SUSITNA HYDROELECTRIC PROJECT

PLAN OF STUDY - REVISION 2

DECEMBER 1, 1981

Prepared by:

ACRES

ALASKA POWER AUTHORITY

Attachment A.3
Amendment No. 2
ALASKA POWER AUTHORITY
SUSITNA HYDROELECTRIC PROJECT

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December 1, 1981

by

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Subtask 3.05 - Flood Studies

(a) Objective

To re-evaluate the probable maximum flood (PMF) estimates based on a more comprehensive climatological study and modeling procedure.

(b) Approach

The approach will entail reassessing precipitation maximums, temperature gradients, and temperature maximums based on thorough study of the meteorological characteristics of the Susitna basin. Applicable storm maximization techniques will be used to develop a probable maximum precipitation storm for both spring and summer seasons.

A further calibration of the SSARR model will parallel the climatological study. This calibration should develop a reasonable watershed model based on procedures that follow generally accepted mathematical modeling technique. The calibration will proceed under the assumption that the basin's meteorological and hydrological parameters used in the Corps of Engineers' PMF estimates as the most representative; these parameters may be adjusted as analysis proceeds.

When the set of watershed parameters presenting the most reliable estimation of spring and summer floods is determined, a verification study will be conducted using this data set. Several floods will be used that are independent of the floods used in the calibration study. The verification of the SSARR model will determine the accuracy that can reasonably be expected from the model.

Estimates of the PMF at critical locations along the Susitna River during both spring and summer will be determined using climatological data developed along with the most reliable set of basin parameters.

(c) Discussion

This addendum is the result of the assessment of the 1975 COE studies. The assessment determined the sensitivity of the PMF estimates to changes in critical meteorological and basin parameters. The magnitude of the changes is discussed completely in Subtask 3.05 (ii) - Probable Maximum Flood Closeout Report.

The meteorological data used in the COE estimates were developed by the National Weather Service (NWS) in a preliminary study which gave a general range of criteria within which values from a more comprehensive study would most probably fall. In their conclusions to the study, NWS noted "Time hasn't allowed checks, evaluation, and comparison of the several types of data summarized here". The NWS recommended further study; this is borne out by the increases to the PMF peak found in the sensitivity analysis.

The operation of the Watana Reservoir for power generation will have an effect on storage attenuation of the spring and summer peaks. On the average it would appear that approximately 2.3, 2.3 and 1.6 million acre-feet of storage are available in April, May and June, respectively. These values are for Watana with a full supply level of 2200 feet and 800 MW installed capacity. In August, September and October, no significant storage is available. A preliminary estimate of the spring PMF volume is about 4.5 million acre-feet; consequently, approximately 36 percent of the spring flood volume could be stored without reservoir surcharging. If 20 feet of surcharge is allowed, then about 50 percent of the spring flood can be stored. The effect of the storage is to attenuate the flood peak significantly.

For the summer PMF, reservoir levels are closed to maximum so no significant flood storage is likely. The case for flood storage in spring is strong as the reservoir can only be full, assuming normal power operation, after snowmelt runoff. Therefore, it may only be applicable to design spillway criteria based on summer floods and full reservoir conditions.

(d) Schedule

Week 73 through 90

Subtask 3.05 Dam Break Flood Wave Studies

(a) Objective

To undertake an initial estimate of flood hydrographs generated by a postulated dam break at Watana and/or Devil Canyon, route them through the downstream reach to below the Talkeetna River confluence and determine potential flood levels and travel time at critical downstream areas.

(b) Approach

It is proposed to develop flood wave profiles arising from a postulated failure of fully constructed Watana and/or Devil Canyon dams, using state-of-the-art techniques such as the Fread-Harbough method. The floods will be routed dynamically through the downstream river reaches to below the Talkeetna confluence.

Using available topographic, reservoir and river section information, and using USGS 1" = 1 mile maps with 100' contours and the 1" = 2000' aerial photographs for river reach below Portage Creek confluence to Talkeetna, the flood waves will be routed to estimate maximum water levels, time of travel, and extent of flooding at critical downstream areas. The Corps of Engineers study of flooding near Talkeetna is assumed to be available to us and information contained therein will be used in our analysis. Based on the results, a qualitative assessment of possible impacts due to failure of construction cofferdams and partially constructed main dam will be attempted.

(c) Discussion

The mechanism of dam failure is not very clearly understood. A complete instantaneous failure of the concrete arch dam will be assumed for the Devil Canyon analysis, with two possible modes of failure analysed for the Watana rockfill dam - (i) due to overtopping and (ii) due to piping in the dam core. A literature review will be made to derive the most likely values of failure parameters, such as the maximum dimension of

the breach, time interval of failure, etc. Studies will be made for a postulated dam break due to extreme flood and due to extreme seismic activity in combination with a smaller river flood.

The synthesis of a flood profile due to a dam break situation is essentially a state-of-the-art approach and will be based on the above failure causes and mechanism. Routing of the synthesized flood hydrograph through the downstream reach is a detail depending much on the available data on the river cross sections and flood plain topographic mapping. The dynamic routing procedure proposed is superior to the hydrologic storage routing in the river reach. The procedure will be used with available topographic information to estimate the extent of possible downstream flooding. A preliminary assessment of additional information required to more accurately determine the flood levels will be made. The more detailed study will be made in later phases of the work.

(d) Schedule

Week 100 through 116.

Subtask 4.11 - Seismic Geology Field Studies

(a) Objective

Excavate a trench for geologic mapping on a significant fault or feature being studied under Subtask 4.11 - Seismic Geology Field Studies.

(b) Approach

Currently four trenches are planned to study the nature of faults and the degree of fault-trenched activity under Subtask 4.11; it may be necessary to have an additional trench to complete these studies. As a result of seismic studies conducted in 1980, thirteen features or faults have been designated as significant features requiring further studies. These features will be studied in the field under Subtask 4.11, and the results will be used as input in Subtask 4.12 - Evaluation and Reporting. The trenches will be used to evaluate these features and can be useful in determining the type, nature, frequency, amount, and last date of movement along a fault. These data are basic to the determination of fault activity, and the lack of any activity during the recent geologic period results in classifying a fault as a "Fault With No Recent Displacement".

The need, location, and extent of the extra trench will be determined during the course of Subtask 4.11. In essence, it will be a floating trench in a critical location that otherwise would not be explored and could leave gaps in the studies due to lack of resolution on certain faults. Such gaps may necessitate postulation of unnecessarily conservative project design assumptions.

(c) Discussion

The data derived from this trench will supplement other data collected under Subtask 4.11 in assessing the maximum earthquake magnitude along significant features, the frequency of occurrence of seismic events along the features, type of faulting, and the amount of discplacement.

(d) Schedule

Week 64 through 95.

Subtask 5.06 - Exploration Program (1981)

(a) Objective

To perform additional surface investigations at the Watana and Devil Canyon sites to provide adequate data under Subtask 5.06 - Exploratory Program (1981), to confirm project feasibility, and for submission of the FERC license application.

To perform a seismic refraction survey to investigate the river alluvium and the relict channel area, and to drill two boreholes at the powerhouse location on the Watana site.

(b) Approach

Mapping of surface geologic features in the field is being undertaken under Subtask 5.04 - Exploratory Program (1980), and 5.06 - Exploratory Program (1981). The scope of these subtasks was prepared on the basis of a review of previously reported data and a limited knowledge of the site region. The activities completed under Subtask 5.01 - Data Collection and Review, and 5.04 - Exploratory Program (1980) indicated the need for a more intensive data collection program using field geology mapping techniques than was originally planned under Subtask 5.06. The data established the need for a senior level geologist in the field to lead the field team on a full time basis. The need for this extended and intensive geologic mapping program stems from the fact that the geology of the Watana and Devil Canyon sites is much more complex than originally reported, and reasonably firm engineering layouts of the project features requires a clear understanding of the geologic and geotechnical model of the site.

This extended scope of the mapping activities will assist in completing the surface geology mapping investigation at the Watana and Devil Canyon sites, interpreting geologic and geotechnical features encountered in borings and seismic refraction surveys, and preparing a more complete geotechnical model of these two sites to the level sufficient to evaluate the feasibility of the sites and develop acceptable engineering layouts and construction costs. The data will be used as input to Subtask 5.08 - Data Compilation, and Task 6 - Design Development.

Activities undertaken during this scope revision will include detailed geologic mapping of the Watana site to more accurately characterize the foundation conditions, identify rock outcrops, rock type and nature, and depth of overburden; identify and characterize major geologic faults, shear zones, and other features within one mile of the dam site; evaluate potential slide and solifluction areas; and define the pluton boundary and its relationship to known shear zones. At the Devil Canyon site, the program will be directed towards mapping of steep river canyon walls (using technical climbers), identification and characterization of shear zones subparallel and subperpendicular to the canyon within 0.5 miles of the dam site, bedding stratigraphy, pluton/argillite contact, and dikes emplaced within the rock.

During the first external review board meeting in January 1981, the investigation program for 1981 activities and the available data on the Watana site were reviewed to determine potential geotechnical and construction problem areas and design considerations. As a result, recommendations made by the Board were reviewed and incorporated into the 1981 program. Implementation of these recommendations requires that the following additional exploratory work be done:

- Exploration of river alluvium for possible use in the Watana dam shell. This will require exploration of the depth, character, and volume of the material both upstream and downstream of the dam site. Seismic refraction survey techniques have been determined to be the most cost effective means of exploring these alluvia.

- Exploration of the relict channel on the right abutment at the Watana dam site to better define the location and geometry of the relict channel. Although direct exploration techniques such as Becker drilling and large scale pumpout tests are more desirable methods, the expenses involved with these techniques, along with the limitation of heavy equipment land transport during the warm weather months and scheduling problems, make seismic refraction techiques more attractive. The results of the seismic work will be supplemented by field geologic mapping.

- Two additional deep boreholes drilled in the vicinity of the proposed powerhouse site. These will be drilled to confirm the quality of rock intended to house the underground powerhouse and associated structures. The borings scheduled under the current Plan of Study are intended to explore major geologic features such as large shear zones, faults and suspected slide blocks.

The seismic refraction lines will be run across the river channel at several locations both upstream and downstream of the dam site. The location will be selected in the field in those areas where exploitation of these materials for the construction of the dam will be economically feasible. The data will be used to estimate the total exploitable volumes. The percentage of usable material and the processing requirement will be determined by correlating data with information at the dam site.

The relict channel on the right abutment is a major ancient river valley filled with up to 500 feet of unconsolidated material containing several sequences of lake deposits, river alluvium, and till-like material. The cross section and shape of this channel is suspected to be similar to that of the current Susitna River channel. The engineering importance of this buried channel is related to potentially large seepage and associated phenomena such as piping which may cause loss of soil particles along seepage channels which could eventually result in the loss of large quantities of soil. Such piping phenomenon may result in large sink holes on the upstream side and eventually form underground concentrated leaks which could cause catastrophic damage. In order to study this problem, the limits of the channel must be defined with relation to entrance and exit points. Once these are defined, parametric studies will be performed to evaluate the sensitivity of the problem under different sets of conditions; its impact on the project cost, in terms of possible mitigating procedures, will be determined once the studies are completed and an understanding of the problem is developed. More detailed investigations using direct investigation techniques such as drilling and field pumpout tests will be undertaken during the next phase of the project to properly define the problem.

The current drilling program at the Watana dam site is directed towards establishing the geologic and geotechnical feasibility of the site and the development of layouts. Provisions for drilling at specific structure locations were not included in the initial program. However, the Board recommended that additional information on the quality of rock and its geologic and engineering character will not only improve the cost estimates of the support requirements for the underground structures but will greatly increase the level of confidence in determining the feasibility of an underground powerhouse. The improvement in estimating the cost of underground excavation support may be insignificant compared to the overall cost of the project; however, any additional information gathered will increase the confidence in the data. The additional drilling was originally planned for the next phase of the investigations and is not an added cost; it is merely being moved up and will contribute significantly to establishing the feasibility of the underground powerhouse. The location of the boreholes will be determined on the basis of the ongoing geologic mapping, seismic refraction survey, and project layout studies.

(c) Discussion

The data gathered under this activity will supplement results of Subtask 5.06 - Exploratory Program (1981). The data will be used to evaluate foundation conditions, establish a detailed geological and geotechnical model, identify, locate, and characterize shear zones and bedrock outcrops, and provide necessary input to project layout and cost estimates. The results of the river alluvium explorations will be used in the dam design studies. The results of the relict channel explorations will be used in developing a better understanding and model of the buried channel geometry and engineering studies. The data resulting from additional boreholes will be integrated with data obtained during Task 5 activities and used in determining the optimum location of the underground powerhouse.

(d) Schedule

Weeks 56 through 91.

Subtask 5.08 - Data Compilation

(a) Objective

Reduce, plot, and interpret geology field mapping data gathered by the U.S. Army Corps of Engineers (COE) and the USBR which was not reduced or reported by the agency.

(b) Approach

During their last year of geology field mapping, the COE collected a large amount of geologic data at the Watana site which represented approximately 12 months of field work. However, these data were not reduced and plotted by the COE, and they became available to Acres in October 1980. The data are available in geologist's field notebooks and contain a wealth of information which, when properly reduced and plotted, will add to the knowledge and understanding of the geologic conditions of the site. The reduction of these data is important for the following reasons:

- The data can become useful with a modest amount of effort.

- Regeneration of these data would require repetition of 12 months of effort in the field with associate support costs running into thousands of dollars.

- The data will be very useful in developing the geotechnical picture of the site.

- The observations and data can be confirmed by Acres' geologists conducting spot checks in the field. Agreement between data collected by the COE and Acres will strengthen the quality of the data and the degree of coverage required to provide a representative picture of the site geology.

Activities undertaken during this scope revision will include detailed geologic mapping of the Watana site to more accurately characterize the foundation conditions, identify rock outcrops, rock type and nature, and depth of overburden; identify and characterize major geologic faults, shear zones, and other features within one mile of the dam site; evaluate potential slide and solifluction areas; and define the pluton boundary and its relationship to known shear zones. At the Devil Canyon site, the program will be directed towards mapping of steep river canyon walls (using technical climbers), identification and characterization of shear zones subparallel and subperpendicular to the canyon within 0.5 miles of the dam site, bedding stratigraphy, pluton/argillite contact, and dikes emplaced within the rock.

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(d) Schedule

Week 56 through 91.

Subtask 6.03 - Evaluate Alternative Susitna Developments

(a) Objective

To provide a reasonable upper limit cost estimate in 1981 dollars for both the Watana and the Devil Canyon development schemes, to provide a similar estimate for transmission line costs within the Susitna development scheme, and to update to 1981 dollars the alternative thermal plant costs, fuel costs and economic analysis as produced under Subtasks 6.32 through 6.36.

(b) Approach

(i) Watana/Devil Canyon Estimates

For each development scheme, estimates will be made for the base case scheme which reflects preliminary design considerations developed. These estimates will be produced under the direction of an experienced construction estimator with quantities being derived from the project drawings. Unit costs will be determined in 1981 dollars for each time using historical data and other available information. Items of lesser importance will be taken as lump sum costs. An upper limit estimate will be produced by expanding the base case estimate to include items about which there is some reasonable level of uncertainty.

(ii) Transmission Line Costs

Previous estimates for transmission line costs will be updated to 1981 dollars. The two schemes which will be costed are:

- Susitna Basin Development with generating facilities at Watana and Devil Canyon

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(iii) Thermal Plant and Fuel Costs

The estimates as produced for the Subtask 6.05 report will be updated to 1981 costs through the use of escalation factors as obtained from industry reference sources and other sources. The appropriateness of assumptions made in the 1980 estimates will be reviewed and, if necessary, adjusted for the 1981 estimates.

(iv) Economic Analysis

A review will be made of the assumptions made in the 1980 economic analysis runs and updated information (as produced by the above work) will be incorporated into the model parameters. The generation planning models will then be run to determine the feasibility of the Susitna development under a series of fuel cost assumptions.

(c) Discussion

As part of Task 6 as outlined in the February 1980 Plan of Study (POS) and the POS revision of September 1980, Acres prepared initial cost estimates for various alternative developments within the Susitna Basin. In addition, Acres compared the various alternative sources of energy with the hydroelectric development of the Susitna Basin. This work was performed under Subtasks 6.32 through 6.36 by use of a computerized generation planning model system. The results of this preliminary costing and economic analysis are reported in the Development Selection Report as produced under Subtask 6.05.

Subsequent to the above, APA requested that Acres provide an upper cost estimate for the two selected development sites. In addition, APA requested that the 1980 cost estimates be updated to 1981 figures and that the economic analysis be similarly updated. This additional update and extension to an upper limit cost was not envisioned in the original plan of study or subsequent revision.

(d) Schedule

Weeks 59 through 74

Subtask 7.01 - Coordination of Environmental Studies

(a) Objective

To ensure coordination and successful completion of the environmental scope of work amendments.

(b) Approach

An increased level of effort will be required by Acres to ensure that the amendments to the environmental program are executed in a coordinated, controlled manner in accordance with the proposed scopes and schedule.

(c) Discussion

Rather than allocating coordination manhours to individual environmental components, this effort has been consolidated under Subtask 7.01 - Coordination of Environmental Studies.

(d) Schedule

Week 80 through 126

Subtask 7.03 - Field Data Collection and Processing

(a) Objective

To supplement the available suspended sediment load data in the Susitna basin in order to better address the lower river morphology.

(b) Approach

A Heli-Smith bed load sampler will be used to measure bed loads at four stations during the summer of 1981. The locations of these stations are:

- Susitna at Gold Creek
- Chulitna near Talkeetna
- Talkeetna near Talkeetna
- Susitna at Sunshine

The program was devised after detailed discussions with the APA and their consultants, USGS experts, and the Acres study group. A lack of existing bed load data on the Susitna and the increased significance of evaluating the pre- and post-project morphology of the river below the dam sites were major factors in the genesis of the proposed additional studies.

The data will be integrated with information assembled under Subtask 3.07 - Sediment Yield and River Morphology Studies, and 3.10 - Lower Susitna Studies. Depending on the findings of the study, the need for more detailed data collection and analyses will be evaluated and planned for Phase II.

(c) Discussion

The ability of the program envisaged in the POS to accommodate modifications, additions, and deletions has been a key feature of the current studies. During discussions held with the agencies and the consultant panel to the APA and Acres concerning data availability analyses and potential environmental and engineering factors being addressed in the

study, it became apparent that some bed load measurements should be taken at typical stations to better evaluate river morphology downstream of the dam sites.

After detailed discussions with the USGS and the APA, Heli-Smith samplers were chosen to measure the coarse bed load on the Susitna based on previous experience on the Tanana River in Alaska. A cooperative program of field measurements and analyses has been formulated. USGS will direct the field studies and analyze data with assistance from R&M Consultants. Interpretation of the results will be undertaken by Acres and R&M, with a possible review being conducted by outside experts.

(d) Schedule

Week 79 - 101

Subtask 7.04 - Water Resources Analysis

(a) Objective

To describe existing water quality in the Susitna River and other streams to be affected by dam construction and operation, and to predict future water quality in these rivers and streams if the dam is constructed.

(b) Approach

(1) The data base for this subtask will be historical water quality data from USGS and other regulatory agency files. Also included will be the water quality data being collected by R&M and USGS as part of Task 3.

(2) Input for this subtask will include the hydrology studies and sediment studies from Task 3. Results of the water quality analysis will be utilized in Task 7.11.

(c) Discussion

The existing data will be interpreted to develop a general description of existing water quality in the project area. Where available, information concerning significant ions, chlorophyll a, nutrients, specific conductance, pH, total dissolved solids, total alkalinity, total hardness, dissolved oxygen, bacteria, temperature, suspended sediments, turbidity, and vertical illumination will be utilized to determine seasonal variation for the streams in the project area. Gradients of these streams will also be discussed.

Existing lakes will be described where information is available for surface area, volume, maximum and mean depth, flushing rate, shoreline length, and substrata.

The impacts of reservoir construction and operation on downstream water quality will be discussed. The expected water quality in the proposed reservoir will also be discussed. Mitigative measures, particularly those recommended by federal and state agencies to protect water quality during construction and operation, will also be described.

The water quality assessment will be conducted in close association with the hydrological and fisheries tasks to to ensure that all mitigation plans are in accordance with engineering and environmental requirements.

(d) Schedule

Weeks 84 through 97

Subtask 7.05 - Socioeconomic Analysis and Sociocultural Studies

(a) Objective

(i) Socioeconomic Program Advancement

To provide economic valuations and quantification of socioeconomic impacts of a Susitna Hydroelectric Project, and initiate work on identification of economic and social impacts on important fish and wildlife resources. The addition of Work Packages 5-9 is designed to comply with anticipated FERC license application requirements.

(ii) Sociocultural Studies

To determine the attitudes of the local residents in the railbelt area between Willow and Healy concerning the project, to assess possible cultural impacts, and to recommend mitigative alternatives.

(b) Approach

(i) Socioeconomic Program Advancement

The approach to correct for the deficiency is presented as an integral part of and addition to Work Packages 1-4 (up to this time, Phase I). Work Packages 5-9 are proposed for inclusion in Phase I. Work Packages 8 and 9 will be initiated to the extent that data are available and will be completed as a Phase II effort.

(ii) Sociocultural Studies

The study team will identify and conduct informal interviews with key local residents and other knowledgeable people who are particularly well situated to reflect the opinions and dynamics of their community. Although the study team will not engage in formal statistical surveys, they will examine existing survey results (ie. Policy Analysts, Ltd. 1980). Also, the study team will analyze the content

of testimony presented in the public hearing process. Perceptions, attitudes, and values under this proposal will be derived from existing surveys, key informant interviews, and content analysis of public testimony.

(c) Discussion

(i) Socioeconomic Program Advancement

Work Package 7 will provide a new dimension to the baseline socio-economic profiles: economic valuations for important commerical, recreational, and subsistence fish and wildlife resources. This new dimension, by itself, will indicate the unit economic value of resources to various user groups. When combined with recent fish and wildlife use patterns of Work Package 2, the economic value and social significance of the resources to each user group may be approximated. When combined with fish and wildlife resources population data, the economic potential of important resources will be estimated. Each of these results will contribute significantly to the quality, depth, and breadth of the socioeconomic baseline. With an enhanced baseline, additional types of impacts can be analyzed and more in-depth impact analysis is made possible. With the inclusion of this Work Package in Phase I, FERC will be provided with a more complete set of baseline data upon which to base their own impact assessment.

Work Package 5 (Forecast of Future Socioeconomic Conditions in Presence of Project), complements Work Package 4 (Forecast of Future Socioeconomic Conditions in Absence of Project). The forecasts of Work Package 5, when used in conjunction with the forecasts of Work Package 4, provide the means by which reliable, detailed quantitative estimates and qualitative assessments of potential changes in socio-economic conditions can be made. Together, these forecasts will be compared and analyzed in Work Package 6 to provide detailed quantitative estimates and qualitative assessments. Although Work Package 3 addresses essentially the same problem as Work Packages 4-6, it employs educated judgements as its primary means for determining

potential impacts; these judgements will provide guidance in selecting particularly sensitive socioeconomic conditions and issues to be studied further in subsequent work packages.

To provide adequate information on which to base decisions, educated judgements must be combined with a comprehensive impact assessment methodology. A methodology proposed to be used in this project is to forecast socioeconomic conditions with and without the project; the difference in results obtained from each forecast will describe the project's impacts. As compared to the impact assessment of Work Package 3, considerably more quantitative estimates for impacts can be provided by Work Packages 4-6. More importantly, the potential accuracy and, therefore, defensibility, of both the quantitatively as well as the qualitatively derived impact results are significantly enhanced.

Work Package 6 is presented in two parts. The first part, Impact of Project on Socioeconomic Conditions (excluding fish and wildlife resources), involves comparing the forecasts with and without the project. As discussed above, quantitative and qualitative impact assessments result from this comparison. In the second part, Economic and Social Significance of Project Impacts, social and economic criteria are developed for use in determining the significance of impacts from local, regional and state perspectives. This will serve to further define the scope and relative magnitude of impacts.

Work Package 8, Economic Implications of Project's Impact on Fish and Wildlife Resources, is scheduled to be initiated in Phase I and to be completed in Phase II. It will provide dollar estimates (where available or determinable) of losses and gains in the economic value of fish and wildlife resources to user groups. This will serve to define more adequately the magnitude of fish and wildlife resource impacts relative to other types of impacts. In addition, it will allow for more accurate comparison of resource use impacts among user groups.

Work Package 9, Social Significance of Economic Implication, is also scheduled to be initiated in Phase I and to be completed in Phase II. It will provide the means for determining social significance of the project's impacts on fish and wildlife user groups.

(ii) Sociocultural Studies

Two major methodological approaches will be used to gather data for this study: a review of relevant published materials (including drafts) and informal interviews with key local residents and other knowledgeable people. The literature review will include readily available materials such as public testimony, relevant agency documents, and related Susitna Hydroelectric Project study components (socioeconomics, land use, recreation and access roads). This study will compliment rather than duplicate data contained in the other Susitna Hydroelectric Project reports.

Two types of key information will be used. The first will be those individuals who occupy key positions in the community (ie. councils, clubs, churches, and other associations) or in one of the institutions which provide services to the communities (ie. boards or agencies). The second type of interview will be with well informed persons who, because of a long local residency and a good knowledge of the area, are able to reflect the opinions and dynamics of the communities.

Because of the time frame of this study, it will be necessary to conduct the interviews during the summer period when many non-local tourists and sport fisherman are in the study area. Also, many of the local residents may be away from home related to summer employment or other seasonal activities. In addition, nearby hydroelectric development may affect many people who, although not year-round residents in the study communities, may have nearby cabins. These people may use the area for recreational or business (trapping, guiding, mining) purposes. Every effort will be made to contact the appropriate key informants in each community. The study team anticipates that the year-round residents and absentee property

owners who use the area seasonally are more important for purposes of this study. Both informal interviews and interaction with the Land Use Analysis Team (Jubenville et al., 1981) will be useful. Little effort will be made to interview non-local tourists.

Because both the study team and the public participation program deal directly with the local residents in the study area, the study team anticipates that it will interact closely with public participation program personnel. This interaction would include a mutual exchange of relevant information. For example, if the researches determine that certain communities or topics require additional information or clarification related to the Susitna project, they will notify the public participation program personnel and discuss their findings. Conversely, through the contract period, if the public participation program staff, through their efforts, determine that certain topics are emerging as more important than others, the study team will make every reasonable effort to pursue them.

(d) Schedule

Week 74 through 112

Subtask 7.10 - Fish Ecology Studies

(a) Objective

To determine the presence and extent of any naturally occuring dissolved gas supersaturation levels in the vicinity of Devil Canyon.

To identify available baseline information and discuss the types of potential impacts of the Susitna Hydroelectric Project with respect to the biological resources of Upper Cook Inlet.

(b) Approach

If supersaturated gas levels occur naturally in the Susitna River, they would be expected near Devil Canyon due to plunging flows through the canyon. Therefore, the planned approach is to first sample dissolved nitrogen and oxygen levels in the vicinity of Devil Canyon. If supersaturated levels are found, samples will be taken downstream at regular intervals (perhaps every 5 miles) until such levels are no longer detected. The intent is to determine how far downstream supersaturated levels occur, if at all. A control site will be located upstream of Devil Canyon. At each station, measurements will be taken at various depths by means of a tensiometer. Sampling will be conducted at approximately peak seasonal flow and repeated on several occasions during the summer.

Concerns about potential estuary impacts have been raised by agency personnel. The effects of project flows on waterfowl of the lower river and Susitna Flats has been raised as a concern that warrants attention. Concern has also been expressed with respect to salmon populations in Cook Inlet as well as in the Susitna River, and subsequent effects on Beluga whales. The volume and quality of the freshwater entering an estuary influences ice conditions, turbidity, circulation, and tides as well as estuarine productivity. Biological populations, including salmon, are affected by environmental conditions in the estuary. The upper Susitna drainage (to be controlled by the hydroelectric project) constitutes a relatively minor percentage of the total freshwater volume entering the upper Cook Inlet estuary. Nevertheless, the abovementioned examples are among the potential impact issues that will be addressed.

(c) Discussion

The above sampling schedule and procedure will indicate whether supersaturation occurs naturally and also document the dissipation of any supersaturation levels downstream of Devil Canyon. Observed variations in supersaturation levels due to changes in flow or water depth will also be documented. The control sample will indicate whether the Devil Canyon rapids change dissolved gas levels in water that passes through the canyon.

It is not expected that any significant levels of naturally occurring supersaturation will be found to occur. However, dissolved gas supersaturation is a potential problem that must be addressed through considerations in dam design, construction, and operation. Supersaturation caused by plunging flows (e.g., water passing over a dam spillway) can cause gas bubble disease in fish.

For this reason, dams should be designed to avoid this potential problem; such design considerations are ongoing. The planned measurements will permit a documentation of conditions in the absence of the hydroelectric project.

This sampling program is dependent upon obtaining transportation support (helicopter and/or boat) from other team members. It is anticipated that coordination of transportation will be possible with other aspects of the fisheries, hydrology, and water quality programs.

This preliminary estuary study will consist of a literature search dealing primarily with the biological oceanography of the Upper Cook Inlet estuary. Material gathered on the waterfowl of the lower Susitna/Susitna Flats will also be included. Information sources include the National Oceanic and Atmospheric Administration (NOAA), the University of Alaska Institute of Marine Science, various Alaska-based federal and state agencies, technical journals, and general sources dealing with estuarine processes and environments. Hydrology, physical oceanography, and water quality information furnished by Acres and R&M Consultants will also be utilized.

As part of Exhibit E of the FERC license application, a brief description of the existing biological conditions will be prepared. A general discussion will be included identifying potential influences that the hydroelectric project could exert on the fish and wildlife resources of the Upper Cook Inlet estuary. This preliminary investigation will help determine if further study is warranted during Phase II.

(d) Schedule

Weeks 80 - 126

Subtask 7.12 - Plant Ecology Studies

(a) Objective

To preliminarily assess the effects of downstream river stages (under project flows) with respect to cover types, navigational use, and fish habitat.

(b) Approach

This effort will consist of two Work Packages, as described below. The first Work Package is a general assessment of the downstream area that is flooded or exposed with different river stages. The second Work Package is a specific assessment of existing navigational use of the river below Devil Canyon and a preliminary determination of the effects of project flows on this navigational use. Assessment of impacts of project flows on fish habitat is being performed under Subtask 7.10 and will be aided by the aerial photos and results of the first Work Package.

(c) Discussion

(i) Work Package 1 - Interpretation of Downstream Photographs

Objective

The objective of this Work Package is to obtain an estimate of the amount of different cover types (including river, gravel bars, etc.) at two different river stages in the downstream floodplain area.

Approach

The methods currently envisioned to accomplish this work involve the utilization of 35 mm vertical aerial photographs taken at two different stages by R&M. If possible, one of these stages will approximate that expected with project flows, at least for the Susitna River above its confluence with the Chulitna. Selected

prints will be obtained from each flight. Only the central portions of the photographs will be utilized to avoid distortion at the edges. If necessary, scale adjustments will be made between each set of photographs.

A series of points will be laid out along a transect across the floodplain on each corresponding set of photographs. The cover type that occurs at each point will be interpreted from the photographs. A field check will also be made to verify the photo interpretation. This check will consist of aerial reconnaissance of selected transects.

Cover types include all vegetation types, water, and gravel bars. Relative percentages will be determined for each cover type. These percentages will be applied to total actual values of each cover type, which are being determined as part of the currently scheduled effort on the downstream floodplain.

The result will be an estimate of the total area occupied by each cover type at a given river stage. Since the degree of change in river stage due to the hydroelectric project will vary by river section, the data obtained from this effort will be segregated into the following river sections: Devil Canyon to Talkeetna, Talkeetna to Montana Creek, and Montana Creek to Delta Islands.

Discussion

The Susitna River is a force of constant disturbance. This disturbance occurs in the floodplain at different elevations depending on the flow and stage of the river. Areas that are flooded annually are usually devoid of vegetation. If a gravel bar or similar area along the river is not disturbed by flooding or ice buildup, it will become invaded by vegetation and, as time passes, develop into different stages of vegetation along successional pathways.

The Susitna Project is expected to result in a reduction in flows in the Susitna River during the summer months. This flow reduction will result in a certain amount of land being exposed that would previously have been disturbed on a regular basis. With a knowledge of how much area will be exposed and an understanding of successional trends, the change in vegetation/habitat types that may occur in the floodplain can then be provided.

Although this effort is directed at identifying the amount of land exposed by reduced flows, it will at the same time identify the reduction in the wetted area of the river. This information will be useful in the fisheries studies and also in the navigational use investigation. This effort will also provide a set of aerial photographs to the fisheries and land use personnel for evaluating stage changes.

(ii) Work Package 2 - Navigational Use Investigation

Objective

The objective of this Work Package is to identify present navigational use of the Susitna River below Devil Canyon, and to preliminary assess the effects of project flows on this navigational use.

Approach

The investigation will address concerns that have been raised regarding effects of project flows and river stage on navigational use. It will be based on available information, some new data to be collected on navigational use, and the results of other Susitna studies.

User Concerns. Concerns expressed by agency personnel or users regarding post-project navigation in the Susitna basin have been documented previously. A brief summary of such concerns will be prepared. In addition, any new concerns which surface during the course of this investigation will be duly noted and described.

Navigational Uses. Information on existing navigational uses of the Susitna River below Devil Canyon will be summarized. The summary will describe estimated numbers of users, types of craft utilized, and areas of concentration. Data will be obtained primarily from existing documents. In addition, a limited field program will entail observation of selected reaches of the Susitna to augment the baseline description of river access and use. The investigation will address use of the river by floatplanes as well as boats, but will not include winter use by dogsleds and snowmobiles.

Hydrology. Pertinent available data on current and post-project hydrologic conditions will be reviewed. As additional data become available, they will be obtained from Acres and other hydrologic investigators. In information concerning possible flows and stage during the construction phase is available, this information will also be reviewed. TES will confer with appropriate investigators to obtain the most reliable estimates of stage-discharge relationships for selected stream reaches under project conditions. For the river section from Devil Canyon to Talkeetna, TES will utilize Acres' determinations of changes in flows and stage under project conditions, which will be based on a hydrological model and data for 62 transects. For the river below Talkeetna, TES will depend upon the results and conclusions obtained from staff gages that are to be established and monitored by ADF&G or R&M, as well as the results of the ongoing Lower Susitna Studies (Subtask 3.10) by R&M. The effort will also be coordinated with TES' evaluation of downstream photographs.

Impact Assessment. TES will preliminarily assess project stage data relative to the navigational use information. If appropriate, various users will be contacted to obtain information regarding the potential impacts of project operation on navigability. The analysis effort will be closely coordinated with inputs from hydrologic investigators. As data allow, TES will make preliminary determinations of the effects of project conditions on navigation. Suggested mechanisms or strategies for minimizing effects of project flows on navigation will be identified in consultation with hydrology and design team members.

Discussion

The Susitna River has been designated "navigable" by the BLM from the mouth to about 5 miles above Gold Creek. Navigational use is known to occur beyond this point to Portage Creek. There has been a high level of concern expressed by federal and state agency personnel for the extent of impact on river stage due to project operation, and the subsequent effects on navigational use of the river for recreation, commerce, and land access. In response to these concerns, TES conducted a preliminary reconnaissance of issues related to navigational use of the Susitna River. Several of those expressing such concerns were contacted, including some who have experience using planes and boats on the river. TES also reviewed what preliminary hydrological data were available, and obtained and reviewed documents describing historical navigational use of the Susitna River and its tributaries.

A definitive description of the impacts of project flows and stage on navigational use cannot be determined based upon existing data. What is known at this time is that (1) project flows will result in reduced stage during summer months, (2) much of the Susitna and many of its principal tributaries have been used for navigation, and (3) an array of concerns remain regarding the effects of project flows on navigation. Additional investigation of the issue is therefore warranted.

(d) Schedule

Weeks 78 - 126

Subtask 7.14* - Access Road Environmental Analysis

(a) Objective

To provide evaluation of alternative access routes as input into the selection of an access route that will be environmentally sound, and to provide a preliminary analysis of the preferred route.

(b) Approach

This subtask will involve the comparison of alternative routes. Major environmental constraints will be mapped along the various proposed alternative routes to screen out some routes and to refine alignments on those remaining from the initial screening. During the 1981 field season, the remaining alternative routes and access plans will be analyzed, and then a recommendation for a selected route will be made. After a final decision on the selected route, an environmental analysis of the selected route will be included in the environmental report.

The approach differs from that described in the February 1980 Plan of Study in that analysis of alternatives will be continued through the second (1981) field season, rather than concentrating on a route selected prior to this field season. It will be necessary to investigate the alternatives at a lower level of intensity than had been anticipated for the one selected route. Detailed analysis of the selected route will now be deferred until Phase II.

(c) Discussion

The first part of this subtask will be a screening of alternative routes. The screening process will be a coordinated effort between R&M, Acres and TES. R&M and Acres will initially propose various viable alternative

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* This Statement of Work replaces page 5-285 of the February 1980 Plan of Study.

routes or areas where viable alternatives could be proposed. TES will then (February-March 1981) provide a map and a discussion of the various major environmental constraints (cultural resources, critial wildlife habitat, wetlands, habitat for endangered or threatened species, etc.) associated with the viable alternatives. A limited number of alternative routes and/or access plans will then be carried through for further analysis during the 1981 field season. It is understood that these alternative routes will be limited to essentially one route from the west to Devil Canyon, northside and southside connections of the Devil Canyon and Watana sites, and one route from the Denali Highway to Watana. Field efforts are dependent upon the provision of adequate helicopter support for investigation of all alternatives by field personnel in each discipline.

Qualitative socioeconomic analysis will be performed to determine relative impacts of alternative access plans.

Cursory cultural resource investigations will be done during 1981 on the alternative access routes. These investigations will be of Step II - type (reconnaissance level survey) instead of Step III efforts (intensive testing) as indicated on page 3-219 of the Plan of Study. This change is due to the increased area over which the effort is to be applied.

Preliminary qualitative analysis will be made of changes in land use and values as they relate to alternative access plans.

Fish ecology studies for access route analysis will consist of qualitative assessment of major river/creek crossings as fish (anadromous and resident) habitat.

Bird studies will include an increment of raptor surveys along the portions of alternative routes judged to have potential as raptor nesting habitat. Small mammal studies will use analysis of similar habitats to do routing anaylsis of the alternative corridors.

Furbearer studies will expand reconnaissance level surveys (observations) to areas along the alternative routes. Big game studies will use a combination of habitat information and location-specific data in their routing analysis. Information from the above terrestrial wildlife studies will then be coordinated with information collected during the plant ecology studies to do a habitat value analysis using selected key species.

Plant ecology routing analysis will consist of vegetation/habitat mapping of the alternative corridors, wetlands mapping, field checks for potential threatened and endangered species or their habitat, and input into the wildlife habitat value analysis.

Using input from all environmental disciplines, including biological, cultural resources, land use and socioeconomics, the alternative corridors will be evaluated and compared. This evaluation will then be used by Acres and APA in conjunction with economic and engineering input to select an access plan in October 1981. A preliminary environmental impact analysis of the selected access plan will then be included in the FERC license application under appropriate discipline-specific sections.

(d) Schedule

Weeks 1 through 126