ALASKA POWER AUTHORITY

SUSITNA HYDROELECTRIC PROJECT

REVIEW AND TESTIMONIES ON ACRES FEASIBILITY REPORT

APRIL 14-16, 1982

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April 15, 1982

REPORT TO
BOARD OF DIRECTORS, ALASKA POWER AUTHORITY

From

EXTERNAL REVIEW PANEL, SUSITNA HYDROELECTRIC PROJECT

After reviewing the comprehensive Feasibility Report prepared by Acres American Inc., the External Review Panel offers to the Alaska Power Authority the following unanimous comments on the proposed Susitna Hydroelectric Project:

1. It is recognized that the project will have environmental impacts on wildlife, fisheries, and botanical resources. However, the extent and severity of these impacts appear to be relatively small and furthermore many of these environmental losses can be mitigated in full or in part.

2. The high dams proposed for Watana and Devil Canyon can be designed to safely withstand the maximum anticipated earthquake forces.

3. The proposed design adequately responds to the hydrologic environment in terms of spillway capacity and dependability.

4. If the project is financed at an opportune time when bond interest rates and oil revenues are favorable, the potential long term benefits of the Susitna project will be considerable.

5. Accordingly we consider that the overall impact of the project on the State of Alaska could be attractive.

6. To this end we endorse the plan to apply in September 1982 for a permit from the Federal Energy Regulatory Commission.

7. Moreover, we endorse the proposal to proceed with site investigations and design of the project, with concurrent work on some of the critical environmental studies, particularly those concerning downstream effects of the dams on the stream and its fish life.

8. The arrival of any opportune time to proceed with construction will depend on critical issues of finance and marketing of power which cannot now be accurately forecast. Our recommendation is that tender documents with all supporting geotechnical investigations and design studies be developed. We estimate that a total period of three to four years will be required for this phase of work. The project will then be ready to be implemented whenever the financial climate for contracting becomes favorable. The advantages of proceeding in this manner are:

(1) The economic benefits of being ready for financing;
(2) the momentum of the ongoing study and an informed staff; and
(3) the ability to avoid a crash design program.

The disadvantage is the small risk of loss of the design costs in the event that, for some reason, the project is never built.

9. We recommend that the Alaska Power Authority develop a detailed business plan which incorporates a financing and marketing plan into an overall business strategy. The plan would describe the critical events that need to be accomplished, the interrelationship of these events, the approach to accomplishing these goals, the management and control practice that are appropriate, the most economic financing strategy, and power alternatives if the Susitna project is delayed or the demand forecast changes.

10. This Panel is of the opinion that the economic climate will eventually indicate that it is advisable to proceed with the construction of the Susitna project and at that time it will be in the best interests of the State of Alaska to develop this important natural resource.

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April 14, 1982

Mr. Charles Conway, Chairman
Alaska Power Authority
334 West Fifth Avenue, 2nd Floor
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Dear Mr. Conway:

In response to your letter of February 3 to members of the Alaska Power Authority External Review Panel for the Susitna Project and your request for a critical evaluation of the Acres American Inc. Feasiblity Report and findings and the responses of individual Panel members to specific questions, we offer the following attached comments on the various aspects of the study.

It has been a pleasure working with members of the Alaska Power Authority staff and Acres American, Inc. on this important study and we would like to express our appreciation to you and all concerned for the help and support we have received in preparing our reports and recommendations over the past two years.

Sincerely,

EXTERNAL REVIEW PANEL
- MEMBERS

Merlin D. Copen

Jacob H. Douma

A. Starker Leopold

Andrew H. Merritt

Dennis M. Rohan

H. Bolton Seed

Attachment: as stated

ENVIRONMENTAL CONSIDERATIONS

Development of the Susitna Hydroelectric Project will impact the environment of the Susitna basin in a number of ways. The two reservoirs will inundate substantial areas which now support forests and some kinds of wildlife; the construction camps, roads, and transmission lines will disturb various upland ecosystems; and the flow of the Susitna River below the dams will be modified as salmon spawning and rearing habitat. A number of on-going studies have shed considerable light on existing animal populations and vegetational types. Although some information is still far from complete, it is possible now to anticipate some of the impacts that the project will impose on these communities. In the aggregate, the total impact will be relatively small. Moreover, by judicious management, it will be possible to mitigate some of the habitat losses by improving habitats elsewhere. The discussions which follow summarize the environmental problems as they are now understood.

Reservoir Areas

The two impoundments, with an aggregate area of about 71 square miles, will obviously be converted from terrestrial to lacustrine habitat with a loss of all the plants and wildlife that use these areas now. Among the larger animals whose numbers will be reduced are moose, black bear, and several species of mustelid fur-bearers. A wide variety of small birds and mammals will be evicted. Yet most of these species are common in this part of Alaska; there are no known endangered species of either plants or animals. In the case of the moose, it is proposed to manipulate vegetation along the lower Susitna, by burning or mechanical means, to create more winter range and hence to increase moose populations there to compensate for losses of moose in the impoundment areas. A somewhat reduced moose population in the upper Susitna basin might mean some reduction in the dependent wolf population. The Watana impoundment intersects a migration route used by the Nelchina caribou herd. Although caribou swim well, and easily cross natural water barriers, there is a possibility that ice shelving along the shore of the Watana reservoir might interfere with caribou movements. If such a problem is detected, the ice shelf could presumably be blasted. Of greater importance, perhaps, is the necessity to clear and remove all the timber from the impoundment areas to preclude the formation of floating log jams that could create a truly dangerous barrier to migrating caribou.

The upper Susitna River supports several native fish, of which the grayling is the primary game species. Although the river habitats that are inundated will be lost to grayling production, it is possible that the reservoirs themselves may support modest populations of grayling and perhaps lake trout.

Downstream Effects

Below the Devil Canyon dam the flow of the river will be substantially altered from its natural cycle. High summer flows will be captured in the reservoirs to supply winter discharge. The reduced summer flows in the river might adversely affect salmon spawning and rearing habitat as far downstream on the confluence with the Chulitna River, near Talkeetna. Side sloughs that are used as spawning areas by chum and sockeye and as rearing areas by juvenile coho and chinook will be cut off from flushing flows which normally occur at high levels of discharge. Considering the total runs of salmon that spawn in the Susitna drainage and its tributaries, the proportions that utilize the reach between Talkeetna and Devil Canyon are as follows (figures from Schmidt and Trihey):

Species	Total Susitna runs (approx.)	Percentage spawning above Talkeetna
Coho	33,000	8%
Chinook	76,000	2%
Sockeye	340,000	1%
Pink (odd years)	113,000	3%
Chum	286,000	15%

Chum and coho salmon are the two species that might be adversely affected by construction of the dams. There are good prospects for mitigation of those potential losses. Thirty-two sloughs have been identified along this stretch of the river. Mechanical opening of intake channels might permit flushing flows at discharge levels planned for normal power production. Occasional higher flows might be released, if needed. Additionally, artificial spawning channels might be constructed. If proper multiple outlet structures are installed in the dams, water temperature can be regulated as well as flows. Much of the silt in the upper river will settle in the reservoirs, resulting in clearer water flowing from Devil Canyon dam, which may be highly advantageous for rearing of young salmon. All of these mitigation measures could preserve the salmon runs at nearly pre-project levels, or potentially at even higher levels. Below Talkeetna, no significant changes in the salmon habitat are anticipated.

Elimination of peak floods may result in stabilization of bars, islands, and river banks in the river bottoms below Devil Canyon Dam, with the result that riparian forest may develop in areas now in willow brush. Such advance in plant succession will be unfavorable to moose, since willow is a prime winter food. This trend can be reversed by a program of logging of the bottomland forest or by judicious controlled burning.

Summary

Considering the environmental impacts as a whole, and the possibilities for partial mitigation, it does not appear that environmental considerations should preclude the development of the Susitna Project.

GEOTECHNICAL CONSIDERATIONS

General

The External Review Panel, as a group and individually, has visited the proposed dam sites, inspected the rock formations, reviewed the results of the exploration program, and read the interpretations and conclusions presented by Acres in their Feasibility Report. We recognize that the site exploration has been done in various stages over the past years and note that the Feasibility Report has included the pertinent portions of these earlier studies.

We conclude that the amount of site geologic investigations completed for the Feasibility Report is adequate to effectively preclude unknown geotechnical conditions which would have a major adverse impact on project design and costs.

Geology and Project Layout

The geologic conditions revealed in outcrops and borings are generally very favorable for the structures required for the project. Where local shear zones or other areas of poorer quality rock have been identified, the proposed project features have been positioned to avoid them to the degree possible. For example, the diversion tunnel inlet structure at Watana has been moved downstream to avoid the "Fins" feature, the major underground chambers at Watana have been moved to the right abutment to avoid the "Fingerbuster" shear zone, and the orientation of the open cuts and underground chambers have been located where possible to obtain the most favorable orientation with respect to the joints and shear zones and thereby avoid major rock stability problems.

The very good rock conditions revealed in the borings are favorable for the major underground openings proposed and we foresee that the excavation and support of the chambers will proceed using well established construction methods. We expect that subsequent exploration will provide the information required to establish the most favorable final position for the chambers as well as providing more detailed information on the most appropriate excavation and support methods for the large diameter tunnels and high slopes.

Special Geologic Conditions

The results of the exploration program at both sites have revealed no geologic structures that can not be handled by conventional methods. Moreover, the field work has been sufficiently widespread to embrace the general geologic conditions so that no major adverse feature is likely to have been overlooked.

One of the most important geologic aspects that will receive careful attention during future field work is the buried or relict channels on both abutments at Watana. To date the studies have identified a deep channel on the right side that passes between Deadman's and Tsusena Creeks that has been filled with varied glacial deposits. The geometry of the channel and general nature of the deposits have been defined by geophysical surveys and borings. More recent studies on the left side in the Fog Lakes areas indicate that a similar channel exists here also.

The importance of this channel and its deposits for the Watana site are threefold: 1) magnitude of seepage, 2) piping of materials towards Tsusena Creek, and 3) seismic instability of the soils under strong earthquake shaking. These items have been fully addressed in our meetings with Alaska Power Authority and Acres and among other items, modifications have been made in the level of the reservoir to decrease the height of water against the saddle dike on the right side. It is clear that further field studies are required (and are planned) to assess the importance of the above mentioned three factors. However, as has been clearly pointed-out in previous reports, we believe that there are technically and economically viable solutions to these potential problems. Acres and their External Review Panel hold the same opinion. For the various possible solutions, estimates have been developed and are reflected in the project costs. We believe that the estimate is reasonable and should cover possible contingencies that may develop as more information becomes available.

SEISMIC DESIGN CONSIDERATIONS

The Susitna Project is clearly located in an area of potentially strong seismic activity and must be designed to safely withstand the effects of earthquakes. For this reason, a greater than normal effort has been devoted during the feasiblity studies to determining the pos-

sible sources and magnitudes of seismic events which could affect the project and the intensity of shaking which these events could produce at the proposed sites for Watana Dam and Devil Canyon Dam.

The extremely comprehensive studies of the seismicity of the project area are probably more extensive than those conducted for any other hydropower project in the world. They have been conducted by a highly competent group of earth scientists and engineers and they have identified the major potential sources of seismic activity, the potential magnitudes of earthquakes which oculd occur on these sources and the levels of ground shaking whicn could occur at the project sites as a result of the largest earthquakes likely to occur on these sources.

Design ground motions for the required studies have been selected with a degree of conservatism appropriate for critical structures, taking into account the possibility of a great earthquake (Magnitude 8.5) occurring on the Benioff Zone underlying the dam-sites as well as the possibility of local earthquakes (Magnitude about 6 1/4) occurring within a few kilometers of either of the sites.

Watana Dam

The preliminary design of the Watana Dam is a high embankment dam with gravel shells and an impervious central core. The design is similar to that successfully used for other very high dams (Oroville Dam in California and Mica Creek Dam in British Columbia, for example) and generally considered to be the most desirable for embankment dam construction. Sources of the required types of soils have been located and investigations have shown that ample quantities are available.

The proposed section of the dam is appropriately conservative with a proven capability to withstand normal loadings and excellent characteristics to enable it to withstand any anticipated earthquake loading. The proposed design is in fact very similar to that of Oroville Dam in California which has probably been subjected to more detailed analysis of seismic stability than any embankment dam in the world. These studies have shown that the Oroville Dam would be stable even if a Magnitude 8 1/4 earthquake should occur within a few kilometers of the dam-site. The controlling design earthquake for Watana Dam is comparable in magnitude but is source is located about 65 kms from the Watana site so that the shaking intensity is less than that used in the Oroville Dam investigation. Furthermore, the proposed materials for construction of the upstream shell of Watana have equally desirable characteristics as the Oroville Dam shell materials. Consequently, there is no reason to doubt, and preliminary analysis by Acres American, Inc., confirm that, with appropriate attention to engineering details, the proposed Watana Dam section will be able to withstand the effects of the conservatively evaluated earthquake shaking with no detrimental effects.

Devil Canyon Dam

The proposed design of Devil Canyon Dam is a concrete arch and an evaluation of the design is presented in the following section. With regard to earthquake-resistant design, dynamic analyses have been made to determine the stresses developed by conservatively-selected design earthquakes: a magnitude 8 1/2 event occurring at a distance of 90 kms and a local earthquake of magnitude 6 1/4 occurring very near the dam-site. The computed stresses are with the acceptable limits for concrete arch dams.

Furthermore, the ability of such dams to safely withstand extremely strong earthquake shaking has been demonstrated by the excellent performance of the Pacoima Dam in California in the San Fernando earthquake of 1971. This 350 ft. high dam safely withstood the effects of a Magnitude 6 1/2 earthquake occurring directly below the dam and producing some of the strongest earthquake motions ever recorded. This full scale test of a prototype structure provides convincing evidence that such dams can be designed to safely withstand the effects of strong earthquake shaking.

Other structures

In final design careful attention will have to be given to the earthquake-resistant design of other features of the project including spillways, powerhouses, intake structures, etc. The safe design of these structures is well within the state-of-the-art of engineering design for the anticipated levels of earthquake shaking and should present no major problems with regard to unacceptable levels of damage or public safety.

Uncertainties in Design

Probably the greatest uncertainty with regard to seismic design is in the required treatment of the buried channel on the right bank of the Watana reservoir. This uncertainty stems mainly from the fact that it has not been possible at this stage of project development to ascertain by borings the types of soils filling the buried channel and their engineering characteristics.

However, this is not a major problem since even if very unfavorable characteristics are assumed for these soils (and this will not necessarily be the case), remedial design measures have been explored and developed to eliminate any problems which could arise. Provisions for the costs of these measures are included in the cost-estimate even though the mitigation measures themselves, which may not be required, are not presented in the feasibility design reports.

Conclusion

In summary, it may be stated that the feasibility studies for the Susitna Project included an extremely comprehensive investigation of the seismicity of the project area and the development of design concepts for the major critical structures which, with appropriate attention to details in the final design and construction, should certainly eliminate any concerns regarding the provision of an adequate level of public safety and the prevention of any signifi ant damage to the project as a result of earthquake effects.

DEVIL CANYON DAM

The Devil Canyon Damsite is ideally suited for an arch dam. The canyon is narrow and V-shaped. The abutment rock is sound and competent.

Devil Canyon arch dam has been designed and analyzed by use of the Arch Dam Stress Analysis System (ADSAS) computer program, which is the computerized version of the Trial Load Method of Analysis. This method was developed by the U. S. Bureau of Reclamation and has been thoroughly examined by rigorous mathematical analyses. In addition, results from this method have been successfully compared with structural models and prototypes in service.

The design selected for Devil Canyon is a thin double curvature arch. It is curved in both horizontal and vertical planes to produce the most efficient distribution of stresses possible under the site and loading conditions to which it may be exposed at this site.

The static loading conditions examined are the most severe combinations of gravity, reservoir and temperature loads anticipated at the site. The resulting stresses indicate a factor of safety greater than four, based on the anticipated compressive strength of concrete in the structure. The maximum tensile stresses occur on the downstream face of the arch, where, if cracking were to occur, no damage would result. The magnitudes of tensile stresses indicated will not occur since a redistribution of load in the dam will result as such stresses develop.

The dynamic loads applied to the dam are considered to be very conservative. Even so the resulting stresses will not cause serious damage to the structure. The analytical method used for stress studies is based on elastic theory. If the stresses indicated should occur, contraction joints in the upper part of the dam may open momentarily but would not result in major release of water or permanent damage to the structure.

The preliminary design for Devil Canyon Dam does, in every respect, respond to the seismic environment of the site.

With proper construction control, the dam will provide adequate safety under all loading conditions. It is extremely important that the very best construction techniques be employed in this dam. Proper concrete mix designs, consistent consolidation of the concrete and careful treatment of the rock contact and construction joints are of the utmost importance. The resulting concrete must be a homogeneous and isotropic product.

There are always risks of inadequate or inconsistent construction practices which would present problems in the behavior of a dam. Fortunately an arch dam has the capability of distributing load from weak areas to stronger, more capable concrete. This is not meant to excuse any but the best concrete control possible, because any weaknesses are not acceptable in this important structure.

Additional foundation investigations and insitu measurements will be required before a final design for Devil Canyon Dam is completed. Deformation moduli, joint orientation and continuity, and shearing resistance along joints will be required. Because of the preliminary nature of the present studies, such investigations are not considered necessary at this time. Instead, conservative assumptions have been made to assure a safe and satisfactory structure.

The proposed foundation treatment, consisting of consolidation and curtain grouting and adequate drainage, is satisfactory.

The engineering consultant has used adequate conservatism throughout the design for Devil Canyon Dam. Very little change from the preliminary design is anticipated for a safe and efficient final design for Devil Canyon Dam.

HYDROLOGY AND HYDRAULIC DESIGN CONSIDERATIONS

Flood Potential

The engineering consultant's assessment of the flood potential in the project area has properly identified the potential magnitudes and frequencies of flood flows.

The assessment utilized all available precipitation, snow survey and stream gaging data for stations within and adjacent to the Susitna River Basin. The probable maximum flood is based on the most critical combination of precipitation, snow melt, infiltration losses and flow

concentrations that is reasonably possible. The hydrologic analyses are in accordance with accepted engineering practice which has been developed in the United States and is being used in many parts of the world.

Spillway Capacity and Dependability

The proposed design adequately responds to the hydrologic environment in terms of spillway capacity and dependability.

Both Watana and Devil Canyon dams will have low-level valve-controlled outlets to pass the once in 50-year flood, a gate controlled chute spillway in combination with the valve outlets would pass the once in 10,000-year flood and a fuse plug emergency spillway in combination with the valve outlets and chute spillway would pass the probable maximum flood without overtopping the dams. Similar valve outlets and emergency spillways have been constructed and operated elsewhere with successful service. There is no reason to believe that they would not be successful at the Susitna project.

Public Flood Safety

The proposed project adequately protects public safety in terms of the flood danger and there are no increased flood risks inherent in building the project.

The reservoirs will be drawn down in winters providing significant amounts of reservoir capacity for storage of summer floods. Virtually all normal river flows would pass through the powerhouses with very little spillway operation. Peak discharges for major floods would be reduced substantially. Consequently, project operation would enhance the public safety by reducing the magnitude and danger of floods in the lower Susitna River.

Spillway capacities and heights of dams are designed with conservative safety factors. The dams and water conveyance structures are designed and would be constructed with high safety factors in accordance with best engineering practice. For these reasons, there would be no increased flood risk inherent in building the project.

Project Damage or Shutdown

There is no reason to expect that the project would experience damage and/or require shutdown as a result of floods.

Major floods may cause some cavitation erosion in spillway chutes, river bank and bed erosion downstream of flip buckets and valve outlets, and erosion in the unlined emergency spillway channel.

Because of the infrequent occurrence and relatively short duration of major floods, none of these types of damage would become so extensive during any single flood to require project shutdown.

One or more of the valve controlled low-level outlets may sustain damage during a major flood requiring temporary shutdown for repairs. This shutdown would not significantly affect flood regulation since each outlet discharges a small percentage of the total flood flow.

As the powerhouses will be underground, floods would not cause them to be damaged or shutdown.

Design and Operation Assumptions

The engineering consultant has not made any major assumptions regarding design, operational mode, etc. of water conveyance structures that lack a satisfactory level of conservatism.

The low-level outlets, main spillways, and fuse plug emergency spillways have all been designed in accordance with current engineering practice which is based on conservative assumptions. Fixed cone valves are superior to any other type of valve for high-head operation. Air slots will be provided in spillway chutes to prevent cavitation erosion by high velocity flow. Pre-excavated plunge pools and/or bank protection will be provided downstream of flip buckets and fixed cone valves to prevent excessive streambed and bank erosion. The fuse plugs are designed conservatively to withstand reservoir pressures until they are overtopped and then wash out rapidly to activate emergency spillway operation. The assumption that excessive erosion would not occur in the unlined emergency spillway channel is conservative in view of the mild channel slope and favorable rock quality.

The proposed operation of the water conveyance structures is believed to be the most reasonable and practical operational mode which provides a satisfactory level of conservatism with respect to downstream effects and project safety.

Reservoir Sedimentation

The effects of reservoir sedimentation have been properly assessed in design of the project.

Based on conservative values of the sediment inflow and reservoir trap efficiency, less than 5 percent of Watana reservoir would be filled in 100 years, and deposits in Devil Canyon would be less than 25 percent of that deposited in Watana reservoir. A large percentage of the sediment would be deposited in the dead storage portion of the

reservoirs. Reservoir sedimentation is not a controlling factor in project design as larger reservoirs or higher dams are not required and power production due to reservoir sedimentation would not be affected for well over 500 years.

Potential Downstream Effects

The proposed design and operation of the water conveyance structures adequately addresses potential downstream effects on river morphology, fisheries and wildlife.

Multi-level intakes will be provided for the power intakes and/or low-level outlets, as necessary, to permit release of reservoir water in the temperature range suitable for the downstream fishery. The valved outlets will discharge into relatively shallow basins, thereby preventing nitrogen supersaturation conditions harmful to fish. Spillway flip buckets and plunge pools will be designed to minimize nitrogen supersaturation. Their infrequent operation of once in 50 years would also greatly reduce any potential for serious effects on fish by nitrogen supersaturation. Planned increased reservoir releases during critical spawning periods together with remedial river channel work in spawning areas would minimize detrimental effects caused by lower river water levels due to project operation. While turbidity levels of reservoir releases would be sharply reduced in the summer, winter turbidity levels may be above natural levels due to suspension of fine sediments in the reservoirs; but this is not believed to be significant. Project operation will cause the following addtional effects in the Susitna River downstream of Devil Canyon Dam:

1) Eliminate and/or reduce thickness of ice cover for 20 to 30 miles downstream of Devil Canyon Dam in the winter due to release of reservoir flows above freezing temperatures which would prevent river crossings over ice by some wildlife and humans.

2) Sediment loads would be reduced in the Susitna River upstream of the confluence with Talkeetna causing some degradation of river channels.

3) Sediment loads would be essentially unchanged below the confluence because of the extremely large volume of sediment in the flood plain and contributed by tributary streams below the Talkeetna confluence.

4) Summer water stages in the lower Susitna River will be reduced by 1.5 to 3.5 feet which would reduce flooding in some areas and should not cause major impacts on navigation and other river operations.

5) The lower river will become more stabilized, resulting in a decrease in the number of small subchannels and an increase in vegetative cover.

6) The absence of annual floods may result in some loss of new lands for moose browse.

In summary, the potential downstream effects do not appear to be of such significance as to seriously jeopardize project construction.

Mitigation Measures in Water Conveyance Structures

Based on successful experience at other projects, mitigation measures that will be incorporated in the design of the water conveyance structures should be reliable and effective.

Multi-level intakes would have ports at several reservoir levels and a gate control system which would permit reservoir water to be released at the best possible temperatures suitable to the downstream fishery. The fixed cone valve sizes and operating heads for the Susitna project are well within their acceptable limits. Additional reliability of operation is provided by the use of 5 and 6 valved outlets at Devil Canyon and Watana, respectively. This enables continued operation at a high level of reservoir release in the event that one or two outlets would need to be closed. Operation of the valved outlets, as proposed, will reduce operation of the main spillway to once in 50 years, thereby reliably and effectively minimizing nitrogen supersaturation effects on the downstream river fishery.

Conclusions

In summary, it may be stated that the feasibility studies for the Susitna Project includes a thorough development of hydrologic aspects of the Susitna River and the development of design concepts for the major water conveyance structures which, with appropriate attention to details in the final hydraulic design, would assure an adequate level of public safety against flooding and the prevention of excessive detrimental downstream effects on river morphology, fisheries and wildlife.

MARKETS, ECONOMICS AND FINANCE FOR THE PROJECT

This section responds to the basic issues of the macroeconomic forces impacting the economic viability of the project, the future demand for power, economic measures and risks for the project, financial

opportunities and problems, marketability of power and suggestions for an overall strategy.

Macroeconomics

Two factors, future world oil prices and market rate of interest strongly impact (if not dominate) the economic and financial viability of the project. Both of these factors are in a large measure outside the control of the Alaska Power Authority.

Oil prices strongly affect the State's revenues, which in turn influence the State's economy, the rate of economic development in Alaska and correspondingly the future demand for power. These prices, through competitive market forces, establish the long run competitive price of natural gas and influence the price of coal and thus strongly influence the costs of thermal alternatives to the Susitna Project. These same prices affect State revenues and available funding from the State for the project, and the marketability of power.

More than 90% of the direct costs of operating a hydro facility are interest charges. The market rates of interest, thus strongly determines the cost of the Susitna Project and its relative economics.

The Susitna project is economically attractive in an environment of rising oil prices and low interest rates. Interest rates for State Government bonds are the highest they have been in fifty years. With a growing surplus of crude on world oil markets, the spot prices of crude have declined and future price trends are uncertain.

Demand For Power

We have reviewed the range of demand forecasts developed by ISER and Battelle and employed by Acres in their report and it is our opinion that these forecasts appear reasonable. Actual growth rates will probably lie between the expected and low cases. This is true because essentially all of the power will serve the residential and commercial market, which tracks population and employment trends.

Economics of the Susitna Project

The present value of the cost of the Susitna Project versus another source of power is related to the time horizon of the evaluation and the discount rate. The time horizon is important because the economics may be different depending on the period of evaluation.

Work done by Acres and Battelle, and supported by our independent evaluation show that over a 30 year period through the year 2010, the Susitna project would probably yield no net benefits. With current interest rates and oil prices, over a thirty year period, power from the Susitna could very likely be more costly than a thermal alternative.

However, hydro projects usually have long useful lives of many decades, and over a 60 year period, the Susitna project appears to be economically attractive.

With this framework, there is a value trade-off for Alaskans to choose between

* Receiving the current benefits from funds that would be invested in the Susitna Project

or

* Investing and receiving the potential long term benefits of hydro power in the next century.

Sensitivity and Risk Analysis

The net economic benefits for the Susitna project versus alternatives are highly sensitive to load forecasts, real discount rates, fuel escalation costs, capital costs of the project, and financing strategies.

For the Acres' base case analysis, which has escalating energy prices of 9-10% per year based on inflation of 7% per year and an implied interest rate of 10%, the net gain over a 60 year period is about $1.3 billion (1982). The investment in the Susitna Project corresponding to this gain is $5.1 billion (1982). If the load forecast follows a low growth scenario, the net gain is reduced to nearly zero, or if the discount rate is reduced to 12% (5% real) the project would yield a loss of $500 million or more.

If the fuel costs escalated at an inflation rate of 7% per annum, the impact would also be a loss of $1.1 billion dollars. Conversely, if the escalation rate for fuel is 10%, the impact would be a net sum of about $1.5 billion. If the capital costs of the project were 20% more than estimated, the cost of the Susitna Project and a thermal alternative would be essentially the same.

There is a wide range of possibilities for forecasts of these variables and corresponding values for the net benefits or losses. Through a probabilistic assessment of each of these variables, Acres estimated that there is about 25 - 30% chance for a net loss and a 70 - 75% chance for a net gain. These assessments were made in an

environment of increasing oil prices and medium increases in load, and did not directly account for the financing and marketing risks in these economic analysis. If we include these factors in todays environment, the risks increase although the weight of the economics still slightly favors the Susitna Project.

The major economic risks for the project are:

(1) Inability to obtain favorable bond rates and corresponding high financing charges for the project.

(2) Lower than expected energy price increases could make the project economically nonviable.

(3) Capital cost estimates may be too low, placing severe financial strain on the project.

(4) Possible opportunity losses, that is, foregoing the benefits of other investments in Alaska, for example, industrial development in enterprises which might generate net revenues or a stable long term employment base. The Susitna project would generate jobs during construction. However, in the long term during operation, the number of jobs added to Alaska's economy is minimal.

(5) Difficulty in entering into long term contracts for the power.

(6) A possible combination of the above.

Management of Economic Risks

Many of these risks can be managed, thereby substantially increasing the possibility of favorable economics for the project. The essence of this management is (1) timing and (2) additional low-cost studies.

A strategy of waiting patiently for favorable bond interest rates and an increase of oil prices would substantially reduce the risks. Taking a long term view, over say ten years, there is a strong possibility that interest rates will decline giving the Power Authority a window to obtain inexpensive financing. Correspondingly in the same time frame, it is likely that oil prices may start to rise again. In order to finance and start construction when these favorable events occur requires positioning now. This includes obtaining in advance all permits and licenses, and completing the engineering design and environmental studies.

To further reduce the risks, it is recommended that the Power Authority develop a business plan which would, among other things, identify viable power alternatives if the Susitna project is delayed or the demand forecast changes.

Financing

In the current inflationary environment, the Susitna Project would probably need state goverment participation of about 50% of the project's value -- $2,500,000,000 in 1982 dollars and more than $3,500,000,000 in actual costs. Because of the high level of risks, the debt portion of the project would probably require implicit or explicit state guarantees, or possible general obligation bonding. The State of Alaska effectively takes all the risk on the entire cost of the project including potential bonding of $2,800,000,000 in 1982 dollars and a correspondingly greater numbers of actual dollars.

A combination of escalating construction costs, high interest rates, and declining state revenues could put a revenue cash flow squeeze on the project. Positioning, patience and timing are critical to minimizing this risk.

These are some major opportunities in the financing area including the arbitraging of funds during the construction period or obtaining low cost debt financing. For example, if the project could be financed today at the lower rates that prevailed in 1977 and 1978 (7 to 8%), the present value of the costs could be reduced by about $1,500,000,000 (1982 dollars). A recurrence of low rates would markedly affect the financing of the project.

The tactics and strategy for financing needs further study and should be developed in the business plan.

Marketability

The power from the Susitna Project probably could not be sold unless it were less costly than alternatives. Anchorage, Fairbanks, and other regions within the Railbelt Area have different power sources and, correspondingly, different cost bases for power. This means that if uniform electric rates were used for Susitna power, the cost of power may be pegged to the least costly alternative. This would further exacerbate the financing and contracting problems.

A solution lies in organizational changes and a possible state referendum to gain support from the interested parties. This problem of marketing needs further study in the suggested business plan.

STATE OF ALASKA

JAY S. HAMMOND, GOVERNOR

DEPARTMENT OF FISH AND GAME

OFFICE OF THE COMMISSIONER

P.O. BOX 3-2000
JUNEAU, ALASKA 99802
PHONE: 465-4100

Statement of Commissioner Ronald O. Skoog to
Alaska Power Authority Board of Directors regarding
Susitna Hydroelectric Project Feasibility Report
FR 16 APR 82

The Alaska Department of Fish and Game appreciates the invitation extended by Mr. Conway to provide the Alaska Power Authority (APA) Board of Directors with this Department's views concerning the "feasibility report" on the proposed Susitna Hydroelectric Project. We have not had sufficient time to review the report in detail, but nevertheless do have some comments to make.

In his January 26 letter to the Department, Mr. Conway stated, "Specifically, we wish to know if, in the area of your agency purview and based on information available to date, you judge the proposed project to be cost effective, environmentally acceptable, technically sound, and in general in the best interests of the people of Alaska." My Department's expertise is limited to the second area of concern--"environmentally acceptable"--and therefore my comments will be confined to that. Higher authority than

mine will judge whether or not the project is "cost effective", "technically sound", and "in the best interests of the people of Alaska."

In support of my response to Mr. Conway's request, I am providing the Board a copy of a March 12, 1982, letter and enclosures from my office to the Northern Alaska Environmental Center. This correspondence will provide additional background information outlining this Department's views. My comments today restate many of our prior positions, comments, or advices pertaining to the proposed Su Hydro project.

At the present time, this Department does not believe that the potential environmental impacts of the proposed Susitna Hydro Project from the fish and wildlife perspective can be evaluated adequately, because

1) The information and analysis to date are not sufficient to identify the full range and magnitude of potential impacts the project will have on fish and wildlife; and, therefore
2) It is unknown as to which mitigation alternatives can or should be applied to offset these impacts.

Absent an adequate evaluation of impacts and applicable mitigation alternatives, we cannot hope to evaluate the environmental costs, the feasibility of mitigation, or the

tradeoffs of fish and wildlife resources and habitat that may be involved. The costs of mitigation should be included as an integral part of the appraisal of the overall costs of the proposed project.

This Department also is unable to conclude at this time whether this proposed hydro project is environmentally sound. It has been this Department's general advice that a minimum of five years would be required to assess and understand project impacts to provide the basis for developing mitigation alternatives. To date, the limited data and impact analysis by the APA's contractor, Acres American (Acres), and the incomplete analysis of mitigation measures do not reflect accurately the actual level of knowledge available thusfar from data collected by the Department this past year. Another constraint upon an acceptable environmental evaluation has been the inadequate time scheduled for impact evaluation and mitigation planning to meet the requirements of State and Federal laws, regulation, and policy regarding fish and wildlife resources.

It has been our general perception that in order to meet predetermined project construction deadlines, the Alaska Power Authority has tended to diminish the views expressed by our agency and others concerning important resource issues, including the level of information that agencies

consider essential to minimize or avoid conflicts on unresolved issues or informational deficiencies which can arise during the review process of the Federal Energy Regulatory Commission (FERC) license application. The APA has had an opportunity to address agency concerns on project issues for over two years, yet generally has remained unresponsive to suggestions to develop a process for formal substantive interagency coordination. Instead resource agencies have had to work on an informal basis through the Susitna Hydro Steering Committee (SHSC). ADF&G recommended in 1979 that this committee, which includes members of my staff, be established with a more formal role than it has now.

I would like to reaffirm that I fully support this committee and the advisory role to the APA they have attempted to fulfill. The SHSC has made a serious attempt to provide advices on project deficiencies and on interagency and interdisciplinary study coordination needs to the APA. (See enclosed copy of letter to Eric Yould from Alan Carson.) APA should recognize and give attention to the concerns the SHSC has advanced even though it has operated only on an informal, advisory basis.

I suggest that the resolution of these concerns about the project prior to initiating the FERC license process application might well be a more prudent course to follow

and might well result in a shorter time-frame for license approval than what might occur should the license application later prove deficient. Additionally, to initiate the application process prematurely with insufficient data probably will result in an undesirable polarization between the APA and the State/ Federal agencies on unresolved resource issues. There are two fundamental elements of resolution that we believe would be desirable before the application for a FERC license is made:

1) Completion of one additional year of fish and wildlife baseline data collection, including commitment of budgetary and manpower resources, before attempting an evaluation of habitat-wildlife relationships.

Particular emphasis needs to be given to the aquatic habitat and instream-flow program of the Alaska Department of Fish and Game. The methodologies involved and data collected are essential to quantifying project impacts on Susitna River fishery resources and to some extent can be applied to impacts on terrestrial wildlife resources. This past year, the ADF&G aquatic studies were limited to collection of baseline information.

The impact analysis and mitigation alternative planning role was delegated solely to Acres-American and Terrestrial Environmental Specialists (TES). In our opinion, Acres and TES underestimated the time and manpower resources required to analyze and prepare an impact evaluation from the large amount of information collected by this Department and other project participants. In recent discussions with APA staff, it has been suggested that ADF&G perform the technical analysis of data we collect in FY 83 to assess project effects on habitats. We would accept this role and function provided that a comprehensive interdisciplinary instream flow study program is implemented.

The FY 83 program that ADF&G proposes should be supportive to and supported by field data collection and efforts of other study contractors. There should be some assurance that other important study elements in water quality and hydrology, for example, will be collected and, when applicable, analyzed and made available so the ADF&G can make an objective assessment of project effects on aquatic habitats.

2) It is of primary importance that APA initiate a formal program of coordination with State and Federal Agencies to review and identify unresolved project issues, scope of studies, and agency expectations with regard to mitigation planning. APA needs to respond to agency recommendations and to develop an organization, process, and strategy to deal with unresolved project issues prior to submitting the FERC license application as well as with any issues identified after submission during the application review process.

Thank you for the opportunity the APA Board of Directors has afforded the Department of Fish and Game to express our views.

Ronald O. Skoog
16 APR 82

STATE OF ALASKA
DEPARTMENT OF FISH AND GAME
OFFICE OF THE COMMISSIONER

JAY S. HAMMOND, GOVERNOR

P.O. BOX 3-2000
JUNEAU, ALASKA 99802
PHONE: 465-4100

March 12, 1982

Mr. Jeff Weltzin
Northern Alaska Environmental Center
218 Driveway
Fairbanks, Alaska 99701

Dear Mr. Weltzin:

This is to clarify further the Department of Fish and Game's position pertaining to the Su-Hydro Project. Copies of prior correspondence between our agencies are necessary for the convenience of the persons and agencies who will receive a copy of this response to insure they can view the context of these letters and the questions you have asked the Department. Therefore, we have enclosed: your original inquiry of December 3, 1981, our response January 19, 1982, and your letter of February 1, 1982.

The first question you advance in your February 1, 1982 correspondence basically asks if ADF&G can grant a Title 16 permit to the Alaska Power Authority (APA) if the APA files a Federal Energy Regulatory Commission (FERC) application this summer. The answer to this question is "perhaps." In our opinion, however, it would not be advisable or reasonable for the APA to make such an application or request an approval of a permit from this Department under Alaska Statute 16.05.840 or 870 at this time or in the near future. Some of the reasons are as follows:

1. Because of the size of this proposed project, a FERC License application undoubtedly will receive a broad range of public, governmental agency, and special interest scrutiny. It is therefore most preferable that the FERC license application process be implemented and basically concluded before an ADF&G Title 16 permit is requested. To apply for and receive a Title 16 permit from the ADF&G would be a disruptive and delaying influence on the FERC license application process. Essentially the FERC license application will start a "clearing house" process within which issues and

concerns about the sufficiency of available data, and the adequacy of fish and wildlife mitigation planning and implementation can be addressed between the Alaska Power Authority and the State and Federal resource agencies. With the successful conclusion of the FERC process, ADF&G should be able to issue a Title 16 permit, pursuant to its authority with conditions or stipulations specifically relevant to the hydroelectric project construction plan, and consistent with a mitigation plan accepted by ADF&G, as well as the U.S. Fish and Wildlife Service and other resource agencies.

2. It is explicit in Section (c) of A.S.16.05.870 (enclosed) that the applicant provide complete plans for the proper protection of fish and game before constructing a hydroelectric project. If these plans are not sufficient in the view of this Department, the approval may be conditioned by this Department with those measures or requirements which must be met to protect fish and game resources before construction of the project may begin. The need and value of the additional studies and mitigation planning which we see as being required for the Susitna Hydroelectric Project are to insure that the mitigation and resource trade-off options are clearly spelled out by the applicant and that the "conditioning" and "stipulations" of our permit are minimized. It is not advisable nor reasonable for APA to initiate a "second front" of permit application which would demand an unreasonable amount of time and effort when the FERC license application process is set up to accommodate this Department's as well as other agencies' concerns.

Your second question asks this Department: "...do you plan to advise the Governor, Legislature and the Alaska Power Authority of your assessment regarding what can and cannot be said about impacts to Susitna fisheries from the proposed project at this time?"

The Department has stated its position to the Alaska Power Authority numerous times in the past regarding the level of existing fisheries information available prior to the initiation of this year's Phase I study, and the time frame we believe will be required to complete a reasonable assessment of fisheries resource impacts. Our basic advice has been that an acceptable mitigation plan would require a minimum of five years of comprehensive fisheries and aquatic habitat assessment. With that time frame a level of information could be attained which would enable resource impacts to be evaluated objectively, and a feasible and prudent mitigation plan to be approved and adopted for implementation.

It must be pointed out, however, that the Su-Hydro Aquatic Studies have many tasks or sub-elements which after an annual review may be dropped or continued, consistent with a determination that the data generated from these tasks is sufficient to define or not define a specific impact. We believe the ADF&G Su-Hydro Aquatic Study Program must be continued at its current level in all task areas, and intensified in the "Aquatic Habitat and Instream Flow" project. We see major rescoping being required for the program to be conducted after June 30, 1983, to resolve probable license application deficiencies that may come up in the FERC review process.

We believe it should be the APA's responsibility to define all of the issues about this project that concern the public, special interest groups, and the resource agencies. We know that resource agencies have forwarded their concerns about the project to the APA. However, we have never seen any publication or presentation of these agency concerns to the public, Governor, or the Legislature. Ample opportunity for APA to publicize these concerns has been afforded since 1979 through their public participation program and reports to the Governor and the Legislature. Such an opportunity, for example, could have been afforded in the Susitna Hydroelectric Project Mid Report to the Governor and the Legislature. We believe the Governor and Legislature should have been informed in March 1981 in the Mid Report that there are issues of concern within the State about the Su-Hydro Project. It is important to recognize too that many of these issues are not related to the fish and wildlife resources.

Your third and fourth questions ask our opinion on whether "...it is appropriate for the State to judge project feasibility and commit to project construction at this time?", and "...if you do not feel an informed decision can be made on Susitna Hydro at this time, how much additional fishery study does ADF&G need before enough is known to determine project feasibility?"

We believe that the feasibility of the Susitna Hydroelectric Project presently is being based on whether a benefit-cost ratio of 1.0 or greater can be obtained for the project. If the benefit-cost ratio calculated for the project is projected to be less than 1.0, we assume that the project would be determined to be "not feasible" from the economic perspective. This Department is not aware to what extent the cost of mitigating fish and wildlife impacts is being included in benefit-cost calculations as a part of determining overall project feasibility, nor are we aware how socioeconomic impacts are being calculated. In our view it logically follows that, if project impacts are neither adequately determined at this time nor prudent and feasible mitigation options described, then the costs of fish and wildlife mitigation efforts in the benefit-cost analysis

cannot be presented objectively because we believe these costs are not presently known.

It should be noted also that it is a fundamental requirement of the Federal "Fish and Wildlife Coordination Act" (48 Stat. 401, as amended, 16 U.S.C. 661 et. seg.) that the cost of mitigation must be incorporated in the benefit-cost assessment relating to project feasibility. Solely from the fish and wildlife resource standpoint project feasibility has not been shown either positively or negatively. That is, while the range of project impacts cannot be addressed adequately now and feasible mitigation alternatives or options outlined, these should occur in due time. As I previously commented in my January 19 letter to you, Terrestrial Environmental Services had a difficult charge to determine fisheries impacts and mitigation alternatives by February 15 of this year. We doubt that the recent delay of FERC licensing to September 30 by the APA will change the quality or objectivity of that effort significantly, due to time and informational restraints. As stated earlier herein, we believe that a five-year study program would be needed as a minimum to assess the impacts of the project from the fish and wildlife perspective. That estimate continues to be this Department's fundamental position.

If you have further questions do not hesitate to contact this Department.

Sincerely,

Ronald O. Skoog
Commissioner

Enclosures

cc: Governor Hammond
John Katz - Commissioner ADNR
Ernst Mueller - Commissioner ADEC

Sec. 16.05.870. Protection of fish and game. (a) The commissioner shall, in accordance with the Administrative Procedure Act (AS 44.62) specify the various rivers, lakes, and streams or parts of them that are important for the spawning or migration of anadromous fish. Before December 31, 1968, the specification may be made by designating areas within which all rivers, lakes, and streams are considered important for the spawning or migration of anadromous fish; provided, that the areas lie within 50 miles of the coastline extending from Dixon Entrance through False Pass to Cape Menshikof, including all islands east of False Pass. A person giving notice under (b) of this section before December 31, 1968, may, if the activity is to take place within such a designated area, request the commissioner to specify individually by name or number, the particular rivers, lakes, and streams or parts of them within the area of operations described in the notice which are important for the spawning and migration of anadromous fish. Upon receipt of the request the commissioner shall promptly make the designation.

(b) If a person or governmental agency desires to construct a hydraulic project, or use, divert, obstruct, pollute, or change the natural flow or bed of a specified river, lake, or stream, or to use wheeled, tracked, or excavating equipment or log-dragging equipment in the bed of a specified river, lake, or stream, the person or governmental agency shall notify the commissioner of this intention before the beginning of the construction or use.

(c) The commissioner shall acknowledge receipt of the notice by return air mail. If the commissioner determines to do so, he shall, in the letter of acknowledgement, require the person or governmental agency to submit to him full plans and specifications of the proposed construction or work, complete plans and specifications for the proper protection of fish and game in connection with the construction or work, or in connection with the use, and the approximate date the construction, work, or use will begin, and shall require the person or governmental agency to obtain written approval from him as to the sufficiency of the plans or specifications before the proposed construction or use is begun. (§ 31 art I ch 94 SLA 1959; am § 1 ch 180 SLA 1960; am § 1 ch 132 SLA 1962; am § 1 ch 89 SLA 1966)

Purpose. — The purpose of this section is to protect and conserve fish and game and other natural resources. 1964 Op. Att'y Gen., No. 10.

Alaska has jurisdiction to enforce its fish and game laws in national forests. 1964 Op. Att'y Gen., No. 10.

Alaska's protective fish and game laws, especially this section, complement rather than conflict with federal government functions in national forests and should be enforced by both federal and state officials. 1964 Op. Att'y Gen., No. 10.

82-8207.0

STATE OF ALASKA

DEPARTMENT OF NATURAL RESOURCES

DIVISION OF RESEARCH & DEVELOPMENT

JAY S. HAMMOND, GOVERNOR

Pouch 7-005
~~[illegible]~~
ANCHORAGE, ALASKA ~~[illegible]~~ 99510

March 5, 1982

Eric Yould
Executive Director
Alaska Power Authority
334 West 5th Avenue
Anchorage, Alaska 99501

Dear Mr. Yould:

In the past 18 months, the Susitna Hydroelectric Steering Committee (SHSC) has reviewed many aspects of the Susitna Hydroelectric Feasibility Plan of Study. We have been briefed by, and have consulted with many of the Acres American, Inc., contractors and subcontractors. On November 21, 1980, the SHSC transmitted to APA a comprehensive review of the entire Task 7 (environmental and socio-economic) Plan of Study for the proposed Susitna Hydroelectric Project. During the summer of 1981, most of the SHSC members participated in a field trip to the proposed dam sites and to some of the field camps where investigations were ongoing.

As a result of these and other Susitna Hydroelectric related meetings and discussions, the members of the Steering Committee are probably the best informed representatives of those agencies who will participate in the decision making and permitting process. The SHSC members believe it is desirable to identify the most important issues prior to the issuance of the draft feasibility study for review and comment. We hope this will achieve three things: (1) provide a basis for agreement between SHSC and the Alaska Power Authority on the status of important Task 7 issues and concerns; (2) provide the vital information to those not well informed so they can be aware when they review the findings provided in the draft feasibility study; (3) where appropriate, to identify potential remedial actions to the APA to minimize if not resolve the concerns that are raised.

The process that the SHSC went through in creating this letter was to request all the SHSC members to compile a list of issues and concerns that merited attention of the APA. This list was then drafted, reviewed, and approved by the SHSC members.

The issues identified below have been placed in two categories. The first entitled "Overall Study Approach" deals with those issues and concerns which transcend specific studies. These concerns are not entirely in the scope of the feasibility study contract or necessarily the sole responsibility of the Power Authority. However, the decisions the APA and Legislature may make with respect to the Susitna project in the next 60 days could obviate these concerns. The other category is entitled "Study Specific Issues" and is self-explanatory.

The following are the overall study approach problems identified:

OVERALL STUDY APPROACH

1. The most urgent and most important issue is the relationship between the timing of findings from studies conducted by Acres American and its subcontractors and when the State of Alaska will decide whether to build Susitna. The problem is that existing law may result in a decision by the state as to whether the dams should be built before the socio-economic and environmental costs, impacts, and trade-offs are known. Although the March 15, 1982, Susitna Hydroelectric Feasibility Study may assist in determining if the dams can be built in a narrow technical (engineering and constructability) sense, it cannot speak to significant public policy questions such as:

a. is it in the best interests of Alaskans to use their money to build the dams?

b. what are the environmental and socio-economic impacts and trade-offs that have to be made if it is decided to build the dams?

In determining answers to such questions, there are accepted methods which should be rigorously applied. No one would consider building the Susitna dams without anwering all questions about soils stability and earthquake hazards. The same level of assured knowledge needs to be acquired to answer questions about environmental and socio-economic effects of the dams.

This issue may be outside the scope of the Acres contract and the sole purview of the Power Authority. A combined effort of the Power Authority and the Governor's Office may be needed to comprehensively frame the issue and devise methods to deal with them.

2. There appears to be a lack of necessary coordination between the various study tasks. Unless extraordinary corrective efforts are made, it is unlikely that an integrated, relevant, and complete environmental assessment which is acceptable to state and federal agencies and to the Federal Energy Regulatory Commission (FERC) will be produced. This need was identified early by the SHSC. The November 21, 1980, review of the Plan of Study says: "The Steering Committee members believe the most compelling need is for a well conceived process to improve the linkage and coordination of the various studies." As an example of this, I refer you to point number 1 below.

The following are studies specific issues:

SPECIFIC ISSUES

1. A coherent and coordinated Fish and Wildlife mitigation policy and plan needs to be established immediately. It is our understanding that, unlike the wildlife mitigation options, the fisheries mitigation options

and the overall Susitna Hydroelectric Project fish and wildlife mitigation policy have yet to produce an agreed upon product. The following issues still require resolution: agreement on mitigation policy, agreement on the roles definition of the APA, the agencies with fish and wildlife authority and expertise, the Federal Energy Regulatory Commission (FERC), and those agencies with land and water management authority. Until these issues have been resolved, determination of the full costs and impacts of the proposed Susitna Hydroelectric project are not possible. Failure to settle these issues will dramatically increase the probability of delay in action by the FERC, unnecessary confrontation between the APA and government management and regulatory agencies and litigation in the courts. Once resolution of the identified issues occurs, the FERC application process may be the appropriate forum to resolve specific mitigation issues.

2. There is a lack of information to describe the relationship between various stream flow levels and the productivity of fisheries and aquatic habitat downstream from the proposed Devil Canyon Dam. Exhibit E of the FERC application for license requires quantification of the anticipated downstream impacts.

3. The fisheries studies have not been going on long enough to acquire the comprehensive data and knowledge needed to assess project impacts. This, coupled with inadequate instream flow studies, provides for a less-than-satisfactory answer to questions on the impact of the proposed hydroelectric project on fishery populations.

4. Wildlife studies and wildlife mitigation appear much further developed than the fisheries issues described above. However, there are issues yet to be resolved in the wildlife area. I refer you to the February 16, 1982, letter from the Department of Fish and Game to Robert Mohn of APA. It appears that additional work is needed to identify realistic mitigation measures for lost wildlife habitat and on relating wildlife use of an area to habitat the characteristics.

5. Public review of the Phase I environmental reports and of most mitigation options discussion papers is now scheduled to occur separately from the distribution and public review of the draft feasibility report. We do understand that the decision to delay for 90 days the application for a license to FERC (assuming that that is the decision from the State of Alaska), the public and agencies will be provided the opportunity to review the detailed study results and data reports for a period of 60 days before final agency comments on the feasibility study are due.

6. The Fairbanks-to-Anchorage Intertie study and the Susitna feasibility study should be integrated. We suggest that the intertie assessment be included in the Susitna feasibility study review package.

7. The decision on access to the dam sites and the policies surrounding their use after construction will be one of the most significant impacts

of the project. The Yukon River to Prudhoe Bay Haul Road built in conjunction with the construction of the Trans-Alaskan oil pipeline is a comparable situation. There is no need to restate the comments made by the SHSC and their parent agencies to the APA on this matter. However, it is appropriate to identify two of the major issues with respect to the access question. First, APA's need to begin construction of a pioneer road prior to FERC licensing of the dams raises some serious public policy issues. Second, the decision as to the mode of access (rail versus conventional road) may well be the determining factor for the extent and type of public access once construction is completed.

8. The socio-economic implications of the availability of 1600 megawatts of electrical power in the railbelt region of Alaska need to be fully described and discussed in a public forum. It would appear that this amount of electrical energy could result in industrialization and socio-economic impacts on the same order of magnitude as would petrochemical development. Because the State of Alaska is sponsoring this hydroelectric proposal, it is incumbent upon the state to provide and present in a public forum, information regarding the end use of the power and advantages and disadvantages of the socio-economic impacts of this end use. The SHSC recommends consideration of an approach similar to that which was done for the Dow-Shell petrochemical proposal.

The SHSC will be advising their respective parent agencies of the contents of this letter in order to insure that formal agency comments to the proposed Susitna feasibility study fully address the issues and concerns detailed above. In order to alleviate the problems identified above, the SHSC recommends the following: (1) The APA should take an interdisciplinary interagency approach in identifying ways to improve coordination of the environmental and socio-economic studies to insure that the scope of and the methodology used in the studies are acceptable and germane. This approach should be funded and staffed appropriately and should have the responsibility, authority and independence to accomplish this objective. (2) The draft instream flow study plan should be updated and made public to provide opportunity for agencies and other groups to participate in the development of the necessary instream flow studies. (3) Comprehensively evaluate all potential and secondary impacts to fish and wildlife both above and below the Devil Canyon and Watana Dam sites. (4) Provide public participation opportunities to: inform the public of the feasibility study and the socio-economic impacts of this project and to provide an opportunity for the public to give comments and advice to the Power Authority Board of Directors before the state determines what course of action it should take on this project.

Because of the nature of some of these suggestions as well as the extent of discussion we anticipate will be required before APA and its . . .

contractors fully comprehend our concerns, the SHSC is prepared to meet with you, your staff and contractors whenever you wish.

Sincerely,

Al Carson

Al Carson, Chairman
Susitna Hydroelectric Steering Committee

cc: SHSC Members
Charles Conway, Chairman, APA
Ernest Mueller, Commissioner, Dept of Environmental Conservation
Ronald Skoog, Commissioner, Dept of Fish & Game
John Katz, Commissioner, Dept of Natural Resources
Lee McAnerney, Commissioner, Dept of Community & Regional Affairs
Curtis McVee, State Director, Bureau of Land Management
Robert McVey, Regional Director, National Marine Fisheries
Keith M. Schreiner, Regional Director, US Fish & Wildlife Service
Reed Stoops, Director, Division of Research & Development
S. Leopold
Quentin Edson, FERC

Testimony presented to the Alaska Power Authority Board by Deputy Regional Director LeRoy Sowl, U.S. Fish and Wildlife Service, on April 16, 1982, concerning the Susitna Hydroelectric Project.

The mission of the U.S. Fish and Wildlife Service is to:

> Provide the federal leadership to conserve, protect, and enhance fish and wildlife and their habitat for the continuing benefit of people.

You might ask, therefore, why is the Fish and Wildlife Service concerning itself with a State energy project?

The Susitna Hydro Project must be licensed by FERC before construction begins. The Fish and Wildlife [redacted] Coordination Act requires that fish and wildlife conservation be given equal consideration with other features of a proposal throughout the planning and decision processes. FERC is further required to consult with state and federal fish and wildlife resource agencies to determine whether there will be project related losses of fish and wildlife resources.

The Coordination Act and Section 102(2)(3) of the National Environmental Policy Act both require:

(1) A description and quantification of the existing fish and wildlife and their habitat within the area of project impacts;

(2) A description and quantification of anticipated project impacts on these resources; and

(3) Delineation of specific mitigation necessary to avoid, minimize, or compensate for these impacts.

The Fish and Wildlife Service has reviewed the draft feasibility report with respect to its area of expertise. Deficiencies are readily apparent with respect to all three requirements. There has been a failure to quantify the habitat types present, anticipate the impacts or to identify required mitigation. All of these deficiencies are directly realted to the unrealistic time constraints placed on data collection.

Some of the specific deficiencies we have noted are, as follows:

(1) Terrestrial studies have focused on the impoundments and their immediate vicinities. The assessment of wildlife and fishery resources must be extended to downstream areas, transmission and access corridors, and areas of secondary or indirect impacts.

(2) The terrestrial studies have been qualitative. Quantification, through an acceptable methodology, is essential to the evaluation of habitat values, the probable impacts and the selection of appropriate mitigation. APA has stated its objective as "no net loss." Without methodology to quantify either losses or mitigation there is no way to assess when this goal has been achieved.

(3) Fisheries studies have been conducted for only one year. A study of this scope is sufficient only for a preliminary evaluation of the impacts and to provide for refinement and focusing of longer term studies. One year is not enough time to provide the data necessary to fully describe the resource. Any attempt to assess impacts or plan mitigation within the context of the license application would be inadequate.

(4) There are inadequate data to describe the relationship between various stream flows and the productivity of fisheries and aquatic habitat downstream from the proposed Devil Canyon Dam. A fully thought-out instream flow study would provide the quantification necessary for any impacts evaluation and mitigation planning. Without this information any evaluation of project impact on fishery resource is missing an essential component, and effective mitigation planning is seriously hampered.

(5) Anticipated water temperatures and turbidity levels in the reservoirs and downstream from Devil Canyon have not been satisfactorily investigated. An adverse temperature regime has severe implications for the fisheries; downstream from Devil Canyon as well as any potential fishery in the reservoirs.

(6) The terrestrial impacts assessment and mitigation options put forth by the consultants are quite general, not sufficiently thought through, and provide an inadequate basis for a full discussion of the project. This is directly related to the lack of an acceptable methodology for quantification.

(7) Public access and the mode and route of construction access need to be fully addressed within the context of mitigation. The environmental consultants have recognized that public access poses the greatest threat to the terrestrial resources, principally through disturbance. It is completely incongruous given this assessment and APA's goal of "no net loss" that the consultant should attempt to divorce access from consideration of mitigation as they have done.

(8) A pioneer road constructed prior to FERC licensing, is proposed. The sole purpose of this road is to facilitate project construction. We do not expect FERC approval for this proposal. FERC cannot

give its approval without an environmental impact statement. In addition, habitat losses sustained must be justified by the need for a project. The need is proven when, in the case of a power facility, the license is issued. Prior to that point, there is no project and there is no habitat degradation that can be justified.

We believe that alternatives to Susitna must also continue to be studied. Comparison of tradeoffs for fish and wildlife resources attendent to the North Slope natural gas, Cook Inlet natural gas, Beluga coal, other hydroelectric generating alternatives,, conservation, and other options have not been evaluated to an acceptable level. Continued studies would allow for a full evaluation of the environmental costs.

The APA proposes to submit a licence application to FERC on September 30, 1982. The application will be based on the feasibility report. Given the numerous deficiences I have just noted a submission on the proposed date would be premature.

The Fish and Wildlife Service has had minimal involvement with the Susitna project during the last 2 and 1/2 years. We believe we have considerable expertise to offer APA in developing an adequate license application for submission to FERC.

One particular area in which we believe we could add substantially to the study is in quantifying the fish and wildlife data for evaluating impacts and formulating mitigation plans. The Service's Habitat Evaluation Procedures would provide a framework within which habitat value can be evaluated. This methodology was used in both the Terror Lake and the Bradley Lake Hydroelectric Projects. Our Incremental Instream Flow Methodology allows for the quantification of the anticipated impacts of proposed flow regimes on aquatic habitat. Modification would need to occur to this methodology but we fully believe that it provides the groundwork upon which to build. It was utilized in the Terror Lake Project to evaluate impacts and formulate mitigation measures to protect the fisheries resources.

The Board should realize that the very decision to file the application with FERC would automatically change the relationship between APA, its consultants, and the Fish and Wildlife Service. With the decision to file, our attention must immediately focus on the licensing process. We no longer would have sufficient time and manpower to assist and provide expertise to APA and its consultants. We would expect that other federal agencies would be similarly affected.

We recommend that the decision whether or not to submit an application to FERC should be deferred until data gathered this year has been evaluated. We must have a better understanding of the fishery-habitat relationships; a more thorough understanding of the relationship of the aquatic habitat to flows and temperatures; an understanding of what the terrestrial tradeoffs are; and a greater comprehension of the reservoirs' temperature and turbidity regimes.

We greatly appreciate the opportunity to present this testimony and look forward to a continued working relationship.

UNITED STATES GOVERNMENT

memorandum

U. S. FISH AND WILDLIFE SERVICE

1011 E. TUDOR RD.
ANCHORAGE, ALASKA 99503
(907) 276-3800

TO: Hedy Ahluwalia (LW)
Tammy Jameson (BSP)

FROM: Linda Kelso (ARD-E)

DATE: 15 APR 1982

SUBJECT: Training

Please check with your immediate supervisors as to who may need warrant training or if they feel there may be a need for any other type of training (personnel actions, timecards, procurement regulations, travel regulations, etc.). Please let me know by May 3, 1982 so that we can check into it. Note: This is the type of training that the field people attended last month.

Thank you.

Linda

UNITED STATES DEPARTMENT OF COMMERCE
National Oceanic and Atmospheric Administration
National Marine Fisheries Service
P.O. Box 1668
Juneau, Alaska 99802

RECEIVED
APR 19 1982
ACRES AMERICAN INCORPORATED

STATEMENT FOR
ALASKA POWER AUTHORITY
BOARD OF DIRECTORS

Anchorage, Alaska
April 16, 1982

by

ROBERT W. MCVEY
REGIONAL DIRECTOR
NATIONAL MARINE FISHERIES SERVICE
Juneau, Alaska

The National Marine Fisheries Service (NMFS), within the Department of Commerce, has Federal responsibility for marine, estuarine, and anadromous fisheries. Several laws, including the Fish and Wildlife Coordination Act, require our agency to assess the impact of water resource developments on fishery resources. Regulations of the Federal Energy Regulatory Commission (FERC) specifically require applicants for license of a major hydroelectric project to consult with

NMFS and respond to those concerns or recommendations our agency feels are necessary to protect fishery resources. Our responsibilities for anadromous fishery resources have resulted in the development of considerable NMFS expertise in addressing the potential impacts of hydroelectric facilities on the salmon resources of the northwestern U.S.. The NMFS and its predecessor agency, the Bureau of Commercial fisheries, has been actively involved in efforts to study and preserve salmon runs to the Columbia River basin over three decades. While the current scope of our involvement with hydropower development in Alaska is considerably less than in the northwest states, we expect to draw upon our agency's overall expertise and involvement with such developments during our review of the Susitna dam proposal.

We recognize the requirement placed upon the Alaska Power Authority (APA) to submit recommendations to the Governor and the legislature on a future course of action regarding the Susitna project. Accordingly, we appreciate the need for APA to have resource agencies' opinions available for consideration at this time. We feel, however that it is premature for NMFS to give a definitive evaluation on the acceptability of the project with respect to energy benefits versus fish losses. It is more appropriate therefore, that we describe our basic expectations with the coordination process and our general environmental concerns.

First, I would like to emphasize the need for a comprehensive understanding of the importance of fishery resources within the project area. The Susitna River drainage is an extremely productive system with an annual salmon run producing a large percentage of the commercial Cook Inlet catch. These fish are very important to both the commercial fishing industry and the sport fishing sector. Salmon and several resident species such as rainbow trout, Dolly Varden and grayling are sought by sport fishermen. The fish of the Susitna River also contribute to the ecosystem of the area by providing food to other fish, birds, and wildlife. Here in Alaska our fisheries represent part of a lifestyle which, while difficult to describe and impossible to place value on, is no less real.

The two-dam proposal will impact these fisheries. While not all of those fish utilizing the system will be directly impacted, we are concerned about any loss of fisheries resources.

Only with an in-depth understanding of the fish and anticipated impacts, can we fully weigh the costs associated with hydro development, and perhaps, find ways to accommodate both. It is important, therefore that fisheries research and studies not only identify the species of fish occupying the Susitna drainage and describe their ecological characteristics and needs, but also identify areas of impact and measure to avoid or mitigate those impacts.

The necessity of obtaining comprehensive environmental data is also recognized by the FERC in their requirement that such information be specific, accurate,, and sufficiently quantified to convey a precise picture of the project and its probable effects.

This leads us to my second point in which I would like to discuss several aspects of the Susitna dam project that are of concern to our gency.

The Susitna Hydroelectric Project Feasibility Report has been prepared to assist decision makers by describing the economic, social and environmental concerns associated with the project. In this regard the document performs well. However, the Feasibility Report is also intended to provide the basis for application for license to the FERC. The regulations of the FERC are clear in describing the importance of including adequate environmental data in the license application. Further, they require this information to be provided on a level commensurate with the scope of the project. At this time we do not feel this level of detail has been reached. Without the results of

additional study in several areas, various aspects of the proposal will be poorly described or understood. These deficiencies do not imply that the Feasibility Report was improperly prepared or presented. Rather, they reflect on the limited information available as of this date.

One area of limited information in the Feasibility Report deals with the effects of post project flows on the fisheries resources. The Feasibility Report discusses the importance of side channels and sloughs between Talkeetna and Devil Canyon. These areas are heavily utilized by spawning and rearing salmon. The impact of project flows to these areas will determine , to a large extent, the fishery impact attributed to the project. These sloughs therefore represent an area requiring consideration of potential mitigation and/or enhancement measures. To date, less than one eighth of the side channel and slough areas have been surveyed. Further, the impacts of various flow regimes on the habitat are unknown because the hydrological and ecological relationships between the mainstem Susitna and these areas have not been adequately studied. An in-depth study of projected flow regimes is needed. The results of a comprehensive In-Stream Flow Study would allow a balancing of fish habitat losses against power generation, and other mitigation possibilities that could be evaluated.

Temperature changes within the Susitna River are expected to result from construction and operation of the dams. These changes could present both positive and negative changes to fish populations. The APA has used a computer model to predict and describe these changes. Currently, we do not believe a high level of confidence exists in the projected post project temperature within the two reservoirs, the Susitna mainstem, and the side channels and sloughs. Thermal changes may present significant problems to salmon, and additional study will be necessary before possible impacts can be adequately defined.

The Feasibility Report states the objective of the Susitna mitigation effort is to achieve no net loss. To achieve this goal, specific studies must occur which will develop mitigation options identified in the Feasibility Report. We do not believe that a mitigation plan can be developed, based upon available information, which would satisfy the requirements of the FERC. Basic to any mitigation plan is a comprehensive understanding of the resource and the potential impact the project will present to the resource. Again, we do not believe this level of understanding has been reached.

The FERC regulations concerning license application require a report that describes the fish, wildlife, and botanical resources. Information in this report is to include temporal and spatical distributions of certain fish species. As some salmon within the Susitna River have life cycles of five or more years, it would seem reasonable to allow at least

this long for fishery studies. To date, the fisheries studies specific to the APA proposal have occurred for only one field season. It is not reasonable to assume that such an abbreviated sampling is adequate for proper characterization of resources. For example, pink salmon exhibit a two year cycle with even year runs being much stronger than the odd years runs in Upper Cook Inlet. At this time, we have no information on the size of even year pink salmon runs to the upper Susitna or the areas of the River in which these fish spawn.

We feel it is unreasonable to discuss mitigation details before adequate knowledge of the fishery resources exists. The Power Authority has been informed of these concerns and data gaps, and of the steps necessary to correct them. Our agency has previously stated that the environmental data available from Phase I studies will not support an adequate evaluation of project impact. We continue to recommend that the anticipated date for submitting the license application be delayed to allow additional data collection.

It is our understanding that the draft license application for the Susitna project will soon be available for review. We are concerned that the application will reflect the serious deficiencies we have mentioned. If our review shows this to be the case, we feel our agency will have no alternative but to request the FERC to reject the application or direct that the deficiencies be corrected. We very much desire to avoid this situation.

Finally, I would like to close my statement with a look towards the future and a word of encouragement. The undertaking of an environmental study for a project such as Susitna is an enormous task. Accordingly, the Power Authority has initiated a very comprehensive series of studies which when completed will provide us with a better understanding of the full range of project related effects. Indeed, it may be possible to construct and operate the dams in such a way as to achieve the Authority's no net loss goal by mitigating fishery impacts, and/or by enhancing fishery habitat in certain areas.

I know the Board of Dirctors appreciates the importance of our fisheris. I hope I have conveyed to you the benefits of detailed studies to obtain essential information. In formulating its recommendations to the legislature, I sincerely encourage the Board to consider the critical need for this information and the implications of proceeding in its absence.