and other parties receiving this approximately 360 page document at the November 6 meeting at BLM, were advised by the BLM TAGS Coordinator that comments had to be submitted by a self-imposed deadline of November 20, 1986 if they were to be considered; however, this presumptuous deadline was modified later in the meeting. The parties requested by BLM to review the draft document were then asked to attempt to provide, on a preliminary basis, significant comments as early as reasonably possible.

As an accommodation to Yukon Pacific Corporation (YPC) and Government agencies reviewing the draft YPC project description, NWA is submitting these preliminary comments in order to afford YPC an early opportunity to correct significant deficiencies, some of which may be mere oversights on its part. Nevertheless, in submitting these preliminary comments, NWA on behalf of the ANGTS project sponsors, reserves the right to submit such additional comments and to take such further actions as deemed necessary regarding such draft project description.

Furthermore, the Federal Register Notice filed November 14, 1986 and published in Federal Register Volume 51, No. 221 on November 17, 1986 (Document 86-25793) purports to give notice of an amended application for a right-of-way (ROW) grant for the TAGS project to be filed December 5, 1986, and calls for written comments. Since BLM has to date only provided NWA the aforementioned draft project description and route maps and has not provided NWA a copy of the proposed amended application, NWA also reserves the right to comment on such amended application and take such further actions as deemed necessary with regard to such document at such time as it is made available.

COMMENT LETTER 12 (Contd)

RESPONSE

Page 2 November 25, 1986

In view of the above, NWA will merely identify broad areas of concern and highlight significant deficiencies. We will address these deficiencies in more detail in additional detailed comments and in a meeting with the BLM's Ad Hoc Compatibility Review Team in Anchorage, currently scheduled for the week of January 5-9, 1987.

The basic deficiencies noted in the November 6, 1986 draft TAGS project description and proposed route maps are divided into two categories, each of which is then briefly highlighted:

I - Lack of Sufficient Information and Detail;

II - Significant Issues that Need to be Addressed;

I. LACK OF SUFFICIENT INFORMATION AND DETAIL

12-29

1) Failure to Comply with BLM Request for Information and Data
As BLM is aware, on July 24, 1984, BLM advised YPC of the need to provide sufficient information and detail in support of its application to enable BLM to commence the EIS process and the review process of the application itself. Enclosed herewith for ready reference is a copy of the BLM's letter of 7/24/84 listing in detail the information it required to be submitted by YPC. Even a cursory comparison of the draft project description with the 7/24/84 BLM list of required information reveals that YPC's latest draft, as was the case with earlier drafts, fails to comply with BLM's request.

12-30

2) Lack of Meaningful Scale of Route Maps and Lack of Meaningful Detail regarding Proximity and Compatibility

Our letters of 9/2/86 and 10/14/86, copies enclosed, amply highlight the problem of lack of information and detail in the 1:250,000 scale maps used by YPC, while the ANGTS project ROW alignment maps were reviewed and subsequently approved by the Department of the Interior on a scale of 1" - 1000'. (BLM's letter of 7/24/84 to TAGS, page 4, calls for a scale of 1: 63,500 for the "preferred alternative").

Regarding the issues of proximity and compatibility, unfortunately, with the exception of a single conceptual sketch of the relative position of the pipelines on the south side of Atigun Pass, the project description contains virtually no detail other than scattered references to ANGTS in the first 400 miles or so. Without sufficient detail, the cumulative impact of TAGS on the environment and ANGTS cannot be determined.

12-31

3) Lack of Information and Detail for EIS Process and ROW Application Review for TAGS as an additional and Third Pipeline System

Although TAGS represents its latest revision of its draft project description as being for a gas pipeline system in addition to the

12-29 BLM has accepted the application as complete. This comment addresses issues raised by BLM in response to the YPC application filed with BLM on May 7, 1987 (also see response to Comment 12-44). Based upon on-the-ground evaluations by federal and state agencies of the proposed TAGS project and its alternative routings, YPC amended its application and supplied additional information in sufficient detail that BLM and USACE subsequently determined that the NEPA process could be started.

12-30 See response to Comments 12-6, 12-13, 12-18, 12-20, 12-23 through 12-28.

12-31 We have noted the statement that TAGS and ANGTS are not alternatives. The timing for initiation of construction of operation of these two distinct projects would be determined in the marketplace.

COMMENT LETTER 12 (Contd)

RESPONSE

12-31 (Contd) Congressionally authorized and Presidentially approved ANGTS project, its draft project description simply fails to provide information or data upon which the environmental impact of such a proposed third pipeline system can be assessed and reviewed. As a matter of fact, the latest draft TAGS project description slips back into the former posture of TAGS as an alternative gas pipeline system to ANGTS, and thus places itself in direct conflict with a vast framework of existing Federal statutes, Federal Energy Regulatory Commission (FERC) orders, a FERC Conditional Certificate of Public Convenience and Necessity, and an express Presidential Decision which itself was ratified by both houses of Congress and is an existing public law. (See, for example, the discussion in Item 6 of Part II below). Nevertheless, assuming three major pipeline systems, it is fact that no substantive study has been made of both the immediate and cumulative impacts of three rather than two such systems on the environment, e.g. on gravel requirements, transportation support needs, construction period disruptions, etc.

12-32 4) Specific Concerns Raised by Lack of Meaningful Information and Data

Although TAGS has modified its earlier stated position (the so-called "70 foot separation" position) regarding physical proximity to ANGTS in its latest draft document, it nevertheless resurrects the problem by omitting all reference to proximity to ANGTS from approximately TAGS M.P. 300 to the Tanana River crossing at Delta Junction, but describes a routing in that segment which in many places appears to be literally superimposed on top of ANGTS.

The overwhelming body of Federal law (statutory, regulatory and court decisions) mandates that the EIS process review the entire project, regardless of the ownership of the land affected. Yet YPC's project description fails to review its relationship to ANGTS over a large segment of the TAGS route. Since this deficiency is so obvious, it is realized that it may be simply an oversight that will be corrected in short order. When such relationship has been detailed in this stretch, and in general along the entire route adjacent to ANGTS, it will be reviewed and commented on.

II. SIGNIFICANT ISSUES THAT NEED TO BE ADDRESSED

The second broad category of basic deficiencies noted in the proposed TAGS project description/EIS process goes beyond the category of basic deficiencies related to a lack of sufficient meaningful information and data highlighted in Part I. This second category includes some very basic misconceptions evident in either the proposed TAGS project description itself and/or in the proposed EIS process.

12-33 1) Basic Misconception Regarding Analysis of Alternatives to Proposed Project

The draft project description evidences a basic misconception

12-32 As noted earlier, YPC has used a "200-foot separation" standard. The area identified is under state jurisdiction. There is no overlap between existing USACE authorizations for ANGTS and the proposed TAGS alignment evaluated in the DEIS. ANGTS has not completed State requirements for authorization to use state ownerships, including state authorizations for the Sales Gas Conditioning Facility at Prudhoe Bay. Accordingly, the only completed approvals for ANGTS are at the federal level. The FEIS has been revised to better portray the existing status of the entire ANGTS project where there is a close relationship with the proposed TAGS project.

12-33 These issues are addressed in the DEIS and in some cases as noted in response to Comment 12-32, the FEIS has been revised. As noted in the response to Comment 12-31, TAGS and ANGTS are not alternatives.

COMMENT LETTER 12 (Contd)

12-33 (Contd)

regarding the requirement that the EIS process identify and analyze alternatives to the proposed action. Although the above-mentioned BLM letter of 7/24/84 instructed YPC to comprehensively address this critical aspect of the EIS process, what YPC has done in the project description is merely address one narrow aspect of the issue, namely, alternative routes to tidewater for an LNG project, and simply ignored BLM's instructions set forth on page 1 of the enclosure to the aforementioned letter. Thus, the following need to be addressed:

a) All of the possible methods of transportation, not merely a few alternate routes to tidewater;

b) The "No Action" alternative;

c) The major feasible alternatives.

12-34

2) Whether the Federal Energy Regulatory Commission is a "Necessary" or Even "Indispensible" Party to the EIS Process

The most cursory examination of the TAGS project description and BLM's proposed EIS process reveals that TAGS proposes what all concede to be a "major Federal action" which involves taking "pipeline quality gas" from a proposed gas conditioning facility on the North Slope which will be a FERC jurisdictional facility and transporting that gas hundreds of miles in close proximity to two other pipelines which are themselves subject to FERC jurisdiction, yet FERC is not even mentioned as a participant in the EIS process. Whether or not the proposed TAGS project will ultimately be determined to be subject to FERC jurisdiction, clearly TAGS as proposed cannot exist without processed "pipeline quality gas" from a proposed FERC jurisdictional facility, and the whole issue of "compatibility" of TAGS, particularly with respect to ANGTS, directly involves a FERC certificated system. The overlooking of FERC in the EIS process may be a legally fatal defect in the EIS itself.

12-35

3) TAGS and BLM Misconceptions Regarding Role of the Federal Inspector for ANGTS

Under Reorganization Plan No. 1 of 1979, 44 Fed Reg. 33663, and Executive Order No. 12142 of June 21, 1979, 44 Fed. Reg. 36927, the Federal Inspector for ANGTS, rather than BLM or the Secretary of the Interior, has the authority to determine compatibility of TAGS to ANGTS since all enforcement authority of the Secretary of the Interior, as well as all other Federal agencies, under all Federal statutes relevant in any manner to pre-construction, construction and initial operation of ANGTS, has been vested exclusively in the Federal Inspector.

Proximity to ANGTS by TAGS within 200 feet is clearly an OFI determination, not BLM, as well as compatibility in the broad sense, including the effect of availability of mineral materials needed for ANGTS, access roads, airports, and all other facilities needed for ANGTS.

RESPONSE

12-34 FERC was a cooperating federal agency during the preparation of the DEIS. The FEIS reflects the current status of that agency in the various federal approvals necessary for the TAGS project. The FEIS fulfills the requirements of the National Environmental Policy Act for initial decisions now pending action by FERC on the TAGS project.

12-35 The Federal Inspector was a cooperating federal agency during the preparation of the DEIS. The DEIS reflects proposed arrangements between the Federal Inspector and BLM to meet their separate authorities and to expedite federal decisions for TAGS. Also see responses to Comments 12-18, 12-20, 12-24, 12-27, 12-46, and 22-75.

COMMENT LETTER 12 (Contd)

Page 5 November 25, 1986

12-35 (Contd) BLM can only make determinations in the TAGS EIS and ROW application process that do not affect ANGTS and are not within the jurisdiction of the Federal Inspector under Reorganization Plan No. 1 of 1979.

12-36

4) Availability of Proven North Slope Gas Reserves for Both ANGTS and TAGS

TAGS, while positing itself as an additional project to ANGTS, and not an alternative project, fails to address a fundamental aspect of its entire project: the availability of proven North Slope gas reserves for use in the TAGS project. Obviously, if proven gas reserves for an additional project to ANGTS are not available, there is no basis for even preparing an EIS, much less reviewing an application for a ROW. Thus, these issues need to be addressed:

a) Are there proven North Slope gas reserves sufficient to meet the commitment of North Slope gas to ANGTS, as well as the additional amounts needed for TAGS? In this regard, the enclosed letter of Secretary of the Interior Clark of March 20, 1984 clearly recognizes the existing commitment to ANGTS.

b) Presuming that there are insufficient proven gas reserves for both TAGS and ANGTS, the environmental impact of depriving the Lower 48 states of 26 TCF of North Slope gas reserves over the years ahead, needs to be addressed.

12-37

5) Potential Conflict between BLM Actions Regarding TAGS EIS and TAGS ROW Application and Existing Canadian-U.S. Treaties

There are two treaties in existence between the United States and Canada which relate to the ANGTS Project. Any actions by BLM in the TAGS EIS/ROW application review process that conflict with, or even appear to conflict with, U.S.-Canadian treaty obligations and commitments would, of course, be beyond the authority and jurisdiction of BLM, and could have international repercussions. As a matter of fact, this entire area is another example of the apparent misconception of BLM of its own authority as it potentially affects ANGTS. Furthermore, since the ANGTS commitment involves international treaty obligations, the U.S. State Department may also be a necessary party to the EIS and ROW application process, as well as those other Federal agencies responsible for national security considerations.

12-38

6) Misconceptions Regarding Availability of Temporary Facilities along TAPS/ANGTS Route

At a number of places in the draft project description, TAGS proposes to use certain temporary facilities along the TAPS/ANGTS route such as airfields, construction camp sites and so forth. See for example p. 5-95; some of these sites are

RESPONSE

12-36 See responses to Comments 12-1 and 12-3.

12-37 On January 12, 1988, the President of the United States stated, "...I do not believe this finding should hinder completion of the Alaska Natural Gas Transportation System (ANGTS)" (see Appendix N).

12-38 Temporary facilities needed to construct the proposed TAGS project that also are under an existing federal authorizaton for ANGTS are available to other users and uses providing the requirements of 43 CFR 2881-1-3(c) are met. That regulation reserves the right of the federal government to "...make, issue, or grant right-of-way grants, temporary use permits, easements, leases, licenses, contracts, patents, permits, and other authorizations to or with third parties for compatible uses on, under, or adjacent to the federal lands subject to a right-of-way grant or temporary use permit." For example, a temporary construction camp has been located by the Alyeska Pipeline Service Company for repair of TAPS at Atigun Pass on an area also under authorization for future use for ANGTS. Many of these areas host a multitude of other compatible resource users ranging from guide camps, state highway maintenance storage areas, mineral exploration bases, biological survey camps, and informal public recreation. Any federal approvals of such a request to use public lands takes into account other authorizations and reasonably foreseeable uses of the adjacent public lands. Decisions to authorize these other uses takes into account the current needs of all other users. Accordingly, we do not agree with the assertion that TAGS or any other future user of public lands, included in a valid federal authorization for ANGTS, could only take place after ANGTS is built (also see response to Comment 12-5).

COMMENT LETTER 12 (Contd)

RESPONSE

12-38 (Contd)

said to be "critical" to TAGS, p. 8-6,7. Unfortunately, TAGS has completely overlooked the fact that such camp sites and airfields are either already permitted to ANGTS for the ANGTS project (or included in its ROW Grant, e.g., Happy Valley) and would only be available to TAGS after the ANGTS project needs have been met. This is an example of the failure of TAGS to prepare a project description for an additional system. Such an additional system would need gravel and borrow material in addition to that required for ANGTS, and each resource impact to be addressed in the project description and EIS process must be addressed in the context of an additional impact, not merely a substituted impact of TAGS for ANGTS, as TAGS suggests in its project description.

12-39

7) Misconception that "Similarity" of Projects means that TAPS or ANGTS data may be used in TAGS EIS process

A continuing theme of the draft project description suggests that "data [are] available from previous studies and projects." See, for example, p. 5-138; p. 7-10. However, an examination of the references in Section 16 fails to indicate the ubiquitous previous studies and projects from which such data is purportedly "available." As YPC and BLM are aware, previous projects have, at great expense, developed a large body of data on many of the aspects of a large diameter pipeline system in the Arctic and sub-Arctic. The issue is not whether such data exists, but rather, whether it is available for use by YPC or BLM in the EIS process, and whether mere "similarity" of the systems equates to interchangeability of criteria, conditions and stipulations. Highlighting these issues:

a) "Availability" - the vast majority of existing TAPS and ANGTS data has already been determined under both Freedom of Information Act proceedings and court decree as not available since they constitute extremely valuable proprietary and confidential information. Furthermore, it is abundantly clear that under Council on Environmental Quality (CEQ) regulations at 40 CFR 1502.21, material based upon proprietary data which is not itself available to the public cannot be used in the EIS process either directly or through incorporation by reference. Thus, unless YPC identifies publicly available reference material upon which its various assumptions are based, such assumptions, charts and statements must be disregarded in the EIS process and considered non-existent. In other words, either TAGS produces publicly available references to support its assumptions, as required by the CEQ regulations, so that such documents can be reviewed and considered, or else such references may not be included in the EIS document. Undocumented statements and assumptions must then be deleted as unsupported, and the project description and EIS are deficient in that respect.

12-39 Confidential and proprietary information cannot be used in the EIS process. The FEIS is built upon the assumption that ANGTS will be built (see Subsection 1.6); therefore, TAGS is "not a substitute" or "alternative" project to ANGTS. Cumulative impacts are an important element of the required evaluations under the National Environmental Policy Act and have strengthened the FEIS accordingly. Although ANGTS and TAGS are not "interchangeable," the overall effects identified and available in the public record for ANGTS reasonably can be used to predict the environmental consequences of construction and operation of the proposed TAGS project. The details of engineering requirements to successfully place the federally-authorized ANGTS chilled 48-inch natural gas pipeline buried in sensitive environments in Alaska is confidential and proprietary. However, there is a public record that states satisfactory solutions have been identified by the Federal Inspector. TAGS has similar environmental consequences to those of ANGTS (see response to Comment 12-17).

COMMENT LETTER 12 (Contd)

12-39 (Contd)

b) "Similarity" of previous projects does not equate to interchangeability. TAGS is not a substitute project or alternative project, it purports to be an additional project. Thus, previous studies and projects are relevant only if the cumulative impact of a third large diameter pipeline system in close proximity is addressed in such previous studies and data, and if such previous studies and data are legally and publicly available. Certainly none of the references by YPC address this cumulative impact issue, whether the impact be with respect to gravel sources, thaw-stable and thaw-unstable soils, stream crossings, fish and wildlife resources, air quality, pollution controls, waste disposal facilities or the like. In other words, "similarity" is merely the start of the process, not the culmination of the process.

12-40

8) 30 U.S.C. 185 (j)- Requires a Determination of Technical and Financial Capability before Issuance of a ROW Grant, not Afterwards

The wording of the statute is unequivocal; technical and financial capability must be established before a grant of ROW can issue, not afterwards, as suggested by BLM and YPC.

12-41

9) Misconception of TAGS Regarding Proximity Criteria

In Section 12 of the draft project description, TAGS asserts that:

> In general, this would mean that TAGS would not be constructed within 200 feet of TAPS or ANGTS unless cost, physical, environmental, or safety constraints indicate the need to construct closer to other pipelines. This statement has been made not as a firm commitment to a stipulation, but as a general goal of the TAGS project.

Although the quoted language is an improvement over the earlier stated TAGS position, it still cannot be said to be wholly acceptable. As already pointed out in our letter of September 2, 1986, referenced earlier, the criteria for separation is that set forth in the ANGTS ROW grant. For example, that document clearly states, "in no case will reducing the cost of construction be the sole consideration upon which such approval [for proximity of less that 200 feet] is based."
The present TAGS position just does not go far enough to assure that environmental and technical criteria for the proximity of all three pipeline systems will be satisfactorily met during the construction and subsequent operation of the pipeline systems.

12-42

10) Misconception Regarding a North Slope Gas Conditioning Facility, its Availability and Environmental Impact.

On Page 1-2 of the TAGS Project Description, the following statement is made: "The proposed TAGS project does not currently include development of a natural gas conditioning facility on the

RESPONSE

12-40 This statute would be applicable to every applicant before a Grant of Right-of-Way could be issued.

12-41 Proximity issues for TAGS are based upon standards used between ANGTS and TAPS in the Agreement and Grant of Right-of-Way for ANGTS. These were reflected in the DEIS (see Subsection 1.5).

12-42 The FEIS has been strengthened to make it clear that the Alaska Gas Conditioning Facility partially authorized for ANGTS is not part of the proposed TAGS project. See Subsection 2.2.1, 3.4 and 4.4.

COMMENT LETTER 12 (Contd)

RESPONSE

12-42 (Contd) North Slope. Existing and authorized gas conditioning facilities in Prudhoe Bay can provide the quality of pipeline gas needed to operate TAGS. Therefore YPC is not requesting authorization for similar facilities at this time. Responsibility for construction and operation of gas conditioning facilities will be the subject of future discussions among YPC, North Slope gas producers, and Northwest Alaskan Pipeline Company." (Emphasis added)

The emphasized statement is highly misleading. The only "existing or authorized" gas conditioning facilities at Prudhoe Bay are: 1) the Miscible Gas Facility (MGF) used to process gas for enhanced recovery of oil, and 2) the Alaska Gas Conditioning Facility (AGCF) proposed to produce pipeline quality gas for the ANGTS. It is anticipated that the MGF and AGCF will be operated in conjunction with each other; however, these facilities have been sized and planned to accommodate only a single large diameter gas pipeline system. A major expansion of facilities, essentially a doubling in an area of considerable environmental sensitivity, would be required to accommodate TAGS. In short, the required gas conditioning facilities can be ignored in the EIS only if it is explicitly assumed that TAGS will be built instead of ANGTS.

12-43 11) Misconception Regarding Location of ANGTS in Atigun Pass

As already noted, TAGS has included a preliminary sketch depicting the location of the ANGTS pipeline and the proposed location of TAGS. Even though the sketch is merely a general, conceptual document, it should be noted that TAGS' assumption regarding the approved location of the ANGTS pipeline is misleading. NWA will be prepared to discuss this matter at the meeting with BLM's Ad Hoc Compatibility Review Team in January 1987.

Sincerely yours,

Harold W. Moles

Harold W. Moles

WJM/HWM/cr

Enclosures

cc: See attached

12-43 The FEIS discusses the proximate relationship of the proposed TAGS alignment with ANGTS, Dalton Highway and TAPS.

COMMENT LETTER 12 (Contd)

RESPONSE

Copy List:

Michael J. Penfold, Alaska State Director
Bureau of Land Management
Anchorage

Jules V. Tileston, Program Manager, TAGS
Bureau of Land Management
Anchorage

Earl N. Kari, Director, Alaska Office
Office of the Federal Inspector

James C. Harle, Alaska Manager, ANGTS Relations
Anchorage

Harry G. Brelsford, General Counsel
Alyeska Pipeline Service Company
Anchorage

Jerry Brossia, State Pipeline Officer for ANGTS
Alaksa Department of Natural Resources
Anchorage

Harry A. Noah, Manager Environmental Permitting
Yukon Pacific Corporation
Anchorage

Howard Griffith, Jr., President & CEO
Yukon Pacific Corporation
Anchorage

COMMENT LETTER 12 (Contd)

JUL 2 4 1984

Mr. Mead Treadwell
Yukon Pacific Corporation
P.O. Box 10-1700
Anchorage, Alaska 99510

Dear Mr. Treadwell:

This letter responds to your Right-of-Way application filed with the Bureau of Land Management (BLM) on May 7, 1984. The application has been serialized as AA-53559 in the BLM Anchorage District Office and as FF-83941 in the BLM Fairbanks District Office.

12-44 In order to perfect your application as filed on SF-299 and in anticipation of the requirements of the National Environmental Policy Act of 1969 (NEPA) and the Alaska National Interest Lands Conservation Act (ANILCA), additional information is requested via an enclosure to this letter. As your proposal develops, additional information may be required. You will receive timely notification of such requirements.

The BLM has been identified as the lead Federal Agency for any NEPA and/or ANILCA compliance requirements stemming from your application. As the lead Federal Agency, the BLM is available to discuss any questions you may have concerning the information requested by the enclosure.

Sincerely yours,

/S/ [illegible] WOLF
State Director
Acting

Enclosure

cc: U.S. F&WS
NPS
DOT
NOAA
Corps of Engineers
FI

[illegible]/rs/7-161[illegible]

RESPONSE

12-44 The applicant has submitted adequate information to meet the requirements outlined by BLM on July 24, 1984.

COMMENT LETTER 12 (Contd)

RESPONSE

I. IDENTIFYING THE APPLICANT'S PROPOSED PROJECT:

Provide a preliminary and generalized presentation of the proposed project and major alternatives favored by the applicant including a narrative and graphic/map discussion showing the source and specific type of product, the generalized construction modes and methods, major routing alternatives and intended markets. In this presentation, applicant's proposed project should be considered as synonymous with a preliminary (applicant) identification of a "Preferred" alternative. Materials submitted should be suitable for use by the BLM in explaining applicant's proposed project to interested agencies and the public in a NEPA/ANILCA type scoping process.

II. IDENTIFYING THE ARRAY OF ALTERNATIVES CONSIDERED BY THE APPLICANT FOR ACCOMPLISHING THE PROPOSED ACTION:

Identify the array of alternatives considered by applicant for accomplishing a broadly defined proposed action of transporting a product/energy source from the site of production in the vicinity of Prudhoe Bay, Alaska to world markets by any method of either proven or unproven technology. This discussion should include general narrative and graphic/map discussions of all methods of transportation considered such as pipeline, air and sea transport methods, liquefaction of gaseous products and injection into the Trans-Alaska Pipeline System, or conversion of product at source to electric energy with transport by high-voltage transmission lines. This analysis should be designed to divide an array of alternatives into those considered possible (and worthy of futher discussion) and those considered impracticable and eliminated from further consideration. All alternatives considered to be impracticable in this analysis must be specifically identified and must be discussed in enough detail to allow a reader to understand what criteria applicant utilized to eliminate an alternative from further consideration. A "No-Action" alternative will be considered in this analysis as per NEPA guidelines.

III. IDENTIFYING THE ARRAY OF ALTERNATIVES CONSIDERED FEASIBLE BY THE APPLICANT FOR ACCOMPLISHING THE PROPOSED ACTION:

For the array of possible alternatives (from item II, as above) for accomplishing the proposed action of transporting the product from source to market, provide an analysis which generally compares and contrasts the economic, engineering, environmental and legal constraints of each possible alternative. This analysis should be designed to divide the possible alternatives resulting from step II into those considered feasible (the major alternatives to the proposed action) and those considered infeasible and eliminated from further consideration because of seemingly insurmountable economic, engineering, environmental or legal constraints. All alternatives considered to be infeasible in this analysis must be discussed in enough detail to allow a reader to understand what criteria applicant utilized to eliminate an alternative from further consideration. In this discussion, the proposed action should be defined as the transport of product from source to market by optimal technology. A "No-Action" alternative will be considered in this analysis as per NEPA guidelines.

Enclosure to BLM letter of 7/24/84.

COMMENT LETTER 12 (Contd)

RESPONSE

IV. IDENTIFYING APPLICANT'S MAJOR ALTERNATIVES FOR ACCOMPLISHING THE PROPOSED ACTION:

For the array of alternatives considered as feasible by the applicant, hereafter referred to as the "major alternatives", provide:

A. Five (5) set(s) of 1:250,00 scale maps (overlays acceptable) which generally depict the similarities and differences in:

1. Each major alternative's construction modes, construction segments, route and temporary and permanent facility sitings for accomplishing the proposed action;
2. The general pattern of proposed and existing land uses and facilities along each major alternative's route:
3. The general pattern of land ownership for all lands potentially disturbed by each major alternative: and
4. Any areas considered critical under a NEPA or ANILCA definition.

These maps, or overlays to a set of base maps, may show the major alternatives as totally separate entities or may show a network of alternatives from which the selection of a preferred alternative may be made after further analysis.

B. A general analysis (narrative, mapped, graphic and/ or tabular information) which compares and constrasts the major alternatives (including a "No-Action" alternative as per NEPA guidelines) with respect to:

1. The existing environment traversed by each major alternative including its:

   a. Geology:
   b. Soils:
   c. Seismicity:
   d. Biota;
   e. Endangered Species:
   f. Climate:
   g. Hydrology:
   h. Air and Noise quality:
   i. Socioeconomics:
   j. Land Use:
   k. Recreation and Aesthetics:
   l. Archaeological features:
   m. Native Culture and Subsistence; and
   n. and other NEPA/ANILCA significant parameters.

2. The general relationship of each major alternative to other existing or proposed systems for the transport of petroleum products from the Alaskan North Slope to markets.

COMMENT LETTER 12 (Contd)

RESPONSE

3. A general survey of the required approvals, authorizations and/or permits required for each major alternative listed by type and issuing entity within the Federal, State or local government.

4. A general survey of the existing location of Private, State and Federal land ownership with identification of the land managing agency for State and Federal lands for all lands potentially disturbed by each major alternative:

5. The general similarities and differences in material estimates, proposed engineering and other design required for each major alternative including:

   a. General design and location of facilities;
   b. Number and location of construction segments:
   c. Assumed mode of construction;
   d. Number and location of construction camps:
   e. Manpower requirements during construction and operation;
   f. Mineral exploration methods and procedures to be used to estimate required volume;
   g. Estimates of resources (gravel, sand, rock, fuel, water, etc.) required for construction and general method and location of extraction;
   h. Estimates of resources (gravel, fuel, water, etc.) required for operation and general method and location or extraction:
   i. The feasibility of rehabilitating disturbed areas after construction;
   j. Oil spill and hazardous material contingency plan including preliminary estimates of spills expected under each major alternative;
   k. Applicant plans to meet applicable standards for ambient air, noise and water emmissions:
   l. Applicant plans to meet applicable standards for solid waste disposal;
   m. Number of disposal sites required for construction and operation:
   n. Construction and operational techniques that will be utilized including any measures that will be undertaken to minimize environmental damage:
   o. Land use following abandonment; and
   p. Total cost estimates for each major alternative.

6. The general similarities and differences in timing and/or timeframes of planning, construction and operational actions for each of the major alternatives including:

   a. Assumed length of time to design each alternative;
   b. Assumed length of time required to obtain all permits, authorizations and approvals prior to construction startup;
   c. Projected construction startup date;

3

COMMENT LETTER 12 (Contd)

RESPONSE

d. Assumed time-of-year (season) and length of time (months) for construction of each alternative:
e. Overall length of time to place each alternative into incremental and full operation:
f. Projected operational startup date for each major alternative: and
g. Predicted or projected operational life of each major alternative.

C. A qualitative and quantitative estimate of impacts, in keeping with NEPA and ANILCA guidelines, for each major alternative, including the "No-Action" alternative.

V. IDENTIFYING APPLICANT'S PREFERRED ALTERNATIVE:

For the applicant's preferred alternative, hereafter referred to as simply the "Preferred Alternative" for the purposes of this discussion, provide:

A. A discussion of the criteria and/or justification utilized by the applicant in designating the applicant's preferred alternative including pilot programs or research supporting applicant's choice.

B. Five (5) set(s) of 1:63,500 scale maps (overlays acceptable) which specifically depict:

1. The preferred alternative's entire route, construction modes (elevated, buried, special treatment), construction segments (with camps and other temporary construction use facilities identified), access roads, communications system, material and disposal sites and permanent facility sitings regardless of whether or not located on Federal lands;

2. Proposed and existing land uses and facilities along the proposed route;

3. For all lands which will or may be disturbed during construction and/or operation show whether Private, State and Federal land ownership exists and show the administering agencies for State and Federal lands; and

4. In areas considered critical under a NEPA or ANILCA definition, the set of 1:63,500 scale maps should be supplemented by additional large scale maps/drawings which depict the specific relationship of the preferred alternative to major geographical features and to existing or proposed land uses and/or facilities.

C. An analysis (narrative, mapped, graphic and/ or tabular information) which specifically describes the preferred alternative with respect to:

COMMENT LETTER 12 (Contd)

RESPONSE

1. The existing environment traversed including its:

   a. Geology:
   b. Soils:
   c. Seismicity:
   d. Biota:
   e. Endangered Species:
   f. Climate:
   g. Hydrology and Water quality:
   h. Air and Noise quality:
   i. Socioeconomics:
   j. Land Use:
   k. Recreation and Aesthetics:
   l. Archaeological and Historical features:
   m. Native Culture and Subsistence: and
   n. and other NEPA/ANILCA significant parameters.

2. The relationship of the preferred alternative to other existing or proposed systems for the transport of petroleum products from the Alaskan North Slope to markets.

3. The required approvals, authorizations and/or permits required for construction and operational implementation of the preferred alternative listed by type and issuing entity within the Federal, State or local governments.

4. The existing location and amount (acres) of Private, State and Federal land ownership complete with the name and address of owner or administrating agency for all lands that will be or may be involved in the construction or operation of the preferred alternative. This information should be broken down to describe:

   a. Location, total acres disturbed and the amount of mineral materials (gravel, sand, rock) to be mined and placed during construction with a similar estimate of operational needs;
   b. Location and total acres to be disturbed by disposal sites and access roads during construction with a similar estimate of sites to be retained for operational needs;
   c. Location and total acres disturbed during construction:
   d. Location and total acres occupied by operational facilities:
   e. Location and total acres to be revegetated/rehabilitated after construction and after abandonment; and
   f. Location and total acres disturbed by the preferred alternative.

5. Material estimates, proposed engineering and other design required for the preferred alterantive including, by segment:

   a. Design and location of facilities (i.e. sketches, photos, or drawings depicting specifications of pipe, compressor stations, access roads, communications network, etc):

COMMENT LETTER 12 (Contd)

RESPONSE

b. Number and location of construction segments;
c. Assumed mode of construction (i.e. elevated, buried, or special treatment) for each segment of the preferred alternative:
d. Number and location of construction camps:
e. Manpower requirements during all phases of construction and operation including a breakdown of construction force by segment, location and time; operational force by segment, location and time; types of personnel required; and probable sources of personnel;
f. A description of mineral exploration methods and procedures to be used in determining type and volume of mineral material to be extracted:
g. Estimates of resources (gravel, sand, rock, fuel, water, etc.) required for construction of compressor stations, construction camps, access roads, revetments and river training structures, workpad, bedding and padding, backfill, etc., including location and amount of extraction and/or use, type of extraction and/or use and time of year of extraction and/or use:
h. Estimates of resources (gravel, fuel, water, etc.) required for operation of the preferred alternative including location of extraction and/or use, type of extraction and/or use and time of year of extraction and/or use for the projected life of the project;
i. The feasibility of and plans for erosion control, revegetation and rehabilitation and future land use of disturbed areas and whether the feasibility analysis and plan are based upon applicant study, survey or research of prior project's success:
j. Oil spill and hazardous material contingency plan including statistical estimates of type, location and amount of spillage expected;
k. Quantification of expected emmissions affecting ambient air, noise and water quality during all construction and operational phases of the preferred alternative including the source of such emmissions and applicant plans to meet applicable standards;
l. Quantification of the expected amounts of solid, non-burnable waste during all construction and operational phases of the preferred alternative including the source of generation of such waste and applicant's plans to meet applicable standards for disposal;
m. Number and location of disposal sites for both construction and operational phases;
n. Construction and operational techniques that will be utilized including any measures that will be undertaken to minimize environmental damage;
o. Land use following abandonment: and
p. Cost estimates broken down for design, pre-construction mobilization, right-of-way cost, construction material cost, construction, operation and total cost:

6

COMMENT LETTER 12 (Contd)

RESPONSE

6. Timing and/or timeframe of planning, construction and operational actions, (to be presented in narrative/graphic/tabular format) including, by segment:

   a. Assumed length of time required to design the preferred alternative:
   b. Assumed length of time required to obtain all permits, authorizations and approvals required prior to construction start-up;
   c. Projected construction startup date;
   d. Assumed time-of-year (season) and length of time (months) for construction of each project segment;
   e. Overall length of time required to place the preferred alternative into both partial and full operation including incremental process outputs (amount of product delivered to market) from operational startup through all incremental increases to full production:
   f. Projected operational startup date for each implementation stage and to reach full operation; and
   g. Predicted or projected operational life for the preferred alternative as a whole and for any component which may not coincide with the overall project life including the total projected amount of product to be delivered over the life of the project;

D. A qualitative and quantitative estimate of impacts, in keeping with NEPA and ANICLA guidelines, resulting from the construction and operation of the preferred alternative and a qualitative and quantitative estimate of residual impacts, in keeping with NEPA and ANICLA quidelines, remaining after project termination and rehabilitation, assuming the preferred alternative is built, operated and terminated in compliance with all applicable laws and regulations. This estimate shall describe expected impacts as follows:

1. Source of impact (e.g. construction of compressor stations)
2. Type of impact (e.g. destruction of natural vegetation and/or archaelogical or historical resources);
3. Magnitude of impact (unmeasureable, measureable or severe):
4. Term or timeframe of impact (short, only during the construction phase, during total project life, extending beyond project life);
5. Location of impact (confined to construction/operational facility or onsite, confined to vicinity of the preferred alternative or local, extending beyond the environs of the preferred alternative or regional);and
6. Irreversible and irrecoverable committment of resources accompanying project approval and execution.

COMMENT LETTER 12 (Contd)

RESPONSE

NORTHWEST ALASKAN PIPELINE COMPANY
ONE OF THE WILLIAMS COMPANIES

HAROLD W. MOLES
VICE PRESIDENT OPERATIONS

1001 NOBLE STREET SUITE 300
FAIRBANKS ALASKA 99701
(907) 456-8700

September 2, 1986
ALO-86-4086

Mr. John Horn
Vice Chairman
Yukon Pacific Corporation
P. O. Box 101700
Anchorage, Alaska 99510

RE: Yukon Pacific Letter Dated July 28, 1986 Regarding Draft "Project Overview" for Trans-Alaska Gas Project

Dear Mr. Horn:

Your letter of July 28, 1986 requested our review and comments on a draft "Project Overview" for your company's proposed Trans-Alaska Gas Project (TAGS). While the draft "Project Overview" and small scale (1:250,000) route maps of the TAGS project enclosed with your letter do not provide enough detail tc permit a meaningful review at this very early conceptual stage of your project, we will attempt to provide some very preliminary comments based upon the documents provided to us.

The principal aspect of the draft "Project Overview" which causes us serious concern, even at this very preliminary stage of your proposed project, is the

12-45 assumption stated in the document that a 70-foot minimum separation "where possible" is planned between the pipeline authorized to the Alaskan Northwest Natural Gas Transportation Company (ANNGTC) and the TAGS pipeline, while a 200-foot minimum separation is planned between the TAPS pipeline and the TAGS pipeline. The asserted rationale for the significantly greater separation between the TAPS system and your proposed system is that "the operational characteristics are different for a hot oil pipeline and a chilled gas pipeline," while the asserted rationale for the lesser separation proposed between TAGS and ANNGTC is that "the operational characteristics of the ANGTS chilled gas pipeline is (sic) compatible with the operational characteristics of TAGS." We feel compelled to point out that the assumptions in the "Project Overview" regarding the rationale for two different minimum separation distances are simply erroneous -- the considerations for establishing a minimum 200-foot separation between the TAPS pipeline and the ANNGTC pipeline were not limited to "operational characteristics" of either pipeline system; rather, they were predicated upon a variety of concerns encompassing both the construction and operational phases of the ANNGTC system and the operational characteristics of the two systems.

12-45 The applicant incorporated this recommended standard on December 5, 1986.

COMMENT LETTER 12 (Contd)

RESPONSE

Mr. John Horn
September 2, 1986
Page two

Based upon careful consideration by our own Arctic engineers and scientists, those of Alyeska Pipeline Service Company, and Federal and State experts, a minimum separation of 200 feet, subject to exceptions, was established as the basic guideline for proximity of the ANNGTC and the TAPS pipeline systems. Exceptions may be possible at site-specific locations where required to avoid environmental damage or due to terrain constraints, provided that specified, stringent criteria are met. This guideline was adopted as an essential prerequisite to the required "compatibility" determination by the Secretary of the Interior, was incorporated into the ANNGTC Right-of-Way Grant, and became a basic guideline for the approved design criteria on the ANNGTC system.

In the absence of any engineering, environmental or construction field testing and research by TAGS that would support a rationale for a lesser separation between TAGS and ANNGTC than in the TAPS - ANNGTC case or the TAPS - TAGS case, it is our considered opinion that the same separation standards that apply between TAPS and ANNGTC must also apply between TAGS and ANNGTC. It is therefore our position that there must be a minimum separation between ANNGTC and TAGS of 200 feet. Any separation of less than 200 feet is unacceptable unless TAGS can demonstrate satisfactorily that a lesser separation at a site-specific location is required to avoid environmental damage or is due to terrain constraints, and that other specified, stringent criteria will be met. Such criteria must be similar to those set forth in the ANNGTC Right-of-Way Grant.

Exceptions to the 200-foot separation can only be considered after a mile-by-mile assessment, on a site-specific basis. In such cases, TAGS would be required to address such proximity-related concerns as: damage from blasting and construction equipment operation; slope stability and soil liquefaction; erosion control and surface drainage; construction safety; alteration of the hydraulic regime in rivers and flood plains; and cathodic protection. Moreover, the interaction, thermal or otherwise, of three large-diameter pipelines in close proximity, and the strategic, economic and security implications for the State and Federal governments, North Slope Producers, and consumers in the event
12-46 of catastrophic failure of one or more of the three systems and the attendant interruption in energy supplies, are major concerns which would require appropriate consideration.

12-47 We also note that the "Project Overview" either fails to address, or makes mere passing reference to, a number of other highly significant factors that will have to be adequately addressed at an early stage of the review process. For example, ancillary to proximity guidelines, and also prerequisite to a "compatibility" determination regarding the three systems are requirements for

12-46 Gas and oil pipelines are built to federal standards which have, as a criteria, avoidance of catastrophic failures. The TAGS project will conform to these pipeline and LNG standards.

12-47 BLM in consultation with the Federal Inspector has determined that ANGTS and TAGS are compatible. BLM has made a similar determination that TAPS and TAGS are compatible.

COMMENT LETTER 12 (Contd)

RESPONSE

Mr. John Horn
September 2, 1986
Page three

12-47 (Contd) appropriate provisions for liability, insurance and indemnification by TAGS to ANNGTC, TAPS and other third parties, as well as requirements for full coordination by TAGS with all other parties having facilities in the vicinity of the proposed TAGS route. We trust that all significant TAGS project issues will be addressed in the project description that you plan to make available in October 1986 in sufficient detail to permit us to provide meaningful comments at that time.

Sincerely yours,

Harold W Moles

Harold W. Moles
Vice President, Operations

HWM:da

cc: Michael J. Penfold, Alaska State Director
Bureau of Land Management, Anchorage
Arlan H. Kohl, Chief, Pipeline Monitoring
Bureau of Land Management, Anchorage
Earl N. Kari, Director, Alaska Office
Office of the Federal Inspector, Anchorage
Esther Wunnicke, Commissioner
Alaska Department of Natural Resources, Juneau
Jerry Brossia, State Pipeline Officer for ANGTS
Alaska Department of Natural Resources, Fairbanks
Harry G. Brelsford, General Counsel
Alyeska Pipeline Service Company, Anchorage
James C. Harle, Alaska Manager, ANGTS Relations
Alyeska Pipeline Service Company, Anchorage
Cuba Wadlington, Jr., Vice President
Northwest Alaskan Pipeline Company, Salt Lake City
J. Clayton LaGrone, Esquire
The Williams Companies, Tulsa

COMMENT LETTER 12 (Contd)

RESPONSE

NORTHWEST ALASKAN PIPELINE COMPANY
ONE OF THE WILLIAMS COMPANIES

HAROLD W. MOLES
VICE PRESIDENT OPERATIONS

1001 NOBLE STREET SUITE 240
FAIRBANKS, ALASKA 99701
(907) 456 8700

October 14, 1986
ALO-86-4091

Mr. Harry A. Noah
Manager Environmental Permitting
Yukon Pacific Corporation
P. O. Box 101700
Anchorage, Alaska 99510

Dear Harry:

We have received your October 3, 1986 letter. Regarding Yukon Pacific's request for a copy of our Revision 4 Alignment Sheets, Bill Moses, General Counsel for Northwest Alaskan Pipeline Company (NWA), and Jeff Lowenfels, Counsel for Yukon Pacific, have communicated on that subject and the matter has been resolved. As you are aware, we first offered to make the material available on September 24, 1986 and subsequently Yukon Pacific submitted a counter proposal, and our respective attorneys have worked to resolve the matter.

As for your invitation for NWA to meet with you to review the alignment and discuss the matter of proximity, first, let me reiterate what I said on the phone and what has been said both in recent meetings with Yukon Pacific and in my letter of September 2, 1986 to John Horn, Vice Chairman, Yukon Pacific Corporation. The minimum 70-foot separation "where possible" between the pipeline authorized for the Alaska Natural Gas Transportation System and Yukon Pacific's proposed pipeline, as stated in your project description, is totally unacceptable to NWA; a minimum separation of at least 200 feet, with certain specified exceptions, is required.

12-48 Moreover, we cannot agree with your assertion that the issue of proximity is merely a private matter that is to be resolved by our two companies separate from the environmental review process. On the contrary, the cumulative effect of three large diameter pipeline systems at the proximity you propose and the resulting impact on thaw-stable and thaw-unstable soils, on stream crossings, on fish and wildlife resources, on mineral materials, air quality, pollution controls, waste disposal facilities and the like are issues that are at the very heart of the environmental review process. These issues are ones inherent in the environmental review process by the Federal Government, not some mere private side issue as you suggest.

12-48 See response to Comment 12-20.

COMMENT LETTER 12 (Contd)

RESPONSE

Mr. Harry A. Noah
October 14, 1986
Page two

We are certainly willing to work with you. In point of fact, the recent discussions between Messrs. Lowenfels and Moses regarding limited use of our Rev 4 Alignment Sheets is a reflection of this willingness.

12-49 However, as stated previously on numerous occasions, without maps of an appropriate scale, we are not able to make the assessments which are an essential part of the preparation for a worthwhile meeting. The only maps we have seen showing the TAGS proposed routing are to a scale of 1:250,000. Needless to say, this type of scale provides little more than an approximate guess as to the proposed location of your pipeline. We further observe that no reasonable determination of compatibility of the three pipeline systems can be made, as required by law, until such information is available, together with the additional information discussed in my letter dated September 2, 1986 to John Horn is available.

For any meeting between ourselves to be truly productive, we must have in advance, as a minimum, a more detailed project description and route maps of a scale sufficient to enable us to review and evaluate the proposed TAGS location. Until such time as you are able to provide an adequate amount of engineering detail, our efforts to prepare for the requested meeting would be seriously impaired.

Sincerely,

Harold W. Moles

Harold W. Moles
Vice President, Operations

HWM:da
cc: Michael J. Penfold, Alaska State Director
Bureau of Land Management, Anchorage
Earl N. Kari, Director, Alaska Office
Office of the Federal Inspector, Anchorage
Jerry Brossia, State Pipeline Officer for ANGTS
Alaska Department of Natural Resources, Fairbanks
Arlan H. Kohl, Chief, Pipeline Monitoring
Bureau of Land Management, Anchorage
Jules V. Tileston, Project Manager - TAGS
Bureau of Land Management, Anchorage
James C. Harle, Alaska Manager, ANGTS Relations
Alyeska Pipeline Service Company, Anchorage

12-49 See response to Comment 12-30.

COMMENT LETTER 12
(Contd)

RESPONSE

THE SECRETARY OF THE INTERIOR
WASHINGTON

March 20, 1984

Honorable Walter J. Hickel
Chairman of the Board
Yukon Pacific Corporation
P.O. Box 101700
Anchorage, Alaska 99510

Dear Governor Hickel:

I enjoyed my conversation with you and your colleagues regarding the Trans-Alaska Gas System as proposed by Yukon Pacific. There appears to be broadly based interest in development of a system to move natural gas from the Prudhoe region into either or both domestic and foreign markets. I have discussed your proposal with colleagues in the State Department, the National Security Council and Secretary Hodel in the Department of Energy. They feel the project deserves serious consideration within the Administration. However, we need much more detail including how the Yukon Pacific Gas Project may interrelate with the Alaska Natural Gas Transportation System (ANGTS) which, as you know, still maintains a right-of-way along a substantial portion of the proposed route.

There is reason to believe that the project could provide substantial benefits to our close allies, Korea and Japan. Prime Minister Nakasone and President Reagan recently encouraged private sectors in their countries to engage in feasibility studies to determine whether moving Alaska natural gas to key markets is economically viable.

I look forward to further discussions with you on the Yukon Pacific Gas Project. Deputy Under Secretary William Horn, Assistant Secretary Garrey Carruthers, and other members of the Department of the Interior are available to discuss the project as it relates to our authorities and responsibilities. As you know, there is an existing legislative commitment to ANGTS for delivering North Slope gas reserves to the domestic market. While that commitment does not foreclose other options for transporting Prudhoe Bay gas reserves, legislation may be necessary to authorize another transportation project. The Department will support initiatives which bring North Slope gas to market.

I look forward to hearing from and seeing you again.

Sincerely,

/s/ William Clark

William Clark

COMMENT LETTER 12 (Contd)

RESPONSE

ARCO Alaska, Inc.
P. O. Box 100360
Anchorage, AK 99510

Sohio Alaska Petroleum Company
Pouch 6-612
Anchorage, AK 99502

February 27, 1984

RECEIVED
MAR 5 1984
A. KUHN

Mr. Jerry Brossia
State Pipeline Officer for the ANGTS
4420 Airport Way
Fairbanks, Alaska 99701

Re: Proposed Location for Alaska Gas Conditioning Facility, Prudhoe Bay, Alaska

Dear Mr. Brossia:

On August 2, 1983, Northwest Alaskan Pipeline Company (NWA) submitted to the State Pipeline Office an amended right-of-way application for the Alaska Gas Conditioning Facility (AGCF). We have reviewed and are familiar with that amended application which primarily dealt with a change in the CO_2 removal process used in the AGCF. In this connection, as Operators of the Prudhoe Bay Unit, we wish to inform you of an action which has recently occurred which affects the proposed location of the AGCF. This is due to ongoing development plans within the Unit and is unrelated to the plant redesign which gave rise to the need for NWA's amended application.

On December 30, 1983, the Prudhoe Bay Unit applied to the Alaska Oil and Gas Conservation Commission for certification of an enhanced oil recovery project, the Prudhoe Bay Miscible Gas Project (PBMGP). The PBMGP could start up as early as 1987 and will provide additional oil during the period when the field oil production is expected to be declining. It will augment the Prudhoe Bay Waterflood Project, a secondary recovery program that will begin operating in mid-1984.

Based on previous studies, surface facilities required for the extraction and pressurization of miscible injectant for this project will be located near the existing Central Compression Plant (CCP). These PBMGP facilities are still in the preliminary engineering stage, and their specific siting relative to the proposed location of the AGCF requires further evaluation and coordination with NWA. We intend to work with NWA toward that end. Our current intention, however, is to locate the PBMGP facilities approximately as shown in the enclosed drawings.

Enclosure A, a drawing entitled "General Location Map, Miscible Gas Project (MGP)/ANGTS," dated February 2, 1984, shows the location of the PBMGP in relation to the AGCF as the latter is shown in the currently pending right-of-way application. Since the PBMGP facilities could potentially provide hydrocarbon dew point control and supply the AGCF with gas requiring only CO_2 removal, compression and chilling, it is possible that the AGCF and PBMGP facilities might later be integrated, which would minimize any relocation of the AGCF. With no integration, however, it might be necessary to shift the planned location of the AGCF to the west to the general location shown in Enclosure B, ARCO drawing entitled "General Location Map, Miscible Gas Project (MGP/ANGTS), Prudhoe Bay, Alaska," dated December 15, 1983.

ENCLOSURE B

COMMENT LETTER 12
(Contd)

RESPONSE

Mr. Jerry Brossia
February 27, 1984
Page 2.

By letter dated October 13, 1983, copies of which were provided to the Unit Operators, you responded to NWA's submission regarding a change in AGCF design, noting your assumption that NWA was coordinating its plans with the Prudhoe Bay Unit. Such coordination has occurred and will continue because of the potential interaction of PBMGP facilities with the AGCF. The Unit Operators earlier provided a Letter of Non-Objection with respect to the AGCF location to John Katz, then Commissioner of the Department of Natural Resources, on April 12, 1982. It is our understanding that NWA is amending their August 2, 1983 right-of-way application in consideration of the Unit's plans for locating the PBMGP facilities as shown on enclosure A. In view of this, we see no significant problem in locating the AGCF in the general area shown in enclosures A and B hereto and reaffirm our non-objection. Our approvals of specific AGCF sitings will, of course, depend on the final plans of both the PBMGP and the AGCF. At that time, we expect to again contact your office. Until that time, we continue to request the opportunity to review and approve any subsequent modifications to the right-of-way application for the AGCF insofar as site location and layout are concerned.

Sincerely,

OPERATOR:
ARCO ALASKA, INC.

Leland E Tate

L. E. Tate
Vice President
Engineering and Extension Exploration

OPERATOR:
SOHIO ALASKA PETROLEUM COMPANY

Paul J. Martin

P. J. Martin
Vice President
Operations and Engineering

Enclosure

xc: Hon. John T. Rhett, Federal Inspector
Ms. Esther Wunnicke, Commissioner of Natural Resources
Edwin (Al) Kuhn, NWA

COMMENT LETTER 12 (Contd)

RESPONSE

ARCO Alaska, Inc.
Post Office Box 100360
Anchorage, Alaska 99510-0360
Telephone 907 276 1215

RECEIVED
APR 8 1985
A. KUHN

April 3, 1985

Colonel Neil Saling, Jr.
District Engineer
U. S. Army Corps of Engineers
Pouch 898
Elmendorf AFB, Alaska 99506

RE: Proposed Amended location for
Alaska Gas Conditioning Facility (AGCF)
Prudhoe Bay Unit; North Slope, Alaska
(PUO/COE 951.00)

Dear Colonel Saling:

On March 29, 1985, ARCO Alaska, Inc., submitted a request for permit to place approximately 644,000 cubic yards of gravel, covering an area of 86.78 acres, in support of the Prudhoe Bay Miscible Gas Project (PBMGP). In our submittal we noted that the PBMGP flare facilities have been designed, and will be constructed, to allow expansion for the future AGCF to potentially share usage of the PBMGP's flare facilities and pits.

On April 1, 1985, Northwest Alaskan Pipeline Company (NWA) submitted a request for amendment to their Permit File No. 071-OYD-4-820121, Beaufort Sea 176. The sole purpose of their amendment is to accommodate the construction of the PBMGP in a nearby area which partially overlaps the currently permitted AGCF.

We see no problem in locating the AGCF in the general area shown in NWA's April 1, 1985 request for amendment and confirm our non-objection. Our approvals of specific AGCF sitings will, of course, depend on the final plans of both the PBMGP and the AGCF. At that time, we expect to again contact your office. In addition, we continue to request the opportunity to review and approve any subsequent significant modifications to the configurations of the facilities and access roads.

Very truly yours,

Elizabeth Shea

Elizabeth Shea
General Landman

ES400:sm

cc: S. Bhatia, Dallas
A. Kuhn, NWA, Washington, D.C.

ARCO Alaska, Inc. is a Subsidiary of AtlanticRichfieldCompany

COMMENT LETTER 12 (Contd)

RESPONSE

NORTHWEST ALASKAN PIPELINE COMPANY
ONE OF THE WILLIAMS COMPANIES

EDWIN (AL) KUHN
VICE PRESIDENT
GOVERNMENT AFFAIRS

1120-20TH STREET N.W.
SUITE S-700
WASHINGTON, D.C. 20036
(202) 872-0280

GOA-84-1068

October 23, 1984

CONFIDENTIAL/PROPRIETARY INFORMATION ENCLOSED

"BUSINESS" Information for
Federal Government Purposes in
Accordance with 10 CFR 1504 (F.R.
Vol. 46, No. 240, December 15,
1981, pages 61222 through 61234)

Chief of Permitting
Regulatory Branch
U.S. Army Engineer District, Alaska
Pouch 898
Anchorage, Alaska 99506-0898

Attention: Don Kohler

RE: Permit File No. 071-OYD-4-820121, Beaufort Sea 176;
Request for Amendment

Gentlemen:

The subject permit was issued to Northwest Alaskan Pipeline Company (NWA), effective July 25, 1983, in connection with construction of the Alaska Gas Conditioning Facility (AGCF). The AGCF is to be constructed as part of the Alaska Natural Gas Transportation System, as authorized pursuant to the Alaska Natural Gas Transportation Act of 1976 (15 U.S.C. § 719, *et seq.*), as amended by Public Law 97-93.

The permit authorized the placement of 2.7 million cubic yards of gravel on 287 acres of wet tundra, at a location northwest of Prudhoe Bay, Alaska, for the construction of a pad to support the gas conditioning facilities, an operations center-construction camp, access and haul roads, flare pit and sewage disposal pond berms, crude oil cooling facilities pad and pipeline corridors.

Enclosed is a revised plan for site development of the general area where the AGCF is expected to be emplaced. You will note that gravel requirements for the AGCF have been recalculated and now total about 2.1 million yards (See page 3-3). This is a major reduction from the amount previously anticipated, largely as a result of a 32% reduction in the area covered by the gas conditioning unit pad (i.e., from 129 acres to 87.8 acres). The revised plan (Enclosure A) is identified as follows:

295 CHIPETA WAY SALT LAKE CITY, UTAH 84108

COMMENT LETTER 12 (Contd)

RESPONSE

Letter GOA-84-1068; October 23, 1984
to Chief of Permitting
Page Two

-- Package No. 5 - Site Development/Civil Construction, Design Review Package for the Federal Inspector, August 1982; Revision 1, July 1983.

The development and submission of this document to the Office of the Federal Inspector (OFI) was in support of a revised process design for the AGCF, which subsequently was approved by OFI (F.R., Vol. 48, No. 241, December 14, 1983, pages 55596 through 55597).

Drawings in support of this plan are also enclosed, identified as follows:

-- General Location Map for Permit Application, PAE-0000-02, Rev. 5. (Enclosure B)

-- Proposed Plan for Right of Way, PAE-0600-22, Sheet 1 of 2 only, Rev. 2. (Enclosure C)

12-50 On February 27, 1984, we amended our application to the State of Alaska for a right-of-way lease covering the AGCF to account for the Prudhoe Bay Miscible Gas Project (PBMGP) which is planned for construction by the Prudhoe Bay Unit in the same general area as the AGCF. ARCO Alaska, acting for the Prudhoe Bay Unit, has advised us that the current intended scope and location of the PBMGP is as shown on the enclosed drawing (Enclosure D) entitled:

-- ARCO Alaska, Inc., North Slope District - Anchorage; NGL/EOR-CGF Unit 19; General Location Plan, Gravel Pad and Access Road; March 30, 1984, CEE-19000001, Rev. 0, August 27, 1984.

We recognize that this siting is subject to possible change as plans are refined.

Although the PBMGP facilities might later be integrated with the AGCF, it is possible that the planned location for certain AGCF facilities, as shown in Enclosures A, B and C, may have to be moved a short distance (not exceeding 1500') to the west of the currently planned location. The "worst case" maximum relocation of the AGCF anticipated, assuming the facilities are not integrated, is shown on the enclosed conceptual drawing (Enclosure E) entitled "ARCO Oil & Gas Company General Location Map, Miscible Gas Project, Prudhoe Bay, Alaska" dated October 12, 1984. We advised the state that when the final sitings of both the PBMGP and the AGCF are completed, a further amplifying amendment to the pending state lease application will be submitted.

12-50 To date, ANGTS has not completed its application to the state for use of the state ownership at Prudhoe Bay needed to construct the Alaska Gas Conditioning Facility and for the ANGTS pipeline system on state ownerships elsewhere in Alaska. The PSD for the ANGTS AGCF was based upon use of the SELEXOL process. This PSD has expired and no new permitting effort has been initiated by the commentor.

COMMENT LETTER 12 (Contd)

RESPONSE

Letter GOA-84-1068; October 23, 1984
to Chief of Permitting
Page Three

In summary, the existing situation is as follows:

-- The PBMGP and the AGCF are compatible facilities and, indeed, may later be completely integrated; however, a decision on the extent of integration cannot be made at this time.

-- The enclosed, updated plan for the AGCF envisions a major reduction in the area of wet tundra impacted and an associated major reduction in gravel requirements compared to the plan originally reviewed by the Corps for the subject permit. Gravel requirements for the AGCF, when it is ultimately built, are likely to be even further substantially reduced (i.e., below 2.1 million cubic yards) as a result of the PBMGP because certain access roads and the emergency flare area are expected to be commonly shared, even if the two facilities are not totally integrated.

-- The PBMGP has received other appropriate government authorizations, is ready to proceed into construction in 1985, but needs a § 404 authorization.

-- Final siting of the AGCF will not take place until after construction plans for the PBMGP have been finalized; the AGCF's final siting is, moreover, also subject to issuance of a state right-of-way lease for the AGCF. The maximum likely change, in any event, would still have both the AGCF and the PBMGP generally within the area currently permitted by the Corps and under the figure currently authorized for gravel, i.e., 2.7 million cubic yards.

-- The sponsors of the AGCF have formally stated that they have no objection to siting the PBMGP in the approximate location shown herein.

Accordingly, the following action by the Corps is requested in order to expedite issuance of a permit for the PBMGP:

-- Amend the Beaufort Sea 176 permit as may be necessary to recognize Enclosures A, B and C as the most current plans for site development/civil construction of the AGCF, with the explicit caveat that additional information will have to be submitted when the final siting plan has been completed;

COMMENT LETTER 12 (Contd)

RESPONSE

Letter GOA-84-1068; October 19, 1984
to Chief of Permitting
Page Four

-- further amend the Beaufort Sea 176 permit to exclude the area covered by the PBMGP, as shown in Enclosure D and as that location may be further amended by the PBMGP project sponsor in the same general area, subject to the proviso that the area excluded shall not exceed the area that is subsequently approved by both state and federal authorities for the PBMGP (including any directly related facilities essential for its construction or operation); and

-- incident to amendment of the Beaufort Sea 176 permit, extend its applicability to at least a full three years from the effective date of the amendment.

It is our understanding that ARCO Alaska, on behalf of the Prudhoe Bay Unit, will separately submit an application for a § 404 permit for the PBMGP that will be in consonance with NWA's amendment request herein. It is our intention to express a non-objection to such an application, presuming that the overall approach that we have set forth is acceptable to the Corps. We would, moreover, be pleased to assist in any reasonable manner to expedite issuance of a permit to the Prudhoe Bay Unit.

Yours truly,

NORTHWEST ALASKAN PIPELINE COMPANY, as Agent and Operator for ALASKAN NORTHWEST NATURAL GAS TRANSPORTATION COMPANY

Edwin Al Kuhn

Edwin (Al) Kuhn

cc (w/o encls.): Honorable John T. Rhett, Federal Inspector
Stuart C. Mut, ARCO
Earl Kari, OFI, Anchorage
Jerry Brossia, State Pipeline Officer

COMMENT LETTER 13

★ Fairbanks North Star Borough

809 Pioneer Road P.O. Box 1267 Fairbanks, Alaska 99707 907 452-4761

November 18, 1987

Jules V. Tileston
Bureau of Land Management, ASO
701 C Street, Box 30
Anchorage, AK 99513-0099

Dear Mr. Tileston:

The Fairbanks North Star Borough has reviewed the draft Environmental Impact Statement for the proposed Trans Alaska Gas Pipeline. A summary of our comments follows.

The Fairbanks North Star Borough fully supports the concept of a gas pipeline from the north slope through the Borough to Valdez. However, we feel that the draft EIS has several serious deficiencies that need to be addressed. Those deficiencies are detailed in the attachments that include a resolution passed on October 22, 1987 by the Borough Assembly and memoranda from the Borough Community Research Center, the Borough Planning Department, and the Borough Health and Safety Department.

13-1 In general we feel the document pays very little attention to potential impacts on the Fairbanks North Star Borough, in particular, socioeconomic impacts. The draft EIS makes questionable assumptions concerning the ability of the local infrastructure to accommodate impacts and local governmental agencies to anticipate and manage impacts. In a few instances, the document recognizes that the pipeline will bring an influx of job seekers to the area and that the excess infrastructure may be absorbed by the expected influx of military personnel. However, these impacts are not consistently recognized throughout the document, certainly not in the impact summary statement.

13-2 The issue of a take-off valve for Fairbanks is totally omitted. Fairbanks has consistently maintained over the years that there should be a take-off valve from any gas pipeline that comes through the Borough to provide the citizens of the Borough with a low cost energy alternative. We realize that the intent of the project is to be licensed for gas export and then negotiate a take-off valve "later". This is not enough assurance for the

13-3 citizens of the Borough. An energy impact analysis is another omission of the DEIS that needs to be included. We would hope that an energy impact analysis would include a study of the impacts of a take-off valve at Fairbanks.

RESPONSE

13-1 Many of the general issues discussed throughout the EIS are applicable to the Fairbanks North Star Borough (FNSB), as well as to the entire area of the project. In each area where the FNSB is particularly affected the impacts are discussed.

13-2 See response to Comment 2-4.

13-3 Such an analysis is not an issue for this EIS since the end use of the project is the export of natural gas to the Pacific Rim. The supply of natural gas to Fairbanks, as discussed in the response to Comment 2-4, would be the subject of further proceedings where this type of analysis is more appropriate. As noted, in response to Comment 2.4, natural gas supplies to Fairbanks are included in the ANGTS project. A recent proposal by Enstar also would provide a natural gas supply to Fairbanks from the Cook Inlet area if implemented.

COMMENT LETTER 13 (Contd)

RESPONSE

Jules V. Tileston
Page 2

13-4 Potential environmental impacts of the project on the Borough are generally ignored. Potential impacts on air quality and the generation and handling of solid and hazardous wastes are the most serious omissions.

In summary, I wish to emphasize that the Fairbanks North Star Borough fully supports the concept of the Trans Alaska Gas System. However, we feel that the draft EIS has several serious deficiencies that need to be addressed.

Thank you for the opportunity to comment on the draft Environmental Impact Statement for the proposed Trans Alaska Gas System. We look forward to future opportunities to participate in the review process.

Sincerely,

Juanita Helms

Juanita Helms
Borough Mayor

JH/TD/bhn

13-4 See responses to Comments 13-43 through 13-52.

COMMENT LETTER 13 (Contd)

RESPONSE

By: Juanita Helms
Introduced: 10/22/87
Adopted: 10/22/87

RESOLUTION NO. 87-102

A RESOLUTION ANNOUNCING THE PRELIMINARY FINDINGS OF THE TRANSALASKA GAS SYSTEM DRAFT ENVIRONMENTAL IMPACT STATEMENT

WHEREAS, the Fairbanks North Star Borough is centrally located to this proposed construction effort; and

WHEREAS, the Fairbanks North Star Borough is the terminus of the Alaska Railroad that would be the vehicle for major equipment and supply shipments for the construction effort of the pipeline; and

WHEREAS, the Fairbanks North Star Borough is the terminus of the Dalton Highway, the supply road leading to the North Slope; and

WHEREAS, the Fairbanks North Star Borough is a major supply point for labor and services and goods that would be used on the proposed pipeline project; and

WHEREAS, the present application and summary is silent as to the role of Fairbanks, other than a maintenance facility will be located in the Fairbanks area; and

WHEREAS, the 63rd parallel has been the traditional separation point in Alaska for union jurisdictional work north of the Alaska Range and that work was the prerogative of Fairbanks; and

WHEREAS, Fairbanks has consistently maintained there should be a take-off in any gas pipeline that comes through the Fairbanks North Star Borough to benefit the citizens of this area with low cost fuel:

NOW, THEREFORE, BE IT RESOLVED by the Assembly of the Fairbanks North Star Borough that:

13-5 1) Yukon Pacific draft environmental impact statement (DEIS) be required to detail its intentions for the Fairbanks North Star Borough concerning the construction effort of the pipeline and its use of the labor and facilities and services of the Borough; and

13-6 2) That the DEIS be required to detail the plans for the M and O operations of the pipeline and the hiring of maintenance workers from Anchorage or Fairbanks; and

13-7 3) That the Yukon Pacific applications clearly state that a take-off valve will be in place for the Fairbanks North Star Borough as a part of its construction effort; and

13-5 See response to Comment 2-2.

13-6 See response to Comment 2-2.

13-7 See response to Comment 2-4.

COMMENT LETTER 13 (Contd)

RESPONSE

13-8 4) That detail will be given the Fairbanks North Star Borough by Yukon Pacific prior to final approval of the drawings of what gas flow can be anticipated from that take-off valve; and

13-9 5) What price will be charged for the gas; and

13-10 6) That the DEIS address the potential social and economic impacts and stipulate mitigative measures which Yukon Pacific must take; and

13-11 7) That Yukon Pacific will provide a mechanism by which communities and local businesses will be provided planning information.

PASSED AND APPROVED THIS 22ND DAY OF OCTOBER, 1987.

Presiding Officer

ATTEST:

Mona Lisa Drexler
Clerk of the Assembly

RESOLUTION NO. 87-102
Page 2 of 2

13-8 See response to Comment 2-4.

13-9 See response to Comment 2-6.

13-10 See response to Comment 2-2.

13-11 See response to Comment 2-2.

COMMENT LETTER 13 (Contd)

RESPONSE

Fairbanks North Star Borough

Mayor: Juanita Helms

M E M O R A N D U M

TO: Nicole McCullough, Planning Aide
Advanced Planning Division

FROM: Tom Duncan, Assistant Planner
Advanced Planning Division

DATE: Oct. 14, 1987

SUBJ: DRAFT EIS ON TRANS-ALASKA GAS SYSTEM

I have reviewed the Draft Environmental Impact Statement on the Trans-Alaska Gas System. Following are my comments.

13-12 Page 2-30, section 2.3.3.5, first sentence. The listing of major fault zones does not include the fault traversing the FNSB from the North Pole area on up past Fox. Perhaps this fault has been considered and not determined to be "major."

13-13 Page 3-5, section 3.2.2.1, last paragraph (top of second column). This entire paragraph is overstated and somewhat misleading. The description of Alaska's infrastructure as being "vast" is highly subjective. The description of Alaska's infrastructure as "inadequate" and "overcrowded" prior to construction of the oil pipeline is incorrect. Indeed, Alaska's infrastructure became stressed during construction of the pipeline because of all the people that were attracted to the state by the pipeline.

13-14 Page 3-23, section 3.2.7, 1st paragraph, last sentence. The disposal sites near Fairbanks need to determined by start of construction. The Borough landfill site would be unable to accommodate the volume and types of waste generated by pipeline construction.

13-15 Page 4-2, section 4.2.2.1.1, 4th paragraph. A policy should be worked out to encourage in-state hiring of welders, despite the union being based out of state.

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13-12 This fault is considered an "inactive" fault. Section 2.3.3.5 in the DEIS addresses the hazard associated with the crossing of "active" faults. Major fault zones exist in Alaska which are not "active", thereby presenting no threat to the integrity of the TAGS pipeline. The fault crossings identified by YPC as requiring special design are the presently recognized active faults crossed by the TAGS route. During the detailed design phase of the project, YPC plans to conduct a fault study program to update previous fault studies along the TAGS pipeline route, and would add additional special crossings if necessary.

13-13 Comment accepted and the FEIS incorporated recommendations into Subsection 3.2.2.1.

13-14 The TAPS project virtually overwhelmed the FNSB landfill. The FNSB indicate that it is very likely that it would be necessary to restrict waste accepted at the FNSB landfill to waste generated within the Borough. In spite of such a restriction, a project of this magnitude is likely to reduce the life of the Borough landfill due to increased population. No new site has been identified. A new site may be needed as soon as 2005. The availability of the FNSB landfill for potential use for TAGS would be determined during Phase II design.

13-15 See response to Comment 9-7.

COMMENT LETTER 13 (Contd)

RESPONSE

Draft EIS on TAGS
Page Two

13-16 Page 4-11, section 4.2.2.2, first paragraph. The statement is made that all people seeking employment would have to travel to Anchorage or Fairbanks. A follow-up statement should be made that these two communities would experience the bulk of the impacts from out-of-state people coming to the state seeking work, perhaps not being successful, and becoming a burden on the social services.

13-16 Such job seekers were not a major burden on the social services in Fairbanks during the oil pipeline. In fact, participation in most public assistance programs dropped dramatically. For example, the number of persons in Fairbanks receiving Food Stamps dropped from 700 prior to the pipeline to only 99 during the peak of construction.

13-17 Page 4-13, section 4.2.2.2.3, last paragraph on page. The statement that Fairbanks has "numerous industrial sites" depends on what kind of industry is being discussed. Many appropriate areas exist for light industry, but siting heavy industry is quite a bit more difficult and controversial.

13-17 Comment accepted and the FEIS incorporates recommendation in Subsection 4.2.2.2.3.

13-18 Page 4-14, section 4.2.2.2.3, second paragraph. This is gross overstatement of the Community Research Center's duties and staffing level. The Borough Planning Department will also play a role in anticipating and managing potential impacts, but to state that any one agency has the resources to manage the impacts of such a large project is ludicrous.

13-18 Comment accepted and the FEIS incorporates recommendation in Subsection 4.2.2.2.3.

13-19 Page 4-16, section 4.2.2.3, 3rd paragraph. The statement regarding the excess infrastructure possibly being absorbed is important and should be reflected in the statements on page 4-13, last paragraph concerning Fairbanks' surplus infrastucture.

13-19 Comment accepted and the FEIS incorporates recommendation in Subsection 4.2.2.3.

13-20 Page 4-18, section 4.2.3.2, 2nd paragraph. The changes in land use caused by the influx of workers will likely require an update of the Comprehensive Plan.

13-20 Comment accepted and the FEIS incorporates recommendation in Subsection 4.2.3.2.

13-21 Page 4-19, section 4.2.3.2, 4th paragraph on the page. The statement that "impacts would be negligible" on industrial development centers and Prudhoe Bay, Fairbanks, and Valdez is hard to comprehend. The oil pipeline caused a refinery and various pipeline support industries to locate in Fairbanks and one could expect similar spinoffs from a gas pipeline.

13-21 Comment accepted and the FEIS incorporates recommendation in Subsection 4.2.3.2.

13-22 Page 4-115, section 4.5.2, 1st paragraph. The statement that "minimal new infrastructure requirements due to the expansion during and following TAPS" should be modified to be consistent with the statement on page 4-16 that Fairbanks' infrastructure could be absorbed by the time TAGS construction begins.

13-22 Comment accepted and the FEIS incorporates recommendation in Subsection 4.5.2.

13-23 Page 4-115, section 4.5.3, 1st paragraph. A moderate land use impact may be increased industry related to the pipeline and land developed for residential use to accommodate the influx of workers to the area.

13-23 Comment accepted and the FEIS incorporates recommendation in Subsection 4.5.3.

COMMENT LETTER 13 (Contd)

Draft EIS on TAGS
Page Three

13-24 Page 4-131, section 4.8, 2nd paragraph on page. The statement "jobseekers coming to Alaska who do not find employment would have to rely on state social services" is important and should be reflected in the statement on page 4-11, section 4.2.2.2, 1st paragraph identifying Fairbanks and Anchorage as the only two hiring centers in the state.

13-25 Page 4-131, section 4.8, 3rd paragraph on page. The statement "Most existing land-use plans would apply to the TAGS project and would not have to be changed to accommodate the proposed action" is probably true for the FNSB Comprehensive Plan, but the Plan would likely need updating as a result of the impacts brought about by TAGS.

RESPONSE

13-24 Comment accepted and the FEIS incorporates recommendation in Subsection 4.8.

13-25 Comment accepted and the FEIS incorporates recommendation in Subsection 4.8.

COMMENT LETTER 13 (Contd)

RESPONSE

Fairbanks North Star Borough

Mayor: Juanita Helms

M E M O R A N D U M

TO: Nicole McCullough, Planning Aide
Community Planning

FROM: Leslye A. Korvola, Manager
Community Research Center

DATE: October 8, 1987

SUBJECT: DEIS for TAGS

After reviewing the Draft Environmental Impact Statement (DEIS) for the Trans-Alaska Gas System (TAGS), I have the following comments and concerns which I believe should be formally presented to the agencies responsible for the preparation of this document.

Section 3.2.2.1 provides a succinct summary of the state's socioeconomic conditions and Section 3.2.2.3 provides a very brief overview of the Fairbanks North Star Borough. In Section 3.2.4.4 the importance of Fairbanks as a transportation hub is mentioned.

Section 4.2.2.1.1 addresses statewide TAGS impacts identifying the
13-26 major impact as being increased population and employment. What seems so remarkable is that personnel increases in Anchorage are calculated at 950 while no location is identified as being impacted by the peak labor force of 7,200 plus the 3,400 indirect jobs during construction.
13-27 In the discussion of the socioeconomic impacts, the role of Fairbanks, identified in Section 3.2.2.3 as a transportation, trade and service center for the project, is inadequately addressed.
13-28 The definitions of impacts on human resources listed in Table 4.1-1 appropriately note that changes in the economic and social well-being of residents require changes in governmental policies, planning and budgeting but Table 4.2.2-3 reflects no additional government employment is anticipated to meet additional demands.

13-29 Section 4.2.2.1.2 discusses infrastructures and social impacts but again seems to overlook Fairbanks. It's fine to observe that "the long lead time available...SHOULD help relieve infrastructure impacts of the project" and that "for the most part Anchorage and communities along the proposed TAGS route could accommodate most anticipated impacts without building new facilities" because of the surplus currently available, but this is not a complete picture. (1) Fairbanks, the service and supply center is currently experiencing an expansion of military personnel, as noted in Section 3.2.2.2.3; the military is anticipating to use some of

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13-26 The direct and indirect employment impacts for other areas are provided in Table 4.2.2-7.

13-27 Comment accepted and the FEIS incorporates recommendation in Subsection 3.2.2.2.3.

13-28 It is agreed that there would be increases in the need for additional government employees. The statistics developed on this table reflect indirect construction employment and an estimate of government service employees. The actual extent of new government employment and their location would be determined as the TAGS project planning proceeds.

13-29 We have acknowledged that some of the existing infrastructure may be absorbed by the time TAGS is built. The addition of the Light Infantry Division, may simply offset some of the impact of the downturn in the local economy. Most observers believe the state's economic downturn may last for several years. It would make less sense to assume that all this infrastructure would be absorbed.

Furthermore, long lead time is a significant difference from the TAPS experience. One of the reasons businessess and government agencies didn't commit to new programs and facilities was that the construction of the project was uncertain. Many believed that the project would not be approved and they were almost right. The bill approving construction of the pipeline was approved by the Vice President's tie-breaking vote. The project was approved in October 1973 and construction was underway before breakup in spring 1974. New facilities could not be built due to the extremely short lead time and cold temperatures. In contrast, there would be more than two years of detailed planning after the project is approved before construction begins. The first two years of construction would be largely site preparation and some compressor station construction. Construction of the pipeline per se would not occur until five years after the project is approved.

COMMENT LETTER 13 (Contd)

13-29 (Contd) the existing infrastructure. (2) The long lead time is meaningless; when a project is uncertain there is a reluctance for a community to invest infrastructure which may or may not be needed. (3) It is inappropriate to assume that surplus capacity which may exist in 1987 will exist when this project is ready to proceed.

13-30 The DEIS deals inadequately with the social and economic effects on Fairbanks; in fact, although it refers to Fairbanks' TAPS experience, it fails to mention Fairbanks by name. To assert that because "all the communities in the TAGS corridor experienced the effects of the TAPS project [this] should help them to anticipate and plan for potential TAGS impacts" is nonsense. Unless the EIS addresses the potential social and economic impacts and stipulates mitigative measures which Yukon-Pacific must take (i.e. pay for) the communities, and primarily Fairbanks, could be in for nothing more than a repeat performance.

13-31 Section 4.2.2.1.3 assumes no new municipalities with taxing powers will be established and that existing borough boundaries will not change. This may not be a valid assumption. Areas with local governments such as Fairbanks are served a great injustice with the DEIS assumption that only areas without local governments would need TAGS assistance. Impact costs whether experienced in areas with local governments or without are costs which should be met by Yukon-Pacific as part of the project. It is not appropriate to assume that local tax revenues will pay for service increases required by the project. Section 4.2.2.1.3 fails to address the issue of how additional expenditures for anticipated government services are to be paid.

13-32 Section 4.2.2.2.3 states the TAGS impacts on Fairbanks would be lesser than those generated by the TAPS project because "most of the management personnel based in Anchorage would not affect the Fairbanks housing supply." This is misleading because the impact on housing is related to the size of the construction work force, indirect jobs and the influx of job seekers. The question not addressed is what the impact will be on hiring out of Fairbanks if most of the management is in Anchorage.

13-33 The DEIS fails to provide information regarding the impact potential to the FNSB when it limits its assessment to current Fairbanks conditions of a surplus of housing, excess utility capacity, etc. Whether Fairbanks will have a surplus or shortage of services and infrastructures when the project goes is unknown. Currently, data are available about existing housing, utility capacity, etc. To assess the impacts of TAGS the DEIS should address demands that would be placed on the community with projections of housing and utility needs, industrial sites, and other retail and service requirements that will have to be met. This would enable the community to determine the impacts of the TAGS at any point in time based on what is needed to what is available.

13-34 Similarly with impacts of increased employment, the DEIS should not assume current labor force conditions will exist when the TAGS is built. Right now it is true that much of the local labor force has had construction and oil industry experience, but as the employment opportunities in these areas decrease, this trained labor force could leave the Fairbanks area and Alaska.

RESPONSE

13-30 The FEIS discusses specific social and economic impacts to the Fairbanks North Star Borough in Subsection 4.2.2.2.3 and in other locations of the FEIS. The statement cited is valid since the impacts to such corridor communities of a project of lesser size than TAPS can be anticipated and planned for by the communities.

In a March 9, 1983 report (Docket No. CP80-435 and Docket No. CP78-123, et.al.) by the Federal Energy Regulatory Commission regarding Northwest Alaskan Pipeline Company's request to include nearly $20 million in socioeconomic impact costs in their rate base, the trial staff "opposes the request in its entirety" and further stated:

> "That the construction of such a large project would affect Alaska's social and economic structure has been accepted by all who have examined the issues; nevertheless, there has been considerable debate over the extent of the impact and the responsibility for its mitigation...the State will also derive considerable financial benefit from the construction of the gas pipeline; the property and corporate income taxes alone will greatly exceed the cost of mitigating the adverse socioeconomic impact that the State anticipates...
>
> We believe the ultimate responsibility for socioeconomic mitigation should rest with the State and local governments as long as the revenues from the project are sufficient to cover the anticipated costs of mitigation...one means that has been used to fund similar mitigation efforts is sponsor-provided loans or other financial assistance, reimbursed by the State or affected communities as a credit against future taxes or in some other appropriate manner."

Although the social and economic impacts are identified, the FEIS cannot stipulate such mitigation measures.

13-31 Subsection 4.2.2.1.3 has been modified. The socioeconomic analysis cannot accommodate every possible variable which "might" change. TAGS would pay the same oil and gas property tax rate to the state regardless of whether a local taxing jurisdiction claims a portion of the revenue or not. It is based on the best available information at the time it was done. To speculate on such changes would not improve the analysis and might be confusing.

13-32 Comment accepted and the FEIS incorporates recommendation in Subsection 4.2.2.2.3.

13-33 To do this type of analysis requires detailed, specific information about project plans, schedules, and requirements which is not available. This type of information can be developed during the five-year detailed design and planning phase with adequate lead time to allow communities to plan for potential impacts.

13-34 Comment accepted and the FEIS incorporates recommendation in Subsection 4.2.2.2.3. While it is true that due to present economic conditions within the State, that some of the trained labor force would leave the Fairbanks area and Alaska prior to the initiation of TAGS. It is likely that many would return to work on the project.

COMMENT LETTER 13 (Contd)

13-35 The DEIS reflects a gross misunderstanding of what the Community Research Center is and how it functions. The Community Research Center, established in 1974, has information which would be extremely valuable in planning for management and mitigation of potential impacts. However, the Community Research Center, which has historically been funded by the Borough to gather and disseminate information, does not have staff to manage impacts. That would require funding by the project causing the impacts in a manner similar to the impact assessment work which the Center has provided for the Light Infantry Division. The TAGS project should include funding for CRC to track the impacts and the effectiveness of measures proposed to mitigate the impacts.

13-36 Who are the local officials who are to assume the responsibility for the negative impacts being offset by the positive aspects of employment, economic development and increases in local tax revenues? If the DEIS does not identify them, what assurance is there that they speak for the community and if they will still be in a position of responsibility when the project actually takes place?

13-37 Based on the inadequacies identified in Section 4.2.2.2.3, I urge that appropriate revisions be made to all of the subsections of 4.2.2.2 analyzing the Regional TAGS Employment Impacts. There are Regional TAGS Impacts that simply are not addressed.

13-38 Section 4.2.2.3 makes a good point in observing, "Unfortunately, by the time TAGS would be built, these [trained and currently unemployed Alaskan] workers might not be available because they left the state or found other employment." The summary makes the uncertainty of the project's timing very clear but fails to identify the project's resource needs that corridor communities in general and Fairbanks in particular will be called upon to provide. The EIS should provide a framework for local communities to work with the project; an enormous step forward would be for the EIS to provide projections of infrastructure needs and to identify a mechanism by which a private/public partnership could work for mutual benefit in the exchange of information.

13-39 Section 4.3.2 addresses the socioeconomics of the Cook Inlet-Boulder Point Alternative. Many of the concerns expressed previously are also appropriate here, except that the inadequacies are even greater. As pointed out in the DEIS, "Unlike the proposed project routing, the Cook Inlet-Boulder Point alternate route has not already experienced a major pipeline project." Thus, there are more unknowns, more uncertainties and a greater need for impact information to be gathered before assessment can begin. I do not believe there is enough known to conclude (as in Table 4.4.1-1) that both routes would have similar socioeconomic impacts, anymore than it is appropriate to assume similarities for nine other environmental factors. In reality too little work has been done to assess the consequences.

13-40 Table 4.10-1 presents an interesting summary of the commitment of resources resulting from the TAGS project. I believe the TAPS experience has demonstrated that more of the consequences of a project of the magnitude of the proposed TAGS are irreversible than have been

RESPONSE

13-35 Comment accepted. The role of the Community Research Center is discussed in Subsection 4.2.2.2.3 in response to Comment 13-4.

13-36 The term "local officials" was inappropriately used. The statement should not have refered to any governmental officials but to business leaders. Subsection 4.2.2.2.3 was modified to remove this statement. Further, see Comment Letter 5 which states that "The Greater Fairbanks Chamber of Commerce supports the Trans-Alaska Gasline System project. Our members welcome progess, the positive economic impact from both construction and operational phases, as well as enhanced quality of life for affected Alaskans.

Opportunities resulting from the TAGS project will be necessary for the community to maintain a diverse and viable spectrum of businesses, especially as oil field production begins to decline, causing this project to outweigh any adverse impacts that have been identified to date. The availability of natural gas as a heating/cooking fuel will help mitigate existing carbon monoxide pollution. We endorse this project for the economic opportunities it affords our community and members."

13-37 See response to Comment 13-33.

13-38 See response to Comment 13-33.

13-39 Much of the discussion contained in the proposed project discussion (Subsection 4.2) would be applicable to the Cook Inlet-Boulder Point Alternative. Using this information along with that specified for the alternative route, it is possible at this initial phase of project development to summarize a comparison as depicted in Table 4.4.1-1.

13-40 Where the term "no significant long-term commitment" was used in Table 4.10-1, it refers to those resources that are irreversible or irretrievable when viewed with the proposed project and anticipated permit mitigation.

COMMENT LETTER 13 (Contd)

13-40 (Contd) admitted. If no significant long-term commitment of resources are required to deal with the impacts on Alaska Socioeconomics, Solid Waste/Hazardous Materials and Sanitation and Wildlife, the DEIS will be little more than a formality document and of no real value in dealing with the environmental consequences of the project.

13-41 Section 5.2 The Fairbanks North Star Borough Community Research Center provided input in the "scoping" process. The response to some of the testimony was that it was not germane to the EIS, but the February 13, 1987 letter of Mr. Jules V. Tileston of the U.S. Department of the Interior indicated that the issue of infrastructure - public safety, schools and medical facilities would be treated in the EIS. They do not appear to be treated with regard to the communities providing these services, however. What is the mechanism by which communities and local businesses will be provided planning information as noted would be treated at a subsequent time?

13-42 The Draft EIS does not appear to address the issue of a gas tap for Fairbanks. Since the economic impacts of such a tap are significant it seems of information and an economic analysis of such a gas tap should be included in the final EIS.

cc: Mayor Helms
Council on Economic Policy

LAK/jlg

RESPONSE

13-41 Detailed information necessary to predict infrastructure impacts would be developed during the detailed project design and construction phase. Yukon Pacific Corporation would work closely with the community in this regard. Since TAPS construction started, the overall state-wide infrastructure, especially schools, public safety, and medical facilities, in Alaska have been expanded substantially. As noted in prior responses to this letter, the extent there are shortages or surpluses of infranstructure in any specific community can only be determined when the final construction time frame has been selected and a determination made as to which TAGS facilities are located in that community.

13-42 See response to Comment 2-4.

COMMENT LETTER 13
(Contd)

Fairbanks North Star Borough

Mayor: Juanita Helms

MEMORANDUM

TO: Nicole McCullough, Advanced Planning Aide
FROM: Kelly McMullen, Acting Manager *KaM*
Compliance and Monitoring Division, Health and Safety Dept.
DATE: November 12, 1987
SUBJECT: Comments on TAGS Draft EIS

The Draft EIS appears to be seriously lacking in several significant areas. These include air quality impact analysis, solid waste disposal, energy impact analysis, and mitigation of socioeconomic impact.

13-43 Fairbanks and Anchorage are both non-attainment areas for carbon monoxide. Eagle River is a non-attainment for PM_{10} particulates. The impact of this project on these non-attainment areas is not addressed at all. The particulate standard was changed effective July 1, 1987 to a PM_{10} standard. The increase in traffic within the Fairbanks North Star Borough caused by the project and economic impacts after construction will hinder progress toward attainment. While traffic figures are currently below FMATS projections this project will likely cause traffic to meet or exceed the projections. Current forecasts conclude that emissions in Fairbanks will reach a minimum in 1991 under current programs, and at that time emissions will be 29% above the attainment level.

13-44 The major determinant of reaching attainment will be the rate of population growth over the next decade. Possible mitigation measures would include provision for plug-ins for all vehicles at all work and camp sites, use of compression ignition (diesel) rather than spark ignition (gasoline, propane, natural gas) engines, and use of buses rather than individual vehicles for transportation wherever possible.

Other air quality concerns include how much land clearing slash will be generated by the project within the borough, particularly where the route deviates from the existing oil pipeline route, and where widening of the existing corridor is necessary.

13-45 Open burning of land clearing materials for projects exceeding 40 acres must be permitted by the Alaska Department of Environmental Conservation.

13-46 Also, all open burning of piles larger than ten feet by ten feet is prohibited within urban, urban preferred, and industrial areas; and all open burning is prohibited from November 1 through February 28 each year.

13-47 During construction smoke from burning of slash, and dust from construction vehicles can cause localized air pollution problems, particularly where the activity is near residential areas.

13-48 Finally, while a natural gas take-off point for Fairbanks is desirable from most points of view, combustion of natural gas does produce more water vapor than combustion of fuel oil or gasoline. If the temperature trends of the last ten years continue this may not be a problem, but at temperatures colder than -25°F the additional water vapor will exacerbate our ice fog problems. In summary, the air quality impact assessment and mitigation needs more work. Additional air quality information is available from this office.

P.O. Box 1267 Fairbanks, Alaska 99707 (907) 452-4761

RESPONSE

13-43 Subsection 3.2.6.3 of the FEIS discusses Fairbanks (and North Pole urban) areas as a non-attainment area for CO. Eagle River is a non-attainment for PM_{10} which is traffic related. Subsections 4.2.6 and 4.3.6 present a revised discussion of TAGS for operational emissions. Operational project air quality impacts would not directly impact either urban area. During construction, both Fairbanks and Anchorage would see increased traffic volume as discussed in Subsections 4.2.4 and 4.3.4. This would be of a temporary nature. The traffic associated with operations would be minimal as discussed in Subsections 4.2.4 and 4.3.4. Since the Eagle River PM_{10} problem is related primarily to dust picked up on dirt roads and carried to paved roads, should the Cook Inlet Alternative be constructed, the condition could be exacerbated for the period of construction.

13-44 Subsection 4.2.6.2 has been revised to reflect this comment.

13-45 The proposed TAGS pipeline route bypasses any urban, urban-preferred, and industrial area of the City of Fairbanks. It does pass near several smaller urban areas in the vicinity of Delta Junction and near several smaller communities along the Richardson Highway south of Delta Junction. The project sponsers would be in compliance with all existing regulations for each of these areas as they related to open burning.

13-46 Subsection 4.2.6.2 was modified to reflect this comment.

13-47 We concur. Such discussions were incorporated in Subsection 4.2.6.1.

13-48 There is no potential impact to ice fog from operation of the two TAGS gas-fired compressor stations located in the FNSB since these compressor stations are located great distances from populated areas. The use of gas in the FNSB must be a local determination. The benefits and impacts of using natural gas versus the formation of ice fog should be balanced; then the FNSB must decide whether the impacts justify the use of natural gas. In so far as TAGS affects from this aspect, it is important to note that TAGS would provide a natural gas supply only if ANGTS has not been constructed. ANGTS has already been directed to provide such gas by the FERC. Further, it is noticed that Enstar has a proposal to deliver natural gas to Fairbanks from the Cook Inlet area. Accordingly, TAGS would not be responsible for any affects of domestic use of natural gas in the Fairbanks area as TAGS would only do so if ANGTS were not already in place and/or as directed by APUC.

COMMENT LETTER 13 (Contd)

13-49 Solid waste impacts are also generally glossed over. The TAPS project virtually overwhelmed the Borough landfill. The population overflow caused the creation of many illegal dumps. The Borough is still trying to get rid of hazardous waste that was improperly dumped at the landfill. It is very likely that it would be necessary to restrict waste accepted at the FNSB landfill to waste generated within the Borough. In spite of such a restriction a project of this magnitude is likely to reduce the life of the Borough landfill. No new site has been identified. Cost of acquiring and opening a new site is estimated at $25 million in 1987 dollars. A new site may be needed as soon as

13-50 2005. Creation of a hazardous waste facility within the state is unlikely to occur within the near future, therefore as stated in the DEIS all hazardous waste will have to be properly packed and transported out of state. Creation

13-51 of new borrow pits for the project also creates a likely site for illegal dumping if the site is not restored to a natural landscape. The Borough does not currently have staff to handle such problems. Mitigation could be to make

13-52 a materials site available for a landfill site upon project completion.

13-53 As you and Leslye Korvola have indicated the socioeconomic impact analysis and mitigation is virtually nonexistent. Contrary to the statements that the cities of Anchorage and Fairbanks have sufficient infrastructure to handle the impacts, only the electric utilities have a true surplus capacity, and all of that excess capacity is of the very expensive oil fired variety. The Fairbanks sewage treatment plant is currently in the process of being expanded to meet current demands, the water treatment plant will be expanded soon, the phone system has only recently caught up with demand, and much of the population has to have water and sewage service by truck due to problems with local water tables. The road network is being expanded continually just to catch up with traffic growth. A major factor for local governments dealing with impacts is the recent passage of tax caps that restrict the ability to change tax rates to meet current needs, and the increased assessed value from the project will only help revenues after the peak impact has occurred.

13-54 Other errors and omissions include discussion of barge traffic in Fairbanks, use of population figures for 1980 and 1985 that are not comparable, lack of evaluation of public safety impacts--particularly in light of severe police and fire personnel cutbacks. The map on page 3-6 incorrectly identifies the Hanley Hot Springs Road as the Parks Highway. The DEIS should have a formal energy impact analysis, required by Council on Environmental Quality regulation 1502.16(e). The findings in Appendix A that economic issues raised in scoping are not germane to the EIS process are directly contrary to CEQ regulation 1508.8, and 1508.14. While the carrying capacity of the Yukon Bridge would appear to be "reserved," it seems an unnecessary environmental impact to build another bridge when the original intent was for the highway bridge to carry all pipelines; only one pipeline is actually in place, and one other has been approved, leaving room for one more. Mitigation of all impacts appears to be inadequately considered.

In summary, these comments are not intended in any way to speak against the project. However, the draft EIS in its present form is fall short of fulfilling the intent and requirements of the National Environmental Policy Act of 1970.

RESPONSE

13-49 As stated in the DEIS, Subsection 4.2.7.3, combustible wastes would be disposed of by burning as permitted by the ADEC. All non-combustible waste would be placed in an approved landfill or at a local solid waste disposal facility. Should the Fairbanks North Star Borough (FNSB) decide to restrict the amount of waste it accepts, the project sponsors would be required to acquire and open an approved landfill to serve project needs elsewhere. Illegal dumping by residences of the FNSB would not be the responsibility of TAGS or any other major project. No hazardous waste resulting from construction and/or operation of the TAGS project would be disposed of at the existing FNSB landfill or any other approved landfill. All hazardous materials would be backhauled to the lower 48 states or a disposal facility within the State of Alaska should one be developed.

13-50 It is generally agreed that it is unlikely that a hazardous waste facility would be developed within the State of Alaska; that is the reason Subsection 4.2.7.4 discusses the need to develop proper procedures for the storage, handling, and shipment of hazardous materials.

13-51 It is possible that illegal dumping could occur in unrestored project developed borrow pits which have road access; this is why the project proponent has developed project mitigations in Subsection 2.83 which discusses restoration and revegetation of disturbed areas and the removal or blockage of nonessential access roads.

13-52 As a general rule, the selection of a landfill site is the responsibility of the concerned local community, state, or federal entity. This is done during the detailed project planning phases. The determination of whether a material site would be suitable for a dump would depend upon several factors such as water table, materials to be discarded, and relation to continuing vehicular access.

13-53 The October 20, 1987 comment letter (Number 5) from the Greater Fairbanks Chamber of Commerce states: "Our community has upgraded its utility infrastructure and is well-prepared and experienced in meeting the service demands for construction and operational activities. There is adequate housing, office, and warehouse space available for economic growth. Our hospital, one of the most modern available, is under-utilized as are many of our other socioeconomic facilities. Consequently, we encourage TAGS to consider our community when locating their operational and administrative headquarters." Although we agree that Fairbanks is continually expanding its facilities, i.e. roads, sewage treatment plants, utilities, and so forth, a program to deal with the TAGS construction could be coordinated during the detailed design phase as previously discussed in Comment 13-25.

Despite the local tax cap, TAGS would pay the appropriate oil and gas property tax rate to the State. (See also previous discussion regarding FERC ruling about who should pay for socioeconomic costs.)

13-54 This comment summarizes several issues which were accepted and incorporated in the FEIS. No formal energy impact analysis was prepared although Subsection 4.7.19 does present a discussion of the potential impacts for the conterminous states arising from export of Alaska Natural Gas and the President issued a finding (Appendix N) of no significant economic impacts.

COMMENT LETTER 14

UNITED STATES DEPARTMENT OF COMMERCE
National Oceanic and Atmospheric Administration
National Marine Fisheries Service
P.O. Box 21668
Juneau, Alaska 99802-1668

November 19, 1987

Mr. Jules V. Tileston
U.S. Department of the Interior
Bureau of Land Management
Alaska State Office
701 C St., Box 30
Anchorage, Alaska 99513-0099

RE: Draft Environmental Impact Statement for Trans-Alaska Gas System

Dear Mr. Tileston:

This letter constitutes our review of the final version of the draft Environmental Impact Statement (DEIS) for the proposed Trans-Alaska Gas System pipeline and terminal. Our specific comments are as follows:

Specific Comments

14-1 p. S-5 Tables S-1 and S-2: "minor" effect defined in Table 1 as applying only to "construction" phase is applied to "operation" column in Table S-2. Under these definitions, the effect of operations on the marine environment and fish would be moderate not minor.

14-2 p. 1-16 Section 1.10: The proposed project schedule indicates that permits will be granted before final designs are approved. This scheduling is not appropriate.

14-3 p. 1-20 Table 1.11-1 NMFS: Please add the Marine Mammal Protection Act to this section.

14-4 p. 2-7 Section 2.2.1.3, par. 3: What "impurities" will be removed from the gas during LNG processing and how will they be disposed of?

14-5 p. 2-24 Section 2.3.3.1: The EIS should acknowledge that timing constraints may be appropriate for stream crossings to protect anadromous fish stocks.

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RESPONSE

14-1 The definition of "minor" impact is to be used for both construction and operation. Since the time reference to "generally lasting no longer than construction" would not apply in all cases, i.e. operations, it was incorrectly used and has been deleted.

14-2 The schedule as discussed in Subsection 1.10 is indeed correct. Both the BLM and USACE could issue permits prior to the project proponent securing approval of final design. Both constructed TAPS and approved ANGTS received such permits. These included authorizations for temporary camps, frost heave test sites, alignment testing boring, studies of cultural sites, fish and wildlife habitats and related project work necessary to develop detailed information for design. Of course the permits are conditioned that specific procedures must be followed and that prior to any construction, the BLM must issue a Notice to Proceed. Conditional permit approvals are necessary for the Yukon Pacific Corporation or any other project proponent prior to their investment of significant amounts of dollars for final design. They must know that within acceptable conditions, a project could proceed.

14-3 Table 1.11-1 modified to reflect comment.

14-4 Comment accepted and FEIS incorporates responses in Subsection 4.2.1.4. Also see response to Comment 25-18.

14-5 Subsection 2.8.3 indicates that the applicant proposed to "schedule construction activities to minimize impacts to construction areas near critical water crossings and to prevent downstream impacts." Timing constraints have been acknowledged by the project proponents. Subsection 2.3.3.1 has been modified to reflect this important comment. (See Table 4.8-2 for additional mitigation measures).

COMMENT LETTER 14 (Contd)

RESPONSE

2

14-6 [p. 2-45 Section 2.5: Fill for the construction dock area should not be placed near the stream mouth immediately to the east.

14-7 [p. 2-45 Section 2.5, par. 6: Where will the excess 5,000,000 cubic yards of excavated material be deposited?

14-8 [p. 3-40 Section 3.2.10.1.2, par. 3, line 9: Jackson Point is east of Anderson Bay.

14-9 [p. 3-42 Section 3.2.10.1.4, par. 1, line 13: It appears floccuation is a misspelling of flocculation.

14-10 [p. 3-44 Section 3.2.10.2.3 par. 3: It should be mentioned that the winter period during which fish egg incubation occurs is also important for salmonid production.

14-11 [p. 3-45 Section 3.2.10.2.5, par. 1, line 5: Should read "three species of endangered whales which may"; also line 10 should read "...(Eschrichtius robustus). These species...". In addition, it would be appropriate to mention that killer whales (Orcinus orca) and minke whales (Balaenoptera acutorostrata) occur regularly in the project area.

14-12 [p. 3-68 Section 3.2.14, par. 6, line 10: Gray whales migrate by Prince William Sound from March through June and from November through January.

14-13 [p. 3-86 Section 3.3.3, par. 9: Commercial salmon fishing is also a very large industry in Cook Inlet (Approx. $95,000,000 ex-vessel in 1987).

14-14 [p. 4-49 Section 4.2.10.1: The fourth listed impact is incomplete and looks as though it should read "and the effect of increased tanker traffic."

14-15 [p. 4-49 Section 4.2.10.2, par. 3, lines 11-15: This "moderate" impact should be reflected in Table S-2 on the "marine environment" line.

14-16 [p. 4-51 Section 4.2.10.4, par. 1, line 8: "Full spill" should read "fuel spill".

14-17 [p. 4-69 Section 4.2.14.1, par. 1, line 11: Apparently, the wrong table is cited for whales and plants.

14-18 [p. 4-120 Section 4.5.10, par. 3, line 25: We feel it is inappropriate to state there will not be "any" cumulative impact on the marine ecosystem of Port Valdez as a result of the construction and operation of the TAGS Terminal.

7-108

14-6 See site plot plan and conceptual design for site development at the Anderson Bay site as shown in Figures 2.2.1-6 and 2.2.1-7. The YPC conceptual design preserves a greenbelt at the stream mouth immediately to the east of the construction dock area. Minimal fill would be used in the vicinity of the construction dock, however, due to site grading and facility design requirements, drainage to the referenced stream would be modified.

14-7 A final spoil material site or sites for excess excavated material from site preparation at the Anderson Bay LNG plant would be selected during the detailed design phase when additional drilling program data concerning volumes of organics, rock and glacial till are available. Preliminary evaluation indicates that the required disposal volume can be accommodated at an upland site on the west side of Anderson Bay in the NE 1/4, Sec. 23 and NW 1/4, Sec. 24, T9S, R8W. A second disposal option which utilizes a portion of the east end of Anderson Bay would also be considered during the detailed design phase. This site, located in the NW 1/4 of Sec. 19, T9S, R7W, would utilize a combination of disposal in the bay and on land. This site offers the advantage of confining the disturbed area to a more localized site. However, any significant disruption of the biologically productive portions of Anderson Bay would not likely be permitted.

14-8 Subsection 3.2.10.1.2 has been modified to reflect this comment.

14-9 Subsection 3.2.10.1.4 has been modified to reflect this comment.

14-10 Comment accepted and the FEIS incorporates recommendation in Subsection 3.2.10.

14-11 Subsection 3.2.10.2.5 has been modified to reflect this comment.

14-12 Subsection 3.2.14 has been modified to reflect this comment.

14-13 Subsection 3.3.3 has been modified to reflect this comment.

14-14 Subsection 4.2.10.1 has been modified to reflect this comment.

14-15 "Moderate" was incorrectly used. The overall impact of a loss of 100 acres of substrate would be minor.

14-16 Subsection 4.2.10.4 has been modified to reflect this comment.

14-17 Subsection 4.2.14.1 has been modified to reflect this comment.

14-18 It was incorrect to imply that there would not be any cumulative impacts on the marine ecosystem since each of the existing and proposed projects have or would impact the marine ecosystem. However, since these impacts would be widely spaced within Valdez Arm the cumulative impacts would be minor.

COMMENT LETTER 14 (Contd)

RESPONSE

3

14-19 p. 5-2 Section 5.4: NOAA should be included here under the U.S. Department of Commerce.

Thank you for the opportunity to comment on this document.

Sincerely,

for Theodore A. Meyers

Robert W. McVey
Director, Alaska Region

NMFS Contact person: Roger W. Mercer

cc: ADF&G, Douglas, Fairbanks
ADEC, Juneau, Anchorage
FWS, Anchorage
EPA, Anchorage
Division of Governmental Coordination, Juneau, Anchorage
COE, Anchorage (William Fowler, Regulatory Branch)

14-19 Subsection 5.4 has been modified to reflect this comment.

COMMENT LETTER 15

Sierra Club
Alaska Field Office
241 E. Fifth Avenue, Suite 205, Anchorage, Alaska 99501, (907) 276-4048

November 19, 1987

Mr. Jules Tileston
Bureau of Land Management
Alaska State Office
701 C Street, Box 30
Anchorage, AK 99513-0099

Dear Mr. Tileston:

On behalf of the Sierra Club, I would like to submit the following comments concerning the Trans-Alaska Gas System (TAGS) Draft Environmental Impact Statement (DEIS). We appreciate this opportunity to comment on the draft and hope that our comments will prove useful in the preparation of the final EIS.

We would first like to commend BLM for choosing a route for TAGS that parallels the existing oil pipeline. As a matter of policy, we support the consolidation of transportation facilities. Clearly, this route is preferable over a route, such as the Cook Inlet/Boulder Point alternative, which would cross undisturbed lands and existing conservation system units (CSU).

15-1 Although we approve of the preferred route selection over other possible alignments, it is not clear that the construction of a gas pipeline is necessary or in the best State or National interest, especially considering that the construction of another gas pipeline (ANGST) has already been approved. One of the assumptions put forth in the draft (p. 1-7) is that there would be adequate supplies of North Slope gas "to support economic operation of both ANGST and TAGS". On what information is this based? Is it not inconsistent that the U.S. *export* natural gas to foreign markets when our current administration is promoting the development of the Arctic National Wildlife Refuge due to domestic energy demands and National security?

15-2 The major fault of the DEIS is the extreme lack of detailed analysis and research. The study appears to gloss over the environmental impacts associated with a project of this magnitude and consistently fails to provide adequate, up-to-date data to substantiate its claims. The following list provides several examples which highlight the inadequacies of this document. We urge BLM to ensure that these important issues are adequately addressed in the final EIS.

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RESPONSE

15-1 The DEIS assumes that the authorized ANGTS would be constructed in order to assure that the cumulative environmental consequences of the proposed TAGS project has been evaluated in accordance with the requirements of the National Environmental Policy Act. (See responses to Comments 12-1 and 12-3 for a discussion of natural gas supply estimates for the Alaska North Slope.) On January 12, 1988, the President of the United States concluded that there was an adequate supply of secure, reasonably priced supplies of natural gas to meet the demand of American consumers for the foreseeable future. The authorized, but unconstructed, ANGTS project would be capable also of transporting any future proven reserves of natural gas on the Alaska North Slope including those that might be discovered in the coastal plain area of the Arctic National Wildlife Refuge; therefore, authorization of the TAGS project to export Alaska North Slope natural gas does not effect the results identified in the DEIS.

15-2 As stated in the DEIS, this is an EIS which tiers on TAPS, El Paso, Arctic Gas, and ANGTS, although none of these projects are interchangeable, the overall effects identified or which actually occurred can reasonably be used to be tiered upon and be used to predict the environmental consequences of construction and operation of the proposed TAGS project.

COMMENT LETTER 15 (Contd)

Sierra Club/TAGS DEIS

Page 2

15-3 1). The DEIS does not provide an adequate review of the no-action alternative. This choice is quickly dismissed with the statement that "the no-action alternative would forego the economic effects of employment and revenue to the state and local jurisdictions of Alaska. Nationally, the opportunities for improving the balance-of-trade imbalance would be lost." (p. 2-64) Simply stating this is not enough. If these are the main arguments in support of this project, they need to be better substantiated. The "positive economic benefits to the state" need to be documented in greater detail. What costs, both short and long term, will be passed on to the state and the nation? How do the benefits balance out with the costs? Where is the supporting data for Yukon Pacific's economic predictions?

15-4 2). Many of the assertions in the DEIS are made based on the findings of previous EIS's (e.g. TAPS, ANGST) which have been "incorporated by reference". The findings from these previous studies may be applicable in certain cases, but they are relied on too heavily and in too general a manner. Because many of the circumstances and conditions have changed and new areas will be affected, new studies need to be done. When findings from previous EIS's are used, the data should be specifically cited, rather than accepted as a whole unit.

15-5 3). The cumulative impacts of TAGS, TAPS, and ANGST must be more adequately addressed. The findings in the DEIS concerning cumulative impacts are generalized and are not substantiated with supporting data. Each pipeline cannot be analyzed in a vacuum without full regard to the potential cumulative impacts caused by the presence of all three pipelines.

15-6 4). A more detailed map showing the *exact* alignment of TAGS is needed. In addition, a map is needed that will show the alignments of TAGS, TAPS, and the authorized ANGST all at once.

15-7 5). *Detailed* maps are needed to show: wildlife habitat, vegetation and wetlands, areas of critical environmental concern (ACEC), construction camps, river crossings, mineral resources, land status (the one included is barely legible), and recreational opportunities. Such maps are sorely lacking from the DEIS.

15-8 6). The status of the gas conditioning facility in Prudhoe Bay needs to be clarified. Would a new facility be built or would the existing Central Gas Facility be used? The DEIS states that "the relationship, if any, of TAGS gas conditioning needs and the existing capabilities of the CGF is not known." (p. S-7) This should be determined.

The impacts of constructing such a facility are significant. It is not adequate simply to "assume that a potential site is available and the air quality impacts...would not significantly affect the air quality of the area." (p. S-3) It is also not acceptable to dismiss the impacts of a TAGS facility by assuming that "the effects of additional conditioning plant capabilities are similar to those evaluated in the ANGTS conditioning plant..." (p. S-3) An entire new site (estimated at 200 acres) would be disturbed. The final EIS must include a study of the environmental impacts of a new facility.

15-9 7). What data was used to support the findings set forth in Table S-2 which summarize the environmental impacts?

RESPONSE

15-3 The "no action" alternative is an important element of the required evaluation under the National Environmental Policy Act. This comment is reflected in the FEIS accordingly by more clearly identifying the "no action" scenario in all pertinent sections.

15-4 See response to Comment 15-2. Certain circumstances and conditions have changed, and some new areas would be impacted by the TAGS project; site-specific environmental studies would be required prior to the proposed TAGS receiving its authorizations to proceed. The EIS process is just the initial stage of project development and refinement. For additional information see Tables 4.8-1 and 4.8-2. The FEIS has been revised to include page and section identification for documents incorporated by reference. For example, see response to Comment 12-3.

15-5 The cumulative impacts discussion of TAGS, TAPS, and ANGST is general. The TAGS project cannot be analyzed in a vacuum without regard to the cumulative impacts caused by the presence of all three. However, it is impossible at this time to further quantify, more than has already been done in the DEIS, the cumulative impacts associated with three pipelines when only one of them has been built. Where there are substantial areas of uncertainty such as in the sections on air quality, the FEIS has used the "worst case analysis" approach.

Baseline environmental conditions for TAGS between Prudhoe Bay and Delta Junction will not truly be known, given the assumption of this FEIS that ANGST will be built. We recognize that the eventual quantification of cumulative impacts along this 550 mile section of the common TAGS, ANGTS and TAPS pipeline corridor will result in the final design of and requirement for appropriate mitigation measures to minimize cumulative impacts associated with this project.

From Delta Junction to Valdez, baseline conditions are well known. Here, given the concentration of impacts associated with TAGS within the existing pipeline corridor for TAPS, cumulative impacts associated with TAGS have been determined to be negligible to minor for all resource parameters except socioeconomics/land use, vegetation/wetlands, and recreation/aesthetics/wilderness. However, for the majority of the resource parameters, moderate or greater cumulative impacts have been identified only for the period of construction. We feel that the level of cumulative impact discussion is appropriate to their findings.

15-6 Detailed maps showing locations of the TAGS pipeline, compressor stations, and the marine terminal/LNG plant at a scale of 1:63,360 and maps showing the general relationship of TAGS to TAPS and to ANGTS, and to state highways are available for public inspection at the following locations:

BLM Alaska State Office (Anchorage)-Alaska Resource Library, Branch of Pipeline Monitoring, Branch of Land Office Services; BLM Support Operations (Fairbanks); BLM Glenallen District Office; BLM (323) Washington D.C.; USACE Alaska District Office-Regulatory Branch (Anchorage); ERA, Washington D.C.; North Slope Borough Planning Department (Barrow); and Fairbanks North Star Borough Planning Department (Fairbanks).

In addition, these maps are available at the following libraries: Loussac (Anchorage); Consortium (Anchorage); Consortium (Valdez); E. Rassmussen and N. Wien (Fairbanks); and Alaska State Library (Juneau). A copy has been provided to the commentor and to the Wilderness Society (Commentor 19). Additionally, the location of TAGS facilities is on the official BLM Master Title Plats at the same scale as is other federal authorizations.

15-7 The FEIS has been strengthened to more clearly identify existing and potential recreation resources associated with the proposed TAGS project. Detailed maps showing wildlife habitats, vegetation, wetlands, river crossings, and mineral resources will be required before final design aspects of TAGS receive federal approval. Also see response to Comment 12-19. See Tables 4.8-1 and 4.8-2.

15-8 See response to Comment 12-1.

15-9 The Summary Table S-2 is a compilation of each of the discussions that appear in Chapter 4, Environmental Effects.

COMMENT LETTER 15 (Contd)

Sierra Club/TAGS DEIS
Page 3

15-10 8). The potential impacts to the marine environment of the Liquefied Natural Gas (LNG) Plant have not been adequately reviewed. Again, more data is needed to substantiate the statements made in the DEIS.

15-11 9). The impacts caused by the construction process and support facilities need to be discussed and analyzed in detail, not just mentioned. This includes access roads, construction workpads, airstrips, gravel extraction...etc.

15-12 10). How will buried river crossings effect small streambeds and the overwintering habitat for fish populations?

15-13 11). The Areas of Critical Environmental Concern need to be analyzed in greater detail. Exactly how will the gas pipeline cross these areas and how will the enviromental impacts be mitigated? The "special management practices" that are mentioned need to be specified.

15-14 12). The impact discussions in the DEIS assume that mitigation measures to limit environmental impacts will be implemented. In what manner will these be enforced? How will ongoing compliance be ensured?

15-15 13). Detailed plans for the 10 compressor stations are needed. A thorough analysis of the impacts of these stations should be included in the EIS.

The above examples reflect the lack of detail that is prevalent in the TAGS DEIS. The study fails to assess adequately the impacts that would be associated with a project of this magnitude. We urge BLM to address these concerns in the final EIS and to perform new studies as they are needed.

Thank you for this opportunity to comment on the Trans-Alaska Gas System Draft Environmental Impact Statement.

Sincerely,

Emily Barnett
Alaska Issues Specialist

RESPONSE

15-10 See response to Comments 25-15 through 25-18.

15-11 This is a tiered project. Detailed project plans and requirements would be developed during later project phases. The generic discussions in this EIS would be followed by site-specific requirements and studies prior to the TAGS project receiving notices to proceed from either the state or federal agencies. Additionally, the Federal Grant of Right-of-Way would require that approximately 25 comprehensive project plans be prepared for approval by the federal agencies. Each gravel extraction site would likewise require a site-specific plan that would include an individual environmental evaluation along with geotechnical information, volume estimates, and identification of use.

15-12 Each river crossing would be evaluated on a site-specific basis. Those rivers and streams with fish would receive special attention since the ADFG require any project, including TAGS, to provide for the uninterrupted movement and safe passage of all fish species during construction and operation of the pipeline. Likewise, since overwintering habitat for fish populations is critical to the continued existence of certain fish populations, construction windows to avoid critical area may need to be implemented.

15-13 Potential Areas of Critical Environmental Concern have been identified for certain federal lands north of the Yukon River. Only two such areas (Galbraith Lake and Slope Mountain) are crossed by TAGS. Others are adjacent to TAGS. Additionally, there are other areas south of the Yukon River where TAGS involves resources having special value. All these are described in Subsection 4.2.19 of the FEIS. Subsection 4.8 describes the process to be used to assure further detailed evaluation of these special areas as project planning for TAGS goes forward.

15-14 The environmental consequences of the proposed TAGS project have been evaluated on the basis of: mitigation proposed by the applicant, mitigation proposed by a federal or state authorization entity, and mitigation proposed during the public review of the proposed action described in the DEIS. The DEIS outlined a range of reasonable enforcement scenarios that are in use on similar large diameter pipelines in the conterminous United States or Alaska. The state has suggested that a joint federal-state effort be developed for the TAGS project. Such a coordinated review and decision strategy has significant merit. The details of how such a system might best work will be developed during Phase II.

15-15 The detail project plans and requirements would be developed during the five-year detailed design and planning phase. The EIS identifies impacts resulting from siting, noise, air quality, socioeconomics, subsistence, and others in Section 4.0.

COMMENT LETTER 16

ARCO Alaska, Inc.
Post Office Box 100360
Anchorage, Alaska 99510-0360
Telephone 907 265 6123

James M. Posey
Manager
Issue Advocacy

November 19, 1987

Jules V. Tileston
TAGS Project Officer
Bureau of Land Management
Alaska State Office
701 C Street
Box 30
Anchorage, AK 99513

RE: Draft Environmental Impact Statement (DEIS) for the Trans-Alaska Gas System (TAGS), Alaska

Dear Mr. Tileston:

ARCO Alaska, Inc. has reviewed the above referenced document and has the following brief comments to offer for your review and consideration.

16-1 The draft environmental impact statement is not clear with regard to conditioned gas availability. It should be noted that the existing facilities at Prudhoe Bay does not produce conditioned gas that would be compatible with TAGS specifications. To meet these specifications the gas from Prudhoe Bay Unit facilities would require CO_2 removal, compression and refrigeration. As a matter of fact, each transportation system would have its own unique conditioning, compression and refrigeration requirements, and, as such, each system must consider a gas conditioning facility to be included as an integral part of a total system.

If we can be of further assistance or answer any questions that you may have, feel free to contact Surinder Bhatia of our Engineering Department at 263-4642.

Sincerely,

J. M. Posey

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AR3B-6080-D

RESPONSE

16-1 We concur that any transporation system must have its gas conditioning facilities to meet their project specifications as identified in Table 2.6-1 which provides the feed gas composition anticipated for the TAGS project. The FEIS in Subsections 2.2.1.1, 3.4, and 4.4 expands DEIS discussions on the conceptual gas conditioning facility which, for purposes of this EIS, is considered a connecting action.

COMMENT LETTER 17

Tanana Chiefs Conference, Inc.
201 First Ave.
Fairbanks, Alaska 99701
(907) 452-8251

YUKON TANANA SUBREGION

November 19, 1987

Jules V. Tileston
Bureau of Land Management
701 C Street, Box 30
Anchorage, AK 99513-0099

Dear Sir:

I am writing to give comments on the Trans-Alaska Gas System (TAGS) draft Environmental Impact Statement.

17-1 I cannot over-emphasize the importance of the subsistence economy to the local people of Stevens Village. Subsistence must be preserved and protected for the Native peoples who live near the proposed TAGS route. They are after all, the primary beneficiaries of the land.

17-2 I don't feel that BLM, Army Corps of Engineers, or the State should issue leases unless Yukon Pacific provides take-off values. Stevens Village could use some of the gas for heating. Fairbanks would also benefit from the take-off values.

17-3 Stevens Village residents want to participate in the economic opportunities through local hire or joint venture work with Dinyee, the village corporation. Stevens Village has an annual median family income of $6250.

17-4 The environmental impact statement admits major impacts to subsistence during the construction phase of TAGS. This should be mitigated. Already the subsistence economy is hurting badly from increased access from the Yukon River Crossing.

17-5 Stevens Village residents oppose construction of another bridge at the Yukon River to accomodate the TAGS pipeline.

17-6 I also think that the comment period should have been longer than Nov. 20.

Thank you for conducting an 810 Subsistence hearing in Stevens Village.

Sincerely,

Oscar Frank

Oscar Frank, Jr.
Community Resource Coordinator

OFJr/alj

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RESPONSE

17-1 The importance of subsistence to rural Alaskan residents is addressed in Subsection 4.2.17.

17-2 See response to Comment 2-4; it is equally applicable to Stevens Village or Fairbanks.

17-3 See response to Comment 13-11.

17-4 Subsection 4.2.17 addresses the subsistence impacts on Stevens Village. Subsection 2.8 describes impact mitigation measures proposed by YPC to address subsistence impacts, which include public access restrictions and employee fishing, hunting and trapping restrictions. Also see response to Comments PH5-4, and PH5-5 for further information.

17-5 As stated in the DEIS, the present Yukon River bridge has pipeline supports on both sides of the roadway. One contains the existing TAPS pipeline and the other, constructed by Alyeska, is reserved for a future oil pipeline crossing. The bridge was designed to possibly accommodate another pipeline beneath the roadway. This access has been identified for use by ANGTS. The proposed separate TAGS Yukon River bridge would be a suspension crossing to support only the TAGS pipeline; no roadway would be constructed across the suspension bridge. It would be similar to the TAPS crossing along the Richardson Highway of the Tanana River.

17-6 The National Environmental Policy Act of 1969 (NEPA) provides a minimum period of public review of 45 days following notice of the availability of a DEIS is published in the Federal Register. An additional 15 days was provided for the review of the DEIS. No other written requests were received to extend this period beyond the 60-day review period.

COMMENT LETTER 18

FEDERAL ENERGY REGULATORY COMMISSION
WASHINGTON 20426

IN REPLY REFER TO:

NOV 20 1987

Mr. Jules V. Tileston
TAGS Project Officer
Bureau of Land Management
Alaska State Office
701 C Street, Box 30
Anchorage, Alaska 99513-0099

Dear Mr. Tileston:

The FERC staff hereby provides its comments on the Trans-Alaska Gas System (TAGS) Draft Environmental Impact Statement (DEIS). In summary, we are not comfortable with the approach taken here that no detailed work need be done regarding facility design and assessing the LNG facility's ability to comply with the Minimum Federal Safety Standards (49 CFR part 193) promulgated by the Department of Transportation (DOT). However, since DOT is a cooperating agency we will defer to its position, at least regarding preparation of the FEIS. The FEIS runs the risk of being inadequate if it does not fully address the acceptability of the Anderson Bay LNG terminal site.

Although the DEIS has addressed most of the specific comments we provided on August 7, 1987, with respect to the preliminary DEIS, most of our fundamental concerns remain. These are updated as follows:

1. Analysis of Alternatives

18-1 (a) While the text of section 1.9.4 now identifies other LNG sites previously reviewed for other projects, there has been no change in the PDEIS analysis to show how these sites compare to those looked at for the current project.

(b) The text should explain the rationale for choosing Gravina Point as the representative Prince William Sound site for comparison with the proposal at Anderson Bay. While this type of rationale was provided for the Cook Inlet sites, there is still some confusion over
18-2 the status of Boulder Point. On page 1-11, section 1.9.4 states that the Boulder Point site is superior to the other Cook Inlet sites whereas section S.3 talks about it as a representative site. As drafted, the text still allows the conclusion that Boulder Point would be the next choice if Anderson Bay were not approved. We don't feel that this result was intended and we do not agree with it.

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RESPONSE

18-1 Each of the Prince William Sound sites identified in previous analyses required a pipeline route through the roadless area of the Chugach Mountains and National Forest. Although the Gravina site required only two minor subsea crossings, both Hawkins Island and Bidarka Point required major subsea crossings.

18-2 YPC has indicated that should any unexpected condition at Anderson Bay be found that would eliminate it as a location for the LNG facility, they would then reevaluate the situation at that time. Additional NEPA compliance would be required should the Anderson Bay site not be acceptable. Boulder Point would not automatically be a fall-back site.

COMMENT LETTER 18 (Contd)

RESPONSE

18-3 (c) The steps necessary to fulfill the requirements of the Alaska National Interest Lands Conservation Act if a Cook Inlet site were chosen should be more fully explained. The potential problems involved in avoiding Denali National Park by routing through Moody Creek Canyon need to be explained in more detail.

2. Cumulative Impacts

18-4 The DEIS still merely assumes that TAGS and the Alaska Natural Gas Transportation System would not be built concurrently. As we stated previously the serious potential for cumulative impact resulting from concurrent construction necessitates a better rationale for that assumption.

3. Conditioning Plant

18-5 The DEIS concluded that a conditioning plant would be needed. However, the environmental impact of such a facility is not analyzed. Issues concerning the availability of sites, material borrow pits and other matters relating to the impact of construction and operation need to be addressed.

4. Seismic Related Site Details

18-6 In response to the request to comment specifically on seismic issues and the Dames and Moore geotechnical background work we have these comments. Harding Lawson's review focuses on two of the concerns with the Anderson Bay site. The first is the assumption that the onsite faults have not moved during the Holocene Epoch. This is an assumption whose accuracy probably cannot be tested conclusively because of the physical nature of the site and the history of deposition on it. Specifically the strata are not old enough to show that no Holocene movement has occurred. However, the work done to date on and off the site provides reasonable indirect evidence that no significant and perhaps no Holocene displacement has occurred at the site.

18-7 The second concern addressed by Harding Lawson, and which we share, deals with the calculation of design ground motion. The most glaring omission in the reports and the EIS is a statement of the earthquake magnitude that was assumed to create figure 1 of the December 3, 1986, Dames and Moore report. Unless the magnitude is known the figure is meaningless. Equally important, and also lacking from the report or the EIS, is an analysis of how the maximum credible earthquake magnitude was determined and whether the deterministic and probabilistically determined magnitudes are the same.

The discussion of magnitude should explain why use of a recurrence of the 1964 earthquake at an epicentral distance of 20 kilometers should not be used, since the Kawashima relationship

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18-3 Detailed requirements for authorization of utility transporation systems crossing a designated unit of a National Conservation System Unit (NCSU) in Alaska are found at 43 CFR 36. A key element of any federal authorization through an NCSU is the determination that there is no realistic or viable alternative routing that would avoid the particular NCSU. The TAGS alignment identified in its DEIS as the preferred route to Anderson Bay by the BLM and USACE avoids crossing any NSCU. The Cook Inlet alternative would pass through or near Denali National Park and Preserve and be very near the Kenai National Wildlife Refuge.

A pipeline can be constructed in very difficult terrain such as found in Moody Creek Canyon. This area is traversed by the Anchorage-Fairbanks Intertie. Construction of this high-voltage transmission line was by aid of helicopter rather than by conventional surface access because of difficult steep terrain and because of public concern about new surface access disruption wildlife migrations to and from Denali National Park.

18-4 See response to Comment 12-3.

18-5 See response to Comment 12-1.

18-6 Included as a reference to the DEIS is the Dames and Moore report "Geologic Considerations, Proposed LNG Plant and Marine Terminal, Anderson Bay, Port Valdez, Alaska," dated August 27, 1987. The Dames and Moore report provides an assessment of the geologic and seismic environment at the proposed TAGS LNG plant site. Addressed in the assessment, are requirements of 49 CFR 193.2061 which pertain to seismic and geologic siting criteria. Specifically, the limiting criteria listed in 49 CFR 193.2061(f) have been evaluated. In summary, results are as follows:

- Most critical ground motion: probabilistic and deterministic calculations yield an estimated design horizontal acceleration less than 0.8g.
- Quaternary fault displacement: survey of geologic and seismological professionals active in the Valdez region and literature review of geological and seismological references indicate that no evidence of Quaternary faulting has been identified within the site region. The closest faults with demonstrable Quaternary displacement are 90 km from the site. There is no evidence that any faults within the Valdez region were active during the great earthquake of 1964, even though the epicenter of this event was only 50 km to the west.
- Differential surface displacement and/or soil liquefaction due to dynamic properties of materials beneath the site: preliminary site geological reconnaissance indicates that most of the site is underlain by near-surface bedrock. The Anderson Bay site appears to be geologically similar to the nearby Trans-Alaska Pipeline System (TAPS) terminal. Experience on the TAPS site indicates that bedrock foundations on the site will be possible. Therefore, differential subsurface displacement and liquefaction during a seismic event due to dynamic properties of soils should not be a concern.

The basis for each of the above-mentioned results are included in the text in the FERC and referenced in Appendix O.

18-7 See Appendix O for response to this comment.

COMMENT LETTER 18 (Contd)

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18-7 (Contd) used by Dames and Moore would estimate a ground acceleration that would disqualify the site!

18-8 In addition, the draft U.S. DOI stipulations (dated 2/12/87) require the use of magnitude 8.5 for design on this portion of the pipeline. This would result in a ground acceleration of 0.6 g not 0.4 g.

18-9 To reiterate our earlier comment: the FEIS should identify the work performed to support the DEIS conclusion that the DOT siting requirements can be met and explain how it supports that conclusion.

18-10 5. <u>LNG Terminal Design Details</u>

Beyond general and/or overall descriptions of the LNG liquefaction terminal facility layout, there is very little detail of the equipment or operational impact. The extent of air, noise and other emissions from the plant will be a function of the equipment located there and must be addressed. Terminal design will also strongly control safety of operations, long-term integrity and reliability of the LNG facility. These areas must be addressed.

18-11 Construction and operational details of the LNG plant are related to its environmental impact. These items should be specified and analyzed in the FEIS. Further, aesthetics, liquid discharges, waste and spoil disposal, and other such matters should be discussed, and analyzed.

18-12 Overall engineering design of the plant must be reviewed. Since it is obvious that specific detail is not currently available, the FEIS should describe how review of those details will be developed and what agency(s) will participate in the review. Compliance with Part 193, Minimum Federal Safety Standards, and overall plant and operating philosophy and reliability, must ultimately be studied.

The FEIS should recognize this need and discuss the method which will be used to evaluate the terminal design and justify how the criteria will be met.

18-13 6. <u>Mitigation</u>

The DEIS does not identify any mitigation measures for either the LNG plant or the conditioning plant. When the environmental impacts of these facilities are added to the FEIS, proposed mitigation should also be added.

RESPONSE

18-8 See Appendix O for a response to this comment.

18-9 As stated in Subsection 4.2.18.4, YPC performed preliminary analyses that reviewed the Federal DOT LNG standards, as prescribed in 49 CFR 193. YPC would conduct further assessments which would include subsurface testing as the more site-specific design and engineering phases proceed. Should unexpected site conditions be found, YPC would evaluate the potential for site-specific mitigation or site relocations.

18-10 YPC has prepared a number of reports discussing air emissions and public safety, has prepared written comments on wastewater discharge, and discussed in the Project Description the facilities which would be sited at Anderson Bay. Under the tiered process which was established at the start of the TAGS permit process by the BLM, USACE and later by the State of Alaska, detailed design information is scheduled to be prepared by YPC in Phase II and III of the process. More specific design data would be available to the involved review agencies in the mid to later portion of Stage II.

18-11 See response to Comment 18-10. The various subsections of Section 4 have been modified to reflect this comment.

18-12 The FERC conducts cryogenic design and technical review of the operational aspects of jurisdictional LNG facilities. However, by Declaration Order in Docket No. GP 87-16-000, the FERC has stated that it has no jurisdiction under section 7 of the Natural Gas Act over the proposed LNG terminal at Anderson Bay. Therefore, FERC apparently will not conduct its usual review on the facility. Section 7 confers jurisdiction over the transportation, and the sale for resale, of natural gas in interstate commerce, and the construction and operation of facilities for that purpose.

The Department of Transportation (DOT) has exclusive authority to promulgate federal safety standards for LNG facilities used in the transportation and associated storage of LNG. DOT has developed safety standards administered by the Office of Pipeline Safety within the Research and Special Programs Administration. The safety standards contained in 49 CFR Part 193 cover the siting, design, construction, testing, inspecting, operation, and maintenance of LNG land based facilities.

The Office of Pipeline Safety, as part of our enforcement activity, will review the engineer design of the proposed LNG plant at Anderson Bay and monitor its construction in order to assure compliance with the standards in 49 CFR part 193, if adequate funding is available. Since the proposed terminal is to be located on state land, the Alaska Department of Natural Resources (DNR) can obtain funds from YPC as part of its grant of right-of-way. DOT has contacted the DNR which is receptive to obtaining funds for the engineering design review and construction monitoring from YPC and making these funds available to DOT through a reimbursable agreement. Cooperative arrangements to cover funding are being discussed by DOT, OPS, the State of Alaska, BLM and the applicant. These discussions are not yet concluded and are therefore not ripe for further discussion in this FEIS.

18-13 The mitigation measures in Subsection 4.8 have been revised in the FEIS. The conceptual gas conditioning facility is considered as a connected NEPA action. See response to Comment 12-1.

The DOT believes that compliance with the federal LNG safety standards in 49 CFR Part 193 adequately addresses the design operation requirements for an LNG facility, at the conceptual stage of project development. However, DOT would discuss LNG plant design and engineering with any agency or with YPC personnel. DOT has previously met with a member of the YPC engineering staff on several occasions to discuss LNG plant design and engineering and submitted written comments on the LNG facility on December 19, 1986, in connection with the Draft Project Description and is a cooperator in the preparation of this FEIS.

COMMENT LETTER 18 (Contd)

RESPONSE

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We appreciate the opportunity to review the DEIS and the help you have provided the staff during its participation in the EIS process. If you have any questions regarding our comments please contact me at (202) 357-8098 or Robert K. Arvedlund at (202) 357-9043.

Very truly yours,

Richard R. Hoffmann

Richard R. Hoffmann, Chief
Environmental Evaluation Branch
Office of Pipeline and Producer
Regulation

cc: Bill Fowler, TAGS EIS Project Leader
U.S. Army Corps of Engineers

COMMENT LETTER 19

THE WILDERNESS SOCIETY

November 20, 1987

Mr. Jules V. Tileston
Bureau of Land Management
701 C Street, Box 30
Anchorage, AK 99513-0099

Dear Mr. Tileston:

The Wilderness Society, with over 190,000 members nationwide including 1,100 in Alaska, is dedicated to the preservation of wilderness and the management of all the public lands.

The Wilderness Society has completed a review of the Bureau of Land Management (BLM)/U.S. Army Corps of Engineers Draft Environmental Impact Statement (DEIS) for the proposed Trans-Alaska Gas System (TAGS), and found that it is flawed, inadequate and does not fulfill the requirements of the National Environmental Policy Act (NEPA). The document has been prepared using dated studies. It should be revised to include current data needed to substantiate environmental impacts, detailed mitigative measures, and a comprehensive review of cumulative impacts that would result from the operation of three pipelines in the narrow utility corridor.

Availability of DEIS

As stated in the DEIS, "the objective of the EIS process is to ensure that decision-makers and the general public have an opportunity to review available environmental information before permit decisions are made and actions taken." However the public comment process was severely constrained by the

19-1 fact that copies of the DEIS were not widely available, since only 500 copies were printed. Just two weeks after its release, the Society was unable to obtain additional copies.

ANGTS and the Current Energy Situation

The DEIS lacks an economic analysis of the feasibility of this project as requiree by NEPA. While the EIS for the Alaska Natural Gas Transportation System (ANGTS) has been

19-2 approved, the pipeline has not been built. Gas discoveries in Mexico and Canada, the low price of natural gas in general, and the 1977 $40 billion estimated price tag for

ALASKA REGION
519 WEST 8TH AVENUE, SUITE 205, ANCHORAGE, ALASKA 99501
(907) 272-9453

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RESPONSE

19-1 Notice of the proposal to consider an application to construct and operate a large diameter, chilled pipeline between Prudhoe Bay and Anderson Bay and the intent of the BLM and USACE to conduct public scoping meetings in Alaska was published in the Federal Register on November 17, 1968. Approximately 170 people or representatives of organizations attended the six scoping meetings held in Alaska between December 8 and 13, 1986. Before the close of the scoping period on December 23, 1986, about 40 written responses were received. In addition to the Federal register Notice, the BLM and USACE sent a combined notice of scoping meetings with a summary of the proposed project to some 1,300 persons, agencies, and organizations. The number of DEIS copies available for review was based upon the results of the 1,300 mailouts and by the number of people attending scoping meetings or written comments received during scoping, e.g. approximately 210 people, wrote, spoke, or attended. Realizing not everyone may have taken part in the scoping process, the BLM and the USACE printed and mailed about 1,300 summaries which contained the complete DEIS Summary and supporting graphics and the proposed USACE Public Notice of Tiered Processing Procedure for TAGS (Appendix M, DEIS). Special mailings containing the complete ANILCA 810 findings (Appendix L, DEIS) were sent to affected regional and local subsistence boards, Alaskan rural communities, and local rural residents. To assure further that the DEIS would be available for public review, heavy emphasis was placed on getting the DEIS into public libraries. Distribution to library systems were as follows:

Anchorage (multiple copies); Fairbanks (multiple copies); Valdez (multiple copies); Juneau (multiple copies); Delta; North Pole; Soldotna; University of Alaska, Consortium Library, Anchorage (multiple copies); North Slope Borough School District, Barrow (multiple copies); Alaska State Legislative Reference Library (multiple copies); Department of the Interior Resource Library, Anchorage (multiple copies); Department of the Interior Library, Washington, D.C.; Nenana; Kenai (multiple copies); Seward; Talkeetna; Tanana Community; Willow; Whitier; Tok; Department of Agriculture, Beltsville, Maryland; Library of Congress; Sheldon Jackson Jr. College; Glenallen (multiple copies); Homer; Delta Junction; Cordova; Cantwell; Palmer (multiple copies); Anchor Point; Alaska Energy Library, Anchorage; Bureau of Mines, Juneau; Alaska State Library (multiple copies); Arctic Environmental Information and Data Center, Anchorage.

Additionally, a copy of the DEIS was sent to the General Printing Office for microfiche distribution through the Federal Repository Library System.

19-2 See response to Comment 6-1.

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Page 2

19-2 (Contd) construction of ANGTS have prevented Northwest from going forth with their approved plan. There is a surplus of natural gas in the world market today. With other countries able to produce gas less expensively than Alaska, a project of this magnitude appears uneconomical at this time. The DEIS includes only incomplete economic modelling and gives no indication of the price of natural gas needed to make the project viable.

Inadequate Consideration of Cumulative Impacts

19-3 A project of the magnitude of TAGS must be evaluated in terms of the cumulative long-term effects of industrial development on the North Slope, Valdez, and all points in-between. The question of whether it is in Alaska's best interests to authorize construction of two gas pipelines at this time should also be considered. Furthermore, BLM has failed to consider the cumulative impacts of three pipelines operating in close proximity to each other.

19-4 BLM is currently preparing a plan for management of the lands within the Utility Corridor. Projects such as TAGS and ANGTS will significantly affect the management of all public lands in and adjacent to the Utility Corridor, particularly during the construction phase. The proposed plan for the Utility Corridor would result in increased traffic on the Dalton Highway by recreationists. Yet BLM fails to consider the potential for conflicts, and even harm, that could result from simultaneous use of the road by tourist and construction vehicles. Finally there is no analysis of the impacts of TAGS on the proposed areas of critical environmental concern (ACEC). The failure to consider impacts such as these leaves the impression that the TAGS DEIS has been compiled in a vacuum, without full consideration of all associated management and development scenarios.

Incomplete Evaluation of Environmental Consequences

19-5 Incorporation of old data, compiled by an outside consulting team that conducted no field research is insufficient for a project of this nature. The DEIS does not discuss in detail the impacts of stream crossings, particularly on overwintering fish populations.

19-6 Water quality and marine fisheries are not adequately evaluated. For example, the impact of TAGS upon the Solomon Gulch Fish Hatchery in Valdez Arm is not considered. Air quality and noise impacts are not substantiated with current data.

Table S-2, summarizing the environmental effects of the

RESPONSE

19-3 The cumultive impacts discussion does indeed consider the effects of industrial development in the various areas identified. As stated in response to comment 12-3, the marketplace would be the determinant whether two major natural gas projects should be constructed in Alaska. It has been identified, see Presidential Finding (Appendix N), that there exists an adequate, secure, and reasonably priced supply of natural gas to meet demands for the foreseeable future. (Also see responses to Comments 12-2, 12-5, and 12-38.)

The technical aspects of cumulative impacts of the three pipelines operating in close proximity are discussed in Appendix B.

19-4 The federal lands within the area known as the "Utility Corridor" has been set aside for such purposes as construction of piplines. Since TAGS and the highway system are already in place, two additional pipelines should have no significant affect on the management of lands within the utility corridor. The pipelines would have non-exclusive use of their right-of-way on BLM lands. Only during construction would there be increased traffic on the Dalton Highway. Conflict between tourists and construction are identified in subsection 4.2.15. Subsection 4.2.19 discusses each of the ACEC's and identifies that none would be directly impacted by construction. (Also see response to Comment 22-40.)

The cumulative impacts to public lands adjacent to this corridor are recognized, particularly with regard to land use, recreation, and subsistence (see section 4.5.3, 4.5.15, and 4.5.17). The potential cumulative impacts inherent in joint use of roads by construction equipment and recreationists is an appropriate concern, and accordingly the transportation and recreation sections of the cumulative impacts discussion (4.5.4. and 4.5.15) have been modified to reflect these concerns. Subsection 4.2.19 summarizes the relationship of TAGS to areas having very special value.

19-5 CEQ Regulations provide for the use of incorporation by reference, the use of existing valid data, even if the data is "old" (1972-1983), providing the basis for present determinations is relevant to past decisions. Detailed field work and research must be a part of detailed design. Site specific information would be incorporated into project decisions. Such information would be provided to BLM and/or USACE for review prior to the receipt of any notices to proceed. The EIS discusses the impacts of stream crossings in general since more than 200 fish streams are crossed by the project. Although no site specific overwintering areas are identified the critical nature of these areas and the impacts are discussed in subsections 3.2.11, 4.2.11, and 4.8.

Information on water quality, marine fisheries, air quality and noise impacts have been strengthened throughout the FEIS. The proposed TAGS alignment crosses above the Solomon Gulch Fish Hatchery (see Figure 2.3.4-12). No significant impacts on the hatchery are expected when mitigation measures discussed in Section 4.8 are applied.

19-6 Table S-2 is a summary of each of the effects discussions found in Section 4.0.

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19-6 (Contd) Anderson Bay and Cook Inlet-Boulder Point Alternative, appears subjective. The DEIS provides no supporting data to prove that the environmental consequences of the proposed TAGS project will be major, moderate, minor or negligible.

19-7 The DEIS states "the gas conditioning facilities required in the Prudhoe Bay area to deliver pipeline quality gas are not part of the TAGS project." Such an omission from the DEIS is inappropriate. No proposed site is indicated, nor is there any evaluation of the effects of a conditioning plant, a facility that could occupy 200 acres of land. Furthermore, the DEIS "has assumed that a potential site is available and the air quality impact attendant to such additional facilities at Prudhoe Bay would not significantly affect the air quality of the area," but no basis for this assumption is provided.

The approval of a conditioning plant proposal for ANGTS by the Federal Energy Regulatory Commission does not constitute implicit approval for a TAGS conditioning plant. The ANGTS site has not been relinquished for use by TAGS. Moreover, to date, there appears to have been no cooperative effort between YPC and Northwest to share information or facilities. An additional conditioning plant would have impacts on the environment that must be evaluated in the context of all existing and proposed development in the region. The DEIS is incomplete without this analysis.

Routing through Critical Environments

The Wilderness Society urges BLM not to route TAGS through critical environments. It is difficult, with a few exceptions, to comment specifically on the proposed routing, as the critical environments and the potential impacts are neither adequately identified nor analyzed in the document.

19-8 The proposed route of TAGS west of Galbraith Lake is of great concern to the Society. This area has the highest concentration of historic and prehistoric cultural resources of any region along the BLM Utility Corridor and has been recommended as an Ecological Reserve and for entry into the Registry of Natural Landmarks. Any future development and the access it would provide invites resource degradation. Yet the potential impacts to this special area are inadequately described.

19-9 The DEIS mentions "special management practices proposed by BLM" in its discussion of Sagwon Bluffs, but the document fails to specify what they are. The proposed TAGS route presents the potential for disturbance to peregrine falcons and other raptors and a threat to the farthest north known

19-7 See response to Comment 12-1. Please note that the FEIS has been revised in that air quality effects associated with the conceptual GCF have been deferred until a subsequent NEPA evaluation (EPA 1988a). Also, much of the technical information associated with the modified ANGTS SGCF has been classified by its sponsers as confidential/proprietary (see response to Comment 12-10 on use of such information).

19-8 The proposed TAGS alignment west of Galbraith Lake was identified as an area of special concern for the reasons identified in this comment. The comment also is correct that Galbraith Lake has been nominated as an ecological natural research area. In 1976, the Joint Federal/State Land Use Planning Commission for Alaska identified area #116 (Galbraith Lake) as follows: "Arctic Mountains Province. Location of pipeline construction camp and airstrip. Canadian and Alaska fish studies from 1969. University of Alaska archaeological studies 1970-71. Revegetation studies since 1970. Natural and undisturbed *Eriophorum* tundra, alpine, and transitional vegetation." (Angle 1976, memo to BLM from 2-FSLUPCA). BLM has researched its records for national landmark or similar types of nominations of the Galbraith Lake area. This research included review of the 1974 USGS administration report "Potential Landform and Lifeform Landmarks" by R.L. Ditterman, 411 pp. We cannot find a record of nomination for Galbraith Lake; there are however, several nominations involving the nearby Arctic National Wildlife Refuge. A check with NPS records in Alaska also did not reveal any landmark proposals for the Galbraith Lake area. Additionally, the BLM has proposed in its Draft Utility Corridor Resource Mangement Plan that the Galbraith Lake area be designated an Area of Critical Environmental Concern.

Because of these special values at Galbraith Lake, BLM requested YPC to identify an optional route that would follow the general location of the Dalton Highway, TAPS, and ANGTS. The east side option is not the preferred routing as it crosses the Atigun River just upstream of the Atigun Canyon (a nominated natural area) and then would be on the upper slopes of the valley where the larger cut and fill required to lay a pipeline would have greater cumulative visual impact than the preferred west side route. The potential impacts to the Galbraith Lake are summarized in Chapter 4.2.19. Briefly, the TAGS alignment enters the area along a previously disturbed winter trail, joins the existing access road to the State airport and the former TAPS construction camp, and then southernly along the bench along the west side of the Atigun River Valley. Crossing of the Atigun River is avoided. The former TAPS construction camp area would be reused as a TAGS construction area. Existing material sites used for TAPS, Dalton Highway, and airport maintenance would be expanded, and as necessary, new ones developed. Public access along the TAGS route south of the Galbraith Lake Construction camp would be restricted to foot travel only. Upon completion of construction, the Galbraith construction camp would be restored to its present condition. Overall effects on scenic values at the conclusion of construction are considered minor.

19-9 Special environmental management practices would be prepared by BLM for the proposed TAGS project within each of the Areas of Critical Environmental Concern (such as Sagwon Bluffs) during the design criteria development phase. These would be reevaluated at the time final design proposals are submitted for review and approval. Special management guidelines for construction, operation, and maintenance of the proposed TAGS project would focus on the areas and resource values as shown in the final Resource Management Plan for the Utility Corridor now being prepared by BLM. Areas along the proposed TAGS route involving endangered or threatened species would be designed, constructed and operated in accord with the factors set forth during the required consultation by BLM with the Fish and Wildlife Service. These are described in Appendix H, Biological Assessment for Endangered Species, in the DEIS.

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19-9 (Contd) other raptors and a threat to the farthest north known Athabaskan archeological sites.

19-10 The DEIS offers no conclusive evaluation of TAGS routing along the Dalton Highway adjacent to Sukakpak Mountain. The Society opposes any route across the mountain which would degrade the outstanding scenic values of the area. Further study and evaluation are essential in the DEIS.

Maps

19-11 The maps included in the DEIS are totally inadequate. The small scale makes it difficult to identify the actual proposed location of the TAGS and ANGTS pipeline. Existing maps from the BLM Utility Corridor DEIS, ANGTS EIS and TAPS DEIS should have been used to produce detailed topographic maps that pinpoint the proposed location of TAGS. Specifically, the maps and accompanying information fail: a) to indicate locations where the pipeline would cross wetlands, streams or critical or sensitive wildlife habitats; b) to include the location of TAPS and ANGTS in relation to the proposed project; c) to locate precisely pre-construction and construction camps, material storage yards and compressor stations; and d) to identify land status. The vague maps included in the DEIS are of limited use in evaluating the land involved and the environmental impacts of TAGS.

A set of detailed topographic maps should be included in the TAGS DEIS, showing the exact proposed placement of TAGS, ANGTS and TAPS, all development sites, detailed land classification, showing federal and state and Native land status, including national parks and wildlife refuges, wild and scenic rivers, Native allotments, proposed BLM areas of critical environmental concern, wilderness recommendations, military withdrawals, wildlife habitats, wetlands, fisheries habitats, vegetative classifications, energy and mineral resources, and soil classifications.

Conclusion

The Wilderness Society is not opposed to the construction of TAGS. However the existence of TAPS and the approval of ANGTS do not relieve the agencies of the requirements of NEPA to evaluate fully the environmental impacts of the project. To sum up, the failure to evaluate the cumulative effects of two or more pipelines and attendant facilities results in an incomplete evaluation of effects upon wildlife, subsistence, aesthetics, marine resources, recreation, cultural resources, and the economy. Furthermore the potential for new technology, such as transporting gas
19-12 through TAPS, is not considered. Finally, the DEIS does not

19-10 We agree and the TAGS sponsors have moved the pipeline alignment (see Figure 2.3.4-3) to avoid Sukupak Mountain.

19-11 See response to Comments 15-6 and 15-7.

19-12 The need and the economic viability are marketplace decisions and beyond the scope of this EIS process.

COMMENT LETTER 19 (Contd)

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19-12 (Contd) analyze the need for the Trans-Alaska Gas System nor examine its economic viability. Without this information, it is difficult, if not impossible, for the public to evaluate the wisdom of the proposal. The Society looks forward to working with BLM to ensure the wise management of BLM lands.

Sincerely,

Susan Alexander

Susan Alexander
Alaska Regional Director

COMMENT LETTER 20

A

ALASCOM Telegram

07013 NL ANCHORAGE ALASKA 1023 11-20 1540 AST

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TRANS-ALASKA GASLINE SYSTEM, DEIS, JUELS V TIELESON

BOX 30, 701 C ST

ANCHORAGE AK 99513-0099

01191

20-1 THE NORTHWEST ALASKA PIPELINE COMPANY AND ANGTS ARE THE SAME. IT CAN ONLY BE FOR REASONS OF DECEIT AND DECEPTION THAT THE DEIS WOULD LET THE READER THINK DIFFERENTLY.

20-2 THE DEIS FURTHER ASSUMED "THAT THERE WOULD BE ADEQUATE SUPPLIES OF ALASKAN NORTH SLOPE NATURAL GAS TO SUPPORT ECONOMIC OPERATION OF BOTH ANGTS AND TAGS." THAT IS A LIE. THERE IS NOT ENOUGH GAS FOR ANGTS IN BOTH RATE AND TOTAL AMOUNT. THEREFORE, IF THERE IS NOT ENOUGH GAS FOR ONE GASLINE, THERE IS NOT ENOUGH GAS FOR BOTH GASLINES. WHY LIE ABOUT IT?

NORTHWEST PIPELINE'S CONTRACTOR, CORE LABORATORIES, FOUND THAT PRUDHOE BAY OIL RECOVERY WAS VERY SENSITIVE TO GAS WITHDRAWAL OF MORE THAN 1.2 BILLION CUBIC FEET PER DAY. IT WAS ONLY LATER FOR POLITICAL REASONS THAT MC MILLAN INCREASED THE SIZE OF THE PIPELINE.

WHILE STUDIES BY THE OIL COMPANIES IN THE STATE OF ALASKA WOULD LEAD THE

RESPONSE

20-1 Northwest Alaska Pipeline Company is the sponsor for ANGTS just as Yukon Pacific Corporation is the sponsor for TAGS. No confusion or deceit was intented.

20-2 The Geological Survey and the Minerals Mangement Service are completing a revision of national oil and gas existing and projected supplies shown in G.S. Circular 680. Although not yet complete, there is every reason to believe that, in addition to what currently has been proven, at least an additional 30 TCF of economically recoverable natural gas would be found (R. Mast, personal communication, January 1988).

COMMENT LETTER 20
(Contd)

RESPONSE

ALASCOM Telegram

PAGE 2

READER TO CONCLUDE THERE WOULD ONLY BE A MODEST LOSS OF OIL RECOVERY, THOSE
20-3 STUDIES WERE MANIPULATED OUT OF THE PURVIEW OF THE READER SO AS TO COVER UP
THE ENORMOUS LOSS OF OIL RECOVERY.

THE STATE OF ALASKA HAS MADE NO SERIOUS ATTEMPT TO OBTAIN THE RESERVOIR STUDIES DONE BY THE OIL COMPANIES THAT WERE WITHHELD FROM THE STATE OF ALASKA. THE STATE SPENT $500,000 FOR A 3-DIMENSIONAL MODEL (AND PAID TWICE FOR IT) THEN REFUSED TO USE IT TO DETERMINE WHAT THE MAXIMUM OIL RECOVERY WOULD BE AND HAS USED IT VERY LITTLE SINCE THEN UNDER THE GUISE THAT IT COSTS TOO MUCH--$10,000 TO $12,000 PER RUN.

DESPITE THE OIL COMPANIES AND THE STATE OF ALASKA COVER-UP, THE REAL PRODUCIBILITY FOR PRUDHOE BAY WAS LEAKED. THE RECOVERY WAS 50% GREATER THAN THE OIL COMPANIES ADMITTED TO THE PUBLIC OR CONGRESS, AND THAT EXTRA OIL IS NOW BEING WASTED.

ALASKA NATURAL GAS TRANSPORTATION SYSTEM HEARINGS BEFORE THE COMMITTEE ON ENERGY AND NATURAL RESOURCES, UNITED STATES SENATE 95TH CONGRESS, FIRST SESSION S.J. RES. 82, SEPTEMBER 26, 27, OCTOBER 11, 12 AND 25, 1977, PUBLICATION NO. 95-73. THE LIBRARY OF CONGRESS NUMBER IS KF 27 I5542 1977K PAGE 570.

PRUDHOE BAY RECOVERY 65% OOIP.

SO WHAT DOES IT MEAN? NOBODY CARED TO FIND OUT, OR IF THEY DID KNOW, THEY WITHHELD IT FROM SENATOR JACKSON BUT THEN MAYBE NOT. IT COULD BE THAT NO ONE

20-3 Studies by the State indicate that under reasonable gas offtake rates (3 BCF/day) in conjunction with ongoing waterflood operations, oil recovery will not be materially affected.

COMMENT LETTER 20
(Contd)

RESPONSE

ALASCOM Telegram

PAGE 3

EVER BOTHERED TO READ THE FILING BY EXXON AFTER THE HEARINGS WERE OVER IN RESPONSE TO QUESTIONS DURING THE HEARINGS.

IT IS A SAD COMMENTARY ON HOW CORRUPT CONGRESS AND OUR GOVERNMENT ARE CLEAR TO THE BOTTOM, OR AT LEAST, HOW USELESS THEY ARE CLEAR TO THE BOTTOM.

THE OIL COMPANIES, INCLUDING EXXON, TOLD THE PUBLIC, THE STATE OF ALASKA AND CONGRESS THAT THE OIL RECOVERY FOR PRUDHOE BAY WAS 9.6 BILLION BARRELS OF OIL AND GAS LIQUIDS. YET THE REAL RECOVERY WAS 50% GREATER OR ANOTHER 5 BILLION BARRELS OF OIL. MUCH GREATER THAN THE EXPECTED RECOVERY OF ANWR OVER WHICH CONGRESS IS NOW SQUABBLING.

O.O.I.P. IS ORIGINAL OIL IN PLACE. FOR PRUDHOE BAY THAT IS 23 BILLION BARRELS, AND 65% OF THAT IS 15 BILLION BARRELS OF RECOVERABLE OIL. SOME 5 BILLION MORE THAN THE WAY THE OIL COMPANIES ARE PRODUCING PRUDHOE BAY TODAY.

THE UNSOPHISTICATED WOULD ASK, WHY WOULD THE OIL COMPANIES WASTE 5 BILLION BARRELS OF OIL? THE SIMPLE ANSWER, IT'S CALLED CUT AND RUN--THE TIME VALUE OF MONEY AND THE WAY THE TAX LAW AND THE TAX LAWS CONGRESS HAS PASSED.

THE EXTRA 5 BILLION BARRELS WOULD REQUIRE INVESTMENTS WHICH WOULD SEE NO RETURN FOR 10 YEARS AND REQUIRE A LOWER RATE OF RECOVERY. SECOND, THE OIL COMPANIES WANTED TO BUILD A GASLINE NOT ONLY TO SELL THE GAS AND AVOID THE COST OF REINJECTION BUT ALSO TO PROFIT FROM THE GASLINE. FOR EXAMPLE, WHEN ONE SUBTRACTS THE $1.6 BILLION IN DELIBERATE COST OVER-RUNS WITH WHICH THE OIL COMPANIES GOT CAUGHT RED-HANDED, THE OIL COMPANIES' REVENUES FOR THE LINE EVERY TWO YEARS ARE EQUAL TO THE COST OF THE PIPELINE.

COMMENT LETTER 20 (Contd)

RESPONSE

A

ALASCOM Telegram

FOR EXAMPLE, HOW WOULD YOU LIKE TO OWN A FOUR-PLEX WORTH $200,000 AND HAVE A GROSS INCOME OF $200,000 EVERY TWO YEARS?

LASTLY, THE TAX LAWS ARE SUCH THAT THE OIL COMPANIES GET TAX BENEFITS FROM TRYING TO RECOVER OIL FROM A RESERVOIR THEY HAVE WRECKED. ARCO ALREADY HAS A TAX DODGE GOING ON AN OIL RECOVERY PROJECT ON THE NORTH SLOPE.

WHAT THE OIL COMPANIES WOULD HAVE TO DO TO GET THE 15 BILLION BARRELS OF OIL

20-4 PLUS THE OTHER 5 BILLION BARRELS THEY ARE NOW WASTING, IS RETAIN ALL OF THE GAS IN THE RESERVOIR. SECOND, REDUCE THE RATE OF RECOVERY. THIRD, REBUILD THE PRESSURE IN THE RESERVOIR AND THIS CANNOT BE DONE WITH WATER INJECTION. YOU CAN ONLY MAINTAIN THE PRESSURE WITH WATER.

WHAT THE UNITED STATES AND ALASKA REALLY NEED IS 20 TO 30 TRILLION CUBIC FEET OF GAS TO INJECT INTO PRUDHOE BAY LIKE THE LARGE AMOUNT OF GAS FROM THE KENAI GAS FIELD THAT THE OIL COMPANIES ARE INJECTING INTO THE SWANSON RIVER OIL FIELD TO INCREASE OIL RECOVERY.

20-4 Experience to date indicates that large quantities of gas are available over and above what will be needed for field operations.

COMMENT LETTER 20 (Contd)

ALASCOM Telegram

THE PROPOSED GASLINE WOULD REDUCE THE GAS IN PRUDHOE BAY WHICH WOULD REDUCE THE OIL RECOVERY. THE TOTAL BTUS WHICH A GASLINE WOULD DELIVER TO ANYWHERE ARE LESS THAN THE TOTAL BTUS WHICH WOULD BE LOST IN THE OIL RECOVERY. FURTHER,

20-5 THE REVERSE IS NOT TRUE. THE GAS IS NOT LOST IF THE OIL RECOVERY PROCEEDS TO COMPLETION AND THE RESERVOIR IS THEN BLOWN DOWN TO RECOVER THE GAS. THE EXISTING OIL LINE, WHICH WOULD BE MOSTLY EMPTY, COULD BE USED FOR A GASLINE AND A NEW SMALLER OIL LINE BUILT.

20-6 THE DEIS FAILS TO ADDRESS THE ABOVE AND MANY OTHER VERY FUNDAMENTAL QUESTIONS. HOW CAN THE DEIS PROVIDE INFORMATION TO COMMENT UPON WHEN IT IS NOT IN THE DEIS? HOW CAN YOU PLAN A GASLINE WHEN YOU DON'T HAVE THE TECHNICAL INFORMATION, AND TAGS IS NEITHER BUYING IT NOR DOING THE NECESSARY RESEARCH? NOR DO WE KNOW EVEN IF TAGS BOUGHT THE DATA AS SUGGESTED IN THE DEIS, THAT IT WOULD BE ADEQUATE FOR THE GASLINE.

THE DEIS IS SO DEFICIENT THAT IT NOT ONLY FAILS TO COMPLY WITH THE LAW, BUT IS A GROSS FRAUD.

JERRY MC CUTCHEON
8541 EAST 4TH AVE APT B
ANCHORAGE AK 99504

RESPONSE

20-5 There are no technical reasons to delay gas production until after oil recovery is complete. It may be much more economical to produce the gas in conjunction with the oil so that field operating costs can be shared.

20-6 The proposed TAGS project is in Phase I of its project development stage as discussed in Subsection 1.10 of the FEIS. Each project phase tiers upon the other. TAGS has not yet purchased data owned by TAPS or ANGTS but at the appropriate time, could enter into negotiation to purchase such data.

COMMENT LETTER 21

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JOHN R. STAFFIER
JOHN H. BURNES, JR.
SHIPPEN HOWE

TELEPHONE
(202) 467-5880

November 20, 1987

Mr. Jules V. Tileston
Chief, Branch of Pipe Line Monitoring
U.S. Department of the Interior
Bureau of Land Management
Alaska State Office
701 C Street, Box 30
Anchorage, Alaska 99513-0099

RE: Comments of Foothills Pipe Lines (Yukon) Ltd. on Trans-Alaska Gas System Draft Environmental Impact Statement

Dear Mr. Tileston:

In September, 1987, the Bureau of Land Management of the U.S. Department of Interior ("BLM") and the U.S. Army Corps of Engineers ("Corps") issued the Trans-Alaska Gas System Draft Environmental Impact Statement ("DEIS"). In that DEIS and the subsequent notice, 52 Fed. Reg. 34424 (September 11, 1987), interested parties were given an opportunity to file comments on or before November 20, 1987.

As the Canadian sponsor of the Alaska Natural Gas Transportation System ("ANGTS"), Foothills Pipe Lines (Yukon) Ltd. ("Foothills") has a vital interest in this proceeding and any other proceeding which involves the disposition of Alaskan North Slope gas reserves. As a result, we filed the attached letter with BLM on December 19, 1986, setting forth our position with respect to various legal issues. In that letter, we recommended that BLM and the Corps remain cognizant of essentially three points as they process the application filed by Yukon Pacific Corporation. First, any action taken by BLM or the Corps which interferes directly or indirectly with the expeditious completion of the ANGTS would violate the 1977 Agreement on Principles between the United States and Canada relating to the project. Second, the letter and spirit of the Alaska Natural Gas Transportation Act, 15 U.S.C. 719 et seq., prohibits BLM and the Corps from taking any action which would change the basic nature of the ANGTS, significantly alter its route, or impair its expeditious financing and completion. Finally, approval of the TAGS project -- or any other alternative (other than the ANGTS) for the transportation of Alaskan gas -- would require, at a minimum, a substantial modification of the President's decision and an act of Congress approving that modification.

21-1

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RESPONSE

21-1 The President of the United States on January 12, 1988 stated "...I do not believe this finding should hinder completion of the Alaska Natural Gas Transportation System (ANGTS)..." (See Appendix N). The BLM and USACE have given very careful attention to, and consideration of, the alignment of ANGTS as shown in Revision 4 and as noted to the official BLM land records. The requirements of 43 CFR 2881.1-1 and 2881.1-3 have been applied. Further the OFI is cooperating in the preparation of this FEIS. THe FEIS focuses on the consequences of the proposed TAGS project and alternatives (routings, including a no-action alternative). The extent, if any, of future Congressional approvals is beyond the scope of the FEIS.

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RESPONSE

McHENRY & STAFFIER, P.C.

Mr. Jules V. Tileston
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Page Two

As its comments on the legal implications of the DEIS, Foothills hereby readopts this position, as described more fully in the attached letter. With respect to the substantive and procedural defects of the

21-2 DEIS, Foothills supports the position taken in the comments being filed simultaneously herewith by Northwest Alaskan Pipeline Company, which is the agent and operator for Alaskan Northwest Natural Gas Transportation Company, the U.S. sponsor of the ANGTS.

Respectfully submitted,

George W. McHenry, Jr.

Counsel for
FOOTHILLS PIPE LINES
(YUKON) LTD.

GWM:jsj

Attachment

cc: All Parties

21-2 See response to Comments 12-1 through 12-50.

COMMENT LETTER 21 (Contd)

RESPONSE

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(202) 467 5880

December 19, 1986

Mr. James V. Tileston
BLM Program Officer-TAGS
Bureau of Land Management
Alaska State Office
701 C Street
Box 30
Anchorage, Alaska 99513

RE: Comments of Foothills Pipe Lines (Yukon) Ltd. on Notice of Intent to Prepare an Environmental Impact Statement for Right-of-Way and Dredging Permits Required for the Proposed Trans-Alaska Gas System

Dear Mr. Tileston:

On November 6, 1986, the Bureau of Land Management of the U.S. Department of Interior ("BLM") and the U.S. Army Corps of Engineers ("Corps") issued a notice of their intent to prepare an environmental impact statement in connection with the applications of Yukon Pacific Corporation for right-of-way and dredging permits which are required for the proposed Trans-Alaska Gas System ("TAGS"). 51 Fed. Reg. 41542 (November 17, 1986). In that notice, interested parties were given an opportunity to file comments on or before December 23, 1986.

21-3 This letter will set forth the comments of Foothills Pipe Lines (Yukon) Ltd. ("Foothills"), which is the Canadian sponsor of the Alaska Natural Gas Transportation System ("ANGTS"). In this respect, our comments will not focus on the environmental issues, but will focus, instead, upon the larger question of whether BLM and the Corps have sufficient legal authority to issue the requested permits.

By way of background, you should be aware that, in 1976, Congress passed the Alaska Natural Gas Transportation Act ("ANGTA"), 15 U.S.C. 719, et seq. Among other things, this act was designed "to provide the means for making a sound decision as to the selection of a transportation system for delivery of Alaska natural gas to the contiguous States ...." 15 U.S.C. 719a. To this end, specific procedures were established under which the Federal Power Commission (predecessor to the Federal Energy Regulatory Commission) was required to issue a recommendation and report to the

21-3 This comment letter notes that it addresses areas that do "...not focus on the environmental issues, but...whether BLM and the Corps have sufficient legal authority to issue the requested permits." The BLM and USACE have determined adequate authority to approve the use of certain lands in Alaska for the proposed TAGS project.

COMMENT LETTER 21 (Contd)

RESPONSE

McHENRY & STAFFIER, P.C.

President (15 U.S.C. 717c); interested parties were given an opportunity to provide their comments on the recommendation and report (15 U.S.C. 719d); and the President was required to issue a decision with respect to an Alaska natural gas transportation system (15 U.S.C. 719e).

ANGTA also contains certain provisions which were designed to prevent Federal agencies from taking any action which would either (a) change the route or basic nature of the system selected, or (b) interfere with its expeditious construction. Specifically, Section 9(d) of ANGTA provides, among other things, that:

> "Any Federal officer or agency, with respect to any certificate, permit, right-of-way, lease, or other authorization issued or granted by such officer or agency, may, to the extent permitted under laws administered by such officer or agency, add to, amend, or abrogate any term or condition included in such certificate, permit, right-of-way, lease, or other authorization, except that with respect to any such action which is permitted but not required by law, such Federal officer or agency, notwithstanding any such other provision of law, shall have no authority to take such action if the terms and conditions to be added, or as amended, would compel a change in the basic nature and general route of the approved transportation system or would otherwise prevent or impair in any significant respect the expeditious construction and initial operation of such transportation system." 15 U.S.C. 719g(d).

On September 22, 1977, pursuant to Section 7 of ANGTS, 15 U.S.C. 717e, and following the negotiation of an Agreement on Principles with Canada, 1/ the President issued a decision approving the construction and operation of the ANGTS, a 5,000-mile pipeline system which will eventually connect Alaskan gas reserves with

1/ "Agreement Between the United States of America and Canada on Principles Applicable to a Northern Natural Gas Pipeline," September 20, 1977, 29 U.S.T. 3581, T.I.A.S. No. 9030.

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RESPONSE

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Mr. James V. Tileston
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Page Three

markets in the lower forty-eight states. 2/ In that decision, as well as the Northern Pipeline Act which was subsequently enacted by the Canadian Parliament, Foothills was identified as the company responsible for the construction and operation of the 2,000-mile Canadian segment of the project.

The President's decision was based upon findings that Alaskan gas reserves are needed by U.S. consumers in the lower forty-eight states. The decision further recognized that the viability and financeability of the ANGTS depends upon the shipment of those reserves to the lower forty-eight states.

The President's decision also stated that it would be beneficial to "prebuild" the southern Canadian and U.S. segments of the ANGTS, prior to commencement of deliveries from Alaska, in order to provide transportation capacity for new volumes of Canadian gas which were sorely needed in the United States. Accordingly, a project designed to accomplish this goal was organized and presented to U.S. and Canadian regulatory authorities in the late 1970's for approval. In 1980, the Federal Energy Regulatory Commission issued the authorizations necessary for prebuilding of the necessary segments of the ANGTS facilities in the lower forty-eight states. In Canada, however, the authorizations required for prebuilding the necessary portions of the Canadian segment were initially withheld because of Canadian concern that the U.S. government would not follow through with completion of the entire ANGTS. In this respect, Section 12 of the Northern Pipeline Act prohibited Canadian approval of prebuilding until the Canadian National Energy Board ("NEB") and the Minister responsible for the Northern Pipeline Agency were satisfied that financing could be obtained for the remainder of the system.

Since early construction of the prebuild phase of the ANGTS was a matter of highest priority in U.S. energy policy, the President and Congress acted swiftly to provide the assurances required for Canadian participation in the project. Specifically, on July 1, 1980, Congress passed a Joint Resolution which reaffirmed Congressional

2/ Decision and Report to Congress on the Alaska Natural Gas Transportation System, issued by the President on September 22, 1977, pursuant to Section 7 of the ANGTA, 15 U.S.C. 719e, and ratified by Congress on November 8, 1977 (H.J. Res. 621, Pub. L. No. 95-158, 91 Stat. 1268, 95th Cong., 1st Sess.).

COMMENT LETTER 21 (Contd)

RESPONSE

McHENRY & STAFFIER, P.C.

support for the ANGTS. 3/ Among other things, the Joint Resolution declared:

> " ... [I]t is the sense of Congress that the [ANGTS] System remains an essential part of securing this nation's energy future and, as such, enjoys the highest level of Congressional support for its expeditious construction and completion. 4/

In addition, on July 18, 1980, President Carter wrote Prime Minister Trudeau a letter expressing the United States' support for prebuilding and the expeditious completion of the remainder of the ANGTS. Specifically, the President stated:

> " ... I can assure you that the U.S. Government not only remains committed to the project; I am able to state with confidence that the U.S. Government now is satisfied that the entire Alaska Natural Gas Transportation System will be completed .... I trust these recent actions on our part provide your government with the assurances you need from us to enable you to complete the procedures in Canada that are required before commencement of construction on the prebuild sections of the pipeline.
>
> * * *
>
> Successful completion of this project will underscore once again the special character of cooperation on a broad range of issues that highlights the U.S./Canadian relationship. 5/

Based upon this commitment by the U.S. government, the Canadian NEB issued a decision in July, 1980, finding that Condition 12 of the Northern Pipeline Act had been satisfied. Thereafter, the Canadian Governor-in-Council (i.e., the Canadian Cabinet) concurred

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3/ S. Con. Res. 104, 96th Cong., 2nd Sess., 126 Cong. Rec. H.5942 (daily ed. July 1, 1980).

4/ Ibid.

5/ President Carter's letter is attached hereto.

COMMENT LETTER 21 (Contd)

RESPONSE

McHENRY & STAFFIER, P.C.

Mr. James V. Tileston
December 19, 1986
Page Five

with the NEB's findings and authorized the prebuild project to go forward.

Parenthetically, it should be noted that approval of the prebuild project was a matter of intense political controversy in Canada. Opponents of prebuilding suggested, for example, that the United States might eventually abandon the ANGTS as a means of transporting the Alaskan gas to the lower forty-eight states. Rejecting these arguments, however, the Canadian government expressed confidence in the U.S. commitments which provided the basis for its decision to approve the prebuild phase. Indeed, Energy Minister Marc LaLonde, speaking to the House of Commons on July 17, 1980, stated:

> "I think it would be silly and irresponsible at this time to assume that the Congress of the United States, and that the President of the United States, will not live up to their word. It would be completely irresponsible and is not the type of assumption I am ready to make.
>
> * * *
>
> What I will say, however, is that if such a thing were to occur, it would probably be the greatest breach of faith committed by the United States on Canada in the last 200 years." House of Commons Debates, Volume III, 1st Sess., 32nd Parl., 29 Eliz. II, 1980.

Subsequent to the Canadian government's approval of the prebuild project, and in reliance upon the U.S. commitments described above, Canadian producers invested approximately one billion dollars (Canadian) in the construction of the production, plant, and gathering facilities required for the prebuild project; Foothills invested approximately one billion dollars in prebuilding approximately 527 miles of the 2000-mile Canadian segment of the ANGTS; and NOVA invested approximately $500 million in providing capacity within its intraprovincial pipeline system to transport the prebuild volumes from numerous Alberta gas fields to interconnections with the Foothills' system. Needless to say, however, the Canadian government would not have permitted this phase of the ANGTS to go forward if there had been any suggestion that the remainder of the project would not be completed.

In view of the foregoing, Foothills recommends that BLM and the Corps remain cognizant of essentially three points as it processes the

COMMENT LETTER 21 (Contd)

RESPONSE

McHENRY & STAFFIER, P.C.

applications filed by Yukon Pacific Corporation. First, any action by BLM or the Corps which interferes directly or indirectly with the expeditious completion of the ANGTS would violate the 1977 Agreement on Principles between the United States and Canada and the prior commitments made to Canada by the President and the Congress. Second, the letter and spirit of ANGTA prohibit BLM and the Corps from taking any action which would change the basic nature of the ANGTS, significantly alter its route, or impair its expeditious financing and completion. Finally, approval of the TAGS project -- or any other alternative (other than the ANGTS) for the transportation of Alaskan gas -- would require, at a minimum, a substantial modification of the President's decision and an act of Congress approving that modification.

In closing, I would make one final point. While the notice invites participation in the EIS process by several other agencies of government, no mention is made of the Federal Energy Regulatory Commission. Given the fact that the Commission has been the lead agency for more than a decade with respect to proposed Alaskan natural gas transportation systems, and given the fact that the U.S. portions of the ANGTS have already been conditionally certificated by the Commission, Foothills believes this is a serious oversight. Accordingly, we urge BLM and the Corps to invite participation by the Commission.

We also believe it would be appropriate to invite participation by the Office of the Federal Inspector for the ANGTS. As you are aware, the Federal Inspector is responsible for overseeing the construction and operation of the ANGTS.

Respectfully submitted,

George W. McHenry, Jr.

George W. McHenry, Jr.

Counsel for
FOOTHILLS PIPE LINES
(YUKON) LTD.

GWM:jsj

Attachment

cc: Howard D. Griffith
Yukon Pacific Corporation

Cuba Wadlington
Northwest Alaskan
Pipeline Corporation

COMMENT LETTER 21
(Contd)

RESPONSE

July 17, 1980

Dear Mr. Prime Minister:

Since you last wrote to me in March, the United States Government has taken a number of major steps to ensure that the Alaska Natural Gas Transporation System is completed expeditiously.

Most significantly, the Department of Energy has acted to expedite the Alaskan project. The North Slope producers and Alaskan segment sponsors have signed a joint statement of intention on financing and a cooperative agreement to manage and fund continued design and engineering of the pipeline and conditioning plant. The Federal Energy Regulatory Commission recently has certified the eastern and western legs of the system.

The United States also stands ready to take appropriate additional steps necessary for completion of the ANGTS. For example, I recognize the reasonable concern of Canadian project sponsors that they be assured recovery of their investment in a timely manner if, once project construction is commenced, they proceed in good faith with completion of the Canadian portions of the project and the Alaskan segment is delayed. In this respect, they have asked that they be given confidence that they will be able to recover their cost from U.S. shippers once Canadian regulatory certification that the entire pipeline in Canada is prepared to commence service is secured. I accept the view of your Government that such assurances are materially important to insure the financing of the Canadian portion of the system.

The Right Honorable
Pierre Elliott Trudeau, P.C., Q.C., M.P.,
LL.L., M.A., F.R.S.C.,
Prime Minister of Canada,
Ottawa

COMMENT LETTER 21 (Contd)

Existing U.S. law and regulatory practices may cast doubt on this matter. For this reason, and because I remain steadfastly of the view that the expeditious construction of the project remains in the mutual interests of both our countries, I would be prepared at the appropriate time to initiate action before the U.S. Congress to remove any impediment as may exist under present law to providing that desired confidence for the Canadian portion of the line.

Our Government also appreciates the timely way in which you and Canada have taken steps to advance your side of this vital energy project. In view of this progress, I can assure you that the U.S. Government not only remains committed to the project; I am able to state with confidence that the U.S. Government now is satisfied that the entire Alaska Natural Gas Transportation System will be completed. The United States' energy requirements and the current unacceptable level of dependence on oil imports require that the project be completed without delay. Accordingly, I will take appropriate action directed at meeting the objective of completing the project by the end of 1985. I trust these recent actions on our part provide your government with the assurances you need from us to enable you to complete the procedures in Canada that are required before commencement of construction on the prebuild sections of the pipeline.

In this time of growing uncertainty over energy supplies, the U.S. must tap its substantial Alaskan gas reserves as soon as possible. The XXVI trillion cubic feet of natural gas in Prudhoe Bay represents more than ten percent of the United States' total proven reserves of natural gas. Our governments agreed in 1977 that the Alaska Natural Gas Transportation System was the most environmentally sound and mutually beneficial means for moving this resource to market. Access to gas from the Arctic regions of both countries is even more critical today as a means of reducing the dependence on imported petroleum.

Successful completion of this project will underscore once again the special character of cooperation on a broad range of issues that highlights the U.S./Canadian relationship.

I look forward to continuing to work with you to make this vital energy system a reality.

Sincerely,

(Signed: Jimmy Carter)

RESPONSE

COMMENT LETTER 22

RESPONSE

STATE OF ALASKA

DEPARTMENT OF NATURAL RESOURCES

DIVISION OF LAND AND WATER MANAGEMENT

STEVE COWPER, GOVERNOR

NORTHERN REGION
4420 AIRPORT WAY
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PHONE: (907) 479-2243

November 20, 1987

Mr. Jules Tileston
Program Manager, TAGS
U.S. Department of the Interior
Bureau of Land Management
701 C Street, Box 30
Anchorage, Alaska 99513

Reference: TAGS DEIS Comments

Dear Mr. Tileston:

Please find enclosed the State of Alaska's comments on the Draft Environmental Impact Statement for the Trans Alaska Gas System.

Sincerely,

Jerry L. Brossia
State Pipeline Officer

Enclosure

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NOV 25 1987

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COMMENT LETTER 22 (Contd)

RESPONSE

STATE OF ALASKA

OFFICE OF THE GOVERNOR

OFFICE OF MANAGEMENT AND BUDGET
DIVISION OF GOVERNMENTAL COORDINATION

STEVE COWPER, GOVERNOR

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SOUTHCENTRAL REGIONAL OFFICE
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NORTHERN REGIONAL OFFICE
675 SEVENTH AVENUE
STATION H
FAIRBANKS, ALASKA 99701-4596
PHONE: (907) 456-3084

November 19, 1987

Mr. Jules Tileston
TAGS Project Manager
Bureau of Land Management
701 "C" Street, Box 30
Anchorage, AK 99513

Dear Mr. Tileston:

SUBJECT: Draft Environmental Impact Statement for the Trans-Alaska Gas System (State I.D. No. AK87091804/F)

The State of Alaska appreciates this opportunity to respond to the Draft Environmental Impact Statement (DEIS) for the proposed Trans-Alaska Gas System (TAGS). The state supports development of Alaska's gas resources and bringing gas to market as expeditiously as possible. It is also in the best interest of the people of the state that the proposed TAGS project is designed and constructed safely, with minimum practicable effect on the environment and with positive effects on the socioeconomic climate of Alaska. Therefore, we will continue in our efforts to work cooperatively with the Bureau of Land Management (BLM), the U.S. Army Corps of Engineers (USACE) and Yukon Pacific Corporation (YPC) during our subsequent review and approval of the various state permits that will be required for this project.

The state's comments are divided into two parts. The first part is a narrative describing the state's concerns with each section of the DEIS, including the description of the proposed action and alternatives, affected environment, and environmental consequences. The second part of our response is an enclosure. This is a page-by-page presentation of specific comments including recommendations for language revisions or the addition of information. This letter with enclosure is submitted on behalf of state agencies and represents a consolidation of state concerns and comments.

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GENERAL COMMENTS

A substantial amount of time and effort has been spent by the staff of various state agencies in evaluating the TAGS project and information presented in the DEIS. We feel confident, therefore, that the comments and recommendations provided in this response will be useful for preparation of the final EIS and further evaluation of the project.

22-1 Before continuing with substantive comments, we would like to point out that the DEIS needs a thorough editorial review to correct case and tense within sentences and paragraphs. It should also receive further technical editing to identify and define specialized terms; for example, the discussion on page 2-23 of the use of a jeep to detect holidays in the pipe coating. Some editorial comments are included in the enclosed specific comments.

A. Comments on DEIS Summary

22-2 The Summary Section of the DEIS provides not only definitions of environmental impacts and summarizes environmental effects, but it describes the environmental impact statement process. However, the descriptions, found in Tables S-1 and S-2 (pages S-4, S-5, DEIS) need further explanation. For example, the definition for "minor" environmental impact on biological resources does not cover its application to the "operation" phase of the TAGS project presented in Table S-2. The text associated with Table S-2 needs an explanation of how the "environmental effects" values were assigned. In the description of "threatened/endangered" in Table S-2, the environmental effects are described as "negligible." By definition, a change in habitat quality is a "minor" impact, not "negligible" (see letter from U.S. Fish & Wildlife Service to Bureau of Land Management, dated June 30, 1987, in Appendix H). For example, changes in habitat quality and some disturbance will occur in peregrine feeding ranges during (and perhaps after) construction. We expect the BLM to use the definitions provided in the DEIS in the FEIS.

22-3 With regards to the permitting process, the DEIS Summary should briefly describe the basic federal and state permits required prior to construction of TAGS and that the Federal right-of-way grant is for federally owned land, the state right-of-way lease is for state owned land and the USACE permits are for wetlands on all lands along the proposed alignment (Section S.6, page S-6, DEIS). The tiered permit

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22-1 Comment accepted and the FEIS incorporates an editorial review. Other technical terms were defined in the glossary, Subsection 6.2.

22-2 Comment accepted and the FEIS incorporates recommendations. In Table S-1, the definition for physical and biological resources under "minor" environmental impacts deletes the reference to the construction period only. Minor does refer to construction, operations and maintenance. In Table S-2, the construction effects for threatened/endangered for the proposed project should be minor, since some disturbance would occur in peregrine feeding ranges during construction.

22-3 Comment accepted and the FEIS incorporates recommendation in Subsections 1.10 and 1.11.

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22-3 (Contd) process is part of the environmental protection and mitigation for the project.

B. Comments on the Introduction

The state offers the following suggestions for improvement to this section.

22-4 In the introduction to the DFIS, it should be clear that the state right-of-way lease for TAGS is not proceeding on the same "public involvement" track as the DEIS process and the Federal Grant of Right-of-Way (ROW). The state has its own public notice and comment requirements that differ from those of the federal government. We would not want the state process placed in jeopardy because of an assumption that all three public involvement processes were coincidental.

22-5 The introduction should briefly describe land ownership patterns along the proposed alignment. This would clarify for reviewers the permitting process and state and federal authorities described in subsequent sections. Plus, reference to maps in the DEIS (Appendix F) would help direct reviewers to information referenced in the text.

22-6 In the "General Project Location" (Section 1.3, page 1-5, DEIS) there is discussion of an option for five larger compressor stations. Since the impacts of individual stations might differ under the two scenarios (five compressor stations versus ten compressor stations), both merit discussion, or at a minimum, cross-referencing. Further comment on this point is provided later in this letter under the "Proposed Action and Alternatives" section.

22-7 The "Intended Use and Purpose of the EIS" section (Section 1.10, page 1-16, DEIS) needs clarification. The description of phases in Table 1.11-1 (page 1-19, DEIS) more accurately reflects their relationship to agency permitting than does Section 1.10. We have provided additions to Table 1.11-1 in the enclosure that will clarify the permitting phases. We would like it emphasized in this section that the DFIS, the major ROW authorizations, the USACE authorizations, and natural gas export licenses must be secured by the applicant prior to proceeding with detailed design engineering, design approval and subsequent authorizations to proceed with construction. It is important to show that more specific tasks will be tiered in at subsequent steps. The text in Section 1.10 implies that authorizations to proceed and

RESPONSE

22-4 The FEIS incorporates this recommendation in Subsection 1.2.

22-5 The FEIS incorporates this recommendation in Subsection 1.3.

22-6 The TAGS ten compressor station configuration has been proposed in consideration of pipeline and compression facility design, overall system operations, overall system reliability, and economics. A five compressor station configuration has been identified as a possible option that would result in a more efficient use of manpower and different environmental effects and should be evaluated during detailed design. Conceptual engineering established the ten station configuration to be acceptable in terms of system design, operations, and reliability; and has only identified the five station option as meriting consideration during detailed design. The ten and five compressor station configurations are shown on the following figure.

A key technical factor in selecting a final compressor station configuration would be overall system reliability. Operational reliability would be an important consideration to potential Pacific Rim gas buyers and to potential project financers. The TAGS pipeline and compressor station system must be capable of making certain minimum natural gas deliveries through periods of scheduled or unscheduled maintenance and downtime.

The ten compressor station configuration satisfies project reliability objectives. The five station configuration compromises overall system reliability due to the fewer number of stations and greater distance between stations as shown in the Compression Station Systems Block Flow Diagram.

Pipeline and compression system operations are also factors to be considered in selecting a compressor station configuration. System efficiency for a ten station configuration is greater than for a five station configuration. Greater distance between stations in a five compressor configuration causes pressure losses to be greater and increases overall fuel requirements and equipment compression ratios. System efficiency requirements would be greatly dependent upon purchase agreements, sales agreements, and resulting fuel usage.

Pipeline design criteria would affect the selection of a specific compressor station configuration. Thermal characteristics of pipeline operations would vary for differing compressor station configurations. Greater distances between stations would cause lower pipeline operating temperatures for a five station configuration than for a ten station configuration. Pipeline operating temperatures are an important parameter in design of the pipeline for frost heave, and the ten station configuration has been proposed for TAGS based upon preliminary evaluation of pipeline system thermal characteristics. During detailed design it would be possible to better evaluate the feasibility of a five compressor station system. Since reliability is achieved by providing sufficient facility redundancy, operating efficiency and fuel use are aspects of the project that would be present throughout the life of the facility, and merit careful optimization. The compressor station configuration and the pipeline design are interrelated and must be considered as a single system for purposes of optimization. See Appendix P for a more detailed discussion of Compressor Station locations.

22-7 The FEIS incorporates these recommendations in Subsections 1.10 and 1.11.

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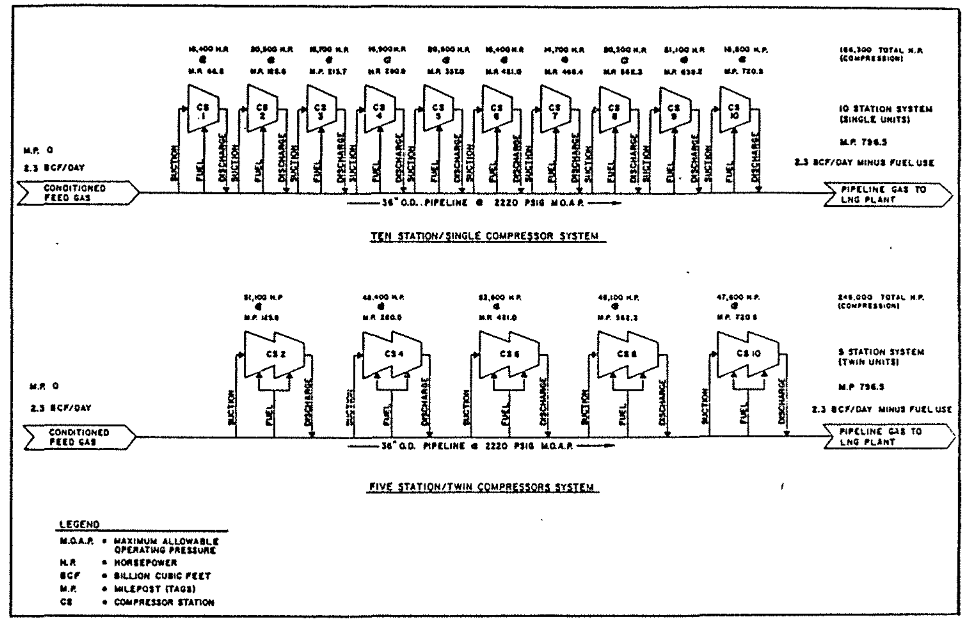

Five and Ten Station Compressor Systems

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22-7 (Contd) permits would be granted during Phase II while design would continue into Phase III. Furthermore, the description of the steps leading to a Notice to Proceed (NTP) outlined in Section 1.11 are oversimplified and do not adequately reflect environmental and engineering design-review processes. The necessity for multiple NTPs in a project of this magnitude should be explicitly stated. This review process is the basis for specific mitigation of adverse impacts.

PROPOSED ACTION AND ALTERNATIVES

The state's concerns with this section are discussed below with detailed recommendations found in the enclosure.

A. <u>Project Description</u>

22-8 The Project Description refers to ten compressor stations. Yet, in the Introduction, the DEIS discusses the option of five larger compressor stations. Throughout the DEIS reference is made to this option, but it is not included in any discussions. The merits of fewer compressor stations deserves further discussion. The DEIS should examine all reasonable alternatives objectively (40 CFR, Parts 1500-1508). There are social, economical, engineering, and environmental differences in the five-station "alternative" that remain unevaluated in the DEIS.

22-9 The DEIS states that compressor station locations were selected to satisfy both engineering and environmental concerns. More rigorous discussion and evaluation should be included for each proposed compressor station site chosen and, for those sites where we have identified environmental concerns, why alternative sites were not selected. For example, Trans-Alaska Pipeline System (TAPS) is frequently in an above-ground mode until it reaches the Richardson Highway at Milepost 63 south of the proposed TAGS Compressor Station 10 location. The DEIS states that refrigeration may only be required at stations 1 through 8. The DEIS does not address the environmental consequences of NOT chilling the gas south of Compressor Station 8 based on geotechnical information available. Not only will there be concerns with pipeline integrity, but environmental and public safety issues are also involved when thawing unstable soils.

22-10 Lastly, the description of compressor station locations needs to at least describe the proximity of TAPS pump stations and proposed Alaska Natural Gas Transportation System (ANGTS) compressor stations and whether co-use could

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22-8 See response to Comment 22-6.

22-9 Comment accepted and FEIS incorporates recommendation in Appendix P.

22-10 As stated in response to Comment 22-6, the criteria for compressor station locataion must include a number of factors, particularly important being optimization of system hydraulics which relates to system efficiency. Safety considerations are another factor, even if an existing pump station or an authorized ANGTS compressor station were located in the same vicinity, project design criteria would require a safety distance between critical facilities. Such a distance normally would preclude the joint use of existing facilities. Each location would still require the same size work area, gravel volumes for pad, access and so forth. It is not reasonable, practical or necessarily a safe practice to co-locate compressor statons/pump stations adjacent to one another.

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22-10 (Contd) limit impacts to a smaller area or if it is preferable to separate them for safety reasons.

22-11 The state commented during the scoping process for the TAGS Preliminary DEIS (PDEIS) that the DEIS needed to more adequately identify environmental impacts associated with construction or operation of the component facilities encompassed by the project. Table 2.2.1-1 is a good example of where this information could be included. The table should detail acreage to be disturbed beyond what is already disturbed along the proposed alignment. The table headings could be broken into the following: which component-facilities are already existing and proposed for use, which require an upgrade of existing sites, and which require new construction. A description such as this is essential for evaluating the extent of impact and the mitigation that might be appropriate.

22-11 Table 2.2.1-1 reflects the newly disturbed areas for the TAGS project for both construction and operation.

22-12 The discussion of pipeline location in the proposed action is generally adequate. However, to clarify, we suggest adding a statement that the TAGS proposed route is generally aligned with the already constructed TAPS with deviations to the west on the North Slope and in the Galbraith Lake and Fielding Lake-Summit Lake areas.

22-12 Comment accepted and the FEIS incorporates recommendations in Subsection 2.2.1.2.

B. Pipeline and Compressor Station Construction

22-13 Discussion of construction must also include an analysis of stability considerations and off-site environmental effects as well as pipeline integrity and impacts on other facilities. The discussion in Section 2.3.2 (pages 2-18 to 2-23, DEIS) is predicated on pipeline integrity and not environmental concerns. Environmental criteria for cut-fill slopes, for example, are necessary (Section 2.3.2, Enclosure). Section 2.3.3.1 (pages 2-24, DEIS) should include discussion on the fact that: 1) temporary stream diversions may be required for pipeline installation, and 2) timing constraints may be imposed to avoid conflicts in resident and anadromous fish streams.

22-13 Comment accepted and the FEIS incorporates recommendations in Subsection 2.3.3.1.

22-14 The pipeline construction section needs a brief geotechnical discussion on how the exact, site-specific alignment will be chosen prior to ROW preparation (page 2-16, DEIS).

22-14 The selected routing for the TAGS pipeline, to the extent possible, meets intended project criteria. The "exact site-specific alignment" would be finalized during the detailed design phase when mile-by-mile geotechnical investigation and characterization are completed. During the detailed design phase, emphasis would be placed on minimizing field design changes due to unexpected geotechnical and environmental conditions encountered in construction. In areas where complex geotechnical conditions are expected, an additional final design confirmation program would be conducted prior to construction.

The section on special construction areas discusses those areas identified by the applicant along the proposed alignment that may require specific construction

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consideration. During the scoping process, the state expressed concern that other minor route deviations had not been fully explored and evaluated in the PDEIS. We request that the FEIS discuss alternative routing in a number of areas for impacts on the physical, environmental, recreation, and fish and wildlife resources. These areas include, but are not limited to, Sagwon Bluffs, Slope Mountain, Grapefruit Rocks, the upper Gulkana River, Hogan Hill, Little Tonsina River, and the Canyon Slough Complex.

22-15 Also, the DEIS has not examined an alternative to the proposed TAGS route crossing Phelan Creek by using the ridge route that TAPS currently uses. Another minor route deviation not discussed is using the existing Yukon River bridge pipeline crossing.

22-16 As discussed in our comments on project description and compressor station location, further examination of other compressor station site alternatives is warranted. Compressor stations 1, 9, and 10 may not be optimally located to satisfy environmental concerns, and the locations are not justified by other criteria. In fact, Compressor Station 9 may off-set mitigative measures previously required of Alyeska by the federal government for TAPS. TAPS was required to mitigate impact to caribou migration by constructing a "refrigerated-burial" caribou crossing immediately south of the proposed Compressor Station 9. There may be alternative compressor station sites to avoid these conflicts and protect the sensitive environmental areas identified. The FEIS should include a discussion and comparison of alternative sites.

C. Mitigative Aspects of the Proposed Project

22-17 The mitigative measures discussed in an EIS must cover the range of impacts of the proposal. They must be considered even for impacts that by themselves would not be considered "significant" (40 CFR, Sections 1402.14(t), 1502.16(h), 1508.14.). With this in mind, the state offers the following recommendations to improve the discussion found in Section 2.8.(page 2-53 to 2-57, DEIS). In order for the mitigative measures listed in this section to be adequate to address environmental concerns, criteria should be added that incorporate avoidance of sensitive terrestrial and aquatic habitats to prevent or minimize adverse effects on major fisheries (Section 4.2.1.9.17, Enclosure), recreation and timber resources of the state. As stated previously, the proposed TAGS route and proposed compressor station

22-15 See State comment 22-28 for additional clarification on the intent of Comment 22-15. Chapter 4 at Subsection 4.2.19 (Areas of Special Concern Along the TAGS Alignment) of the DEIS discusses the environmental consequences associated with the proposed TAGS project alignment. Seven of these were identified by the applicant in the project description (see DEIS at Subsection 2.3.4, p. 2-30 through 2-42) because of special engineering constraints, environmental sensitivities, or land-use conflicts associated with the construction and operation of two or more large-diameter pipelines. These seven areas are: Atigun Pass, Sukakpak Mountain area, Yukon River Crossing, Moose Creek Dam, Phelan Creek, Keystone Canyon and the TAPS oil terminal at Valdez. Each of these, with the exception of the TAPS oil terminal (which is an engineering concern) is discussed in the DEIS at Subsection 4.2.19, p. 4-91 through 4-99: Sagwon Bluffs, Toolik Lake, Slope Mountain, Galbraith Lake, West Fork Atigun River, Snowden Mountain, Nugget Creek, Grayling Lake, Jim River, Grapefruit Rocks, Chatanika River area, Salcha River area, Summit Lake/Upper Gulkana River area, and Blueberry Lake State Recreation area. The FEIS has been revised to include a discussion about the Hogan Hill area, and about the Canyon Slough complex. Supplemental information developed in response to the general issues in Comment 22-31 also is reflected in the appropriate sections of the FEIS.

22-16 As stated in Appendix P, compressor station locations were selected to optimize pipeline hydraulics, system efficiency and reliability, hydrologic conditions, and site access, as well as with consideration of the environmental conditions. This response identifies optimum locations and why such locations could not be used.

The FEIS discusses in Subsections 4.2.5 and 4.2.14 the environmental issues associated with Compressor Station Number 1. Further, the U.S. Fish and Wildlife Service indicated in Appendix B that with the proposed mitigation, the location of the station should not affect the continued existence of the peregrine falcon.

The location of Compressor Station Number 9 is indeed close to the TAPS refrigerated-buried crossings. The documented use of those crossings by caribou was published by Carruthers, et al. (1984). The concern expressed that the special TAPS crossing, installed at considerable expense and shown to be effective (Carruthers et al. 1984), might be rendered less useful by the proximity of the compressor station does not imply cumulative impacts. It is precisely because the crossing is effective that a concern is raised. We believe there is merit in this concern. Carruthers et al. (1984) indicates that the special refrigerated burials were used by 27% of the 7900 caribou documented to have crossed during surveys over a 3-year period. The herd at the time numbered nearly 25,000.

The location of Compressor Station Number 9 may not be optimally located to satisfy environmental concerns because of its location in an important migration corridor of the Nelchina Herd. As part of the response to Comment 22-9, YPC admits that this location is approximately 20 miles south of the optimum hydraulic location, but the site takes advantage of the only significant bedrock exposure between Paxson and Glennallen. Due to the potentially high frost heave conditions within the Copper River Basin area, the site allows for higher operating temperatures in the Tonsina area. YPC further states that locations north of Hogan Hill with bedrock conditions will be considered during detailed design phase if the current site proves to be environmentally unacceptable.

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RESPONSE

22-16 Compressor Station siting has been identified by BLM as an element of the TAGS project where development of comprehensive plans and/or programs will be required in the next tier of planning by YPC (see Table 4.8-1). These compressor station plans and/or programs will consider: overall system operating reliability, frost heave, noise, air quality and fish and wildlife (see Table 4.8-2). An additional mitigation measure also required for TAGS final route selection, facility placement, and construction in environmentally sensitive areas is discussed in Subsection 4.2.19 (see Table 4.8-2). Compressor Stations 1 and 9 respectively are within areas discussed at 4.2.19.2 and 4.2.19.19. For additional discussion about the Nelchina Caribou Herd, see response to Comments 22-41, 22-42, 22-54, 22-278 and 22-282.

The location of Compressor Station Number 10 is located in the previously impacted Tonsina Camp. During construction, the existing camp pad would be used for two construction camps--one for pipeline Section 6 construction and one for construction of Compressor Station Number 10. Use of this area would reduce perimeter use and impacts to other locations in the vicinity. This location also provides an adequate safety buffer from TAGS Pump Station Number 12 which is located approximately 0.5 miles southeast.

22-17 The mitigation measures identified by YPC in Subsection 2.8 of the DEIS have been relocated to Subsection 4.7 of the FEIS and are now in a combined discussion along with agency proposed mitigation.

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22-17 (Contd) locations have not been fully examined to the point where comparative environmental impacts are identifiable.

22-18 The mitigative goals should explicitly state an intent to: (1) minimize negative impacts and (2) promote positive impacts of the project. Although this may be implied in the goals stated in the DEIS, we encourage it be more explicit. This is in keeping with YPC's goal of preventing or mitigating major impacts, which in Table S-2 (page S-5, DEIS) includes mitigating socioeconomic and subsistence impacts, both of which are essentially human dimensions. In order to assist the BLM and USACE in revising this DEIS to address this concern we have provided in the enclosure a list of specific criteria to be added to the section on mitigation (Section 2.8.3, Enclosure).

D. Discussion of "No-Action" Alternative

22-19 The National Environmental Policy Act (NEPA) requires an analysis in the DEIS to "include the alternative of no action." (40 CFR, Section 1502.14(d)). "No action" means the proposed activity would not take place, and the resulting environmental effects from taking no action must be compared with the effects of allowing the proposed or the alternative action to go forward. Where a choice of "no action" would result in predictable actions of others, the consequence of the "no action" alternative should be included in the analysis. The "no action" alternative described in the TAGS DEIS may have implications on other actions such as ANGTS project, gas injection for Prudhoe Bay oil recovery, existing separation and marketing of gas liquids, and net revenue to the state from this and other projects. These interactions should be explored and discussed in Section 2.9.5.

AFFECTED ENVIRONMENT OF THE PROPOSED ACTION AND ALTERNATIVES

The state's review of Section 3 includes comments on the following sections: land use and ownership; meteorology and air quality; liquid, solid, and hazardous wastes; physiography, geology, soils, seismicity, and permafrost; surface and ground water; fish; vegetation and wetlands; wildlife; recreation; and, subsistence.

A. Land Use and Ownership

22-20 We recommend two additions to the DEIS discussion of land use patterns and ownership. The DEIS needs a more accurate

RESPONSE

22-18 See response to Comment 22-17. Subsection 4.8 of the FEIS has been expanded to reflect this comment.

22-19 The discussion of the "No Action" alternative has been expanded.

The "No Action" alternative, as viewed in the EIS would have no effect on ANGTS. ANGTS is an authorized project which would be constructed when the market conditions make it a viable project. Certainly natural gas is used for enhanced oil recovery, but other methods are available such as the waterflood program or the injection of CO_2. The existing ARCO central gas facility presently separates natural gas liquids for injection into the TAPS line, this process would continue whether or not TAGS were constructed. The state would defintely not benefit from its 12.5 percent royalty ownership of the natural gas if a "no project" alternative occurred. The "No Action" alternative discusses these points.

22-20 The maps found in Appendix F were used primarily for descriptive purposes. Since the site specific alignment has not been surveyed, only a gross estimate could be made at this time. The general ownership conditions along the route are 50 percent federal, 45 percent state and 5 percent Alaskan Native or other private holdings. The various plans cited were incorporated into Subsection 3.2.3.2.

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RESPONSE

22-20 (Contd) description of ownership along the TAGS route and this description should be supplemented by maps of a larger scale. Maps found in Appendix F are unreadable and inaccurate making it difficult to discern ownership patterns. Ownership patterns affect management intent and potential mitigative measures. Plus, land use patterns may affect the alternatives proposed. The description of land use plans also warrants further discussion and revisions as follows. All of the existing and draft land use plans should be listed with correct titles and respective agency jurisdiction from Prudhoe Bay to Valdez. These are: North Slope Borough Comprehensive Land Use Plan, the North Slope Borough Coastal Management Program, Utility Corridor Draft Resource Management Plan (Federal--BLM), Fairbanks North Star Borough Comprehensive Land Use Plan, Tanana Basin Area Plan (State--DNR), Tanana Valley State Forest Management Plan, Delta-Salcha Area Plan, Copper River Basin Area Plan (State--DNR), Delta and Gulkana Wild and Scenic Rivers Plan, Draft Prince William Sound Area Plan (State--DNR), City of Valdez Comprehensive Land Use Plan, and Valdez Coastal Management Program. Other approved plans or studies include: Corridor Management Framework Land Use Plan and Denali Scenic Highway Study (Federal--Alaska Land Use Council). The DEIS should note that all future proposed land actions such as TAGS must be consistent with these plans or inconsistencies should be described in the DEIS.

22-21 The DEIS discusses the potential environmental impacts only on areas north of the Yukon River, on federal lands or within areas of critical environmental concern (ACEC's) as identified in federal planning documents. An examination of impacts on all lands along the proposed route regardless of ownership must be included.

B. Meteorology and Air Quality

22-22 The sources (citations) or the data used to determine the environmental consequences on meteorology and air quality from the proposed project and alternatives need to be included to provide credibility for this issue.

C. Liquid, Solid, and Hazardous Wastes

22-23 This section states that "long-term disposal sites north of Fairbanks are under review by the state, BLM, and the North Slope Borough." Define "under review" or explain this statement in the FEIS. There are no TAGS solid waste disposal sites under review by the state, nor any sites

22-21 Regardless of ownership, all areas having special value should be identified and evaluated if they might be affected by TAGS. Such areas are discussed in the FEIS in Subsections 3.2.15 and 3.3.15 and throughout pertinent sections of Section 4 (see Subsection 4.2.19 for a summary). These special areas also are recognized in Subsection 4.8. ACEC's are formal designations for lands under BLM jurisdiction. Usually, they are developed through the RMP process such as that for the Utility Corridor north of the Yukon River. At this time, there are no completed ACEC's associated with TAGS (see response to Comment 22-151 for additional discussion).

22-22 As stated in the DEIS and with revised data in the FEIS, Dames and Moore, 1986, 1987, and 1988 were the sources of the data and are listed in the References in Section 6.0. At the request of EPA (1988a), Appendix D in the DEIS has been deleted from the FEIS. As noted in the response to Comment 25-4, EPA has reviewed and approved the methodology used to calculate air quality impacts (EPA 1988a). Further, EPA has carefully reviewed the calculations and has determined that the revisions incorporated in the FEIS for air quality adequately evaluate expected impacts from the TAGS project alone and adequately evaluate compliance with NAAQS (EPA 1988b).

22-23 Comment accepted and the FEIS incorporates recommendation in Subsections 3.2.7 and 4.2.7.

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RESPONSE

22-23 (Contd) planned which would be capable of handling the volume of wastes we expect from the the TAGS project. For example, the Trans-Alaska Pipeline (TAPS) project generated on the order of 500 destroyed vehicles, 3,000 batteries, 9,000 to 10,000 tires, 15,000 to 20,000 tons of scrap construction materials, 4,000 to 6,000 tons of equipment components, thousands of used drums, thousands of cubic yards of various camp-related wastes, dozens of prefabricated buildings, and large quantities of unused pipe. Is this the order of magnitude we can expect from TAGS and, if so, how will it be disposed of?

D. Physiography, Geology, Soils, Seismicity, and Permafrost

22-24 Major elements of the affected geological environment as they relate to construction of the project should be discussed. For example, physiography (includes major drainages), bedrock geology, surficial geology (unconsolidated sediments), the occurrence of permafrost, moisture content/thaw stability/susceptibility to frost heaving and the seismic environment should be evaluated. We suggest discussing each element in relationship to each physiographic unit. Plus, a section on geologic hazards should be included.

E. Surface and Ground Water

22-25 Water use is a critical issue related to fish habitat. Over-wintering habitat for fish is believed to be a population-limiting factor on the North Slope, even in the absence of industrial or domestic withdrawals. Because of this, the DEIS analysis of the affected environment should discuss the impacts the "Proposed Action and Alternatives" may have on water use and subsequent impacts to fish habitat. Furthermore, present water sources within economical haul distances of existing facilities are already fully committed. Water withdrawals from Arctic rivers during the winter season are not permitted by state policy. If withdrawals are planned, alternatives need to be identified and evaluated. The DEIS does not address this issue relative to the impacts the availability (or lack of) of water will have on the proposed action or alternatives.

F. Fish

22-26 Table 3.2.11-1 is not up to date and requires substantial revision to reflect current knowledge and remove inaccuracies. We also note that the milepost numbers

22-24 Major elements of the affected geologic environment (physiography, bedrock geology, surficial geology, permafrost, seismicitiy, and other factors) are discussed in Subsection 3.2.8. Geologic hazards, such as permafrost and seismic activity, are also discussed in Subsection 3.2.8. Major drainages are discussed in Subsection 3.2.9 and are shown on Figure 3.2.8-1. A discussion of potential impacts to the geologic environment that could result during the construction as well as the operation of TAGS is presented Subsection 4.2.8.

22-25 Comment accepted and the FEIS incorporates recommendation in Subsection 4.2.9.2.

22-26 The milepost numbers used were those from the original TAGS project description. The alignment will continually undergo revisions, and the critical factor was the identification of the exceptionally productive fish streams along the proposed TAGS route. Not all of these streams would be crossed by the pipeline but may be impacted by other types of construction activity on adjacent lands.

See discussion in Subsection 3.2.11.1 for rationale for using these exceptionally productive streams. Comment 22-183 identifies another 115 fish streams along the alignment in addition to the 104 exceptionally productive streams identified on Table 3.2.11-1. Subsection 3.2.11.1 when it introduces Table 3.2.11-1 indicates that there are more than 200 fish streams along the route. Since the state has compiled the entire list, it along with those identified completes the listing of all fish streams. Table 3.2.11-1 will be revised to accommodate recommendations made in this comment which are adopted by reference in the FEIS. The BLM identified key fish areas in "Zones of Restricted Activity for Protection of Key Fish Access Along TAPS on Federally Administered Lands" (April, 1987).

COMMENT LETTER 22 (Contd)

22-26 (Contd) provided in Table 3.2.11-1 do not match those appearing on the YPC TAGS route maps (1" = 1 mi). The table identifies "most critical" and "least critical time" with no definition of what these terms mean or how they were established. Are they based on spawning occurrence, fish migration, species presence, or some other factor? The rationale should be defined in the table or text in 3.2.11.1 (page 3-46, DEIS). The text should include an explanation that the state will ultimately determine critical time periods for fish streams.

For the area from Summit Lake to Valdez, we have provided extensive suggested revisions to the table. For the remainder of the TAGS route, we have only provided a list of streams to be added to the table (Section 3.2.11.1, Enclosure).

G. Vegetation and Wetlands

22-27 Discussion under the introduction to this section should include Markon (1980) and the system used for ANGTS.

H. Recreation, Aesthetics, and Wilderness

22-28 The Grapefruit Rocks area is state land and has been recommended for future legislative designation as a public reserve in the Tanana Basin Area Plan. Wickersham Dome is within the White Mountains National Recreation Area and should not be mentioned separately. Not only should the Chena Lakes Recreation Area managed by the Fairbanks North Star Borough be correctly identified, but the Chena River State Recreation Area managed by DNR/DCPOR should be included (the two areas should not be confused).

22-29 The text should say what is meant by BLM's reference to the Chatanika and Chena Rivers as Canoe Trails. These rivers are navigable and state-owned.

22-30 Increasing recreational use of the Fielding Lake - Summit Lake area should be mentioned. The Fielding Lake Campground is state-owned. The Fielding Lake area is recommended for future legislative designation as a State Recreation Area in the Tanana Basin Area Plan.

22-31 All federal and state parks, preserves and reserves, wildlife refuges, recreation sites/areas, campgrounds, historic sites, national wild and scenic rivers, existing and future recreation areas proposed in approved land use plans, etc. that are crossed by, or are located in proximity to the TAGS project should be listed in a table.

RESPONSE

22-27 The Markon classification and mapping system is similar to others cited in Subsection 3.2.12. The lumping of wetland types into three categories as used by Markon is not appropriate for this phase of the project.

22-28 Comment accepted and the FEIS incorporates recommendations in Subsection 3.2.15.1.

22-29 Comment accepted and the FEIS incorporates recommendations in Subsection 3.2.15.1.

22-30 Comment accepted and the FEIS incorporates recommendations in Subsection 3.2.15.1.

22-31 Comment accepted and the FEIS incorporates recommendations in Subsection 3.2.15. and 3.3.15.

COMMENT LETTER 22 (Contd)

RESPONSE

I. Subsistence

22-32 The ANILCA Section 803 definition of subsistence presented in the DEIS, Section 3.2.17.1, page 3-75, is not quite complete. The following phrase should be inserted after "family consumption;": "for barter, or sharing for personal or family consumption;". Later in the same paragraph, the correct language is the "State Boards of Fisheries and Game." This should be corrected at various places in the DEIS. Although subsistence uses of resources are discussed in this section, principally in the context of Alaska Natives, such uses also occur among other residents, especially in rural communities.

22-33 Technically speaking, residents of the Fairbanks North Star Borough no longer are eligible to participate in subsistence activities, although at this writing not all regulations governing use of salmon fisheries in the Interior have been modified in accordance with the revised state subsistence law. These changes are expected to be made later this year, at which time Fairbanks area residents who formerly participated in the Tanana River and Yukon River Bridge area subsistence salmon fisheries will qualify for personal use fisheries in those areas.

22-34 Technically it is incorrect to discuss subsistence in the context of "the remaining three communities." The communities discussed in this paragraph (Section 3.3.17.1.2 page 3-76, DEIS) are classified as non-rural by the Joint Board of Fisheries and Game; therefore, hunting by residents of these communities must be conducted under sport-hunting regulations.

22-35 Plus, Cantwell and Summit are in Game Management Unit 13, currently designated as rural by the Joint Board of Fisheries and Game. Residents of these communities may hunt and fish under subsistence regulations. Conversely, Peters Creek, Petersville, and Talkeetna lie in non-rural areas, as currently designated by the Joint Board of Fisheries and Game. Characterizing Cantwell as a railbelt community with a mix of urban and rural characteristics is incorrect. Cantwell has a notable Native population. Both Native and non-Native residents are active hunters of moose and caribou. The best source of subsistence information for Cantwell is found in Technical Report No. 107, published by the Division of Subsistence: Lee Stratton and Susan Georgette, 1984. Use of Fish and Game by Communities in the Copper River Basin, Alaska: A Report on a 1983 Household

22-32 Comment accepted and the FEIS incorporates recommendation in Subsection 3.2.17.1.

22-33 Comment accepted and the FEIS incorporates recommendation in Subsection 3.2.17.4.

22-34 Comment accepted and the FEIS incorporates recommendation in Subsection 3.3.17.1.2.

22-35 Comment accepted and the FEIS incorporates recommendation in Subsection 3.3.17.2.

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RESPONSE

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22-35 (Contd) Survey. See also the ADF&C Regional Habitat Management Guide for the Southcentral Region, which is cited in the DEIS.

ENVIRONMENTAL CONSEQUENCES OF THE PROPOSED ACTION AND ALTERNATIVES

A. Socioeconomics

22-36 A key industry omitted from the analysis yet potentially impacted by the development of TAGS is tourism. The DEIS should evaluate the increasing importance of tourism as an industry which uses the corridor and the communities along the corridor. Plus, TAGS construction may have a "moderate" rather than "minor" (as defined in the DEIS) impact on tourism as a result of construction in such places as Keystone Canyon.

22-37 Increased use of the corridor by the mining industry has also not been addressed for potential impacts from TAGS. Both these industries are important factors in Alaska's economy.

B. Land Use

22-38 Much of the discussion in this section relates to the use of public land. The use of private property along the route as well as third-party interest uses on federal and state land warrants discussion. In order to make a meaningful evaluation of environmental consequences that might result from the TAGS project, baseline information regarding the total amount of disturbance in construction areas should be provided to the reviewer. Statements regarding the restriction of access and the resulting impact are not accurate. Restriction of access to adjacent lands may have severe consequences and is a very important consideration when adjudicating any land action.

C. Transportation

22-39 This section states that existing and planned improvements to the Alaska Railroad will result in a secondary impact of increased rail traffic which, especially during winter periods, will result in "the associated moose kill." The associated moose kill by the Alaska Railroad in its existing configuration in 1986 was over 200 moose. Expansion of the system is expected to increase moose mortality. BLM should expand this section by acknowledging the moose problem,

22-36 During construction we anticipate the following short-term impacts on tourism:

- Increased highway traffic;
- Increased air passenger activity;
- Shortage of hotel and other visitor accommodations;
- Problems hiring and retaining tourism service employees due to the attraction of higher paying pipeline jobs.

However, these impacts should be offset by the following:

- The airlines will likely add more flights; the airline terminal facilities built in recent years should be able to accommodate any foreseeable increase in demand.
- The year-round occupancy rates should be significantly higher, thus increasing bed tax revenues which are used primarily to support tourism promotion and development efforts.
- Today Prudhoe Bay, the TAPS pipeline, and Valdez Marine Terminal are major tourist attractions.
- Improvements in the transportation infrastructure will be of long-term benefit to the tourism industry.
- Increased state and local government revenues from the TAGS project can be used to advertise tourism and finance development projects.

Although we agree that in specific areas such as during the two seasons of construction in Keystone Canyon, there would be "moderate" impacts to tourism, the FEIS must rate the impact for the entire project. When placed in that context, the impacts would be "minor." YPC plans to coordinate its construction schedule to reduce impacts to transportation and tourism.

22-37 We agree that mining is an important use of public lands. The proposed TAGS alignment on federal lands is located principally within the "inner corridor" of a transporation and utility corridor created by Public Land Order 5150 in 1970. The "inner corridor," subject to existing valid mining claims, has since 1971 remained closed to new locations under the federal mining laws. Access to existing mining claims within the "inner corridor" and to mineralized areas on adjacent state and federal areas are recognized as an important factor in scheduling construction activities in or near mining areas. Reasonable access to adjacent public and private lands would be continued. We believe the proposed TAGS project would neither enhance nor supplement existing or anticipated mining opportunities, nor would it detract nor reduce existing or anticipated mining uses on nearby state and federal areas.

22-38 Table 2.2.1-1 (Estimate of Disturbed Area for TAGS) at p. 2-2 of the DEIS presents such estimates for the complete TAGS project regardless of ownership. The FEIS has been strengthened by adding a conceptual footprint and mineral material requirement for a natural gas conditioning plant capable of providing to TAGS natural gas of a quality suitable for conversion to LNG. Base line,

COMMENT LETTER (Contd)

RESPONSE

22-38 detailed information requirements would be developed at the time design criteria are approved. Such detailed information would then be collected during the actual design phase of the proposed TAGS project. Chapter 4 (Mitigation) has been strengthened to reflect this process. The discussion of access in the FEIS has been strengthened to more clearly show the extent of anticipated access restrictions to adjacent lands. TAGS will be a buried pipeline system, therefore, the types of access restrictions observed with the some 250 elevated sections of TAPS are not anticipated to occur with TAGS. Accordingly, we believe the DEIS, at p. 4-17 and 4-18, correctly assessed the effects of the proposed TAGS project on access to adjacent property.

22-39 Moose kills associated with operation of the state owned Alaska Railroad take place in winter when heavy snows cause moose to use the cleared train tracks as travel routes within moose winter range. The majority of the moose-train incidents are concentrated along 70 miles of train track between Wasilla and Talkeetna. The Alaska Railroad and Alaska Department of Fish and Game have been, and are continuing to, seek ways to reduce the number of moose killed by trains. Already investigated and found ineffective were sound emitting devices placed on the trains. Current investigations are focusing on clearing the snow further away from the tracks so there is greater opportunity for the moose to move to the side. Also being studied is the effect of train speed, (C. Grauvogel, ADFG personnel communication 1/26/88).

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22-39 (Contd) addressing existing and potential future traffic volume that might result from TAGS construction-related activities, listing present and expected future moose mortality rates, and providing mitigative options to avoid or reduce this mortality.

22-40 There are many alternatives that could be explored to mitigate road closures that have not been covered by the DEIS. Closures could be scheduled for certain times of the day, alternate access may be provided, or the closures could be restricted to a limited length.

D. Noise

22-41 The proposed location of Compressor Station No. 9 is not "outside the migration route of a portion of the Nelchina Caribou Herd." The location is immediately adjacent to a major migratory-use and overwintering area and within the overall migratory path of a portion of the herd. Because of the significant increase in noise levels during operations (including "blowdown") which can elevate the ambient noise levels of from 15 dBA's to 45 dBA's up to 140 dBA's, alternatives for siting this station need to be explored and discussed in this section of the DEIS.

22-42 As discussed in our comments on compressor station construction and potential conflicts, Alyeska Pipeline Service Company constructed a mechanically chilled "special burial" segment of TAPS, approximately 9500 feet long, that extends to within 1500 feet of the proposed Compressor Station #9 and is intended to pass caribou. To the extent that operational noise from the station operation would be detectable "to about 5000 to 6000 feet," up to 4500 feet of the TAPS caribou crossing could be rendered ineffective. We would characterize such long-term disturbance to caribou migration as moderate, not "minor" as stated in the referenced paragraph (Section 4.2.5.3, pages 4-24, DEIS). We disagree with the conclusions presented in Section 4.2.5.4, page 4-24, DEIS). While we concur that the overall noise impacts of TAGS would be minor, moderate impacts from noise are likely at specific locations (especially at Compressor Station No. 9) along the TAGS route as currently proposed.

22-43 The proximity of Compressor Station 7 to the Salcha River and private property with regards to noise impact should also be discussed. Property owners may consider the impact "moderate" rather than "minor."

RESPONSE

22-40 The operation of the Dalton Highway from Livengood to Prudhoe Bay, since the completion of the Trans-Alaska Pipeline, has shown that the route can safely be used by industry, government and the public. Further, the surface of the highway has been substantially upgraded. The geometric standards for the highway are adequate for safe operations by all users, even during the construction phase of a new pipeline. Public users would likely be discouraged from using the remote portions because construction traffic would cause many inconveniences, such as dust, lack of public facilities, delays and perhaps detours for road crossing constructions in actual work areas.

The project sponsor could request the State to limit travel to industrial traffic only, but it should be understood that such a decision would be for convenience and isn't necessary for the safety of the travelling public.

It should be noted that many areas along the Elliott and Richardson Highways were completely opened to all travellers during construction of the oil pipeline and there were no serious conflicts among user groups.

The Alaska Legislature determines whether to open all or portions of the Dalton Highway to public use. Since the recent planning efforts by the Bureau of Land Management and others feature the recreational potential of the corridor, the State will not further limit travel on the road or public access to corridor lands along the road unless there is a heretofore unforeseen problem with safety.

Plans to mitigate road closures are very site and time specific. Although general guidelines would be developed to accommodate local concerns, plans would likely need to be developed on a case-by-case basis. Information on all the potential road closures is not available at present. Closures would be identified during the detailed design and planning phase, and coordinated with the local authorities and tourism operators to accommodate the peak period schedule requirements.

22-41 See response to Comment 22-16. The EIS identifies that TAGS crosses the migration route of the Nelchina Herd and as stated in the DEIS, Compressor Station Number 9 and the Sourdough Campsite are located at Hogan Hill.

The operational venting or blowdowns of the compressor station would be controlled to occur during non-critical migration periods so that the ambient noise levels during normal operations at the compressor station would not exceed ambient at 5,000 to 6,000 feet as identified in Subsection 4.2.5.3. For additional discussion of the Nelchina Caribou Herd also see responses to Comments 22-16, 22-42, 22-54, 22-278 and 22-282; and for peregrine falcons, see 22-16, 22-67, 22-255, 22-279, 22-285, 22-298 and 22-301.

22-42 The FEIS at 4.2.13.2.1 has been revised to show that construction of Compressor Station 9 would cause a minor to moderate impact due to deflection of the Nelchina Caribou Herd during its annual migration to and from the winter range. The predicted effect of the TAGS project (Compressor Station 9, plus pipeline maintenance) activities during operation would be negligable to minor. Direct habitat loss from the TAGS project through the area used by the Nelchina Caribou Herd would be minor to negligable. (For additional discussion about the Nelchina Carbou Herd see responses to Comments 22-16, 22-41, 22-54, 22-278 and 22-282.

22-43 We agree that on a site specific basis, noise levels could be considered moderate. In the Salcha River location of Compressor Station Number 7, compressor noise should not exceed ambient to any residence located beyond a distance of 6,000 to 7,000 feet except during periodic or emergency venting as discussed in Subsection 4.2.5.3. Noise may be audible at certan points along the river; however, with most people using motor driven boats to reach their property, any noise from the station which could reach the river would be masked.

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E. Air Quality

22-44 The open burning of slash, construction wood, and paper waste is listed as an emission source. Open burning is subject to permit and may not be an option depending on local air quality conditions at any given time. Criteria for open burning and restrictions should be included. The concentration shown for both NO_2 and SO_2 may be too high relative to the new increment standard being promulgated by the U.S. Environmental Protection Agency (USEPA) (due out approximately January 1988). The anticipated outputs may not be acceptable particularly if a compressor station is in proximity to other industrial sources. Also, considering that North Slope operators have recently been encountering sour gas, the emissions for the compressor stations and the Liquid Natural Gas (LNG) facility could be higher than predicted. Based on the modeling outputs for the LNG facility, it appears likely that the NO_2 and SO_2 outputs could be in violation of existing or proposed new increment standards. New standards and whether or not emissions can be in compliance should be explained.

22-45

F. Liquid, Solid and Hazardous Wastes

22-46 Table 4.2.7-1 has no narrative discussing the table content. The headings appear to be mixed up and the final column (Average Daily Wastewater Quantities) (gallons) requires a discussion of how the figures were derived. Further, there is no reference to the volumes of construction wastes and debris which will be generated by the project. Tables 4.2.7-2 and 4.2.7-3 (pages 4-31 and 4-32, DEIS) list large volumes of materials to be stored in 55 gallon drums, yet there is no mention of how drums will be tracked, stored, drained, cleaned, and disposed of (crushed, buried, backhauled, recycled etc.). The discussion on page 4-32 refers to Table 4.2.7-1 as a list of solid wastes to be generated at each camp. However, the table is a listing of liquid wastes. Discussion on how this project relates to others with regards to waste generation is not complete. Waste generation, treatment, and disposal or other environmental aspects of this project deserve a much more thorough description and rigorous examination for environmental consequences. Offsite disposal of liquid wastes from operational compressor stations assumes that approved treatment facilities are available within economical haul distances. It appears that several tanker loads of liquid wastes (depending upon tanker volume and station population) would be generated at each compressor

RESPONSE

22-44 See responses to Comments 13-45, 13-46, and 13-47.

22-45 See responses to Comments 25-4 and 25-6. It should be noted that whether natural gas is "sweet" or "sour," LNG pipeline quality gas, as outlined in Table 2.6-1 of the DEIS, is expected to remain sweet.

22-46 Table 4.2.7-1 was corrected to reflect both wastewater and solid waste produced at construction camps.

The volume of construction waste and debris could not be estimated at this time; however, since the magnitude of the TAGS project is less than that for TAPS, the volume of construction waste and debris would be less than that identified in Comment 22-23 and cited in Subsection 3.2.7.

As stated in Subsection 4.2.7.4, and as would be required in a specific Hazardous Materials Plan, required for approval by the BLM, all hazardous materials and their containers must be properly stored, handled, consumed, and disposed of in accordance with applicable state or federal regulations. This would include the residue remaining in 55-gallon drums.

Detailed procedures for the handling and disposal of hazardous waste would be prepared during the detailed design phase of project development.

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22-46 (Contd) station each week. We believe that the DEIS should realistically evaluate the feasibility of this approach by listing approved disposal facilities and discussing haul distances and frequencies, and expected mitigative costs and benefits.

G. Geologic Environment

22-47 The state has concerns over the sources of mineral materials along the entire TAGS route. For example, there are limited sources of materials in the Copper Valley segment (construction spread 5). The exploration for and development of new material sources may have a significant impact on fish and wildlife resources in this pipeline segment. We request that the FEIS describe the expected impact. The DEIS states that this project facet will be addressed in Phase II (page 4-37, DEIS). It should be noted that this issue is a significant one and will require close coordination with the state to avoid/reduce adverse impacts to fish and wildlife populations.

H. Fish Impacts

22-48 We believe that potential direct and cumulative impacts to fisheries resources have not been adequately explored in the DEIS, in part because a large number of fish streams and potential fish streams were overlooked (see our comments on Table 3.2.11-1, Enclosure). For brevity, our comments on this topic are incorporated into our discussion of cumulative impacts on subsequent pages of this letter, Section M. We request that BLM address these impacts in the FEIS.

22-49 Streams are not normally blocked during stream crossings. Alternatives include temporary diversion, fluming, pumping, or working in flowing water. This section should be expanded to indicate fish passage shall be maintained during stream crossing activities unless otherwise authorized by the State of Alaska Department of Fish and Game.

22-50 Nonglacial streams and lakes rarely experience high turbidity or siltation as a result of natural cycles. Breakup data collected by ADF&G amply demonstrate relatively low natural turbidity in undisturbed systems (nonglacial) even at high discharges. Construction-related siltation is likely to far exceed naturally occurring levels of suspended solids. We see little or no justification for the statement that "most streams and lakes and the organisms therein adjust readily to some level of silt and turbidity."

RESPONSE

22-47 No specific material sites in the Copper Valley segment of construction Spread Number 5 have yet been identified. The identification of specific sites to secure the 5.4 million cubic yards of borrow material would be developed during the detailed design phase. Locations of material sites would be based on consideration of environmental conditions, quality and quantity of material available, access, and haul distance.

22-48 See response to Comment 22-26.

22-49 Comment accepted and the FEIS incorporates recommendation in Subsection 4.2.11.1.

22-50 Stream systems without active glaciers in the drainage basin can become turbid during high flow periods. Examples along the route are the Sagavanirktok and the Dietrich Rivers, where silt can originate from bank erosion. This is particularly true in steep braided rivers because the flood runoff is so rapid. Some streams with low slopes and much storage of water, such as the Gulkana, do not have the large variation between normal flow and flood peaks. This type of stream has much less bank erosion, and therefore, less turbidity. Turbidity during construction would be minimized by preventing runoff from entering the stream. Should construction-related siltation enter the stream, it will not be a chronic problem, but rather one of very short duration (2 to 3 days). See discussion of mitigation measures in Subsection 4.8.

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22-50 (Contd) Research conducted by ADF&G and the Alaska Cooperative Fisheries Research Unit has shown striking biological, physical, and chemical differences between undisturbed streams and those receiving anthropogenic suspended solids. These publications are available from the Alaska Department of Fish and Game and the Alaska Cooperative Fisheries Research Unit.

22-51 This section should be expanded to indicate that, with site-specific ADF&G approval, properly designed and constructed borrow sites in or adjacent to anadromous fish streams may provide additional rearing habitat as mitigation for on-site or off-site habitat losses. The state does not intend to permit construction of instream structures that significantly "impede upstream migration" of fish or result in significant "reduction of rearing habitat" for anadromous fish.

22-52 This section should also include a discussion on how BLM intends to require development of a mining plan pursuant to their grant of ROW. The plan would address material sources, quantities to be mined at each site, opportunities for multiple use of the material sources, future site expansion, mitigation of the environmental impacts of development, erosion control, water-quality control, techniques for dewatering of pits, and restoration procedures, and will be used to control site development in a sound environmental manner.

22-53 In addition, the potential thermal impacts of the frost bulb created by the buried, chilled gas line are only addressed in terms of the mitigation to prevent or reduce the effects of icing. What water quality impacts could be expected in the winter where the line parallels rivers and streams? Possible volume reductions and subsequent thermal effects could change water quantity and/or quality to the extent that over-wintering habitat could be severely disrupted. Even though some impacts may be able to be mitigated through insulation and deep burial of the pipe, during the three year period after placement, and before the line is activated, could frost heave potentially negate preventive measures taken during construction? BLM should provide a thorough analysis of these impacts in the FEIS.

I. Wildlife

22-54 In addition to impacts expected from operation of Compressor Station No. 9 at its currently proposed location, colocation

RESPONSE

22-51 Comment accepted and the FEIS incorporates recommendation in the expanded mitigation Subsection 4.7.

22-52 General information on mineral material required for each construction spread for the proposed TAGS project is shown in the DEIS in Table 2.3.2-1 at p. 2-20. The detailed information required to approve mineral material site location, quantities to be mined at each site, opportunities for multiple-use, future site expansion and related data will be developed during the design criteria phase. Requirements for comprehensive plans and programs (including schedules) for material exploration and extraction have been added to the FEIS, Chapter 4.8 (Mitigation).

22-53 See response to Comment 27-8.

22-54 The concern expressed regarding "displacement of caribou from winter ranges" is grossly overstated; the area affected is very small in relation to the herd's overall winter range and the effect is thus negligible to minor during operation. Significant range displacement would occur only if migratory movements across the TAGS-TAPS-Richardson Highway corridor ceased or were curtailed significantly. Nelchina Herd caribou have crossed the highway for decades and have crossed the TAPS corridor since its construction; there is no reason to think they would refuse to cross the TAGS corridor, especially in view of the fact that the entire line would be buried. The primary TAGS impact will be deflections of migratory movements on a localized basis. This impact will be minor to moderate during construction, depending on location of facilities and activity scheduling; minor near Compressor Station 9 during operation; and negligible away from the compressor station during operation. Carruthers et al. (1984:i) stated that "over 80 percent of the Nelchina caribou herd crossed TAPS each fall and spring in 1981 to 1983, based on an estimate by Ken Pitcher of ADF&G." Of the sample of 7,905 caribou they documented to have crossed TAPS during their study, 71 percent did so in areas away from special crossing structures (refrigerated burials, sag bends, elevated big-game crossings, but not including sections buried for geotechnical reasons).

We agree that it is worthwhile to consider the combined effects of the two facilities being located in the Hogan Hill area. The primary impact of locating the two facilities together would be an increased amount of human activity, traffic, and construction noise in a relatively small area. This locaton, near the TAPS refrigerated-burial crossings would likely decrease use of those crossings during spring and fall migrations. In such an event, caribou that were deflected from the buried crossings would most likely parallel the route until they reached a less disturbed area in which to cross. The results of the study by Carruthers et al. (1984) indicate that the above-ground portions of TAPS do not pose a barrier to the Nelcnina Herd. Therefore, the State's concern that deflection of caribou from the buried crossings to above-ground portions of pipe "will adversely affect" caribou migration and result in "restriction of migratory movements" is overstated. At most, deflections will result in shifts in the locations at which caribou cross TAPS, not in failure to cross TAPS. Similarly, as long as TAGS construction activities are scheduled to leave some stretches of the proposed route undisturbed at any given time in the general area of Hogan Hill during known migration periods, then additional deflections of caribou at the TAGS corridor would not result in major disruptions of migratory movements.

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22-54 (Contd) of a construction camp with its attendant activity level will adversely affect migration of the Nelchina Caribou Herd. As discussed in our comments on compressor stations, deflection of migrating caribou southward from Hogan Hill would reduce the effectiveness of the TAPS refrigerated caribou crossing that extends to within 1500 feet of Compressor Station No. 9. If camp-induced disturbance extended for several miles, caribou could be deflected into the above-ground portion of TAPS resulting in restriction of migratory movements. We also note that location of a construction camp in this area will concentrate traffic on the Richardson Highway which may produce cumulative effects on wildlife above those individually associated with TAPS, the pipeline right-of-way, the construction camp, and the compressor station. We do not believe that either of the latter two facilities should be located as proposed but feel that the construction camp poses a greater threat to caribou movement in the short term. We request that the FEIS include an analysis of impacts expected from colocating Compressor Station #9 and Sourdough Creek Construction Camp at Hogan Hill including interactions with TAPS mitigation, cumulative effects, and displacement of caribou from winter ranges.

22-55 Mountain-top communication repeater sites should be evaluated with regard to any effects on sheep and goats. Also, this section should be expanded to evaluate the possibility of disruption of sheep and/or goat movements to mineral licks and seasonal ranges across the TAGS route. We note that the proposed TAGS route passes near or intersects a sheep mineral lick at Milepost 145. If construction occurs and disrupts movements during traditional movement periods, then animals could be prevented from reaching important seasonal range or mineral licks. Construction activities near recognized travel routes could be scheduled to minimize disruptions of movements and such mitigation should be discussed in the DEIS.

J. Subsistence

22-56 The potential direct and indirect effects of the TAGS project on subsistence uses are clearly delineated in this section. However, we do not agree with the statement asserting that the duration of impacts will not exceed two years. In fact, recovery of any affected fish or wildlife population(s) could take several years, while the infrastructure remaining after TAGS construction could have long-term term effects on species movement patterns. We

RESPONSE

The primary impact of locating the compressor station and construction camp together would be a concentration of traffic, as noted in the State's comment. Increased traffic will be an unavoidable effect anywhere during construction, and the potential for wildlife mortality from collisions with vehicles will increase correspondingly, as will the potential for localized deflections of caribou movements across the Richardson Highway. However, there may be no advantage to separating the two facilities and locating them in different areas because the amount of highway traffic actually could increase as personnel moved between the two sites; the length of highway experiencing these increased traffic levels would also increase if the facilities were separated. To mitigate traffic impacts, consolidation of the two facilities may be preferable.

It is further noted that between 1972 and 1988 the Nelchina herd has increased from 8,000 to 30,000 animals. The Alaska Game Board has raised the 1988-89 allowable sport and subsistence harvests from that herd by 40 percent. The 40 percent increase was reported to be opposed by ADF&G biologists because it was not large enough and there is concern the Nelchina herd was growing too fast (The Anchorage Times, 3/20/88 pp. B-1 and B-5). For additional discussion of the Nelchina Caribou Herd, see responses to Comments 22-16, 22-41, 22-42, 22-278 and 22-282.

22-55 The proposed option for the TAGS project is to use existing communications facilities already existing along the entire corridor. Should existing facilities not be available for use by TAGS, Figure 2.6-1 provides a typical diagram for a communications site. No sites have been selected for such facilities. Sites selected for such facilities would receive specific engineering and environmental review which would evaluate any effects to sheep and goats. The option of using a fiber optics communication system also is being considered. The extent, if any, that line-of-sight communication requirements might be reduced is unknown. For the purposes of this FEIS, it is assumed a worst-case analysis approach would require continued use of mountain/ridge top communication sites.

Locations where specific environmental restrictions may be required would be identified early in the planning process so that design and scheduling could be coordinated to comply with specified restrictions.

22-56 Special attention has been given by BLM, USACE and YPC to avoiding undue and unnecessary effects to fish and wildlife habitats and populations associated with the TAGS project. These range from avoidance, to constructon scheduling, to special construction/engineering features (see Subsection 4.8 and Tables 4.8-1 and 4.8-2).

Evaluations and discussions in the FEIS have concluded that most impacts to local and regional fish populations could be prevented or avoided. There is no indication that anadronomous fish populations would be significantly reduced. Mitigation measures such as restricting access where new access is developed for TAGS would further reduce pressure on fish. Setting of bag and size and length of season for sport or commercial fish harvests, if deemed necessary by the appropriate stab entities, would also present any widespread or long-term effect of subsistence use of fish resources (see 4.2.11, 4.2.17, 4.7.11 and 4.17 for additional information).

Similar conclusions were reached for wildlife habitats and populations associated with the TAGS project (see 4.2.13, 4.2.17, 4.7.13 and 4.7.17 for additional information).

It should be further noted that the impacts on subsistence uses and subsistence resources contained in this FEIS has been evaluated on a "worst case" basis; with the main factor being the influx of construction workers that would also qualify as a local resident for subsistence purposes (see response to Comment PH7-2).

COMMENT LETTER 22 (Contd)

RESPONSE

22-56 (Contd) request that BLM state why impacts will only last two years and why infrastructure effects are discounted.

22-57 We believe it is important not to view potential TAGS subsistence impacts in isolation of other potential or actual development activities. The cumulative effects on subsistence of pipelines, roads, oil and gas exploration and development and related activities are potentially very significant to the North Slope and other corridor communities. These cumulative effects should be explored by the BLM in the FEIS.

In addition, we believe the potential is great for impacts on subsistence to extend well beyond the TAGS corridor. This issue has not been discussed in the DEIS, but we have seen evidence of its occurrence. For example, the Yukon River Bridge area already attracts a large and possibly growing number of non-local residents who hunt and fish in an area important to local residents. The Haul Road thus facilitated access to the Yukon River, from which even more areas can be reached. Increased competition in the TAGS Corridor area related to expanding use of the Dall River fishery by non-local residents has already occurred from increased access facilitated by the Haul Road. This is also a major concern to Stevens Village residents (see article in Fairbanks Daily News-Miner, 8-23-87). The TAGS project could exacerbate this situation or contribute toward its replication in other areas.

22-58 Any restrictions imposed on public use of areas in or near the corridor during or after construction, whatever their purpose, must be viewed as potential restrictions on subsistence uses. Whether or not local pipeline workers qualified for subsistence uses or sought to establish rural residence only partially addresses the real issue. We request that BLM address use restrictions in their analysis of subsistence issues, as they are affected by TAGS, in greater detail.

22-59 Communities like Glennallen may be susceptible to substantial population growth if they emerge as service and supply centers for the TAGS project. This could result in the Boards of Fisheries and Game re-evaluating the community's rural status. Loss of this designation likely would have more far-reaching impacts than would the long-term gains to the community of TAGS-related growth. We view this as a significant long-term impact on residents who have a demonstrated long-term reliance on fish and wildlife

22-57 The cumulative impacts associated with the project are discussed in Subsection 4.7.17. See Comments to 9.1, 9.6, PH5-4 and PH5-5.

22-58 Comment accepted and the FEIS incorporated recommendation in Subsections 4.2.17.3 and 4.2.17.4. During construction of the TAPS project, regulations providing the ADFG with the ability to curtail sport harvests in favor of subsistence harvests by eligible rural residents did not exist. The Department now has that ability, as an alternative to closing the corridor to all harvest of fish and wildlife.

22-59 Comment accepted and the FEIS incorporates the recommendation in Subsection 4.2.17.7. Under certain conditions TAGS construction workers would qualify for subsistence as a "rural resident" in places like Glenallen. The effect of long-term growth in Alaska is more likely to be concentrated in communities such as Fairbanks, Anchorage and Valdez and less likely for smaller communities such as Wiseman, Livengood, and Glenallen.

COMMENT LETTER 22 (Contd)

RESPONSE

22-59 (Contd) resources in their economy. An analysis of socioeconomic impacts from loss of rural status should be included in the FEIS.

K. Anilca 810 Evaluation (Appendix L)

Referring back to Appendix L, we wish to comment briefly on the ANILCA 810 Evaluation. Our comments that follow are directed at technical corrections or improvements to the 810 Evaluation.

22-60 We request that BLM incorporate these points into the FEIS. Table 2 should include a double asterisk after North Pole and Delta Junction, since they were also determined not to be rural communities by the Joint Boards. In Section 2.2.2 (page L-8, Appendix L), we believe that Minto probably uses the TAGS corridor area as much as do some of the other listed communities. The listing of subsistence resources utilized on page 3-77 (with our recommended additions) is more comprehensive than those presented in the 810 Evaluation. Section 2.2.4 (page L-9, Appendix L), should note that a winter subsistence caribou hunting season does exist in the Copper River area.

22-60 Comments accepted and the FEIS incorporates recommendations in Appendix L, Table 2, and in Subsections 2.2.2, and 2.2.4. Associated recommendations have been incorporated in Subsections 3.2.17.3 and 3.2.17.5.

22-61 While we agree with the three project impacts listed in Section 2.3 (pages L-10 to L-12, Appendix L), which can affect subsistence resources, we believe another type of impact merits discussion--particularly for the Glennallen area. We are referring to the rural designation assigned to Glennallen and other Copper River Basin communities by the Joint Boards, after considerable discussion and debate. As we have pointed out, the potential that the economy of Glennallen could change markedly during TAGS construction is high, and could result in reclassification of the community as a non-rural place. Economic change in the community prompting such a designation by the Joint Boards would not necessarily benefit all segments of the community, but the non-rural status would have a major impact on hunting and fishing patterns in the community. We believe this topic warrants further consideration because of its potential far-reaching effects on the Glennallen community and economy.

22-61 See response to Comment 22-60.

22-62 In Section 3.1, whether or not significant restrictions to subsistence uses would occur in the North Slope Borough, we must point out that little information has been presented which adequately describes the relationship of lands in and near the TAGS Corridor to other areas used for subsistence

22-62 Comment accepted and the FEIS incorporates recommendation in Subsection 3.2.17.2.

COMMENT LETTER 22 (Contd)

Jules Tileston - 20 - November 19, 1987

22-62 (Contd) purposes by North Slope communities. Access restrictions, for example, could limit the ability of Nuiqsut hunters to use areas seasonally important located east of the TAGS Corridor.

22-63 As has been noted previously, not all Nenana Corridor communities listed in Section 3.2 have rural status for purposes of the state subsistence law. Further attention may be given to the status of some communities at a spring 1988 Joint Boards meeting.

We appreciate the attention given in this document to subsistence uses by rural communities located in and near the proposed TAGS Corridor. We also believe that additional attention must be given to subsistence use patterns in these communities in order to adequately evaluate how they might be affected by construction and operation of a new pipeline. This will facilitate the BLM and state efforts to develop the appropriate mitigative measures. We appreciate the DEIS acknowledging that this project will result in significant

22-64 restrictions to subsistence uses in some areas. However, the DEIS has not presented evidence that would lead us to conclude that potential negative effects will be only of short-term nature or that they will be offset by the injection of pipeline-related cash and jobs into the community economy. The FEIS must examine the potential negative effects in this light and state that if impacts are not of a short-term nature, what long-term impacts are expected.

L. <u>Areas of Special Concern Along TAGS Alignment</u>

22-65 The state believes that the two proposed crossings of the Little Tonsina River are very sensitive due to important fisheries and recreational values and require discussion in this section (pages 4-91 to 4-92, DEIS). Alternative placement of Compressor Station No. 10 and pipeline realignment could eliminate these crossings.

22-66 The state further believes that the Canyon Slough alignment is unacceptable based on the area's importance for fish production. The impacts of this alignment requires further discussion in the FEIS.

22-67 The state supports BLM and USACE implementation of peregrine falcon mitigative measures described in Appendix H of the DEIS. We are concerned, however, with the lack of correspondence between Appendix H and the

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22-63 Comment accepted and the FEIS incorporates recommendation in Subsection 3.3.17.1.

22-64 Comment accepted and the FEIS incorporates recommendation in Subsections 4.2.17.5 and 4.2.17.7.

22-65 See response to Comment 22-16 and Appendix P.

22-66 See response to Comment 22-15, 22-16, and Appendix P.

22-67 The FEIS has been revised so it conforms to the information contained in the DEIS at Appendix H (Biological Assessment for Endangered Species, p. H-1 through H-21.) Subsection 4.2.14.2 also has been strengthened to more clearly reflect concerns and mitigation measures intended to prevent long-term or cumulative negative effects on peregrine falcons. For additional discussion of peregrine falcons see responses to Comment 22-279.

COMMENT LETTER 22 (Contd)

RESPONSE

22-67 (Contd) threatened/endangered species discussions in the body of the DEIS. As pointed out in our comments in the enclosure, ambiguities are present in the language of the mitigative measures and in the specific measures applicable to TAGS activities at Sagwon Bluffs. Clarification of these points, correction of several apparent oversights, explicit identification of all areas along the proposed TAGS route that are inconsistent with the mitigative measures, and a clear statement of BLM and USACE intended actions. For example, reroutes at these sites are necessary to integrate Appendix H to the DEIS.

M. Cumulative Impacts

22-68 The orientation of the cumulative impacts section equates the presence of previous disturbance (e.g., the Utility Corridor) with minimal effects of further increments of disturbance (i.e., disturbance of pristine areas is more significant than an increment of disturbance in a previously developed area). Potential direct and cumulative impacts to fisheries resources and short-term habitat losses will occur even with the best designed and located stream crossings. Long-term habitat losses and cumulative impacts on aquatic systems occur when elevated concentrations of suspended solids and resulting downstream sedimentation are induced by river crossings. Long-term habitat losses are also associated with drainage structures and channelization. The latter losses are particularly important in terms of cumulative impacts on streams crossed or potentially crossed by highways, the TAPS, the ANGTS, and the proposed TAGS. On small systems, many of which were not identified in the DEIS, the cumulative length of disturbed or constricted channel may represent a proportionately greater habitat loss than on larger systems. Multiple drainage structures may impede fish migration, an important cumulative effect. As previously noted, water withdrawal from fish-bearing waters is a cumulative impact that must be discussed. Another cumulative impact is the loss of fisheries habitat, including spawning beds, by multiple river crossings (e.g., two TAPS and two proposed TAGS crossings of the Little Tonsina River). An analysis of cumulative impacts must be oriented toward identifying those increments of disturbance that are expected to significantly affect previously stressed environments. We believe that the cumulative impacts of noise and other construction disturbance (e.g., traffic, clearing) on the Nelchina Caribou Herd, particularly with regard to migratory movements and use of winter range in the vicinity of Hogan Hill, requires more

22-68 Comment accepted and the FEIS incorporates recommendations into Subsection 4.7. We recognize that the DEIS generally equates cumulative impacts with incremental disturbance to areas already disturbed by the presence of the Utility Corridor. We also recognize the difficulties inherent in attempting to identify those increments of disturbance that would be expected to significantly affect previously stressed environments. Fisheries experts have made strides toward identifying threshhold criteria for significant impacts that permit the design of mitigation measures to protect fisheries and fish habitat. Often however, our lack of understanding of these impacts results in mitigation through the avoidance of construction activities during key times of the year, such a spawning times, since we do not often know significant threshhold criteria with a certainty sufficient to ensure resources protection through anything but avoidance. We have therefore modified the fisheries and wildlife cumulative impacts sections to include the additional concerns raised in this comment, but we defer specific impact quantification to future, site-specific studies on a stream-by-stream basis, and we recognize that specific mitigation measures would utlimiately be formulated and required before project construction could proceed. In many instances experiences gained through the actual construction and operation of TAPS over the past ten years provide a very reliable guide as to best mitigation practices. For discussion of the Nelchina Caribou Herd, see response to Comments 22-16, 22-41, 22-41, 22-54, 22-278 and 22-282.

COMMENT LETTER 22 (Contd)

RESPONSE

22-68 (Contd) detailed discussion. With TAGS construction, three parallel, potential impedances to migration will lie perpendicular to the generalized migratory path: the TAPS above-ground pipe with buried, refrigerated caribou crossings at Hogan Hill and Sourdough, the Richardson Highway, and the TAGS ROW. Compressor Station No. 9 and the colocated Sourdough Creek construction camp would significantly add to this disturbance.

The DEIS has not critically examined the cumulative impacts of the proposed TAGS as to whether they simply add to impacts already experienced from TAPS, highways, and the proposed ANGTS, or if they act synergistically. If increased negative impacts are expected from TAGS, can they be mitigated and how? If no additional impacts are expected, the FEIS should state this and explain why.

N. Mitigation Measures

22-69 This section does not identify specific mitigation plan/measures to address environmental consequences of the proposed project and alternatives. The mitigation efforts identified in this section are largely predicated on federal regulatory agency permit requirements. Will BLM require the development of a formal mitigation plan which identifies the total area and types of habitat impacted and which defines specific mitigative actions for any unavoidable impacts?

Pipeline alignment, facility siting, design criteria, operational plans and procedures, and quality assurance/quality control are at least as important as construction timing in mitigation of environmental impacts. BLM should clarify this in the FEIS.

It should not be implied that "mitigation measures proposed by YPC" are the only focus for monitoring. Monitoring primarily includes assurance that governmentally approved designs, plans, and procedures submitted pursuant to the federal Grant of ROW, the State ROW Lease, and agency permit application requirements are adhered to by YPC and includes enforcement of the terms and conditions of the referenced Grant, Lease, and permits.

The remaining comments in this letter are organized by section in the enclosure. These issues are specific comments and examples of our larger concerns discussed in this overview.

On behalf of the State of Alaska, thank you for the opportunity to review this draft Environmental Impact Statement for the

22-69 Comment accepted and the FEIS incorporates recommendations in Subsection 4.8 which has been modified to include Subsection 2.8 of the DEIS and additional mitigation measures.

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RESPONSE

Trans-Alaska Gas System Project. If we can be of any assistance in clarifying these comments, please contact this office. The state looks forward to reviewing the final Environmental Impact Statement.

Sincerely,

Bob Grogan
Director

E.A. Benson

by Elizabeth A. Benson
Project Review Coordinator

Enclosure

cc: Commissioner Brady, DNR, Juneau
Commissioner Collinsworth, DF&G, Juneau
Commissioner Kelso, DEC, Juneau
Jerry Brossia, DNR, Fairbanks
Paul Bateman, DEC, Fairbanks
Al Ott, DF&G, Fairbanks
Rod Swope, Office of the Governor, Juneau

COMMENT LETTER 22 (Contd)

ENCLOSURE
TAGS DEIS

	Section	Para.	Line	Comments
22-70	S.5.7	1	-	The proposed TAGS alignment is proximate to TAPS, the federally authorized ANGTS right-of-way, the existing State highway system, the Haines-Fairbanks military pipeline right-of-way, and major GVEA and CVEA transmission line rights-of-ways within the 796.5 mile transportation-utility corridor.
22-71	S.7.1.2	1	-	Clarify what is meant by the term "entire authorized ANGTS". It should be noted that no state R/W Lease has been issued for ANGTS.
22-72	S.6	1	-	Clarify the statement regarding additional land to be transferred. Some of the land is National Forest and has already been transferred to State ownership.
22-73	1.2	1	2	"project's right-of-way ..."
22-74	1.3.1	1	34-37	A significant portion of this 21-mile distance lies in the Lowe River floodplain and not on bedrock slopes. This merits mention based on expected impacts to anadromous fisheries, particularly in the vicinity of Canyon Slough.
22-75	1.4	1	-	GVEA and CVEA powerlines and Haines Pipeline should be mentioned.
22-76	1.5	2	-	This paragraph does not explain what the referenced memorandum of understanding between the OFI and the BLM has to do with the subject of this section, pipeline compatibility.
22-77	1.9.2	1	4	"detail [TO] <u>for</u> the ANGTS ..."
22-78	Fig. 1.9.3-1	-	-	Heading for <u>Southeast Alaska</u> is missing.
22-79	1.9.4	1	-	It should be clarified here who specifically conducted (and/or concurred with) the evaluation of alternative LNG plant/marine terminal sites within Cook Inlet and Prince William Sound regions.

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22-70 Comment accepted and the FEIS incorporates recommendation in Subsection 5.5.7.1.

22-71 The "entire authorized ANGTS" means the 745 mile pipeline project authorized by the Federal government from Prudhoe Bay, Alaska to Alaska/Yukon Territories border, of which 550 miles, to Delta Junction, would be adjacent to the proposed TAGS alignment. The authorized ANGTS, as discussed in the FEIS, is the federally authorized project. ANGTS has applied for a state right-of-way lease shortly after receiving its Federal authorization. Although it was not specifically stated in the DEIS, it should be noted that no state right-of-way lease has been issued to ANGTS. A statement to that effect is incorporated into Subsection 5.5.7.1.2.

22-72 The proposed TAGS construction site at Anderson Bay has already been transferred to State ownership. However, a portion of the buffer zone remains under U.S. Forest Service management and may or may not be transferred to State ownership prior to construction. Should any portion of the pipeline route or the Anderson Bay facility remain in the control of the U.S. Forest Services, this Federal environmental document will satisfy their NEPA responsibilities.

22-73 Editorial correction incorporated.

22-74 Comment accepted and the FEIS incorporates recommendation in Subsection 1.3.1.

22-75 These additional utilities have been added to Subsection 1.4

22-76 An issue of some concern to the Northwest Alaskan Pipeline Company relates to how the Federal Inspector and the BLM would interact where both ANGTS and TAGS are in close proximity. This relationship is discussed in the DEIS in Table 1.11-1 (Authorizing Agencies, p. 1-19) and at other appropriate places in the DEIS, such as Appendix B (Preliminary Compatibilty Determination), p. B-8 and B-9 wherein the Federal Inspector discusses his role in the proposed TAGS project. This discussion of ANGTS is expanded in the FEIS to more accurately portray the existing status of federal and state decision processes in response to Comments 12-32, 22-3, 22-4, 22-5, 22-7, 22-9 and 22-71. The overall summary approach used in the DEIS at Subsection 1.5 (Availability of ANGTS or TAPS Federal Rights-of-Way for Co-Use by TAGS) is similar to that used at Subsection 4.2.19 of the DEIS (Areas of Special Concern Along the TAGS Alignment).

22-77 Editorial correction incorporated.

22-78 Comment accepted and the FEIS incorporates recommendation in Figure 1.9.3-1.

22-79 Comment accepted and the FEIS incorporates recommendation in Subsection 1.9.4.

COMMENT LETTER 22 (Contd)

RESPONSE

	Section	Para.	Line	Comment		Response
22-80	1.9.4	1	28-29	"Other Prince William[S] Sound and Cook Inlet sites were [TO BE] inferior ..."	22-80	Editorial correction incorporated.
22-81	1.9.4.2	1	3	"Cape Starichkof ..."	22-81	Editorial correction incorporated.
22-82	1.9.4.3	1	19	"and was eliminated ..."	22-82	Editorial correction incorporated.
22-83	1.9.4.5	1	10	"resulting in impacts ..."	22-83	Editorial correction incorporated.
22-84	1.10	7	4-6	The specific "state recreation areas" involved should be identified and the U.S. Coast Guard's use of such areas should be explained.	22-84	As identified in Subsection 3.2.15.1, only one such area, Blueberry Lake State Recreation Site near Thompson Pass would be impacted by the proposed TAGS. The Federal DOT 4(f) requirements relate to designated state park areas. (See responses to Comments 1-1 and 1-2).
22-85	1.11	1	2	"[ANY] the BLM ..."	22-85	Editorial corrections incorported.
	1.11	2	12-13	"at a minimum ..."		
22-86	Table 1.11-1	OMB/DGC		Under the terms of the draft Administrative Order for state oversight of TAGS, DGC will be making consistency determinations during Stage III of the project (e.g., coastal dredge and fill activities not qualifying for abbreviated reviews under the TPP).	22-86	Comments accepted and Table 1.11-1 incorporates recommendation for DGC's action during Phase III.
22-87	Table 1.11-1	ADF&G		We have two additional ADF&G actions and associated "Project Features" for inclusion in the table as follows: NATURE OF ACTION — PROJECT FEATURES Fish and Wildlife Coordination Act Reviews — Placement of Fill in Waters of the United States (Phase II, III, IV) Special Area Permits — Activities in State Refuges, Sanctuaries and Critical Habitats (Phase III, IV)	22-87	Additional ADF&G actions have been incorporated into Table 1.11-1.
22-88	Table 1.11-1	ADEC		The following should be included as required authorizations from ADEC: NATURE OF ACTION — PROJECT FEATURES Short-term Variances — Pipe burial at River Crossings; Fill Placement in Anderson Bay (Phase III)	22-88	Additional ADEC actions have been incorporated into Table 1.11-1.

COMMENT LETTER 22
(Contd)

RESPONSE

Section	Para.	Line	Comment	
22-88 (Contd)			Certificate of Reasonable Assurance (Water Quality)	Discharge of Wastewaters to Waters of the United States (NPDES) (Phase II, III, IV)
			Oil & Hazardous Substances Pollution Control (Permit)	Surface Oiling for Dust Control (Phase III, IV
			Pesticide Control Licensing	Applicator License Applying Pesticides (Phase II, III, IV)
			Food Service (Plan Review/Inspections)	Camps Terminal Compressor Stations (Phase II, III, IV)
			Air Quality Control Permit to Operate	Incinerators Greater Than 1000 Lb/hr Fuel Burning Equipment, Greater Than 100 MM BUT/hr or Greater Than 10,000 HP or 9000 KW Gravel Dryers, Rock Crushers (Phase II, III, IV)
			Water/Wastewater Operator Certification	Water/Wastewater Treatment Facilities at Camps, Terminal, Compressor Stations (Phase II, III, IV)
22-89 Table 1.11-1	ADNR		Should be revised to reflect the following DNR authorizations:	
			NATURE OF ACTION	PROJECT FEATURES
			Right-of-Way Lease	pipeline, pipeline related facilities, LNG plant site/ marine terminal (Phase I)
			Right-of-Way Permit	access roads (Phase II, III)
			Material Sale Contract	material sites (Phase II, III)

22-89 Additional ADNR actions were incorporated into Table 1.11-1.

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RESPONSE

22-89 (Contd)

Section	Para.	Line	Comment	
			Tideland Lease	other permanent facilities (Phase II, III)
			Negotiated or Competitive Lease	other permanent facilities (Phase II, III)
			Land Use Permit	temporary use (up to 1 year) (Phase II, III, IV)
			Water Appropriation Permit/Temporary Water Use Permit	water use (Phase II, III, IV)
			Archaeology Permit/ Cultural Resources Clearance	field investigation activities/project authorization (Phase II, III)

The State Historic Preservation Office should be listed under the Department of Natural Resources.

	Section	Para.	Line	Comment		Response
22-90	2.2	1	16	"state right-of-way [GRANT] lease ..."	22-90	Comment accepted and the FEIS incorporates recommendation in Subsection 2.2.
22-91	2.2	1	6	Section 1 uses "BCFD" rather than "BCF/D."	22-91	Editorial correction incorporated.
22-92	2.2.1	2	12	Section 1.1, para. 5, lines 1-3, states that "approximately 2.5 BCFD of North Slope natural gas is currently produced and reinjected during oil extraction." This appears at variance with exceeding the 3.3 BCF/D capacity stated in this section.	22-92	The latest information is that up to 3.3 BCFD of natural gas is being handled at the Central Gas Facility at Prudhoe Bay. Comment accepted and the FEIS incorporates recomendation in Subsection 1.1
22-93	2.2.1	3	17	"Produces (?) a blend ..."	22-93	Comment accepted and the FEIS incorporates recommendation in Subsection 2.2.1.
22-94	2.2.1	Table 2.2.1-1		This section estimates the total acreage of habitat that will be lost due to project operation. Will BLM require, after the project begins its operational phase, a survey of acreage lost be completed to document total habitat loss for mitigation purposes?	22-94	The decision by BLM on the proposed TAGS project covers only federal ownerships, the DNR would cover state ownerships; the ADFG would cover certain water bodies; and the USACE would cover all wetlands and all water bodies. BLM during the design criteria development phase, in cooperation with other federal and state permitting entities would determine the extent and type of all information needed to assure compliance with environmental protection stipulations, public health and safety and pipeline system integrity. This cooperative determination also would address the timing for such data deliveries.
22-95	2.2.1.1	all	-	The length, approximate width and the resulting number of acres required for both pipeline ROW construction and operation should be clearly stated in this section.	22-95	Comment accepted and the FEIS incorporates recommendation in Subsection 2.2.1.1.

COMMENT LETTER 22 (Contd)

	Section	Para.	Line	Comment
22-96	2.2.1.1	6	1-3	Pipeline river crossings are often pretested at the time of installation and thus could occur at any time of year, depending on site-specific construction scheduling.
22-97	2.2.1.2	1	23	"Environmental sensitivities" appear to have been a low priority at compressor stations #1 (peregrine falcon concerns), #9 (caribou migration concerns), and #10 (effects on pipeline routing and proposed river crossings) (see comments in cover letter).
22-98	2.3.1	4	-	Second sentence "dedicated" should be proposed.
22-99	2.3.1	5	-	Where conditions are determined to be advantageous would be in part dependent on an adequate winter supply of surface water.
22-100	2.3.1	6	-	Material Sites definitely need reference to a table or an appendix listing similar to Appendix E - Access Roads.
22-101	2.3.1	8	-	Are the material storage yards all at existing disturbed gravel pad sites?
22-102	2.3.1	9	-	The description of "abandoned" airports is incorrect. Both Galbraith Lake and Coldfoot are alive, well and functioning State airports.
22-103	2.3.1	Table 2.3.1-1		No bed spaces are listed for Compressor Station #9-Sourdough Creek, but 900 beds are implied by construction-spread totals.
22-104	2.3.1	Table 2.3.1-2		Other previously used TAPS temporary storage areas exist at or near Prospect, Gulkana, and Willow Lake. Why are these not cited as previously used TAPS sites? Will new sites be developed at these locations?
22-105	2.3.2	3	-	TAGS criteria for grading design must include control of hydraulic and thermal erosion that could produce off-site environmental effects.
22-106	2.3.2	13	20-28	Ditch crowns must be broken to provide cross drainage and prevent ponding or longitudinal erosion.

RESPONSE

22-96	Comment accepted and the FEIS incorporates recommendation in Subsection 2.2.1.2. YPC has indicated in their mitigating measures that should such action be necessary, they would confine test water releases to designated areas to comply with discharge permit limitations.
22-97	See response to Comment Number 22-16.
22-98	Comment accepted and incorporated in the FEIS.
22-99	Comment accepted and the FEIS incorporates recommendation in Subsection 2.3.1.
22-100	Such information would not be available until the completion of the design criteria and detailed design phase of the proposed TAGS project with final site locations available primarily in Phase III.
22-101	As shown in Table 2.3.1-2, the location for temporary material storage areas would not be located at existing disturbed gravel pad sites.
22-102	The reference was to abandoned TAPS airfields. Throughout the DEIS, Galbraith Lake and Coldfoot are identified as operational. Subsection 2.3.1 has been modified to prevent a misunderstanding.
22-103	Comment accepted and the EIS incorporates modification in Table 2.3.1-1.
22-104	Use of these sites was evaluated during initial project scoping. Although YPC initially proposed to use the old Prospect Creek TAPS site, it has been designated by BLM as not available for reuse due to the environmental concerns related to fisheries. While there is no previous TAPS storage site at Gulkana, use of a TAPS site at Glennallen was considered. Use of this site is not feasible since a large portion of this site is privately owned by the Alyeska Pipeline Service Company, and used for operation of the TAPS pipeline. Use of the previous TAPS material storage site at Pippin Lake near Willow Lakes was considered and found to be located too far south. It was rejected in favor of a site more suitable for TAGS project construction needs located farther to the north.
22-105	YPC agrees that criteria for grading design must include control of hydraulic and thermal erosion. Comment noted.
22-106	Comment accepted and the FEIS incorporates recommendation in Subsection 2.3.2.

COMMENT LETTER 22 (Contd)

	Section	Para.	Line	Comment
22-107	2.3.2	15	1-3	See comment on 2.2.1.1 (paragraph 6) this enclosure.
22-108	2.3.3.1	2,5	-	Frost bulb formation is quite important and should be addressed as to what the affects might be and how the effects will be mitigated. Will the frost bulb cause stream icing?
22-109	2.3.3.4	2	2	"pipeline[S] would be ..."
	2.3.3.4	2	13	"support bents [BENDS] of an ..."
	2.3.3.4	3	2	"pipeline[S] would also ..."
	2.3.3.4	3	9	"buried pipeline[S]."
22-110	2.3.4.4	all	-	It would be informative to have an illustration of the Moose Creek Dam Crossing in this section.
22-111	2.3.4.6	4	-	This section should acknowledge that timing constraints for stream crossings will be required to avoid anadromous fish migtation. The period from July through December is considered critical although crossings may be allowed in in November/December time period.
22-112	2.4	7	2	"2,300,000 bank[ED] cubic yards ..."
22-113	2.5	all	-	The DEIS does not address specific engineering geology concerns associated with LNG plant at Anderson Bay and potential impacts that may result. According to Randall Updike, Chief, Engineering Geology Section, DGGS/DNR, and data from J.M. Brown and E.L. Brudie, the potential for rock failure on cut slopes in this area is substantial.
22-114				The DEIS should clearly state that engineering geology studies will be required prior to actual design of facilities and that rock-failure potential may dictate actual layout of the facilities.
22-115	2.6	3	-	"Operating temperatures below 32 degrees Fahrenheit would be maintained through the northern and interior permafrost areas. Conventional warm gas operation would be utilized in southern areas where essentially permafrost-free soils

RESPONSE

22-107 See response to Comment 22-96.

22-108 As stated in Subsection 2.3.3.1, detailed design, Phase II, would evaluate the potential for frost bulb formation. The objective would be to minimize the formation of frost bulb growth on surface and subsurface flow with the use of insulation and deep burial of the pipe. Each water crossing would be considered on a site-specific basis. Should frost bulbs develop, they could potentially cause stream icing similar to those which naturally occur, or can be observed in many areas of Alaska during the winter season. The final design would implement a design which considers potential environmental disturbance and system integrety during the construction and operational mode with consideration given to maintenance frequency.

22-109 Editorial correction incorporated.

22-110 A drawing of the Moose Creek Dam area and any of the construction cross sections are included in Subsection 2.3.4.4.

22-111 Subsection 4.2.11.2 indentifies that each anadromous stream would require specific stream crossing permits from ADF&G, these permits would reflect specific timing constraints. Acknowledgment is made in Subsection 2.3.4.6.

22-112 Editorial correction incorporated

22-113 The engineering geology studies required at the LNG plant site would be performed by YPC during the detailed design and engineering phase of the project.

22-114 A detailed site investigation is necessary at the Anderson Bay site (see response to Comment 27-1) to assure that all engineering geology concerns are addressed during the detailed design phase. A comprehensive discussion of engineering geology concerns associated with the Anderson Bay site has been provided by YPC. This information is included in the February 23, 1987 response by YPC to the BLM request for supplemental information to the TAGS Project Description. Additional information is contained in the Dames and Moore report of August 27, 1987 titled Geologic Consideration Proposed LNG Plant and Marine Terminal, Anderson Bay, Port Valdez, Alaska. These references clearly indicate that engineering geology studies would be required prior to actual detailed design of facilities.

The potential for rock instability due to over-steepening of rock cuts has been taken into account in the current conceptual layout for the Anderson Bay site.

22-115 See response to Comment 22-9.

COMMENT LETTER 22 (Contd)

	Section	Para.	Line	Comment
22-115 (Contd)				conditions exist." The DEIS does not explain or discuss these statements. Permafrost areas are present to within 65 miles of Valdez.
22-116	2.6	Figure 2.6-1		This figure is mislabeled here and in the list of figures (page vii).
22-117	2.6	25	4	"ballast. Should ..."
22-118	2.8.1	3	3-5	"and special [RIGHT-OF-WAY] stipulations to [ITS] BLM's right-of-way[S] grant and USACE's Section 404 and Section 10 permits."
22-119	2.8.1	3	7	"all rights-of-way[S] as well as ..."
	2.8.1	6	13-14	"to fish, wildlife, and marine[,] and ..."
22-120	2.8.3	all	-	We see no provision for segregation of organic spoil for use in restoration of the pipeline right-of-way and temporary facility sites. This mitigation measure should be included.
22-121				For ease of identifying these mitigating measures, it would appear helpful that they be numbered for easier reference.
22-122	2.8.3	2	-	The number of equipment crossings should also be limited at sensitive or highly erodible crossings.
22-123	2.8.3	7	-	Add "and/or number of crossings, if necessary."
22-124	2.8.3	15	-	Provisions should also be made for annual light grading of those sections with continued or annual settlement, erosion, or drainage problems. YPC will need mitigative measures beyond performing "light grading of the right-of-way the year after construction of each segment of pipeline where localized settlement, erosion, or drainage problems occur." Erosion and drainage problems will require stabilization, application of approved erosion control procedures, and installation of properly engineered structures.

RESPONSE

22-116 Figure 2.6-1 title has been corrected.

22-117 Editorial correction made.

22-118 Clarification added to Subsection 4.8.

22-119 Editorial correction made.

22-120 Comment accepted and FEIS incorporates recommendation in Subsection 4.8.

The suggestion for segregation of organic spoil is included in government proposed mitigation found in Table 4.8-2.

22-121 Subsection 2.8 has been relocated to Subsection 4.8 and reorganized.

22-122 All construction equipment movement would be limited to the pipeline right-of-way and access roads. The right-of-way route (including access roads) was selected to minimize the number of crossings and would be designed to prevent adverse impacts from crossing and be capable of sustaining heavy vehicular movement without serious environmental degradation.

22-123 This suggestion is inappropriate as the DEIS at 2.8.3 summarized information proposed by the applicant in the requests pending action by BLM and USACE. It is agreed that the number of crossings of critical waters is important from both a biological and a pipeline integrity prespective. This is reflected in the FEIS in Subsection 4.8 (Mitigation Measures). Also see response to Comment 12-19.

22-124 Subsection 4.8 identifies that mitigating measures proposed by YPC refer to grading required to maintain the proper depth of backfill in the trench. Additionally, YPC would be required to submit for approval, comprehensive plans for, among others, erosion and sedimentation control, restoration, overburden, and excess material disposal.

COMMENT LETTER 22 (Contd)

RESPONSE

	Section	Para.	Line	Comment
22-125	2.8.3	25	-	While we support winter construction for certain crossings of fish streams, it is not clear what "redundant" crossings are. Unnecessary crossings should be eliminated by alignment adjustments. YPC should be aware that winter crossings may not be appropriate for streams containing incubating fish eggs at or below the crossing point.
22-126	2.8.3	31	1	"sensitive stream and wetland areas ..."
	2.8.3	33	1	"[IN GENERAL,] For water ..."
	2.8.3	36	-	Add "and minimize impacts to adjacent resources."
22-127	2.8.3	39	-	"Emplace riprap on slope and stream embankments and at the inlet and outlet of drainage structures, as required, and revegetate, as appropriate, to mitigate ..."
22-128	2.8.3	45	-	YPC will be required to "provide for the uninterrupted movement and safe passage of all [ANADROMOUS] fish species during construction and operation of the pipeline."
22-129	2.8.4	all	-	Mitigation measures 1 (see above comment), 12,15,16,17,18, and 19 more appropriately belong in with the Construction mitigation measures Section 2.8.3.
22-130	2.8.17	17	-	"Protect existing telephone and electric transmission lines, roads, pipelines and other existing facilities..." This should include homes, and other improvements.
22-131	2.9.2	4	-	The statement regarding the infrastructure should be further explained.
22-132	2.9.2	8	-	Explain "dual" pipelines-primary and secondary.
22-133	2.9.2	8	14-15	"and traverses the Susitna Flats ..."
22-134	2.9.3	10	2	Table 2.9.3-1 gives a loading-line length of 1 mile for the Cook Inlet-Boulder Point alternative rather than the "greater than 1 mile in length" stated here.

22-125 "Redundant" was incorrectly used. Modification was made to reflect the comment in Subsection 2.8.3.

22-126 Subsection 2.8.3 was modified to reflect comment.

22-127 See revised mitigation discussion in Subsection 4.8 of the FEIS.

22-128 YPC would comply with all state and federal requirements for protection of fisheries habitat. A specific determination of fish passage requirements would be made by the Authorizing Officer and under the Title 16 Permit process for the State of Alaska.

22-129 See response to 22-115 for chilled gas operations. Mitigation measures identified as construction mitigation have been relocated to Subsection 4.8.

22-130 No homes would be directly affected by the proposed TAGS project. Mitigation measures are incorporated to include other improvements. (See Table 4.8-2).

22-131 Infrastructure used throughout the DEIS means basic facilities, equipment, services and installations needed to support the proposed TAGS project.

22-132 Normally when a major pipeline is constructed across large bodies of water where potential hazards exist, such as those found in Cook Inlet, specifically, strong currents, high tidal action, severe erosion and ship traffic with the potential for dragging anchors, a second security crossing is constructed. This would provide for continued operations should one of the lines be rendered unusable.

22-133 Editorial change incorporated.

22-134 Comment accepted and the FEIS incorporates recommendation in Table 2.9.3-1.

COMMENT LETTER 22 (Contd)

RESPONSE

	Section	Para.	Line	Comment	Response
22-135	2.9.7	1	-	Should this sentence be that the "USFS proposes to issue appropriate land use authorization on the basis of this EIS." not the DEIS?	22-135 DEIS was changed to EIS in Subsection 2.9.7.
22-136				The way the first sentence is written implies that the BLM and the USACE are accepting what the applicant has applied for without any objections. It would be much better to state that the BLM and the USACE have accepted respective applications for the preferred route from Prudhoe Bay to Valdez as identified by YPC.	22-136 Comment accepted and the FEIS incorporates recommendation in Subsection 2.9.7.
22-137	3.2.2.2	2	8-14	It seems likely that the magnitude (billion dollar +?) of TAPS facilities in Valdez accounts for their high contribution to the total assessed valuation of the community as much as lack of "continual expansion of the tax base ..."	22-137 The statement in Subsection 3.2.2.2 was modified to prevent misunderstanding. Since TAPS construction 10 years ago, the Valdez area has not expanded like other areas in Alaska such as the North Slope Borough or FNSB. Thus, Valdez is more dependent on a single declining tax base whereas these other areas continue to grow and expand their tax base.
22-138	3.2.2.2.1	2	15	"so students [WERE] <u>do</u> not ..."	22-138 Editorial correction incorporated.
22-139	3.2.2.2.1	Table 3.2.2-3		How does "N/A" differ from "*Information not available?" Perhaps <u>*Site not occupied</u> would be more appropriate. What do dashes signify under Kenney Lake in 1980 and 1985? Why is N/A not used for Livengood population figures? What is the source of the 1985 population data for the Copper Basin? These figures do not correspond with those presented in the Department of Labor's recent publication which includes 1985 estimates. In the Table, Glennallen's population is higher than the Department of Labor estimate, but the overall area population is lower.	22-139 Several data bases were used and there was no consistancy between these data bases. Table 3.2.2-3 was modified because there is no single reporting base in the Glennallen/Copper Center area.
22-140	3.2.2.2.2	1	8	"more than 800 person<u>s</u>, 80 ..."	22-140 Editorial correction incorporated.
	3.2.2.2.3	1	13	"the Fairbanks <u>area</u> experienced ..."	
22-141	3.2.2.2.3	-	-	Mention the communities of Fox, Moose Creek, Chatanika, Ft. Wainright Army Base, Eielson Air Force Base and Salcha.	22-141 Comment accepted and the FEIS incorporates recommendation in Subsection 3.2.2.2.3.
22-142	3.2.2.2.4	-	-	Mention the communities of Big Delta, Ft. Greely Army Base and Summit Lake.	22-142 Comment accepted and the FEIS incorporates recommendation in Subsection 3.2.2.2.4.
22-143	3.2.3.2	all	-	The discussion of the availability of gravel in Spreads 1 and 5 and other sources of material on page 3-13 in paragraphs 7, 8	22-143 The availability of gravel is discussed in Subsection 3.2.8.9. Comment accepted and the FEIS incorporates recommendation in Subsection 3.2.2.2.4. Paragraphs seven and eight have been removed from this subsection, Paragraph 9 remains.

COMMENT LETTER 22 (Contd)

RESPONSE

	Section	Para.	Line	Comment		Response
22-143 (Contd)				and 9 belongs in another section of the EIS.		
22-144	3.2.3.2	3	-	Subsistence and commercial fisheries for whitefish exist in the Colville River Delta.	22-144	Comment accepted and the FEIS incorporates recommendation in Subsection 3.2.3.2.
22-145	3.2.3.2	4	-	Explain this paragraph. Cite specific federal actions in relation to lands with high wilderness values. Explain last sentence with specific federal action. Is BLM talking about the "Central Arctic Management Area Wilderness Study?"	22-145	The wilderness evaluation, required by Sections 1001 and 1005 of ANILCA, is part of the Utility Corridor Resources Management Planning effort. The wilderness evaluation DEIS has been prepared and is now undergoing public review. It together with the Central Arctic Management Area (CAMA), are due to be submitted to Congress no later than December 2, 1988.
22-146	3.2.3.2	5	-	The military tracts traversed by TAGS are more correctly referred to as Eielson Military Reservation and Fort Greely Military Reservation (the main base is along the route also).	22-146	Comment accepted and the FEIS incorporates recommendation in Subsection 3.2.3.2.
22-147	3.2.3.2	5	-	Another restriction not mentioned is that Alaska Statute, AS 19.40 prohibits the use of all-terrain vehicles within 5 miles of the Dalton highway.	22-147	Comment accepted and the FEIS incorporates recommendation in Subsection 3.2.3.2.
22-148	3.2.3.2	8	-	The following statement is unclear and needs further explanation: "This area of state administration is no longer using active floodplains of rivers for material sites."	22-148	Comment accepted and the FEIS incorporates recommendation in Subsection 3.2.3.2.
22-149				Will winter surface water supplies be sufficient to allow for ice road construction?	22-149	Comment accepted and the FEIS incorporates recommendation in Subsection 3.2.3.2.
22-150	3.2.3.2	10	11	"and camp[L]ing ..."	22-150	Editorial correction incorporated.
22-151	3.2.3.3	2	-	This section needs much more analysis. No areas south of the Jim River have been identified as ACEC's or equivalent. This section should include discussion about Paxson and Summit lakes, the Little Tonsina River, and the Lowe River through Keystone Canyon for their fisheries resource values and important historic and scenic values. Grapefruit Rocks also merits inclusion in this section.	22-151	Areas of critical concern are identified through the BLM planning system. Such areas north of the Yukon River were developed during the ongoing BLM planning for the Utility Corridor Resource Management Plan. Existing land use plans by BLM south of the Yukon River will be updated in the near future. Planning by the Glennallen District for lands associated with the proposed TAGS route is scheduled to start during 1988 if there are adequate funds. Information supplied by the State for Comment 22-31 has been included in the FEIS. Also see response to Comment 22-15.
22-152	3.2.3.3.1	all	-	This ACEC also contains the "farthest north known Athapaskan archeological sites." ("Utility Corridor Draft Resource Management Plan and EIS", BLM, p. E-17). This	22-152	Reference to the archaeological significance of this area was already included in Subsection 3.2.3.3.1 but the citation has been incorporated. Subsection 3.2.16 does identify this archaeological site and it would not be directly impacted by the project.

COMMENT LETTER 22 (Contd)

RESPONSE

	Section	Para.	Line	Comment	Response
22-152 (Contd)				occurrence should be noted in the description of the ACEC, and Section 3.2.16 should address whether this resource would be affected by TAGS, and noted in Section 4.2.16, if necessary.	
22-153	3.2.3.3.6	2	4	"sport[S] hunting."	22-153 Editorial correction incorporated.
22-154	3.2.4.5	1	7-9	"the Tonsina River, <u>the Little Tonsina River, the Tiekel River, the Tsina River,</u> and Ptarmigan [RIVER] <u>Creek</u> to ..."	22-154 Comment accepted and the FEIS incorporates recommendation in Subsection 3.2.4.5.
22-155	3.2.4.5	1	10-13	Paved airfields are present at Delta Junction (military, but with scheduled civilian flights during TAPS) and near Glennallen (Gulkana Airport with scheduled air service during TAPS) and should be included in the transportation discussion.	22-155 Comment accepted and the FEIS incorporates recommendation in Subsection 3.2.4.5.
22-156	3.2.4.6	2	-	The Alaska Railroad connections between these ports and Anchorage deserve mention.	22-156 Comment accepted and the FEIS incorporates recommendation in Subsection 3.2.4.6.
22-157	3.2.7	3	7	"There <u>are</u> [IS] virtually no ..."	22-157 Editorial correction incorporated.
22-158	3.2.8.1	2	-	Unconsolidated sediments overlying bedrock are confused with soil formation and "limits" to soil development in permafrost areas. Types of unconsolidated sediments should be referred to consistently throughout Section 3.2.8, in relation to their geologic origin.	22-158 Comment accepted and the FEIS incorporates recommendation in Subsection 3.2.8.1.
22-159	3.2.8.1	3	-	The southern limit of discontinuous permafrost occurring along the proposed TAGS alignment should be noted. Seasonal frost (active layer) should be discussed here. The difference in the types of unconsolidated sediments that are thaw stable if allowed to thaw vs. those types at certain moisture contents that may be unstable if permafrost is allowed to thaw should be briefly discussed. Types of permafrost—interstitial ice and/or segregated ice should be discussed.	22-159 Comment accepted and the FEIS incorporates recommendation in Subsection 3.2.8.1.
22-160	3.2.8.2	3	-	It is implied in another section of the EIS that there is a lack of gravel (inexpensive gravel) in Spread 1. It should be explained that the unconsolidated, frozen Quaternary gravel overlying bedrock on the coastal plain is more expensive to obtain	22-160 Comment accepted and the FEIS incorporates recommendation in Subsection 3.2.8.2.

COMMENT LETTER 22 (Contd)

	Section	Para.	Line	Comment
22-160 (Contd)				from upland or abandoned floodplain sites. However, there is not much seasonal deposition of alluvium in arctic rivers and any unfrozen gravel (relatively inexpensive to obtain) extracted from the active floodplain is not replenished rapidly. For this reason, gravel extraction from the active floodplain of the Sag River will be limited in the future.
22-161	3.2.8.4	4	-	"large irregular granitic batholiths make up the muck ..." Use the term organic-rich colluvium instead of muck.
22-162	3.2.8.4	8	10	"[L]fragment, gravel ..."
22-163	3.2.8.6	all	-	The three major faults and their location should be discussed here—Donnelly Dome, Denali and McGinnis.
22-164	3.2.8.7	1	6	"near the settlement [TOWN] of Tonsina ..."
22-165	3.2.8.7	6	11-12	"be crossed just south [NORTH] of Summit Lake ..."
22-166	3.2.8.8	4	-	The significance of "seismic risk zone 4" should be explained.
22-167	3.2.8.9	all	-	This section should address the availability of mineral materials as part of the affected environment.
22-168	3.2.9.2.3	-	-	"Springs in the Brooks Range that flow all year-round are of excellent quality." A citation or water quality data is necessary to back up such statements.
22-169	3.2.9.3.3	-	-	What is the reference to support the statement that the alluvium is 820 ft. thick near Fairbanks?
22-170	3.2.9.3.3	3	15-17	Words appear to be missing from this sentence.
	3.2.9.3.4	1	11-12	"in the Chandalar (?) River valley ..."
	3.2.9.4.1	2	1	"vary [VERY] ..."
	3.2.9.4.1	2	6	"linearly [LINERARLY] ..."

RESPONSE

22-161 Comment accepted and the FEIS incorporates recommendation in Subsection 3.2.8.4.

22-162 Editorial correction incorporated.

22-163 Comment accepted and the FEIS incorporates recommendation in Subsection 3.2.8.6.

22-164 Editorial correction incorporated.

22-165 Editorial correction incorporated.

22-166 Comment accepted and the FEIS incorporates recommendation in Subsection 3.2.8.8.

22-167 The FEIS has been revised accordingly.

22-168 Citation provided in Subsection 3.2.9.2.3.

22-169 Citation provided in Subsection 3.2.9.3.3.

22-170 Editorial corrections incorporated.

COMMENT LETTER 22
(Contd)

	Section	Para.	Line	Comment
22-171	3.2.9.4.2	-	-	"Concentrations reach 2,000 MG/L ..." Concentration of what? This needs further explanation. "Water quality of these lakes is good, although phosphate levels are very low, and nitrate levels are often quite high." This suggests that there is some minimum level of phosphates necessary for good quality water. Are nitrate levels above established recommended levels? Citations or data would be appropriate.
22-172	3.2.9.5.2	-	-	"Water from deeper wells sometimes exceeds the U.S. public Health Service limits for chloride, sulfate, and magnesium (USGS 1971)." Are these levels high enough to pose treatment problems or make the water unsuitable for use?
22-173	3.2.10.1.2	3	9	"<u>east</u> ? [NORTH] of Anderson Bay ..."
	3.2.10.1.4	1	13	"flocculation of ..."
22-174	3.2.10.1.6	-	-	"Hydrocarbon concentrations have nearly all been below 1.0 ppb and are never greater than 10 ppb." There are some recent reports which document hydrocarbon concentrations in Port Valdez in excess of 10 ppb (e.g. Woodward Clyde/Entrix, 1986).
22-175	3.2.10.2.1	2	4	"bear, <u>goat,</u> and waterfowl ..."
	3.2.10.2.2	3	4	"<u>study</u> [STYDY] ..."
22-176	3.2.10.2.3	2	-	Red salmon usually arrive in early to mid-June; pink salmon arrive later, usually in mid-July. Change "silvers" to <u>coho</u> here and everywhere else to be <u>uniform</u> throughout the DEIS. This section should also identify the presence of anadromous Dolly Varden in the Port Valdez area, and spawning generally occurs during the October and November time period.
22-177	3.2.10.2.4	all	-	This section should be expanded to include bald eagle presence. According to USFWS

RESPONSE

22-171 Comment accepted and the FEIS incorporates modification.

22-172 High levels of chloride, sulfate, and magnesium can be removed, but treatment is relatively expensive.

22-173 Editorial corrections incorporated.

22-174 Comment accepted and the FEIS incorporates recommendation in Subsection 3.2.10.1.6.

22-175 Editorial correction incorporated.

22-176 Comment accepted and the FEIS incorporates recommendation in Subsection 3.2.10.2.3.

22-177 Comment accepted and the FEIS incorporates recommendation in Subsection 3.2.10.2.4.

COMMENT LETTER 22 (Contd)

	Section	Para.	Line	Comment
22-177 (Contd)				this area supports nesting and migratory populations of bald eagles.
22-178	3.2.10.2.4	1	2	"seabirds ..."
	3.2.10.2.4	1	4	"vicinity [,] and in ..." Shoup Bay is in the western, deep end of Port Valdez.
	3.2.10.2.4	5	6	"sites, which are scarce ..."
	3.2.10.2.5	1	5	"whales that may be ..."
	3.2.10.2.5	1	10	"robustus). They are likely ..."
22-179	3.2.10.2.6	all	-	No sportfish information is presented for Port Valdez. What about the coho salmon derby? This section should be expanded to include this information.
22-180	3.2.10.2.6	2	18-22	Special fishing openings for salmon have occurred east of this line near the hatchery at Solomon Gulch.
22-181	3.2.10.2.6	4	1-8	The discussion of Robe Lake and Corbin Creek is unclear. The reference to "in excess of 40,000 sockeye" salmon from the Robe Lake system has not been substantiated according to Ken Roberson (ADF&G). These numbers may represent production from various systems in the Valdez area.
22-182	3.2.10.2.6	5	9-17	Solomon Gulch Hatchery does not produce chinook salmon according to Ken Roberson (ADF&G). Chinooks released at Anderson Bay were reared in state facilities.
22-183	3.2.11.1	Table 3.2.11-1		The following fish streams are crossed by the proposed alignment north of Summit Lake and should be included:

Stream Name	Milepost
Mark Creek	73.5
Spoiled Mary Creek	79.3-79.6
Stout Creek	80.6
Milke Creek	84.0
Dan Creek	88.5
Upper Lori Creek	92.3
N.F. Arthur Creek	97.2
S.F. Arthur Creek	98.5
Gustafson Gulch	99.5
Polygon Creek	101.9

RESPONSE

22-178 Editorial corrections incorporated.

22-179 Sport fishing is indeed a major activity in the Valdez area. In addition to modifying Subsection 3.2.10.2.6 to reflect this comment, Subsection 3.2.15 of the DEIS discussed the sport fishing and the annual summer contest.

22-180 Comment accepted and the FEIS incorporates recommendation in Subsection 3.2.10.2.6.

22-181 Sockeye salmon runs in the Robe Lake system were greater in the 1950's and 1960's than in more recent years; the number 40,000 is deleted.

22-182 Comment accepted and the FEIS incorporates recommendation in Subsection 3.2.10.2.6.

22-183 In Subsection 3.2.11.1 it is stated that "more than 200 rivers and streams inhabited by fish would be crossed by the TAGS project" and that Table 3.2.11-1 provided a list of exceptionally productive streams. The list of fish streams that are identified on pages 14 through 21 of the Enclosure to the State of Alaska's comment letter to the TAGS DEIS is a complete listing of fish streams crossed by the proposed pipeline alignment. The DEIS indicated that there were more fish streams than the 104 listed in Table 3.2.11-1. The ADF&G's list, as presented, is indeed a comprehensive list and should be used as the TAGS project list of fish streams until site-specific fish surveys can be conducted along the proposed alignment and until the route survey is completed. It should be noted that of the approximately 800 streams crossed by TAPS, only 27 streams were identified as "highly sensitive" by BLM and ADF&G, 1986.

COMMENT LETTER 22 (Contd)

RESPONSE

22-183 (Contd)

Section	Para.	Line	Comment	
			Poison Pipe Creek	102.9
			Climb Creek	103.3
			Dennis Creek	104.1
			N.F. Rudy Creek	104.7
			Rudy Creek	105.6
			Shyfish Creek	116.0
			Terry Creek	132.9
			Mack Creek	133.4
			Ed Creek	133.8
			Jill Creek	134.2
			Galbraith Camp Creek	141.2
			Sten Creek	162.6
			Spike Camp Creek	162.7
			4F Creek	172.8-172.9
			Unnamed Creek	175.2
			Wetfoot Creek	177.2
			Oskar's Eddy (mouth)	178.4
			Unnamed Creek	185.8
			Tracey's Trickle	187.2
			Ugh Creek	195.2
			Numbers Lake Creek	196.8
			Disaster Creek	200.6
			Airport Creek	201.6
			Stietz Lake Inlet	202.6
			Brockman Creek	203.6
			Bettles River	205.5-205.7
			Sukakpak Creek	209.1
			Gold Creek	215.0
			Rainbow Creek	218.8
			Richardson Slough	218.9
			M.F. Confusion Creek	226.0
			Confusion Creek	226.1
			Pence's Pond Creek	231.4
			Calf Creek	236.0
			Trent's Trickle	245.7
			S.F. Windy Arm Creek	248.4
			Abba Dabba Creek	257.4
			E.F. Abba Dabba Creek	258.3
			Jim River Slough	266.1
			Little Nasty Creek	280.1
			S.F. Little Nasty Ck	280.5-280.6
			Grizzly Creek	284.3
			Pung's Crossing Creek	287.9
			Alder Mountain Creek	290.8
			Caribou Mountain Ck	303.7
			Olson Lake Creek	306.3
			Finger Mountain Creek	309.9
			Fed Creek	322.8
			Ft. Hamlin Hills Ck	332.3
			Phelps Creek	341.4
			Woodchopper Creek	347.0
			Burbot Creek	347.8

COMMENT LETTER 22
(Contd)

RESPONSE

Section	Para.	Line	Comment	
22-183 (Contd)			Hot Cat Creek	367.0
			Mastodon Creek	374.1
			Erickson Creek #2	378.6
			Shocker Creek	432.6
			Knokanpeover Creek	473.1-473.3
			French Creek (upper)	476.4
			Million Dollar Creek	479.7
			Two Nineteen Creek	485.8/486.0
			Unnamed Slough (mth)	489.5
			W. Br. Keystone Creek	510.5
			Unnamed Branch of Keystone (fish?)	510.7
			Keystone Ck (2 chls)	512.4
			Trib. to Keystone Creek (fish?)	513.0
			Tanana R. Slough	524.8
			Fielding Lake Creek	597.2

Table 1 presents our suggested fish list revisions south of Summit Lake.

Table 1. Drainages along TAGS preferred route alignment.

Sheet #	TAGS Milepost	Stream Name	Stream #	Fish Species	Period of Sensitivity
24	600.8	Unnamed	N/A	(GR)[1]	May - Oct
	602.0	Unnamed	N/A	(GR)	May - Oct
	605.3	Summit Lake trib	N/A	(GR)	May - Oct
	611.0	Gulkana River	212-20-10080-2461	BB,CD,GR,KS,RS LS,LT,LW,RB,RW SH	Jan - Dec
	612.1	N. Br. One-Mile Cr. (Fast Creek)	N/A	GR*[2]	May - Oct
	612.4	S. Br. One-Mile Cr.	N/A	GR,DV*	May - Mar
	613.25	Gulkana River trib	N/A	(DV)*	Aug - Mar
	614.5	Paxson Lake trib	N/A	(GR,DV)*	May - Mar
	616.9	Paxson Lake trib	N/A	GR,DV	May - Mar
	617.0	Unnamed	N/A	DV*	Aug - Mar
25	619.8	Paxson Lake trib	N/A	(GR,DV)*	May - Mar
	621.1	Paxson Lake trib	N/A	(GR,DV)	May - Mar

1. Species inferred by subjective evaluation but not yet confirmed by "on-the-ground" surveys are enclosed by parentheses.

2. Species known or inferred to be present elsewhere in the drainage but which may not occur at the TAGS crossing are marked with an asterisk.

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Sheet #	TAGS Milepost	Stream Name	Stream #	Fish Species	Period of Sensitivity
25	627.1	Meiers Creek	N/A	DV	Aug - Mar
	628.3	Gillespie Creek	N/A	BB,CN,GR,KS,RS	May - Mar
	635.5	Haggard Creek	N/A	GR,LS	May - Oct
	644.6	Sourdough Creek	N/A	GR,DV	May - Mar
26	649.5	Gulkana River	212-20-10080-2461	BB,CD,GR,KS,LS,LT IW,RB,RS,RW,SH	Jan - Dec
	651.8	Ginny Creek (Three-Sisters Creek)	N/A	GR	May - Oct
27	678.8	Tazlina River	212-20-10080-2431	BB,DV,GR,KS,LS, LT,PW,RS,RW,SH	Jan - Dec
	681.9	Tazlina River trib	N/A	(GR,DV)*	May - Mar
	683.8	N. F. Yetna Creek[3]	N/A	GR,DV*	May - Mar
	686.1	M. F. Yetna trib	212-20-10080-2405	KS,SS,GR*	May - Aug
	686.2	M. F. Yetna trib	212-20-10080-2405	KS,SS,GR*	May - Aug
	686.4	M. F. Yetna Creek	212-20-10080-2405	KS,SS,GR*	May - Aug
	688.2	S. F. Yetna Creek	212-20-10080-2405	KS,SS,GR*	May - Aug
	689.3	Klutina River	212-20-10080-2461	KS,RS,SH,GR	Apr - Nov
28	698.5	Willow Creek	N/A	DV,GR*	May - Mar

3. We have renamed the branches of the Yetna Creek drainage to better reflect the overall pattern of flow.

RESPONSE

COMMENT LETTER 22 (Contd)

Sheet #	TAGS Milepost	Stream Name	Stream #	Fish Species	Period of Sensitivity
28	699.0	Willow Creek trib	N/A	(DV,GR)	May - Mar
	703.5	Rock Creek	N/A	DV,GR*	May - Mar
	708.4	Squirrel Creek	212-20-10080-2331-3068	SS,DV	Jun - Mar
	709.4	Squirrel Creek trib	N/A	(GR)*	May - Oct
	710.4	Tonsina River trib	N/A	GR*	May - Oct
	714.5	Tonsina River trib	N/A	DV,GR*	May - Mar
	715.0	Tonsina River	212-20-10080-2331	KS,SS,RS,DV	May - Nov
	716.3	Little Tonsina River	212-20-10080-2331-3081	KS,SS,RS,WF LT,BB,CD,DV GR	Jan - Dec
	716.6	Little Tonsina trib (YP1-4)	N/A	(DV,GR)	May - Mar
	717.2	Little Tonsina trib	N/A	(DV,GR)	May - Mar
29	723.2	Little Tonsina River	212-20-10080-2331-3081	KS,SS,RS,WF, LT,BB,CD,DV, GR	Jan - Dec
	723.6	Little Tonsina trib	N/A	DV	Jun - Nov
	730.5	Fiftynine Mile Cr.	N/A	DV	Jun - Nov
	734.3	Squaw Creek	N/A	DV	Jun - Nov
	734.7	S. F. Squaw Creek	N/A	DV	Jun - Nov
	736.0	Tiekel River trib	N/A	DV	Jun - Nov

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RESPONSE

COMMENT LETTER 22 (Contd)

Sheet #	TAGS Milepost	Stream Name	Stream #	Fish Species	Period of Sensitivity
29	736.4	Tiekel River trib	N/A	DV	Jun - Nov
	737.1	Boulder Creek	N/A	DV	Jun - Nov
	738.0	Tiekel River trib	N/A	(DV)	Jun - Nov
	738.2	Tiekel River trib	N/A	(DV)	Jun - Nov
	738.5	Tiekel River trib	N/A	(DV)	Jun - Nov
	739.4	Tiekel River trib	N/A	(DV)	Jun - Nov
	742.6	Stuart Creek	N/A	DV	Jun - Nov
	745.4	Tsina River trib	N/A	DV	Jun - Nov
	747.5	Tsina River	N/A	CD,DV	Aug - Oct
	747.7	Tsina River trib	N/A	(DV)*	Jun - Nov
	748.2	Tsina River trib	N/A	(DV)*	Jun - Nov
	749.0	Tsina River trib	N/A	(DV)*	Jun - Nov
	750.0	Tsina River trib	N/A	(DV)*	Jun - Nov
30	752.6	Small Creek	N/A	DV*	Jun - Nov
	753.6	Cascade Creek	N/A	(DV)	Jun - Nov
	755.9	Tsina River trib	N/A	DV	Jun - Nov
	757.1	Tsina River trib	N/A	DV	Jun - Nov
	757.3	Ptarmigan Creek	N/A	DV,RB	Aug - Oct
	759.3	Ptarmigan Creek	N/A	DV,RB	Aug - Oct

Sheet #	TAGS Milepost	Stream Name	Stream #	Fish Species	Period of Sensitivity
30	766.8	Sheep Creek	N/A	(DV)	Jun - Nov
	768.1	Seventeen-Mile Creek	N/A	SS,DV	Jul - May
	768.5	Lowe River	221-60-11370	SS,RS,DV	Jul - Dec
	768.8	Lowe River trib	N/A	(DV)	Jun - Nov
	769.8-772.2	Keystone Canyon (Lowe River)	221-60-11370	SS,RS,DV	Jul - Dec
	773.2-773.5	Brown Creek	221-60-11370-2254	SS,DV	Jul - May
	774.0	Clear Stream	221-60-11370-2250	SS,PS,DV	Jul - May
	774.3-774.7	Lowe River	221-60-11370	SS,PS,DS,DV	Jul - Dec
	774.7	Lowe River trib	N/A	DV	Jun - Nov
	776.3	Lowe River trib	N/A	DV	Jun - Nov
	776.7	Lowe River trib	N/A	DV	Jun - Nov
	777.8	Lowe River trib	N/A	DV	Jun - Nov
	777.8-780.4	Canyon Slough Complex	221-60-11370-2230	SS,PS,DS,DV	Jul - May
	780.8	Lowe River trib	N/A	DV	Aug - Oct
	781.4	Sulphide Gulch	N/A	DV	Aug - Oct
	782.3	Lowe River trib	N/A	DV	Aug - Oct
31	784.8	Abercrombie Gulch	221-60-11368	SS,PS,DS,DV	Jul - May
	785.3	Dayville Flats Creek	221-60-11366	SS,PS,CD,DV	Jul - May

RESPONSE

COMMENT LETTER 22 (Contd)

Sheet #	TAGS Milepost	Stream Name	Stream #	Fish Species	Period of Sensitivity
31	785.8	Trickle Creek	221-60-11364	PS,DS,DV	Jul - May
	786.8	Solomon Creek	221-60-11360	SS,PS,DS,CD,DV	Jul - May
	787.6	Port Valdez trib	N/A	PS,DS,DV.CD	Jul - May
	787.8	Port Valdez trib	N/A	PS,DS,DV,CD	Jul - May
	788.7	Allison Creek	221-60-11350	PS,DS,DV,CD	Jul - May
	790.1	Sawmill Creek	221-60-11330	PS,DS,DV,CD	Jul - May
	791.5	Salmon Creek	221-60-11320	PS,DS,DV,CD	Jul - May
	793.6	Ann Creek	221-60-11310	PS,DS,DV,CD	Jul - May
	794.4	E.O.P.	N/A	N/A	N/A
	795.3	Short Creek	?	PS,DS,(DV,CD)	Jul - May
	795.8	Nancy Creek	221-60-11300	PS,DS,DV,CD	Jul - May
	796.4	Henderson Creek	?	PS,DS,(DV,CD)	Jul - May

KEY

BB - Burbot
CD - Sculpin
DS - Dog (Chum) salmon
DV - Dolly varden
GR - Grayling

KS - King (Chinook) salmon
LS - Longnose sucker
LT - Lake trout
LW - Lake Whitefish
PS - Pink (Humpback) salmon

PW - Pygmy whitefish
RB - Rainbow trout
RS - Red (Sockeye) salmon
RW - Round whitefish
SH - Steelhead trout
SS - Coho (Silver) salmon
WF - Whitefish

COMMENT LETTER 22 (Contd)

	Section	Para.	Line	Comment
22-184	3.2.11.2	9	all	Pink and chum salmon occur in the Sagavanirktok River below the Lupine River.
22-185	3.2.11.3	4	8-11	Salmon spawn at the mouth of the Delta River but do not migrate up the mainstem.
22-186	3.2.11.4	1	11	This statement is false. The Copper River system drains into the Gulf of Alaska and may account for up to one million commercially caught salmon but not in Northern Prince William Sound. Also "pink" should be replaced with silver in the last line of this paragraph if the Copper River is being referenced.
22-187	3.2.11.4	3	2	"accessible by road for part [MOST] of its length ..." Road access is not present between Paxson Lake and Sourdough. Between Sourdough and Gulkana, road access to the river is limited, generally requiring a hike down into the river valley.
22-188	3.2.11.4	4	9-10	"on the upper [LOWER] Copper River ..."
	3.2.11.4	4	13-15	Delete "however, subsistence fishing occurs on other major tributaries within this basin." Subsistence and the personal use fishery occurs only on the mainstem.
	3.2.11.5	1	4	"During summer and fall ..."
	3.2.11.5	2	2	"laid in the summer and fall ..."
	3.2.11.5	2	4-5	"for a year or two (or sometimes longer) [SO] before migration ..."
	3.2.11.5	4	2	"for about 15 [SEVERAL] miles ..."
	3.2.11.5	4	10	"Resident and anadromous populations ..."
	3.2.11.5	4	12	"production area for coho, sockeye ..."
	3.2.12.1	1	10	"types along ..."
22-189	3.2.13.2.1	6	all	Bison do not occur in the Arctic Slope Drainage; therefore, this paragraph should be deleted or combined with bison discussions for the appropriate drainages. Because the Chitina/Copper River bison populations range on the east side of the Copper River, the TAGS project will not affect this population. Modify the last

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22-184 Comment accepted and the FEIS incorporates recommendation in Subsection 3.2.11.2.

22-185 Comment accepted and the FEIS incorporates recommendation in Subsection 3.2.11.3.

22-186 Comment accepted and the FEIS incorporates recommendation in Subsection 3.2.11.4

22-187 Comment accepted and the FEIS incorporates recommendation in Subsection 3.2.11.4.

22-188 Editorial corrections incorporated.

22-189 Comment accepted and the FEIS incorporates recommendation in the paragraph related to Subsection 3.2.12.4.1.

COMMENT LETTER 22 (Contd)

	Section	Para.	Line	Comment
22-189 (Contd)				portion of the last sentence of this paragraph referring to the bison population in the Chitina and Copper river areas.
22-190	3.2.13.2.2	Table 3.2.13-2		Raptors have nested on the Yukon River bluffs upstream and downstream from the Dalton Highway bridge, at Grapefruit Rocks, near the Chatanika River, near the Chena River, near the Salcha River, near the Tanana River, and elsewhere along the TAGS route. These areas should be listed in the table. The primary use periods listed for raptors are not correct for early nesting species (e.g., gyrfalcons, bald eagles).
22-191	3.2.13.3.1	2	13	"[D]Valkenburg ..."
22-192	3.2.13.4.1	6	5	Delete the last portion of this paragraph. No data are available to substantiate the suggestion that hunting and trapping limit wolf populations in this drainage.
22-193	3.2.14	Table 3.2.14-1		The Arctic peregrine "Location/Comment" should read "Present north of the Brooks Range and nests along the Sagavanirktok [TANANA] River during summer." The American peregrine "Location/Comment" should read "[OCCASIONAL] Nests along Yukon and Tanana rivers and tributaries [SOUTHERN ROUTE]." The "Location/Comment" for the bald eagle should read "Common near Valdez and [SEVERAL AREAS] occurs along rivers in the Copper and Tanana River drainages."
22-194	3.2.14	8	6-7	Bald eagles nest at low density in the Interior and Copper River basin as well.
22-195	3.2.15.1	3	-	We believe there is a camping area at the Arctic Circle.
	3.2.15.1	4	-	A public boat-launching facility is present at the Yukon Crossing.
	3.2.15.1	8	all	Public camping areas are present at Harding Lake, Quartz and Lost lakes, and Delta Junction.
	3.2.15.1	9	3	Public camping is available at Donnelly Creek.
	3.2.15.1	9	3-7	Fielding Lake is south of Black Rapids, rendering the last sentence incorrect.

RESPONSE

22-190 Areas listed by the ADNR are sensitive areas. They are included in Table 4.2.14-1. Changes have been made on both Tables 3.2.13-2 and 4.2.14-1 to reflect this comment.

22-191 Editorial correction incorporated.

22-192 We disagree; there are ample data to substantiate the suggestion. Speaking about Game Management Unit 13, through which the proposed TAGS route passes, Alaska Department of Fish and Game biologists have stated directly that "This wolf population was limited by human exploitation" during an intensive seven-year study (1975-1982) (W.B. Ballard, J.S. Whitman, and C.L. Gardner, 1987; Ecology of an Exploited Wolf Population in Southcentral Alaska, Wildl. Monogr., No. 98, p. 44). The region is one of very few in the history of the state to have been closed to wolf hunting and trapping by emergency order (1977). In the June 1986 ADF&G Survey and Inventory report (Vol. 16, Fed. Aid in Wildl. Restoration Proj. W-22-5), Tobey pointed out that the reported 1985-86 human take had declined for the first time since 1980, due to poor snow conditions for land-and-shoot trapping; the wolf population had increased correspondingly. Future increases are likely as a result of the recent Board of Game decision to prohibit land-and-shoot trapping, although illegal aerial hunting is a perennial problem in GMU 13.

22-193 Comment accepted and the FEIS incorporates recommendation in Table 3.2.14-1.

22-194 Comment accepted and the FEIS incorporates recommendation in Subsection 3.2.14.

22-195 Comments accepted and the FEIS incorporates recommendation in Subsection 3.2.15.1.

COMMENT LETTER 22 (Contd)

	Section	Para.	Line	Comment
22-195 (Contd)	3.2.15.1	10	1-3	Public camping is available on Paxson Lake, and the Gulkana River is heavily used by salmon sportfishers.
	3.2.15.1	11	all	Public camping is available at Sourdough Creek on the Gulkana, a popular area for grayling fishing. Camping is also available near Gulkana Airport.
22-196	3.2.15.1	12	5	"Klutina"
22-197	3.2.15.1	13	-	Public camping is available on the Little Tonsina and Tiekel rivers.
22-198	3.2.15.1	14	9	"a wide, braided [MEANDERING] stream."
22-199	3.2.15.1	16	-	Anderson Bay receives heavy use by salmon anglers.
22-200	3.2.15.1	18	1-3	"state park area[S] ..." Explain 4(F) land.
22-201	3.2.15.3	1	9-11	What is the current status of this report?
22-202	3.2.16	2	-	Koyukon Athabaskans should be added to the list of Alaska Native peoples represented in the area. The traditional territory of the Koyukon in the 19th century extended eastward to the Wiseman and Stevens Village areas (See A. McFadyen Clark, 1981. Koyukon. In Handbook of North American Indians, Vol. 6: Subarctic. Pp. 582-601. June Helm, vol. ed. Washington, DC: Smithsonian Institution).
22-203	3.2.16	2	8-9	"Pass, [WHERE] the ..."
	3.2.16	5	16	"except [FOR SOME] small-scale ..."
	3.2.17.2.1	3	3	"and hare [RABBIT]."
	3.2.17.2.1	4	1	"seabirds [AND], game birds, small mammals, and..."
	3.2.17.2.1	5	3	"grayling, whitefish, lake trout, and..."
	3.2.17.3	1	-	The community of Coldfoot should be noted.
	3.2.17.3.1	1	4-5	"Dall sheep, hare [RABBIT], porcupine, game birds, muskrats, and variety..."

RESPONSE

22-196 Editorial correction incorporated.

22-197 Comment accepted and the FEIS incorporates recommendation in Subsection 3.2.15.1.

22-198 Comment accepted and the FEIS incorporates recommendation in Subsection 3.2.15.1.

22-199 Comment accepted and the FEIS incorporates recommendation in Subsection 3.2.15.1.

22-200 Editorial correction incorporated. The federal DOT 4(f) lands designation refers to specific designated parks or recreational areas. The reason for even mentioning the 4(f) designation was that the USCG could not issue bridge permits if such lands were crossed, however, as indicated in Comment Letter Number 1, the responsibility for the bridge permitting function is being transferred to the USACE, and the 4(f) status does not apply to USACE permits (see responses to Comments 1-1 and 1-2). Until transfer is completed, existing procedures will be in place.

22-201 The wilderness evaluation, required by Section 1001 and 1005 of ANILCA, is part of the Utility Corridor Resource Management Planning effort.

22-202 Comment accepted and the FEIS incorporates recommendation in Subsection 3.2.16.

22-203 Editorial corrections incorporated.

COMMENT LETTER 22 (Contd)

	Section	Para.	Line	Comment
22-204	3.2.17.3.1	1	8	"grayling, several species of whitefish, burbot, sheefish, and pike [OTHER VARIETIES OF FISH];"
	3.2.17.3.1	1	10	"marte[I]n, lynx, fox..."
	3.2.17.3.1	4	1-2	"during April, May [AND], the late summer and fall months, usually..."
	3.2.17.3.1	6	6-7	"through September [AUGUST], primarily with set gill nets and fishwheels.
	3.2.17.3.1	6	11-13	"salmon, early spring[,] and late fall with small-mesh gill nets, and winter ..."
	3.2.17.3.1	6	15-16	"is by boat during the open-water months and by snow machine..."
	3.2.17.3.1	7	6-8	"in May through June and..."
	3.2.17.3.1	9	5	"trapping[S], moose ..."
	3.2.17.3.1	10	17	"diet than in other communities ..."
22-205	3.2.17.3.1	14	-	Minto should be designated as an Athabaskan community. Minto residents utilize the Tanana River and its tributaries, the Minto Flats, and the area south of the Elliott Highway to the Tanana River.
22-206	3.2.17.3.1	14	4-7	This sentence is garbled or has missing text.
22-207	3.2.17.3.1	8-14	-	The reader hopefully will not misconstrue these brief community subsistence use descriptions as accurately characterizing what is a far more complex pattern of fish and wildlife use.
22-208	3.2.17.4	1	-	The community of Salcha should be noted.
22-209	3.2.17.4	1	8	"Fisheries..."
22-210	3.2.17.5	all	-	Furbearer trapping should be included as an important harvest activity among Copper River area households.
22-211	3.2.17.5.1	3	8-9	"have allowed [IN] a fall ..." There is also a winter subsistence caribou hunt that is very important to communities in the Copper River Basin.

RESPONSE

22-204 Editorial corrections incorporated.

22-205 Comment accepted and the FEIS incorporates recommendation in Subsection 3.2.17.3.1.

22-206 Comment accepted and the FEIS incorporates recommendation in Subsection 3.2.17.

22-207 Comment accepted and the FEIS incorporates recommendation in Subsection 3.2.17.3.1.

22-208 Comment accepted and the FEIS incorporates recommendation in Subsection 3.2.17.4.

22-209 Comment accepted and the FEIS incorporates recommendation in Subsection 3.2.17.4.

22-210 Comment accepted and the FEIS incorporates recommendation in Subsection 3.2.17.5.

22-211 Comment accepted and the FEIS incorporates recommendation in Subsection 3.2.17.5.1.

COMMENT LETTER 22
(Contd)

	Section	Para.	Line	Comment
22-212	3.2.17.5.2	1	3-7	"Nearly 4,000[7,000] permits were issued for this fishery in 1987[1983]. Individuals are allocated up to 20[15] fish and households up to 40[30] fish [(ADF&G 1985)]."
22-213	3.2.17.5.3	1	1-4	Sourdough is located at MP 647.
22-214	3.2.17.5.3	6	1-4	Chitina is about 30 miles from Tonsina. Kenney Lake is about 12 miles from Tonsina.
22-215	3.2.17.5.3	7	-	It should be pointed out that Tatitlek is a Prince William Sound community not located on the TAGS pipeline route. The general overview provided in the DEIS for Tatitlek is adequate, but further information is available in the 1981 Chugach Region Community Subsistence Profiles developed by the North Pacific Rim.
22-216	3.3.3	2	2	"Livengood, sport and subsistence hunting and fishing ..." Minto Flats has been proposed as a State Game Refuge, and the enabling legislation is in the Legislature. Lands along the Tanana River are also part of the Tanana Valley State Forest, which should be discussed.
22-217	3.3.3	3	9-10	"plants in Fairbanks, Healy, and [ANOTHER AT] Clear AFS ..."
22-218	3.3.3	3	12-14	We do not believe that there is any "ongoing production of gold, lead, silver, zinc, and antimony in areas in and around Denali Park." Mining in the park has not occurred for several years as a result of legal action against the National Park Service. Placer gold is mined east of Rex and Ferry, well removed from park boundaries, but we are not aware of any commercial-scale hardrock mining for the other referenced metals.
22-219	3.3.3	4	-	Gravel mining is an important activity in the southern portion of the Railbelt Corridor and merits discussion.
22-220	3.3.3	6	3-6	Dimensional lumber is produced from local timber in Fairbanks.
22-221	3.3.3	10	-	Commercial fishing is also a primary industry in Upper Cook Inlet. The 1987

RESPONSE

22-212 Comment accepted and the FEIS incorporates recommendation in Subsection 3.2.17.5.2.

22-213 Comment accepted and the FEIS incorporates recommendation in Subsection 3.2.17.5.3.

22-214 Comment accepted and the FEIS incorporates recommendations in Subsection 3.2.17.5.3.

22-215 Comment accepted and the FEIS incorporates recommendations in Subsection 3.2.17.5.3.

22-216 Comment accepted and the FEIS incorporates recommendation in Subsection 3.3.3.

22-217 Comment accepted and the FEIS incorporates recommendation in Subsection 3.3.3

22-218 Agree with comment, sentence deleted.

22-219 Comment accepted and the FEIS incorporates recommendation in Subsection 3.3.3.

22-220 Comment accepted and the FEIS incorportes recommendation in Subsection 3.3.3.

22-221 Comment accepted and the FEIS incorporates recommendation in Subsection 3.3.3.

COMMENT LETTER 22 (Contd)

	Section	Para.	Line	Comment
22-221 (Contd)				catch of 10.2 million salmon had an ex-vessel value of approximately $95 million (ADF&G 1987 Commercial Salmon Season Summary).
22-222	3.3.3	11	2-3	"Susitna Flats State <u>Game</u> [WILDLIFE] Refuge ..."
22-223	3.3.7	all	-	The discussion of leach fields is misleading. Properly sized and installed leach fields are a common and very acceptable means of disposing of sanitary wastes. Leach fields installed in water or in frozen ground are not properly installed and are in violation of state standards.
22-224	3.3.7	2	-	Hazardous wastes have created disposal problems on the Kenai Peninsula in the area near the Boulder Point Alternative Route. These problems merit discussion in this section.
22-225	3.3.7	4	11	"winter's accumulation ..."
22-226	3.3.8.1	3	7-8	What are "muskeg deposits?" Peat?
22-227	3.3.11	all	-	This section is over simplified and contains broad and erroneous statements like "approximately 100 rivers and streams are crossed ... and [IN] all five species of Pacific salmon are present in most of them ..." The Susitna River is a significant anadromous fish producing river that should be discussed in this subsection. It is not mentioned.
22-228	3.3.12	2	5	"<u>spruce</u> [SPURCE] ..."
22-229	3.3.13	4	-	This paragraph should be expanded to indicate that large concentrations of geese occur in spring and fall, including snow and cackling Canada geese. It should also be noted that the only known nesting and rearing areas for the limited population of Tule white-fronted geese occur along the eastern area of the Susitna Flats State Game Refuge.
22-230	3.3.13	5	all	Minto Flats supports duck-nesting densities that are among the highest in North

RESPONSE

22-222 Comment accepted and the FEIS incorporates recommendation in Subsection 3.3.3.

22-223 Comment accepted and the FEIS incorporates recommendation in Subsection 3.3.7.

22-224 Comment accepted and the FEIS incorporates recommendation in Subsection 3.3.7

22-225 Editorial correction incorporated.

22-226 Muskeg deposits and peat can be used in this situation interchangeably.

22-227 The discussion in Subsection 3.3.11 is a generic discussion of resources to be found along the Cook Inlet-Boulder Point alternative route. Neither a site specific fisheries study nor an in-depth review of fish streams was conducted or available. Comments accepted and the FEIS incorporates recommendations.

22-228 Editorial correction incorporated.

22-229 Comment accepted and the FEIS incorporates recommendation in Subsection 3.3.13.

22-230 Comment accepted and the FEIS incorporates recommendation in Subsection 3.3.13.

COMMENT LETTER 22 (Contd)

RESPONSE

	Section	Para.	Line	Comment		Response
22-230 (Contd)				America, comparing favorably with those characteristic of prairie potholes. The area is also important nesting habitat for trumpeter swans.		
22-231	3.3.14	3	2-6	Words are missing from this sentence, since there are more than two plant species on the alternative route.	22-231	Editorial correction incorporated.
22-232	3.3.15.1	4	1	This figure, based on 1984 data, is inconsistent with "a daily average of about 25,000 visitors during the 1986 summer season" quoted in Section 3.3.4, paragraph two. The more recent data, if correct, should be used.	22-232	Comment accepted and FEIS incorporates recommendation in Subsections 3.3.4 and 3.3.15.1.
22-233	3.3.15.1	5	-	Expand this section to include the newly developed Montana Creek Wayside.	22-233	Comment accepted and FEIS incorporates recommendation in Subsection 3.3.15.1.
22-234	3.3.15.1	6	3-6	"the Susitna Flats State Game Refuge, the proposed Minto Flats State Game Refuge (currently in the legislative process), and the ..."	22-234	Comment accepted and the FEIS incorporates recommendation in Subsection 3.3.15.1.
22-235	3.3.15.1	11	-	The hunting discussion overlooks the use and value of Minto Flats, the Tanana Flats, and the northern foothills of the Alaska Range for sport waterfowl, moose, and caribou hunting, respectively.	22-235	Comment accepted and the FEIS incorporates recommendation in Subsection 3.3.15.1.
22-236	3.3.15.3	1	6-7	"route traverses [BOTH] Minto Flats ..."	22-236	Editorial correction incorporated.
22-237	3.3.17.1	all	-	Actions taken by the Joint Boards in March 1987 resulted in all the Nenana Corridor communities excluding Minto and Nenana being classified as non-rural for purposes of the state subsistence law. Although these classifications are subject to change, the discussion presented here probably should reflect the current situation.	22-237	Comment accepted and the FEIS incorporates recommendation in Subsection 3.3.17.
22-238	3.3.17.1	1	6	"Sun[L]trana ..."	22-238	Editorial corrections incorporated.
	3.3.17.1.1	1	5	"hares [RABBITS] ..."		
	3.3.17.1.1	2	10	"Tekla[I]nika ..."		
	3.3.17.1.1	3	25	"hares [RABBITS] ..."		
	3.3.17.1.1	4	13	"summer and fall."		

COMMENT LETTER 22 (Contd)

	Section	Para.	Line	Comment
22-238 (Contd)	3.3.17.1.2	1	3	"salmon, whitefish, pike, waterfowl..."
22-239	3.3.17.1.2	1	4-7	The area used includes the Tanana River and its tributaries, the Minto Flats, and the area south of the Elliott Highway to the Tanana River.
22-240	3.3.17.2.2	1	-	Specific data on household participation are available for Cantwell in the references cited above and in ADF&G permit records for moose and caribou. Information for Talkeetna, Montana Creek, and Trapper Creek appears in Division of Subsistence Technical Paper No. 143: James A. Fall and Dan J. Foster, 1987. Fish and Game Harvest and Use in the Middle Susitna Basin. The information presented for these communities in the DEIS is accurate but very general.
22-241	4.1	3	1-3	This sentence is garbled or has missing words.
22-242	4.2	-	-	"TAGS PROJECT ..."
22-243	4.2.2.2.2	3	3-5	This is unclear since the northern-most of the seven maintenance camps is actually Deadhorse. Chandalar is the northernmost of the five camps in the "Southern Dalton Highway Area."
22-244	4.2.2.2.4	1	2-3	"would be located [IN] at big Delta, about 10 miles west of the city of Delta Junction, and a 400-bed construction camp would be located adjacent to Compressor Station No. 8 about 30[40] miles south of the latter community."
22-245	4.2.2.2.4	2	6	"only about 100 [75] highway miles ..."
22-246	4.2.3.2	all	-	Need to know the baseline information regarding the total amount of disturbance, in construction areas, the TAGS project will cause that is above and beyond what is already disturbed/existing. This should be accomplished by reference to tables or an appendix (as commented on in Section 2) inventorying proposed new sites vs. use of existing sites or areas directly adjacent to existing sites for access roads, material sites, construction camps, compressor stations, the pipeline right-of-way (100 ft. for construction),

RESPONSE

22-239 Comment accepted and the FEIS incorporates recommendation in Subsection 3.3.17.1.2.

22-240 The data presented ~~is~~ are adequate for the purposes of the EIS.

22-241 Editorial correction incorporated.

22-242 Editorial correction incorporated.

22-243 Comment accepted and the FEIS incorporates recommendation in Subsection 4.2.2.2.2.

22-244 Comment accepted and the FEIS incorporates recommendation in Subsection 4.2.2.2.4.

22-245 The distance is approximately 90 highway miles. The FEIS incorporates corrected mileage.

22-246 Reference to Table 2.2.1-1 has been included. This table does not reflect the use of already disturbed areas but does include any expansion of the previously disturbed areas.

COMMENT LETTER 22 (Contd)

	Section	Para.	Line	Comment
22-246 (Contd)				airstrips, and material storage yards should be included. The total new construction area required by TAGS has a direct impact on current land use.
22-247	4.2.3.2	1	-	"Due to the nature of most of the area of Alaska this restriction would create minor impact to official access." Restriction of access to adjacent lands is a very important consideration when adjudicating any land action. Any restrictions to adjacent state land even in remote locations must be carefully considered. "Minor" should be "moderate," if the applicant proposes to restrict access.
22-248	4.2.3.2	4	2-3	"plus a small number of the material sites and all the compressor ..." Most material sites will be closed and rehabilitated unless needed by ADOT/PF or other projects. We see little need for operations use of gravel for TAGS.
22-249	4.2.3.2	6	3-5	Not all proposed campsites are on existing pads; therefore, long-term habitat loss will occur at these sites. The same is true for camp facilities associated with compressor stations.
22-250	4.2.3.2	8	-	Delete the word "possibly".
	4.2.3.2	12	12	"and access roads ..."
	4.2.4.3	1	12	"permitting phase. Such ..."
22-251	4.2.4.4	4	-	A possible mitigating measure to this and other dust problems mentioned in the DEIS would be to water or treat the roads with dust-control materials.
22-252	4.2.4.4	4	20	"During TAPS there were [WAS] dust ..."
22-253	4.2.5.3	3	4	Discuss the effect of blowdowns occurring at Compressor Station 1 on nesting peregrines.
22-254	4.2.6.2	1	4	"equipment, camp heating and waste incineration emissions, dust..." Camp heating emissions merit discussion as one of the specific topics listed in paragraph 1. It should be noted that general workpad,

RESPONSE

22-247 Access restriction for the below-ground TAGS would be similar to those in place for TAPS or for authorized ANGTS. Because of the potential for impacts to a buried pipeline, the movement of heavy equipment or other vehicles indiscriminately across the pipeline would be prohibited. To minimize the potential access impacts to adjacent state lands, the State of Alaska and TAGS could develop a program for access to tne state lands along the corridor which would be impacted.

22-248 Comment accepted and the FEIS incorporates recommendation in Subsection 4.2.3.2.

22-249 Comment accepted and the FEIS incorporates recommendation in Subsection 4.2.3.2.

22-250 Editorial corrections incorporated.

22-251 Dust control treatment is an appropriate mitigating measure but not totally effective.

22-252 Editorial correction incorporated.

22-253 Agreed. The FEIS incorporates the concept that during the TAGS operational phase compressor station blowdowns would occur relatively infrequently. Scheduled major maintenance of turbine and compressor equipment would require blowdown of compressor casings at 30,000 operating hour intervals. Routine maintenance to turbine equipment would not require blowdown of compressor casings.

Unscheduled blowdowns would occur infrequently during activation of emergency shutdown systems. It is anticipated that during the operational life of the TAGS facility, blowdown of any given compressor station facility would be limited to only a few occurrences annually. Although maintenance blowdown could be timed not to coincide with nesting activities of the Peregrine falcon, unexpected emergency blowdowns could lead to a temporary or permanent nest abandonment by an adult pair.

22-254 Comment accepted and the FEIS incorporates recommendation in Subsection 4.2.6.2.

COMMENT LETTER 22 (Contd)

RESPONSE

	Section	Para.	Line	Comment
22-254 (Contd)				access road, and highway (unpaved) traffic generates particulates.
22-255	4.2.6.3.1	all	-	This section should address the effects, if any, of gaseous pollutants (particularly methane) on nearby species, such as the nesting peregrines at Compressor Station 1.
22-256	4.2.7.3	Table 4.2.7-1		The last column in the table is mislabeled. We assume that the quantities listed represent solid waste.
22-257	4.2.7.3	1	-	This section should be expanded to discuss the use of fencing and appropriate land fill operations measures to preclude the development of an attractive nuisance and unwanted human/bear conflicts associated with solid waste disposal.
22-258	4.2.7.4	-	-	Will any radioactive substances (e.g., gamma sources) associated with nondestructive weld testing be stored or otherwise located at TAGS facilities? If so, they merit inclusion. Have photographic chemicals used for developing x-ray films of welds been considered? This section fails to address the large volume of waste oil generated by equipment servicing during construction.
22-259	4.2.8.4	all	-	This section should address the magnitude and duration of an earthquake that the pipeline will be engineered to withstand. The possibility of unknown faults and the flexibility of the buried portions of the line should also be addressed.
22-260	4.2.8.6	5	-	Unless prompt remedial action is taken by YPC "ponding of surface water on the upstream side of the pipeline and redirection of surface water flow" can be expected to generate significant amounts of suspended solids. Turbidity resulting from such erosion may be carried well downstream of the source.
22-261	4.2.8.6	6	1	"frost heave[Y] ..."
	4.2.8.7	3	4	Define "bimodal failure scars."
	4.2.8.8	3	9	"heave[Y] ..."

22-255 No impacts from gaseous pollutants (particularily methane) would be expected to occur to any animal species in the vicinity of a compressor station should a venting (blowdown) or accidental leak occur. Natural gas, which is primarily methane, is lighter than air. In the TAGS system it would be under pressure and rise rapidly. Unless an organism is directly in the path of the releasing natural gas, no impacts would occur to animals, including the peregrines which could be nesting near Compressor Station Number 1. For additional discussion on peregrine falcons see responses to Comments 22-16, 22-41, 22-67, 22-279, 22-285, 22-298 and 22-301.

22-256 Editorial correction incorporated.

22-257 YPC intends to completely enclose compressor stations with fencing. At construction camps, food scraps and wastes with the potential to attract carnivores will be secured in fenced areas or other appropriate locations to avoid human-carnivore interaction. Any landfilled wastes would be covered daily or as required to avoid creating an attractive nuisance. Landfill wastes are identified in Subsection 4.2.7.4. Additionally, the BLM stipulation would require an approved program for dealing with human/carnivore interaction.

22-258 Radioactive isotopes would be used during nondestructive weld testing. This testing service would typically be provided as a service by a contractor licensed by the Nuclear Regulatory Commission. Radiographic substances would be handled and stored per NRC regulations. Radioactive sources are generally returned to the facility that originally provided the source.

Photographic chemicals used in field testing would be collected, stored, and transported to the nearest approved facility for proper handling and disposal. Similarly, waste oils would be collected, stored, and disposed of in accordance with appropriate regulations.

22-259 Both TAPS and ANGTS authorizations require designs suitable for crossing active fault areas. YPC also will be required to develop and submit, for appropriate federal and state review and approval, a seismic design criteria program. The LNG facility has seismic requirements (see 49 CFR 193) that do not apply to either TAPS or ANGTS.

22-260 As stated in Subsection 4.2.8.6, should uplifting of the pipe occur, it would tend to be localized as would the impacts. Although ponding could occur and surface flow could be redirected, no significant amounts of suspended solids would be expected, see mitigation measures in Subsection 4.8.

22-261 Editorial corrections incorporated.

COMMENT LETTER 22 (Contd)

	Section	Para.	Line	Comment
22-262	4.2.9.2	all	-	This section should be expanded to address project related alteration of flows due to winter construction (i.e., temporary and permanent diversions for pipeline installation).
22-263	4.2.9.2	3	3	Define "flood hydrograph."
	4.2.9.2	7	2	"glaciers, are formed by successive ..."
	4.2.9.2	9	7	"thermally ..."
22-264	4.2.9.2	9	8-13	These sentences significantly understate the impacts of sediment and turbidity on aquatic resources. Moderate impacts on the spawning beds of anadromous fish could result from sediment deposition induced by upland erosion. The biological effects of turbidity, where silt- and sand-sized particles are not present in runoff from eroding areas, are minor (as stated) only if localized and of short duration. We suggest expansion of this paragraph to indicate that erosion, deposition, and turbidity can adversely affect fish and their habitat by filling spawning beds, suffocating incubating fish eggs and fry, and eliminating basal food chain organisms.
22-265	4.2.10.3	-	-	The anticipated effluent treatment constituents and effluent levels are not consistent with a combined industrial/domestic wastewater. The parameters listed with the exception of oil and grease, are more typical of a domestic sewage effluent. For a combined wastewater Total Hydrocarbons (TH) and Total Aromatic Hydrocarbons (TAH) should be indicated. The standard for TH is 15 ug/l and for TAH 10 ug/l. Chlorine residual should also be indicated; the standard is 2 ug/l. Rather than indicating a most probable number (MPN) for bacteria, the standard is usually stated as numbers of Fecal Coliform colonies per 100 milliliters (FC/100 ML).
22-266	4.2.10.5	2	6	"and moor[V]ing dolphins ..."
22-267	4.2.11.1	2	9-13	This table requires major revision. See comments on Section 3.2.11.

RESPONSE

22-262 Comment accepted and the FEIS incorporates recommendation in Subsection 4.2.9.2.

22-263 Editorial corrections incorporated.

22-264 Comment accepted and the FEIS incorporates recommendation in Subsection 4.2.9.2.

22-265 LNG plant effluent would be more typical of domestic wastewater than effluent associated with a petroleum refining or storage facility. With the exception of lubricants and cleansing substances, few industrial sources with the potential for entering the wastewater stream would be used in the plant. In any case, YPC would comply with all applicable water quality requirements.

22-266 Editorial correction incorporated.

22-267 See response to Comment 22-183.

COMMENT LETTER 22 (Contd)

	Section	Para.	Line	Comment
22-268	4.2.11.2	2	14	"each [ANADROMOUS] stream frequented by fish would require ..." See Table 1.11-1 for activities requiring ADF&G permits.
22-269	4.2.11.2	3	1-3	Research conducted by the state produced the conclusion that man-induced sediment deposited in low-gradient stream reaches will produce long-term impacts.
22-270	4.2.11.5	4	16	It should be clear that the state is concerned with maintenance of resident as well as anadromous fish resources.
22-271	4.2.11.5	5	-	Water withdrawal from anadromous fish overwintering areas will not be authorized by the state where such withdrawal would result in fish mortality. Also we note that "disposal pits" containing other than gravel or rock most likely would not be permitted in floodplains.
22-272	4.2.11.5	6	13-14	The South Fork Koyukuk, Chatanika, and Salcha rivers are considered sensitive streams in addition to those referenced in this paragraph.
22-273	4.2.11.5	6	16-22	The very high anadromous fisheries values associated with these sites merit the protection afforded by realignment. Alternative routes to avoid crossing the upper Gulkana River, the Little Tonsina River, and the Canyon Slough Complex are possible, yet have not been examined in the DEIS.
22-274	4.2.11.5	7	12	"larva[E]l ..."
22-275	4.2.12.3	all	-	This section should be expanded to discuss the specifics of the revegetation plan. An explanation of how the federal Grant of ROW (and State ROW Lease) will address rehabilitation and revegetation plan review and approval would be useful.
22-276	4.2.12.4	1-2	-	The use of insulated pipe should be researched as a possible mitigating measure. In areas of high erosion potential such as slopes, an insulated pipe may allow soil temperatures to rise enough so as to not retard the growth of plants which would otherwise be able to anchor the slope and prevent erosion.

RESPONSE

22-268 Comment accepted and the FEIS incorporates recommendation in Subsection 4.2.11.2.

22-269 Comment accepted and the FEIS incorporates recommendation in Subsection 4.2.11.2.

22-270 Comment accepted and the FEIS incorporates recommendation in Subsection 4.2.11.5.

22-271 Comment accepted and the FEIS incorporates recommendation in Subsection 4.2.11.5.

22-272 Comment accepted and the FEIS incorporates recommendation in Subsection 4.2.11.5.

22-273 The crossing of the upper Gulkana River has been modifed by subsequent discussion at the State agency/YPC meeting held January 20, 1988. The identified problem has been solved for the Little Tonsina River according to the DNR letter of January 27, 1988, Brossia to Tileston.

The Canyon Slough Complex is now considered an area of special concern along the TAGS alignment in Subsection 4.2.19.22. The FEIS reflects material about Canyon Slough included in the State's Draft Prince William Sound Area Plan.

22-274 Editorial correction incorporated.

22-275 It is not appropriate at this stage of project development to discuss the specifics of the revegetation plan. The BLM's Grant of Right-of-Way requires that YPC prepare a detailed restoration plan which would include rehabilitation and revegetation for approval before any notice to proceed could be issued.

22-276 The use of insulated pipe would be considered by YPC as a possible mitigating measure to prevent frost bulb blockage at stream crossings and other areas with high ground water flow. Use of insulated pipe in areas such as slopes would be examined along with other mitigative measures during detailed design. Retardation of plant growth due to cold pipe effect is not expected to be a significant problem.

COMMENT LETTER 22 (Contd)

	Section	Para.	Line	Comment
22-277	4.2.12.4	6	12	"sludge and [ON] refus[G]e at ..."
	4.2.12.4	6	13	"or eu[A]trophying ..."
22-278	4.2.13.2.1	9	11-13	We believe that moderate impacts to the Nelchina Herd may occur if the Sourdough Creek camp and Compressor Station No. 9 are constructed as proposed. Since the Nelchina Herd is of both regional and statewide significance due to good hunter access these impacts should be pointed out in this summary paragraph.
22-279	4.2.13.3.1	6	-	This paragraph should discuss all instances where conflicts occur between the proposed pipeline alignment or facilities and recommendations in the Alaska Peregrine Falcon Recovery Plan. Alternatively, Appendix H could be referenced for more information.
22-280	4.2.13.3.2	1	-	Although the total amount of nesting habitat affected may be small and the overall impact minor, the local impact would be highly significant and impact would be moderate to high. Plans to minimize this impact must be incorporated into the construction and operational phases.
22-281	4.2.13.3.3	3	-	Floodplain material sites may adversely affect crane roosting areas.
22-282	4.2.13.4	3	7-9	The statement "The overall impacts from disturbance during construction would be moderate to minor" is an oversimplification. The state has concerns regarding impacts to the natural movements of migratory species due to construction as well as the potential for pushing animals out of critical overwintering habitat due to operation of the pipeline Compressor Station No. 9. This potential impact has not been adequately addressed in the DEIS.
22-283	4.2.14.1	1	9-13	Table 4.2.14-1 does not list whales or plants as stated.
22-284	4.2.14.1	Table 4.2.14-1		The sensitive periods for bald eagles and gyrfalcons may begin earlier than indicated.

RESPONSE

22-277 Editorial corrections incorporated.

22-278 The BLM and USACE have carefully reevaluated the proposed location of TAGS facilities, construction activities, and operation activities as they relate to the Nelchina Caribou Herd. The FEIS has been revised, but not to the extent reflected in this comment. For additional discussions of the Nelchina Caribou Herd also see responses to Comments 22-16, 22-41, 22-42, 22-54 and 22-282.

22-279 Comment accepted and the FEIS incorporates the reference to Appendix H. The Biological Assessment included in Appendix H of the DEIS for TAGS was developed in cooperation and coordination with U.S. Fish and Wildlife Service (FWS) Endangered Species staff specialists in accordance with Section 7 of the Endangered Species Act of 1969 as amended. Concurrence with the assessment and the mitigation factors was made by FWS. The intent of a Biological Assessment is to provide sufficient information and analysis to evaluate the potential effects of an action on listed and proposed species and determine whether such species or habitats are likely to be adversely affected by the proposed action.

Information on peregrine falcon nest sites and territories was provided by FWS Endangered Species staff specialists, the recognized authorities in Alaska. Although information supplied omitted reference to nest sites along the Salcha River, the assessment covers the types of impacts anticipated, given the available data, and mitigation developed would provide for future protection and conservation of peregrine falcons that may be discovered or establish themselves in the proposed project area during the life of the pipeline rights-of-way grant. This holds true for any nest sites not specifically mentioned in the biological assessment but within 15 miles of the proposed pipeline route.

An arbitrary 8 miles was used for illustrative purposes in describing potentially impacted nest territories along the proposed pipeline right-of-way. Limiting the discussion to 1 or 2 miles, or increasing it to the 15-mile limit of protection indicated in the recovery plan guidelines would not, in this case, be indicative of what could be considered a realistic assessment of potential impacts on peregrine populations along the proposed route.

Mitigation specific to the Sagwon Bluffs area would take precedence over the more general mitigation measures where the conditions of the measures overlap. Where specific mitigation measures do not replace or take precedence, the general mitigation measures apply.

As stated in the Mitigation Measures, it is understood that the restrictions imposed by mitigation measures may not be appropriate under all circumstances and in all conditions. Exceptions may be granted on a case-by-case basis after consultation with FWS. Additionally, all phases of the project require consultation with BLM and FWS on design of site locations, construction timetables, operation, maintenance, and repair and termination/rehabilitation activities.

The term "pipeline realignment," as used in the assessment and mitigation measures, includes repositioning an existing pipeline that has been permitted, realignment of a staked centerline within a granted rights-of-way to cause it to encroach on a buffer zone for a peregrine falcon nest or move closer to a nest where USFWS and BLM have jointly determined that a pipeline could be staked and/or constructed within a buffer zone around a nest or nest territory. The restrictions on habitat alteration identified in the mitigation measures and the recovery plan guidelines (e.g. habitat alteration within 1 mile of nest sites) will remain in effect unless excepted by BLM in consultation with FWS. This will be accomplished as identified in the preceding paragraph.

COMMENT LETTER 22
(Contd)

RESPONSE

Nothing in the Biological Assessment or the Mitigation Measures implies or is intended to imply permitting of any action. Permitting of construction of facilities within a granted rights-of-way is a separate legal process. The assessment and mitigation only serve to help condition any permits and actions to conserve and protect the peregrine falcon populations in the proposed project area. All conditions of the mitigation measures and guidelines of the recovery plan must be met by YPC before construction can take place. If they cannot meet the conditions or do not get an exception granted, they will not be able to carry on construction or other activities that are related to the project in areas of peregrine falcon habitat or occupancy as per the mitigaton measures and the recovery plan guidelines.

The purpose of the mitigation measures is not to preclude activities, but to conserve and protect resource values to prevent a jeopardy situation as directed by the Endangered Species Act. For additional discussion on peregrine falcons, see responses to Comments 22-16, 22-41, 22-67, 22-255, 22-285, 22-289, and 22-301.

22-280 The discussion does indicate that a moderate localized impact could result in some areas, we cannot agree that these impacts would be major within the existing utility corridor. Major means a regional change in habitat availability or quality that would likely modify the natural abundance or distribution of a species potential through the life of the project. The impacts would be short-term, construction-related impacts. Brink (1978) described the potential local impact of flooding on tundra birds as major. She suspected that White-fronted Geese, the only waterfowl species she discussed, benefited from such flooding. Therefore, as stated, the total amount of waterfowl nesting habitat loss would be small, and impacts minor. We do agree that pipeline engineering should attempt to minimize this problem, but for the general reason of reducing impacts on wetland habitats.

22-281 Although some roosting sandhill cranes may be affected by floodplain material site activities, no area of known concentrations of roosting sandhill cranes would be impacted by material site activities. Each location for a material site would receive site-specific evaluation. Comment accepted and the FEIS incorporates recommendation.

22-282 We believe the statement quoted in the comment is appropriate for a summary section and is consistent with the impact definitions in Table 4.1-1, as well as with the expanded information presented above under Comments 22-16, 22-41, 22-42, 22-54, and 22-278. The State's concerns regarding impacts on caribou migration have been responsed to also in these comments. The concern regarding "the potential for pushing animals out of critical overwintering habitat due to operation of the pipeline Compressor Station No. 9" is unfounded. Based on a worst case scenario of a 6,000-foot radius of influence, a circular area of approximately 4 square miles would be affected by operational noise from the compressor station, and no 4-square-mile area within the winter range of the Nelchina Herd can be characterized as "critical." Operation of Compressor Station 9 would cause local impacts on spring and fall migratory movements, as discussed in the cited comments. It should be noted that the proposed location of Compressor Station 9 on the southeastern flank of Hogan Hill would cause noise dispersion in the west and north to be significantly reduced below the 6,000-foot radius of influence due to the topography of the site and its relationship to the existing steep-walled material site used for state highway and TAPS maintenance.

22-283 Editorial correction incorporated.

22-284 Table 4.2.14-1 has been modified to reflect earlier time period.

COMMENT LETTER 22
(Contd)

	Section	Para.	Line	Comment
22-285	4.2.14.4	1	11-12	YPC's compliance with FWS conditions should be assured by BLM and not be "to the extent possible."
22-286	4.2.15.2	-	-	One impact not discussed in this section is closing of public campgrounds due to the presence of marauding bears habituated to humans. Such habituation results from bear feeding by pipeline workers and poor handling and disposal of garbage and other attractants. This situation occurred at the public campground on the upper Little Tonsina River near Pump Station #12 during TAPS construction.
22-287	4.2.15.2	3	4	The realignment of the TAGS pipeline west of Summit Lake is not recommended by the ADF&G. This is one of the areas where there is significant deviation from the TAPS alignment. This area should be maintained in its current semi-wilderness state to protect the important fish and wildlife values found along the proposed TAGS alignment.
22-288	4.2.15.2	3	9	"[PARKS] federal conservation units, ..."
22-289	4.2.15.5	1	-	What does this paragraph mean? How do the federal DOT and the U.S. Coast Guard relate to state parks?
22-290	4.2.15.5	1	-	This paragraph should identify the lands in question and should explain why and how the federal DOT and U.S. Coast Guard are involved in state designation of land for public purposes.
22-291	4.2.17.2	4	4	"Fisheries ..."
22-292	4.2.17.2	4	6-10	A personal use salmon fishery was established in the Yukon River bridge area this year for non-local residents, many of whom reside in the Fairbanks area.
22-293	4.2.17.2	5	5-7	As previously discussed, the TAGS project as currently proposed is likely to produce moderate impacts on the Nelchina Caribou Herd. Disturbance-related deflections of migrating caribou are likely to reduce the effectiveness of the TAPS refrigerated-burial caribou crossing south of Hogan Hill.

RESPONSE

22-285 Agree, but it is noted that the standards for protection of threatened and endangered species provide certain latitudes when site-specific information is available. For additional comments on peregrine falcons, see responses to Comments 22-16, 22-41, 22-67, 22-255, 22-279, 22-298, and 22-301.

22-286 State comment accepted and the FEIS incorporates recommendation in Subsection 4.2.15.2.

22-287 See response to Comment 22-15.

22-288 Editorial correction incorporated.

22-289 See Comment Letter Number 1 from the U.S. Coast Guard. The first paragraph of Subsection 4.2.15.5 is deleted.

22-290 See response to comment 22-289.

22-291 Editorial correction incorporated.

22-292 Comment accepted and the FEIS incorporates recommendation in Subsection 4.2.17.2.

22-293 See response to Comment 22-54.

COMMENT LETTER 22 (Contd)

	Section	Para.	Line	Comment
22-294	4.2.17.4	4	1, 14	"Fisheries ..."
22-295	4.2.17.5	3	10-13	We would argue that employment-induced reductions in subsistence participation also have economic effects. The interrelationship of cash and subsistence is alluded to in this section, but the discussion clearly demonstrates that sociocultural and economic factors are at play.
22-296	4.2.17.6	2	14	"would result in a ..."
22-297	4.2.17.9	1	32-38	We question the exclusion of North Slope and other Northern Corridor communities from those listed that might experience major but possibly temporary restrictions on subsistence uses.
22-298	4.2.19.2	1	-	The proposed TAGS alignment at Sagwon Bluffs is not consistent with peregrine falcon restrictions provided in Appendix H, which prohibit habitat alterations within one mile of nest sites.
22-299	4.2.19.4	1	-	The proposed TAGS alignment at Slope Mtn. is not consistent with peregrine falcon restrictions provided in Appendix H, which prohibit habitat alterations within one mile of nest sites.
22-300	4.2.19.5.1	2	12	"construction[,]. Impacts to ..."
	4.2.19.9	2	6	"Koyu[O]kuk River ..."
	4.2.19.11	1	8	"point[,]. The TAGS ..."
	4.2.19.13	2	1	"[TAPS] TAGS bridge ..."
	4.2.19.13	4	9	"bridge [RAMP] ramp ..."
22-301	4.2.19.14	1	7-9	"is within 1 mile of a previously occupied peregrine falcon aerie and is within 2 miles of a currently occupied peregrine falcon aerie located ..." Pipeline leasing at Grapefruit Rocks is not an approved activity under the Tanana Basin Area Plan.
22-302	4.2.19.17	all	-	This section needs to be expanded to describe the importance of the sockeye salmon fishery in the Upper Gulkana. Ken Roberson (ADF&G) has indicated that from

RESPONSE

22-294 Editorial correction incorporated.

22-295 Comment accepted and the FEIS incorporates recommendation in Subsection 4.2.17.5.

22-296 Editorial correction incorporated.

22-297 The BLM and USACE have carefully reevaluated subsistence uses and subsistence use patterns of those North Slope communities closest to the proposed TAGS project and to other Northern Corridor communities. On a worst-case basis, we still find no compelling evidence to suggest the proposed TAGS project would create a significant short-term or long-term impact to existing subsistence uses and/or access to subsistence resources for residents of Anaktuvik Pass (about 60 air miles to the east), Nuiqsut (about 75 air miles to the east), or Kaktovik (about 115 air miles to the west). Over the past number of years, there has been a gradual shift of subsistence use away from the Utility Corridor where TAGS would be located. This shift also appears to be directly related to increasing public access as a result of state actions on use of the Dalton Highway and is independent of the proposed TAGS project. Should conflicts between sport and subsistence uses intensify, there exists a state regulatory mechanism that gives priority to subsistence uses (see Subsection 4.2.17 and Appendix L). Accordingly, it is still concluded there would be no significant impact or "significant restriction" on residents of North Slope communities.

The BLM and USACE have concluded that residents of Stevens Village under a worst-case scenario could have a significant impact to subsistence uses during the 36-month period that TAGS was under construction. Operation of TAGS would cause no significant restriction to subsistence uses by residents to Stevens Village. The FEIS and Appendix L have been revised accordingly. (For additional discussion, see response to Comment 22-57.)

22-298 We disagree. The BLM prepared a detailed Biological Assessment on the anticipated effects of the proposed location of the TAGS and compressor station. That evaluation was submitted to the FWS on June 3, 1987 in accordance with the provisions of the Endangered Species Act.

On June 30, 1987, the FWS concurred with the BLM conclusion that the proposed TAGS project would not have any long-term or cumulative negative effects on penegrine populations providing protective measures outlined in the BLM Biological Assessment were followed. Also see responses to Comments 22-16, 22-41, 22-67, 22-255, 22-279, 22-285, and 22-301.

22-299 See response to Comment 22-298.

22-300 Editorial correction incorporated.

22-301 Comment noted.

22-302 Comment accepted and the FEIS incorporates recommendation in Subsection 4.2.19.17.

COMMENT LETTER 22 (Contd)

	Section	Para.	Line	Comment
22-302 (Contd)				5000 to 10,000 sockeye spawn below the proposed crossing site, and the construction activity is expected to adversely affect this resource. He has also pointed out that there is no least sensitive time period for fisheries concerns in this system. To avoid unnecessary fish and wildlife impacts the ADF&G will request realignment of TAGS to avoid crossing the upper Gulkana River. It should also be noted here that, with respect to the Gulkana River, there is a sockeye salmon incubation facility below as well as "above" the proposed crossing site.
22-303	4.2.19.19	all	-	It is unclear if further constriction of the Lowe River channel would occur during construction of the pipeline. Constriction in narrow canyon areas that would impact salmon migration are not acceptable. Impacts on fish passage, if any, should be discussed in this section.
22-304	4.3.3	1	8-9	Minto Flats is currently in the legislative process for designation as a State Game Refuge.
22-305	4.3.16	4	10	It is not clear why the "Healy Lake site" is mentioned here since it has not been discussed in preceding paragraphs. Also, Healy Lake lies between Delta and Tok, not near the TAGS alternative route.
22-306	4.3.17.1	2	all	Minto, Nenana, and Cantwell are the only communities in the Nenana Corridor that are classified as rural by the Boards of Fisheries and Game.
22-307	4.3.17.2	1	11-13	Anderson/Clear, Healy/Suntrana, and McKinley Village are not rural.
22-308	4.3.17.3	1	14-15	Anderson/Clear, Healy/Suntrans, and McKinley Village are not rural.
22-309	4.3.17.3	2	1	"Fisheries ..."
22-310	4.4.2.1	1	7	"Appendix H [A]." We are unconvinced that the impacts will be "negligible."
22-311	4.4.3.1	1	9	"including the proposed Minto Flats State Game Refuge, ..."

RESPONSE

22-303 YPC plans to construct the TAGS pipeline crossing of the Lowe River within Keystone Canyon in a single operation without constriction of the river flow. If geotechnical conditions require a staged trench excavaton at the crossing with diverson structures, then activities would be restricted to periods of low impact on fish passage.

22-304 Comment accepted and the FEIS incorporates recommendation.

22-305 The Dry Creek site is in the vicinity of Healy. Reference to Healy Lake was incorrect.

22-306 Comment accepted and the FEIS incorporates recommendation in Subsection 4.3.17.1.

22-307 Comment accepted and the FEIS incorporates recommendation in Subsection 4.3.17.2.

22-308 Comment accepted and the FEIS incorporates recommendation in Subsection 4.3.17.3.

22-309 Editorial correction incorporated.

22-310 Editorial correction incorporated. As stated in Appendix H, the U.S. Fish and Wildlife Service found project-related activities, if mitigated, to be acceptable.

22-311 Editorial corrections incorporated.

COMMENT LETTER 22 (Contd)

	Section	Para.	Line	Comment
22-311 (Contd)	4.5.1.1	1	8-9	"in 1974, a portion of the federal ..."
	4.5.1.2	2	5	"be constructed[ION] first ..."
	4.5.1.5	2	2	"TAGS are [IS] ..."
	4.5.4	2	6	"TAGS [TAPS] ..."
	4.5.8.2	2	"Offshore"	"Diapir [DIAPHER] Field ..."
	4.5.11	1	9	"major cumulative[S] ..."
	4.5.11	4	4	"TAPS [TAGS] ..."
22-312	4.5.13	all	-	As previously noted, we expect cumulative impacts on the Nelchina Caribou Herd. We do not agree that the statement "Impacts could be absorbed without decrease to the local or regional population" is necessarily true, particularly with reference to the Nelchina Herd.
22-313	4.5.14	1	13-17	While we concur that loss of individuals is unlikely to occur, analysis of cumulative impacts should address habitat losses and the additive effects of disturbance associated with permanent facilities on threatened and endangered species.
22-314	4.5.18	all	-	This section addresses the possibility of TAGS affecting the other pipelines. What about the other pipelines affecting TAGS?
22-315	4.5.20	2	8-10	ENSTAR has proposed a gas pipeline from Big Lake to Fairbanks that should be considered in this analysis. An upgrade of the power transmission intertie system has also been proposed and should be considered.
22-316	4.5.20	6	20-24	This section should also address the plans and efforts by the Matanuska-Susitna Borough to develop a Port Facility at Point McKenzie in Upper Cook Inlet. An EIS is currently being developed for this project.
22-317	4.5.20	18	4	"Preserve, proposed Minto Flats State Game Refuge, Denali ..."
	4.5.20	23	4	"Boards of Fisheries ..."
22-318	4.5.20	23	3-11	Rural and non-rural areas were designated by the Joint Board of Fisheries and Game in

RESPONSE

22-312 The cumulative impacts on the Nelchina Herd would be limited to minor or negligible increases in energy expenditure by any animals that deflected around Compressor Station 9 during migrations, after already having been deflected by the highway or TAPS; to increased, but negligible, mortality from a small amount of additonal poaching; and to increased mortality, probably negligible but perhaps minor, as a result of increased collisions with vehicles on the Richardson Highway. Any decrease in herd population size from the increased mortality described would most likely be negligible. Increased energetic costs during migration would not cause mortality unless the animals in question were already in extremely poor body condition as a result of other factors unrelated to TAGS. Caribou have the lowest net cost of locomotion of any terrestrial species yet studied (S.G. Fancy and R.G. White 1987, Energy expenditures for locomotion by barren-ground caribou. Can. J. Zool. 65:122-128), and although migrating females appear to have low energy reserves during spring migration, the additional distance traveled in deflecting around localized construction or operational activties associated with TAGS would be very small in terms of the total distance covered during spring migration to the calving grounds. No adult mortality caused by increased energetic demands resulting from deflected movements is expected; it is conceivable, but not likely, that some pregnant cows in very poor condition could suffer abortion of fetuses if forced to detour long distances around project activities or facilities.

22-313 Comment accepted and the FEIS incorporates recommendations in Subsection 4.5.14.

22-314 Comment accepted that the other pipelines effects or TAGS should be identified. Appendix B discusses the compatibility of the various pipeline systems.

22-315 Comment accepted and the FEIS incorporates recommendation in Subsection 4.5.20.

22-316 Comment accepted and the FEIS incorporates recommendation in Subsection 4.5.20.

22-317 Editorial correction incorporated.

22-318 Comment accepted and the FEIS incorporates recommendation in Subsection 4.5.20.

COMMENT LETTER 22 (Contd)

RESPONSE

	Section	Para.	Line	Comment
22-318 (Contd)				the spring of 1987. The referenced sentence is therefore incorrect.
22-319	4.10	all	-	The DEIS does not provide the reviewer with a clear definition of "irretrievable" and "irreversible," nor does the narrative accompanying Table 4.10-1 fully explore the concepts of "irretrievable" and "irreversible" as the are applied to the various environmental disciplines outlined in the DEIS. In order to evaluate Table 4.10-1 as to the accuracy of the yes/no notations, definitions are required.
22-320	5.2	1	-	Delete all references to state requirements for environmental assessment prior to authorizing a right-of-way for the project. DGC is coordinating state agency reviews (designated cooperating agencies) of the DEIS as correctly stated in Section 5-4.

22-319 Subsection 4.10 is meant to be a summary of those impacts identified in Subsection 4.2 for the proposed project. The terms "yes" and "no" in Table 4.10-1 rely on the definitions of irreversible and irretrievable with respect to the impacts defined and the knowledge of what is generally occurring along the existing TAPS right-of-way.

22-320 Statement deleted from the FEIS in Subsection 5.2.

APPENDIX F COMMENTS

22-321 The maps in Appendix F do not accurately show land status along the proposed TAGS route. It is important to represent it graphically and accurately. Present maps are not legible.

22-321 The maps included in Appendix F provide an overview of land ownership. More detailed maps would be available as identified in the response to Comment 15-6.

APPENDIX H COMMENTS

22-322 The state has reviewed Appendix H for completeness and has discussed its contents with the USFWS Endangered Species staff. We believe that the Biological Assessment requires some clarification. Our comments follow and are arranged by headings used in BLM's Biological Assessment.

Specific Areas That May be Affected

It appears that a criterion of identifying peregrine nest sites within an eight-mile distance from the proposed TAGS route has been used in the Biological Assessment. Using this criterion, two historic nest sites near Richardson fall within the "Big Delta area" and should be included in the discussion. Two additional sites have been noted on the Salcha River within 1.5 to 2.5 miles from the proposed TAGS route. These should be discussed. One historic nest site, although apparently not well documented, exists on the Chena River within four to five miles of TAGS and should be at least mentioned.

At Grapefruit Rocks, the proposed TAGS route passes less than one mile from the historic aerie which, although on state land, is not consistent with the proposed peregrine mitigation measures. The ADF&G has recommended disapproval of the TAGS route at this location.

22-322 See response to 22-279.

COMMENT LETTER 22 (Contd)

RESPONSE

22-322 (Contd)

Although the "Slope Mountain area" discussion acknowledges that the proposed TAGS route passes within one mile of a nest site, which is not consistent with proposed peregrine mitigation, no discussion of realignment at this location appears in the DEIS.

The discussion for the area "South of Sagwon" on the Sagavanirktok River discusses two nest sites but does not give the distance from the proposed Happy Valley Camp and airstrip to the nearby nest site. This distance is required in order to determine compatibility between proposed facilities and the peregrine mitigation measures.

In the "Sagwon Bluffs area" discussion, only six nest sites are mentioned but seven are known within eight miles of the proposed TAGS route: two near PS #2 as stated; one about 3.75 miles from the TAGS route between PS #2 and Sagwon, which was apparently overlooked; and four within three miles of the route as stated. Although the discussion correctly states that two nests are within two miles of the proposed Compressor Station No. 1 location, it fails to state that one of these sites is slightly less than one mile from the station location (station perimeter). Also, although the discussion correctly states that one nest is within one mile of the proposed pipeline, actually two of the nests fall within this range, being only about 0.5 miles from the route. The proposed TAGS route appears to conflict with the peregrine mitigation measures even though an exception has been made for Compressor Station No. 1, if it is located at least one mile from a nest site.

At Franklin Bluffs, a preconstruction camp is stated to be planned "approximately four miles from the nearest nest"; however, <u>three miles</u> from the nearest portion of the large, previously mapped (ANGTS) nest area appears closer to the mark.

<u>Chemical Contamination</u>

22-323 The fifth paragraph should clearly state that the proposed location of Compressor Station No. 1 is slightly less than one mile from a peregrine nest site.

22-323 Comment noted, see response to Comment 22-279.

<u>Conservation and Mitigation Measures</u>

22-324 Throughout the mitigation measures, BLM has referred to "pipeline realignment" as a prohibited habitat alteration. We believe that <u>pipeline construction</u> more clearly states the intent of the prohibition on habitat alteration. Our discussion with USFWS Endangered Species personnel revealed that they understood "pipeline realignment" to mean <u>pipeline construction</u>. We believe the confusion arises from the ANGTS Section 7 consultation where the word "realignment" was used in its dictionary sense of deviation from an approved route. The ADF&G recommends that the TAGS language be amended to prohibit pipeline routing within one mile of nest sites unless specifically authorized within the mitigation measures.

22-324 See response to Comment 22-279.

COMMENT LETTER 22 (Contd)

RESPONSE

Section	Para.	Line	Comment

22-325 With reference to construction near the Sagwon Bluffs nest sites (Section D of the mitigation measures), it is unclear whether or not mitigation measures B.1.b, B.2.a, and B.3 would apply (i.e., be additive), as well as D.1 and D.2, in the event occupied nests are present. Likewise, would C.3 apply to TAGS activity in the Sagwon area? If approval of the proposed location for Compressor Station No. 1 is granted following a diligent search for alternative sites, we recommend that mitigation measures B.1.b., B.2.a, and B.3 (=C.3) apply to TAGS-related activity in the area. We assume that this would require disapproval of the proposed TAGS route south of the compressor station where the pipeline would be 0.5 mile from two peregrine nest sites.

22-325 See response to Comment 22-279.

COMMENT LETTER 23

RESPONSE

United States Department of the Interior

FISH AND WILDLIFE SERVICE
1011 E. TUDOR RD.
ANCHORAGE, ALASKA 99503

IN REPLY REFER TO:
ANC-FWE

NOV 20 1987

Mr. Jules V. Tileston
U.S. Department of the Interior
Bureau of Land Management
Alaska State Office
701 C Street, Box 30
Anchorage, Alaska 99513-0099

Dear Mr. Tileston:

The U.S. Fish and Wildlife Service (Service) has reviewed the Trans-Alaska Gas System Draft Environmental Impact Statement and offers the following comments for your consideration. Specific comments are referenced by page number, column listing, and number.

GENERAL COMMENTS

The document adequately provides a broad description of the proposal, including the potential adverse environmental impacts. We understand that construction specifics will be provided during the Tiered Processing Procedure as proposed by the U.S. Army Corps of Engineers.

23-1

In general, we find deficiencies in two areas. First, the document needs to clearly identify measures to avoid adverse impacts, thereby reducing overall mitigation needs. The Service believes that certain high-value wetlands should be avoided during pipeline siting and construction,and thus should be specifically excluded from the Tiered Processing Procedure. These wetlands are undisturbed ponds (1.0 acre or larger), undisturbed lakes (10.0 acres or larger), and brackish sedge marsh (or equivalent types in alternative classification schemes). Other sensitive habitats should be avoided as well. Secondly, the document fails to address mitigation of direct habitat losses associated with the project. To correct this deficiency, the following information should be developed and included:

1. Predictions of direct and indirect losses of wildlife and wildlife habitat.
2. Mitigation measures for the habitat lost to the project. Consideration should be given to off-site and out-of-kind mitigation techniques when adequate mitigation cannot be achieved on-site and in-kind.
3. Procedures for (a) comparing actual post-construction habitat impacts with pre-construction estimates; (b) measuring the effectiveness of selected mitigation techniques; and (c) determining mitigation requirements.

The aforementioned items should be addressed in a comprehensive mitigation plan which would address all mitigation requirements for the project. This plan would also include Best Management Practices and agency stipulations which in-turn could be used as a field guide during project construction.

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23-1 Many of the adverse impacts identified in the EIS would result in moderate to negligible long-term effects. The mitigation measures in Subsection 4.7 along with expected permit stipulations would assist in reducing the adverse impacts, but many of the identified impacts would occur if the project is constructed. NEPA does not require that all adverse impacts be mitigated, but that they are addressed so that the decision maker can evaluate the project and the impacts, and then reach a determination.

The USACE proposes to exclude these wetland types from the tiered processing procedure, however, this will not preclude YPC from applying for individual Section 404 permits in these wetland types. The USACE does not have the authority to deny an applicant the use of a specific wetland or wetland type without first going through the full permit process and determining that it would not be in the public interest to authorize the proposed work in that specific wetland or wetland type.

The TAGS project is not yet at the detailed design and engineering stage, nor have they initiated the site-specific environmental studies necessary to comply with the various federal and state requirements to provide the information suggested for inclusion in the EIS.

The BLM's Grant of Right-of-Way would require YPC to develop 25 comprehensive environmental and engineering plans to comply with proposed stipulation 1.8.1 of the grant.

COMMENT LETTER 23 (Contd)

RESPONSE

SPECIFIC COMMENTS

23-2 Page 1-19; Table 1.11-1
Agency - Fish and Wildlife Service
The Service has been designated as a cooperating agency in the preparation of the document. The provisions of the Fish and Wildlife Service Coordination Act and the Service Mitigation Policy Statement will be implemented in Phase IV-Startup and Operations as well as in Phases II and III.

23-2 Comment accepted and FEIS incorporates recommendation in Table 1.11-1.

23-3 Page 2-2; Table 2.2.1-1
The total amount of fish and wildlife habitat that will be lost to project operations is estimated at 8,119 acres. We recommend that surveys, to be completed within one year of startup, be made to determine the actual total of habitat acreage lost.

23-3 There is a requirement on federal lands that the applicant provide "as builts" following completion of construction. This would identify areas occupied by TAGS, which in turn could be compared to information provided during initial design stages.

Since the pipeline involves both federal and state authorizations, uniform data collection and analysis requirements would be developed during the design criteria phase to coordinate the federal and state efforts.

23-4 Page 2-17; column 1, line 28 and Table 2.3.1-1
Please explain why the Trans-Alaska Pipeline System Sourdough Construction site will not be used. Please complete the Table for Construction Spread #5 as it relates to Compressor Station #9 - Sourdough Creek.

23-4 Use of the abandoned Sourdough construction site was considered by TAGS during initial project scoping, but was eliminated when the TAGS pipeline routing was relocated to the east of the Richardson Highway to avoid the Gulkana National Wild and Scenic River area. The TAPS Sourdough camp site and storage yard is bounded on the north and south by the Gulkana Wild and Scenic River corridor and to the west by a TAPS special buried refrigerated caribou crossing. The co-location of the TAGS pipeline construction camp and the constructon camp for Compressor Station No. 9 at the Hogan Hill/Sourdough Creek site reduces the bedspace requirements (to 600 for the pipeline and 300 for the compressor station) and reduces impacts to the caribou crossing by creating a single point of construction camp activity to the north of the crossing.

23-5 Page 2-18; Table 2.3.1-2
Temporary material storage areas were developed near Prospect, Gulkana, and Willow Lakes during construction of the Trans-Alaska Pipeline System. Please discuss why these sites have not been designated for use during construction of this project. A stated objective of this project is "Reuse former Trans-Alaska Pipeline System facilities . . . as much as possible" (Page 2-53, column 2, line 38).

23-5 See response to Comment 22-104.

23-6 Page 2-53; column 2, lines 13 and 14
Please rewrite the "Minimize impacts . . ." statement to be more encompassing. Suggestion: "Minimize adverse impacts to fish and wildlife, including marine species, and their aquatic and terrestrial habitats."

23-6 Language contained in this section has been summarized from the application filed with the BLM and USACE. As such, the suggested revision of the applicant's words is inappropriate. Agree with the intent and will treat as outlined in response to Comments 22-123 and 12-19.

23-7 Page 2-54; column 2, line 15
Replace "light" with "stabilization" so it reads "Perform stabilization grading . . ."

23-7 This section deals with YPC's proposed mitigation and it is not appropriate to add to or take away from them.

23-8 Page 2-55; column 2, line 21
Add "and wetland" after "stream" so it reads "In sensitive stream and wetland areas . . ."

23-8 See response to Comment 23-7.

23-9 Page 2-55; column 2, lines 31, 32, and 33
Please rewrite the "In general, for water . . ." statement to be more restrictive. Suggestion: "Quantities and methods of removing water from fish streams and lakes will be in accord with Alaska Department of Fish and Game directives."

23-9 See response to Comment 23-7.

23-10 Page 2-56; column 1, line 13
After ". . . sensitive streams" add "in accord with State Water Quality Standards."

23-10 See response to Comment 23-7.

COMMENT LETTER 23 (Contd)

RESPONSE

23-11 Page 2-57; column 2, line 10
The mitigative aspects of the proposed project should consider mitigation for the habitat lost due to the construction of permanent facilities. NOTE: The lack of consideration for the mitigation of permanently lost habitat will be mentioned throughout the text of our review and discussed with our comments pertaining to "Other Agency Participation . . .," Page 5-2, column 1, line 24.

23-11 See response to Comment 23-7.

23-12 Page 3-16; column 1, line 39
Please change "Erigeron myirii" to read "Erigeron muirii."

23-12 Editorial correction incorporated.

23-13 Page 3-17; column 1, lines 8, 9, and 10
The statement is made that "Dall sheep habitat is also important for . . . hunting." Please discuss this within the context of the hunting prohibition within five miles of the Dalton Highway.

23-13 The only type of hunting permitted within 5 miles of the Dalton Highway north of the Yukon River is with bow and arrow. Use of firearms is prohibited within the 5-mile area.

23-14 Page 3-19; column 1, lines 24, 25, and 26
To be more descriptive, the statement should read: "From Glennallen the Richardson parallels the Copper, Little Tonsina, Tiekel and Tsina Rivers and Ptarmigan Creek."

23-14 Comment accepted and the FEIS incorporates comment.

23-15 Page 3-33, column 1, lines 32 and 33
The statement is made that "The pipeline crosses more than 200 streams." With reference to Pages 3-47, 48 and 49, Table 3.2.11-1, please make the distinction between the "number of streams crossed by the pipeline" and the "number of pipeline stream crossings." It is possible that a single stream may have multiple crossings. See Page 3-46, column 2, lines 17 and 18.

23-15 There is no difference between the two phrases. The listing of 104 fish streams in Table 3.2.11-1 identifies the exceptionally productive fish streams crossed or impacted by the proposed TAGS project. In Comment 22-183, the State identifies the remainder of the fish streams crossed, providing a complete inventory of all fish streams. Often, the project crosses streams that are not presently inhabited by fish. The total number of streams crossed is greater than 200, but until site-specific alignment is completed, an exact number cannot be identified.

23-16 Page 3-44; column 1, line 21
This section on fish in Port Valdez should include anadromous populations of Dolly Varden char.

23-16 Comment accepted and the FEIS incorporates recommendation in Subsection 3.2.10.2.3.

23-17 Page 3-44, column 2, line 22
This section on birds in Port Valdez should include nesting and migrating populations of bald eagles.

23-17 Comment accepted and the FEIS incorporates recommendation in Subsection 3.2.10.2.4.

23-18 Page 3-45; column 2, line 7
This section on commercial and sport fisheries contains no sport fishing information. Please expand it to include relevant data, e.g., species, man-hours, dollar values, fishing locations, etc.

23-18 Comment accepted and the FEIS incorporates recommendation in Subsection 3.2.10.2.5.

23-19 Page 3-52; column 2, line 27
Coho salmon and anadromous, as well as resident, populations of Dolly Varden char occur in the Lowe River.

23-19 Comment accepted and the FEIS incorporates recommendation in Subsection 3.2.11.5.

23-20 Page 3-62; column 2, lines 6 and 7
The Chitina/Copper River bison range is historically east of the Copper River. The Trans-Alaska Gas System line, west of the Copper River, will not impact this herd.

23-20 Comment accepted and the FEIS incorporates recommendation in Subsection 3.2.13.2.1.

COMMENT LETTER 23 (Contd)

RESPONSE

23-21 Page 4-22; column 2, lines 1, 2, and 3
An "associated moose kill" is listed as a secondary impact of increased rail traffic. Please develop this discussion to include a problem statement, present traffic volume and expected increases, timing, present rate of moose mortality, projected rates of loss, and planned mitigation.

23-21 See response to Comment 22-39. Although more construction material would be transported by rail, no schedules are yet available.

23-22 Page 4-31; Table 4.2.7-1
On the far-right column heading, consider a change to: Average Daily Solid Waste Quantities (lbs.).

23-22 Comment accepted and FEIS incorporates recommendation in Table 4.2.7-1.

23-23 Page 4-32; column 1, lines 19 and 20
An accepted mitigation technique is the construction of fencing to keep carnivores away from foodstuffs and putrescible wastes. Please discuss how this fencing recommendation will be used at the camp and compressor station locations.

23-23 See response to Comment 22-257.

23-24 Page 4-45; column 1, line 4
Add "are formed" after "glaciers," so it reads ". . . or glaciers, are formed by successive . . ."

23-24 Comment accepted and FEIS incorporates recommendation in Subsection 4.2.9.2.

23-25 Page 4-45; column 1, lines 43, 44, and 45
The possible impacts of turbidity and sedimentation are perhaps too lightly dismissed. Please expand the discussion to include the smothering of spawning beds, the loss of eggs and/or fry, the disruption of the food chain by the displacement of aquatic organisms and changes in stream flora.

23-25 Comment accepted and FEIS incorporates recommendation in Subsection 4.2.9.2.

23-26 Page 4-46; column 1, lines 34 through 39
Leaking fuel lines caused contamination problems at several Trans-Alaska Pipeline System locations (Prospect, Galbraith, Franklin Bluffs). It was determined that frost heaves cracked threaded pipes that were buried in the camp pads. Please discuss techniques to preclude this problem, i.e., fuel lines in utilidors, welded joints, metered delivery systems.

23-26 Yukon Pacific Corporation is aware of concerns related to past problems with separation of threaded fuel lines buried in camp pads. The use of welded joints and, where practical, utilidors has been determined to be the best technique to minimize such leaks.

23-27 Page 4-47, column 2, lines 36 through 42
Tributaries of the Delta River aggrade rapidly and threaten highway crossings. Please discuss the possible use of this mineral material to meet construction needs and to relieve highway maintenance problems.

23-27 The use of the material deposited by tributaries of the Delta River on the east side of the Richardson Highway would be considered by YPC for use in meeting TAGS construction gravel requirements. The use of any particular site as a material source would be based on an evaluation of quantity, quality, and accessibility.

23-28 Page 4-54; column 1, line 42
This section should include a discussion on mining plan development, including quantities available, co-users, aliquot expansion, environmental considerations, restoration, erosion control.

23-28 See response to Comment 22-52.

23-29 Page 4-63; column 1, lines 16 through 38
The discussion of impacts to caribou populations seems to have been sidetracked into a general evaluation of noise on wildlife. This discussion and the reference to bald eagles could perhaps be located in more appropriate sections.

23-29 This paragraph more appropriately belongs in the discussion of noise and has been relocated to Subsection 4.25.

COMMENT LETTER 23 (Contd)

RESPONSE

23-30 Page 4-66; column 1, line 34
The mammal section should be expanded to include marine mammals - sea otter, seal, sea lion - and the Marine Mammal Act of 1972, as amended.

23-31 Page 4-69; column 1, line 25
The statement is made that impacts of direct habitat loss due to Trans-Alaska Gas System would be minor. Please expand this discussion to include pre- and post-construction assessments of habitat values to the species identified in the Service Mitigation Policy Statement. This document was provided to you on May 13, 1987.

23-32 Page 4-82; column 1, line 25
Please verify the statement pertaining to a 5-mile-wide corridor closure on each side of the pipeline. The closure may have been applicable only north of the Yukon River (Dalton Highway).

23-33 Page 4-92; column 2, lines 26 and 27
This statement implies that a Trans-Alaska Pipeline System construction camp existed at Slope Mountain. Any camp(s) in that vicinity was probably associated with either the state highway department or the Northwest gas line effort. Please verify.

23-34 Page 4-114; column 1, lines 4 and 5
The statement that ". . . there is no firm commitment to proceed for the two proposed Valdez refineries . . ." appears to be contradicted on Page 4-114, column 2, line 20 - The Alaska Pacific Refinery ". . . is scheduled to be built beginning in 1988 . . ." and on Page S-7, item 5.5.7.2.2, the statement is made that the proposed Valpetro Refinery construction would begin in 1987. Please clarify.

23-35 Page 4-97; column 2, line 12
Please provide justification for the proposed pipeline routing west of Summit Lake as opposed to paralleling the Trans-Alaska Pipeline System line east of the Richardson Highway.

23-36 Page 4-128; column 2, line 25
This section contains no mitigation provisions for habitat lost. Please address.

23-37 Page 4-131; column 1, lines 39 through 46
Unavoidable adverse impacts could be mitigated by off-site, out-of-kind considerations. Please address.

23-38 Page 5-2; column 1, line 24
The Service is a cooperating agency under provisions of the Fish and Wildlife Coordination Act (48 Stat. 401, as amended). Accordingly, we recommend that the Service's Mitigation Policy Statement be considered in establishing mitigation for lost habitat.

23-30 Comment accepted and FEIS incorporates recommendation in Subsections 4.2.10.6 and 4.2.10.7.

23-31 Our assessment that direct habitat loss due to TAGS would be minor was based upon past experience on the TAPS oil pipeline project and our belief that mitigative measures such as rehabilitation and revegetation of disturbed areas, as well as avoidance of some of the most sensitive areas, would assure that direct habitat losses, when looking at the entire project, would be minor. Page 2 of USFWS Service Mitigation Policy Statement recognizes that there are site-specific high value habitat components and recommends that "concerns for these highly valuable habitat components must be addressed during the final siting of the pipeline right-of-way and appurtenances. Special "field-fitting" and the development and implementation of site-specific construction methodologies are strategies available to achieve mitigation goals." Both the USACE and the BLM are committed to minimizing habitat loss through this process during the final permitting and siting of the pipeline and its various component parts.

23-32 Comment accepted and FEIS incorporates recommendation in Subsection 4.2.17.4.

23-33 It should read ANGTS fly camp pad.

23-34 The first statement is correct. The Alaska Pacific Refinery appears to be on an indefinite hold and the status of the Valpetco Refinery is unknown.

23-35 The proposed routing west of Summit Lake rather than paralleling the TAPS line to the east was selected by YPC based on environmental and engineering evaluation of both routes. The western route is preferred for several reasons:

- The geotechnical conditions are better for construction and operation of a chilled gas pipeline. Both the soils and the slopes encountered on the western route offer more favorable conditions for constructability and for long-term operation than conditions along the eastern route.
- The route avoids the poor geotechnical conditions and the environmental values of the Gunn Creek flats area.
- The route avoids conflicts with both the TAPS pipeline and the Richardson Highway by eliminating several pinch points and crossings.
- The western route has only one stream crossing at the upper Gulkana River, versus numerous stream crossings on the eastern route.
- It avoids the Fish Creek area and associated environmental values.
- The western route is shorter.

In response to agency concerns, a field evaluation of the proposed route was conducted during the summer of 1987. The purpose of this site visit was to gather additional information and evaluate both routing options at Summit Lake. This field investigation confirmed the initial YPC choice of the western option as the preferred route. Potential fisheries habitat near Mile Post 503.0 on the western route was evaluated during this field program and it was determined that slight adjustment of the routing may be appropriate to protect habitat values. The field study also confirmed that special design and construction procedures may be required at the crossing of the Gulkana River. More detailed geotechnical and hydrological studies would be needed to evaluate any impacts of the pipeline on a proposed ADF&G fish hatchery and to select the proper pipeline design.

COMMENT LETTER 23
(Contd)

RESPONSE

23-36 The primary responsibility for implementing these recommendations rests with the USACE, BLM, and ADNR. It is important that all three agencies be consistent in applying mitigation of this type. At this point in time, there is no agreement among these agencies on how to apply these recommendations.

23-37 See response to Comment 23-36.

23-38 See response to Comment 23-36.

COMMENT LETTER 23
(Contd)

RESPONSE

SUMMARY

23-39 In summary, we find the Trans-Alaska Gas System Draft Environmental Impact Statement deficient in addressing mitigation issues. We do feel, however, that by addressing the general and specific comments identified previously, the document will be acceptable to the Service.

The Service has and will continue to respond directly to the Corps of Engineers with similar comments on Appendix M - Public Notice of Tiered Processing Procedure for Trans-Alaska Gas System, which was issued concurrently with this Draft Environmental Impact Statement.

Thank you for the opportunity to comment. We are available and willing to assist in mitigation planning. Please contact Mr. Hank Hosking of my Anchorage Fish and Wildlife Enhancement staff at 271-4575 with any questions.

Sincerely,

Walt Stieglitz

Regional Director

cc: Fairbanks Fish and Wildlife Enhancement
Corps of Engineers, Anchorage
Environmental Protection Agency, Anchorage
National Marine Fisheries Service, Anchorage
Alaska Department of Natural Resources, Anchorage
Alaska Department of Environmental Conservation, Anchorage
Division of Governmental Coordination, Anchorage
Alaska Department of Fish and Game, Anchorage
National Park Service, Anchorage
Alaska Department of Fish and Game, Fairbanks
Regional Environmental Officer

23-39 See revised mitigation, Subsection 4.8.

COMMENT LETTER 24

Office of the Federal Inspector

Alaska Natural Gas Transportation System

FA-1
1000 Independence Avenue, SW
Washington, DC 20585

November 20, 1987

Michael J. Penfold, State Director
Bureau of Land Management
Alaska State Office
701 C Street, Box 30
Anchorage, Alaska 99513

Dear Mr. Penfold:

At the request of the Bureau, the Office of the Federal Inspector (OFI) has participated as a cooperating agency in the environmental review process for the Trans-Alaska Gas System (TAGS). During this process, my office has worked closely with the Bureau to expedite consideration of the TAGS project in a manner consistent with my responsibilities concerning the Alaska Natural Gas Transportation System (ANGTS). My review of the Draft Environmental Impact Statement (DEIS), along with the draft Right-of-Way Grant for TAGS, indicates these efforts have been productive.

OFI is interested in the TAGS project and the DEIS for TAGS because of my responsibilities as Federal Inspector under the Alaska Natural Gas Transportation Act and Reorganization Plan No. 1 of 1979. These responsibilities include the coordination and monitoring of Federal activities concerning ANGTS, as well as the "enforcement of all Federal statutes relevant in any manner to pre-construction, construction, and initial operation" of ANGTS. Since in many locations TAGS would be constructed adjacent to or across the existing ANGTS Right-of-Way, it is inevitable my responsibilities will involve TAGS.

OFI's review of the DEIS indicates it raises many of the same concerns I identified in my July 9 letter on the preliminary DEIS. In particular, OFI believes the DEIS may not focus sufficiently on the cumulative effects of constructing both ANGTS and TAGS. The analysis of cumulative effects, including
24-1 especially the incremental effects of constructing a second gas pipeline, is important to OFI because of my responsibility to determine and ensure the compatibility of ANGTS and other pipelines such as TAGS.

As I have stated previously, most of OFI's concerns can be addressed if the Right-of-Way for TAGS recognizes my responsibilities and contains provisions to facilitate fulfillment of these responsibilities. In this regard, I have reviewed the draft Right-of-Way Grant for TAGS you sent to me on October 15, and the modifications to that draft your staff transmitted to OFI on November 19. As modified, the draft Grant contains several provisions that recognize and facilitate fulfillment of the Federal Inspector's responsibilities, including the

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RESPONSE

24-1 Comment noted. Comments relative to cumulative affects on constructing both ANGTS and TAGS have been reflected in Subsection 4.7 of the FEIS.

The BLM, in consultation with CRREL and DOT/OPS, initially determined that the proposed TAGS project would be compatible with ANGTS to the extent that TAGS and ANGTS are within 20 feet of each other (a combined distance of about 15 miles). This determination has been made under the requirements of 43 CRF 2881.1-1(a) and 2881.1-3(c). The initial finding by BLM was coordinated with the OFI (see Appendix B of the DEIS). BLM recognizes, however, the continuing role of the OFI whenever the TAGS project is on or adjacent to the authorized ANGTS alignment as described in Revision Number 4 as noted in the official BLM land office records. As noted on page 4-130 of the DEIS and in this comment letter, BLM and OFI are preparing an agreement to clarify respective roles where there may be overlap between TAGS and ANGTS. The product of these discussions is expected to be a process that assures coordinated and expedited decision making at the federal level and for appropriate coordinated enforcement of technical and environmental terms and conditions for both TAGS and ANGTS. Discussions between OFI and BLM have not yet been concluded. Thus, it is premature to discuss the noted recommendations specifying the BLM-OFI roles.

COMMENT LETTER 24
(Contd)

responsibility to determine and ensure compatibility of ANGTS and TAGS. In particular, the Federal Inspector can insist on compliance with the provisions and requirements of the Grant to the extent they affect ANGTS. The Federal Inspector also has the right to review, approve, and condition the designs, plans, and schedules for TAGS in order to ensure compatibility of TAGS and ANGTS and compliance with the Federal Inspector's other enforcement responsibilities. I believe the modified draft Grant substantially addresses OFI's concerns since it contains a comprehensive, "built-in" mechanism for exercising the Federal Inspector's responsibilities concerning ANGTS.

I also have reviewed the draft Memorandum of Agreement (MOA) which accompanied the draft Grant. The draft MOA, as modified by your November 19 transmittal, appears to offer an excellent basis for quickly finalizing an agreement following the issuance of the Right-of-Way Grant for TAGS.

24-2 The DEIS for TAGS discusses the role of the Federal Inspector in several places. Since these discussions do not accurately reflect our current agreement concerning the Right-of-Way Grant and the MOA, I have attached substitute language.

In closing, I want to commend you and your staff for your efforts in clarifying our respective roles and in establishing a mechanism for the efficient exercise of my responsibilities concerning ANGTS in the context of the TAGS project. The level of agreement we have achieved would not have been possible without the spirit of cooperation and reasonableness that has prevailed in our discussions concerning the EIS, the Grant and the MOA. I believe our cooperative efforts will result in the Bureau's and the Federal Inspector's carrying out our respective responsibilities in a manner that fosters the efficient development of our Nation's vast natural resources at the North Slope of Alaska.

Sincerely,

Theodore J. Garrish
Federal Inspector

cc: Steven Griles
Jules Tileston
Earl Kari

Enclosure

RESPONSE

24-2 See response to Comment 24-1.

COMMENT LETTER 24
(Contd)

RESPONSE

<u>Changes to DEIS</u>

Section 1.5

Revise last paragraph as follows:

24-3 Reorganization Plan No. 1 of 1979 provides that the Federal Inspector has "exclusive responsibility for enforcement of all Federal statutes relevant in any manner to pre-construction, construction, and initial operation" of ANGTS. The right-of-way grant for TAGS will recognize these enforcement responsibilities of the Federal Inspector and will contain provisions to facilitate their exercise with respect to those aspects of the TAGS project relevant to ANGTS. In fulfilling these responsibilities, the compatibility of TAGS and ANGTS will be a primary concern of the Federal Inspector.

Table 1.11-1

24-4 Revise description of Project Features for OFI as follows:

Compatibility determination; review and approval of designs, plans, and schedules for TAGS; and enforcement of provision and requirements of TAGS right-of-way relevant to ANGTS.

Section 4.7

Revise sixth paragraph as follows:

24-5 The Alaska Natural Gas Transportation Act established OFI to coordinate and monitor Federal activity concerning ANGTS. Reorganization Plan No. 1 of 1979 transferred to OFI exclusive responsibility for enforcing all Federal statutes relevant to ANGTS. OFI coordinates its activities with those of other Federal agencies in order to provide "one-window" service for obtaining necessary Federal permits and authorizations for ANGTS and to eliminate unnecessary duplication and administrative burden in the enforcement of those permits and authorizations. OFI mobilized and attained its statutory purposes successfully during the construction of the Eastern and the Western Legs (the prebuild portions) of ANGTS. In this effort, OFI utilized employees of other Federal agencies and technical support contractors to supplement its staff. OFI reduced its staff following completion of the Eastern and the Western Legs. OFI currently monitors events relevant to ANGTS and exercises its coordination and enforcement responsibilities where appropriate. OFI is prepared to remobilize fully when work begins to complete ANGTS.

Revise last paragraph as follows:

24-6 For example, BLM, USACE, and OFI have initiated discussions to clarify respective roles where these areas overlap between YPC, TAPS, and ANGTS. As a result of these discussions, the

24-3 See response to Comment 24-1.

24-4 See response to Comment 24-1.

24-5 Revised text has been incorporated in Subsection 4.8.

24-6 Revised text has been incorporated in Subsection 4.8.

COMMENT LETTER 24 (Contd)

RESPONSE

2

24-6 (Contd) right-of-way for TAGS will set forth the responsibilities of the Federal Inspector under Reorganization Plan No. 1 of 1979 and will contain specific provisions to facilitate the exercise of these responsibilities. In addition, BLM and OFI are working on a Memorandum of Agreement that will specify the way in which BLM and OFI will exercise and coordinate their respective roles in areas where ANGTS and TAGS could interact.

Section 5.7

Revise as follows:

24-7 Reorganization Plan No. 1 of 1979 placed in the Federal Inspector "exclusive responsibility for enforcement of all Federal statutes relevant in any manner to pre-construction, construction, and initial operation" of ANGTS. The right-of-way grant for TAGS will recognize the enforcement responsibilities of the Federal Inspector and contain specific provisions to facilitate their exercise. In particular, the Federal Inspector will be able to require compliance with the provisions and requirements of the grant to the extent they affect ANGTS. The Federal Inspector also will be given the right to review, approve, and condition the designs, plans, and schedules for TAGS. The comprehensive, "built-in" provisions will facilitate fulfillment of the Federal Inspector's responsibility to determine and ensure the compatibility of ANGTS and TAGS and to enforce Federal statutes, regulations, and authorizations relevant to ANGTS. In addition, the Federal Inspector and BLM are working on a Memorandum of Agreement (MOA) to coordinate their activities with respect to the TAGS project. This MOA will set forth the details of a working arrangement between the Federal Inspector and BLM designed to ensure both agencies can carry out their respective roles efficiently and responsibly without imposing any unnecessary burden on the TAGS project.

24-7 See response to Comment 24-1.

COMMENT LETTER 25

U.S. ENVIRONMENTAL PROTECTION AGENCY
REGION 10
1200 SIXTH AVENUE
SEATTLE, WASHINGTON 98101

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY

NOV 24 1987

REPLY TO ATTN OF: WD-136

Jules V. Tileston
Bureau of Land Management
Alaska State Office
701 C Street, Box 30
Anchorage, Alaska 99513-0099

Dear Mr. Tileston:

In accordance with our responsibilities under Section 309 of the Clean Air Act and the National Environmental Policy Act, we have completed our review of the Trans-Alaska Gas System (TAGS) Draft Environmental Impact Statement (DEIS). The project proposal consists of an 800 mile, 36 inch buried pipeline from Prudhoe Bay to Anderson Bay, Alaska. Included are 10 compressor stations along the pipeline, a liquefied natural gas (LNG) plant to reduce gas temperature for transport, and a marine terminal for loading tankers.

Based on our review we have rated the DEIS EC-2 (Environmental Concerns - Insufficient Information). Attached is a copy of our rating system. We have environmental concerns because of potential adverse air quality effects from the LNG plant and terminal in the Valdez area. We have requested additional information on water quality effects, air quality effects and mitigation planning for primary effects.

The FEIS needs to include a more thorough air quality analysis for the following reasons:

25-1 1. The DEIS predicts that Valdez would likely become a nonattainment area for sulphur dioxide if all projects planned for the area were implemented.

25-2 2. Section 176(c) of the Clean Air Act requires that Federal Agencies not issue permits or approvals for projects that would not conform to the State Implementation Plan (SIP). The EPA approved SIP prohibits deterioration of air quality in Valdez below National Ambient Air Quality Standards.

25-3 3. The level of air quality controls needed for compressor stations, LNG plant, and LNG terminal may affect project feasibility and costs.

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RESPONSE

25-1 The FEIS has been revised to delete reference to the potential that ADEC might classify the Valdez area as a non-attainment area for SO_2 under 18 ACC 50.021(a). Predicted maximum short-term (three-hour and 24-hour) SO_2 impacts of 12.5 ug/m^3 and 6.9 ug/m^3, respectively, fall below PSD increment and federal standards. Although the predicted 24-hour impact exceeds the SIL of 5 ug/m^3, the annual SO_2 impact of 0.9 ug/m^3 is well below all quantifiable levels (see Table 4.2.6-4).

25-2 Revised pollution emission analysis reviewed and approved by EPA (1988b), as discussed in Subsection 4.2.6, indicates TAGS facilities would be well within NAAQS. As recommended by EPA (1988a), the air quality analysis for the conceptual GCF has been deferred to a future NEPA evaluation.

25-3 This recommendation is reflected in the FEIS in Subsection 4.7.6.

COMMENT LETTER 25
(Contd)

RESPONSE

We provided scoping comments on January 6, 1987 and comments on the preliminary DEIS on July 2, 1987. Several of the concerns raised were addressed and others were not. The attached report details our comments on the DEIS. Also enclosed is a copy of our October 15, 1987, comments on the Corps of Engineers Tiered Processing Procedure for permitting of activities relating to construction and operation of TAGS. If you have any questions about our comments please contact Wayne Elson (206) 442-1463 or Brian Ross at (907) 271-5083.

Sincerely,

Robert S. Burd
Director, Water Division

Enclosures

cc: USFWS, Fairbanks
USFWS, Anchorage
COE, Anchorage
NMFS, Anchorage
ADGC, Fairbanks
ADEC, Fairbanks
ADEC, Anchorage
ADEC, Juneau
ADFG, Fairbanks
ADNR, Fairbanks

COMMENT LETTER 25
(Contd)

U.S. ENVIRONMENTAL PROTECTION AGENCY COMMENTS ON
THE TRANS-ALASKA GAS SYSTEM
DRAFT ENVIRONMENTAL IMPACT STATEMENT

(page)

25-4 — 4-26 The compressor station section must include a complete emissions inventory for operation of each of the two typical compressor station types (with and without refrigeration). Table 4.2.6-1 shows modeled ambient impact levels, not emissions (emissions for a single turbine are shown in a footnote). Emissions and impacts for ANGTS and TAPS are not a substitute for calculating air quality effects for TAGS. The TAGS EIS must stand on its own.

25-5 — 4-27 Table 4.2.6-1, Modeling for Typical Compressor Station, must show the ambient air quality impacts associated with all of the emission sources at the two typical compressor stations, not just a single turbine. EPA significant impact levels for NO_2 and CO are not included in the table. They are:

NO_2	Annual	1.0 microgram per cubic meter
CO	1-hr	2000 micrograms per cubic meter
	8-hr	500 micrograms per cubic meter

The national ambient air quality standards for particulate matter were revised on July 1, 1987. This table needs to be changed to reflect the new PM_{10} standards instead of the old TSP standards. Specifically, the annual standard is now 50 micrograms per cubic meter, not 60. The table should include the prevention of significant deterioration increments for SO_2 and TSP and a footnote to indicate that EPA is currently working under a court-ordered schedule to promulgate NO_2 increments by no later than October 1988.

25-6 — 4-26 The LNG plant section must include a complete emissions inventory for its operation. Also, the modeling results in Table 4.2.6-2 indicate that the calculated NO_2 concentration would exceed the EPA significant impact level, contrary to the statement on page 4-28.

25-7 — 4-28 As we stated in our scoping comments, the Industrial Source Complex Model should be used in addition to the Complex 1 Model. The logic for selecting receptor location is not provided. A map showing receptor and maximum impact locations relative to plant boundaries should be provided in the FEIS. Pre-construction ambient air quality monitoring is needed, at least for NO_2.

RESPONSE

25-4 The air quality sections in the FEIS have been revised to reflect the methodology reviewed and approved by EPA (EPA 1988a). The air quality analysis has been determined to adequately evaluate expected impacts from the TAGS project alone and adequately evaluates compliance with NAAQS. With regard to increments, however, uncertainties remain (EPA 1988b).

25-5 See response to Comment 25-4.

25-6 See response to Comment 25-4.

25-7 See response to Comment 25-4. The map showing receptor locations for both the compressor station and LNG plant/marine terminal is included in the Work Plan approved by EPA (1988a). This information has not been included in the FEIS, but is available for public inspection from BLM or USACE upon request.

COMMENT LETTER 25 (Contd)

2

25-8 4-28 Table 4.2.6-2, Dispersion Modeling for the LNG Plant Site Emissions, must show the ambient air quality impacts associated with all of the emission sources at the LNG plant, not just a single turbine. Also, there are EPA significant impact levels for CO as noted above.

Finally, this table should include the prevention of significant deterioration increments for SO_2 and a footnote to indicate that EPA is currently working under a court-ordered schedule to promulgate NO_2 increments by no later than October 1988.

All sources need to be included in the dispersion model. They include the proposed project, any growth induced new sources, other permitted sources not yet built, existing sources and ship emissions.

25-9 4-29 This section needs to include a complete emissions inventory for the LNG terminal. Also, dispersion modeling of worst-case conditions needs to be done in order to quantify the impact that the LNG tanker emissions could have on existing air quality concentrations.

25-10 4-29 Since each compressor station, the LNG plant, and the LNG terminal will need PSD permits, the EIS needs to discuss the emission controls which will be utilized on sources subject to the PSD regulations. Specifically, the best available control technology that will be required to reduce NO_x emissions and subsequent air quality deterioration needs to be discussed.

25-11 4-29 Although it is too early to make any final determinations, it is important to point out that EPA is developing NO_2 increments under a court-ordered schedule. EPA must propose increments by February 1988 and promulgate increments by October 1988. In accordance with Section 166 of the Clean Air Act, any NO_2 increments must be at least as effective as the current TSP and SO_2 increments in preventing significant deterioration.

25-12 4-29 Based on the dispersion modeling results presented in this DEIS, this project could not meet NO_2 increments which are basically equivalent to the SO_2 increments. For example, the annual SO_2 increment for Class II areas is 20 micrograms per cubic meter, which is one quarter of the annual standard of 80 micrograms per cubic meter. An NO_2 annual increment of 25 micrograms per cubic meter (one quarter of the 100 microgram per cubic meter annual standard) would be exceeded at any of the compressor stations and at the LNG plant. Given that this project will probably have to comply with whatever NO_2 increments are promulgated, the feasibility of additional controls should be evaluated.

RESPONSE

25-8 See response to Comment 25-4.

25-9 See response to Comment 25-4.

25-10 The best available control technology (BACT) would be used but cannot be specified for this project at this time due to future potential advancements in technology. Details concerning the BACT would be developed during the PSD permitting process. General emission controls are discussed in Subsection 4.2.6. It should be noted that the FEIS has been revised to include a more comprehensive section on mitigation measures (see Subsection 4.8). Table 4.8-1 identifies a series of comprehensive plans or programs to be developed by YPC during Phase II. Air quality is expressly identified for such treatment and also is referenced in several other mitigation concepts listed in Table 4.8-2.

25-11 See response to Comments 25-4.

25-12 See response to Comments 25-4 and 25-10. Predicted annual NO_2 emissions at the TAGS compressor stations are 11.7 ug/m^3; whereas those at the TAGS LNG plant and marine terminal are 18.0 ug/m^3. These predicted NO_2 emissions appear to be well within the probable NO_2 increment standard of 25 ug/m^3 recommended by EPA. The overall concern about future increments recommended by EPA (1988a) has been incorporated in the FEIS. Also see response to Comment 25-3.

COMMENT LETTER 25 (Contd)

3

25-13 4-43 The air quality sections of the DEIS appropriately discuss effects in term of compliance with NAAQS. In describing water quality effects the FEIS should likewise discuss effects in context of applicable marine and fresh water numeric limits for parameters under Alaska Water Quality Standards.

25-14 4-46 Accidental leaks and spills to surface water and groundwater are identified as a potential significant environmental effect. The DEIS states that ground-water contamination frequently occurred during the TAPS project. Prevention and mitigation techniques including but not limited to construction management, hazardous material handling techniques, spill detection, or trained clean-up crews should be discussed in the FEIS.

25-15 4-49 Methods which may be used to minimize the environmental impact of surface runoff from the LNG plant and terminal facilities should be addressed within the FEIS. The DEIS states that "excessively high sedimentation rates from river and stream discharges" occur during construction periods. While the DEIS indicates that the impact of the increased suspended sediment discharge "would probably be negligible," the FEIS needs to address what measures will be taken to ensure that water quality standards will be met during construction. The water quality criteria, especially turbidity, may be exceeded unless treatment of surface runoff is provided. Treatment methods which could be utilized to meet standards during construction include, but are not limited to runoff collection, the use of settling basin(s), and filtering.

During operation, onsite surface runoff may be contaminated with oil and other wastes. The FEIS should address methods which may be used to ensure that the surface runoff will meet water quality standards. Prior to discharge surface runoff may need to be collected and treated in the oil/water separator which is planned for the facility.

25-16 4-50 In our scoping comments we noted that LNG storage tank cleaner and hydrotest discharges are potential discharges of concern. No mention of this is made in the DEIS. Will the LNG storage tanks be pressure-tested after construction and before use? If so, will the seawater typically used for hydrotesting be discharged? (Sodium sulfite is often added to the water to act as a corrosion inhibitor and should be regulated in the permitting process.) This issue needs to be addressed in the FEIS.

25-17 4-51 The DEIS emphasizes the fact that separate ballast water storage compartments are present on LNG tankers and there is no mingling of the ballast water and the LNG cargo. Therefore, the ballast water will be clean seawater and no treatment will be required. However, bilge water which collects in the lower internal parts of a vessel's hull may be contaminated and require treatment prior to discharge. The DEIS states that liquid wastes (bilge water, sanitary, and domestic wastes) from

RESPONSE

25-13 Appropriate technology would be developed during various permitting processes to comply with Alaska Water Quality Standards (18 AAC 70). Mitigation measures would be implemented to reduce impacts to marine and fresh water. Impacts would also be minimized by special conditions in various required permits issued by regulatory agencies.

25-14 Prevention and mitigation of accidental leaks and spills to surface water or ground water would be an integral part of YPC's construction and operating procedures. A Spill Prevention Control and Countermeasure Plan (SPCC) would be prepared for all required facility locations. In addition, procedures and practices for prevention, control, and mitigation of spills threatening water quality would be developed and implemented for all phases of the project.

Typical approaches that would be used to ensure protection of water resources from accidental spills include:

- Training of all construction and operational personnel in proper handling of hazardous substances, in spill detection, in notification, and in appropriate response;
- At key location e.g., LNG plant and compressor stations, staffing, and training of a specialized spill response team;
- Proper storage of substances in locations where the potential for contamination is minimized by the use of berming, siting away from water bodies, etc.;
- Proper handling of substances to avoid the risk of spillage and to ensure a timely and coordinated response to an accidental spill;
- Visual inspection of facilities to detect and correct any situation causing the potential for a spill;
- Storage of needed equipment and material for spill cleanup at each facility as appropriate;
- Contract agreements for use of special response teams in situations beyond the expertise or capacity of YPC spill response teams.

25-15 YPC would fully comply with water quality standards for surface runoff during construction and operation of the LNG plant/marine terminal. In order to meet turbidity criteria, standard techniques to minimize erosion and sedimentation during construction would be used. Examples of these techniques could include:

- Diversion berms on steep longitudinal slopes;
- Geotextiles, plastic sheeting, or mulches on moderate slopes;
- Ditch plugs;
- Revegetation;
- Temporary sedimentation basins.

COMMENT LETTER 25 (Contd)

RESPONSE

25-15 These representative techniques would substantially reduce sediment loading to the marine environment and ensure compliance with state and federal requirements. In addition, as stated in the DEIS, the increased discharge of sediment to Port Valdez from construction activity would probably be negligible in the context of natural sediment loads contributed by rivers and streams.

The completed LNG plant/marine terminal would have a system of storm drains and/or ditches for collection of surface runoff. Standard oil and grease separators would be incorporated as appropriate into this drainage system, and discharge would be routed through a retention basin prior to discharges to Port Valdez.

25-16 At this stage of project design, YPC plans to use freshwater with no added substances for hydrostatic testing per 49 CFR 193 and API 610. If later in the project the use of saltwater with added inhibitors appears to be a preferable approach, seawater would be treated to meet water quality requirements prior to discharge.

25-17 Both oily and nonoily liquid wastes from tugs and other support vessels would be collected for treatment and disposal in accordance with federal and state requirements. Oily wastewater would be routed through an oil/water separator and then treated at the LNG plant/MT facility's wastewater treatment plant. Nonoily wastewater would be routed directly to the wastewater treatment plant.

COMMENT LETTER 25 (Contd)

4

25-17 (Contd) LNG tankers will be discharged at sea in accordance with U.S. Coast Guard regulations. However, liquid wastes are also formed on smaller support vessels such as tugs and ferries. If bilge water, sanitary or domestic wastes from any vessel may be off-loaded at the TAGS terminal, it should be addressed in the FEIS.

25-18 4-51 The wastewaters generated within the LNG plant and the anticipated treatment methods should be addressed within the FEIS. Page 2-50 of the DEIS notes that the proposed LNG Plant will prepare the natural gas for liquefaction by passing the gas through a series of driers and scrubbers to remove any moisture and impurities. The treatment and disposal methods planned for these removed contaminants should be explained in the FEIS. Further, the dehydration during the liquefaction process often results in the formation of produced waters. Will produced waters be generated by the processes planned for TAGS? If so, treatment and disposal methods should be addressed within the FEIS. In addition, any other specific wastewaters formed by processes used at the TAGS LNG plant and planned treatment technologies need to be detailed in the FEIS.

25-19 4-53 The DEIS states that "blockage of a stream" would be an effect of stream crossings. Stream blockages should be avoided. Other methods are available for constructing stream crossings.

25-20 4-102 Air quality effects to any Class I areas need to be quantified. Cumulative effects considering existing sources in the Healy and Kenai areas need to be quantified.

25-21 4-117 Although sulfur dioxide impacts were not properly quantified, violation of ambient SO_2 standards is anticipated. This is not acceptable, and the project could not be permitted to construct. Best Available Control Technology would be required regardless of projected ambient levels, not only in the case of non-attainment.

25-22 4-128 The FEIS needs to provide much more precision in its discussions on mitigation plans. We would suggest that the FEIS include a list of mitigation planning tasks that remain until project implementation. Presumably these tasks would be grouped along regulatory lines. Each task would include an outline of new information needed, who is responsible for obtaining it and its relationship in a time scale to other tasks. These mitigation plans should be prepared in the context of Section 2.8 of the EIS, Mitigative Aspects of Proposed Project.

25-23 4-129 The compliance monitoring concepts presented are good. The FEIS should provide a firm commitment to implement the field compliance monitoring concepts presented.

RESPONSE

25-18 Feed gas impurities removed by driers and scrubbers would typically include particulates, dust, iron oxide, lubricant oils, and possibly some petroleum liquid condensates. Effluent from the dryer/scrubber system would be collected at a lift station, combined with other oily wastewater and pumped to the LNG plant/marine terminal's oil/water separator. This separator is designed to produce an effluent with less than 10 ppm oil. This effluent then would receive further treatment at the site's wastewater treatment plant.

25-19 See response to Comment 22-49.

25-20 Quantifiable pollutant impacts from the compressor stations or LNG facility are limited to the immediate vicinity of the emission release points. Any long-range transport would result in pollutant contributions in Class I areas below significant impact levels (refer to Subsections 4.2.6.3.1 and 4.2.6.3.2) (Dames and Moore 1988b).

This comment also references the Cook Inlet-Boulder Point Alternative and the Denali National Park and Preserve. A TAGS Compressor Station located at Healy, north of Denali National Park and Preserve would not impact the Class I area. Levels of emissions as presented in Tables 4.2.6-1 and 4.6.2-2, are below PSD increments and NAAQS. It is extremely unlikely that SIL for annual NO_2 would be measurable in the park/preserve. The LNG plant at Boulder Point is directly associated with a portion of the Kenai National Wildlife Refuge where production fields and also is an area where petrochemical facilities exist. We are not sure of any areas on the Kenai Peninsula that have a Class I designation under 18 AAC 50.021(b).

25-21 See responses to Comments 25-4 and 25-10. Based upon the use of low-sulfur natural gas as a primary fuel, SO_2 concentrations due to emissions from compressor station and LNG facility operation are expected to be negligible. Furthermore, there is no evidence from background levels provided to the applicant by the ADEC that violations of the SO_2 standards is anticipated. Clearly, the project will not interfere with the maintenance of the NAAQS for SO_2 (Dames and Moore 1988b).

25-22 Subsection 2.8 has been relocated in the FEIS to Subsection 4.8 and the mitigation measure section has been revised.

25-23 Although we recognize that a compliance monitoring program would be implemented to monitor field construction compliance, it is premature to identify the specifics of the program. The USACE and BLM are committed to a monitoring program and will have appropirate monitoring. Steps will be initiated in Phase II to develop a joint federal/state monitoring program.

COMMENT LETTER 25
(Contd)

RESPONSE

25-24 D-4 The use of the Ozone Limiting Method is not clearly documented. It appears that contributions from existing sources were not included. Therefore, the conclusion tnat the gas conditioning facility would not cause air quality problems in the Prudhoe Bay are not adequately supported.

25-24 The contribution of existing and permitted sources to the NO_x concentration near the proposed site was assumed to be approximately 40 ug/m^3. Utilizing the OLM method in a worst-case mode (assuming a background O_3 concentration of 51 ug/m^3 for every hour of the year), the total NO_2 concentration was calculated as follows:

Total Annual Average NO_2

= O_3 background (converted to NO_2) + 0.1
(proposed facility + existing/permitted sources)

= 48 ug/m^3 + 0.1 (311 ug/m^3 + 40 ug/m^2)

= 49 ug/m^3 + 35 ug/m^3

= 83 ug/m^3

As recommended (EPA 1988a), the FEIS has selected Appendix D. This action considers: the high level of uncertainty on the final design of a conceptual GCF needed to provide LNG quality natural gas to TAGS; significant modifications made to the proposed ANGTS SGCF that may cause prior NEPA conclusions together with its expired SELEXOL process PSD; and new air quality standards. These create a situation where prior evaluations may not be necessarily transferrable or appropriate for use in this FEIS. Accordingly, air emission analysis for the conceptual GCF has been deferred for future NEPA evaluation.

COMMENT LETTER 25 (Contd)

RESPONSE

U.S. ENVIRONMENTAL PROTECTION AGENCY

ALASKA OPERATIONS OFFICE
Room E535, Federal Building
701 C Street, Box 19
Anchorage, Alaska 99513
Phone (907) 271-5083

October 15, 1987

Mr. Robert Oja, Chief
Regulatory Functions Branch
U.S. Army Corps of Engineers,
P. O. Box 898
Anchorage, Alaska 99506-0898

Re: Tiered Processing Procedure (TPP 87-1)
(Trans-Alaska Gas System)

Dear Mr. Oja:

We have reviewed the referenced Public Notice describing the Tiered Processing Procedure (TPP) the Corps proposes to follow for permitting of activities relating to construction and operation of the proposed Trans-Alaska Gas System (TAGS). The following comments are meant to help clarify the intent and effectiveness of the TPP.

General Comments:

For several of the Special Conditions, the wording is confusing as to intent. Many of the conditions (e.g., 2a, 2e, 2g, 2p, 2q, 2v, 2z, 2aa, 2bb) require approvals from or coordination with specifically stated authorized officers. However, conditions 2d, 2m, 2o, 2w, 2x, and 2y, while mentioning approvals, do not state by whom. Other conditions (e.g., 2l, 2t, 2u, etc.) state that certain measures will be taken, but approvals (by anyone) are not mentioned. We recommend that wherever approvals are envisioned, the TPP clearly state whom the appropriate approving entity would be.

25-25 In several instances the Special Conditions discuss that different types of disturbances will be "minimized", that "measures will be taken", and that certain activities or results should occur "to the maximum extent possible", without describing or referencing how these things are to be done. Conditions 2f, 2k, 2l, 2r, 2s, 2t, and 2u are examples. At a minimum, the TPP should reference that requirements (similar to Best Management Practices) will be spelled out in the specific plans that are to be developed and approved during subsequent pre-construction phases of the TAGS project.

Under Procedures (Section 3), there should be some description or guidance regarding the size or type of activity that could generally be suitable for consideration under the accelerated timeframe of the TPP. For example, the General Permit for the North Slope Housing Authority (No. 83-8M) expresses bounds on the size of any project, and also implies other bounds by requiring projects involving stream crossings to be processed individually. As currently written, there are no bounds even implied on the size or type of activities which applicants could propose per project under the TPP.

25-25 The TPP process will have its own separate NEPA document which would tier upon this EIS.

COMMENT LETTER 25 (Contd)

RESPONSE

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General Comments: (continued)

Inspection and Monitoring (Section 5), should also be expanded to describe more specifically how the Corps would monitor permit-related construction activity. This section should also reference that the Corps' role is currently separate from any other monitoring and enforcement plan that may be developed for the project overall. Certainly all such plans should be coordinated to the extent possible; however, the Corps' role and authorities will necessarily remain somewhat distinct from those of other entities.

Finally, we note that nothing in the TPP would supercede the established "local procedures". These will continue to be followed in resolving areas of concern or disagreement.

Specific Comments:

Condition 2d. The phrase "by the District Engineer" should be added at the end of this condition.

Condition 2h. This condition should be reworded to reflect that its objective is to minimize erosion of material into waterbodies, rather than to minimize the loss of fill.

25-25 (Contd)

Condition 2i. We recommend that permanent drainage structures be designed to accommodate at least 100 year flows. The consequences of damaging a high pressure gas pipeline or its supports could be severe. The anticipated life of the project, combined with drainage structures designed to accommodate only 50 year flows, would result in little margin for error in the hydrographs for the hundreds of drainages to be crossed, and therefore in an unnecessary risk of impacts.

Condition 2j. The "District Engineer's approval criteria" referenced here should be described.

Condition 2p. It is unclear whether "workplan submission" is synonymous with permit application (or more precisely, pre-application). We must emphasize that, without the referenced plans being reviewed and approved in advance, we will be unable to determine whether any permit would be acceptable.

Condition 2z. The referenced "liquid limits" should be provided, or reference made to where they are described.

Procedure 3a. The last sentence should state that the best available site aerial photography must be provided. This is particularly critical where site-specific alternative routing may need to be considered.

COMMENT LETTER 25 (Contd)

RESPONSE

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Specific Comments: (continued)

Procedure 3g. The description of the type or amount of work that would be considered under the TPP under one permit (as discussed above in General Comments) might reasonably be inserted in this location.

25-25 (Contd) Penalties for Violations (Section 4). The wording here should be revised to clarify for permitees that work is not performed under the TPP--rather, application for a permit is made.

Thank you for the opportunity to provide these comments. We would appreciate being kept informed of any actions you take on this matter. We look forward to reviewing the final TPP proposal, to be distributed with the TAGS final EIS. Please call me at 271-5083 if there are any questions.

Sincerely,

Richard Sumner
NEPA & Wetlands Review Team Leader

cc: Region 10, EPA
USFWS, Fairbanks
NMFS, Anchorage
ADFG, Fairbanks
ADEC, Fairbanks
ADGC, Fairbanks
ADNR, Fairbanks

COMMENT LETTER 25 (Contd)

RESPONSE

SUMMARY OF THE EPA RATING SYSTEM
FOR DRAFT ENVIRONMENTAL IMPACT STATEMENTS:
DEFINITIONS AND FOLLOW-UP ACTION *

Environmental Impact of the Action

LO--Lack of Objections

The EPA review has not identified any potential environmental impacts requiring substantive changes to the proposal. The review may have disclosed opportunities with no more than minor changes to the proposal.

EC--Environmental Concerns

The EPA review has identified environmental impacts that should be avoided in order to provide adequate protection for the environment. Corrective measures may require substantial changes to the preferred alternative or consideration of some other project alternative (including the no action alternative or a new alternative). EPA intends to work with the lead agency to reduce these impacts.

EO--Environmental Objections

The EPA review has identified significant environmental impacts that must be avoided in order to provide adequate protection for the environment. Corrective measures may require substantial changes to the preferred alternative or consideration of some other project alternative (including the no-action alternative or a new alternative). EPA intends to work with the lead agency to reduce these impacts.

EU--Environmentally Unsatisfactory

The EPA review has identified adverse environmental impacts that are of sufficient magnitude that they are unsatisfactory from the standpoint of public health or welfare or environmental quality. EPA intends to work with the lead agency to reduce these impacts. If the potential unsatisfactory impacts are not corrected at the final EIS stage, this proposal will be recommended for referral to the CEQ.

Adequacy of the Impact Statement

Category 1--Adequate

EPA believes the draft EIS adequately sets forth the environmental impact(s) of the preferred alternative and those of the alternatives reasonably available to the project or action. No further analysis or data collection is necessary, but the reviewer may suggest the addition of clarifying language or information.

Category 2--Insufficient Information

The draft EIS does not contain sufficient information for EPA fully assess environmental impacts that should be avoided in order to fully protect the environment, or the EPA reviewer has identified new reasonably available alternatives that are within the spectrum of alternatives analyzed in the draft EIS, which could reduce the environmental impacts of the action. The identified additional information, data, analyses, or discussion should be included in the final EIS.

Category 3--Inadequate

EPA does not believe that the draft EIS adequately assesses potentially significant environmental impacts of the action, or the EPA reviewer has identified new, reasonably available alternatives that are outside of the spectrum of alternatives analyzed in the draft EIS, which should be analyzed in order to reduce the potentially significant environmental impacts. EPA believes that the identified additional information, data, analyses, or discussions are of such a magnitude that they should have full public review at a draft stage. EPA does not believe that the draft EIS is adequate for the purposes of the NEPA and/or Section 309 review, and thus should be formally revised and made available for public comment in a supplemental or revised draft EIS. On the basis of the potential significant impacts involved, this proposal could be a candidate for referral to the CEQ.

*From EPA Manual 1640 Policy and Procedures for the Review of Federal Actions Impacting the Environment

COMMENT LETTER 26

Department of Energy
Washington, DC 20585

November 25, 1987

Mr. Steven J. Griles
Assistant Secretary for Land
and Minerals Management
U.S. Department of the Interior
18th and "C" Streets, N.W.
Washington, D.C. 20240

Dear Mr. Griles:

The Department of Energy (DOE) has reviewed the draft environmental impact statement (DEIS) prepared by the Bureau of Land Management (BLM) for the proposed Trans-Alaska Gas System (TAGS) project. Under Section 3 of the Natural Gas Act (NGA), DOE is responsible for approving exports of natural gas. Since approvals must comply with the provisions of the National Environmental Policy Act (NEPA), you requested that DOE participate as a cooperating agency in the NEPA process, and we accepted that responsibility.

DOE's participation as a cooperating agency and our review of the DEIS are directed at assuring that the final EIS, when issued, is sufficient to support any DOE decision under Section 3 of the NGA. By our letter dated June 26, 1987, DOE provided comments to you on the preliminary draft EIS (PDEIS) for the TAGS project. DOE appreciates the areas in which our concerns regarding the PDEIS described in our letter have been addressed in the DEIS.

26-1 For example, we note that the results of the study prepared by DOE regarding project effects expected to occur in the lower 48 states have been incorporated as Appendix K and are discussed at 4.5.19 of the DEIS. Also, as DOE recommended, the discussion of the liquefied natural gas facility has been expanded, as has the discussion of the conditioning plant that will be a necessary project component at the beginning of the pipeline.

26-2 DOE continues to believe that certain improvements to the EIS are needed, as per our recommendations provided to you in response to the PDEIS. For example, we note that Chapter 4 continues to be unclear in some areas as to whether it is analyzing the effects of constructing one or two natural gas pipelines. In light of the fact that another pipeline (the Alaska Natural Gas Transportation System) already has been authorized, DOE believes that the full NEPA analysis should consider the cumulative consequences of building both projects, where appropriate.

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RESPONSE

26-1 These discussions have been further expanded as a result of comments received to the DEIS.

26-2 The environmental impacts discussion throughout Section 4 assumes that the ANGTS project will be constructed since a specific right-of-way Rev. 4 as amended has been granted and reserved for ANGTS across federal lands. The TAGS project, in identifying its right-of-way, frequently was required to take less optimum alignments due to the ANGTS alignment. Thus, since TAGS alignment was totally dependent on the location of existing TAPS and authorized ANGTS, the discussions had to assume TAGS project impacts on the presumption that ANGTS would be built.

The cumulative impacts discussions also assumes ANGTS will be built. These discussions have been revised; see Subsection 4.7.

Additionally, as indicated in Section 4.7.1, the cumulative impacts of TAGS considers TAPS, the existing highway, authorized ANGTS, the Alyeska oil terminal, the proposed Alaska Pacific Refinery, and the Valpetro Petroleum Refinery in Port Valdez. As for the need for a detailed analysis of the cumulative consequences of concurrent construction of TAGS and ANGST, see response to Comment 12-3.

COMMENT LETTER 26 (Contd)

RESPONSE

-2-

26-3 In particular, we remain concerned that the analysis found in Section 4.5 is too general, qualitative and conclusory to allow an informed judgment concerning the potential for cumulative impacts of both projects. We recommend that attention be given, in particular, to portions of the right-of-way where the two projects share a common utility corridor and where competition for resources could occur should construction schedules overlap.

26-4 We wish to reiterate our previous statement that there is no EIS requirement associated with the Presidential finding required under Section 12 of the Alaska Natural Gas Transportation Act, and we recommend that the DEIS be reviewed carefully to remove any unintended implications that an EIS is necessary for a Presidential finding.

26-5 Finally, DOE remains concerned that BLM has retained Appendix A which contains the summary of issues and remarks raised during scoping with rankings "1" through "3". This Appendix, provided in the DEIS, conveys the impression that certain of the topics identified with a "3" will be treated at a subsequent time, without clarity as to where they will be addressed. It is our understanding, however, that these topics are not going to be given attention in the EIS. Therefore, DOE recommends that the scoping chart be either eliminated or modified to contain only two categories which indicate clearly whether or not an issue will be considered in the EIS.

If you have questions about these comments or the analysis under NEPA, please contact Constance L. Buckley, Director, Natural Gas Division, Economic Regulatory Administration at 586-9497, or Yvonne B. Weber, Office of NEPA Project Assistance at 586-4610. We appreciate the opportunity to review and provide comments on the DEIS prepared for this proposed project and look forward to working with you to complete the NEPA process.

Yours truly,

Grover A. Smithwick for
Mary L. Walker
Assistant Secretary
Environment, Safety and Health

cc: Jules V. Tileston
TAGS Project Officer
Bureau of Land Management

26-3 The placement of TAGS and ANGTS within the Utility Corridor will minimize cumulative impacts to as small an area as practical while still allowing adequate space for the safe placement of both pipelines. While the competition for resources associated with construction of both pipelines is a real concern, the likelihood of simultaneous construction is considered very remote (see response to Comment 12-3). Carefully monitored construction, to ensure compliance with mitigation measures, should guarantee that impacts associated with the TAGS project be incremental disturbances to the disturbance associated with construction and operation of TAPS.

26-4 Comment accepted.

26-5 A review of Appendix A and those topics identified as "3," topics that "will be treated at a subsequent time," are topics that would be the subject of detailed design and engineering approvals; permit or stipulation requirements; and field, construction, or operational monitoring. It also should be noted that when scoping took place there were questions as to whether the FEIS would cover FERC and DOE decisions. Subsequently, it was determined that this FEIS would be designed to meet DOE and FERC NEPA requirements. Accordingly the scoping document is no longer completely correct.

COMMENT LETTER 27

United States Department of the Interior

GEOLOGICAL SURVEY

4200 University Drive
Anchorage, Alaska 99508-4667

December 8, 1987

Mr. Jules V. Tileston
TAGS Project Officer
Bureau of Land Management
Alaska State Office
701 C Street, Box 30
Anchorage, Alaska 99513

Dear Mr. Tileston:

This office has reviewed the Trans-Alaska Gas System Draft Environmental Impact Statement, and the report concerning "Geologic Considerations, Proposed LNG Plant and Marine Terminal, Anderson Bay, Port Valdez, Alaska, August 27, 1987", prepared by Dames and Moore.

I am favorably impressed with the rationale presented in the Dames and Moore report that, while the Anderson Bay location is in an area of ubiguitous faulting, the faults are, and have been for some thousands of years, inactive, and that any involvement of the shallow crust is quite limited. The opinions quoted to this effect by Dames and Moore are from well-recognized experts in the field of seismology for the Prince William Sound area and the unanimity of their quoted opinions is reassuring.

The Dames and Moore report would have been more helpful had the included maps indicated the locations of the field stations for which Brown and Brudie provided descriptive notes. The Bedrock Geology Map, included with the report, could suggest that some of the mapped northwest-southeast trending lineaments also might be fault traces, particularly in view of the geologists attributing the E-W linear features to be easily eroded phyllite zones within

27-1 the more resistant graywacke. Because of this question, because of the project's heavy reliance on near-surface competent bedrock, and because of the experience of TAPS in having to excavate deeper than planned at their tank farm, it is suggested that data from several strategically-placed boreholes, including a couple offshore in the area of the proposed loading berths, be obtained before entering into the final design phase of the project.

27-2 This office concurs that a natural gas pipeline system can be constructed from the Prudhoe Bay area to the vicinity of Valdez without undue impact to the environment. However, while alternative routings and terminal locations are discussed in the DEIS summary (S-1), there is no alternative mentioned to a buried, chilled gas pipeline, in spite of the Soviet experiences with constructing large-diameter gas pipelines in areas of continuous and discontinuous permafrost during the past 20 years, and in spite of the potential for creating a frost bulb that eventually could reach perhaps 30 feet in diameter and be attached to the pipeline along some portions of the proposed routing. Possible alternatives to the proposed essentially 100 percent burial, such as perhaps a combination of burial, surface-berm and

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RESPONSE

27-1 The need for careful geologic investigation at the Anderson Bay LNG plant and marine terminal is recognized. The TAPS oil terminal has provided TAGS with a baseline of data and experience applicable to the nearby Anderson Bay site. A comprehensive field investigation and evaluation of geotechnical conditions at the site would be done prior to the final design. These investigations would include detailed geologic mapping, ground-water study, rock quality evaluations, extensive core and soil borings and testings, and soil (including marine sediments) and rock slope stability evaluations.

27-2 The applicant is aware of the references cited in the comment letter and has reviewed the Soviet experience during development of conceptual design. The references provided could be misleading unless used in conjunction with the following references:

- Johns, H.O. and Heuer, C.E., 1983, Frost Heave Mitigation and Permafrost Protection for a Buried Chilled-Gas Pipeline, National Academy Press, Proceedings, Fourth International Conference on Permafrost, Washington, D.C., pp. 531-536.
- Ferrians, Jr., O.J., 1983, Pipelines in the Northern U.S.S.R., National Academy Press, Final Proceedings, Fourth International Conference on Permafrost, Washington, D.C., pp. 98-99.
- Krivoshein, B.L., 1983, Thermal Interaction Between Pipelines and the environment, National Academy Press, Final Proceedings, Fourth International Conference on Permafrost, Washington, D.C., pp. 242-247.
- Carlson, L.E., et al., 1981, Field Test Results of Operating a Chilled, Buried Pipeline in Unfrozen Ground, National Research Council of Canada, Proceedings of the Fourth Canadian Permafrost Conference, The Roger J.E. Brown Memorial Volume, H.M. French ed., pp. 475,480.
- Peyton, H.R., 1976, Trip Report on Visit to the U.S.S.R. by the U.S. Rorking Group on Permafrost-Related Environmental Problems Posed by the Construction and Operation of Pipelines and Other Transport Systems, Final Report.

The comment is not entirely applicable since the extent of Soviet experiences with constructing large-diameter gas pipelines in areas of continuous and discontinuous permafrost is overstated. It should be further noted that the referenced "Spiridonov, 1983" is a general overview of engineering and construction methods in northern regions and refers only to U.S. and Canadian design for large-diameter chilled gas pipelines in northern Alaska and Canada.

See response to Comments 27-8 and 27-24 which discuss the potential for creating a frost bulb. Alternatives to burial are discussed in response to Comment 27-26.

COMMENT LETTER (Contd)

RESPONSE

27-2 (Contd) above-ground, need to be rigorously examined and discussed in the light of the Soviet experience with gas pipelining in permafrost areas (7,500 miles constructed prior to 1978; 13,750 miles planned for 1981-85; Spiridonov, 1983) and the Soviet, Canadian and United States permafrost literature, before the project moves to the final design phase. Parenthetically, it is noted that, in the 16 pages of references (about 250) listed in the DEIS, there are virtually no references (S.W. Muller, excepted) concerning permafrost or pipeline engineering per se.

The following detailed comments are also offered, generally by page number in the DEIS:

27-3

1. Page 1-7. While proprietary frost heave engineering design information data may not be available, this is not the case for the published literature, for example the following, among many articles, are in the public domain:

   a) Svec, Otto J., Frost Heave Control of a Chilled Gas Pipeline, National Research Council Canada, DBR Paper No. 994, NRCC 19676, 1981;

   b) Mel'nikov, P.I., et al, Geocryological Conditions and Procedures for Laying the Noril'sk-Messoyakha Pipeline (28" diameter), National Academy of Science, USSR Contribution to Second International Conference on Permafrost, Washington, D.C., 1978, pp. 599-604;

   c) Spiridonov, V.V., et al, Pipeline Construction in Permafrost Regions, same publication as (b), pp. 604-609;

   d) Spiridonov, V.V., Engineering Designs for Laying Pipelines in Permafrost Areas and Boggy Terrain in the North, National Academy Press, Proceedings Fourth International Conference on Permafrost, Washington, D.C., 1983, pp. 1184-1187;

   e) King, G.G., Cooling Arctic Gas Pipelines, The Oil and Gas Journal, Aug. 15, 1977, 3 p.

   f) Kinoshita, S., and Ono, T., Heaving Force of Frozen Ground, National Research Council of Canada, Technical Translation 1246, Ottawa, 1966, 29 p.

   g) Lachenbruch, A.H., Some Estimates of the Thermal Effects of a Heated Pipeline in Permafrost, Geological Survey Circular 632, Washington, D.C., 1970, 23 p.

   h) Kachadoorian, R., and LeSchack, L., How the Soviets Build on Permafrost, Reprinted from Civil Engineering - ASCE, April 1975, 3 p.

27-3 We agree with the comment and the references have been provided to YPC for their consideration during the detailed design and engineering phase of project development.

COMMENT LETTER 27 (Contd)

27-4 2. Page 1-16. The statement is made, "This (the Gold Creek) alternative offered no overriding advantage (emphasis added) over the proposed project at Anderson Bay." This could be a case of unintended wording as it implies that the Gold Creek alternative was, at least marginally, somewhat better than the Anderson Bay location. If correct, it would appear that either the Anderson Bay location has to possess rather strong advantages, or else that the Gold Creek location must be discussed in much greater detail in order to be able to make the choice between the two locations.

27-5 3. Page 2-3. The gas will be refrigerated through Compressor Station No. 8 (Milepost 562.3). However, the discontinuous (and relatively warm) permafrost zone spans the area from Compressor Station No. 5 (Milepost 357) to about Compressor Station No. 10 (Milepost 720.5); permafrost temperatures at Bettles and Glennallen are similar and a trifle colder than those around Fairbanks. Thus, why the change in operation near the mid-point in the traverse through the discontinuous permafrost zone? Additionally, the report is silent on the refrigerated temperatures or how these relatively might change along the route, although p. 4-38 mentions "mean operating temperatures between 0°F and 32°F in permafrost areas". The ANGTS FEIS Overview volume provides gas temperature information, which is of great importance in estimating the potential for the amount of frost heave and what that differential frost heave might do to both the integrity of the pipeline and to the environment.

27-6 4. Page 2-5. It is stated that "The proposed TAGS pipeline will have cathodic protection facilities," but then says "that stations would consist simply of a post with lead wires and terminal connections encased in a central box and conduit", nothing about protection facilities, null currents, etc.

27-7 5. Page 2-22. States, "In normal soils, cover would very from 30 to 36 inches." Nothing is said about trying to keep the top of the pipeline below the permafrost table on the North Slope, or above the water table in the discontinuous permafrost areas, in order to reduce major frost heave problems. While high water tables are mentioned, it is only in connecting with the ease of using a ditching machine, or a backhoe, rather than the danger that the differential frost heaving could pose to the integrity of the pipeline.

27-8 6. Page 2-24. The plan calls for burial of the pipeline beneath about 200 streams. Concern is expressed about degradation, scour, and erosion, but the potential for frost bulb formation, in spite of the readily available water, is only alluded to. A perusal of the Soviet literature suggests that, based on experience, they would provide aerial crossings for the 200 streams, especially those crossing cold permafrost, and

RESPONSE

27-4 See response to Comment 18-2. The evaluation of the various alternative LNG sites as summarized in Figure 1.9.4-3 and discussed in detail in Appendix C does not lead to the conclusion that Gold Creek is better than Anderson Bay. What is implied is that it is the second best site of those considered for Valdez Arm for the reasons discussed. There were several serious problems associated with Gold Creek that are not found at Anderson Bay. See Subsection 1.9.4.4.

27-5 Additional discussion of the pipeline operating temperature transition point from chilled to warm gas operation is given in the TAGS DEIS page 2-48, 2.6 Operations and Maintenance. The transition point from cold to warm gas flow would be determined during detailed design when site specific geotechnical data are available for the pipeline route. The transition point would be located where warm gas flow becomes more favorable for pipeline design. Preliminary evaluation suggests that the transition point would probably be located at either Compressor Station 9 or 10.

It is understood that significant temperature differences would develop along the pipeline due to soil properties, seasonal and climatic conditions, and the Joules-Thomson effect.

27-6 The TAGS pipeline would have cathodic protection facilities in order to meet the requirements for corrosion control as prescribed by Federal Pipeline Safety Regulations. Test stations for measuring pipeline electrical potential would be installed at one mile intervals along the pipeline route. Test stations would also be installed at all road, foreign pipeline, and river crossings. A test station would consist simply of a post with lead wires and terminal connections encased in a control box and conduit. The test wires would be attached to the pipeline.

During the pipeline detailed design phase and upon completion of the pipeline construction, a pipe to soil potential survey would be conducted for the purpose of determining anode groundbed locations. Where thawed soil areas or areas of low soil resistivity are encountered, sacrificial anodes would be bured and electrically connected to the pipeline in order that the pipe steel would be protected against corrosion. Anodes would be zinc, magnesium, aluminum or other similar metal higher in activity than steel.

Where necessary, a direct current voltage would be impressed on the circuit between the pipeline and the groundbed. Rectifiers would provide the D-C voltage from available alternative current (A-C) power sources. These devices would be located at each compressor station and at block valve sites where A-C power is available. Based on conceptual design, it is estimated that D-C voltages impressed on the pipeline circuit would be on the order of one volt.

Design and selection of a cathodic protection system would consider and avoid conflicts with currently operating pipelines and their related cathodic protection systems. Design for compatibility with existing cathodic protection systems would be accomplished throughout design and implementation of the TAGS cathodic protection system.

27-7 Route selection by YPC was based on conditions expected along the proposed TAGS alignment and relationship of the route to major surrounding geographic features and existing facilities. Soil thermal conditions (permafrost conditions) were generally assessed for each route segment. Selection of the specific TAGS pipeline routes was based on optimizing the following criteria:

COMMENT LETTER 27 (Contd)

RESPONSE

- Minimize total length of pipeline as is environmentally acceptable and economically feasible.
- Avoid environmentally sensitive areas.
- Maximize routing in geotechnical and thermal conditions favorable to pipeline operating characteristics.
- Provide routing with associated high degree of pipeline constructability.
- Utilize existing infrastructure to the extent possible and appropriate.
- Utilize parallel construction techniques with existing facilities where feasible.
- Locate downslope of existing facilities where possible.
- Maintain 200-foot separation from existing TAPS facilities and ANGTS right-of-way where feasible.
- Maintain sufficient separation from all foreign facilities to allow for safe construction of TAGS and safe operation of all facilities.
- Minimize number of crossings of existing or proposed TAPS, ANGTS, and highway facilities.
- Avoid bracketing existing highway facilities within highway right-of-way.
- Minimize number of river and stream crossings.
- Avoid blocking surface water cross-drainage.
- Avoid geohazardous areas.
- Avoid existing land-use conflicts.

The routing of the TAGS chilled gas pipeline has and would continue to consider the potential for frost heave in the selection of a route which reduces, where practical, major frost heave problems. The concerns related to frost heave effects (including differential frost heaving) on the pipeline are discussed in more detail in Subsections 4.2.8.6, 4.2.8.7, and 4.2.8.8. Also see Tables 4.8-1 and 4.8-2 for additional mitigation measures.

27-8 The concerns identified for frost bulb formation beneath streams in thawed flood plains at TAGS pipeline crossings are addressed in Subsections 4.2.9.2 and 4.2.11.5. The TAGS pipeline conditions on the Alaskan North Slope (cold permafrost area) provide a routing which avoids major stream crossings. The crossing of minor streams with a chilled pipeline in Alaskan North Slope cold permafrost (where permafrost exists beneath minor streams) is not a serious problem since the pipeline would operate in frozen ground. The reference to Soviet literature appears to address warm gas pipeline concerns, not chilled pipeline operating conditions.

The growing frost bulb could restrict or redirect subsurface flows and can increase the potential for icings (aufeis) to develop. In stream crossing areas, it could lead to lowered water temperatures which could affect aquatic life and biological organisms and may contribute to stream bank erosion.

Subsurface flows would, however, interact with the frost bulb and would retard frost bulb growth. Heat supplied from the ground water to the freeze front would retard growth of the frost bulb and, in open, coarse-grained soils, could actually prevent the development of a frost bulb. The use of pipe insulation would allow ground-water flows to have an even larger impact on frost bulb development. In coarse-grained soils, ground-water flow would therefore be a natural frost heave mitigating measure. Computer models are currently available which evaluate the interaction of ground-water flow and frost bulb growth.

Design measures to mitigate the impact of frost bulb growth on subsurface flow would include placement of insulation on the pipe and deep burial of the pipe. Properly designed pipe insulation can eliminate frost bulb growth in these areas. Deep burial of the pipe would provide less impact to near-surface flows. Properly applied, each measure could mitigate most of the adverse impacts of the frost bulb on subsurface flows.

COMMENT LETTER 27
(Contd)

RESPONSE

There are areas where icings occur regularly along the TAPS alignment; TAGS would attempt to avoid these areas. In general, however, it is extremely difficult to identify future icing areas, and because of their intermittent occurrence, it is unlikely that mitigative measures can be successfully applied in advance to eliminate icings. The control of icings, when and where they occur, would have to be handled during pipeline operation using standard approaches (e.g., ice fences and the like).

Adequate separation between the pipeline and other facilities located in areas with a high potential for subsurface flow would also mitigate the impacts caused by frost bulb growth on existing facilities.

The site-specific design of major river crossings in a particular environment is dependent on site-specific geotechnical conditions, environmental concerns, construction capabilities, and pipeline operating characteristics.

COMMENT LETTER 27 (Contd)

RESPONSE

27-8 (Contd) probably bury the pipeline beneath the Yukon, Tanana, Gulkana and Tazlina rivers, or at least beneath the Yukon River, i.e., they buried the pipelines crossing "The major Yenisey, Norilka, Bol'shaya and Malaya Khetna rivers, with their wide floodplains and islands, with spring floodwaters, and ice-jams during the breakups, and the sandbars with permafrost developed on them" (Mel'nikov, et al, 1978). A review of early pictures of frost-heaved bridges at Alaska Railroad stream crossings also can be informative.

27-9 7. Page 2-52. The DEIS states that polluted ballast water would not be disposed of in PWS, but where would it be disposed of—in the open ocean or through treatment? and what might be the potential pollutants?

27-10 8. Page 2-55. The words "frost-susceptible" and "thaw-unstable", referring to soil materials, are used, but neither of these critical technical terms is defined in Section 6.0, even though one finds definitions for more common terminology such as "berm" and "bedrock". This is a serious omission since without agreed-upon definitions prior to the onset of a project, there often is a tendency to retroactively decide on a definition to fit the materials found in the field. It is noted that Casagrande, the daddy of soil mechanics, stated that "under <u>natural freezing conditions</u> (emphasis added) and with sufficient water supply one should expect considerable <u>ice segregation</u> (emphasis added) in non-uniform soils containing more than 3% of grains smaller than 0.02 mm, and in very uniform soils containing more than 10% smaller than 0.02 mm." It also is noted that capillarity, thermal conductivity (about 4 times as great for ice as for water), diffusivity, and heat capacity play a role in the determination of the frost penetration depth and the rate and amount of heaving.

27-11 9. Page 3-21. The statements that Umiat is 50 miles west of Prudhoe, and that Anaktuvuk Pass is about 100 miles southwest of Prudhoe Bay, are a bit wide of the mark; Umiat is about 110 miles southwest and Anaktuvuk Pass is about 170 miles south-southwest might be better.

27-12 10. Page 3-27. A network of ice-wedge polygons forms patterned ground not only between the thaw lakes, as stated, but also under most of them unless they are deep.

27-13 11. Page 3-29. The statement that, "Large irregular <u>granitic batholiths</u> make up the <u>muck</u> (a mixture of frozen organic matter and silt) of the southeastern part of the Yukon-Tanana Uplands Province", as stated on P. 3-29, is in error as regards the granitic batholith/muck connection.

27-9 The ballast water identified in Subsection 2.6 would be in separate compartments, separated from the LNG tanks. When LNG tankers return from the Orient, they would pick up ballast water at a harbor in the Orient, proceed out into the North Pacific, empty the ballast water in the North Pacific, take on new ballast water in the North Pacific, and proceed into Port Valdez. The degree, if any, of the potential pollutants would be those in the waters of the port where the LNG is delivered.

27-10 Section 6.0 has been revised to include terms "thaw-stable" and "thaw-unstable" as used in the FEIS at Subsection 3.2.8.1 and elsewhere. Section 6.0 also has been revised to include the term "frost susceptible" as used in Subsection 4.2.8.6 and in Table 4.8-2.

27-11 Editorial correction incorporated.

27-12 Editorial correction incorporated.

27-13 Comment accepted and the FEIS incorporates recommendation in Subsection 3.2.8.4.

COMMENT LETTER 27 (Contd)

RESPONSE

27-14 12. Page 3-31. The description of permafrost in the Copper River lowlands would make it appear to be quite benign, in spite of the experiences of some GS personnel and TAPS reported in the case of the Alyeska pipeline. The DEIS states, "North of the Klutina River, permafrost is essentially continuous except in major river valleys. South of the Klutina, permafrost is discontinuous with the permafrost table often depressed as much as 25 feet below ground . . . Segregated ice is generally absent except in silty materials where it takes the form of lenses and seams". It is believed that the write-up gives an erroneous impression of the permafrost conditions that might be encountered in the Copper River lowlands.

27-14 Comment accepted and FEIS incorporates recommendation in Subsection 3.2.8.7.

27-15 13. Page 3-31. Other than stating that there are extremely rugged east-west trending ridges ranging from 7,000 to 13,000 feet high, there isn't much in the way of a geologic description for the Chugach Mountains, or the Prince William Sound area, in spite of the earthquake potential.

27-15 Comment accepted and FEIS incorporates recommendation in Subsection 3.2.8.8.

27-16 14. Page 3-32. Says the 1964 earthquake epicenter was 33 miles from the terminal site; P. 3-31 says about 30 miles; the Dames and Moore report says 40 miles.

27-16 Editorial correction incorporated.

27-17 15. Page 3-33. Says breakup begins in late March in the Arctic foothills; it should read late May. March is the second coldest month of the year up there.

27-17 Editorial correction incorporated.

27-18 16. Page 3-35. This office knows of no ground water being produced from the alluvium below major rivers on the Arctic coastal plain, even less about the quality of such waters.

27-18 Editorial correction incorporated.

27-19 17. Page 3-38. In the Prince William Sound area, it is difficult to imagine that only 12 inches of runoff would be provided by an annual precipitation of 160 inches.

27-19 The units were incorrectly cited from Plate 12 of USGS (1971a); it should be 13 cfs per square mile. The FEIS has been changed to reflect correction.

27-20 18. Page 3-65. The DEIS says that 7 active peregrine aeries had been identified on the Middle Yukon River from Fort Hamlin to Tanana. However, Tanana is about 90 miles west of the TAGS route. It also states that 7 pairs of the birds were recorded along the Tanana River between Fairbanks and Tanacross. However, Tanacross is about 90 miles east of the TAGS route. The statements tend to give an erroneous impression of the potential for impacts to peregrine falcons.

27-20 Editorial correction resolved conflict.

27-21 19. Page 3-68. The DEIS states that, "gray, fin, and humpback whales <u>occur</u> in and around northern Prince William Sound and <u>use</u> the Valdez Arm area as a summer feeding grounds, <u>eating</u> marine phytoplankton, zooplankton, squid, and small fish", but P. 3-45 states that these same species of endangered whales <u>may be present</u> in Valdez Arm and Port Valdez according to the National Marine Fisheries Service. Some consistency would be desirable.

27-21 Comment accepted and the FEIS incorporates recommendation in Subsection 3.2.14.

COMMENT LETTER 27 (Contd)

27-22 20. Page 4-31, Table 4.2.7.-1. The right-hand column of the table probably should be titled, "average daily solid waste quantities, in pounds".

27-23 21. Page 4-37. Material extraction from river gravel bars, above water levels, leaves no permanent scars; if taken during the winter the extraction provides no sedimentation and does not harm fish eggs, which can't stand subzero terperatures; however, upland borrow leaves scars that tend to last for many tens of hundred of years. This office understands that the ADF&G is moving towards that conclusion.

27-24 22. Page 4-43. The DEIS states that, "Impacts to the geologic environment would occur mainly during construction and would consist of changes in topography, thermal effects on permafrost, and increased erosion. Impacts to the pipeline system would be realized primarily during operation as a result of differential heave, erosion, and seismicity of the proposed route." This office concurs that these should be the expected impacts from a gas pipeline but has reservations that these statements will necessarily be proven to be correct if the applicant attempts to bury essentially 100 percent of the pipeline as advertised, or were he to be locked into that mode of construction by statements provided in the FEIS. The basic reasons for the reservations are:

a) A buried, chilled pipeline in permafrost would be gripped by the soils as in a vise. In cold permafrost areas, such as are found on the North Slope, soil tensile forces increase markedly in winter, because of a decrease in near-surface soil temperatures of as much as 25°C. These tensile forces are almost instantaneously and locally relieved by tension cracking of big blocks (10 to about 70 meters in diameter) of the soil to depths of 3 to 6 meters, i.e., the noted polygonal cracking. The integrity of the steel pipe, being weaker in tension than in compression, might not be able to withstand those forces. It also is noted that one cannot totally escape polygonal ground on the North Slope.

b) A buried, chilled pipeline in a discontinuous permafrost area would be gripped as in a vise, particularly in wet areas, by a bulb of frozen soil of variable and growing diameter during the operational phase. While one can talk about non-frost susceptible soils, really a capillarity problem, that is only part of the equation since moisture availability, thermal conductivity, thermal diffusivity, heat capacity, and almost micro variability in the soils being traversed also play large roles in determining the amount and rate of <u>differential</u> frost heave, even over short distances. The resulting circumferential tensile

RESPONSE

27-22 Editorial correction incorporated.

27-23 Subsection 4.2.8.3.3 was modified to reflect this comment. However, there are other factors that must be considered in addition to the visual aspects; namely, the method or approach to gravel extraction, removal process (i.e., large stock piles thawing between seasons carried downstream by floods), potential for fuel spills, and the accidental impact to fish overwintering areas. See response to Comments 22-51 and 22-52.

27-24 In the winters of 1968-69 and 1969-70, full-scale field testing was initiated near Barrow, Alaska on ice wedge cracking and related effects on buried cold pipelines by the Institute of Arctic Environmental Engineering, a research branch of the University of Alaska. The results, reported by Knight, 1970, show that some strain is induced into the pipeline, but the amount of strain is not large enough to cause pipe failure. The results were based on tests conducted on pipe diameters of 12 inches and 40 inches. The soil around the pipeline failed either at the pipe/soil interface or further into the soil where the shear strength of the soil was less than the bond strength between the pipe and soil.

Alyeska completed construction and has operated a small diameter fuel gas pipeline on the Alaska North Slope (an area of active ice wedges) for 10 years. The fuel gas pipeline consists of over 140 miles of 10-inch and 8-inch gaslines routed between TAPS Pump Station 1 (Prudhoe Bay) and TAPS Pump station 4 at the Atigun River near Galbraith Lake. This ambient temperature pipeline has been subjected to below-freezing operating conditions for approximately 10 years. According to Alyeska personnel (1988), there have been no operations and maintenance problems associated with the over-straining of the pipeline due to the phenomenon of ice wedge cracking. See reference below.

Knight, George R., 1970, Ice Wedge Cracking and Related Effects on Buried Pipelines, Proceedings of the Symposium on Cold Regions Engineering, Volume One, American Society of Civil Engieers, Alaska Section, John L. Burdick, Editor, pp. 384-395.

The TAGS pipeline would be routed through a variety of geotechnical conditions over its length. YPC routed the pipeline, where possible, in the most favorable geotechnical conditions, with a major criterion being avoidance of areas of potentially large frost heave. However, other routing concerns, including geographic and environmental, make it impossible to avoid all areas of significant frost heave potential.

There are no plans to drain wetlands in order to reduce frost heave impact. Where this type of terrain is unavoidable and is confirmed by geotechnical study and review, YPC would employ a number of mitigation measures to reduce impact. The primary mitigation measure would be increased pipeline wall thickness as determined by detailed pipeline design. (See Subsections 4.2.8 and 4.7.)

COMMENT LETTER 27 (Contd)

27-24 (Contd) forces on the pipeline would be variable, being greatest in the upper one-third of the pipe, and would be additive to the tensile forces generated by the coefficient of contraction during the time of decreasing winter temperatures. It is noted that water would be available for differential frost heave in discontinuous permafrost areas since it would not be practical to try to drain every piece of wetland or swamp the pipeline might need to cross.

These reservations could be eliminated through an engineered combined burial, surface berm, and above-ground mode of construction.

27-25 23. Page 4-47. Nothing is said about the possibility that the bottom of the Yukon River might not be suitable for a pier foundation in the upstream area indicated. This is of importance in view of the pier foundation problems encountered by Alyeska and the indication of an old fault system in the area.

27-26 This office is confident that a Trans-Alaska Gas System pipeline can be constructed from Prudhoe Bay to Valdez without undue harm to the environment and without endangering the integrity of the pipeline. However, it also believes that, in order to accomplish these purposes, flexibility is needed to allow the applicant and the regulatory agencies to engineer a combination burial--surface berm--above ground mode of construction.

Sincerely,

Max C. Brewer

Max C. Brewer
Staff Geologist/Geophysicist

RESPONSE

27-25 Comment accepted and recommendation is incorporated in Subsection 4.2.9.4. Unanticipated geotechnical conditions could be encountered during the construction of the foundation piers for the TAGS Yukon River Bridge. Though such conditions should not pose a fatal flaw, they could require modifications of the pier foundation to accommodate any fractured rock beds. YPC intends to conduct a detailed field investigation that includes core drilling and testing at the pipeline bridge pier location. Design of the pier foundation would then be based on evaluation of the site specific conditions found by the field investigation.

27-26 A conceptual design has been developed for an above-ground mode of construction for the TAGS pipeline. These designs are limited to elevated river crossings (including approaches) and active fault crossings. Although many of the concerns related to TAGS pipeline construction in discontinuous permafrost could be simply avoided by elevating the pipeline above ground, a buried pipeline is preferred since it provides for a higher degree of security. A buried pipeline also avoids exposure to very cold air temperatures which, in the event of a winter shutdown, could cause pipe steel to behave in a relatively brittle manner. Insulation alone cannot prevent these problems (Johns and Heuer, 1983).

A surface berm mode has been considered by previous projects and again by YPC. Except for special design uses such as at crossings of the TAPS and ANGTS below ground pipeline (See Figure 2.3.3-4(b)) the surface berm mode has been discouraged for the following reasons:

- The surface berm mode is a positive relief structure creating a barrier to transporation and drainage, and is highly subject to soil erosion.
- The surface berm mode does not prevent the formation of a frost bulb and frost heave beneath the pipeline.
- The surface berm mode increases the requirements for high quality gravel or rock material sources.
- The surface berm mode is difficult to construct.

COMMENT LETTER 28

RESPONSE

STATE OF ALASKA

DEPARTMENT OF NATURAL RESOURCES

DIVISION OF LAND AND WATER MANAGEMENT

STEVE COWPER, GOVERNOR

NORTHERN REGION
4420 AIRPORT WAY
FAIRBANKS, ALASKA 99709-3896
PHONE: (907) 479-2243

December 11, 1987

Jules Tileston
Program Manager, TAGS
U.S. Department of the Interior
Bureau of Land Management
701 C Street, Box 30
Anchorage, Alaska 99513

Dear Mr. Tileston:

The state's concern for the evaluation of minor alternatives to the alignment e.g. Canyon Slough, Summit Lake, etc., were not intended to deny the proposed alignment in the Environmental Impact Statement (EIS) process. Potential impacts to resources in these areas should be fully explained and another tier of information should be provided in a subsequent phase of the project before the exact construction alignment is approved. This process will be followed on state land and should be used on federal land. We request a commitment by the Bureau of Land Management (BLM) and the U.S. Army Corps of Engineers to this process under the mitigation section of the EIS. The state will participate fully in identifying sites or alternative alignments, providing more detailed resource information, and developing mitigation through the state adjudication process of the alignment.

28-1 Comment noted and has been incorporated. See Comment Letter 22 and Subsection 4.8 of the FERC.

Thank you for your consideration in this matter and if you have further questions regarding the state comments on the TAGS Draft EIS, please call me at 451-2819.

Sincerely,

ELIZABETH BENSON
Project Review Coordinator
Division of Governmental Coordination

12-11-87
Date

JERRY L. BROSSIA
Pipeline Coordinator

12-11-87
Date

cc: Commissioner Brady, ADNR, Juneau
Commissioner Kelso, ADEC, Juneau
Commissioner Collinsworth, ADFG, Juneau
Rod Swope, Office of the Governor, Juneau
Paul Bateman, TAGS Liaison Officer, ADEC, Fairbanks
Al Ott, TAGS Liaison Officer, ADFG, Fairbanks
Mike Tinker, TAGS Liaison Officer, ADOT/PF, Fairbanks

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DEC 11 1987

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COMMENT LETTER 29

UNITED STATES DEPARTMENT OF COMMERCE
The Chief Scientist
National Oceanic and Atmospheric Administration
Washington, D.C. 20230

December 5, 1987

Mr. Jules V. Tileston
U.S. Department of the Interior
Bureau of Land Management
Alaska State Office
701 C Street, Box 30
Anchorage, Alaska 99513-0099

Dear Mr. Tileston:

29-1 This is in reference to your Draft Environmental Impact Statement on the Trans Alaska Gas System. Enclosed are additional comments from the National Oceanic and Atmospheric Administration.

We hope our comments will assist you. Thank you for giving us an opportunity to review the document.

Sincerely,

David Cottingham

David Cottingham
Ecology and Conservation
Division

Enclosure

RECEIVED
DEC 14 1987

NOAA

RESPONSE

29-1 Comment noted. Enclosure included a copy of the November 19, 1987 letter from Robert McVey (Comment Letter 14) that is not repeated here. See responses to Comment Letter 14.

COMMENT LETTER 29 (Contd)

RESPONSE

UNITED STATES DEPARTMENT OF COMMERCE
National Oceanic and Atmospheric Administration
NATIONAL OCEAN SERVICE
OFFICE OF OCEAN AND COASTAL RESOURCE MANAGEMENT
Washington, D.C. 20235

NOV 23 1987

TO: BF/EC - David Cottingham

FROM: N/ORM - Peter Tweedt

SUBJECT: DEIS 8709.07--Trans-Alaska Gas System

29-2 Although this DEIS does not contain Federal Consistency certification for those aspects of the project which affect the Alaska coastal zone, the document, in table 1.11-1, clearly indicates that such certifications and other State permits will be obtained during the next phase of project development. The DEIS correctly identifies the Alaska Governor's Office of Management and Budget, Division of Governmental Coordination as the State CZM agency.

29-2 Comment noted.

APPENDIXES

INTRODUCTION TO APPENDICES

Other than Appendix L, all of the appendices listed below from the DEIS remain identical and are therefore not reproduced in this FEIS. These appendices are hereby incorporated by reference.

APPENDICES

A	Summary of Issues and Remarks Raised During Scoping	A-1
B 1/	Compatibility and Gas Conditioning	B-1
C	Evaluation of Alternative Pipeline Routes and LNG Plant/Marine Terminal Locations to the Trans-Alaska Gas System Proposal for Southcentral Alaska	C-1
D 2/	Air Quality Impact Screening Analysis, Gas Conditioning Facility Prudhoe Bay Unit	D-1
E	TAGS Access Roads	E-1
F	Maps of Land Status Along Proposed TAGS Route	F-1
G	LNG Federal Safety Regulations	G-1
H	Bioligical Assessment for Endangered Species	H-1
I	Results of YPC Thermal Radiation Protection and Flammable Vapor-Gas Dispersion Protection Studies	I-1
J	Review of the El Paso Alaska Project	J-1
K	An Assessment of the Potential Environmental Residuals in the Lower 48 States Arising from Alaskan Natural Gas Exports	K-1
L	ANILCA 810 Findings	L-1
M	U.S. Army Corps of Engineers - Public Notice of Tiered Processing Procedure for Trans-Alaska Gas System	M-1
N	Presidential Finding Concerning Alaska Natural Gas	N-1
O	Supplemental Report, Seismic Considerations, Proposed LNG Plant and Marine Terminal, Anderson Bay, Port Valdez, Alaska	O-1
P	Compressor Station Location Discussion	P-1

Due to minor changes in Appendix L, it is included in the FEIS. Several other Appendices, N, O, and P, are new appendices included in the FEIS. Appendix N is a copy of the "Presidential Finding Concerning Alaska Natural Gas;" Appendix O is the "Supplemental Report, Seismic Considerations, Proposed LNG Plant and Marine Terminal, Anderson Bay, Port Valdez, Alaska;" and Appendix P is the "Compressor Station Location Discussion."

1/ On June 6, 1988, the Northwest Alaskan Pipeline Company issued a press release about a future potential for modification to the ANGTS project as described in Appendix B of the DEIS. These prospective modifications are summarized as follows: 1) make greater use of snow/ice construction in Alaska where possible; 2) shorten the overall construction schedule by greater use of winter construction; 3) revise the mix of previously approved construction methodology; 4) increase the flow of natural gas throughout from 2.1 BCFD to 2.3 BCFD; 5) decrease pipe diameter in the Alaska segment from 48 inches to 42 inches; 6) increase operating pressure from 1,260 psig to 2,160 psig; 7) reduce the number of compressor stations; 8) reduce the number of other related facilities. On June 8, 1988, a representative of Northwest Alaska Pipeline Company indicated there were no firm plans at this time as to when remobilization of ANGTS would start or when the modifications would be submitted for Federal review/approval. Although detailed technical information is not yet available on the potential June 6, 1988 ANGTS modifications, the overall cumulative effects described in this FEIS are based upon the assumption that ANGTS will be constructed. The FEIS appears to still represent a reasonable estimate of cumulative effects; if anything, the overall thrust of the prospective ANGTS modifications would cause a letter degree of total cumulative effect.

2/ Appendix D has been deleted at the request of EPA since there is substantial uncertainty on the process and design of a gas conditioning facility at Prudhoe Bay needed to provide LNG quality natural gas to TAGS. Prior NEPA evaluations and an expired PSD analysis may not be transferrable or may not be appropriate for TAGS (EPA 1988a).

APPENDIX I

RESULTS OF YPC THERMAL RADIATION PROTECTION AND FLAMMABLE VAPOR-GAS DISPERSION PROTECTION STUDIES

- Thermal Radiation Protection
- Flammable Vapor-Gas Dispersion Protection

RESULTS OF YPC THERMAL RADIATION PROTECTION AND FLAMMABLE VAPOR-GAS DISPERSION PROTECTION STUDY

Thermal Radiation Protection

Significant to siting of an LNG plant, thermal exclusion zones are postulated worst case radiant heat flux areas inside of which specified public or private facilities may not be located, unless an LNG facility of the operator.

Calculation of thermal exclusion zones for the proposed TAGS LNG plant shows that the proposed facility can be safely sited at Anderson Bay and meet the thermal radiation protection requirements of 49 CFR 193. Maximum incident radiant flux values from postulated LNG pool fires have been calculated to assess the effect on publicly or privately used lands in the Port Valdez area. Results of the thermal radiation analyses have been used to further refine the LNG plant facilities definition.

Thermal exclusion distances were calculated for an LNG pool fire within a typical storage tank dike, LNG pool fires within transfer system impoundment areas, and a pool fire for a loading arm spill onto water. Calculations were initially performed for the LNG plant conceptual layout, and subsequently after the conceptual layout was modified based on the results of various LNG safety analyses.

Several "target" areas of public or private use were identified within the vicinity of Port Valdez. Analysis indicates that each of these target areas is located outside of the plant thermal exclusion zone associated with incident flux greater than 1,600 Btu/hr-ft^2 for each postulated LNG pool fire. The target areas were as follows:

North Shoreline of Port Valdez	14,300'
Entrance Island	14,800'
Shoup Bay Spit	15,000'
Alyeska Pipeline Service Company Property Line	16,500'
Mouth of Mineral Creek	25,600'
City of Valdez	31,400'
Old Valdez	44,000'

Thermal radiation calculations were performed for both conditions of atmospheric attenuation as well as for unattenuated conditions. Unattenuated flux considers no adsorption or scattering of the radiation as it travels from the flame through the atmosphere. Wind speed and relative humidity are significant parameters affecting the flux levels from an LNG pool fire. These parameters were used in the analysis to develop a prediction of longer exclusion distances than would be created by other weather condiitons at the site at least 95 percent of the time, based on Valdez climate data.

Thermal radiation analyses were performed using an American Gas Association methodology. This methodology has been validated with large-scale tests on LNG and liquefied petroleum gas (LPG) fires, and has been accepted by the Materials Transportation Bureau of the U.S. Department of Transportation.

Results of thermal radiation analyses for each postulated LNG pool fire indicated that the greatest thermal exclusion distances were for the contents of an 800,000 barrel LNG storage tank spilled and burning within its impoundment. Utilizing a 450' x 450' x 35' high dike (modified from a 670' x 580' x 18' high dike), thermal radiation calculations indicated that unattenuated incident radiant flux levels of 1,600 Btu/hr-ft^2 extend a maximum distance of 1,726 feet from the center of any tank dike. Attenuated flux levels of 1600 Btu/hr-ft^2 extended a maximum distance of 1,509 feet from the center of any dike. For all of the other postulated pool fires, maximum distances for unattenuated flux levels of 1600 Btu/hr ft^2 were less than 1,726 feet.

As prescribed by 49 CFR 193, 1600 Btu/hr-ft^2 is the lowest limiting value for incident radiant flux on an offsite target. All public and private land-use target areas lie outside of the 1600 Btu/hr-ft^2 unattenuated flux isopleth. Based upon the results of thermal radiation analyses, development of the Anderson Bay site will comply with the radiation protection requirements of 49 CFR 193. Final thermal exclusion zones will be determined during detailed project design, along with optimization of process, storage tank, transfer system and related impoundment designs.

Flammable Vapor-Gas Dispersion Protection

Dispersion exclusion zones have been calculated for the proposed TAGS LNG plant, showing that the proposed facility will meet the flammable vapor-gas dispersion protection requirements of 49 CFR 193. Significant to siting of an LNG plant, dispersion exclusion zones are postulated worst-case vapor-gas dispersion areas inside of which specified public or private facilities may not be located, unless an LNG facility of the operator. Maximum downwind dispersion distances from postulated LNG spills have been computed to assess the effect on publicly or privately used land areas in Port Valdez. Results of the vapor dispersion analyses have been utilized in further refinement of LNG plant facilities definition.

Dispersion distances were computed for an LNG spill from a typical storage tank into impoundment, for LNG spills from transfer systems into impoundment areas, and for a loading arm spill onto water. Distances were computed initially for the LNG plant conceptual layout, and subsequently after modification of the conceptual layout based upon initial vapor dispersion analyses.

Several "target" areas of public or private use were identified within the vicinity of Port Valdez. Analysis indicates that each target area is located outside of the plant dispersion exclusion zone associated with average gas concentrations of 2.5 percent in air for each postulated LNG spill. The target areas are as follows:

North Shoreline of Port Valdez	14,300'
Entrance Island	14,800'
Shoup Bay Spit	15,000'
Alyeska Pipeline Service Company Property Line	16,500'
Mouth of Mineral Creek	25,600'
City of Valdez	31,400'
Old Valdez	44,000'

Vapor dispersion analyses were performed for atmospheric conditions which result in longer predicted downwind dispersion distances than would be created by other weather conditions at the site at least 95 percent of the time, based on Valdez climate data. Analyses were also performed for the most prevalent atmospheric conditions.

Vapor dispersion analyses were performed utilizing two models to evaluate each postulated spill, and were run for each set of atmospheric conditions. An American Gas Association model, "Evaluation of LNG Vapor Control Methods", 1974 was used in order to assess compliance with respect to 49 CFR 193.2059(c), published in 1980. A model developed by the U.S. Coast Guard, "Development of an Atmospheric Dispersion Model for Heavier-Than-Air Gas Mixtures", 1985, was also used in order to consider recent developments in vapor dispersion technology.

The American Gas Association method does not consider many of the physical phenomena that occur in the dispersion of heavier-than-air vapor clouds. This method provides conservative values, predicting greater vapor dispersion distances than an actual vapor cloud would travel. In some cases where model results were compared with actual spills, predicted distances to the lower flammable limit have been almost an order of magnitude greater than actual distances.

Regulations provide for the use of other calculation methods if proper validation of the method can be provided. The U.S. Coast Guard model provides proper documentation and validation for the acceptance by 49 CFR 193 regulators to be used in vapor dispersion prediction. This model provides predictions of downwind gas concentration decay which agree with the full range of field experimental data currently available.

Results of vapor dispersion analyses for each postulated LNG spill indicated that the greatest vapor dispersion distances were for the case of an 800,000 barrel storage tank spill into impoundment, or for the case of a ten minute loading arm spill onto water at the rate of 12,000 gallons per minute. Considering a 450' x 450' x 35' high dike (modified from a 670' x 580' x 18' high dike), results of the American Gas Association (1974) Model indicated that the maximum dispersion distance would extend 11,700' from the dike wall for the case of a storage tank spill into impoundment. Using the U.S. Coast Guard model (1985), a maximum vapor dispersion distance of 6,854' was predicted for this case. For the case of a ten minute loading arm spill onto water, predicted maximum vapor dispersion distances were 11,920' and 6,243' for the American Gas Association and U.S. Coast Guard models, respectively.

For all other postulated spills, maximum vapor dispersion distances predicted by the American Gas Association model were less than 5,000', and less than 2,200' as predicted by the U.S. Coast Guard model. The maximum vapor dispersion distance considering all cases for the most prevalent weather conditions was predicted to be 3,550' (American Gas Association model). Utilizing worst case weather conditions and the U.S. Coast Guard model for computing vapor travel over land, maximum vapor dispersion distances were predicted to be 3,600'. This value was used as an input to determining the TAGS LNG Plant land requirement.

When the results of vapor dispersion analyses are compared with the location of identified target areas, it is shown that development of the Anderson Bay site will comply with the flammable vapor-gas dispersion protection requirements of 49 CFR 193. All public and private land-use target areas lie outside the computed maximum vapor dispersion distances. Final dispersion exclusion zones will be determined during detailed project design, along with optimization of process, storage tank, transfer system and related impoundment designs.

Appendix I (Supplement)

This supplement to Appendix I of the DEIS provides the report upon which results of thermal radiation analyses and flammable vapor-gas dispersion analyses are based. The report, entitled "Trans-Alaska Gas System Project LNG Safety Analysis for the Anderson Bay Site" was prepared by Energy Analysts, Inc. and dated January 28, 1987.

The Energy Analysts, Inc. report contains preliminary LNG vapor dispersion and fire radiation results for the Anderson Bay LNG plant site. The computations are based on conceptual plant design. The computations provide reasonable assurance that the Anderson Bay site is capable of meeting the exclusion zone criteria of 49 CFR 193, Subpart B. Actual exclusion zones for the Anderson Bay LNG plant will be determined in accordance with 49 CFR 193, Subpart B during the project detailed design stage.

The report was initially submitted to Yukon Pacific Corporation on January 28, 1987. Since issuing the report, supplemental information has become available. Supplemental information is indicated by a superscript in the report, and is contained in Appendix D to the report.

TRANS-ALASKA GAS SYSTEM PROJECT

LNG SAFETY ANALYSIS

FOR THE

ANDERSON BAY SITE

ENERGY ANALYSTS, INC.

TRANS-ALASKA GAS SYSTEM PROJECT

LNG SAFETY ANALYSIS

FOR THE

ANDERSON BAY SITE

Prepared For

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January 28, 1987

87-1-400

TRANS-ALASKA GAS SYSTEM PROJECT

LNG SAFETY ANALYSIS

FOR THE

ANDERSON BAY SITE

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TRANS-ALASKA GAS SYSTEM PROJECT
LNG SAFETY ANALYSIS
FOR THE
ANDERSON BAY SITE

SECTION 1.0 INTRODUCTION

LNG marine tank ships and LNG land-based facilities have been safely operated for over twenty years. This record has been achieved due, in part, to the stringent standards used in design, siting, construction, and operation of these facilities. Historically, most land-based LNG facilities have been built to NFPA 59A, *Storage and Handling of Liquefied Natural Gas*. All LNG marine tank ships have been designed to IMO Standard, *Code for the Construction and Equipment of Ships Carrying Liquefied Gases in Bulk*.

With the adoption of 49 CFR 193 in 1980 [1], the regulatory responsibility for the plant falls under the jurisdiction of the U.S. Coast Guard and the Materials Transportation Bureau (MTB)[1] of the Department of Transportation (DOT). The U.S. Coast Guard[2] is responsible for the marine cargo transfer system and associated facilities between the marine vessel and the last valve located immediately before the storage tanks. The MTB is responsible for the rest of the plant. Although discussions are taking place concerning different divisions of responsibilities, the Anderson Bay site would presently have to meet 49 CFR 193, 1980.

The Anderson Bay site lies on the southern bank of Port Valdez. The site is located approximately three miles from the entrance of the port. The Alyeska Oil Terminal is approximately three miles to the east of the Anderson Bay site. In order to determine the feasibility of a site for a baseload liquefaction plant, several items must be considered. The two main safety concerns in the event of an inadvertent release of LNG are the downwind distance a flammable cloud would travel, and the distance to particular thermal radiation fluxes from pool fires. This report addresses the vapor dispersion and thermal radiation for postulated releases.

SECTION 2.0 RELEASE SCENARIOS

For vapor dispersion calculations, 49 CFR 193 specifies ten minute spills into impoundment areas where the flow can be shut off. For a release from a tank into a dike, two cases can exist: for bottom or side connections, the spill must continue until the LNG is hydraulically equalized; for over-the-top connections, the spill must continue until the vapor exits the dike. The over-the-top connection spill scenario is not described in 49 CFR 193, but has been addressed by MTB regulators (see Appendix A). For a loading arm spill, the LNG will spread over the water until the boil-off rate equals the discharge rate. Fire radiation calculations were made for each impoundment area and a spill onto water. For this study, four release scenarios were considered.

First, gas would be liquefied at a rate of 20,330 gpm. Using an impoundment area with 110 percent of a ten minute release and a wall height of 6.6 ft, the impoundment area was 4,530 ft^2.

Second, the release from the tank produced the maximum downwind cloud travel. In order to minimize downwind cloud travel, the dike area versus wall height was modified for the bottom connection release. Usually, cost increases as dike height increases. The dike size was modified from a 580 x 670 x 18 ft dike to a 450 x 450 x 35 ft dike. The maximum flow rate into the dike was calculated from a single line rupture of a 28-inch line with 100 ft of head as the driving force. The maximum flow rate for these conditions is 78,000 gpm. With over-the-top connections, the vapor dispersion distances are a strong function of subdiking. Since subdiking design was not included in the conceptual design and due to the increased cost of over-the-top connections, we have not included dispersion results for the over-the-top configuration.

Third, a release from the on-shore transfer line, from the tanks to the trestle structure, was considered. The average transfer rate was 48,000 gpm. For a ten minute spill, the impoundment area was 10,700 ft^2 for 110 percent of the release using a 6.6 ft high dike.

Fourth, assuming multiple transfer lines and loading arms, a release from a single dock transfer line or a single loading arm was considered. The single line release rate of 12,000 gpm (one-fourth the total flow rate) was utilized. The spill spread onto water until it covered an area of 20,855 ft^2.

SECTION 3.0 VAPOR DISPERSION CALCULATIONS

49 CFR 193 gives a method for vapor dispersion calculations for determining exclusion zones surrounding the plant. The method was published in 1974 [2] and does not consider many of the physical phenomena that occur in the dispersion of heavier-than-air vapor clouds. The published method gives conservative values (greater distances than an actual vapor cloud would travel). In some cases of comparison with actual spills, predicted distances to the lower flammable limit have been almost an order of magnitude greater than actual distances. The regulations provide for the use of other calculation methods if proper validation of the method can be provided. We believe that the development of the DEGADIS [3] method by the U.S. Coast Guard provides proper documentation and validation for the acceptance of the DEGADIS model for dispersion calculations. In order to demonstrate the differences in the two models, dispersion distances were calculated for each model.

An unignited release of LNG will result in a flammable vapor cloud which can travel downwind until sufficient heating and mixing with the turbulent atmosphere dilutes the vapor concentration below the limits of flammability. Although LNG vapor has a molecular weight of 16, the gas is heavier than air at the time it is vaporized at an atmospheric boiling point of -260°F. The gas remains heavier than air until it reaches a temperature of -170°F. From a safety viewpoint, interest is focused on the area covered by the unignited flammable vapor cloud as it travels downwind. In order to estimate the downwind travel distance of the flammable cloud, several factors regarding the type of accident, surrounding area, and local weather conditions must be considered. Figure 3-1 presents an overview of the major factors that must be considered in a vapor dispersion mathematical model.

3.1 Vapor Generation

The rate of cold gas evolving from a liquid pool is mainly a function of the heat transfer rate from the underlying substrate. Vapor generation models require information regarding substrate temperature and impoundment dimensions. For the 49 CFR 193 calculations, we used the vapor generation rates that were prescribed as part of the 49 CFR 193 dispersion method. In the case of impoundment, the cold gas was assumed to fill the area and the

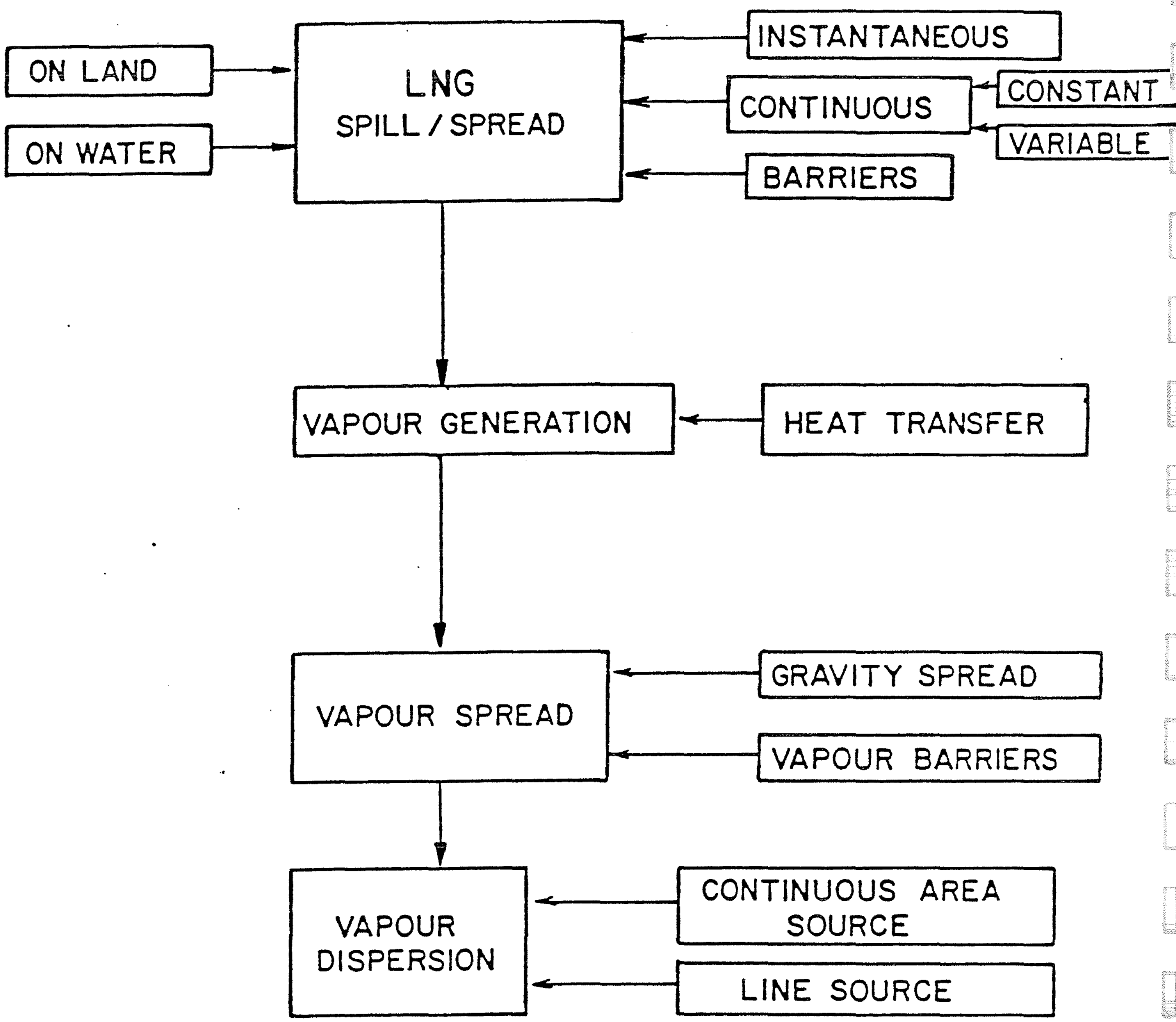


Figure 3-1

Elements of Vapor Dispersion Model

rate of gas evaporating from the pool was assumed to form a line source at the base of the dike.

For the DEGADIS model, we used the vapor generation rates from our spills model[3]. If the wind was capable of removing the gas as it evolved, the size of the source was the pool area and the cold gas was allowed to fill one-half the dike height before the gas was dispersed. When the evolution rate was higher than the wind field could accommodate, the dike was allowed to fill with cold gas and overflow the dike, forming an even larger stationary source surrounding the impoundment area.

3.2 Weather Conditions

The 49 CFR 193 model only considers wind speed and stability. The DEGADIS model considers wind speed, stability, relative humidity, temperature of substrate, and surface roughness. The vapor dispersion calculations were done at the worst case conditions, as defined by 49 CFR 193, Paragraph 193.2059(c)(2).

> "Dispersion conditions are a combination of those which result in longer predicted downwind dispersion distances than other weather conditions at the site at least 90 percent of the time, based on U.S. Government weather data, or as an alternative where the model gives longer distances at lower wind speeds, Category F atmosphere, wind speed equals 4.5 miles per hour, relative humidity equals 50 percent, and atmospheric temperature equals 0.0°C."

The only weather condition at the site that does not meet the above criteria is relative humidity. In order to be ultra conservative, we used the above conditions and 80 percent relative humidity which resulted in slightly longer downwind cloud travel than if 50 percent relative humidity had been used. Table 3-1 shows the values used and the source of the data.

3.3 Dispersion Results

Four vapor dispersion cases were run for the two sets of weather conditions with the 49 CFR 193 and DEGADIS models. The results for the two models are presented in Table 3-2 for worst case weather conditions, and in Table 3-3 for the most prevalent weather conditions. The DEGADIS calculations presented in Tables 3-2 and 3-3 are for a release onto the given surface and spread over a water surface. Spread over a water surface, which is

Table 3-1

Weather Conditions at Anderson Bay

Data	Worst Case	Most Prevalent	Source
Wind speed	4.5 mph	5.9 mph	Star data (Valdez)
Wind direction	90°	90°	Star data (Valdez)
Stability	F	D	Star data (Valdez)
Relative humidity	80%	80%	Local climatological summaries (Valdez)
Air temperature	32°F	38°F	Local climatological summaries (Valdez)
Water temperature	51°F	46°F	Environmental study
Soil temperature	37°F	43°F	Estimate
Land surface roughness	0.5 ft	0.5 ft	Estimate

Table 3-2

Summary of Vapor Dispersion Results
Distance to 1/2 LFL
(4.5 mph Wind Speed, F Stability, 32°F Air Temperature,
37°F Surface Temperature, 80% Relative Humidity, 51°F Water Temperature)

Case No.	Release Description	Duration	49 CFR 193		DEGADIS*	
			Maximum Distance (ft)	Maximum Width (ft)	Maximum Distance (ft)	Maximum Width (ft)
1	Transfer line from liquefaction to storage into impoundment, 20,330 gpm	10 min	3,020	166	1,454	1,929
2	Storage tank into dike, 800,000 bbl, 78,000 gpm	Continuous	11,700	630	6,854	10,092
3	Transfer line from tanks to trestle into impoundment, 48,000 gpm	10 min	4,970	260	2,122	2,831
4	Dock transfer line or loading arm onto water, 12,000 gpm	10 min	11,920	530	6,243	9,120

* Distances are for cloud travel over water.

Table 3-3

Summary of Vapor Dispersion Results
Distance to 1/2 LFL
(5.9 mph Wind Speed, D Stability, 38°F Air Temperature,
43°F Surface Temperature, 80% Relative Humidity, 46°F Water Temperature)

Case No.	Release Description	Duration	49 CFR 193		DAGADIS*	
			Maximum Distance (ft)	Maximum Width (ft)	Maximum Distance (ft)	Maximum Width (ft)
1	Transfer line from liquefaction to storage into impoundment, 20,330 gpm	10 min	1,050	140	917	431
2	Storage tank into dike, 800,000 bbl, 78,000 gpm	Continuous	3,320	550	3,356	3,122
3	Transfer line from tanks to trestle into impoundment, 48,000 gpm	10 min	1,630	208	1,642	738
4	Dock transfer line or loading arm onto water, 12,000 gpm	10 min	3,550	400	3,451	3,262

*Distances are for cloud travel over water.

much smoother, usually yields further travel distances due to less atmospheric turbulence. Since the spill into a dike gave the greatest downwind travel distance, the DEGADIS calculations were made for that case considering the spread onto land which had increased surface roughness. The DEGADIS calculations for dispersion onto land are given in Table 3-4 for the case of a release into a dike.

The maximum travel distance for the worst case weather conditions was approximately 12,000 ft for both the spill into the dike and the spill onto water. The 49 CFR 193 calculations for the worst case conditions yielded distances that were approximately twice the distances for the DEGADIS spread over water. For the spread over land, the DEGADIS maximum distance was 3,567 ft versus 6,854 ft for the spread over water. The distances are for the actual greatest distance from the release point. The distances are usually greater than the downwind distances because the clouds, as a rule, have a maximum half-width as great as the downwind length. To determine the land allocation for a buffer zone, the vaules in the table should be used to strike an arc for encompassing the area. The difference in travel distance can be attributed to the large change in surface roughness between water and the forested area adjacent to the plant. Figure 3-2 illustrates the shape and downwind travel of the 49 CFR 193 and DAGADIS clouds.

For the most prevalent weather conditions, the 49 CFR 193 and DEGADIS calculations over water were almost identical with regard to downwind distance. However, the DEGADIS cloud predictions yielded cloud widths that were four to eight times wider. For the Case 2 release, the DEGADIS prediction over land gave a maximum downwind travel of 1,736 ft compared to 3,320 ft for the 49 CFR 193 model.

Table 3-4

Summary of DEGADIS Dispersion Results for Case 2 Spread Over Land
Distance to 1/2 LFL

Case No.	Release Description	Duration	Worst Case Weather Conditions		Prevalent Weather Conditions	
			Maximum Distance (ft)	Maximum Width (ft)	Maximum Distance (ft)	Maximum Width (ft)
2	Storage tank into dike, 800,000 bbl, 78,000 gpm	Contin-uous	3,567	5,892	1,736	2,112

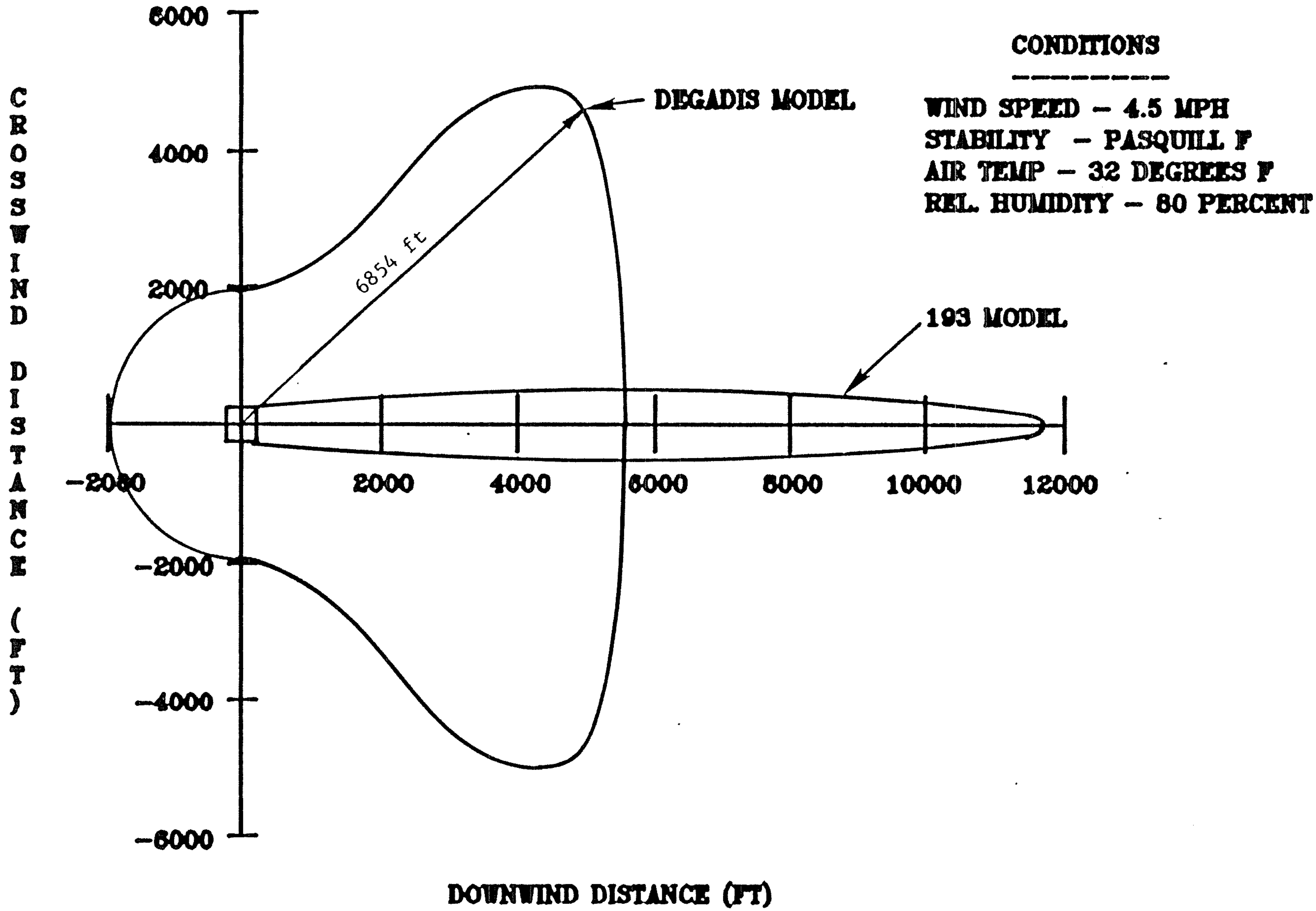


Figure 3-2

1/2 LFL Contours for a Tank Spill into a Dike for 49 CFR 193 and DEGADIS Model Predictions for Spread over Water

SECTION 4.0 THERMAL RADIATION CALCULATIONS

Fire radiation exclusion zones are required for a full tank dike, plus other impoundment areas. The method used in 49 CFR 193 is a technique requiring a minimum of technical expertise. The 49 CFR 193 method is a shorthand method for predicting fire radiation based on a method described by the American Gas Association [4]. We use this method, as described in Appendix C. The method is based on transport theory and has been validated with large-scale tests on LNG and LPG fires. The method is accepted by the MTB[4]. The exclusion zones are defined in terms of heat flux levels for various land uses adjacent to the plant.

Wind speed and relative humidity are the controlling parameters affecting the flux levels from an LNG pool fire. A wind speed of 22 mph and relative humidity of 80 percent were selected, resulting in longer exclusion distances than other atmospheric conditions occurring at least 95 percent of the time. For this study, wind speed values were taken from the Star data for Valdez, and the relative humidity values were taken from the Local Climatological Summaries.

Thermal radiation calculations were done for each of the impoundment areas and the spread area over the water for the loading arm spill for attenuated and unattenuated conditions. Unattenuated flux considers no adsorption or scattering of the radiation as it travels from the flame. Water vapor and particles in the air cause some of the radiation to be lost as it travels from the fire to the receptor. When adsorption and scattering of the radiation are considered, the lesser amount of radiation received at a given distance from the flame is called the attentuated flux. Tables 4-1 and 4-2 show the distances to attenuated and unattenuated flux levels, respectively. Calculated flux levels were for 500, 1,600, 4,300, and 10,000 Btu/hr-ft^2. Figure 4-1 shows the flux levels versus distance from the center of the source, and Figures 4-2 and 4-3 are isopleths of the attenuated and unattenuated flux levels, respectively. The controlling release for thermal radiation is the storage tank into a dike release. For the unoccupied area adjacent to the plant, the 10,000 Btu/hr-ft^2 isopleth is the main concern; from the tables, the maximum distance to that level is 957 ft.

Table 4-1

Summary of Thermal Radiation Attenuated Results
Distances to Flux Levels from Center of Area
(20 mph Wind Speed, 80% Relative Humidity, 32°F Air Temperature)

Case No.	Release Description	Size (ft)	Attenuated Flux Levels ($Btu/hr\text{-}ft^2$)			
			10,000 Distance (ft)	4,300 Distance (ft)	1,600 Distance (ft)	500 Distance (ft)
1	Transfer line from liquefaction to storage into impoundment, 20,330 gpm	67 x 67	192.6	235.6	302.3	422.4
2	Storage tank into dike, 800,000 bbl, 78,000 gpm	450 x 450	859.0	1120.2	1509.3	2227.6
3	Transfer line from tanks to trestle into impoundment, 48,000 gpm	103 x 103	274.6	339.0	440.1	623.2
4	Dock transfer line or loading arm onto water, 12,000 gpm	188.2 diameter	351.8	499.5	663.1	971.0

Table 4-2

Summary of Thermal Radiation Unattenuated Results
Distances to Flux Levels from Center of Area
(20 mph Wind Speed, 80% Relative Humidity, 32°F Air Temperature)

Case No.	Release Description	Size (ft)	Unattenuated Flux Levels ($Btu/hr\text{-}ft^2$)			
			10,000 Distance (ft)	4,300 Distance (ft)	1,600 Distance (ft)	500 Distance (ft)
1	Transfer line from liquefaction to storage into impoundment, 20,330 gpm	67 x 67	202.2	246.9	320.8	461.3
2	Storage tank into dike, 800,000 bbl, 78,000 gpm	450 x 450	957.0	1248.0	1726.3	2645.0
3	Transfer line from tanks to trestle into impoundment, 48,000 gpm	103 x 103	288.3	359.0	474.0	693.9
4	Dock transfer line or loading arm onto water, 12,000 gpm	188.2 diameter	390.5	543.5	741.7	1127.5

TANK INTØ DIKE SPILL

AMBIENT CØNDITIØNS

AMB.TEMP (F)......= 32

REL.HUMIDITY ( )..= 80

WIND SPEED(FT/SEC)= 28.7

TARGET PØSITIØN

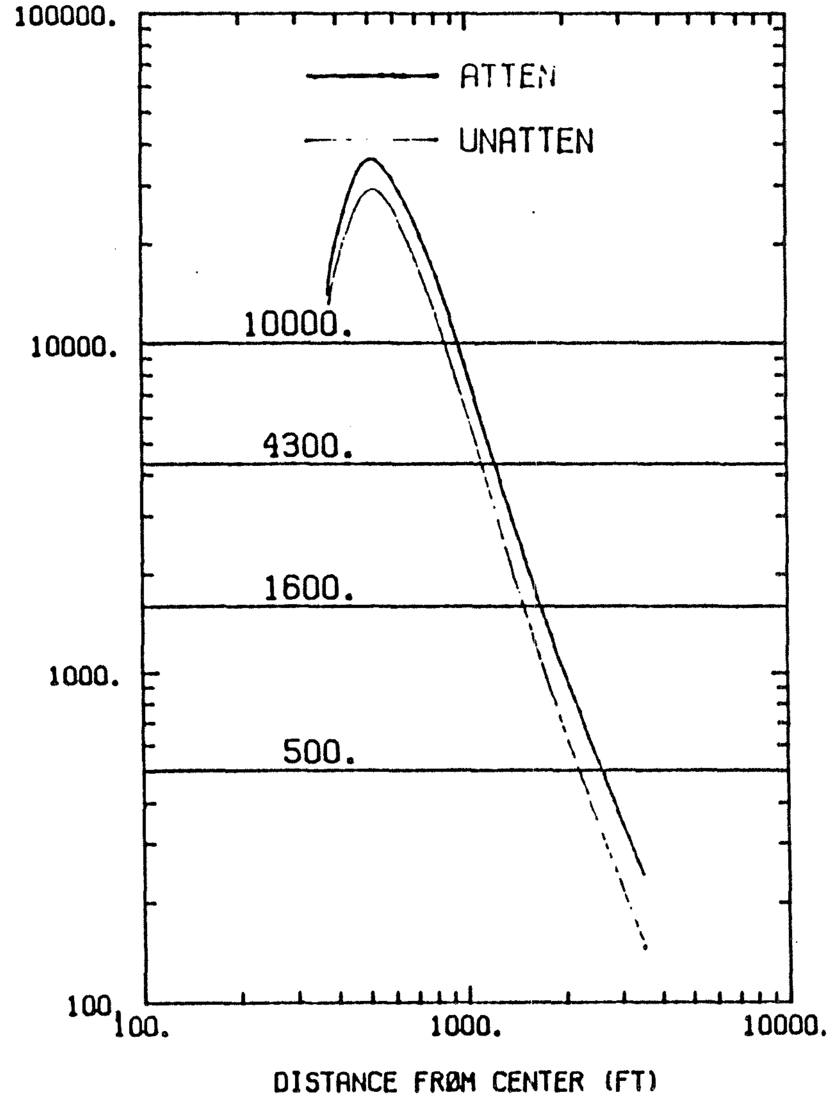
TARGET ANGLE (DEG)= 0.

TARGET HEIGHT (FT)= 0.

FIRE DIMENSIØNS

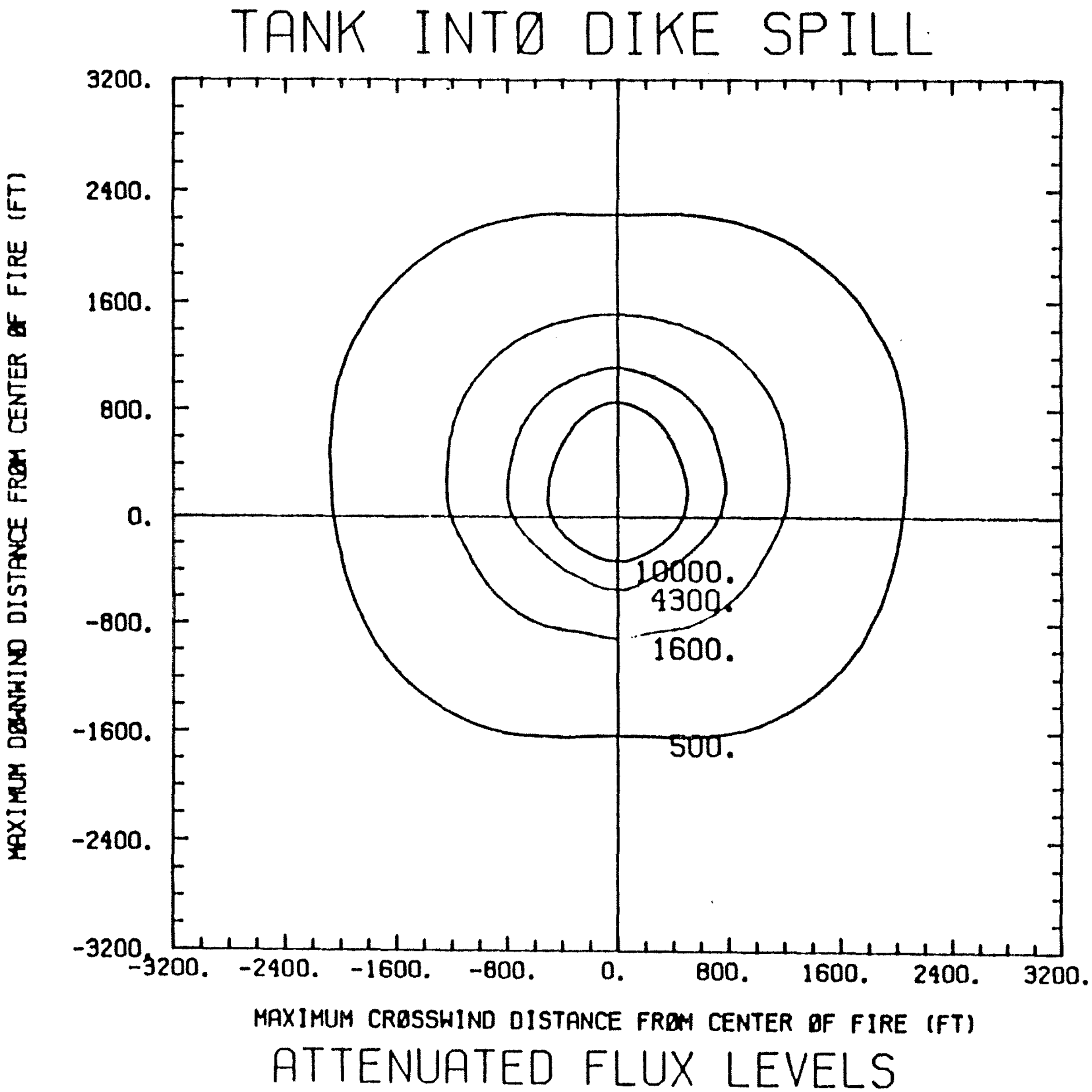
FIRE WIDTH (FT)...=450.

FIRE LENGTH (FT)..=450.



RECTANGULAR FIRE RADIATIØN FLUX

Figure 4-1



TANK INTØ DIKE SPILL
3200.
2400.
1600.
800.
0.
-800.
-1600.
-2400.
-3200.
MAXIMUM DØWNWIND DISTANCE FRØM CENTER ØF FIRE (FT)
-3200.
-2400.
-1600.
-800.
0.
800.
1600.
2400.
3200.
10000.
4300.
1600.
500.
MAXIMUM CRØSSWIND DISTANCE FRØM CENTER ØF FIRE (FT)
ATTENUATED FLUX LEVELS

Figure 4-2

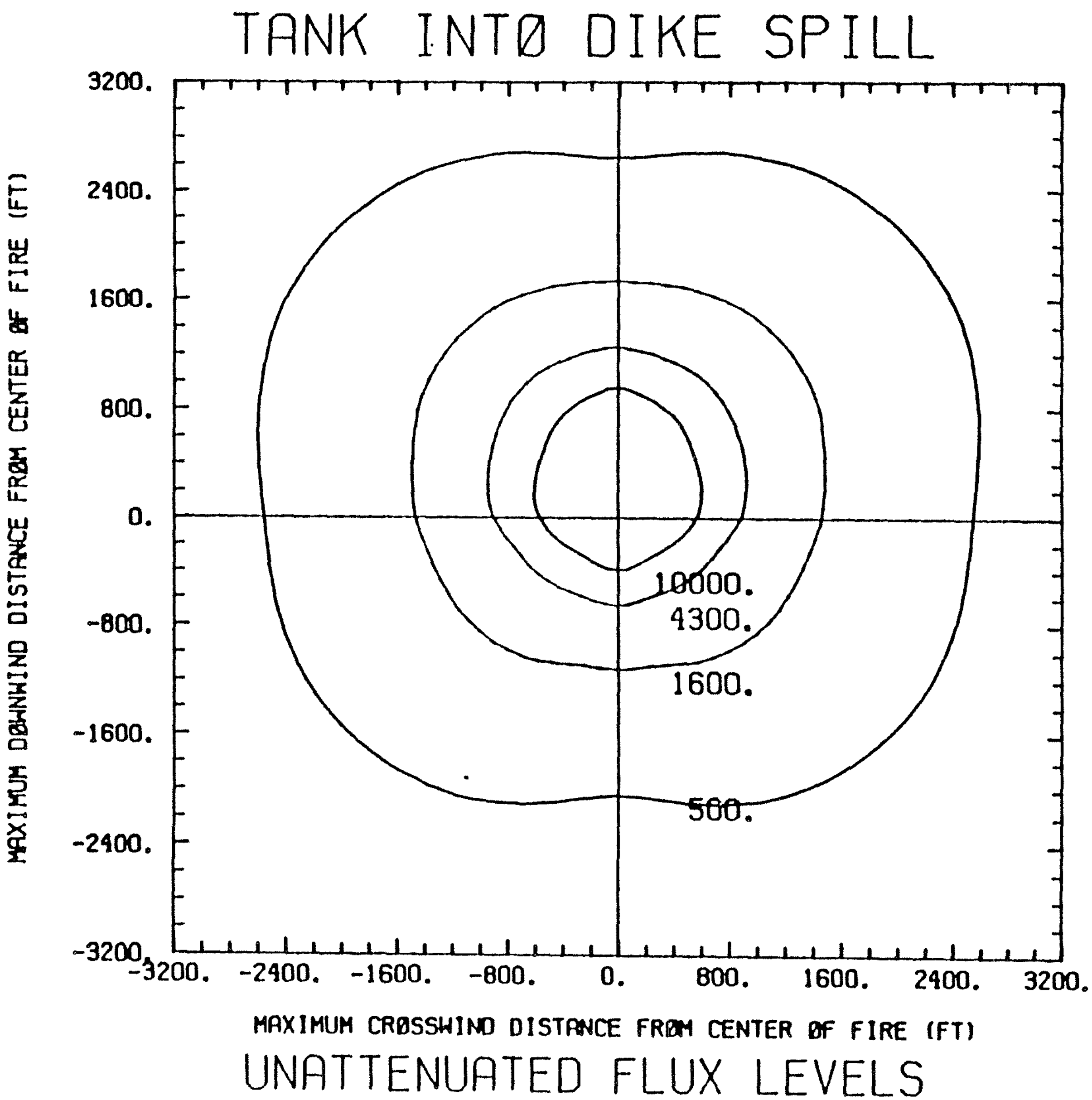

TANK INTØ DIKE SPILL
3200.
2400.
1600.
800.
0.
-800.
-1600.
-2400.
-3200.
-3200.
-2400.
-1600.
-800.
0.
800.
1600.
2400.
3200.
10000.
4300.
1600.
500.
MAXIMUM DØWNWIND DISTANCE FRØM CENTER ØF FIRE (FT)
MAXIMUM CRØSSWIND DISTANCE FRØM CENTER ØF FIRE (FT)
UNATTENUATED FLUX LEVELS

Figure 4-3

SECTION 5.0 CONCLUSIONS

For the vapor dispersion calculations, we used 12,500 ft as a maximum permissible downwind travel distance to 1/2 the lower flammable limit. With modification to the preliminary design (a deeper tank dike and an additional loading arm), the releases can meet the 12,500 ft criterion using the 49 CFR 193 model. Using the DEGADIS model, the distances of maximum downwind travel are 6,854 ft for the spread over water, and 3,567 ft for the spread over land. The DEGADIS model considers only flat terrain, and arguments can be made that the distances are longer than would actually exist for the postulated releases since the cloud would be spreading into an area of steeper terrain and would cause a greater spread in the crosswind direction.

The thermal radiation calculations show that the hazard zones are contained within the vapor dispersion zones. The lowest flux level considered in 49 CFR 193, 1,600 Btu/hr-ft^2, extends a maximum distance of 1,726.3 ft from the center of the tank dike.

Based on the results, the Anderson Bay site will meet the 49 CFR 193 requirements for vapor dispersion and thermal radiation, with preliminary storage and impoundment designs as analyzed.

SECTION 6.0 REFERENCES

1. U.S. Department of Transportation, "Liquefied Natural Gas: New Federal Safety Standards. 49 CFR 193, Washington, D.C., 1980.

2. American Gas Association, "Evaluation of LNG Vapor Control Methods." Arthur D. Little, Inc., Cambridge, Massachusetts, October, 1974.

3. Havens, J. A., and T. O. Spicer, "Development of an Atmospheric Dispersion Model for Heavier-Than-Air Gas Mixtures." U.S. Coast Guard, Report No. CG-D-23-85, May, 1985.

4. American Gas Association, "Project IS-3-1: LNG Safety Program, Interim Report on Phase II Work." 1973.

APPENDIX A. TECHNICAL NOTE

This technical note by Walter Dennis was in a March 6, 1986, letter from MTB to one of our clients.

A TECHNICAL NOTE ON VAPOR DETENTION CAPACITY AND ITS EFFECTS ON VAPOR DISPERSION DISTANCE

by
Mr. Walter Dennis

As you correctly note, the vapor detention capacity can significantly affect the downwind travel of flammable LNG vapor (vapor dispersion distance). This is due to the potential for change in the proportionate detention capacity (the capacity relative to other spill conditions) to change the duration of LNG contact with heat transfer surfaces, the consequent degree of cooling, and the related rate of heat transfer from those surfaces before initial vapor overflow occurs.

Under the prescribed model in S193.2059(c), a constant rate spill is presumed to continue at least until vapor overflows the diking (continuous spill). For this purpose, the term diking applies to either diking for the impoundment of spilled LNG, or as appropriate, to an extended or additional barrier (if any) designed to increase holding volume for detention of evolving LNG vapor, as provided in S193.2059(d)(1)(iv). In applying the model, initial vapor overflow is assumed to occur when the combined volume of evolved vapor, and the impounded volume of unvaporized spilled liquid equals all space outside the component served that is provided for liquid impoundment and vapor detention. Thus, occurrence of initial vapor overflow is assumed at the moment of overflow due to overfill without consideration of scooping by wind entrainment or ejection by vapor velocity.

Vaporization rate at the moment of initial overflow defines source strength in determining uniform unit source strength under the model, the primary parameter that directly influences dispersion distance. The strength at this moment is considered to be at its highest, thereby predicting the maximum dispersion distance, since thereafter, vaporization rate is assumed to be diminishing as heat transfer surfaces in contact with liquid will be cooling.

From the foregoing, it is seen that with an increase in proportionate detention capacity, the time needed to fill the impoundment-detention space and reach max'mum source strength will increase. V'ith a reduction in the proportionate capacity, this time delay will diminish. It is evident, thereby, that both contact duration of the liquid and consequent cooling of heat transfer surface in contact will vary directly with proportionate detention capacity.

Conversely, the rate of heat transfer along with the vaporization rate, and related source strength will vary inversely with proportionate detention capacity. It follows that, under the prescribed model, the predicted dispersion distance will vary inversely with the proportionate detention capacity—the former diminishing as the latter increases and vice versa.

Thus, in S193.2059, there is no specified fraction of impoundment-detention space arbitrarily dedicated to vapor detention. Rather, as defined in S193.2059(d)(1)(iv), the space dedicative to vapor detention is the total space available for liquid impoundment and vapor detention minus the volumetric space occupied by impounded liquid at the moment of initial overflow due to overfill.

This definition is necessary, since for a given total impoundment-detention capacity, the latter fraction will vary with spill volume, spill rate, differential enthalpy in spillage, and similar design specific variables. For example, under a given design, an increase in overall detention-impoundment volume provided by increasing the height or perimeter of vapor detention fencing would be allocable only in part to vapor detention, since the increase in time for initial overflow from overfill would result in an additional liquid spill volume which must be accommodated.

Of course, in spite of this increase in spill volume, time duration to initial overflow would still be increased with a consequent reduction in source strength and predicted dispersion distance. Solution of respective liquid-vapor volumes would be relatively simple, once cumulative vaporization and liquid accumulation is established either as a volume-time function or simply by iterative convergence. Although you refer only to storage tank impoundment, the foregoing applies to all impounding-detention systems.

The prescribed model under §193.2059 was developed only with conventional low remote diking in mind. Therefore, it may be important also for you to be aware of certain limitations. For conventional designs and clear field dispersion, predictions are generally thought to be overly conservative. But this has never been conclusively evaluated, and some comparisons give rise to uncertainties. Certain design conditions, however, could result in hazardous nonconservatism.

One (which the model cannot address) is channeling or diversion of the vapor by large downwind structures or other topography. Very large detention capacity, where source strength based on initial overflow could be significantly less than actual source strength due to wind entrainment, is another. A third probelm is envisaged with multiple diking.

High close-in diking, a more recently proposed design, presents a fourth and potentially more serious problem. This problem results from the potential for actual source strength to continue increasing (if actual LNG spillage continues) after initial vapor overflow, thereby exceeding the theoretical maximum source strength. It is seen that this would occur where the heat transfer rate continues to increase, despite cooling, as the contact area continues to increase with the rising level of LNG from continuing spillage into the narrow impoundment annulous.

Because of limitations in predictive capability of the current model, costs for protection distance at new plants could be economically burdensome. Preclusion of expansion at most existing plants would be likely. Yet unsafe conditions could prevail with certain designs. OPS recognized this problem even at the writing of current standards, but available options were limited.

Accordingly, in 1983, OPS initiated a six phase research program, and subsequently was joined in co-sponsorship by the Gas Research Institute, to resolve this problem. The program is intended to develop definitive and verified methodologies and procedures for regulatory application of wind tunnel simulation independently or conjunctively with a select mathematical model to predict dispersion distance where diffusion is influenced by: (a) eddy entrainment from excess capacity LNG vapor detention systems, (b) wake turbulence from on site structures and natural obstacles, and (c) topographically induced diversion or meander. Independent physical simulation will be dependent on scale. With such methodologies, protective distance for dispersion may be safely reduced by as much as one order of magnitude with tank top transfer and designs to provide the conditions described in (a), (b), and (c) above. Although results of this effort will not be in place until after 1988, it may be useful for you and operators under your jurisdiction to be aware of this potential development in planning for expansion.

APPENDIX B. VAPOR GENERATION METHODOLOGY

An unignited release of a liquefied gas will result in a flammable and/or toxic vapor cloud which can travel downwind until sufficient heating and mixing with the turbulent atmosphere dilutes the vapor concentration below the limits of flammability/toxicity. From a safety viewpoint, interest is focused on the area covered by the vapor cloud as it travels downwind. In order to estimate the downwind travel distance of a flammable/toxic cloud, several factors regarding type of accident, surrounding area, and local weather conditions must be carefully considered. Important parameters required for vapor dispersion models are the area and the rate of vapor generation. Vapor generation rates are considered for two major types of releases: releases onto water, and releases onto land. These types of releases are described, in detail, in the following sections.

B.1 Spread and Vaporization of Liquefied Gas Spills on Water

The spread and vaporization of large liquefied gas spills on water have been addressed in a number of papers. Havens (1979) has reviewed, in detail, the approach taken by Science Applications, Inc. (1975), while Raj and Kalelkar (1973) have proposed a somewhat different approach than Science Applications, Inc.

For this analysis, the Raj and Kalelkar models were modified and used for the spreading and vaporization of liquefied gases on water. The radius of a liquefied gas spill on water is assumed to be represented by the equation developed for LNG.

$$R = 1.854\ V_S^{0.25}\ t^{1.50} \tag{1}$$

where: R = radius of the spill, m
V_S = volume of the spill, m^3
t = time, sec

The vaporization rate for liquefied gases is given by:

$$\dot{m} = \pi\rho(1.854)^2\ V_S^{0.50}\ w\ t \tag{2}$$

where: $\dot{m}$ = vaporization rate, kg/sec
ρ = liquefied gas density, kg/m^3
w = liquefied gas regression rate, m/sec

The pool radius is described by Equation (1) until a minimum pool thickness is reached. At that time, the liquid pool begins to break up. The minimum pool thickness has been calculated using an equation proposed by Feldbauer (Feldbauer, et al., 1972).

$$H_{mw} = 0.0017\ D^{0.56} \tag{3}$$

where: H_{mw} = minimum pool thickness, ft
D = pool diameter, ft

Following pool breakup, the vaporization rate is assumed to decrease according to the following relation, also proposed by Feldbauer.

$$\dot{m} = \dot{m}_{max} \left[\exp \left(\frac{-0.04}{\rho H_{mw}} (t - t_{max}) \right) \right] \tag{4}$$

where: $\dot{m}$ = pool vaporization rate at time t, kg/sec
$\dot{m}_{max}$ = vaporization rate at time of pool breakup, kg/sec
t_{max} = time of pool breakup, sec

Using Equations (1) through (4) and the assumed liquefied gas boiling rate per unit area, the total vapor generation rate for an instantaneous spill can be computed. The pool radius for the spill as a function of time is given by the solution of Equation (4) until pool breakup begins, after which the radius is assumed constant. For most pressurized liquids, some fraction of the liquefied gas will flash during the release.

B.2 Spread and Vaporization of Liquefied Gas Spills on Land

Liquefied gas spills on land will spread until either they are confined by topography. Topography can include both natural land characteristics and engineered spill confinement systems. Thus, topography is a site specific characteristic of a petrochemical plant.

In the early stages of vapor cloud formation subsequent to a spill on land, the rate of evolution of vapor due to heat transfer to the pool is a function of the thermal properties of the substrate beneath the pool. In the later stages of vapor cloud formation, it is a function of the convective heat transfer from the ambient air to the pool. In general, the vaporization rate, $\dot{m}$, is the sum of all heat inputs to the pool, divided by the latent heat of vaporization of the liquid.

$$\dot{m} = \frac{q_{total}}{\Delta H_v} \tag{5}$$

where: q_{total} = total heat gain by the liquid
ΔH_v = latent heat of vaporization of the liquid

The total heat flux into the pool is given by the equation:

$$q_{total} = q_s + q_a + q_r + q_{sen} \tag{6}$$

where: q_s = rate of transfer from bottom surface of pool (pool floor)
q_a = rate of convective heat transfer from the atmosphere
q_r = rate of radiant heat transfer due to solar radiation
q_{sen} = rate of sensible heat release due to cooling of the pool

Assuming constant pool floor properties, the temperature beneath the floor is given by:

$$k \frac{\partial^2 T}{\partial Z^2} = \rho c \frac{\partial T}{\partial t} \tag{7}$$

where: T = floor temperature
k = floor thermal conductivity
ρ = floor density
c = floor specific heat
t = time
Z = vertical distance below floor surface

With the initial condition $T = T_o$, where T_o is the initial floor temperature and the boundary conditions are:

$$-k \frac{\partial T}{\partial Z} = h(T - T_p) \tag{8}$$

$$\frac{\partial T}{\partial Z} = 0 \text{ for large } Z \tag{9}$$

Equation (7) can be solved giving:

$$\frac{T - T_p}{T_o - T_p} = \text{erf}\left(\frac{Z}{2\sqrt{\alpha t}}\right) + \left[\exp\left(\frac{hZ}{k} + \frac{h^2 t}{k\rho c}\right)\right] \left[\text{erfc}\left(\frac{Z}{2\sqrt{\alpha t}}\right) + h\left(\frac{t}{k\rho c}\right)^{0.5}\right] \tag{10}$$

where: T_p = bulk pool temperature
h = heat transfer coefficient between the floor and liquid
α = $k/\rho c$

The rate of heat transfer from the floor to the liquid is:

$$q_s = h(t - T_p) \text{ at } Z = 0 \tag{11}$$

Substituting Equation (10) into Equation (11) gives:

$$q_s = h(T_o - T_p) \exp\left(\frac{h^2 t}{k\rho c}\right) \text{erfc}\left[h\left(\frac{t}{k\rho c}\right)^{0.5}\right] \tag{12}$$

Equation (12) does not model exactly the heat transfer process between the floor and the liquid, but it is sufficient for estimating the contribution of heat transfer from the floor to the vaporization rate of the liquid.

A relatively small amount of heat is transferred directly from the atmosphere to the liquid pool by convection. Thus:

$$q_a = h_a(T_a - T_p) \tag{13}$$

where: q_a = rate of convective heat transfer from the atmosphere
h_a = convective heat transfer coefficient between the atmosphere and the liquid
T_a = air temperature

The atmospheric heat transfer rate is relatively unimportant during the early phases of vaporization immediately after a spill; however, it becomes relatively more important after the floor has sufficiently cooled so that the heat transfer rate from the floor is very small.

Another small amount of heat may be added to the pool by solar radiation. The maximum solar radiant, q_r, will be present during the daytime when clear skies prevail. As in the case of convection from the atmosphere, solar radiation will not be important until floor heat transfer decreases. Furthermore, much of the solar radiation will not reach the pool because of absorption by the vapor cloud, particularly during the early stages when the vaporization rates are high and the cloud is dense.

Energy to vaporize the liquid may also come from the sensible heat in the liquid itself. Depending on the rate of heat transfer from the floor, the temperature of the pool can decrease below its boiling point. As the pool cools below its boiling point, sensible heat will be released and, as a result, vaporization will continue since the pool is not in equilibrium with the atmosphere. Rate of sensible heat release can be estimated adequately by assuming that the pool temperature remains uniform throughout its depth as its temperature decreases, so that:

$$q_{sen} = \rho_L H C_L \frac{dT_p}{dt} \tag{14}$$

where:
- q_{sen} = rate of sensible heat release
- ρ_L = density of the liquid
- H = pool depth
- C_L = specific heat of the liquid

The sum of all the foregoing modes of heat transfer represents the energy available to vaporize the liquid. Thus:

$$\dot{m}\Delta H_v = q_s + q_a + q_r + q_{sen} \tag{15}$$

where ΔH_v is the heat of vaporization of the liquid. Units in Equations (12) through (15) must be consistent. Typically, heat fluxes q_s, q_a, q_r, and q_{sen} will have units such as cal/s-m^2, ΔH_v will be in cal/kg, and $\dot{m}$ will be in kg/hr-m^2. The heat transfer models are used as the vapor generation source models in both the fire radiation and vapor dispersion computer models for spills on land.

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APPENDIX C. FIRE RADIATION METHODOLOGY

C.1 Methodology

Objects near a flame are heated due to the absorption of thermal radiation that is given off by the flame. The radiant heat intensity from a flame can be predicted if the radiant heat flux at the flame surface and the view factor between the flame and the exposed object are known. The following equation is often used to calculate radiant heat flux levels (American Gas Association, 1973).

$$q = F\,\bar{\tau}\,q_{sm}(1-e^{-bD}) \qquad (1)$$

where:
- q = incident radiant flux at any point, kW/m^2
- q_{sm} = maximum surface flux of the flame for a large fire, kW/m^2
- F = geometric view factor
- D = fire diameter, m
- b = extinction coefficient for radiation within the flame, m^{-1}
- $\bar{\tau}$ = atmospheric transmittance

The flame is approximated by a cylinder with length, L, and diameter, D, and tilts under the action of wind with an angle of ϕ from vertical. For circular pool fires, D is the pool diameter; for rectangular or square pools, equivalent diameter, D_{eq}, can be used instead. D_{eq} is defined by:

$$D_{eq} = 4 \text{ (hydraulic radius)} = 4 \text{ (pool area)/(perimeter)} \qquad (2)$$

The flame length for pool fires can be computed from the equation given by Thomas (1963).

$$\frac{L}{D} = 42 \left(\frac{\dot{m}}{\rho_a (gD)^{0.5}}\right)^{0.61} \qquad (3)$$

where:
- L = length (height) of the flame, m
- D = diameter of the pool, m
- $\dot{m}$ = mass burning flux, kg/m^2-sec
- ρ_a = air density, kg/m^3
- g = gravitational acceleration, m/sec^2

The angle of tilt for large buoyant flames is calculated using the equation given by Welker and Sliepcevich (1970).

$$\frac{\tan\phi}{\cos\phi} = 3.2 \left(\frac{Du\,\rho_a}{\mu_a}\right)^{0.07} \left(\frac{u^2}{Dg}\right)^{0.7} \left(\frac{\rho_g}{\rho_a}\right)^{-0.6}$$

where:
- ϕ = angle of tilt from vertical, degrees
- D = flame diameter, m
- u = wind speed, m/sec
- μ_a = viscosity of air, kg/m-sec
- ρ_a = density of air, kg/m^3
- ρ_g = density of fuel vapor, kg/m^3
- g = gravitational acceleration, m/sec^2

Since the flame is a volume of reacting gases and soot particles, it is a volumetric emitter rather than simply a surface emitter. As the flame emits radiation energy, the gases and soot particles within it absorb part of the radiation. The term, $1\text{-}e^{-bD}$, accounts for this effect. The extinction coefficient, b, is dependent on the scale of turbulence and wavelength of the radiation. An average extinction coefficient based on test data is usually used. From the results of the tests performed for the United States Department of Energy (Johnson, et al., 1980), a value of 0.682 m^{-1} is derived for propane.

The term, $1\text{-}e^{-bD}$, approaches unity as flame size increases. This means the flame becomes optically thick and behaves like a black-body radiator. The thermal radiation intensity at the surface of the flame then becomes a constant, regardless of the size of the flame.

The view factor between the flame and exposed target is dependent on the size of the flame, the relative orientation, and distance. It can be obtained from:

$$F_{dA_1-A_2} = \int_{A_2} \frac{\cos \beta_1 \cos \beta_2}{r^2} \, dA_2 \tag{5}$$

where:
- dA_1 = differential area of target surface
- A_2 = effective emitting area of flame
- dA_2 = differential area of flame surface
- r = distance from target element to flame element along a line from dA_1 to dA_2
- β_1 = angle between the normal to dA_1 and the line from dA_1 to dA_2
- β_2 = angle between the normal to dA_2 and the line from dA_1 to dA_2

The geometry is shown in Figure C-1. Equation (5) must be integrated over the entire effective emitting area of the flame, A_2, that can be seen by a differential element of the target, dA_1, to obtain the view factor. View factors depend only on the geometry of the flame-target system; their values for a variety of configurations have been calculated and are available in the literature (Rein, Sliepcevich, and Welker, 1970; Raj, et al., 1979; Hottel and Sarofim, 1967).

The radiation intensity from the flame to the target is attenuated along its path due to absorption and scattering by water vapor, carbon dioxide, dust, and aerosol particles. Only the attenuation by water vapor is considered in calculating atmospheric transmissivity. The absorptivity of a gas volume of water vapor can be determined by the following relation (Hottel and Sarofim, 1967).

$$\epsilon \alpha = \left(\frac{T_g}{T_s} \right)^{0.45} \tag{6}$$

where:
- α = absorptivity of a gas body of water vapor
- ϵ = emissivity of water vapor at one atmosphere total pressure and zero water vapor partial pressure
- T_g = gas temperature, °K
- T_s = source temperature, °K

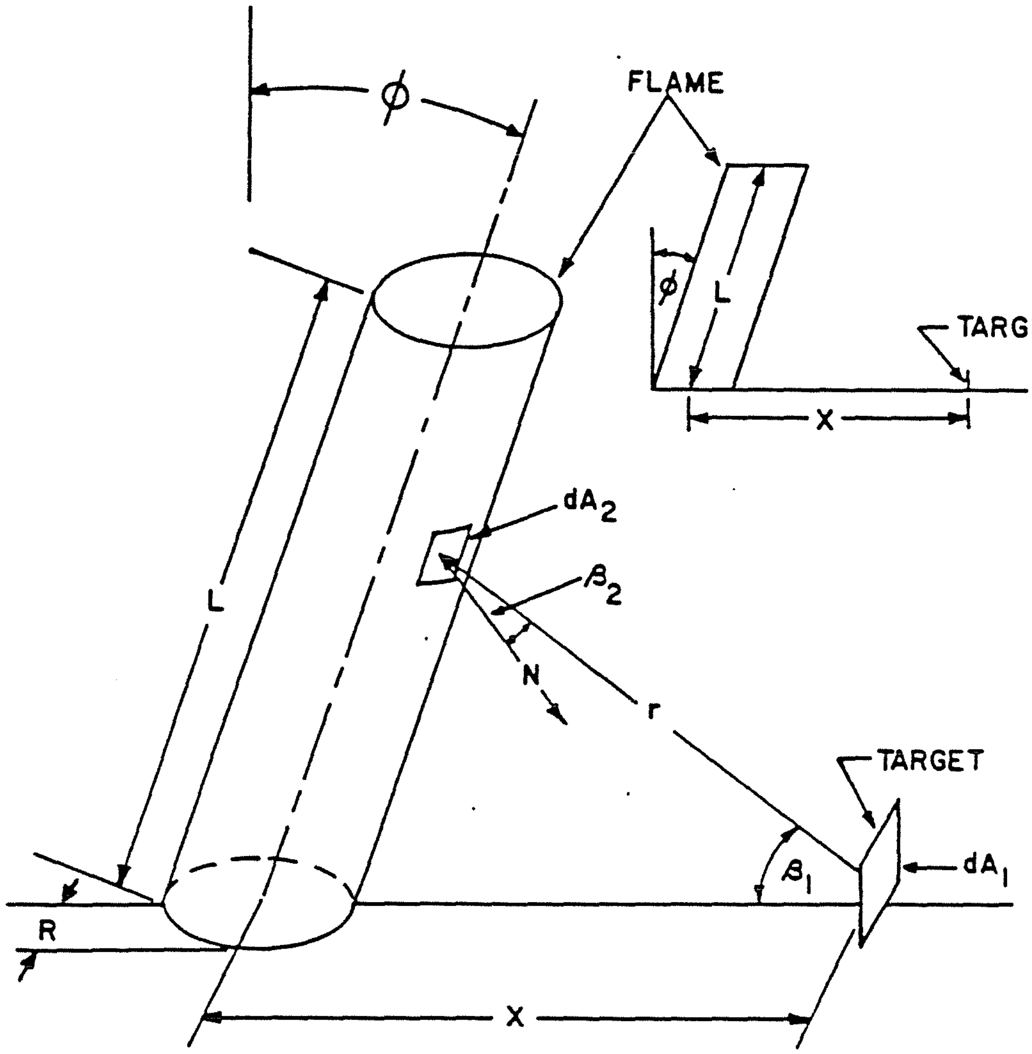

Figure C-1

Geometry Used for Calculation of View Factors

In this case, the gas temperature is ambient temperature and the source temperature is the equivalent black-body flame temperature. The emissivity can be obtained from the published charts by Hottel and Sarofim (1967). The transmissivity can then be calculated, assuming negligible reflectivity for conservatism, as follows.

$$\bar{\tau} = 1 - \alpha \tag{7}$$

Figure C-2 shows parametrically the atmospheric transmittance, $\bar{\tau}$, as a function of separation distance from the fire center for various values of relative humidity.

C.2 Damage Criteria for Radiant Heating

Combustible solids exposed to thermal radiation begin to decompose as their temperatures rise. If the radiant heat flux is high enough and the exposure is long enough, ignition will result. Noncombustible structures can be weakened and thus damaged or completely destroyed if the radiant flux is high enough and persists long enough to heat the structure to its damage point. People can suffer skin burns from relatively low fluxes. The fluxes required to cause such damage are useful for estimating potential effects of a large fire.

Table C-1 shows the approximate radiant fluxes required to damage wooden structures and to harm human beings. The flux for continuous human exposure includes solar radiant fluxes and is for sedentary activity. Acclimatization or intermittent exposure will raise the injury threshold.

Maximum temperatures of large pieces of equipment exposed to radiant heating can be approximated by assuming that the absorbed radiant energy is all lost from the surface as convection and radiation at steady state. This assumption results in:

$$\bar{\alpha}q = \bar{\epsilon}\sigma T^4 + U(T-T_\infty) \tag{8}$$

where:
- $\bar{\alpha}$ = average absorptance of the exposed surface
- $\bar{\epsilon}$ = average emittance of the exposed surface
- σ = Stefan-Boltzmann constant
- T = surface temperature
- U = overall convective heat transfer coefficient
- T_∞ = ambient temperature
- q = incident radiant heat flux at surface

If the absorptance and emittance are equal (a good approximation for nonmetallic surfaces), surface temperatures will be approximately those shown in Figure C-3. Temperatures are shown for parameters of $U/\bar{\alpha}$, assuming an ambient temperature of 26.7°C, so that the approximate steady state temperature can be found for a variety of heat loss conditions. Note that Equation (8) assumes that heat is gained only by radiation and lost only by radiation and convection at the exposed surface (i.e., the unexposed surface is insulated). If the unexposed surface is cooled, either by being open to natural cooling or by other means, temperatures will be lower. Figure C-3 gives temperatures near maximum at steady state. A long time period may be required to reach steady state, depending on material properties and geometry.

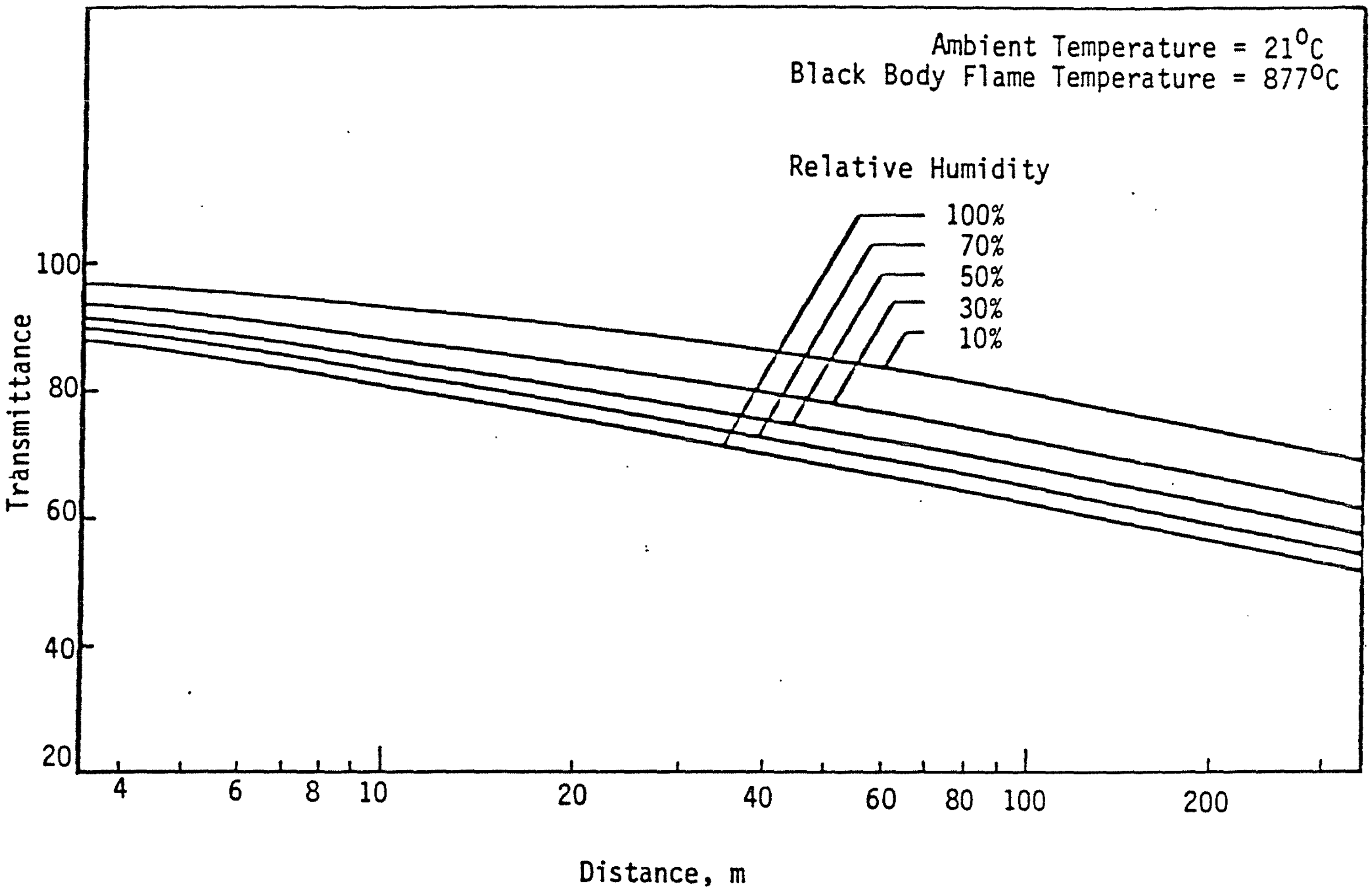

Figure C-2

Atmospheric Transmittance as a Function of Path Length and Relative Humidity

Table C-1

Approximate Radiant Flux Damage Criteria

Damage Conditions	Radiant Flux	
	kW/m^2	$Btu/hr\text{-}ft^2$
Spontaneous ignition of wood, minimum flux	63.00	20,000
Piloted ignition of wood, 1 minute exposure	31.50	10,000
Piloted ignition of wood, minimum flux	13.50	4,300
Second degree skin burns, 30 second exposure	5.00	1,600
Human injury through continuous exposure (API)	1.55	500

Notes:

1. Spontaneous ignition occurs without direct contact with flame.
2. Piloted ignition involves contact with flame.
3. Radiant fluxes required to ignite many synthetic polymers are in the same range as those for wood. However, some synthetic polymers are more fire resistant than wood.

References: American Petroleum Institute (1974)
Buettner (1957)
Wesson, Sliepcevich, and Welker (1971)

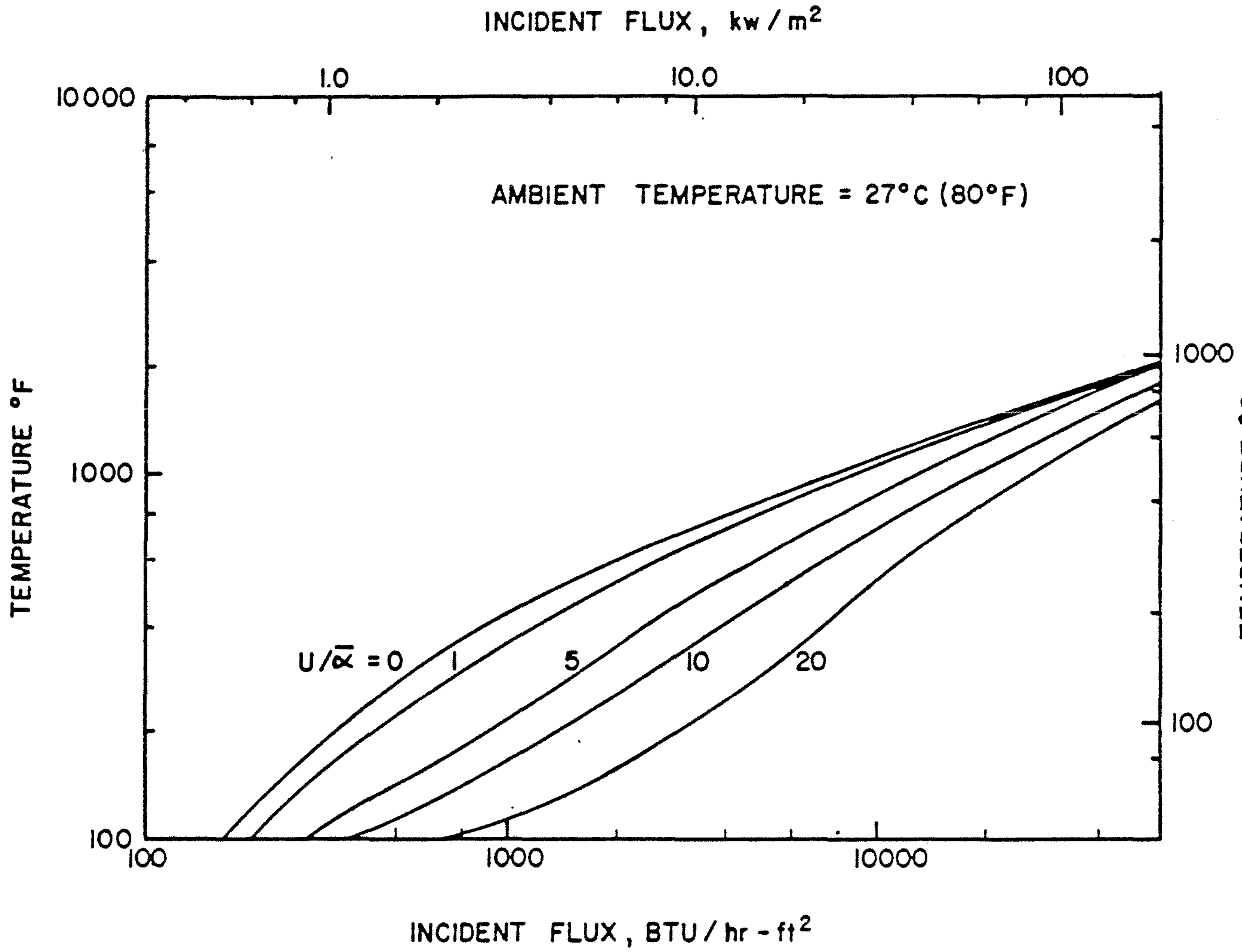

Figure C-3

Steady State Temperatures for Objects Exposed to Radiant Heating

Figure C-4 shows the effect of wind speed on the equilibrium temperature of metal insulated on one side. A metal temperature of 300°C is considered the safe upper limit. Therefore, Figure C-4 shows that the minimum incident flux required to damage metals can vary from 15 to 32 kW/m², depending on the local wind speed.

C.3 Thermal Injury Classification

Most of the quantitative research work on skin burns originated with the goal of determining the number of casualties to be expected following nuclear weapons blasts. The quality of emitted thermal radiation from a nuclear blast differs substantially from that of a typical hydrocarbon flame. Hence, it is important to recognize the difference in thermal radiation emission spectra in order to develop the proper thermal injury exclusion zones.

Several classifications of skin burn severity have been proposed, each depending on the degree of skin damage. The most familiar classification is the division of skin burns into three degrees. A first degree burn is the mildest level of skin burn, characterized by erythema, without formation of blisters. No permanent damage will result from a first degree burn. A second degree burn, characterized by blister formation, is the intermediate thermal injury category. The skin can heal from a second degree burn without skin graft. A third degree burn is characterized by destruction of all skin layers. Underlying tissue may also be destroyed. Survival of healthy adults can normally be expected if less than 20 percent of the body has second and third degree burns. Survivability decreases rapidly until it is almost impossible to recover from severe burns covering more than 80 percent of the body surface.

The present discussion focuses upon burns caused by thermal radiation because this is the dominant mode of heat transfer from hydrocarbon fires, whether from direct flame contact or from exposure to nearby fires. The thermal radiation spectral quality can have an important effect on radiation heat transfer because of the absorption characteristics of human skin. The absorptance of flame radiation by skin is in the region of 80 to 90 percent.

Thermal radiation skin burns may be caused by either short-duration exposure to a high level of thermal energy flux, or long-duration exposure to a lower level of thermal energy flux. At high fluxes, the injury requires less total energy than at lower fluxes because more of the heat is transmitted to underlying tissue.

Figure C-5 presents an estimate of the response of human tissue to different levels of impinging thermal radiation. The pain threshold and severe burn threshold curves indicate the time required to produce the respective thermal injury levels as a function of the imposed heat intensity level. The 50 percent and 100 percent fatality estimates are based on the nuclear thermal radiation data of Davis (1979), corrected for the differences for hydrocarbon fire emission spectra.

The most common thermal exclusion zone, defined by 5 kW/m² for a 30 second bare skin exposure time, is adopted as the second degree burn exclusion

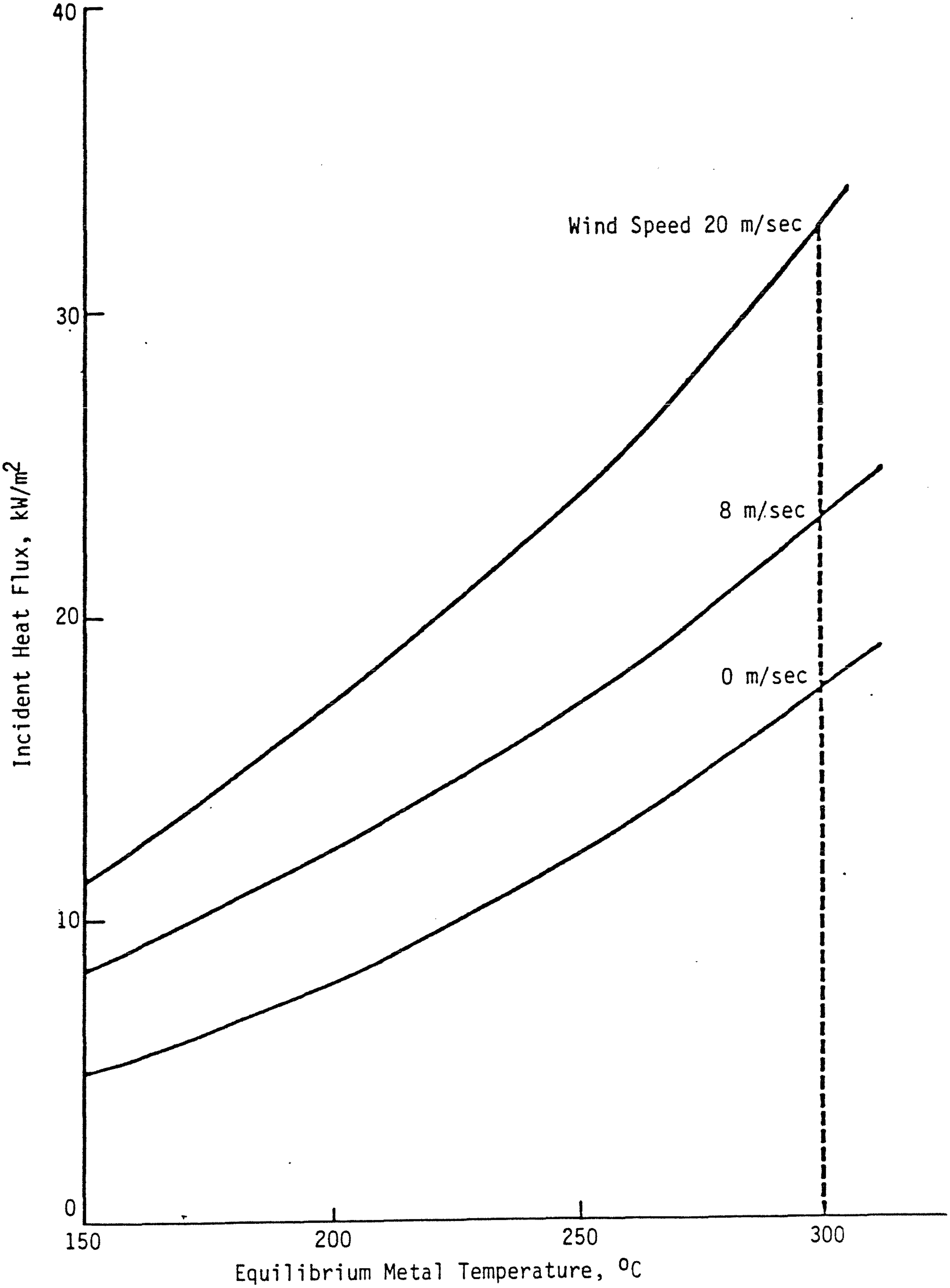

Figure C-4

Relationship Between Metal Temperature and Incident Heat Flux for Various Wind Speeds

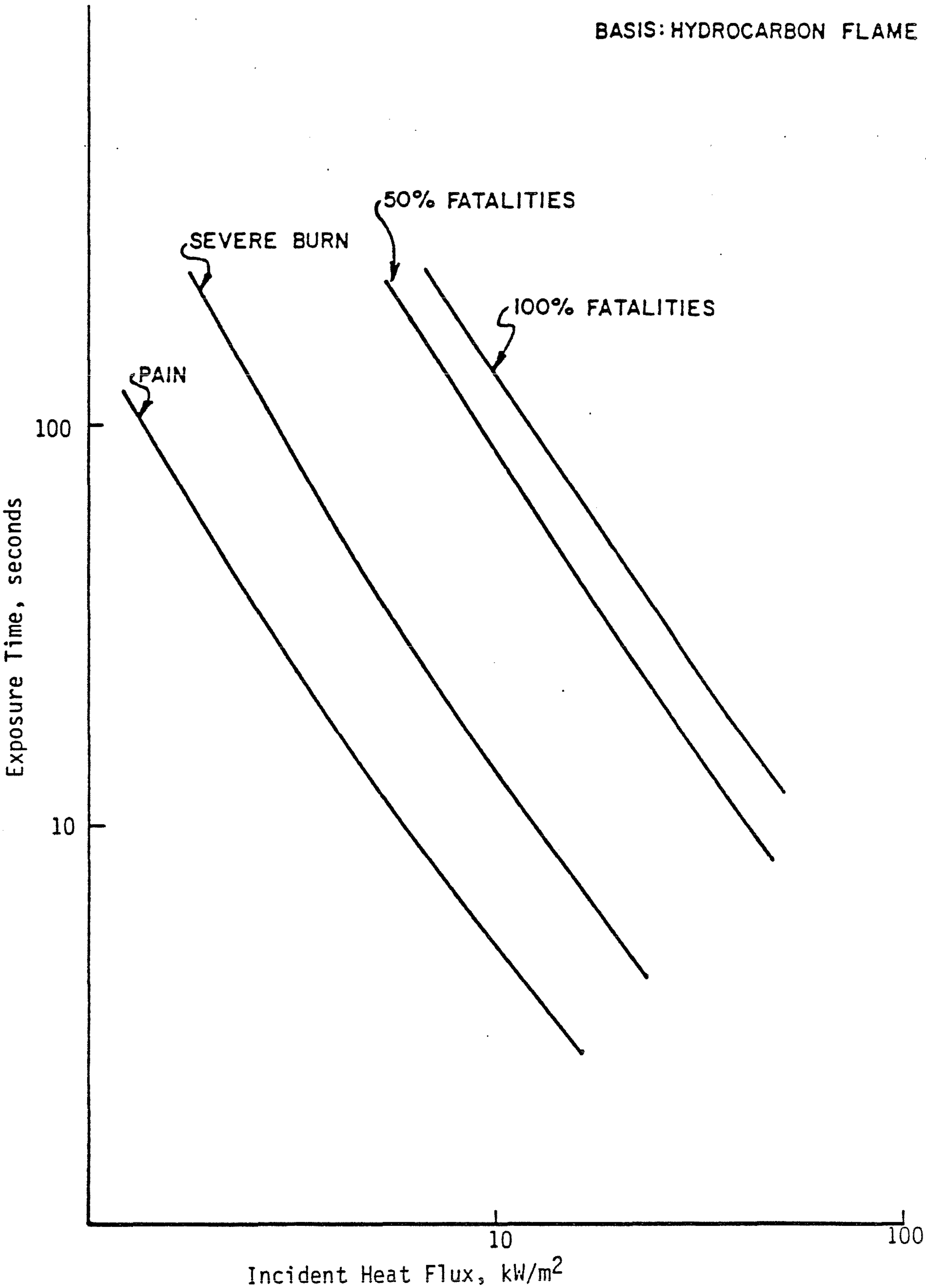

Figure C-5

Effect of Heat Flux and Exposure Time on Burn Injury

zone. It is assumed that people can easily shield themselves or escape from the fire beyond this point.

The minimum heat intensity required to ignite wood is approximately 13.5 kW/m^2. At this minimum level, the wood must be exposed for about 10 minutes. This level of potential thermal damage from a pool fire can be used to define the unprotected building thermal exclusion zone.

The severe damage thermal exclusion zone has been defined by several organizations as 31.5 kW/m^2. This heat intensity level will reduce the structural strength of unprotected steel. Since structural steel damage may cause propagating failures in many situations, the severe damage thermal exclusion zone is an important fire assessment criterion.

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APPENDIX D. SUPPLEMENTAL INFORMATION TO ENERGY ANALYSTS' REPORT 87-1-400
MARCH 30, 1988

(1) Approximately two years ago, the Materials Transportation Bureau (MTB) was changed to the Office of Pipeline Safety (OPS).

(2) Areas of responsibility for LNG marine terminal safety between OPS and the U.S. Coast Guard have been defined and became effective 1 January 1988. OPS now has responsibility for all aspects of shoreside LNG facilities.

(3) Appendix B provides the vapor generation models.

(4) The thermal radiation model used by Energy Analysts to compute thermal radiation exclusion zones is based on all the available LNG fire test data. The following reports and papers provide comparisons between model predictions and experimental results.

   (a) American Gas Association, "Project IS-3-1: LNG Safety Program, Interim Report on Phase II Work." AGA, 1973: 478 pages.

   (b) Mizner, G. A., and J. A. Eyre, "Large-Scale LNG and LPG Pool Fires." The Assessment of Major Hazards, The Institution of Chemical Engineers, Pergamon Press Ltd., Oxford, United Kingdom, Symposium Series No. 71, 1982: pp. 147-163.

   (c) Raj, P. K., N. A. Moussa, K. Aravamudan, and C. D. Lind, "LNG Spill Fire Tests on Water - An Overview of the Results." American Gas Association Operating Section Proceedings, 1979: pp. T-246-T-251. (Tests conducted under contract to the U.S. Coast Guard and the U.S. Department of Energy.)

The thermal radiation model used has been available in the open literature since 1973, and accurately predicts all the experimental LNG data. The thermal radiation public exclusion zone formulas in 49 CFR 193 assume a conservative flame height. The result is that the 1,600 Btu/hr-ft^2 exclusion zone predicted by 49 CFR 193 is greater than that obtained using actual data. For the conceptually designed storage tank dikes, the heat radiation public separation zone using experimental data is 1,726 ft, while using the 49 CFR 193 equation results in a distance of about 2,063 ft, both measured from the center of the storage tank dike. During detailed design, the thermal radiation exclusion zones for the Anderson Bay Terminal will be determined, based on actual dike dimensions. The computations performed show the Anderson Bay site can meet the thermal radiation exclusion zone requirements of 49 CFR 193.

APPENDIX L

ANILCA 810 FINDINGS

APPENDIX L
ANILCA SECTION 810(a) EVALUATIONS AND FINDINGS

1.0 PURPOSE OF THE PROPOSED ACTION

In November 1986, the Yukon-Pacific Corporation applied for a Department of the Army permit (Section 10, Section 10 River and Harbor Act 1899 and Section 404, Clean Water Act) and a Bureau of Land Management Federal Grant of Right-of-Way permit (Section 28, Mineral Leasing Act of 1920) to construct a large diameter buried gas pipeline, liquid natural gas plant and tanker loading port facilities, and other related facilities. Prior to issuance of these permits for the proposed work, an evaluation of the effects of the proposed action on subsistence uses and needs, is required under Section 810 of the Alaska National Interest Lands Conservation Act (ANILCA). Because the U.S. Army Corps of Engineers (Corps) and the Bureau of Land Management has determined that the issuance of these permits for the proposed work are major Federal actions which may significantly affect the human environment, an Environmental Impact Statement (EIS) will be prepared prior to a decision to issue or deny the permits, and the ANILCA 810 process shall be incorporated as part of the EIS process and document.

The ANILCA 810 process requires up to four steps. The steps are:

- preparation of an evaluation of the effect of the proposed activities on subsistence uses and needs;
- preparation of a finding of whether or not the proposed activities will significantly restrict subsistence uses;
- if the evaluation results in a finding of significant restriction of subsistence uses, a public hearing proceeded by proper notice must be held in the vicinity of the area involved; and
- if the evaluation results in a finding of significant restriction of subsistence uses, an 810 Determination will be prepared.

For further information on the subsistence uses along the TAGS project and environmental consequences, refer to Sections 3.2.17 Subsistence, 4.2.17 Subsistence, and References of the Environmental Impact Statement.

2.0 EVALUATION OF THE EFFECTS OF THE PROPOSED ACTIVITIES ON SUBSISTENCE USES AND NEEDS

2.1 DESCRIPTION OF THE PREFERRED ALTERNATIVE

The Yukon-Pacific Corporation (YPC) project is a Trans-Alaska Gas System (TAGS) that will transport natural gas from Prudhoe Bay to Port Valdez, reduce the gas to a liquid state, and ship the liquefied natural gas (LNG) to markets in Pacific Rim countries.

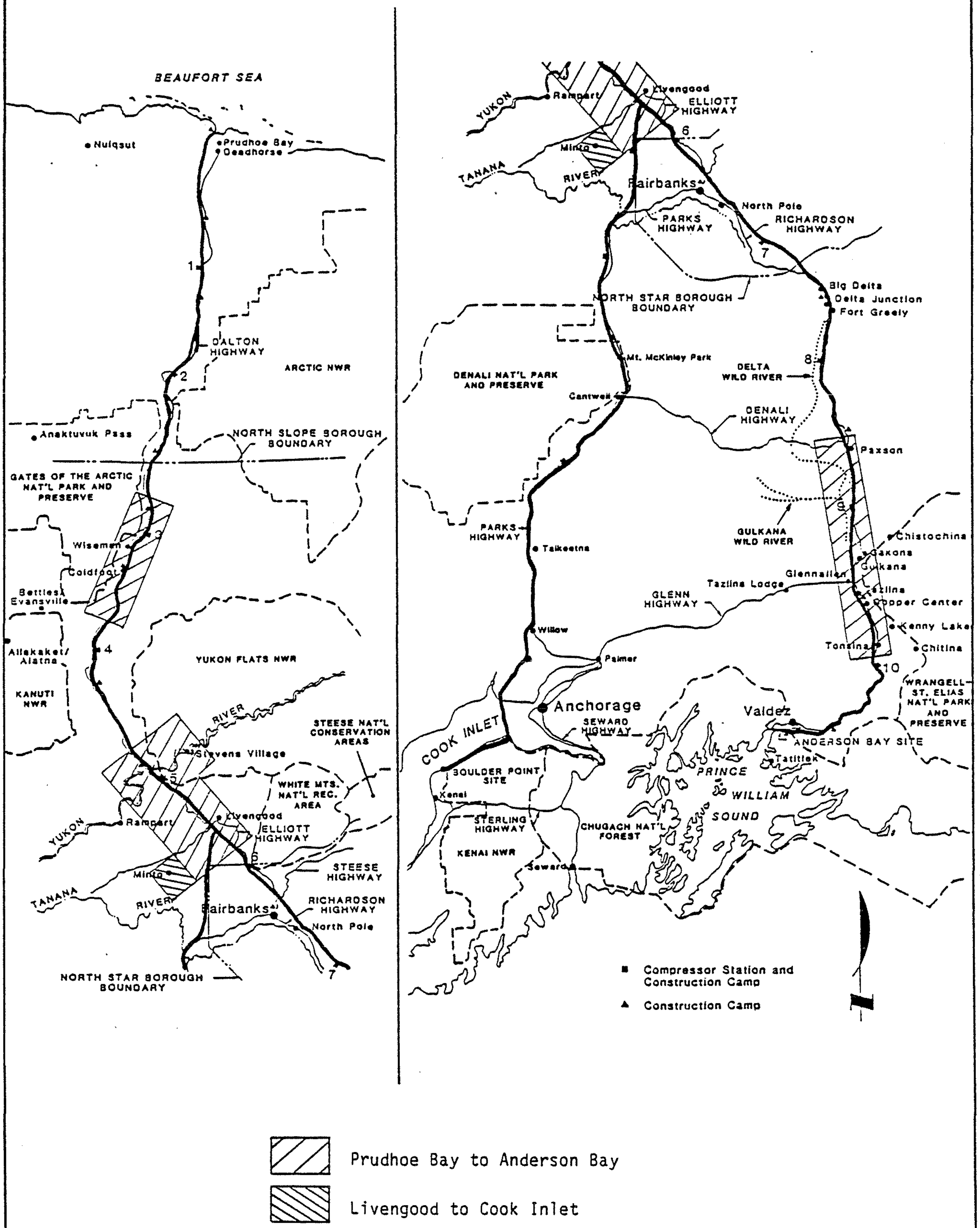
The project is comprised of three major components: a pipeline, gas compressor stations, and an LNG terminal (Figure 1).

A 36-inch (outside diameter), buried, chilled gas pipeline from Prudhoe Bay to Anderson Bay in Port Valdez will be located in an established utility and transportation corridor, approximately parallel to the existing Alyeska Trans-Alaska Pipeline System route and a segment of the authorized but unconstructed Alaska Natural Gas Transportation System Route. The pipeline right-of-way (ROW) will generally have a width of 120 feet and extend approximately 796.5 miles. Total area disturbed by pipeline construction is estimated at 14,473 acres; during the operation of the pipeline, the disturbed area will be reduced to 5,114 acres (Table 1).

Ten gas compressor stations will be located along the route to control the pressure and temperature of the gas flowing through the pipeline. Each station will occupy approximately 20 acres. Construction camps will generally be located at the compressor station sites.

A 300-acre LNG plant and marine terminal will be located at Anderson Bay on the south side of Port Valdez, three miles west of the TAPS oil terminal. Facilities include four 800,000-barrel LNG tanks. The marine terminal dock will extend 500 feet out from shore and include two loading berths for the 1,000-foot LNG tankers.

A connecting action to the proposed TAGS project would be the construction of a conceptual natural gas conditioning facility on the North Slope at Prudhoe Bay in the vicinity of the existing central gas



Reference: U.S. Department of Interior Geological Survey, Alaska National Interest Lands Conservation Act, December 2, 1980

Figure 1 Area of Significant Restriction of Subsistence Use During Pipeline Construction Proposed TAGS Project

Table 1
Estimate of the Disturbed Area
Required for Facilities

	Construction	Operation
	Acres	
Gas Conditioning Facility (conceptual)	300 1/	300 1/
Pipeline	*14, 473*	*5,114*
Ten Compressor Stations	*278*	*200*
Access Roads	*430*	*430*
Temporary Camps and *Storage Yards*	*730*	*255*
Air Strips	*144*	*0*
River Crossing Extra Work Space	*55*	*20*
Communication Sites 2/	6	6
Spoil	*700*	*80*
Construction Material Sites and Access Roads	*5,800*	*1,740*
LNG Facility	*300*	*280*
Total Area Disturbed	23,216	8,425

1/ The 300-acre worst case is based on the information in FERC (1980). Since FERC (1980), ANGTS has scaled down the plant size to less than 200 acres due to their ability to use recently constructed facilities at Prudhoe Bay and a process change.

2/ This includes an estimate of acreage should it not be possible to co-locate communication site at existing TAPS sites.

facility of ARCO. Approximately 300 acres would be required to construct this facility.

Associated facilities and estimates of construction disturbance include access roads (430 acres), air strips (144 acres), temporary camp storage yards (730 acres), construction materials and access roads to sites (5,800 acres), and spoil storage (700 acres).

Construction of the TAGS project will take place over a five-year period, with construction of the LNG plant/marine terminal requiring five years, and construction of the pipeline and compressor stations taking place during years three, four, and five (Figure 2). Pipeline construction will progress in the following sequence: material acquisition and stockpiling; camp construction; ROW preparation (clearing and grading); ditching; pipe stringing, bending and welding; pipe lowering-in and tie-in; ditch backfilling; and cleanup and restoration. The pipeline will be constructed simultaneously over six construction spreads; construction for each spread will require roughly 34 months to complete. On a given spread, camp and ROW/work pad preparation will occur throughout the year over years 3 and 4; pipe ditching and laying will occur primarily over the winter-spring months of years 3, 4, and 5 (except in the southernmost spread); and cleanup and restoration will occur during the summer and fall months of year 5.

2.2 CURRENT SUBSISTENCE ACTIVITIES IN THE AFFECTED AREA

The indigenous people of Alaska have pursued subsistence as a way of life for generations; subsistence contributes to the economy, social structure and cultural traditions, nutrition, and identity of those who participate in it. The foundation of their sociocultural systems is the utilization of the natural environment and its biological resources. Subsistence foods constitute a significant portion of the diet of Native Alaskan communities, particularly in smaller villages where imported foods are not readily available or expensive. Subsistence resources represent income; the combination of subsistence and employment contribute to the overall village economy.

Subsistence harvest patterns ***for both indigenous and non-indigenous rural Alaskan residents*** are seasonal, responding to biological cycles, proximity of resources, environmental conditions, and ease of travel and access. These patterns have a historical basis, and have been modified with the establishment of permanent settlements. Each community relies on specific subsistence resources to varying degrees, depending on their abundance, seasonal distribution and proximity to the village.

The area affected by the proposed TAGS project includes 18 communities that participate in subsistence activities. For the purposes of discussing subsistence activities in the EIS, the route has been divided into five subregions: 1) the North Slope Borough, 2) the Northern Corridor communities, 3) the Fairbanks-Delta Junction communities, the 4) Glennallen-Copper Center communities, 5) and Valdez-Tatitlek (Table 2).

2.2.1 <u>North Slope Borough</u>

The portion of the route within the North Slope Borough lies approximately between mileposts 0 and 160. Three North Slope Borough communities use this area of the route for subsistence activities: Nuiqsut ***(approximately 70 miles from Compressor Station No. 1)***, Kaktovik ***(approximately 70 miles from Prudhoe Bay)***, and Anaktuvuk Pass ***(approximately 60 miles from Compressor Station No. 2).***

A brief discussion of the general subsistence activity patterns of Nuiqsut, Kaktovik, and Anaktuvik Pass are provided below:

<u>Nuiqsut</u>

Caribou represents both the single most available food source and the greatest harvest from one source. However, its availability is not stable and fluctuates with changes in population and migration patterns. Caribou are hunted when available year round, although major harvest activities center around spring and the early fall. Moose are harvested during the fall months, and furbearers are harvested during the winter and spring months.

Marine mammals are also a significant component of subsistence. The fall harvest

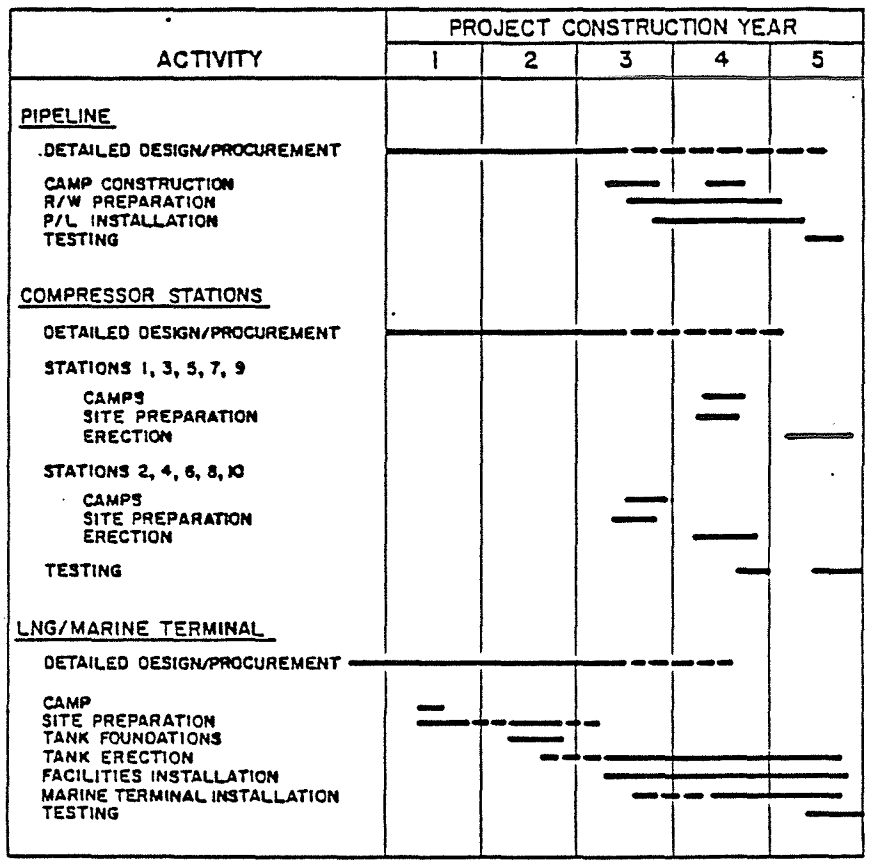


Figure 2
TAGS Overall Construction Schedule

Table 2 Communities Participating in Subsistence Uses

Area/Community

North Slope Borough

Nuiqsut

Kaktovik

Anaktuvik Pass

Northern Corridor

Nolan/Wiseman

Livengood

Bettles/Evansville

Allakaket/Alatna

Stevens Village

Rampart

Minto

Fairbanks/Delta

Fairbanks *

North Pole

Delta Junction

Glennallen-Copper Center

Paxson/Sourdough

Gakona

Gulkana

Glennallen

Copper Center

Upper Tonsina

Valdez-Tatitlek

Valdez **

Tatitlek

* Fairbanks is not considered a "rural" area under ANILCA Section 803 to which ANILCA Section 810(a) requirements apply (96th Congress 1st Session, Senate Report 96-43, p.233)

** In 1987, Valdez was classified by the Alaska Joint Boards of Fisheries and Game as not being a "rural" area to which priority hunting and fishing rights would be granted when resources are limited.

of bowhead whales has great cultural significance; seal and polar bear are harvested during the fall, winter and spring. Other important resources utilized include freshwater fish (exploited during the entire year) and birds.

Hunting for caribou and moose occurs by snowmobile during fall, winter and spring months. Traditional harvest areas include portions of the project route. Fish harvests are concentrated at traditional fish camps during the summer months; ice fishing occurs closer to the village.

Kaktovik

Kaktovik residents depend primarily on caribou, sheep, bowhead whale, seal, polar bear, fish, furbearers, waterfowl and other birds. for the most part primary harvest areas are located east of the Yukon Pacific project, although hunting for caribou, seal, and sheep can bring residents into areas potentially affected by the project. Caribou are hunted summer, fall and winter; sheep primarily during the winter; bowhead whale during the fall; seal year around; polar bear during the fall, winter and spring; furbearers during the winter; and waterfowl primarily during spring and summer.

Anaktuvik Pass

The subsistence emphasis for Anaktuvik Pass is on caribou; like Nuiqsut, caribou availability is not stable and fluctuates with changes in population and migration patterns. Caribou are hunted when available, although hunting occurs in spring and fall peaks coinciding with migration. Sheep is also a seasonally important component of diet, hunted more intensively during the fall but available year around. Other important resources include moose (year round with a fall peak), grizzly bear (spring through fall, furbearers/small mammals(year round), birds and fish (year round). Moose are only occasionally taken for subsistence purposes (J. Pepper, NPS, pers. comm., March 1988).

Resources are harvested in a broad area of the Brooks Range, including a portion of the Yukon Pacific route. Access to resources is provided primarily by snow machine, when snow cover permits. ATV's are also used.

Marine mammals are important North Slope Borough subsistence resources and include seal (ringed, bearded, and spotted), walrus, polar bear, Beluga and Bowhead whale. Terrestrial mammals hunted for subsistence include caribou, moose, brown/grizzly bear, Dall sheep, and rabbits. Hunting for seabirds, waterfowl and gathering bird eggs occurs during the late spring, summer and early fall. A variety of fish contribute to the subsistence diet including salmon, char, cisco, grayling, and varieties of marine fish. Fish are taken year around, both in coastal waters by boat and at traditional fish camp sites on rivers and the coast. Various plant resources for food and other needs, such as berries, roots, seeds, fuel wood and construction materials make up the last category of subsistence resources.

None of these communities are located in the immediate vicinity of the TAGS route. In addition, their subsistence use areas are relatively broad, and the TAGS route is located on the periphery of these areas.

2.2.2 Northern Corridor Communities

The Northern Corridor area runs from milepost 160 to 420, and is used for subsistence activities by seven communities: Nolan/Wiseman, Bettles/Evansville, Allakaket/Alatna, Livengood, Stevens Village, Rampart, and Minto. Several of these communities are traditionally Northern Athabascan; the others are the result of mining activities or highway and Trans-Alaska Pipeline System maintenance activities. *The descriptions of community subsistence patterns presented below are general in nature and summarize more complex harvest patterns. (Residents of Nolan do not qualify as living in a "resident zone" for purposes of subsistence in the nearby GAAR [L. Wasker, NPS, pers. comm., March 1988]).*

Five major types of subsistence resources are utilized by Northern Corridor communities along the proposed route: hunting for moose, caribou, bear, Dall sheep, rabbits, and a variety of waterfowl; fishing for salmon, char, cisco, grayling, and other varieties of fish; trapping various furbearers, including beaver, martin, fox, wolf, wolverine, marmot, and others; and collecting various plant resources for food and other needs, including berries, roots, seeds, fuel wood and construction materials. Of these activities, moose hunting and fishing exhibit the highest percentages of house participation and are considered the most significant subsistence activities.

Several of the communities are located adjacent to or near the TAGS route, notably Nolan/Wiseman and Livengood, with Stevens Village and Rampart located respectively upstream and downstream of the Yukon River crossing. Other area communities potentially affected by the TAGS project are not easily accessible from the Utility Corridor and have subsistence use areas that are relatively broad, with the TAGS route located on the periphery of these areas.

2.2.3 Fairbanks-Delta Junction Communities

Unlike the areas to the north, the Fairbanks-Delta Junction communities are more urban in their orientation, with greater participation in wage employment and the cash economy. They are not as economically or culturally tied to pursuit of subsistence activities, and are not considered rural subsistence areas by the State Boards of Fisheries and Game. Some residents participate in subsistence-like activities (hunting, fishing and wood harvesting) and personal use fisheries. This portion of the TAGS route contains 3 major communities: Fairbanks, North Pole, and Delta Junction (smaller communities such as Fox, ***Salcha,*** and Big Delta are included).

2.2.4 Glennallen-Copper Center Communities

Located between TAGS mileposts 560 and 760, this subregion contains six communities: Paxson/Sourdough, Gakona, Gulkana, Glennallen, Copper Center, and the Upper Tonsina Area. These communities are located adjacent to or in the vicinity of the TAGS route. Similar to the Northern Corridor subregion, this area is a mix of traditional Athabascan communities, regional service centers and highway/pipeline maintenance camps.

Subsistence patterns are further influenced by readily available road access. In addition to subsistence activities, several of the rivers in the subregion support popular personal use fisheries.

Fish harvests are the most important subsistence activity in the subregion, with sockeye salmon constituting the majority of the harvest (ADF&G 1985). Salmon are harvested from June through September, using fish wheels, dip nets and rod and reel. Grayling, trout and burbot are also harvested. Access to subsistence sites is by road and boat.

Moose are highly valued subsistence resources. They are hunted during fall months, with hunting access provided by highway vehicles, off-road vehicles, airplanes and boats. Due to ease of highway access, there has been significant competition for moose between subsistence and sport hunters. Over the past few years, subsistence hunting regulations have been changed to help ensure an adequate subsistence harvest.

Caribou have been a historically important subsistence resource. However, since population declines in both the Nelchina and Mentasta caribou herds over the last two decades, hunting has been restricted to allow for an increase in herd size. Recent changes in subsistence hunting regulations have ***allowed*** a fall caribou subsistence hunt. ***A winter subsistence caribou hunting season does exist in the Copper River Area.*** Access to hunting areas is similar to that of moose.

Other activities include ***hunting furbearers and*** harvesting berries and native vegetation. Wood harvesting, for firewood and construction, is popular in this area; a subsistence permit is required to harvest wood on federal public lands by subsistence users.

The Copper river is the location of a very popular personal use dipnet fishery for sockeye salmon; nearly 4000 permits were issued for this fishery in 1987. Many non-residents participate in the fishery; approximately 35% of the permits issued in 1983 went to Anchorage residents. Currently, the most popular location for dipnetting is just outside of Chitina, to the east of the TAGS route.

2.2.5 Valdez-Tatitlek

The area between milepost 760 and the proposed LNG terminal at Anderson Bay (MP 796.5) is sparsely populated and contains only two communities: Valdez and Tatitlek. Valdez has a wage employment and cash economy; it is not considered a rural subsistence area by the State Boards of Fisheries and Game, and subsistence by residents is limited to activities like wood harvesting. Tatitlek is a traditional Chugach Eskimo community that is oriented towards coastal subsistence activities. ***Tatitlek is not located along the Yukon Pacific pipeline; however, it could be affected by related tanker traffic.***

While no detailed subsistence surveys of Tatitlek have been completed, resource availability and harvest patterns are similar to those of the Cordova/Eyak area. A wide variety of subsistence resources are available throughout the year, unlike interior locations. Harvest activities of residents tend to be oriented to use of relatively nearby marine and coastal areas. Access to resources is primarily by boat. Major subsistence resources include fish, invertebrates, marine mammals, deer, waterfowl and bird eggs, and firewood and house logs.

2.3 IMPACTS ON HABITAT AND FISH AND WILDLIFE IMPORTANT TO SUBSISTENCE

Construction and operation of the project can affect fish and wildlife resources used for subsistence activities in three ways, resulting in their reduced availability for subsistence harvest. First, mortality could occur from project construction or accidental events such as an oil spill. Fish would be most at risk due to the potential for siltation or fuel spills into a watercourse. Second, fish and wildlife might avoid the project area due to construction activities or, in the case of poorly placed drainage and fish passage structures, be unable to physically migrate through the project area. Animals that can avoid the area during construction activities, such as moose and caribou, are likely to do so. Finally, construction and operation of project related facilities could result in habitat loss and a reduced level of utilization of the project area by fish and wildlife. The potential for impacts to fish and wildlife resources used for subsistence purposes varies along the TAGS route. ***Additional discussion for fish see Subsections 3.2.11 and 4.2.11, for wildlife see Subsections 3.2.13 and 4.2.14, and for subsistence see Subsections 3.2.17 and 4.2.17 of the FEIS.***

2.3.1 North Slope Borough

In the North Slope Borough, some subsistence resources like marine mammals would not be affected by the project. Some fish resources would be affected by mortality, obstructions to migration, and loss of critical habitat, primarily along the Sagavanirktok River. However, there are other important areas used by village residents for fishing, and impacts to fish would be minimized through proper design and construction procedures proposed for the TAGS project. Impacts to moose, sheep and caribou are potentially more significant on a short-term basis. Avoidance of construction areas and induced changes to distribution or migration patterns would cause temporary hardship to individuals who utilize areas along the route for the subsistence harvest of moose and caribou, requiring increased harvest effort elsewhere. Loss of riparian habitat could reduce the availability of moose. Because the area along the TAGS route is not a primary subsistence use area of Kaktovik, Nuiqsut, and Anaktuvuk Pass, impacts to fish and wildlife in this area would not be significant in terms of subsistence.

2.3.2 Northern Corridor Communities

Along the Northern Corridor, caribou, moose and fish would also be sensitive to TAGS-related impacts. Communities close to the TAGS route would be more likely to be significantly affected, such as Nolan/Wiseman, Livengood and ***Stevens Village. This last community is included in this group due to readily available public boat access up the Yukon River from the Utility Corridor.*** Fish and wildlife avoidance of the construction area would temporarily require a greater level of harvest effort in areas more remote from construction activities. The cumulative effect of avoidance impacts (when added to other subsistence use impacts discussed below) would contribute to temporary but significant restriction of use in this area. The communities of Allakaket/Alatna, Bettles/Evansville, and Rampart ***and***

Stevens Village use many areas other than the TAGS route for subsistence activities and would experience minor impact to fish and wildlife used for subsistence purposes. ***(Residents of Nolan do not qualify as living in a "resident zone" for purposes of subsistence in the nearby GAAR [L. Wasker, NPS, pers. comm., March 1988]).***

2.3.3 Fairbanks-Delta Junction Communities

Because there is significant development that already affects fish and wildlife in this area, and there is negligible subsistence use, impacts to fish and wildlife would not affect subsistence use.

2.3.4 Glennallen-Copper Center Communities

The type of impacts in the Glennallen/Copper Center Corridor would be similar to those in the Northern Corridor, with fish, moose, and caribou being the most sensitive subsistence species. Because there would be no pipeline crossings of streams important to subsistence or personal use fisheries there would be minimal direct impacts to fisheries, except in the unlikely event of a catastrophic fuel spill. Some avoidance of the construction area by moose and caribou would occur. The TAGS project would add to the cumulative habitat disruption and avoidance by moose and caribou resulting from existing development in the area, and would contribute to temporary but significant restriction of subsistence use in this area. Nearly all the communities in the area are adjacent to the TAGS route and would be affected, including Paxson/Sourdough, Gulkana, Glennallen, Copper Center, and the Upper Tonsina communities.

2.3.5 Valdez-Tatitlek

Like the Fairbanks area, subsistence hunting and fishing by Valdez residents is negligible and effects on subsistence from fish and wildlife impacts would not be significant. Tatitlek is reliant on coastal and marine subsistence species, and primary harvest areas are located outside Valdez Arm (City of Valdez 1986). Marine mammals used for subsistence may be sensitive to increased levels of tanker traffic; other subsistence fish and wildlife species are unlikely to be affected.

2.4 IMPACTS ON SUBSISTENCE USES AND NEEDS

Adverse impacts to fish and wildlife used for subsistence purposes and resulting loss of harvest would require some increased effort for adequate subsistence harvest, and create adverse economic and social impacts. In addition, interference with harvesting activities and access to resources, increased competition from sport hunting, fishing, and trapping, and adverse impacts from project employment would also result in relocation of and/or increased harvest effort, economic impacts, and social impacts. These topics are discussed below.

2.4.1 Interference and Access Impacts

TAGS project construction and operation has the potential to interfere with subsistence activities. The primary causes of interference are restriction of access to traditional subsistence use areas and restrictions on hunting and fishing in the vicinity of the TAGS project. Construction activities and placement of facilities, roads and borrow pits would eliminate or restrict some access to areas traditionally used for subsistence activities throughout the project area. During TAPS construction and operation, Glennallen area residents have mentioned restricted access to wood harvesting areas as a concern. During construction, work pad construction and pipeline ditching and laying activities will last for periods of up to eleven months (although the pipeline ditch would not likely be open for more than 30 days in any given location); construction camps, access roads and borrow pits could be operational for the period of construction. Therefore, the potential for these impacts would be temporary, and limited to the duration of construction activities in a given area. ***State*** regulations regarding hunting and trespass in the vicinity of the completed TAGS line can also have the effect of restricting subsistence use of traditional sites.

Communities located adjacent to the TAGS route, such as those in the Northern Corridor (Nolan/Wiseman, ***Stevens Village*** and Livengood) and Glennallen/Copper Center area (Paxson/Sourdough, Gulkana, Glennallen, Copper Center, and the Upper Tonsina communities) are more sensitive to interference and access impacts. They harvest resources and/or require access in the immediate vicinity of the route, compared to those which are farther away or have broad subsistence use areas. Access and interference impacts in these areas adds to the cumulative restriction of subsistence uses.

2.4.2 Increased Sport Hunting, Fishing, and Trapping Competition

Increased levels of sport hunting, fishing and trapping would be associated with construction and operation of the TAGS project. The project will introduce large numbers of direct and indirect employees into the project area and likely result in improved access into many places with fish and wildlife resources. This work force and its dependents would participate in sport hunting, fishing, and trapping activities. Left unregulated, such participation would compete with subsistence users for fish and wildlife resources and threaten maintaining the populations of fish and wildlife used for subsistence purposes. Sport hunting, fishing and trapping activities by employees will be concentrated around the locations of construction camps.

Due to the ***ready*** availability of public access for sport hunting, fishing and trapping, and subsistence reliance on the area in the immediate vicinity of the TAGS project, the Northern Corridor (Nolan/Wiseman, ***Stevens Village,*** and Livengood), Glennallen/Copper Center area (Paxson/Sourdough, Gulkana, Glennallen, Copper Center, and the Upper Tonsina communities) would be more vulnerable to increased competition from sport hunting, fishing, and trapping than those which are farther away or have broad subsistence use areas. Even though a five mile corridor along the Dalton Highway is subject to hunting ***and access*** restrictions, sport hunting would still compete with subsistence hunting outside ***the Dalton Highway*** corridor. Sport fishing is not similarly restricted. Fish (salmon, grayling, burbot, and whitefish), moose and caribou are important dietary components to communities of these areas, and are also popular sport hunting and fishing species. Small and medium size furbearers are trapped to provide materials for local handicrafts, and pelts which are an important source of cash for some families. Increased competition from sport hunting, fishing and trapping would result in some increased effort for adequate subsistence harvest, and economic and social impacts.

Specific actions by the Boards of Fisheries and Game to reduce the effects of TAGS on subsistence resources in the Glennallen and Northern Corridor communities areas is dependent upon the actual extent of TAGS workers establishing ***a place of primary*** residency in these two areas. Some of the pipeline work force could potentially meet residency requirements and become rural subsistence users and compete with current rural subsistence users. However, because the period of pipeline construction is relatively short and pipeline crews will be moving regularly from camp to camp along the pipeline spread, this is not likely to happen. ***Further YPC has indicated they will follow a policy of local hire that could mean workers would have already a primary domicile elsewhere in the State of Alaska.***

Competitive impacts would not result in a significant restriction of subsistence use; moderate impacts would be limited to the period of construction. During operation, the work force could continue to compete with subsistence users on a smaller scale.

There is a possibility that some increased sport hunting and fishing competition may occur in national parks and preserves along the project route. However, the State of Alaska is empowered to exercise a subsistence harvest preference over sport harvest if a scarcity is determined to exist, and this would apply to fish and game resources (which are managed by the State) on park lands. Such an action could be taken to minimize this impact. Similarly, there is a potential for non-resident project employees to become rural residents and increase the number of qualified subsistence users eligible to hunt and fish on park lands. However, as described above, the requirements for one year residency and legal change of address would make it unlikely that non-resident construction workers would qualify as subsistence users.

2.4.3 Impacts From Employment

Project employment opportunities are very important to local residents, and wage income will offset loss of subsistence resources to some degree. However, employment also presents some disadvantages to participating in the traditional subsistence way of life. Subsistence harvest patterns follow the seasonal availability of resources; and are also flexible to take advantage of unexpected harvest opportunities as they arise. Full-time employment does not provide the flexibility to participate in subsistence activities as they arise, particularly those that cannot be scheduled in advance. ***Disadvantages include loss of available time to prepare for and pursue subsistence activities. Decreased participation in subsistence activities due to employment would have some related economic impact; this would be partially offset by wages provided by employment.***

The communities most likely to be sensitive to employment-created subsistence impacts are those that are predominantly Native, and which have a social structure and personal identity that revolves around participation in subsistence activities. These include the North Slope communities, Evansville, Allakaket/Alatna, Stevens Village, Rampart, Minto, Copper Center and Tatitlek. The effects of an employment-induced reduction in subsistence participation are primarily social. Because the majority of local employment opportunities will be during project construction, impacts from employment will generally be temporary and are not considered significant restrictions of subsistence use.

2.4.4 Relocation/Increased Harvest Effort

An indirect impact of the TAGS project, resulting from the primary impacts described above, is increased harvest effort required to offset loss of subsistence resources in the vicinity of the project. Any reduction in harvest levels attributable to the project would result in increased effort to make up the loss in other areas unaffected by the project (relocation). In addition to the time involved with extra travel, an increased harvest effort usually requires additional outlays of cash for fuel and supplies.

Communities located adjacent to the TAGS route, such as those in the Northern Corridor (Nolan/Wiseman, ***Stevens Village*** and Livengood) and Glennallen/Copper Center area (Paxson/Sourdough, Gulkana, Glennallen, Copper Center, and the Upper Tonsina communities), are more sensitive to impacts from relocated or increased effort than those which are farther away or have broad subsistence use areas. In these areas, relocation and increased effort impacts lead to the cumulative restriction of subsistence uses. Because of greatly reduced levels of activity and construction facility closure/rehabilitation after construction, relocation and increased effort impacts will be minimal during project operation.

2.4.5 Economic Impacts

A second indirect subsistence impact of TAGS construction and operation is adverse economic impact on communities that are oriented towards a subsistence way of life. This impact would be partially offset by any local hire/employment opportunities. Economic impacts result from increased outlays of cash to replace reductions in subsistence harvests and to support increased harvest efforts to make up for reductions in resources. Where a reduction of harvest in traditional use areas occurs, a resulting increase in or relocation of harvest effort may require additional cash outlays for supplies such as food and fuel for boats and snowmobiles. In addition, harvest replacement with expensive store-bought foods may be necessary , and cash used for these purposes may be diverted from other needs, such as heating fuel, clothing and equipment.

In communities where employment opportunities are few, additional cash outlays are a hardship, since no ready sources of cash are available. This would be partially offset by local hire employment opportunities provided by the project. ***In at least one instance, at Stevens Village, there is interest in developing a joint venture with YPC for elements of the TAGS project.*** Communities with limited employment opportunities and located adjacent to the TAGS route, such as Native communities in the Northern Corridor and Glennallen/Copper Center area, are more sensitive to competition impacts than those which are farther away or have broad subsistence use areas. The level of economic impacts will be minimal after completion of construction activities, which are the major source of fish and wildlife, interference/access, and relocation/increased effort impacts.

An additional economic impact could result from a decision by the Joint Boards of Fisheries and Game to redesignate a community from rural to non-rural. This could occur if project induced changes to population growth and employment characteristics resulted in the Joint Boards of Fisheries and Game reevaluating the communities rural subsistence status. Loss of this designation would prevent residents of an affected community from receiving subsistence preference in the harvest of fish and wildlife, and participate in subsistence hunting and fishing seasons. This in turn would create associated economic impacts. The greatest likelihood would occur during the construction phase in communities like Glennallen, which could become a regional supply center for pipeline activities. Housing non-resident employees of Yukon Pacific and its contractors in camp facilities would minimize this impact. After project construction, operation-related employment would not be significant enough to result in redesignation.

2.4.6 Social Impacts

The social impacts from the loss of participation in subsistence activities include loss of cultural identity and status in the affected community, dietary impacts, and aggravation of social problems such as depression and substance abuse. As indicated earlier, the foundation of the sociocultural systems of many rural communities is the subsistence utilization of the natural environment and its fish, wildlife, and vegetation resources. A reduction in the ability to participate in subsistence activities would result in community and individual identity loss through being unable to provide and distribute subsistence resources at traditional levels. Subsistence foods are a physically and psychologically important source of nutrition to Alaskan Natives.

A significant reduction in such foods, and their replacement with a limited range of store-bought foods can also lead to dietary problems and a loss in sense of "well being".

The communities that are most likely to be sensitive to social impacts from reduced subsistence activities are those that are predominantly Native and which have a social structure and personal identity that revolves around participation in subsistence activities. These include the North Slope communities, Evansville, Allakaket/Alatna, Stevens Village, Rampart, Minto, Copper Center and Tatitlek. Proximity to the TAGS route, severity of harvest opportunity reduction, and limited alternatives for relocation of effort will also aggravate social impacts. Duration of social impacts are likely to be limited to the period of project construction.

2.5 ALTERNATIVES

Suitable alternatives to the proposed action are limited to routes between Prudhoe Bay, where the gas resource lies, and an ice free LNG terminal site at tidewater. Various alternative routings and facility sites from previously proposed oil and natural gas pipeline systems in Alaska were considered and screened by YPC, along with some additional sites not previously considered. Through this screening process, two primary pipeline corridors and seven terminal sites were evaluated in detail (refer to Section 1.0 for further detail). Alternative evaluation included cost, engineering, safety, social and environmental factors. Three alternatives are considered as part of the EIS: 1) the preferred alternative of Prudhoe Bay to Anderson Bay, 2) Prudhoe Bay to the Boulder Point site on Cook Inlet, and 3) no action. There are no other reasonable and feasible alternatives that would reduce or eliminate the proposed action from lands needed for subsistence purposes. Mitigation measures are discussed in ***Subsection 4.8*** of the Environmental Impact Statement.

2.5.1 Prudhoe-Bay to Boulder Point Alternative

From the perspective of subsistence, the Prudhoe Bay-Boulder Point Alterative would be similar to the preferred alternative. The route would be identical from Prudhoe Bay to a point just north of Fairbanks, where it would diverge south across the Minto Flats and past Nenana along the Parks Highway. These latter two areas would be of equal or greater sensitivity to subsistence impacts compared to the Glennallen-Copper Center Corridor. In the Upper Cook Inlet communities, while not considered to be a rural subsistence area by the State of Alaska, subsistence-like activities occur and would be subject to competition and interference/access impacts. Therefore, this alternative would provide no advantages in reducing subsistence impacts over the preferred alternative. ***Additional discussions for fish see Subsections 3.3.11 and 4.3.11, for wildlife see Subsections 3.3.13 and 4.3.13, and for subsistence see Subsections 3.3.17 and 4.3.17 of the FEIS.***

2.5.2 No Action Alternative

Under the No Action Alternative, the TAGS project would not be constructed and operated, and there would be no impacts to subsistence uses and resources.

3.0 SECTION 810(a) FINDING

The Section 810(a) Findings for each of the three alternatives are presented below.

3.1 Preferred Alternative

Construction of preferred alternative of the TAGS project would result in some restriction of subsistence uses along the route. In limited areas, discussed below, these restrictions will be significant. The duration of restrictions, particularly those that are significant, will be short-term and limited to the 34 month pipeline construction period. Significant restrictions are not associated with construction of other project facilities, nor with operation of the project.

In the North Slope Borough, restriction of subsistence uses associated with construction and operation of the project would not be significant. This is due to the fact that the affected communities are not located in the immediate vicinity of the TAGS route, that they have relatively broad subsistence uses areas, that the TAGS project is located on the periphery of these use areas, and that public access for competing sport hunting, fishing and trapping is ***currently*** restricted. ***ADF&G staff indicate that Nuiqsut hunters use the area east of TAGS on a seasonal basis. Additionally, the TAGS alignment involves areas where wildlife are at least partially habituated to a pipeline, highway and aircraft overflights.***

Because the Fairbanks-Delta Junction Area is not considered to be a rural subsistence use area by the State and the participation in subsistence-like activities is lower in that area, there would be negligible impacts except in the unlikely event of a catastrophic fuel spill event. There would be no significant restriction of subsistence uses.

Similarly, restriction of subsistence uses in the Valdez-Tatitlek area would not be significant. Like Fairbanks, Valdez has negligible participation in subsistence activities. Tatitlek subsistence activities are oriented towards coastal resources and utilize broad areas removed from the Anderson Bay terminal. Impacts would be limited to potential disturbance of marine mammal movement due to increased levels of tanker traffic.

However, in the Northern Corridor and Glennallen-Copper Center Communities, there would be some short term but significant restriction of subsistence uses. The duration of significant restriction of subsistence use would be limited to the 34 month pipeline construction period. Communities significantly affected are those adjacent to or in the immediate vicinity of the TAGS route, and include Nolan/Wiseman, Livengood, ***Stevens Village,*** Sourdough/Paxson, Gulkana, Glennallen, Copper Center, and the Upper Tonsina communities. The justification for the finding of significant restriction of subsistence uses is based on the level of several specific environmental consequences and their cumulative effects on the these two areas. These affects are described below in order of importance:

- project construction would result in some restrictions of access to subsistence use areas and interference with subsistence activities during the period of construction;

- moose, an important subsistence resource, would likely avoid the area of construction activities during the period of construction;

- these communities utilize the area in the vicinity of the pipeline route for subsistence uses and have relatively smaller use areas compared to other affected communities.

The combination of these effects would result in a temporary but significant restriction of subsistence uses. There will be no significant restrictions of use in the Northern Corridor and Glennallen-Copper Center Communities resulting from subsequent operation of the project.

3.2 Prudhoe-Bay to Boulder Point Alternative

Construction of Prudhoe Bay to Boulder Point alternative of the TAGS project would result in some restriction of subsistence uses along the route. In limited areas, the Northern Corridor and the Nenana Corridor communities, these restrictions will be significant. The duration of restrictions, particularly those that are significant, will be short-term and limited to the 34 month pipeline construction period. Significant restrictions are not associated with construction of other project facilities, nor with operation of the project.

Like the Preferred alternative, this alternative includes the North Slope Borough, and for the reasons discussed above, some restrictions of subsistence use would occur during pipeline construction but would not be significant.

The Upper Cook Inlet and Anchorage-Kenai communities are not classified as rural subsistence use areas by the State Boards of Fisheries and Game, although subsistence-like activities occur. Temporary restrictions to these activities would occur during construction of the pipeline, but would not be significant.

In the Northern Corridor and Nenana Corridor communities,there would be some short term but significant restriction of subsistence uses. The duration of significant restriction of subsistence use would be limited to the 34 month pipeline construction period. Communities significantly affected are those adjacent to or in the immediate vicinity of the TAGS route, and include Nolan/Wiseman, Livengood, Stevens Village, Minto, Nenana, Anderson/Clear, Healy/Sultrana, ***and Cantwell. Cantwell has a notable Native population. Both Native and non-Native residents are active hunters of moose and caribou.*** The justification for the finding of significant restriction of subsistence uses is based on the level of several specific environmental consequences and their cumulative effects on the these two areas. These effects are described below in order of importance:

- project construction would result in some restrictions of access to subsistence use areas and interference with subsistence activities during the period of construction;

- moose, an important subsistence resource, would likely avoid the area of construction activities during the period of construction;

- these communities utilize the area in the vicinity of the pipeline route for subsistence uses and have relatively smaller use areas compared to other affected communities.

The combination of these effects would result in a temporary but significant restriction of subsistence uses. There will be no significant restrictions of use in the Northern Corridor and Nenana Corridor Communities resulting from subsequent operation of the project.

3.2 No Action Alternative

The No Project alternative would have no affects on subsistence uses. Therefore, this alternative would not result in any significant restrictions of subsistence use.

4.0 DETERMINATIONS

Section 810(a)(3) ANILCA requires that when a significant restriction would result determinations also must be made that the proposed action 1) is necessary and consistent with sound management of public lands, 2) involves the minimum amount of public lands, and 3) reasonable steps will be taken to minimize adverse impacts upon subsistence uses and subsistence resources. Using a worst case analysis it has been determined that a significant restriction would occur.

4.1 Proposed TAGS Project to Anderson Bay

The evaluation of the proposed TAGS project concludes that reasonably foreseeable events arising during the 36-month construction period for the TAGS pipeline in the vicinity of the Wiseman-Livengood and Paxson-Tonsina could entail a significant restriction on subsistence by local rural residents in these two areas. The facts leading to this conclusion are discussed in this Appendix and in Chapters 3.2.17, 3.4, 4.2.17, 4.4, and 4.7.17 of the FEIS.

Such a significant restriction of subsistence use is necessary because the proposed project would support the timely, economic development of Alaskan resources in accord with the principals of sound multiple-use management of public lands in Alaska. The proposed use is consistent with existing federal and state land use plans which give a high priority to transportation and utility systems (see discussions at 3.2.3).

The proposed construction of TAGS would involve new disturbance of about 23,216 acres of land. Operational requirements would reduce project lands to approximately 8,425 acres. The proposal uses previously disturbed sites such as construction campsites and material storage areas and air strips used for TAPS construction wherever practicable. Final acreages used for operation of TAGS will comply with existing federal guidelines and regulations. The estimated 8,425 acres is the minimum land necessary for safe operation of a buried high pressure natural gas pipeline and its related facilities. The larger acreage of 23,216 acres of new disturbance during construction is the minimum amount needed to construct TAGS and to reduce risk of accidental damage to other transportation systems such as TAPS.

In addition to using the minimum amount of land and minimizing new disturbances, mitigation measures to minimize adverse impacts on subsistence uses and resources have been developed. These are described in subchapter 4.8 and Table 4.8-2. These subsistence related mitigation measures include: location of facilities to avoid sensitive wildlife habitats and sensitive fish habitats and/or schedule activities and/or use special designs to prevent undue and unnecessary effects; avoid wildlife harrassment; prohibit TAGS construction workers from hunting while domiciled at TAGS construction camps; keeping new access open only when needed for operation and maintenance of TAGS or for other uses of public lands; blocking public access on all temporary construction access construction roads for TAGS, and; give priority to employment of Alaskan residents in addition to equal opportunity hiring.

It, therefore, is the determination of this report that after considering all alternatives, subsistence evaluations, public hearings on the DEIS and public hearings at Glenallen, Stevens Village and Coldfoot on subsistence, that under a worst case analysis a significant restriction of subsistence uses is necessary, consistent with sound management principles for the utilization of this land, and that the proposed TAGS project will involve the minimal amount of public land necessary to construct and to operate TAGS. Finally, reasonable steps have and will be taken to minimize the adverse impacts upon subsistence uses and resources arising from this action.

APPENDIX N

PRESIDENTIAL FINDING CONCERNING ALASKA NATURAL GAS

Federal Register
Vol. 53, No. 10
Friday, January 15, 1988

Presidential Documents

Title 3—

The President

Presidential Finding of January 12, 1988

Presidential Finding Concerning Alaska Natural Gas

This Administration has been dedicated to encouraging free trade and to removing regulatory impediments that inhibit the development of our Nation's natural resources. Proven natural gas reserves in the Prudhoe Bay area of Alaska's North Slope represent approximately 15 percent of total U.S. gas reserves. In addition, undiscovered, recoverable supplies of natural gas from Alaska's North Slope may exceed 100 trillion cubic feet. There can be no doubt the development of Alaskan oil has played an important role in ensuring adequate energy supplies at reasonable prices for American consumers. I believe efficient development of Alaska natural gas will provide similar benefits. Leaving this resource undeveloped benefits no one.

Efficient development of Alaska natural gas on the basis of market financing could encompass the export of some of this gas to other countries. Because world energy markets are interrelated, our Nation will benefit from an enlarged international gas supply. Production of Alaska reserves will increase the amount of secure energy sources available at market prices and, thus, displace less secure or more expensive energy sources, including oil from the Persian Gulf.

Before Alaska natural gas can be exported to nations other than Canada or Mexico, Section 12 of the Alaska Natural Gas Transportation Act (15 U.S.C. 719j) requires me to find exportation "will not diminish the total quantity or quality nor increase the total price of energy available to the United States." In order to make this finding, it has been necessary to assess the relationship of Alaska natural gas to the U.S. energy market.

There exist adequate, secure, reasonably priced supplies of natural gas to meet the demand of American consumers for the foreseeable future. This demand can be met by lower-48 production and already-approved Canadian imports. If necessary, this demand also can be met at lower delivered energy cost by coal, oil, imported liquified natural gas (LNG), natural gas from Mexico, and other energy sources.

Given these facts, exports of Alaska natural gas would represent a judgment by the market that the energy demands of American consumers can be met adequately from other sources at comparable or lower prices. Exports of Alaska natural gas would not diminish the total quantity or quality of energy available to U.S. consumers because world energy resources would be increased and other more efficient supplies would thus be available. Finally, exports would not increase the price of energy available to consumers since increased availability of secure energy sources tends to stabilize or lower energy prices.

Accordingly, I find that exports of Alaska natural gas in quantities in excess of 1,000 Mcf per day will not diminish the total quantity or quality nor increase the total price of energy available to the United States.

This finding removes the Section 12 regulatory impediment to Alaskan natural gas exports in a manner that allows any private party to develop this resource and sets up competition for this purpose. It is my belief that removal of this impediment to private sector development of Alaska's vast natural gas resources, using private sector resources with no government subsidy, will benefit our entire Nation.

This finding represents a determination that the effects of exports of Alaska natural gas on American consumers would comply with the market criteria of Section 12 in the context of current and projected future energy markets and that such exports would be consistent with our comprehensive energy policy. It does not assess the merits or feasibility of a particular project, but rather lets the marketplace undertake a realistic consideration of various options concerning Alaska natural gas. The operation of market forces is the best guarantee that Alaska natural gas will be developed efficiently and that there is an incentive to find additional reserves.

I do not believe this finding should hinder completion of the Alaska Natural Gas Transportation System (ANGTS). This Administration supports the timely, economic development of Alaskan natural resources. To this end the Administration has removed all regulatory barriers to the private sector's expeditious completion of this project. In particular, I want to reaffirm our support for the special regulatory treatment of the "prebuild" portion of ANGTS, including the minimum revenue stream guarantees.

This finding shall be published in the **Federal Register**.

Ronald Reagan

THE WHITE HOUSE,
Washington, January 12, 1988.

[FR Doc. 88-888
Filed 1-13-88; 2:38 pm]
Billing code 3195-01-M

A P P E N D I X O

SUPPLEMENTAL REPORT
SEISMIC CONSIDERATIONS

Supplemental Report
Seismic Considerations
Proposed LNG Plant & Marine Terminal
Anderson Bay, Port Valdez
Alaska
February 16, 1988

Preliminary studies were performed by Dames & Moore to show that the seismic requirements are not such that they can be considered a "fatal flaw" in terms of the siting criteria in Section 193.2061 (f)(1) The Code of Federal Regulations Title 49, Subchapter D, Part 193 (49 CFR 193) the Pipeline Safety Regulations prepared by the Department of Transportation which prescribes Federal Pipeline Safety Standards for natural gas facilities. The ground motions obtained from this preliminary study are considerably below the limiting peak acceleration value of 0.8g contained in the regulations. It should also be emphasized that this study has been completed on the understanding that more comprehensive studies which will include the development of uniform risk response spectra will be undertaken during the design phase of the project.

It was noted that the magnitude used to develop the curves presented in Figure 1 of the Dames & Moore December 3, 1986 report was not given. The omission was deliberate. The report text described the curves as being representative of "a maximum event occurring in the Valdez area" and compared the curves with instrumental data obtained during the subduction zone earthquakes off the Chilean and Mexican coasts.

Describing an earthquake by using a magnitude scale is a relatively straight forward process. Unfortunately, there are many different magnitude scales and all the magnitude scales which are based on instrumental measurements are unable to correctly measure the size of large earthquakes. Large earthquakes reach limiting readings on the instruments used to compute magnitude. This limit is a seismological effect and is not a limitation of the instrumental ability to record larger values. It is believed, for example, that local magnitude M_l and surface wave magnitude M_s, the two most widely used scales in the Western United States, saturate at approximately 7.4 and 8.4, respectively. Only the moment magnitude M_w, which may also be shown by a heavy strike **M**, proposed by Hanks and Kanamori 1979), which is computed from the seismic moment instead of from a peak seismographic reading, does not reach a limit. A comparison of magnitude scales and their limiting values compared with moment magnitude **M** shown in the figure below which was first prepared by Heaton, et al (1982).

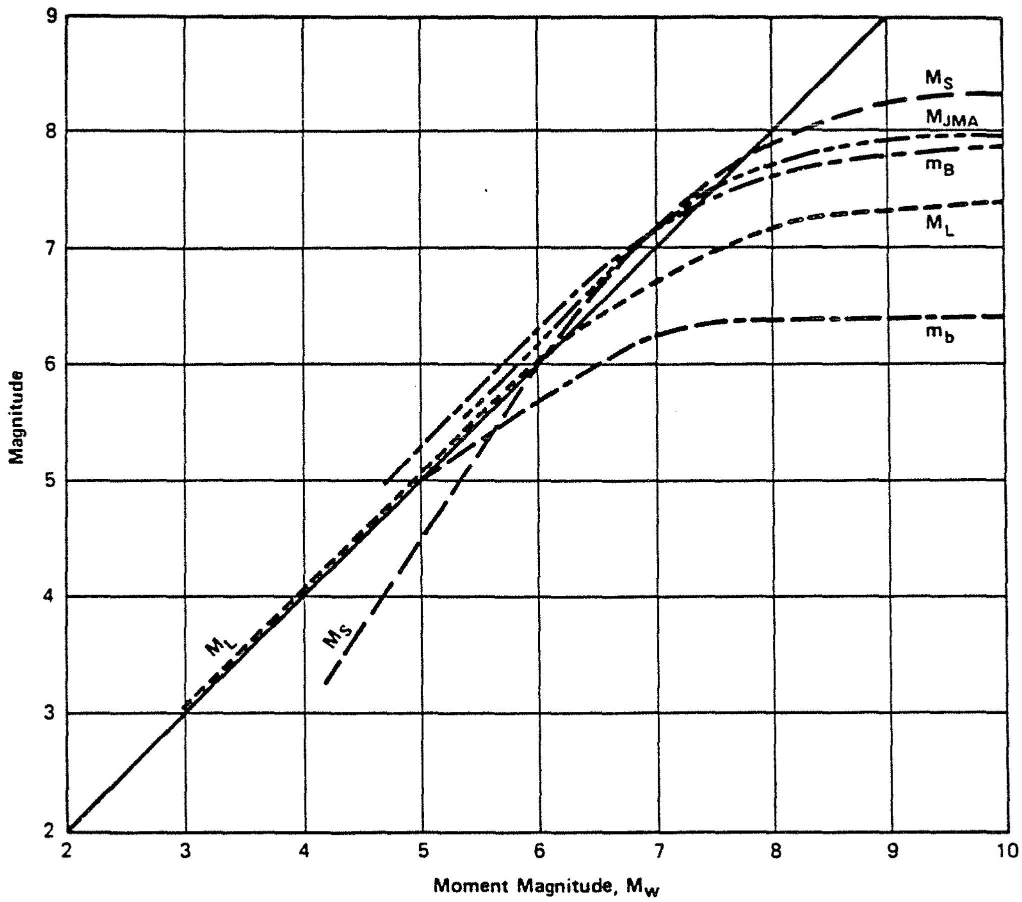


Fig. 12 Relation Between Moment Magnitude and Various Magnitude Scales: M_L (local), M_s (surface wave), m_b (short-period body wave), m_B (long-period body wave), and M_{JMA} (Japan Meteorological Agency) (From Heaton et al, 1982)

For the 1964 Prince William Sound Earthquake the moment magnitude, which more correctly estimates the total energy release in an earthquake gives a moment magnitude **M** of 9.2.

The limiting motion level which controls the maximum magnitude value has a direct corollary in the estimation of ground shaking levels as the ground shaking levels also reach limiting maximum values. In a great earthquake several hundreds of kilometers of fault must rupture with the results that much of the motion reaching any site will be attenuated over large distances. The major difference between ground motions anticipated close to the rupture surface in great earthquakes compared to somewhat smaller large earthquakes will no be differences in peak motion values but in longer durations and response spectra which contain more long frequency motion. Local magnitude values are computed for motions with a period of about 0.8 seconds, motion of significance to engineered structures, rather than long periods for such scales as Ms. Jennings and Kanamori (1979) have demonstrated that local magnitudes can be computed from strong motion records and that saturation does occur. In applying their attenuation equations at large magnitudes Joyner & Fumal (1985) recognize the onset of saturation and note the following, "For magnitudes greater than 7.7, we use the values computed from the predictive equations for a magnitude of 7.7." In developing their attenuation equations Kawashima et al (1986) used a very biased data set. Figure 1 of their paper, reproduced below, shows a complete absence of data from large magnitude earthquakes at small distances and no data for magnitudes greater than 8.0. Indeed, no data for events larger than 7.9 appear in the data set used by Kawashima, et al because saturation magnitude value has been reached. It is therefore, not appropriate to extrapolate the magnitude value used with the Kawashima, et al equations beyond the saturation value of 7.9.

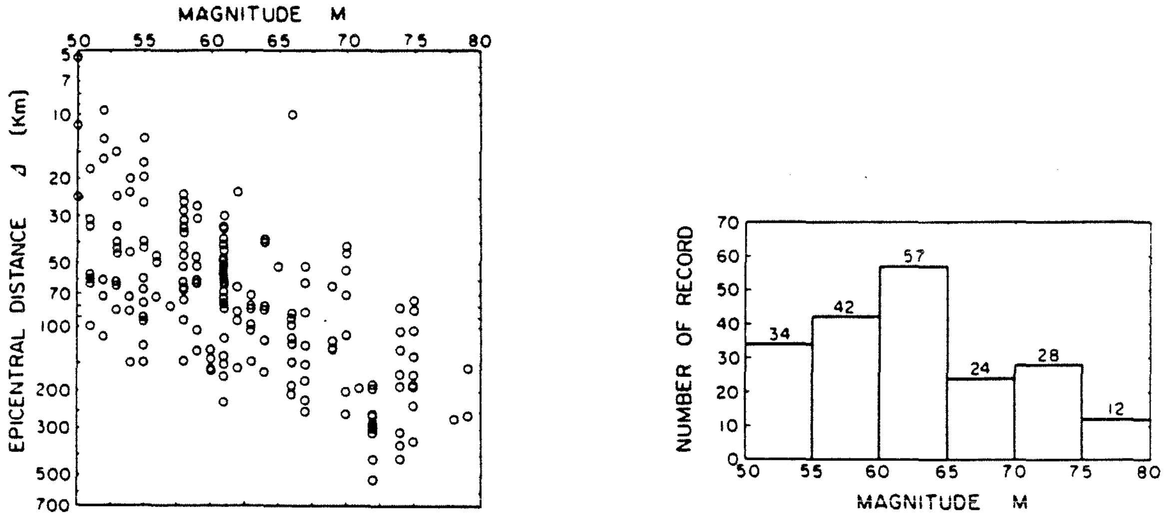


Figure 1. Classification of records in terms of earthquake magnitude and epicentral distance

The curves based on the Kawashima equation shown on Figure 1 of the earlier Dames & Moore report were computed using the limiting moment magnitude **M** value for attenuation equations of 7.7 suggested by Joyner & Fumal and an epicentral distance of 20 kilometers. If the limiting JMA magnitude of 7.9 is substituted into the Kawashima equation for peak acceleration with a 20 kilometer distance the acceleration value obtained is 0.44g. The peak acceleration value obtained in the depth to the Benioff Wadati zone is assumed to be 30 kilometers is 0.35g. We believe therefore that the curves shown on Figure 1 are an appropriate preliminary representation of the ground motions for the maximum event.

The value used for the maximum magnitude has only a small impact on the peak acceleration value obtained from a probabilistic hazard study. Because event sizes are distributed exponentially the probability of a large event occurring is quite small compared to the probability of a moderate sized event with the result that the choice of the upper cut off magnitude level is not a critical part of a probabilistic study. By contrast the maximum event used for a deterministic estimate of ground motion may be critical if the earthquake is in a zone of moderate seismicity. In areas of high seismicity the saturation of the ground motion at magnitude levels that can be as large as the maximum event on the Benioff Wadati Zone in Alaska the choice of the actual size is moot. We believe the motions we have recommended are equivalent to what would occur in Port Valdez should there be repetition of the 1964 Prince William Sound Earthquake, an event with a moment magnitude larger than 9.

Response spectra for the site were not prepared for the preliminary seismicity study. It is intended that appropriate design response spectra will be a part of the detailed study performed prior to design. Recent publications have included attenuation equations for direct estimation of the spectral amplitudes. Several of these will be used in the later work. Two sets of attenuation equations are attached to this report supplement for information and their ability to illustrate points made above. It was noted that spectral values are much more sensitive to magnitude variation than peak ground motion values and that this sensitivity increases with structural response period. This can be readily seen from the increasing values of c1 with increasing period on Table A-1 and for a similar increase in the value of coefficient b on Table A-2. In their respective equations these coefficients represent the effect of magnitude.

The attached list of references and tables complete this report.

Respectfully submitted,

DAMES & MOORE

Neville C. Donovan
Partner, (Ltd.)

NCD:jam

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November 17, 1987

TABLE A-1

Joyner & Fumal Spectral Attenuation Equations
(rock site)

$$\log y = c_0 + c_1(M_0-6) + c_2(M_0-6)^2 + c_3 \log r + c_4 r$$

$$\text{where } r = (d^2 + h^2)^{1/2}$$

period secs	c_0	c_1	c_2	h	c_3	c_4	sigma
0.1	0.97	0.25	−0.06	11.3	−1.0	−0.0073	0.64
0.15	1.03	0.30	−0.08	10.8	−1.0	−0.0067	0.64
0.2	0.97	0.35	−0.09	9.6	−1.0	−0.0063	0.64
0.3	0.80	0.42	−0.11	6.9	−1.0	−0.0058	0.64
0.4	0.64	0.47	−0.13	5.7	−1.0	−0.0054	0.71
0.5	0.52	0.52	−0.14	5.1	−1.0	−0.0051	0.76
0.75	0.27	0.60	−0.16	4.8	−1.0	−0.0045	0.76
1.0	0.09	0.67	−0.17	4.7	−1.0	−0.0039	0.76
1.5	−0.18	0.74	−0.19	4.7	−1.0	−0.0026	0.76
2.0	−0.37	0.79	−0.20	4.7	−1.0	−0.0015	0.76
3.0	−0.65	0.85	−0.22	4.7	−0.98	0.0	0.76
4.0	−0.84	0.88	−0.24	4.7	−0.95	0.0	0.76
peak acceleration							
	0.43	0.23	0.0	8.0	−1.0	−0.0027	0.64
peak velocity							
	2.09	0.49	0.0	4.0	−1.0	−0.0026	0.76

y is either
peak spectral acceleration or peak acceleration in g
or peak velocity in cm/sec

standard deviation sigma are natural logarithmic values

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TABLE A-2

KAWASHIMA Spectral Attenuation Equations
(3 soil profile groups †)

$$y = a\ 10.0^{bM}\ (D+30)^{c}$$

where D is epicentral distance in kilometres
and M is JMA magnitude

	Ground Group 1			Ground Group 2			Ground Group 3		
period secs	a	b	σ	a	b	σ	a	b	σ
0.10	2420.	0.211	0.262	848.0	0.262	0.256	1307.	0.208	0.219
0.15	2407.	0.216	0.229	629.1	0.288	0.244	948.2	0.238	0.218
0.20	1269.	0.247	0.226	466.0	0.315	0.273	1128.	0.228	0.211
0.30	574.8	0.273	0.241	266.8	0.345	0.270	1263.	0.224	0.217
0.50	211.8	0.299	0.278	102.2	0.388	0.249	580.6	0.281	0.240
0.70	102.5	0.317	0.239	34.34	0.440	0.245	65.67	0.421	0.243
1.0	40.10	0.344	0.273	5.04	0.548	0.305	7.41	0.541	0.307
1.5	7.12	0.432	0.254	0.719	0.630	0.288	0.803	0.647	0.305
2.0	5.28	0.417	0.267	0.347	0.644	0.264	0.351	0.666	0.276
3.0	1.67	0.462	0.249	0.361	0.586	0.248	0.262	0.635	0.263
peak acceleration	987.4	0.216	0.216	232.5	0.313	0.224	403.8	0.265	0.197
peak velocity	20.8	0.263	0.236	2.81	0.430	0.239	5.11	0.404	0.243

c = −1.218 for peak acceleration
= −1.222 for peak velocity
= −1.178 for all spectral periods

peak spectral acceleration and peak acceleration in cm/sec^2
peak velocity in cm/sec
standard error σ values are logarithmic values to base 10
† see Table A5a for detailed soil profile type descriptions

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TABLE A-3

Classification of Ground Conditions for
KAWASHIMA Spectral Attenuation Equations

Soil Condition by Kawashima	highway bridges †	Geological Description	Site Natural Period
Group 1	Group 1	Tertiary or older rock (defined as bed-rock), or diluvium with $H<10m$	$T_G<0.2s$
Group 2	Group 2	Diluvium with $H\geq10m$, or alluvium with $H<10$ m.	$0.2<T_G<0.4s$
	Group 3	Alluvium with $H<25m$ including soft layer with thickness less than 5 m.	$0.4<T_G<0.6s$
Group 3	Group 4	Other than the above, usually alluvium or reclaimed land	$T_G>0.6s$

† Highway Bridge site classification adopted in Japan in "Earthquake Design Specifications of Highway Bridges" (1975).

APPENDIX P

COMPRESSOR STATION LOCATION DISCUSSION

APPENDIX P

COMPRESSOR STATION LOCATION DISCUSSION

Criteria for compressor station location include system hydraulics, environmental conditions, hydrologic conditions, and site access. The site selection process for each compressor station began with system hydraulic analysis to determine optimum locations for compression. Once the optimum site location was determined, the suitability of geotechnical, hydrologic, topographic, and environmental conditions at each site was analyzed. If unsuitable conditions existed, alternate sites near the optimum milepost location were screened until an acceptable site was located.

Identification of optimum compression sites is critical since gas travelling through a pipeline loses pressure and drops in temperature over distance. Decreasing distance between stations from the optimum leads to inefficiency, and if done regularly would lead to a design requiring more compressor stations--thus greater environmental impacts. Increasing distance between stations leads to greater pressure and temperature drops as well as decreased system reliability.

Based upon Japanese market demand, TAGS pipeline gas would be of relatively high BTU-value requiring dense-phase operations. If excessive pressure drops are allowed, components of the gas would condense and cause liquid formation and operational difficulties. The system must be designed to allow dense phase gas operation through anticipated and unanticipated maintenance and shutdowns. Compressed natural gas characteristically has greater unit pressure loss at low pressures than at high pressures, thereby increasing the sensitivity of operations to greater station spacing.

Compressor Station (CS) #1 is located at Milepost (M.P.) 66.5 of the TAGS alignment. While the optimum location for CS #1 was determined to be at M.P. 65.9, the site has been located at 0.6 miles south of optimum due to geotechnical conditions. This area is characterized by upland silt soil conditions with organic-rich zones and massive ice underlain by sedimentary bedrock. Site specific investigation confirmed that the selected CS #1 location has exposed bedrock, suggesting conditions suitable for station foundations. Similar bedrock conditions are not expected north of M.P. 66.5. Locating CS #1 further north would require longer permanent access roads. South of M.P. 66.5, the thickness of fine-grained surficial silt soils is expected to increase, and could be ice-rich in character. There is no indication of shallow bedrock conditions on the TAGS route for many miles south of M.P. 66.5.

The planned access road to CS #1 extends less than one mile from the Dalton Highway. Because of Peregrine falcon nesting along Sagwon Bluffs, the station has been located west of the Dalton Highway and one mile from Sagwon Bluffs.

Compressor Station #2 is located at M.P. 125.6 on a ridge adjacent to the Dalton Highway. Optimum location for CS #2 was determined to be at M.P. 125.1, 0.5 mile north of optimum. The topographically attractive ridge site with existing access from the Dalton Highway, made the 0.5 mile compromise from optimum acceptable.

Compressor Station #3 is located at M.P. 213.7 on the east side of the Dalton Highway near Linda Creek. It is located near an existing large gravel site used for TAPS and Dalton Highway purposes. The general area also is included within several placer gold mining claims. Optimum location for CS #3 was determined to be at M.P. 209.5 approxiately 2 miles south of Sukakpak Mountain. The Linda Creek area is the nearest location to optimum where acceptable topographic and geotechnical conditions are expected to exist. Glacial till soils are expected to be underlain by bedrock at this location. With the exception of the Sukakpak Mountain area, soil conditions north of M.P. 209.5 are expected to be fine-grained, ice-rich and not thaw-stable. Further to the north, the Dietrich River valley is not considered suitable for a station due to the potential for aufeis, flooding, absence of competent bedrock, and the possibilty of massive ice even in the active floodplain.

Compressor Station #4 is located at M.P. 280.9, very near the optimum location determined at M.P. 281.0. Igneous bedrock with some surficial weathering occurs at this site. Preliminary evaluation indicates that the environmental, topographic, geotechnical, and hydrologic conditions are acceptable at this site. Approximately 0.5 mile of new access road would have to be constructed for this site.

Compression Station #5 is located at M.P. 357.0, approximately 8 miles southeast of the existing Yukon River bridge. The optimum location was underlain by thick, frozen nonthaw-stable silts. The current site is 1.3 miles north of an optimum location on generally unfrozen upland silt soils underlain by igneous bedrock. The current site is located near an existing material site and would require approximately 0.5 mile of new access road construction. Preliminary evaluation indicates that the environmental, geotechnical, and hydrologic conditions at this site are acceptable. The selected site takes advantage of good topographic conditions.

Compressor Station #6 is located at M.P. 422.0, approximately 0.6 miles north of optimum at a previously disturbed area between TAPS and the Elliott Highway. Surface silt soils have been removed, and metamorphic bedrock site conditions are anticipated. No new access road construction would be required at this site. No environmental conflicts have been identified at this site. Siting of CS #6 was located 0.6 mile from optimum in order to use this favorable topographic and previously disturbed site meeting design criteria.

Compressor Station #7 is located at M.P. 486.4, approximately 1.5 miles north of the Salcha River along the TAGS alignment. This station has been sited more than 15 miles north of the optimum site at M.P. 502. The proposed CS #7 site was selected because of its location north of the Salcha River, allowing access from the existing Johnson Road. The site was located as the most favorable location with acceptable geotechnical conditions the furthest south of Johnson Road, yet north of the Salcha River. This station site maintains a distance of 1.5 miles from the Salcha River at its nearest point of encroachment. The site is approximately 8 miles east of the Richardson Highway and 5 miles southeast of TAPS Pump Station #8.

Construction of approximately 5 miles of access road would be required from Johnson Road. Selection of this site avoids permanent all-weather compressor station access into the area between the Salcha River and Shaw Creek Flats. In addition to adverse environmental effects, access road construction into the area between the Salcha River and Shaw Creek Flats would require a long access road. Although a significant compromise in system hydraulics, siting of CS #7 over 15 miles north of optimum has been justified for environmental and constructability reasons.

Siting alternatives south of M.P. 502.0 were rejected as no acceptable site could be identified even as far south as the Rosa Creek area (M.P. 511.0). Locations beyond Shaw Creek were rejected because of excessive station spacing between CS #6 and CS #7.

Compressor Station #8 is located at M.P. 562.3 of the TAGS alignment. Approximately 0.7 mile north of optimum, the site is located on an abandoned gravelly terrace adjacent to Ruby Creek. The site location was compromised slightly from optimum to take advantage of attractive topographic, geotechnical, and hydrologic conditions. No environmental conditions have been identified that would require site relocation. Less than a mile of new access road construction would be required at this site.

Compressor Station #9 is located at M.P. 639.2 of the TAGS alignment. Approximately 20 miles south of optimum, the site takes advantage of the only significant bedrock exposure between Paxson and Glennallen. The site is proximate to an existing intensively-used material site on Hogan Hill used by the state for highway maintenance and for TAPS. Due to the potentially high frost heave conditions within the Copper River Basin area, the site further south allows higher operating temperatures in the Tonsina area. For construction and long-term operating reasons, the approximate 20 mile compromise from optimum is acceptable. Other sites south of Hogan Hill provide inferior fine-grained, highly frost susceptible foundation conditions. Locations north of Hogan Hill with bedrock conditions would be considered during the detailed design phase if the current site proves to be environmentally unacceptable.

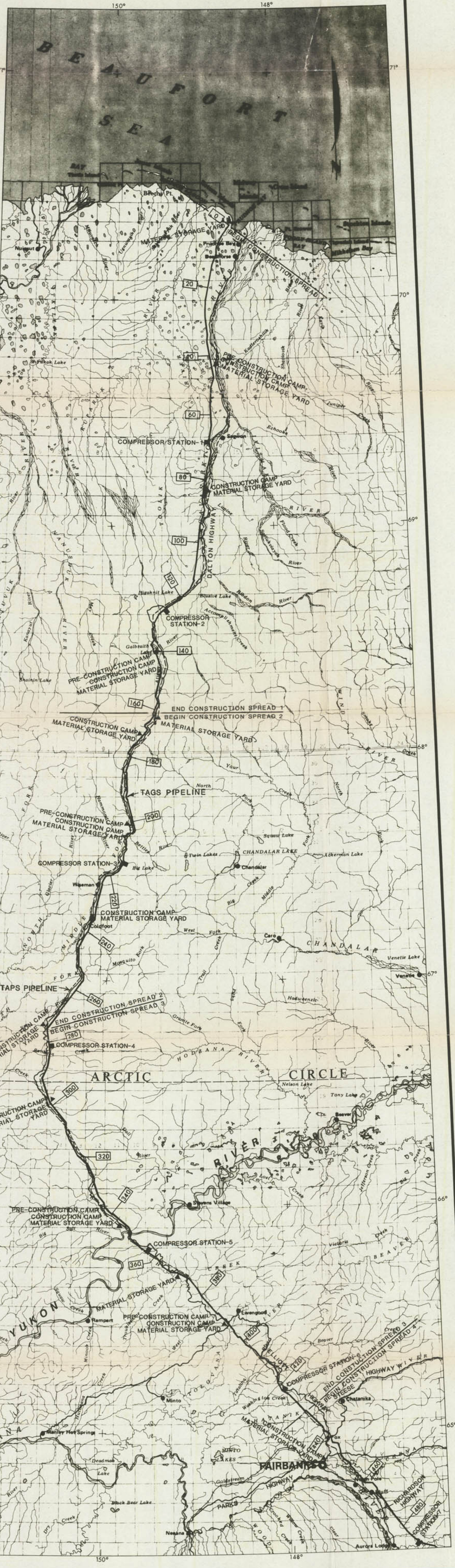
Compressor Station #10 is located at M.P. 720.5. This site is the southernmost location with acceptable geotechnical conditions near the southern limit of permafrost, allowing the transition from cold to warm gas operating temperatures.

The selected site is the previously disturbed TAPS Tonsina Camp. This site is expected to be thawed after over 14 years of thermal disturbance. As an alternate, a previous material site at approximately M.P. 715 was rejected because of its location between and at the confluence of the Tonsina and Little Tonsina Rivers. Other sites in the area were rejected because development would require new disturbance.

The selected site has acceptable topographic, geotechnical, and hydrologic conditions. During detailed design, specific measures will be developed to assure that site drainage does not adversely affect the Little Tonsina River. No new site access will be required.

Where required to prevent degradation of soil permafrost conditions, pipeline gas would be chilled to remove the heat of compression. Based upon preliminary evaluation, without site-specific geotechnical data, the TAGS project has assumed a requirement of refrigeration capability at Compressor Stations #1 through #8. Actual determination of the single point of chilled to warm gas operation will be accomplished during detailed design phases of the project. Thus, no concrete determination has been made on Compressor Station #9.

Where refrigeration capability is required, a closed loop, external refrigerant gas would be used to chill pipeline gas immediately after compression. The major refrigeration system components would include a compressor, condensers, and natural gas heat exchangers.



PROPOSED TAGS PIPELINE
EXISTING TAPS PIPELINE
200 TAGS MILEPOST
COMPRESSOR STATIONS
TEMPORARY FACILITIES

LEGEND

SCALE 1:1,000,000

0 10 20 30 40

MILES

ALIGNMENT MAP 1
PRUDHOE BAY to FAIRBANKS

JUNE, 1988

PROPOSED TAGS PIPELINE
ALTERNATIVE TAGS PIPELINE
EXISTING TAPS PIPELINE
200 TAGS MILEPOST
COMPRESSOR STATIONS
TEMPORARY FACILITIES

LEGEND

SCALE 1:1,000,000

0 10 20 30 40

MILES

ALIGNMENT MAP 2
FAIRBANKS to ANDERSON BAY

JUNE, 1988

PROPOSED TAGS PIPELIE
ALTERNATIVE TAGS PIPELINE
EXISTING TAPS PIPELINE
200 TAGS MILEPOST
COMPRESSOR STATIONS
ALTERNATIVE COMPRESSIR STATIONS
TEMPORARY FACILITIES

LEGEND

SCALE 1:1,000,000

0 10 20 30 40

MILES

ALIGNMENT MAP 3
COOK INLET –
BOULDER POINT ALTERNATIVE

JUNE, 1988