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ALASKA POWER AUTHORITY

SUSITNA HYDROELECTRIC PROJECT

VOLUME II

REVISED DRAFT - PLAN OF STUDY

JANUARY 1930



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A.5.8 - TASK 7: ENVIRONMENTAL STUDIES

(i) Task Objectives

The environmental program is designed to evaluate primarily the Susitna Hydroelectric Project and associated facilities, with respect to environmental impacts. To accomplish this, a comprehensive program of studies has been developed in the following disciplines: socioeconomics, archaeological and historical resources, geology, land use and recreation, water resources, fish ecology, wildlife ecology and plant ecology. Access roads, site facilities and transmission corridors will also be studied for environmental compatibility.

The overall objective of the environmental studies is to describe the existing environmental conditions, evaluate alternatives in light of the existing conditions and, for the selected alternatives, predict future conditions with and without the proposed project so that changes (impacts) caused by the project may be assessed. To accomplish this overall objective, the following activities will be completed by the environmental study team:

- (a) Assist the design team in selecting the best alternatives for power generation, access road and site facility locations and power transmission corridor based on the environmental impact of the proposed facility.
- (b) Prepare the exhibits required to support the FERC license application.
- (c) Prepare amendments to the Corps of Engineers' approved EIS for the Susitna Project responding to and eliminating areas of concern or shortcoming in the EIS, in a format appropriate for the current studies.
- c* (d) Respond to intervenors' petitions, inquiries from local, state and Federal agencies, and public participants at the request of APA.
- a* (e) Assist APA in obtaining Water Quality Certification.
- e* (f) Respond to other environmental needs of APA or the project engineering team as they occur throughout the study.
- f* (g) Supervise and coordinate both the field and office activities of all the environmental consultants including liaison with ADF&G as authorized by APA.
- g* (h) Monitor all field activities for environmental acceptability.

During preparation of the FERC license application, intensive baseline and impact-related investigations will be performed with the work progressing from general to specific in a timely manner as the project definition is developed. Because of the magnitude of the proposed action, the life cycle of some of the resources to be studied and the time required to evaluate alternatives and develop design specifications, environmental studies will be required beyond the time of license application. Thus, one objective of the early studies is to initiate baseline studies and to develop detailed plans of study for the further environmental impact analysis that will be completed after the license application submission, but prior to a final FERC decision on the license application.

This approach will allow for a refinement of the environmental program at approximately the midpoint of its duration. It will also minimize unproductive expenditures in the event that the project is determined to be infeasible or a new scheme is proposed as the primary alternative. For the purposes of the environmental plan of study, a two-dam scheme (Watana and Devil Canyon) in the Upper Susitna Basin was assumed to be the best alternative, and studies will commence accordingly. If a different scheme is selected as the primary alternative, the program will need to be restructured and costs and schedule adjusted accordingly.

(ii) Task Output

The Alaska Power Authority will be provided with quarterly progress reports describing in summary the activities, results, and conclusions of the studies in progress or to be performed. Annual reports describing in detail the results and conclusions will be prepared. The annual reports will be used to prepare the environmental exhibit (Exhibit E) for the FERC license application. The pre-license application program is based upon an understanding that the forthcoming revision of FERC requirements (for Exhibit E) will demand less intensive environmental analysis at the license application stage than do the existing requirements for Exhibits W, R, S, and V.

Subsequent study outputs will include written testimony and responses to interrogatories. Oral testimony at public hearings will be provided as required. The results of the studies completed after license application submission, including refinement of the impact analysis, are anticipated to be presented in two annual supplementary environmental reports for submission to FERC.

At the request of the APA, environmental documents necessary to obtain approval of an ~~amended~~ EIS, Water Quality Certifications or other required permits will be prepared.

(iii) List of Subtasks

- Subtask 7.01 - Coordination of Environmental Studies
- Subtask 7.02 - Monitoring of Field Activities for Environmental Acceptability
- Subtask 7.03 - Evaluation of Alternatives
- Subtask 7.04 - Water Resources (Quality) Analysis
- Subtask 7.05 - Socioeconomic Analysis
- Subtask 7.06 - Cultural Resource Investigation
- Subtask 7.07 - Land Use Analysis
- Subtask 7.08 - Recreation Planning
- Subtask 7.09 - Susitna Transmission Corridor Assessment
- Subtask 7.10 - Fish Ecology Studies
- Subtask 7.11 - Wildlife Ecology Studies
- Subtask 7.12 - Plant Ecology Studies
- Subtask 7.13 - Geological Analysis
- Subtask 7.14 - Access Road Environmental Analysis
- Subtask 7.15 - Preparation of FERC License Application Exhibit

(iv) Subtask Scope Statements

The primary objective of Task 7 is described in Section A.5.8(i). The subtasks required to adequately respond to this objective are divided into activities undertaken prior to submission of the FERC license application, Subtasks 7.1 through 7.15, and those activities on which continuing work is to be performed after submission of the FERC license application, as described in Section A6.

Subtasks 7.1 through 7.14 may be further subdivided into:

- (a) Management and monitoring functions that continue throughout the project, Subtasks 7.1 and 7.2.
- (b) Those activities initiated and completed prior to license application submission, Subtasks 7.3, 7.4, 7.13 and 7.14.
- (c) Those activities for which baseline studies are largely completed and substantial impact analyses are initiated during the preparation of the license application, Subtasks 7.5 through 7.9. These subtasks are then completed after the license application is submitted to FERC.
- (d) The ecological studies that require extensive, long-term field programs, and that are planned and initiated during the early stages of the project, Subtasks 7.10 to 7.12. During this early time period, the primary effort is directed toward data collection and compilation with little detailed analysis being undertaken. The data collection is continued after the license application is submitted until the four or five years of data required to form an adequate base is accumulated. An intensive data analysis and impact assessment is then completed. It should be noted that sufficient data analysis will take place during the early time period to guide and follow-up baseline studies and insure that no gaps exist in the data base being compiled.

If any deficiencies in an original program plan are detected, the analysis performed during the early time period will be used to modify the plan and redirect the emphasis of the field studies as required.

Subtask 7.15 is the culmination of the early activities, i.e., preparation of Exhibit E of the license application.

The following discussions are summaries of the work to be completed during each of the environmental subtasks. More detailed descriptions of the pre-license application scope of work for some of the more complex environmental studies (Subtasks 7.05, 7.06, 7.07, 7.08, 7.10, 7.11 and 7.12) are also presented. A detailed description of the fish and wildlife studies to be performed by the Alaska Department of Fish and Game to complement Subtasks 7.10 and 7.11 is included in the appropriate subtask description.

Subtask 7.01 - Coordination of Environmental Studies

(a) Objective

The objectives of this subtask are:

- (1) to ensure that all environmental Plans of Study are executed in a coordinated, controlled manner in accordance both with the scopes of work and compliance schedules;
- (2) to coordinate the implementation of all discipline-specific environmental Plans of Study;
- (3) to maximize study effort and efficiency through organized inter-discipline coordination in accordance with the subtask responsibility statements;
- (4) to ensure that all project efforts are non-duplicative and cost-effective; and
- (5) to provide the Alaska Power Authority and third-party interests with a framework for communication on all environmental matters.

(b) Approach

Dr. John W. Hayden, Environmental Division Manager of Acres, and Mr. Jeffery O. Barnes, President of Terrestrial Environmental Specialists will provide management for all environmental studies conducted for the Susitna Project. Mr. Barnes will be responsible for obtaining the services of qualified subcontractors to perform the discipline-specific tasks necessary for the licensing of the project. As the prime contractor, Acres is solely responsible to APA for the cost, schedule and quality of all work; thus, subcontract agreement between TES and their subcontractors shall be submitted to Acres' Project Manager for final review and approval. TES will provide the day to day technical guidance of and coordination among their subcontractors to insure their compliance with both time schedules and cost estimates and to assure technical satisfaction of licensing requirements.

A preliminary environmental studies schedule appears in this Plan of Study. A detailed schedule of all environmental activities will be developed early in the study program. The final schedule will be coordinated with the engineering studies to ensure timely input from Tasks 1, 2, 3, 5, 8 and 12. The environmental studies schedule will identify the tasks to be accomplished, the length of time allocated for task accomplishment and project milestones. The finalized schedule will be submitted through Acres' Project Manager to APA for review, comment and approval.

Quality control procedures previously utilized by Acres and TES will be implemented to insure the uniformity and accuracy of data

collected in support of the environmental programs. These procedures will be established and put into effect at the outset of the study and will be rigorously followed throughout the course of study.

The division of responsibilities for the accomplishment of subtask objectives will also be clearly defined at project initiation. Technical, inter- and intra-discipline meetings will be held on a regular basis throughout the study effort to facilitate understanding of subtask duties. Meetings for the purpose of keeping engineering personnel, the APA, and third party interest groups abreast of environmental study activities and findings will also be held on a regularly scheduled basis.

(c) Discussion

Management and administration of the environmental studies will be accomplished through the formulation of a three-tiered management pyramid with the third (or lowest level) being the working level. At the top will be the Environmental Study Managers (ESM) consisting of Dr. Hayden and Mr. Barnes. Next in command will be the Environmental Study Directors (EPD) consisting of the Principal Director, Dr. Vincent J. Lucid, Director of Environmental Studies for TES and the Deputy Director, Ms. Cathie Baumgartner, Vice President of TES. Beneath them appear the Group Leaders for the environmental disciplines and/or the Principal Investigators.

Administration of environmental studies will be handled by the Environmental Study Managers. They will be responsible for insuring the successful completion and applicability of that portion of the FERC application pertaining to environmental matters. In conducting their duties and responsibilities, they will:

- (1) insure the fulfillment of contract requirements;
- (2) insure coordination with all technical aspects of the overall study;
- (3) conduct liaison with regulatory agencies and interested third parties;
- (4) recommend approval/disapproval on all project cost and/or work scope changes to Acres Project Manager;
- (5) keep the following personnel and agencies informed of pertinent decision and/or environmental activities:
 - Project Manager, Acres
 - Appropriate Engineering Group Leaders
 - Local, state and federal agencies, as designated by Acres Project Managers, (including APA, ADF&G, USFWS, BLM, ADNR, Corps and others).

- (6) provide monthly progress reports to Acres' Project Manager;
- (7) approve minor Project Work Scope adjustments with an information copy to Acres' Project Manager; and
- (8) review, approve, and recommend release and distribution of reports to Acres' Project Manager.

The Environmental Study Managers will provide direction for the timely initiation of the environmental studies and other project activities on an as-needed rather than a day-to-day basis for maximum study schedule and cost efficiency.

Administration of all day-to-day project activities will be the responsibility of the Environmental Study Directors. Their responsibilities will include, but not be limited to:

- (1) developing comprehensive quality control procedures applicable in all phases of the environmental effort;
- (2) approving the initiation of all environmental sampling efforts;
- (3) providing problem resolution on an as-needed basis;
- (4) supervising expenditures and cost-accounting procedures and audit invoices;
- (5) providing design recommendations to the Acres' Project Manager, and
- (6) reviewing and approving all reports for internal action and transmit final copies to the ESM for appropriate disposition.

The management and administration of all technical programs will be the responsibility of the Environmental Study Directors. However, they may delegate this authority and responsibility to Group Leaders when appropriate. The Group Leaders' responsibilities include:

- (1) insure completeness and effectiveness of discipline-specific studies in meeting study objectives;
- (2) provide direction of and assistance with the initiation of all field sampling efforts;
- (3) maintain active supervision of project staff efforts on a day-to-day basis;
- (4) recommend approval/disapproval of adjustments to discipline-specific studies;
- (5) maintain a detailed status report of all discipline-specific studies to insure conformance with program objectives;

- (6) approve minor program/sampling procedure adjustments to make the program more compatible with existing conditions;
- (7) inform the ESD of program activities on a regularly scheduled basis;
- (8) provide design recommendations to ESD.

Principal Investigators (PI) will share some of the duties previously identified as Group Leader responsibilities, especially with respect to the conduct of the field sampling efforts. In addition, each PI will, as a minimum:

- (1) recommend modifications to cost and/or discipline-specific study efforts based upon sampling results; and
- (2) provide monthly progress and activity status reports either to the Group Leader or the ESD.

The proposed environmental Plan of Study is designed to meet the needs of the Susitna Project license application to FERC, and to ~~update the Corps EIS in a format appropriate for the current studies.~~ However, flexibility and judgement affecting study details should be reserved for the purpose of matching study efforts to an ever-changing public demand for environmental quality protection and to changing regulatory requirements and attitudes.

(d) Schedule

Weeks 1 - 130

Subtask 7.02 - Monitoring of Field Activities for
Environmental Acceptability

(a) Objective

To keep the environmental impact of surface-disturbing and all other field activities to a minimum.

(b) Approach

Surface-disturbing activities of any kind will be monitored by a field representative. This representative will also coordinate certain activities within the environmental discipline and may coordinate activities among groups to avoid conflicts. Of particular concern is the unintentional disturbance of an important archaeological or historical site or an environmentally sensitive area.

(c) Discussion

As the environmental, geotechnical and other study programs are implemented, a certain amount of field sampling and testing will be required. A field representative will be on hand to outline areas that are sensitive to disturbance and also to monitor surface-disturbing activity while it is occurring. This monitoring will ensure compliance with existing environmental regulations. In certain instances, mitigation measures will be recommended to reduce impacts.

The field representative will also have a certain amount of coordination responsibilities. This will include coordinating sampling locations of the various groups. Conflicts could arise, for example, if one group plans to clear an area for testing purposes, while another group is in the process of collecting biological data that would be affected by such clearing. Although conflicts may not always be avoidable, the field representative will be responsible for keeping track of present or proposed sampling programs and notifying groups when conflicts may occur.

(d) Schedule

Weeks 8 through 130

Subtask 7.03 - Evaluation of Alternatives

(a) Objective

To compare, from an environmental standpoint, the various alternatives for power generation and associated transmission facilities.

(b) Approach

The environmental evaluation of power development alternatives will identify the potential impact issues, and their relative magnitudes, associated with alternative developments. The engineering staff of Acres and WCC will identify and describe the alternatives, and the environmental staff of TES (hydroelectric alternatives) and WCC (non-hydro alternatives) will perform the environmental analysis on the basis of available data, which will be compiled for this purpose. Since the impact issues associated with the two-dam scheme for the Upper Susitna have already been identified, this scheme will be used as the yardstick against which other alternatives will be measured.

(c) Discussion

The evaluation of alternatives will be completed as part of Task 1 - Power Studies.

Subtask 7.04 - Water Resources Analysis

(a) Objective

The primary objective of the water resources analysis is to generate data that will be used to determine if the anadromous and resident fisheries in the Susitna River or Cook Inlet will be enhanced or adversely impacted by the proposed project. To achieve this objective the following study areas must be addressed:

- (1) Changes in river discharge characteristics due to flow regulation.
- (2) Changes in water quality due to impoundment, including sediment load, temperature, dissolved gas production, and chemical constituents.
- (3) Changes in wintering conditions along the river due to increased low flow during the winter and changes in ice conditions.

A secondary objective of the water resources analysis will be to assist in estimating the benefits to land use, recreation and flood prevention balanced against the inundation of approximately 50,000 acres above the two dams.

(b) Approach

Accurate baseline water quantity and quality data are essential for predicting the effect of the Susitna Project on the fisheries of the Susitna River and for assuring that construction, filling and operation of the hydroelectric project can be accomplished while achieving possible beneficial environmental effects.

The water quantity and quality information needed will be taken from the engineering studies, particularly Task 3 - Hydrology, from the fisheries study, and from the water quality studies and geological studies to be done by R&M as part of Task 3 and Task 5 - Geotechnical Exploration.

(c) Discussion

Water quality conditions will be affected above and below the dam sites. Stratification conditions within the reservoirs could cause temperature and dissolved gas problems within the reservoir and downstream. The supersaturation of nitrogen and other atmospheric gases could cause gas bubble disease in the downstream fishery. Previously unknown outcrops of soluble metal compounds could be inundated by the reservoirs causing problems to the resident or developing fish populations. Flow characteristics that are essential for upstream migration of salmon to the spawning grounds and for proper conditions for overwintering of both salmon and resident fisheries will be studied as part of Subtask 7.10.

Most of the technical data required will be available at the completion of Task 3 - Hydrology. However, to ensure that the correct data is collected in a format useful to this subtask, early coordination of the requirements of this subtask, with the lead personnel responsible for the field and office studies completed under Task 3, will be made. Information relative to parameters to be tested, frequency and location will be provided as input to the hydrologic and water quality field studies to be conducted by R&M. Data relative to sediment loads, dropout rates and resuspension, as well as streambed degradation downstream of Devil Canyon Dam will also be requested from the hydrological and geological studies group.

Finally, these data will be combined with input from the fisheries subtask (Subtask 7.10) to assess the impact of the Susitna Project on the fisheries. The data will also be used in Subtasks 7.07 and 7.08 relative to land use and recreational development analysis.

It is anticipated that all activities on this specific subtask will be completed before the FERC license application is submitted. However, final use of the data in other subtasks will not occur until after the license application has been submitted.

At the present time, no distinct water quality program is proposed for the time period after license application submission other than that to be conducted as part of the engineering studies and the in-situ measurements taken by ADF&G in conjunction with fish sampling. If early studies reveal a need for further water quality analysis, a program will be developed and proposed at that time.

(d) Schedule

Weeks 26 through 130

Subtask 7.05 - Socio-economic Analysis

(a) Objective

To identify and describe the existing socio-economic conditions and to determine which are most likely to be impacted by the Susitna Hydroelectric Project, as required under the Federal Energy Regulatory Commission regulations. Subsequent to the submission of the FERC license application, the detailed analysis and assessments of the socio-economic impacts related to the Susitna development will be completed.

(b) Approach

The completion of the socio-economic analysis is not a prerequisite to submission of the FERC license application. Thus, the work packages to be completed have been divided into those that are scheduled to be completed prior to application submission (1 to 4 below) and those work packages that may be completed during a later time period (discussed in Section A.6). The work packages to be completed are:

- (1) literature search
- (2) socio-economic profile development
- (3) preliminary socio-economic impact studies
- (4) forecast of future socio-economic conditions in the absence of the Susitna Project
- (5) forecast of future socio-economic conditions with the Susitna Project
- (6) identification and evaluation of significant socio-economic project impacts
- (7) assessment of economic aspects of important commercial, recreational and subsistence fish and wildlife resources without the project
- (8) determination and evaluation of project impacts on important commercial, recreational and subsistence fish and wildlife resources
- (9) assessment of social significance of the economic impacts of the project on important commercial, recreational and subsistence fish and wildlife resources

Impact studies of projects similar to the proposed project will be identified and evaluated in the first work package. Socio-economic profiles covering the immediate vicinity of the project, broader regions, and the state are developed in the second work package.

The socio-economic conditions most likely to be impacted by the Susitna Project are identified and described in depth. For the identified socio-economic conditions, forecasts of future conditions are made. These forecasts will serve as a baseline for the preliminary socio-economic impact studies as well as the detailed socio-economic impact assessments of project impacts to be completed in work package 6 during the post-license application studies.

In the post-license application studies, potential impacts of the project will be determined by comparing the forecast "with the project" to the baseline forecast. This analysis will yield quantitative estimates for impacts as well as qualitative descriptions of impacts.

(c) Discussion

Impact studies of hydroelectric projects similar to the proposed Susitna Project will be reviewed. These reviews will provide a range of impacts which may be expected to result from the proposed project.

Next, the following types of detailed socio-economic profiles will be developed for the local area and for the generalized area, where applicable:

- Population totals and distribution, current and projected;
- Housing stock, by type of unit and price/rent levels;
- Employment and income levels;
- Tax rates and revenues by type of jurisdiction;
- Public facilities, availability, adequacy, and cost;
- Land-use patterns and trends;
- Business activity, level, and trends;
- Education, enrollment trends, capacity, revenues, and costs;
- Transportation facilities, by type;
- Attitudes toward life style and quality of life;
- Attitudes toward growth.

These profiles will also include the range of impacts which may be expected in the Alaskan environment. The range of impacts for large hydroelectric projects combined with those in the Alaska environment will constitute a comprehensive list of potential impacts which may result from the proposed Susitna Project.

In the final work package to be completed before license application

submission, relevant socio-economic conditions are forecast. This forecast is made assuming the Susitna Project will not be undertaken. It includes only those areas which would be impacted by the Susitna Project.

(d) Schedule

Weeks 8 through 117.

(e) Detailed Scope of Work

Table 7.05-1 summarizes the proposed scope of work for Phase I of the study (pre-license application). The work packages mentioned above are divided into work items, and intermediate products resulting from several of these work items are identified.

Discussion in this subsection focuses upon work items from the Outline Summary of the Phase I Scope of Work (Table 7.05-1) which require further explanation. The work item approach and methods, and the relation among work items within a work package are the main topics developed. In addition to the four work packages described below for Phase I, the Phase I scope of work includes a refinement and documentation of the Phase II plan of study for inclusion in the FERC license application.

(1) Literature Review

a. Socio-economic impact studies for hydroelectric projects similar to the range of proposed projects for the Susitna vicinity will be identified. A consultant(s) with extensive familiarity with socio-economic studies will be provided with a data compilation format. The purpose of this format will be to acquire data concerning the consultant's past work in socio-economic impact analysis. In addition the consultant(s) will be relied upon to furnish suggestions regarding strategies for further identification of relevant studies.

Bibliographies and major entities such as the Army Corps of Engineers and the Alaska Department of Fish and Game will be consulted to identify further hydroelectric and related studies. It is anticipated that the major source of bibliographies will be those found in the studies initially identified.

b. All studies will be placed in a similar data format to facilitate extraction of impacts, by nature and degree. The format will be developed, studies will be reviewed, and the format will be implemented. Data particularly relevant to Alaska will be highlighted in the format.

c. General socio-economic conditions in the local area (immediate vicinity of the range of alternative dam sites), the region (the area surrounding the immediate dam-site vicinity, including Matanuska-Susitna Borough, and the Fairbanks/Tanana and Anchorage/Cook Inlet regions) and the State will be reviewed. This review will include:

- a review of current major assessments of Alaska demographic, social and economic conditions, by region;
- a review of literature pertaining to the Alaska social/cultural environment; and
- interviews with recognized authorities on Alaska economic and social conditions, including but not limited to:

Mr. Lawrence Kimball, Jr., Alaska Department of Community and Regional Affairs

Dr. David Kresge, Harvard University and The Institute of Social and Economic Research, University of Alaska

Dr. David Reaume, Alaska Department of Commerce and Economic Development

Mr. Bob Richards, National Bank of Alaska

Regional and local authorities including those of the Matanuska-Susitna Borough, will also be contacted. Finally, profiles of general socio-economic conditions will be developed with local, regional, and state geographic orientations.

d. The relevance of impacts, identified and characterized in work item 1b., for the State of Alaska will be assessed at local, regional, and state levels. This assessment will yield a list of impacts, by geographic area, type and degree, which may be relevant for the Susitna Project impact studies.

(2) Socio-economic Profile Development

The purpose of this work package is to develop detailed profiles of socio-economic conditions most likely to be impacted by a broad range of alternative hydroelectric projects and associated facilities. Attention is focused only on those conditions⁴ which are highly vulnerable.

a. Potential impacts peculiar to the local area, region and state will be determined. This list of impacts will be combined with those of work item 1d. to provide a complete list of potential impacts for the broad range of alternative projects.

b. Next, potential impacts on the list will be assessed for their relevance to the Susitna Project at the local, regional, and state levels. Some of the less relevant potential impacts will drop out; what will remain is a list of socio-economic conditions most likely to be impacted by the broad range of alternative projects.

4. Socio-economic condition will be described by social and economic variables. The range of variables considered for the impact analyses will include at the minimum the variables mentioned in Exhibit W, components 2.3, 3.1.3, 3.2.3, 5.1, and 7.3. Only those relevant for the Susitna Project will remain for treatment in subsequent tasks. Reasons for eliminating variables from the Exhibit W set will be elaborated.

c. Data collection guides will be developed to gather information necessary to support the production of detailed profiles of socio-economic conditions most likely to be impacted.

d. Data collection guides will be implemented; information will be gathered at local, regional, and state levels.

e. Information will be compiled in a format conducive to profile development.

f. Detailed profiles will be developed from the information presented in e. above and also from the general profiles developed in 1c.

(3) Preliminary Socio-economic Impact Studies

For hydroelectric alternatives to be evaluated in Subtask 7.03, potential socio-economic impact issues and their relative magnitudes will be identified in work item 2b. Other Susitna Project Team members will then provide a narrow range of alternative dam projects. It is anticipated that as few as one or two alternative projects will remain at this stage of the study. There will be substantial physical specification and other information made available on each alternative project by these team members, including transmission corridors and access road routes.

a. Socio-economic conditions most likely to be impacted will be identified for each alternative, by local area, region and state. Conditions that might be impacted include population, employment, business activity, land-use patterns, tourism, housing, taxes, and availability of government services (education, fire and police protection, transportation, etc.) and utilities. Extensive use will be made of the table developed in work item 2b. above (conditions most likely to be impacted by the broad range of alternative projects).

b. The nature and degree of potential impacts will be determined for each alternative by local area, region, and state. Potential impacts for each alternative will be shown in matrix form at local, regional, and state levels of geographic aggregation. To the extent physical and other information allow, an attempt will be made to show impacts by project phase.⁵ To arrive at potential impacts, the economic and social implication of each alternative will be determined quantitatively to the maximum extent possible. The nature and degree of potential impacts will also be determined by project phase to the extent physical and other information allow.

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5. Each alternative dam project has 4 phases:
- Testing
 - Conceptualization and Design
 - Construction
 - Operating

c. The impacts of alternative projects will be presented in matrix form by local area, region and state. This form of results presentation will be useful in screening the alternative projects for socio-economic considerations. In the accompanying text discussion, emphasis will be placed on preliminary evaluation of the impacts associated with the alternative selected.

d. After one of the alternative projects has been selected, and upon completion of work package 4 (below), the potential impacts of the selected alternative will be determined and evaluated in a preliminary manner. Anticipated deviations in the baseline forecast of economic and social conditions will be discussed. Such deviations will be further refined and elaborated in Phase II (post-license application studies).

(4) Forecast of Future Socio-economic Conditions in the Absence of the Susitna Project

a-f. Studies and methods for forecasting Alaska socio-economic conditions will be identified and investigated by interacting with knowledgeable public and private economists. A list of studies and forecasting approaches will be developed. Next the studies will be evaluated using, at the minimum, the following criteria:

- appropriate geographic disaggregation of results;
- appropriate methodology;
- appropriate conditions (variables) are forecast; and
- recency of study.

The chosen methodology(s) will be modified to be consistent with the criteria. The revised methodology(s) will be implemented to produce a baseline forecast of socio-economic conditions.

TABLE 7.05-1

OUTLINE SUMMARY OF THE SOCIO-ECONOMIC SCOPE OF WORK - PHASE I

WORK PACKAGE	WORK ITEM	PRODUCT
1. Literature review	a. Identify socio-economic impact studies for similar hydroelectric projects (include foreign studies)	1-a. List of socio-economic impact studies for similar hydroelectric projects
	b. Determine the nature and extent of studies' impacts	1-b. Table showing socio-economic impacts, by project, type, and degree
	c. Review general socio-economic conditions in the Local and Generalized areas ¹ , and State of Alaska	1-c. Draft profiles of socio-economic conditions, by Areas and State
	d. Assess relevance of studies' impacts for Local and Generalized areas, and for the State of Alaska	1-d. Partial list of potential Susitna Project impacts, by Areas and State
2. Socio-economic profile development	a. Identify potential impacts peculiar to the Local and Generalized areas, and the State	2-a. Table showing potential Susitna Project impacts, by Areas and State
	b. Determine conditions ² most likely to be impacted, by Areas and State	2-b. Table showing conditions most likely to be impacted, by Areas and State
	c. Develop data collection guides	
	d. Collect data and information on most vulnerable conditions at Area and State level	
	e. Compile data and information	

1. The Local Area is in the immediate vicinity of the Project while the generalized area includes the region surrounding the Local Area, including Matanuska-Susitna Borough, as well as the Fairbanks/Tanana and the Anchorage/Cook Inlet regions.

2. Conditions will be described by social and economic variables such as population, per capita income, employment, housing, taxes, government services, etc.

TABLE 7.05-1 (CONT. - 2)

WORK PACKAGE

WORK ITEM

PRODUCT

3. Preliminary socio-economic impact studies

f. Develop profiles of socio-economic conditions likely to be impacted, by Areas and State

2-f. Profiles of socio-economic conditions likely to be impacted, by Areas and State

a. Identify conditions most likely to be impacted, by alternative, and Areas and State

3-a. Table showing most vulnerable conditions by alternative, and Areas and State

b. Determine the nature and degree of potential impacts, by alternative, and Areas and State

c. Compare and contrast impacts of alternative projects, by alternative, Areas and State

3-c. Table showing nature and degree of impacts, by alternative, and Areas and State

d. Evaluate potential impacts of selected alternative (preliminary)

3-d. Text discussion supported by tables

4. Forecast of future socio-economic conditions in absence of Susitna Project

a. Identify studies which forecast socio-economic conditions in Alaska in the absence of significant hydroelectric power development

4-a. List of socio-economic conditions forecast studies

b. Select studies which have geographically disaggregated results for further consideration

4-b. List of socio-economic conditions forecast studies with significant geographical disaggregation

c. Develop and apply study methodology evaluation criteria

d. Select study(s) and study(s) results for adoption

4-d. Partial forecast of future socio-economic conditions in absence of Susitna Project

If at this stage of the study one of several alternative types of dam projects has been selected, then the work items of this work package will apply solely to the selected alternative.

TABLE 7.05-1 (CONT. - 3)

<u>WORK PACKAGE</u>	<u>WORK ITEM</u>	<u>PRODUCT</u>
or, if necessary	e. Revise study(s) methodology to allow for proper geographic disaggregation and/or new factors of change	
	f. Implement revised methodology	4-f. Forecast of future socio-economic conditions in absence of Susitna Project

Subtask 7.06 - Cultural Resource Investigation

(a) Objective

To identify the archeological and historical resources of the project study area and to propose mitigation measures to lessen the impact of ground-disturbing preconstruction and construction activities.

(b) Approach

The Cultural Resource Investigation is designed to fulfill the cultural resource obligation for both the licensing and construction phases of this project, through pre-license application (Phase I) and post-license application (Phase II) efforts.

Cultural resource experts at the University of Alaska Museum (Museum) will execute an intensive five-step research effort specifically tailored to satisfy both state and federal legislation pertinent to cultural resources. The five steps are:

- (1) preparation for field studies;
- (2) reconnaissance level archeological survey of project areas;
- (3) intensive testing of archeological and historic sites discovered during step (2) above;
- (4) final report preparation; and
- (5) curation of all collections in accordance with state and federal requirements pertinent to the preservation of antiquities.

(c) Discussion

As the Susitna Hydropower Project is a federally licensed project for the State of Alaska, the legal framework and authority for the consideration of cultural resources are spelled out in a number of federal and state regulations. As early as 1906 the Antiquities Act (P.L. 59-209) directs the preservation of cultural resources on public lands. The Historic Preservation Act of 1935 (P.L. 74-292) required the preservation of properties "of national historical or archeological significance and authorized interagency, intergovernmental, and interdisciplinary efforts for the preservation of such resources." The Reservoir Salvage Act of 1960 (P.L. 86-523) provides for the recovery and preservation of "historical and archeological data" that might be lost or destroyed as a result of the construction of federally funded or licensed dams, reservoirs, and attendant facilities and activities. This law was extensively amended in 1974. The Historic Preservation Act of 1966 (P.L. 89-655) declares it to be a national policy to preserve and protect historic and prehistoric sites, buildings, and objects of natural significance. Continuing with this policy the National Environmental Policy Act of 1969 (P.L. 91-180) requires evaluation of the effects of major federal actions on the environment including cultural resources. The Archeological and Historic Preservation Act of 1974 (P.L. 93-291) is an amendment to the Reservoir Salvage Act of 1960. The 1974 Act provides for the protection of historic and archeological sites

... which might otherwise be irreparably lost or destroyed as a result of (1) flooding the building of access roads, the erection of workman's communities, the relocation of railroads and highways, and other alterations of terrain, caused by the construction of a dam by any agency or (2) any alteration of the terrain caused as a result of any federal construction project or federally licensed activity or program. (Sec. 1).

Section 7 of the Act authorized that up to 1% of the total budget of a federally funded or licensed project may be allocated for archeological survey, recovery, analysis and publication. Executive Order 11593 directs all federal agencies to make an inventory of historic and pre-historic properties under their control and to nominate eligible properties to the National Register of Historic Places, and to give priority inventory to federally owned properties to be transferred and/or altered.

The Alaska Historic Preservation Act of 1975 reflects the same spirit concerning cultural resources as the above federal regulations. It is the general policy of the State of Alaska that before any construction of public improvement of any nature is undertaken by the state, by a governmental agency of the state, or by a private person under contract with or licensed by the state, that the cultural resources must be considered.

As described above, specific cultural resource preservation efforts are required by federal and state law to satisfy licensing requirements for the Susitna Hydropower Project. These tasks include at minimum: (1) Identification and documentation of cultural resources within project areas, (2) formulation and explication of recommendations for mitigation for each historic or archeological site identified. However, it is also recognized that the initial studies essential to meet licensing requirements may have direct impact on cultural resources which may pose immediate adverse effects. Examples of such activities are construction of camps to house study personnel, test holes to locate proposed borrow areas, access roads to study locales, etc.

Any proposal to identify cultural resources and make recommendations for preservation must be structured in such a fashion as to permit mitigation of potential damage to archeological and historic sites during the course of the impact study. If such mitigation procedures are not incorporated into the proposed action for historic preservation, needless delays and unnecessary additional costs will be inevitable. This has been repeatedly demonstrated in other large construction projects which have required the identification and mitigation of cultural resources for licensing. This Plan of Study foresees this need and provides methods by which these delays can be avoided. The proposed historic preservation efforts should be conceptually divided into (1) the effort necessary to obtain the license, (2) the effort necessary to mitigate possible adverse effects during the course of the study essential to obtain the license, and (3) effort necessary to mitigate damage to all historic and prehistoric sites that will be impacted by the construction.

(d) Schedule

Weeks 8 through 117.

(e) Detailed Scope of Work

(1) Synopsis

The University Museum will execute a five-step research effort specifically designed to satisfy both state and federal legislation pertinent to cultural resources.

The five steps are:

- Step I Essential prefield season tasks: literature review, analysis of the data base, development of a research design and sampling strategy, recruitment of personnel and staging for field work.
- Step II Reconnaissance-level archeological survey of project areas based on priorities determined by the sequence of construction events. The needs of the specific study teams engaged to satisfy licensing requirements will obtain highest priority. It is impossible at this point to project temporal and fiscal requirements for mitigation efforts for adversely affected sites during the course of pre-license studies. Mitigation efforts, if required, will be conducted on a cost reimbursable basis during this step.
- Step III Intensive testing of archeological and historic sites discovered during Step II. This testing effort is essential to determine both the horizontal and vertical dimensions of specific sites, and to estimate reasonably accurately the kinds of materials contained within them. This information is necessary to delineate mitigation measures for any sites potentially subject to adverse effects. Step II tasks may continue simultaneously with Step III activities.
- Step IV Final report preparation. The final report will at a minimum provide the location and description of every archeological and historic site recorded during the course of the study. It will also provide recommendations for mitigating adverse effects to sites which may be subject to disturbance or destruction during construction activities based upon the data derived from Steps II and III. The Phase I report will be based on all information that is available at the end of two years of investigation, and will discuss as many sites as possible. Information not available at this time will be reported in a subsequent report as a part of the Phase II effort. The Phase I report will provide a description of the types of information that would be forthcoming in subsequent reports.
- Step V All recovered artifactual material and supporting documentation will be deposited with the University of Alaska Museum and will be retained as public information within the

State of Alaska. The collections and supporting documentation will be curated in accordance with state and federal requirements pertinent to the preservation of antiquities.

It is recognized that effective historic preservation efforts must be coordinated with other aspects of the Susitna Hydropower Project. The University Museum will make every reasonable attempt to anticipate the needs of the project pertinent to cultural resources. However, it will be the responsibility of the prime contractor to coordinate between subcontractors and to provide the scheduling information essential to successfully anticipate and to deal effectively with these needs.

(2) Discussion of Steps

- Prefield Season Tasks

Prior to initiating field investigations during the summer of 1980, the University of Alaska Museum will execute the following tasks:

- Apply for, and secure a Federal Antiquities Permit and state documents that may be necessary for the archeological portion of the project. (Office of Archeology and Historic Preservation, Interagency Services Division, National Park Service, U.S. Department of the Interior, Washington, D.C. 20204; State Archeologist's Office, State of Alaska, Department of Natural Resources, State Division of Parks, Anchorage, Alaska).
- Conduct an exhaustive literature review of available documents that pertain to the history, prehistory, ethnography, geology, flora, fauna, and late Pleistocene and Holocene geology of the areas covered by this project. Museum staff will utilize the resources of the University of Alaska Library and Archives, data files of the University Museum, and records at the State Office of History and Archeology. Consultation with other professionals who have worked in or have knowledge of the study area will be utilized as necessary.
- The results of the literature search will be used to synthesize the regional and local cultural chronology of the study area as well as to provide the basis for the research design.
- Air photos of the study area will be examined and their interpretation will focus on the identification of probable areas containing cultural resources.
- Known historic and archeological sites will be plotted on 1:63,360 scale maps. Each resource will be specifically identified. A preliminary aerial reconnaissance of the project area will be conducted.
- Utilizing the information base produced by the above research, a research design will be developed to include a sound professional sampling strategy specifically designed for the unique needs of this project.

- Following formulation of the research design and sampling designs, the Principal Investigator and Project Supervisor will recruit essential personnel for the field portion of this project.

It is estimated that these prefield season tasks will take approximately five months. Upon completion of the prefield tasks (Step I), the necessary personnel and data base will be utilized for the reconnaissance level survey (Step II), and for mitigation of adverse effects on cultural resources which may possibly be affected as a result of the licensing study.

- Archeological Reconnaissance

The purpose of this step is to identify, locate, and inventory archeological and historical sites. These sites will later be subject to more intensive study. As specified in 36 CFR 66 in the Federal Register, Vol, 42 No. 19, a reconnaissance level survey should be used only as a preliminary tool prior to intensive survey. The information gathered during Step II of this project will form the data base for intensive survey in Step III.

As it is not the intent of a reconnaissance level survey to cover 100% of the study area, preselected areas identified in the research design (Step I) will be selected for survey. Within these areas field crews will implement surface and subsurface testing procedures in order to locate, document, and inventory historic and prehistoric sites that may occur in the study area. This site-specific data will be used to develop and direct Step III studies. Aerial reconnaissance will also be conducted at the preselected areas in order to enhance site location during Step II. Available aerial photographs, as well as LANDSAT photos, will be reviewed for all preselected areas in order to aid in locating potential site areas.

During Step II the dam impoundment areas and associated facilities will be field surveyed. The proposed primary transmission route will be field surveyed at a later date, as part of the post-license application studies.

Based on both state and federal guidelines as discussed in an earlier section, it is possible that preconstruction studies may have an adverse impact on cultural resources. These include, but are not limited to, the installation and operation of seismic monitoring systems, the examination of foundation conditions for access roads and transmission lines, borrow pit exploration and testing, geophysical subsurface investigation, exploration and testing for dam site locations, testing in association with the construction of an airstrip, construction of access roads into the study area, movement of heavy equipment into and within the study area, or any other preconstruction activities that would create subsurface disturbances and hence have the potential of destroying cultural resources.

During Step II every effort will be made to work with other professionals involved in the Susitna Hydropower Project, to see that an archeological survey is conducted early in each ground disturbing activity so as to be compatible with the needs of other portions of the project. If any archeological sites are found during the course of the survey in areas slated for subsurface disturbance during preconstruction activities, it will be necessary to undertake immediate mitigating measures.

All archeological and historical sites that will be adversely impacted by the licensing study for this project will be mitigated in connection with the regulations of the Advisory Council on Historic Preservation. These measures include avoidance, preservation, and excavation. If excavation is recommended then it will be necessary to deploy a crew to each site specified for this procedure. As it is not known how many and how large these sites might be, a line item for excavation cannot be included in this proposal. Instead, it is proposed that if it should become necessary to excavate any site that will be adversely impacted by preconstruction studies, the cost of additional personnel and equipment will be covered on a cost reimbursable basis.

- Intensive Survey

Step III consists of intensive testing of sites located during the reconnaissance survey (Step II) of the project. Grids will be established at each site and a sampling scheme applied for testing. Each square selected for test excavation will be systematically excavated and all artifacts and features recorded, using standard archeological field methods. Site maps and soil profiles will also be prepared. Photographs will be taken to document artifacts and features in situ as well as to document the site and its location. Site limits will be delineated and data will be recovered for analysis and evaluation. Based on the analysis of this material, National Register criteria will be applied to see if the site is eligible for inclusion in the National Register of Historic Places as specified in the federal regulations that apply to this project.

Intensive testing will also provide the means for evaluating the effects of the preconstruction and construction phases of the Susitna Hydropower Project on cultural resources. Each site will be evaluated and recommendations as to mitigating measures will be made and incorporated into the final report. Field crews, teams consisting of the dam sites, impoundment areas, access roads, staging areas, camps, borrow pits, and other potential ground disturbance areas.

- Analysis and Report Preparation

This step is an integral part of each step of the project. It entails compilation of the individual reports for the other steps of the project as well as synthesizes all data recovered and makes appropriate recommendations for mitigation, if necessary. Step IV is specially aimed at the final analysis of the project in terms

of sites located and documented during the other steps. The final report will include the location, description, and a mitigation recommendation for each site reported during Steps I, II, and III. Step IV will include mitigation recommendations, if necessary, for the sites located, and an estimated budget for an archeological excavation that must be done prior to the start of actual construction of the Hydropower Project as specified by federal and state regulations. The overall effectiveness of the research design, field procedures, and analysis will be discussed. A full-scale report, including sections on the vegetation, fauna, geology, history, prehistory, and native populations will be part of the report.

As presently scheduled, the FERC license application will be prepared prior to the completion of the Cultural Resources Analysis. The cultural resources section of the exhibit will be based on the Phase I Final Report. This report will include recommendations on as many sites as possible and will be based on all the information that is available at the time of report preparation (i.e. after two years of investigation). There are, however, constraints which will make it impossible to provide certain critical information until Phase II. One such constraint is the time required to obtain radio-carbon determinations from samples collected during the 1981 field season.

The Phase I final report will include a description of information to be provided during Phase II. In addition, a Plan of Study for Phase II of the Cultural Resources Investigation will be developed near the end of Phase I. The Plan of Study will be formulated on the basis of needs that become apparent during Phase I.

- Curation of Recovered Collections and Supporting Documentation

Curation of recovered artifactual material and associated contextual data will be an ongoing program throughout the duration of the project. With the University of Alaska Museum performing the archeological investigations, there will be no packaging and shipping costs to the designated repository or necessity to inventory the incoming collection. All recovered material and supporting documentation will be housed at the University of Alaska Museum and curated in accordance with state and federal requirements pertinent to the preservation of antiquities.

Subtask 7.07 - Land Use Analysis

(a) Objective

To evaluate past, present and future land use trends to facilitate the identification of the major changes in land use that would result with the development of the project, and to preliminarily identify these changes.

(b) Approach

The approach is basically a comparison of land use trends to determine the major effects of the project will have on the future land use of the area, and employs a modification of the McHarg Overlay Technique. McHarg has basically used the superimposition of overlays showing specific resource values to determine where there is least conflict with existing values. The modification will be to develop overlays which graphically depict Propositions A-C below; and through superimposing them, one would arrive at the Actual Change in Land Use Caused by the Project. The historical land use trends will be described; the present land use of the project area will be examined; and an attempt will be made to isolate the factors and management decisions that have resulted in the land use that exists. The future land use of the area without the project will be predicted on the basis of interviews with Mat-Su Borough officials, landowners, land management and resource agencies, and a consideration of the resource potentials and limitations. Unique and significant scenic and natural features of the area will also be identified for consideration during the impact analysis.

The changes that will be attributed to the project in the future, and the significance of these changes cannot be evaluated without consideration of the changes that would occur without the project. The evaluation process is illustrated below:

Proposition A (Change from present land use)

$$\begin{array}{r} \text{Area land use with project} \\ \text{(minus) Area land use without project} \\ \hline \text{(equals) Overall change caused by project} \end{array}$$

Proposition B (Future land use without project)

$$\begin{array}{r} \text{Future land use (based on projections of long-term} \\ \text{trends)} \\ \text{(minus) Present land use} \\ \hline \text{(equals) Future change without project} \end{array}$$

Proposition C (The actual change caused by project)

$$\begin{array}{r} \text{Overall change caused by project} \\ \text{(minus) Future change without project} \\ \hline \text{(equals) Actual change caused by project} \end{array}$$

Proposition C (the actual change caused by project)

Overall change caused by project
(minus) Future change without project
(equals) Actual change caused by project

(c) Discussion

An assessment of the effects of particular land uses on a specific environmental setting is not a simple, one-for-one relationship. When one disrupts an essentially pristine environment to develop a modern industrial project such as the one proposed for the Upper Susitna River Basin, many environmental disturbances occur. Some of these disruptions are predictable. However, others may occur which are not anticipated because there are few, if any, previous experiences on which the experts can rely. One then begins to rely on theoretical models, integration techniques, and other technological thought to give a "best judgement" as to what might take place if certain proposed actions (dam building, transmission lines, roads, etc.) are implemented. Land-use analysis is one way of obtaining overview of the systematic effects of a proposed development; the specific details of the project are then filled in by the specialists on the team. This land use analysis will evaluate the change in the present use of the land caused by the proposed project and will provide the basis for summarizing the overall impact of the project, including the dam, reservoir, transportation access, and transmission corridor. This analysis is designed to provide information (baseline and impact assessment) that will satisfy FERC licence application requirements.

(d) Schedule

Weeks 8 through 117

(e) Detailed Scope of Work

(1) Synopsis

- Year 1: Present Land Use

1. Detailed field procedures manual will be developed.
2. The study area will be defined to encompass the actual area covered by the project including the dams, reservoir, the road, and transmission corridor, plus the contiguous land influenced by these developments.
3. Prior land use (map 1a-c)
 - (a) Prior to white man.
 - (b) Early white man through World War II.
 - (c) World War II to present.

4. Present land use (map 2)
 - (a) Aerial photo and topographic map reconnaissance of present land use.
 - (b) Aerial and ground reconnaissance of present land use.
 - (c) Inventory of unique scenic/natural features.
5. Discussion with present landowners
 - (a) Landownership (map 3).
 - (b) Existing resource management programs (map 4).
 - (c) De facto programs (map 4).
 - (d) Communicate land-use concerns of landowners to project specialists concerned with particular technical fields.
6. Review access transportation system and transmission line corridor in terms of location and design as it affects other land uses, as an input into the selection and design process.

- Year 2: Future Land Use Without Project (map 5)

1. map anticipated landownership changes. If all native and state selections have not been conveyed, a "best estimate" of landownership changes will be made.
2. Interview landowners and managers, borough officials, and state and federal agencies on long-range objectives, existing proposals for other land uses, and projects (other than the hydroelectric one) already being planned within the boundaries.
3. Plot anticipated changes and reconcile differences in these based on landownership rights, supporting legislation, and the probability of implementation of the particular programs. The overlap and potential conflict between projected changes will be analyzed using the McHarg overlay technique.
4. Using preliminary project design information, aerial photo and aerial reconnaissance, and data generated by other disciplines, an estimate of what changes in land use will likely occur will be made.

(2) Discussion of Steps

- Identification of Study Area

The first step in the land-use analysis will be the identification of the project area boundaries. These boundaries will include adjacent lands that will be affected or influenced by the project, as well as the access transportation system and transmission corridors when the routes for these facilities have been identified.

The downstream effects will also be considered in the overall land-use analysis. The boundaries will include the following zones:

1. Project Zone (actual occupied by project).
2. Management Zone (land acquired for management purposes such as watershed, recreation, etc.).
3. Influence Zone (that contiguous land whose use patterns would be influenced by what development takes places within Zones 1 and 2).

- Prior Land Use

Past land use will be described through a review of historical documents using archives, development of oral history using interviews, and review of administrative files of managing agencies. The documentation of the historical overview of land use including the pre-white man, early white man, and modern eras is essential to understanding land-use trends if they are to be adequately extrapolated into the future.

- Present Land Use

The present land-use of the project area will be determined by utilizing a number of sources of information. These sources will include aerial photo and map reconnaissance, vegetation cover maps produced by the Plant Ecology Team, discussions with landowners and government officials, and a field review of specific land uses identified through the reconnaissance and discussions. A preliminary list of potential agency contacts is presented in the next section. Existing resource management programs, either planned or de facto (they exist but were not planned by the agent) will be identified and described in detail. As a part of the total reconnaissance, unique scenic and natural features within the project boundaries will be identified and described. The preliminary location and design of the access transportation system and transmission corridor will also be evaluated by the land-use team in terms of long-term effects on land use. Furthermore, the land-use team will identify concerns raised by the landowners and agencies and communicate these concerns to TES, who will make them known to the appropriate disciplines.

- Future Land Use Without the Project

Regardless of the status of the project, certain future changes will take place within the project boundary. The land-use team will describe these changes through documented landownership changes, landowner or agency interviews to ascertain long-range objectives, projects on the drawing board, and ones already underway. These will possibly show some overlap and subsequently will be reconciled based on the existing landownership rights, supporting legislation, and a best estimate of the probability of the implementation program (if it is not already funded). It is

essential that we account for those changes that would have occurred without the project in order to determine the real effects of the hydroelectric project.

- Preliminary Identification of Project Impacts

Realizing that certain conclusions will be based on preliminary location and design of the project structures and systems, the actual change in land use caused by the project will not be totally analyzed until phase II (post-license application) when the final locations and designs are selected. The major impacts or changes that are expected to occur as a result of the project will, however, be preliminarily identified at the end of Phase I (i.e., prior to license application). This preliminary identification of changes will be developed after evaluating the results of the office and field reconnaissance, the interviews with landowners and land managing and planning agencies, and available data generated by other disciplines including at least the wildlife ecology, plant ecology, and socio-economic groups. The preliminary identification of project impacts will not represent a detailed description of the impacts that will be associated with the project; instead it will be utilized in the development of the Phase II Plan of Study to assure that adequate attention is given to those concerns and potential impacts that are expected to be most relevant and significant with respect to the construction and operation of the project.

(3) Preliminary List of Agency Contacts

FEDERAL

U.S. Department of the Interior

Bureau of Mines	Mineral Potential
Heritage Conservation & Recreation Service	River Survey and Use
U.S. Fish & Wildlife Service	Endangered species management (Pere- grine falcon)

U.S. Department of Agriculture

Soil Conservation Service	Susitna Basin Water Study
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U.S. Corps of Engineers	Regional water planning
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Federal Aviation Administration	Present & future airport facilities
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STATE

Department of Natural Resources

Division of Lands State land
management

Division of Geological &
Geophysical Surveys Geologic hazards

Division of Parks Recreation planning

Department of Fish and Game Land use related to
hunting and fishing,
key habitat

Department of Community and
Regional Affairs Regional planning

University of Alaska University land
management

Department of Transportation &
Public Facilities Transportation
planning

MUNICIPAL

Matanuska-susitna Borough Management of
Borough Lands

Trapper Creek Community Council Community interest

Montana Creek Community Council Community interest

Homemakers Club-Talkeetna Community interest

PRIVATE

AHTNA, Inc. Native land use and
management on Upper
Susitna

Cook Inlet Region Inc. Native land use and
management on Middle
Susitna

Talkeetna Air Taxi Historical and
present land use

Other air taxi services)
Ackland Helicopter Service) Historical and
Tokosha Citizens Council) present land use
Montana Creek Dogmushers)

Subtask 7.08 - Recreation Planning

(a) Objective

To prepare a detailed master area plan that will optimize public recreational use of the project lands and water, in a manner that will:

- (1) provide the maximum variety of activities and levels of development that will be consistent with the quality of the recreation experiences to be offered. User perceptions of the desired kinds of experiences and appropriate levels of development will be measured within the region;
- (2) analyze the environmental setting so that the proposed recreation development is consistent with the experiences to be offered, the access transportation system, the water impoundment, and other land uses;
- (3) balance the development of facilities with the capacity of the natural resources to sustain that use;
- (4) identify and incorporate into the total plan the unique scenic and natural features within the project boundaries;
- (5) be consistent with planning guidelines and objectives of the managing agencies; and
- (6) maximize compatibility with the proposed operation of the project and other public uses of the land.

(b) Approach

The basic approach is to develop specific planning objectives for a master area plan based on the perceptions of the public, the limitations of the resource, and the planning guidelines of the managing agencies. A two-phased planning approach will be utilized. The first phase of the subtask will generate information that will be used in Phase II (post-license application), when the master area plan will be developed. The Phase I planning effort can be divided into a series of steps:

- (1) Literature review (complete review of pertinent periodicals and texts, and agency publications relating to Alaska, including the Statewide Comprehensive Outdoor Recreation Plan);
- (2) Mail questionnaire (on the perception of Alaskans to various types and levels of development);
- (3) Preliminary assessment of resource potential for recreational use.

(c) Discussion

There may be some controversy generated by the proposed Susitna Hydroelectric Project, but few people know the area intimately and can speak with authority on the potentials or limitations of the area for other uses. It is relatively isolated yet close to the greater Anchorage area (nearly 60% of the state's population) and only 3/4 of a day's driving time from Fairbanks. When considering hydroelectric development, other uses of the area must also be considered to maximize the potentials of the area.

This subtask offers a mechanism for providing recreational opportunities at the proposed project. This will be an important element in the evaluation of the project since the recreational use of the area will affect many of the environmental impacts associated with the project, including socio-economics, fisheries, wildlife, and land use. The level of recreational development and the use generated by the provision of public facilities will be important considerations in the determination of these impacts.

Most recreation planning decisions relate to the development of access to the area; consequently, the access road, types of facilities, and level of development are critical decisions in encouraging specific types of recreational opportunities and levels of development. This proposal is based on the theorem that recreation planning, while controlling development and minimizing impacts, is done for a more important reason - controlling the experience norms to be offered.

(d) Schedule

Weeks 52 through 117

(e) Detailed Scope of Work

(1) Literature Review

An extensive literature review will be conducted to identify and make use of existing pertinent information and data. This literature search will include a complete review of the appropriate periodicals and texts, as well as agency publications related to Alaska, including the Statewide Comprehensive Outdoor Recreation Plan. The review will examine the existing literature on reservoir planning in relation to recreation, river recreation, supply-demand modeling, systematic approaches to recreation program planning, and agency publications on participation patterns, changing socio-economic factors, and user perceptions of specific recreational experiences.

(2) Projection of Recreational Use

It will be necessary to predict the initial and future recreational use that can be expected to occur at the facilities that are provided as a part of this project. Forecasting is at best a hazardous enterprise, but predicting the levels of participation in various

recreational activities is an essential ingredient in recreation planning. The types and numbers of facilities to be provided and the appropriate level of management cannot be determined without an estimate of predicted use.

The projections of participation are made more difficult in this case by the size of the area, the limitation of comparison to similar opportunities within the region, and minimal past-use data. The uniqueness of the area and lack of available data preclude the use of many methods of projecting participation and suggests the use of the "judgment" method. To predict initial and future use of the facilities, all available data related to historical, present, and projected use trends will be analyzed. Indicators and basic causal factors, such as trends in population, income, leisure and mobility, will be evaluated. The prime potential market areas of Anchorage, and secondarily, Fairbanks, will be given particular consideration.

In conjunction with this, a mail questionnaire will be sent to 2,000 Anchorage-Fairbanks residents to assess their perceptions of the appropriate levels of recreational development at the proposed reservoirs and their willingness to participate at those levels of development. The questionnaire will be designed to determine the combination of access and facilities (based on descriptions) that people would respond to best, in terms of indicating a willingness to participate. This will provide an aggregate estimation of participation, in various activities, based on varying levels of recreational development. The design of the questionnaire will be critically reviewed and be pretested prior to distribution. Dr. Jordan Louviere, University of Iowa, has tentatively agreed to assist in the development and analysis of the questionnaires. The number of questionnaires to be distributed was determined based on a desired level of accuracy and an assumed rate of response. The mailing will be divided between Anchorage and Fairbanks in proportion to population. One follow-up is planned and a second will be used if necessary.

(3) Preliminary Assessment of Resource Potential for Recreation

A preliminary assessment of the resource potentials will be completed in this phase. An initial evaluation of the project area will be completed in the lab, using vertical aerial photography to isolate potential sites. The project lands will be evaluated on the basis of general resource capabilities, levels of access and anticipated management problems (such as natural hazards). This initial evaluation will determine the zones that have greatest potential for development. Selected suitable areas, potential visitor attractions and related management concerns will be located on a base map and evaluated during a field reconnaissance. The summer field season will be spent assessing the potentials and the inherent limitations of the areas. Standardized criteria will be utilized to eliminate personal bias in the field site evaluation process.

Subtask 7.09 - Susitna Transmission Line Assessment

(a) Objective

To provide input into the selection of an environmentally sound one-half mile wide transmission line corridor from the Susitna Project area to load center substations in or near both Anchorage and Fairbanks.

(b) Approach

The corridor will be selected by means of the following process:

- (1) conduct literature search for pertinent data sources;
- (2) concurrently, obtain aerial photography and land-based photography for the study area routing analysis;
- (3) review alternative routes proposed by previous studies and select project-specific alternative corridors;
- (4) conduct site-sensitive avoidance routing analysis on alternative routes;
- (5) provide input into the selection of a primary, one-half mile wide corridor;
- (6) define criteria for establishing and conducting final design and location analyses.

(c) Discussion

A wealth of data dealing with the selection and evaluation of transmission line corridors exists with respect to the Susitna Project (note list of previous studies at end of discussion). Several studies have been obtained and reviewed. They will serve as a basis for initiating project investigations. All data sources pertinent to a routing impact analysis will be obtained and catalogued for further reference.

Aerial photography exists for much, if not all, of the proposed routing analysis study area. In addition, other photography available for the study area, including land-based photography, will be sought. Many sensitive or unique areas within the Central Railbelt area have been photographed during previous studies, including many areas within the transmission corridor study area. All such available photographs will be catalogued and stored for further reference.

Transmission line corridors proposed by other studies will be reviewed and recommendations as to their environmental acceptability will be provided. Criteria will be established for the purpose of avoiding, where possible, areas such as wetlands, steep mountain slopes, scenic vistas, population centers, and other constraints.

The criteria will be applied to all alternative route segments. Following an analysis of the data, a primary corridor of approximately ten miles' width will be selected.

Additional criteria will be established to provide rationale for further refinement of the primary corridor. Items such as access, clearing requirements, soils limitations (where applicable) and restoration requirements, to name a few, will be factored into the analysis process. The end result of this effort will be a proposed primary corridor of one-half mile width between the project and both Anchorage and Fairbanks.

TES will assist Acres in the selection of both the ten mile and one-half mile wide primary transmission line corridors. Based upon the alternative routes proposed by Acres, TES will conduct the necessary environmental analysis and identify sensitive areas. TES will also provide environmental input into the development of criteria to be utilized for further corridor refinement studies.

List of Previous Studies

- 1) International Engineering Company, Inc., Anchorage-Fairbanks Transmission Intertie - Economic Feasibility Study Report April 1979.
- 2) Robert W. Retherford Associates, North Slope Natural Gas Transport Systems and Their Potential Impact on Electric Power Supply and Uses in Alaska, March 1977.
- 3) U.S. Army Corps of Engineers, Southcentral Railbelt Area, Alaska, Upper Susitna River Basin Interim Feasibility Report, (Appendix I, Part II (G) Marketability Analysis, (H) Transmission System, (I) Environmental Assessment for Transmission Systems, December 1975.
- 4) Kozak, Edwin, under the direction of J. R. Eaton, Performance Characteristics of a 350-Mile Electric Power Transmission Line (Fairbanks to Anchorage), A project in EE 494, Department of Electrical Engineering, University of Alaska, June 1973.
- 5) Ch2M-Hill, Electrical Generation and Transmission Intertie System for Interior and Southcentral Alaska, 1972.
- 6) Federal Power Commission, Alaska Power Survey, 1969.
- 7) Alaska Power Administration, Alaska Railbelt Transmission System, working paper, December 1967.
- 8) The Ralph M. Parsons Company, Central Alaska Power Study, undated.
- 9) The Ralph M. Parsons Company, Alaska Power Feasibility Study, 1962.

Schedule ?

Subtask 7.10 - Fish Ecology Studies

(a) Objective

To determine the relative abundance and distribution of adult anadromous fish populations in the Susitna River, determine the distribution and relative abundance of selected resident and juvenile anadromous fish populations in the Susitna River, determine the spatial and seasonal habitat requirements of anadromous and resident fish species during each stage of their life histories, and determine the impact the Susitna hydroelectric project will have on the fishery resources and describe any required mitigation. This is the primary objective the both pre-license application and post-license application studies.

(b) Approach

The Alaska Department of Fish and Game will be responsible for field data collection, data reduction, progress reports, and complete annual reports based upon an in-depth procedures manual that is accepted by the Alaska Power Authority. The ADF&G program will consist of using recently developed techniques for the collection and analysis of field data. The use of side-scanning sonar fish counters and electrophoresis for the anadromous fish program, and the in-stream flow analyses for the habitat studies, are examples. ADF&G is familiar with the field conditions in Alaska and should provide an effective base for the studies.

A TES Operations Office will be established in Anchorage for the coordination and quality assurance of the studies. As part of the quality assurance function, TES personnel will frequently accompany ADF&G field crews into the study area for the purpose of observation of sampling activities. TES will also review and comment on the ADF&G reports, and will perform the impact assessment. A preliminary impact analysis will be done prior to license application using the data available. However, many of the fishery studies will not be completed until after license application. The anadromous fishery studies will be extended to include a complete life cycle of the fish, as much as five years. The final impact study on the fisheries will be prepared during the post-license application period when the data are available.

(c) Discussion

The major impacts on the fishery resources of the Susitna River as a result of hydroelectric development are expected to be due to habitat changes. Alteration of the normal flow regimes and the physical and chemical water characteristics are likely to have the greatest impact.

Many of the physical and chemical studies necessary for an understanding of the effects on the resident and anadromous fish below the dam, as well as resident fish in the impoundment areas, will

be completed in Task 3 - Hydrology. However, intensive baseline data collection on the fish of the Susitna River must also be performed using the plan of study developed by ADF&G with input from Acres and TES. Resident fish populations will be studied in relation to their habitat requirements. Studies of fish populations in the proposed impoundment areas including rare and endangered species will also be included. Additionally, migrational usage of the Susitna River by salmon species as well as main stream spawning observations and rearing information will be collected.

During the first phase of this project the following studies are planned to begin. These are described in more detail in (e) below.

(1) Stock Assessment of Adult Anadromous Fish

The following areas will be examined:

- Cook Inlet Area. Investigation of the contribution of the Susitna River salmon stocks will begin using scale pattern analyses and electrophoresis techniques.
- Cook Inlet to the Confluence of the Yentna River. Migrational movement of salmon stocks will be assessed including differentiation of the Susitna and Yentna stock contribution, timing, movements related to stream flow, and utilization of the mainstem river for spawning.
- Yentna River to Talkeetna. Migrational movements of salmon stocks will be assessed including numbers of adult salmon utilizing this area for spawning, timing of migration, relation of movements to stream flow, and recreational use of the stocks.
- Talkeetna to Devil Canyon. Abundance, migrational movement as related to flow, timing, and recreational usage will be investigated.

(2) Stock Assessment of Adult Resident Fish and Juvenile Resident and Anadromous Fish Populations

The following areas will be investigated:

- Cook Inlet to Talkeetna River Confluence. The occurrence and composition of resident and juvenile anadromous stocks, as well as apparent seasonal changes in occurrence, relative abundance, and habitat-type utilization will be defined.
- Talkeetna River Confluence to Devil Canyon. The occurrence and composition of resident and juvenile anadromous stocks as well as apparent seasonal changes in occurrence, relative abundance, and habitat-type utilization will be defined.

- Devil Canyon to Tyone River Confluence. The occurrence and species composition of fish stocks, as well as seasonal changes in abundance of fish and habitat-types utilized by fish will be investigated. The possible presence of salmon stocks above Devil Canyon will also be investigated as part of this study.

(3) Seasonal and Spatial Habitat Studies of Anadromous and Resident Fish Species During Each Stage of Their Life Histories

The following areas will be investigated:

- Cook Inlet to Talkeetna River Confluence. Seasonal habitat requirements for incubation, rearing, spawning, and passage, as well as seasonal relationships between flow regimes and physical and biological habitat characteristics will be defined.
- Talkeetna River to Devil Canyon. The study in this section is an investigation of fish habitat in the area immediately downstream of the proposed dam site.
- Devil Canyon to Tyone River. The study in this section is an investigation of fish habitat to be affected by the proposed impoundments.

TES, using the information gathered on the water quality by R&M and fishery resources by ADF&G will evaluate the potential impact of the hydroelectric project on the Susitna River fisheries. A preliminary assessment will be made on the basis of data collected during 1980 and 1981. However, many of the fishery studies will continue beyond the scheduled time of license application. Thus, post-license application submission studies will be required to adequately describe the baseline situation and to permit a detailed assessment of the impact of the proposed project on this important resource.

(d) Schedule

Weeks 26 through 130.

(e) Detailed Scope of Work

Individual study proposals are designed to provide the necessary background information to enable proper evaluation of impacts. Six general objectives have been outlined:

1. Determine the relative abundance and distribution of adult anadromous fish populations within the drainage.
2. Determine the distribution and abundance of selected resident and juvenile anadromous fish populations.
3. Determine the spatial and seasonal habitat requirements of anadromous and resident fish species during each stage of their life histories.
4. Determine the economic, recreational, social, and aesthetic values of the existing resident and anadromous fish stocks and habitat.
5. Determine the impact the Devil Canyon project will have on the aquatic ecosystems and any required mitigation prior to construction approval decision. This is the primary objective of both Phase I and II studies. This will be discussed in detail in the Phase II work when it is written.
6. Determine a long-term plan of study, if the project is authorized, to monitor the impacts during and after project completion. This is also an objective of Phase II.

Work on objectives 1, 2 and 3 will be undertaken during 1980 and 1981.

The study areas are generally categorized within the following locations:

- A. Cook Inlet area
- B. Cook Inlet to the Yentna River confluence
- C. Yentna River to the Talkeetna River confluence
- D. Talkeetna River confluence to the Devils Canyon dam site
- E. Devil Canyon dam site to the Tyone River confluence

Scaling of the proposed studies with respect to timing, geographic locations, and intensity has been done with consideration of the resource knowledge available for each of the geographic locations identified above.

1. Stock Assessment of Adult Anadromous Fish Populations

Objectives

To determine the relative abundance and distribution of the anadromous fish populations within the Susitna River drainage.

Study Approach

Adult anadromous fisheries studies will be divided into five major geographical areas. All studies, however, will be interrelated. The following outlines baseline studies required for each area and general work plans.

(1) Cook Inlet Area. Contribution of the Susitna River salmon to the Cook Inlet fisheries - Quantitative separation of stocks

Objectives

The objectives of this study area to:

- Identify the proportion of the Susitna River salmon stocks harvested by the commercial and recreational fisheries; and
- Determine quantitatively that portion of the total catch produced in the Susitna River drainage.

Background

The major area of salmon resource competition is within the Upper Cook Inlet area, i.e. that area north of the latitude of Anchor Point. The Susitna River salmon stocks are intermixed with other large salmon stocks produced from the Kenai Peninsula and west side of Cook Inlet.

All five species of Pacific salmon are harvested in Upper Cook Inlet. The majority of these salmon pass through the area at the same time, thus creating a mixed species and mixed stock fishery. Any feasibility study of the Susitna River project will require an assessment of the contribution of the Susitna River salmon populations to the commercial and recreational fisheries.

Work Plan

Commercial catch data is available through the Alaska Department of Fish and Game. Final statistical runs are available through 1976 and preliminary data is available through the current years harvest.

Identification and separation of the various stocks of salmon will be by scale pattern analysis and/or electrophoresis. Differences in scale patterns have already been found to exist in sockeye and coho salmon populations in Cook Inlet and the Susitna River stocks have been statistically separated from the other major Cook Inlet stocks. Data is, however, only available for one age class. Chum and pink salmon stocks have not successfully been separated on the basis of scale pattern analysis in other areas, due to the absence of freshwater growth. Electrophoretic techniques would be employed for stock identification of these species. An analysis of length-weight relationships may provide sufficient data for these two species.

The program requires the regular collection of scales and tissue samples from the commercial catch and from the major salmon producing areas (i.e. known escapement samples). Expansion of the ongoing Alaska Department of Fish and Game Stock Separation Program would provide the necessary data base for stock assessment of sockeye, coho, and chinook salmon. Cost estimates and design of this program are based on incorporating these studies with ADF&G programs. If a separate program is designed, additional funding would be required for sampling crews and laboratory equipment and analysis.

Sampling design would be divided into two major components: collection of scales and laboratory and computer analysis of scale patterns.

A minimum of 250 scales per species and age class will be obtained during each fishing period. Known escapement samples would be obtained from existing research and management programs. Three additional cannery sampling crews (2 people each) will be required to obtain scale samples. Staff time will be required to design a program for chinook salmon. Existing crews should, however, be adequate to conduct sampling.

The ADF&G scale laboratory would be used to process samples. A supervisor and a second shift would be added to the staff to maximize the use of existing equipment. A digitizing station would have to be added to the existing microcomputer. Additional computer time would be required.

The feasibility of separating pink and chum salmon stocks by electrophoretic techniques probably could be determined after one sampling season. If this technique is unsuccessful it would be discontinued and other methods would be evaluated. Analysis could best be done by the University of Alaska. A minimum of 1000 fish samples per fishery should be obtained for each species. Known escapement samples will also have to be collected. Three sampling crews would be required.

- (2) Cook Inlet/Susitna River confluence to the Yentna River Confluence. Stock assessment of the adult salmon populations.

Objectives

The objectives of these studies are to provide:

- escapement data, by salmon species, into the Lower Susitna River;
- differentiation of the Susitna and Yentna River stock contribution;
- timing of the salmon migrations;
- movements as related to stream flow and water quality; and
- utilization of the mainstream river for spawning.

Background

Total escapement information for the Susitna River drainage is generally lacking. Various methods have been utilized by the Alaska Department of Fish and Game since 1974. Recent developments in side-scan sonar have provided the most valuable tool, to date, for evaluating in-season escapement by species. Emphasis has, however, been on sockeye salmon.

Work Plan

Commercial Fisheries Division of the Alaska Department of Fish and Game currently operates an escapement project in the vicinity of Susitna Station as a part of their ongoing sockeye salmon research program. Expansion of this program would provide the necessary escapement data required for the Susitna Hydro Project baseline studies. Sonar counters and fishwheels would be operated from May through mid-October to determine escapement by species. This would require funding of the existing project beyond its normal operating dates. Data from this program would be correlated to the Stock Separation program within Cook Inlet and additional escapement studies in the upper Susitna River.

A sonar escapement enumeration program would be required in the lower Yentna River to differentiate between Yentna and Susitna River production. Comparative analysis of the Yentna River escapement data and the mainstem Susitna River sonar data would be made to determine stock contribution of each system. Two side-scan sonar counters and two fishwheels (for species apportionment) would be deployed on the Yentna River.

All salmon captured in the fishwheel at the "Sunshine site" will be marked with a color- and number-coded Peterson disc tag. Marked fish will be recaptured upstream to provide an assessment of stocks utilizing this area.

Migrational timing data would be obtained from fishwheel catch data at the sonar site.

Scale samples will be obtained from the fishwheel catch to provide a known data base for Cook Inlet stock separation studies. A minimum of 40 samples per day will be required for each species.

Migrational characteristics may vary greatly for each salmon species and must therefore be determined for each separately. Data obtained from these studies may also be useful in the final selection of proposed sonar projects and deployment of gear.

Federal law requires obtaining an FCC license for transmitting. License application approval may require up to one year.

Feasibility studies will include testing of equipment and tags from major companies. Various companies will be contacted regarding the possibility of leasing equipment. If radiotelemetry is a successful technique in the Susitna River, equipment will be purchased for the second field season and the program will be expanded. Emphasis will be on one species during the testing period. Chinook salmon are suggested as the first year target species.

Fish will be tagged at the Susitna Station of the "Deshka" site and tracking will be conducted daily by boat and by-weekly by aircraft. A statistically valid sample size probably will not be attained during the first year of feasibility studies, but evaluations of equipment will be made. If deemed feasible, a maximum of 50 fish a season will be tagged in subsequent years.

Coordination with and assistance from USF&WS Research Section will be required throughout the project.

Eulachon, an anadromous smelt, utilize the lower mainstem Susitna and Yentna Rivers for spawning. The extent of utilization of the mainstem river will be documented and evaluation of the populations will be made.

(3) Yentna River confluence to Talkeetna. Stock Assessment of adult salmon populations

Objectives

The objectives of these stock assessment studies are to determine the:

- numbers of adult salmon utilizing this area for migration and spawning;
- migrational timing of the adult salmon;
- recreational utilization of these stocks; and
- movement of salmon as related to stream flow and water quality.

Background

Many of the important recreational use areas occur within this area of the river. These areas have road access on the east side of the river and receive high use via aircraft transportation on the west side. All five species of adult salmon utilize this area for spawning and migration. Due to the braided nature of the Susitna River in this area many impacts are expected to be seen due to alternations of stream flow.

Work Plan

One side-scan sonar project will be established within this area of the river. Seasonal apportioned counts by species will be compared to the lower Susitna and Yentna River sonar projects to determine importance of this area to the entire drainage. Fishwheels and possibly other sampling gear will be used to apportion sonar counts.

The sonar projects will be located between the Yentna River confluence in the vicinity of Sunshine. These programs will provide information on: 1) the importance of this area of the river for spawning; 2) the extent to which this area is used for migration to spawning areas upstream of Talkeetna; and 3) the contribution of these salmon stocks to the total Susitna River drainage. A total of two side-scan sonar counters and four fishwheels will be required.

All salmon captured in the fishwheels at the "Sunshine site" will be marked with a color- and number-coded Peterson disc tag. Marked fish will be recaptured upstream to provide an assessment of stocks utilizing this area.

Migrational timing will be determined by fishwheel catches at the sonar projects and survey crews.

Recreational utilization of these salmon stocks will be determined partially by ongoing ADF&G creel census programs. Expansion of these program will be required to adequately monitor all species. The creel-census programs will also provide data on migrational timing and tag recoveries.

Movement of salmon through this geographic area will be monitored by remote sensing devices for radio-tagged fish. Sonar counters may also provide horizontal distribution data for that particular area.

Alaska Department of Fish and Game survey data will be used to determine chinook salmon escapements into major tributaries. These surveys may have to be expanded to assure adequate coverage of major tributaries.

(4) Talkeetna to Devil Canyon Dam Site. Stock assessment of adult salmon populations

Objectives

The objectives within this study area are to determine the:

- abundance of adult salmon;
- stock assessment of the Susitna-Chulitna-Talkeetna stocks;
- migrational timing of the salmon stocks;
- recreational utilization;
- movement of salmon stocks through this area as related to stream flow and water quality.

Background

Population estimates of salmon species utilizing the Susitna River above the Chulitna River confluence were estimated during the 1974, 1975, and 1977 field seasons based on tagging and subsequent recovery of fish. These studies indicate a portion of the salmon tagged are not destined to spawn above the tagging site, but rather below it. The importance and extent of this milling behavior in the upper river areas requires definition. The alterations in flow and water quality in the mainstem river after project completion could significantly affect this behavior and consequently spawning success.

Observations of spawning areas between the Chulitna and Susitan River confluence upstream to Portage Creek during fall surveys indicate that a reduction in flow to proposed post-construction levels would prevent access to many important spawning areas.

Work Plan

Salmon escapement estimates will be determined by a tag and recovery program in this area. Fish marked at the "Sunshine site" will be recovered by ground survey crews upstream from the Chulitna River confluence.

Surveys of major spawning areas between Talkeetna and Devil Canyon dam site will be conducted in conjunction with juvenile studies to determine distribution.

Escapement estimates will be compared to sonar project located in the lower river, primarily the "Sunshine site", and will provide information on importance of the supper river for spawning and also contribution of the Talkeetna and Chulitna river salmon stocks to the entire drainage.

Migrational timing of salmon stocks utilizing this area will be determined by stream surveys.

Recreational use within this area will be determined by a creel-census program.

- (5) Devil Canyon dam site to the Tyone River confluence. Stock assessment of adult salmon populations

Objective

To determine if salmon utilize that area of the Susitna River above Devil Canyon.

Background

Studies conducted during the late 1950's indicate that Cook Inlet salmon stocks are unable to ascend the Susitna River beyond Devil Canyon, the latter being a natural water velocity barrier to migration (U.S. Department of the Interior, 1957). Reports from local residents of salmon observations above Devil Canyon indicate that this should be investigated further.

Work Plan

Surveys and escapement sampling will be conducted in the proposed impoundment areas between the Denali Highway and Devil Canyon during periods of peak adult salmon abundance. Initial observations will be conducted by aerial surveys to document the presence or absence of adult salmon. Surveys will be done in conjunction with resident fish investigations. Data obtained will be utilized to determine necessary mitigation measures.

2. Stock Assessment of Adult Resident Fish and Juvenile Resident and Anadromous Fish Populations

Objectives

To determine the relative abundance and distribution of adult and juvenile resident fish and juvenile anadromous fish populations.

Study Approach

Adult and juvenile resident fisheries studies will be divided into three major geographical areas. All studies, however, will be interrelated. The following outlines baseline studies required for each area and general work plans.

(1) Cook Inlet/Susitna River confluence to the Talkeetna River confluence. Stock assessment of the resident and juvenile anadromous fish populations

Objectives

- Determine specific occurrence and species composition of resident and juvenile anadromous stocks throughout the year within the Susitna River mainstem and within the reaches of tributary streams regularly influenced by the Susitna River. Of particular importance to this study are the Alexander Creek, Flat Horn Lake, Deshka River, Willow Creek, Iron Creek, and Rabideux Creek tributary systems;
- Define any apparent seasonal changes in occurrence and relative abundance of resident and juvenile anadromous species at the confluence of tributary systems and the Susitna mainstem;
- Develop suitable sampling techniques for the collection and determination of relative abundance of resident and juvenile anadromous species in the Susitna mainstem throughout the year;
- Define and describe habitat type utilization by resident and juvenile anadromous species throughout the year and at varying hydrologic conditions.

Background

This reach of the Susitna River encompasses many important fish producing and recreational fishing tributaries and is an area of critical environmental concern because of the possible seasonal use and migration between clearwater tributaries and the Susitna river. Studies of these seasonal migrations and the distribution of resident and juvenile anadromous fish in and to habitats in the Susitna River are essential. The studies would be initiated for selected streams and for a prescribed distance: upstream throughout the year. Expansion or retirement of these studies would depend on confirmation for migration and habitat use by

resident and juvenile anadromous fish in the Susitna River. If confirmation of these movements and distribution to the Susitna is positive, the basic inventory will, in conjunction with the study task on habitat evaluation, identify specific year-to-year study locations for ongoing programs required to determine fishery impacts on the fish populations.

While the time frame allotted for accomplishment of these four objectives is 30 months, we feel that these same objectives should remain ongoing through the termination of the project with appropriate adjustment and redirection being made as resultant data are analyzed.

Also we see that it is imperative to incorporate the hydrologic studies as an integral component in achieving our stated study goals.

Work Plan

The initial year of this study, 1981 will be comprised of essentially two field operations, a summer and a winter program on the Susitna River.

A crew of three biologists, utilizing a riverboat as their primary means of transportation, will operate in the Susitna mainstem and tributary systems during the ice free months, May through October. Their responsibilities will include:

- Sampling using established techniques and their adaptations including gill nets, minnow traps, adult traps, angling, seines, and electrofishing.
- Developing suitable techniques for sampling the Susitna mainstem. Particular emphasis will be placed on the design of an effective stationary fish trap.
- Classifying in terms of depth, velocity, turbidity and substrate types in conjunction with the sampling of resident populations. It is essential that close cooperation is maintained between hydrologic and fisheries research.
- Tag adult resident fish and note species, size, date and location of capture.

A crew of four biologists will carry out fisheries research during the winter months. This facet of the field operations will be based on road access until such time as the mainstem Susitna ice condition has stabilized sufficiently to provide safe transportation via snowmachine. This crew will:

- Survey in the proximity of areas surveyed during the previous summer using established sampling techniques such as gill nets and minnow traps. As ice conditions improve and data is analyzed, this effort will be expanded to include as much of the study area as possible.
- Design an effective resident species adult trap for use in this study area as established sampling techniques meet with limited success when applied under a cover of ice in the river environment.
- Classify habitat in terms of ice cover, depth, velocity turbidity, and substrate in conjunction with sampling of resident populations.

A project leader position is included in this segment. Responsibilities will include:

- Organizational functions and oversight of entire Susitna Basin study.
- Analysis of data and report preparation.

Following the first season's determination of resident and juvenile anadromous fish occurrence, areas of greatest availability and suitable methods of capture, the 1982 program will be directed to largely the same areas and intensified with respect to relative abundance and preferred habitat utilization. The 1982 study plan will again consist of two segments, summer field operations and winter field operations.

A crew of three biologists utilizing a riverboat as their primary means of transportation will operate in the Susitna mainstem and tributary systems during the ice free months to:

- Confirm previous seasons data base with regard to occurrence and species composition.
- Determine relative abundance of resident stocks in predetermined locations by seasonal period and further establish patterns of intrasystem migration.
- Further define preferred habitat parameters.
- Continue to tag adult resident fish and note any recaptures from previous year.

A crew of four biologists will carry on the initial year's study from January through April. This four-man crew will begin the second field season in December of 1982 and following the first season's determinations the program will:

- be expanded to include additional areas;
- be intensified at one or two predetermined locations; and
- continue to determine habitat requirements.

A project leader position will continue through 1982.
Responsibilities will include:

- Coordination of field activities
- Data analysis and report writing.

(2) Talkeetna River confluence to Devil Canyon. Stock assessment of the resident and juvenile anadromous fish populations

Objectives

The objectives of programs within this study area are to:

- Determine specific occurrence and species composition of resident and anadromous stocks utilizing the mainstem Susitna River and its major tributaries;
- Define seasonal changes in occurrence and abundance of resident and anadromous species within the mainstem Susitna River and its tributaries;
- Define habitat types utilized by resident anadromous fish species, seasonally throughout this year, at varying hydrologic conditions, both within the mainstem Susitna River and the major tributaries; and
- Establish the impacts of flow regulation upon the habitat which currently meets seasonal requirements of resident and anadromous fish stocks within the study area.

Background

This study area includes the mainstem Susitan River and a number of important clearwater tributaries which have indigenous populations of resident game fish and provide spawning and rearing habitat for anadromous species. Several of the more important lateral tributaries are Portage Creek, Indian River, Gold Creek, and Fourth of July Creek. All are located in the upper reaches of the study area and in the general vicinity of the railroad crossing at Gold Creek.

Five species of Pacific salmon, chinook, choh, sockeye, pink and chum are native to this portion of the study area. The most important resident fish species within this area are Arctic grayling and rainbow trout; however, burbot, whitefish, Dolly Varden, and various other species are also present.

While a higher degree of reliability in knowledge of possible flow, water quality, and stream morphology changes exists in this reach because of previously collected baseline data, baseline studies on resident and juvenile anadromous fish must be initiated to better detail specific occurrence, distribution, and seasonal migration and habitat use of the Susitna River as well as document the population sizes of resident fish.

Work Plan

Due to limited access to much of the Susitna River upstream of Talkeetna, and related high cost of transportation, work proposed for 1981 is limited to the Indian River - Portage Creek - Gold Creek area. This area is accessible by railroad and can be investigated by a single field crew located in the Gold Creek area. These investigations will be extended downstream into other areas in the second and third years of study.

A four-man crew will be located in the Gold Creek or Indian River area housed in a local cabin or tent camp, and provided with a river boat and Zodiac-type raft to conduct the following activities:

- Establish the occurrence and species composition of resident and anadromous fish stocks utilizing the mainstem Susitna River during the period May through October of 1981. This work will entail intensive netting, electro-shocking, trapping, or use of set lines or other suitable collection methods within the mainstem reach from Fourth-of-July Creek upstream to Portage Creek. Some of these collection devices are expected to require modification and/or development as the season progresses.
- Perform similar sampling by net, electro-shock, trap or angling within the Indian River, Portage Creek, Gold Creek, and Fourth-of-July Creek Tributaries. A program of fish tagging will be implemented to define intro-system movement.
- Creel census anglers utilizing these four streams to determine harvest of resident fish by: a) species, b) age class, c) size, d) seasonal period, and e) area of availability. The creel census will also help with recovery of tagged fish.
- Conduct the adult anadromous studies in this area in cooperation with the anadromous program.

Following the first season's determinations of resident and anadromous fish occurrence, areas of greatest availability, and suitable methods of capture, the 1982 program will be directed to largely the same areas and intensified to include population estimations and preferred habitat utilization.

A similar two-man crew will be located in the Indian River or Gold Creek area, depending which seems more appropriate as a result of the first year study. The same equipment will be utilized. Study objectives for 1982 will be as follows:

- Determine relative abundance of resident and anadromous fish stocks in Indian River and Portage Creek, at predetermined locations, by seasonal period, and further define intra-system movement and migrations. These studies will necessitate an intensified tag and recovery program to provide instantaneous population estimates at specific seasonal periods and also numerous aerial surveys. While the methods with which to accomplish this work may be more apparent after the first years efforts, it is at this time considered likely that trapping devices or a statistically designed angling scheme may be most appropriate.
- Conduct similar studies in appropriate sections of the mainstem river and side channels during spring, summer, and fall. Techniques for this work segment will be similar to objective No. 1.
- Define habitat utilization of resident and anadromous species both within the mainstem and the Gold Creek, Fourth-of-July Creek, Indian River and Portage Creek tributaries as related to hydrologic conditions.

Areas of resident and anadromous fish preference will be surveyed in terms of flow, substrate, turbidity, depth, etc. to determine if these parameters are responsible for instream movements and distribution. These data will be correlated with historical climatological data and mainstem flows. Particular emphasis will be placed upon this facet during periods when mainstem flows approach the proposed regulated flow.

- Determine mid-winter occurrence and distribution of resident and juvenile anadromous fish species both in Indian River and the mainstem Susitna River.

As Indian River is the only major accessible upper tributary stream during mid-winter, these studies will be limited to it.

The mainstem river is characterized as being extremely dangerous to work in mid-winter due to poor ice conditions. As deemed possible, netting, trapping, and set lines will be utilized to determine occurrence and distribution of resident species during the winter months and to recapture fish tagged earlier in the year.

Winter sampling of both the tributary and mainstem will be conducted during November and December on a field trip basis, on a monthly schedule. No permanent camp is contemplated.

It is expected that by the end of 1982 field season estimates of the magnitude of intra-system migrations will be possible, by time; as will be population estimates of resident fish available at the mouths of the two tributaries throughout the seasonal period when sport angling occurs. Population estimates will also be formulated for the two years runs of salmon. It is further

expected that habitat requirements or needs dictating spring/fall migrations of resident and juvenile anadromous fish will be definable, as will be the role played by the mainstem Susitna River.

(3) Devil Canyon to the Tyone River confluence. Stock assessment of resident and anadromous fish populations

Objectives

The objectives in this study area are to:

- Determine specific occurrence and species composition of fish stocks utilizing the mainstem Susitna river and its major tributaries;
- Define seasonal changes in occurrence and abundance of fish species within the mainstem Susitna River and tributaries;
- Define habitat types utilized by fish species, seasonally throughout the year, at varying hydrologic conditions, both within the mainstem Susitna River and major tributaries;
- Establish the impacts of inundation upon the aquatic habitat of the clearwater tributaries necessary to sustain the indigenous fish species; and
- Conduct complete hydrological surveys at the tributary mouths and at predetermined locations on each tributary.

Background

This area of study includes the more than fifty miles of the mainstem Susitna River and tributary streams, which will be either totally or partially inundated by construction of the Devil/Watana Hydroelectric Complex.

This portion of the Susitna River drainage lies in a truly wilderness setting, is roadless, is inaccessible except by boat or light aircraft, and is only moderately utilized by recreational anglers at this time. Angling in this reach of the Susitna River system can be termed a "quality experience".

This area has obvious identifiable habitat and biological impacts due to eventual inundation of segments of the clearwater tributaries feeding the impoundment. Critical habitat needs, as well as recreational fishing opportunities, are provided primarily at the mouths of these respective tributaries.

Work Plan

A three-man crew will work in the proposed impoundment area during the ice-free months, utilizing a helicopter and light aircraft for transportation throughout the study area. The study crew will be housed in a temporary/portable field camp. Investigations will be directed to:

- Conduct extensive on-the-ground surveys of Goose, Jay, Kosina, Watana, Deadman, Tsusena, and Fog Creeks, and the Oshetna River. These investigations will include hydrological surveys and will determine the types of aquatic habitat currently available to resident species.
- Determine the types, magnitude of, and location of aquatic habitats which will be lost upon inundation, by respective stream. Geographical features blocking upstream migration will be noted. Conversely, stream areas which will benefit in terms of improved access to fish stocks, upon impoundment, will be recorded.
- Extensive netting, trapping, and fish collection will be conducted to determine the specific occurrence, and composition of resident species occupying these eight tributarial waters. As possible, efforts will be directed to determine the extent of seasonal intra-seasonal migrations.
- To tag any and all adult fish captured for determination of intra-system movement and migrations.

Upon completion of the first year's (CY-81) assessment of aquatic habitats and biological distribution of fish species within the impoundment area tributaries, investigations will be directed to the upland lake areas and the mainstem Susitna proper.

A two-man field crew will again operate with a transportable field camp, utilizing helicopter and light aircraft for transportation. Investigations will begin as soon as "ice-out" occurs in the spring and continue until freeze up in the fall.

Studies in CY-1982 will be directed to:

- Surveys of fish utilizing selected tributarial stream mouths throughout the season to determine intra-system movements of resident fish, and their reliance upon the mainstem river during the critical winter months. Tentative stream selections are Kosina, Jay, and Watana Creeks.

A semi-permanent camp will be located in the vicinity of these stream mouths, and the individual streams sampled for fish occurrence on an established sampling schedule throughout the season.

- Conduct surveys of upland lakes associated with mainstem Susitna River tributary streams for fish population and related biological data. Habitat information will also be collected from inlet and outlet streams, and be used later in determining the impacts to seasonal migrations and biological requirements of resident fish as a result of impoundment, road construction, and transmission corridor placement.
- To determine resident fish occurrence and distribution within the mainstem Susitna River throughout the spring-summer-fall periods. This work will be accomplished by the same field crew utilizing a chartered boat for transportation on a pre-determined sampling schedule. Nets, trot lines, traps, etc., will be used to determine fish presence.
- To continue to collect complete hydrological data.

It is anticipated the single two-man crew will be capable of performing all the above tasks. Determination of mainstem fish occurrence and distribution (#3) will be accomplished by two or three scheduled week-long trips through the impoundment area.

The upland lake surveys will be accomplished during "non-sample" periods at the tributary mouths. Close coordination will be necessary, as will helicopter support at frequent intervals.

3. Seasonal and Spatial Habitat Study

Objectives

Determine the spatial and seasonal habitat requirements of anadromous and resident fish species during each stage of their life histories.

Study Approach

Spatial and seasonal habitat studies will be divided into three major geographical areas. Sampling upstream of the Susitna-Talkeetna River confluence will be conducted primarily by fisheries study groups. Design of sampling programs will be done by the habitat studies supervisor. These studies will be performed in addition to work proposed by DNR, but will be done in close cooperation and coordination with that agency and other tasks performed by consultants as a part of the overall Susitna hydro-feasibility study. If the DNR instream flow study is not funded, ADF&G will need to increase its budget in the amount that DNR requested in order to perform the required work. It is anticipated that other agencies such as the USGS and USFWS will also provide support for these instream flow studies.

The following outlines baseline studies required for each study area are:

- (1) Cook Inlet to the Talkeetna-Susitna River Confluence.
Spatial and Seasonal Habitat Requirements of Fish Populations

Objectives

The objectives within this study area are to:

- define essential seasonal habitat requirements for incubation, rearing, spawning, and passage of anadromous and resident fish populations;
- define the seasonal relationships between flow regimes and essential physical and biological habitat characteristics;
- define the relationships between the tributary and slough physiochemical and biological habitats within the mainstem Susitna River at various flow regimes;
- develop state-of-the-art capabilities to evaluate habitat characteristics in this difficult reach of river; and
- generate data essential for evaluating the effects of various flow regimes on terrestrial and riparian habitat.

Background

This reach of the Susitna River provides important habitat for rearing, incubating, spawning, and migrating resident and anadromous fish species. Unfortunately, its physical characteristics also make it one of the most difficult to evaluate. Studies of seasonal habitat characteristics will be coordinated on an annual basis with the life history and distribution fish studies (both anadromous and resident).

Expansion or determination of these studies will depend upon determination and confirmation of:

- The seasonal habitat requirements between various life history stages of the resident and anadromous fish.
- The relationship of seasonal habitat to various discharges.

If positive confirmation is provided by the habitat study in conjunction with other biological studies, specific year-to-year study locations should be identified for ongoing programs to determine the effects of the project on the fish and wildlife resources in this portion of the basin.

Work Plan

The initial year of this study will be comprised of essentially three field operations:

- mainstem seasonal instream flow measurements;
- tributary seasonal instream flow measurements; and
- collection of other physiochemical and biological habitat data.

A crew of biologists utilizing a customized riverboat as their primary means of transportation will operate in the mainstem and selected tributary systems during the ice-free months May through October to:

- procure equipment;
- establish and refine large river instream flow measurement techniques;
- collect instream flow data in terms of depth, velocity, wetted perimeter, and substrate; and
- collect water quality data as related to discharge.

- (2) Talkeetna River Confluence Upstream to Devil Canyon. Spatial and Seasonal Habitat Requirements of Fish Populations

See Resident Fish Study Proposal.

- (3) Devil Canyon Damsite Upstream to the Tyone River Confluence. Spatial and Seasonal Habitat Requirements of Fish Populations

See Resident Fish Study Proposal.

(4) ADF&G Big Game Studies

- Moose distribution, movements and habitat use in the vicinity of proposed impoundments.

Objectives

To identify moose subpopulations using habitat that will be inundated by proposed impoundments.

To determine the seasonal distribution, movement patterns, size and trends of those subpopulations.

To determine the timing and degree of dependency of those subpopulations on habitat to be impacted by the Susitna Hydroelectric Project.

Background

Preliminary studies indicated that several loosely defined subpopulations of moose inhabit proposed impoundment areas for all or part of the year. Most moose studied exhibited altitudinal migration patterns, spending summers at higher elevations often outside of the proposed impoundment areas and winters at lower elevations often within or adjacent to impoundment areas. Therefore the most severe impacts of the Susitna Hydropower project on moose upstream from Devils Canyon are expected to result from inundation of and blockage of migrations to critical winter range. Since some moose migrate to summer range up to 60 miles from their winter range, reductions in the capacity of winter range may result in reduced densities of moose over a vast area.

The basic approach of this study is to identify the subpopulations of moose using potential impoundment areas and to quantify their dependence on those areas. For example, winter range of each subpopulation will be delineated and the proportion of available winter range that will be lost will be estimated. Factors such as browse production, quality and availability under varying environmental conditions will be considered. Since environmental conditions influencing these factors vary from year to year it will be necessary to continue these studies for several years.

Both the short term impact on the present moose population and the longer term loss of potential population size will be estimated by determining the size and trends of the existing population and assessing its status in relation to the present capacity and trends of the range.

The relationship between moose habitat and moose populations is complex. It is difficult to quantify this relationship and impractical to attempt to measure all aspects over the entire impact area. Therefore it will be necessary to conduct intensive studies

in only portions of the area to estimate the relative capacity of certain habitat types under certain environmental conditions. These estimates will then be extrapolated to the entire impact area on the basis of more extensive moose population studies and habitat maps.

Data derived directly from the moose will be collected under this subtask while data derived from the moose's habitat will be collected under other subtasks, particularly 7.12 Plant Ecology.

It is anticipated that by the end of Phase I the basic distribution and movement patterns of the major moose subpopulations will be known. The present number of moose using the study area will be estimated. A rough estimate of the percentage of winter habitat used during the winter of 1980-81 that will be lost should be possible. In other words it should be possible to estimate the overall scope and a range of magnitude of potential impacts. Studies must be continued through Phase II to determine impacts under a wider variety of environmental conditions and to test and refine the estimates made at the end of Phase I.

Procedures

1. Approximately 60 moose will be radio-collared during the first year of study. Most of these will be collared in March 1980 when moose are on winter range and most likely to be in or near proposed impoundment areas. Subsequent collaring operations will be conducted as needed to replace collars and to fill data gaps. Moose will be collared from Devils Canyon to the confluence of the Maclaren and Susitna Rivers, however it is anticipated that most will be collared in the vicinity of the proposed Watana impoundment which is expected to impact more moose than the Devils Canyon impoundment. Radio-collared moose will be relocated at least twice a month to delineate seasonal ranges. More intensive monitoring will be conducted as needed to determine migration patterns and calving areas and to delineate critical winter range. The specific location, habitat type, activity, and association with other moose will be recorded for each relocation. Habitat type will be classified according to the system that will be used in habitat mapping under subtask 7.12.
2. Periodic systematic aerial surveys will be made during winter to further delineate winter ranges and quantify the relative use of specific areas and habitat types in and out of proposed impoundment areas. To the extent possible moose will be classified by sex and age class as an aid in identifying segregation patterns and determining population trends.
3. Moose numbers will be estimated through quadrat sampling techniques during later winter.

4. The long and short term nutritional status of moose captured for collaring will be assessed through established techniques using morphometric measurements, condition classification, blood chemistry and hair mineral element levels.

Relationship to Other Subtasks

Procedures for recording and handling data will be coordinated with those of other wildlife studies to ensure efficiency in later impact analysis.

Personnel and logistics will be coordinated among all big game studies. In particular wolf and wolverine tagging will be coordinated with moose tagging and when feasible several species will be radio-tracked on the same flight.

Moose studies will be closely coordinated with plant ecology studies. Moose distribution data collected between January and March 1980 will be used to delineate areas for detailed habitat mapping and for selection of intensive vegetation study areas. These habitat maps will be used in the analysis of moose distribution data. It is anticipated that continual coordination between investigators of both subtasks will be maintained to ensure efficiency of study design and compatability of data.

Snow conditions strongly influence moose movements and browse availability. Requirements for snow data will be determined on the basis of final project design and selection of detailed vegetation study areas. If possible these needs will be coordinated with those of the hydrologic field data collection program. It may be necessary to establish additional stations solely on the basis of moose study needs.

- Moose distribution, movements and habitat use downstream from Devils Canyon.

Objectives

To identify moose subpopulations using habitat that will be altered by changes in stream flow below Devils Canyon.

To determine the seasonal distribution, movement patterns, size and trends of those subpopulations.

To determine the timing and degree of dependency of those subpopulations on habitat to be impacted by altered flow regimes of the Susitna River.

Background

Islands and bars in the Susitna River are heavily used by moose during winter, particularly in years of deep snow. A major factor making these areas attractive to moose appears to be the maintenance of vegetation in a subclimax stage by the existing flow regime of the river. The mechanism setting back plant successive is not known. Periodic flooding may be the dominant factor but other factors such as siltation, normal channel erosion, ice scouring and soil moisture may also be important.

Alteration of the Susitna River flow regime by the Susitna Hydroelectric Project will probably result in changes in vegetation downstream. The nature and magnitude of these changes are unknown but could be significant to moose and other species of wildlife. It is possible that even minor changes in flow such as dampening of extreme flood levels by a few inches could alter many acres of critical moose winter range. Such alterations could influence moose abundance over a large area.

Because of the many unknowns, assessment of the impact of the Susitna Hydroelectric Project on moose populations in the lower Susitna River drainage will require synthesis of information from several disciplines including hydrology, geomorphology, plant ecology and wildlife ecology. Under ideal circumstances a systematic progression of studies starting with hydrology and ending with wildlife ecology should be followed. However, the schedule time frame for developing the Susitna Hydroelectric Project is incompatible with this approach. Therefore it will be necessary to conduct a number of studies simultaneously.

The basic approach will be to identify mechanisms of impact and roughly estimate the potential magnitude of impact during Phase I. If significant impacts are identified the studies will be redesigned to produce a more reliable estimate of impact and to provide an initial assessment of mitigation possibilities.

Studies of the effects of water conditions on moose habitat will be conducted under Subtask 7.12 Plant Ecology. It is anticipated that by the end of Phase I these studies will indicate if substantial changes will be caused by the predicted post-construction flow regime. A habitat map, which will also be prepared under Subtask 7.12 during Phase I, will provide a basis for preliminary estimates of acreages that might be altered. If significant vegetation changes are indicated by the Phase I studies these estimates will be refined during Phase II.

The dependency of moose on habitat subject to alteration will be assessed under this subtask. During Phase I moose wintering areas on and adjacent to the river will be delineated and the relative use of various habitat types, particularly those subject to periodic flooding, will be determined. This will provide the basis for a preliminary estimate of the proportion of winter range that may be altered, however, this estimate will be valid only for the

environmental conditions existing during the winters of 1979-80 and 1980-81.

Characteristics of moose use of habitat subject to flooding will be determined by more intensive study of moose using one or more limited study areas. These study areas will include areas selected for intensive vegetation studies. Movements of individual moose will be monitored to determine whether habitat subject to flooding is used transiently by large numbers of moose or more regularly by smaller numbers. Moose use of specific plots being studied under Subtask 7.12 will be assessed through direct observation and pellet group counts.

Seasonal ranges of moose wintering on the intensive study area will be superficially delineated to indicate the approximate geographic scope of any impacts that are identified.

If Phase I studies indicate that the Susitna Hydroelectric Project will cause significant alteration of habitat downstream and that alteration of this habitat is likely to result in significant changes in moose distribution and numbers, Phase II studies will be designed to delineate moose subpopulations using the entire area of potential habitat alteration and to predict the impact on each subpopulation.

Procedures

The following procedures are for Phase I studies only:

1. Existing data on moose distribution and movements adjacent to the lower Susitna River will be compiled. Sources will include historic fall sex and age composition counts, records of road and railroad kills, and incompletely analyzed data on a major winter die-off that occurred along the river in 1970-71.
2. Periodic systematic aerial surveys will be made during winter to delineate winter ranges and quantify the relative use of specific areas and habitat types adjacent to the Susitna River. To the extent possible moose will be classified by sex and age class as an aid in identifying segregation patterns and determining population trends.
3. A limited number of moose (up to 20 during 1980) will be radio-collared in areas selected for intensive vegetation study (see Subtask 7.12). These moose will be relocated approximately weekly while they are in the vicinity of the river to determine the pattern of use of specific habitats. They will be relocated approximately monthly at other times of year to roughly delineate other seasonal ranges and ensure continued contact with each animal.
4. Pellet group counts will be conducted within the intensive study areas to provide a quantitative comparison of moose use of specific habitats that will also be studied under Subtask 7.12.

Relationships to Other Subtasks

Procedures for recording and handling data will be coordinated with those of other wildlife studies to ensure efficiency in later impact analysis.

Moose studies will be closely coordinated with plant ecology studies. Moose distribution data collected between January and March 1980 will be used to delineate areas for detailed habitat mapping and for selection of intensive vegetation study areas. These habitat maps will be used in the analysis of moose distribution data. It is anticipated that continual coordination between investigators of both subtasks will be maintained to ensure efficiency of study design and compatability of data.

Snow conditions strongly influence moose movements and browse availability. Requirements for snow data will be determined on the basis of final project design and selection of detailed vegetation study areas. If possible these needs will be coordinated with those of the hydrologic field data collection program. It may be necessary to establish additional stations solely on the basis of moose study needs.

- Wolf distribution, abundance, habitat use and prey selection.

Objectives

To identify wolf packs occupying areas that will be impacted by the Susitna Hydroelectric Project.

To delineate the territories of each pack and identify den sites, rendezvous sites and major feeding areas.

To determine the numbers of wolves and rates of turnover for each pack.

To determine the food habits of each pack.

Background

Recent studies indicate that the Nelchina Basin supports moderate densities of wolves. Wolves may be affected by the Susitna Hydroelectric project if critical portions of a pack's territory are inundated or if the abundance or condition of prey is altered.

Limited available data indicate that portions of the territories of several packs may be inundated. Since all parts of a pack's territory may not be equally important to the maintenance of the pack, the effect of this loss of territory may vary from pack to pack. Therefore it is necessary to delineate the territories of each pack and determine the degree and nature of use of areas within proposed impoundments.

A major factor influencing wolf numbers and distribution is prey availability. Recent studies in other parts of the Nelchina Basin indicate that large ungulates, particularly moose, are the most important prey of most packs of wolves. Since moose and caribou tend to be migratory it is possible that the Project will result in reduced prey availability in the territories of wolf packs many miles from the impoundments.

An assessment of the impact of the Project on wolves requires a knowledge of prey populations. Therefore wolf studies will be closely coordinated with studies of potential prey species.

Initially studies will be concentrated on wolf packs that are likely to be directly impacted through loss of territory. If studies of prey species indicate that prey densities are likely to be altered in other areas, the wolf study will be expanded to delineate packs in those areas.

Procedures

1. Several members of each wolf pack will be radio-collared. Each radio-collared wolf will be relocated at least twice a month. More frequent relocations will be made when necessary to provide specific information such as location of dens and rendezvous sites. Territories will be delineated by plotting relocations on maps. Numbers of wolves in each pack will be monitored continuously by direct observation of radio-collared wolves and other wolves accompanying them.
2. Habitat selection will be determined by recording the habitat type and activity of the wolves for each sighting made.
3. Standardized track count censuses will be conducted after fresh snowfalls to provide additional information on wolf distribution and numbers and identify packs not radio-collared.
4. Food habitats will be determined by observation of kills located during radio-tracking flights and analysis of scats collected at dens. When possible the age, sex and condition of prey will be determined.

Relationship to Other Subtasks

Procedures for recording and handling data will be coordinated with those of other wildlife studies to ensure efficiency in later impact analysis.

Personnel and logistics will be coordinated among all big game studies. In particular wolf and wolverine tagging will be coordinated with moose tagging and when feasible several species will be radio-tracked on the same flight.

Data from studies of prey, particularly moose and caribou will be used in modification of design of wolf studies. Studies of both predators and prey will be closely coordinated so that interactions between species which might influence impacts of the Susitna Hydroelectric Project can be identified.

- Wolverine distribution, abundance, movement patterns and habitat use.

Objectives

To determine the distribution and abundance of wolverines in the vicinity of proposed impoundments.

To determine movement patterns and home range size of wolverines.

Background

Little is known about wolverine movement patterns and habitat requirements. A basic understanding of these questions is necessary before impacts of the Susitna Hydroelectric Project can be addressed. For example, if wolverines have well defined home ranges and strict habitat requirements, impacts might be quite different than if they have large and loosely defined home ranges and are able to exploit a wide variety of habitat types.

Observations made in the vicinity of the study area indicate that techniques that will be employed in the wolf study could be adapted to provide the necessary basic information on wolverines.

Since very little is known of wolverines at the present time, it is anticipated that only rough estimates of the mechanisms and potential magnitude of impacts will be possible at the end of Phase I. At that time it may be necessary to redesign studies to provide a more reliable basis for assessment of impact.

Procedures

1. The distribution and abundance of wolverines will be assessed through track counts and direct observations made during wolf census surveys.
2. Wolverine (up to 10 in 1980) will be radio-collared and relocated approximately twice per month to determine movement patterns and home range.
3. Habitat selection will be determined by recording habitat type and activity for each sighting made.

Relationship to Other Subtasks

Procedures for recording and handling data will be coordinated with those of other wildlife studies to ensure efficiency in later impact analysis.

Personnel and logistics will be coordinated among all big game studies. In particular wolf and wolverine tagging will be coordinated with moose tagging and when feasible several species will be radio-tracked on the same flight.

Personnel from the University of Alaska are expected to have opportunities to collect additional information on wolverines in the course of studies directed at other furbearers. All aspects of both studies will be coordinated to maximize data collection with a minimum of duplication of effort.

- Bear distribution, movements, abundance and habitat use.

Objectives

To determine the distribution and abundance of black and brown/grizzly bears in the vicinity of proposed impoundment areas.

To determine seasonal ranges, including denning areas, and movement patterns of bears.

To determine seasonal habitat use of black and brown/grizzly bears.

Background

Much of the Nelchina Basin is known to support high densities of brown/grizzly bears. Black bears are believed to be less abundant and less widely distributed. The main mechanism of impact affecting bears is likely to be direct loss of habitat, particularly seasonally important feeding areas or denning areas. Some bears may be indirectly affected through reduction in ungulate densities in areas outside of proposed impoundments as moose, and perhaps caribou, constitute a major portion of bears' diet during summer in adjacent areas. Shorter term impacts will result from bear-human conflicts which are likely to occur when field facilities are established for the Susitna study program and subsequent dam construction if the project is approved.

Studies in other parts of Alaska indicate that bears have specific habitat and food preferences. These preferences often vary seasonally in a manner that suggests very specific seasonal habitat requirements. While both species of bear sometimes occur in close proximity, their habitat requirements are probably different. Therefore the impact of inundation of bear habitat may not be in direct proportion to the number of acres lost and the impact on one species of bear may be quite different from that on the other.

Procedures

1. Adult bears will be radio-collared in and adjacent to the proposed impoundment areas. Approximately 35 bears will be collared the first year. Incidentally caught bears too small to be radio-collared will be marked with visual tags. Black bears and brown/grizzly bears will be marked in the approximate proportion of their occurrence in the area. At this time it is not known if significant members of black bears will be found.
2. Radio-collared bears will be relocated periodically throughout their active period to delineate seasonal ranges and determine movement patterns. The den location for each radio-collared bear will be recorded each year.
3. All observations of both marked and unmarked bears will be recorded. For each sighting the location, habitat type, activity and association with other animals will be recorded.
4. Information on seasonal food habits will be gathered through observations of bear feeding and to the extent possible through scat analysis.

Relationship to Other Subtasks

Procedures for recording and handling data will be coordinated with those of other wildlife studies to ensure efficiency in later impact analysis.

Personnel and logistics will be coordinated among all big game studies. When feasible several species will be radio-tracked on the same flight.

- Caribou herd identity, migration patterns and habitat use.

Objectives

To delineate calving areas.

To determine the numbers and sex and age composition of caribou occupying habitats on both sides of proposed impoundments at different seasons.

To determine migration routes and the timing of major movements in the vicinity of proposed impoundments.

Background

The distribution and movement patterns of the Nelchina caribou herd were extensively studied during the 1950's and 1960's. At that time large numbers of caribou regularly crossed proposed impoundment areas during migrations between seasonal ranges, particularly on their

migration from calving areas south of the Susitna River to summer range north of the river and subsequent fall migrations to the east. Early assessments of the impact of various Susitna hydroelectric proposals suggested that impoundments could block migrations and isolate caribou from portions of their traditional range.

A number of major changes have occurred during the last decade which limit the value of data collected prior to 1970. The herd suffered a major decline in the early 1970's, dropping from an estimated peak of over 70,000 to less than 10,000. The herd is currently increasing and estimated to number 20,000. Current management plans call for stabilizing the herd at the present level. Movement patterns appear to have become quite variable from year to year. While movements across proposed impoundment areas still occur it is not clear whether they are as significant to the population as they were thought to be in past years.

Location of calving areas is believed to be the most consistent characteristic of caribou distribution and movement patterns. The traditional concept of a herd assumes a well defined common calving area. The Nelchina herd still uses its traditional calving area south of the Susitna River, however, in the last few years there have been indications of significant numbers of caribou north of the river during the calving period. These caribou may represent a subherd with all sex and age classes represented or they may be segments of the main herd that are not involved in calving.

If a new subherd exists the "need" to migrate across the proposed impoundment areas may be reduced. But if different sex and age classes are on opposite sides of the river at that time of year the need to migrate would be great.

It is not likely that caribou would be completely excluded from any part of their range other than those areas that are inundated. However, even a partial barrier to movements could result in reduced use of portions of the present range and increased use of other portions. If the desire to migrate along routes blocked by impoundments is strong, caribou may attempt to cross impoundments. Potential hazards such as ice shelves and mud flats could increase mortality rates among caribou attempting to cross.

Unfortunately there is no way to predict with confidence the reaction of caribou to impoundments. The caribou impact assessment will necessarily be more subjective than those for other big game species. The approach of this study is to describe the existing patterns of caribou distribution, movements and habitat use. This should provide a basis for estimating the importance of specific migration routes to the present population and for determining the availability of alternative migration routes.

Procedures

1. Aerial surveys will be made to delineate distribution of caribou on both sides of proposed impoundments and to determine if calving is occurring north of the Susitna River.
2. Post-calving concentrations on both sides of the river will be censused by commonly used photo extrapolation techniques to determine the proportion of the herd occupying habitat north of the river.
3. Sex and age composition counts will be made in spring and fall as part of the census procedure. These counts will also indicate if the sexes and ages caribou using habitat on one side of the river are different from those using habitat on the other side.
4. Caribou (up to 40 in 1980) on both sides of the river will be radio-collared. Collars will be placed on animals in different groups of caribou scattered throughout the herd. The frequency of relocation of radio-collared caribou will vary depending on the location and activity of the caribou. Relatively low levels of monitoring will be maintained when caribou are away from the impoundment areas or are sedentary to provide basic information on seasonal ranges and habitat use and to ensure continued contact with collared individuals. The frequency of monitoring will be increased when caribou are close to impoundment areas, particularly during migrations.
5. Habitat type will be recorded for all caribou sightings.

Relationship to Other Subtasks

Procedures for recording and handling data will be coordinated with those of other wildlife studies to ensure efficiency in later impact analysis.

Personnel and logistics will be coordinated among all big game studies. In particular individuals working on other species will record caribou observations and periodically scan radio frequencies in the vicinity of impoundments to assist in identifying periods when intensive caribou monitoring is needed.

- Distribution and abundance of Dall sheep.

Objectives

To determine the distribution and abundance of Dall sheep adjacent to proposed impoundments.

Background

- Relatively isolated groups of Dall sheep inhabit mountainous areas on both sides of the proposed Watana impoundment. At the present time it is not believed that sheep regularly use habitat that will be inundated or that they regularly migrate through areas which will be inundated. It is possible that the Watana impoundment might further isolate groups north of the river from larger adjacent populations south of the river reducing possibility of repopulation should these groups decline in the future.

The main concern is the effect of disturbance during construction of hydroelectric generation and transmission facilities. It may be possible to zone construction activities in both time and space to minimize this disturbance. The purpose of this study is to provide a basis for decisions on such zoning.

Procedures

Aerial surveys will be made to delineate seasonal ranges including rutting and lambing areas.

Relationship to Other Subtasks

Since the scope of this study is limited, only minor coordination of personnel and logistics will be necessary.

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Subtask 7.11 - Wildlife Ecology Studies

(a) Objective

The primary objective of this subtask is to accurately determine the impact the proposed Susitna Project will have on the wildlife resources of the Upper Susitna River Basin. In order to accomplish this objective, it will first be necessary to: 1) determine the species present, their distribution and relative abundance; 2) gather sufficient data to develop an understanding of the relationship between key wildlife species and the distribution, quality and seasonal utilization of habitat components; and 3) determine the predator-prey relationships that exist in the terrestrial system.

(b) Approach

The general philosophy upon which the approach to the wildlife ecology program was developed is that the wildlife community represents a system; this system is connected by means of a complex variety of interrelationships, and is influenced by the nature and distribution of plant communities. In order to assess the impact of the Susitna Project on any one component of the system it is necessary to have at hand baseline data on all members of the system. To achieve the objectives of this study, an appropriate approach has been developed for each section. Following is a summary of the approach that will be taken in regard to: 1) big game, 2) furbearers, and 3) birds and non-game mammals.

(1) Big Game

The big game studies have been divided into the following categories: population studies, habitat studies, impact assessment and mitigation measures.

Prior to the development of an impact assessment, a detailed survey of current big game populations will be conducted. Population data will be collected by the Alaska Department of Fish and Game as detailed in (e) below. Species to be surveyed by ADF&G include: moose, caribou, bears, wolf, wolverine and Dall sheep. Seasonal distribution, abundance, habitat preference and movement patterns will be determined for each big game species by ADF&G.

An extensive habitat analysis will also be conducted. The habitat effort will be performed primarily as a part of the Plant Ecology Studies (Subtask 7.12). Although much of the data collected under the habitat analysis will be applicable to several big game species, as well as the other wildlife disciplines, the major emphasis will be in regard to moose habitat. Phase I (pre-license application) of the big game habitat study will be limited primarily to the production of vegetation cover/habitat maps that will provide acreage, location, and distribution information on major habitat types.

During the first year of the study, an expert will be selected to perform the big game impact assessment. The person selected for this effort will be highly qualified and totally objective. Approval of the APA will be secured prior to finalizing any arrangement. The impact assessment will deal with both short-term and long-term impacts. The impact zone will include the entire Upper Susitna River Basin as well as downstream portions of the Susitna River.

Phase I of this study will also include the consideration and identification of possible mitigating alternatives. To prepare an actual mitigation plan during Phase I, without the benefit of a sound data base, would most likely result in the production of a plan based on speculation rather than facts. Therefore, during 1982, TES will submit a proposal and cost estimate to develop a detailed mitigation plan.

(2) Furbearers

The furbearer study effort during the pre-application phase will be a two-year survey and will include an extensive survey of populations within the project region. This will include a literature search, as well as the identification of key species, general abundance levels, and the location of preferred habitats and areas of notable abundance. A preliminary assessment of impacts will also be prepared at the conclusion of Phase I.

(3) Birds and Non-Game Mammals

An extensive approach as well as an intensive approach will be used for these studies. The extensive bird study will cover a large portion of the Upper Susitna Basin and will determine the presence of possibly unexpected species or unexpected concentrations of species. Intensive census sites will be located in the upland and wetland habitats and will provide data on bird species composition and density in each of the most extensive habitats of the region, providing, among other things, an indication of habitat uniqueness and productivity.

A survey of non-game mammals will be conducted, primarily in the proposed impoundment area, and will provide useful data on many important prey species, such as hares, voles and mice. Sampling efforts will be coordinated with the avian study and will utilize similar sampling areas and habitat data.

(c) Discussion

In dealing with a large area such as the Upper Susitna River Basin, and attempting to develop an adequate understanding of potential impacts and possible mitigative measures, it is necessary to study the entire faunal community and delineate the complex interrelationships that exist among the components of the terrestrial system. We realize that certain portions, or species, within the system are considered important by certain groups or agencies. This plan of study has been designed to concentrate on such important species; however, regardless of the importance of these species, they are all part of the total community system and a satisfactory understanding of any member of the system cannot be developed without investigating the entire system.

In the case of many species a minimum of 4 or 5 years is needed to gain a thorough understanding of population dynamics. Many species, particularly small to medium-sized mammals, demonstrate cyclic changes in density; and thus a 1- or 2-year study is highly restrictive in perspective. Likewise, larger species such as moose and caribou, demonstrate different movement patterns and habitat needs under various weather conditions. Thus the wildlife data collected during Phase I will enable the preparation of only a preliminary impact assessment. Studies proposed after the licensing application is submitted are designed to satisfy the time requirements of some aspects of the Susitna Wildlife study and assure that adequate consideration of the basic research needs are addressed. A refined and more thorough impact prediction, as well as a consideration of mitigation alternatives, will result from proposed Phase II efforts.

(d) Schedule

Weeks 1 through 117

(e) Detailed Scope of Work

(1) Big Game

Although TES proposes to approach the impact evaluation of the wildlife resources of the Upper Susitna River Basin by considering all components of the faunal community, we recognize that big game species have a unique importance in this case. There is little doubt that to the people of Alaska, and to the major resource agencies, big game is a very valuable resource and is thus worthy of major consideration in the impact analysis for the Susitna Project.

- Population Studies

Prior to the development of an impact assessment, a detailed survey of current game populations will be conducted. Population data will be collected by the Alaska Department of Fish and Game as presented in (4) ADF&G Big Game Studies. Species to be surveyed by ADF&G include: moose, caribou, bears, wolf, wolverine, and Dall sheep. Seasonal distribution, abundance, habitat preference and movement patterns will be determined for each big game species by ADF&G. A variety of techniques will be used during this portion of the study and will include aerial surveys and radio-telemetry. While the major emphasis will be placed on the Upper Susitna Basin and the impoundment area, the moose population studies will also include the riparian areas downstream from Talkeetna.

- Habitat Studies

In addition to population data collected on big game by ADF&G, an extensive habitat analysis will be conducted by TES. The habitat effort will be performed primarily as a part of the Plant Ecological Studies. Habitat data will be needed in order to accurately predict the impact of the proposed project, as well as to determine changes that can be expected to take place in the absence of the project. Although much of the data collected under this effort will be applicable to several species, the major emphases will be on moose habitat.

Phase I of the big game habitat study will be limited primarily to the production of vegetation cover/habitat maps that will provide acreage, location, and distribution information on major habitat types. The Upper Susitna Basin will be mapped at a scale of 1:250,000. Vegetation cover/habitat maps at a scale of 1:63,360 will then be produced for an area 10 to 12 miles on both sides of the Susitna River, from the proposed site of the Devil Canyon dam to the confluence of the McClaren River. The downstream floodplain south to Talkeetna will be mapped at a scale of 1:25,000. The classification system to be utilized for the mapping is the system developed by Dryness and Viereck. The mapping will be to the 3rd and 4th level of this system. Additional details concerning the vegetation cover/habitat mapping efforts are discussed in Subtask 7.12.

The quantitative information required for more detailed impact predictions concerning moose habitat will be obtained during the Phase II effort. This will include an estimate of available browse, productivity of key browse species, browse quality and utilization by moose. Data of this nature will be collected in portions of both the Upper Susitna Basin and the downstream floodplain. Portions of the study area identified during the Phase I moose population studies as critical wintering areas will be used for the quantitative browse studies.

An associated aspect of the habitat study will be a plant succession study to be conducted during Phase I. This study will attempt to gain an understanding of successional trends and the factors influencing successional changes. This information will be very useful in predicting changes, especially in regard to moose habitat, that are likely to occur with or without the project. Additional details concerning plant succession studies can be found in Subtask 7.12.

- Impact Assessment

TES will obtain the services of an individual, or group, to perform an independent impact assessment on big game. We will utilize the first part of 1980 to determine which individual is best qualified to assist on this aspect of the study effort. The two criteria that will be applied in the selection process are: (1) expert qualifications in dealing with the species involved, and also familiarity with these species in similar subarctic ecosystems, and (2) independence from any interest or concerns with the study area or the political aspects of Alaskan wildlife resource management.

The impact assessment will deal with both short-term impacts, such as construction activity, as well as long-term impacts which could involve disruption of movement patterns or predator-prey dynamics. The impact zone on these species will probably include the entire Upper Susitan River Basin as well as downstream portions of the Susitna River. In order to accurately determine the impact of the project it will also be necessary to predict long-term changes in habitat and population levels that can be expected to occur without the proposed project.

Of paramount importance throughout the impact zone will be the location and distribution of preferred habitat, particularly in regard to potential barriers created by the impoundments. This will be of prime importance to moose and caribou, species whose annual habitat needs vary from season to season and also differ under various weather conditions. An associated concern, particularly in regard to wolves, and to a lesser extent bears, will be the location of denning sites. Whether or not traditionally used wolf dens are flooded, or disturbed by human activity, will likely influence the abundance, at least in the near future, of wolves in the Upper Susitna Basin.

- Mitigation

Assuming that the net effect of the Susitna Project on big game will be of a negative nature, it will be necessary to consider mitigative measures that can be taken. Mitigative measures can be grouped into two categories. First are efforts that can be implemented to reduce the impact of the project on the game populations within the study area or impact zone. The second type of mitigative measures involve the improvement of habitat outside of the impact zone to increase game populations to an extent which would compensate for losses attributable to the Susitna Project.

In either case, it will require the collection of at least two years' data before enough is known about likely impacts so that a mitigation plan can be formulated. This plan of study includes time and expenses to consider and identify possible mitigative alternatives. However, at this point in time, based on the available information, it would have been premature and highly speculative to propose a full-scale effort to develop a mitigation plan. Therefore, it is recommended that during 1982 TES, through Acres, submit to the APA a proposal and associated cost estimate to develop a mitigation plan. At that point sufficient information, both of a biological and engineering nature, will exist upon which to structure a well designed program to address the issue of mitigation for big game.

(2) Furbearers

Furbearers will be investigated for a period of two years during Phase I and for three additional years during Phase II. The following species of furbearers will be considered: red fox, coyote, pine marten, mink, river otter, lynx, beaver and muskrat. Studies of furbearers will be synchronized with field and laboratory investigation conducted by project personnel preparing vegetation cover/habitat type maps and conducting studies of project impacts upon other terrestrial mammals and birds. Utilization of data from other disciplines such as hydrology and socio-economics will also be required to accurately predict the impact of the Susitna Project on furbearers.

Phase I (1980 and 1981) will focus on collecting essential data for a generalized assessment of the project upon furbearer population. The first portion of Phase I will entail the identification and review of existing information concerning furbearers in the Susitna Valley. During the early months of 1980, libraries with northern reference collections in Alaska, Canada and the contiguous 48 states will be

searched to gather background information. Biologists, trappers and others with knowledge of the Susitna Valley will be interviewed to obtain data to supplement published literature. Field techniques will be tested and where needed, new techniques developed at this time. Extensive field surveys will start in late February and March 1980. Additional field surveys will be conducted in late February and March 1981, summer 1980 and 1981, and early winter (November-December) 1980 and 1981.

Field work will be conducted on a number of study sites in representative habitats in and adjacent to the impoundment zones and downstream areas likely to be altered by the proposed development. Study sites will include predominant vegetation types and major physiographic features. Furbearer abundance and habitat preferences will be determined by transect and scent station surveys. Aerial surveys will be used to locate terrestrial furbearer sign and to locate beaver lodges and dams. Floats of the river in summer will be conducted to count furbearers directly and to correlate tracks on sandbars with winter tracks in the same areas. Seasonality of use will be determined where possible. Interviews of trappers and other persons with knowledge of the area will be conducted to supplement field surveys. Relative abundance of each species of furbearer will be correlated with the major types of habitat, utilizing the University of Alaska computer system. Assessments of probable impacts will be based upon predictable changes in habitat and anticipated human use of the area if construction proceeds.

(3) Birds and Non-Game Mammals

The overall objective of the studies proposed below is to determine what species of birds and non-game mammals use the Upper Susitna River Basin in the vicinity of the proposed impoundments and to determine on a seasonal basis the habitats in which they are found and their abundance. This data can then be used to evaluate habitat potential in the area, to extrapolate population data for given geographic or habitat units within the region, and to evaluate possible mitigative measures, should they prove necessary.

- Extensive Avifauna Survey

A survey of the avifauna of the Upper Susitna River Basin will be conducted within an approximate 10-mile band on either side of the river, from Gold Creek to the upriver location above which the impoundment will not influence the current habitat. Particular attention will be paid to long-lived species, those that are particularly sensitive to human disturbance, those subject to hunting pressure, and any endangered species.

All habitats of the region will be visited on a regular basis throughout the migration and summer periods, and all birds seen or heard will be recorded. This activity will provide data on seasonal use of the entire region by birds and provide a basis for determining the relative abundance of species within habitats as well as a general indication of habitat productivity.

One or two aerial surveys will be made each year to search for evidence of large nesting raptors such as the osprey, bald and golden eagles, peregrine falcon, and gyrfalcon. Aerial surveys of waterfowl will also be conducted over wetland areas periodically throughout the migration and summer seasons.

- Intensive Avifauna Census

Census plots will be established during 1980 in each of the major terrestrial habitats in the vicinity of the proposed dam sites. Wherever possible, these plots will be square 10-ha plots on sites of uniform habitat. Censusing will be done with a modification of the territory mapping method. During the breeding season (1981), 7-9 censuses will be conducted on each plot; 1 or 2 censuses will be conducted during the winter months (1980 and/or 1981). The habitat for each bird census plot will be sampled in detail during 1980, using the point-centered quarter method, with modifications to include sampling of ground cover and shrub vegetation.

For each of the major habitats censused, avian species composition and density will be calculated. For each of the more common bird species in the upland habitats, determination of habitat preferences will be attempted through the use of multivariate statistical techniques (1982 only).

These data on habitat productivity and avian habitat preferences will provide insights into the effects of construction activities and subsequent impoundments on the avifauna of the region. It should be possible, through extrapolation, to roughly estimate the number of birds of each species that will be displaced from terrestrial habitats as a result of habitat destruction caused by construction and impoundments. It will also be possible to predict what species will be attracted to the region after construction, based on habitat changes caused by construction (revegetation) or changes in water level.

- Non-Game Mammal Survey

During 1980 trapline transects will be established in each of the major terrestrial habitats in the vicinity of the proposed dam sites and in several wetland habitats. Censusing of shrews, voles and mice will be conducted using the North American Census of Small Mammals snap-trapping technique. Two parallel transects will be established, each a straight line, 289 m. long, consisting of 20 trap stations. At each station, a maximum of three snap-traps and one pitfall trap will be set for three consecutive nights. One late-spring/early-summer, one fall, and possibly one winter census will be conducted on each of the habitat plots. Sampling will be conducted during 1980 and 1981 of Phase I and continued through Phase II (1982 and 1983).

Habitat data at each trap site will be gathered in coordination with that gathered for the avian studies, using the point-centered quarter method, with additional variables used to quantify ground cover and other microhabitat variables. If a winter census is made, snow cover characteristics will be sampled (e.g., snow depth, density and hardness, layering, etc.).

For each of the habitats censused, mammal species composition and relative abundance will be calculated. For each non-game mammal species of sufficient sample size, quantification or macro- and micro-habitat preferences will be attempted.

More general methods will be used to quantify the presence of such species as the little brown bat, collared pika, snowshoe hare, hoary marmot, arctic ground squirrel, red squirrel, and flying squirrel. Within the study plots, the relative amount of sightings and sign (burrow entrances, cone "middens", scat, etc) will be tabulated, and attempts will be made to locate and map any concentrations of hoary marmot and arctic ground squirrel.

Some random trapping will be conducted, as time and opportunity permit, in other parts of the Upper Susitna River Basin and in lesser habitats not covered by the main plots, in order to permit the detection of species in the area that may not occur on the intensive plots.

Subtask 7.12 - Plant Ecology Studies

(a) Objective

To map and characterize the vegetation cover/habitat types occurring in the areas to be affected by the proposed Susitna Hydroelectric Project and to predict impacts that will result from the proposed facilities.

(b) Approach

The Phase I (pre-license application) portion of the plant ecology studies will concentrate on the production of vegetation cover/habitat type maps. These cover maps will be used in the plant ecology, wildlife ecology, and land use studies, and perhaps other disciplines. Phase I of the plant ecology studies will also include literature reviews, qualitative assessments of the major plant communities, succession studies, endangered species surveys, preliminary impact assessments, and the development of a Plan of Study for Phase II (post-license application).

The plant ecology studies will require coordination and input from other studies proposed by the Acres team. The coordination will primarily be involved with personnel performing the faunal and hydrological studies. Coordination with federal and state agencies is also anticipated.

(c) Discussion

The characteristics of vegetation/habitat types within an area is not only used for the prediction of impacts on plant communities, but also in predicting wildlife habitat removal and changes in land use patterns. Since the type maps will be utilized in a number of different studies, their development will be closely coordinated with the personnel involved in these studies. The Dyrness and Viereck Classification system modified to reflect the needs of other disciplines will be used as a basis for the mapping effort. Types will be mapped on LANDSAT and high altitude (U2) photography. The scale of the photography and level of mapping will vary depending on the area under consideration. The map scales and corresponding areas of coverage proposed are 1:250,000 for the entire upper basin; 1:63,360 for an area 10 to 12 miles on either side of the river from Devil Canyon to the McLaren River, floodplain below Talkeetna, and associated facility corridors; and 1:25,000 for the impoundment areas, floodplain between Devil Canyon and Talkeetna, and selected sampling areas below Talkeetna. Ground verification and qualitative assessments will be performed following the initial mapping efforts. Sensitive habitats, especially wetlands and those containing endangered or threatened species of plants, will be emphasized, and any natural landmarks (U.S. National Park Service Programs) in the area will also be noted. Literature reviews, a succession study, surveys for

threatened and endangered species, and preliminary impact assessments will also be part of the Phase I Study. A review of published literature and ongoing research will be performed to elucidate data voids, uncover supplemental information, and support findings. The succession study will be directed toward elucidating the temporal changes in riparian communities and the causal factors involved in these changes. This information will aid in the prediction of impacts on faunal species, especially moose. Although there are no plant species presently listed for Alaska by federal or state authorities, as endangered or threatened, twenty-seven species are under review by the U.S. Fish and Wildlife Service for possible protection. For these species distribution and habitat information will be assembled from literature and herbaria sources. Known stations and potential habitats for these species in the study area will be searched to determine the present status.

The proposed studies will be initiated early in 1980. Field work will be performed in the June to September period of both 1980 and 1981. Field sampling for the succession study and the mapping effort for the transmission and access corridors will be performed in the latter part of 1981.

Impacts on vegetation will be preliminarily assessed on the basis of information gathered prior to license application. The prediction of vegetation impacts at this stage will rely primarily on vegetation cover/habitat type maps. Acreage of the various cover types to be destroyed or altered will be estimated.

(d) Schedule

Weeks 8 through 117

(e) Detailed Scope of Work

(1) Literature Review

Comprehensive searches of the scientific literature will be made to generate a bibliographic and actual data base of the Susitna Region and on similar types of vegetation in Alaska and adjacent Canada. These studies will consist of literature searches in standard bibliographic sources (Biological Abstracts, Wildlife Review, etc.), data collation from literature on methods and other studies of Alaskan vegetation, government institution reports, and vegetation impact studies in other northern regions.

Methods used in quantitative ecological studies of boreal forest or taiga in other northern regions will be included in the searches. Literature dealing with the effect of water level changes on riparian vegetation will also be reviewed.

The data base review will also include a review of pertinent ongoing or proposed research. This information may be used to supplement or support findings of the proposed plant ecology studies and may perhaps require a redirection of efforts.

Part of the data base review will also include coordination with personnel involved in other aspects of the Susitna Hydroelectric Project. Input will be requested from other associated disciplines on schedule, methods, and types of data being collected. Vegetation information on data will be disseminated at the request of personnel in associated disciplines when it is available. It is anticipated that data exchange will primarily be involved with personnel in the hydrological and faunal studies.

(2) Vegetation Cover/Habitat Mapping

LANDSAT imagery and high altitude (U2) photography will be used to map vegetation/habitat types in the Susitna River Basin. The vegetation is primarily boreal forest types and upland tundra. This type of photography has proved adequate to delineate the types occurring in the area according to recent experience of staff of the Alaska Agricultural Experiment Station, in conjunction with the River Basin Cooperative Survey.

Vegetation cover/habitat maps will be produced at various scales. The entire Upper Susitna Basin will be mapped at a scale of 1:250,000. LANDSAT imagery will be used as a basis for this mapping. Much of this area has already been mapped for the Denali Planning Unit Remote Sensing Project. It is anticipated that these existing maps will be incorporated into the proposed mapping effort, with any areas that are not currently mapped being covered under the proposed mapping effort. These vegetation maps will, however, be modified so that the classification scheme will more appropriately match that envisioned for the proposed mapping effort.

Vegetation cover/habitat maps, to a scale of 1:63,360 will be produced for an area 10 to 12 miles on either side of the Susitna River from the Devil Canyon Dam site to the confluence of the McLaren River. Imagery enlarged to a scale of 1:63,360 will be utilized for this mapping effort. This area will be mapped primarily for use by personnel involved in the faunal studies, especially the big game studies. USGS topographic maps, which are available for this area at the 1:63,360 scale, will be useful in field orientation when used in conjunction with the cover maps. If possible, the cover maps will be printed over their corresponding topographic maps for use by field personnel.

The impoundment area and the downstream floodplain from Devil Canyon to Talkeetna will be mapped at a scale of 1:25,000, since these will be the primary areas of direct impact. Some selected moose habitat areas upstream and downstream will also be mapped at this scale for use in the moose habitat and successional

studies. This mapping effort is detailed in later sections. The photography to be utilized for the 1:25,000 mapping will be enlarged from existing color infrared (CIR) obtained from NASA U2 flights. This scale was selected because the U.S. Geological survey is mapping Alaska at this scale. Also, an enlarged scale of this nature has been requested by the Alaska Department of Fish and Game for use in the big game studies.

The two remaining areas for which vegetation cover/habitat maps will be produced will be the downstream floodplain below Talkeetna and the selected transmission line and access road corridors. In these areas, maps will be produced at a scale of 1:63,360. Much of the downstream floodplain has already been mapped by the Soil Conservation Service as a part of the Susitna River Basin Comprehensive Study, and their mapping will be incorporated in the proposed mapping effort. The downstream floodplain is being investigated primarily because of potential changes in flow regimes after the dams are constructed. Alterations of flows may result in changes in successional trends, which may affect the potential of this area to provide key habitats for important wildlife species, such as moose. Additional mapping and studies specific to successional trends are discussed in greater detail in the sections entitled Moose Habitat Evaluation and Succession Studies.

The classification system to be utilized for the mapping is the system developed by Dyrness and Viereck. The mapping will be to the 3rd and 4th level of this system. It is anticipated that this system will be modified to increase its application and usefulness for faunal studies. An attempt will be made to factor in parameters, such as physiognomy (overall growth form), that will help attain this goal. Several of such parameters have been identified by the U.S. Fish and Wildlife Service during the River Basin Survey. Personnel involved in this study will be contacted for their input into the proposed classification scheme.

Preparation of the vegetation cover/habitat maps will begin in early 1980 with the acquisition of LANDSAT and presently available CIR aerial imagery. These photographs will yield delineation of vegetation types in the Susitna River Valley which will be preliminary and require extensive field verification. The initial mapping effort will attempt to delineate the occurrence of wetland areas. This will be done to aid in the compliance with Section 404 of the Clean Water Act prior to surface disturbing activity.

Field verification of vegetation types will be performed during the 1980 and 1981 field seasons. Respective land areas covered by each vegetation/habitat type in the impoundment areas will be determined by manual planimetry or computer integration from the LANDSAT imagery. A table showing the acreage of each vegetation type and percent of total study area acreage will be prepared.

The vegetation mapping will begin at the commencement of the study. The different vegetation cover/habitat maps will be completed at different times during the Phase I effort. At the present time, the following schedule is anticipated: the 1:63,360 moose zone map at 3 to 6 months from start of study; the 1:25,000 direct impact area map at 9 to 12 months from commencement; and the 1:250,000 upper basin map at 12 to 16 months from initiation of study. A schedule for completion of the mapping for the downstream floodplain and moose habitat studies is presented in the Succession Studies section.

(3) Qualitative Assessment

For the Phase I studies, the descriptions of the major plant communities/habitat types will be based largely on qualitative assessments of the types mapped. These assessments basically involve walk-throughs of each type in the field with observational information obtained on characteristics, such as: dominant species composition, species abundance, estimated heights, estimated percent cover, unique trends or mosaics, etc. Relationships of types to topographic, geologic, and edaphic factors will also be noted. A list of the plant species encountered during these assessments will be produced, with identifications checked in floristic works available at this time and known collections of Alaskan plants in herbaria.

The qualitative assessments will probably be performed during the 1980 and 1981 field seasons in conjunction with ground truth surveys for the cover mapping and/or endangered or threatened plant species surveys. In order to avoid snow cover, the field season will be from June to September.

(4) Moose Habitat Evaluations

Impact prediction for several animal species will be dependent, to a certain extent, on the vegetation cover/habitat maps. This is especially true for important big game species such as moose. However, the total acreage of habitat, especially key winter habitat, is not only factor involved. Total available browse, browse quality, utilization, community trends, and other factors that are based on the information obtained from literature and quantitative vegetation sampling methods are necessary for the prediction of impact on moose.

Phase I of the habitat study will be limited primarily to the production of vegetation cover/habitat maps that will provide acreage, location, and distribution information on habitat types for use in faunal studies. The areas to be mapped, map scales, and classification scheme have resulted to a certain extent, as detailed in the vegetation cover/habitat mapping section, from input of the personnel involved in the faunal studies. The quantitative information required for more detailed impact predictions will be obtained during the Phase II effort.

The one exception is the quantitative data that will be collected during the successional studies. Details on this effort are provided in the following section.

(5) Succession Studies

The succession studies will be directed primarily towards identifying the interrelationships between the existing river characteristics and the perpetuation of key moose habitat in the floodplain of the Susitna River. Certain vegetation cover/habitat types, especially willow and balsam poplar types, found on the floodplain of the Susitna River provide important winter moose habitat. These types are thought to be maintained by certain river characteristics, such as annual or catastrophic flooding. The proposed project will alter the flow regimes of the river and may, therefore, cause changes in the types of vegetation that will eventually dominate that area. This may, in turn, either increase or decrease the capacity of the area for important wildlife species, such as moose.

The area of most concern for the succession studies will be the downstream floodplain below Talkeetna. What the impacts will be in this area is not known, because of the present lack of biological information on these systems and the absence of defined flow regimes that will result from the proposed action. It will be the purpose of the succession studies to attempt to establish historical trends in succession for this area and to identify causal factors in sufficient detail that will permit a knowledgeable prediction of the magnitude of the downstream impacts.

The approach that will be used for the succession studies will be to gather information from specific literature surveys; interpret existing current and historical aerial photographs for changes in vegetation over time; relate the vegetation changes in hydrological changes, topography, soils and perhaps other physical factors; and collect information on age and community structure for selected habitats of various ages.

Specific searches will be performed for pertinent published literature and ongoing research on succession. Literature on selected important species will be collected and reviewed. For these species information on root systems, ability to withstand flooding, shade tolerance, ability to pioneer areas, etc., will be important in the succession studies. Part of the literature review will also include the identification of types and sources of available historical aerial photographs and hydrological information.

The vegetation mapping effort for the succession studies will basically involve the production of vegetation cover/habitat maps from current and variously-aged aerial photographs, a comparison of vegetation changes over time, and an investigation of the

relationships of these changes with hydrological changes and other physical factors, such as topographic and edaphic.

The vegetation cover/habitat type mapping will be performed on selected historical aerial photographs. Information on the type, age, coverage and other factors related to the usefulness of the historical aerial photographs will be reviewed in conjunction with the available historical hydrological information in order to select the aerial photographs that will be utilized. The 1:25,000 photographs to be used in the impoundment areas will form the base for the current aerial photographs.

The vegetation mapping for the succession studies will not be performed for the entire floodplain area, but in selected sampling areas. It is anticipated that these areas in bands running across the floodplain perpendicular to the long axis of the river will be mapped at a 1:25,000 scale between Talkeetna and the mouth of the Yentna River. The number and location of these bands will be based on a number of biological and physical factors, including: moose utilization, vegetation types, soils, hydrological sampling locations, and river characteristics.

Once the mapping in these selected bands is completed for all the different-aged aerial photographs involved, a comparison of the changes that have occurred over time will be made. These maps will be analyzed with past hydrological information, such as flood flow records and other information on physical factors to see if correlations exist among the different factors involved.

The succession studies will require a certain amount of field sampling. The sampling will be directed towards aging communities, gathering observational information, and determining species composition and structure of the variously-aged communities. Some physical information will probably also be collected during the field effort.

Community age information will be obtained by counting the number of annual rings on cores of the dominant woody vegetation. The additional sampling methods to be utilized for this portion of the study will be selected during the first year following literature reviews and input from personnel involved in faunal studies. The field sampling will be performed primarily during the 1981 field season. Areas to be sampled will be selected in the impoundment area and the downstream floodplain. In the downstream floodplain the sampling areas will probably be within the selected bands that will be mapped as part of the mapping effort.

Data gathered from the succession studies will be used in the preliminary impact prediction of the proposed action. Information on flow regimes and predicted changes in hydrological characteristics downstream will be utilized in an attempt to answer the downstream impact question. This effort will be performed in the latter part of 1981 when succession information is available and flow regimes from the project have been defined.

(6) Corridor Selection

The selection process for the transmission and access road corridors is detailed in Subtasks 7.09 and 7.14, respectively. Input from the plant ecological studies will be made into these tasks. In the initial route selection analysis, the alternative routes will be evaluated on a superficial basis for major vegetation constraints (e.g. stations of proposed endangered species, unique habitats, etc.). Once the primary routes have been selected for these facilities, they will be cover mapped as detailed in the Vegetation Cover/Habitat Maps section. This mapping effort is anticipated to be performed in the latter part of 1981.

(7) Endangered Species Surveys

Presently there are no plant species-listed by federal or state authorities as endangered or threatened in Alaska. However, twenty-seven species are being reviewed by the Fish and Wildlife Service for protection under the Endangered Species Act of 1973. For these species distribution and habitat information will be assembled from literature and herbaria sources. Known stations and potential habitats for these species in the study area will be searched to determine the present status.

(8) Impact Assessment

All identified potential impacts of the proposed projects on vegetation will be discussed in the reports. The accuracy of impact predictions will vary depending upon the area under consideration. For the impoundment areas and access road and transmission line rights-of-way, accurate values of the total acreage of each vegetation type to be affected (inundated or traversed) by the proposed facilities can be determined. The effect of the proposed facilities on downstream floodplain vegetation will be more difficult to accurately predict.

In the downstream area plant ecological information will be used in conjunction with various physical data to aid in predicting changes. Depending upon the accuracy with which the botany personnel feel that they can predict vegetation changes, a map indicating type and extent of changes may be produced. Supplementary field information required for predicting impacts will be acquired during the 1981 field season.

(9) Phase II POS Development

The license application submission to the FERC in 1982 will contain a Plan of Study for the Phase II plant ecology studies. The development of this POS will be a part of the Phase I effort and will be based on the experience and knowledge gained in the Phase I effort.

Subtask 7.13 - Geological Analysis

This subtask will be completed as part of the studies conducted under Task 5 - Geotechnical Exploration.

Subtask 7.14 - Access Road Environmental Analysis

(a) Objective

To provide input into the selection of an access road route that will be environmentally sound and to provide an impact assessment of the preferred route.

(b) Approach

This subtask will initially involve the comparison of alternative routes. Major environmental constraints will be mapped along the various proposed alternative routes. One preferred route will then be selected that will be feasible from environmental, economic and engineering viewpoints. Direct and indirect impacts of the proposed action will be discussed in the environmental report.

(c) Discussion

The first part of this subtask will be the screening of alternative routes. The screening process will be a coordination effort between R&M Consultants, Inc., Acres and TES. R&M and Acres will initially propose various viable alternative routes or areas where viable alternatives could be proposed. TES will then provide a map or a discussion of the various major environmental constraints, (cultural resources, critical wildlife habitats, wetlands, habitat for endangered or threatened species, etc.) in these areas. A proposed route will then be selected taking environmental, engineering and economic concerns into consideration.

Once a proposed route is selected, more detailed environmental information will be collected for that specific route. Examples of environmental information include a vegetation cover map, wildlife habitats, available biological information for any water bodies crossed and other pertinent environmental information.

Impacts of the proposed access road will be presented. The impacts of associated activities, such as the acquisition of fill material, will be addressed. Socioeconomic, land use, and recreation impacts related to increased access to the area will also be discussed.

The comparison of alternative access roads will be performed primarily in the first year. More detailed information on the proposed route will be collected during the second summer.

(d) Schedule

Weeks / through 112

12

Subtask 7.15 - Preparation of FERC License Application Exhibit

(a) Objective

To compile and organize the reports of all the various environmental disciplines into one environmental report required for the license application submission to the Federal Energy Regulatory Commission.

(b) Approach

The collation and organization of the various environmental reports into a license application environmental report will require keeping abreast of the changes in regulations, report format and implementation procedures throughout the project period. An environmental report commensurate with the regulations in effect during the time of submission will then be prepared.

(c) Discussion

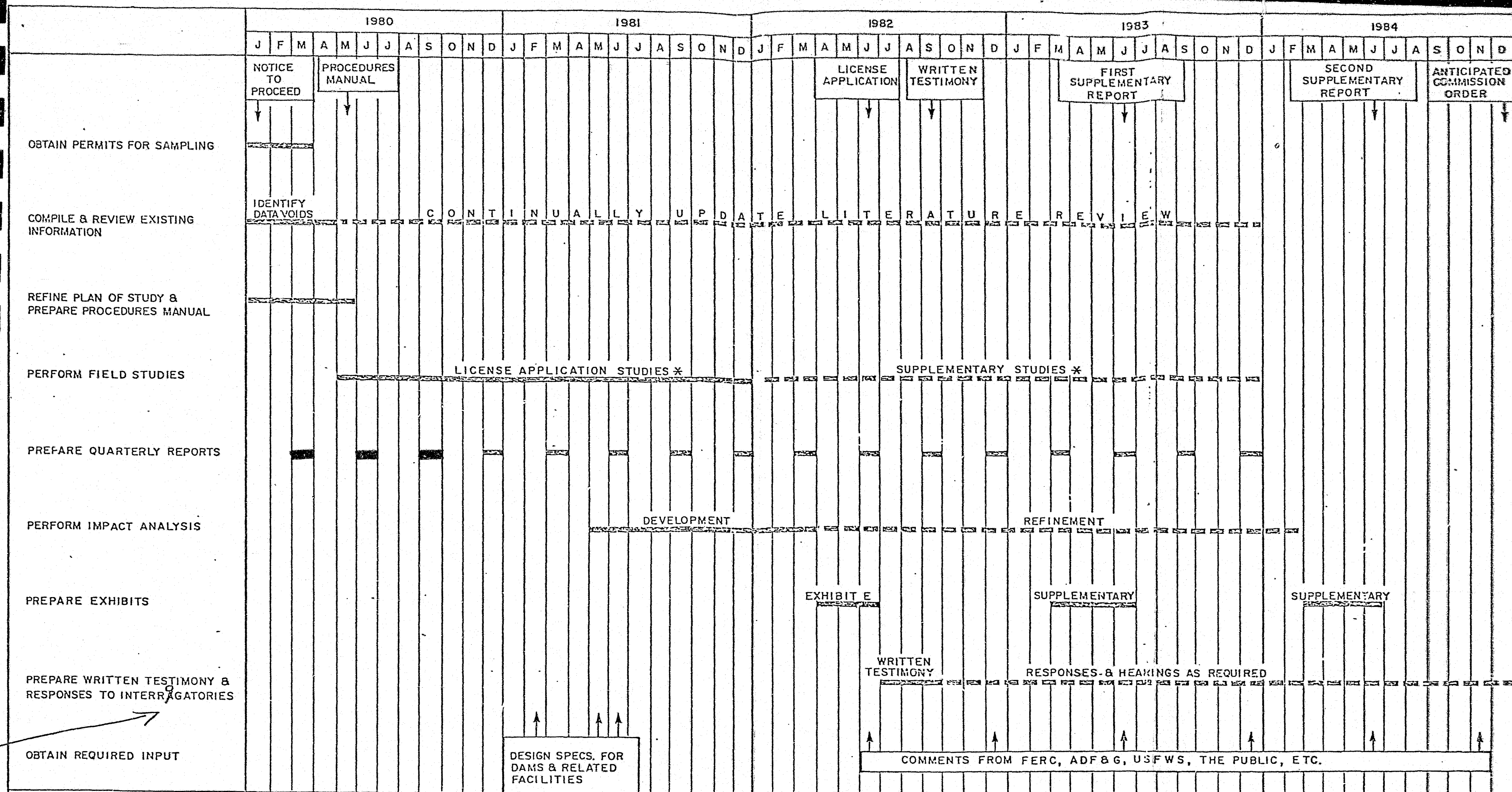
An environmental impact statement for the proposed Susitna River Project is required under various Commission Orders of the FERC, and in accordance with the National Environmental Policy Act (NEPA). Presently the FERC regulations pertinent to the environmental studies are Exhibits R, S, V and W. For major hydroelectric projects, these Exhibits are currently being reorganized into Exhibit E-Environmental. Officials of FERC are not certain as to when the reorganization will be completed, but it will be effective before application submission for the Susitna Project.

As the project progresses any revised environmental legislation pertinent to the proposed project will be obtained. These regulations will be reviewed and action taken to insure compliance as part of the Coordination Subtask (7.01).

Regulations in effect at the time of the permit application will be used for preparation of the exhibit for the environmental report. Although the format of the environmental report will depend upon the revised regulations, it is anticipated that the FERC environmental report outline will follow the recently effective (July 30, 1979) Implementation of Procedural Provisions promulgated by the Council on Environmental Quality. Certain parts of the reports for the various disciplines will be summarized or reorganized to meet the requirements. Sections tying different disciplines together will also be prepared.

(d) Schedule

Weeks 109 through 126



* LICENSE APPLICATION STUDIES

SOCIOECONOMICS
CULTURAL RESOURCES
LAND USE
RECREATION
WATER QUALITY
FISHERIES
WILDLIFE
PLANT ECOLOGY

* SUPPLEMENTARY STUDIES

(ALL DISCIPLINES, AS REQUIRED)



SUSITNA HYDROELECTRIC PROJECT
PLAN OF STUDY
PLATE T7.1: TASK 7 SCHEDULE

A.5.9 - TASK 8: TRANSMISSION

(i) Task Objectives

To select the transmission route and produce conceptual designs and cost estimates for the FERC license application for the following project components:

- Transmission line linking the project damsites to Fairbanks and Anchorage, with potential intermediate stations to feed local communities
- Substations, with particular reference to the two major terminals at Fairbanks and Anchorage, together with a suitable design for intermediate load points
- Dispatch center and communications system

(ii) Task Output

During 1980

Issue a design memorandum outlining the results of the Acres review of the 1979 IECO report and a preliminary screening of the routes identified in that report.

During 1982

Basic design information dealing with the following aspects:

- Transmission-line voltage level
 - .Tower types
 - .Route map
 - .Conductor data
 - .Insulation levels
 - .Construction access
 - .Construction schedule
 - .Cost estimates
- Substations
 - .Single-line diagram for each main type of substation
 - .General arrangement drawings
 - .Transformer criteria
 - .Circuit-breaker criteria
 - .Outline of relay protection philosophy
 - .Cost estimates

- Dispatch Center and Communications

- .Location and size of center
- .Level of automation proposed for remote stations
- .Extent of real-time functions required
- .Type of communication channel proposed together with appropriate data transmission rates
- .Basic type of software
- .Man-Machine interface

In addition, descriptions of the design studies will be written for inclusion in the Project Feasibility Report, and documentation for the FERC license application will be prepared.

(iii) List of Subtasks

- 8.01 - Transmission Line - Corridor Screening - 1980
- 8.02 - Electric Systems Studies
- 8.03 - Transmission Line - Route Selection - 1981
- 8.04 - Tower, Hardware and Conductor Studies
- 8.05 - Substations
- 8.06 - Dispatch Center and Communications
- 8.07 - Transmission Line Cost Estimate

(iv) Subtask Scope Statements

Our basic approach to the work outlined in this task will initially be to review the 1979 IECO reports with respect to their approach and their level of detail. Following this, we will undertake more detailed study and conceptual design up to a level appropriate for FERC license and for basic technical and economic feasibility.

Included in this work will be the utilization of such geologic (Task 5) and climatologic (Task 3) field data as can be obtained during that study period. We also propose an extensive field reconnaissance during 1980 plus mapping a limited selection of key sections of the various corridors (Task 2).

The field reconnaissance, review of the IECO studies, and preliminary screening of the corridors will take place during 1980 (Subtask 8.01). During this period we will also start the electric system studies (Subtask 8.02). During 1981 the general location of the transmission line route(s) within the selected corridor(s) will be established (Subtask 8.03) and conceptual designs produced. Design studies and cost estimates for the Towers, Hardware and Conductors (Subtask 8.04), Substations (Subtask 8.05), and Dispatch and Communications Center (Subtask

8.06) will also be developed. Particular attention will be devoted to producing feasibility-type cost estimates and to reconcile the differences between previous estimates made by IECO and the Alaska Power Administration.

Subtask 8.01 -Transmission Line Corridor Screening - 1980

(a) Objective

To review the 1979 IECO report initially, to eliminate some of the less attractive corridors, to identify such considerations of route selection that may require additional work and to plan the 1981 field data collection.

(b) Approach

This activity will involve an extensive field reconnaissance of selected potential corridors. We also anticipate being given full access to all available IECO data with regard to system studies (load flow, etc.) and also structural studies of towers if such exist. This subtask would also include a detailed review of the economics of a dc alternative.

Once the above-mentioned review studies are completed, a preliminary screening study will be undertaken to eliminate the obviously less desirable corridors from further consideration. The corridors selected for further study will be identified as bands on the one-inch-to-one-mile mapping and made available as input for the biological and foundations studies. The centerline of these bands will be marked upon existing photography coverage. This, together with the marked-up one-inch-to-one-mile maps, will be used to direct the high aerial photographic program which will provide specific coverage along the potential routes.

The preferred corridors will be made available in time for the start of the 1981 summer survey season so that the required geological exploration and mapping work can be undertaken. For this stage of the work, we propose to define a number of key sections of the various corridors for mapping in the 1981 season. Such sections will be chosen as being typical of the various features of the corridor, muskeg, permafrost, steep grades, etc. For the purposes of the present submission, we propose that each section be between 5 and 10 miles in length and that up to 10 such sections be mapped.

(c) Discussion

The prescreening activities will be carried out on the basis of the following considerations:

- Review of all background data (USBR, IECO, etc.).
- Assessment of differential costs as determined by geological or climatic considerations.
- Relative assessment of environmental considerations, land use, etc.
- Review of power system related aspects such as the number of intermediate load points to be served.

We anticipate that this prescreening process will allow us to eliminate approximately 75 percent of the currently identified routes.

(c) Schedule

Weeks 11 through 52

Subtask 8.02 - Electric System Studies

(a) Objective

To ensure that the electrical aspects of the project design are integrated with the existing Railbelt area power systems and to design an electrical power system which is reliable and economic.

(b) Approach

The following steps will be carried out:

- Review all previous studies (including source data and computer outputs if available)
- In the event that no load-flow studies have as yet been done, the following data would be obtained from the APA and other utilities:
 - generating station plant capacity
 - transmission line impedances
 - substation transformer capacities and loads
- Obtain information from the load forecasting study (Task 1) including details of the following:
 - existing load conditions
 - historical load growth
 - load and energy projections
 - daily and annual load duration curves
 - location of load centers
- Meet with APA, the Alaska Power Administration and the Railbelt utilities to obtain system data and review of proposed future expansion at the utility level.
- Determine economic and security criteria and review with APA.
- Determine main and intermediate substation locations and capacities.
- Establish transmission line requirements, including most economical voltage levels together with conductor sizes and appropriate spacings.
- Perform preliminary load flow studies to verify transmission system configuration and parameters.
- Determine line energizing and compensation requirements.
- Establish general electrical equipment specifications such as:
 - insulation levels
 - equipment ratings and connections
 - transformer tap ranges
 - switchyard single-line diagrams

Acres has developed a comprehensive set of computer programs which will be employed to assist the foregoing studies. These programs include:

- Load-flow - Newton Raphson Method (Acres Program No. EL 012)
- Three-Phase Short Circuit (Acres Program No. EL 020)
- Transient Stability (Acres Program No. EL 030)
- Dynamic Stability (Acres Program No. EL 034)
- Transmission Line Dynamic Overvoltages (Acres Program No. EL 831)
- Conductor Thermal Current Rating (Acres Program No. EL 834)

The studies will identify the basic transmission line requirements and characteristics of electrical substation equipment, generation equipment and relay protection.

(c) Discussion

We anticipate that during 1980, load-flow studies would be made for a variety of preliminary system configurations. During 1981, these load flow studies would be refined to represent the preferred system. During the latter period, short circuit and stability studies would also be carried out.

A study of potential grounding problems associated with permafrost as experienced at Prudhoe Bay and the effect on protective ground relaying would also be undertaken.

(d) Schedule

Weeks 20 through 120

Subtask 8.03 - Transmission Line - Route Selection 1981

(a) Objective

To identify two selected routes, each about a half-mile wide, one from the project sites to Anchorage and the other to Fairbanks.

(b) Approach

The alternative corridors carried forward from Task 8.01 will be subjected to a further process of elimination and a final route selected. Input to this task will be obtained from the following:

- Preliminary environmental studies (Task 2) including aesthetic considerations
- Land use studies (Task 7)
- Mapping of key sections (Task 2)
- Climatological studies (Task 3)
- Identification of seismic problems (Task 4)
- Geotechnical exploration (Task 5)
- Geotechnical footing design (Task 6)

The possible advantages to be obtained from a staged construction sequence will be evaluated. If appropriate, separate routes for future stages will be identified. The result of this study will be the selection of a complete route, approximately a half-mile wide.

(c) Discussion

In arriving at the final route selection, the following potential design difficulties peculiar to cold climates will be taken into account.

Damage to footings due to frost heave and muskeg conditions. It is known that such problems have been encountered on other transmission lines, specifically on the 230-kV lines between Twin Falls and Labrador City. In designing the 735-kV Churchill Falls lines, Acres successfully solved these problems by the choice of guyed towers and the careful selection of routes and anchor details.

The possible effect of permafrost conditions on route selection will also be taken into account.

The possible need to contend with extremely high wind velocities such as those encountered at Snettisham will be reviewed. Such winds cannot normally be accommodated in the design of the transmission line. This problem can be solved by rerouting and stockpiling a number of spare towers.

(d) Schedule

Weeks 60 through 120

Subtask 8.04 - Tower, Hardware and Conductor Studies

(a) Objective

To select the most appropriate tower configuration, hardware and conductor arrangements for the line.

(b) Approach

The existing data contained in previous studies, particularly the 1979 IEC0 report, will be taken into account in developing the following.

(1) Design Criteria

We will establish basic design requirements using the data from field studies and system studies. These include climatologic (Task 3), geotechnical (Task 6) and electrical parameters (Subtask 8.02).

(2) Towers

We will establish security levels and other line performance levels and select overload factors for various loading conditions. Nonclimatological load parameters; i.e., broken wire, construction loads etc., also will be determined.

We will conduct a study of tower-types this will involve a preliminary review of the different types and construction materials available and the associated transportation requirements. The types considered include rigid and guyed towers and wood-pole H-frames. The geometry of tower outlines based on electrical clearances will be developed. Based on this study, a representative range of tower types will be determined. In the event that a staged construction sequence is found to be desirable, the relative economics of double-circuit towers versus two single-circuit towers will be assessed.

Tower loads will be established. Those include average span, wind span, weight span, broken wire and stringing and maintenance requirements.

(3) Footings

Design criteria will be determined from the results of geotechnical field investigations. We would undertake conceptual designs of alternative types of footing for the family of tower types selected.

(4) Miscellaneous System Features

The conductor would be selected taking into account electrical requirements (including evaluation of losses) and mechanical strength.

The environmental effect of audible conductor noise and RIV and TIV will be assessed.

The basic insulation level (BIL) will be established and the type, number and configuration of insulators selected.

In the event that wood-pole construction is selected, the possible economy of eliminating the overhead ground will be considered.

Line hardware, the choice of arrangement for suspension, dead end and jumper assemblies will be selected. Grounding requirements will be determined and suitable arrangements for line and towers developed.

(c) Discussion

Acres has extensive experience in transmission line design for regions with cold climates, deep frost penetration of the ground and permafrost conditions. This will provide a solid base for developing a sound design for the various elements of the transmission system.

Optimization of the design will be assisted by our "in-house" computer program TROP which is a transmission optimization program. This program is supplied with the basic design requirements as input data and determines conductor sags, tensions, tower loads, voltage gradients, losses (including corona), for a series of alternative situations involving variations in conductor type and size, span length and climatological conditions. On the basis of conceptual cost information, it is used in the evaluation and choice of the most economical conductor size and the optimum average span for the line analyzed.

(d) Schedule

Weeks 81 through 120

Subtask 8.05 - Substations

(a) Objective

To provide conceptual designs and cost estimates for the major terminal substations at each end of the system, together with typical designs for substations at the intermediate load points.

(b) Approach

From the Electrical Systems Studies (Subtask 8.02) parameters will be obtained, which will be employed in finalizing station single-line diagrams, equipment specifications and configurations, philosophy of operation and control of the substations. Early decisions will be made on whether to man the substations or depend on automatic operation with supervisory control of switching equipment.

The chosen arrangement will be reviewed to ensure that it complies with system, environmental and operational requirements. Major equipment characteristics will be determined and sketches will be produced to allow cost estimates to be prepared.

Details of the substations and switchyards will be determined and will include:

- single-line diagrams
- transformer capacity
- typical substation layouts and arrangements
- shunt reactors (when required)
- auxiliary station service

(c) Discussion

The layout of the substations will be coordinated with the transmission line entry. For aesthetic, climatic and land management reasons, gas-insulated substation layouts will be examined. Final selection of gas-filled or conventional type will be made once the location of the substations is determined.

(d) Schedule

Weeks 65 through 120

Subtask 8.06 - Dispatch Center and Communications

(a) Objective

To produce a conceptual design and cost estimate for a computerized control and dispatch center that will provide reliable and secure operation of the proposed Susitna development and the Anchorage-Fairbanks transmission link. Appropriate communications for the center will be included.

(b) Approach

The Susitna River Basin project will introduce considerable hydroelectric generating capacity into a predominantly thermal-electric generating system. It is proposed to interconnect the Fairbanks area with that of Anchorage, thus developing a larger power system than the two existing systems. To make effective use of facilities in the enlarged power pool, a dispatch center with reliable communication system will be required. The following studies will be undertaken during the feasibility stage:

- Review and previous studies related to system control and communications in the Railbelt area.
- Collect data on existing communications and system control practised by the Railbelt utilities.
- Meet with the Alaska Power Administration and the utilities to discuss future or committed plans with respect to control centers or communications systems.
- Propose a range of alternatives to achieve the goal of providing effective control of the power pool. The cost of these alternatives will be estimated and compared in a report.
- Examine various degrees of sophistication and schedules and prepare estimated costs for introduction.
- Consider the question of which agency will have overall operating responsibility.
- Select a system and prepare conceptual designs and cost estimates.

(c) Discussion

It is necessary to define overall responsibility at the beginning of this phase of the work in order to establish the criteria for choosing the most suitable scheme.

The dispatch center and a comprehensive communications system will provide the following functions:

- Real time monitoring of system conditions
- Enhancement of system security
- Economic dispatch of generating facilities, both thermal and hydro
- Monitoring of transmission loads
- Economic dispatch of intertie power
- Provision of supervisory control for selected unattended substations

In our opinion, considerable advantage can be derived if the Railbelt power interconnection is operated with a central dispatch center and the complementing communications channels.

Arrangements will be made to enlist the services of specialized consultants such as Energy and Control Consultants from California to assist Acres and to review this section of the preliminary report.

(d) Schedule

Weeks 65 through 120

Subtask 8.07 - Transmission Line Cost Estimates

(a) Objective

To arrive at a feasibility estimate type of cost of the transmission system.

(b) Approach

Utilizing Acres' experience in northern construction logistics, a capital cost estimate will be prepared for the construction of the lines. Special care will be taken to fully reflect the need to respect strict controls on construction activities, to control environmental impacts and carry out a mitigation program during and following the completion of construction.

(c) Discussion

Costs of the procurement of material and their shipment to site will be carefully evaluated by investigations and supplemented by enquiries of competent suppliers.

Acres' estimates of costs for construction will be refined by the involvement of experienced contractors who will be asked to provide input regarding construction logistics and schedule.

(d) Schedule

Weeks 20 through 120

A.5.10 - TASK 9: CONSTRUCTION COST ESTIMATES AND SCHEDULES

(i) Task Objectives

To develop comprehensive, contractor-type, construction cost estimates for each major element of the recommended Susitna Hydroelectric Project, detailed engineering and construction schedules and an associated analysis of potential contingency constraints and impacts.

(ii) Task Output

The primary outputs of Task 9 will be cost estimate summary reports and construction schedules appropriate for inclusion in Task 10, FERC Licensing documentation. The final versions of these documents will be submitted for review and approval by Alaska Power Authority on or about Week 126 of the Study. These documents will be suitable for continuous updating and/or modifications during the subsequent study period through commencement of construction and for use in preparation of engineers' estimates during the construction and equipment supply contract bidding phases of the project.

Preliminary cost estimates and schedules will be the subject of design transmittals issued on or about Week 60 of the Study for inclusion in the Development Selection Report under Task 6.

(iii) List of Subtasks

- Subtask 9.01 - Assemble Cost and Schedule Data
- Subtask 9.02 - Prepare Preliminary Cost Estimates
- Subtask 9.03 - Prepare Cost Estimate Update
- Subtask 9.04 - Develop Engineering/Construction Schedule
- Subtask 9.05 - Perform Contingency Analysis

(iv) Subtask Scope Statements

The primary purpose of Task 9 is to provide the basis for more detailed planning, marketing and financing of the Susitna Project during the period following submission of the FERC License Application through commencement of construction. The development of these estimates and schedules prior to license application and the relationships between Task 9 and other task activities are illustrated in the Master Schedules, Plates A7.1 and A7.2. This portion of the study will be divided into two parts. The initial part of Task 9 activities will be used to establish the information systems and basic mechanisms necessary to develop the cost estimates and schedules for selection of the optimum Susitna development. The second part of Task 9 activities will be devoted to the incorporation of more up-to-date information and appropriate revisions of the estimates and schedules prior to submission of the FERC License Application. For ongoing cost estimating and scheduling purposes, a continuous exchange of information will be necessary with Task 2 - Surveys, Task 5 - Geotechnical Exploration, Task 6 - Design Development, Task 7 - Environmental Studies and Task 8 - Transmission activities.

For purposes of the current Plan of Study, development of Task 9 activities has been based on the assumption that the optimum Susitna development will comprise dams at Watana and Devil Canyon and associated structures. This development is essentially the same as that recommended by the Corps of Engineers in its 1979 Supplemental Feasibility Report.

Subtask 9.01 - Assemble Cost and Schedule Data

(a) Objective

To assemble Alaska-based and national cost and schedule data appropriate to construction of large hydroelectric projects.

(b) Approach

Input to the activities of Subtask 9.02 will commence with the following preliminaries:

- Identify required project labor, material, and equipment (construction and permanent) categories
- Assemble cost and scheduling data including Alaskan and national labor, materials and equipment (construction and permanent), taxes, insurance, finance charges, other indirect costs, and delivery items
- Identify and assemble facility operating costs

On the basis of parallel Task 6 design development studies, appropriate construction activities will be identified together with construction method plans and diagrams for temporary site installations.

(c) Discussion

Early studies related to alternatives and development of an optimum Susitna development were undertaken on the basis of conceptual engineering-type cost estimates. These estimates will essentially be developed from previously published reports and available data from the Corps of Engineers or other sources. Establishment of reliable costs and schedules for the recommended Susitna Development will use a much more basic approach.

A computerized data base will be established which will be made available for use and further development during all subsequent cost estimating and scheduling activities.

(d) Schedule

Weeks 70 through 75

Subtask 9.02 - Prepare Preliminary Cost Estimates

(a) Objective

To prepare preliminary, construction-type cost estimates for the Susitna Hydroelectric Project.

(b) Approach

Preliminary cost estimates will be prepared for

- Site access arrangements,
- Permanent camp facilities,
- Watana Dam and associated works,
- Devil Canyon Dam and associated works, -
- Transmission facilities,
- Reservoirs and related facilities.

These estimates will be based on reviews of previously published reports of the Susitna development, appropriately modified and updated in the light of such reviews. Lists of construction pay items and quantity estimates will be prepared for appropriate construction activities.

Unit and/or lump sum prices will be developed and assembled for appropriate pay items, including all direct and indirect costs, and total facility investment and operating cost estimates.

(c) Discussion

The results of this activity will provide the input for ongoing Task 6 - Design Development activities. Although these data may be subject to modification during later stages of the study when further drilling and testing information becomes available, the groundwork laid at this time will form the basis of all further costing activities to be performed.

(d) Schedule

Weeks 73 through 78

Subtask 9.03 - Prepare Cost Estimate Update

(a) Objective

Prepare updated, comprehensive, construction-type, cost estimates for the Susitna Project for inclusion in FERC License Application.

(b) Approach

To preliminary cost estimates prepared under Subtask 9.02 will be updated and modified for incorporation in the FERC License Application documents.

Construction methods, scheduling and cost studies already performed under Task 6 studies will be further developed and expanded under this subtask. The accuracy of construction costs will be improved by application of updated information, including the following:

- (1) Site costs for labor, materials, equipment and fuel
- (2) Installation procedures to be adopted for each project component; construction methodology for the dams, spillways and power plants
- (3) Detailed construction schedule and resource allocation for each project component and the total project
- (4) Site development requirements for power, access, transport, construction materials, water, and support facilities
- (5) Technical and economic analysis for concrete manufacture, borrowed fill, quarries and disposal of excavated materials
- (6) Construction manpower schedules
- (7) Mechanical and electrical equipment price variation due to escalation and market pressures
- (8) Short and long-term interest rates and cost escalation assessments
- (9) Detailed list of pay items and quantity take-offs
- (10) Detailed construction cost estimates, including unit prices, directs, indirects, contingencies, interest during construction and administration, cash flow diagram

Project engineering designs and preliminary equipment specifications prepared under ongoing Task 6 activities will serve as the baseline for each cost estimate. A standard estimating format will be adopted and sound accounting practices will be followed to separate direct costs, indirect costs and capital expenses. All costs will be tabulated into natural divisions that lend themselves to the application of the FERC code of accounts for hydropower projects.

Detailed quantity take-offs will be prepared from the project engineering drawings to support permanent material cost estimates. Consumable materials will be estimated using known rules-of-thumb and accepted unit rates.

Updated labor estimates will be prepared in conjunction with the scheduling effort. Typical project labor agreements will serve as a basis for these revised estimating costs. Rates of productivity, as dictated by the schedule and tempered by the Alaskan climate and work force, will be established for each type of work.

More realistic plant and equipment costs will be estimated using actual experience gained from similar work performed in Alaskan environments.

Indirect costs will be estimated based upon a number of factors, including total construction time, numbers of craft labor, length of shifts, volume of subcontracted work, etc. Finally, a cost escalation factor will be applied to each cost estimate to account for increases in labor and material costs throughout the life of the project.

(c) Discussion

The estimated cost of construction will be a key factor in establishing feasibility and licensing as well as financing of the project. Estimating construction costs in Alaska presents some unique factors and situations that can only be dealt with through practical experience at the field level. The Acres/Moolin team provides senior individuals with a wealth of experience of large hydroelectric developments in cold climate regions and with specific Alaskan construction experience. Input and review of all cost estimates by these personnel will ensure the reliability of the estimates.

Some of the unique problems that must be accounted for include the following:

- A relatively inexperienced labor force,
- Unusual environmental/weather constraints,
- High level of government surveillance/interaction,
- Low equipment productivity during cold weather,
- High freight costs for materials/spare parts.

(d) Schedule

Weeks 110 through 126

Subtask 9.04 - Develop Engineering/Construction Schedule

(a) Objective

To develop integrated engineering, construction and equipment installation network logic diagrams and bar chart schedules, optimize resource allocations, and perform analyses to identify probable critical path for construction of the Susitna Hydroelectric Project.

(b) Approach

The engineering, construction and equipment installation network will be established and updated on the basis of parallel Task 6 design development studies. A consolidated construction schedule will also be prepared to identify major construction activities and their required start and finish dates in bar chart format. Determination of the critical path will be accomplished by means of an appropriate computerized mathematical model which will facilitate later updating requirements. The proposed model will be that described in Part C3 of this proposal, or similar.

The critical path analysis will show duration, early start date, late start date, early and late finish dates, float and zero float critical path for all major activities.

Preliminary schedules will initially be prepared as input to the Task 6 Development Selection Report and subsequently developed and modified for inclusion in FERC licensing documents under Task 10.

As discussed in Section A6, it is proposed that prior to commencement of construction of the Susitna Project a Program Planning Guide will be prepared. This guide will identify for Alaska Power Authority management the specific planning requirements for the project. It will also provide, for the eventual project management group, those products essential to the planning and management of the development.

(c) Discussion

The basic groundwork for the key elements of the Project Planning Guide will be performed under this subtask. Senior level personnel from the Acres/Moolin team will initiate the development of the specific elements that will be required for planning and management of the project. Experience gained on other "giant" projects such as the Churchill Falls Development, and the preparation of similar planning guides (Moolin has recently completed the Project Planning Guide for the Alaska Gasline) will serve as a basis for the task.

It is apparent in the industry that sponsors of giant projects are beginning to recognize the importance of first developing a program planning guide for the management of these projects. We feel this type of planning can best be done by a relatively small number of senior level, highly qualified individuals. This small group of personnel, selected because of their first-hand experience in managing and planning other projects, is in the best position to understand and convey the problems associated with giant projects.

As the size of the project increases, especially in remote areas where a greater dependence upon outside support is required, so does the number and complexity of the interfaces between the various elements of the project. It will be the responsibility of the planning team to concisely and completely define the additional level of input required for successful advancement of the project.

(d) Schedule

Weeks 73 to 126

Subtask 9.05 - Perform Contingency Analysis

(a) Objective

To investigate potential contingencies/risks and to evaluate their effects upon cost estimates and schedules.

(b) Approach

A preliminary assessment will be made for each aspect of the cost estimate and construction schedule to examine potential risks involved in terms of cost escalation and/or schedule slippage. Sources of risk will be considered both individually and collectively, and their potential impacts determined. From the results of the risk analysis options, fall-back position and contingency plans will be developed.

The results of this study will provide input to risk analysis to be performed under Task 11.

(c) Discussion

There are a number of contingencies that can have adverse effects upon the project, each of which must be analyzed. They include the following:

- The selected thin arch or other design for the Devil Canyon Dam may not stand up to further seismic testing. This may require a change in design, thus requiring new cost and schedule estimates.
- Unforeseen foundation problems (unstable bedrock, permafrost, etc.) discovered during the POS and/or initial construction phases may lead to a requirement for deeper excavation or extensive confined excavation procedures.
- Unexpected flooding conditions, due to the size of the watershed involved, can have a significant impact upon costs.
- Unusually restrictive environmental conditions imposed by governmental agencies can have significant impacts. Large projects in Alaska have a history of attracting an unusually high involvement by the agencies that cannot be ignored.
- Unforeseen inclement weather may reduce the already short Alaskan construction season and force scheduled events into unfavorable weather conditions. Also, poor weather may require the use of special heated enclosures to allow the work to progress.
- Unexpected river icing conditions may require changes in design and/or construction of unplanned structures to contend with winter ice forces and spring breakup conditions.

(d) Schedule

Weeks 115 through 126

A.5.11 - TASK 10: LICENSING

(i) Task Objectives

To provide for timely preparation and assembly of all documentation necessary for application for license to the Federal Energy Regulatory Commission (FERC).

(ii) Task Output

The output from this task will be a completed application for licensing the Susitna Hydroelectric Project. This completed package, including exhibits A through W (less P and Q, which are not required for licensing a major hydroelectric project) will be prepared for final review by external review panels and by APA on or before the end of the 128th week of the study period, with earlier preliminary design transmittals having been assembled and reviewed in-house and by APA upon substantial completion of significant individual exhibits.

(iii) List of Subtasks

Subtask 10.01 - Impact of New FERC Regulations

Subtask 10.02 - Establish Regulatory Requirements

Subtask 10.03 - Data Acquisition from Others

Subtask 10.04 - Coordinate Exhibit Preparation within Major Task Categories

Subtask 10.05 - Prepare Exhibits D and E

Subtask 10.06 - Prepare Exhibit R

Subtask 10.07 - Prepare Exhibit T

Subtask 10.08 - Prepare Application Form

Subtask 10.09 - Documentation Review and Deficiency Correction

Subtask 10.10 - External Review, Client Execution, and Filing

(iv) Subtask Scope Statements

Assuming that technical and economic feasibility are found and that environmental impacts and proposed mitigatory actions are acceptable, the major target toward which all other work is aimed is the successful completion of a license application to FERC. Indeed, this entire Plan of Study has been prepared in such a manner that only those tasks and subtasks considered to be the minimum necessary for acceptance by FERC of the license application are included in the first 30 months. To be sure, a significant amount of follow-on

work must necessarily be accomplished prior to eventual construction, but the historically lengthy periods associated with federal processing of applications clearly suggest that the earliest possible submission is in the best interest of the Power Authority. This latter observation was confirmed, during preparation of this Plan of Study, by Mr. Ron Corso, FERC, whose comments on the matter are summarized in Annex A to Task 10. Mr. Corso assures us that it is entirely appropriate--even advisable--to file an application which meets minimum requirements for submission while at the same time detailing plans for initiation or continuation of studies whose results may be required before the license itself is actually awarded. It will be noted in Annex A that new regulations will probably change the letter designation of various exhibits and will combine many into single packages. For purposes of clarity in succeeding subtasks, we have chosen to refer to the production of exhibits in terms of the current official titles.

There is a complication associated with the preparation of this task package. The current applicable FERC regulations are now under revision, and there is little doubt that they will be in force prior to that time we have proposed for filing. The most likely form of the new rules, we are given to understand, will be essentially the same as is now required, but there will be some effort made to streamline and expedite processing as well as to simplify procedures. Aside from Subtask 10.01, all remaining subtasks have been prepared to conform to the regulations as they now stand. Subtask 10.01 itself provides for review, assessment, and if necessary, adjustments associated with new regulations as they become effective. Subtask 10.02 establishes a complete listing, together with actions and responsible project personnel for compliance with all regulatory requirements, including, if appropriate, any new regulations which become effective during the course of the study.

The basic application must be made in accordance with a prescribed format and must be accompanied by a series of exhibits, each of which must meet certain criteria as detailed in the regulations. Table 1, Task 10, summarizes exhibit content and shows those points at which the output from other Tasks contributes to preparation of or actually furnishes individual exhibits. The last column of that table summarizes certain work to be accomplished in Task 10. Note that the exhibits may be generally broken down into the following categories:

- (1) Those exhibits which must be acquired from sources external to the Acres team, such as State laws. Subtask 10.03 provides for data acquisition from others.
- (2) Those exhibits which will be outputs from other tasks, prepared by various members within the Acres team. Subtask 10.04 accounts for monitoring and coordinating this type of exhibit.
- (3) Those exhibits and the application form itself which must be prepared based upon data produced in other tasks or developed from other sources. Subtasks 10.05 through 10.08 cover necessary activities.

- (4) Review of documentation. Subtasks 10.09 and 10.10 account for the often arduous and frequently time-consuming process of essential review, both in-house and by external panels, as well as final execution and filing.

Subtask 10.01 - Impact of New FERC Regulations

(a) Objective

To review draft and final versions of new FERC regulations to be issued in the near future; prepare revisions to subtask work statements as appropriate; and assess cost and schedule impacts for consideration by the Power Authority.

(b) Approach

Immediately upon publication of proposed new regulations, a careful review will be conducted to identify changes which apparently must be addressed. Comments will be prepared, if appropriate, to ensure that obvious ambiguities are resolved and to recommend changes, particularly insofar as they might favorably and reasonably facilitate compliance. A comprehensive list of actions will be drawn up and responsibilities for implementation within the Acres team will be assigned to appropriate project personnel by name. Subtask work statements will be revised as necessary. To the extent that changes-- increases or decreases--in estimated costs and schedules appear necessary, a report will be made to the Power Authority, along with recommendations as how best to proceed.

(c) Discussion

As a matter of policy, we continuously monitor activities of the FERC, since there is much to be learned from the experience of Acres and others in recent past and ongoing application processing. A necessary part of this monitoring effort is, of course, associated with development of regulatory changes and of new or innovative interpretations and decisions on existing ones. We know with certainty that new proposed regulations are imminent, having already received some initial advice from Mr. Ronald Corso, Deputy Chief, Division of Licensed Projects, FERC (see Annex A to Task 10). We have been assured that no major substantive changes for major hydroelectric projects are likely, and therefore we have some confidence that the remaining subtasks in this major Task are valid. Even so, it is prudent to provide for comprehensive review of any change, since a variation of even one tenth of one percent on a multibillion dollar project can produce millions of dollars in new requirements. The matter of preparing action lists and designating responsible individuals is one we regard as essential to the management of all phases of this project. It is fully in keeping with our earlier announced intent to accomplish all those things which are necessary for successful filing, and to provide for initiation or continuance subsequent to filing, all those additional activities required for award of a license, and beyond that, for eventual project construction.

(d) Schedule

To be furnished upon publication of proposed draft regulations.

Subtask 10.02 - Establish Regulatory Requirements

(a) Objective

To identify all regulatory requirements to be satisfied as a condition for licensing and provide for compliance.

(b) Approach

All statutes, rules, regulations, and other requirements directly or indirectly affecting the process of investigating and subsequently constructing the proposed project will be reviewed and a design transmittal will be prepared setting forth the steps which will be required for compliance. Specific action responsibilities will be assigned to members of the Acres team. Some of the federal statutes having significant impact on the project--and therefore to be reviewed under this subtask--include:

- Federal Water Power Act of 1920
- National Environmental Policy Act (P.L. 91-190)
- Fish and Wildlife Coordination Act (P.L. 85-624)
- Endangered Species Act (P.L. 93-205)
- Historical Preservation Act (P.L. 89-665)
- Federal Water Pollution Control Act Amendments of 1972 (P.L. 92-500)
- Anadromous Fish Act
- Wilderness Act (P.L. 88-577)
- Wild and Scenic Rivers Act (P.L. 90-542)
- Coastal Zone Management Act (P.L. 93-612)
- Federal Land Policy and Management Act of 1976 (P.L. 94-579)
- Fuel Use Act of 1978
- Alaska Native Claims Settlement Act of 1971 (85 Stat. 706)

Rules, regulations, and procedures for permits are imposed as well under the laws of the State of Alaska. Some of the Departments and Agencies having direct responsibilities or significant interests within the State include:

- Department of Fish and Game
- Department of Economic Development
- Department of Commerce
- Department of Natural Resources

- Department of Environmental Conservation
- Department of Community and Regional Affairs
- Department of Labor
- Alaska Growth Policy Council
- Alaska Historical Commission
- Capital Site Planning Commission
- Land Use Planning Commission of Alaska
- Department of Public Safety
- Department of Transportation and Public Facilities

In addition, requirements imposed by municipalities, boroughs or Native organizations (who will eventually acquire title to land in and around the project area) will be identified and analyzed. Plans will be drawn up for compliance.

Assistance will be requested from the Alaska Department of Law in identifying and interpreting applicable State and local regulatory requirements. In the event that the Department of Law cannot assist, an Alaskan law firm will be engaged for consultation on these matters.*

(c) Discussion

As may be noted from the incomplete listing of federal laws and state and local interests above, there will be a complex web of permits and procedures to be satisfied. It is all the more important, then, to devote time and attention early in the study effort to ensure compliance. Indeed, some of the various permitting procedures provide opportunities for public notice and comment and, on occasion, for public meetings or hearings. Time requirements tend to be lengthy in such cases, and the process cannot begin until application is made. Much of the effort involved in completion of this subtask will contribute to the work involved in other subtasks. Subtask 10.05, for example, provides for preparation of Exhibit D, wherein evidence of compliance with State laws must be provided. It follows that identification of appropriate laws and description procedures for compliance are important first steps as well as convenient check lists for the provision of evidence of compliance.

(d) Schedule

Weeks 3 through 12 and intermittently thereafter throughout the study period.

*Legal consultation on applicable federal laws will be provided by Mr. Charles McCarthy, Esq., a Director of Acres and a long-time practitioner and expert before the former Federal Power Commission and the Current Federal Energy Regulatory Commission.

Subtask 10.03 - Data Acquisition from Others

(a) Objective

To coordinate the preparation and collection of data to be provided by various parties external to the Acres team and to assemble those exhibits for which no other input is required from the Acres team.

(b) Approach

Exhibits A, B, and C generally require that certain copies and certifications be provided. In each case, these documents are available from, or must be produced by, others. We will request the necessary items and review them for adequacy insofar as FERC requirements are concerned. In the event that deficiencies are noted, further efforts will be undertaken to assure they are corrected. Once the necessary documentation is received and found to be adequate, completed exhibits will be assembled and made available for preliminary review. Subsequent reviews will occur under subtasks 10.10 and 10.11. For purposes of task analysis, we assume that the actual license applicant will be the State of Alaska. Certain specific items and sources are noted below:

- (1) For Exhibit A, copies of the laws under authority of which the application is made.
- (2) For Exhibit B, copies of all minutes, resolutions of directors of the Power Authority, as well as any pertinent legislative proceedings and executive decisions substantiating authority to file the license application.
- (3) For Exhibit C, copies of special hydroelectric, water power, or irrigation laws of the State. Note that this information will already have been assembled under Subtask 10.02, so that the only additional requirement under this Subtask is to review for completeness and assemble as an exhibit.

(c) Discussion

Although the level of effort associated with this Subtask is minimal, it is included to ensure that every item required under FERC regulations is accounted for.

(d) Schedule

Weeks 12 through 16

Subtask 10.04 - Coordinate Exhibit Preparation within Major Task Categories

(a) Objective

To ensure that outputs from various tasks are consistent with FERC requirements pertaining to applicable exhibits.

(b) Approach

FERC regulations will be reviewed in detail to identify specific products, along with their specifications, to be developed as outputs from other tasks within this Plan of Study. Criteria will be prepared and distributed to appropriate responsible individuals. Progress will be monitored throughout the course of the work and design transmittals will be reviewed in each case to ensure consistency with current--and to the extent that changes occur, future--FERC regulations. Complete exhibit packages will be prepared for Exhibits F through O, S and U through W. As noted in Table 1, Task 10, each of these products is a required output from another task.

(c) Discussion

This subtask provides for positive controls to ensure that the work produced in other tasks will, in fact, be available for use without further modification (except, perhaps, for certain introductory materials and tables of contents) as exhibits in the application package. Certain specific criteria for dimensions, degree of detail, drawing content, and the like must be identified at the start to avoid costly abortive efforts and redundant work.

(d) Schedule

Throughout project period.

Subtask 10.05 - Prepare Exhibits D and E

(a) Objective

To acquire and evaluate data incident to preparation and prepare exhibits D and E.

(b) Approach

Exhibits D and E are sufficiently closely related that concurrent work on both is justified.

Exhibit D calls for evidence of compliance with requirements of the laws of the State of Alaska with respect to bed and banks and to the appropriation, diversion, and use of water for power purposes and with respect to the right to engage in the business of developing, transmitting, and distributing power, and in any other business, necessary to effect the purposes of the license applied for, including a certificate of convenience and necessity, if required. This evidence shall be accompanied by a statement of the steps that have been taken and the steps that remain to be taken to acquire franchise or other rights from the State, boroughs, and municipalities before the project can be completed and put into operation.

Exhibit E requires a description of the nature, extent, and ownership of water rights in the development of the project, together with satisfactory evidence that the applicant has proceeded as far as practicable in perfecting its rights to use sufficient water for proper operation of the project works. A certificate from the proper State agency setting forth the extent and validity of the applicant's water rights shall be appended if practicable. In case the approval or permission of one or more State agencies is required by State law as a condition precedent to the applicant's right to take or use the water for the operation of the project works, duly certified evidence of such approval or permission, or a showing of cause why such evidence cannot be reasonably submitted shall also be filed. When a State certificate is involved, one certified copy and the required additional uncertified copies shall be submitted.

Subtask 10.02 seeks to identify applicatory laws and regulations as well as to plan a program for compliance. In this subtask, we will monitor the compliance program to ensure that it is being fulfilled. A report will be prepared setting forth the steps taken to the point of application as well as a description of further programs leading to eventual total compliance. Although application for license filed by the State implies that State law has itself been complied with, we will nonetheless take suitable measures to make known our compliance efforts. Thus will Exhibit D be prepared.

We will seek the assistance of the Alaska Department of Natural Resources in providing a definitive certificate of the extent and validity of the State's water rights. In the event that water-use conflicts are discerned (current authorities to reserve water for various uses are complicated or vague where they exist at all), they

will be documented and evaluated. A report detailing the results of our own research on the water rights issue together with appropriate certification by the Department of Natural Resources will become Exhibit E.

We will provide draft copies of proposed Exhibits D and E to various State agencies under whose auspices regulatory and legal requirements are monitored or enforced. The earliest coordination of these items will contribute significantly to our ability to ensure understanding and compliance.

(c) Discussion

It is important to note that the issues of compliance with state law, and particularly of water rights, will be addressed in various public meetings, since it is in those forums that public perceptions of potential conflict are most likely to surface. In addition, workshops to be conducted under the public participation program (Task 12) are designed to seek involvement of interested and affected State agencies while the work goes on, rather than present them with a "fait accompli" at the end of the 30-month study effort.

(d) Schedule

Weeks 12 through 24 and 100 through 116.

Subtask 10.06 - Prepare Exhibit R

(a) Objective

To acquire and evaluate data incident to preparation and prepare Exhibit R - Recreation.

(b) Approach

We will seek to determine the interests and desires of the public insofar as recreation is concerned through the public participation program. The particular views of owners and residents who may be affected will be sought. Certainly, for example, Native organizations whose lands lie within or adjacent to project boundaries and residents within the river basin--particularly downstream--are especially important.

We will consult with the Department of Interior, the Power Authority and interested State Agencies on a continuing basis, and particularly during the eight scheduled workshops described in Task 12, Public Participation.

Three alternative concepts will be drawn up, one of which considers strictly controlled access and purposeful avoidance of man-made recreational features. These concepts will be available for review by the end of the 11th month so that they can be presented at the second public meeting to be held early in 1981. Environmental impacts will be evaluated as a portion of the work to be accomplished under Task 8 - Environmental Studies.

That alternative which appears to best satisfy the public interest, after a careful evaluation of all factors, will be presented for consideration at a workshop in May 1981. Modifications will be made as appropriate and a revised recommended concept will be presented at a workshop in September '81. A final conceptual recreational plan will then be developed in the detail required by FERC regulation for preparation of Exhibit R.

(c) Discussion

It will be noted that environmental studies conducted during Task 7 provide for the development of a rigorous final recreation plan during the post-license application phase. The conceptual plan prepared under this subtask will provide a basis for proceeding with that work. Should significant changes to the original concept be indicated, supplementary reports will be provided to FERC as the final plan emerges.

It is extremely unlikely that total consensus will be achieved on any single recreational concept. Indeed, it is probable that the spectrum of desires will range from no recreational development and strictly controlled access to a Disneyland North. It follows that the

evaluation and selection process for a single recommended plan should be understandable and should, insofar as is possible, best balance environmental concerns, desired developments, and economic factors. In any case, we do not intend to assign a specific value to recreation in order to boost what might otherwise be an economically unjustifiable project into a seemingly attractive marginal development. Indeed, where private financing is sought, it will be achieved or denied on the basis of power benefits alone.

Consultation with various federal agencies will also be required in view of current federal interests in all project lands and expected continued federal interest in portions of the project area, including certain access routes and transmission routes.

(d) Schedule

Throughout project period.

Subtask 10.07 - Prepare Exhibit T

(a) Objective

To acquire and evaluate data incident to preparation and prepare Exhibit T--Statement of Reasons for Non-Federal Development.

(b) Approach

The reasons why development of the project by the State of Alaska rather than by the Federal Government is in the public interest will, of course, have been debated at length within the State prior to the decision to select a consultant to undertake the proposed work. We will review the minutes and transcripts of those meetings and sessions which led to that decision with a view toward expressing the reasoning in a formal report. Any additional light which may be shed on the matter as a result of public participation will be included as well. We will also seek the views of the Chief of Engineers, U.S. Army Corps of Engineers, since federal development would be accomplished by the Corps of Engineers if the State chooses not to use a consultant to accomplish the work.

After a selected development plan is developed, cost estimates and schedules are prepared, financial planning and risk analysis are essentially completed, and environmental impacts assessed, we will attempt to discern differences--both positive and negative--which deserve to be addressed in Exhibit T. A final report to serve as Exhibit T will be prepared upon completion of the last public meeting in April 1982.

(d) Schedule

Weeks 1 through 12, 122 through 125, with intermittent activities at other times.

Subtask 10.08 - Prepare Application Form

(a) Objective

To prepare application in prescribed format.

(b) Approach

The prescribed format for license application requires brief summaries of data which are contained in detail in the exhibits. We will prepare this document in draft form upon substantial completion of the various exhibits. An initial legal review will be accomplished at this time.

(c) Discussion

Although this task becomes relatively simple once all exhibits have been prepared, it is nonetheless extremely important, since the summary application form will be far more widely read than the detailed documentation which accompanies it.

(d) Schedule

Week 126

Subtask 10.09 - Documentation Review and Deficiency Correction

(a) Objective

To provide for final in-house review of draft license application.

(b) Approach

Whereas continuous reviews will have been conducted throughout the study period as individual subtasks are completed and various design transmittals and draft exhibits are offered for comment, we propose to conduct an exhaustive in-house review of the recommended final license application. A full two weeks will be set aside for this purpose and our designated in-house review panel will individually review and collectively meet to consider the proposed final draft application. Deficiencies will be corrected wherever they are found to occur. After the first week of the two-week review period, copies will be made available for final review by the expert external boards established for the purpose. That effort is covered under Subtask 10.10.

(c) Schedule

Weeks 127 and 128.

Subtask 10.10 - External Review and Client Execution

(a) Objective

To provide for final review by external boards and for final production of application ready for filing.

(b) Approach

External board members will be provided final draft copies of the proposed application three weeks before targeted completion date. Reviews will be conducted individually for approximately one week, and the boards will convene during a second week to permit discussion of concerns, if any. Members of the Acres team will be made available as necessary upon request to answer questions. To the extent that correctable deficiencies are discovered at any time during the review period, immediate action will be taken to alleviate the problem. For that purpose, a representative from the Acres team will be made available to the board for liaison and review throughout the two-week review period.

The final week of the study period will be devoted to final correction, production, and delivery of the application for execution and filing by the State.

(c) Discussion

The proposed careful review will serve several purposes. First, it is clearly important on a project of such magnitude to avail oneself of the best available opinion as to the adequacy of the work. Secondly, the collective efforts of eminent review groups may serve to reduce the challenges or interventions which may be made during the license processing period. Certainly, members of the external board may also be called as expert witnesses during later periods. Thirdly, the vital confidence of potential investors will surely be bolstered by the thoughtful deliberations of such an august body.

(d) Schedule

Weeks 128 through 130

A.5.12 - TASK 11: MARKETING AND FINANCING

(i) Task Objectives

To establish the feasibility of financing the project and to develop an approach which provides optimum financing cost to Alaska power Authority and the best overall benefit to the State of Alaska. An essential element of this task will be to build confidence in the project.

(ii) Task Output

The principal output of this task will be the draft support documentation for bond offering. While nine primary documents and approximately sixteen additional support documents are involved, some will be prepared with relative ease because the data contained therein will necessarily have been produced for other purposes. Notable outputs unique to the marketing and financing issue include a series of risk analyses and procedures for risk control and minimization, as well as a taxation report addressing the important question of eligibility for tax-exempt bond issuance.

Documents will be produced under three main categories:

- | | |
|---|---|
| (a) Project Overview,
including | Review of Design and Construction
Concepts and Methodology |
| | Review of Cost Estimates and Schedules |
| | Economic Limits of Project |
| | Preliminary Assessment of the Financing
Plan and Bond Offering Documentation |
| | Review of Environmental Constraints |
| | Development of the Organization and
Expertise Sources |
| | Major Risks and Responses |
| (b) Internal Reports
for Management/
Financial
Consideration
(Provisional
Listing) | Financing Requirements of all Parties and
the Completion Guarantee |
| | Assessment of Capital Costs and
Schedules |
| | Assessment of Critical Engineering Tasks
and Associated Risk Analysis |
| | Project Contingencies, Risk Analysis and
Planning |

(b) Internal Reports
for Management/
Financial
Consideration
(Provisional
Listing) (Cont.)

Environmental Agencies Requirements

Native Peoples Requirements

Probable Economic Limits to Project

Inflation and Escalation Assessment

Overrun Possibilities

Risk Management Organization and Risk
Minimization Policy

Security of Project Capital Structure

Economic Impact Preview

Evaluation of Alternative Markets
Available for Susitna Output

Evaluation of Alternate Options for
Meeting Railbelt Power Needs

Review of Construction Contract
Performance History in Alaska re Cost and
Schedule

General Economic Review

(c) Draft Bond
Documentation
(Provisional
Listing)

A. Primary Volumes

Power Contracts

Engineering Report

Statutory Agreements, Legal Approvals
and Land Claims

Summary of Corporate Documents

Technical Abstract and Engineer's
Certificate

Construction Cost Estimate Summary

Construction Schedule and Project
Expenditure Program

Insurance

Financing Summary

(c) Draft Bond

B. Support Volumes

Overall Project Organization

Engineering Reports (Construction)

- Access and Site Preservation
- Environmental Standards, Monitoring and Control
- Quality Assurance and Testing Programs
- Support Facilities and Logistics

Engineering Reports (Operations)

- Operating and Replacement Expenditures
- Chargeable Corporate Expenditures

Labor Agreements

Plan for Alaska Manpower and Procurement Content

Risk Management and Minimization

- Risk Analysis and Control
- Risk Minimization

Taxation Report

Legal Report

Review of Giant Projects

- Financing
- Construction and Engineering

Alternative Energy Sources

(iii) List of Subtasks

- Subtask 11.01 - Project Overview Preparation and Updates
- Subtask 11.02 - Internal Report Preparation
- Subtask 11.03 - Alternative Power Source Risk Analysis
- Subtask 11.04 - Susitna Base Plan Initial Risk Analysis
- Subtask 11.05 - Susitna Base Plan Extension and Revision
- Subtask 11.06 - Susitna Financing Risk Analysis
- Subtask 11.07 - Resolution of Tax Exempt Bond Issue
- Subtask 11.08 - Identify Parties in Interest
- Subtask 11.09 - Revenue Assurance Procedures
- Subtask 11.10 - Liaison with APA Bond Underwriting Managers
- Subtask 11.11 - Draft Documentation for Bond Offering Support

(iv) Subtask Scope Statements

It is recognized that Susitna is most likely to proceed on the basis of a Project Financing. Essential to this will be an accurate determination of revenues and properly established energy sales agreements. Furthermore, all project risks must be identified, their potential impact assessed, and appropriate contingency plans and provisions made.

In the approach recommended, a close working arrangement will be established from the outset of the study between technical, economic and financial advisory groups. The interaction between these interests will be developed through a series of specific tasks which provide the Authority with successively more comprehensive outlines and definition of a financing plan.

As the study proceeds, the specific requirements for supporting material essential for financing will be identified and its preparation undertaken in close collaboration with the selected bond underwriters. The completeness and excellence of bond offering support documentation is judged to be of crucial importance to a successful project. The work involves numerous, complex and interlinked tasks; and only comprehensive pre-planning can achieve the desired result.

In order to present the project in proper perspective to the many parties involved--Federal, State and local agencies, regulatory authorities, power purchasers, potential lenders, institutions, political groups and public--a comprehensive overview will be prepared. This will initially be in general terms, but will endeavor to cover all the interrelated elements of the project. As work proceeds, successive editions of the overview report become more explicit and complete.

It will be recognized that the knowledge and enthusiasm of many who have the power of veto or constraint over the Susitna project will be less than that of Alaska Power Authority and those most closely involved. Studies and explanations which may seem unnecessary to the sponsoring group may well be needed to convince third parties and engender their enthusiasm.

It is furthermore vitally important to disperse the knowledge among those employed in the project that all potential problems have been thoroughly examined and solved. This will generate the necessary degree of infectious enthusiasm which is an essential ingredient for even a determined team to succeed.

The work of the interdisciplinary group incorporating technical, economic, financial, and other skills would, furthermore, demonstrate clearly for management consideration the clear economic limits to the Susitna project (e.g., its maximum acceptable cost) and the time period in which its accomplishment must be regarded as a certainty before other measures to meet Alaska's power needs would have to be adopted. While examination of the negative limits of the project could be regarded as an expression of pessimism or even, in the ultimate, capable of cancelling the project, we consider such analysis vital. It should serve to establish the general robustness of the project and to demonstrate beyond doubt to the various governments, investors, lenders, completion guarantors and others the viability of any recommended scheme for development.

As the various elements of the project study reach the appropriate level of completion, it is planned to apply a rigorous analysis of risk and to recommend contingency provisions. The approaches to be used would involve modern techniques of analysis and probability assessment and deal with cost, schedule, technical and other controlling elements of the project.

The approach to be adopted would derive full benefit from previous financing efforts for major capital projects requiring capital funding of \$1 billion or more. Experience has demonstrated the need for close and effective interaction between the owner and the various elements of his advisory team.

(v) Logic Diagram

A logic diagram is presented at Plate 1 of Task 11 as the basis for graphically illustrating the manner in which various documents are prepared, interrelated, and assembled.

(vi) Investment Banker Inputs

Associated with us in Task 11 will be the investment banking firm of Salomon Brothers which is described in their memorandum at Section C of this Plan of Study. Salomon Brothers will apply its professional skills, experience, and judgment as a major investment banker to assist us in every aspect of Task 11 at a total level of effort equal to that provided by Acres. Costs throughout the various subtasks include both Acres and Salomon Brothers work.

Subtask 11.01 - Project Overview Preparation and Update

(a) Objective

To provide a key project document which reviews all major aspects of the project and its objectives, determining in principle whether these can be successfully met; provide through successive updating a continuing reassessment of the project's overall viability and financibility as various milestones are reached; and allow multidisciplinary inputs from many sources to be properly coordinated into a cohesive and well- balanced definition of the project.

(b) Approach

This Subtask will be performed by a small team who will receive inputs from many multidisciplinary sectors involved in the study. Initially the Project Overview will concentrate on a descriptive outline of the project objectives, the site for development and the project facilities. Capital costs and schedules will be at the outset preliminary only, but nonetheless considered adequate to determine initial overall viability. The Project Overview will identify the sensitivity to various risks and outline methods of mitigating these and possibly removing some from further consideration. The initial project overview preparation will occur after the go-no-go decision point at the end of the study.

The project overview and its subsequent revisions in updated form at intervals of about 6 months throughout the study will be presented from the "owner's viewpoint" and will consider all important aspects which affect acceptance, financibility and the undertaking of construction of the hydroelectric facilities.

The team will be directed by experienced senior staff familiar with the approach essential to projects of such magnitude and the complex financing arrangements that these involve.

In achieving its goal of preparation of a comprehensive, clearly understandable, concise and accurate overview of the project, the Project Overview Task Force will call on specific inputs from many sources, including:

- Technical
- Environmental
- Economic
- Marketing
- Financial
- Insurance
- Transportation
- Labor
- Tax
- Legal
- Political

Typical elements of the Project Overview are listed in Subparagraph (ii)(a) of Task Output above.

The final issue of the Project Overview during the study phase will provide a valuable summary document to bridge into subsequent licensing and preliminary design phases of the work. Eventually its content will have significant value for the Bond Offering Support Document and a variety of other applications, including preparation of project brochures as part of the public participation program.

(c) Discussion

The concept of the continuously updated "Project Overview" is of relatively recent origin and has developed from the special needs of large complex projects. It is necessary to address the complexity with a well planned compilation of material which places all the technical, commercial, economic, financial, contractual, environmental and other aspects in proper perspective and demonstrates that all vital problems are being sensibly addressed. The overview is planned to provide a consistent thread of documentation through the whole study process and, if construction should proceed, to provide a datum baseline for judging actual performance of the many elements in relation to the plans.

As the documents will have to serve many varied and non-technical interests, the language must be appropriately chosen and carefully edited for clarity and ease of understanding. Extensive use will be made of graphics, drawings, maps and pictorial illustrations. Production and binding will reflect the level of economy appropriate to draft and eventually final documentation.

(d) Schedule

Weeks 53 through 130.

Subtask 11.02 - Internal Report Preparation

(a) Objective

To prepare topical reports, for management consideration, on those aspects of the projects which have a strong bearing on financibility of the project; present material derived from the overall study in form suitable for easy assimilation by non-engineering participants in the overall task; and present the risks to which the project is exposed in the proper perspective.

(b) Approach

The team provided to assess the overall financibility of the project will be responsible for drawing together from many sources data, viewpoints, reports, assessments, impact statements, documents and a variety of other supporting material. In carrying out this task, the multidisciplinary specialists who will be supporting the team will assemble and edit topical internal reports for consideration by managerial staff of the Authority, their financial advisors/under-writing managers and others guiding the project through its study phase to implementation or abandonment. The internal reports may ultimately form a substantial proportion of documents to be subsequently produced in direct support of the financing or for a variety of other purposes. Every effort will be made to foresee all future possible uses of the material, and its presentation will be appropriately arranged.

One element of the internal reports which will receive special consideration is risk assessment, which will be applied to several aspects of the project such as technical, financial overrun, schedule delay, operating reliability, etc. Means of mitigating project risks will be dealt with in a comprehensive fashion as will be the contribution from insurance sources in dealing with residual exposures. The important detailed risk analysis itself is covered under subtasks 11.04 through 11.06. Related internal reports prepared as a part of this subtask will present the results of those detailed professional studies in a manner which can be easily understood by decision makers whose ultimate agreement is essential to eventual construction.

Subparagraph (ii)(b) of the Task Output sets out a provisional listing of typical documents which may be required. The final listing would be planned at an early stage of the study in conjunction with the Authority and their advisors. Control sheets outlining responsibilities for specific input, index of contacts, and required schedule will be prepared in this planning stage.

The internal reports provide, on a selective basis, much of the material for the various editions of the Project Overview and the production of both series will be closely coordinated.

A consistent and cohesive series of reports will be prepared which will clearly address all the vital issues affecting project release for construction.

(c) Discussion

While documents of the type envisaged are the inevitable product of a comprehensive study, the benefit of a specific source of consistent internal reports is that the Authority will receive objective, well balanced, professional arguments on key issues to allow properly informed decisions. It is important to note that this approach is responsive to the APA plan to remain a lean, efficient organization. In a bigger and more highly staffed organization undertaking a major project of the scale of Susitna, the internal reports would be produced, no doubt, by individual specialist departments for the owners' project team responsible for final decision.

The proposed approach permits APA to avoid overstaffing for relatively short study or project management periods. An opportunity is offered for the special project task force to perform these functions under the control and direction of the Executive Director and the Board.

The team would be closely linked to the overall project study organization and perform functions which will be an essential part of the study task. It will serve, however, the owners' control group directly in providing the basis for assessment and decision on many issues having an impact on the project.

This subtask will continue during the post-application phase of the work.

(d) Schedule

Weeks 52 through 130.

Subtask 11.03 - Alternative Power Source Risk Analysis

(a) Objective

To examine uncertainty with an emphasis on relative differences dependent upon electricity source patterns; identify key uncertainty differences and key interdependencies; and if necessary, quantify uncertainty differences and their interdependencies; establish the validity of key assumptions; and assess viable levels of risk in terms of the State of Alaska's electric power generation mix.

(b) Approach

Acres will coordinate the assessment. Input will be obtained from personnel responsible for each study component, APA source documents and their authors, related reports, and related general literature. Established cross-impact analysis techniques will be recast in the general risk analysis framework developed by Acres to establish potential variation ranges conditional upon the values of other key variables. The key difference is the treatment of time as a continuous process rather than a series of events. To consider these relationships, we will identify the reasons for potential variations, concentrating on broadly defined reasons which have different effects upon each of several source mixes. For example, alternative growth rates developed under Task 1, Power Studies, will be related to two or three different rates of fuel cost escalation. Simple functional relationships will be established to illustrate key interdependencies. A number of power generation patterns with and without Susitna will be evaluated in terms of a sensitivity analysis using these conditional relationships between extremes.

If the case for or against Susitna is not clear, on expected cost grounds, these simple relationships will be refined, associated uncertainty will be quantified, and the validity of key assumptions will be established to the extent possible within budget extensions not considered in this proposal. Expected future electric power cost risk relationships for each electric power generation pattern considered will then be related to the need for the APA to avoid risky situations and mitigate the effects of undesirable situations.

(c) Discussion

General agreement on the extent of such dependencies will not be easily obtained. However, it is a key issue which should not be ignored. Most people will be sympathetic to the existence of some dependence, and minimal dependency assumptions may be all that is necessary to establish a clear case. A simple but realistic initial approach is a low cost minimum risk approach. Extension must be assessed in terms of initial results.

Providing conditional estimates will be a useful aspect of assessing base estimates, and associated costs for other participants are incorporated in their provisions, with the exception of WCC. For related reasons, no attempt to cost APA input has been made. Expenses account for the need to seek a wide spectrum of expert opinion.

(d) Schedule

Weeks 20 through 50

Development of initial conditional relationships and sensitivity analysis based evaluation of alternatives

After week 30

Extension and refinement as necessary, overlapping Subtask 12.04 if necessary.

Subtask 11.04 - Susitna Base Plan Initial Risk Analysis

(a) Objective

To identify all relevant risks in terms of specific problems associated with specific major components of the project and key aspects of the alternative power source risk assessment developed in subtask 12.03; identify all relevant preventative and responsive measures for these risks; identify which risks are minor given effective responses, and which need further attention; make a preliminary quantitative assessment of some key construction time risks, and their relationships with other key project cost risks, flagging risks which are important but best treated as conditions with respect to the current quantitative analysis; stimulate information flow between planning groups with respect to likely departures from the base plan; and stimulate documentation of problems and solutions to those problems underlying the base plan.

(b) Approach

Acres will coordinate the assessment. Input will be obtained from project personnel responsible for each component. Procedures developed by Acres will be used to assess construction time risk as follows:

Risk lists will be produced, labelling and describing all the relevant risks all those involved can identify.

Response lists will be produced, labelling and describing all relevant responses associated with each risk.

Secondary risk and response lists will be produced, considering risks associated with responses.

Rough quantitative assessment of risk/response sequences will allow some risks to be identified as minor, and not worth further analysis at present.

Still using risk/response lists, responses will be partially structured. Responses common to more than one risk will be identified. Responses will be preference ordered. Where possible, decision rules defining when responses would be used will be identified.

Special diagrams will be constructed to summarize the above analysis in a simple form.

Key base plan assumptions and key assumptions concerning responses to potential problems will be identified.

Probabilities necessary to assess key assumptions will be estimated. Most will be very specific conditional probabilities: for example, what is the probability of X working days for a particular activity in a particular month?

The implications of key assumptions will be examined, first in the context of specific risks for specific activities, gradually at a broader and broader level. For example, we will assess the chance of achieving the planned work on a specific activity in a specific season in relation to one or two key risks first, then look at other risks and other seasons. We will not relate different activities until we are satisfied with assumptions critical to the activity itself.

A variety of output forms will be used, depending on the questions being asked of the analysis. Most will be comparative probability distribution representations; for example, the probability of finishing activity Y by month X given a start in May, June, July, etc.

Construction time risk will be summarized, and converted to construction cost risk.

Other sources of construction cost risk will be considered in a similar manner, and linked to produce overall construction cost probability representations for confidence limit assessment purposes. Appropriate confidence limit assessment will be based on a comparison of quantified risks and nonquantified risks which must be treated as conditions.

Construction cost risk analysis will take place in a fixed time frame structure, unlike the PERT based analysis usually employed. That is, we will consider uncertainty in terms of "how much work can we achieve in a given time", instead of "how long will it take to achieve a given amount of work". This approach makes it much easier to assess probabilities, always a difficult task. It facilitates the consideration of weather windows and other seasonal dependencies. It also facilitates integrating construction cost risk with inflation and escalation studies at this point.

Other sources of project risk will be considered qualitatively in a similar manner, structuring risks and responses via listing procedures and simple summary diagrams.

Computation procedures are based on numerical integration techniques in a semi-Markov process framework. Another key advantage of the fixed time frame is the efficiency and precision of this approach relative to the more usual simulation or moment-integration analytical procedures.

All aspects of the Acres approach to risk analysis have been widely used in the context of fault-tree and event-tree analysis, reliability analysis, generalized PERT, Markov process and decision-tree analysis. However, the way we have integrated these aspects into a procedure tested in a variety of application areas is unique. Areas of application of the integrated procedure include hydro projects, thermal power projects, arctic gas pipelines, offshore North Sea oil pipelines and platforms and underground energy storage projects.

(c) Discussion

The effort expended on risk analysis can be tailored to an available budget. However, it must be expended in a systematic manner, and

experience suggests that at this stage in a project's life a relatively simple quantitative analysis will suffice provided risks and associated preventative and responsive measures are carefully identified. If they are not, quantification of risks is rather meaningless, because it is not clear what has and has not been included.

(d) Schedule

Weeks 53 through 75 Develop initial risk analysis as base plan is developed, including quantitative analysis to test key base plan assumptions.

After week 75 Prepare risk analysis documentation for license application submission.

Subtask 11.05 - Susitna Base Plan Extension and Revision

(a) Objective

To revise the base plan initial risk assessment periodically as the base plan develops; explore key risk areas identified earlier; assist with base plan development as and when necessary; and respond to FERC requests for further analysis.

(b) Approach

Within the basic framework established in Subtask 12.04, further specific extensions and revisions.

(c) Discussion

Experience suggests risk analysis can be extremely useful at this stage in a project's development, but it is difficult to predict what sort of issues will benefit from further analysis until preliminary risk analysis results are available.

Costing is necessarily vague at this stage, but we believe the figure quoted should allow updating as necessary, response to a reasonable number of risk areas uncovered earlier and assessment of key changes proposed for the base plan.

This effort will continue during the post-application phase of the work.

(d) Schedule

As and when necessary.

Subtask 11.06 - Susitna Financing Risk Analysis

(a) Objective

To build on earlier risk analysis consideration of financial issues not yet developed, including assessment of contract and insurance arrangements, and an appropriate level of direct and indirect "insurance".

(b) Approach

Within the basic framework established in Subtask 11.05, specific extensions and revisions, in terms of both quantitative and qualitative analysis.

(c) Discussion

Earlier listing and structuring of risks and responses is of great value at this stage. Each proposed contract can be assessed against appropriate checklists of potential problems, and contract arrangements or insurances which cover a number of different sources of risk can be developed into an effective overall risk management pattern.

This subtask will be performed in its entirety subsequent to submittal of license application.

(d) Schedule

From license application to bonding.

Subtask 11.07 - Resolution of Tax Exempt Bond Issue

(a) Objective

To explore all legal means to secure tax-exempt financing for the Susitna Project and identify and describe those measures which must be taken in each case to secure that end.

Rank in order preferred approaches in the event more than one legal means is identified. Prepare a report summarizing reasons tax exempt financing is found to be impossible in the event no legal means is identified.

(b) Approach

A memorandum on financing considerations prepared by Salomon Brothers is included in Section C to this Plan of Study. As noted therein, a number of possible alternatives under the IRS Code can be explored. The special rules provided under Section 103 of Treasury Regulations for applying trade or business test and security interest test to bonds issued to finance an electric generating facility owned and operated by an exempt person (in this case, the State of Alaska or a public power authority) will be considered in a series of sequential steps summarized as follows:

- (1) Classify the anticipated purchasers of power from the Susitna project into exempt and nonexempt persons. For example, municipalities such as Anchorage and Fairbanks will be exempt persons, whereas private electrical co-ops will be nonexempt.
- (2) Determine whether any one nonexempt person will contract to take, or take or pay for, more than 25 percent of the project output of the Susitna project. If there is such a person, then the trade or business test is met.
- (3) If there is no such person, identify the nonexempt persons who will each pay annual guaranteed minimum payments exceeding 3 percent of the average debt service on the Susitna bonds. The trade or business test is satisfied if the aggregate amount of power which these persons contract to take, or take or pay for, exceeds 25 percent of the project output of the Susitna project.
- (4) If the trade or business test is met, total the payments that will be both pledged or used to pay debt service on the Susitna bonds and made pursuant to the contracts referred to in either paragraph 2 or 3 above. The security interest test is met if this aggregate amount exceeds 25 percent of the total debt service on the Susitna bonds.

If it appears that the Susitna bonds may be industrial development bonds because of the commitments by nonexempt persons to purchase power, consideration may be given to altering the makeup of the group of purchasers to avoid the trade or business test or security interest test. Further details are provided in the

Salomon Brothers memorandum. Assuming that one or more approaches are found to be possible, each will be evaluated in terms of the associated difficulties and probabilities of successful defense against challenge by or on behalf of regulatory authorities. All reasonable approaches will be rank ordered and the apparent best will be developed into a series of explicit measures to be taken by the State (including recommendations for legislation to be passed), the Alaska Power Authority, and others.

In the event that tax exempt financing is found to be impossible, a report will be prepared detailing the reasons that no reasonable approach could be found.

(c) Discussion

The question of tax-exemption on interest to be paid on bonds issued to finance the project is of extreme importance, for the overall cost of the project power and the type of financing plan to be developed hinge upon its resolution. So important, in fact, is this issue that even a negative report should not necessarily be regarded as a final and irrevocable ruling on the matter. Indeed, given the importance which the federal government has now attached to domestic energy production (especially from renewable resources) it is not inconceivable that federal regulatory or statutory changes can be achieved.

In the event, however, that negative findings on the tax exempt question are produced and cannot be reversed, the financibility of the project will not then necessarily become doubtful. The best alternative to tax exempt bonds will be recommended by an experienced professional investment banking firm whose successful historical participation in large project financing is well documented.

Legislation now pending could serve to resolve this issue in favor of tax-exemption for bonds associated with hydroelectric development. In the event that this legislation passes, the level of effort will be reduced to that amount necessary to ensure compliance with new laws.

(d) Schedule

Weeks 30 through 52. Intermittent updates thereafter.

Subtask 11.08 - Identify Parties in Interest

(a) Objective

To identify potential candidates to share some of the direct and indirect project risks and describe their possible involvements.

(b) Approach

A survey of all organizations and entities with any possible direct or indirect risk sharing involvement will be accomplished. These parties might include, for example, municipal electric systems, rural electric cooperatives, investor owned utilities, the Alaska Power Administration, and others. A profile will be drawn up for each and an assessment will be made as to how much of the total risk each may be expected to share under appropriate alternative scenarios and as to how such sharing can reasonably be accomplished.

(c) Discussion

There are a number of basic project financing risks which must be addressed. The analysis, assessment, and, where appropriate, quantification of these risks will be accomplished under Subtasks 11.04 through 11.06. Financing risks include:

- Cost overruns prior to completion
- Late completion and non-completion
- Partial or total post-completion outages
- Customer failure to provide anticipated cash flows
- Regulatory risks, particularly insofar as new regulations affect the operation (and, therefore, of course, the profitability and/or consumer costs).
- Technological risks, particularly insofar as the extent to which new or relatively unproven technology may increase financing difficulties.

Given these risks and reasonably detailed profiles of potential risk sharing parties, it is possible to consider a number of alternative participation scenarios. As successive iterations of the risk analysis efforts occur, the possible involvements of parties-in-interest are correspondingly clarified. An essential first step in this process, however, is the task of identifying and profiling potential candidates. Thus, this subtask provides an explicit recognition of that need.

(d) Schedule

Weeks 10 through 30

Subtask 11.09 - Revenue Assurance Procedures

(a) Objective

To explore alternative means to provide adequate revenue assurance to protect investors against the risk of default; develop a strategy for success.

(b) Approach

For large energy projects, the necessary revenue assurance may be derived from a demonstration of demand for the project output and adequate customer and regulatory support of the price for the power. Demonstration of demand can be satisfied by power sales contracts between APA and the immediate customers (e.g., municipalities, cooperatives, military bases, industrial plants, etc.). We intend to consider a number of alternative types of commitments and match them against immediate customers identified earlier in the group of parties-in-interest (see Subtask 11.08). Certain specific commitment types are described in the Salomon memorandum in the Appendix. These include take-or-pay obligations, take-and-pay obligations, minimum payment obligations, and step-up provisions.

Since price regulation and other regulatory constraints would necessarily affect the project, it is important to include discussions with all governmental and regulatory agencies in this exploration of revenue assurance.

In addition to power sales contracts, guarantees by the State or Federal government or others would provide further assurances. Guarantee possibilities will be identified and a preliminary assessment will be made of the probability of acquiring them.

A number of funds will be required (including, for example, "Reserve and Contingency Fund" or "Operating Fund") to ensure protection against unexpected shortfalls. Each such requirement will be identified along with its source.

As a final step in the development of revenue assure procedures, the apparent best strategy for successfully achieving the desired degree of revenue assurance will be described in a report to be prepared as a part of this subtask.

(c) Discussion

The basic credit risk against which investors attempt to protect themselves is the risk of default. The risk of default lies in the borrower's inability to meet interest and principal payments on his debt obligations in a timely fashion. Adequate revenue assurance protects the investor against this risk.

It will not be sufficient to conduct a one-time study of the revenue assurance issue and then assume the results will continue to remain valid throughout the course of the financing effort. Rather, a

relatively continuous updating process is essential. In this regard, the provision of investment banker's services by a firm experienced in providing financial services for large projects is particularly important. This subtask will continue during the post-application phase of the work. The level of effort shown in cost summary tables includes only pre-application costs.

(d) Schedule

Weeks 100 through 120. Subsequent schedule to be determined.

Subtask 11.10 - Liaison with APA Bond Underwriting Managers

(a) Objective

To provide a continuing input as appropriate from study tasks of information and data which may have an impact on financing; provide engineering advice to the financing management group; and report to the Project Manager on any issues where financing considerations have an impact on the evolution of the project.

(b) Approach

Financing of a major project such as Susitna will call for a level of effort and ingenuity well beyond that normally involved in public works undertakings. Experience (particularly from the \$1 billion Churchill Falls Project) has established the benefit in a particularly close relationship between technically oriented senior staff closely associated with the engineering related development of the project and the financial, legal, insurance, economic and other professional advisors assembled by the owner. The leader of the task force carrying the responsibilities under Subtasks 11.01 and 11.02 will be eminently suited and placed to provide this liaison function as an essential part of his other duties.

(c) Discussion

In major projects, there must be continual emphasis on multidisciplinary approaches to most of the important issues that have to be resolved. When capital investment is more modest and where many precedent cases are available for guiding decisions, the degree of liaison and interlinking of interests contemplated here might be viewed as extravagant. However, it may be suggested that the exigencies of even less ambitious capital works exposed to excessive cost escalation and the many risks imposed by current public and political attitudes call for closeknit coordination of all project interests throughout the undertaking from concept to completion.

The target is completion in the most efficient and cost-effective way possible and the strictest level of adherence to schedule and budget throughout the project. The aim can be most effectively taken by close cooperation between all interests from the outset.

(d) Schedule

Continuous through the full period of study.

Subtask 11.11 - Draft Documentation for Bond Offering Support

(a) Objective

To review with the Authority's Bond Underwriting Manager the requirements for support documents; prepare and issue outline index and content specifications and allocated responsibility for input; prepare, edit and produce successive draft documents in parallel with other findings, reports, etc, being produced in the later phases of the overall study, and prepare "Engineers Opinions" to support certification of the project.

(b) Approach

Throughout the financing support task, attention will be continually focused on the ultimate objective of a successful bond issue. Very large projects requiring financing at levels of \$1 billion or more call for a particularly high standard of support documentation to build a sufficient level of confidence in the investment potential. Managers of major financing institutions are becoming increasingly sophisticated in their approach, particularly to major projects, and owners and underwriting managers must respond to their more exacting requirements.

We see the vital importance of preparing inputs to the bond offering support documents as the study proceeds. It is planned that draft documents will be available by the conclusion of the study and will be available for further refinement as the project proceeds through licensing to its release date.

The specific approach to be adopted would parallel the successful precedent of Churchill Falls Hydroelectric Power Development which led in 1968 to the marketing of \$550 million in First Mortgage bonds. While in this case work was heavily concentrated in a 3-month period in 1967 and continued at a lesser level for 15 months in 1968, it is recommended that for Susitna the support materials should be methodically assembled throughout the study period and prepared in draft form well in anticipation of any offering. A provisional listing of Bond Offering Documentation is set out in subparagraph (ii) of Task 11 above, and a summary of the objectives of each of the proposed documents is repeated at Table 1 of Task 11.

(c) Discussion

It will be apparent from the provisional listing of documents that a wide range of interrelated topics must be addressed. This calls for input from a multidisciplinary group of specialists and sensitive coordination of all material into a cohesive, balanced and interrelated series of documents. These serve to demonstrate that all important questions have, in fact, been properly addressed and that the project has a high level of overall security as a result.

In view of the legal significance of these documents, the process of editing, approval and publication will require close working arrangement with the Authority's counsel, the underwriting managers,

legislative interests in the State of Alaska, and the owners' management team. The effort requires a painstaking level of processing of very large amounts of data and material and justifies its assignment to our selected team which has appropriate prior exposure to this function.

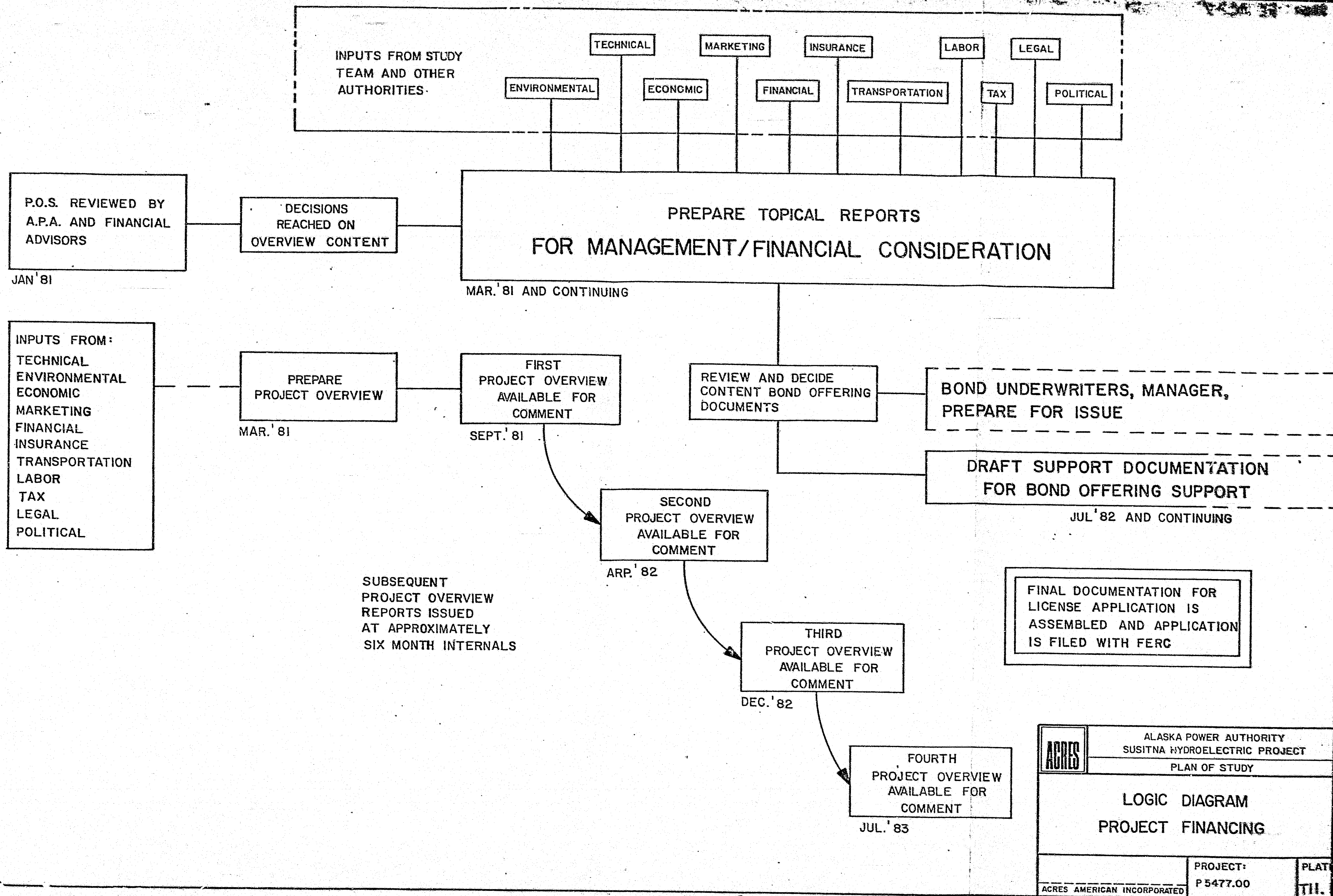
A perusal of the list of bond offering support documentation as displayed in Table 1 reveals that there are great similarities to documentation required as exhibits to the FERC license application (see Task 10). Thus, in many cases, we will use the same documentation both as an exhibit and as bond offering support documentation. In others, it will be necessary to reformat exhibit data to meet financing needs. To the extent possible, however, bond offering support documentation will be delayed until after license exhibits are prepared.

Annex A to Task 11 refers to work carried out for BRINCO on Churchill Falls Hydroelectric Power Development in 1967-68.

This subtask was contained in the September 11 version of the POS along with a schedule commencing in the sixth month of the feasibility study. As a result of discussions with the Alaska Power Authority, the proposed work will be deferred until after license application has been accomplished. A description of the required effort is retained in this version of the POS in order to ensure a complete description of the financing task.

(d) Schedule

Commence after license application and to be presented in a form for continuing effort into subsequent phases of the project.



A.5.13 - TASK 12: PUBLIC PARTICIPATION PROGRAM

(i) Task Objectives

To keep the public fully informed of plans, progress, and findings associated with conduct of the detailed feasibility study, and to provide a means whereby the public (including individuals, public and private organizations, and various government agencies) can influence the course of the work.

(ii) Task Output

Outputs of the public participation program will include:

- Transcripts of public meetings, together with subsequent written comments and proposed action lists derived from public inputs
- Monthly progress reports published and distributed widely
- Film clips and recordings for release to the news media and for subsequent historical record
- Minutes of workshop meetings (to be made available upon request at the cost of reproduction and mailing)
- Minutes of deliberations of external environmental and engineering boards (to be made available upon request at the cost of reproduction and mailing)
- Progress report brochure to be published and distributed in advance of the January 1981 public meeting
- Written responses to individual letters of inquiry addressed to the project information office

(iii) List of Subtasks

- 12.01 Operate Information Office
- 12.02 Conduct Public Meetings
- 12.03 Conduct Workshops
- 12.04 Prepare, Publish, and Distribute Information Materials
- 12.05 Prepare and Maintain Action List

(iv) Subtask Scope Statements

The logic diagram at Plate T12.1 provides a broad overview of the manner in which the public participation program will be conducted. In general, this program has been constructed to provide a series of iterations which are structured for feedback. Plate T12.2 illustrates the process. On a continuing basis throughout the course of the work, information regarding progress, preliminary

findings; and plan revisions will be published; comments will be sought; action lists incorporating issues and concerns will be prepared; the plan of study will be updated; and a new information publication will be triggered.

External engineering and environmental boards will provide an independent review as well as a recourse in the event that the consultant's proposed actions or actual efforts are perceived as unresponsive to expressed concerns. Detailed descriptions of individual subtasks are contained in succeeding paragraphs.

Subtask 12.01 - Operate Information Office

(a) Objective

To provide a central point for public access to project information; provide a coordinating agency for processing information requests, comments, and objections; and provide positive control for meeting scheduled information milestones.

(b) Approach

As soon as work commences on the feasibility study, an information office will be opened and a public participation project officer will be designated. The effort will demand the full time services of the information officer throughout the period during which the study is conducted as well as require administrative support and the part time assistance of others as the work progresses. By providing this vital link between the public and the study team, we expect to ensure that all inquiries are answered, that no comments are ignored, and that an aggressive information program is carried out.

It will be the duty of the information officer as well to make administrative arrangements for other information activities (e.g., acquiring suitable meeting places for public meetings, arranging for verbatim transcripts, processing written comments, etc.).

The public participation project officer and assistants will be employees of the Alaska Power Authority.

(c) Discussion

Experience has shown that the typical professional engineer is reluctant to subject his preliminary findings to public scrutiny (and possibly criticism) until he has gathered all of the data he believes is necessary and has checked and double checked his results. The existence of an information office and the designation of an information officer will provide a means for the public to be kept abreast of what is transpiring as well as what is planned. Daily contact with various project personnel will allow the information officer to discharge his duties properly as well as free the engineers and the environmental scientists to concentrate on the skills at which they are most adept.

It is highly probable that periods of frenetic activity will occur as the information program is carried out. On such occasions, we anticipate seeking the assistance of additional locally hired staff to augment the normal information staff.

Coordination on a regular basis with agencies charged by statute or by executive order with direct involvement, or with organizations such as bulk recipients and distributors of electric power, will generally be accomplished directly at the appropriate action level without

intervention or involvement of the information office. Even so, the information officer will be expected to assume the role of expeditor in any case where it comes to his attention that required coordination is not being accomplished.

(d) Schedule

Entire study period.

Subtask 12.02 - Conduct Public Meetings

(a) Objective

To provide widely publicized opportunities, scheduled in advance in convenient locations, for presenting information to the public, soliciting their comments and concerns, addressing their questions, and involving them in the work; establish an official record of these public participation milestones as the basis for subsequent identification of specific actions to be incorporated into follow-on work; and offer the benefit of public reactions to the views of independent external environmental and engineering boards who will review the recommendations of the project managers at crucial milestones.

(b) Approach

Public meetings will be scheduled for the three following decision points:

- (1) Near the start of the work so that the public may be informed of the plan of study and afforded an opportunity to comment on it.
- (2) After one year's work is completed, at which time sufficient data will be available to permit recommendations as to whether to proceed. At this point, the public will have available for consideration a river basin plan, a comprehensive alternatives study, a progress report on all study work completed to date, and an updated plan for work to be undertaken in succeeding years.
- (3) After preliminary findings are developed and initial drafts of all exhibits to be submitted with license application to the Federal Energy Regulatory Commission are prepared.

At each of the above milestones, three separate public meetings will be held in a two-week period--one each at Anchorage, Fairbanks, and Talkeetna. Information to be addressed at each of the meetings will be made available at conveniently accessible points (e.g., public and school libraries) or at cost to those who wish to acquire personal copies. In each case, brochures summarizing progress, future plans, and problem areas will be prepared and distributed free of charge.

A comment period of 15 days will be established so that written comments received during that interval can be incorporated in verbatim transcripts. (Note that the 15-day period does not in any way limit public comment throughout the course of the work. Indeed, the information office will receive and acknowledge written and oral inputs throughout the entire study period, and will coordinate the preparation of entries on action lists.) The value of the relatively brief period for response to the public meeting lies in making transcripts available as early as possible and distributing them for consideration prior to the next workshop (scheduled within a few months of each public meeting).

(c) Discussion

The value and complexity of the proposed project as well as its location necessarily demand thorough--and almost inevitably, voluminous--reports, calculations, data tabulations, and the like. While such information will be made available for public scrutiny each time a reasonably separable package has been prepared, it is unlikely that the average concerned citizen will have the time or the education and experience to read and digest all of it. The public meeting affords an opportunity for every citizen to learn of what is planned and what has transpired, as well as to offer comment, advice, and/or criticism in a public forum. To be sure, public meetings are generally too large (and too diverse in interests represented) to make them efficient vehicles for generating compromises and courses of action which best meet study objectives while simultaneously addressing key issues raised by conflicting interests. We anticipate satisfying the latter need in part by scheduling and conducting workshops.

The meeting will be conducted in each case by a key member of the Acres organization (usually the project manager or the study director). A panel including a representative of each of the companies forming a part of the Acres team as well as one or more employees of the Alaska Power Authority will be available so that certain questions and concerns can be addressed at the meeting itself.

Public meetings are designed to be just what their name implies--an opportunity for the public to become aware of and involved in the work. They are primarily held to satisfy the needs of individuals, though no attempt will be made to stifle the inputs of organizations or agencies. While public inputs during the meeting and subsequent written comment periods are likely to include significant numbers of expressions of concurrence or of opposition, the results will not be regarded as a vote. Even so, summary records of the range of reactions will be maintained as a part of the record for later consideration during FERC hearings and interventions (if the latter occur).

(d) Schedule

Weeks ~~4~~ to ~~6~~; 52 to 54; 120 to 122

10 to 12

Subtask 12.03 - Conduct Workshops

(a) Objectives

To provide scheduled opportunities for discussion, coordination, achieving appropriate and acceptable compromises, and in general addressing the needs of organizations and agencies having particularly strong interests in the course of the work; provide the vehicle for inputs and advice from particularly knowledgeable representatives of special interest groups, as well as an opportunity for dialogue not readily available at public meetings; and provide the public a chance to observe the face-to-face encounters and the discussions occurring at workshop sessions.

(b) Approach

Eight workshops are planned, six of which are scheduled in advance and two of which are reserved to address issues of opportunity. Each such session may last three days or more and may be divided into a series of subsessions so that time can be set aside for addressing the special interests of certain groups.

While it is clear that special workshop interests necessarily include those of the utilities in the Southcentral Railbelt, state and federal agencies charged with regulation and preservation associated with the project, native villages whose lands or livelihood will be impacted, and certain environmental organizations, it is also true that the productivity and advantages of workshop sessions deteriorate rapidly as the number of participants increases beyond about a dozen. We propose to recommend a manageable number of organizations to APA based upon an attempt to identify interests most clearly and substantively impacted by the project. (In this regard, for example, we would choose a recognized environmental organization operating in Alaska and concerned specifically about project impacts as they directly affect the Alaskan environment and the Alaskan quality of life over a national environmental organization whose objectives may be oriented toward "national" interests and whose representatives have not lived in and may seldom visit the State).

Observation is possible. Even so, oral comments and suggestions from individual observers in attendance will not be solicited during any session. Forms will be available, however, for attendees to express their views.

Subsequent to each workshop, minutes of the meetings will be prepared and published, and action lists will be updated to account for agreements reached during the session as well as to reflect important inputs from various observers.

(c) Discussion

Whereas public meetings (Subtask 12.02) were described as responsive to the participation needs of individuals, the workshop sessions are designed to satisfy group or agency participation needs. The difficulty comes, of course, in selection of proper participating groups. We will make recommendations in this regard, but the choice is properly one for the State of Alaska. Thus we will rely on APA as the arbiter in the event that any interested organization seeks recourse from proposed exclusion.

There is some slight danger that exposing workshop sessions to public view may inhibit participants and keep them from "letting their hair down." In balance, though, we regard the public's right to know as the more important consideration and our costs are derived on the assumption that reasonably large facilities will be required and that a substantial number of interested persons will observe and will express views on the forms to be provided.

By regularly scheduling most of the workshops, we hope to ensure that surprises are avoided and that both the team and sub-session participants are kept fully aware of each other's progress. Given the sheer magnitude of the work, though, it is entirely possible that unforeseen events of great consequence for the proposed project will occur. Two workshops are included in the estimated costs to account for our perception that certain important new issues will need to be addressed when they arise rather than at a future scheduled meeting.

(d) Schedule

Weeks 18, 32, 47, 58, 72, 89, 106.

Two additional weeks to be scheduled during the course of the study.

Subtask 12.04 - Prepare, Publish, and Distribute Information Materials

(a) Objective

To ensure project information is made available on a regular and convenient basis; make explicit provisions for commitment of resources in support of a strong and aggressive public participation program; and support the assemblage of a proper historical record of the sequence of events leading to license application, and, if results so indicate, to eventual design, construction, and operation of a hydroelectric plant(s).

(b) Approach

This subtask will be undertaken through use of innovative multi-media coverage under the direction of an information officer whose duties will include management of a strong information program. Specific efforts include, but are not limited to, preparation, publication, and appropriate distribution of the following:

- (1) Final approved plan of study
- (2) Periodic film clips of "as is" conditions in Susitna basin, alternative sites and/or examples for electric power generation, public meetings and workshops in progress, field investigations, and the like
- (3) Transcripts of all public meetings
- (4) Minutes of workshop meetings
- (5) Monthly progress reports
- (6) Information brochures and pamphlets
- (7) Basin development plan
- (8) Alternatives plan
- (9) Action lists, together with notes as to status of pending actions
- (10) Draft preliminary findings
- (11) Audio and video recordings
- (12) News releases
- (13) Minutes of external board deliberations
- (14) Acknowledgements of written correspondence
- (15) Displays to be set up and periodically updated, regularly rotated from one location to another.

Although the information officer will manage publication and distribution, actual preparation will be undertaken by the appropriate team member responsible for technical details, or in the case of special facilities or capabilities for films and recordings, by subcontract to Alaskan business.

The costs of such an extensive effort are not inconsequential. Thus, certain distribution categories will be established as follows:

- Extensive distribution, free to the public, of summary data such as information brochures and pamphlets,

- Wide distribution of bulky or voluminous materials (such as basin plan, alternative study) to strategically located information centers (e.g., libraries) (Requests for individual copies will be fulfilled at cost),
- Pinpoint target distribution of materials for publication by others (newspaper, magazines, etc.) at no cost to the recipient,
- Satisfaction of information requests at cost for various intermediate reports and data collections not normally routinely distributed.

We anticipate awarding one or more subcontracts (for printing and binding information materials) on a competitive basis to Alaskan firms (unless no capacity is available in Alaska at the time a subcontract is advertised or unless cost savings of 25 percent or more can be otherwise achieved).

(c) Discussion

A key element in the entire information publication process is timeliness. Thus, it will be important to ensure pertinent materials are available sufficiently far in advance of various meetings and workshops to permit review prior to the event.

Our plans to put the entire public participation program in the hands of a single manager and to deal exclusively with locally available subcontractors for logistical support of the program will contribute to our successful satisfaction of the timely distribution problem.

To provide maximum coverage without incurring unreasonable costs, we intend to opt for austere standards. In this regard, for example, covers (where needed) will be paper; colors will not be used except where necessary for clarity of a particular map or figure; volumes will be stapled rather than spiral bound or glued, and a variety of similar restrictions will be enforced.

(d) Schedule

Throughout project period.

Subtask 12.05 - Prepare and Maintain Action List

(a) Objective

To provide a positive system for ensuring all issues are addressed; permit up-to-date status reports on progress and procedures for addressing issues; and ensure that all necessary actions arising from the public participation program are assigned by name to team members.

(b) Approach

Subsequent to the first public meeting, all comments will be reviewed and a list will be drawn up in the form of individual actions sought by the public. The action list will be prepared and maintained by the APA public participation staff. The project manager will review the list and will mark certain actions as inappropriate for further pursuit, together with a brief note explaining why the requested action was recommended for rejection.

The action list will then be completed to include, for each approved action, a control number to facilitate tracking, the name of the team member responsible for carrying it out, cost and schedule implications (if any), and a target date for completion. Once the list is completed, it will be reviewed by APA, who will accept the recommendations of the project manager or revise the list as appropriate. Additional columns on action list registers will be available to indicate status, to permit recording remarks, and to indicate the number of times the particular action is requested by various members of the public.

The action list will be updated on a regular basis after each succeeding workshop or public meeting, or more often if significant numbers of substantive comments are received in the information office.

(c) Discussion

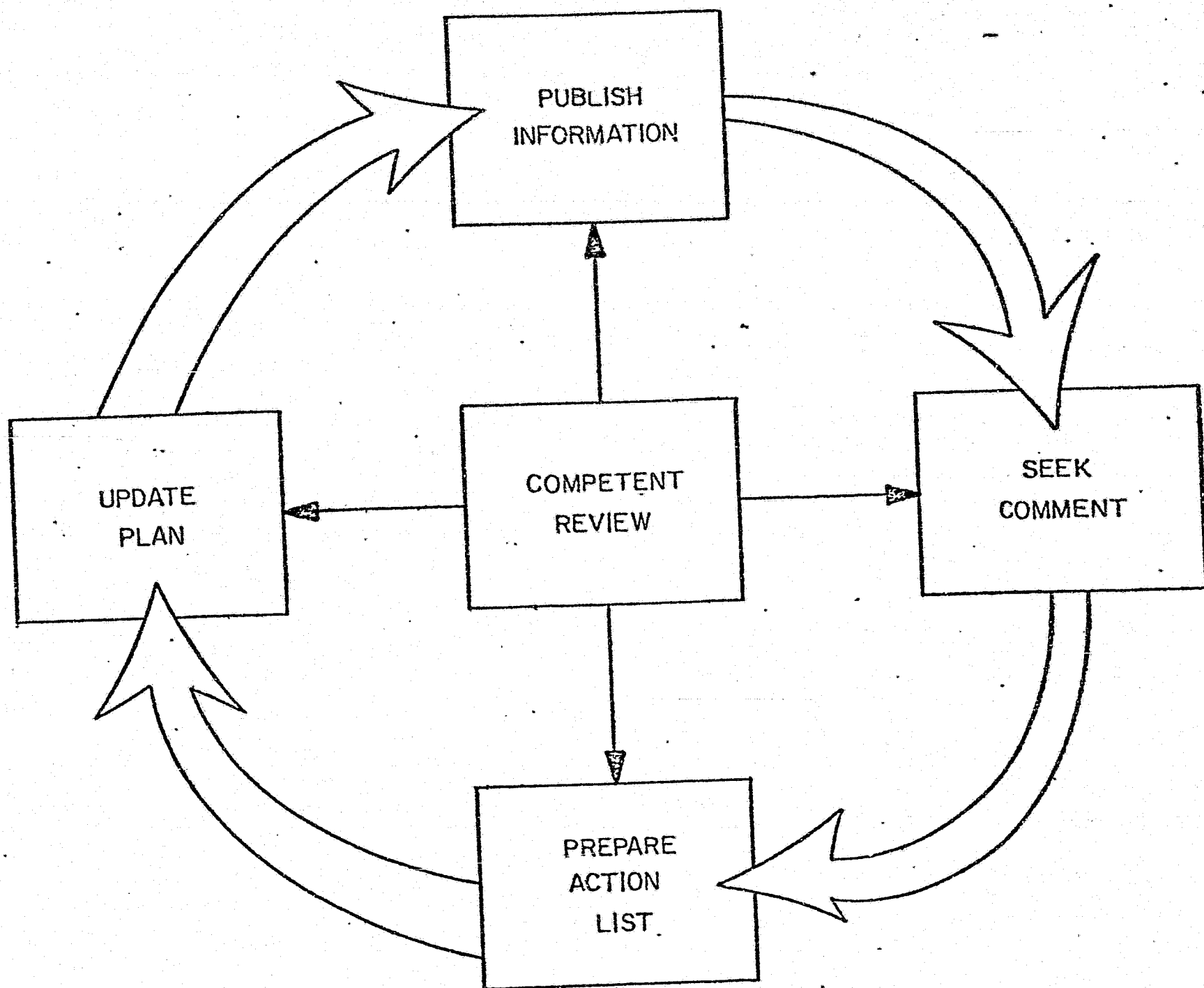
Assuming our study plan is a good one (and we are convinced that it is), it is logical to assume that most requested actions will already have been provided for.


In such cases, of course, neither cost nor schedule impacts will accrue and the "remarks" column of the action list will note that the necessary work is already planned. Even so, a public participation effort is specifically designed to ensure that individual concerns are considered--and it follows that some new ideas, real concerns or innovative approaches will be earmarked for consideration.

We suggest that the proposed action list system is a positive means for demonstrating to the public that their views are being carefully considered and that public participation is not being regarded as a necessary evil to which lip service must be paid.

(d) Schedule

Throughout project period.



	ALASKA POWER AUTHORITY SUSITNA HYDROELECTRIC PROJECT	
	PLAN OF STUDY	
FEEDBACK PROVISIONS-- PUBLIC PARTICIPATION PLAN		
ACRES AMERICAN INCORPORATED	PROJECT: P 5477.00	PLATE T12.2

A.5.14 - TASK 13: ADMINISTRATION

(i) Task Objectives

To develop for the Acres team plans, policies and procedures that will set forth the basic scheme for accomplishing the POS.

(ii) Task Output

The following documents, reports, manuals, etc. will be produced as a result of this task:

- Division of Responsibilities Manual
- Financial Control Procedures
- Project Master Schedule
 - Updates produced as required
- Schedule Control System
 - Periodic reporting to management
- Cost Control Manual
 - Periodic reporting to management
- Manpower Loading Schedule
 - Updated as appropriate
- Accounting Policies and Procedures Manual
 - Payroll reports
 - Accounts payable reports
 - Job cost reports
- Documentation Control System Manual

(iii) List of Subtasks

Corporate

- 13.01 - Prepare Division of Responsibility Manual
- 13.02 - Develop Financial Control Procedures

Project Control System

- 13.03 - Prepare Project Master Schedule
- 13.04 - Develop Schedule Control System
- 13.05 - Develop Cost Control System
- 13.06 - Prepare Manpower Loading Schedule
- 13.07 - Develop Accounting Policies and Procedures

Documentation

- 13.08 - Prepare Documentation Control System
- 13.09 - Pre-project planning
- 13.10 - Project office Operation
- 13.11 - ADF&G Support

(iv) Subtask Scope Statements

Administrative procedures will be identified and developed to form the elements of the project control system that will provide management visibility and control of the planning, data gathering, design, engineering, and finally, license application, portions of this POS. Preparation of documentation control procedures will assure that the information so valuable to completion of the POS moves smoothly and reliably. Certain administrative support effort and pre-contract award work must also be accounted for.

Subtask 13.01 - Prepare Division of Responsibilities Manual

(a) Objective

To establish the basic "How we will work" rules for the duration of the POS.

(b) Approach

Acres/Moolin corporate level personnel will prepare and review all input to this manual including:

- Project responsibility matrix
- Organization charts
- Approval authorities
- Specific duties and responsibilities of individuals/organizations
- Description of control systems and how they will be used
- Correspondence procedures

We will draw upon a depth of expertise within both organizations that has been gained on other similar projects to produce a valuable working tool.

(c) Discussion

Obviously, it is extremely important to establish early in the project, the basic documents that will be used to chart the course of the project and provide a basis for future strategy and policy decisions. The remoteness and sensitivity of the prime work location require that these policies and procedures be clearly understood by all field personnel in order that the work effort be advanced in a timely and cost effective manner.

(d) Schedule

Weeks 0 through 2

Subtask 13.02 - Develop Financial Control Procedures

(a) Objective

To develop and document the procedures used to pay the project costs and to establish budgetary control procedures.

(b) Approach

Acres/Moolin will work directly with the appropriate APA personnel in order that an agreed upon plan for handling these procedures be prepared early in the project. The following subjects will be addressed:

- Funding of engineer
 - Cash advances
 - Zero balance bank accounts
- Paying project costs
 - By advances or zero balance accounts
 - Directly by APA after verification
- Budget control
 - Original estimates
 - Basis for making budget revisions
 - Budget change procedures

(c) Discussion

It is important to recognize that the difficult site conditions may well lead to severe constraints on the field data gathering operations. The possibility of expanded/revised investigative requirements that may be imposed, either by design or other outside influences (APA, Federal, environmental), should also be understood. It is important that clear procedures be in force to handle such eventualities.

(d) Schedule

Weeks 0 through 4

Subtask 13.03 - Prepare/Update Project Master Schedule

(a) Objective

To establish and monitor the POS schedule showing the relative schedules of all functional areas/organizations.

(b) Approach

Each company within the Acres team will be responsible for the identification and scheduling of all the necessary tasks/subtasks to complete the project in accordance with the overall objectives. Each of these individual schedules will then be consolidated into a tentative Project Master Schedule, the basis of which is presented in this POS as Plate A7.1 and A7.2. The schedule will be presented in two separate forms:

- Bar chart format
 - Showing relation to progress for each individual subtask
 - Indicating dates of critical milestones/decisions
- Time based logic diagram showing:
 - Decision milestones
 - Report submissions
 - License applications
 - Key meetings
 - Special presentations

As final reviews by APA and others dictate changes to the master schedule, it will be updated to reflect these changes. Also, the Project Master Schedule will be updated throughout the life of the project to reflect the completion of the various stages of the project and the possible changes required by early completion dates, slippages and other situations/constraints.

A computerized scheduling system will be employed for schedule control purposes. This system will be that presented in Part C3 of the POS or similar.

(c) Discussion

Adequate identification of the complete scope of work and a thorough understanding of potential constraints are the key elements to establishing a realistic schedule. For the purposes of this POS, it is assumed that the majority of the work effort will be directed towards eventual construction of Watana and Devil Canyon dams. This seems a likely probability; however, unforeseen events may expand the scope of work at either of these two sites or even require additional work at alternate sites. Although these occurrences cannot be predicted with any accuracy, and thus not scheduled, there are a number of "fall-back" positions that will be developed to ensure a timely completion of the work. Many of these problems can be handled by early identification of additional/alternate personnel and equipment, larger or alternate camp facilities, expansion of "off-season" operations, where possible, etc.

(d) Schedule

Weeks 0 through 4 (Initial review)
Continuous update as required

Subtask 13.04 - Develop Schedule Control System

(a) Objective

Identify the necessary parameters, establish information gathering systems and reporting methods to eliminate or minimize schedule slippages.

(b) Approach

Acres and Moolin personnel will work jointly to accomplish the following tasks leading up to a working schedule control system:

- Each discrete activity will be entered into a weighted percent complete reporting system.
- A baseline schedule for each category of work showing percent complete versus time will be prepared.
- Data gathering procedures and reporting formats and levels will be identified.
- Programs will be developed to accomplish the following:
 - Pinpoint and analyze all schedule slippage areas
 - Determine potential impact of slippages
 - Recommend corrective actions
 - Forecast anticipated completion dates
 - Perform regular reviews with management

(c) Discussion

Schedule control requires an accurate and timely reporting of data and the timely and committed review of data by those personnel responsible for control. The Acres/Moolin team has a great deal of experience in this regard, both in the planning of other large hydroelectric projects, and in remote arctic environments. The ability to identify schedule problems at an early stage has been demonstrated on projects of equal or greater complexity.

As in the actual schedule preparation phase, the constraints must be identified early, by working directly with government agencies and others, to control schedules successfully. These agencies and others must be willing to participate, accept and commit themselves to this effort. In addition, the cost and benefits of constraints must be developed to allow senior APA and government officials to make rational go/no-go decisions.

(d) Schedule

Weeks 2 through 125

Subtask 13.05 - Develop Cost Control System

(a) Objective

To develop the necessary management tools and control systems for monitoring, reporting and control of project costs.

(b) Approach

The cost control system will be developed using the expertise of both Acres and Moolin personnel. Proven methods used on similar projects will be employed to ensure that a workable, unencumbered system is established. The following steps will be necessary:

Establish cost control centers. The work effort will be broken down into various elements, each of which will be controlled by a single manager/supervisor. This manager/supervisor will ultimately be responsible for all costs incurred in his area of responsibility.

Establish a project Code of Accounts. This will be the lowest level of detail utilized by the cost and schedule control system. The Code of Accounts will allow easy identification and isolation of each basic work element.

Prepare a cost estimate, based upon the cost estimates for each individual task/subtask, for each cost center.

Establish data gathering systems and reporting formats and levels. Both manhours and dollars expended will be reported for the control period and the total to date. Completion costs will be forecast and projected overruns/underruns will be tabulated.

A program will be developed to:

- Identify and analyze all cost overrun areas
- Recommend corrective actions to eliminate or minimize cost overruns
- Forecast total costs and potential scope of overruns
- Regularly review with management all cost reports, analyses and recommendations

(c) Discussion

The cost center concept is a valid one and has been used successfully on other similar projects. The success of the program depends to a great extent upon the participation, acceptance and commitment of those managers/supervisors identified as having cost center responsibilities. It requires a careful selection of personnel to ensure that costs are controlled. Many qualified personnel exist within the Acres/Moolin team who are familiar with this concept.

The main center will be established at Acres head office in Buffalo where established in-house project cost-control systems have been in operation for many years. A secondary center will be established in the proposed Acres' Anchorage office and appropriately linked with the Buffalo center.

(d) Schedule

Weeks 0 through 125

Subtask 13.06 - Prepare Manpower Loading Schedule

(a) Objective

To establish a manpower requirements schedule for the duration of the POS.

(b) Approach

This schedule will be established to coordinate employment, support services and equipment needs. As the manpower requirements for each discrete element of work are identified, they will be consolidated, based upon the Project Master Schedule, to produce a tabulation of manpower requirements versus time and location. In addition, the equipment needs to support the level of manpower required will be tabulated in a similar manner.

(c) Discussion

The Manpower Loading Schedule is a straightforward tabulation and will be used primarily to determine the size and location of camps. However, camp size must include space not only for the engineers field personnel, but also for management, government and transient personnel.

(d) Schedule

Weeks 3 through 4

Subtask 13.07 - Develop Accounting Policies & Procedures

(a) Objective

To develop and implement the necessary accounting policies and procedures to satisfy project requirements and support administrative control systems.

(b) Approach

Acres and Moolin personnel will work together to identify the project accounting requirements that will satisfy the needs of APA and other agencies involved, project control, procurement and tax aspects of the project. The input/output requirements will be identified and appropriate systems will be developed to provide the required output. Tentatively, all activities occurring in Alaska, both in the field and local project offices, will be processed by Acres' Anchorage office personnel with the backup assistance of the offices of Frank Moolin & Associates in Fairbanks and Acres' Buffalo facilities. Activities occurring in the corporate/design offices of Acres American will be handled by computer capability from the Buffalo, New York offices. Written accounting procedures will be prepared and issued as soon as possible after contract award to cover the following areas:

- General accounting
- Accounts payable
- Billings
- Invoicing
- Internal control
- Auditing
- Banking
- Expense accounts

(c) Discussion

Since much of the accounting input originates from remote field locations, it is imperative that timely and accurate transmittal of data be maintained. It will be the responsibility of the individual field supervisors and the field project manager to review all input prior to transmittal to the processing facility. It is important that the field personnel be aware of the input requirements and that they be committed to following through with this effort. Both Acres and Moolin personnel have worked under similar circumstances before and are familiar with these types of problems and how to cope with them.

(d) Schedule

Weeks 0 through 4 (Continuous update as required)

Subtask 13.08 - Prepare Documentation Control System

(a) Objective

To establish the methods to be used throughout the project for transmittal, storage, retrieval and display of all pertinent documentation.

(b) Approach

FERC license application and APA requirements will be used as guidelines to determine the documentation requirements. In addition, the requirements of local, state and federal agencies will be included. Finally, "in-house" document flow in support of design, cost and schedule activities must be considered and accounted for. Filing systems, records retrieval and a record storage system will be established, along with orderly methods for flow/transmittal of both internal and external documentation and correspondence. Included will be a tracking system to monitor the flow of documentation between field and office locations.

(c) Discussion

Prior to preparation of FERC license application and the various individual POS reports (power alternatives, development selections, environmental, hydrological, etc), it is extremely important that a system be implemented as early as possible to control and account for the large volume of documentation that will be gathered. Particular care and attention must be used when transferring documentation from remote field locations to the central offices where it will be reduced and stored.

(d) Schedule

Weeks 8 through 9

Subtask 13.09 - Pre-Project Planning

(a) Objective

To execute changes in the plan of study and carry out other activities at the request of the Authority in the pre-project time; i.e. prior to the actual project start date.

(b) Approach

At the request of APA incorporate revisions to the POS stemming from agency input, public input, meetings with public interest groups, study of certain options relating to more economical camp and logistics support, preparation of estimates to reflect ISER involvement and revisions to the financing and public participation programs.

(c) Discussion

This subtask covers work undertaken on behalf of the Authority subsequent to October 1, 1979 and prior to contract execution and covers such items as trips and coordination associated with ADF&G, DNR and APA.

(d) Schedule

Prior to contract execution.

Subtask 13.10 - Project Office Operation

Text is being written.

Subtask 13.11 - ADF&G Support

(a) Objective

To provide both administrative support and office facilities for ADF&G personnel engaged exclusively on the Susitna project.

(b) Approach

The ADF&G personnel to be engaged on the project exclusively as determined by ADF&G will be housed in Acres' project office. At this location they will be provided with administrative and office support which will be common to all project office activities.

(c) Discussion

The project office expenses related to this subtask will include additional office space lease costs, furnishings, office equipment, communications equipment, office supplies and the like, including storage facilities for equipment. The actual costs associated with this subtask are included under Task 7, Subtask 7.10.

(d) Schedule

~~Throughout the project.~~

Weeks 26 through 130

SECTION A6 - POST LICENSE APPLICATION SUBMISSION ACTIVITIES

SECTION A6 - POST-LICENSE APPLICATION SUBMISSION ACTIVITIES

A6.1 - Introduction

The study activities detailed in other sections of this proposal have been provided in accordance with the original APA Request for Proposals dated June 25, 1979, and subsequent modifications as noted throughout this POS. APA has also requested a description and preliminary cost estimate for activities which will follow submission of the license application up to a point when the license is received and construction work commences.

The Acres proposal is based on a preliminary assessment of the probable sequence of construction of project components which in turn is based on the Corps of Engineers' 1979 Report construction schedule. The first construction contract will consequently be for the Watana diversion facilities. Assuming no unforeseen serious interventions occur during the licensing process, the FERC license (which would allow construction to commence) should be awarded by early 1985. Engineering work to that point should therefore concentrate on design activities and preparation of bid and contract documents leading to award of a diversion construction contract immediately after receipt of the FERC license. Construction of the pioneer access road to Watana should also be completed by 1985.

A more conservative approach would involve accomplishment of only those activities necessary for award of the FERC license, deferring advanced design and access road work until later. Throughout the remaining portions of this section, work packages associated with expediting project completion are referred to as "Fast Track" and the conservative approach is designated as "License Only".

In this section of the proposal, summaries of activities to accomplish alternative post-license objectives are presented under the same general task headings discussed in Sections A1 through A5.

No significant activity is anticipated under the following tasks:

Task 1: Power Studies
Task 8: Transmission

The following tasks will continue, but at a lower level of activity than during the first phase:

Task 2: Surveys and Site Facilities
Task 4: Seismic Studies
Task 10: Licensing
Task 12: Public Participation

The remaining tasks will continue at a similar or increased level of activity including:

Task 3: Hydrology
Task 5: Geotechnical Exploration

Task 6: Design Development
Task 7: Environmental Studies
Task 9: Cost Estimates and Schedules
Task 11: Marketing and Finance
Task 13: Administration

The following discussion describes the anticipated activities that will be undertaken during the period through commencement of construction of the Watana project or through receipt of license.

The schedule associated with this work is shown on the Summary Schedule (Plate A2.1) and on the Master Schedules (Plates A7.1 and A7.2).

A6.2 - Surveys and Site Facilities

(a) Fast Track

The permanent base camp at Watana will be used as the base from which continued field studies in hydrology, geotechnical exploration, seismicity and the environmental areas will be conducted. Detailed surveying of the Watana site in support of Watana dam design activities will also be continued. A description of the camp is contained in Section A.8 - Logistical Plan. Equipment, most of which will be used in conjunction with the field activities and thus located at the base camp, will continue to be used after having been purchased during the first phase of the work.

During this phase, the airstrip at the Watana site would be upgraded to support the level of activity required to complete the preliminary engineering of the Watana facilities. In the event that no airstrip has yet been built, the need for it will be thoroughly evaluated. At the same time, a pioneer access road would be constructed utilizing portable or prefabricated bridges.

Additional activities conducted during this phase include photogrammetric mapping, hydrographic surveys, slope stability and erosion studies along the road access route.

(b) License Only

The permanent base camp at Watana will support continuing field studies in hydrology (particularly in-stream flow studies), seismicity and environment areas. No further design support work will be conducted. To the extent that the External Review Board requires additional work to support initial findings (e.g., in the seismic area), it will, of course, be supported under Task 2.

A.6.3 - Hydrology

(a) Fast Track

Following submission of the FERC license application, work will

continue on obtaining hydrologic, hydraulic, ice and climate data. This information will provide the input to further studies necessary to complete the detailed project design and prepare contract documents and specifications. The data will also be used to provide detailed information in response to queries arising out of the FERC license application and to provide partial basis for the final EIS.

A brief discussion of the additional work to be done is given below.

(i) Field Data Index and Distribution System

Work in this activity will continue as discussed under Task 3.

(ii) Field Data Collection and Processing

Work in this activity will continue as discussed under Task 3. It may be possible to reduce the number of climatic stations during the later years as sufficient design information is obtained, particularly along the transmission line route.

(iii) Water Resources Studies

Utilizing the 2 to 3 years of additional data obtained from the existing and the new stream gauges, the streamflow extension studies will be revised. The same methodology as that proposed for this activity under Task 3 will be used. The streamflow data obtained from the sites will be used to improve the extrapolation of long-term streamflow data to these sites.

The "Low-Flow Frequency Duration Analysis", "Reservoir Filling and Operation Studies", and "Statistical Analysis of Pre- and Post-Project Streamflow" analyses will be reviewed and, if necessary, repeated utilizing the improved basic streamflow data and refined Watana project layouts and construction schedules. The same basic methodology as that described under Task 3 activities will be employed. The "Evaporation Studies" will be updated using the additional climatic data collected.

(iv) Flood Studies

The "Regional Flood Peak and Volume Frequency Analysis" will be reviewed in the light of additional data. It is not anticipated that additional analysis will be called for.

The "Probable Maximum Flood Determination" will be redone using a more comprehensive methodology than originally employed by the Corps of Engineers during Phase 1. A detailed storm maximization study will be undertaken to determine the probable maximum precipitation. More extensive

meteorologic studies will be performed to improve the estimates of maximum temperature sequence and snow depths.

Consideration will be given to recalibrating the SSARR river basin model. However, should the studies in Subtask 3.05 indicate that deficiencies in the model's performance are due to inadequacies or lack of detail in the model algorithms, a more sophisticated catchment model such as the National Weather Services Flood Forecasting System (incorporating either the Stanford or Sacramento Models) or HSP (Hydrologic Simulation Package marketed by Hydrocomp Inc., California) will be substituted. These better models offer an improved representation of the infiltration process and the subsurface water balance which could be important in improving calibration results.

The "Reservoir Flood Routing" exercises will be repeated using the revised flood data and Watana project layouts.

(v) Hydraulic and Ice Studies

It is anticipated that the FERC will stipulate a significant amount of engineering to be undertaken prior to commencement of construction of the major project facilities. It may be possible to defer some of these activities until after commencement of diversion construction. However, the anticipated requirements are presented herein and included in estimated costs.

Unless substantial changes to the hydrology, the basic project layouts or system operating policies are made, it will not be necessary to rerun the backwater calculations (HEC-2) and the ice-cover process model dynamic flow model downstream or upstream from the Watana site. Additional refinement of the diversion design will, however, be necessary. This will require additional runs using HEC-2 and the ice-cover process model.

In addition to the above analyses, it will be necessary to undertake further computer model studies as well as hydraulic model studies. These include:

(1) Computer Model Studies

One-dimensional dynamic flow model - Applied to Susitna reach downstream from damsite for simulating dam break conditions.

Two- or three-dimensional dynamic flow model (numeric) or alternatively an analytical solution technique. - Applied to the proposed reservoir to simulate landslide induced surges

Computer Model Studies Continued:

One-, two- and three-dimensional water quality models - Applied to the reservoir and downstream channel reaches to simulate water quality changes.

Reservoir sediment deposition model - Applied to reservoir predict location of sediment deposition (only if required and considered to be reliable).

(2) Hydraulic Model Studies

Diversion facilities (including an ice cover) - To refine design of diversion facilities (design for ice conditions and erosion protection)

Spillways - To refine design of spillway and plunge pool facilities, determine stage-discharge relationships and minimize air entrainment in plunge pools.

Glacial studies may also have to be undertaken. If significant future changes in the glacial regime are anticipated, a more intensive field program would be required to monitor these changes. If necessary, project design and/or operation would have to be modified to suit the predicted changes.

(vi) Sediment Yield and River Morphology

The sediment yield and river morphology analysis undertaken under Task 3 action will be reviewed and, if necessary, modified by incorporating additional data.

(vii) Access Road Studies

Additional hydraulic calculations will be undertaken to determine the dimensions of all bridges and culverts.

(b) License Only

Certain data collection activities will be continued in order to improve the current limited hydrological and meteorological data base.

In this category, for example, is included operation and maintenance stream gauges and climate stations. Instream flow studies described in Section A5 under Subtask 3.10 will continue to ensure complete satisfaction of needs expressed by DNR, ADFG, and the USFWS.

A6.4 - Seismicity Studies

The long-term seismic network designed under the pre-license application phase will be installed and monitored and the data assembled and processed.

This activity applies equally to the "Fast Track" and "License Only" alternatives.

A.6.5 - Geotechnical Exploration

(a) Fast Track

Detailed drilling and in-situ permeability testing will be conducted at the Watana site to improve delineation of the stratigraphy and identify rock properties both for dam foundations and underground powerhouses. This will include borehole photography and conventional downhole permeability testing.

At the dam sites, pump tests will be conducted to determine accurately the permeability of materials in the dam foundations. A more detailed drilling program will be undertaken in the borrow areas to delineate approximately three times the borrow materials required to provide alternatives and contingencies. Sieve analysis, Atterburg limits and moisture profiles as well as hardness tests for aggregates will be performed to identify materials. Static and dynamic triaxial tests with pore pressure measurements will be run on reconstituted samples to represent in-place materials in the dam. In addition, constant mean normal stress triaxial tests and resonant column tests will be performed to determine dynamic and static elastic parameters.

Drilling programs in the borrow areas will be supplemented by seismic surveys to delineate stratigraphy and provide a more complete picture.

Laboratory testing will be undertaken to evaluate dynamic soil properties under simulated earthquake loading conditions.

(b) License Only

No further work under Task 5 will be undertaken except as necessary to support FERC requests.

A6.6 - Design Development

(a) Fast Track

The objective of project design development activities following submission of the FERC license application is essentially to continue

design activities to the extent necessary for project construction to commence as soon as possible after award of license. For the purposes of this POS, it has been assumed that one site, probably Watana, will be developed first. Thus activities during this period of approximately 2-1/2 years will be devoted to design of the Watana Project, and the preparation of bid documents and completion of the bidding process for the diversion system. Responses to FERC requests for additional design data prior to award of license will also be provided.

The design development concept during this period will be geared to the methods of construction and the contract packaging proposed as a result of feasibility studies prior to license application. It is most likely that contracts will be packaged in accordance with construction schedule requirements over a period of some years. Thus, to minimize the financial risks, preconstruction design development costs will be appropriately spread over a period of more than 2-1/2 years, depending on the recommended phasing of award of construction and equipment supply contracts. The work that will be undertaken includes the following:

- Update of Design Criteria Manual
- Engineering support for construction of access roads
- Engineering studies, stability analyses, permafrost thaw analysis and designs for excavation, rock support, foundation treatment, grouting, drainage, embankment material sources and placement, steel and concrete structures and mechanical and electrical equipment design and selection for:
 - . Dams
 - . Spillways
 - . Intakes
 - . Penstocks
 - . Surge tanks (if required)
 - . Tailraces
 - . Diversion facilities
 - . Power facilities
 - . Switchyards
 - . Mechanical/electrical equipment
 - . Reservoirs and site facilities

During this phase, studies for major dams and structures will include determination of design aspects such as the following:

- geotechnical criteria with respect to other disciplines such as hydraulic, civil and others
- design parameters from the assessment of the field and laboratory investigation data
- appropriate analytical techniques to meet the design criteria for each technical aspect of the design.

(i) Dam Design

The major design effort will be the dam and the diversion system. The main design aspects to be considered include:

- foundation and abutment conditions
- construction materials
- seismic effects
- dam sections
- cofferdams
- diversion tunnels
- permafrost studies
- construction sequence and methods.

The details that will be considered for the above aspects are as follows:

(1) Foundation and Abutment Conditions

Depending on the extent of riverbed alluvium, excavation requirements will be determined for the type of cutoff (total or partial) and impervious blanket and other foundation treatments. Excavation requirements will include removal of loose alluvium and talus materials on the abutments.

Dewatering requirements during excavation will be determined using field permeability values and field pump test data and selection of primary and secondary wells.

The following studies also will be made:

- Seepage analyses for conditions during diversion and excavation of the main dam
- Seepage through bedrock foundation and abutments with consideration of permafrost zones thawed prior to impoundment and thaw due to reservoir impoundments
- Grouting requirements in the foundation bedrock and abutments and grouting methodology in cold weather including thaw analysis
- Abutment shaping and bedrock stripping and treatment of permafrost
- Pressure relief in overburden and bedrock.

(2) Construction Materials

Further testing and evaluation of construction materials will continue with respect to impervious and rock fills, to study static and dynamic shear strength behavior and crushing potential of rock fills under high confining dam loadings. Studies related to placing constraints due to

to cold weather, exploitation and hauling methods along with test fills will be performed. Excess moisture contents in the impervious fills and methods of handling will be determined.

Availability and adequacy of filter and drainage materials will be confirmed. This aspect is particularly important as unusually large zone thicknesses of such material will be required for the earth/rockfill dam, as a defense against seismic effects.

(3) Seismic Effects

- The seismic design in this phase will consider in detail the following aspects:
 - Review in detail of the earthquake design spectrum, the preliminary design and findings from prelicensing studies.
 - Evaluation of the cyclic mobility and the liquefaction potential of the foundation and embankment materials and consideration of the various alternative methods of minimizing the damage associated with these problems.
 - Evaluation of the potential for generation and dissipation of pore water pressures in the embankment and foundation materials and the possible loss of strength that may accrue as a result of these pore pressures during and following an earthquake. Dynamic analysis techniques will be used for the evaluation and prediction of field performance.
 - Employment of finite element techniques to study the dynamic response and the time history of stresses and deformations. Nonlinear material properties and the interaction between the dam and the reservoir will be given adequate consideration.
 - Selection of criteria for soil placement and improvement by considering the stability and deformations during earthquake loadings.
 - Provision of an adequate system of filter and transition zones to ensure progressive erosion through continuous cracks resulting from earthquake shaking can be minimized.
 - Provision of wide cores with self-healing and erosion resistant properties in the event cracking develops during an earthquake.
 - Consideration of seismic effects into proper arrangement of core, transition zones, filters and shells.

Based on the evaluation of engineering conditions of the rock, design criteria will be established for rock excavation, rock reinforcement and rock support systems. Grouting requirements to treat the mass rock against seepage and uplift and the pressure relief requirements will be determined.

(ii) Powerhouse Design

Rock mechanics design activities will be undertaken to prepare a semi-detailed design of the powerhouse caverns and to firm up the location and alignment based on data obtained during exploration activities.

(iii) Other Design Activities

Spillway and intake structure will be founded on rock. The study will involve detailed design treatment to provide rock support and pressure relief systems to ensure stability of the structures. Rock slope stability of the spillway foundation and side slopes will be assessed in terms of the potential presence of weak zones of rock such as shear zones and joint sets, for various loading conditions with and without seismic effects.

Intake tunnel structures will involve evaluation of the structural geology, such as faults, shear zones and joint sets in order to establish the competency of the mass rock to support the gate structures. The design will involve determination of consolidation grouting, rock reinforcement, concrete lining, etc. The design of intake structures will largely be governed by geologic and hydraulic considerations.

Studies and designs of structures will be taken to the point of producing drawings in sufficient detail for bid purposes.

(iv) Bid Documents for Watana Diversion System

Bid documents for the Watana diversion system will be prepared and issued on behalf of APA for bidding. These documents will include specifications and drawings adequate for bidding purposes. Bids will be evaluated and a recommendation made to APA for an award of the contract to allow construction to commence on receipt of the FERC license and other necessary permits.

(b) License Only

No further work under Task 6 will be undertaken except as necessary to support FERC requests.

A6.7 - Environmental Studies

Environmental Studies will be the same for both "Fast Track" and Licensing Only". Subsequent to submission of the FERC license application, some studies planned and initiated prior to license application submission must be completed. The extended time period required for completion of some of the environmental subtasks is due to one or more of the following reasons:

- The required input to a specific environmental subtask must wait completion of other tasks such as surveys, hydrological studies, geotechnical exploration or design development.
- The length of life cycle that should be observed for the environmental element being studied is greater than the 30 months pre-license application period, particularly anadromous fish and big game.
- The activity to be completed is a slowly developing study that requires longer time periods in order to obtain input from all relevant groups such as socio-economic analysis.
- Mitigation efforts, such as archeological excavations, are dependent upon time of discovery.
- Input from FERC is desirable before the study is completed.
- Some activities do not start until a license application is submitted, i.e., response to interrogatory or preparation of testimony.

As a result the environmental study team anticipates work to continue on at least the following subtasks into the post-license application phase of the overall project:

- monitoring of field activities
- completion of the socio-economic analyses
- final registration, documentation and field investigation of archeological or historical resources
- completion of the land use analysis
- completion of the recreation plan development
- assessment of the finalized transmission corridor
- completion of the fish, wildlife and plant ecological baseline studies and impact analysis

Additional studies to be completed by the environmental study team in support of FERC license would include:

- construction impact analysis
- operative impact analysis
- preparation of expert testimony and response to interrogatories
- preparation of amendments to the Corps' approved EIS for the Susitna Project in a format appropriate for the current studies
- Finally, completion and/or revision and amendment of FERC license application exhibits.

Anticipated work effort on the above listed follow-on studies is discussed in the following paragraphs. Unlike previous Tasks 3, 5, and 6, this task will still be concerned with both the Watana and Devil Canyon sites.

(a) Land Use Analysis

During this phase the information that was generated in the pre-license application phase will be refined with the focus on the lands that have been determined to be directly impacted by the project. This refinement will aim towards the elimination of data voids, additional investigation of important leads, and the development of a more detailed description of the impacted areas. Additional interviews and field reconnaissance will be conducted.

The primary emphasis of this phase will be the prediction and evaluation of the impacts on current and future land use that would result with the development of the project. The critical concerns that were identified in Phase I will be re-evaluated on the ground and in consultation with the relevant project specialists, and additional study that has been determined to be necessary will be conducted. At that point, the team will segregate graphically and summarize the actual changes expected to be caused by the development and operation of the project. The detailed specialists' reports will be the primary source documents on the specific impacts. The impacts associated with these changes, as reported by the specialists, will also be summarized and identified with specific locales (zones of change) within the project area. The magnitude, duration, and significance of the impacts will be evaluated and discussed. The impacts will be evaluated for both the construction and operation phases of the project. A discussion of measures that could be used to mitigate the adverse effects will be provided.

These results will be evaluated internally through TES staff and externally through the landowners, management agencies, and government officials. Revisions will be made with minimal additional field work and presented in the supplementary environmental report.

(b) Recreation Plan Development

The goal of the recreation planning process is to develop a master area plan based on the perceptions of the public, the limitations of the resources, the planning guidelines of the managing agencies, and compatibility with the proposed operation of the project and other public uses of the land.

Phase I (pre-license application) of the planning process will result in an analysis of the available literature, preliminary projections of recreational use, and a preliminary assessment of the resource potential for recreation. The preliminary information generated in Phase I will be refined in Phase II (post-license application) in response to detailed plans for the construction and operation of the project and data generated by other disciplines (e.g. socio-economic, fish and wildlife).

The project lands will be initially evaluated in Phase I to determine the areas that have the greatest potential for recreational development. During Phase II the potential areas, visitor attractions and related management concerns will be located on a base map and

evaluated in more detail during brief field reconnaissances. Standardized criteria will be utilized to eliminate personal bias in the field site evaluation process. After the field suitability studies are completed, those sites that are identified as having the greatest potential for specific opportunities will be further evaluated in the field to determine their feasibility in terms of providing specific experiences, site durability, safety hazards and related impacts.

It is important to relate the development as well as possible to the requirements of the managing agency. The management staff of the agency will be interviewed to determine their basic management goals, their legal mandate to operate such an area, experience in such operations, probable funding, and specific site/facility requirements in order for them to be acceptable to the agency.

Prior to the formation of the concept plans, the information that has been gathered and generated during the planning process (including information from other project specialists) will be evaluated and conclusions synthesized to establish the program goals and objectives. The objectives will be developed based on:

- User perceptions in terms of desired recreational opportunities, levels of development, and visitor services.
- Unique scenic and natural landscape features and how these might be incorporated into the plan.
- Suitability of the resource to provide specific kinds of recreation and the durability to sustain that use.
- Compatibility with hydroelectric project operations. Certain activities, developments or their location may not be compatible and must be reviewed with the design engineers.
- Compatibility with other land use. Existing and future land uses will be described, and the compatibility of the proposed recreation development with these land uses will be evaluated.
- Potential management problems. Potential problems and their location will be brainstormed and placed on a base map. Problems such as natural hazards can be avoided in the site selection process; other problems may be overcome by proper site designs; still others can be mitigated through informational programs.
- Probable managing agency. The plan should fit within the scope of the agency.

Once the program objectives (activities, experience levels, and necessary site and facility development) are established, the evaluative criteria for each objective will be established. Then three distinctly different concept plans will be developed that at least minimally meet those objectives. These concept plans will be critiqued in relation to the evaluative criteria.

A trade-off table will summarize how each of the concept plans were rated for each objective. After this a panel of experts (agency and consultants) will be asked to critique this evaluation. Adjustments will then be made and the final plan will be selected that best meets the objectives and their criteria.

The final Master Area Plan will include map(s) showing the location of the project lands and waters that will be developed for recreational uses, initially and in the future. It will identify the location, type, and number of the various recreational facilities planned, initially and in the future. The predictions of recreational use of the facilities will be discussed. The management responsibilities of the various facilities will be described and a schedule of recreational development and cost estimates will also be included.

This Master Area Plan is designed in accordance with the requirements of Exhibit R of a FERC license application, under existing guidelines. Modifications, if needed, can be made to conform with the upcoming revision of FERC requirements. The development of the plan is scheduled to begin in Phase I and to be completed in Phase II, after detailed hydroelectric design specifications and operational information are available.

(c) Socio-Economic Analysis

After the initial license application submission, emphasis will be placed upon analyzing and assessing significant impacts at local, regional, and state levels. Examples of such impacts are (1) the possible influence of low electricity rates on the growth of manufacturing and processing industries in the region surrounding the project, and (2) the pressure to develop in new areas as a result of improved access.

Each of these potential impacts could significantly affect population and employment levels, business activity, land-use patterns, and other socio-economic conditions. The impact analysis and assessment will therefore address immediate project impacts as well as the implications of such impacts for important socio-economic conditions.

Additionally, the study will focus on the effects of the project on important commercial, recreational and subsistence fish and wildlife resources. It is known that some of these resources are of substantial value to user groups and that changes in the availability of these resources could have far-ranging effects.

The design of the study will also allow for in-depth analysis and assessment of other important impacts not yet firmly identified. This flexibility and adaptability will insure that effort is allocated only to the evaluation of relevant impacts.

(d) Cultural Resources

This effort represents the conclusion of all archeological field investigations and laboratory analyses. Also to be included is an investigation of the cultural resources along the primary transmission line corridor. Accomplishing this task will involve the following:

- (1) identification and documentation of the cultural resources, by site, of the entire study area;
- (2) formulation and explication of recommendations for mitigating construction impacts on each identified site; and
- (3) development of a detailed report covering not only cultural resources but also those physical parameters affecting culture.

Both state and federal regulations mandate that all cultural resources of the project area be identified and inventoried; that effects of the project on each resource site be determined; and that any impacts be mitigated before any such sites are irreparably damaged. Procedures for identifying and discussing cultural resources of the primary one-half mile wide corridor will be the same as for the studies previously mentioned.

The final cultural resources report will include the location, description and mitigation recommendations for each site reported. The report will also detail the anticipated budget for any archeological excavation that is deemed appropriate prior to initiation of construction. The report will also include sections on culture-influencing factors such as vegetation, fauna, geology, history, prehistory and native populations. All topical discussion will be focused upon assessing the cultural resources of the entire study area.

(e) Transmission Corridor Assessment

Having established the one-half mile wide primary corridor prior to license application submission, these studies will be undertaken to further refine the corridor to a defined right-of-way no wider than that which will satisfy the minimum width requirements of the National Electric Safety Code. To accomplish this, the following will be necessary:

- (1) provide environmental data to design engineers;
- (2) apply previously established impact mitigation procedures to the selected right-of-way;
- (3) develop the least impact right-of-way; and
- (4) recommend specific construction impact mitigation procedures.

Following the development of a preliminary right-of-way, previously established construction impact mitigation procedures will be evaluated to insure that all anticipated impacts have been properly addressed. Among the impact topics to be reviewed are: clearing and slash disposal methodologies; stream crossing and erosion control practices; and access road, structure laydown and wire-stringing zone construction methods. If unanticipated impacts are identified, mitigation procedures addressing those impacts will be developed. Restoration plans will be addressed for areas of unavoidable impact.

(f) Fish Ecology Studies

The salmon fishery studies to be undertaken during the post-license application period will provide for continuing data collection to insure that a complete birth-to-reproduction cycle has been examined. Other baseline studies dealing with habitat and resident fish, may also continue into the post-license application period. In addition, detailed impact analysis and development of mitigation and monitoring program plans will be performed after license application submission.

The baseline studies to be completed after license application submission, as proposed by ADF&G, are as follows:

- Stock assessment of adult anadromous fish of the Susitna River will continue through a complete birth-to-reproduction cycle.
- Habitat studies of the Susitna River are scheduled to continue into this period.

These stock assessments and habitat studies to be performed by ADF&G after license application submission, as described in their proposal, include the following items:

- Investigation of the contribution of Susitna salmon stock to the Cook Inlet fishery. Continuation of this investigation into the post-license application period will depend on the outcome of the scale and electrophoretic feasibility study.
- Studies of the distribution of adult and juvenile salmon in the lower river.
- An attempt to identify new spawning stocks. Because of the inaccessibility of many areas and the turbidity of water, the possibility exists that unknown spawning stocks may exist. During the course of the entire program they will be sought.
- Definition of seasonal habitat requirements for incubation, rearing, spawning and passage of anadromous and resident fish populations.
- Definition of seasonal relationships between flow regimens and essential physical and biological habitat characteristics.

This project, like all hydroelectric projects in which major storages are involved, has three time periods that must be considered after the baseline studies have been done. These periods are the construction period, the filling period, and the plant operation period. The baseline studies, conducted before and after license application, will provide information needed to develop criteria for long-term protection and, perhaps, enhancement of the fishery. Therefore, in addition to the continuing baseline studies to be conducted by ADF&G as described above, TES will do the following during the post-license application period:

- Detailed impact analysis will be performed
- A mitigation plan will be developed
- Long-term studies will be developed to monitor the aquatic environment during construction, filling and operation of the hydroelectric project.

The detailed impact analysis to be prepared by TES will occur when the fishery studies conducted by ADF&G have generated the necessary information. The impact analysis will contain specific predictions about the effect of the hydroelectric project on the fishery resources of the Susitna River, including descriptions of the expected changes in the fishery resources of the proposed impoundment area as well as the area downstream of Devil Canyon.

Assuming that activities during one or more of the periods (construction, filling or operation) will have a negative effect on the fishery resources, it will be necessary to consider mitigative measures. As part of the post-license application activities, a mitigation plan will be proposed that will be designed to reduce the impact during these three periods. Hydrological data, and fishery data through the complete salmon study, will be necessary before enough is known about likely impacts so that a mitigation plan can be developed. At least preliminary information must be available before an estimate can be made of the effort required for the plan development. Therefore, it is recommended that when more information is available, TES, through Acres, submit to APA a proposal and associated cost estimate to develop a mitigation plan during the post-license application period.

If the Susitna Hydroelectric Project is authorized, a monitoring program of project impacts on the aquatic ecosystem may be required for the construction, filling, and operation periods. A plan of study and associated cost estimate for such a monitoring program will be developed during the post-license application program.

(g) Wildlife Ecology

In general, the wildlife ecology studies undertaken after the license application submission will be a more intensive, in-depth evaluation of the work that was started in the pre-license application phase.

As stated earlier for big game, it is impossible to gain the necessary understanding of habitat utilization and movement patterns within a 2-year period. Therefore, the post-license application phase will form the second half of the data collection effort. It is likely that by the beginning of this phase some preliminary conclusions can be drawn. The pre-license application phase effort will also serve to identify areas of concern and data voids. During Phase II, continued monitoring of big game populations will take place. Quantitative evaluation of moose habitat, both in the Upper Susitna Basin and the downstream areas, will also be conducted during this period. This will include an estimate of available browse, browse productivity, and browse utilization by wintering moose populations. Prior to the initiation of Phase II, a proposal will be submitted to prepare a mitigation plan during this phase.

Following the identification of key furbearer species and areas of abundance and preferred habitat an intensive survey of the furbearers will be conducted. A 3-year study effort started late in the pre-license application phase and continued following the submittal of the license application will be undertaken to gather data on population density, family units, home ranges, denning sites, diets, and seasonal use of habitats. In addition, the relationship of furbearers with other species will be evaluated. The type of information to be collected in this phase is necessary if appropriate mitigation measures are to be undertaken.

During this phase, a continuation of the intensive avian census will take place. Non-game mammal trapping will be a continuation of the program started in the preceeding phase and will result in covering the minimum 4-year time period needed to identify the cyclic properties of this group.

Intensive study sites in upland and wetland habitats will provide data on bird and non-game mammal species composition and density in each of the most extensive habitats of the region. This will provide an indication of habitat uniqueness and productivity. Also, these intensive sites should provide data that can be extrapolated to similar habitats throughout the upper basin and should provide a basis for predicting faunal changes based on habitat changes caused by construction alternatives.

If the results of the pre-license application phase identify the presence of significant concentrations of waterfowl, an intensive waterfowl study will be conducted during this phase. This study will determine, for each of the major wetland habitat types of the region, the type and degree of utilization by waterfowl and other water birds.

Data gathered during this phase is essential to developing a comprehensive understanding of the interrelationships that exist within communities. A refined, detailed impact evaluation will be prepared during Phase II. Data collected during Phase II will be vital in the preparation of the final impact evaluation and also in recommending appropriate mitigation measures. Information obtained during this phase will also be needed in order to respond to interrogatories that will be received during the license application review period.

(h) Plant Ecology

The primary objectives of this phase of the plant ecology study are to collect and analyze quantitative vegetation data for the various vegetation/habitat types to be affected by the proposed Susitna River Project, and to refine impact assessments utilizing collected data.

Quantitative data will be collected from the major types present in the impoundment areas and the riparian communities downstream. This information will not only be required to describe the vegetation community, but it will also be necessary for the development and

implementation of a successful wildlife mitigation program. Specific quantitative sampling methods will be utilized to determine available browse, productivity, and browse quality in key moose habitats. Additional information will be derived from available literature. These data will be required to make an accurate prediction of the impact on moose populations.

Representative aquatic plant communities will be studied in the project area. Notes will be made on frequency, abundance, and vigor of plants.

Impacts of the proposed project, especially in the downstream floodplain to Talkeetna, will be discussed in the reports. Supportive literature concerning similar habitats and impacts on woody riparian communities will be utilized.

(i) Construction and Operation Impact Analysis

A detailed impact assessment for the construction phase and operational phase of the project will be completed. For the construction phase, impacts to be considered would include:

- Visual quality impact due to access roads, site facility, borrow pit operation, disposal of debris
- Air and water quality affected by land clearing process, and construction activity within stream beds
- Primary resource utilization including fuel, materials, land and manpower
- Financial resource commitment
- Safety

For the operational phase in addition to the specific impacts discussed earlier in this section and Section A.5.8 of the proposal, the following will be considered:

- Visual consequence of irreversibly changing the existing boreal forest area to a reservoir area.
- Resource commitment or conservation in terms of energy and land use.
- Long-term water quality impact.
- Safety and accidental fire potential due to recreational use of area.

It is anticipated that the environmental impacts of the Susitna Project will be documented in two annual supplementary environmental reports for submission to FERC. These reports will include detailed impact analysis for each environmental discipline (socio-economics, wildlife ecology, etc.) as well as a summary of the significant impacts of constructing and operating the Susitna Project.

(j) Completion of the Environmental Process

During the licensing processing, supplemental studies in many disciplines will be required for thorough impact analysis. The technical aspects of these studies are summarized under the subtask descriptions for these disciplines. It is proposed that annual supplementary environmental reports be prepared for submission to the FERC during the licensing process.

Principal Investigators in each discipline will prepare annual reports on the activities, results, and conclusions of the supplementary investigations. These reports will be compiled into comprehensive supplementary environmental reports. Every effort will be made to keep these reports in tune with the information needs of FERC and other regulatory agencies.

As necessitated by the environmental approval process or the Alaska Power Authority, written testimony relating to the Susitna Project environmental report will be prepared by the appropriate experts. This testimony will be for the purpose of highlighting project organization, activities and findings in conformance with FERC licensing requirements. Discussions among all discipline-specific groups will be held prior to preparation of testimony. This will allow the group to deal with the most pressing issues and devote equal attention to all problem areas. Oral testimony at public hearings will also be provided as required.

Upon receipt of interrogatories, and a request by the APA to respond to such interrogatories, they will be assigned to the appropriate Environmental Discipline Group Leader who will, in cooperation with the Principal Investigators, prepare an appropriate response.

Upon receipt of an interrogatory, the Environmental Discipline Group Leader will make a determination as to the type of response that would be appropriate. The response alternatives are as follows:

- Alternative 1

The data exist and can be used to prepare an adequate response to the interrogatory.

- Alternative 2

The data needed to reply to the interrogatory exist but will be available at some time in the future in a scheduled report. If the need for a detailed response is not critical, the response will indicate when and in what form the appropriate information will be available.

Contracts
Quality assurance and quality control
Camps
Communications
Procurement and logistics
Permanent materials
Construction equipment
Construction

out
of
order

Each package will explain in detail its respective area and will include:

- An explanation of the objective of the work plan,
 - A detailed scope of work outlining the planning products and activities to be developed within its area,
 - Situations and factors to be considered in developing the planning products,
 - An estimate of the manpower required to produce the planning products,
 - A detailed critical path network showing the precedence relationship and logical ties of the planning activities within the package and its logical relationship to other work packages.
- A critical path analysis that shows duration, early start date, late start date, early finish date, float and critical path for all major activities,
 - An estimate of manpower required for the planning effort,
 - An estimate of manpower required for the pre-construction effort.

(b) License Only

No further work under Task 9 will be undertaken except as necessary to support FERC requests.

A6.9 - Licensing

Acres will provide all the assistance requested by APA to secure approval of the FERC license for the Susitna Project. This assistance is necessary for both the "Fast Track" and "License Only" alternatives.

After the license application has been prepared and submitted to FERC, as discussed in Section A.5.11, work will continue on preparation of supplemental material to support the initial application. The principal areas of activity include all work necessary to present bid documents for the Watana Dam and completion of all environmental studies impact assessments.

At this time, an accurate estimate of the work effort to prepare testimony, respond to interrogations or attend meetings is not available. Even so, our own experience to date has demonstrated such needs will arise. The level of effort shown below includes anticipated requirements to secure legal consultation and expert testimony in response to interventions.

- Alternative 3

The necessary data have not yet been collected and/or analyzed. In this case, the response will indicate when a detailed reply can be prepared.

- Alternative 4

The data needed to reply to the interrogatory do not exist and are not planned to be collected in the future. Therefore, a detailed response is impossible and will be so explained.

All responses to interrogatories will be sent to the APA for approval and submission to the party that prepared the interrogatory.

Finally any reports, addenda, or supplements required to obtain final approval of an EIS for the Susitna Project will be prepared and submitted to APA.

The level of effort required for these and other post-license application activities can be estimated only on a preliminary basis at this time, but will be refined when more information is available on what will be needed for a FERC license decision and EIS approval.

A6.8 - Cost Estimates and Schedules

(a) Fast Track

Activities under this task will continue in support of the ongoing Task 6 design development effort. In particular, Engineer's estimates and schedules will be required for access road and diversion scheme construction contracts.

For purposes of effective overall project management during subsequent phases, a Program Planning Guide will also be prepared. This will provide a complete guide to identify for APA management the specific planning requirements and, for the eventual project management contractor, those products essential to the planning and management of the Susitna hydropower project.

The products of the planning guide will include the following:

- A project master schedule that shows in graphical form the major milestone dates for planning products, events and decisions.
- A consolidated construction schedule that identifies the major construction activities and shows their required start and finish dates in bar-chart format.
- Fifteen specific work packages that explain in detail the planning required for each of the following areas:

- Corporate
- Engineering
- Permits and land
- Construction support
- Support services
- Project control
- Labor relations

A6.10 - Marketing and Financing

(a) Fast Track

The primary shift in activity in the area of marketing and financing is the availability of Salomon Brothers as direct consultants to APA to assist APA in matters of project financing and Bond Underwriting.

Acres will continue to be the focal point of all other activities in the marketing and financing areas, particularly in the areas of risk analysis, base plan extension and revenue assurance studies. All other activities discussed in Section A.5.12 will be continued on an as-needed basis to meet the needs of APA.

(b) License Only

Financing activities will be reduced to the minimum necessary to support FERC information needs and to update project overview documents as new information is developed in other tasks.

A6.11 - Public Participation

Activities in this area will be the same for both "Fast Track" and "License Only" alternatives. To keep the public fully informed of the progress being made relative to preliminary design and completion of the environmental assessment, the public participation program as described in Section A5.13 will be continued into the second phase. The goal during this phase will be to continue to seek feedback from all groups, agencies or individuals identified as interested parties during the first phase. Information materials will be prepared periodically and the information office will remain active to provide a continuous point of contact for the public. However, the anticipated level of activity during this phase should be lower than prior to submission of the FERC license application.

A6.12 - Administration

Project administration will continue through award of the FERC license at essentially the same level as described in Section A.5.14 for pre-license submission.

SECTION A7 - PROJECT SCHEDULES

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A.7.1 - Introduction

A master schedule is presented on the following pages as the basis for graphically portraying the timing of various subtasks which must be conducted concurrently or sequentially in achieving the overall project objectives. It will be noted that successful implementation of this plan demands a very early resource commitment, particularly in terms of acquiring and installing important site support facilities. By the end of the first year of work, a decision point will be reached that will allow the State of Alaska to consider recommendations to proceed as planned, or as modified by efforts to that point -- or to terminate if negative findings so indicate.

The second year of the project will include an acceleration of design activity as preliminary field investigations feed results to design teams. Design transmittals will be regularly prepared and reviewed and refinements will continue so that, during the final months of the two-and-a-half year period, all FERC exhibits can be completed.

Reviews throughout the progress of the work will be conducted internally and externally by proposed review boards, appropriate State and Federal agencies, utilities, environmental interests, and other interested parties. During the 30th month, a review of the fully assembled proposed draft license application will be conducted so that it can be executed and filed by the State of Alaska at the end of the period.

Schedules are contained on:

Plate A7.1: Master Schedule-Sheet 1

Plate A7.2: Master Schedule-Sheet 2

SECTION A8 - LOGISTICAL PLAN

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(a) Statement of Problems

The sheer magnitude of the proposed project is itself virtually a guarantor of problems scaled to match. This plan seeks to anticipate and address major problems in advance--and thus to reduce the force of their impacts. Problems to be considered include:

- (1) Land Use Restrictions and Permit Requirements. The unique nature of the proposed project area is such that land use restrictions and permit requirements will be imposed by multitudinous agencies. This subject is developed in further detail in subparagraph (b) below.
- (2) Access. Perhaps the single greatest physical constraint on rapid successful completion of necessary site investigations is the difficulty of access. The project area is far from existing roads and no airfield is available to serve Watana dam site. The bulk of the project supplies (including fuel needs) must be brought overland during the winter months, demanding careful, detailed, expert advanced planning for a full year's operation. Even helicopter access is difficult (in addition to being expensive) since weather conditions including fog, winds, freezing rains, icing conditions, and snow frequently restrict or prevent helicopter use.
- (3) Seasonal and Cyclical Constraints. The nature of the required work is such that a number of peak manning loads will occur, particularly during short summer seasons. The relative brevity of important data collection periods and the extensive time lapse before like collection activity can occur make it imperative that the proper investigators be at the correct location with the necessary equipment on time. (In this regard, for example, abortive data collection efforts during a particular spawning season may not be recouped for five years.)
- (4) Weather. The effect of adverse weather on helicopter operations has already been noted above. Beyond the access question, though, is the extent to which weather conditions impact project operations. Consider aerial photography requirements, for example. The period after snow melt and prior to leaf cover is important, but weather conditions may severely limit its already short duration. Project planning must allow for weather delays as well as for gainful production on alternative tasks during inclement weather.
- (5) Coordination of Subcontractor Activities. Acres has assembled a strong team representing high qualifications in a number of project areas as well as a substantial Alaskan presence. The strength of such a team can only be brought to bear fully and well if a proper system for management and coordination of diverse

activities is employed. This is especially true in view of the widespread geographical dispersion of various design offices.

(b) Summary of Land Use Restrictions and Permit Requirements

(1) Interested Agencies. A number of organizations and agencies have direct interests in the project area. These include:

- Bureau of Land Management under whose control some project lands now fall.
- Native villages which have already made selections, generally along the Susitna River, bordering federal power reserves which had been established prior to Alaska's assumption of Statehood. It should be noted that the power reserve does not include all of the land which would be required for the Watana reservoir as proposed in the Corps of Engineers' pre-authorization study (resulting, of course, from the Corps' selection of a higher dam at Watana than had earlier been proposed in studies by the Bureau of Reclamation). Native villages ultimately acquire surface rights to virtually all of the lands bordering proposed reservoirs as well as certain downstream and general vicinity parcels.
- Cook Inlet Region Incorporated, which will acquire all subsurface rights to the Native Village lands and which may temporarily receive and hold lands in trust until they are ultimately conveyed to individual villages in accordance with prior selections.
- Alaska Department of Natural Resources, which administers water rights. The State is the owner of all lands lying under the Susitna River and its tributaries.
- The Alaska Department of Fish and Game, whose responsibilities for protection and management of wildlife resources are essentially independent of ownership.
- The U.S. Army Corps of Engineers who are charged by Congress with administering permit programs for navigable waters and for wetlands.
- Other federal agencies whose involvement is assured because a federal license is required. (Thus, it is not necessarily true that the passage of land ownership to Native Corporations will eliminate most federal permit requirements or interventions. In this regard, for example, federally legislated archeological checks and clearances are expected to be required even though land ownership may have been transferred from the federal domain.) Particular agencies involved in coordination and/or permitting include the Fish and Wildlife Service, National Marine Fisheries Service, and the Environmental Protection Agency.

- Other State agencies whose concerns include water and air quality--and others which will control certain lands in the Susitna Basin which may ultimately be acquired by the State in exchange for lands selected elsewhere by Natives.
- The MATSU Borough whose coastal zone management plan must be accounted for and whose other direct interests must be identified and satisfied.

(2) Constraints. The net effects of dealing with diverse permitting agencies and resolving uncertainties in land ownership or water rights will be multifold. Surely they demand careful and detailed advanced planning, backed by experience in Alaska, for it matters little that 15 necessary permits have been acquired when one forgotten one holds up any work on a project. They also demand carefully coordinated application and implementation procedures, for care must be taken to ensure that funds are not twice expended to comply with a single provision common to two permits.

We intend to produce a high quality, technically correct, economically sound, environmentally acceptable report--including FERC license application if alternatives analysis and other studies support it--on time and without introducing permanent damages in the project area. It is this latter damage avoidance objective on which most permits are based. It follows that permittee and permittor should, in every case, be able to resolve apparent difficulties and proceed with the necessary activities.

(c) Proposed Methods for Dealing With Problems

The very fact that land use is severely restricted suggests that the closest possible relationship should be established with the land owners. Because we anticipate seeing ownership pass to the Cook Inlet Region, Inc., (CIRI), and thence ultimately to various selecting Native Villages, we propose to engage CIRI (in association with its engineer, Holmes and Narver (H&N)) to undertake a major share of the logistics activities in support of the project. Our own management system will be such that a responsible senior Acres official with decision-making authority will establish a project office in Anchorage, from which all in-state activities will be coordinated. The Project Manager will divide his time between in-state field data collection and out-of-state activities to include sophisticated design efforts in the home offices, seismic analysis at WCC offices in California, coordination with federal agencies (including FERC) as appropriate, and similar tasks. In later stages of detailed design, he will also need to review hydraulic model tests in Niagara Falls, ice studies at the Cold Regions Laboratory in New Hampshire (provided government projects do not preempt), and confer with potential manufacturers and suppliers.

Certain specific points may be made regarding the proposed logistical operation:

- (1) CIRI/H&N will provide the layout and design of a semipermanent camp near Watana.

- (2) CIRI/H&N will furnish all camp equipment, furniture, materials and supplies including fuel and pad for the camp.
- (3) CIRI/H&N will furnish transportation of all building materials for the camp at Watana.
- (4) CIRI/H&N will operate and maintain the Watana camp and furnish all food and camp operating supplies.
- (5) CIRI/H&N will obtain the permits required for the camp.
- (6) CIRI/H&N will operate the camp on the following schedule:
 - Watana: Year round, February 1980-June 1982
- (7) The Watana Camp will house a maximum of 40 persons (including O&M staff).
- (8) CIRI/H&N will furnish electrical power, water and sewage systems. A small, biological sewage treatment plant will be installed to handle the camp sewage wastes. Incineration and/or approved burial methods will be used to dispose of other camp wastes. All operations will be conducted in accordance with DOI stipulations and DEC permits and regulations.

Local surface water sources will be investigated and economic studies performed to determine the suitability of supplying the camp water needs. If local surface water proves unsuitable, then installation of a well will be required.

- (9) CIRI/H&N will furnish communications equipment:
 - Ground to aircraft: appropriate navigational aids and communication facilities will be installed in support of air operations.
 - Camp to work site: A base station shortwave radio will be installed at each camp location, and mobile radios will be carried by each work crew in the field. In addition, mobile radios will be installed in helicopters to allow communication with the camp and ground crews.
 - Camp to outside: It is expected that the communication needs of the POS will require the installation of telephone lines to the camp facilities. Typically, these requirements have been grossly underestimated. We will work closely with local communication subcontractors to establish the level of hardware required to support the project.

(10) The Watana Camp, as furnished by CIRI/H&N, will consist of the following facilities::

- Dormitories of 40 persons (2 persons/room), toilet, showers, and personal laundry facilities (washer/dryer).
- Kitchen/diner with food storage
- Offices: 4 each (200 sq. ft., total 800 sq. ft.) with furniture, but without office machines, i.e., typewriters, adding machines or photocopiers, etc.
- Recreation hall with: pool table, ping pong table, TV/Video tape player, movies.

CIRI/H&N will supply movies and video tapes.

- Fuel storage: fuel storage dumps will be installed to provide adequate storage of diesel and jet (helicopter) fuels. Bladder tanks installed in approved, lined and diked areas will service the needs of the camp and aircraft:

Jet fuel - 2 each, 25,000 gallon bladder tanks
Gasoline - 1 each, 10,000 gallon bladder tanks
Diesel fuel - 4 each, 25,000 gallon bladder tanks
Propane - 2 each, 500 gallon tanks

- Laundry facilities for sheets, towels and kitchen linen
- Warehouse/shop, not including shop equipment
- Generators and generator shelter
- Water system with storage
- Sewage/incinerator system
- Dormitories, kitchen/diner, and recreation facilities to be connected via Arctic walkways.

(11) If camp facilities are required at Devil Canyon, a local lodge will be used.

(12) Food services will include well-balanced meals (three times per day - typically):

Hot breakfast: 6 a.m. to 7 a.m.
Cold sack lunch
Hot dinner: 6 p.m. to 7 p.m.
Pastries, fruit and coffee for snacks

(13) The following items are to be supplied as noted:

- All fuel required for camp operations (CIRI).

Note: diesel fuel required for power plant, water pumping and incineration of sewage/garbage.

- Office equipment and supplies (Acres)
- Air transportation (including emergency) for personnel

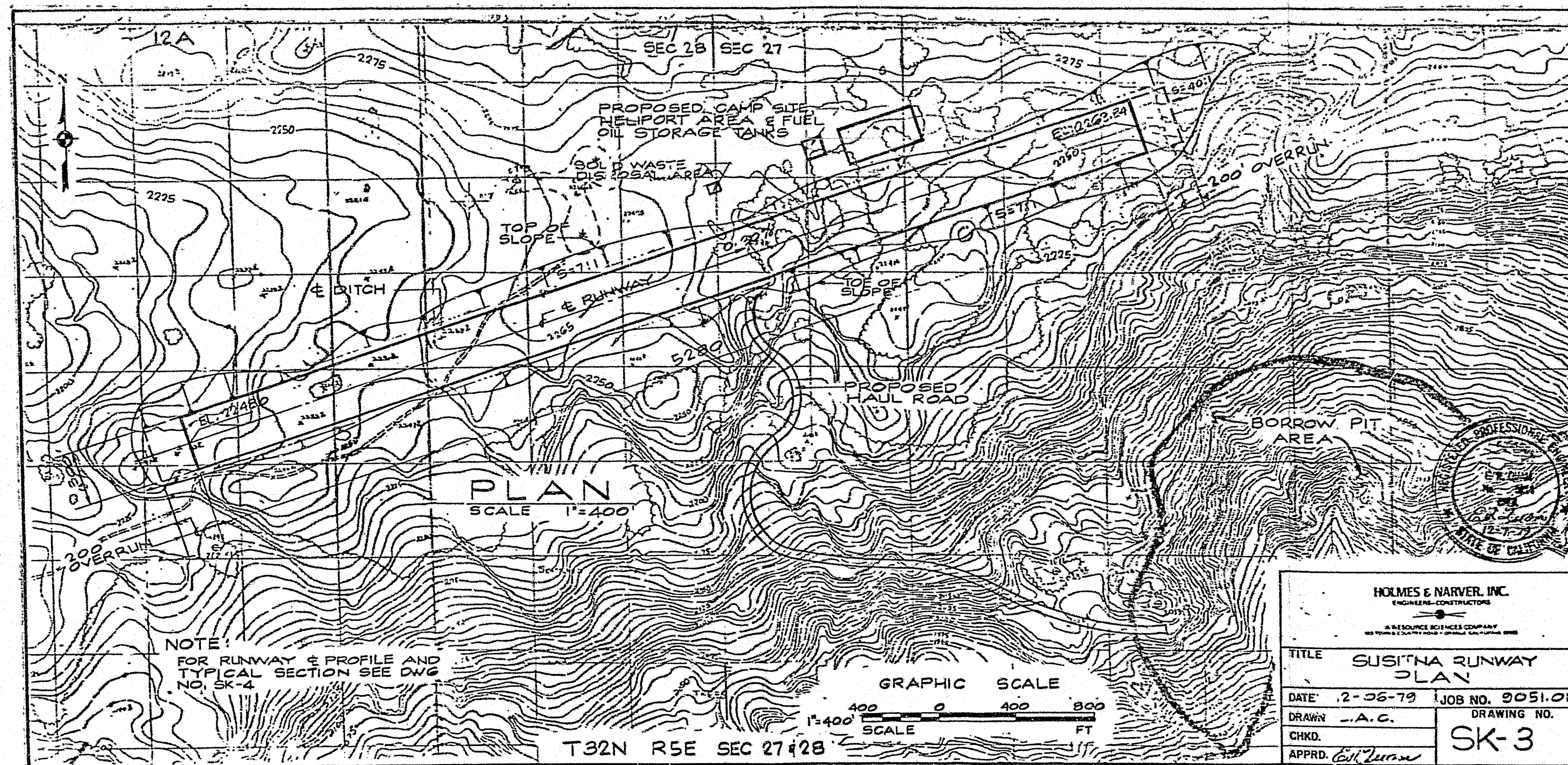
All personnel will move to and from the field camp by helicopters originating at the Talkeetna airfield or in Anchorage. Overland transportation will be provided to Talkeetna from other locations. Transportation from the field camp to specific work sites will be provided by helicopter support. Where possible, field personnel will travel to work sites on foot.

- Helicopter transportation of food and consumable supplies from Anchorage as required (Subcontract with helicopter service company)
- (14) The timely mobilization of the Susitna Camp in February 1980 is contingent upon having lead time to procure (90 - 120 days) camp buildings, generators, sewage treatment plant, pillow tanks, etc.
 - (15) CIRI/H&N will apply for and secure all permits necessary for any aspect of camp establishment and operation.
 - (16) CIRI/H&N will provide the single coordinating point for satisfaction of Alaskan Native Corporation land use stipulations.
 - (17) Acres American Incorporated will establish a project office in Anchorage and will designate a senior staff member with decision authority as Chief Engineer for Alaska operations (CEAO). The project office will accommodate representatives of other team members as well.
 - (18) All plans of operations as required by Bureau of Land Management will be prepared under the direction of the Acres CEO. Specific responsibilities for preparation of plans within the proposed project team include:
 - Overland transportation - CIRI/H&N
 - Foundation and materials explorations - R&M
 - Fuel transportation and storage - CIRI/H&N
 - Fire prevention and suppression - CIRI/H&N
 - Wetlands survey - TES
 - Biological studies - TES
 - Waste disposal - CIRI/H&N
 - Air operations - FMA
 - Surface resource rehabilitation - R&M
 - Personnel housing and transportation - CIRI/H&N
 - (19) The CEO will prepare a detailed affirmative action plan for APA approval in which precise measures are set out to ensure maximum opportunities are made available to minorities, females, and handicapped persons. (We have already sought the assistance of CIRI/H&N to serve in the role of labor broker to ensure that, when available, necessary skills are drawn from the Native population in villages which have selected project lands.)

- (20) If it can be shown to be cost effective, a tie line connecting the corporate headquarters of Acres American with the CEA0's office will be established to permit frequent uninhibited contact. In addition, Telex facilities in the Alaska project office will be installed so that time zone difficulties will not preclude receipt of messages transmitted at times when one or another of the various Acres' offices on the net is unmanned.
- (21) A trained value engineering officer, drawn from within the Acres' staff, will review major operational plans and project designs throughout the course of the work.
- (22) To the extent that necessary goods and services are available in Alaska, they will generally be procured in Alaska (unless significant economic advantages to APA can otherwise be secured).
- (23) If use of a local lodge is found to be impracticable or uneconomical, a tent camp may be provided near Devil Canyon.
- (24) To permit the earliest possible start of field activities, initial minimal winter camp facilities will be established in the same location as used by the Corps of Engineers in their recent drilling program. No expansion beyond the bounds of that area will be possible until snow cover disappears and appropriate archeological clearances are obtained.
- (25) During winter months after 1980, an accessible frozen lake may be cleared to allow access to the study site by fixed-wing aircraft. The first year of project effort will be supported by helicopters. The need for later construction of an airfield will be evaluated by November 1980.
- (26) Fire is the most persistent danger to a camp and its occupants in Alaska. The most common cause of camp fires are uncontrolled incinerators and leaking seals on individual oil fired furnace units. Because of the risk involved, positive actions will be taken including:
- Installation and periodic inspection of smoke alarms
 - Periodic inspection of furnaces
 - Installation of fire fighting equipment
 - Establishment of a fire brigade.
- (27) Safety/OSHA/Fire Prevention - Periodic inspections of all site facilities will be performed by trained personnel to evaluate and make recommendations regarding safety, compliance with OSHA standards and fire prevention programs. A safety officer will be designated. This person will organize camp fire brigades and report on the effectiveness of the effort. He/she will report directly to the project manager of field activities and will have the authority to stop work that is being performed in an unsafe manner.
- (28) Medical - At a minimum, each field camp will have complete first aid facilities and personnel identified with advanced first aid

training. Qualified personnel will review the first aid program and make recommendations as appropriate. Medevac facilities and procedures will be available in the event injured personnel need to be transported to other facilities.

- (29) Office Services - Office services (typing, reproduction, etc.) appropriate to each field location will be provided as needed. Complete facilities will be available through Moolin and R&M offices in both Anchorage and Fairbanks, as well as the project office to be established in Anchorage by Acres.
- (30) Purchasing - A purchasing office within the project office, staffed by an experienced procurement person(s), will be established to support the needs of the POS. In addition, a purchasing/warehouse person will be located in the field camp to coordinate the procurement needs, operate the camp warehouse and administer a spare parts program.
- (31) Shipping/Marshalling - Procurement personnel will coordinate the movement of all project materials from vendors to the camp location(s). Most materials will travel overland to a marshalling yard to be established in Talkeetna where materials will then be shipped to the field site. Perishable items and "hot" items will be shipped direct from Anchorage to the field locations. Materials that cannot be shipped by helicopter will be transported overland during winter in accordance with DOI stipulations.
- (32) Warehousing - An appropriate warehouse will be established at the field construction camp to store/control the material needs of the POS. Minimal indoor storage will be provided, with the bulk of the material being stored outdoors.
- (33) Equipment Support/Spare Parts - Based upon previous experience with equipment use in Alaska, particularly during winter/arctic conditions, the establishment of a spare parts program is a necessity to ensure equipment availability and cost effective completion of the POS. Such a program will be developed, with the help of the local equipment vendors, and administered through the procurement/warehouse person.
- (34) Winter access - The camp facilities and enough fuel for the first year of operation will be transported overland by Rolligons and/or cat trains in February 1980. Fuel and other heavy items will be brought in by the same technique in succeeding winters. To accomplish these movements, a snow clearing operation will be undertaken on the Denali Highway and a staging area will be established just off the highway. Overland transportation will involve a series of trips from staging area to camp site.
- (35) Location - The camp location is shown in Plate A8.1. Although an airfield is shown on that diagram, it will not be constructed during the first year of operation. Should subsequent evaluation after the first year demonstrate its need and its environmental acceptability, it will be constructed in the location shown.



APR 1980	ALASKA POWER AUTHORITY SUSITNA HYDROELECTRIC PROJECT PLAN OF STUDY	
	CAMP LOCATION POSSIBLE RUNWAY LOCATION	
ACRES AMERICAN INCORPORATED	PROJECT P5700.12	PLATE A4.1

- (36) Camp Facilities - A schematic diagram of proposed camp facilities is provided at Plate A8.2.

It is important to note that camp facilities will be designed to accommodate a peak load. This approach will permit some flexibility in meeting the difficulties associated with short data collection seasons and possible unfavorable weather conditions. In addition, our plan to establish a large camp at Watana greatly reduces the daily helicopter transportation system used by the Corps of Engineers during their most recent field investigations. The question of needed flexibility is further addressed by observing that the necessary equipment for field investigations and, in particular, for geotechnical investigations is integral to the proposed project team. Because R&M Consultants, Inc., is unique in its possession of a major investigatory equipment inventory, we anticipate being able to respond rapidly when requirements arise--and, at the same time, to avoid the costly downtime which would accrue for equipment brought into Alaska specifically for the project purpose.

In short, R&M's equipment will be available for project purposes as necessary; but its use on other tasks when not required for the Susitna project will reduce the total cost to the Alaska Power Authority.

(d) Schedule Requirements

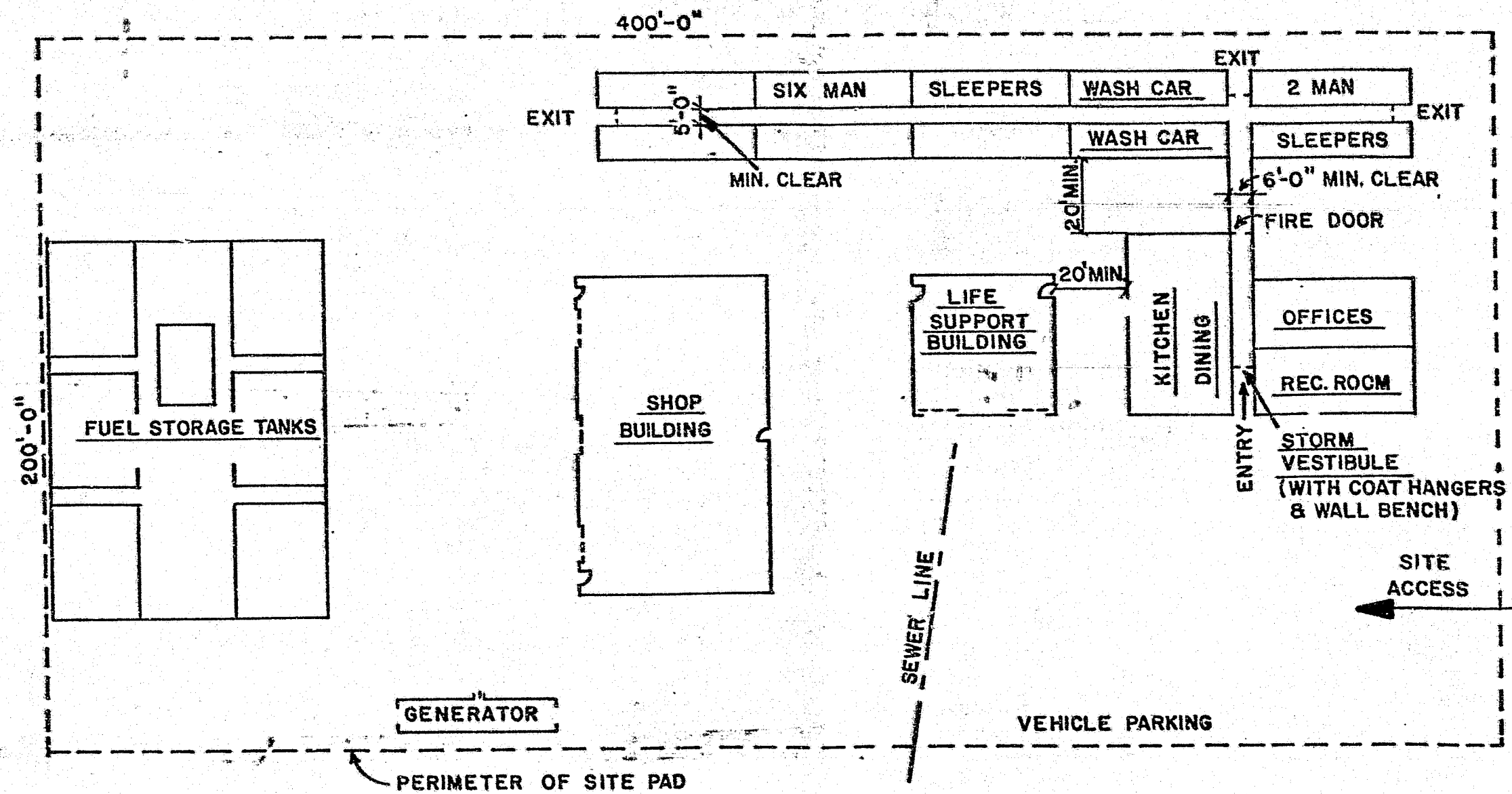
A brief outline logic diagram is displayed at Plate T2.1 (following Task 2). As may be noted thereon, we intend to have a permanent camp in operation prior to the end of February 1980. This requires herculean effort and high early mobilization costs. Once the camp has been established, the subsequent loading will, of course, be a function of requirements of the various field investigation teams.

We anticipate at the outset that submittal of license application will not mark the end of field data needs. On the contrary, certain environmental field studies will be scheduled as far as 2-1/2 years beyond the planned FERC application. In addition, the history of major hydroelectric licensing effort is replete with post-application federal demands for additional field data. It follows that the permanent camp should remain in place at the termination of the first phase of the work to support scheduled and directed activities.

(e) Public Participation Philosophy

Details of the proposed public participation program are contained within the detailed task descriptions at Task 12 of the Plan of Study. Within the context of logistical planning, however, it is important to highlight several points:

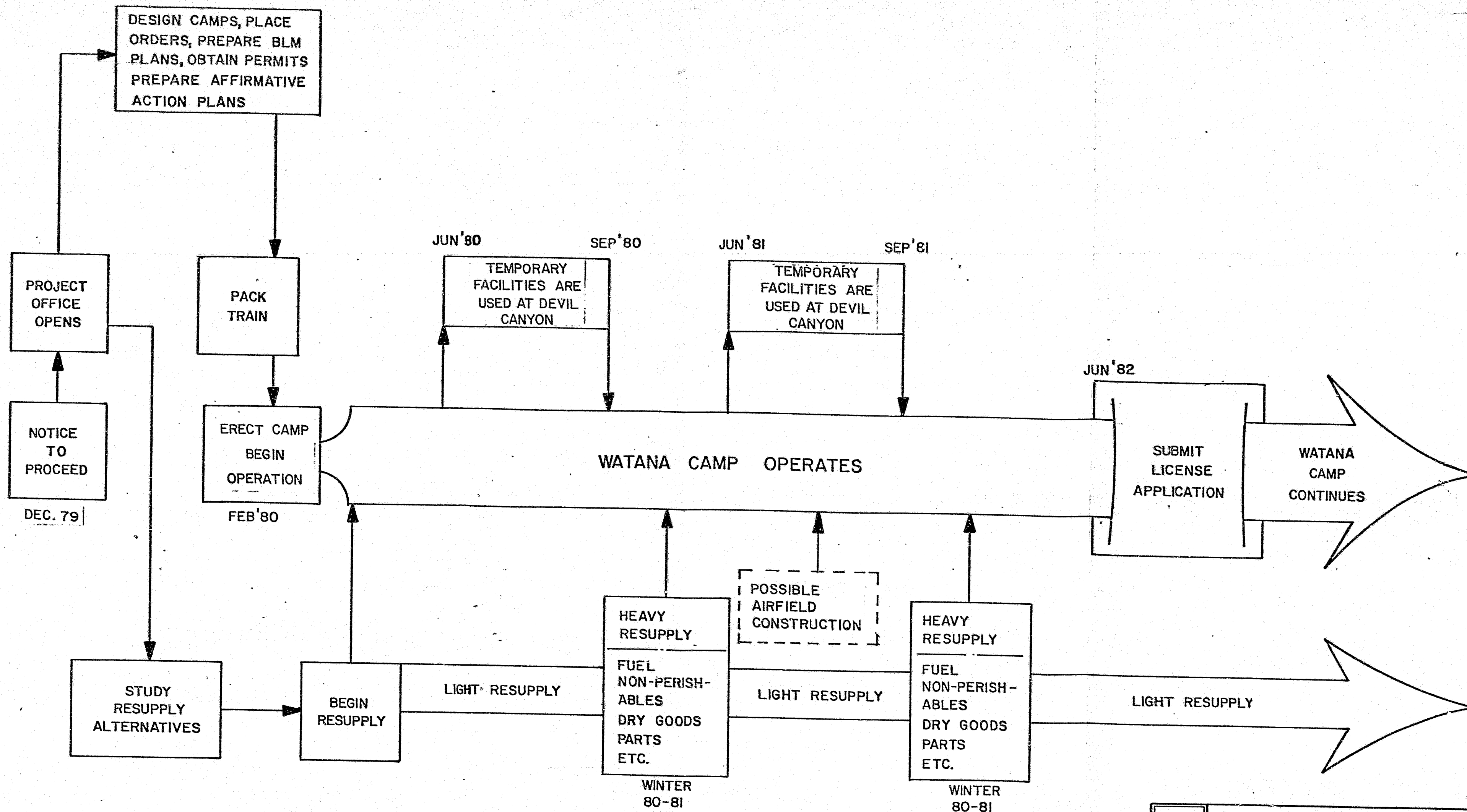
- (1) Needs and Desires of Area Residents. Whereas it is obvious that, if a major project is constructed, permanent impacts will be felt by area residents, it is also true that even the conduct of a deliberate and extensive study can cause disruption of lifestyle



NOTE:

CAMP FACILITIES (BASED ON A DRAWING BY HOLMES & NARVER, INC.)

APCS ALASKA POWER AUTHORITY SUSITNA HYDROELECTRIC PROJECT PLAN OF STUDY		
CAMP FACILITIES		
ACRES AMERICAN INCORPORATED	PROJECT P5700.12	PLATE A4.2



ACRES	ALASKA POWER AUTHORITY SUSITNA HYDROELECTRIC PROJECT PLAN OF STUDY	
	LOGIC DIAGRAM FIELD LOGISTICAL SUPPORT	
ACRES AMERICAN INCORPORATED	PROJECT: P 5477.00	PLATE T2.1

for that group. The public participation plan includes provisions for public meetings in Talkeetna (where local impacts are possible) as well as a number of workshops, the locations of which have been purposely not pinned down in order to permit us to be responsive to sensitive problems when - and especially where - they arise. We have also chosen to include a full time public information officer whose duties demand sensitivity to needs and desires of all who will be affected either by the study or by the proposed project if studies indicate it should be built.

- (2) The Action List. The unique action list system will be administered by APA and will provide a means to ensure that every required action, whether initiated by the request of a private individual or any representative of public or private organizations, is a matter of record. The proposed system provides for frequent update and the ability to check action status at any time. It follows that, for the first time to our knowledge, a means will be available to ensure that every action requested will have explicit attention and a by-name action officer - or will have an explicit statement of rejection available for review by external review panels, APA, or others. In short, the desires of area residents will be sought, recorded, acted upon, and the action status will be available in real time all the time!
- (3) Getting Out the Information. With a project as large and complex as the one proposed, it is almost inevitable that a steady flow of highly technical data and reports will be generated. Whereas such information will generally be available to the public at the cost of reproduction, it will not have been prepared for the layman. In cooperation with the Acres technical staff, the APA public participation staff will prepare special brochures, to be distributed free of charge, wherein project status is encapsulated in a readable form. Pertinent reports of all kinds will be available sufficiently far in advance of public meetings to permit thoughtful study prior to presenting public testimony.
- (4) Keeping Objectivity. No matter how well intentioned the project manager and his staff may be, they may well succumb to their own enthusiasm. We propose to avail ourselves of the objectivity which can be brought to bear by external engineering and environmental boards whose reviews from time to time will not only provide the public a measure of confidence that the course of the work is correct and proper, but also will serve to offer some recourse in the event that the project manager's recommendation and APA's decision to reject a citizen's proposed action is not accepted.

In short, the public participation program as proposed herein is responsive to the needs and desires of local residents - and to the public in general - because it provides explicit actions which can be tracked, because it includes an affirmative and vigorous public information program, and because it provides objective review groups whose eminence will be unquestionable and whose deliberations will provide an unprecedented quality and reliability check.