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SUSITNA HYDROPOWER FEASIBILITY ANALYSIS

ENVIRONMENTAL ASSESSMENT

Alaska District
U.S. Army Corps of Engineers
December 1978

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SUSITNA HYDROPOWER FEASIBILITY ANALYSIS

ENVIRONMENTAL ASSESSMENT

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PROJECT DESCRIPTION

PURPOSE

The function of this environmental assessment is to conduct a systematic and analytical assessment of the environmental impacts, including ways to minimize adverse impacts, related to the field activities of the project feasibility analysis as detailed in the June 1978 "Plan of Study for Susitna Hydropower Feasibility Analysis." This project feasibility analysis will consist of engineering, economic, social, and biological studies which are considered necessary to establish the feasibility of developing the upper Susitna hydropower potential.

This environmental assessment can only be undertaken in a general manner because the very nature of the activities over the study period, as well as the length of the period itself, precludes a specific assessment. Activities conducted during the first year may cause modification of later activities because unexpected information or circumstances may occur. This environmental assessment endeavors to deal with first year activities in as specific a manner as possible while dealing with remaining activities in a more general way. If the remaining activities are substantially modified or if environmental impacts are significantly changed because of such modifications a supplemental environmental assessment will be prepared if required.

AUTHORITY

Under the provisions of Alaska Statute 44.56, the Alaska Power Authority was created to (Section 44.56.70), "...promote, develop and

advance the general prosperity and economic welfare of the people of Alaska by providing a means of constructing, acquiring, financing and operating hydroelectric and fossil fuel generating projects." Section 44.56.80 empowers the Alaska Power Authority to (Subparagraph 12), "...apply to the appropriate agencies of..., the United States and ...any other proper agency for permits, licenses or approvals as may be necessary..." and (Subparagraph 13), to "...perform feasibility studies with respect to hydroelectrical..power generating projects;". It is under this authority that the Alaska Power Authority is conducting these feasibility studies and applying for all necessary permits.

PROJECT AREA

The majority of the exploration activities will occur within the upper Susitna River basin (Figure 1). Some of the activities associated with biological studies, transmission line studies, and archeological surveys will be conducted outside of the upper Susitna River basin. Biological studies will be conducted along the entire Susitna River extending downstream as far as the estuarine area and may even extend into the Cook Inlet. Transmission line studies and related archeological surveys will be conducted within the proposed transmission corridor, some portions of which extend beyond the upper Susitna River basin (Figure 2). The southern portion runs from Gold Creek southwest along the Susitna River and the Alaska Railroad to Talkeetna. From Talkeetna the corridor follows the east bank of the Susitna River to the Nancy Lake area and then due south to Point MacKenzie. The

northern portion of the corridor runs from Gold Creek north to Chulitna and then parallels the Parks Highway and the Alaska Railroad through Broad Pass and the Nenana Canyon to Healy. From Healy the corridor will follow the existing GVEA 138 kV transmission line to the existing substation at Ester.

PROPOSED ACTION AND ALTERNATIVES

The Alaska Power Authority and the Alaska District, Corps of Engineers proposes to conduct engineering, economic, social, and environmental studies beginning early in 1979 and ending approximately 46 months later. These studies are described in the "Plan of Study (POS) for Susitna Hydropower Feasibility Analysis" prepared in June 1978. The following major categories, as described in the POS, will entail some field work: field camp (including site access), survey, hydrology, environmental water quality, recreation, foundations and materials, design, real estate, cultural resources, and biological studies. A tabulation of the field activities according to season and year of accomplishment is provided as Appendix B.

Field Camp

The proposed field camp activity consists of a camp including housing and support facilities to be constructed at the Watana damsite (Figure 3) and a combination office, shop, and emergency shelter to be installed at the Devil Canyon damsite (Figure 4).

The Watana facilities will include total support for about 75 personnel for which approximately 10 acres will be reserved. The camp

will be utilized year-round during the 46-month period, however, most use will occur during the summer months with only a few personnel utilizing the camp during the winters. Note that for all activities a figure for the number of required personnel is given. If all the figures were added the sum would not be correct because of the high degree of personnel overlap between activities. It is expected that the number of full-time personnel onsite will number about 70 with from 5 to 15 others being used periodically. These figures do not include personnel required for the biological studies.

Sewage will be handled in a 5,000 gallon per day treatment plant which will discharge into an adjacent lake or pond through a surface laid outfall pipe. Effluent discharges will meet all applicable State and Federal standards. An alternative means of treatment includes incinerating toilets, and the disinfection and discharge of remaining waste waters. Waste waters could also be discharged into the Susitna River after treatment, however, the distance of the proposed camp from the river limits the feasibility of this alternative.

Water will be supplied from a well to be drilled adjacent to the camp. Well capacity will be about 5,000 gallons per day. Water treatment will consist of disinfection and possibly iron removal.

The majority of the solid wastes produced will be disposed of by incineration. Those materials which cannot be incinerated (glass and metal) will be hauled to an existing approved disposal site (e.g. Talkeetna).

Power for the camp will be supplied by diesel generators to be located onsite.

Construction of the proposed camp will require gravel pads to support buildings. Approximately 5,000 cubic yards of gravel will be required.

The borrow source is located approximately 3.5 miles southwest of the proposed camp, at the mouth of Tsusena Creek. Conventional earthwork equipment (dozer, graders, compactors, loaders, and dump trucks) will be required for borrow pit operations. The borrow source will also supply materials for intrasite access trails and an airstrip. Approximately 265,000 cubic yards of material will be extracted from this source.

A 4.5-mile haul trail will be constructed from the borrow source to the field camp area. This 20-foot-wide trail will be one way with turnouts at selected locations. It is assumed that adequate borrow may be selected from the excavation. Waste material from the stripping of overburden will be disposed of adjacent to the borrow area.

In addition to the haul trail, a low grade access trail system from the field camp area to adjacent work areas will be required. This system will be constructed of a nominal 12-inch gravel overlay and will be approximately 3 miles in length and 12 feet wide. Approximately 10,000 cubic yards of gravel will be required. Vehicles will travel from the field camp via the trail system to its terminus, then overland to the main work areas.

An airstrip approximately 5,000 feet long will be constructed adjacent to the field camp. The airstrip will serve Electra and Hercules

aircraft. A short access trail will connect the camp and the strip. Approximately 250,000 cubic yards of material will be required.

An alternate field camp-airstrip could be located approximately 1,500 feet south of the proposed location. The configuration would lie entirely within Native selected lands. The major differences between the proposed and alternate field camp-airstrip locations are as follows.

1. The discharge of treated waste water through surface laid piping is less feasible for the alternate field camp-airstrip site due to the longer distance from a suitable lake.

2. The haul trail from the borrow area would be approximately 1,500 feet shorter for the alternate site.

3. An archeological survey was conducted for the proposed field camp-airstrip location but not for the alternate location. This fall 1978 survey resulted in "clearance" of the land required for the proposed location in that no archeological or historic resources were found. If the alternate site were selected an archeological survey would be required. This would probably delay installation of the field camp-airstrip until well after spring breakup in that archeological surveys are difficult and extremely expensive to conduct in frozen ground.

Proposed facilities to be installed at the Devil Canyon site include a combination office, work shop, and emergency shelter. These facilities will consist of a small house trailer and plywood structures. Access will either be by helicopter or by tracked vehicle across the existing

4-wheel drive road from Gold Creek to Devil Canyon. Improvements will be limited to clearing brush. Personnel will be housed at the Watana field camp, in Talkeetna, or in private lodges in the area.

Alternatives to the proposed field camp include lodging personnel at private lodges in the project area or lodging personnel at lodges in an adjacent community such as Talkeetna. If either of these alternatives were selected combination office, work shop, and emergency shelter facilities will still be required at the Watana and Devil Canyon sites.

Access to the Watana site for the initial mobilization of the project feasibility analysis operations will be by winter trail from the Denali Highway near Canyon Creek during the winter of 1979. The route will be generally the same as that followed by the cat train during the winter of 1978 (Figure 5). The heavy equipment required for the 1st year activities and the camp modules will be delivered to the Watana site over this winter haul trail. Winter trails will also be used in succeeding years. Personnel utilized during the first season will be housed in public facilities in Talkeetna or in local lodges until the field camp is complete.

An alternate means of access to the Watana site would involve the installation of a 41 mile pioneer trail from the Denali Highway near Canyon Creek which would generally follow the winter trail route. This low grade pioneer trail would serve 4-wheel drive vehicles and larger wheeled or tracked vehicles. The trail will be 16 feet wide with turnouts spaced approximately 1 mile apart. It would be constructed on a

nominal 12-inch gravel overlay. The trail would not be utilized during spring breakup, but it would provide access throughout the remainder of the year if adequately maintained. Construction of this trail requires that approximately 16 stream crossings be made. These crossings would either be done by installing culverts or fording the streams. Construction of the pioneer trail would require approximately 160,000 cubic yards of borrow material. Borrow sources would be developed along the trail alinement. Construction would be by conventional earthmoving equipment. If construction of the project is authorized, the pioneer trail would have the potential of being upgraded to an access road.

If the pioneer trail alternative were selected, a 2,000-foot airstrip would be required at the Watana site rather than a 5,000-foot airstrip. Borrow material requirements at the Watana site would be 25,000 cubic yards rather than 265,000 cubic yards.

The winter trail-pioneer trail-short airstrip combination is desirable for the following reasons.

1. Monetary advantages of a pioneer trail would be realized from the standpoint of decreased mobilization and demobilization costs, and savings in helicopter support. Experience gained during the summer of 1978 has shown that supplies and personnel movement may be delayed by adverse weather in the project area for days, while operating costs and rental costs accumulate. A pioneer trail would minimize this loss. Additional savings would result from heavy equipment lease costs; lack of a trail would necessitate leasing heavy equipment from prebreakup

until after freezeup, although the actual time in use might be only a few weeks. Lease costs for such items as heavy drag lines or bucket auger equipment would be very high.

2. Year-round access would result in more efficient operations and more precise data since specialized equipment or drills could easily be mobilized when required. The large volume of samples to be tested could also be transported from the site in a timely manner without excessive cost.

3. The operation of several helicopters for 3 years under the kind of weather experienced in the project area could result in accidents and fatalities. A trail would minimize this problem. Furthermore, a trail would insure the capability of evacuating personnel, if required, under all weather conditions. This capability is a high priority for workers whose occupation requires continual contact with heavy machinery and impact equipment.

4. The pioneer trail would provide a time contingency in that funding delays may prevent mobilization by winter trail. If this occurs, the field camp modules and heavy equipment could be mobilized over the pioneer trail during the summer months. Construction of the proposed 5,000-foot airstrip is contingent upon mobilization of heavy equipment by winter trail and is thus susceptible to a 1 year delay.

Construction of a pioneer trail is not now proposed because of wilderness considerations.

Survey

The survey activities include the basic field work required to provide river hydrographic data and topographics data necessary for detailed design and cost estimates, environmental studies, and hydrology and power studies. The topographic data will also be used in the preparation of real estate ownership maps.

River channel cross sections will be obtained using conventional survey and electronic sounding equipment during the winter months or during late summer when discharges are low. Summer data will be obtained by using small boats and winter data will be obtained by working on the ice. Access to cross section sites will be by helicopter. This 1st year activity will be conducted by two crews of four men each for about 30 days during the fall and 90 days during the winter.

Topographic data will be obtained by using aerial photographs. Helicopters will be required to set control monuments.

Hydrology

The hydrology activities include both field work and the related analysis. The collection of data in the field will allow a definitive description of the climate and hydrology of the river basin and transmission corridor to be made. Emphasis will be placed on comparing the pre- and postproject characteristics for the purpose of determining project effects.

Three climatological stations will be established in upper Susitna River basin (Figure 6). Specific locations will be determined by

field reconnaissance, however, the sites will be located adjacent to lakes, where possible, to enhance access by fixed-wing aircraft for winter snow surveys and summer site inspection and maintenance. The stations will be equipped with telemetry equipment, a transmitter, batteries, antenna tower, solar panel, tipping bucket precipitation station, temperature sensors, and a snow pillow. The 20-foot antenna tower will be anchored to a 4-foot square prefabricated wooden base and will be vertically supported by three guy lines. Batteries and telemetry equipment will be housed in a wooden box approximately 4 feet wide by 6 feet long by 2 feet deep. The precipitation gage and protective windshield will be mounted on a 6-foot stand supported by a prefabricated wooden platform. The snow pillow will be supported by a prefabricated wooden frame. A snow survey course in the vicinity of the site will be marked by colored stakes.

Installation of climatological stations will occur in late summer and early fall and is expected to begin in 1979 and be completed in 1980. Each site can be installed by two persons in 3 days. Personnel will remain at the site for the duration of the installation period and will live in small tent camps. Site preparation will be limited to leveling an area suitable to provide a level surface for each piece of equipment using hand tools. Prefabrication will be maximized in staging areas to keep disturbance at the site to a minimum. All refuse will be removed from the site by helicopter when fabrication and installation is complete. In addition to the installation of the

three proposed sites, seven existing sites will be upgraded by installing precipitation equipment, telemetry equipment, and a snow pillow. Equipment erection and installation will be similar to the new stations. When completed, all climatological stations will have identical facilities and transmitting capabilities.

Most data collection at climatological sites will be for the duration of the proposed action. It may be determined after several years that some stations are unnecessary. These stations will be removed and the site restored to near natural conditions.

Sixteen anenomometers will be installed to evaluate wind velocities at anticipated critical areas along the proposed transmission corridor (Figure 7). Anemometer Sites 1 through 7 will generally be located along the Alaska Railroad right-of-way whenever possible. Where appropriate, they will be placed on existing buildings or structures which are accessible from the Parks Highway or the Alaska Railroad right-of-way. Anemeter Sites 8 through 16 will be located at remote sites in areas of maximum exposure to high velocity winds. Normally these sites will be established at maximum elevation along individual legs of corridors in uninhabited areas. Access to the sites for installation and maintenance will be by helicopter.

Each anemometer site will be equipped with a 20- or 30-foot metal tower with an anemometer, antenna, and solar panel attached. The tower will be anchored to a 4-foot square prefabricated wooden base and will be vertically supported by three guy lines. Batteries and

telemetry equipment will be housed in a wooden box approximately 4 feet wide by 6 feet long by 2 feet deep. Several of the sites will also be equipped with a small recording precipitation gage and protective windshield mounted on a 6-foot stand. Site preparation and installation will be similar to that for the climatological stations. Data collection at the majority of anemometer stations will be limited to 5 years, however, data collection at sites located in critical areas may be continued until construction of the transmission line is completed.

Stream gaging sites will be established or upgraded (Figure 6) to obtain streamflow data for use in engineering and design studies and to develop a stream gaging network which will provide real time data for operating the project on completion.

The new stream gaging sites will be established at locations with stable river cross sections. The sites will generally be developed with a cableway for sampling suspended and bedload sediments, and collecting flow data. The cableway will be anchored in bedrock or suspended from an 'A' frame adjacent to the stream. Where stream velocities permit, a boat will be used in place of the cableway. Site preparation and installation will be similar to that for the climatological stations. A manometer activated recorder will be used to measure the river stage. Each will be equipped with a 20- or 30-foot metal tower with an antenna, solar panel, radio transmitter, and associated telemetry equipment similar to the climatological stations.

Operation of the stream gaging stations will require a two-man crew about once a month. Data collection at the majority of the stream gaging stations will be continued to be used for project regulation. If the project is determined to be infeasible the stations will be deactivated and the area returned to as near a natural state as possible.

Environmental

Physical, chemical, and biological water quality data will be collected so that baseline environmental conditons can be documented prior to construction. This data will be collected at the following four gaging stations: (1) the confluence of the Susitna and Tyone Rivers; (2) below the Watana damsite; (3) below the Devil Canyon damsite; and (4) the confluence of the Susitna River and Gold Creek. The data collection will occur on a monthly basis to ensure that conditions are fully understood. In some instances sampling may occur on a more frequent basis. No equipment will be installed. Data collection will be scheduled to coincide with stream gaging and biological activities. A two-man crew using portable monitoring equipment will gain access by helicopter.

Recreation

Visual inspections will be conducted as part of this activity in order to develop measures for enhancing environmental quality and esthetics. This second year, summer activity will involve a maximum of two individuals. Helicopter overflights will be conducted with some landings.

Foundations and Materials

The foundations and materials activities involve field work to assess geologic and soil conditions in the project area. An extensive program of field reconnaissance, seismic monitoring, drilling, and materials testing is expected at the Watana and Devil Canyon sites. In addition, foundations and materials activities will be conducted along the proposed access roads and transmission corridor.

The foundations and materials activities will require a total of 50 persons to be onsite full-time during the course of the operations. In addition, 5 to 15 persons will rotate to the site periodically and 13 persons, who will not be housed onsite, will be required for the transmission line and access road corridor investigations.

Equipment required for the foundations and materials activities includes the following major items: two to four Bell 206B helicopters; two Bell 205A1 helicopters; two D-4 or D-6 dozers with backhoes; two to six D-8 or D-9 dozers; one rough terrain crane; one screening plant; two to five 4-wheel drive trucks; three large rotary drills; six core drills; two auger drills; two tracked personnel carriers; four support Nodwells with air compressors; one grizzly (a large gravel screen); two wagon drills; four separate air compressors; four large pumps; and four underground loaders.

A seismic monitoring system consisting of eight stations will be installed and monitored within the upper Susitna River basin. The exact locations of these stations is as yet undetermined, however, they

will be within a 50- to 60-mile radius of the proposed damsites. Each station will consist of a geophone covered by a 3-foot square box, a battery or solar cell, a transmitter, and a 20- or 30-foot-high antenna supported by three guy lines. Site preparation will entail minimal amounts of leveling. Each geophone will be buried approximately 6 inches deep. Installation of all sites will take a three- to six-man crew approximately 4 weeks during the first summer.

Station maintenance will occur year-round on a minimum schedule of once every 3 months. Access will be by helicopter. All stations will be removed at the end of the study period if the project is not approved.

Permanent access road studies will include: the selection of a route; geological and soils studies; and detailed foundations and materials exploration and testing. Corridors within which the access roads will lie will be studied. Corridors from Chulitna to Devil Canyon to Watana, (Figure 8) and the Denali Highway to Watana (Figure 5) will be studied. The corridors are 2 miles wide and 64 and 40 miles in length respectively.

A field reconnaissance of the alternate access routes within the 1 mile wide study corridors will be performed concurrently with geologic and soils mapping. A three- to four-person team of geologists, soils engineers, and design personnel will study the entire length of the corridors. Occasional hand samples and photographs will be taken. Access will be by helicopter during the late spring and early summer.

Foundations and materials exploration and testing along the road corridors will involve drilling to verify foundation conditions and materials quality and quantity. Approximately 400 holes will be drilled along the Watana route and 700 holes along the Devil Canyon route to a depth of 10 to 20 feet. Three augers mounted on Nodwells or similar vehicles will be used. In areas of heavy vegetation a brushed centerline would be needed. Occasionally a frost tube or piezometer will be set in a hole. This will consist of a 3/4-inch galvanized pipe capped on both ends and extending 48 inches above ground. All augered holes will be backfilled. Borrow sources along the corridors will also be investigated. The Watana route investigations will require approximately 120 days for the centerline and 45 days for the borrow sources. The Devil Canyon investigations will require 90 days and 45 days respectively. Daily access will be by helicopter. Some clearing of helio pads may be required. All debris will be removed by helicopter.

Field activity related to transmission corridor studies will be much the same as the access road studies, with several exceptions. Approximately 1,150 auger holes will be drilled in the flatland areas and 500 core drill holes in the mountainous areas. Equipment required will include: two auger drills with drive samplers mounted on tracked vehicles; one core drill mounted on skids or a tracked vehicle; two air compressors mounted on tracked vehicles; and three 4-wheel drive trucks. Eight personnel will be required. Access will be by helicopter or 4-wheel drive truck. Investigations will begin in the 2nd year and continue through the 4th year. Activities will be conducted for about 10 months a year.

The Watana site geology study will investigate geologic features in detail to provide information so that the direction of the subsurface explorations program can be determined. This study will be conducted by four to eight geologists during the first 2 years from March through September. Survey instruments will be used to locate approximately 1,000 survey points which will be marked with stakes and flagging. Rock and soil samples will be collected using hand tools. Access will be by helicopter.

Borrow site exploration and testing will be conducted at Watana (Figure 9) to locate potential material sources and to determine material quality. Rock Quarry Sites A and B will be investigated to determine if they can provide the 37,290,000 cubic yards of rock which would be required for embankment construction. In Quarry B, work will consist of core drilling four holes to a depth of about 150 feet with a skid mounted core drill. In Quarry A, approximately 20 holes will be core drilled up to a depth of about 350 feet. In order to determine the techniques required to produce rock of the sizes required for construction an opening shot and at least two test shots will be detonated. The opening shot will consist of the detonation of approximately 1,000 pounds of low explosive which will open a hole about 200 feet long and less than 20 feet deep. Two separate test shots, each of approximately 3,000 pounds of low explosive will then be detonated. This will result in an actual hole approximately 200 feet long, 40 feet into the cliff face and 30 feet deep. The disturbed area will be around 300 feet long.

A glacial till source will be evaluated in Borrow Area D to see if it can provide core and semipervious materials. Approximately 20 air rotary drill holes averaging about 200 feet in depth will be drilled to define the horizontal and vertical extent of materials in the area. This data will be supplemented by about 80 auger holes averaging 40 feet in depth. Twenty test pits 30 feet deep will be excavated to obtain adequate amounts of representative materials for testing and analysis.

Two sources of sands and gravel for use as embankment material and concrete aggregate have been identified. Borrow Area E will require approximately 20 test pits averaging 30 feet deep to define the limits of the borrow area and to obtain samples for engineering analysis. A small screening plant will be set up for test processing of aggregate and filter materials. Rotary drill holes may also be required. Test pits may also be required in Borrow Area C.

Equipment required for the borrow site activity is as follows: one core drill on skids; two wagon drills on a tracked vehicle; one rotary drill on a tracked vehicle; one dragline or rough terrain crane; one backhoe on a tracked vehicle; and one bulldozer. Approximately eight persons will be needed to conduct these operations year-round during the first 2 years, with other followup work to be conducted during the last 2 years. Access will either be by helicopter or if the areas are adjacent to the staging area by tracked vehicle.

The exploration and testing for the final Watana facilities design will consist of geologically mapping the area of the dam and appurtenant structures so that the area can be evaluated as a damsite.

Drilling for the 2,500-foot square damsite area will be done on a grid system with holes on 250-foot centers. The hole depth will average 200 feet. A light core drill will be used because of the need to air-lift the rig into inaccesible areas by helicopter. A total of four core drills and two rotary drills will be required to properly investigate the damsite. The appurtenant structures will require from 100 to 150 additional holes with an average depth of 200 feet. This drilling will also require the use of core drills. At the higher elevations, especially along the right abutment, exploration holes will be drilled to determine what materials are present and to obtain samples for testing. These holes will be drilled with air rotary, Becker, and auger drills. In addition, a backhoe will be used to excavate test pits and a dozer to excavate trenches to expose inplace materials for examination and also to obtain samples for testing. A pneumatic drill will be used to drill vertical shafts at selected sites to study inplace permeabilities and soil temperatures if necessary. Total equipment required for this activity includes: four skid-mounted core drills; two track-mounted rotary air drills; one track-mounted auger drill; one track-mounted backhoe; and three bulldozers. Approximately 24 persons will be required throughout the course of the activity. Access will be by helicopter. Drilling will start on the river ice in February of the first year and will continue until May. From May to September drilling will occur on the abutments. The total effort is expected to take 4 years.

Geophysical investigations will be conducted at Watana to study the presence, depth, and configuration of certain underground formations. This will be done by ground level explosive charges, averaging from 5 to 10 pounds (maximum 50 pounds), which generate vibrations that strike formations of differing densities and are reflected back to ground level sensors (a refraction seismic survey). Holes uncovered by the explosions are small, averaging about 5 feet in diameter and 3 feet deep. A survey of this type will require the clearing of a survey line in brushy areas. About 200,000 feet of seismic line is planned. Access will be by helicopter for four to six persons. The activity is planned for the summer months of all 4 years.

Field activities related to the design of the spillway, powerhouse, and outlet works will consist of reconnaissance trips for one- to six-person teams of geologists and engineers. No equipment will be required for this activity and access will be by helicopter. Reconnaissance trips of from several hours to several weeks will be required during the 4 years of the study.

The Devil Canyon site geology study will concentrate on the right abutment where no exploratory drilling has been done and the river channel itself where there is a need to define the rock line in the river and to insure that no serious faulting exists in this critical area. An access tunnel or adit below the river may be used to examine the foundation if necessary. This activity, which will consist of inspections by four to six geologists, will be conducted during the summer months. Hand samples will be taken. Access will be by helicopter.

Exploration and testing of the Devil Canyon site is needed in the right abutment area and the river channel as previously mentioned. Two core drill rigs will be used to drill on the right abutment. The rigs will be moved by helicopter. Where possible existing clearings will be used. An adit will be sunk in the left abutment which will extend beneath the river channel. This will be accomplished by extending a horizontal shaft off a vertical shaft. The vertical shaft will be 7 feet square and 100 feet deep. The horizontal shaft will be 7 feet square and 150 feet long. This shaft system will require dewatering and air handling equipment. Rock rubble generated will be left close to the mouth of the shaft until final disposition. The shaft will be closed using a reinforced concrete lid dowled into the rock. Equipment to be used includes: four jackleg drills; four rubber tired loaders; and two underground core drills. Approximately 12 persons will be utilized for this activity year-round during the 2nd, 3rd, and 4th years. Access will be by helicopter.

The in situ rock conditions of the Devil Canyon site will be evaluated by lowering test instruments into previously drilled holes. This will require three persons year-round during the 2nd, 3rd, and 4th years. Access to the site will be by helicopter.

Exploration of the Cheechako Creek aggregate source will be undertaken to determine the quality of material available. Approximately 50 cubic yards of material will be removed for testing. In the event that the Cheechako Creek source is inadequate in quantity or quality,

additional sources will be investigated. This will require four to eight persons during the summer months of the last 3 years. Access will be by helicopter.

Design

The design category comprises the activities associated with the project's structural components. Initial activities provide the conceptual designs for preliminary screening of alternatives. More detailed design work is then accomplished on the selected plan for purposes of detailed feasibility analysis and of detailed design for the proposed plan's initial phase of development.

The field work associated with this activity will be either on ground or aerial visual inspections. Any activity which would have a direct impact within the project area is included under other activities (e.g. Foundations and Materials). These activities will be conducted during the summer months of the first 3 years by approximately three persons. Access will be by helicopter.

Real Estate

Real Estate field investigations will be conducted so that personnel can be familiarized with physical characteristics affecting land value in the project area. Inspections of the proposed transmission corridors will be accomplished by overflight in a fixed-wing aircraft. No on-ground access will be required.

Cultural Resources

An archeological and historic resource reconnaissance will be conducted within the area of potential project impacts so that an intensive

survey can be planned if the project is determined to be feasible. In addition, specific sites will be cleared so that Phase I feasibility analysis activities can be undertaken. This reconnaissance will be conducted during the summer months of the first 3 years of the analysis. In general, small test pits will be dug and recontoured, however, in some cases larger excavations may be required. It is anticipated that four archeological crews of two persons each will be utilized. Access will be by helicopter with foot movement on the ground. Personnel may be housed in small two person tent camps or in other facilities as provided.

Biological

The biological activities will determine the abundance, distribution, and habitat requirements of fish and wildlife species throughout the project area. By utilizing the information gained through these activities, pre- and postproject conditions can be compared to determine impacts and mitigation or enhancement measures can be determined.

Fisheries related field activities will be conducted from the proposed impoundment area at the Denali Highway crossing downstream to the estuarine area in the vicinity of the mouth of the Susitna River. Studies will be confined primarily to the mainstem river and its clearwater tributaries and lakes.

The total number of persons required for field activities will vary from a minimum of 4 to a maximum of 30. Activities are expected to be the most extensive from May through October, although monitoring will

be conducted on a year-round basis. Individual field camps will range in size from two to six persons, depending on the activity.

Access to remote field camps will be by train and/or boat during spring and summer months. Trains and snow machines will be utilized during winter months. Fixed-winged aircraft and helicopters will be used for aerial surveys and winter access.

All field facilities for fisheries studies will be temporary. Seasonal tent camps will be established for area specific studies. These will most likely be at Lake Louise, Gold Creek, and Susitna station. The remainder of the field crews will be mobile throughout the sampling season and will be responsible for various areas within the drainage. Mobile crews will consist of two to four persons. Approximately seven crews are expected to operate within the study area.

Water for field camps will be obtained from clear water streams. All solid wastes will be transported to Talkeetna or Anchorage, depending on locations of camps. Pits will be dug for sewage since most camps will be mobile and personnel will only be onsite for 1 to 2 days.

Types of sampling equipment deployed may include weirs for counting adult and juvenile fish, fish wheels, and sonar counters and associated hardware. Weirs will be installed within the lower reaches of selected clear water tributaries. Exact locations will be dependent on the stream characteristics of each creek. All structures will be temporary and will consist of conduit inserted in 4 by 4 inch drill wooden

stringers. Weirs will be supported upright by log tripod structures. Determining total escapement will require blocking the entire creek. Weirs will be monitored 24 hours a day and fish will be allowed to pass through the structures as they enter the creek.

The most recently developed sonar counters utilized in the Cook Inlet area consist of a 60-foot long cylindrical aluminum substrate which is deployed along the river bottom perpendicular to the riverbank and cabled to the shore. A single transducer is mounted on the inshore end and associated electronics are housed in a temporary 4 by 8-foot shack located on the riverbank. A variation of this design may be required for the Susitna River. Counters would not prevent boat navigation in the vicinity, although it would be desirable to channel boat traffic around the substrates. Locations of each substrate would be well marked with buoys and signs.

Fish wheels may be utilized for tag and recovery programs to determine salmon abundance. Suitable sites will be selected prior to the initial field season. A tag and recovery program would most likely include a lower tagging camp with four to five fish wheels and one or two recovery camps in the upper drainage. Fish wheels would be disassembled at the end of each season and stored onsite until the program is discontinued.

Fisheries and related water quantity and quality monitoring equipment will be portable and will be transported to sampling sites by field crews working in each area.

Big game studies will be conducted almost exclusively from aircraft. Aerial surveys and radio tracking flights will be flown over the impoundment areas, drainages flowing into the impoundments and along the mainstem below the impoundments on an almost daily basis throughout the study period. These flights will involve one to four single engine fixed-wing aircraft and two to eight persons at any given time. Approximately 200 big game animals (moose, caribou, bears, wolves, and wolverines) will be captured and radio collared with the aid of a helicopter. The majority of these animals will be captured between October 1978 and July 1980, however, smaller numbers will be captured after that period as required.

Aircraft operation will be staged from existing airstrips. Landings in the study area will be limited to the capture sites of animals, wolf and bear den sites, and occasional other places where detailed inspection is necessary such as location of dead study animals. Time on the ground will be limited to a few minutes or few hours at any one site. Tagging operations will involve one helicopter, one to four fixed-wing aircraft, and 4 to 10 persons.

Occasionally it may be necessary to refuel aircraft in the study area. Whenever possible this will be done at existing airstrips or near camps established for other activities. No camps or other temporary or permanent on the ground facilities will be established for biological activities related to large mammals, although facilities established for other activities might be occasionally used.

Moose habitat and small animal studies will involve ground work within the impoundment areas and along the mainstem Susitna below the impoundments. Timing, specific locations, and amount of ground work will depend on final project design, however, it is anticipated that it will be limited to small temporary camps with two to six persons. Access will probably be by helicopter, fixed-wing aircraft, and boat. Disturbance to the area will be limited to that which normally occurs during browse studies and small animal trapping. Long-term effects will be minimal.

EXISTING ENVIRONMENTAL SETTING

PHYSICAL CHARACTERISTICS

General

Three glaciers flow down the southern flanks of the Alaska Range near 13,832-foot Mount Hayes to form the three forks of the upper Susitna River. These forks join to flow southward for about 50 miles through a network of channels over a wide gravel flood plain composed of the coarse debris discharged by the retreating glaciers. The cold, swift, silt-laden river then curves toward the west where it winds through a single deep channel, some 130 miles through uninhabited country, until it reaches the Alaska Railroad at the small settlement of Gold Creek.

After the Susitna leaves the confinement of Devil Canyon, the river's gradient flattens. The river then turns south past Gold Creek, where it flows for about 120 miles through a broad silt and gravel filled valley into Cook Inlet near Anchorage, almost 300 miles from its source.

The upper Susitna River is a scenic, free flowing river with very few signs of man's presence. The extreme upper and lower reaches of the Susitna occupy broad, glacially scoured valleys. However, the middle section of the river, between the Denali Highway and Gold Creek, occupies a stream cut valley with extremely violent rapids in Devil Canyon.

The principal tributaries of the Susitna in the upper basin are the silt-laden Maclaren, the less turbid Oshetna, and the clear-flowing Tyone. Numerous other smaller tributaries generally run clear.

High summer discharges are caused by snowmelt, rainfall, and glacial melt. The main streams carry a heavy load of glacial silt during the high runoff periods. During the winter when low temperatures retard water flows, streams run relatively silt free.

Much of the upper Susitna River basin is underlain by discontinuous permafrost. The area above and below the Maclaren River junction with the Susitna is generally underlain by thin to moderately thick permafrost. Maximum depth to the base of permafrost in this area is about 600 feet. Around the larger water bodies, such as lakes, permafrost is generally absent. In some areas of the lower section of the upper Susitna basin, permafrost is not present.

Most of the Susitna basin above Devil Canyon is considered to be potentially favorable for deposits of copper or molybdenum and for contact or vein deposits of gold and silver, although much of the drainage basin has never been geologically mapped. The Alaska State Department of Natural Resources states that there are "active" and "nonactive" mining claims in the upper Susitna River drainage area between Devil Canyon and the Oshetna River.

The climate of the basin is characterized by severe winter temperatures and warm summers. Temperature extremes are estimated at minus 54° F and plus 89° F. Normally, the first freeze occurs early in September, and the last freeze occurs in mid-May. Mean annual precipitation in lower elevations of the basin are estimated to range between 18 and 22 inches, while precipitation in higher elevations, because of

orographic effects, reach 80 inches per year. Mean annual snowfall ranges from 60 inches in the lowlands to as much as 400 inches in the high mountains. Freezeup in the highest reaches of the Susitna River starts in early October, and by the end of November the lower regions of the river are icebound. The river breakup begins in early May, and within 2 weeks of breakup, the river tributaries are free of surface ice.

Esthetics

That portion of the project area contained within the upper Susitna River basin is a pristine landscape of high esthetic value which is almost devoid of signs of man's presence. Some minor visual disturbances of the "natural" condition can be observed such as cabins and trails, however, these are scarce. For the most part, this area could best be described as wilderness.

The transmission corridor portions of the project area have relatively less esthetic value. Much of these areas will be adjacent to existing developments such as the Alaska Railroad and the Parks Highway which serve to lower esthetic value. In addition, much of the terrain along the proposed transmission corridors is flat and blanketed with a fairly uniform mosaic of spruce, hardwoods, and muskeg.

It is important to note that an esthetic evaluation of this sort is entirely subjective in nature and can only deal with those values which are considered to be pleasing by the majority. There will always be a portion of the population which "marches to a different drummer"

and considers esthetically pleasing areas which are at odds with the opinions of the majority.

Executive Order 11988 (Flood Plain Management)

The proposed activities are not deemed to be an "activity" as defined in Executive Order 11988, therefore, considerations or evaluations under this order are not required.

Preliminary Section 404(b) Evaluation

A preliminary Section 404(b) evaluation is provided as Appendix A.

Other

The portion of the proposed project area within the upper Susitna River basin is virtually untrammelled by man. For this reason, water and air quality are high and background noise levels are low. In those portions of the proposed project area nearer man's activities water and air quality may be lower and background noise levels may be higher.

BIOLOGICAL CHARACTERISTICS

Fish

Both anadromous and resident fish inhabit the proposed project area. Baseline fisheries inventories were conducted by the Alaska Department of Fish and Game (ADF&G) in the upper Susitna River during the 1974-1977 field seasons, however, little information is available for the remainder of the project area.

The Susitna River basin is recognized as important habitat for five species of Pacific salmon (chinook, coho, chum, pink, and sockeye).

Although total escapements have not yet been derived, according to ADF&G, a significant percentage of the Cook Inlet salmon run migrates into the Susitna River basin. No salmon migrate above Devil Canyon.

Grayling, rainbow trout, Dolly Varden, burbot, lake trout, whitefish, sucker, and sculpins are some of the more common and important resident fish species present within the proposed project area. Past studies have provided some preliminary fisheries data, however, detailed population, distribution, or habitat data is not available.

Mammals

Mammals and birds found within the proposed project area are representative of wildlife species common to interior Alaska.

One of the most significant wildlife resources of the area is the Nelchina caribou herd. Segments of this herd range throughout much of the upper Susitna River basin and along the northern transmission corridors. The major calving area for the herd is on the northeast slopes of the Talkeetna Mountains on the upper reaches of the Kosina Creek, Oshetna River, and Little Nelchina River drainages. Calving generally takes place between mid-May and mid-June. Except for intermittent seasonal migration routes across the Susitna River in areas upstream from Tsusena Creek, caribou are not resident to the main Susitna River canyon between Devil Canyon and the Oshetna River. Caribou depend upon climax range, expecially for winter forage; alteration of the vegetation, especially of sedges and lichens, has a detrimental impact upon their distribution and numbers. A trait of the

Nelchina herd is an almost constant change of winter ranges, a phenomenon that has undoubtedly characterized Alaska's caribou populations for centuries. The Alaska Department of Fish and Game considers the Nelchina herd to be one of the State's most important caribou populations. Several thousand hunters from Anchorage and Fairbanks participate in the annual hunting of this species, and thousands of nonhunting recreationists view the migrations of caribou as they cross the State's major highways. In addition, the herd provides sustenance to predators and scavengers such as wolves, grizzly bears, black bears, wolverines, lynx, and various species of birds.

Moose range throughout the proposed project area. Populations have been declining since the early 1960's because of loss of productive browse habitat, increasing predator populations and several severe winters. ADF&G estimates that the Susitna basin resident moose population falls between 4,000 and 5,000 animals (1977). These animals depend heavily upon the river bottoms and adjacent areas for winter habitat and calving areas.

Grizzly or brown bears are common throughout the proposed project area and are fairly numerous in the upper Susitna basin. Alpine and subalpine zones are the habitats most frequently used by grizzles, although the more timbered areas are seasonally important. Grizzles are adversely effected by contact with man and are sensitive to aircraft noise.

Black bears are fairly common throughout the forested and semi-forested portions of the proposed project area. River bottoms, lake

shores, and marshy lowlands are favored black bear habitat. Black bears are not as adversely affected by contact with man as are grizzlies.

Dall sheep are present in many areas of the Alaska Range, Talkeetna Mountains, and in the higher elevations of the Susitna River basin. The greatest concentrations of Dall sheep in the Susitna basin occur in the southern portions of the Talkeetnas; herds become scattered on the northern portion of the range, where parts of the mountains are uninhabited by sheep. Dall sheep are also found in the Watana Hills. Because of the relatively gentle nature of much of the Talkeetna Mountains and Watana Hills, predation in this area has more effect on sheep numbers than in more rugged habitats. Sheep have always furnished some of the diet of wolves and other carnivores in this area. Hunting pressure for rams is fairly heavy due to relatively good access from highways, by air, and by ATVs (all-terrain vehicles). Nevertheless, as is true elsewhere in the State, ram-only hunting seems to have little effect on overall numbers. Sheep populations are almost entirely controlled by natural factors such as habitat, weather conditions, predation, and disease. Conflicts between man's activities and critical sheep habitat, such as lambing or wintering areas, can adversely impact Dall sheep populations, in that sheep are extremely sensitive to noise.

Mountain goats occur in low numbers in various areas of the Talkeetna Mountains and in the Watana Hills area. Goats generally inhabit rougher terrain than do Dall sheep, and are thus less susceptible to man's activities.

Wolves occur throughout the proposed project area. Populations are subject to rapid fluctuations because of prey abundance fluctuations. If 1976, ADF&G estimates of wolf density in the Nelchina basin were approximately 1 wolf per 70 square miles. Hooved mammals such as moose, caribou, and sheep are the major source of food for wolves although small mammals are occasionally important. Wolves are closely tied to large mammals. Small changes in the distribution and abundance of large mammals may have long-range impacts on wolf predation patterns, and small changes in predation patterns may have long-range impacts on the distribution and abundance of large mammals.

Almost all species of fur bearers common to Alaska occur in the proposed project area. Beaver, otter, mink, and muskrat are the most prominent species in riparian and aquatic habitats. Wolverine, lynx, coyote, red fox, marten, weasels, squirrels, and marmots are common in upland forest and alpine habitats. Population levels and trends of carnivorous fur bearers are closely tied to prey species.

Birds

The east-west stretch of the Susitna River between the Tyone River and Gold Creek is a flyway for waterfowl. The majority of the waterfowl nesting areas in the upper Susitna River basin are on the nearby lakes of the Copper River lowland region, on the Tyone River and surrounding drainage areas, and on the ponds and lakes of the wide flood plain in the Denali area. The upper Susitna River basin has a moderate amount of use by waterfowl when compared with the lower Susitna River

basin. The lower basin has a substantially greater amount of waterfowl habitat, and a greater number and variety of waterfowl seasonally use the thousands of lakes and ponds in the this area to nest and to raise their young. Large numbers of migrant birds also use the lower Susitna River basin for feeding and resting during spring and fall flights to and from Alaska's interior and north slope.

Raptors which occur within the proposed project area include the bald and golden eagles, osprey, red-tailed, Harlan's, rough-legged and Swainson's hawks, marsh hawk, goshawk, sharp-shinned hawk, gyrfalcon, and the great-horned, great-gray, snowy, hawk, boreal and short-eared owls. Peregrine falcons have occasionally been sighted within the area and along migration routes through the Broad Pass area of the upper Chulitna River.

Vegetation

Within the proposed project area are found six of the major vegetative ecosystems of Alaska. The lowland spruce hardwood forest type is found along the upper Susitna River and along the southern portion of the Nenana River. The bottom land spruce poplar forest type occurs adjacent to the lower Susitna River, and along the northern portion of the Nenana River. The low brush, muskeg-bog type is found in isolated locations in the extreme northern portion of the transmission corridor near Fairbanks, and in the southern portion of the transmission corridor near Big Lake. The moist and alpine tundra types are found in the upper Susitna River basin.

Threatened or Endangered Species

The only animal species classified as threatened or endangered which may migrate through or reside in the project area are the two subspecies of the peregrine falcon: Falco peregrines anatum (American) and Falco peregrines tundrius (arctic). There are no threatened or endangered plant species known to occur within the project area.

CULTURAL CHARACTERISTICS

Access

The Alaska Railroad runs from Seward through Anchorage and up the lower Susitna valley. It crosses the Susitna River near Gold Creek, and then runs past Mount McKinley National Park and on to Fairbanks.

Paved roads in the region include the 358 mile Parks Highway between Anchorage and Fairbanks, the 328 mile Glenn Highway connecting Anchorage with Tok Junction, and the 266 mile Richardson Highway than runs from Valdez to Delta Junction, 97 miles southeast of Fairbanks.

The only road access through the upper Susitna basin is the 135 mile gravel Denali Highway between Paxson on the Richardson Highway and Cantwell on the Parks Highway, and the 20 mile gravel road from the Glenn Highway to Lake Louise. The Denali Highway is normally not open for use during the winter months.

Several small remote landing strips are scattered throughout the basin, and float planes utilize many lakes and streams to ferry freight and passengers to the remote backcountry areas.

ATV's and other types of off road vehicles provide transportation into areas in the upper Susitna basin where there are no developed

roads. Several trails exist which are utilized by ATV's, trail bikes, hikers, horseback riders, and winter travelers. Of special note are two trails proposed for possible use in this action. One is the trail built by the Bureau of Reclamation in the 1950's. Constructed to support an exploration program at the Devil Canyon damsite, it extends from the Alaska Railroad at Gold Creek to Devil Canyon. The trail is currently used over its western two-thirds to support mining activity. There also exists a less well developed ATV trail that begins at the Denali Highway near Butte Lake and heads southwest for about 12 miles before it fans out into several barely distinguishable branches. This trail was used in March 1977 to transport equipment to the Watana site. Two cat trains were passed over the trail with some minor impacts, such as vegetation damage or destruction, resulting. The trail was reseeded and fertilized at the end of the field activities.

Shallow draft river boats, small boats, canoes, rubber rafts, and kayaks utilize sections of the upper Susitna River, as well as a few tributary streams, mostly above the confluence of the Tyone River.

Public Use

The greatest constraint to public use of the upper Susitna River basin is the shortage of road access. As a result, float planes are used to fly in hunters, fishermen, and other recreationists to various areas within the basin, but, except for a few larger isolated lakes, this form of access is relatively minor. All-terrain vehicles and snowmobiles also provide off road access to areas within the upper

Susitna basin. Boats are used to some extent to provide access on the Tyone River drainage and to areas of the Susitna River between the Denali Highway and Devil Canyon. Much of the upper Susitna River basin has very little recreational activity at the present time. Great distances, rough or wet terrain, and lack of roads limit use of most of this area to a relatively few.

Though limited, the major recreational use of the upper Susitna area is big-game hunting and associated recreational activities. The greatest hunting pressures are exerted from a few fly-in camps, and from areas along the Denali Highway. Most wolves and bears harvested are taken while hunting caribou or moose. The increased use of ATVs to provide access and to haul big game is a significant factor in improved hunting success, even in the face of declining game populations. The mechanized ATV can penetrate deeply into previously inaccessible country, leaving few areas that provide havens for the reduced numbers of caribou and moose. The hunting of Dall sheep, mountain goats, and waterfowl is minimal in the upper basin even in areas of road access such as the Denali Highway.

Access is again the major factor in determining areas that are utilized in fishing for grayling, rainbow trout, whitefish, and lake trout. The Susitna and Maclaren Rivers are silt laden throughout their entire courses during the warmer months of the year. Sport fishing is limited to lakes, clear water tributaries, and to areas in the main Susitna near the mouths of these tributaries. Sport fishing

pressure in the upper Susitna basin is light. Many lakes and some areas of the river afford landing sites for float equipped aircraft. A few areas along the main Susitna and some tributaries, such as the Tyone River and Lake Louise, have some pressure from boat fishermen. An increasing number of hunters use ATVs to get into and out of the back country, exerting incidental fishing pressure in some areas. Salmon do not migrate into the upper Susitna River above Devil Canyon so they are not a factor in the sport fishery of this area.

A minor amount of recreational boating occurs in the waters of the upper Susitna basin. Some lakes such as Lake Louise have a heavier amount of boating activity, and some rivers such as the Tyone and the Susitna have a lighter amount of boating activity. Some kayakers utilize portions of the main Susitna River, but very few have braved the difficult waters of the Susitna through Devil Canyon.

Most camping use in this area is incidental to other recreational activities such as hunting, fishing, boating, and highway travel. Most other recreational activities in the upper Susitna River basin exert varying environmental impacts on the area. Many activities such as hiking, backpacking, and photography take place incidentally to other recreational pursuits such as hunting, fishing, boating, camping, and driving for pleasure. Trail bikes, snowmobiles, 4-wheel drive vehicles, and other mechanical equipment can cause extreme adverse environmental damage to the fragile ecosystems of the basin when used in a careless, uncontrolled manner.

At the present time, recreation is one of the major uses of the upper Susitna River drainage area, but the overall utilization of this area by humans remains comparatively light.

Public use of the remainder of the project area (those portions of the proposed transmission corridors outside of the upper Susitna River basin) is somewhat heavier because access is made easier by the presence of roads and the Alaska Railroad.

Historic Resources

The current National Register of Historic Places has been consulted, and no National Register properties will be affected by the exploration and survey program. A historical-archeological study completed for the Corps of Engineers by the Alaska Division of Parks (Heritage Resources Along the Upper Susitna River, August 1975) indicates 11 historic sites within the study portion of the upper Susitna basin. These are all essentially related to the discovery of gold. Most of the early mining activity occurred on Valdez Creek, where the town of Denali was established. Nine of the sites are located in that general area. Two sites, both designated as cabins, are located on Kosina Creek, one near its mouth, and one about 6 miles upstream. The apparent lack of historical locations between Devil Canyon and the Maclaren River is explained by the following excerpt from the Alaska Division of Parks' report (in discussing the first mapping of the area in 1912): "Except for a few prospects on the Oshetna River, the USGS never received any reports of gold being found on the Susitna between Devil Canyon and the Maclaren

River in significant quantities. Though the Tanaina and Ahtna Indians did a great deal of hunting and fishing on the river in this area, the white man found little gold, an almost unnavigable river, and no reason to settle anywhere near the 'Devil's Canyon'."

A 1978 archeological survey conducted by the Corps of Engineers resulted in the finding of one historic site. A log crib of unknown significance was discovered at the Watana site. Archeologist, Glenn Bacon in his report "Archeology in the Upper Susitna River Basin 1978", states that "Recent historic utilization of the area appears to be very limited and probably insignificant."

Archeological Resources

Archeological surveys conducted by archeologist Glenn Bacon for the Corps of Engineers during 1978 in the Watana and Devil Canyon areas resulted in the discovery of several previously unknown archeological sites. The sites discovered have not been nominated for inclusion in the National Register. According to "Archeology of the Upper Susitna River Basin 1978", although the sites discovered do little to improve the local data base, they do indicate that prehistoric use of the area "appears to have been considerable". It is reasonable to assume that the 1978 survey "detected only a tiny part of the total range of task specific sites...utilized by prehistoric populations. This indicates that the site density of both project areas (Devil Canyon and Watana) is going to be high. On reflection this should not be too surprising, since the Tangle Lakes Archeological District

is not too far distant. The Tangle Lakes District was entered on the National Register, in part, because it is reported to exhibit one of the highest archeological site densities in North America."

The National Register was consulted for sites within the proposed transmission corridors. One site, the Dry Creek archeological site, in the vicinity of Lignite is near the northern portion of the proposed corridor.

Land Use/Status

Lands within the upper Susitna River basin (Figure 10) are essentially in large block ownership with the majority under the control of the Department of the Interior, Bureau of Land Management (BLM). These lands are generally in their natural state and undeveloped with improvements or land access routes. Air transportation is the primary means of access to and within the area. There are some scattered small parcels of land in private ownership as homestead sites or mining claims. Many of these private parcels have no developed overland access. For the most part, development in the area is concentrated along the established transportation routes such as the Parks Highway and the Alaska Railroad on the west and the Denali Highway on the north.

Because of the absence of roads and other development in the basin, the area has high wilderness value potential. The area includes approximately 5 million acres of lands that show little or no sign of man's presence except for fringe areas along established transporation routes and isolated mining or recreational development. The area is geographically

located in the center of the most highly developed and populated portion of the State. The Anchorage area to the south is the population center of the State and Fairbanks, across the Alaska Range to the north, is the second most highly developed and populated area. The Alaska Highway to the east is the primary overland route to the State from Canada and the contiguous 48 States. The transportation links between Anchorage and Fairbanks are the Parks Highway and the Alaska Railroad to the west and the Richardson and Glenn Highways to the east and south. The Alaska Range is a natural barrier on the north and the Denali Highway parallels the range connecting the Parks Highway and the Richardson Highway to form an access system on the northerly side of the subject area. These transportation systems surround the area and make it one of the most potentially accessible wilderness areas in the State.

The wilderness characteristics of the area also inhibit use because of the lack of transportation facilities within the area. Given man's dependence on motorized transporation and the severity of the Alaskan climate, the area is simply too large to attempt entry without mechanization of some sort. Since there are relatively few people who have access to air transportation or long-range ATVs, the area's use by man is extremely limited, and then primarily to the fringes. Transportation by water that might otherwise be provided by the Susitna River is limited because of the natural barrier created by the extremely rough water through Devil Canyon. Another factor that tends to limit the use of the area as a wilderness is the wilderness characteristic of the State

as a whole. Wilderness conditons can be encountered within a few miles of almost any development in the State, including metropolitan Anchorage.

Most of the public lands in the basin have been selected by Native corporations under the Alaska Native Claims Settlement Act (ANCSA), P.L. 92-203, 18 December 1971. These selected lands remain under the jurisdiction of BLM pending final conveyance of fee simple title to the various Native corporations. Any use of these lands prior to conveyance of title is subject to specific permission from BLM.

The gross land area required for containment of the proposed Devil Canyon and Watana reservoirs is approximately 157,440 acres. Of this land, 67,200 acres are to be conveyed to the Cook Inlet Region, Incorporated (CIRI) for later reconveyance to various village corporations. This transfer of lands is directed by a 1976 amendment to ANCSA, P.L. 94-456 and will include both the surface and subsurface interests. This transfer also includes lands within Power Site Classification No. 443 which was established in 1958 for potential future development of the Susitna River for hydroelectric power production.

In addition to the lands discussed above, as many as 53,760 acres have been selected for conveyance to satisfy any deficiencies that may exist in total acreage entitlements under ANCSA. These "deficiency" selections in the area have a selection priority of nine (9) and, in all probability, will not be conveyed to CIRI on behalf of the village corporations. These lands have, however, been overselected by CIRI

for its own benefit and could conceivably be conveyed to CIRI. A portion of these lands south of the Susitna River (24,686 acres) has been made available for selection by the State of Alaska pursuant to the agreement titled "Terms and Conditions for Land Consolidation and Management in the Cook Inlet Area" (Cook Inlet Land Swap Agreement) The State's right to select these lands for conveyance is superior to that of CIRI but is inferior to valid village corporation selections. Since the village corporation selections are priority nine (9) it is probable that the State could receive the title to the lands.

The remaining area within the proposed reservoir boundaries (36,480 acres) is controlled by BLM and has been withdrawn from appropriation for either study and classification or for selection by CIRI as a "deficiency" selection area. Again, this "deficiency" selection is an excess, or overselection, to make lands available for satisfaction of total acreage entitlements. Conveyance of any portion of such selected lands is limited to fulfillment of acreage entitlements and is indeterminable at this time. As discussed above, the State of Alaska will have a right to select a portion of this area south of the Susitna River (5,120 acres), and such a selection would be superior to that of CIRI.

The lands discussed above that have been selected by various Native corporations are considered to have been withdrawn from the public land system to be held for the benefit of Alaska Natives pending final disposition in accordance with ANCSA. This withdrawal from the public

land system precludes the requirement for formal wilderness area studies under Section 603 of BLM's Land Policy and Management Act. Upon final settlement of land entitlements under ANCSA, the lands not conveyed to Native groups will revert to a study classification. Under this classification, the lands could be made available for selection by the State under the Alaska Statehood Act. This again would remove the lands from the public lands system and preclude the wilderness area study requirements. Lands remaining after conveyance to the State of eligible selected lands would revert to a study classification wherein BLM could apply its normal procedures to study the alternatives available for use of uncommitted public land under Federal management.

Pursuant to P.L.O. 5653, November 16, 1978, lands along the Susitna River upstream from Gold Creek near the Alaska Railroad were withdrawn from all forms of appropriation and entry for protection of potential wild and scenic river values. This withdrawal included all lands within 2 miles of the ordinary high water mark on each bank of the river. This withdrawal was made subject to valid, existing rights and interests in land within the boundaries of the included area. Since much of the land along the river is selected by Native corporations, there appeared to be a valid, existing interest that required an interpretation of the intent of the P.L.O. Because the 2 mile wide corridor along the river contained Native land selections with varying degrees of merit, it was determined by BLM that the only lands that should be exempted from the operation of P.L.O. 5653 were those that were committed

for conveyance to CIRI pursuant to P.L. 94-456. Of particular concern in this report are those lands of this type located in Township 32 North, Range 5 East. All lands outside the boundaries described in Appendix A and B of the agreement dated 31 August 1976 between CIRI and Thomas S. Kleppe, Secretary of the Interior, but within the boundaries of the 2 mile wide corridor, would be subject to the operation of P.L.O. 5653.

The above discussion of land relates to the proposed reservoir area and does not account for lands necessary for access roads and transmission line corridors. There are various alternatives available for the location of these facilities and a discussion of land use and status must be of a general nature. Generally, the lands immediately surrounding the proposed reservoir are as discussed above, i.e., to be conveyed to Native groups. Lands to the west of the proposed project are subject to the influence of enhanced access that is provided by the Alaska Railroad and the Parks Highway. These lands are predominately State and privately owned and are not subject to Federal land management regulations.

Demography

The southcentral railbelt area of Alaska contains the State's two largest population centers, Anchorage and Fairbanks, and 73 percent of the State's total population. Population figures for 1976 show that 413,289 people live in Alaska, with 301,250 of these living in the railbelt area. The rapid population growth of the past in Alaska

is expected to continue, especially in the railbelt area. With the possible relocation of Alaska's capital from Juneau to Willow, an additional population impact will be exerted on this area of the State. At the present time, only a few small settlements are located along the Parks Highway between Anchorage and Fairbanks and the Alaska Railroad in the Susitna River valley. Talkeetna, located at the confluence of the Talkeetna and Susitna Rivers, is an important tourist and and recreation center. Except for the small settlement at Denali, there are few permanent full-time residents in the upper Susitna River basin above Devil Canyon.

Economics

The southcentral region of Alaska includes the Kodiak-Shelikof area, the Cook Inlet area, and the Cooper River-Gulf of Alaska area. The southcentral railbelt area is that portion of the southcentral and Yukon subregions that is served by the Alaska Railroad. Both Anchorage and Fairbanks are regional economic centers for the southcentral railbelt area. Government, trade, and services comprise the major portion of the area's total employment. Construction and transportation are also important. Making relatively less significant contributions are the financing, mining, and manufacturing industries, while agriculture, forestry, and fisheries contribute less than 1 percent of the employment dollar to the economy of the railbelt area.

PROBABLE ENVIRONMENTAL IMPACTS AND POSSIBLE MITIGATION MEASURES

PHYSICAL CHARACTERISTICS

Esthetics

One of the most significant impacts of the proposed activity will be related to visual quality in that the activities will degrade local areas within the upper Susitna River basin which presently show little sign of man's presence. Areas along the proposed transmission corridor will be impacted to a lesser extent because of the more numerous signs of man's presence.

The foundations and materials and field camp activities will result in both short-term and long-term esthetic impacts. Many of these impacts can be minimized by recontouring and reseeding disturbed areas, however, the impacts cannot be entirely obliterated. Signs of man's presence will be reflected in the fragile tundra vegetation for many years to come. The fact that the visual degradation will be local in nature and will be seen by few people will also serve to mitigate the impacts to some degree. Other activities of lesser scope such as hydrology and survey will cause visual impacts of a local and temporary nature.

Air Quality

Aircraft and ground vehicles will cause minor degradation of air quality in the immediate vicinity of the field camp and drilling sites within the project area. In addition, there will be some local degradation attributable to portable powerplants and petroleum fuels utilized for camp heating and cooking purposes. Air pollutants are expected

to be minor and localized and will cease with termination of activities and withdrawal of camps and equipment.

Water Quality

Wintertime activities will have essentially no impact on water quality while soils and water surfaces are frozen. Potential for water pollution will increase during the frost-free months although care will be taken in field camp, airstrip, and trail construction to minimize this possibility. Threats to water quality will essentially be wholly attributable to introduction of mineral or organic soil particles caused by these activities. No other organic pollution should occur. Fuels and chemicals will be stored and handled in a manner designed to prevent entry into water courses. Solid wastes will be disposed of by burning and/or removal from the area. Domestic liquid waste will be disposed of in compliance with Federal and State effluent discharge standards.

Noise

Unavoidable noise will be attributable to aircraft and ground vehicles required to move personnel and equipment to and from the field camp and exploration sites. This will be a source of periodically recurring noise as these particular activities are engaged in. A more constant source of noise will be related to equipment utilized in daily exploratory activities. However, this will be very localized, occurring only in the immediate vicinity of the dam and camp sites. Disturbance to humans will be limited primarily to workers associated with the project. Additional disturbance will occur to the relatively few people

expected to frequent the area for other purposes, such as hunting, fishing, or white-water boating. Impacts may be substantially more disturbing to wildlife in the area. This is more specifically addressed in a following section.

BIOLOGICAL CHARACTERISTICS

Fish

Although some unavoidable minor introduction of mineral or organic soil materials may occur to streams as a result of gravel borrow, drilling activities, and other actions which displace vegetation or disburb soil surfaces, there is no identifiable source of likely soil erosion significant enough to pose a potential threat to fishery resources. No other sources of pollution are likely to occur with implementation of the provisions envisioned for waste disposal, effluent discharge, and accidental spillage contingencies. Thus, no measurable impact to fishery resources are envisioned as a result of the proposed activities.

Mammals

Disturbances associated with construction and use of the winter trail and field camp, and exploration activities will have adverse impacts on large mammals inhabiting the project area. These disturbances will result from increased human activity, the operation of heavy equipment, and low-flying helicopters. The disturbances will be greatest in the Watana damsite area but will also occur to a lesser extent at the Devil Canyon damsite, along the access road corridors and along the transmission corridor.

Disturbances to wildlife will disrupt normal behavior patterns, will generate increased physiological stress and will force some species to vacate areas of activity. Studies have shown that disturbances during and immediately following birth can result in decreases in survival of the new born young in moose, caribou, and mountain sheep. During winter periods disturbances of large animals can cause increased mortality because animals are forced to expend more energy than they can consume.

Direct disturbances as well as physical disruption of habitat may result in the displacement of large mammals from the areas of concentrated activity. Animals displaced from existing habitat may not find suitable new habitat to support them in surrounding areas. It can be presumed that mammal populations in adjacent areas are in relative balance with their food and other habitat requirements and that no suitable unoccupied habitat exists to absorb displaced animals. If this balance does exist, displaced animals would be expected to succumb to natural mortality or to displace other resident animals. This may not be important to wide ranging species such as caribou or wolf but it may be significant to species with smaller ranges such as moose.

It is not expected that this will be significant to mammal populations in the area because disturbances will generally be concentrated at the Watana damsite, the Devil Canyon damsite, and along the winter trail, which are relatively small areas. Local populations may be impacted but the significance of these impacts is unknown.

The reestablishment of large mammal populations within activity areas following the activity will be dependent upon the level and type of disturbances which will remain. It is expected that large mammals will quickly reoccupy activity areas, however, depending on the rate of revegetation, their use of the areas may be diminished. This diminished use is not expected to be significant because of the small size of the areas.

Because of the limited research that has been done to date on the behavior of wild animals, the significance of the disruption of behavior patterns on the well-being of wildlife cannot be fully evaluated. The majority of the potential impacts will be temporary and will affect individual animals or small segments of the populations. Some of the impacts, however, may be far more significant, affecting basin animal populations over long-term periods. The exact nature and degree of long-term impact is unknown.

Small mammals will also be adversely impacted by disturbances produced by the proposed activity, however, these impacts are not expected to be significant.

Birds

Impacts to birds are expected to be minor. Noise and human activities may temporarily displace local populations of resident birds such as ptarmigan and grouse and some species of summer residents - mostly song birds. On the basis of presently known raptor use and populations, these species should be minimally effected since population densities

appear to be low within the river canyon area. Waterfowl, whose use of the canyon area is essentially limited to a flyway between the upper and lower Susitna basins, should not be impacted. Direct habitat loss to any bird species will be extremely minor.

Vegetation

Plant life potentially impacted by the proposed action is characteristic of six of the major vegetative ecosystems of Alaska.

Vegetation along the proposed winter trail is classified as either moist or alpine tundra. Utilization of the winter trail would destroy or damage vegetation along the 41 mile trail. Moist or alpine tundra would also be destroyed or damaged as a result of the field camp and foundations and materials activities at the Watana damsite. Some spruce and brush will also be cleared in the Watana area as well as at Devil Canyon.

Limited clearing of vegetation will be required along the proposed transmission corridor.

After individual activities are completed or at least after the cessation of the proposed activites, all disturbed areas will be recontoured, reseeded, and fertilized if required.

Threatened or Endangered Species

The only presently known threatened or endangered animal species which might be found in the area are the American and arctic subspecies of the peregrine falcon. These brids have been observed migrating through the basin, although no known nesting occurs within the proposed

hydropower project area. Unless nesting is discovered to occur within areas of immediate impact of proposed activities, there should be no adverse effect on these birds. Should nesting be found to occur, extreme care will be exercised in avoiding these sites. There are no known threatened or endangered plant species occurring within the project area.

CULTURAL IMPACTS

Access and Public Use

Existing access to the project area will not be significantly affected by the proposed activities. Construction of an airstrip at Watana may result in some increased attraction to aircraft. This might create some increased use by hunters, fisherman, and boaters although the effect on surrounding areas would be negligible due to lack of other forms of transporation. The proposed activities will have no significant impact on recreation use of the project area.

Historic Resources

On the basis of the historical record of man's recent activity in the canyon area of the Susitna River, there is no evidence of existing historic sites which would potentially be affected by the proposed activity.

Archeological Resources

The proposed activities are not expected to significantly impact archeological resources which may be found within the project area. Archeological surveys will be conducted before any activity which may

potentially impact archeological resources is allowed to proceed. If archeological sites are found, exploration activities will be conducted so as to avoid the sites.

Some preliminary studies were conducted by the Corps of Engineers during the fall of 1978 to clear areas at the Watana damsite which would be required for the proposed field camp, airstrip, and borrow area. No archeological resources were discovered.

Land Use/Status

The proposed activities are temporary in nature and minimal in scope with respect to land use and status. There is considered to be no impact on land status and very little, if any, impact on land use. The proposed activities will increase the presence of man in the work area with a corresponding degree of temporary pollution associated with his presence such as noise, dust, smoke, etc., but there is nothing planned that would significantly impact the long-term land use or status. Similarly, the proposed activities are considered to be neither an attractant nor a deterrent to customary use of the area.

Demography and Economics

The proposed activities are not expected to adversely impact the human population of surrounding areas or the economy of the area. Positive economic benefits will result in that money will be infused into Talkeetna in the form of lodging receipts, local labor wages, and other increased expenditures in the community.

RELATIONSHIP BETWEEN SHORT-TERM USE AND LONG-TERM PRODUCTIVITY

For the purpose of this environmental assessment, the short-term is defined as being that period of time in which the proposed activities will occur. The long-term is that period of time in excess of the short-term.

The potential for long-term environmental impacts as a result of short-term activities does exist and is recognized. This potential will be minimized by the activities being conducted as they are outlined in this report. Also their conduct will be in accordance with stipulations to be developed by BLM. These long-term impacts may reduce the biological productivity within the project area over the long-term, however, the nature or extent of such reductions is unknown. For example, increased human activity may disturb wildlife, particularly large mammals such as wolves, caribou, and moose. It may be that these disturbances will cause short-term changes in distribution, however, the relationship of these changes to long-term productivity or the exact nature or extent of these changes is unknown.

While the biological productivity of the area may be reduced over the long-term as a result of short-term project activities, other "types" of productivity may be increased. The proposed activities will increase scientific knowledge of the area which will aid in making future use decisions about the area.

The high wilderness potential of this area is recognized and all available means have been taken to assure that its suitability for preservation as a wilderness area is not impaired. The short-term use

proposed contemplates no permanent activity nor constructed facility that would degrade a potential wilderness area. Activities are scheduled to take advantage of natural protective characteristics of the area such as frozen ground, snow cover, and frozen water surfaces. There are no activities planned that are considered to have a significant impact on the long-term productivity of the area nor its' suitability for preservation as a wilderness.

IRREVERSIBLE AND IRRETRIEVABLE COMMITMENTS OF RESOURCES

Perhaps the greatest potential irreversible or irretrievable commitment of a natural resource is related to land use. If not conducted in such a manner so as to substantially reduce or minimize environmental impacts the proposed activity may commit the lands within the project area to a use which may not have been in the public interest. For example, construction of roads or other wilderness degrading activities may exclude the area from wilderness consideration. This potential is not expected to be realized, however, because the proposed activities will be conducted so as to reduce or minimize environmental degradation. If actions do result in degradation and the Susitna Hydropower Project is considered not feasible, the lands within the project area will be returned to as near a natural state as possible.

Other irreversible or irretrievable commitments of resources which would result from the proposed project include the expenditure of fossil fuels and labor.

PERSONS, GROUPS, AGENCIES CONSULTED

CONSULTATION

Interested persons, groups, State and Federal agencies will be consulted for input to this environmental assessment. A list of persons, groups and agencies consulted as well as a summary of significant input or opinions will be included as part of the final environmental assessment.

COORDINATION

The Bureau of Land Management (BLM) and the State of Alaska will enter into an agreement whereby study and exploration activities will be allowed to proceed on Federal lands. The BLM will provide stipulations which will regulate the proposed activity. It is anticipated that the stipulations will provide that both BLM and CE environmental monitors will approve any and all activities in an effort to minimize or eliminate unnecessary environmental impacts. Upon completion of the authorized exploration work, the Corps of Engineers may be required to restore access and work areas to as near their natural state as possible.

INTENSITY OF PUBLIC INTEREST

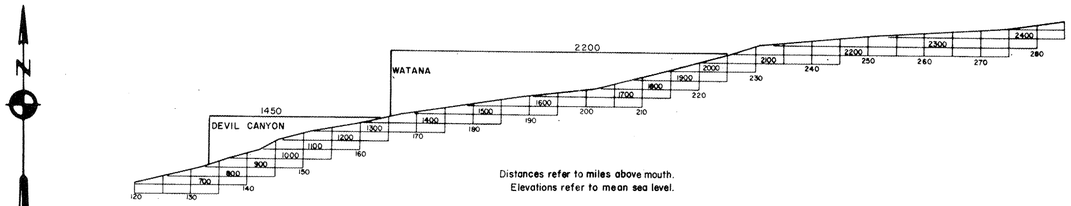
It is anticipated that public interest in the proposed activities will be extremely intense and that the proposed activities will generate a significant degree of controversy. Local, State, and possibly national interest both for and against the proposed activities is expected.

A summary describing the nature and level of interest in relation to interest groups will be completed after the public review period as per BLM regulations.

APPENDIX A

TABULATION OF FIELD ACTIVITIES ACCORDING TO SEASON AND YEAR OF ACCOMPLISHMENT

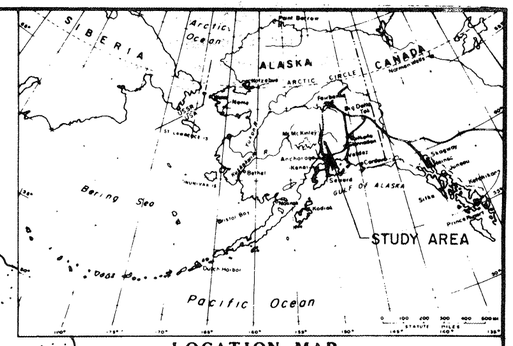
	Month												Year			
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	1	2	3	4
SURVEY																
Survey River Cross Sections	X	X	X									X	X			
Damsites, Reservoirs, Access Roads, Transmission Corridors				X	X	X	X	X	X					X		
HYDROLOGY																
Collect Climatic Data	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
Collect Water Data	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
Collect Wind Data	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
ENVIRONMENTAL																
Collect Physical, Chemical & Biological Water Data	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
RECREATION																
Develop Plans for Public Recreation & Resource Uses					X	X	X	X						X		
FOUNDATIONS AND MATERIALS																
Seismic Monitoring	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
Access Road Studies					X	X	X	X	X				X	X		
Transmission Line Studies					X	X	X	X	X					X	X	X
Watana Site Geology			X	X	X	X	X	X	X				X	X		
Watana Borrow Site Exploration & Testing	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	
Watana Design Testing	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
Watana Geophysical Investigation						X	X	X	X				X	X	X	X
Watana Features Design	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
Devil Canyon Geology			X	X	X	X	X	X	X	X					X	X
Devil Canyon Design Testing	X	X	X	X	X	X	X	X	X	X	X	X		X	X	X
Devil Canyon Aggregate Studies					X	X	X	X	X					X	X	X
DESIGN																
Site Inspections					X	X	X	X	X				X	X	X	
REAL ESTATE																
Aerial Field Inspections					X	X	X	X	X				X	X		
CULTURAL RESOURCES																
Archeological & Historical Site Recon					X	X	X	X	X	X			X	X	X	
FIELD CAMP																
Operate Field Camp	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
BIOLOGICAL STUDIES																
Anadromous & Resident Fisheries Studies	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
Wildlife Studies	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X



Distances refer to miles above mouth.
Elevations refer to mean sea level.

UPPER SUSITNA RIVER PROFILE

RIVER MILES 120–290



LOCATION MAP

BASIN BOUNDARY
To Fairbanks
To Cantwell
West Fork
East Fork
Valdez Creek
DENALI
Windy Creek
Butte Creek
Denali Highway
To Paxson
MACLAREN RIVER
Parks Highway
Alaska RR
Devil Canyon Access Road (Proposed)
Portage Creek
Devil Creek
DEVIL CANYON DAMSITE
Tsusena Creek
Deadman Creek
Watana Creek
Coal Creek
Jay Creek
GOLD CREEK
Cheechako Creek
Fog Creek
SUSITNA RIVER
WATANA DAMSITE
Watana Access Road (Proposed)
Kosina Creek
BASIN BOUNDARY
TYONE RIVER
Tyone Lake
Susitna Lake
Lake Louise
Lake Louise Road
To Glenn Highway
OSHETNA RIVER
TALKEETNA
To Anchorage

SCALE
0 5 10 15 20 Miles

LEGEND

RESERVOIR
ACCESS ROAD
TRANSMISSION ROUTE

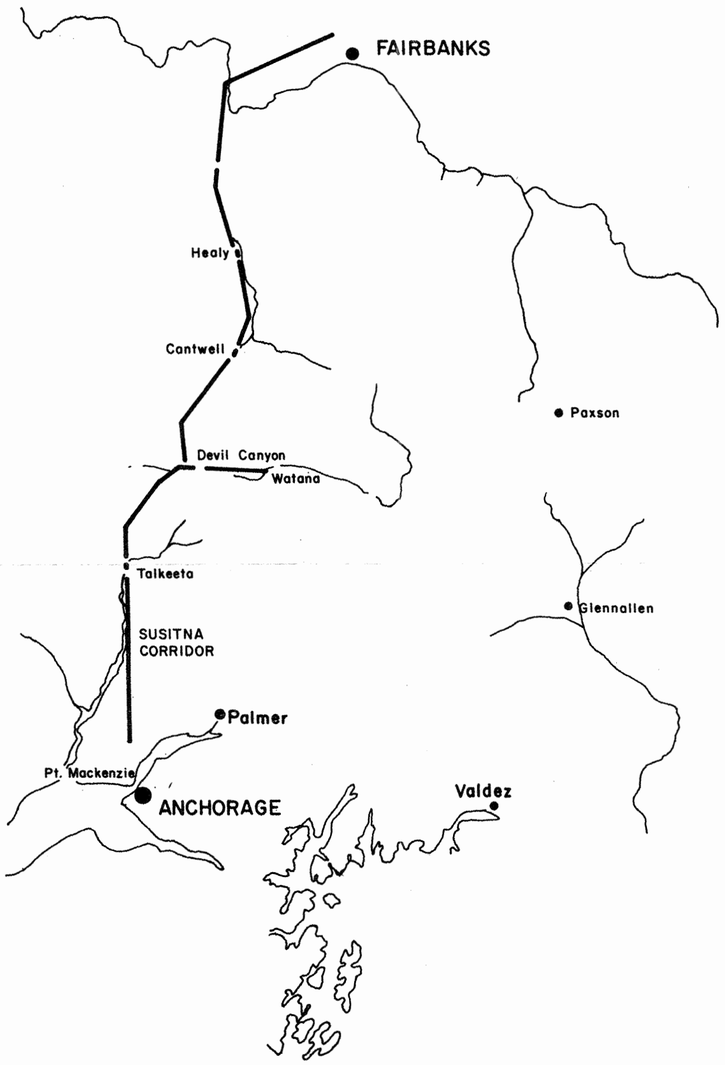
SOUTHCENTRAL RAILBELT AREA, ALASKA

UPPER SUSITNA RIVER BASIN

ALASKA DISTRICT, CORPS OF ENGINEERS
ANCHORAGE, ALASKA
DECEMBER 1978

EUGENE DIETZGEN COMPANY

FIGURE 1 791-79



SOUTHCENTRAL RAILBELT AREA, ALASKA

UPPER SUSITNA RIVER BASIN

PROPOSED TRANSMISSION CORRIDOR

ALASKA DISTRICT, CORPS OF ENGINEERS

ANCHORAGE, ALASKA

DECEMBER 1978

EUGENE DIETZGEN COMPANY

FIGURE 2

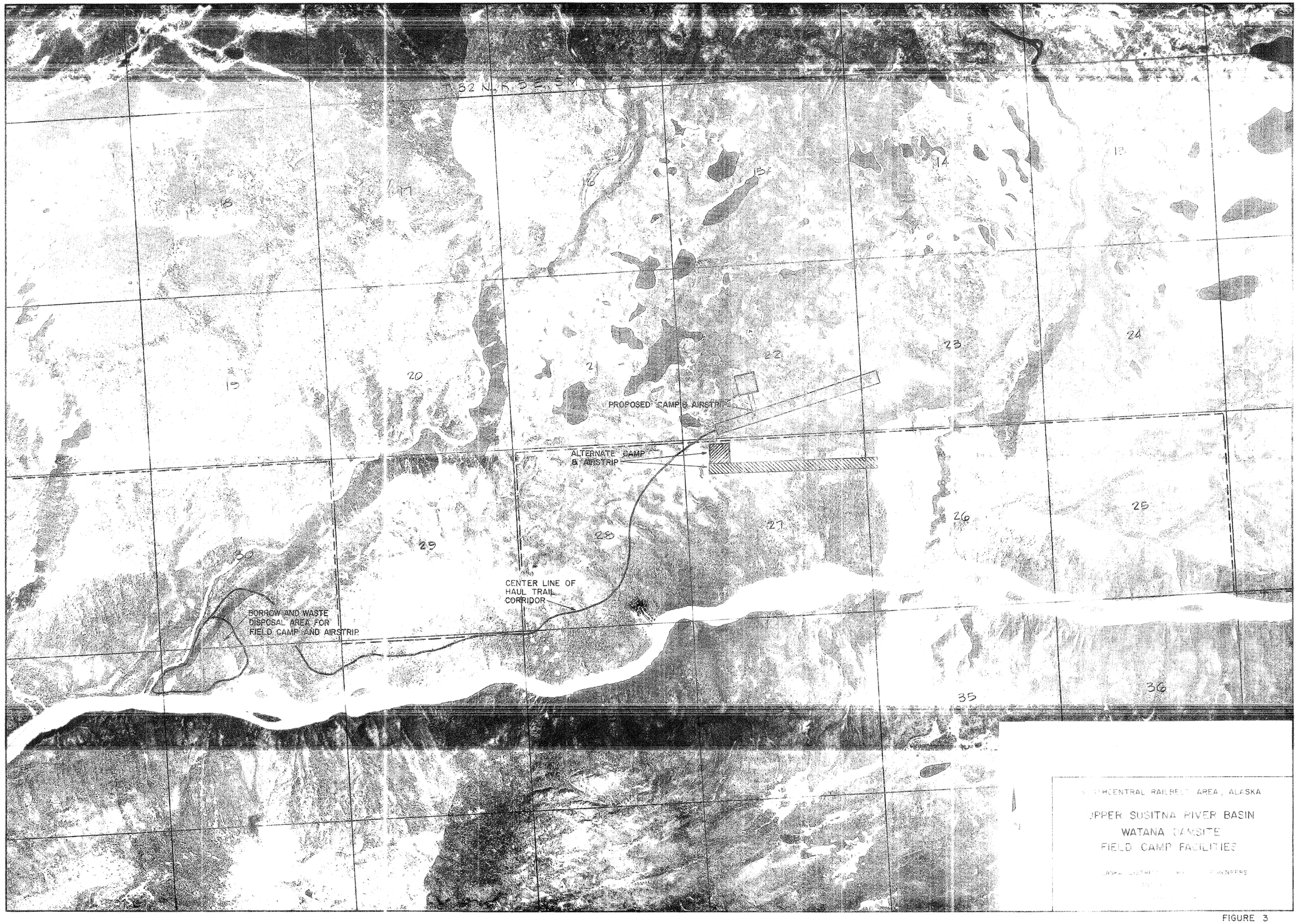
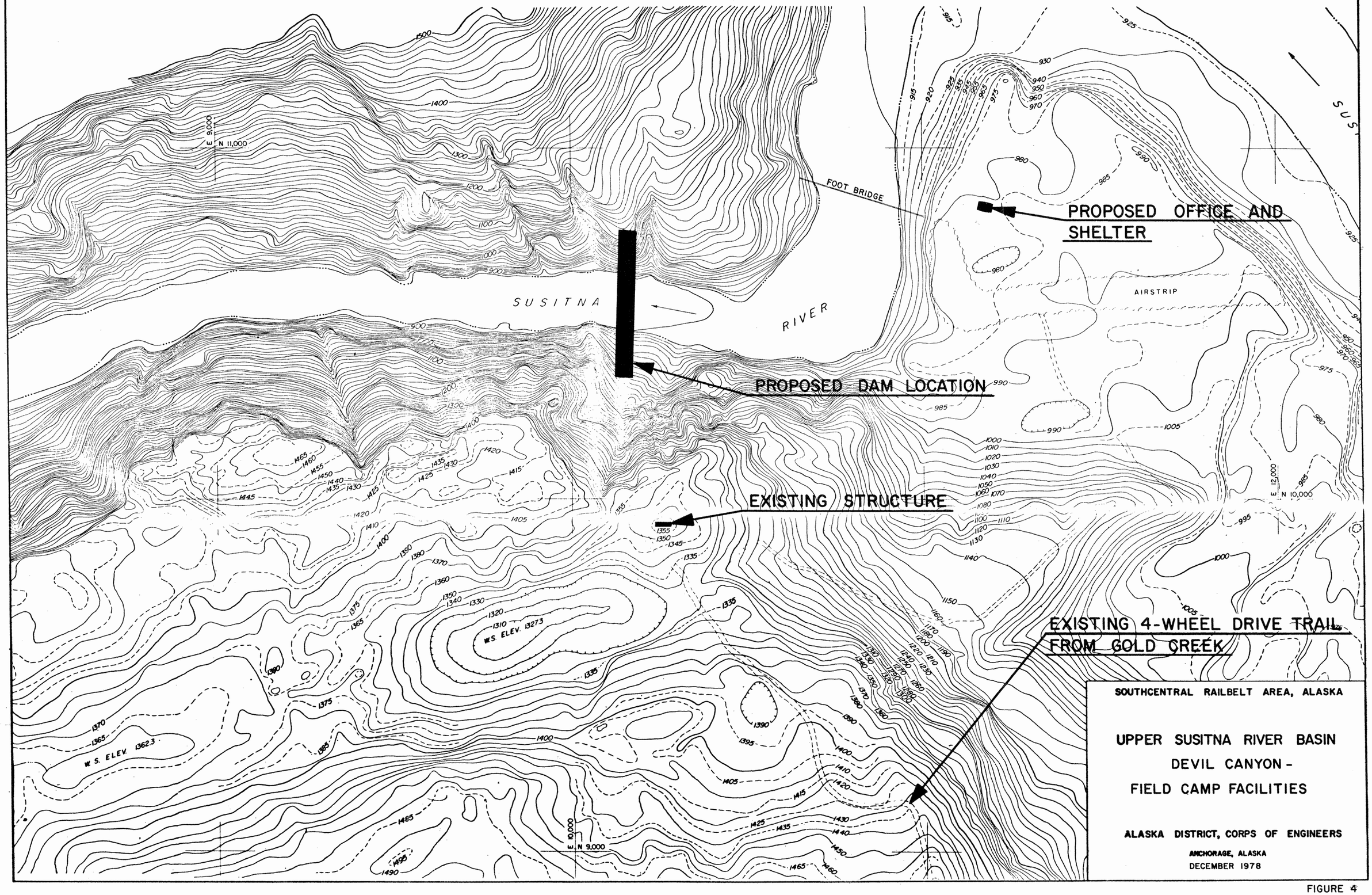

T32N, R3E, SM
PROPOSED CAMP & AIRSTRIP
ALTERNATE CAMP & AIRSTRIP
CENTER LINE OF HAUL TRAIL CORRIDOR
BORROW AND WASTE DISPOSAL AREA FOR FIELD CAMP AND AIRSTRIP
SOUTHCENTRAL RAILBELT AREA, ALASKA
UPPER SUSITNA RIVER BASIN
WATANA DAMSITE
FIELD CAMP FACILITIES

FIGURE 3



SOUTHCENTRAL RAILBELT AREA, ALASKA

UPPER SUSITNA RIVER BASIN
DEVIL CANYON - FIELD CAMP FACILITIES

ALASKA DISTRICT, CORPS OF ENGINEERS
ANCHORAGE, ALASKA
DECEMBER 1978

FIGURE 4

SOUTHCENTRAL RAILBELT AREA, ALASKA

UPPER SUSITNA RIVER BASIN

**PROPOSED ACCESS CORRIDOR -
DENALI HIGHWAY TO WATANA DAMSITE**

ALASKA DISTRICT, CORPS OF ENGINEERS

ANCHORAGE, ALASKA

DECEMBER 1978

EUGENE DIETZGEN COMPANY

FIGURE 5

LEGEND

- PROPOSED CLIMATOLOGICAL STATION
- EXISTING CLIMATOLOGICAL STATION
- STREAM GAGING STATION

CLIMATOLOGIAL STATIONS

C-1 EAST FORK OF SUSITNA
C-2 MONAHAN FLAT
C-3 MACLAREN GLACIER
C-4 CLEARWATER LAKE
C-5 LAKE LOUISE
C-6 LITTLE NELCHINA
C-7 SQUARE LAKE
C-8 DEADMAN LAKE
C-9 FOG LAKE
C-10 DEVIL CANYON

STREAM GAGING STATIONS

G-1 SUSITNA LODGE
G-2 MACLAREN RIVER
G-3 SUSITNA RIVER NEAR TYONE
G-4 TYONE RIVER

G-5 OSHETANA RIVER
G-6 SUSITNA RIVER NEAR WATANA

G-7 SUSITNA RIVER AT DEVIL CANYON
G-8 SUSITNA RIVER AT GOLD CREEK
G-9 SUSITNA RIVER NEAR SUNSHINE

G-10 SUSITNA RIVER NEAR CANTWELL

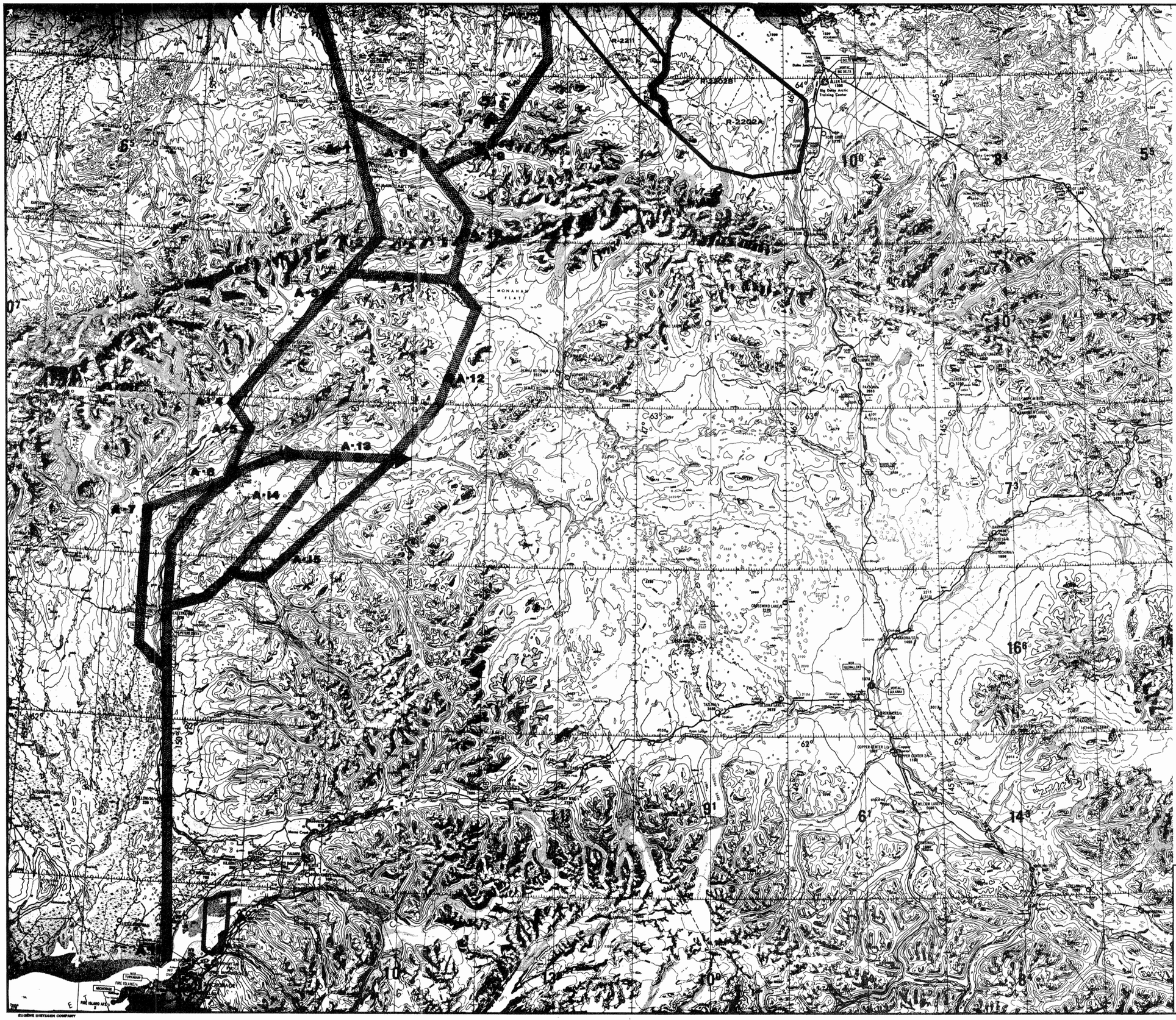
ELEVATIONS IN FEET

MILES
10 0 10 20 30

SOUTHCENTRAL RAILBELT AREA, ALASKA
SUPPLEMENTAL FEASIBILITY STUDY
UPPER SUSITNA RIVER BASIN
CLIMATOLOGICAL AND STREAMGAGING STATIONS

ALASKA DISTRICT, CORPS OF ENGINEERS
ANCHORAGE, ALASKA

EUGENE DIETZGEN COMPANY



ANEMOMETERS

A-1 MCKINLEY PARK
A-2 WINDY
A-3 SUMMIT
A-4 HURRICANE
A-5 CHULITNA
A-6 GOLD CREEK
A-7 CHULITNA RIVER
A-8 MOODY PASS
A-9 WOOD RIVER
A-10 WELLS CREEK
A-11 DENALI HIGHWAY
A-12 DEADMAN MOUNTAIN
A-13 WATANA / DEVIL CANYON
A-14 UPPER CHULITNA CREEK
A-15 TALKEETNA RIVER
A-16 SUSITNA FLATS

ELEVATIONS IN FEET

10 0 10 20 30

STATUTE MILES

SOUTHCENTRAL RAILBELT AREA, ALASKA
SUPPLEMENTAL FEASIBILITY STUDY
UPPER SUSITNA RIVER BASIN

ANEMOMETER STATIONS

ALASKA DISTRICT, CORPS OF ENGINEERS
ANCHORAGE, ALASKA

FIGURE 7

SOUTHCENTRAL RAILBELT AREA, ALASKA

UPPER SUSITNA RIVER BASIN

PROPOSED ACCESS ROUTE CORRIDOR -
CHULITNA TO DEVIL CANYON
DAMSITE TO WATANA DAMSITE

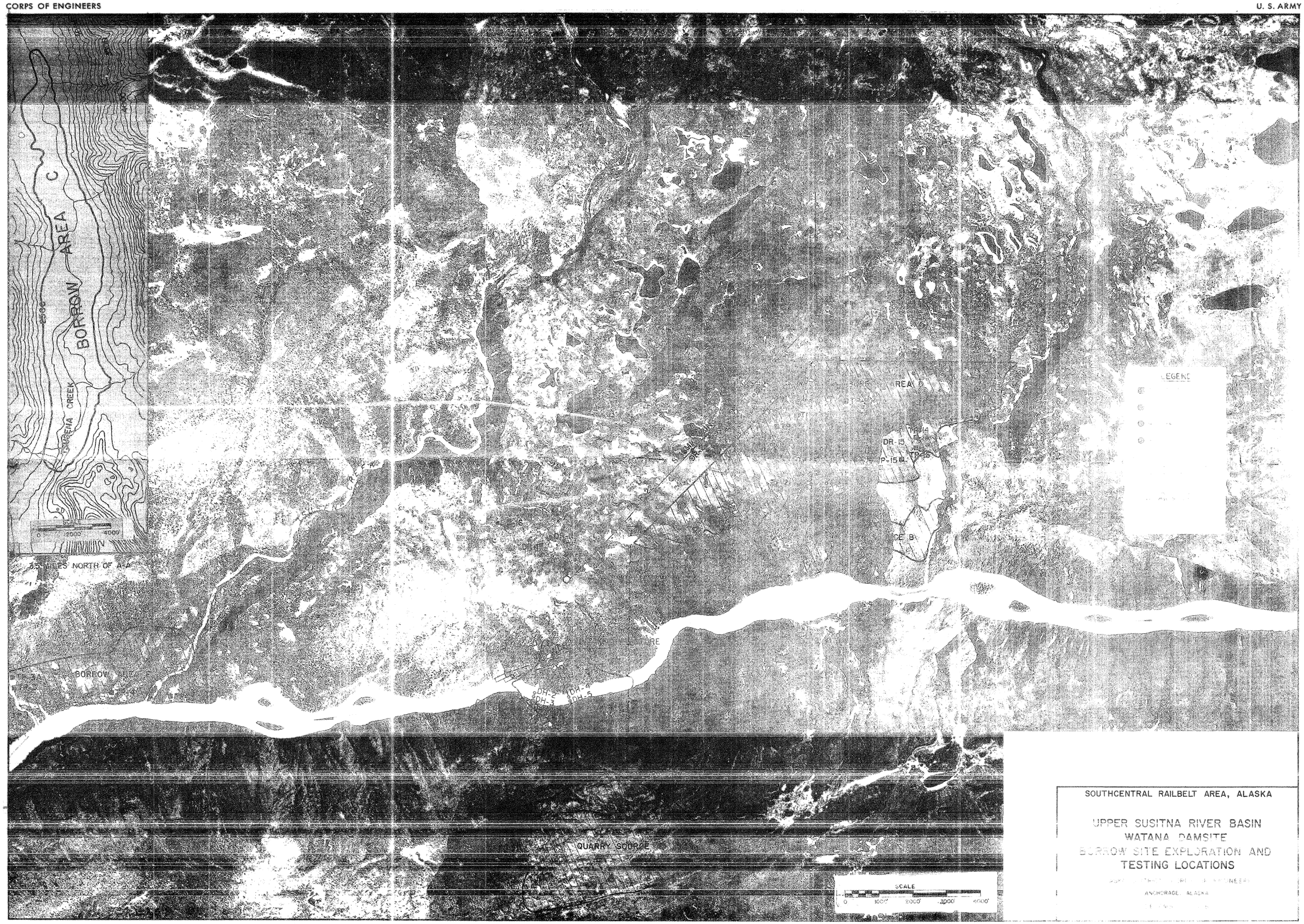
ALASKA DISTRICT, CORPS OF ENGINEERS

ANCHORAGE, ALASKA

DECEMBER 1978

EUGENE DIETZGEN COMPANY

FIGURE 8

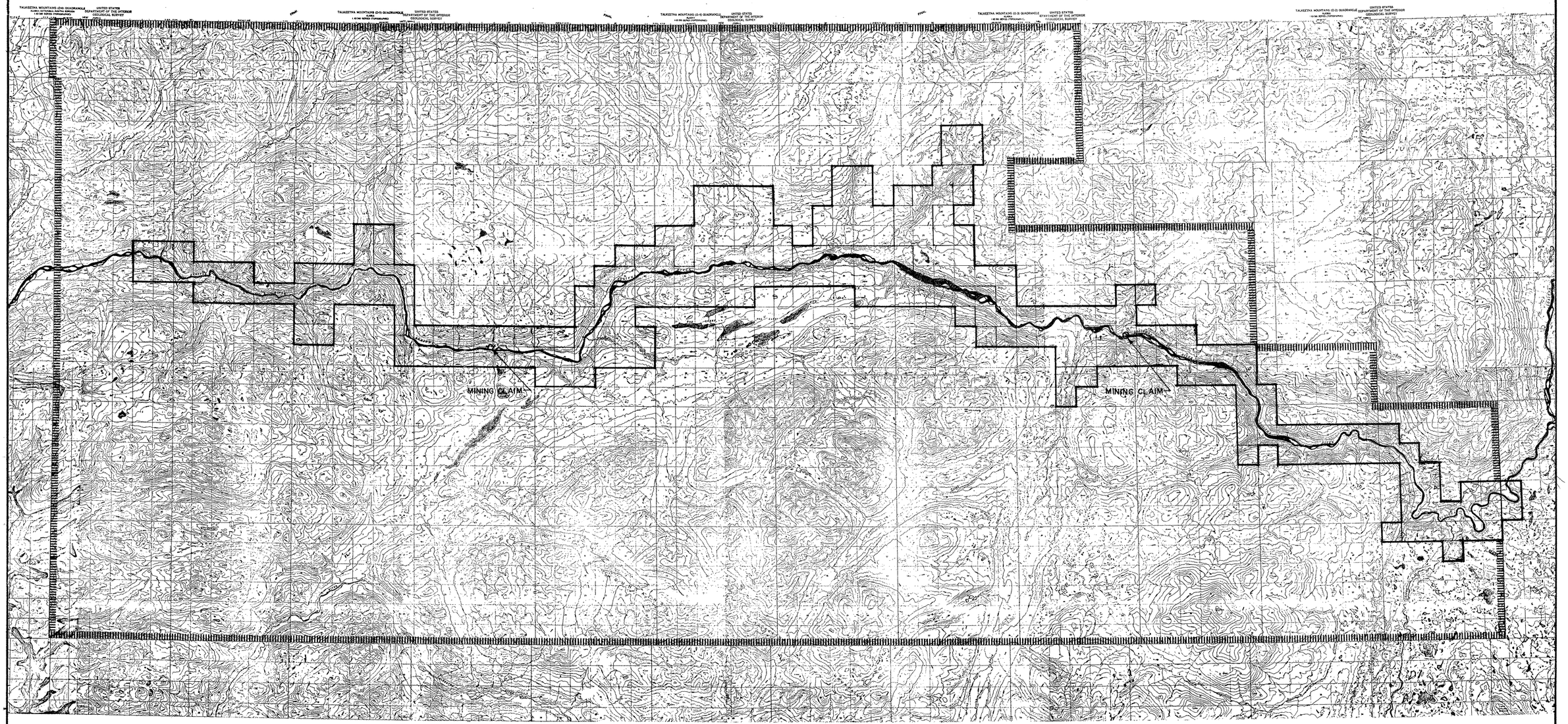


SOUTHCENTRAL RAILBELT AREA, ALASKA

UPPER SUSITNA RIVER BASIN
WATANA DAMSITE
BORROW SITE EXPLORATION AND
TESTING LOCATIONS

CORPS OF ENGINEERS
ANCHORAGE, ALASKA

FIGURE 9



LEGEND

- FEE AREA BOUNDARY
- STATE LAND SALE AS OF NOV, 14, 1978
- LANDS TO BE CONVEYED TO CIRI PER P.L. 94-456
- DEFICIENCY AREAS FOR CONVEYANCE TO CIRI PER P.L. 94-456
- LANDS CONTROLLED BY BLM (WITHDRAWN FOR CIRI REGIONAL DEFICIENCY AREA)
- LANDS CONTROLLED BY BLM (WITHDRAWN FOR CLASSIFICATION-D-1)

SOUTHCENTRAL RAILBELT AREA, ALASKA

UPPER SUSITNA RIVER BASIN

LAND STATUS

ALASKA DISTRICT, CORPS OF ENGINEERS

ANCHORAGE, ALASKA

DECEMBER 1978

EUGENE DIETZGEN COMPANY

FIGURE 10