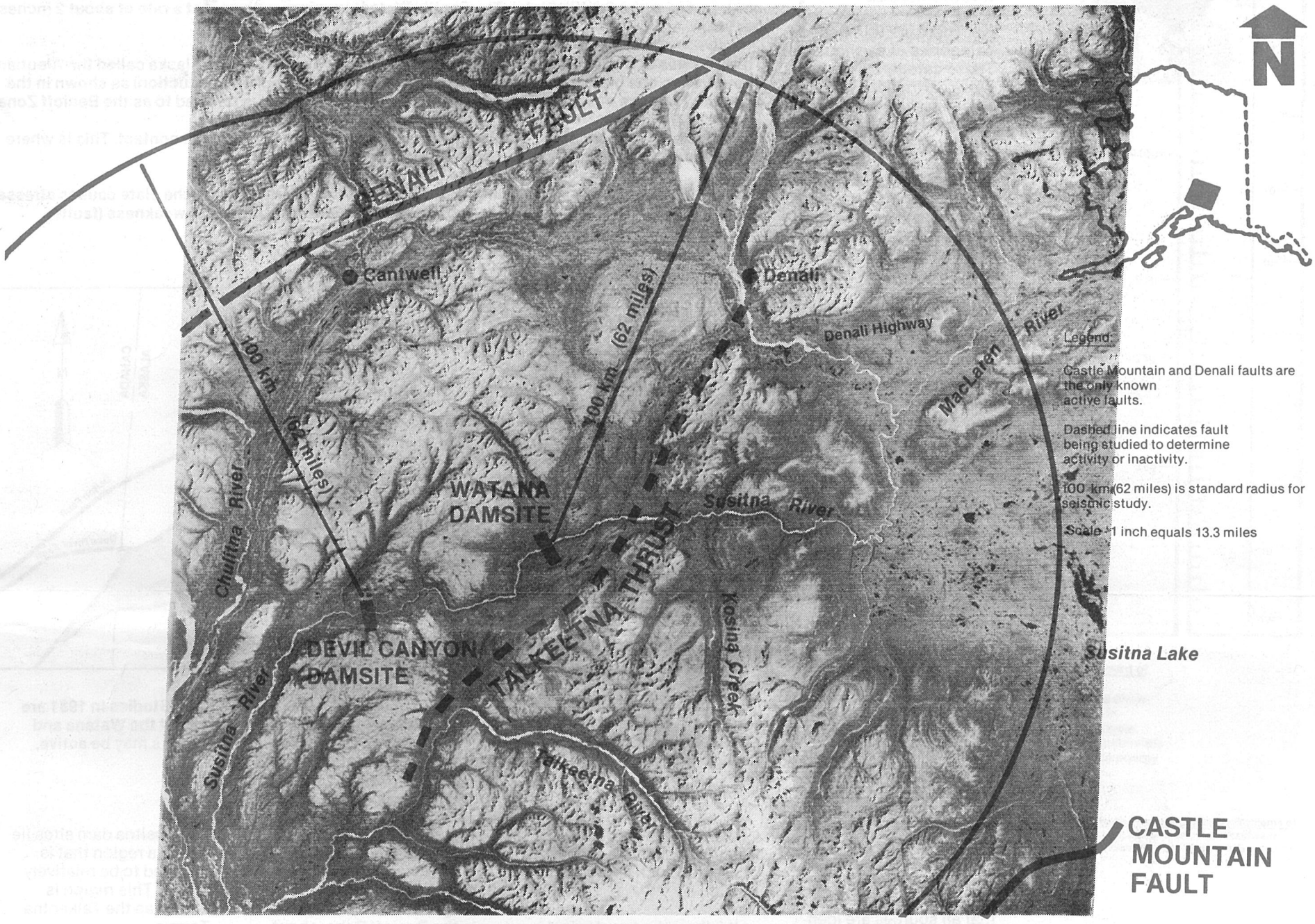
# the susitna hydro studies



September 1981




Talkeetna ●

**For the Susitna project all faults and lineaments (possible faults) within 100 km (62 miles) of either dam have been compiled from published and unpublished reference materials, satellite imagery, radar imagery, high-altitude aerial photography, and low altitude aerial photography.**

**Based on this work, the only faults in the North American Plate within approximately 62 miles of the dams which are judged to be active are the Denali fault and the Castle Mountain fault.**

**Beneath the upper 15 to 20 miles of the earth's crust is the Benioff Zone. This is also an active fault zone. The depth to the Benioff Zone beneath the Susitna dam sites is about 34 miles.**

# Preliminary findings available on Susitna basin seismicity

**This issue gives information about the seismicity of the upper Susitna River basin and discusses the question of building safe dams in seismic areas.**

The following are the preliminary seismic conclusions.

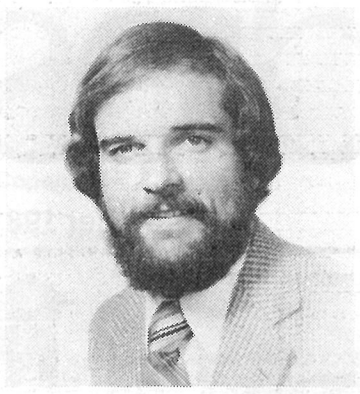
1. No faults with known recent movement (movement in the last 100,000 years) pass through or near the proposed Susitna dam sites.
2. The known faults with recent movement are: the Denali fault (north of the sites), the Castle Mountain fault (south of the sites) and the Benioff Zone (about 34 miles beneath the sites).
3. The closest distances of these faults from each site and the preliminary maximum credible earthquake magnitudes for the faults are the following:

| Fault | Preliminary Maximum Credible Earthquake Magnitude | Closest Distance of Fault to Site (miles) Watana | Devil Canyon |
|---|---|---|---|
| Denali | 8.5 | 43 | 40 |
| Castle Mountain | 7.4 | 65 | 71 |
| Benioff Zone | 8.5 | 31 | 37 |

4. Within the site region, 13 faults and lineaments (potential faults) are receiving additional study in summer 1981 to better define their potential effect on dam design. Four of these faults and lineaments are near the Watana site and nine are in the area of the Devil Canyon site.
5. At present, the 13 features are not known to be faults with recent movement. If present studies show any recent movement, then the potential for surface rupture through either dam site and the ground motions associated with earthquakes on the fault will need to be evaluated.
6. Preliminary estimates of ground motions at the sites were made for the Denali and Castle Mountain faults and the Benioff Zone. Of these sources, an earthquake of magnitude 8.5 occurring within the Benioff Zone would create the maximum ground shaking at the dam sites.

Source:
Interim Report on the Seismic Studies for (the) Susitna Hydroelectric Project, December 1980, prepared by Woodward-Clyde Consultants for Acres American, Inc. and the Alaska Power Authority.

# We've been asked



Lovegreen

The following are responses to frequently asked questions. The information was developed by Jon R. Lovegreen, Senior Project Geologist, Woodward-Clyde Consultants.

1. **Do earthquakes occur only along faults?**

   No. There are four general categories of earthquakes. These categories are collapse earthquakes, volcanic earthquakes, explosion earthquakes, and tectonic earthquakes.

   Tetonic earthquakes are the most common type of earthquakes and are the earthquakes pertinent to the design of the Susitna project.

   Tectonic earthquakes result when stresses within the earth build up to the point that the strength of the rock is exceeded. Relatively instantaneous release of strain energy takes place along a zone of weakness. The energy release causes the ground shaking of the earthquake and the zone of weakness is the fault.

2. **How do you ensure that you are identifying virtually all sources of earthquakes that could affect the dam?**

   The identification of sources for earthquakes in Alaska is based on experience with faults and earthquakes in Alaska and worldwide. From this experience, it is possible to make judgements about the potential sources of earthquakes in a region such as the Talkeetna Mountains. These judgements do not ensure that all sources are identified, rather, the judgements identify all sources of earthquakes which experience has shown could be possible.

   For large projects such as the Susitna hydroelectric project, a conservative approach is used. This approach includes the study of faults which are only remotely possible sources of earthquakes.

   The past experience of the firm which is studying the faults and earthquakes (Woodward-Clyde Consultants) includes examination of active faults and earthquakes in Alaska, California, Nevada, Utah, Central and South America, Europe, Africa, the Middle East, Australia, New Zealand, and Japan.

3. **You use the term "maximum credible earthquake." What is that?**

   A Maximum Credible Earthquake is considered to be the most severe earthquake associated with a fault and is assumed to occur at the point on the fault closest to a proposed project, such as a dam site.

   It is based on geological and historical data, and is usually of a magnitude greater than historical earthquakes.

4. **How reliable is it?**

   The Maximum Credible Earthquake is considered to be a reliable parameter to use for dam design. There are over 11,000 dams worldwide. Some of these have been built in moderate to high seismic areas such as Oroville dam in California and several dams in the San Francisco Bay Area along the San Andreas fault.

   Several dams have been damaged during earthquakes, such as Koyna in India and Hsinfengkiang in the People's Republic of China. This damage was due in large part to the absence of design considerations for reservoir-induced seismicity.

5. **What are your estimates for the largest earthquakes that could occur in the area of the proposed dams?**

   One is a magnitude 8.5 earthquake on the Denali fault, 40 miles from the dams; the other is a magnitude 8.5 earthquake in the Benioff Zone, about 34 miles below the surface of the earth at the dams.

6. **How much ground shaking would that cause?**

   The ground shaking that would occur at the dams from a magnitude 8.5 earthquake on the Denali fault is considered to have an average peak acceleration of 20%g.

   The ground shaking that would occur at the dams from a magnitude 8.5 earthquake in the Benioff Zone is considered to have an average peak acceleration of 40%g.

7. **How does that compare to the 1964 earthquake?**

   As a comparison, the average peak acceleration estimated at Susitna would be 1/3 to 1/2 as much as the average peak acceleration estimated at Valdez during the 1964 earthquake.

8. **Just how seismically active is the area where the proposed dam sites are?**

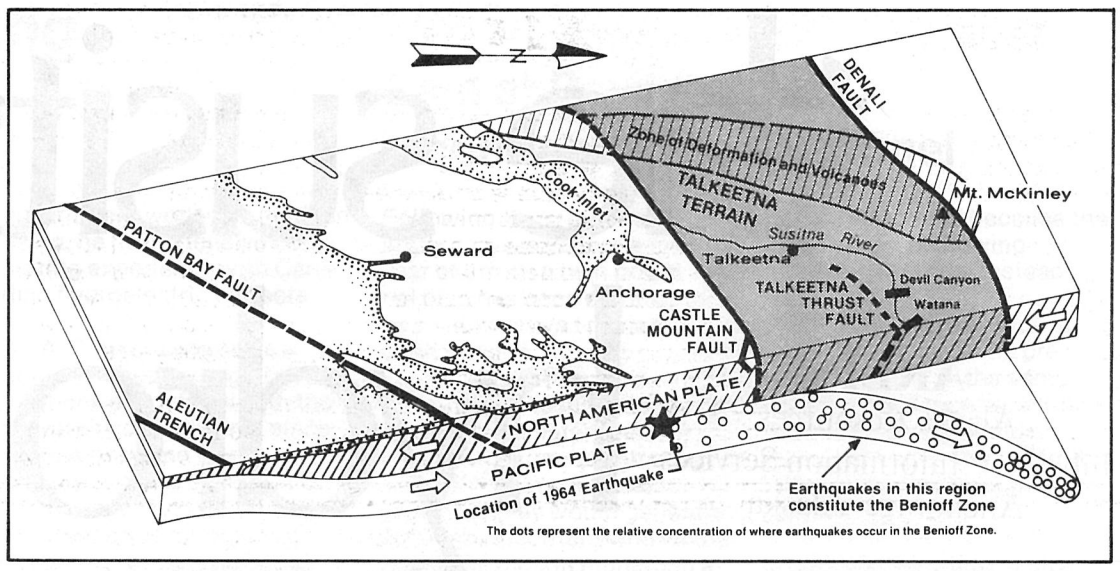
   The Susitna dam sites lie within a region that is believed to be relatively stable. This region is known as the Talkeetna Terrain.

   The boundaries of the Terrain are the Denali fault, the Castle Mountain fault, and the Benioff Zone (which is about 34 miles below the surface of the earth). These are all active fault areas.

   Energy release appears to be occurring primarily along the boundaries of the Talkeetna Terrain rather than within it.

   Within the Terrain, no evidence of active faults has been observed. Some earthquake activity is occurring and has occurred within the Terrain, but the earthquakes are typically small to moderate in size.

   To date no active faults have been identified in the Talkeetna Terrain itself. Studies in 1981 are further evaluating 13 faults and lineaments (potential faults) in the vicinity of the Watana and Devil Canyon damsites to determine whether or not the faults and lineaments may be active.

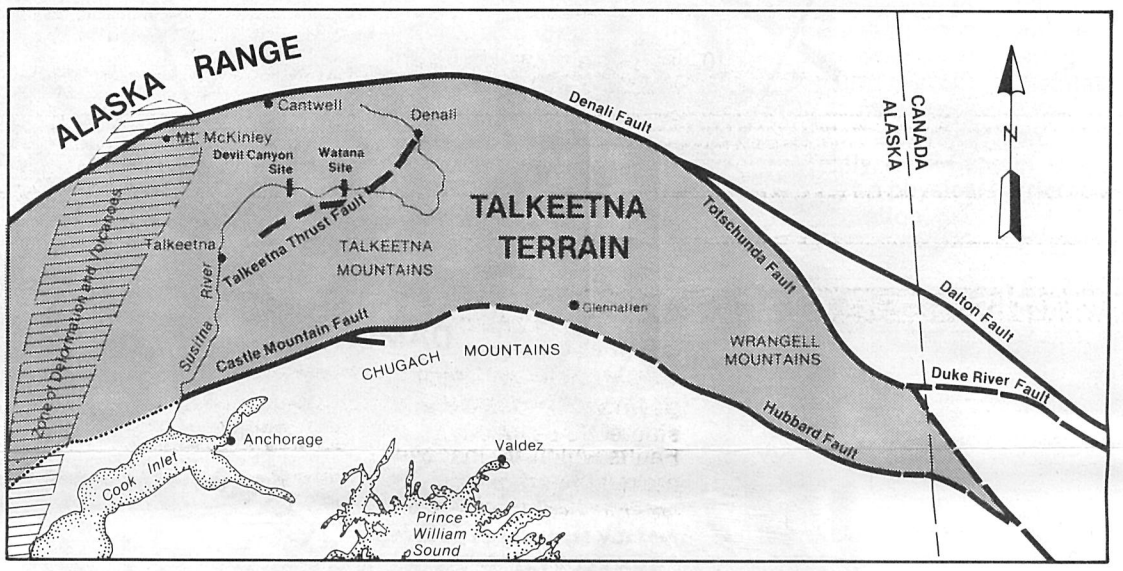



**Alaska is part of a large continental landmass (the North American Plate) which lies adjacent to an oceanic mass (the Pacific Plate). The Pacific Plate is moving northwest at a rate of about 2 inches per year.**

**This 2 inches of movement gets absorbed along a feature in the Gulf of Alaska called the Aleutian Trench. Here one plate is thrust below the other (in a process called subduction) as shown in the diagram. The zone of seismicity associated with the subduction is referred to as the Benioff Zone.**

**Earthquakes can occur along the Benioff Zone where the two plates are in contact. This is where the 1964 earthquake occurred as shown in the diagram.**

**Earthquakes are also caused within the plates themselves. Movement of the plate causes stresses to build up and the energy is released by rapid movement along planes of weakness (faults).**




**To date no active faults have been identified in the Talkeetna Terrain itself. Studies in 1981 are further evaluating 13 faults and lineaments (potential faults) in the vicinity of the Watana and Devil Canyon damsites to determine whether or not the faults and lineaments may be active. One of those receiving additional study is the Talkeetna Thrust Fault.**

9. **How can there be no active faults in the area of the dam sites when historic records show many earthquakes occurring there?**

   In the area of the proposed Susitna dam sites earthquakes occur within the North American Plate (which includes the upper 15 to 20 miles of the earth's crust) and in the Pacific Plate (which is being subducted, or drawn downward, beneath the North American Plate).

   Preliminary evaluation of the seismicity in these two plates, within the Talkeetna Terrain, suggests that many of the earthquakes, including virtually all of the moderate to large earthquakes are occurring in the Pacific Plate at depths of at least 34 miles beneath the dam sites.

   Activity occurring in the North American Plate is associated with energy release on small fault planes which are too deep and too small to cause displacement at the earth's surface.

10. **Why do your studies not consider faults that are inactive?**

    All faults and possible faults within about 100 km (62 miles) of the Susitna dam sites have been evaluated to determine whether or not they are active faults. Those faults which have not had displacement in recent geologic time are considered to be inactive. Faults which are inactive are not important for seismic design of a dam because earthquakes are not expected to occur along inactive faults.

11. **What is considered an active fault?**

    Various governmental and regulatory agencies have defined active faults in order to assess the importance of faults to the design of critical facilities such as dams. Initially these definitions were based on how recently there has been movement along a fault.

    For example, the U.S. Bureau of Reclamation defines a fault which has moved in the last 100,000 years as active. The U.S. Army Corps of Engineers uses 35,000 years.

    Recently there has developed an increasing consensus that the activity of a fault should be considered by how often it moves, how much movement is likely to occur and what type of movement will occur. From this information the likelihood of fault movement can be made and incorporated into dam design.

12. **When you refer to active faults, how long a period of time are you referring to?**

    As a guideline for the Susitna project, Acres American, Inc. has defined an active fault as one which has had movement, or displacement, in the last 100,000 years.

---

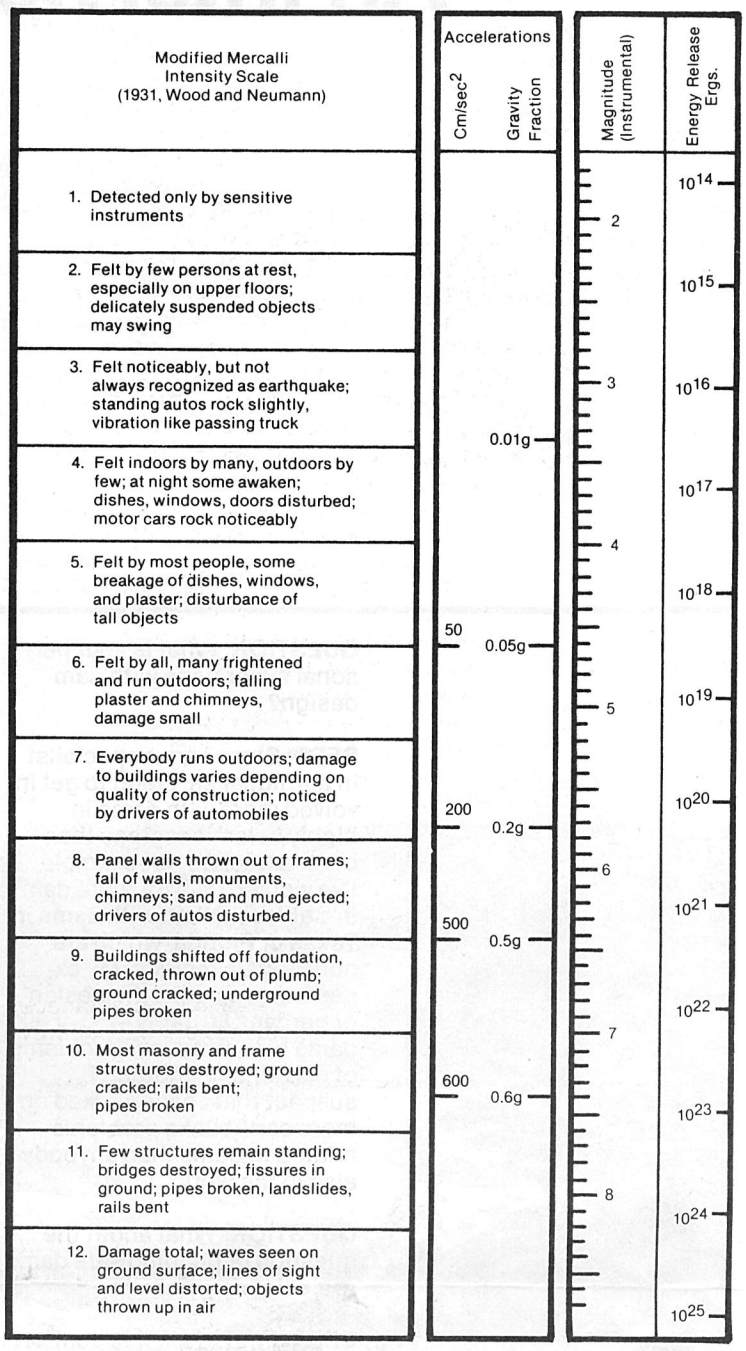
Source:
Interim Report on Seismic Studies for Susitna Hydroelectric Project, December 1980, prepared by Woodward-Clyde Consultants for Acres American, Inc. and the Alaska Power Authority.

In Anchorage, copies are available at the Alaska Resources Library in the Federal Building; at the University of Alaska Consortium Library; at the Arctic Environmental Information and Data Center; and at the Z.J. Loussac Library.

In Fairbanks, copies are available at the Elmer E. Rasmuson Library, University of Alaska; and at the Noel Wien Library.

In Talkeetna, a copy is available at the Talkeetna Public Library.

# Three ways to measure the force of an earthquake




**Modified Mercalli scale**
**This scale verbally describes the effects of earthquakes.**

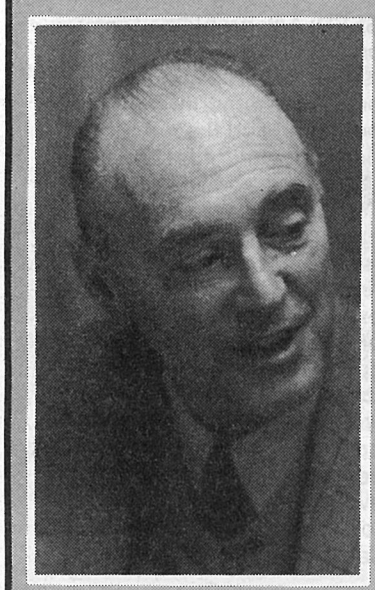
**Acceleration**
**Engineers often use acceleration to measure the severity of earthquake motions. The relationship of acceleration to magnitude must include a consideration for the distance from the earthquake source.**

**Magnitude and amount of energy release**
**These two columns show that each increase in magnitude (for example, from 5 to 6) is approximately a 30-fold increase in energy release.**

Source:

Modified from Earth-Rock Dams, Engineering Problems of Design and Construction, J.L. Sherard, R.J. Woodward, S.F. Gizienski, W.A. Clevenger, John Wiley and Sons, Inc., New York.

# What about reservoir-induced seismicity (RIS)?



Dr. Harry Seed

1. **What is reservoir-induced seismicity (RIS)?**

   Reservoir-induced seismicity (RIS) refers to earthquakes which are triggered by the filling of a reservoir. Typically these earthquakes occur beneath the reservoir area. Recent studies suggested that RIS earthquakes are triggered in certain geologic and seismologic terrains by the weight of the water in the reservoir and by the reduced friction along fractures (caused by water being forced into the fractures.)

2. **Does that mean reservoirs can cause earthquakes?**

   "A reservoir cannot induce more seismic activity than an area could have produced if the reservoir had not been there. In other words, a seismic event that would have occurred sooner or later is induced to occur sooner."

   "If, at the time of the filling of the reservoir, the accumulated strain energy is small, the corresponding seismic event could be small. Conversely, if the accumulated strain energy is high, the resulting event could be large, but not larger than what would naturally occur sooner or later."

3. **What is the potential for RIS at Watana and Devil Canyon dam sites?**

   The potential for RIS is largely a function of the size and depth of the reservoir. Since the Watana reservoir would be both very large and very deep, Woodward-Clyde Consultants has estimated both the probability of RIS occurrence and the potential magnitude of the resulting earthquake.

   Preliminary results suggest a moderate reservoir-induced earthquake could occur at the Watana site. The estimated magnitude of such an earthquake is 5.5 or less, because no active faults have been found in the immediate area of the Watana reservoir. The probability of occurrence was estimated by comparing the Watana reservoir with other very large and very deep reservoirs that have experienced RIS worldwide.

   Preliminary results indicate a similar likelihood of RIS at Devil Canyon.

   Additional evaluation of the likelihood of reservoir-induced seismicity is currently being done.

4. **Is the potential for RIS taken into account in dam design?**

   Yes. The design criteria for the dam actually exceeds design criteria for a reservoir-induced earthquake.

   Dam design criteria will incorporate both the effects of earthquakes on more distant active faults (the Denali Fault and Benioff Zone) as well as earthquakes which occur near the sites including those which are reservoir-induced.

---

Source:
Dr. Harry Seed,
Specialist in Earthquake-Resistant Design,
University of California, Berkeley.

# Designing Dams in Earthquake Country —An Interview With Dr. Harry Seed

**Dr. H. Bolton (Harry) Seed, is a specialist in earthquake-resistant design and professor of civil engineering at the University of California, Berkeley. He also serves on the Susitna External Review Panel which is made up of six eminent engineers and scientists who provide independent review of the Susitna hydroelectric feasibility study.**

**Dr. Seed has been a consultant on soil mechanics and seismic design problems since 1953. Over the years, he has worked extensively with a variety of clients, including the U.S. Army Corps of Engineers, the Executive Office of the President of the United States, the World Bank, the Federal Power Commission, Bechtel Corporation, Woodward-Clyde, the Metropolitan Water District of Los Angeles, the Canadian Ministry of the Environment, and many foreign government agencies. He has worked on about 80 dams worldwide, most of which were in seismic areas. After a dam failure in California in the early 70's, Dr. Seed authored design procedures for California so that dam failures would not happen again. These procedures are now used throughout the world to produce safe, seismic designs for dams.**

**Following are excerpts from an interview conducted by Nancy Blunck, Director of Public Participation, the Alaska Power Authority. The complete text is available upon request.**

**QUESTION:** What is your personal experience with dam design?

**SEED:** Since I am a specialist in earthquakes, I tend to get involved more with dams in highly seismic regions than other areas. So, for example, I've worked on a lot more dams in California than with dams in Texas or Florida, which are nonseismic regions. My experience includes the design of perhaps 80 dams—50 or 80 dams for earthquake problems of one kind or another. I suspect that I have worked on more earthquake problems related to dams than anybody else in the world.

**QUESTION:** What about the question of building safe dams in a seismic area?

**SEED:** First of all, it is comforting that at the present level of knowledge of the Susitna project the intensity of shaking which can be anticipated at either dam site is considerably less than those in areas for which we have already designed dams. Secondly, the people in Alaska should know that dams have been proposed to be built in some extremely critical areas.

**QUESTION:** What must dam design in highly seismic areas take into account?

**SEED:** The first thing in a highly seismic area is to study the dam site and find out if there is a fault in the foundation of the dam or very close to the dam. We prefer not to build dams directly over faults, although once in a while we have done that when there is no way to avoid it.

Even if you avoid the faults in a highly seismic region, that doesn't eliminate the problem of the dam being subjected to extremely strong ground shaking in the event of a major earthquake...

So the second aspect of the problem is to design the dam to remain stable even though it is shaken by very strong motions from an earthquake. There are various ways in which that is effected. One is by controlling the materials of which the dam is built. When I say controlling them, I mean selecting materials which are capable of withstanding earthquakes better than others. Also, placing them in the dam using construction techniques which enhance their natural ability, and providing a finished product which can safely withstand the effects of the earthquake shaking.

The primary construction procedure involved in placing earth materials in dams is in compacting the material to a high enough density to make it strong enough to withstand the earthquake shaking. That has been done in many areas, but first you must carefully predict the effects of earthquake shaking on the dam and how dense the material needs to be to withstand a given level of earthquake motions.

**QUESTION:** What projects are you familiar with that resemble the Susitna project?

**SEED:** Oroville Dam in California is a cobble and gravel fill dam 700 feet high. Auburn dam in California is a concrete dam about 600 feet high...The Uribante-Caparo project in Venezuela is a complex of four dams and three powerhouses, with 400 to 500 foot high dams. The Alicura project in Argentina is a complex of three dams about 400 feet high...The Pueblo-Viejo dam in Guatamala is a rockfill dam 500 feet high...And many others.

**"I suspect that I have worked on more earthquake problems related to dams than anybody else in the world."**

**QUESTION:** How do these projects resemble Susitna, and are there greater or lesser problems?

**SEED:** The Oroville dam is in California. The region in which it was built was supposedly nonseismic, but in 1965 they had an earthquake very near the dam. So the design earthquake for Oroville is now a magnitude 6.5 (on the Richter scale) earthquake occurring directly under the dam site, which is a very strong earthquake.

Oroville is about the same height as the proposed Watana dam and, as a matter of fact, was the one we suggested in our first report as probably being the best model for that particular dam. I have been on the consulting board for that dam since it became an earthquake problem, which means having responsibility for determining the adequacy of the seismic design.

The Auburn dam in California is a highly controversial dam. Again, the design earthquake is a magnitude 6.5 event directly at the dam site. The complicating feature of that dam is that there is much debate about the possibility of a fault going through the foundation of the dam and, therefore, directly through the dam.

The Consultant Board on which I served determined that the dam ought to be designed for a fault offset in the foundation of about 6 inches. That recommendation led to redesign of the dam from the thin arch dam to a concrete gravity dam...

The Uribante-Caparo project in Venezuela involves four dams and three powerhouses and some parts of this project are built about 15 miles from the Bocono fault, which is one of the largest faults in the world.

The seismic design of the project in Venezuela is an important controlling aspect of the project. The materials available for building the dams there are not the best in the world. There is a lot of friable sandstone (friable means breaks easily, from solid to sand), and so it turns out that designing the dam to be seismically stable is a critical aspect of the design...One of the design earthquakes is a magnitude 7.5 event occurring about seven miles from the dam. This is almost identical with one of the possible design earthquakes for the Watana dam unless Acres is successful in proving that the Talkeetna thrust is not active...

The Talkeetna thrust is a fault near the Watana dam site whose activity is questionable, but it is believed to be inactive. If it remains in the inactive category, then the severity of shaking for Watana will be less than that for Uribante-Caparo project in general.

The Pueblo Viejo project in Guatemala is designed for a magnitude 7.75 earthquake passing directly through the project site—not the site of the dam, but the overall project site. The fault passes through a power tunnel very close to the dam site. The shaking there is of the order of 0.7g acceleration, lasting for maybe 45 seconds—one of the most severe seismic environments of any dam in the world. Nevertheless, a safe design has been worked out for that project.

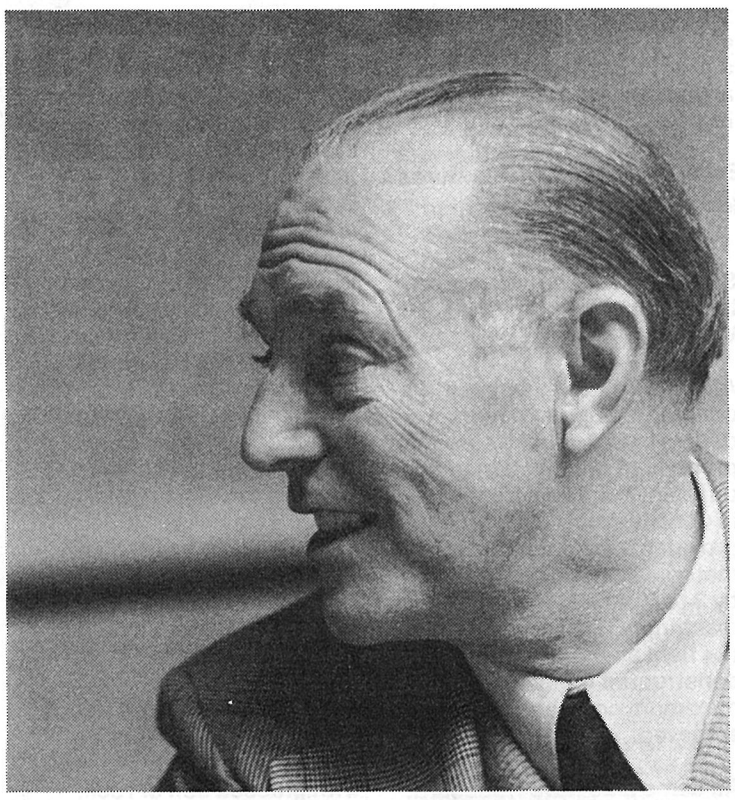
Incidentally, on all these dams, designs have been produced which have been adequate to accommodate the motions produced by the earthquakes. It is a matter of how you build the dam, how you arrange the dam, what materials you use in the dam, and how you place the materials in the dam. These factors will determine whether the dam will adequately withstand the effects of the earthquake.

**"...on all these dams, designs have been produced which have been adequate to accommodate the motions produced by the earthquakes. It is a matter of how you build the dam, how you arrange the dam, what materials you use in the dam, and how you place the materials in the dam."**

**QUESTION:** What knotty problems have you encountered on other hydroelectric projects?

**SEED:** Any problems that you encounter are essentially related to three major ones—the amount of water to be stored and the amount of flooding water that has to be stored at any given time; the stability of the foundation materials; and the possible effects of faults in the foundation. The first is not my area of expertise. It is a hydrological problem and there are other specialists who can handle that part of the problem. I would say the most difficult problems, in the earthquake sense, are primarily those of evaluating the stability of the foundation materials on which dams are to be built.

For example, there was much debate about the safety during earthquakes of Revelstoke Dam in Canada and what they should do about the foundation. I was invited to be a consultant on that project because of the different points



of view about the safety of the dam...

They were dealing with a very difficult foundation soil. As a matter of fact, I told them that the foundation soils in some parts of the dam foundation bore a great resemblance to those at Turnagain Heights in Alaska (the soils that failed in the 1964 earthquake). Some of the foundation material for Revelstoke Dam reminded me alot of Bootlegger Cove clay. I told them that it was an unstable material, especially at the level of shaking they were designing for. I advised them to excavate the material out, and that's what they elected to do. I would say that was a knotty problem.

*Other knotty problems involve faults in the foundation.* After the San Fernando dam nearly failed in the San Fernando earthquake in California, the people living downstream did not want another dam to be built at that site, but it turns out to be a critical point of entrance for water into California for the city of Los Angeles. Therefore, the Department of Water and Power in Los Angeles considered it essential to have a reservoir in that area, and it was necessary to rebuild the dam at that location. There was a possibility of a fault movement in the foundation, so we had to devise a special design which could accommodate a very high level of shaking and the possibility of a fault movement in the foundation both occurring at the same time. That was successfully done.

**"...it is a comforting fact that at the present level of knowledge of the Susitna project, the intensity of shaking which can be anticipated at either dam site is considerably less than those areas for which we have already designed dams."**

The Teton dam involved problems with highly erodible soils. The dam failed, but I believe that if the design had been modified, a safe dam could have been built at that site. The knotty problem there was assessing the effect of the jointing of the rock and the simultaneous erodibility of the soils used to build the dam on the safety of the dam. That was a tricky problem. The engineers who made the design thought they had solved it, but as events eventually proved, they had not. The dam failed. I believe we know enough about it now that we could rebuild the dam very safely...
To tell you the truth, I don't know of any dam which doesn't involve one or two knotty problems.

**QUESTION:** How does the seismicity of the Susitna area compare to the seismicity of other regions where you have worked?

**SEED:** I would say that the seismicity of the Susitna area as it is presently understood (and if it is established) is somewhat less than that which I have encountered in other parts of the world. There are a number of faults whose activity has not yet been established in the Susitna area. They are believed to be inactive faults, but they are on record for being investigated very carefully during the 1981 summer. The Talkeetna thrust fault is one of these and probably the most important of them. If all the faults that are presently not clearly recognized as active are found to be inactive, then the seismicity of the Susitna area (or the intensity of ground shaking that would develop) would not be as strong as many of the dams that we have already designed.

**QUESTION:** And what if the opposite were true?

**ANSWER:** If the opposite were true, if the Talkeetna trust turns out to be an active fault, then the level of shaking at Susitna would be comparable to that of some of the strongest seismic regions where dams have been built.

Since we have been able to build and design dams which can be shown to be seismically stable in those regions, then I believe that the same techniques would be capable of demonstrating the same thing for the dams of the Susitna project.

The design in any case will require great care, but it would require even more care if those faults like the Talkeetna thrust turn out to be active faults...

**The design of the Oroville dam in California has been suggested as an appropriate model for preliminary design of the Watana dam. It is an earthfill dam like Watana is proposed to be, is in a seismic area, and is of a similar height (Oroville is 770 feet, Watana is proposed to be 880 feet).**

**The design earthquake for Oroville was a magnitude 6.5 earthquake occurring directly under the dam site. The Oroville dam design can accommodate strong ground motions very near the dam for a relatively large earthquake.**

There has been tremendous progress in the field of earthquake engineering, and the earthquake-resistant design of dams has been totally revolutionized in the last 10 years. It is almost like the developments of space technology. Things we can do now, our understanding of the problems now, are so very much greater than they were 10 years ago that we can feel enormous confidence now in comparison. In those days people felt confident because they didn't really understand the problems. Now we feel confident because we have a very good understanding of the problems.

**QUESTION:** Can you give some examples of why you can be so confident?

**SEED:** We can point to virtually dozens of dams which have withstood very strong earthquake shaking, even the strongest imaginable earthquake shaking. In California, in 1906 there were at least 15 dams within 5 miles of the San Andreas fault on which a magnitude 8.3 earthquake occurred, and they were built by the rather primitive pre-1900 construction methods. There wasn't a single one of them that suffered any major damage due to the earthquake. During the last 10 years we have learned what the properties of those dams are that enabled them to do that. We can also point to a few dams that have failed during earthquakes and what we have learned over the last 10 years is what made those dams fail as compared with the other ones that haven't failed.

**"...the earthquake-resistant design of dams has been totally revolutionized in the last 10 years."**

The record is very positive. There have been literally hundreds of dams which have withstood strong earthquake motions. In the total history of the United States, so far as I know, I think there are only four or five known failures of dams during earthquakes, and some of those were quite small dams...We better understand which ones are likely to be safe and how to transform the unsafe ones into safe ones...

In the most recent survey of the safety of dams in California, the conclusion was that there are no dams in California which are a threat to the public...In the last 10 years there have been a number of dams in California which have been recognized as earthquake hazards that have either been taken out of service or rebuilt or modified in some way to eliminate the threat to the public.

California is obviously one of the more seismically active states in the United States, along with Alaska, and if we can do it here, you can do it in Alaska, too.

# Earth dams combine natural materials and careful construction

**Earth/rockfill dam:**

*"Any dam constructed of excavated materials placed without addition of binding materials other than those inherent in the natural material. The materials are usually obtained at or near the dam site."*

—The International Commission on Large Dams

Earth/rockfill dams contain about 25 percent earth to retain the water and 75 percent rock to hold the earth up and ensure stability.

In seismically active regions it is not unusual to flatten the slopes of the dam more than in non-seismic areas. The actual slope and proportions at a particular site is dependent on the materials available for construction and the size of the design earthquake.

One of the most important requirements for earth dams is that the materials be selected and compacted—and the foundation stabilized—so that settlement of the earth and rock is minimized. For dams in high seismic regions, any river bed materials under the dam which would be unstable during earthquakes is either removed or improved.

**The core**

The core is a membrane built within an earth dam to form an impermeable barrier. It may be of natural materials (clays, sands, etc.) or prepared materials (cement or asphaltic concrete), or of metal, plastic, or rubber.

In the case of Watana, the core is proposed to be of glacial till (a mixture of gravels, sands, silts, and clays). It would be more than 400 feet thick at the riverbed level, and tapered to about 30 feet in thickness at the crest of the dam.

Unlike concrete, earth cores cannot support their own weight even though they are as effective as concrete at impounding water. Gently sloping man-made mountains of compacted sand, gravel, and rockfill are needed to support the dam's core and keep it in position.

**Location of core**

In general, a centrally located core provides the best security under earthquake conditions. A central core is illustrated in the diagram of the Watana cross-section.

**Design**

Each earth/rockfill dam is unique — its watertightness and stablility are directly related to the materials used for its construction and the materials upon which it is founded.

Earth/rockfill dams are usually constructed in zones. The primary purpose of this is to ensure safety in terms of strength, control of seepage, and protection against cracking.

**Earthquake-resistant features in earth/rockfill dams:**

Some of these provisions are being considered for the Watana dam.

All earth/rockfill dams are compacted to make them dense. In earthquake areas the process of compaction is no different but more compaction is done because denser rock provides more stability. Most materials can be compacted by 3 to 8 passes with heavy machinery. Tests are made in the field as the dam is being constructed to ensure that maximum compaction is achieved.

All dams also have freeboard. This is the height above normal water level and it allows for waves, floods, and ice. In earthquake areas, additional height is added to allow for settlement.

If there is a potential for waves passing over the crest of earth/rockfill dams, the crest can be treated so that the waves pass safely. Such a wave could result from a seismic disturbance or a landslide into the reservoir. Preliminary studies indicate there is no potential for landslides in the Watana reservoir because of the topographic character of the valley.

Earth/rockfill dams are usually zoned for strength and stability. In earthquake areas, wider filter zones are provided to increase stability.

In addition, the materials in the filter zones are selected to provide self-healing of cracks. This conservative approach increases the level of confidence in the design. The dam is designed not to crack and also designed to self-heal if it did crack.

**Slope Protection**

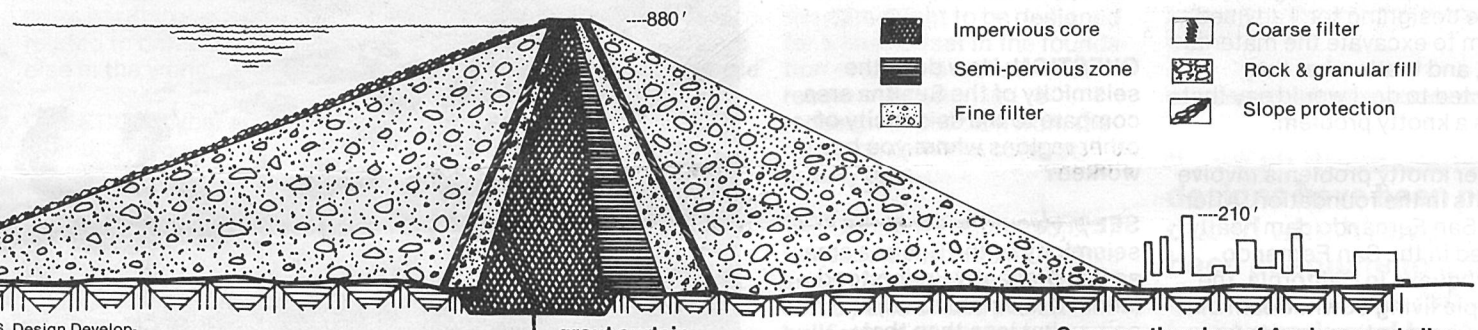
Both faces of an earth dam must be protected against structural damage.

The downstream face needs protection against natural erosion and may be covered with grassed soil or rock.

The upstream face must be protected against damage by wave action, ice, or floating debris. Various methods include rock (riprap), precast concrete forms, soil cement, or the waterproofing membrane of the dam.

Source:
The Engineering of Large Dams Part II, Henry H. Thomas, 1976, John Wiley & Sons Publishers, New York, A Wiley-Interscience Publication.

## Cross-section view of proposed Watana earth dam




Source: Development Selection Report, Task 6, Design Development, Second Draft, June 1981, prepared by Acres American, Inc. for the Alaska Power Authority.

# Susitna construction not assured by SB 25

The 1981 Alaska Legislature authored a far-reaching bill that relates closely to the evaluation of the Susitna project's feasibility and to the possible development of the project. SB 25 provides for direct State funding of at least a portion of the construction costs of certain power projects and it provides for a single wholesale rate for power from all projects that are part of the State program.

The following discussion answers some questions about SB 25 and the Susitna studies.

**What SB 25 Does Do**

1. The new law, along with a companion appropriation bill (SB 26), **DOES** indicate a desire on the part of the 1981 Legislature to lower the cost of power to Alaskans. The portion of the Susitna construction cost funded by the State would not have to be recovered through power sales. The rates for the power would, however, have to be set sufficiently high to cover the costs of project operation, maintenance, and inspection and high enough to also cover the debt service associated with any borrowed construction costs not funded by the State.

2. SB 25 **DOES** mean that the Susitna project will be easier to finance if the decision is made to build it. It is recognized that Wall Street is hesitant to buy revenue bonds for the full cost of Alaskan hydroelectric power projects. The primary problem is Wall Street's perception that Alaskan projects are extremely expensive in relation to the size of the population that will use the power.

3. SB 25 **DOES** indicate an intent by the 1981 Legislature to appropriate as much as $5 billion for the construction of power projects over the next five years. Based on very preliminary estimates, this amount would be enough to fund most of the construction costs of all the power projects presently under serious consideration throughout the State, including the Susitna project. Several projects have already been funded under this program, but Susitna is not one of them.

4. SB 25 **DOES** differentiate between power rates to utilities and those to industrial consumers. According to the legislation, the rate for industrial consumers may not be less than the rate charged residential consumers and it may be higher.

**What SB 25 Does Not Do**

1. The new law **DOES NOT** mean, at least as far as the Alaska Power Authority is concerned, that a decision has already been made to build the Susitna project.

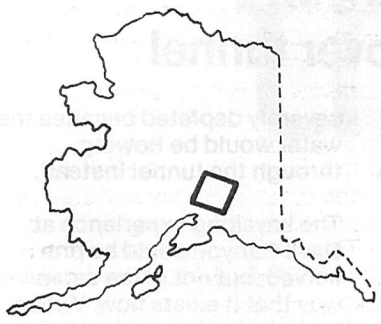
   Several points should be kept in mind. They are:

   - According to SB 25, State money can only be used for a power project that will provide the lowest power cost to utility customers. It has not been determined that the Susitna project is, in fact, the lowest cost alternative for the Railbelt. The Susitna project feasibility study and the companion Battelle alternatives study will provide this relative cost information during the first three months of 1982.
   - **A decision has not yet been made by the Alaska Power Authority to recommend the preparation and submittal of a license application to the Federal Energy Regulatory Commission (FERC). That decision will be made in late April 1982.**
   - Construction of the project cannot begin until the FERC prepares an environmental impact statement and grants a license.

2. SB 25 **DOES NOT** affect the determination of project feasibility, either in the Susitna feasibility study program or in the independent Battelle power alternatives study.

   The basic approach being used in both studies involves a comparison of Railbelt electrical system power production costs with various combinations of power alternatives. The costs associated with any alternative will reflect the actual full cost of construction, operation, and maintenance without any consideration of subsidies. This approach is designed to ensure that, if the State is going to contribute funds to power project construction, those funds will go towards the most economical and preferred alternatives.

# Background information on proposed Susitna project



The Susitna hydroelectric project as currently proposed involves two dams and reservoirs on the Susitna River in the Talkeetna Mountains of southcentral Alaska.

The project area is about 50 miles northeast of Talkeetna, Alaska and 118 miles north-northeast of Anchorage, Alaska.

The upstream dam, Watana, is proposed to be developed first. It is currently being considered as an earth/rockfill dam, approximately 880 feet high. This would make it the fifth highest dam in the world and the highest in North America. It would impound a 54-mile-long reservoir.

The downstream dam at Devil Canyon is currently being considered as a concrete arch dam approximately 635 feet high. It would impound a 28-mile long reservoir.

These dimensions are approximate and subject to change during detailed design.

The feasibility study is being managed and conducted by Acres American, Inc. for the Alaska Power Authority. The studies conducted to date represent the first year of a planned two-year study (1980 and 1981). A draft feasibility report detailing research efforts in 10 different areas including economics, engineering, and environmental aspects of the proposed power project is due in March next year.

## How proposed Susitna projects compare with existing dams

| Name | Year completed | River or Basin | Nearest city | State or Province | Country | Dam type | Height above lowest foundation m | Crest length m | Reservoir capacity $m^3 \times 10^6$ | Rated capacity now (MW) | Rated capacity planned (MW) | Year of initial operation |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| [1]Bonneville | 1943 | Columbia | Portland | Oregon-Washington | USA | concrete gravity | 32 | 277 | | 588 | 1,076 | 1938 |
| [2]Glen Canyon | 1964 | Colorado | Page | Arizona | USA | concrete arch | 216 | 475 | 33,305 | 1,021 | 1,431 | 1964 |
| [3]Grand Coulee | 1942 | Columbia | Coulee City | Washington | USA | concrete gravity | 168 | 1,272 | 11,795 | 7,460 | 10,830 | 1942 |
| [4]Hoover | 1936 | Colorado | Boulder City | Nevada-Arizona | USA | concrete arch/gravity | 221 | 379 | 36,703 | 1,345 | 1,345 | 1936 |
| [5]Mica | 1973 | Columbia | Revelstoke | British Columbia | Canada | earth/ rockfill | 245 | 792 | 24,670 | 1,736 | 2,610 | 1976 |
| [6]Oroville | 1968 | Feather | Oroville | California | USA | earth | 235 | 2,316 | 4,299 | 679 | 679 | 1967 |
| [7]Devil Canyon | (Proposed) ( 2000 ) | Susitna | Talkeetna | Alaska | USA | concrete arch | 200 | 378 | 1,235 | 0 | 400 | (Proposed) ( 2000 ) |
| [8]Watana | (Proposed) ( 1993 ) | Susitna | Talkeetna | Alaska | USA | earth/ rockfill | 271 | 1,662 | 12,347 | 0 | 800 | (Proposed) ( 1993 ) |

Sources:
[1]Corps of Engineers, Portland, Oregon
[2]Western Area Power Office, Golden, Colorado.
[3]) "Major Dams of the World," T.W. Mermel, International Water Power
[4]) and Dam Construction, Special Issue May 1981, Published by IPC
[5]) Electrical-Electronic Press Ltd., Quadrant House, The Quadrant, Sutton, Surrey SM25AS, England
[6]Civil Design, State of California, Oroville, California
[7]Acres American, Inc., Anchorage, Alaska
[8]Acres American, Inc., Anchorage, Alaska

1 Meter = 3.25 Feet

# Construction timed to match power demand

The proposed Susitna development is presently envisioned as having three distinct stages:

1) the Watana dam with installed capacity of 400 MW;

2) an addition to the Watana capacity of another 400 MW; and

3) the Devil Canyon dam with an installed capacity of about 400 MW.

Both the Watana capacity addition and the Devil Canyon project could be brought on line earlier or at the same time, if needed, while all three stages could be postponed if demand turned out to be less than anticipated.

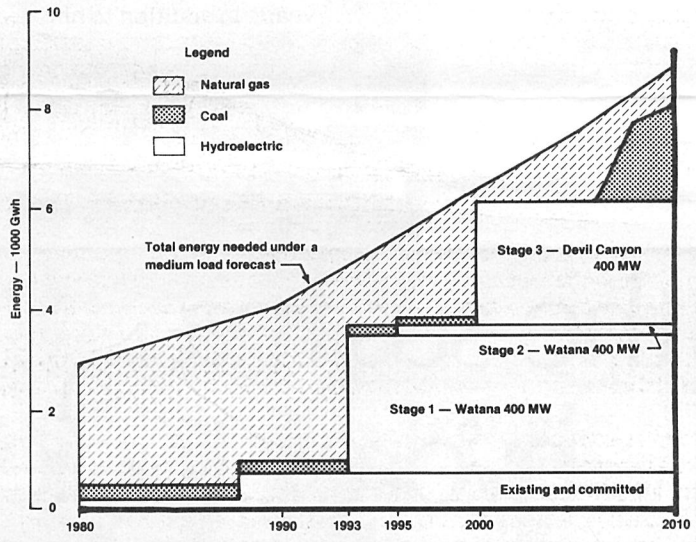
This staging provides some flexibility in the sequence and timing of construction. At the same time, there are certain constraints on that flexibility.

In staging the Susitna development, the primary objective is to keep the cost of power as low as possible. This is done by minimizing expenditures while selling as much of the available power as possible. But the power cannot be sold if there aren't consumers ready to buy it. The energy consumption forecasts provide estimates of how much power can be sold in the years ahead.

The Power Authority's approach, then, is to postpone spending money for the next stage as long as possible to ensure that there is the demand for purchasing the project's power. Money spent on a project whose power cannot be sold is money wasted.

Waiting too long to construct the next stage, however, is unacceptable because there would be an increasing likelihood of not being able to meet the peak demands. If this occurred, customers would have to go without electricity during high use periods. Thus, a balance has to be struck between postponing additional investments and ensuring adequate generation to meet peak loads.

Meanwhile, the balancing has to be done in the midst of a great deal of uncertainty about what the actual demand for power is going to be in the future. As time goes on and future power demands become more certain, the planned staging would be adjusted to suit actual conditions.




**Possible staging of Susitna project**

**This diagram shows how the Susitna development would be staged under the medium forecast of future energy requirements. With this energy demand and ensuring that adequate generating reserves are maintained, power costs would be minimized if:**

1) **The Watana dam with 400 MW would be completed in 1993, which is the earliest possible date because of time periods involved in project evaluation, permitting, and construction;**

2) **the additional 400 MW of capacity at Watana is ready for operation in 1995; and**

3) **the Devil Canyon dam with its 400 MW is completed in the year 2000.**

## If you want to get future newsletters

**This public information document on the Susitna hydropower project was developed by the Alaska Power Authority Public Participation Office, Nancy Blunck, Director. Comments on the substance of this newsletter and ideas for future publications should be forwarded to the Public Participation Office by way of the following coupon.**

Last First Initial

Name

Mailing Address

City State Zip

**and mail to: Alaska Power Authority**
**Public Participation Office**
**333 W. 4th - Suite 31 - Anchorage, AK 99501**

**THANK YOU FOR YOUR INTEREST**

# Independent panel reviewing Susitna feasibility studies

**External Review Panel Members:**

Copen

Douma

Leopold

Merritt

Seed

Rohan

Six leading scientists and engineers have been named to an independent external review panel by the Alaska Power Authority Board of Directors. The specialists, who collectively have more than 200 years' experience in their fields, are reviewing the Susitna feasibility studies conducted by Acres American and other research contractors.

Interview with members of the review panel will be available in future publications as the specialists comment on general plans for the Susitna development and specific feasibility studies.

Exerpts from an interview with Dr. Seed appear in this newsletter.

**Merlin D. Copen** is an expert on concrete dams. He has had major responsibility for the design of the Glenn Canyon Dam on the Colorado River, California's Auburn Dam (proposed as one of the longest concrete arch dams in the world), and many others. He has consulted on numerous international projects as well as other Alaskan developments.

**Jacob H. Douma** served as chief of the Hydraulic Design Branch of the U.S. Army Corps of Engineers prior to his retirement from active government service after more than 40 years. In addition to his government work on American dams, he has extensive consulting experience with Canadian hydroelectric projects.

**Dr. A. Starker Leopold** is a distinguished zoologist who has been associated with the University of California since 1946. A one-time vice-president of the Sierra Club, he has served on many wildlife and conservation organizations and has conducted extensive research around the world.

**Dr. Andrew H. Merritt** is a geologist who has been involved in the research, design, and review of major construction projecs around the world. A specialist in tunnels and rock work, he has extensive experience with hydroelectric and nuclear power projects.

**Dr. H. Bolton Seed** is a former chairman of the Department of Civil Engineering at the Berkeley campus of the University of California. A specialist in earthquake engineering problems, he has consulted on dozens of the world's largest dam projects.

**Dr. Dennis M. Rohan** is an economist with the Stanford Research Institute who specializes in energy matters. He has been involved in economic analyses of all phases of energy production and consumption.

## Dam at Devil Canyon recommended over tunnel

Following 2,500 manhours of study (in excess of one man year of effort) a twin power tunnel plan has been eliminated as an alternative to a dam at Devil Canyon.

The tunnels, 15 miles long and 30 feet in diameter, were eliminated from further consideration when it became clear that they would generate 26% less electricity and would cost $637 million more than a dam at Devil Canyon.

The difference in energy output, primarily due to friction losses along the length of the tunnel, is equivalent to about 30% of the total energy generated in 1980 by both Anchorage utilities (Municipal Light and Power and Chugach Electric Association).

In the long term, an additional generating plant would have to be added to fill this gap and this could create an additional source of environmental impact which has not been included in the comparison at this time.

Excluding consideration of this additional generation to make up the shortfall, the tunnels' main advantages were environmental. The adverse effects upon the aesthetic value and uniqueness of Devil Canyon would be lessened with a tunnel, although the flows through the canyon would be severely depleted because the water would be flowing through the tunnel instead.

The kayaking experience at Devil Canyon could be preserved, but not in the same way that it exists now. With a tunnel, kayaking would be dependent upon the controlled release of water through the canyon.

In addition, by virtue of size alone, construction of the smaller re-regulation dam (245 feet) would have less environmental impact than the Devil Canyon dam. The river miles flooded and the reservoir area created by the re-regulation dam for the tunnel would be about half those of the Devil Canyon dam, thereby reducing negative consequences such as loss of wildlife habitat and possible archeological sites in the reservoir area.

With the tunnel, there could conceivably be a rare mitigation opportunity of creating new salmon spawning habitat in an 11-mile section of the river above Devil Canyon. Presently, Devil Canyon presents a physical barrier to fish migration.

Source:
"Susitna Hydroelectric Project, Tunnel Alternatives Report, Task 6, Design Development," prepared by Acres American, Inc. for the Alaska Power Authority, July 1980.

the susitna hydro studies

*This is the second of several newsletters published by the Alaska Power Authority for citizens of the railbelt. The purpose is to present objective information on the progress of the Susitna hydroelectric feasibility studies so that readers may make their own conclusions based on accurate information.*

Eric P. Yould, Executive Director
Nancy Blunck, Director of Public Participation

Alaska Power Authority
333 W. 4th - Suite 31
Anchorage, Alaska 99501
phone (907) 276-0001

*The state of Alaska is an equal opportunity employer.*

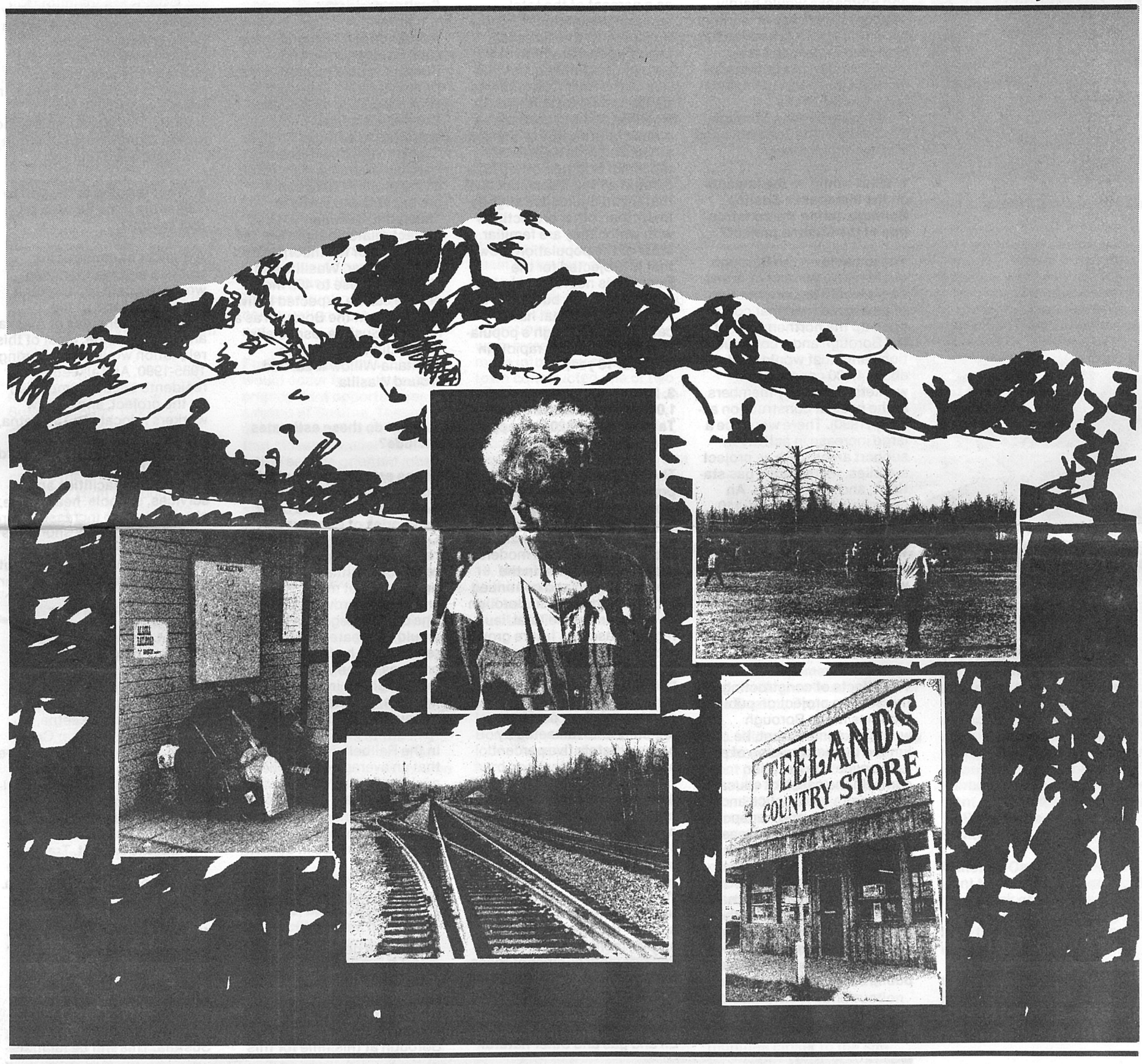
**IN THIS ISSUE:**

preliminary seismic conclusions . . . . . page 1
questions and answers on earthquake studies . . . . page 2
reservoir-induced seismicity . . . . . page 3
designing dams in earthquake country . . . . . page 4
earth dams . . . . . page 6
the Susitna studies and SB 25 . . . . . page 6
comparison of Susitna with existing dams . . . . . page 7
staging of Susitna proposed . . . . . page 7
independent review of Susitna studies . . . . . page 8
dam recommended over tunnel . . . . . page 8

ALASKA POWER AUTHORITY
PUBLIC PARTICIPATION OFFICE
333 West 4th - Suite 31
Anchorage, Alaska 99501
(907) 276-0001

# the susitna hydro studies

june 1982




# Impacts on people

**A major construction project such as Susitna can cause fundamental changes in nearby communities and affect the lives of the residents of those communities. People in the Matanuska-Susitna Borough, particularly in the Talkeetna and Trapper Creek areas, have the highest potential for being directly impacted if Susitna were to be constructed.**

**Previous issues of this newsletter discussed the technical and environmental aspects of the proposed Susitna project. This issue focuses on the effect the proposed Susitna project may have on people, especially those living nearest the project.**

# How would Susitna affect growth in the Matanuska-Susitna Borough?

## A discussion with Peter Rogers

Peter Rogers

We've been asked questions about the socioeconomic impacts of the proposed Susitna hydroelectric project. The responses are taken from an interview with Peter Rogers, Vice-President of Frank Orth & Associates.

For the most part, if Susitna were constructed, Anchorage and Fairbanks would hardly notice any increase in workers or related activity because the expected increases are so small. Most of the population increase (and related impacts) would be felt in the Matanuska-Susitna Borough, especially in the Talkeetna and Trapper Creek areas.

**1. What would be the impacts on the Matanuska-Susitna Borough during the construction of the Susitna project?**

The impacts on the Borough could take a number of forms. There would be construction of an access road that could open up the northern part of the Borough and a construction camp that would contain about 4,000 construction workers and family members at the peak of construction activity (1990). There would be a large increase in activity in support areas such as project supplies, restaurants, gas stations, and retail stores. An estimated increase of 1,110 people in the population of the Borough would occur between 1983 and 1990. The largest population-related impacts would occur in Trapper Creek and Talkeetna. This would be due to the number of people moving into the area in order to live close to the site.

The effects of constructing the Susitna project on public facilities in the Borough would, to some extent, be limited by the provision of a full service construction camp. In the cases of education, health care, police and fire protection, and transportation, the population increase associated with the project would speed up the need for new facilities by a couple of years. Even without Susitna the population growth in the Mat-Su Borough will be significant and result in substantial increases in the demand for public services.

**2. The "base case" projects that 69,000 people will live in the Borough in the year 2000. What is this based on?**

The estimate of population without the project is based on assumptions of moderate growth in the central Railbelt Region and of the continued growth of the Mat-Su Borough as a percent of the total regional population. Specifically, this forecast assumes construction of the natural gas pipeline, completion of the Knik Arm crossing by 1991, and no capital move. Houston and Big Lake are expected to grow due to the construction of the Knik Arm crossing. Borough officials indicated during December 1981 that these figures are slightly lower than other projections with which they are familiar. Most of the population growth that is projected for the Borough is not related to the Susitna project, but rather to the tendencies that have caused the Borough's population to increase so rapidly in the past 10 years.

**3. How was it determined that 1,000 people will live in Talkeetna and 320 in Trapper Creek by the year 1990?**

These figures refer to the total population increases that would occur in Talkeetna and Trapper Creek if the Susitna project is not undertaken. This growth is based on a moderate growth assumption in the Railbelt region and continued growth of the Mat-Su Borough as a percent of the total region. Based on future growth assumptions and observations of past growth trends, it is expected that Trapper Creek's population will increase by approximately four percent annually and Talkeetna by approximately five percent annually.

**4. How can that many people move into the Trapper Creek and Talkeetna areas in the year 1990 without Susitna? It seems quite high.**

We have observed that people tend to settle in the area in spite of the general lack of employment opportunities. A considerable number of these persons must obtain seasonal or other employment outside of the immediate area (for example, on the North Slope). As oil and gas and other natural resource developments intensify during the 1980's more people will be attracted to and settle in the area. While it is difficult to forecast population so far in advance, it is felt that the estimates are reasonable.

**5. How many people might be moving into Borough communities as a result of the Susitna project?**

As mentioned previously, the total population of the Borough would increase by approximately 1,110 people. Between 1983 and 1990, about 340 project related people are expected to settle in Trapper Creek, to the extent there is housing available. As a result of the project, 260 people are expected to settle in Talkeetna. Between 40 to 50 project related people will settle in each of the incorporated cities: Palmer, Wasilla, and Houston. Close to 400 more people can be expected to live elsewhere in the Borough as a result of Susitna, especially near Indian River, in the Montana-Willow area, and around Wasilla.

**6. What do these estimates include?**

These estimates include direct construction work force, their dependents, and two other categories of employment. One category is jobs that will result in local industry as a result of Susitna in such areas as local sheet metal shops or wholesale hardware stores. The other category is jobs that would be created in the service related area by the spending patterns of the workers. These jobs would be in supermarkets, gas stations, restaurants, and the like.

In the Railbelt, it is estimated that an average of 82 secondary jobs would be created for every 100 direct construction jobs on Susitna. The majority of people moving to the Borough would be in service related jobs.

**7. When would these people be coming?**

If the State decides to construct Susitna and the present schedule is followed, limited construction related activities would begin about 1985. Some people could move into the Borough at this time for this work and in anticipation of additional employment opportunities when construction activities accelerate in the late 1980's.

Over 85 percent of the people moving into the Borough as a result of Susitna would occur between 1987 and 1990. About 200 people are expected to leave the Borough in the early 1990's as construction on the Watana dam winds down. Employment on the second phase of the project is expected to be filled by people in the Borough (including workers that stayed) so that no further significant population increases are expected.

**8. What is going to happen to Talkeetna if the Susitna project is built?**

A number of construction workers and their families would relocate to Talkeetna from other parts of the Railbelt, other areas of Alaska, and from Outside. Most of this relocation would occur during 1985-1990. As Talkeetna residents become employed on the project, and as new workers relocate to Talkeetna, additional income would be spent in Talkeetna. This would increase business activity. Demands on facilities and services, schools, health care, etc. would also increase. There could be temporary shortages if planning is inadequate or if the population influx turns out to be significantly greater than anticipated.

**9. What would happen to Trapper Creek?**

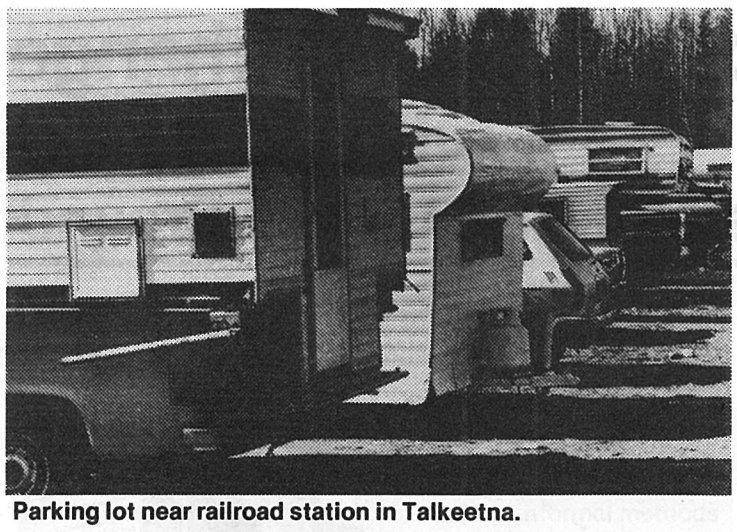
The effects on Trapper Creek would be much the same as the effects on Talkeetna, except more so. Trapper Creek would have considerably more traffic and business activity along the highway. Additionally, because the influx of people is anticipated to be about equal to the population size without the project, Trapper Creek could experience more acute impacts than Talkeetna.

**10. Would schools in the Mat-Su Borough be overcrowded?**

Most schools in the Borough will experience major growth in enrollments as a result of population growth without Susitna. This will be far more

## Chart compares population growth with and without Susitna

| Geographic area | 1981 population | Expected population in the year 1990 without Susitna | Additional people with Susitna (during peak construction 1990) | 1990 population with Susitna |
|---|---|---|---|---|
| Entire Matanuska-Susitna Borough | 22,300 | 43,000 | 1,100 | 44,100 |
| Anchorage | 174,700 | 225,200 | 1,100 | 226,300 |
| Fairbanks/North Star Borough | 54,600 | 71,200 | 90 | 71,290 |
| Kenai Peninsula | 22,900 | 35,600 | insignificant | 35,600 |
| **Community** | | | | |
| Trapper Creek | 225 | 320 | 340 | 660 |
| Talkeetna | 640 | 1,000 | 260 | 1,260 |
| Wasilla | 2,168 | 4,150 | 50 | 4,200 |
| Palmer | 2,567 | 4,500 | 40 | 4,540 |
| Houston | 600 | 1,400 | 40 | 1,440 |



Parking lot near railroad station in Talkeetna.

significant than the increase in enrollment associated with Susitna. Project induced population influx would most affect the schools in the northern part of the Borough. With Susitna, Trapper Creek's elementary school would increase by about 60-70 students between 1983 and 1990 over the baseline projection of 80 students. Talkeetna's elementary school population would increase by about 40 students over the baseline forecast of 126 during the same time. The planned Trapper Creek elementary will have a capacity for 100 students. Although it may not need to be expanded without Susitna, additional classroom space would be necessary with Susitna. The Talkeetna elementary school will have reached its capacity without Susitna around 1990 and would need to be expanded.

The project would also increase the enrollment of Susitna Valley High by about 75 students over the baseline forecast level by 1990. The school would probably have to be expanded to accommodate the increase.

**11. Would taxes for education increase to cover the costs of building new schools?**

In general, no. Capital improvements for education are currently funded by the State. In organized boroughs, the State reimburses the school district for 80 percent of the school debt.

**12. Would there be adequate housing?**

The pressure on housing would be greatest in Trapper Creek and Talkeetna, due to the projected lack of vacant housing. There could be a significant amount of temporary housing utilized during the period of greatest immigration (1987-1990). This would take several forms: staying in lodges and motels, purchase of mobile homes on individual lots, as well as the use of trailers.

However, it is possible that the long lead time between the start of construction and the peak of activity in 1990 may result in speculative housing construction which would provide additional housing.

**13. What kinds of people would be moving to Mat-Su as a result of the Susitna project?**

In the initial years of the construction project, the predominant type of people to move into the Borough would be construction workers and their families, originating from other areas of Alaska. The single greatest factor in determining how many and what type of people would relocate is the nature of construction camps. Presently there are plans for a full-service facility at each dam site with family provisions at a separate village for engineers and professionals, and single status accommodations for construction workers. The full-service facility would include schools, stores, a bank, and a variety of recreational facilities. The majority of the work force on the project would be Alaska residents and they would, in most cases, live at the work camp. Engineers and professionals would have the option of relocating their families to the construction village, but construction workers would not.

Further population increases would occur from secondary employment opportunities as a result of Susitna. These individuals would work at jobs that closely parallel the existing service-oriented jobs. Here, too, a percentage of jobs would be filled by out-of-staters. Many of those out-of-staters would be related to the construction workers (wife, child, etc.).

Many workers coming from other areas of Alaska (primarily Anchorage) would view their employment on the project as an opportunity to move to the Mat-Su. Therefore, most of the people moving to the Borough will be Alaska residents with lifestyles similar to those of current residents of the Borough. It is likely most on-site construction workers who move into the Borough communities would have families and would remain once the Susitna construction is completed.

**14. If the full-service construction facilities (with families, schools, banks, stores, recreation facilities) are not provided, how much worse could it be for the Talkeetna/Trapper area?**

More people would settle in Talkeetna and Trapper Creek, but it is difficult to say how many more. Currently, Acres American, Inc. has anticipated the need for a temporary construction town site that would accommodate up to 350 families as well as a single status camp for construction workers. If these accommodations are not provided, a significant number of these families might choose to settle at Talkeetna or Trapper Creek. Although no detailed estimate was made, factors that would influence settlement decisions include work schedules (e.g. four weeks on, one week off, or seven weeks on, two weeks off), commuting modes (whether personal vehicles and private/commercial planes are allowed at the construction sites), availability of mass transit (e.g. bus) to the sites, and so forth.

**15. Why would workers and families live in the construction camp rather than relocating in the local communities?**

Several factors would discourage the relocation of workers to local communities. The major ones are: the long commuting distance; construction workers' preferences; mobile/transient lifestyle; the planned work-schedule; and the lack of available housing in these communities.

**16. Would the workers living in the Mat-Su commute to the site on a daily basis?**

Given what the work schedules are likely to be and the distances to the site, it is unlikely that the Mat-Su workers would commute on a daily basis. Workers would probably commute weekly, bi-weekly, or less frequently depending on the final work schedule. In any event there would be much less traffic than if they were to commute daily

**17. What size town would remain at the dam sites?**

As the hydroelectric facilities become operational, the operations and maintenance work force is proposed to move into a new permanent town constructed one or two miles west of the Watana construction camp. This town could eventually accommodate 170 operations workers plus their families and provide all the necessary services. A preliminary design of this town site was provided in the March 1982 feasibility report.

**18. How many people that live in the Mat-Su Borough now will be able to get jobs on Susitna if it were built?**

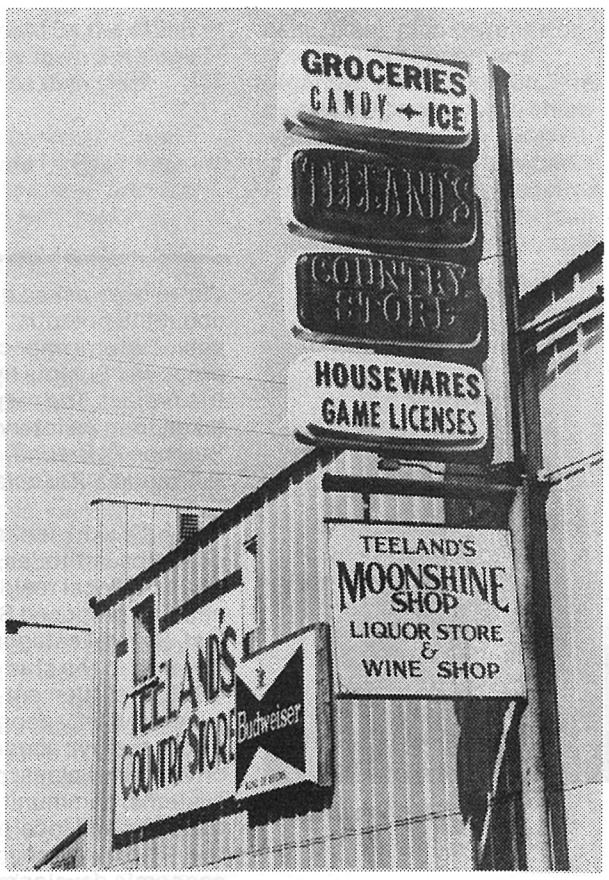
On-site employment opportunities during the construction will reach a peak of 3,500 in 1990, and it is estimated at least 200 people in the Borough would be able to get jobs. There is, of course, no hard and fast limit on this number. In addition, it is expected that business created by the project will result in another 335 jobs in other industries and service/retail businesses. About 25 percent, or 85, of these jobs would be located in the Trapper Creek/Talkeetna area.

**19. What kind of jobs would be available?**

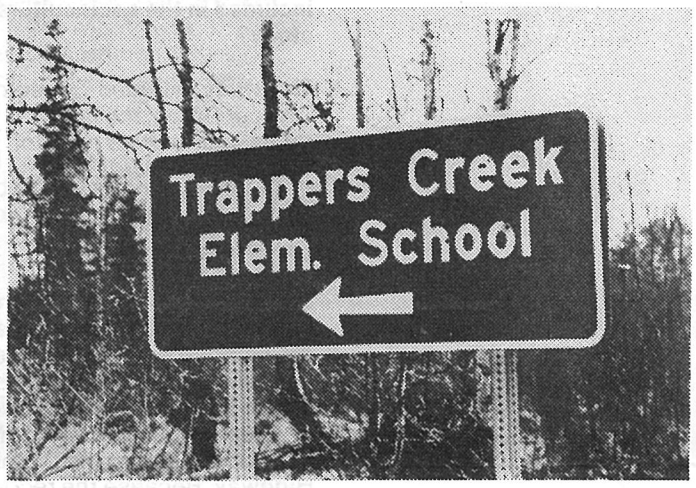
About two-thirds of the construction work force is expected to be made up of general laborers and trades such as drilling and blasting, pumping, excavation, steel, and cement workers. There will also be positions for truck drivers, mechanics, welders, sheetmetal workers, carpenters, engineers, and assorted other positions.

**20. Will the Mat-Su Borough administration have additional expenditures for services to the new residents?**

Yes. In the short-term, the Mat-Su Borough Administration will incur additional costs in providing areawide and non-areawide services; however, in the long term revenues from local property taxes, user charges, and State funds will increase to cover these costs. The short-term lag in revenues will be approximately two years. The cost would be covered by property taxes, state revenues, and user fees.




Teeland's Country Store in Wasilla.




Trapper Creek Elementary School, Mile 2.5 Petersville Road.

**21. Would Palmer or Wasilla get much growth as a result of the Susitna Project?**

No. Without Susitna, Palmer is expected to grow from its present population of approximately 2,600 to 6,400 by the year 2000 and Wasilla is projected to grow from approximately 2,200 to 8,500. The population increases to these communities associated with the Susitna project are approximately 50 at the construction peak in 1990. This would decrease to approximately 25 by 2005. Although Wasilla and Palmer are currently the major population centers in the Borough, most construction workers are expected to settle in the more northern communities closer to the site.

**22. Would the Susitna project cause much growth in Anchorage, Fairbanks, or other parts of the Railbelt?**

No. Anchorage is expected to grow from its present population of approximately 179,000 to 253,000 by 2000, without the Susitna project. Population increases associated with Susitna would total approximately 1,000 persons by 1990; and by the year 2005 approximately 300 of these persons would leave.

Population growth in Fairbanks related to the project would be slightly less than 100 at the peak (1990) and, as is the case in Anchorage, the Fairbanks region will experience net outmigration of approximately 100 persons by the year 2005.

The Kenai Peninsula will experience an insignificant amount of project induced growth during the initial years of construction and after 1987 there will be a net outmigration of population for the same reasons as in Anchorage and Fairbanks—increased employment opportunities in the Mat-Su Borough associated with Susitna.

Although Cantwell seems to want to encourage growth, the area's lack of services and land available for housing will limit the ability of project workers to settle there.

Source: Susitna Hydroelectric Project Environmental Report, Socioeconomic Analysis Phase I Report, April 1982, prepared by Frank Orth & Associates.

# How would people's lives change with Susitna?

## A discussion with Stephen Braund

Stephen Braund

We've been asked questions about the potential sociocultural impacts from the proposed Susitna hydroelectric project. The responses are taken from an interview with Stephen R. Braund, of Stephen R. Braund & Associates.

Braund's work looked at the concerns, attitudes, and values of local residents living near the proposed Susitna project. Several categories were involved in the study including: settlement patterns (when and why people come to a community); economic conditions and values; political systems; community response capacity; and local attitudes toward growth, change, and economic development.

**1. Which communities were included in the sociocultural study?**

The study included Talkeetna, Trapper Creek, the railroad communities north of Talkeetna (Chase, Curry, Sherman, and Gold Creek), Cantwell, and the McKinley Park area.

The emphasis was less in the McKinley Park area because of its distance from the proposed dam sites. Cantwell was studied from the perspective of effects from the northern access route from the Denali Highway. Because the recommended access route would be to the south of Cantwell and the park, the impact of Susitna on Cantwell and the McKinley Park area was determined to be minimal.

**2. Would you characterize the "lifestyle" of the area you studied?**

The area's abundance of natural resources is the basic attraction for most of the residents who came to these areas: some came primarily to develop and extract those resources; others came primarily to enjoy the resources. In some ways these motives are extremes on a continuum that represents the entire spectrum of the motives, values, and attitudes of the area's residents.

On one extreme there is the more pro-development attitude; on the other extreme the more pro-recreation or enjoyment of the natural environment attitude. In spite of these two extreme attitudes or opinions, the residents of the area have one commonality that makes them unique and that is the desire to live in a non-industrial, rural, undeveloped, semi-wilderness environment.

**3. How would you characterize the general attitudes and values of the two groups you just described?**

Based on this continuum, residents on one end have a desire to protect rural, small-town, and wilderness atmospheres, minimize change, avoid industrial development in the area, and to preserve the wildlife and recreational characteristics of the environment. Many residents in this group take issue with the charge that they are against growth and economic development per se. Rather, they point out that economic development for the upper Susitna Valley does not only mean industrial growth (such as mineral extraction or hydro development), but also its potential for visual and recreational enjoyment, both summer and winter. These residents argue that a recreational/tourist economy caters to people who enjoy the land without defacing it, which is preferred to a commercial, industrial economy which does scar the landscape. They tend to be opposed to the Susitna Hydroelectric Project as well as any other large-scale development schemes for the area.

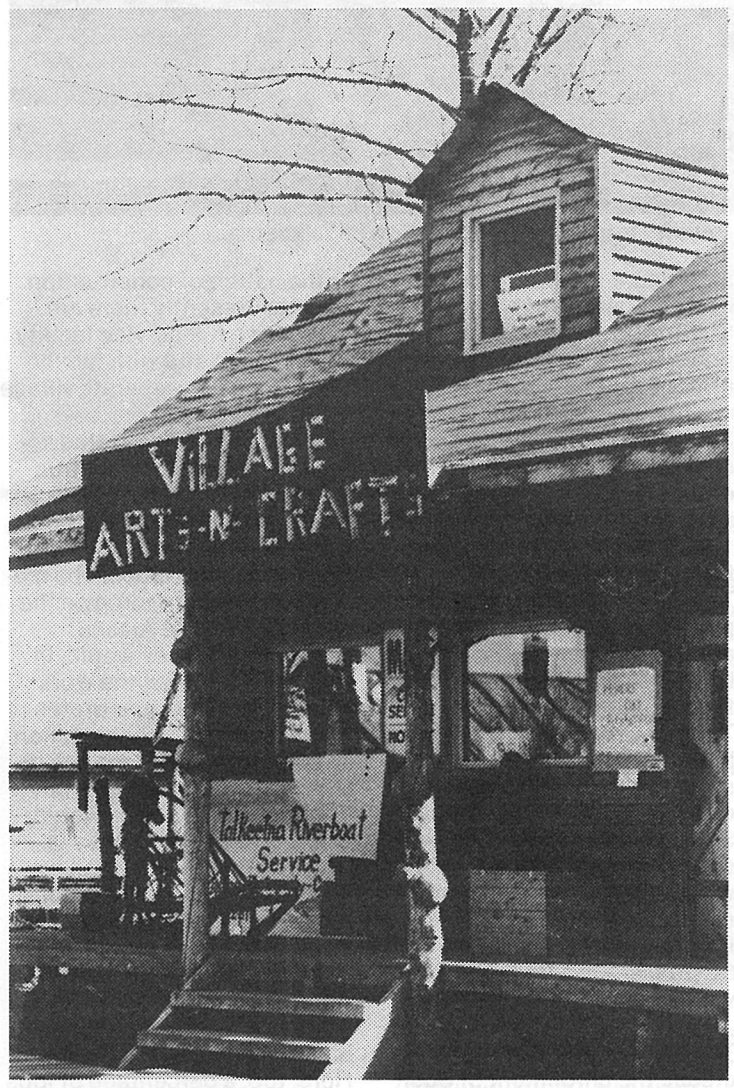
On the pro-development end of the continuum are residents who do not necessarily desire industrial development in the area, but they cannot identify with what they feel is a no-growth attitude. These residents do not generally desire to see their community radically changed, nor do they necessarily wish for industrial development to become the economic base in the area. Like their neighbors, they enjoy small-town qualities and desire to live in a non-industrial, relatively isolated, wilderness environment. Nevertheless, they feel the local economy will benefit from development, and as long as there is no danger to life, not necessarily lifestyle, the Susitna project is acceptable.

Residents with an extreme development view tend to favor roads to open up additional country and believe that progress (including hydroelectric dams, more people, and roads) will come regardless of what they, or anyone else, want. Generally long-time residents, many of whom have already witnessed considerable change in the area, they do not view future developments as necessarily undesirable.

**4. Is one of these groups larger than the other?**

Trapper Creek and Talkeetna are basically split in these attitudes. The railroad communities are very much on the end of the continuum that desires to maintain a wilderness environment. The old-time residents are the ones who have seen various changes and tend to be on the more pro-development end, whereas the newcomer who has come to escape development elsewhere tends to be more preservation oriented toward the environment.

In recent years many people have moved to Talkeetna, Trapper Creek, and the areas north of Talkeetna because they liked the quality of life or the wilderness, not specifically to go after employment or to make money. Once they got there, they figured out some way to make ends meet and to live at a lower standard of living where cash is not the motive. A population increase would make the area less




desirable for these people, because its wilderness quality would be diminished.

**5. How would you characterize the changes that could occur in the Trapper Creek and Talkeetna areas as a result of the Susitna project?**

In order to get an idea of the magnitude of the changes that might result from Susitna, it is best to compare it to what could happen without the project. One good indication is population. The following figures were developed by Frank Orth & Associates.

Trapper Creek, with a growth rate of about 4% a year, is projected to have a population of 320 by the year 1990 without Susitna. With Susitna another 340 people would be added. In Trapper Creek the Susitna project would cause a doubling of the 1990 population. This would classify Trapper Creek as a "boom town".

Talkeetna, with a growth rate of about 5% a year, is projected to have a population of 1,000 by the year 1990 without Susitna. This would be a 64% increase without Susitna. With Susitna another 263 people would be added. This would not have the same kind of impact for Talkeetna that the Susitna-related increase in Trapper Creek would have. Talkeetna's greatest impact would seem to come from its base case growth, not Susitna-related growth.

**6. What do you mean by "boom town"?**

Social scientists have defined a "boom town" as:

1. a community experiencing above average economic and population growth;
2. which results in benefits for the community, such as expanded tax base, increased employment opportunities, and social and cultural diversity;
3. but which also places or results in strain on existing community and societal institutions (such as family, education, political, economic).

Not all impacts associated with boom towns are negative. For example, positive consequences include substantial benefits to the local economy such as more jobs, more businesses, higher pay scales, increased prosperity, and an increased tax base. Generally, the positive benefits associated with rapid growth caused by a large development project are primarily economic. In the case of Trapper Creek, for the segment of the population which is not primarily motivated by economic advancement, the negative effects of rapid growth will likely overshadow any benefits.

**7. What types of problems could happen in Trapper Creek if it does become a boom town?**

Based on its lack of infrastructure, its small rural nature, and the characteristic that a significant portion of its residents are not primarily motivated by economic advancement, many of the problems associated with boom towns seem to apply to Trapper Creek.

Some of these problems are:

- Existing facilities and services (schools, fire and police protection, water and sewer, etc.) cannot meet the increased demand.

- High inflation caused by increased demands of large, incoming population and increased cost of living, especially housing
- New pay scales beyond the limits of some local businesses
- Hardships associated with inflation on those people living on fixed incomes
- Increase in crime and "people problems" (child abuse, alcoholism, divorce, etc.)
- Potential conflicts between local residents and "newcomers"
- Local government is forced to grow and expand.

These problems are compounded by a lull in 1995 when Watana would wind down and a second project peak in 1999 when Devil Canyon would be built. Based on the projections, Trapper Creek would experience a boom (1986-1990), a downswing (1991-1995), an upswing (1996-1999), and a slow decline in project-related persons beginning in 2000. The lull in the 1990's could be especially difficult for people whose jobs were not directly related to the project, such as service and support businesses. This period would likely be easier for primary construction workers because they will likely go elsewhere to work.

**8. Do you expect much resistance from local residents to newcomers? Will this cause much tension in the communities?**

Local residents who live in the small community prior to a growth tend to blame the developer and the new residents for problems associated with population influxes. These problems can become worse if the community does not have the infrastructure to accommodate the new growth. Resentment between current residents and newcomers may develop because the former often bears the burden of the expense for new facilities and services, often in the form of higher taxes.

**9. What are the consequences of the small communities being unorganized?**

The danger is that a community may be very ineffective in implementing or influencing any changes that may affect the community or its residents. By not being organized, the community encourages higher levels of government to deal with a lot of different voices, different attitudes, and different concerns. Government officials don't really know which voice speaks for the majority of the citizens. An organization that represents community consensus is the only effective way to give outside higher levels of government a means to listen to the community.

**10. Could a community organization or structure solve some of the potential problems?**

A community organization could solve some problems but could create others. Successful response to the development project will likely compel people who wanted to get away from people and government to band together. In effect residents have to form government to fight government and industry. This is time-consuming and generally conflicts with the rural values of the study area. People moved to the area to escape government and don't want to spend all their time at meetings and in political organizations.

Planning and community organization to prepare for the boom become part of the problem. The planning process makes personal relationships more formal and contractual, adds bureaucracy, and reduces the informal methods of communication that characterize small towns.

**11. You've described the impacts on Talkeetna and Trapper Creek. What would be some of the impacts expected in the railroad communities north of Talkeetna?**

Although there is an abundance of land available, primarily due to the State land disposals, it is unlikely that the permanent population in the Chase/Curry area would increase dramatically, either with or without Susitna.

Without Susitna, the main attraction to the area would continue to be recreational for most people and residential for only a few. Recreation seekers would continue to use the area as Talkeetna continues to promote tourism. As more and more people visit this area, the chances increase that they would apply for some of the surplus available State land.

With the Susitna project, recreation in the Chase/Curry area would likely increase more than without the project. Improved access to and increased awareness of the railroad area east of the Susitna River would likely attract more recreationists. The access road initially recommended by Acres American would provide vehicle access to the Gold Creek and therefore make the general area more accessible to more people. (Ed. note: As a result of State and Federal agency and public comment, the Alaska Power Authority is reviewing other access routes in addition to that recommended by Acres. The re-evaluation includes a new option, a route north of both Gold Creek and the Indian River remote parcels. If selected, this option reduces the impacts on Gold Creek and the Indian River remote parcels.)

The Susitna project could also result in increased employment opportunities for residents in this area. At the same time, the increased employment opportunity created by the project would attract more people into the general area. This would likely have a negative effect on the existing semi-wilderness way of life for residents who value a semi-wilderness environment.

**12. Can the rural semi-wilderness nature of the railroad communities north of Talkeetna be preserved?**

I think the railroad communities' rural, semi-wilderness nature will remain the same simply because of the limited access into them. The thing that may influence the railroad communities even more than access to Susitna is the State land disposal programs. The State has many parcels ready for disposal to the public in this area. If this occurs it will slowly erode the wilderness environment. Rural yes. Wilderness no. People cannot totally subsist off the land as they may have been able to do ten years ago, because it takes more than five acres to subsist in that area.

**13. With Susitna, Gold Creek could be the area most heavily impacted by the currently recommended access. Will you expand on this?**

With Susitna, the Gold Creek area would likely be the most heavily impacted if the currently recommended access route is chosen. Gold Creek would then be connected by an 18-mile road to the Parks Highway.

If vehicular access occurs in this area, local residents and absentee landowners between Hurricane and Gold Creek, as well as entrants in the Indian River Remote Parcel land disposal would be subjected to increased traffic, noise, and congestion. Potential development would mainly affect local miners, about ten full-time local residents, and absentee, recreational property owners, all of whom value their wilderness retreat.

Without the recommended access or a railhead at Gold Creek, the area would likely remain the way it is. This is true for the Indian River remote parcels as well as Gold Creek. Without Susitna there would probably be no large population influx.

**14. If Susitna is developed, will Talkeetna or Trapper Creek become more like Wasilla?**

I don't think Talkeetna will ever become a strip development along a highway. Talkeetna is partially protected by the Spur road, a 15 mile dead end. It will always have that to protect it. That's what makes Trapper Creek so vulnerable to the Susitna project. It's along the main corridor of the Parks Highway. It would get all the traffic and it is quite possible that commercial, strip development could occur if property is available. This could occur with or without Susitna depending on local planning efforts.

**15. What could be the effect of having a new town developed at the Watana dam site?**

On the positive side it could tend to locate more of the new families in the new town and fewer in the existing ones.

It would also tend to open up a whole new area that is now wilderness. This would be negative for those people who value the area as a wilderness area. It would be positive for the development-oriented people in those communities who value opening it up, extracting the resources, developing the region, providing access and road, and more recreational opportunities.

**16. Do you expect that the people coming to work on Susitna would have significantly different values than the ones who already live in Trapper Creek and Talkeetna?**

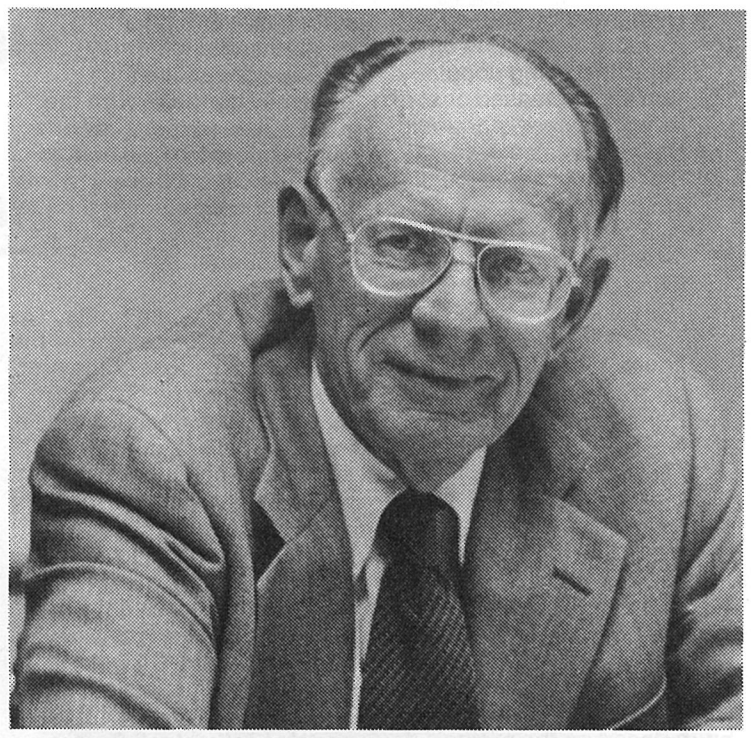
People who move into the area as a result of Susitna and locate their families in Talkeetna or Trapper Creek may have quite similar values to people who are there. They'll enjoy the semi-wilderness, the small town environment, the good fishing, the cross country skiing, and other recreational opportunities. But it's the same old problem: more people tend to degrade the quality of that experience. Even though they'll all enjoy it, many people may tend to view the quality of the experience as declining as the population increases. People who come in just to work and live in the construction camps may have different values and attitudes.

**17. What can be done to alleviate the impacts that may result from the Susitna project?**

Generally, a town facing rapid growth desires to develop the local capability to ensure that the effects of growth will be as beneficial as possible. Not all impacts can be alleviated, but many can be successfully mitigated. Controlling the impacts of rapid growth on small, rural towns within the context of local values begins with community planning, community organization, and research. It is important to understand that urban planning techniques may not apply; a rural community needs rural planning. The success of any plan depends on community support and organization. In addition, it requires the developer to share with the community detailed information about the project. Finally, a community requires time, at least 2 years, for planning and preparation for rapid growth.

Source: Susitna Hydroelectric Project Environmental Report, Sociocultural Report Final Draft, March 1982, prepared by Stephen R Braund & Associates.

# Designing dams for "Noah's Flood" —An interview with Jacob Douma



**Because people have been concerned about flooding, Jacob Douma, a member of the External Review Panel, was asked to discuss how the proposed dams are being designed to safely accommodate everything from very small to very large floods.**

**Jacob H. Douma, an internationally recognized hydraulics expert, served as Chief of the Hydraulic Design Branch of the U.S. Army Corps of Engineers prior to his retirement from active government service after more than 40 years. In addition to his government work on American dams, he has extensive consulting experience with Canadian hydroelectric projects.**

**Question:** How are the frequency and intensity of large floods predicted?

**Douma:** In the case of the Susitna project, flood frequency analyses were made for 12 recording stations located within and adjacent to the upper Susitna River Basin. These were then used to develop regional relationships of instantaneous flood peaks to mean annual flow for various flood frequencies. Flood frequency is related to the size and probability of a flood occurring. In addition, the data from the stations were utilized to develop equations which relate the mean annual flow to the location, geography, and climate of the basin.

**"To ensure against dam failure, both dams are being designed with enough spillway capacity to pass the probable maximum flood without overtopping the dams."**

By combining the estimated mean annual flow derived from the equations along with the regional relationships associated with specific frequencies, flood frequency curves were developed for the dam sites. From these relationships, instantaneous flood peaks at various recurrence intervals, or frequencies, could be predicted for the Susitna River at the dam sites.

The frequencies used for the study are floods occurring once in 100 years, once in 500 years, once in 10,000 years, and the probable maximum flood.

**Question:** What does the term "probable maximum flood" mean?

**Douma:** The probable maximum flood is considerably larger than the one-in 10,000-year flood. Its recurrence interval is considerably less often than once in 10,000 years.

There are three primary factors that cause the probable maximum flood and there must be a reasonable probability of these three factors occurring simultaneously.

Those factors are: 1) the greatest amount of precipitation and snow melt possible; 2) the most severe concentration of runoff; and 3) the least amount of precipitation and snow melt absorbed by the soil. The combination of these generates the greatest amount of runoff possible at a specific location.

A computer model was used to derive the probable maximum flood on the Susitna River. The model was developed by the North Pacific Division Corps of Engineers and is called the Streamflow Synthesis and Reservoir Regulation (SSARR) computer model. The model was calibrated using observed precipitation, temperatures, and discharges in the Susitna River basin for four major flood events in the period of record May through August. It was verified by comparing computer results and actual recorded data.

**Question:** What are the peak discharges for the 100-year, 500-year, 10,000-year, and probable maximum floods in the Susitna River?

**Douma:** Flood peaks were estimated for the Susitna River at the Gold Creek gauging station (about 15 miles downstream of Devil Canyon).

The peak discharge for the 100-year flood would be 104,500 cubic feet per second (cfs). This is about equal to the largest flood on record, which was 90,700 cfs at the Gold Creek Station in June 1964.

The 500-year flood is estimated to be 131,900 cfs, or 1½ times greater than the largest recorded flood.

The 10,000-year flood is etimated to be 198,000 cfs, or more than 2 times greater than the largest recorded flood.

The probable maximum flood would be 408,000 cfs, or 4½ times larger than the largest flood of record.

**Question:** What level of flood is being used in design of the dams?

**Douma:** Both Watana and Devil Canyon dams are being designed with sufficient spillway capacity to pass the one-in-10,000-year flood with no damage to structures.

**Question:** How is this done?

**Douma:** The reservoir-routed flood discharges at Watana and Devil Canyon dams for the one-in-10,000 year flood are 145,000 cfs and 165,000 cfs, respectively. At Watana dam, 7,000 cfs would pass through the power generating facilities and 24,000 cfs would be released through tunnels with six 78-inch fixed cone valves located in an abutment of the dam. The remaining 114,000 cfs would pass over a service spillway. At Devil Canyon dam, a total of 42,000 cfs would be released through a combination of the power units and five 108-inch fixed cone valves near the base of the dam, while 123,000 cfs would pass over a service spillway.

The fixed cone valves at both dams would be used for normal operation during most years when small floods occur.

The service spillways would be used infrequently for short durations when floods exceed the combined release capacity of the power units and the fixed cone valves.

**Question:** Is the probable maximum flood used in dam design?

**Douma:** Yes.

**Question:** How?

**Douma:** To ensure against dam failure, both dams are being designed with enough spillway capacity to pass the probable maximum flood without overtopping the dams.

In addition to the cone valves and service spillways already mentioned, an emergency fuse plug spillway will be provided at each dam to pass all discharges in excess of the one-in-10,000-year flood

**"The probable maximum flood would be 408,000 cfs, or 4½ times larger than the largest flood of record which occured in June 1964."**

discharges. For the probable maximum flood, the fuse plug spillway would pass 140,000 cfs at Watana dam and 160,000 cfs at Devil Canyon dam.

**Question:** What is an emergency fuse plug?

**Douma:** An emergency fuse plug is a small dam placed across the entrance to an emergency spillway. It is "designed to fail" with floods as large as the probable maximum flood. The fuse plugs at Watana and Devil Canyon dams would be small earth dams about 31.5 feet high.

For the probable maximum

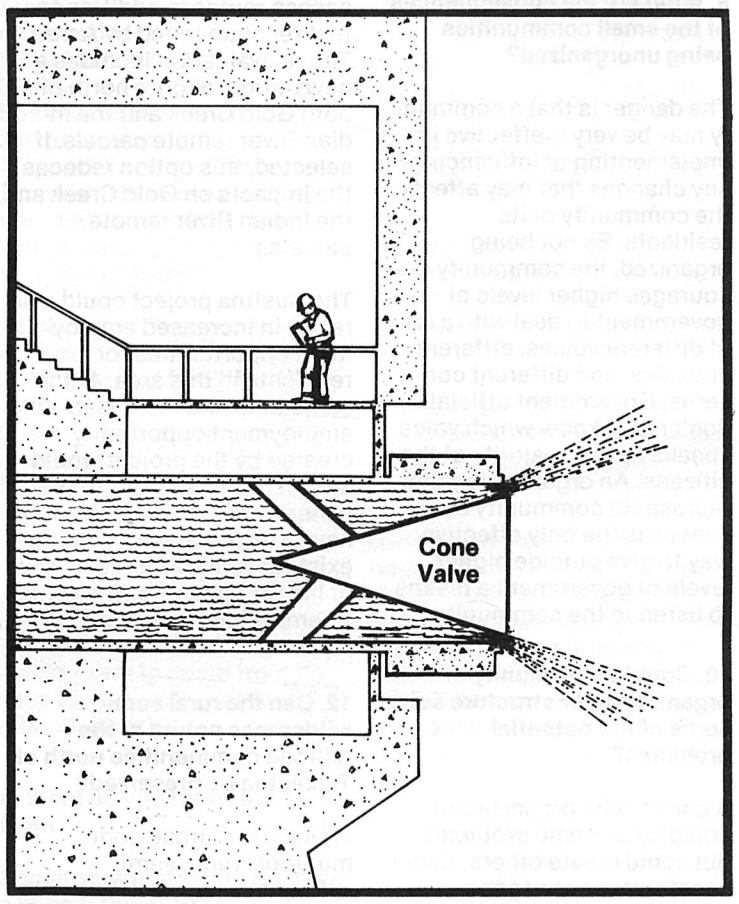



**Diagram shows the size of cone valve that would be used in both dams. They would be placed near the base of the dam to spray water out like garden hose nozzles. This prevents the formation of deep plunge pools and reduces the chance of a nitrogen supersaturation problem for fish.**

flood, the fuse plugs would be overtopped. The downstream side of the fuse plugs (consisting of small-size crushed stone or gravel) would erode as the water passed over, allowing the excess water to safely pass down the emergency spillways. The fuse plug would be rebuilt after the flood subsided.

**"An emergency fuse plug is a small dam placed across the entrance to an emergency spillway. It is 'designed to fail' with floods as large as the probable maximum flood, allowing water to pass safely down the emergency spillway...the fuse plug would be rebuilt after the flood subsided."**

**Question:** Will the dams reduce the effects of flooding downsteam?

**Douma:** Yes, by reducing peak discharges for various sized floods.

The reservoirs are planned to be operated to produce maximum hydroelectric power consistent with power demands and downstream flow requirements. By drawing down the reservoirs in winter, a significant amount of reservoir capacity can be provided for storage of summer floods. The peak discharge (90,700 cfs) for the flood of record in the Susitna River at Gold Creek would be reduced to about 45,000 cfs with the dams in operation.

The general effect of the reservoirs would be to moderate the flows establishing a more consistent flow pattern rather than the wide range of flows that have traditionally occurred.

**Question:** Will spillway operation cause a nitrogen supersaturation condition in flows downstream of the dams which would be harmful to salmon?

**Douma:** Whenever air-entrained, high-velocity spillway flows plunge into a deep pool or stilling basin, an excess amount of air is absorbed in the water. This produces a nitrogen supersaturation condition harmful to fish.

The possibility that a harmful nitrogen supersaturation condition will occur in the Susitna River downstream of the dams is small because:

1) Normal flood flows (up to one-in-50-year floods) at the two dams will be released through low-level cone valves, which will not produce deep plunge pools;
2) Service spillways, which would only be needed for floods with a recurring interval of less than once in 50 years, would have flip buckets designed to minimize the depth of the plunge pool;
3) The rock below the dams, particularly at Devil Canyon, is quite hard and will not erode enough to cause a deep plunge pool to form;
4) Any nitrogen supersaturation resulting from using the service spillway at Watana dam would be largely dispersed in the Devil Canyon reservoir;
5) Much of the nitrogen supersaturation that may occur by spillway operation at Devil Canyon dam would be dispersed in the steep, rough river channel downstream of Devil Canyon dam.

If a harmful nitrogen supersaturation condition should result from Devil Canyon spillway operation, it would not occur more often than once in 50 years, as that is as often as the spillway would operate.

**Question:** Are the reservoirs likely to fill up with silt?

**Douma:** No. Less than 5 percent of the Watana reservoir and less than 10 percent of the Devil Canyon reservoir would be filled up in 100 years. This is based on a conservative approach that assumes high estimates for the amount of sediment coming into the reservoirs and the subsequent amount of silt that will settle out.

A large percentage of deposited sediment would be in what is called the dead storage portion of the reservoir. Dead storage is that portion of the reservoir not needed for power production. Operation of the project would not be affected by a decrease in the dead storage volume due to siltation.

Since a large part of the Susitna River total sediment load would deposit in the Watana reservoir, sediment storage in Devil Canyon is estimated to be less than 25% of that in the Watana reservoir.

**Question:** How much water level change is expected on the lower Susitna River (below the Talkeetna confluence)?

**Douma:** Analyses of pre- and postproject water levels in the lower Susitna River indicate that summer water depths will be 1.5 to 3.5 feet lower, depending on which reach of the river is being considered.

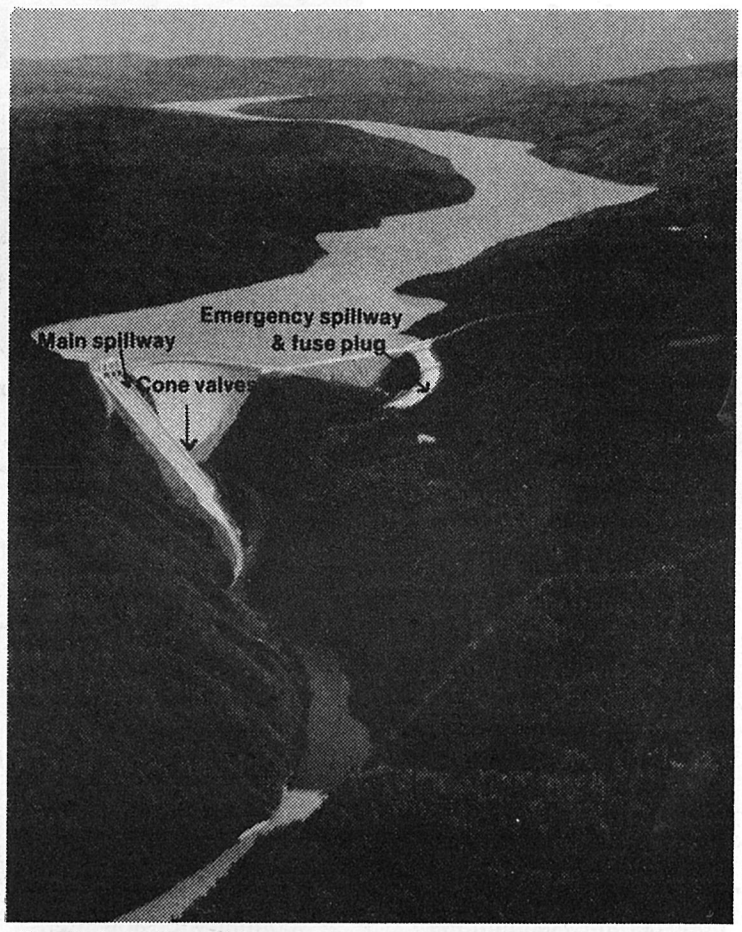
This would be about 10-25% lower than the river is now for corresponding flows.

**"Less than 5% of the Watana reservoir and less than 10% of the Devil Canyon reservoir would be filled up in 100 years."**

**Question:** What are the impacts on the lower river which could result from sedimentation?

**Douma:** Sediment analysis indicates that sediment loads in the lower Susitna River will be essentially the same for both pre- and postproject conditions. This is due to two factors: 1) the extremely large volumes of sediment in the long, wide gravel floodplain below the confluence of the Susitna River with the Talkeetna River; and 2) the large sediment load contribution from the Talkeetna River.

Between Talkeetna and the Delta Islands, a trend towards relative stabilization of the floodplain features should occur over a long period of time.




**Rendering of Devil Canyon dam shows location of cone valves, service spillway, emergency spillway, and fuse plug. These structures would allow water from various sized floods to pass safely over the dam.**

The main channel and major subchannels could develop a more uniform meandering pattern. A vegetative cover could develop on the gravel floodplain and the minor subchannels could begin to fill in.

It should be recognized that an extreme flood generated by either the Chulitna, the Talkeetna, or both could disrupt this process and delay observable changes for several years.

Below the Delta Islands, the changes would be minimal.

# Potential river navigation impact identified

One potential navigational problem area has been identified that could result from construction of the proposed Susitna hydroelectric project. This location, as shown on the map is:

- upstream of Talkeetna near Sherman (about River Mile 128 to 130).

In addition, a second location currently does not have enough data to determine if navigational problems would occur. This location provides access to Alexander Creek from upstream of Alexander Slough.

Further work will be done in summer 1982 in order to define the magnitude of problems which may develop, as well as recommended mitigation options.

Source: "A Preliminary Analysis of Potential Navigational Problems Downstream of the Proposed Hydroelectric Dams on the Susitna River", by Paul Janke, Alaska Department of Natural Resources, Division of Land and Water Management, March 5, 1982.

**Map shows areas of possible navigational difficulties**

**Sherman:**

If the Susitna project were operated for maximum power production, navigational difficulties may occur near Sherman about one year out of three in August, and one year out of two in September.

If the Susitna project were operated for minimal impact on fisheries, navigational difficulties may occur near Sherman about one year out of 10 during June.

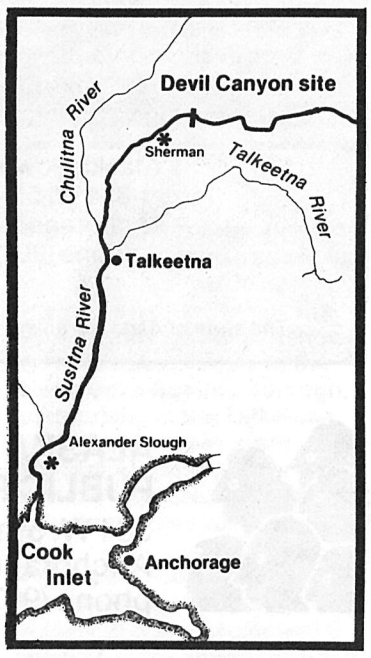
**Alexander Slough:**

At present there is not enough data to determine if navigational difficulties would occur at the upstream access to Alexander Slough (also known as the West Channel.)

**Definitions**

**Navigational uses:** past and present uses of the river for transportation by boats and float planes between May 1 and October 31.

**Navigability:** the lower limit of flow depth which still permits navigation by waterborne vessels. During Phase I studies, a required depth of 2.5 feet was the primary criteria used for identifying problem areas in the Susitna River.



# Board of directors concludes Susitna "offers potential long-term benefits", but not without risk

From left, Board of Directors Robert Ward, Chuck Webber, Chuck Conway, Ernst Mueller, Robert Weeden, John Schaeffer.

In late April, the Alaska Power Authority Board of Directors formulated their recommendations concerning the Susitna hydroelectric project. The recommendations were sent in a letter dated April 26 to Governor Hammond, Senate President Kerttula and House Speaker Hayes.

In the letter, Board Chairman Chuck Conway concluded that "The Susitna project offers a potential of long-term benefits to the State." The letter continued to say "While this potential exists, the realization of those benefits is dependent upon certain assumptions about the future that are far from certain: upon proper project development timing; and upon very skillful project management. Because of these uncertainties and the time before any actual construction decision is necessary, the Authority believes it is premature to make any commitment, at this time, to actual project construction."

The Board's recommendations were:

- "Pre-construction developmental efforts on the Susitna Hydroelectric Project should continue.
- The Alaska Legislature should authorize the Power Authority to submit a Federal Energy Regulatory Commission (FERC) license application at a time deemed appropriate by the Authority. The issue of license application timing will be resolved not later than June 30, 1982.
- Funds in the amount of $25.6 million should be appropriated to the Power Authority in FY 83 for the continuation and intensification of environmental studies, for site exploration activities, and for the initiation of project design."

These recommendations were based on the potential for long-term benefits and because "no information has come to light to suggest that environmental and social impacts, after mitigation, would be unacceptable".

Conway's letter also made it clear that the Board's action to continue the Susitna developmental activities was not an endorsement of Acres American's recommendations regarding specific project details. An example is Acres' recommended access plan. According to Conway, "The engineer's plan for access to the project site is the subject of reanalysis and will be reconsidered by the Authority at an appropriate future time."

The Board also recommended that the Legislature fund two alternative power generation option studies. First, it was recommended that $200,000 be appropriated to assess the use of North Slope gas generation in the Railbelt. Second, $3.3 million was recommended to continue studies of the proposed Chakachamna hydroelectric project. The Board considered both these projects as options that should be pursued in the event the Susitna development does not proceed as scheduled, for one reason or another.

Source: Letter sent to Governor Hammond, Senate President Kerttula, and House Speaker Hayes, April 26, 1982, from Charles Conway, Chairman, Alaska Power Authority Board of Directors.

# Independent cost estimate reduces chance of cost overruns

It is the policy of the Alaska Power Authority to obtain second party cost estimates on all feasibility level studies. This does not prevent cost overruns; it does, however, reduce the chance of them. By obtaining a second cost estimate, the confidence in the original cost estimate can be strengthened by identifying and resolving specific differences.

The Power Authority currently has a contract with Ebasco Services to provide independent cost estimating on its projects. Ebasco is a large international consulting firm that specializes in power production facilities, including hydroelectric and water resource development.

Ebasco's estimate for the Susitna project was $5.487 billion, or 7% higher than Acres' estimate of $5.127 billion. This cost difference is considered to be well within the limits of acceptability. By way of comparison, the U.S. Army Corps of Engineers considers bids that are 15% above cost estimates on government work (such as work on military bases) and 25% above cost estimates for civil works (such as hydroelectric projects) to be acceptable.

The Ebasco estimate was made without knowledge of Acres' final cost estimate. It was based on: project drawings, feasibility study information, and quantities furnished by Acres; a visit to the dam sites; manufacturer and vendor quotations; and Ebasco experience.

june 1982

# the susitna hydro studies

*This is the fifth newsletter published by the Alaska Power Authority for citizens of the railbelt. The purpose is to present objective information on the progress of Susitna hydroelectric feasibility studies so that readers may make their own conclusions based on accurate information.*

Eric P. Yould, Executive Director
Nancy Blunck, Director of Public Participation

Alaska Power Authority
334 W. 5th Avenue
Anchorage, Alaska 99501
phone (907) 276-0001

*The state of Alaska is an equal opportunity employer.*

## IN THIS ISSUE:

how would Susitna affect growth in Mat-Su Borough? . . . . . pages 2-3
how would people's lives change with Susitna? . . . . . pages 4-5
designing dams for "Noah's Flood" . . . . . pages 6-7
potential river navigational problems identified . . . . . page 7
board of directors' recommendations to governor and legislature . . . . . page 8
independent cost estimate reduces chance of cost overruns . . . . . page 8

ALASKA POWER AUTHORITY
PUBLIC PARTICIPATION OFFICE
334 W. 5th Avenue
Anchorage, Alaska 99501
phone (907) 276-0001

# the susitna hydro studies

november 1980

## Fairbanks, Anchorage and Railbelt face major energy decision

Citizens in the "railbelt region" will face a major energy decision in 1982.

At that time, the feasibility studies on the proposed Susitna hydroelectric project and a study of the feasibility of a variety of other energy alternatives will both conclude with their findings.

Information on the energy alternatives study can be anticipated from the Office of the Governor.

The purpose of this newsletter, the first of several, is to present what is going on with the Susitna studies that are now underway. The intent is to present the information objectively so that readers may make their own conclusions based on facts.

### A BRIEF HISTORY

There has been a great deal of interest for many years in the building of a hydroelectric project on the Susitna River.

It was initially looked at in the 1940's by the U.S. Bureau of Reclamation and later studied by the U.S. Army Corps of Engineers.

The previous assessments indicated that the Susitna project was economically feasible and that anticipated environmental impacts would not be of such a magnitude as to warrant it undesirable. Consequently, in 1976 the Alaska State Legislature created the Alaska Power Authority and asked the new state corporation to begin detailed feasibility studies on the development of the hydroelectric potential of the upper portion of the Susitna River. Initial funding was provided in July 1979, and the explorations were initiated in January 1980.

Those explorations, never adequately undertaken before, are now 10 months into a 30-month examination period. Acres American, Inc. (Acres) has been retained by the Power Authority to manage the $30 million effort.

The state is also funding a related but separate $1 million study to consider alternatives to Susitna hydroelectric power. That study, contracted by the governor's Policy Review Committee, is being conducted by Battelle-Pacific Northwest Laboratories. It will be completed in the spring of 1982, concurrent with the Susitna feasibility studies.

### INDEPENDENT REVIEW BY EXTERNAL CONSULTANTS

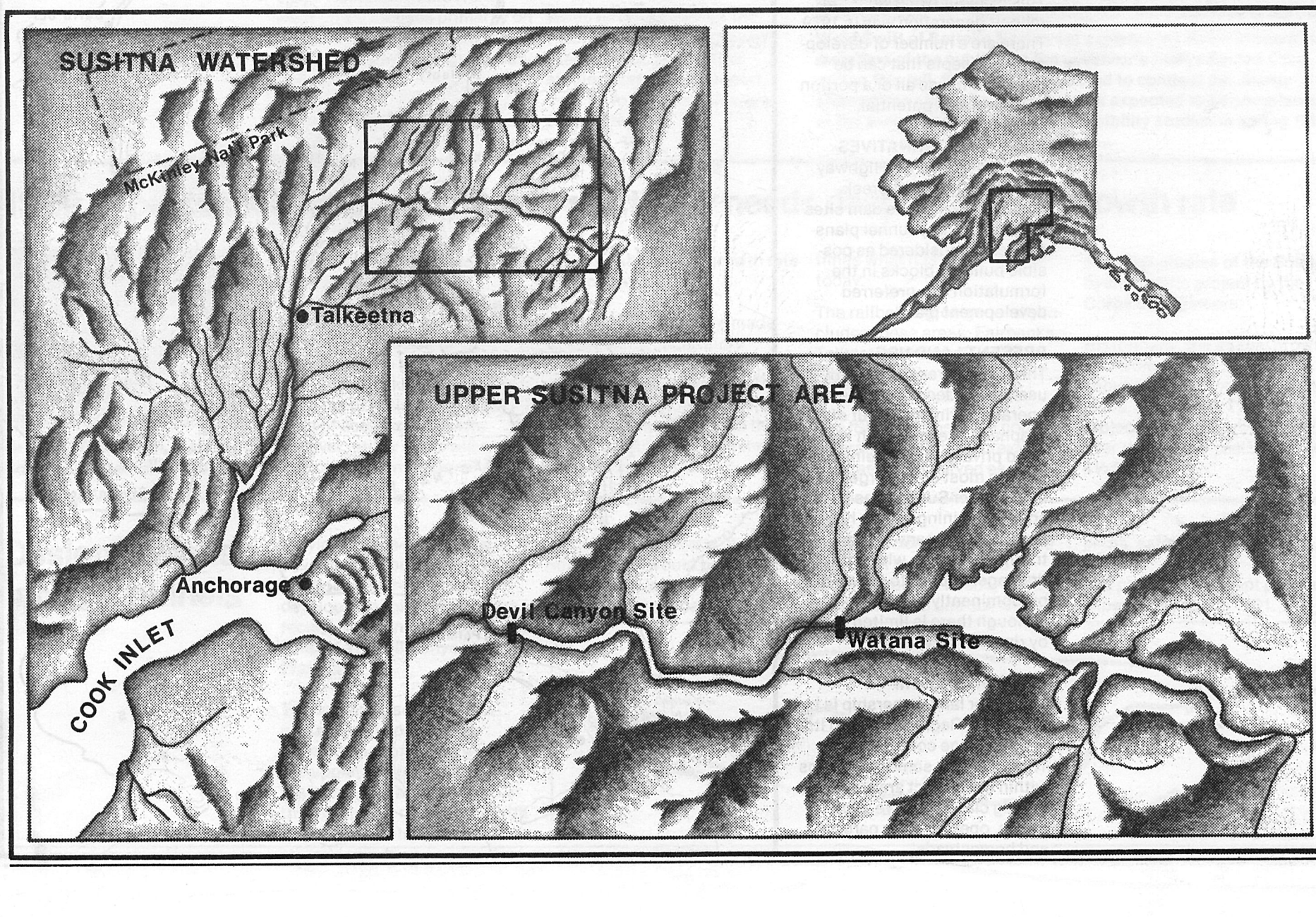
As a part of the Susitna explorations, the Alaska Power Authority is appointing an external review board composed of eminent engineers, scientists, and economists to review the feasibility studies performed by Acres. Approximately $1 million has been budgeted by the Alaska Power Authority for this review, which will include an independent cost estimate of constructing the Susitna project.

### THE SUSITNA HYDRO STUDIES

The Susitna investigations fall into 10 general categories. Not all the studies are going on at this time, nor are all described in this newsletter. They include:

- forecasts of future electrical needs in the railbelt area between the Kenai Peninsula and Fairbanks from 1990 through 2010
- hydrologic analysis of the Susitna River
- seismic examination
- geotechnical exploration near the dam sites
- engineering design development
- environmental data collection and impact assessment
- transmission line analysis

continued on page 3



Jim Gill, Resident Manager, Anchorage office of Acres American, Inc.

# Firm brings extensive cold region experience to hydro studies

In November 1979, the Alaska Power Authority Board of Directors selected Acres American, Inc., an international consulting engineering firm, to conduct the feasibility studies on the Susitna hydroelectric project.

Reasons for the selection included Acres' past experience with hydroelectric projects in sub-arctic regions.

Also important was Acres' decision to utilize Alaskan expertise in the field work (which would maximize the expenditure of monies within the state), and its proposal to provide for an extensive and direct public participation process.

The selection was made with support from both the public and the State House Power Alternatives Study Committee, a legislative subcommittee set up to oversee the feasibility work.

The Acres organization is active in diversified fields of planning, engineering, feasibility studies, environmental assessment, and project management. Among other energy technologies, the company has more than fifty years of experience with large and small hydroelectric development.

Included in these are the Churchill Falls project in Labrador and the Nelson River project in Canada, both of which are located in northern climates and presented problems similar to those the proposed Susitna project may encounter.

The Susitna project is managed by Acres out of its main office in Buffalo, New York. Its resident office is in Anchorage and the field camp is in the upper Susitna basin close to Deadman Creek.

# Expertise applied to socioeconomic questions

The construction and operation of a hydroelectric project in the Susitna River basin might affect the lives of Alaskans, in both positive and adverse ways. While Railbelt residents generally might experience energy independence and lower costs for electricity (relative to other alternatives), certain groups of people might experience population shifts, changes in service requirements, tax rate and revenue changes, and changes in the general quality of life.

Frank Orth & Associates, Inc., a firm with experience in conducting socioeconomic analyses, particularly in Alaska, is presently conducting the first phase of a two-phase study that will identify and analyze potential changes in socioeconomic conditions.

Between now and spring of 1981, the firm is developing socioeconomic profiles for local, regional, and to some extent, statewide areas. These profiles are descriptions of existing conditions such as population levels, availability and type of housing, employment and income levels, business activity, education enrollment and cost, transportation facilities, and land use patterns.

Later, between late spring and early fall 1981, these same conditions will then be described for a future without the Susitna project. The result will be a baseline from which comparisons can be made. A preliminary assessment of socioeconomic impacts that could result from a Susitna development will be made prior to a state decision on Susitna in 1982.

If the state decides to file a license application in 1982, a detailed analysis of what affect construction and operation of the Susitna project might have on social and economic conditions will then be conducted.

Frank Orth & Associates will identify and examine changes in socioeconomic conditions so that people can make their own evaluations of how such changes could affect their life styles.

# Background information on proposed Susitna project

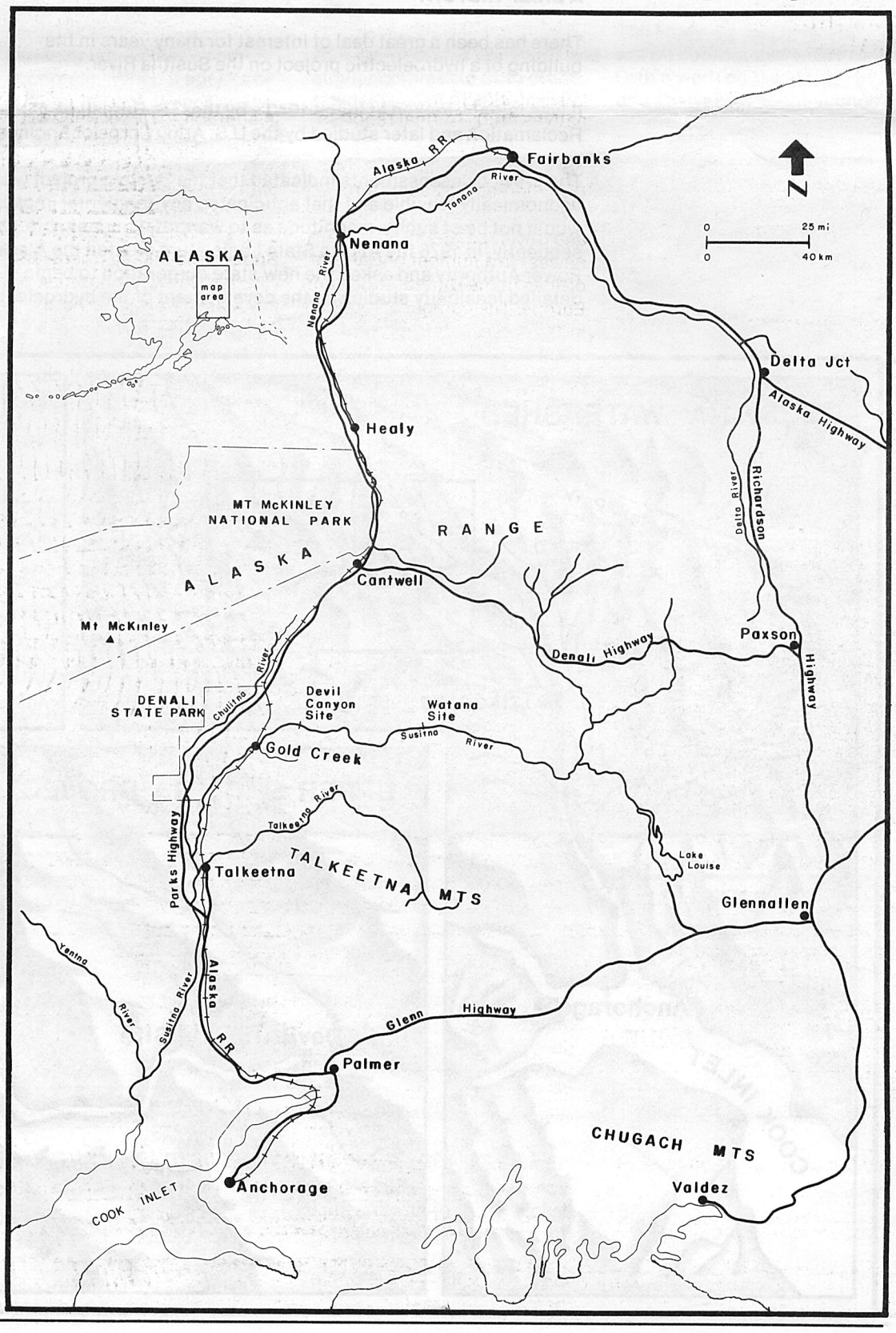
**LOCATION**
The proposed Susitna River hydroelectric project is located on the upper Susitna River, approximately 125 air miles north of Anchorage, 150 air miles south of Fairbanks, and 70 miles northeast of Talkeetna.

**POTENTIAL POWER**
For a year with typical precipitation and climatic conditions, the average energy potential of the basin is about 7 billion Kwh. This is about twice what the railbelt generation was in 1979. There are a number of development concepts that can be designed to use all or a portion of this energy potential.

**SUSITNA ALTERNATIVES**
Between the Denali Highway upstream and Gold Creek downstream, twelve dam sites and two primary tunnel plans are being considered as possible building blocks in the formulation of a preferred development plan.

**PRESENT LAND USE**
The project area is presently used by guided hunters operating principally out of the Stephan Lake area, with scattered private cabins being present on most of the larger lakes in the upper Susitna basin. In addition, mining claims have been filed on many of the tributary streams within the drainage. Access to the area is predominently by aircraft, although there is limited access by river from the east.

**LAND OWNERSHIP**
The major land ownership is by Cook Inlet Region, Inc., and its Native village corporations. There are also some inholdings within the project area, such as mining claims, Native allotments, open-to-entry parcels, and homesteads.



continued from page 1

- cost estimating
- preparation of FERC (Federal Energy Regulatory Commission) licensing documents, if appropriate
- marketing and financing analysis

**THE SUSITNA WORK THUS FAR**

Last summer, scientists and engineers went into the field to begin the Susitna work. An explanation and first examination of this work is the text that follows on the inside pages of this newsletter. Further information will follow in subsequent reports.

**FINAL RECOMMENDATIONS ON POWER DEVELOPMENT**

In April 1982 the five-member Alaska Power Authority Board of Directors will formulate its recommendation to the governor and the legislature in regard to power development along the railbelt. At approximately the same time, the governor's Policy Review Committee will be forwarding its independent recommendation.

**THE DECISION**

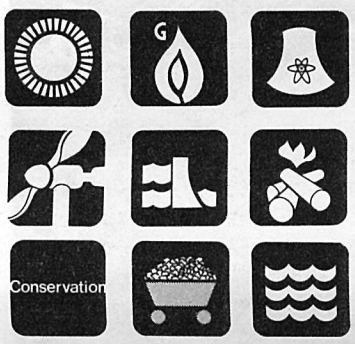
Final determination on the subject rests with the state in 1982. If the decision is made to proceed with the development of Susitna, a license application for construction will be filed with the Federal Energy Regulatory Commission in Washington, D.C.

## Who is the Alaska Power Authority

The Alaska Power Authority is a public corporation funded by the state and headed by a five-member board of directors appointed by the governor and approved by the legislature. Its day-to-day business is conducted by a sixteen-member staff located in Anchorage.

The purpose of the Power Authority is to assist the residents of Alaska in both urban and rural areas in constructing, acquiring, financing, and operating power production facilities of various types. Those types include fossil fuel, wind power, tidal, geothermal, hydroelectric, solar energy production, and waste energy conservation facilities. The Power Authority is currently developing a number of hydropower and alternative energy projects statewide.

# Alternative energy study goes to Battelle




To assure sufficient checks and balances, the 1980 state legislature determined that an independent consulting firm should conduct the Railbelt power alternatives study.

In the original plan of study presented to the Alaska Power Authority by Acres American, Inc., Acres was to conduct the alternatives study in parallel with feasibility level studies of the Susitna hydroelectric project.

This fall the governor's Policy Review Committee selected Battelle-Pacific Northwest Laboratories to make the alternatives study. A final report is expected in the spring of 1982.

Battelle-Pacific Laboratories, a Richland, Washington, research and development firm, is the newest in a number of Battelle offices in the United States and Europe. The company, founded in 1929, has a staff today of 6,000. Research in the Northwest office focuses primarily on the technological and environmental issues of energy production and use.

Recent studies by Battelle have included a national coal utilization assessment and an assessment of the effects of thermal power plant site and design alternatives on the cost of electric power, both for the federal government.

"Battelle has a lot of experience doing exactly what this request for proposal calls for, and they have a great amount of experience doing projects in Alaska," said Fran Ulmer, chairwoman of the Policy Review Committee and director of Policy Development and Planning in the governor's office.

In addition to Ulmer, members of the Review Committee include Clarissa Quinlan, director of the Division of Energy and Power Development; Ron Lehr, director of the Division of Budget and Management; and Charles Conway, chairman of the Alaska Power Authority Board of Directors.

While Acres American, Inc. reports to the Alaska Power Authority for the Susitna studies, Battelle will report directly to the Policy Review Committee.

**OBJECTIVE / COST**

The objective of the alternatives study is to determine if there are more cost effective ways to meet the energy needs of the Anchorage-Fairbanks railbelt area than through the development of the Susitna River's hydroelectric potential.

Cost of the 18-month study is $1 million.

**WHAT ABOUT THE RECOMMENDATION?**

When the Battelle study is completed in April, 1982, the Policy Review Committee and the Alaska Power Authority Board of Directors will consider the results in formulating their respective recommendations for Railbelt power developments to the governor and the legislature.

**WHERE QUESTIONS SHOULD GO**

Questions regarding the alternatives study should be directed to Fran Ulmer, Director of the Division of Policy Development and Planning (DPDP), Pouch AD, Juneau, Alaska 99811, phone (907) 465-3577.

Questions regarding the Susitna hydroelectric exploration should be sent to Eric Yould, Executive Director of the Alaska Power Authority, 333 West 4th Avenue, Suite 31, Anchorage, Alaska 99501, phone (907) 276-0001.

**Ward Swift of Battelle Northwest explains his firm's proposal to members of the public and the governor's Policy Review Committee this fall. Battelle was selected to conduct the energy alternatives study. Battelle's work is expected to be completed at the same time as the Susitna feasibility studies in spring 1982.**

# ISER expects more than doubling of electricity needs despite slower growth rate

**Dr. Scott Goldsmith, Institute of Social and Economic Research.**

Initial forecasts from the Institute of Social and Economic Research (ISER) indicate that future growth of electric utility sales is expected to be slower than the historical Alaskan growth rate. Because of anticipated high rates of economic growth, however, utility sales will equal or exceed recent national electricity consumption growth rate projections.

Several forecasts were made to reflect the uncertainty surrounding both future economic activity and relative prices of energy. ISER's "most likely" forecast indicates that electrical utility sales in the year 2000 are likely to be about 2.4 times what it is in the railbelt today.

The railbelt region generally includes these areas: Fairbanks, Talkeetna, Palmer/Wasilla, Anchorage, the Kenai Peninsula, Glenallen, and Valdez.

The ISER forecasts are considerably lower than previous forecasts that served as a basis of earlier studies of the Susitna hydroelectric project by the Corps of Engineers.

Historically, the annual growth rate from 1965 to 1975 was about 14%. During the last five years, it has been 7%. The projected annual growth rate over the next 20 years averages 4½%.

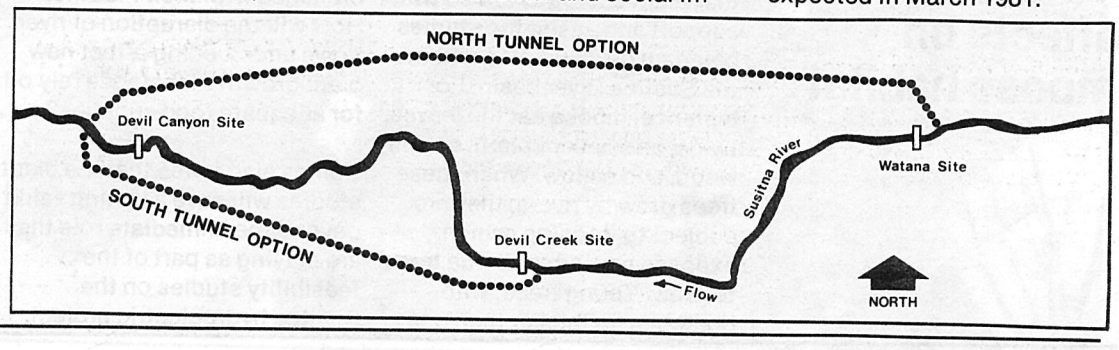
## Design options include tunnels

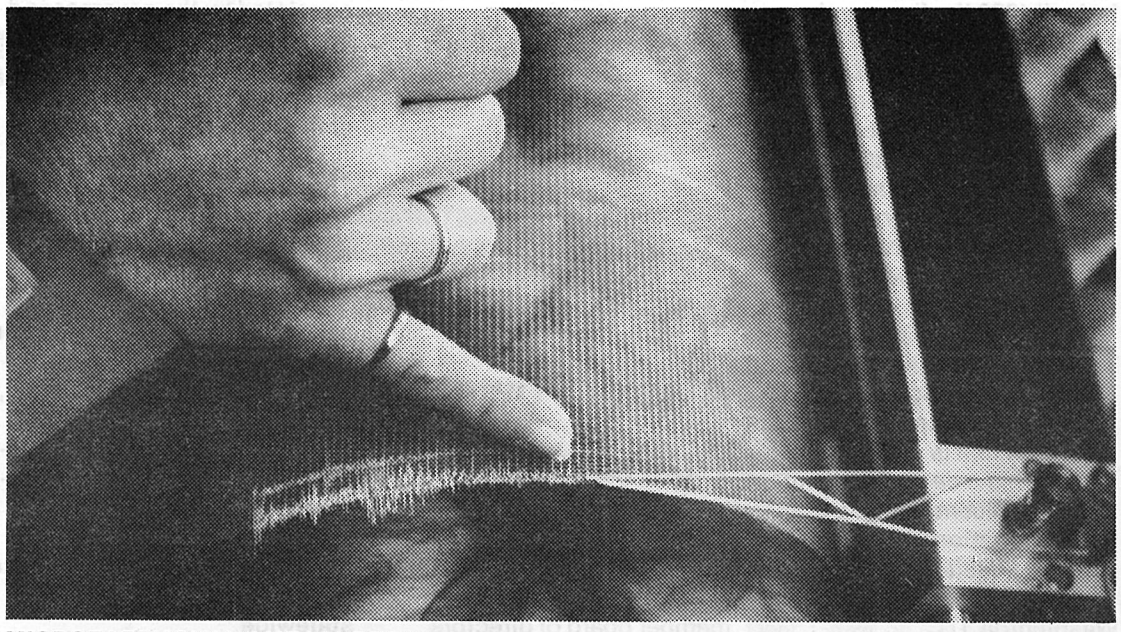
Previous plans indicated a basin development preference ranging from a four-dam basin development plan to the more recent preference for two dams located at Devil Canyon and Watana.

Tunnels are also being considered in the options for development of power within the upper Susitna. Two conceptual tunnel plans are shown in the map to the right, along with three of the potential dam sites.

The sites and tunnels shown do not imply all would be developed. Using a multi-disciplinary approach, the preferred concept plan will be based on such things as anticipated power needs, costs, environmental and social impacts, safety and reliability.

The preferred concept plan is expected in March 1981.





**MICROEARTHQUAKE MEASURES 2.0:**
**Portable seismographs like this one have been set up at the Watana base camp to register microearthquake activity. This particular microearthquake, with an epicenter in the southwest corner of Mt. McKinley Park, measured 2.0 on the Richter scale last August 27th. Microearthquakes usually are not felt by human beings. They occur constantly throughout the railbelt.**

# Microearthquake studies review old data, collect new

Seismic activity in the project area is being studied by Woodward-Clyde Consultants' seismologists.

In addition to reviewing historical earthquakes, seismologists have been monitoring microearthquake activity in the vicinity of the dam sites. During this year 10 very sensitive seismometers were installed in shallow holes within a 25-mile radius of the dam sites.

The seismometers measure ground motions for earthquakes as small as Richter magnitude zero (magnitude 3 or larger earthquakes usually can be felt).

The signal from each seismometer was transmitted from radio to recording seismographs that were installed at the Watana base camp.

Analysis of the records (seismograms) from the seismographs provides information on microearthquakes in the vicinity of the dam sites. This information includes the size, location, and depth of each microearthquake.

The microearthquake data and geological data are studied by both geologists and seismologists. This interdisciplinary approach provides scientists with information to evaluate the seismic design criteria for the dam sites.

# How to study earthquake potential

Geologic and seismologic studies are conducted to obtain an understanding of the seismic activity within an area. These studies begin with a comprehensive review of the literature and aerial photography to identify all faults and lineaments. Faults and lineaments that may be potentially important to dam design are then studied in the field.

A lineament is a straight line feature observed on aerial photographs, maps or from an aircraft. A lineament may be produced by glacial ice, by faults, or by other earth shaping forces. All lineaments are not necessarily faults.

For the Susitna project, all potentially important faults and lineaments within approximately 60 miles of either dam site have been studied. During the past year, these preliminary studies have included aerial reconnaissance with helicopters and small airplanes, along with investigations on the ground.

Features that are considered to be of potential importance are scheduled to be studied in detail next year.

The objective of these studies is to determine if the lineaments are faults and to estimate how recently the faults may have moved. Active faults, those that have moved during recent geological time, are important to dam design.

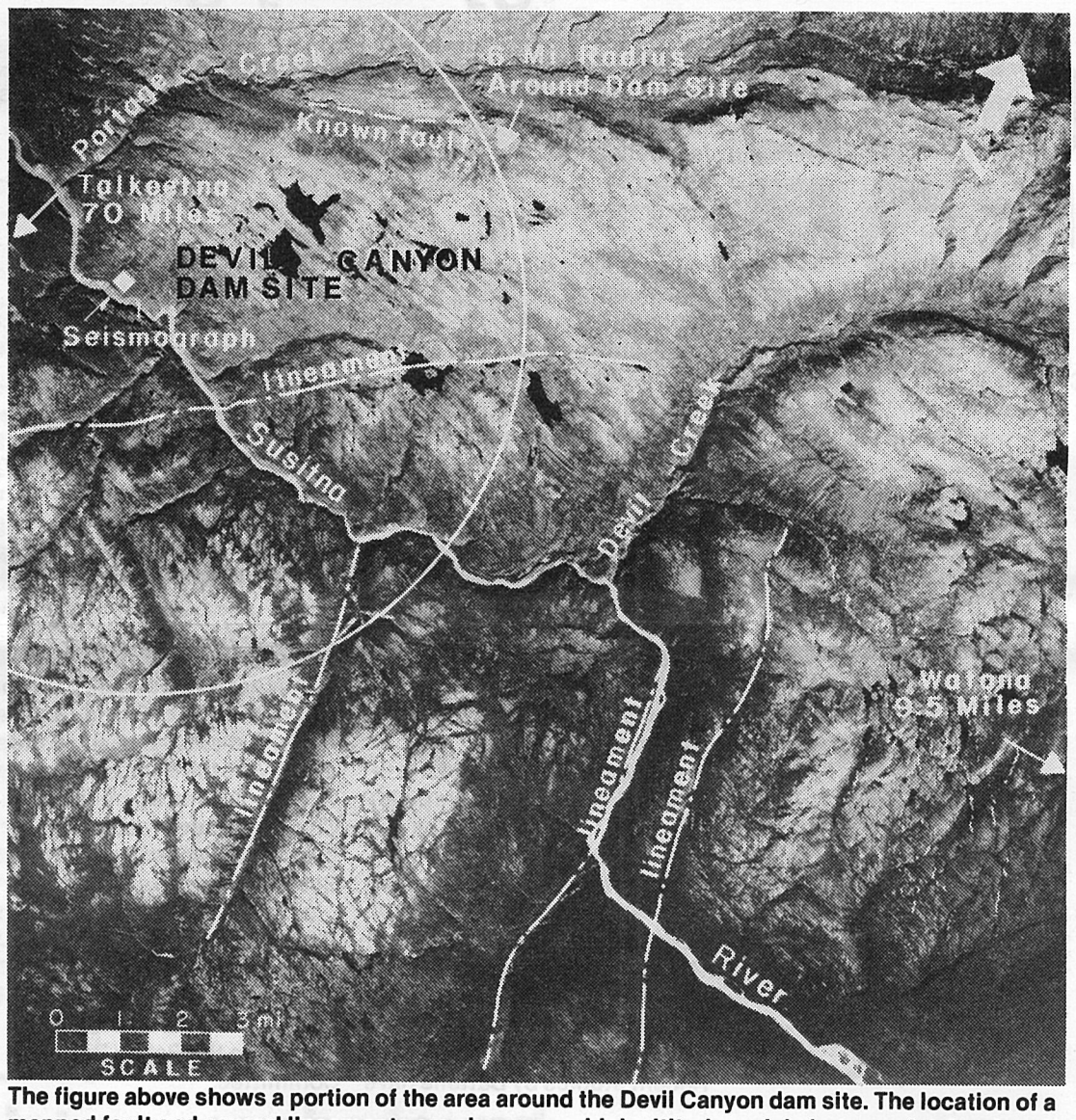
The Denali Fault is an example of a fault which has had movement during recent geologic time. The fault is 40 miles north of both the Devil Canyon and Watana dam sites. The Denali Fault is more than 800 miles long as it runs in generally an east-west direction through the Alaska Range.

Studies by a number of geologists show that movement has occurred along various sections of the Denali fault during large earthquakes that have occurred over several hundred thousand to several million years. The average rate of movement has been approximately one-half inch per year.

Woodward-Clyde Consultants are working under contract to Acres American, Inc., to evaluate potential seismic activity.

The first data from Woodward-Clyde Consultants is expected by the end of 1980. It will include information obtained to date and a discussion of lineaments and faults that need to be studied in more detail to understand their potential significance to the design of project facilities.

The Alaska Power Authority will schedule meetings in Spring 1981 and information collected and analyzed by the consultants will be presented to the public.




**The figure above shows a portion of the area around the Devil Canyon dam site. The location of a mapped fault and several lineaments are shown on a high-altitude aerial photograph taken by a U-2 aircraft. These features along with others in the vicinity of two dam sites are being analyzed by geologists and seismologists from Woodward-Clyde Consultants. In addition, the Alaska Power Authority will retain independent experts to review the work done by Woodward-Clyde, a conservative policy much like "getting a second opinion" within the medical profession.**

# Plant study considers affects on moose habitat

William Collins of the University of Alaska's Agricultural Experiment Station in Palmer notes that plant ecology studies will support and assist the studies being made on wildlife within the Susitna River basin. For instance, moose eat the leaves, twigs, and bark of birch, cottonwood, and willow. When these trees grow by rivers, they are subject to flooding, which exposes new sites for the trees to grow. Young trees, with branches no thicker than one inch in diameter, are excellent forage for moose, since the animals cannot break large branches with their mouths. How will the disruption of river flows and flooding affect new plant growth that moose rely on for adequate food supplies?

Collins also notes that the plant studies will have a lasting value beyond the immediate role they are playing as part of the feasibility studies on the Susitna hydroelectric project.

For instance, few descriptions of vegetation have been made for the area. Therefore, the species list of vegetation and the first detailed vegetation maps will be two important products of the current Susitna studies.

The specific goals of the two-year plant ecology studies are to forecast what effect construction of the dams would have on plant life within the area, to identify the wetland areas, and to identify plants that are endangered, rare, or threatened. Collins and his assistants will accomplish this by studying old and new aerial photographs, and by observing the area on foot, noting such findings as the age of vegetation and the effect of seasonal flooding on the establishment and maintenance of plants that are important as forage for moose. Their first vegetation maps will be completed by December of this year.

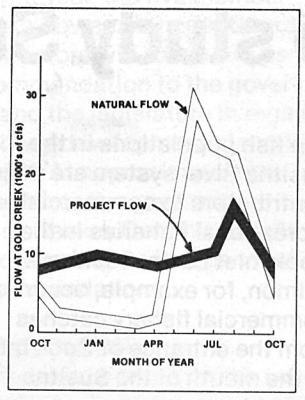
# Studies identify change in downstream water flow

**GENERAL**
Flow studies are one of a number of types of hydrologic investigations. Also included are assessments of reservoir operation, sediment yield, river morphology, glacial contribution and ice formation.

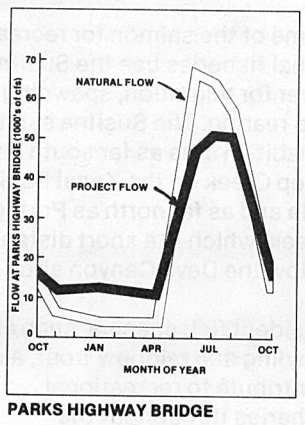
The development of any hydroelectric scheme on the upper Susitna will result in seasonal changes in downstream flow patterns. Taking the two-dam proposal as an example, the three graphs show the difference between natural seasonal flow patterns and project seasonal flow patterns at three points along the Susitna River. As one goes downstream, the difference between natural and project flows begins to dissipate as the effects are diluted by the normal flows from the other tributaries.

Changes in flow patterns can have a positive or negative impact on such things as fisheries, moose habitat, flooding, and navigation.

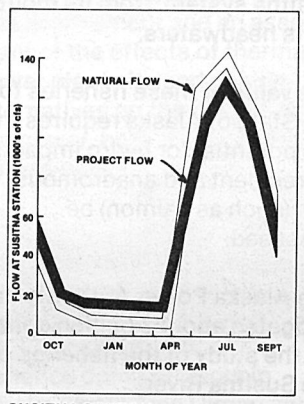
Fisheries directly depend on water flow. Since the effects of flow are greater on the upstream portion of the river, the initial emphasis of study efforts is most intensive upstream. Following the review of the basic river hydraulics, Acres will determine the required extent of assessment of downstream resources.



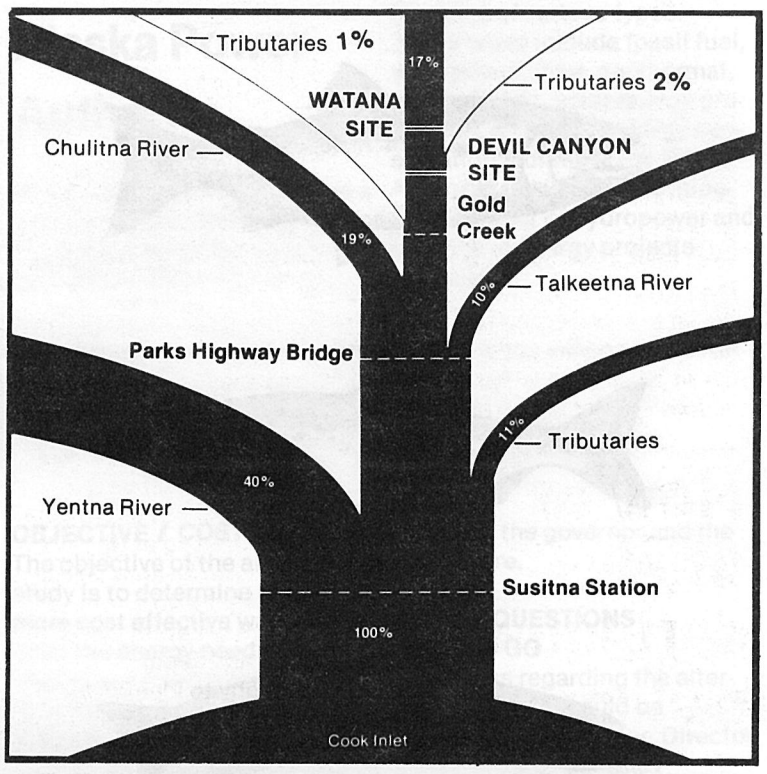
GOLD CREEK



PARKS HIGHWAY BRIDGE



SUSITNA STATION



**This is a schematic diagram of the Susitna River system. An important aspect of this system is that the upper Susitna (the area under consideration for hydroelectric development) contributes less than 20 percent of the river's average total flow. Other tributaries, including the Yentna, Chulitna, and Talkeetna Rivers, contribute the other 80 percent.**

# Radio collaring used to study wildlife

What effect would the construction of a large hydroelectric project have on the wildlife that inhabits the upper Susitna basin and downstream areas? Since this is a question of serious concern to those studying the feasibility of building the project in the Susitna River basin, a number of respected scientists have been hired to find the answer.

"It is important that people know we are not politicians, that we are not here to decide if the Susitna project should be built in the first place," said Dr. Phil Gipson of the University of Alaska, Fairbanks, Cooperative Wildlife Research Unit.

"We are here to study the area and to determine the impact on the animal life if construction takes place. The purpose of all the studies is to give the decision makers the facts so that they can make the best decision with full knowledge of the positive and negative consequences." he said.

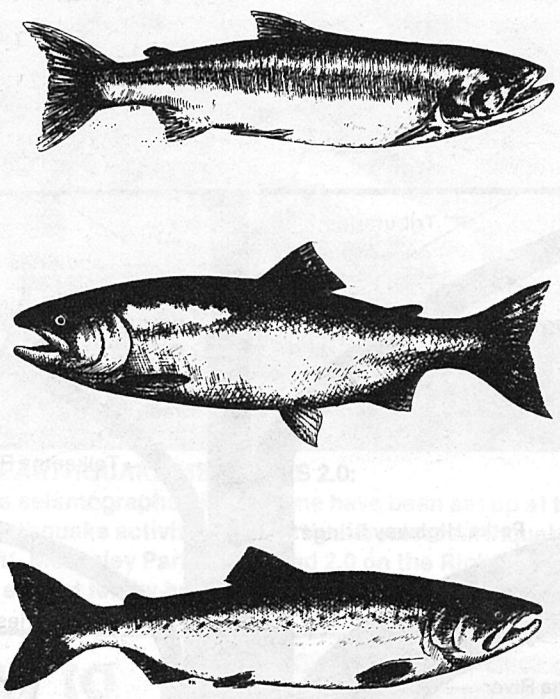
There are vast numbers of animals that live within the Susitna basin. Bears, wolves, caribou, moose, fox, otter, and mink all live in abundance. Why do they live there? And could they live somewhere else just as well?

As part of the Power Authority investigations, the Alaska Department of Fish and Game began monitoring big game animals last summer by airplane following earlier tagging and radio collaring efforts. Studies will continue this winter as the researchers note animal distribution, abundance, habitat preference, and movement patterns. It is easier to study most animals during the winter months, because they are more visible and it is easier to follow their tracks.

The group of scientists headed by Gipson has begun a two-year study of the furbearing animals that live within the area. Again, the purpose is to identify and count them, observe their seasonal habits, and determine what kind of habitat they need in order to live. In view of existing fodder, how large a range, for instance, does a red fox need? Gipson and his colleagues are studying the animals by tracking them in the snow and by radio collaring. Survey lines are established in representative types of vegetation and tracks of furbearers are identified in each vegetation type.

**Karl Schneider of the Alaska Department of Fish and Game puts a radio collar on moose number 38. An iridescent orange ear tag makes the moose more visible from the air. Schneider heads a team of researchers who have identified big game animals within the Susitna basin. The scientists began monitoring the animals last summer by airplane following earlier tagging and radio collaring efforts.**

# $3 million budgeted to study Susitna fish



Alaska Department of Fish and Game
*Wildlife Notebook Series*

The fish populations in the Susitna River system are major contributors to commercial and recreational fisheries in the Cook Inlet basin. Susitna salmon, for example, occur in commercial fishery catches from the entrance of Cook Inlet to the mouth of the Susitna River.

Some of the salmon for recreational fisheries use the Susitna River for migration, spawning and rearing. The Susitna salmon inhabit an area as far south as Deep Creek on the Kenai Peninsula and as far north as Portage Creek, which is a short distance below the Devil Canyon site.

Resident fish species, such as grayling and rainbow trout, also contribute to recreational fisheries throughout the Susitna system, from its mouth to its headwaters.

The value of these fisheries to the State of Alaska requires that the potential for hydro impacts on resident and anadromous fish (such as salmon) be assessed.

The Alaska Power Authority has budgeted about 3 million dollars for the study of the fisheries of the Susitna River.

Field data on the fish populations and habitat of the Susitna River will be collected by biologists of the Alaska Department of Fish and Game (ADF&G). Utilizing data supplied by ADF&G, existing fisheries information, and past experience, the private consulting firm of Terrestrial Environmental Specialists (TES) will assess the positive or negative impacts of development and operation of the proposed hydroelectric project and suggest measures to avoid, minimize, or compensate for possible adverse affects. Comparisons will be made to similar systems found in other cold regions of the world (for instance, Sweden and Russia).

TES will be assisted by noted specialists from the University of Washington, Dr. Clinton Atkinson and Dr. Milo Bell. Clint Atkinson has extensive experience with Alaska salmon fisheries, including those in the Susitna basin, while Milo Bell has 50 years of experience working on related engineering problems throughout North America on hydropower projects.

The Department of Fish and Games' responsibility during the field studies will be to determine existing fisheries conditions in the Susitna River. This includes identifying the distribution and abundance of salmon and resident fishes in the system as well as the seasonal importance of the river to their migration, spawning, and rearing.

Initial field work for these studies will begin late in 1980 and continues for 15 months. If the project goes to the Federal government for license approval, studies will continue through the post license application period.

A major question in the fisheries study is what would happen to the Susitna River fisheries if the dams were built. For example, will important fish habitats for migration, spawning, and rearing be favorably or unfavorably altered? If the impacts are negative, can they be minimized or offset in some manner such as by hatchery propagation of fish or through a scheme of regulation of river flows and discharge through the dams?

Tom Trent, one of the study coordinators from the Department of Fish and Game, emphasizes that study efforts of those conducting river hydrology and water quality studies must be closely coordinated.

Mr. Trent also noted that, "The Department of Fish and Game conducted very limited assessment work during the years 1973 to 1978, but the intensity and design for the next fifteen months and beyond will be aimed at collecting information enabling the State to make objective judgements of probable project impacts on the Susitna River fishery resources."

## Environmental studies use Alaska experts

Terrestial Environmental Specialists (TES), the consulting firm retained by Acres American, Inc., to conduct the environmental studies on the proposed Susitna project, has contracted with the University of Alaska on a number of the studies.

They include: furbearers, birds and small mammals, land use and recreation, cultural resources, and plant ecology.

"We chose the university because experts there are familiar with environmental conditions in Alaska," Jeffrey O. Barnes, TES president, said. TES is headquartered in Phoenix, New York.

## Drilling program completes first year

Deep drilling (over 700 feet per hole) into the areas around the proposed dam sites determines the types of rock, the rock structure, its strength, and the stability of the bedrock on which dams would sit or through which a tunnel would pass. Core samples are then retrieved and studied by geologists.

R & M Consultants is the subcontractor conducting the drilling program at the Watana and Devil Canyon sites.

# Keys to upper Susitna prehistory may be found

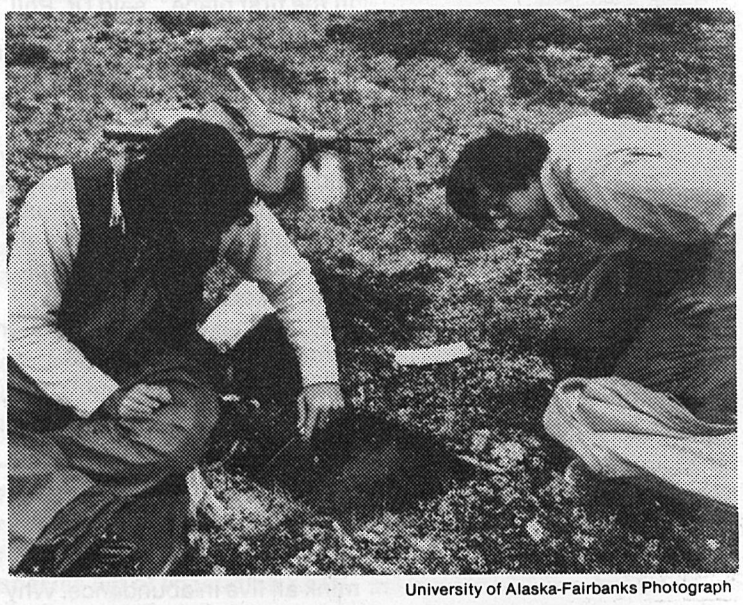
"Before any land-disturbance activities may take place on federal or state lands, an inventory of cultural resource sites must be made and recommendations developed to lessen or avoid the impact of the project on them," George Smith, an archaeologist with the University of Alaska Museum in Fairbanks, noted last summer.

In other words, before the construction of a hydroelectric project in the Susitna River basin may begin, there must be an archaeological survey to locate sites within the area.

Last summer archaeologists examined 55 sampling sites, determining that 33 of them were of archaeological importance. Next summer the museum will send several crews into the field to systematically test and analyze a portion of each site in order to evaluate its significance and to then make recommendations to minimize possible adverse effects. Sites that might be adversely impacted by project construction will be excavated if the decision to construct the hydroelectric project is made.

During the extensive testing scheduled for 1981, each site will be divided into a checkerboard of squares one meter in size. Artifacts found in the sampled squares will be catalogued and become a part of the University of Alaska Museum's archeological collection, where they will be available for display and research.

Although it may be premature to assess the significance of artifacts before their analysis is complete, Dixon and Smith are excited about the results of the survey. They have discovered several sites which will help unravel the poorly understood prehistory of this area of the state and which will provide important information about the way people lived in the upper Susitna thousands of years ago.



University of Alaska-Fairbanks Photograph

**Dr. E. James Dixon and Mr. George S. Smith of the University Museum head a team of scientists who will investigate the area for evidence of human activity which, they say, may extend back 10,000 years. Shown above are Les Baxter and George Smith. They are looking at buried animal bone fragments.**

# University survey seeks public comment on recreation potential


If the Susitna project is built, the areas surrounding it may be developed for recreational use. What kind of use is the subject of a questionnaire being sent this fall to residents of Anchorage, Fairbanks, and the smaller communities along the railbelt (Talkeetna, Palmer, Wasilla, Willow). More than 2,000 people, randomly selected in these locations, will be asked by the University of Alaska, Fairbanks, to describe the kind of facilities they would like to see developed. From their answers, Dr. Alan Jubenville and Ms. J. K. Feyhl at the university will determine which of five concept plans presented to the respondents is most acceptable.

In May, the Alaska Power Authority tentatively will hold community meetings and recreation will be one of the topics. Comments from both the meetings and from the questionnaire will be analyzed by the University of Alaska and a second survey on the subject will follow. A report will be made to the Alaska Power Authority in 1981, even though at that time the question of whether to develop the project will not have been decided.

In brief, people are being asked if they would prefer minimum or maximum recreation development (or something in between) in the areas of the two proposed damsites.

One concept plan calls for minimal development and management. It assumes that public access by road into the reservoir areas is restricted or not permitted. Development would be limited to a visitor information center on the Parks Highway. However, access by float plane would be possible on the reservoirs and access by canoe and kayak on the upper rivers would continue as it does at the present.

Another plan suggests that access by road to both reservoirs is possible. As a result, primitive campgrounds and simple boat ramps would be constructed at the damsites. A tour boat service of the reservoir would be offered at the Devil Canyon site.

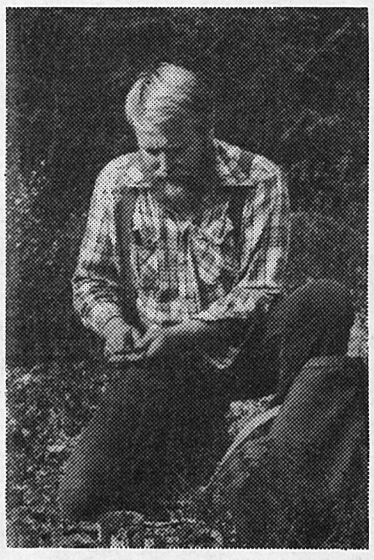
A third approach calls for extensive development at the Watana damsite and only minimal development at the Devil Canyon location. Simple backcountry campsites would be provided at selected locations around Watana. Additional services would include a boat ramp and docking facility, store and service station and float plane tie-downs.

In a fourth concept plan, the development would be at reversed locations, with highly-developed facilities provided at the Devil Canyon reservoir and damsite and only minimal facilities at Watana.

In the fifth concept plan, both damsites would be extensively developed to include complete visitor facilities with backcountry boat-in campsites built at five locations. Facilities, in addition to those suggested as extensive development in the third and fourth plans, would include lodging, such as motels, and restaurants with minimal or full service.

"The surveys we are making are more thorough than any made previously in regard to recreation plans associated with the development of a hydroelectric project," Jubenville said. He noted there were no good plans at the federal level to assist him.

"We are surveying the people who live in the area where the dams are proposed to be built as well as those who live in the urban areas both north and south, and we are surveying more than once."



## Mice important in food chain

Stephen O. McDonald, University of Alaska biologist, is directing a two-year study of small mammals that live within the project area. Among the small mammals under observation at present are mice, shrews, red squirrels, snowshoe hares, arctic ground squirrels, porcupines, and hoary marmots. The scientists set up sampling lines to aid them in collecting such information as the type of mammal, its abundance, and habits. Here, McDonald baits a mouse trap in an effort to determine the kinds and numbers of mice present in the different habitats of the study area. Since mice and other small mammals are part of the natural "food chain," their numbers and condition are of crucial importance in determining the health of the project area ecosystem.

## Two year study on birds underway

A number of bird species use the upper Susitna River basin during the summer and during migration. They include large birds such as eagles, hawks, and swans, and a number of smaller species.

Dr. Brina Kessel of the University of Alaska, Fairbanks, is project leader for a group of scientists studying bird life within the Susitna River basin.

The goal is to identify species that occur, their abundance, and what habitats the birds utilize. Answers will enable the scientists to predict the impact that construction of the Susitna hydroelectric project would have on the existing bird life.

Kessel began a field study last summer, observing birds by sight and sound, and by using aerial surveys to search for evidence of the larger nesters. Bird habitats will be visited on a regular basis throughout the migration and summer periods over the course of the two-year period.

## If you want to get future newsletters

**This public information document on the Susitna hydropower project was developed by the Alaska Power Authority Public Participation Office, Nancy Blunck, Director. Comments on the substance of this newsletter and ideas for future publications should be forwarded to the Public Participation Office by way of the following coupon.**

Last First Initial

Name

Mailing Address

City State Zip

**and mail to: Alaska Power Authority**
**Public Participation Office**
**333 W. 4th - Suite 31 - Anchorage, AK 99501**

**THANK YOU FOR YOUR INTEREST**

# How YOU can be involved...

**COMMUNITY MEETINGS** are held prior to important study decisions at four locations throughout the railbelt area. Meetings review the progress of studies and provide people with an opportunity to make comments and have questions answered.

**WORKSHOPS** are held as needed in individual railbelt communities. Workshops are narrower in scope than community meetings and serve as a forum for presenting in-depth information on a limited number of subjects.

**NEWSLETTERS** are widely distributed to the public and report factual information about the studies. This newsletter is the first of several. To receive future newsletters, clip and mail the coupon on page 7.

**The ACTION SYSTEM** is a means of suggesting changes to the plan of study. Send comments to the Public Participation Office for review and comment by Acres and Power Authority staff.

**Community meetings (like this one in Anchorage in April) will be held in spring 1981. They are tentatively scheduled for Fairbanks, Talkeetna, Kenai/Soldotna, and Anchorage. Another set of meetings will be held in spring 1982, just prior to the decision on Susitna.**

## Public concerns bring changes in study plan

For about a year, individuals and agencies have had a number of opportunities to comment on the adequacy of the Susitna study plan. Their comments have steadily improved the document. For instance, the 1980 legislature appropriated an additional $1,365,000 to add more resources and take more time in conducting the energy alternatives study. An independent firm was also hired to conduct the study.

Another example began with a concern expressed last spring. One person from Talkeetna articulated a concern for anticipated impacts on life style with the following comment:

"When this plan speaks of social or human impacts, it consistently labels this 'socio-economic.' When it speaks of cultural impact, it does so in terms of archaeology and historical investigation.

"I feel that it is desirable and timely that the plan recognize the existence of that concept which is socio-cultural, in a contemporary sense. The Plan of Study is deficient in that [illegible] not."

As a result of this comment and similar comments from other residents of the Talkeetna area, the Alaska Power Authority concluded that an additional look should be made on the subject to which the comment spoke: how would the construction of the Susitna project affect the current life style of the people who live in the immediate damsite vicinity?

The study will begin in 1981, and will be coordinated with Frank Orth's work on the identification and analysis of socio-economic conditions.


# the susitna hydro studies

*This is the first of several newsletters published by the Alaska Power Authority for citizens of the railbelt. The purpose is to present objective information on the progress of the Susitna hydroelectric feasibility studies so that readers may make their own conclusions based on accurate information.*

Eric P. Yould, Executive Director
Nancy Blunck, Director of Public Participation

Alaska Power Authority
333 W. 4th - Suite 31
Anchorage, Alaska 99501
phone (907) 276-0001

*The state of Alaska is an equal opportunity employer.*


## *IN THIS ISSUE:*


railbelt faces energy decision . . . . . page 1
social and economic impacts . . . . . page 2
susitna vicinity map . . . . . page 2
energy alternatives study . . . . . page 3
energy needs to double . . . . . page 3
tunnel option . . . . . page 3
earthquake studies explained . . . . . page 4
wildlife and water flow . . . . . page 5
susitna fish studies . . . . . page 6
potential recreation, birds, small mammals . . . . . page 7
how to be involved . . . . . page 8
public comment brings change . . . . . page 8



**ALASKA POWER AUTHORITY**
**PUBLIC PARTICIPATION OFFICE**
333 West 4th - Suite 31
Anchorage, Alaska 99501
(907) 276-0001


**BULK RATE
U.S. POSTAGE PAID
PERMIT NO. 272
ANCH. AK. 99502**

# the susitna hydro studies



november 1980

## Fairbanks, Anchorage and Railbelt face major energy decision

Citizens in the "railbelt region" will face a major energy decision in 1982.

At that time, the feasibility studies on the proposed Susitna hydroelectric project and a study of the feasibility of a variety of other energy alternatives will both conclude with their findings.

Information on the energy alternatives study can be anticipated from the Office of the Governor.

The purpose of this newsletter, the first of several, is to present what is going on with the Susitna studies that are now underway. The intent is to present the information objectively so that readers may make their own conclusions based on facts.

### A BRIEF HISTORY

There has been a great deal of interest for many years in the building of a hydroelectric project on the Susitna River.

It was initially looked at in the 1940's by the U.S. Bureau of Reclamation and later studied by the U.S. Army Corps of Engineers.

The previous assessments indicated that the Susitna project was economically feasible and that anticipated environmental impacts would not be of such a magnitude as to warrant it undesirable. Consequently, in 1976 the Alaska State Legislature created the Alaska Power Authority and asked the new state corporation to begin detailed feasibility studies on the development of the hydroelectric potential of the upper portion of the Susitna River. Initial funding was provided in July 1979, and the explorations were initiated in January 1980.

Those explorations, never adequately undertaken before, are now 10 months into a 30-month examination period. Acres American, Inc. (Acres) has been retained by the Power Authority to manage the $30 million effort.

The state is also funding a related but separate $1 million study to consider alternatives to Susitna hydroelectric power. That study, contracted by the governor's Policy Review Committee, is being conducted by Battelle-Pacific Northwest Laboratories. It will be completed in the spring of 1982, concurrent with the Susitna feasibility studies.

### INDEPENDENT REVIEW BY EXTERNAL CONSULTANTS

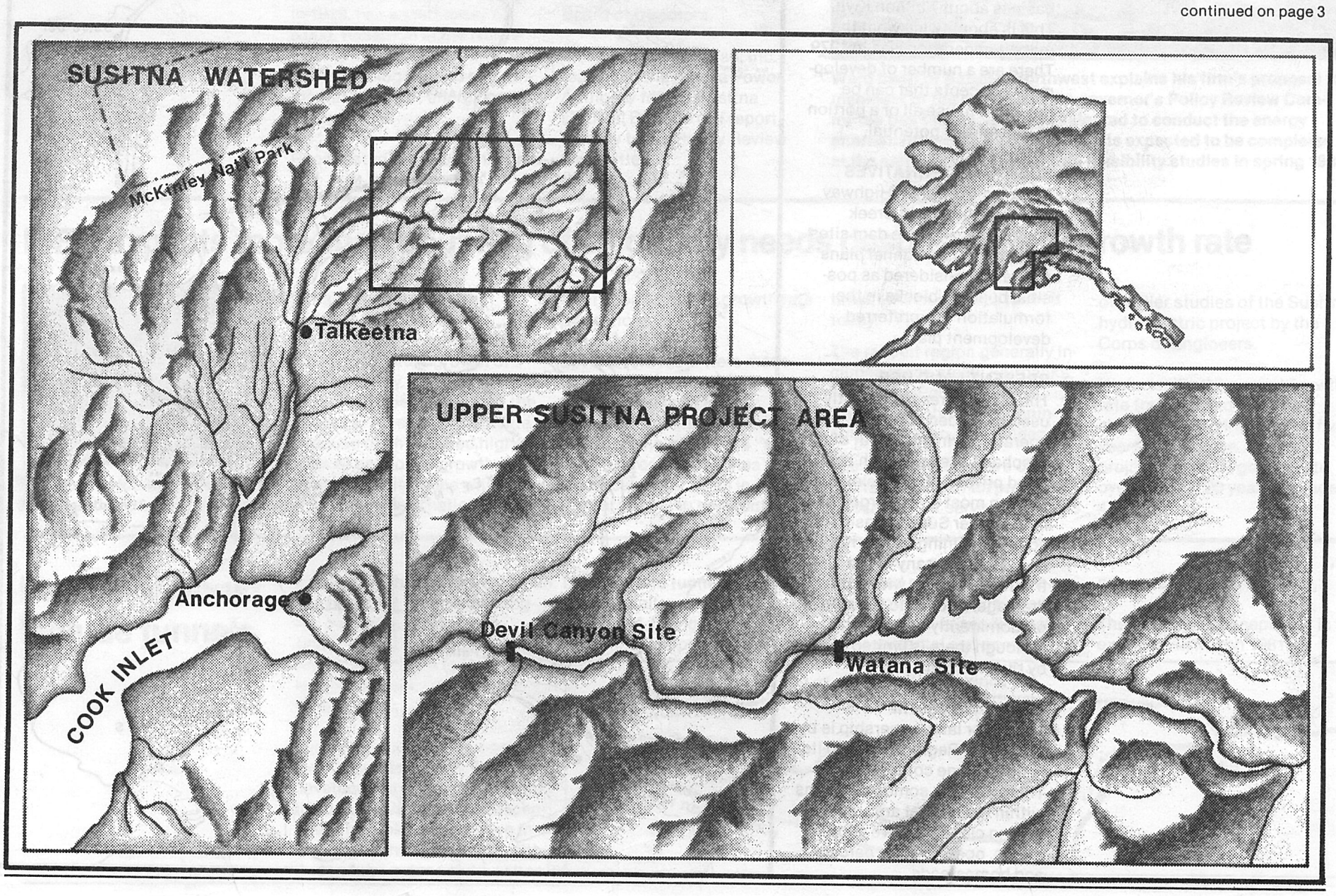
As a part of the Susitna explorations, the Alaska Power Authority is appointing an external review board composed of eminent engineers, scientists, and economists to review the feasibility studies performed by Acres. Approximately $1 million has been budgeted by the Alaska Power Authority for this review, which will include an independent cost estimate of constructing the Susitna project.

### THE SUSITNA HYDRO STUDIES

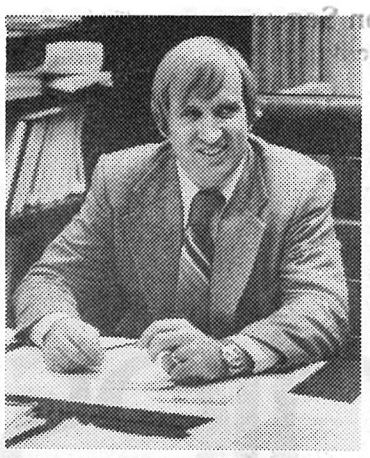
The Susitna investigations fall into 10 general categories. Not all the studies are going on at this time, nor are all described in this newsletter. They include:

- forecasts of future electrical needs in the railbelt area between the Kenai Peninsula and Fairbanks from 1990 through 2010
- hydrologic analysis of the Susitna River
- seismic examination
- geotechnical exploration near the dam sites
- engineering design development
- environmental data collection and impact assessment
- transmission line analysis

continued on page 3



# Firm brings extensive cold region experience to hydro studies



**Jim Gill, Resident Manager, Anchorage office of Acres American, Inc.**

In November 1979, the Alaska Power Authority Board of Directors selected Acres American, Inc., an international consulting engineering firm, to conduct the feasibility studies on the Susitna hydroelectric project.

Reasons for the selection included Acres' past experience with hydroelectric projects in sub-arctic regions.

Also important was Acres' decision to utilize Alaskan expertise in the field work (which would maximize the expenditure of monies within the state), and its proposal to provide for an extensive and direct public participation process.

The selection was made with support from both the public and the State House Power Alternatives Study Committee, a legislative subcommittee set up to oversee the feasibility work.

The Acres organization is active in diversified fields of planning, engineering, feasibility studies, environmental assessment, and project management. Among other energy technologies, the company has more than fifty years of experience with large and small hydroelectric development.

Included in these are the Churchill Falls project in Labrador and the Nelson River project in Canada, both of which are located in northern climates and presented problems similar to those the proposed Susitna project may encounter.

The Susitna project is managed by Acres out of its main office in Buffalo, New York. Its resident office is in Anchorage and the field camp is in the upper Susitna basin close to Deadman Creek.

# Expertise applied to socioeconomic questions

The construction and operation of a hydroelectric project in the Susitna River basin might affect the lives of Alaskans, in both positive and adverse ways. While Railbelt residents generally might experience energy independence and lower costs for electricity (relative to other alternatives), certain groups of people might experience population shifts, changes in service requirements, tax rate and revenue changes, and changes in the general quality of life.

Frank Orth & Associates, Inc., a firm with experience in conducting socioeconomic analyses, particularly in Alaska, is presently conducting the first phase of a two-phase study that will identify and analyze potential changes in socioeconomic conditions.

Between now and spring of 1981, the firm is developing socioeconomic profiles for local, regional, and to some extent, statewide areas. These profiles are descriptions of existing conditions such as population levels, availability and type of housing, employment and income levels, business activity, education enrollment and cost, transportation facilities, and land use patterns.

Later, between late spring and early fall 1981, these same conditions will then be described for a future without the Susitna project. The result will be a baseline from which comparisons can be made. A preliminary assessment of socioeconomic impacts that could result from a Susitna development will be made prior to a state decision on Susitna in 1982.

If the state decides to file a license application in 1982, a detailed analysis of what affect construction and operation of the Susitna project might have on social and economic conditions will then be conducted.

Frank Orth & Associates will identify and examine changes in socioeconomic conditions so that people can make their own evaluations of how such changes could affect their life styles.

# Background information on proposed Susitna project

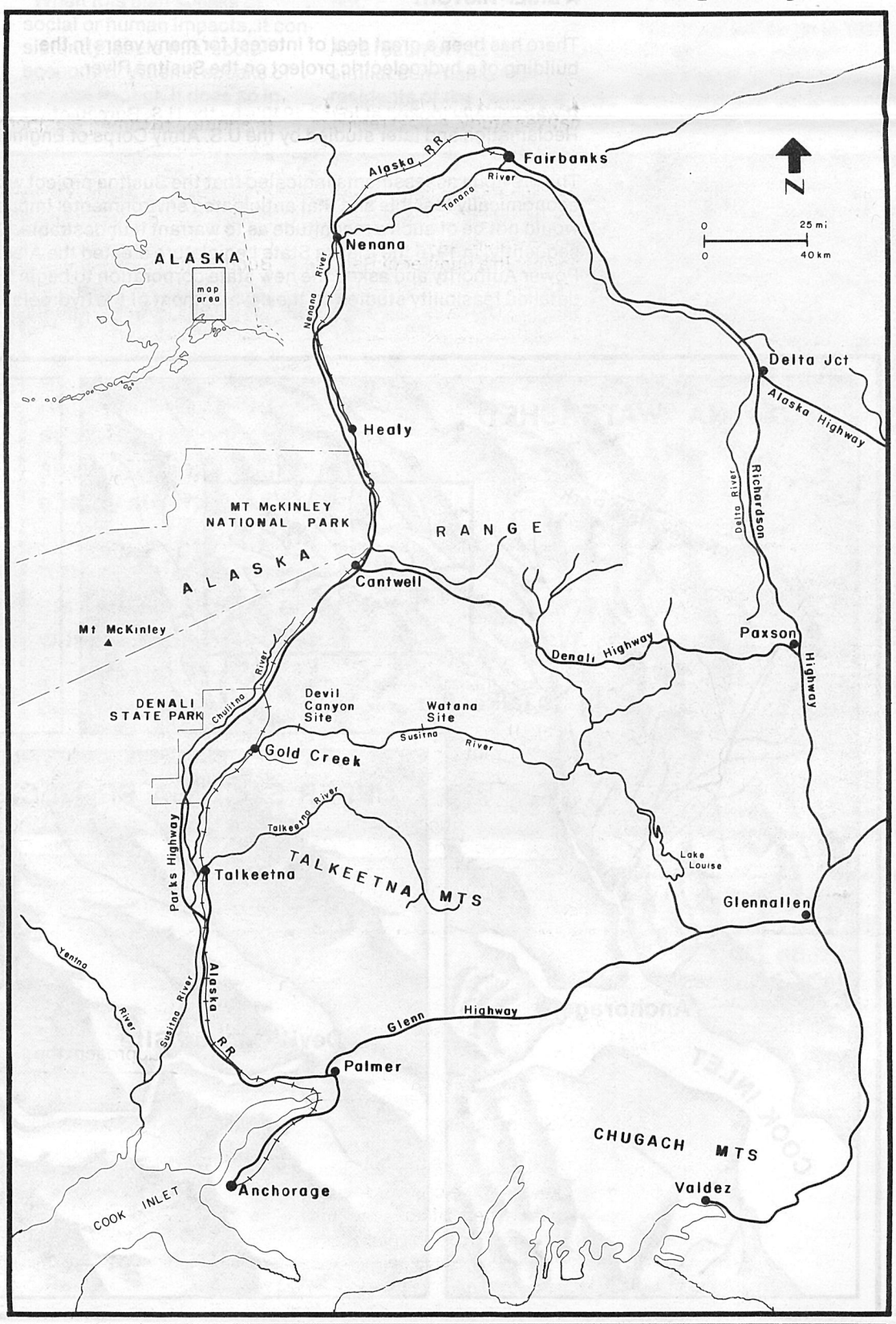
**LOCATION**
The proposed Susitna River hydroelectric project is located on the upper Susitna River, approximately 125 air miles north of Anchorage, 150 air miles south of Fairbanks, and 70 miles northeast of Talkeetna.

**POTENTIAL POWER**
For a year with typical precipitation and climatic conditions, the average energy potential of the basin is about 7 billion Kwh. This is about twice what the railbelt generation was in 1979. There are a number of development concepts that can be designed to use all or a portion of this energy potential.

**SUSITNA ALTERNATIVES**
Between the Denali Highway upstream and Gold Creek downstream, twelve dam sites and two primary tunnel plans are being considered as possible building blocks in the formulation of a preferred development plan.

**PRESENT LAND USE**
The project area is presently used by guided hunters operating principally out of the Stephan Lake area, with scattered private cabins being present on most of the larger lakes in the upper Susitna basin. In addition, mining claims have been filed on many of the tributary streams within the drainage. Access to the area is predominently by aircraft, although there is limited access by river from the east.

**LAND OWNERSHIP**
The major land ownership is by Cook Inlet Region, Inc., and its Native village corporations. There are also some inholdings within the project area, such as mining claims, Native allotments, open-to-entry parcels, and homesteads.



continued from page 1

- cost estimating
- preparation of FERC (Federal Energy Regulatory Commission) licensing documents, if appropriate
- marketing and financing analysis

**THE SUSITNA WORK THUS FAR**

Last summer, scientists and engineers went into the field to begin the Susitna work. An explanation and first examination of this work is the text that follows on the inside pages of this newsletter. Further information will follow in subsequent reports.

**FINAL RECOMMENDATIONS ON POWER DEVELOPMENT**

In April 1982 the five-member Alaska Power Authority Board of Directors will formulate its recommendation to the governor and the legislature in regard to power development along the railbelt. At approximately the same time, the governor's Policy Review Committee will be forwarding its independent recommendation.

**THE DECISION**

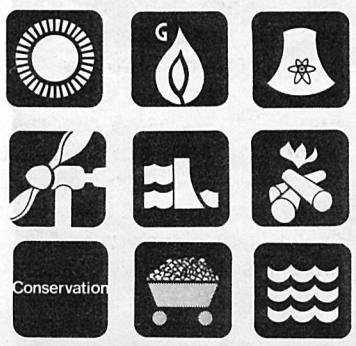
Final determination on the subject rests with the state in 1982. If the decision is made to proceed with the development of Susitna, a license application for construction will be filed with the Federal Energy Regulatory Commission in Washington, D.C.

## Who is the Alaska Power Authority

The Alaska Power Authority is a public corporation funded by the state and headed by a five-member board of directors appointed by the governor and approved by the legislature. Its day-to-day business is conducted by a sixteen-member staff located in Anchorage.

The purpose of the Power Authority is to assist the residents of Alaska in both urban and rural areas in constructing, acquiring, financing, and operating power production facilities of various types. Those types include fossil fuel, wind power, tidal, geothermal, hydroelectric, solar energy production, and waste energy conservation facilities. The Power Authority is currently developing a number of hydropower and alternative energy projects statewide.

# Alternative energy study goes to Battelle




To assure sufficient checks and balances, the 1980 state legislature determined that an independent consulting firm should conduct the Railbelt power alternatives study.

In the original plan of study presented to the Alaska Power Authority by Acres American, Inc., Acres was to conduct the alternatives study in parallel with feasibility level studies of the Susitna hydroelectric project.

This fall the governor's Policy Review Committee selected Battelle-Pacific Northwest Laboratories to make the alternatives study. A final report is expected in the spring of 1982.

Battelle-Pacific Laboratories, a Richland, Washington, research and development firm, is the newest in a number of Battelle offices in the United States and Europe. The company, founded in 1929, has a staff today of 6,000. Research in the Northwest office focuses primarily on the technological and environmental issues of energy production and use.

Recent studies by Battelle have included a national coal utilization assessment and an assessment of the effects of thermal power plant site and design alternatives on the cost of electric power, both for the federal government.

"Battelle has a lot of experience doing exactly what this request for proposal calls for, and they have a great amount of experience doing projects in Alaska," said Fran Ulmer, chairwoman of the Policy Review Committee and director of Policy Development and Planning in the governor's office.

In addition to Ulmer, members of the Review Committee include Clarissa Quinlan, director of the Division of Energy and Power Development; Ron Lehr, director of the Division of Budget and Management; and Charles Conway, chairman of the Alaska Power Authority Board of Directors.

While Acres American, Inc. reports to the Alaska Power Authority for the Susitna studies, Battelle will report directly to the Policy Review Committee.

**OBJECTIVE / COST**

The objective of the alternatives study is to determine if there are more cost effective ways to meet the energy needs of the Anchorage-Fairbanks railbelt area than through the development of the Susitna River's hydroelectric potential.

Cost of the 18-month study is $1 million.

**WHAT ABOUT THE RECOMMENDATION?**

When the Battelle study is completed in April, 1982, the Policy Review Committee and the Alaska Power Authority Board of Directors will consider the results in formulating their respective recommendations for Railbelt power developments to the governor and the legislature.

**WHERE QUESTIONS SHOULD GO**

Questions regarding the alternatives study should be directed to Fran Ulmer, Director of the Division of Policy Development and Planning (DPDP), Pouch AD, Juneau, Alaska 99811, phone (907) 465-3577.

Questions regarding the Susitna hydroelectric exploration should be sent to Eric Yould, Executive Director of the Alaska Power Authority, 333 West 4th Avenue, Suite 31, Anchorage, Alaska 99501, phone (907) 276-0001.

**Ward Swift of Battelle Northwest explains his firm's proposal to members of the public and the governor's Policy Review Committee this fall. Battelle was selected to conduct the energy alternatives study. Battelle's work is expected to be completed at the same time as the Susitna feasibility studies in spring 1982.**

## ISER expects more than doubling of electricity needs despite slower growth rate

**Dr. Scott Goldsmith, Institute of Social and Economic Research.**

Initial forecasts from the Institute of Social and Economic Research (ISER) indicate that future growth of electric utility sales is expected to be slower than the historical Alaskan growth rate. Because of anticipated high rates of economic growth, however, utility sales will equal or exceed recent national electricity consumption growth rate projections.

Several forecasts were made to reflect the uncertainty surrounding both future economic activity and relative prices of energy. ISER's "most likely" forecast indicates that electrical utility sales in the year 2000 are likely to be about 2.4 times what it is in the railbelt today.

The railbelt region generally includes these areas: Fairbanks, Talkeetna, Palmer/Wasilla, Anchorage, the Kenai Peninsula, Glenallen, and Valdez.

The ISER forecasts are considerably lower than previous forecasts that served as a basis of earlier studies of the Susitna hydroelectric project by the Corps of Engineers.

Historically, the annual growth rate from 1965 to 1975 was about 14%. During the last five years, it has been 7%. The projected annual growth rate over the next 20 years averages 4½%.

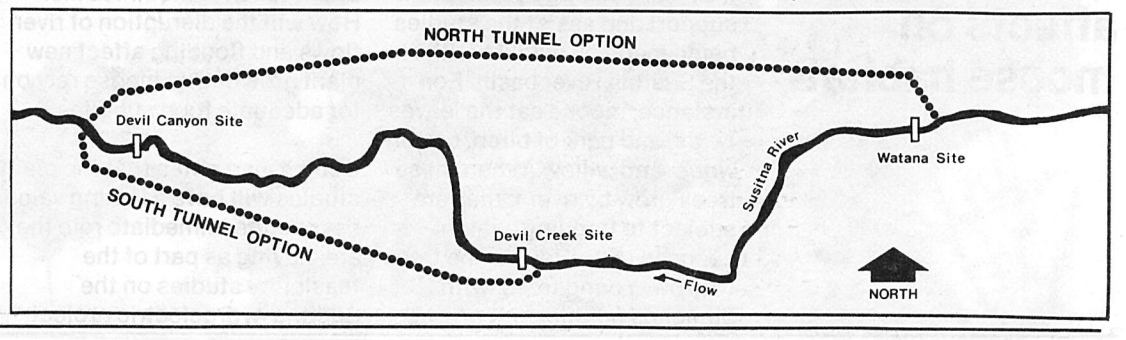
## Design options include tunnels

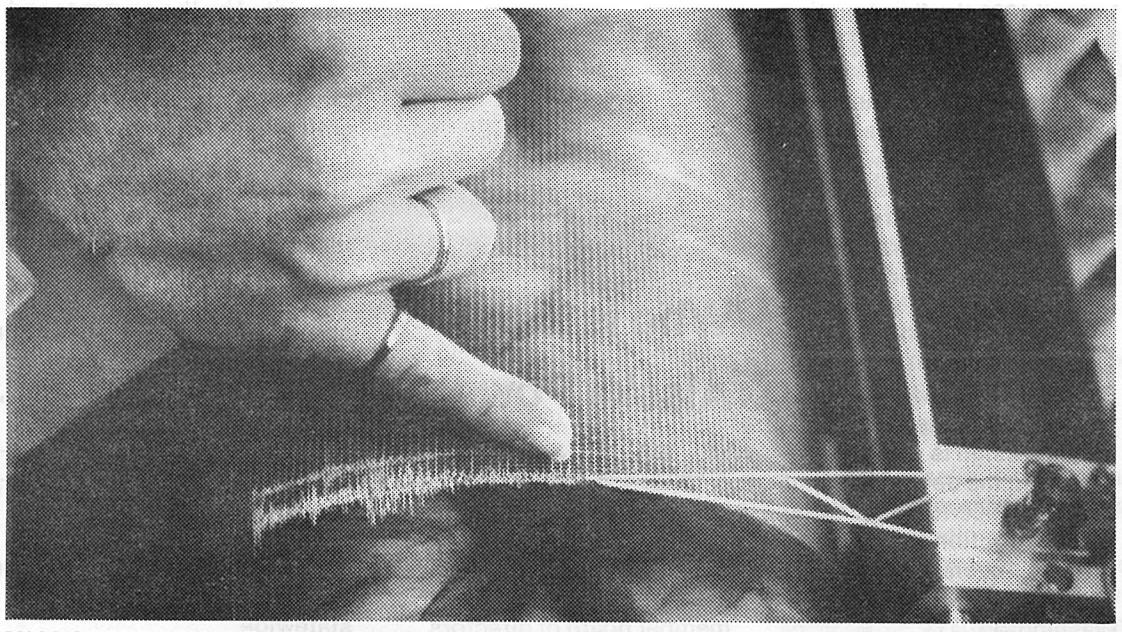
Previous plans indicated a basin development preference ranging from a four-dam basin development plan to the more recent preference for two dams located at Devil Canyon and Watana.

Tunnels are also being considered in the options for development of power within the upper Susitna. Two conceptual tunnel plans are shown in the map to the right, along with three of the potential dam sites.

The sites and tunnels shown do not imply all would be developed. Using a multidisciplinary approach, the preferred concept plan will be based on such things as anticipated power needs, costs, environmental and social impacts, safety and reliability.

The preferred concept plan is expected in March 1981.





**MICROEARTHQUAKE MEASURES 2.0:**
**Portable seismographs like this one have been set up at the Watana base camp to register microearthquake activity. This particular microearthquake, with an epicenter in the southwest corner of Mt. McKinley Park, measured 2.0 on the Richter scale last August 27th. Microearthquakes usually are not felt by human beings. They occur constantly throughout the railbelt.**

# Microearthquake studies review old data, collect new

Seismic activity in the project area is being studied by Woodward-Clyde Consultants' seismologists.

In addition to reviewing historical earthquakes, seismologists have been monitoring microearthquake activity in the vicinity of the dam sites. During this year 10 very sensitive seismometers were installed in shallow holes within a 25-mile radius of the dam sites.

The seismometers measure ground motions for earthquakes as small as Richter magnitude zero (magnitude 3 or larger earthquakes usually can be felt).

The signal from each seismometer was transmitted from radio to recording seismographs that were installed at the Watana base camp.

Analysis of the records (seismograms) from the seismographs provides information on microearthquakes in the vicinity of the dam sites. This information includes the size, location, and depth of each microearthquake.

The microearthquake data and geological data are studied by both geologists and seismologists. This interdisciplinary approach provides scientists with information to evaluate the seismic design criteria for the dam sites.

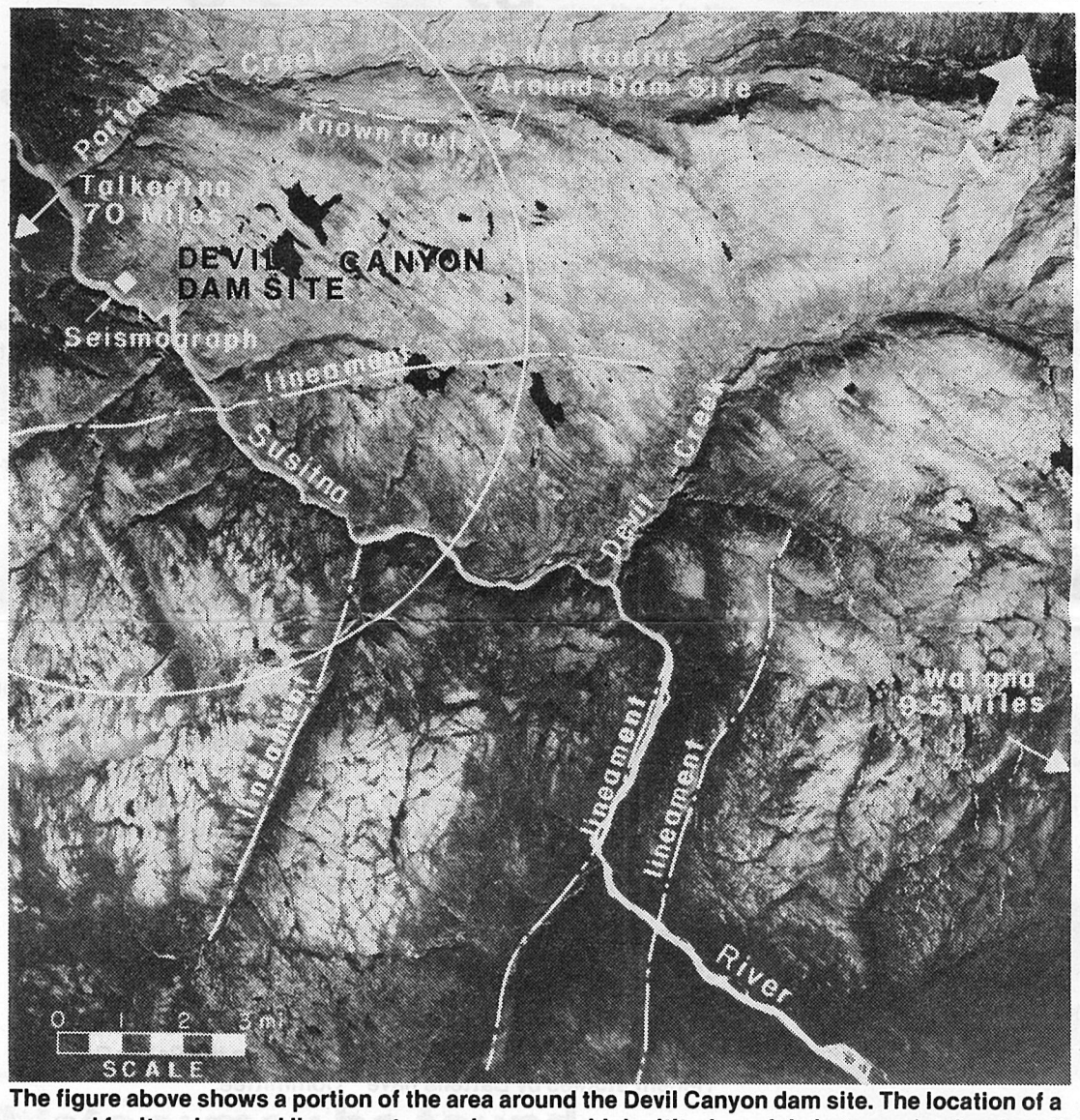
# How to study earthquake potential

Geologic and seismologic studies are conducted to obtain an understanding of the seismic activity within an area. These studies begin with a comprehensive review of the literature and aerial photography to identify all faults and lineaments. Faults and lineaments that may be potentially important to dam design are then studied in the field.

A lineament is a straight line feature observed on aerial photographs, maps or from an aircraft. A lineament may be produced by glacial ice, by faults, or by other earth shaping forces. All lineaments are not necessarily faults.

For the Susitna project, all potentially important faults and lineaments within approximately 60 miles of either dam site have been studied. During the past year, these preliminary studies have included aerial reconnaissance with helicopters and small airplanes, along with investigations on the ground.

Features that are considered to be of potential importance are scheduled to be studied in detail next year.




**The figure above shows a portion of the area around the Devil Canyon dam site. The location of a mapped fault and several lineaments are shown on a high-altitude aerial photograph taken by a U-2 aircraft. These features along with others in the vicinity of two dam sites are being analyzed by geologists and seismologists from Woodward-Clyde Consultants. In addition, the Alaska Power Authority will retain independent experts to review the work done by Woodward-Clyde, a conservative policy much like "getting a second opinion" within the medical profession.**

The objective of these studies is to determine if the lineaments are faults and to estimate how recently the faults may have moved. Active faults, those that have moved during recent geological time, are important to dam design.

The Denali Fault is an example of a fault which has had movement during recent geologic time. The fault is 40 miles north of both the Devil Canyon and Watana dam sites. The Denali Fault is more than 800 miles long as it runs in generally an east-west direction through the Alaska Range.

Studies by a number of geologists show that movement has occurred along various sections of the Denali fault during large earthquakes that have occurred over several hundred thousand to several million years. The average rate of movement has been approximately one-half inch per year.

Woodward-Clyde Consultants are working under contract to Acres American, Inc., to evaluate potential seismic activity.

The first data from Woodward-Clyde Consultants is expected by the end of 1980. It will include information obtained to date and a discussion of lineaments and faults that need to be studied in more detail to understand their potential significance to the design of project facilities.

The Alaska Power Authority will schedule meetings in Spring 1981 and information collected and analyzed by the consultants will be presented to the public.

# Plant study considers affects on moose habitat

William Collins of the University of Alaska's Agricultural Experiment Station in Palmer notes that plant ecology studies will support and assist the studies being made on wildlife within the Susitna River basin. For instance, moose eat the leaves, twigs, and bark of birch, cottonwood, and willow. When these trees grow by rivers, they are subject to flooding, which exposes new sites for the trees to grow. Young trees, with branches no thicker than one inch in diameter, are excellent forage for moose, since the animals cannot break large branches with their mouths. How will the disruption of river flows and flooding affect new plant growth that moose rely on for adequate food supplies?

Collins also notes that the plant studies will have a lasting value beyond the immediate role they are playing as part of the feasibility studies on the Susitna hydroelectric project.

For instance, few descriptions of vegetation have been made for the area. Therefore, the species list of vegetation and the first detailed vegetation maps will be two important products of the current Susitna studies.

The specific goals of the two-year plant ecology studies are to forecast what effect construction of the dams would have on plant life within the area, to identify the wetland areas, and to identify plants that are endangered, rare, or threatened. Collins and his assistants will accomplish this by studying old and new aerial photographs, and by observing the area on foot, noting such findings as the age of vegetation and the effect of seasonal flooding on the establishment and maintenance of plants that are important as forage for moose. Their first vegetation maps will be completed by December of this year.

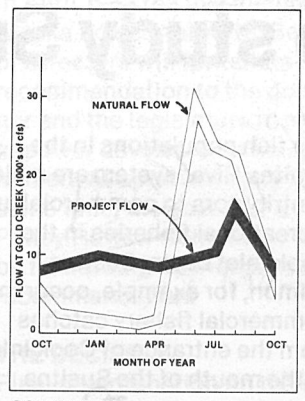
# Studies identify change in downstream water flow

**GENERAL**
Flow studies are one of a number of types of hydrologic investigations. Also included are assessments of reservoir operation, sediment yield, river morphology, glacial contribution and ice formation.

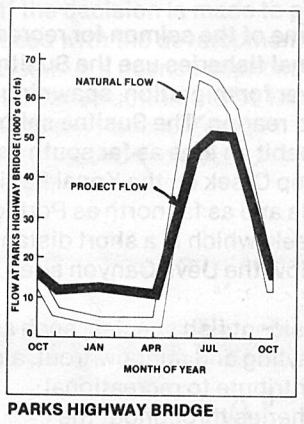
The development of any hydroelectric scheme on the upper Susitna will result in seasonal changes in downstream flow patterns. Taking the two-dam proposal as an example, the three graphs show the difference between natural seasonal flow patterns and project seasonal flow patterns at three points along the Susitna River. As one goes downstream, the difference between natural and project flows begins to dissipate as the effects are diluted by the normal flows from the other tributaries.

Changes in flow patterns can have a positive or negative impact on such things as fisheries, moose habitat, flooding, and navigation.

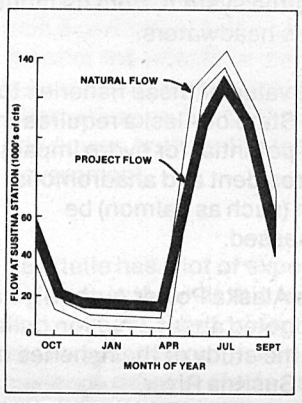
Fisheries directly depend on water flow. Since the effects of flow are greater on the upstream portion of the river, the initial emphasis of study efforts is most intensive upstream. Following the review of the basic river hydraulics, Acres will determine the required extent of assessment of downstream resources.



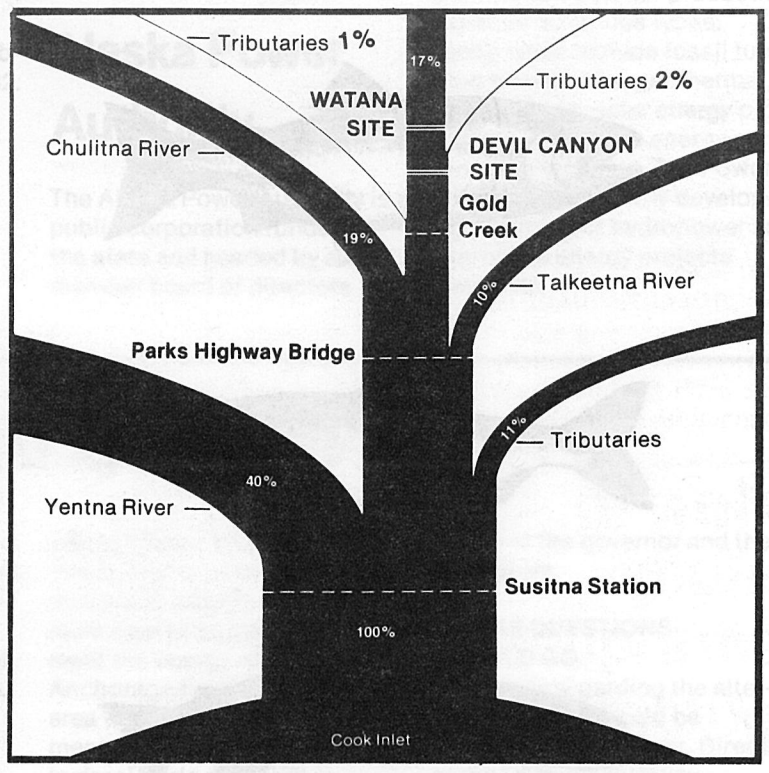
GOLD CREEK



PARKS HIGHWAY BRIDGE



SUSITNA STATION



**This is a schematic diagram of the Susitna River system. An important aspect of this system is that the upper Susitna (the area under consideration for hydroelectric development) contributes less than 20 percent of the river's average total flow. Other tributaries, including the Yentna, Chulitna, and Talkeetna Rivers, contribute the other 80 percent.**

# Radio collaring used to study wildlife

What effect would the construction of a large hydroelectric project have on the wildlife that inhabits the upper Susitna basin and downstream areas? Since this is a question of serious concern to those studying the feasibility of building the project in the Susitna River basin, a number of respected scientists have been hired to find the answer.

"It is important that people know we are not politicians, that we are not here to decide if the Susitna project should be built in the first place," said Dr. Phil Gipson of the University of Alaska, Fairbanks, Cooperative Wildlife Research Unit.

"We are here to study the area and to determine the impact on the animal life if construction takes place. The purpose of all the studies is to give the decision makers the facts so that they can make the best decision with full knowledge of the positive and negative consequences." he said.

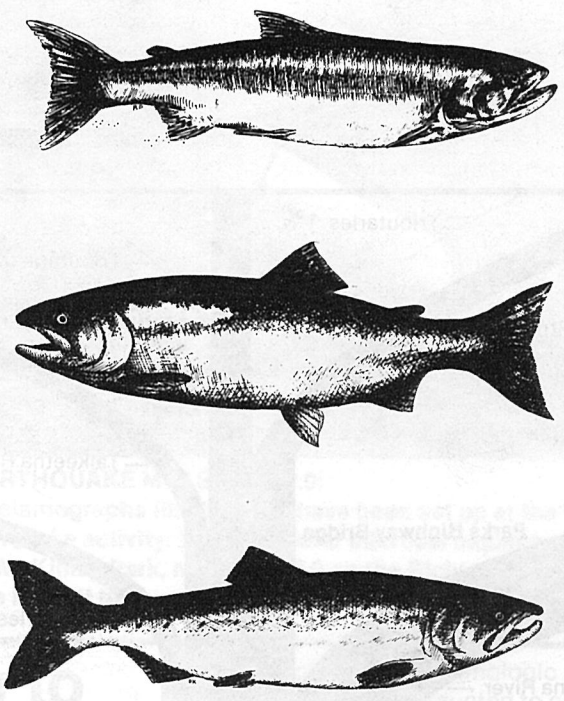
There are vast numbers of animals that live within the Susitna basin. Bears, wolves, caribou, moose, fox, otter, and mink all live in abundance. Why do they live there? And could they live somewhere else just as well?

As part of the Power Authority investigations, the Alaska Department of Fish and Game began monitoring big game animals last summer by airplane following earlier tagging and radio collaring efforts. Studies will continue this winter as the researchers note animal distribution, abundance, habitat preference, and movement patterns. It is easier to study most animals during the winter months, because they are more visible and it is easier to follow their tracks.

The group of scientists headed by Gipson has begun a two-year study of the furbearing animals that live within the area. Again, the purpose is to identify and count them, observe their seasonal habits, and determine what kind of habitat they need in order to live. In view of existing fodder, how large a range, for instance, does a red fox need? Gipson and his colleagues are studying the animals by tracking them in the snow and by radio collaring. Survey lines are established in representative types of vegetation and tracks of furbearers are identified in each vegetation type.

**Karl Schneider of the Alaska Department of Fish and Game puts a radio collar on moose number 38. An iridescent orange ear tag makes the moose more visible from the air. Schneider heads a team of researchers who have identified big game animals within the Susitna basin. The scientists began monitoring the animals last summer by airplane following earlier tagging and radio collaring efforts.**

# $3 million budgeted to study Susitna fish



Alaska Department of Fish and Game
Wildlife Notebook Series

The fish populations in the Susitna River system are major contributors to commercial and recreational fisheries in the Cook Inlet basin. Susitna salmon, for example, occur in commercial fishery catches from the entrance of Cook Inlet to the mouth of the Susitna River.

Some of the salmon for recreational fisheries use the Susitna River for migration, spawning and rearing. The Susitna salmon inhabit an area as far south as Deep Creek on the Kenai Peninsula and as far north as Portage Creek, which is a short distance below the Devil Canyon site.

Resident fish species, such as grayling and rainbow trout, also contribute to recreational fisheries throughout the Susitna system, from its mouth to its headwaters.

The value of these fisheries to the State of Alaska requires that the potential for hydro impacts on resident and anadromous fish (such as salmon) be assessed.

The Alaska Power Authority has budgeted about 3 million dollars for the study of the fisheries of the Susitna River.

Field data on the fish populations and habitat of the Susitna River will be collected by biologists of the Alaska Department of Fish and Game (ADF&G). Utilizing data supplied by ADF&G, existing fisheries information, and past experience, the private consulting firm of Terrestrial Environmental Specialists (TES) will assess the positive or negative impacts of development and operation of the proposed hydroelectric project and suggest measures to avoid, minimize, or compensate for possible adverse affects. Comparisons will be made to similar systems found in other cold regions of the world (for instance, Sweden and Russia).

TES will be assisted by noted specialists from the University of Washington, Dr. Clinton Atkinson and Dr. Milo Bell. Clint Atkinson has extensive experience with Alaska salmon fisheries, including those in the Susitna basin, while Milo Bell has 50 years of experience working on related engineering problems throughout North America on hydropower projects.

The Department of Fish and Games' responsibility during the field studies will be to determine existing fisheries conditions in the Susitna River. This includes identifying the distribution and abundance of salmon and resident fishes in the system as well as the seasonal importance of the river to their migration, spawning, and rearing.

Initial field work for these studies will begin late in 1980 and continues for 15 months. If the project goes to the Federal government for license approval, studies will continue through the post license application period.

A major question in the fisheries study is what would happen to the Susitna River fisheries if the dams were built. For example, will important fish habitats for migration, spawning, and rearing be favorably or unfavorably altered? If the impacts are negative, can they be minimized or offset in some manner such as by hatchery propagation of fish or through a scheme of regulation of river flows and discharge through the dams?

Tom Trent, one of the study coordinators from the Department of Fish and Game, emphasizes that study efforts of those conducting river hydrology and water quality studies must be closely coordinated.

Mr. Trent also noted that, "The Department of Fish and Game conducted very limited assessment work during the years 1973 to 1978, but the intensity and design for the next fifteen months and beyond will be aimed at collecting information enabling the State to make objective judgements of probable project impacts on the Susitna River fishery resources."

## Environmental studies use Alaska experts

Terrestial Environmental Specialists (TES), the consulting firm retained by Acres American, Inc., to conduct the environmental studies on the proposed Susitna project, has contracted with the University of Alaska on a number of the studies.

They include: furbearers, birds and small mammals, land use and recreation, cultural resources, and plant ecology.

"We chose the university because experts there are familiar with environmental conditions in Alaska," Jeffrey O. Barnes, TES president, said. TES is headquartered in Phoenix, New York.

## Drilling program completes first year

Deep drilling (over 700 feet per hole) into the areas around the proposed dam sites determines the types of rock, the rock structure, its strength, and the stability of the bedrock on which dams would sit or through which a tunnel would pass. Core samples are then retrieved and studied by geologists.

R & M Consultants is the subcontractor conducting the drilling program at the Watana and Devil Canyon sites.

# Keys to upper Susitna prehistory may be found

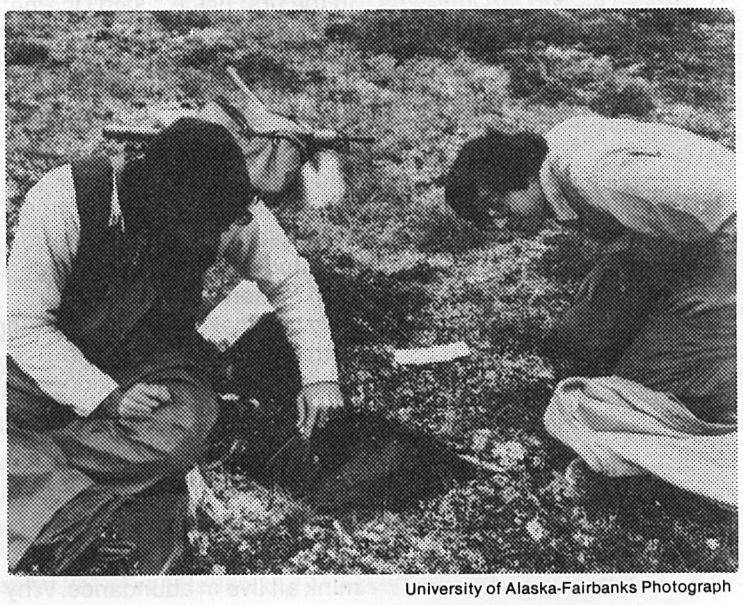
"Before any land-disturbance activities may take place on federal or state lands, an inventory of cultural resource sites must be made and recommendations developed to lessen or avoid the impact of the project on them," George Smith, an archaeologist with the University of Alaska Museum in Fairbanks, noted last summer.

In other words, before the construction of a hydroelectric project in the Susitna River basin may begin, there must be an archaeological survey to locate sites within the area.

Last summer archaeologists examined 55 sampling sites, determining that 33 of them were of archaeological importance. Next summer the museum will send several crews into the field to systematically test and analyze a portion of each site in order to evaluate its significance and to then make recommendations to minimize possible adverse effects. Sites that might be adversely impacted by project construction will be excavated if the decision to construct the hydroelectric project is made.

During the extensive testing scheduled for 1981, each site will be divided into a checkerboard of squares one meter in size. Artifacts found in the sampled squares will be catalogued and become a part of the University of Alaska Museum's archeological collection, where they will be available for display and research.

Although it may be premature to assess the significance of artifacts before their analysis is complete, Dixon and Smith are excited about the results of the survey. They have discovered several sites which will help unravel the poorly understood prehistory of this area of the state and which will provide important information about the way people lived in the upper Susitna thousands of years ago.



University of Alaska-Fairbanks Photograph

**Dr. E. James Dixon and Mr. George S. Smith of the University Museum head a team of scientists who will investigate the area for evidence of human activity which, they say, may extend back 10,000 years. Shown above are Les Baxter and George Smith. They are looking at buried animal bone fragments.**

# University survey seeks public comment on recreation potential


If the Susitna project is built, the areas surrounding it may be developed for recreational use. What kind of use is the subject of a questionnaire being sent this fall to residents of Anchorage, Fairbanks, and the smaller communities along the railbelt (Talkeetna, Palmer, Wasilla, Willow). More than 2,000 people, randomly selected in these locations, will be asked by the University of Alaska, Fairbanks, to describe the kind of facilities they would like to see developed. From their answers, Dr. Alan Jubenville and Ms. J. K. Feyhl at the university will determine which of five concept plans presented to the respondents is most acceptable.

In May, the Alaska Power Authority tentatively will hold community meetings and recreation will be one of the topics. Comments from both the meetings and from the questionnaire will be analyzed by the University of Alaska and a second survey on the subject will follow. A report will be made to the Alaska Power Authority in 1981, even though at that time the question of whether to develop the project will not have been decided.

In brief, people are being asked if they would prefer minimum or maximum recreation development (or something in between) in the areas of the two proposed damsites.

One concept plan calls for minimal development and management. It assumes that public access by road into the reservoir areas is restricted or not permitted. Development would be limited to a visitor information center on the Parks Highway. However, access by float plane would be possible on the reservoirs and access by canoe and kayak on the upper rivers would continue as it does at the present.

Another plan suggests that access by road to both reservoirs is possible. As a result, primitive campgrounds and simple boat ramps would be constructed at the damsites. A tour boat service of the reservoir would be offered at the Devil Canyon site.

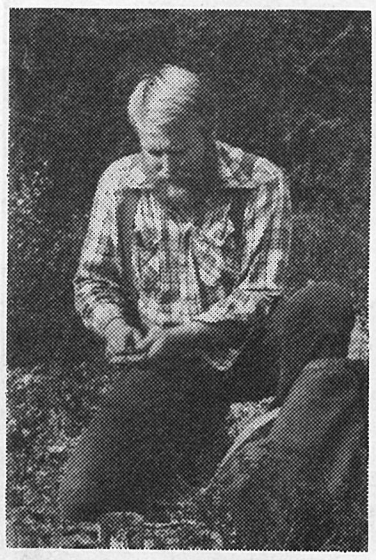
A third approach calls for extensive development at the Watana damsite and only minimal development at the Devil Canyon location. Simple backcountry campsites would be provided at selected locations around Watana. Additional services would include a boat ramp and docking facility, store and service station and float plane tie-downs.

In a fourth concept plan, the development would be at reversed locations, with highly-developed facilities provided at the Devil Canyon reservoir and damsite and only minimal facilities at Watana.

In the fifth concept plan, both damsites would be extensively developed to include complete visitor facilities with backcountry boat-in campsites built at five locations. Facilities, in addition to those suggested as extensive development in the third and fourth plans, would include lodging, such as motels, and restaurants with minimal or full service.

"The surveys we are making are more thorough than any made previously in regard to recreation plans associated with the development of a hydroelectric project," Jubenville said. He noted there were no good plans at the federal level to assist him.

"We are surveying the people who live in the area where the dams are proposed to be built as well as those who live in the urban areas both north and south, and we are surveying more than once."



## Mice important in food chain

Stephen O. McDonald, University of Alaska biologist, is directing a two-year study of small mammals that live within the project area. Among the small mammals under observation at present are mice, shrews, red squirrels, snowshoe hares, arctic ground squirrels, porcupines, and hoary marmots. The scientists set up sampling lines to aid them in collecting such information as the type of mammal, its abundance, and habits. Here, McDonald baits a mouse trap in an effort to determine the kinds and numbers of mice present in the different habitats of the study area. Since mice and other small mammals are part of the natural "food chain," their numbers and condition are of crucial importance in determining the health of the project area ecosystem.

## Two year study on birds underway

A number of bird species use the upper Susitna River basin during the summer and during migration. They include large birds such as eagles, hawks, and swans, and a number of smaller species.

Dr. Brina Kessel of the University of Alaska, Fairbanks, is project leader for a group of scientists studying bird life within the Susitna River basin. The goal is to identify species that occur, their abundance, and what habitats the birds utilize. Answers will enable the scientists to predict the impact that construction of the Susitna hydroelectric project would have on the existing bird life.

Kessel began a field study last summer, observing birds by sight and sound, and by using aerial surveys to search for evidence of the larger nesters. Bird habitats will be visited on a regular basis throughout the migration and summer periods over the course of the two-year period.

## If you want to get future newsletters

**This public information document on the Susitna hydropower project was developed by the Alaska Power Authority Public Participation Office, Nancy Blunck, Director. Comments on the substance of this newsletter and ideas for future publications should be forwarded to the Public Participation Office by way of the following coupon.**

Last First Initial

Name

Mailing Address

City State Zip

**and mail to: Alaska Power Authority**
**Public Participation Office**
**333 W. 4th - Suite 31 - Anchorage, AK 99501**

**THANK YOU FOR YOUR INTEREST**

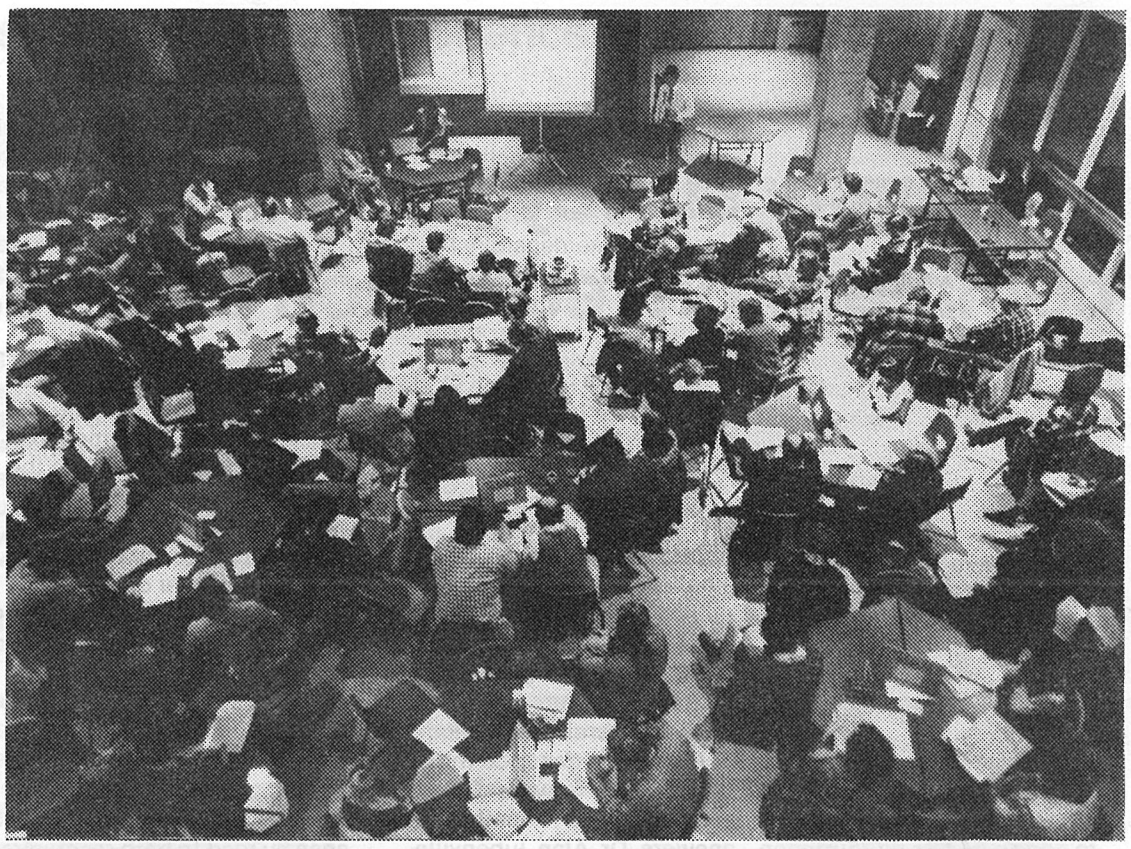
# How YOU can be involved...

**COMMUNITY MEETINGS** are held prior to important study decisions at four locations throughout the railbelt area. Meetings review the progress of studies and provide people with an opportunity to make comments and have questions answered.

**WORKSHOPS** are held as needed in individual railbelt communities. Workshops are narrower in scope than community meetings and serve as a forum for presenting in-depth information on a limited number of subjects.

**NEWSLETTERS** are widely distributed to the public and report factual information about the studies. This newsletter is the first of several. To receive future newsletters, clip and mail the coupon on page 7.

**The ACTION SYSTEM** is a means of suggesting changes to the plan of study. Send comments to the Public Participation Office for review and comment by Acres and Power Authority staff.



**Community meetings (like this one in Anchorage in April) will be held in spring 1981. They are tentatively scheduled for Fairbanks, Talkeetna, Kenai/Soldotna, and Anchorage. Another set of meetings will be held in spring 1982, just prior to the decision on Susitna.**

## Public concerns bring changes in study plan

For about a year, individuals and agencies have had a number of opportunities to comment on the adequacy of the Susitna study plan. Their comments have steadily improved the document. For instance, the 1980 legislature appropriated an additional $1,365,000 to add more resources and take more time in conducting the energy alternatives study. An independent firm was also hired to conduct the study.

Another example began with a concern expressed last spring. One person from Talkeetna articulated a concern for anticipated impacts on life style with the following comment:

"When this plan speaks of social or human impacts, it consistently labels this 'socio-economic.' When it speaks of cultural impact, it does so in terms of archaeology and historical investigation.

"I feel that it is desirable and timely that the plan recognize the existence of that concept which is socio-cultural, in a contemporary sense. The Plan of Study is deficient in that it does not."

As a result of this comment and similar comments from other residents of the Talkeetna area, the Alaska Power Authority concluded that an additional look should be made on the subject to which the comment spoke: how would the construction of the Susitna project affect the current life style of the people who live in the immediate damsite vicinity?

The study will begin in 1981, and will be coordinated with Frank Orth's work on the identification and analysis of socio-economic conditions.


# the susitna hydro studies

*This is the first of several newsletters published by the Alaska Power Authority for citizens of the railbelt. The purpose is to present objective information on the progress of the Susitna hydroelectric feasibility studies so that readers may make their own conclusions based on accurate information.*

Eric P. Yould, Executive Director
Nancy Blunck, Director of Public Participation

Alaska Power Authority
333 W. 4th - Suite 31
Anchorage, Alaska 99501
phone (907) 276-0001

*The state of Alaska is an equal opportunity employer.*


## *IN THIS ISSUE:*


railbelt faces energy decision . . . . . page 1
social and economic impacts . . . . . page 2
susitna vicinity map . . . . . page 2
energy alternatives study . . . . . page 3
energy needs to double . . . . . page 3
tunnel option . . . . . page 3
earthquake studies explained . . . . . page 4
wildlife and water flow . . . . . page 5
susitna fish studies . . . . . page 6
potential recreation, birds, small mammals . . . . . page 7
how to be involved . . . . . page 8
public comment brings change . . . . . page 8



**ALASKA POWER AUTHORITY**
**PUBLIC PARTICIPATION OFFICE**
333 West 4th - Suite 31
Anchorage, Alaska 99501
(907) 276-0001



**BULK RATE**
**U.S. POSTAGE PAID**
**PERMIT NO. 272**
**ANCH. AK. 99502**