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Alaska Power Administration
Juneau, Alaska, 99802

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## PART I. INTRODUCTION

For the last several years, hydroelectric investigations for the Alaska Railbelt have focused on the Upper Susitna and Bradley Lake hydroelectric projects. Many other potential projects, larger and smaller, have been identified which are accessible to the Railbelt, thus there are important questions to ask as to how these projects were selected and whether some other project or group of projects might offer a more sensible hydroelectric development plan for the Alaska Railbelt.

This report provides a review of the data and studies that brought about the selection of the two projects, and a current appraisal as to whether that selection remains appropriate.

In Alaska the electric power demands are greater in the winter than in summer. This is due to the long winter nights and the cold dominated climate. Streamflow characteristics are opposite of the power demands. Streamflows are greater in summer when the power demands are less and subject to fall freeze up or very minimal flows in winter. Typically only about 20 percent of the average annual runoff occurs between October and May. Because of this need for firm energy, "run-of-the-river" (non-storage) sites were not considered as alternatives to Susitna.

In addition to references within the text, this report is based on those publications listed as references within the appendix.

## PART II. SUMMARY

In connection with the power market analyses for the Corps of Engineers (Corps) 1979 supplemental feasibility studies of the Upper Susitna Project, Alaska Power Administration (APA) conducted a review of alternative potential hydroelectric development plans for the Alaska Railbelt. The purpose of the review was to examine whether selection of the Upper Susitna Project remains appropriate.

The principal findings are:

There are no hydro generation opportunities available to generate power in sufficient quantity to be alternative to the Susitna project. Small individual sites may be available, but would satisfy only a small portion of the market area demand. Other sites with apparently acceptable capacity and economic capability have been, or may be, precluded by restrictive land use designations such as national parks, national monuments, national wildlife refuges, and wild and scenic rivers.

# PART III. PREVIOUS STUDIES

This section has a few notes on the principal investigations of alternative hydroelectric power projects for the Alaska Railbelt.

Except in Southeast Alaska, very little was known about the extent of Alaskan hydroelectric resources prior to World War II. During the war, and in the immediate post-war period, serious interest in the hydro developed. It appears that there were two primary motivating factors: (1) the world-wide search for large low-cost hydroelectric projects that could be used in aluminum production, and (2) intensive interest in providing a viable economy in the then Territory of Alaska.

Key events included initiatives by the Territorial government and private studies on both the Wood Canyon and Yukon-Taiya projects. A comprehensive inventory of Southeast Alaska hydroelectric resources was published by the Forest Service and Federal Power Commission in 1947 covering an accumulation of studies in that region since the early part of the century.

The Bureau of Reclamation conducted its first field reconnaissance of several Alaskan hydro projects in the fall of 1946. This led to a statewide reconnaissance completed in 1948, which first brought attention to the hydroelectric potentials of the Upper Susitna and other hydro projects in the Susitna River basin. That reconnaissance triggered the studies that led to authorization of the Eklutna Project in 1950, Reclamation's Susitna River basin investigations which were completed in 1953, U.S. participation in the first Canadian-U.S. investigation of the Yukon-Taiya Project, as well as investigation of several smaller projects in other parts of the State.

Reclamation's Susitna basin report recommended feasibility investigation for the Upper Susitna Project based on the results of comparative studies, including initial fish and wildlife evaluations, for more than 20 potential hydroelectric projects in the Susitna River basin. The detailed studies confirmed viability of the project, and Reclamation's 1960 feasibility report recommended project authorization. This process of statewide reconnaissance, a comprehensive river basin study, and then detailed investigations of specific sites brought about the initial Susitna Project construction proposal.

A separate series of regional water resources investigations by the Corps of Engineers brought about alternative strategy keyed to the Rampart Project on the Yukon River. Reconnaissance studies on Rampart in the late 1950's indicated an immense potential for low-cost power, leading to a determination that further action on the proposal for Susitna authorization be deferred pending completion of: (1) feasibility reports on Rampart by the Corps of Engineers, and (2) investigations by the Interior Department of the power market and natural resources aspects of Rampart. That action was set in the March 14, 1962 agreement between the Secretaries of Army and Interior.

At the time, Susitna and Rampart were the apparent alternatives for long-term major power supplies in the Railbelt. Interim solutions were also needed, and the options included a number of smaller projects, including Bradley Lake near Homer for which the Corps had completed its review report in 1961. Bradley Lake was authorized for construction in the 1962 Flood Control Act, and the aforementioned studies concerning Rampart proceeded.

As a part of the Interior Department Rampart investigations, the Bureau of Reclamation prepared a comprehensive inventory of statewide hydroelectric resources during the period 1962 to 1967 (APA has updated portions of that inventory since that time). The inventory benefited from a great deal of information that was simply not available for previous inventory and basic studies by the Corps and the Bureau:

- The extensive work on regional and basin studies had, by now, accomplished an essentially complete identification of available sites.

- Post World War II data collection efforts, principally in topographic mapping and hydroelectric data, provided a much firmer basis for assessing the potential.

- Individual project studies had been completed providing specific field information of reconnaissance or higher level for several potential projects.

The actual processes for conducting the inventory are discussed in more detail subsequently. They included a comprehensive search for physical potential based on all previous studies; an exhaustive examination of available mapping to identify new sites; screening processes to focus in on sites having apparent potential; inventory-grade site studies including hydrology, reservoir and power production studies, cost estimates, and field checks of the better sites on geologic; and engineering suitability.

The initial inventory results were summarized and published in the June 1967 Interior Department Report, Alaska Natural Resources and the Rampart Project. That report also summarized more detailed evaluations of the Susitna, Wood Canyon, Yukon-Taiya, and Woodchopper Projects which were found to be the principal major project alternatives to Rampart. These studies reaffirmed the previous general findings concerning Susitna and Bradley Lake.

Similar findings appeared in the 1969 and 1976 Alaska Power Surveys of the Federal Power Commission (FPC). The evaluation of hydroelectric resources for the two FPC reports was again premised on the statewide inventory.

For a time during the 1960's and early 1970's, natural gas and fuel oil dominated thinking in Alaskan power supply planning. Thus, while action on Upper Susitna was deferred pending the Rampart outcome, interest in smaller projects such as Bradley Lake was diminished because of the availability and low cost of natural gas. The Corps completed its report on Rampart in 1971 with the recommendation that the project not proceed. This led directly to the renewed interest in Upper Susitna. Further impetus to the hydroelectric initiatives came about with the 1973 oil embargo and the new round of project investigations was launched.

PART IV. HYDROELECTRIC POWER INVENTORY

The term "inventory" means different things to different people. The APA-USBR inventory included assessment of physical potential and screening and evaluation process to provide appraisals of engineering and geologic suitability, sizing studies to approximate the optimum levels of development, estimates of probable construction costs, and relative cost of power for the more promising sites. There are two published summaries of the inventory:

- The list of 76 "more economical" potential projects which, with minor variations, has appeared in numerous reports.

- A longer list of 252 sites for which inventory-grade plans and cost estimates were prepared during the inventory process. The list of 252 includes the 76.

The steps in the inventory were as follows:

1. The search for possible sites.

2. The screening to identify those with reasonable possibility of economic and engineering viability.

3. Specific site studies.

4. Field check of the promising sites.

5. Coordination.

The inventory process was designed specifically to examine projects with potential of 2,500 kW or more prime power capacity (equivalent to 22 million kilowatthours per year, or roughly one-half of 1 percent of the 1977 electric power use in Alaska).

## Site Identification

This was accomplished by assembling information from all available previous studies supplemented by a careful map search to identify additional possible sites. The map search involved examination of each drainage area on the available topographic maps for possible dam and reservoir sites or diversion schemes that could possibly produce power. In all, some 2,000 sites were identified in this process.

## Screening Processes

The screening processes used several techniques. Very rough estimates of power potential were prepared using regional interpretations of runoff characteristics, measured drainage areas, and estimates of available head based on the topographic maps. The initial group of around 2,000 sites was reduced to about 700 in this preliminary screening.

which eliminated the very small sites and those which, by judgment, would involve excessively expensive construction costs for the amount of power available.

The second level of screening produced rough indications of relative cost of major features--volume of dam or size and length of major waterways. This process identified projects for which excessive costs of obtaining necessary reservoir storage and head would rule out a significant chance of feasibility. The second screening left a residual list of 252 sites for which inventory-grade plans and estimates were prepared.

## Site Studies

Inventory-grade plans and estimates were prepared for each of the 252 remaining sites. To assure a reasonable level of consistency, a series of procedures for sizing and cost estimating was developed.

As appropriate to each project, the following steps were followed:

1. Water supply available for power production was estimated using all available streamflow records supplemented by climate data and correlations.

2. Reservoir area-capacity values were determined by map measure.

3. Alternative plans for project development were determined using the topographic maps (i.e., alternative heights of dam or length of penstocks and waterways).

4. Preliminary estimates of reservoir sedimentation were developed.

5. Sizing studies were prepared to approximate the optimum scale of development for each project. This included evaluation of reservoir regulation capability (usually by mass diagram techniques) and comparison of project costs and firm power capability.

The site studies are quite accurate for those projects which had the benefit of considerable previous field data. For other projects, particularly those in remote areas of the State, the inventory-grade site studies are probably much less reliable. By judgment, the largest single variable is actual foundation conditions for major features, especially dams.

Some field reconnaissance work, including observations of surface geology, was accomplished for purposes of verifying the site studies. This focused on the projects that appeared to have good physical potential, but for which foundation information was lacking.

The inventory produced few surprises. It located a few new projects (relatively small) that had not been found in earlier studies. It eliminated many projects that had been listed in earlier studies by reason of excessive costs or evident engineering or geologic problems. The net result was a reasonably consistent evaluation of the State's hydroelectric resources including appraisal of engineering and economic viability.

## Coordination

A major step in the coordination was reconciliation of data and project assumptions arising from Bureau of Reclamation inventory studies and the series of Corps of Engineers river basin reports. This was accomplished on a project-by-project basis so that the end result of the inventory reflected the best available data on each site.

Portions of the inventory have been modified from time to time as new data became available through specific project studies or new mapping.

## PART V. ALTERNATIVE HYDROELECTRIC PLANS

There are a number of significant new facts that are relevant to deciding which project makes most sense and when. Substantially better information is available on likely environmental aspects of the projects; construction costs and interest rates have risen dramatically, as have levels of demand for power; fuel costs have skyrocketed; major changes in land ownership and management are affecting the availability of individual projects.

As a part of the most recent round of Susitna investigations (1979 Supplemental Feasibility Report), APA again reviewed the available hydroelectric alternatives to see if a different selection of projects would be more appropriate under present conditions.

Considering present hydroelectric proposals, the current strategy involves development of the authorized Bradley Lake Project with power on line in about 1987, followed by Watana in 1994 and Devil Canyon in 1998. This timing is consistent with the APA mid-range power demand estimates. Actual timing would depend on load expectations at the time when construction decisions are reached on each unit of each project. For example, if lower load growth occurs through the 1980's, it would follow that construction start on Devil Canyon would be deferred somewhat.

The range of possible alternatives can be summarized about as follows:

1. Early construction of one of the major Alaskan hydro projects such as Wood Canyon or Rampart.

2. Pursue regional or river basin development using smaller individual projects and attempt to optimize development in each area.

3. Pursue a strategy of constructing the most economical smaller projects available anywhere in the Railbelt area.

4. A strategy of very small hydro projects (say small river basins, with project capacity up to about 30 MW, where minimal environmental costs are expected).

Each of these strategies is examined in subsequent parts of this report.

### Bases of Comparison

There are four general bases of comparison:

1. Demand for the power (in lieu of the Upper Susitna Project, to what extent would the alternative strategy meet the needs).

2. Relative costs; i.e., would the alternative strategy result in lower or higher costs to the consumer.

3. Land use and management aspects as they affect availability of the alternative sites.

4. Environmental aspects, anticipated impacts.

Power Demands

The projected power demands (APA) for the Upper Susitna River Project market area (Anchorage-Fairbanks "Railbelt" area) are:

| | 1980 | | 1990 | | 2000 | |
|---|---|---|---|---|---|---|
| | MW* | GWH** | MW | GWH | MW | GWH |
| High | 890 | 3,930 | 2,360 | 10,680 | 4,650 | 20,940 |
| Medium | 830 | 3,660 | 1,590 | 7,080 | 2,850 | 12,740 |
| Low | 770 | 3,390 | 1,180 | 5,220 | 1,780 | 7,890 |

* MW (Megawatt) equals 1,000 kW
** GWH (Gigawatthour) equals 1,000,000 kWh

These projections include the total utility, industrial, and national defense needs, and are based on Institute of Social and Economic Research (ISER) 1978 population and employment estimates.

For the purposes of this study, it was assumed that the hydro strategy would focus on requirements between 1990 and 2000. Under the low and high load projections, alternative hydro plans were analyzed that would tie to those demands.

Costs

Estimates of the cost of power generation (mills per kWh) were prepared for each of the 252 sites. This is the index cost (last column) of the list of 252 sites, which is the basis of economic comparison of the sites (generation only--no transmission). (Costs are based on 1965 to 1966 prices, 50-year repayment at 3 1/8-percent interest rate, and complete utilization of average annual energy.)

The combination of the four Susitna River sites (127--Devil Canyon, 128--Watana, 129--Vee, 130--Denali) resulted in an index of 6.3 (mills per kWh). This is the basis of economic comparison of possible alternatives.

For information purposes, possible alternatives are discussed that are within twice the cost range of Susitna (12.6 mills per kWh). This is to allow some flexibility for contingencies and unknowns should more detailed consideration become warranted, and candidly, because very few sites are within the cost range.

Even though economic comparison is based on work that is several years old, it is concluded to be valid. More recent estimates of the Susitna River sites correspond generally with costs that would be obtained by indexing earlier costs to present levels. More specifically, cost estimates for energy from the four Susitna River sites, by the Corps of Engineers in the December 1975 interim feasibility report Southcentral Railbelt Area, Alaska - Upper Susitna River Basin, are within 10 percent of the index cost escalated to 1975 by construction cost trends. Therefore, economic comparison of possible alternatives is based on relative costs from the list of sites rather than updating all costs on the list.

Land Use and Management

Of specific concern are present and pending designations of wilderness, national parks, refuges, and wild and scenic rivers since hydroelectric development is not compatible with such designations.

Environmental Aspects

Based on published materials of ADF&G, the Land Use Planning Commission, and others, we are able to offer general statements of likely major fish and wildlife implications of alternative hydroelectric projects, with particular reference to anadromous fish. Significant potential for impact lies with the Tanana, Yentna, Skwentna, and Talachulitna River basins.

In addition, the extreme recreation development and use of the Kenai River would likely preclude serious consideration of identified powersites on that river.

## Larger Capacity Single Sites

Aside from Upper Susitna, the best known major hydro potentials of Alaska are Rampart on the Yukon River, Wood Canyon on the Copper River, and the Yukon-Taiya diversion from the head of the Yukon in Canada to Tidewater near Skagway in Alaska. Yukon-Taiya and Wood Canyon each have a power potential about three times that of the Upper Susitna Project; Rampart is about five times as large as Susitna.

Other large projects of possible interest include Woodchopper and Ruby on the mainstem Yukon, and Porcupine which is on a major Yukon tributary.

A final large project--the downstream Holy Cross site--would be of interest only in connection with development of major upstream storage projects.

These large projects are not considered to be available alternatives in the time frame proposed for the Upper Susitna Project for a variety of reasons.

| No. | | Site | Stream | Firm Energy GWH/yr. | Capacity MW | Cost Mills/kWh |
|---|---|---|---|---|---|---|
| 16 | (06) | Holy Cross | Yukon R. | 12,300 | 2,800 | 9.0 |
| 29 | (11) | Ruby | Yukon R. | 6,400 | 460 | 3.9 |
| 54 | (20) | Rampart | Yukon R. | 34,200 | 5,040 | 2.0 |
| 59 | (21) | Porcupine | Porcupine R. | 2,320 | 530 | 5.0 |
| 60 | (22) | Woodchopper | Yukon R. | 14,200 | 3,200 | 4.5 |
| 64 | (24) | Yukon-Taiya | Yukon R. | 21,000 | 3,200 | 3.3 |
| 173 | (54) | Wood Canyon | Copper R. | 21,900 | 3,600 | 3.2 |

On the cost aspect, several projects have potential equivalent to or lower than Susitna. Present and pending land use designations preclude consideration now of the mainstem Yukon sites as well as Wood Canyon; Yukon-Taiya is affected by legislation creating the Klondike Gold Rush National Park, although it should be noted that all of the field studies indicated the park and the hydro project were basically compatible.

On the demand side, the larger projects would substantially exceed anticipated Railbelt area demands through 2000 and beyond. However, they could be designed to serve larger power markets through interconnection with Canada.

Serious environmental problems have been documented with regard to Rampart, and Wood Canyon is known to have major anadromous fishery problems. Of the large projects, Yukon-Taiya would likely have the least severe environmental problems.

<u>Combinations of Smaller Sites by Geographic Area</u>

In addition to the larger capacity single sites discussed in the preceeding section, combinations of individual, small capacity sites were also considered as possible alternatives. These sites were grouped by eight geographic areas and compared with the projected power demands and with the Upper Susitna Project generation capacity and 1966 cost criteria. The areas are listed on the following page:

| | Area | Capacity MW | Firm Energy GWH/yr | % of Projected, Low Level, Power Demands 1980 | 1990 | 2000 | Weighted Cost Mills/kWh * |
|---|---|---|---|---|---|---|---|
| 1. | Matanuska River Basin | 194 | 935 | 25 | 18 | 12 | 87.5 |
| 2. | Tanana River Basin | 1,316 | 5,806 | 171 | 111 | 74 | 18.5 |
| 3. | Cook Inlet - West Drainage | 533 | 2,347 | 69 | 45 | 30 | 10.3 |
| 4. | Skwentna-Yentna River Basin | 509 | 2,312 | 68 | 44 | 29 | 29.6 |
| 5. | Talkeetna River Basin | 237 | 1,107 | 33 | 21 | 14 | 40.4 |
| 6. | Chultina River Basin | 345 | 1,542 | 46 | 30 | 20 | 12.3 |
| 7. | Kenai Peninsula | 475 | 2,211 | 71 | 46 | 31 | 19.9 |
| 8. | Scattered Sites, Tributary to Railbelt | 462 | 2,207 | 65 | 42 | 28 | 31.6 |

* Does not include transmission system cost.

Sites within the Nenana River Basin have also been identified in the past, but all are precluded by Mt. McKinley National Park.

A brief description of each area follows, while specific information on each site may be found in the appendix.

1. Matanuska River Basin

This basin lies to the immediate northeast of Palmer, Alaska, and drains the southern slopes of the Talkeetna Mountains and the northern slopes of the Chugach Mountains. The basin contains primarily State and private lands, is bisected by the Glenn Highway, and is easily accessible to the Anchorage area.

The basin contains six small, potential hydroelectric sites that range in capacity from 9 MW to 67 MW with total generation capability of 935 GWh per year. Costs, not including provision for transmission, would be in the magnitude of 14 times that of the Upper Susitna Project.

The basin contains a variety of wildlife including moose, bear, caribou, and Dall sheep, as well as furbearers, waterfowl, and upland game birds. Five species of salmon are found in the basin, principally in the lower reaches, in addition to trout, grayling, whitefish, and burbot. The Alaska Coastal Zone extends into the basin and includes half of the sites, representing 78 percent of the potential capacity.

Even though no major environmental impacts have been identified, there is possibility for conflict. Principal, potential impacts include disruption of anadromous fish passage, loss of fish and wildlife habitat, and degradation of aesthetics.

2. Tanana River Basin

This basin is located in the east-central part of the State and stretches southeast from the Yukon River to Canada. Lands in the Tanana River Valley are principally State and private; however, there are several major Federal land withdrawals in the basin for military reservations, Mt. McKinley National Park, the Alaska Pipeline, and settlement of the terms of the Alaska Native Claims Settlement Act. The Richardson and Alaska Highways are located within the basin and provide access to Fairbanks and a number of smaller communities.

The basin contains seven potential hydroelectric sites that range in capacity from 25 MW to 532 MW with total generation capability of 5,806 GWh per year. Costs without provision for transmission, would be in the magnitude of 2.9 times that of the Upper Susitna Project.

The basin contains a wide variety of wildlife including moose, bear, caribou, Dall sheep, and one of the State's two bison herds, as well as furbearers and upland game birds. The Tanana River Valley provides extensive waterfowl nesting areas. Three species of salmon are present with the majority of spawning located in the lower half of the basin. Trout, grayling, whitefish, burbot, and sheefish are also present.

Principal potential impacts include major highway relocation; disruption of anadromous fish passage; loss of fish and wildlife habitat, particularly waterfowl; loss of bison calving grounds; and loss of recreation use of natural waters.

3. Cook Inlet-Western Drainage

This area is located immediately to the west of Cook Inlet between Tuxedni Bay on the south and Mt. Susitna on the north. Lower lying lands are mostly State and private while the higher elevation lands to the west and south are Federally withdrawn for the Lake Clark National Monument and settlement of terms of the Alaska Native Claims Settlement Act. The area lies within the Alaska Coastal Zone.

The area contains seven potential hydroelectric sites that range in capacity from 9 MW to 366 MW with total generation capability of 2,347 GWh per year. Costs, not including provision for transmission, would be in the magnitude of 1.6 times that of the Upper Susitna Project.

A variety of wildlife are found in the area including moose, bear, sea mammals, furbearers, upland game birds, and water fowl. Five species of salmon use the area and the Alaska Department of Fish and Game has identified several major salmon fishing areas along the shores of Cook Inlet. Whitefish and trout are also present. The area is scenic with the lofty, ice clad Mt. Spurr and other mountains forming a picturesque backdrop for the forest clad lowlands. Even though there is no road network, recreation use is heavy.

Principal, potential impacts include reduction in anadromous fish passage and habitat, conflict with bear in intensive use and denning areas, and degradation of aesthetics.

4. Yentna-Skwentna River Basin

This basin lies across Cook Inlet to the northwest from Anchorage and drains a large area into the lower reaches of the Susitna River. Lands are nearly all State and private with some Federal withdrawals at the higher elevations of the mountains to the west. The basin lies within the Alaska Coastal Zone. While there is no road network and access is by air and boat, recreational use is intense.

The basin contains eight potential hydroelectric sites that range in capacity from 15 MW to 145 MW with total generation capability of 2,312 GWh per year. Costs, without provision for transmission, would be in the magnitude of 4.7 times that of the Upper Susitna Project.

The basin supports numerous wildlife including moose, bear, Dall Sheep, furbearers, upland game birds, and migrating water fowl, as well as a significant part of the Cook Inlet anadramous fish resource. Five species of salmon are present and use the basin extensively. Trout, grayling, whitefish, burbot, and Northern Pike are also present.

Principal, potential impacts include loss of recreation use of natural waters; disruption of anadromous fish passage; loss of fish, wildlife, and waterfowl habitat; conflicts with bear denning and concentration use areas; and degradation of aesthetics.

5. Talkeetna River Basin

This basin lies to the east of the community of Talkeetna and drains the central and western portions of the Talkeetna Mountains. Lands are mostly in State ownership, while Federal land withdrawals lie along the northern rim of the basin and just east of the junction of the Talkeetna River and Iron Creek. There is no road network in the basin, and access is mostly by air.

The basin contains six potential hydroelectric sites that range in capacity from 5 MW to 74 MW with total generation capability of 1,107 GWh per year. Costs, without provision for transmission, would be in the magnitude of 6.4 times that of the Upper Susitna Project.

Wildlife in the basin include moose, bear, Dall Sheep, mountain goat, caribou, furbearers, upland game birds, and migratory waterfowl. Five species of salmon use the basin, principally below the confluence of the Talkeetna River and Prairie Creek. In addition, trout, burbot, grayling, and whitefish are found in various parts of the basin.

The major potential impacts would relate to disruption to, and possible loss of, anadromous fish and passage to spawning areas; loss of big game intensive use areas; and loss of the relatively unchanged, natural condition of the basin.

6. Chulitna River Basin

This basin lies to the southwest of Cantwell and drains the southeast slopes of Mt. McKinley into the Susitna River at Talkeetna. Lands at the lower elevations of the river valleys are mostly State and private, while Federal withdrawals cover the higher lands to the north and south. The Parks Highway and Alaska Railroad bisect the basin and provide easy access for the Railbelt population. The basin is quite scenic with Mt. McKinley serving as a spectacular backdrop.

The basin contains six potential hydroelectric sites that range in capacity from 12 MW to 184 MW with total generation capability of 1,542 GWh per year. Costs, without provision for transmission, would be in the magnitude of double that of the Upper Susitna Project.

Wildlife in the basin include moose, bear, caribou, Dall Sheep, furbearers, upland game birds, and migratory waterfowl. Four species of salmon are found in the basin in addition to trout, grayling, whitefish, and burbot.

No major environmental impacts have been identified; however, there is potential for disruption, and possible loss of the anadromous fish resource and degradation of aesthetics.

7. Kenai Peninsula

This area is just south of Anchorage and joins Cook Inlet on the west and the Pacific Ocean on the east and south. The area contains a significant part of the State's highway and road network and includes several of the State's larger communities. The majority of the lands are within Federal withdrawals for a national wildlife refuge, national forest, national monument, and settlement of terms of the Alaska Native Claims Settlement Act. State, and some private, lands are located around the western and southern rims of the Peninsula and in the Seward area. The area lies within the Alaska Coastal Zone.

The area contains 13 potential hydroelectric sites that range in capacity from 6 MW to 94 MW with total generation capability of 2,211 GWh per year. Costs, not including provision for transmission, would be in the magnitude of 3.2 times that of the Upper Susitna Project.

The area supports a wide variety of wildlife including moose, bear, Dall Sheep, mountain goat, caribou, sea mammals, furbearers, upland game birds, seabirds, and waterfowl. Five species of salmon are found within the area and several major salmon fishing areas along the shores of Cook Inlet have been identified by the Alaska Department of Fish and Game. The area is highly scenic, ranging from ocean fjords to rugged ice clad mountains. Recreation use is intensive.

Major potential environmental impacts would include disruption of the intense recreation use, reduction of anadromous fish resources, and degradation of aesthetics.

8. <u>Scattered Sites, Tributary to Railbelt</u>

These sites are scattered all the way from east of Fairbanks to Anchorage and the Valdez areas. The sites are generally small, widely separated, and interconnection would be extremely expensive. Lands involved include State, private, and Federal, dependent on the specific site location. In some cases, Federal withdrawals would preclude development.

Thirteen potential hydroelectric sites are included that range in capacity from 4 MW to 82 MW with total generation capability of 2,207 GWh per year. Costs, not including provision for transmission, would be in the magnitude of 5 times that of the Upper Susitna Project.

The general variety of wildlife found in the areas discussed previously is representative of these site locations. A number of the streams and rivers support salmon in addition to trout and other resident fish. No major environmental impacts have been identified; however, there is potential with each project, particularly those that involve the larger streams and rivers with anadromous fish, are in highly scenic areas, or would extinguish extensive wildlife habitat areas.

## Combinations of the Most Economical Smaller Sites

The third approach to evaluating a possible alternative to the Susitna Project is to combine the economically best small sites from each of the geographic areas. Only one site (Chakachamna) is within the economic range of Susitna. Twelve sites are within twice the cost range, and are included in the following tabulation of the best small sites within the Railbelt area.

| No. | | Site | Stream | Firm Energy GWH/year | Capacity MW | Cost Mills/kWh |
|---|---|---|---|---|---|---|
| 93 | (32) | Cresent Lake | Cresent R. | 179 | 41 | 9.9 |
| 94 | (33) | Chakachamna | Chakachatna R. | 1,600 | 366 | 6.5 |
| 97 | (34) | Coffee | Beluga R. | 160 | 37 | 11.5 |
| 98 | (35) | Upper Beluga | Beluga R. | 210 | 48 | 11.1 |
| 105 | (36) | Yentna | Yentna R. | | 145) | |
| 106 | (37) | Talachulitna | Skwentna | 1,390 | 75) | 10.1 |
| 107 | (38) | Skwentna | Skwentna | | 98) | |
| | | (Yentna, Talachulitna, and Skwentna operated as a system) | | | | |
| 109 | (39) | Lower Chulitna | Chulitna | 394 | 90 | 8.1 |
| 110 | (40) | Tokichitna | Chulitna | 806 | 184 | 8.8 |
| 112 | (41) | Keetna | Talkeetna R. | 324 | 74 | 11.3 |
| 150 | (49) | Snow | Snow R. | 278 | 63 | 11.2 |
| 158 | (51) | Lowe | Lowe R. | 254 | 55 | 11.2 |
| | Total | | | 5,595 | 1,276 | |

The Lowe site has the severe disadvantage that it would block the major land access route to Valdez; it would also involve relocating the Trans-Alaska Oil Pipeline and a highway, and a planned transmission line between Valdez and Glennallen.

Sites that are in designated national monuments or are included in proposed Federal land withdrawals include Cresent Lake and Chakachamna in the Lake Clark area, and Tokichitna in the Denali area. These sites represent approximately half of the total potential power from the sites, leaving 685 MW capacity and 3,010 GWh energy.

Bradley Lake (no. 154--Kenai Peninsula) with an index cost of 8.0 is not included because it is already an authorized project (Corps of Engineers).

Another site, Lane (no. 124, 240 MW), with an index cost of 8.9 could also be included based on the less than 12.6 criteria. However, it is actually a part of the Susitna River system because it is immediately downstream from the Devil Canyon site.

Cost: This would involve smaller increments of new investment, at uniformly and progressively higher costs per installed kW. Transmission system needs would be substantially greater also.

The program would very quickly move into significant fisheries problems--by judgment substantially more significant than those of Upper Susitna. Expect significant impacts on game habitats, primarily moose.

## The "Small" Hydro Approach

The existing hydroelectric projects near Anchorage (APA's Eklutna Project and Chugach Electric Copper Lake Project) are examples of smaller projects including relatively small drainage basins and generally favorable environmental aspects. If a large number of small projects (say size range up to 30 MW or so) with favorable environmental aspects could be located, an alternative small hydro approach would make a great deal of sense. The viability of the strategy depends on the extent of the resources of good small projects, their cost, availability, and cumulative environmental impacts.

Sites smaller than 2.5 MW would likely have to be fully automated operations because a significant part of the revenue would be required for personnel to attend the plant. For example, operation costs alone for a five-person staff would cost $200,000 per year, which would amount to 4.5 cents per kWh for a 1-MW plant operating at 50 percent plant factor. Sites of 2.5 MW and smaller cannot support transmission lines for very long distances; hence, to contribute positively to a power system, sites have to be close to the power market or an existing grid power system. A 50-mile transmission line costing $40,000 per mile would add 3.7 cents per kWh to the cost for a 1-MW plant.

To meet Railbelt power needs by small hydros alone in the 1990 decade, 200 of the 1-MW powerplant sites would need to be developed annually. It is doubtful that 1/10 to 1/20 of this number of sites would be available every year as an alternative to meet the full power needs of the Railbelt area.

The criteria and examination procedure for evaluating cumulative environmental effects of developing several small hydro project sites will be the same criteria and procedure used in evaluating larger powersites. Sites that need only relatively short access roads, short transmission lines, and small dams could meet the criteria. Conversely, development of dozens of the small sites that each need roads, transmission lines, and dams, or long roads and transmission lines, could have accumulative environmental impacts that may exceed the effect of a single large project. Logic suggests that several of the more economical smaller sites having a minimum of environmental effects could be constructed as supplemental local energy sources to large projects which meet major city utility requirements.

# ALASKA POWER ADMINISTRATION

## Inventory of Potential Hydroelectric Sites in Alaska

size criteria is generally 2500 KW (continuous power) and larger

| No. | Power Site | Stream | USGS Map sheet | Drainage Area (sq. mi.) | Maximum Regulated Water Surface (ft.) | Average Head (ft.) | Average Annual Runoff (1000 AF) | Per Cent Regulation | Firm Energy (million Kwh) | Installed Capacity (1000 KW) | 1/ (plant factor %) | Index Cost 2/ | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| ARCTIC REGION | | | | | | | | | | | | | |
| 1 | Killik Bend | Colville R. | Killik R. | 9,780 | 700 | 218 | 4,100 | 97 | 718 | 148 | 55 | 26.6 | |
| 2 | Awuna River | Awuna R. | Lookout Ridge | 605 | 1,000 | 528 | 230 | 100 | 101 | 21 | 55 | 62.9 | |
| 3 | Kucher Creek | Colville R. | Killik R. | 6,240 | 975 | 120 | 2,600 | 100 | 254 | 53 | 55 | 35.4 | |
| NORTHWEST REGION | | | | | | | | | | | | | |
| 4 (1) | Agashashok | Noatak R. | Noatak A-2 | 12,700 | 150 | 132 | 7,500 | 100 | 820 | 186 | 50 | 8.7 | |
| 5 (2) | Misheguk | Noatak R. | Baird Mtn. D-6 | 8,700 | 550 | 199 | 5,600 | 83 | 760 | 174 | 50 | 10.8 | |
| 6 (3) | Nimiuktuk | Noatak R. | Baird Mtn. D-3 | 7,000 | 750 | 166 | 4,500 | 100 | 613 | 140 | 50 | 12.7 | |
| 7 (4) | Kobuk River | Kobuk R. | Baird Mtn. A-1 | 7,840 | 150 | 114 | 5,700 | 100 | 526 | 120 | 50 | 15.8 | |
| 8 | Kogoluktuk | Kogoluktuk R. | Shungnak D-2 | 412 | 400 | 129 | 351 | 100 | 37 | 8 | 55 | 27.2 | |
| 9 | Upper Kobuk River | Kobuk R. | Shungnak | 2,970 | 275 | 62 | 2,200 | 99 | 114 | 23 | 55 | 39.5 | |
| 10 | Buckland River | Buckland R. | Candle D-5 | 2,410 | 130 | 103 | 930 | 100 | 79 | 16 | 55 | 42.0 | |
| 11 (5) | Tuksuk Gorge | Tuksuk Channel | Teller A-2 | 4,275 | 190 | 187 | 1,880 | 100 | 289 | 66 | 50 | 19.0 | |
| 12 | Kuzitrin River (Bunker Hill site) | Kuzitrin R. | Bendleben A-6 | 1,790 | 150 | 95 | 860 | 100 | 67 | 14 | 55 | 49.4 | Would be inundated by a Tuksuk Gorge project, or would reduce Tuksuk to elevation 50 and 77 million Kwh. |
| 13 | Salmon Lake | Kruzgamepa R. | Solomon D-6 | 107 | 500 | 155 | 267 | 70 | 24 | 5 | 55 | 126.0 | |
| 14 | Fish River | Fish R. | Solomon D-3 | 1,120 | 150 | 103 | 720 | 100 | 60 | 13 | 55 | 48.0 | |
| YUKON (INTERIOR) REGION | | | | | | | | | | | | | |
| 15 | Upper Chuilnak River | Atchuilnak R. | Holy Cross D-5 | 162 | 625 | 103 | 140 | 95 | 11 | 2 | 55 | 422.0 | |
| 16 (6) | Holy Cross | Yukon R. | Holy Cross A-1&2 | 320,000 | 137 | 94 | 160,000 | 100 | 12,300 | 2,800 | 50 | 9.0 | |
| 17 | Kaltag | Yukon R. | Nulato | 296,000 | 200 | 117 | 137,000 | | 13,100 | 3,000 | 55 | | An alternative to Holy Cross. |
| 18 (7) | Dulbi | Koyukuk R. | Kanteel R. B-1 | 25,660 | 225 | 68 | 19,200 | 100 | 1,070 | 244 | 50 | 14.8 | |
| 19 | Fry Island | Koyukuk R. | Melozitna D-4 | 19,950 | 270 | 54 | 14,000 | 100 | 622 | 114 | 55 | | Alternative to Dulbi, cost was not calculated. |
| 20 (8) | Hughes | Koyukuk R. | Hughes A-3 | 18,700 | 320 | 49 | 12,300 | 100 | 482 | 110 | 50 | 11.2 | |
| 21 (9) | Kanuti | Koyukuk R. | Hughes | 17,970 | 500 | 166 | 11,900 | 100 | 1,612 | 368 | 50 | 12.2 | |
| 22 | Alatna River | Alatna R. | Hughes | 2,860 | 725 | 109 | 2,000 | 100 | 175 | 36 | 55 | 23.1 | |
| 23 | Alatna River, Upper | Alatna R. | Survey Pass | 1,325 | 1,050 | 158 | 920 | 100 | 123 | 25 | 55 | 64.5 | |
| 24 | Jim River | Jim R. | Bettles D-2 | 470 | 975 | 162 | 320 | 100 | 43 | 9 | 55 | 42.6 | |
| 25 | Jack White | Koykuk R. | Bettles | 4,350 | 800 | 136 | 3,000 | --- | 315 | 65 | 55 | 18.1 | |
| 26 | John River | John R. | Wiseman A-4 | 2,695 | 800 | 107 | 1,900 | 90 | 149 | 31 | 55 | 38.8 | |
| 27 (10) | Melozitna | Melozitna R. | Ruby D-6 | 2,659 | 550 | 270 | 1,400 | 91 | 282 | 64 | 50 | 11.2 | |
| 28 | Melozitna River | Melozitna R. | Melozitna B-4 | 2,020 | 700 | 129 | 1,100 | 100 | 117 | 13 | 55 | 48.5 | |
| 29 (11) | Ruby | Yukon R. | Ruby D-5 | 256,200 | 210 | 72 | 109,000 | 100 | 6,400 | 460 | 50 | 3.9 | 3/ Inventory plan is premised on development of Rampart. |
| 30 | Nowitna River | Nowitna R. | Ruby B-2 | 2,570 | 450 | 180 | 1,900 | 100 | 280 | 58 | 55 | 16.1 | |
| 31 | Vachon Island | Tanana R. | Kantishna R. D-3 | 44,500 | 350 | 96 | 26,000 | 96 | 2,050 | 426 | 55 | 29.0 | Alternative site to Junction Island. |
| 32 (12) | Junction Island | Tanana R. | Kantishna R. D-1 | 42,490 | 400 | 114 | 25,000 | 100 | 2,330 | 532 | 50 | 15.1 | |
| 33 | Kantishna River | Kantishna R. | Kantishna R. B-1 | 5,440 | 500 | 95 | 5,200 | 99 | 394 | 82 | 55 | 22.2 | |
| 34 | McKinley River | McKinley R. | Mt. McKinley B-3 | 710 | 1,775 | 297 | 910 | 90 | 201 | 42 | 55 | 42.3 | |
| 35 | Chatanika River | Chatanika R. | Livengood A-4 | 770 | 500 | 91 | 420 | 99 | 32 | 7 | 55 | 63.0 | |
| 36 | Teklanika River | Teklanika R. | Healy D-6 | 520 | 1,800 | 457 | 728 | 100 | 272 | 57 | 55 | 24.2 | |
| 37 | Browne | Nenana R. | Fairbanks A-5 | 2,450 | 1,000 | 207 | 3,400 | 66 | 385 | 80 | 55 | 58.0 | |
| 38 | Walker Creek | Nenana R. | Fairbanks A-5 | 2,330 | 1,200 | 166 | 3,300 | 35 | 166 | 35 | 55 | 87.5 | ( Alternative for upper Nenana River System. It would inundate |
| 39 | Yanert No. 2 | Nenana R. | Healy C-4 | 1,190 | 2,200 | 232 | 1,670 | 93 | 298 | 62 | 55 | 37.2 ) | Carlo and Bruskansna sites. |
| 40 (15) | Healy | Nenana R. | Healy D-4 | 1,900 | 1,700 | 291 | 2,675) | | | 130) | | | |
| 41 (14) | Carlo | Nenana R. | Healy C-4 | 1,190 | 1,900 | 166 | 1,670) | 83 | 840 | 30) | 50 | 10.7 | Assumes operation as a system. |
| 42 (13) | Bruskansna | Nenana R. | Healy B-4 | 650 | 2,330 | 212 | 826) | | | 40) | | | |
| 43 | Totatlanika River | Totatlanika R. | Fairbanks A-4 | 250 | 1,600 | 420 | 320 | 100 | 114 | 24 | 55 | 33.1 | |
| 44 | Chena River | Chena R. | Big Delta D-5 | 950 | 900 | 107 | 523 | 99 | 46 | 10 | 55 | 128.0 | |
| 45 | Salcha River | Salcha R. | Big Delta C-5 | 1,990 | 975 | 136 | 1,170 | 95 | 123 | 25 | 55 | 69.4 | |
| 46 | Tanana River (Little Delta) | Tanana R. | Big Delta B-6 | 18,080 | 900 | 107 | 14,500 | 25 | 315 | 65 | 55 | 43.1 | |
| 47 (16) | Big Delta | Tanana R. | Big Delta A-4 | 15,300 | 1,100 | 99 | 12,500 | 98 | 987 | 226 | 50 | 16.8 | |
| 48 (17) | Gerstle | Tanana R. | Mt. Hayes D-2 | 10,700 | 1,290 | 59 | 9,500 | --- | 438 | 100 | 50 | 17.0 | |
| 49 (18) | Johnson | Tanana R. | Mt. Hayes C-2 | 10,450 | 1,470 | 149 | 7,830 | 97 | 920 | 210 | 50 | 16.1 | |
| 50 (19) | Cathedral Bluffs | Tanana R. | Tanacross B-6 | 8,550 | 1,650 | 146 | 5,800 | 100 | 693 | 158 | 50 | 15.3 | |
| 51 | Nabesna | Nebesna R. | Nebesna D-3 | 2,145 | 2,025 | 191 | 2,300 | 88 | 320 | 66 | 55 | 33.9 | |
| 52 | Chisana River | Chissana R. | Nebesna A-3 | 732 | 3,250 | 883 | 1,100 | 100 | 797 | 170 | 55 | 21.8 | |
| 53 | Rock Lake | Ptarmigan Creek | McCarthy D-1 | 93 | 3,600 | 514 | 140 | 98 | 58 | 12 | 55 | 56.5 | |
| 54 (20) | Rampart | Yukon | Tanana B-3 | 200,000 | 665 | 445 | 81,000 | 100 | 34,200 | 5,040 | 75 | 2.0 | |
| 55 | East Fork Chandalar River, Afterbay | E.F. Chandalar R. | Chandalar | 5,500 | 900 | 99 | 1,500 | 100 | 122 | 25 | 55 | 21.1 | |
| 56 | East Fork Chandalar River, Zimmerman Creek | E.F. Chandalar R. | Chandalar | 5,500 | 1,100 | 169 | 1,500 | 100 | 210 | 44 | 55 | 29.3 | |
| 57 | East Fork Chandalar River, Little Rock | E.F. Chandalar R. | Christian | 4,200 | 1,600 | 132 | 1,150 | 95 | 119 | 25 | 55 | 70.3 | |
| 58 | East Fork Chandalar River | E.F. Chandalar R. | Arctic | 2,500 | 2,025 | 162 | 680 | 100 | 90 | 19 | 55 | 56.0 | |
| 59 (21) | Porcupine | Porcupine R. | Coleen B-1 | 23,400 | 975 | 313 | 9,100 | 100 | 2,320 | 530 | 50 | 5.0 | |
| 60 (22) | Woodchopper | Yukon | Charley R. B-5 | 122,000 | 1,020 | 300 | 57,600 | 100 | 14,200 | 2,160 | 75 | 4.5 | |
| 61 (23) | Fortymile | Fortymile | Eagle B-1 | 6,060 | 1,550 | 324 | 3,230 | 84 | 723 | 166 | 50 | 8.9 | |
| 62 | No. Fork Fortymile | N.F. Fortymile | Eagle B-2 | 2,065 | 1,800 | 249 | 1,400 | 85 | 245 | 51 | 55 | 17.2 | |
| 63 | So. Fork Fortymile | S.F. Fortymile | Eagle A-2 | 2,800 | 1,775 | 228 | 1,500 | 88 | 245 | 51 | 55 | 24.9 | |
| 64 (24) | Yukon-Taiya | Yukon | Skagway C-1 | 25,700 | 2,200 | 1,913 | 13,500 | 100 | 21,000 | 3,200 | 75 | 3.3 | Yukon-Taiya would reduce downstream potential. |

| No. | Power Site | Stream | USGS Map sheet | Drainage Area (sq. mi.) | Maximum Regulated Water Surface (ft.) | Average Head (ft.) | Average Annual Runoff (1000 AF) | Per Cent Regulation | Firm Energy (million Kwh) | Installed Capacity (1000 KW) | 1/ (plant factor %) | Index Cost 2/ | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| SOUTHWEST REGION | | | | | | | | | | | | | |
| 65 (25) | Crooked Creek | Kuskokwim R. | Sleetmute D-6 | 31,100 | 500 | 352 | 32,400 | 100 | 9,400 | 2,140 | 50 | 5.0 | |
| 66 | So. Fork Kuskokwim River | S.F. Koskokwim R. | McGrath A-1 | 870 | 2,000 | 174 | 840 | 60 | 72 | 15 | 55 | 112.0 | |
| 67 | Lake Kulik | Wind R. | Dillingham | 236 | 123 | 30 | 3,800 | 100 | 95 | 20 | 55 | 40.6 | |
| 68 (26) | Nuyakuk Lake | Nuyakuk R. | Dillingham D-6 | 1,530 | 342 | 176 | 4,300 | 90 | 555 | 127 | 50 | 15.9 | |
| 69 | Chikuminuk | Allen R. | Taylor Mtns. | 286 | 630 | 262 | 800 | 90 | 154 | 32 | 55 | 22.8 | Would be reduced 11 million Kwh by development of Nuyakuk. |
| 70 | Upnuk Lake | Tikchik R. | Taylor Mtns. | 100 | 830 | 170 | 280 | 100 | 39 | 8 | 55 | 46.6 | |
| 71 (27) | Iliamna Lake | Kuichak R. | Dillingham A-2 | 6,440 | 150 | 114 | 14,600 | 100 | 1,370 | 313 | 50 | 11.1 | |
| 72 | Kakhonak Lake | Kakhonak R. | Iliamna B-4 | 145 | 300 | 200 | 275 | 100 | 45 | 9 | 55 | 53.8 | |
| 73 | Newhalen River | Newhalen R. | Iliamna D-6 | 3,319 | 325 | 74 | 6,675 | 100 | 411 | 85 | 55 | 11.9 | New mapping indicates Newhalen could be included on list of lower priced hydro. |
| 74 (28) | Tazimina | Tazimina R. | Iliamna D-5 | 346 | 725 | 393 | 724 | 96 | 224 | 51 | 50 | 15.0 | |
| 75 | Kontrashibuna | Tanalian R. | Lake Clark A-4 | 200 | 510 | 226 | 461 | 99 | 83 | 17 | 55 | 17.6 | |
| 76 (29) | Ingersol | Kijik R. | Lake Clark B-3 | 300 | 1,460 | 1,120 | 695 | 99 | 630 | 144 | 50 | 14.2 | |
| 77 | Alagnak River | Alagnak R. | Iliamna A-8 | 530 | 775 | 170 | 960 | 35 | 47 | 10 | 55 | 53.5 | |
| 78 | Nonvianuk Lake | Nonvianuk R. | Iliamna A-7 | 370 | 631 | 115 | 670 | 100 | 63 | 13 | 55 | 22.6 | |
| 79 (30) | Kukakluk Lake | Alagnek R. | Iliamna A-7 | 480 | 825 | 326 | 870 | 100 | 232 | 53 | 50 | 10.9 | |
| 80 (31) | Naknek | Naknek R. | Naknek C-2 | 2,720 | 150 | 124 | 4,600 | 100 | 473 | 108 | 50 | 13.2 | |
| 81 | American Creek | American Creek | Mt. Katmai D-4 | 100 | 1,625 | 861 | 180 | 95 | 120 | 25 | 55 | 22.7 | |
| 82 | Ukak River | Ukak R. | Mt. Katmai B-4 | 194 | 375 | 145 | 330 | 75 | 30 | 6 | 55 | 164.0 | |
| 83 | Contact Creek | Contact Creek | Mt. Katnai A-6 | 54 | 1,050 | 274 | 92 | 65 | 13 | 3 | 55 | 354.0 | |
| 84 | Becharof | Eggegik R. | Naknek A-3 | 1,280 | 70 | 58 | 1,600 | 100 | 76 | 16 | 55 | 21.3 | |
| 85 | Ugashik Lakes | Ugashik R. | Ugashik C-3 | 830 | 50 | 33 | 1,100 | 100 | 30 | 6 | 55 | 50.2 | |
| SOUTHCENTRAL REGION | | | | | | | | | | | | | |
| 86 | Olga Bay | Olga Narrows | Karluk A-1 | 335 | 70 | 64 | 710 | 100 | 37 | 8 | 55 | 68.6 | Alternative to Fraser Lake. |
| 87 | Fraser Lake | Dog Salmon Creek | Karluk A-1 | 72 | 353 | 302 | 130 | 100 | 32 | 7 | 55 | 33.0 | |
| 88 | Ayakulik | Ayukulik | Karluk A-2 | 181 | 200 | 181 | 330 | 100 | 49 | 10 | 55 | 42.6 | |
| 89 | Karluk Lake | Karluk | Karluk C-1 | 165 | 400 | 344 | 300 | 100 | 85 | 18 | 55 | 24.9 | |
| 90 | Terror Lake | Unnamed | Kodiak C-4 | 15 | 1,325 | 1,057 | 72 | 94 | 85 | 12 | 55 | 24.9 | |
| 91 | McNeil River | McNeil River | Iliamna A-4 | 102 | 150 | 112 | 180 | 50 | 8 | 2 | 55 | 145.0 | |
| 92 | Paint River | Paint R. | Iliamna A-4 | 205 | 150 | 115 | 370 | 80 | 28 | 6 | 55 | 115.0 | |
| 93 (32) | Crescent Lake | Crescent R. | Kenai B-8 | 200 | 599 | 517 | 454 | 98 | 179 | 41 | 50 | 9.9 | |
| 94 (33) | Chakachamna | Chakachatna R. | Tyonek A-7 | 1,120 | 1,127 | 793 | 2,460 | 100 | 1,600 | 366 | 50 | 6.5 | |
| 95 | Chuitna | Chuitna R. | Tyonek A-4 | 66 | 800 | 552 | 140 | 70 | 45 | 9 | 55 | 83.4 | |
| 96 | Lower Beluga | Beluga R. | Tyonek A-3 | 950 | 100 | 49 | 1,790 | 100 | 72 | 15 | 55 | 19.1 | |
| 97 (34) | Coffee | Beluga R. | Tyonik A-4 | 860 | 210 | 109 | 1,800 | 100 | 160 | 37 | 50 | 11.5 | |
| 98 (35) | Upper Beluga | Beluga R. | Tyonek B-4 | 840 | 375 | 142 | 1,800 | 100 | 210 | 48 | 50 | 11.1 | |
| 99 | Strandline Lake | Beluga R. | Tyonek B-6 | 54 | 1,300 | 852 | 115 | 100 | 81 | 17 | 55 | 30.8 | Development of Upper Beluga would reduce energy 12 million Kwh. |
| 100 | Lake Creek (Lower) | Lake Creek | Talkeetna A-2 | 335 | 800 | 305 | 710 | 60 | 105 | 22 | 55 | 32.6 | |
| 101 | Upper Lake Creek | Lake Creek | Talkeetna B-3 | 85 | 1,400 | 560 | 180 | 90 | 74 | 15 | 55 | 20.3 | |
| 102 | Talachulitna River | Talachulitna R. | Tyonek C-4 | 360 | 700 | 231 | 720 | 100 | 137 | 28 | 55 | 41.6 | |
| 103 | Hayes, Skwentna R. | Skwnetna R. | Tyonek D-5 | 1,730 | 575 | 187 | 3,500 | 80 | 429 | 89 | 55 | 72.8 | |
| 104 | Emerald | Skwentna R. | Tyonek D-8 | 370 | 1,900 | 366 | 790 | 74 | 177 | 37 | 55 | 69.7 | |
| 105 (36) | Yentna | Yentna R. | Tyonek C-2 | 6,400 | 150 | 82 | 12,750) | | | 145) | | | |
| 106 (37) | Talachulitna | Skwetna R. | Tyonek D-4 | 2,250 | 350 | 124 | 4,500) | 79 | 1,390 | 75) | 50 | 10.1 | Assumes operation as a system. |
| 107 (38) | Skwentna | Skwetna R. | Tyonek D-6 | 950 | 1,000 | 291 | 1,900) | | | 98) | | | |
| 108 | Chulina Creek | Chulina Creek | Talkeetna B-1 | 240 | 800 | 198 | 380 | 40 | 25 | 5 | 55 | 50.9 | |
| 109 (39) | Lower Chulitna | Chulitna R. | Talkeetna B-1 | 2,600 | 500 | 89 | 6,350 | 84 | 394 | 90 | 50 | 8.1 | |
| 110 (40) | Tokichitna | Chulitna R. | Talkeetna C-1 | 2,560 | 725 | 186 | 6,200 | 85 | 806 | 184 | 50 | 8.8 | |
| 111 | Talkeetna River (sheep) | Talkeetna R. | Talkeetna Mt. B-6 | 1,790 | 605 | 91 | 4,400 | 50 | 149 | 31 | 55 | 40.4 | |
| 112 (41) | Keetna | Talkeetna R. | Talkeetna Mt. B-6 | 1,260 | 950 | 286 | 1,690 | 82 | 324 | 74 | 50 | 11.3 | |
| 113 | Iron Creek | Iron Creek | Talkeetna Mt. B-5 | 210 | 1,750 | 750 | 400 | 60 | 147 | 31 | 55 | 63.9 | |
| 114 | Granite Gorge | Talkeetna R. | Talkeetna Mt. B-5 | 865 | 1,500 | 416 | 1,160 | 87 | 345 | 72 | 55 | 43.8 | |
| 115 | Greenstone | Talkeetna R. | Talkeetna Mt. C-5 | 790 | 1,575 | 304 | 1,150 | 65 | 246 | 51 | 55 | 38.6 | Alternative to Granite Gorge. |
| 116 | Trapper | Talkeetna R. | Talkeetna Mt. C-5 | 760 | 1,700 | 245 | 1,140 | 94 | 216 | 45 | 55 | 68.6 | |
| 117 | Lucy | Chulitna R. | Talkeetna Mt. D-5 | 1,080 | 1,100 | 166 | 2,600 | 20 | 71 | 15 | 55 | 19.3 | |
| 118 | Coal | Chulitna R. | Talkeetna Mt. D-6 | 985 | 1,450 | 241 | 2,400 | 40 | 193 | 40 | 55 | 36.3 | Would be inundated by development of Ohio site. |
| 119 | Ohio | Chulitna R. | Talkeetna Mt. D-6 | 916 | 1,500 | 224 | 2,220 | 35 | 144 | 30 | 55 | 21.0 | |
| 120 | Chulitna-Hurricane | Chulitna R. | Healy A-6 | 795 | 1,600 | 207 | 1,900 | 50 | 166 | 34 | 55 | 26.7 | Would be inundated by development of Ohio site. |
| 121 | West Fork Chulitna | W.F. Chulitna R. | Healy A-6 | 355 | 1,900 | 287 | 640 | 45 | 68 | 14 | 55 | 33.4 | |
| 122 | East Fork Chulitna | E.F. Chulitna R. | Healy A-5 | 135 | 2,500 | 380 | 240 | 80 | 59 | 12 | 55 | 31.3 | |
| 123 (42) | Whiskers | Susitna R. | Talkeetna B-1 | 6,320 | 490 | 59 | 7,500 | 100 | 368 | 84 | 50 | 11.5 | |
| 124 (43) | Lane | Susitna R. | Talkeetna C-1 | 6,280 | 660 | 169 | 7,500 | 100 | 1,052 | 240 | 50 | 8.9 | |
| 125 (44) | Gold | Susitna R. | Talkeetna Mt. C-6 | 6,160 | 850 | 189 | 7,327 | 100 | 1,139 | 260 | 50 | 13.1 | |
| 126 | Deadman Creek | Deadman Dr. | Talkeetna Mt. D-3 | 160 | 3,000 | 962 | 350 | 60 | 165 | 34 | 55 | 22.7 | |
| 127 (45) | Devil Canyon | Susitna R. | Talkeetna Mt. D-5 | 5,810 | 1,450 | 575 | 6,840) | | | 738) | | | |
| 128 (46) | Watana | Susitna R. | Talkeetna Mt. D-4 | 5,180 | 1,905 | 425 | 6,040) | 100 | 7,000 | 478) | 50 | 6.3 | Assumes operation as a system. |
| 129 (47) | Vee | Susitna R. | Talkeetna Mt. C-2 | 4,140 | 2,355 | 430 | 4,730) | | | 386) | | | |
| 130 (48) | Denali | Susitna R. | Talkeetna Mt. D-1 | 1,260 | 2,552 | --- | 2,310) | | | ---) | | | |
| 131 | McLaren River | McLaren R. | Gulkana D-6 | 485 | 2,875 | 263 | 1,410 | 85 | 263 | 55 | 55 | 45.2 | |
| 132 | Boulder Creek | Boulder Cr. | Healy B-1 | 42 | 3,575 | 917 | 67 | 70 | 35 | 7 | 55 | 55.6 | |
| 133 | Palmer | Matanuska R. | Anchorage C-6 | 2,070 | 400 | 166 | 2,918 | 20 | 79 | 16 | 55 | 195.5 | |
| 134 | Moose Creek | Matanuska R. | Anchorage C-6 | 2,070 | 500 | 166 | 2,918 | 25 | 100 | 21 | 55 | 124.2 | Alternative to Palmer site. |
| 135 | King Mountain | Matanuska R. | Anchorage D-5 | 1,635 | 1,050 | 276 | 2,300 | 40 | 210 | 44 | 55 | 37.6 | |

| No. | Power Site | Stream | USGS Map sheet | Drainage Area (sq. mi.) | Maximum Regulated Water Surface (ft.) | Average Head (ft.) | Average Annual Runoff (1000 AF) | Per Cent Regula-tion | Firm Energy (million Kwh) | Installed Capacity (1000 KW) | 1/ (plant factor %) | Index Cost 2/ | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 136 | Coal Creek | Matanuska R. | Anchorage D-4 | 1,128 | 1,300 | 291 | 1,600 | 80 | 307 | 64 | 55 | 78.5 | Alternative to King Mtn. site. |
| 137 | Boulder Creek | Boulder Cr. | Anchorage D-4 | 90 | 2,600 | 1,317 | 82 | 80 | 69 | 14 | 55 | 57.0 | |
| 138 | Rush Lake | Boulder Cr. | Anchorage D-4 | 89 | 1,950 | 892 | 78 | 79 | 45 | 9 | 55 | 92.7 | |
| 139 | Purinton Creek | Matanuska R. | Anchorage D-4 | 1,082 | 1,450 | 291 | 1,500 | 90 | 324 | 67 | 55 | 108.1 | Alternative to Hick site. |
| 140 | Hicks Site | Matanuska R. | Anchorage D-3 | 950 | 1,675 | 281 | 1,300 | 90 | 286 | 59 | 55 | 37.2 | |
| 141 | Caribou Creek | Caribou Cr. | Anchorage D-2 | 260 | 2,450 | 527 | 220 | 93 | 90 | 19 | 55 | 21.7 | |
| 142 | Eagle River | Eagle R. | Anchorage B-7 | 194 | 450 | 167 | 397 | 82 | 45 | 9 | 55 | 38.8 | |
| 143 | Sunrise | Sixmile Cr. | Seward D-7 | 238 | 450 | 327 | 350 | 55 | 52 | 11 | 55 | 122.2 | |
| 144 | Lower Kenai | Kenai R. | Kenai B-3 | 1,650 | 160 | 84 | 4,300 | 88 | 263 | 55 | 55 | 18.2 | |
| 145 | Moose Horn | Kenai R. | Kenai C-2 | 1,540 | 275 | 95 | 4,000 | 93 | 290 | 60 | 55 | 18.8 | |
| 146 | Killey River | Killey R. | Kenai B-2 | 160 | 725 | 358 | 380 | 90 | 100 | 21 | 55 | 38.1 | |
| 147 | Stelters Ranch | Kenai R. | Kenai B-1 | 849 | 500 | 199 | 2,600 | 97 | 403 | 84 | 55 | 17.9 | |
| 148 | Kenai Lake | Kenai R. | Seward B-8 | 660 | 650 | 341 | 2,030 | 97 | 552 | 115 | 55 | 22.3 | Alternative to Stelters Ranch site. |
| 149 | Crescent Lake | Crescent L. | Seward B-7 | 23 | 1,454 | 934 | 38 | 100 | 29 | 6 | 55 | 31.4 | |
| 150 (49) | Snow | Snow R. | Seward B-7 | 85 | 1,250 | 653 | 535 | 97 | 278 | 63 | 50 | 11.2 | |
| 151 | Kasilof River | Kasilof R. | Kenai B-4 | 738 | 200 | 136 | 1,729 | 100 | 193 | 40 | 55 | 15.8 | |
| 152 | Tustumena | Tustumena Glacier | Kenai A-2 | 57 | 1,496 | 1,100 | 133 | 85 | 102 | 21 | 55 | 17.1 | |
| 153 | Sheep Creek | Sheep Cr. | Seldovia D-2 | 101 | 725 | 382 | 460 | 54 | 94 | 20 | 55 | 23.8 | |
| 154 (50) | Bradley Lake | Bradley Cr. | Seldovia D-3 | 88 | 1,195 | 1,155 | 445 | 93 | 410 | 94 | 50 | 8.0 | Authorized Project. |
| 155 | Resurrection River | Resurrection R. | Seward A-7 | 141 | 425 | 233 | 600 | 75 | 86 | 18 | 55 | 58.5 | |
| 156 | Nellie Juan River | Nellie Juan R. | Seward B-5 | 130 | 400 | 240 | 708 | 34 | 47 | 10 | 55 | 32.0 | |
| 157 | Upper Nellie Juan | Nellie Juan R. | Seward B-6 | 35 | 1,189 | 421 | 190 | 90 | 57 | 12 | 55 | 17.6 | |
| 158 (51) | Lowe | Lowe R. | Valdez A-6 | 190 | 800 | 334 | 1,400 | 66 | 254 | 55 | 50 | 11.2 | |
| 159 | Allison Creek | Allison Cr. | Valdez A-7 | 6 | 1,380 | 1,191 | 32 | 55 | 18 | 4 | 55 | 19.5 | |
| 160 | Solomon Gulch | Unnamed | Valdez A-7 | 18 | 660 | 608 | 100 | 20 | 11 | 2 | 55 | 27.0 | |
| 161 | Silver Lake | Duck R. | Cordova D-7 | 25 | 390 | 346 | 180 | 95 | 48 | 10 | 55 | 15.6 | |
| 162 | Power Creek | Power Cr. | Cordova C-5 | 21 | 560 | 490 | 182 | 90 | 66 | 14 | 55 | 20.9 | |
| 163 (52) | Million Dollar | Copper R. | Cordova C-2 | 24,200 | 200 | 89 | 38,000 | 71 | 1,927 | 440 | 50 | 14.8 | |
| 164 | Van Cleve | Unnamed | Cordova C-1 | 17 | 1,450 | 475 | 95 | 25 | 10 | 2 | 55 | 234.0 | |
| 165 | Little Bremner River | Little Bremner R. | Valdez A-2 | 182 | 600 | 272 | 503 | 62 | 70 | 15 | 55 | 67.8 | |
| 166 | Bremner R., Salmon Site | Bremner R. | Valdez A-1 | 660 | 525 | 166 | 2,100 | 30 | 86 | 18 | 55 | 46.7 | |
| 167 | So. Fork Bremner River | S.F. Bremner R. | Cordova D-1 | 148 | 1,150 | 537 | 470 | 75 | 156 | 32 | 55 | 32.5 | |
| 168 | Three Mile Canyon | Bremner R. | Cordova D-1 | 526 | 725 | 228 | 1,660 | 41 | 127 | 26 | 55 | 51.5 | Alternative to Salmon site. |
| 169 | No. Fork Bremner River | N.F. Bremner R. | Bering Glacier | 150 | 1,625 | 490 | 470 | 87 | 166 | 35 | 55 | 56.0 | |
| 170 (53) | Cleave | Copper R. | Valdez A-3 | 21,500 | 420 | 165 | 28,000 | 96 | 3,600 | 820 | 55 | 13.3 | |
| 171 | Tsina | Tsina | Valdez A-5 | 104 | 1,750 | 360 | 220 | 90 | 58 | 12 | 55 | 64.2 | |
| 172 | Tiekel River | Tiekel R. | Valdez A-3 | 421 | 950 | 400 | 900 | 35 | 105 | 22 | 55 | 37.8 | |
| 173 (54) | Wood Canyon | Copper R. | Valdez B-2 | 20,600 | 1,400 | 950 | 26,700 | 100 | 21,900 | 3,600 | 69.4 | 3.2 | |
| 174 | Hanagita Lake | Hanagita R. | McCarthy A-8 | 100 | 2,575 | 1,010 | 228 | 85 | 160 | 33 | 55 | 27.0 | |
| 175 | Tebay Lakes | Tebay R. | Valdez A-1 | 105 | 1,875 | 1,007 | 240 | 95 | 193 | 40 | 55 | 23.6 | |
| 176 | Kuskulana River | Kuskulana R. | McCarthy C-8 | 260 | 2,050 | 508 | 550 | 50 | 114 | 24 | 55 | 66.9 | |
| 177 | Young Creek | Young Cr. | McCarthy A-4 | 40 | 3,475 | 2,017 | 110 | 45 | 82 | 17 | 55 | 60.3 | High Wood Canyon plan would reduce potential by about 5%. |
| 178 | Canyon Creek | Canyon Cr. | McCarthy A-4 | 100 | 3,100 | 1,308 | 270 | 45 | 131 | 27 | 55 | 46.1 | |
| 179 | Kiagna River | Kiagna R. | McCarthy A-4 | 185 | 2,500 | 970 | 490 | 50 | 193 | 40 | 55 | 77.9 | High Wood Canyon plan would reduce potential by about 10%. |
| 180 | Kotsina River | Kotsina R. | Valdez C-1 | 209 | 2,075 | 524 | 440 | 70 | 133 | 28 | 55 | 47.9 | |
| 181 | Klutina | Klutina R. | Valdez D-5 | 670 | 1,800 | 335 | 950 | 100 | 263 | 54 | 55 | 17.6 | |
| 182 | Tolsona Creek | Tolsona Cr. | Gulkana A-4 | 174 | 2,025 | 460 | 200 | 70 | 53 | 11 | 55 | 52.5 | |
| 183 | Tazlina | Tazline R. | Gulkana A-5 | 1,970 | 1,875 | 273 | 2,300 | 100 | 503 | 104 | 55 | 15.6 | |
| 184 | Nelchina River | Nelchina R. | Gulkana A-6 | 820 | 2,250 | 285 | 940 | 99 | 219 | 45 | 55 | 53.3 | |
| 185 | Lower Gulkana River | Gulkana R | Gulkana B-3 | 1,850 | 1,700 | 232 | 2,000 | 11 | 42 | 9 | 55 | 84.8 | |
| 186 | Upper Gulkana River | Gulkana R. | Gulkana B-3 | 1,770 | 1,850 | 124 | 1,900 | 23 | 45 | 9 | 55 | 86.8 | |
| 187 | Gulkana River | Gulkana R. | Gulkana C-4 | 575 | 2,475 | 405 | 620 | 80 | 164 | 34 | 55 | 27.5 | |
| 188 | West Fork Gulkana River | W.F. Gulkana R. | Gulkana C-5 | 398 | 2,375 | 192 | 440 | 100 | 69 | 14 | 55 | 58.7 | |
| 189 | Summit Lake | Gulkana R. | Mt. Hayes A-4 | 83 | 3,210 | 500 | 88 | 100 | 36 | 8 | 55 | 19.9 | |
| 190 | Gakona Site | Copper R. | Gulkana B-3 | 3,965 | 1,750 | 266 | 4,400 | 75 | 727 | 150 | 55 | 35.2 | Alternative to Sanford site. |
| 191 | Sanford | Copper R. | Gukana B-3 | 3,365 | 1,825 | 178 | 3,700 | 70 | 385 | 80 | 55 | 29.3 | |
| 192 | White River | White R. | Bering Glacier A-4 | 29 | 375 | 282 | 210 | 80 | 39 | 8 | 55 | 51.3 | |
| SOUTHEAST REGION | | | | | | | | | | | | | |
| 193 | Alsek River | Alsek R. | Yakutat B-1 | 11,000 | 450 | 166 | 12,000 | 90 | 1,490 | 310 | 55 | 17.9 | Major portion of reservoir area is in Canada. |
| 194 | Endicott River | Endicott R. | Juneau D-5 | 56 | 800 | 483 | 270 | 97 | 105 | 21 | 55 | 25.9 | |
| 195 | Chilkoot | Chilkoot R. | Skagway B-2 | 130 | 175 | 136 | 780 | 90 | 78 | 16 | 55 | 35.8 | |
| 196 (55) | Chilkat | Chilkat R. | Skagway C-3 | 190 | 600 | 320 | 870 | 80 | 180 | 41 | 50 | 10.6 | |
| 197 | West Creek | West Creek | Skagway C-2 | 40 | 800 | 625 | 268 | 75 | 105 | 21 | 55 | 25.9 | |
| 198 | Goat Lake | Pitchfork Falls | Skagway C-1 | 4 | 2,915 | 2,017 | 30 | 95 | 46 | 10 | 55 | 16.5 | |
| 199 | Lace River | Lace R. | Juneau D-3 | 363 | 200 | 166 | 2,300 | 97 | 298 | 62 | 55 | 51.8 | |
| 200 | Unnamed Lake near Lace R. | Unnamed | Juneau D-3 | 3 | 3,160 | 3,003 | 20 | 100 | 48 | 10 | 55 | 19.4 | |
| 201 | Antler River | Antler R. | Juneau D-3 | 5 | 1,950 | 1,813 | 29 | 100 | 43 | 9 | 55 | 17.8 | |
| 202 | Nugget Creek | Nugget Cr. | Juneau B-2 | 16 | 725 | 607 | 151 | 40 | 30 | 6 | 55 | 52.9 | |
| 203 | Carlson Creek | Carlson Cr. | Juneau B-1 | 24 | 450 | 344 | 246 | 66 | 46 | 10 | 55 | 27.5 | |
| 204 | Boundary Lake | Boundary Cr. | Taku R. C-6 | 23 | 925 | 795 | 170 | 85 | 95 | 20 | 55 | 22.2 | |
| 205 | Yehring Creek | Yehring Cr. | Taku R. B-6 | 16 | 1,100 | 1,077 | 112 | 26 | 26 | 5 | 55 | 29.0 | |
| 206 (56) | Lake Dorothy | Dorothy Cr. | Taku R. A-6 | 11 | 2,422 | 2,248 | 81 | 100 | 150 | 34 | 50 | 7.3 | |
| 207 (57) | Speel Division Snettisham Project | Speel R. | Taku R. A-5 | 194 | 325 | 273 | | | 275 | 63 | 50 | 8.1 | |

| No. | | Power Site | Stream | USGS Map sheet | Drainage Area (sq. mi.) | Maximum Regulated Water Surface (ft.) | Average Head (ft.) | Average Annual Runoff (1000 AF) | Per Cent Regulation | Firm Energy (million Kwh) | Installed Capacity (1000 KW) | 1/ (plant factor %) | Index Cost 2/ | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 208 | (58) | Tease Creek | Tease Cr. | Taku R. A-5 | 11 | 1,100 | 1,034 | 110 | 75 | 70 | 16 | 50 | 14.9 | |
| 209 | (59) | Sweetheart Falls | Sweetheart Falls Cr. | Sumdum D-5 | 35 | 684 | 612 | 250 | 100 | 125 | 29 | 50 | 9.6 | |
| 210 | (60) | Houghton | Unnamed | Sumdum D-3 | 39 | 550 | 457 | 370 | 98 | 136 | 31 | 50 | 11.0 | |
| 211 | | Farragut | Farragut R. | Sumdum A-3 | 64 | 525 | 493 | 480 | 56 | 163 | 37 | 50 | 13.8 | ( Recent calculations indicate Farragut could be included on list of lower priced hydros. ) |
| 212 | (61) | Scenery Creek | Scenery Cr. | Sumdum A-3 | 21 | 957 | 620 | 147 | 90 | 67 | 15 | 50 | 10.8 | |
| 213 | (62) | Thomas Bay | Cascade Cr. | Sumdum A-3 | 19 | 1,514 | 1,442 | 160 | 88 | 166 | 38 | 50 | 8.1 | |
| 214 | | Ruth Lake | Delta Cr. | Petersburg D-3 | 8 | 1,550 | 1,449 | 59 | 90 | 63 | 13 | 55 | 18.1 | |
| 215 | (63) | Stikine River | Stikine R. | Petersburg C-1 | 20,000 | 350 | 291 | 45,000 | 90 | 9,900 | 2,260 | 50 | 9.0 | |
| 216 | (64) | Goat | Goat Cr. | Bradfield Canal C-6 | 14 | 1,298 | 1,056 | 112 | 90 | 87 | 20 | 50 | 13.9 | |
| 217 | | Katate River | Katate R. | Bradfield Canal C-6 | 73 | 650 | 249 | 594 | 82 | 99 | 21 | 55 | 18.3 | |
| 218 | | Aaron | Aaron Cr. | Bradfield Canal C-6 | 81 | 300 | 183 | 652 | 56 | 58 | 12 | 55 | 86.0 | |
| 219 | | Harding River | Harding R. | Bradfield Canal C-5 | 68 | 250 | 207 | 548 | 92 | 85 | 18 | 55 | 49.2 | |
| 220 | | No. Bradfield River | N. Bradfield R. | Bradfield Canal B-5 | 150 | 250 | 157 | 1,200 | 61 | 131 | 27 | 55 | 71.0 | |
| 221 | (65) | Tyee Creek | Tyee Cr. | Bradfield Canal A-5 | 15 | 1,387 | 1,275 | 123 | 93 | 120 | 27 | 50 | 8.9 | |
| 222 | | Anan Creek | Anan Cr. | Bradfield Canal A-6 | 27 | 325 | 230 | 200 | 89 | 33 | 7 | 55 | 34.4 | |
| 223 | (66) | Spur | Unnamed | Bradfield Canal A-4 | 10 | 1,889 | 1,776 | 83 | 87 | 105 | 24 | 50 | 10.7 | |
| 224 | | Saks Cove | Saks Cr. | Ketchikan D-4 | 22 | 675 | 621 | 150 | 93 | 72 | 15 | 55 | 18.7 | |
| 225 | (67) | Leduc | Leduc R. | Ketchikan | 7 | 1,384 | 1,241 | 61 | 100 | 62 | 14 | 50 | 14.5 | |
| 226 | | Chickamin River | Chickamin R. | Bradfield Canal A-2 | 562 | 325 | 228 | 4,800 | 82 | 727 | 150 | 55 | 26.1 | |
| 227 | | Granite Creek | Granite Cr. | Ketchikan C-3 | 9 | 945 | 863 | 82 | 67 | 39 | 8 | 55 | 17.2 | |
| 228 | (69) | Punchbowl Creek | Punchbowl Cr. | Ketchikan C-3 | 14 | 650 | 622 | 126 | 99 | 64 | 15 | 55 | 10.6 | |
| 229 | (68) | Rudyerd | Unnamed | Ketchikan C-2 | 8 | 1,775 | 1,600 | 63 | 100 | 83 | 19 | 50 | 10.6 | |
| 230 | | Wilson River | Wilson R. | Ketchikan B-2 | 70 | 400 | 166 | 560 | 93 | 71 | 15 | 55 | 30.7 | |
| 231 | (70) | Red | Red R. | Ketchikan A-2 | 44 | 400 | 347 | 410 | 89 | 104 | 24 | 50 | 12.2 | |
| 232 | | Davis River | Davis R. | Ketchikan D-1 | 78 | 450 | 367 | 667 | 67 | 131 | 28 | 55 | 17.4 | |
| 233 | | Kelp | Unnamed | Sitka B-4 | 21 | 675 | 612 | 161 | 82 | 66 | 16 | 50 | 15.1 | |
| 234 | (75) | Takatz Creek | Takatz Cr. | Sitka A-3 | 11 | 1,040 | 991 | 129 | 87 | 97 | 20 | 50 | 12.5 | |
| 235 | | Baranof Lake | Baranof R. | Sitka A-3 | 32 | 145 | 108 | 316 | 42 | 11 | 2 | 55 | 19.1 | |
| 236 | | Carbon Lake | Unnamed | Sitka A-3 | 27 | 300 | 260 | 350 | 65 | 49 | 10 | 55 | 24.8 | |
| 237 | | Milk Lake | Unnamed | Port Alexander D-3 | 11 | 700 | 666 | 167 | 36 | 33 | 7 | 55 | 19.0 | |
| 238 | | Brentwood Creek | Brentwood Cr. | Port Alexander C-3 | 7 | 950 | 655 | 98 | 71 | 38 | 8 | 55 | 27.7 | |
| 239 | (74) | Deer | Unnamed | Port Alexander C-3 | 7 | 374 | 339 | 114 | 96 | 31 | 7 | 50 | 14.8 | |
| 240 | (73) | Maksoutof River | Maksoutof R. | Port Alexander C-3 | 24 | 600 | 570 | 272 | 93 | 117 | 24 | 50 | 12.6 | |
| 241 | | Plotnikof Lake | Unnamed | Port Alexander D-3 | 20 | 350 | 315 | 24 | 76 | 44 | 9 | 55 | 17.7 | |
| 242 | (76) | Green Lake | Vodopad R. | Port Alexander D-4 | 29 | 400 | 353 | 212 | 84 | 52 | 11 | 50 | 12.4 | |
| 243 | | Hasselborg Creek | Hasselborg Cr. | Sitka C-1 | 83 | 331 | 306 | 343 | 90 | 77 | 16 | 55 | 22.3 | |
| 244 | | Thayer Creek | Thayer Cr. | Sitka C-2 | 61 | 407 | 377 | 252 | 100 | 78 | 16 | 55 | 22.1 | |
| 245 | | Kathleen Creek | Kathleen Cr. | Sitka D-3 | 29 | 525 | 502 | 126 | 94 | 48 | 10 | 55 | 33.7 | |
| 246 | | Towers Creek | Towers Cr. | Petersburg D-5 | 81 | 275 | 259 | 300 | 100 | 64 | 13 | 55 | 108.7 | |
| 247 | | Orchard Creek | Orchard Cr. | Ketchikan D-5 | 60 | 200 | 170 | 420 | 75 | 44 | 9 | 55 | 17.8 | |
| 248 | (71) | Lake Grace | Grace Cr. | Ketchikan C-3 | 29 | 500 | 456 | 281 | 90 | 99 | 20 | 50 | 10.1 | |
| 249 | | Manzanita Lake | | Ketchikan C-4 | 63 | 300 | 269 | 620 | 91 | 124 | 26 | 55 | 17.5 | |
| 250 | (72) | Swan Lake | Falls Cr. | Ketchikan C-4 | 36 | 326 | 275 | 336 | 91 | 69 | 15 | 50 | 12.8 | |
| 251 | | Thorne | Thorne R | Craig C-2 | 166 | 125 | 103 | 1,100 | 85 | 80 | 17 | 55 | 17.6 | |
| 252 | | Reynolds Creek | Reynolds Cr. | Craig A-2 | 7 | --- | --- | 54 | 99 | 54 | 11 | 55 | 19.7 | Three power plants and lakes involved. |

Power site numbers refer to map locations.

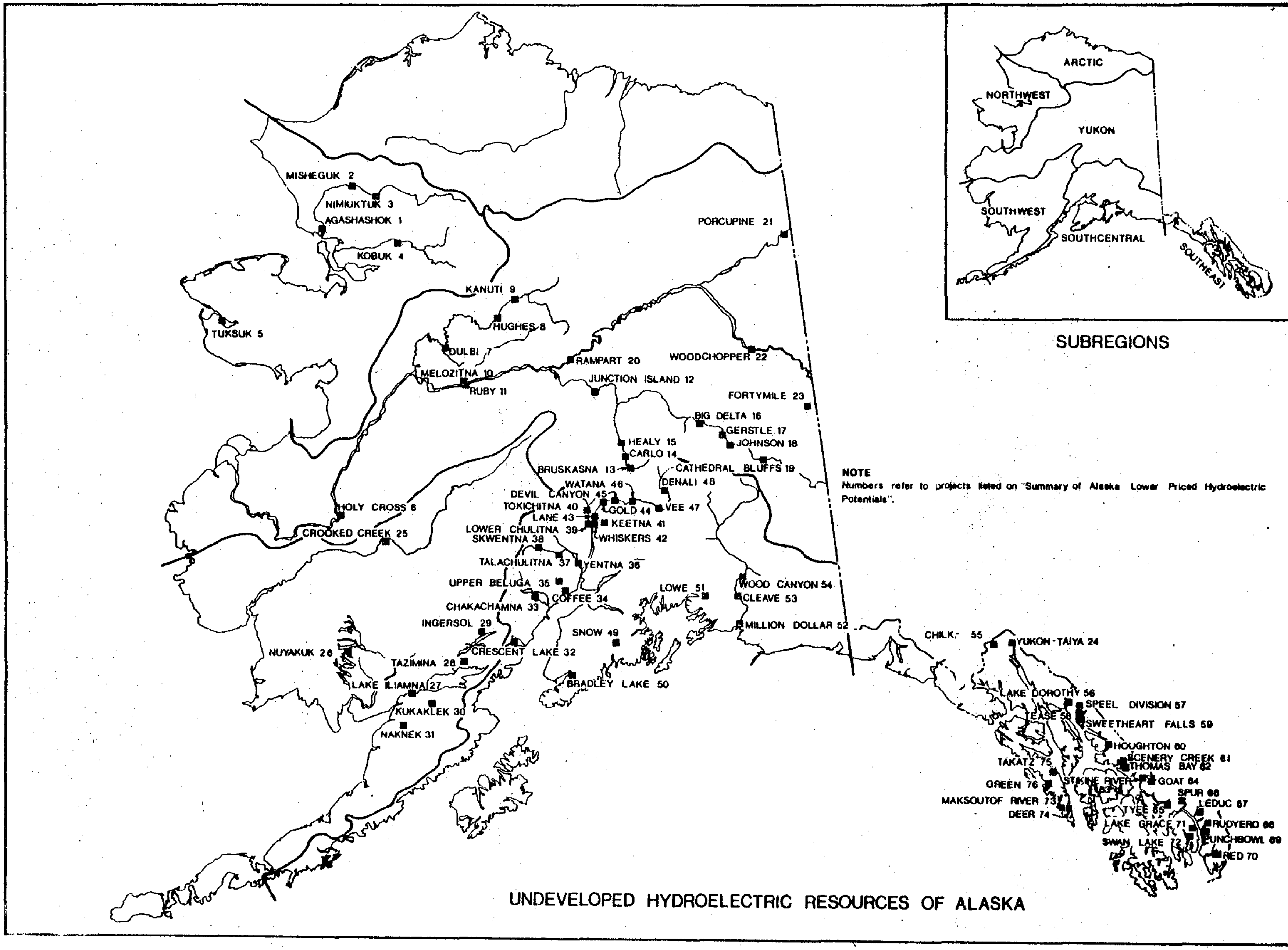
Numbers in parentheses refer to the published list and map of lower priced hydroelectric potentials 2500 kw continuous power and larger.

1/ The size and cost of the power plants for the inventory study was based on 55% plant factor. The list of the 76 lower priced sites assumes 50% plant factor with no significant change in cost. There are exceptions for the larger sites which were considered base load plants. Specific plant factors are noted.

2/ The index cost is a relative comparison cost of energy at the power plant bus bar. Substation and transmission costs are not included.

3/ An alternative development of the Ruby site to elevation 325 would inundate the Rampart dam site. Power production at Ruby would increase to 14.2 billion kwh annually and 3,250,000 kw.

APPENDIX B




UNDEVELOPED HYDROELECTRIC RESOURCES OF ALASKA

## APPENDIX C
## Description of Small Capacity Sites Within Geographic Areas

Following are tabulations of parameters of sites within each of the geographic areas examined, and descriptions of some of the particular factors of each area. The site number refers to the list of 252 sites while the number in parentheses refers to the list of (best) 76 sites. The comparison is to a 1966 Susitna Project energy cost index of 6.3 mills/kWh and generation capability of 6,100 GWh/year (range from 2,670 to 10,260 GWh/year).

### 1. Matanuska River Basin

| No. | Site | Stream | Firm Energy GWH/year | Capacity MW | Cost Mills/kWh |
|---|---|---|---|---|---|
| 133 | Palmer | Matanuska R. | 79 | 16 | 195.5 |
| 134 | Moose Creek | Matanuska R. | 100 | 21 | 124.2 |
| | (Alternative to Palmer) | | | | |
| 135 | King Mountain | Matanuska R. | 210 | 44 | 37.6 |
| 136 | Coal Creek | Matanuska R. | 207 | 64 | 78.5 |
| | (Alternative to King Mountain) | | | | |
| 137 | Boulder Creek | Boulder Cr. | 69 | 14 | 57.0 |
| 138 | Rush Lake | Boulder Cr. | 45 | 9 | 92.7 |
| 139 | Purinton Creek | Matanuska R. | 324 | 67 | 108.1 |
| | (Alternative to Hicks) | | | | |
| 140 | Hicks Site | Matanuska R. | 286 | 59 | 27.2 |
| 141 | Caribou Creek | Caribou Cr. | 90 | 19 | 21.7 |
| | Total (excluding Palmer, King Mountain, and Hicks) | | 935 | 194 | |

The small Caribou Creek site, which has the lowest index cost, was determined to be unfeasible because it is located in a broad glaciated valley with poor foundation, and probable severe reservoir sedimentation.

### 2. Tanana River Basin

| No. | | Site | Stream | Firm Energy GWH/year | Capacity MW | Cost Mills/kWh |
|---|---|---|---|---|---|---|
| 31 | | Vachon Island | Tanana R. | 2,050 | 426 | 29.0 |
| | | (Alternative to Junction Island) | | | | |
| 32 | (12) | Junction Island | Tanana R. | 2,330 | 532 | 15.1 |
| 45 | | Salchia River | Salchia R. | 123 | 25 | 69.4 |
| 46 | | Tanana River (Little Delta) | Tanana R. | 315 | 65 | 43.1 |
| 47 | (16) | Big Delta | Tanana R. | 987 | 226 | 16.8 |
| 48 | (17) | Gerstle | Tanana R. | 438 | 100 | 17.0 |
| 49 | (18) | Johnson | Tanana R. | 920 | 210 | 16.1 |
| 50 | (19) | Cathedral Bluffs | Tanana R. | 693 | 158 | 15.3 |
| | Total (excluding Vachon Island) | | | 5,806 | 1,316 | |

Three of the sites--Vachon Island, Salcha River, and Tanana River (Little Delta)--are significantly more costly than the others. All sites except Salcha River involve regulation of the main stem of the Tanana River.

Additional geologic investigation after development of cost estimates revealed that Cathedral Bluffs would require extensive foundation treatment, which is not reflected in the cost estimate.

### 3. Cook Inlet - Western Drainage

There are several sites west of Cook Inlet, all but one of which are smaller than 50 MW.

| No. | | Site | Stream | Firm Energy GWH/year | Capacity MW | Cost Mills/kWh |
|---|---|---|---|---|---|---|
| 90 | (32) | Cresent Lake | Cresent R. | 179 | 41 | 9.9 |
| 94 | (33) | Chakachamna | Chakachatna R. | 1,600 | 366 | 6.5 |
| 95 | | Chuitna | Chuitna R. | 45 | 9 | 83.4 |
| 96 | | Lower Beluga | Beluga R. | 72 | 15 | 19.1 |
| 97 | (34) | Coffee | Beluga R. | 160 | 37 | 11.5 |
| 98 | (35) | Upper Beluga | Beluga R. | 210 | 48 | 11.1 |
| 99 | | Strandline Lake | Beluga R. | 81 | 17 | 30.8 |
| | | (Upper Beluga would reduce Strandline Lake energy 12 GWH/year) | | | | |
| | Total | | | 2,347 | 533 | |

Two of the sites, Chuitna and Strandline Lake, are very costly. Chakachamna has an index cost comparable to Susitna (6.5 versus 6.3). Chakachamna could supply 60 percent of the low estimate 1990-2000 power requirement, 30 percent of the medium estimate, and 15 percent of the high estimate. Part of Lake Chakachamna is included in the recently designated Lake Clark National Monument, and it may not be available for development. Cresent Lake is also in the Lake Clark National Monument.

4. Yentna-Skwentna River Basin

| No. | | Site | Stream | Firm Energy GWH/year | Capacity MW | Cost Mills/kWh |
|---|---|---|---|---|---|---|
| 100 | | Lake Creek (Lower) | Lake Creek | 105 | 22 | 32.6 |
| 101 | | Upper Lake Creek | Lake Creek | 74 | 15 | 20.3 |
| 102 | | Talachulitna River | Talachulitna R. | 137 | 28 | 41.6 |
| 103 | | Hayes, Skwentna R. | Skwentna R. | 429 | 89 | 72.8 |
| 104 | | Emerald | Skwentna R. | 177 | 37 | 69.7 |
| 105 | (36) | Yentna | Yentna R. | | 145) | |
| 106 | (37) | Talachulitna | Skwentna R. | 1,390 | 75) | 10.1 |
| 107 | (38) | Skwentna | Skwentna R. | | 98) | |
| | | (Yentna, Talachulitna, and Skwentna operated as a system) | | | | |
| | | Total | | 2,312 | 509 | |

The cost of the Yentna-Skwentna system includes 70 miles of access road. This system is the lowest cost potential hydro development other than authorized projects and those that would be precluded by land use designations. The capacity of the system would be 318 MW.

5. Talkeetna River Basin

| No. | | Site | Stream | Firm Energy GWH/year | Capacity MW | Cost Mills/kWh |
|---|---|---|---|---|---|---|
| 108 | | Chunilna Creek | Chunilna Cr. | 25 | 5 | 50.9 |
| 111 | | Talkeetna R. (Sheep) | Talkeetna R. | 149 | 31 | 40.4 |
| 112 | (41) | Keetna | Talkeetna R. | 324 | 74 | 11.3 |
| 114 | | Iron Creek | Iron Creek | 147 | 31 | 63.9 |
| 115 | | Greenstone (Alternative to Granite Gorge) | Talkeetna R. | 246 | 51 | 38.6 |
| 116 | | Trapper | Talkeetna R. | 216 | 45 | 68.6 |
| | | Total (excluding Granite Gorge) | | 1,107 | 237 | |

Most of the sites in this basin require large dams (from 300 to 565 feet high and more than 3,000 feet long).

6. Chulitna River Basin

| No. | | Site | Stream | Firm Energy GWH/year | Capacity MW | Cost Mills/kWh |
|---|---|---|---|---|---|---|
| 109 | (39) | Lower Chulitna | Chulitna R. | 394 | 90 | 8.1 |
| 110 | (40) | Tokichitna | Chulitna R. | 806 | 184 | 8.8 |
| 117 | | Lucy | Chulitna R. | 71 | 15 | 19.3 |
| 118 | | Coal | Chulitna R. | 193 | 40 | 36.6 |
| 119 | | Ohio | Chulitna R. | 144 | 30 | 21.0 |
| | | (Would inundate Coal and Chulitna-Hurricane) | | | | |
| 120 | | Chulitna-Hurricane | Chulitna R. | 166 | 34 | 26.7 |
| 121 | | W. Fork Chulitna | W.F. Chulitna R. | 68 | 14 | 33.4 |
| 122 | | E. Fork Chulitna | E.F. Chulitna R. | 59 | 12 | 31.3 |
| | Total (excluding Coal and Chulitna-Hurricane) | | | 1,542 | 345 | |

Two sites (Coal and Chulitna-Hurricane) are eliminated by a more economical third site (Ohio) which would involve the same reach of river. Only the Lower Chulitna and Tokichitna sites are near the economic range of Susitna. Part of the Tokichitna reservoir would be included in the new Denali National Monument.

7. Kenai Peninsula

The Kenai Peninsula has several sites, most of which are small and at best marginally economical.

| No. | | Site | Stream | Firm Energy GWH/year | Capacity MW | Cost Mills/kWh |
|---|---|---|---|---|---|---|
| 143 | | Sunrise | Sixmile Cr. | 52 | 11 | 122.2 |
| 144 | | Lower Kenai | Kenai R. | 263 | 55 | 18.2 |
| 145 | | Moose Horn | Kenai R. | 290 | 60 | 18.8 |
| 146 | | Killey River | Killey R. | 100 | 21 | 38.1 |
| 147 | | Stelters Ranch | Kenai R. | 403 | 84 | 17.9 |
| 148 | | Kenai Lake | Kenai R. | 522 | 115 | 22.3 |
| | | (Alternative to Stelters Ranch site) | | | | |
| 149 | | Cresent Lake | Cresent L. | 29 | 56 | 31.4 |
| 150 | (49) | Snow | Snow R. | 278 | 63 | 11.2 |
| 152 | | Tustumena | Tustumena Gla. | 102 | 21 | 17.1 |
| 153 | | Sheep Creek | Sheep Cr. | 94 | 20 | 23.8 |
| 154 | (50) | Bradley Lake | Bradley Cr. | 410 | 94 | 8.0 |
| | | (Authorized Project) | | | | |
| 155 | | Resurrection R. | Resurrection R. | 86 | 18 | 58.5 |
| 156 | | Nellie Juan River | Nellie Juan R. | 47 | 10 | 32.0 |
| 157 | | Upper Nellie Juan | Nellie Juan R. | 57 | 12 | 17.6 |
| | Total (excluding Kenai Lake) | | | 2,211 | 475 | |

For comparison purposes Bradley Lake energy cost on a January 1977 price basis is 36 mills per kWh compared to the index cost of 8.0. This factor of 4.5 includes several plan modifications and refinements to reduce costs. Bradley Lake is an authorized Corps of Engineers project with final planning, design, and construction funding pending. It is a supplement to the Susitna Project and not a significant alternative.

An average of two to five of these sites would have to be developed each year to meet the Anchorage-Kenai area projected power growth of 200 MW annually during the 1990's. Environmental impacts for development of the Kenai River sites would be significant, primarily due to extensive fishery.

8. Scattered Sites Tributary to Railbelt

Scattered sites and small basins tributary to the Railbelt area include:

| No. | Site | Stream | Firm Energy GWH/year | Capacity MW | Cost Mills/kWh |
|---|---|---|---|---|---|
| 33 | Kantishna River | Kantishna R. | 394 | 82 | 22.2 |
| 34 | McKinley River | McKinley R. | 201 | 42 | 42.3 |
| 35 | Chatanika River | Chatanika R. | 32 | 7 | 63.0 |
| 36 | Teklanika River | Teklanika R. | 272 | 57 | 24.2 |
| 43 | Totatlanika River | Totatlanika R. | 114 | 24 | 33.1 |
| 44 | Chena River | Chena R. | 46 | 10 | 128.0 |
| 51 | Nabesna | Nabesna R. | 320 | 66 | 33.9 |
| 126 | Deadman Creek | Deadman Cr. | 165 | 34 | 22.7 |
| 131 | McLaren River | McLaren R. | 263 | 55 | 45.2 |
| 132 | Boulder Creek | Boulder Cr. | 35 | 7 | 55.6 |
| 142 | Eagle River | Eagle R. | 45 | 9 | 38.8 |
| 158 | (51) Lowe | Lowe R. | 254 | 55 | 11.2 |
| 159 | Allison Creek | Allison Cr. | 18 | 4 | 19.5 |
| 161 | Silver Lake | Duck R. | 48 | 10 | 15.6 |
| | Total | | 2,207 | 462 | |

Most of these sites are small—less than 100 MW. Their scattered locations are not conductive to intertieing energy supplies of a large area such as the Railbelt. Several sites are in designated national monuments or in proposed national park areas. The Lowe site is in a canyon occupied by the Trans-Alaska Oil Pipeline and the only highway access to Valdez, and the route of a planned Valdez-Glennallen transmission line.

The Silver Lake site, with an index cost of 2.5 times the Susitna index, has a possibility of serving a part of the local power needs of the Valdez area, but would not be a significant alternative or contributor to meeting the larger Railbelt area needs.

FBC F

OPTIONAL FORM NO. 10
MAY 1962 EDITION
GSA FPMR (41 CFR) 101-11.6

UNITED STATES GOVERNMENT

# *Memorandum*

RECEIVED
SEP 5 9 AM 1969

TO : T. R. Cantine, Chief, Project Development
Alaska Power Administration, Juneau, Alaska

DATE: September 4, 1969

| CODE | INIT | DATE |
|---|---|---|
| 100 | N | 9/9/69 |
| 700 | [illegible] | 9/5 |
| 720 | [illegible] | 9/5 |
| [illegible] | [illegible] | 9/5 |
| | [illegible] | 9/8 |
| 900 | | |

FROM : Regional Fish & Wildlife Administrator, BCF,
Juneau, Alaska

SUBJECT: Initial evaluation of project effects on fish and wildlife

The attached table presenting our appraisal of the effects of project development on fish and wildlife resources was prepared in response to Gary Long's request this week. The projects are those listed in the F.P.C. Alaska Power Survey, July 1966. 7

We judged effects to be significant where we would anticipate recommending major mitigation facilities or where losses, even though infeasible to mitigate, would be large. Minor effects are those which possibly would not justify additional mitigation features beyond those which could be accommodated in design and operation of the project at little or no additional cost. For example, we judged the minimum flows required for movement of fish below the mainstem Susitna River dams to fall in this category, which may or may not be correct. Negligible effects are those which would not justify project modification. We reported "effects unknown" in these cases where we did not have sufficient knowledge of the project area to even speculate on possible project effect.

Thus, because of the lack of project data and our lack of information on fish and wildlife resources in the project area in many cases, this evaluation of project effects should be considered very preliminary.

M. A. Monson

Melvin A. Monson

Attachment



*Buy U.S. Savings Bonds Regularly on the Payroll Savings Plan*

## Initial Evaluating Effects of Project Development on Fish and Wildlife

| Project | Significant effects | | Minor effects | | Negligible effects | | Effects Unknown | |
|---|---|---|---|---|---|---|---|---|
| | fish | wildlife | fish | wildlife | fish | wildlife | fish | wildlife |
| 1. Agashashok | x | x | | | | | | |
| 2. Misheguk | | | | | | | x | x |
| 3. Nimiuktuk | | | | | | | x | x |
| 4. Kobuk River | x | x | | | | | | |
| 5. Tuksuk | x | x | | | | | | |
| 6. Holy Cross | x | x | | | | | | |
| 7. Dulbi | | | | | | | x | x |
| 8. Hughes | | | | | | | x | x |
| 9. Kanuti | x | x | | | | | | |
| 10. Melozitna | x | x | | | | | | |
| 11. Ruby | x | x | | | | | | |
| 12. Junction Island | | | | | | | x | x |
| 13. Healy | | | | | x | | | x |
| 14. Carlo | | | | | x | | | x |
| 15. Bruskasna | | | | | x | | | x |
| 16. Big Delta | | | | | | | x | x |
| 17. Gerstle | | | | | | | x | x |
| 18. Johnson | | | | | | | x | x |
| 19. Cathedral Bluffs | | | | | | | x | x |
| 20. Rampart | x | x | | | | | | |
| 21. Porcupine | x | x | | | | | | |
| 22. Woodchopper | x | x | | | | | | |
| 23. Fortymile | | | | | | | x | x |
| 24. Yukon-Taiya | x | | | | | x | | |
| 25. Crooked Creek | x | x | | | | | | |
| 26. Nuyakuk | x | | | x | | | | |
| 27. Lake Iliamna | x | | | | | | | x |
| 28. Tazimina | | | | | | | x | x |
| 29. Ingersol | x | | | x | | | | |
| 30. Kukaklek | x | | | | | | | x |
| 31. Naknek | x | | | | | | | x |
| 32. Crescent Lake | x | | | | | x | | |
| 33. Chakachamna | x | | | | | x | | |
| 34. Coffee | x | | | x | | | | |
| 35. Upper Beluga | x | | | x | | | | |
| 36. Yentna | x | x | | | | | | |
| 37. Talachulitna | x | x | | | | | | |
| 38. Skwentna | x | x | | | | | | |
| 39. Lower Chulitna | x | | | | | | | x |
| 40. Tokichitna | | | | | | | x | x |
| 41. Keetna | x | | | | | | | x |
| 42. Whiskers | x | | | | | | | x |

## Initial Evaluating Effects of Project Development on Fish and Wildlife

| Project | Significant effects | | Minor effects | | Negligible effects | | Effects Unknown | |
|---|---|---|---|---|---|---|---|---|
| | fish | wildlife | fish | wildlife | fish | wildlife | fish | wildlife |
| 43. Lane | x | | | | | | | x |
| 44. Gold | | | x | | | | | x |
| 45. Devil Canyon | | | x | | | x | | |
| 46. Watana | | | x | | | x | | |
| 47. Vee | | | x | x | | | | |
| 48. Denali | | | x | x | | | | |
| 49. Snow | | | x | x | | | | |
| 50. Bradley Lake | | | | | x | x | | |
| 51. Lowe | | | x | x | | | | |
| 52. Million Dollar | x | | | | | | | x |
| 53. Cleave | | | | | | | x | x |
| 54. Wood Canyon | x | We have reported on mitigation possibilities and costs. | | | | | | |
| 55. Chilkat | | | x | | | | | x |
| 56. Lake Dorothy | | | | | x | x | | |
| 57. Speel Div. Snettisham | | | x | | | x | | |
| 58. Tease | | | | | x | x | | |
| 59. Sweetheart Falls Cr | | | x | | | x | | |
| 60. Houghton | | | | | | | x | x |
| 61. Scenery Creek | | | | | x | x | | |
| 62. Thomas Bay | | | x | x | | | | |
| 63. Stikine River | x | x | | | | | | |
| 64. Goat | | | | | | | x | x |
| 65. Tyee Creek | | | | | x | x | | |
| 66. Spur | | | | | x | x | | |
| 67. Leduc | | | | | | | x | x |
| 68. Rudyerd | | | | | x | x | | |
| 69. Punchbowl Creek | | | | | x | x | | |
| 70. Red | | | | | | | x | x |
| 71. Lake Grace | x | | | | | x | | |
| 72. Swan Lake | | | | | x | x | | |
| 73. Maksoutof River | | | | | | | x | x |
| 74. Deer | | | | | | | x | x |
| 75. Takatz Creek | | | | | x | x | | |
| 76. Green Lake | | | | | | | x | x |

## APPENDIX E

### Sample of Inventory-grade Hydroelectric Site Study

This appendix is included to provide a typical example of the data developed for a potential site included on the list of 76.

The appendix includes discussions on topography, geology, hydrology, estimates of power, descriptions of engineering features, and cost estimates.

### Project Snow

#### Location

The dam would be on the Snow River, river mile 8, latitude 60° 18'N, longitude 149° 16'W. The powerplant would be on the northeast shore of a small unnamed lake at latitude 60° 17'N, longitude 149° 19'W.

#### Topography

Damsite topography is available to the scale of 1:2,400 with 10-foot contours from the USGS river sheet "Snow River, Alaska." Reservoir topography is shown on the above sheets to the scale 1:24,000 with 20-foot contours.

#### Geology

A U.S. Bureau of Reclamation geologist conducted a surface geology reconnaissance of this site in June 1965.

The Snow River, at the damsite, flows in a deep, narrow gorge incised in bedrock on the floor of a steep-walled, U-shaped, glacial valley. Graywacke and slate are well exposed in the near-vertical abutments although thin overburden mantles portions of the upper left abutment. The beds strike nearly due north, normal to the canyon, and dip steeply upstream. Insofar as could be determined from the very brief aerial reconnaissance, geologic conditions are favorable for construction of a concrete dam at this site. However, a thorough ground examination is necessary to adequately appraise the foundation. A tunnel along the right valley wall would penetrate rock similar to that exposed at the damsite.

Construction materials could be obtained from the alluvial and glacial deposits along the lower reaches of the river near its confluence with South Fork Snow River 2 to 3 miles downstream of the site.

## Hydrology and Power Estimates

Drainage Area. The damsite has a tributary drainage area of 85 square miles. The mountainous basin lies north of Seward in the Kenai Mountains. The lower elevations support the growth of timber and other vegetation while the upper elevations contain numerous glaciers and the vegetal cover is sparse to non-existent.

Water Supply. Streamflows of the Snow River have been measured at a point upstream from the proposed damsite. The records from this gage "Snow River near Divide" are available from December 1960 to July 1965. These records were extended by a correlator with the records from the gage "Trail River near Lawing." The Trail River records are available from May 1947 to the present time.

The average annual streamflow at the damsite was estimated at 535,000 acre-feet, based upon the extensive Snow River gage records.

Power Estimates. The reservoir, with normal maximum water surface at elevation 1,200, would contain a total of 152,000 acre-feet of storage. The active storage capacity of 151,000 acre-feet would be sufficient to provide 75 percent regulation of the flows of the Snow River for power production. Average tail water elevation was assumed at elevation 500, yielding a new average head of 620 feet. The proposed development with an overall efficiency of 80 percent would be capable of producing 23,300 kilowatts of continuous power. The installed capacity would be 42,400 kilowatts with an assumed load factor of 55 percent.

## Plan

Three alternates were estimated with normal maximum water surface elevations of 1,150, 1,200, and 1,250 feet. Elevation 1,200 was determined to be the optimum water surface elevation.

A concrete arch dam would be built with the crest at elevation 1,210 and the base at elevation 900, for a maximum structural height of 310 feet, and a height above the river of 250 feet. The crest length would be about 820 feet.

The powerplant would be connected to the reservoir by 10,000 feet of 11-foot-diameter tunnel and 2,000 feet of 8-foot-diameter surface penstock.

The powerplant would house two generators of 21,200 kW each for a total installed capacity of 42,400. The generators would be driven by Francis-type turbines operating at 400 r.p.m. under an average head of 620 feet. Average tail water would be at about elevation 500.

The estimated construction cost of the major features of the selected plan based upon January 1967 prices are as follows:

| | |
|---|---|
| Dam | $23,500,000 |
| Powerplant | 6,800,000 |
| Tunnel | 6,500,000 |
| Penstock | 3,300,000 |
| Roads | 1,300,000 |
| Log Boom | 600,000 |
| General Property | 1,600,000 |
| Miscellaneous | 4,400,000 |
| TOTAL | $48,000,000 |

Cost per installed kW = $1,130

Remarks

The U.S. Geological Survey discussed this project in a report, Preliminary Report on the Waterpower Resources of Snow River, Nellie Juan Lake, and Lost Lake, Kenai Peninsula, Alaska, dated February 1961. This report discusses the geography, climate, water supply, and possible plan of development for this project. A cost analysis was not included.

HYDROLOGIC DATA

PROJECT: Snow

BY: RHL
DATE: 8/30/65

| ITEM | UNIT | VALUE |
|---|---|---|
| Drainage area | Sq. mi. | 84.7 |
| Streamflow records at site | Years | 4 (80 sq. mi.) 7/ |
| Average discharge | | |
| Recorded | Acre-ft. | 505,000 |
| | Cfs | 696 |
| Estimated 1/ | Acre-ft. | 535,000 |
| | Cfs | 738 |
| Inflow design flood | Cfs | |
| Spillway capacity | Cfs | |
| Diversion requirements | Cfs | |

| | Reservoir W.S. Elev. (ft.MSL) | Total Capacity (acre-ft) | Active Capacity (acre-ft) | Ave. Elev. (ft.MSL) 5/ | Ave. Head (ft) 2/ | Firm Water Supply (acre-ft) | Firm Power (kw) 3/ | Install. Cap. (kw) 4/ | % Reg. 6/ |
|---|---|---|---|---|---|---|---|---|---|
| | 1150 | 55,000 | 54,000 | 1117 | 587 | 187,000 | 10,300 | 18,700 | 35 |
| SE → | 1200 | 152,000 | 151,000 | 1150 | 620 | 401,000 | 23,300 | 42,300 | 75 |
| | 1250 | 355,000 | 354,000 | 1183 | 653 | 519,000 | 31,700 | 57,600 | 97 |

1/ Basis of estimate: Recorded flows of Snow R. & correlation with Trail R. nr. Lawing.

2/ Losses: $2\frac{1}{2}$ mi tunnel & penstocks - est loss 30'

Ave. tailwater elev. : 560'

3/ Plant efficiency: 80 %

4/ Load factor: 55 %

5/ Min W.S. elev. 1050'

6/ Ave. of storage-release diagrams for Kenai & Bradley R.

Sediment est. 1.2 AF/mi²/yr (by flow duration method).
This is negligible

7/ Published drainage area (USGS) is 99.8 sq mi. above the gage.
Figure of 80 mi² is from planimeter measurement on
1" = 63,600" quad sheets.

7-1654
(11-58)
Bureau of Reclamation

# COMPUTATION SHEET

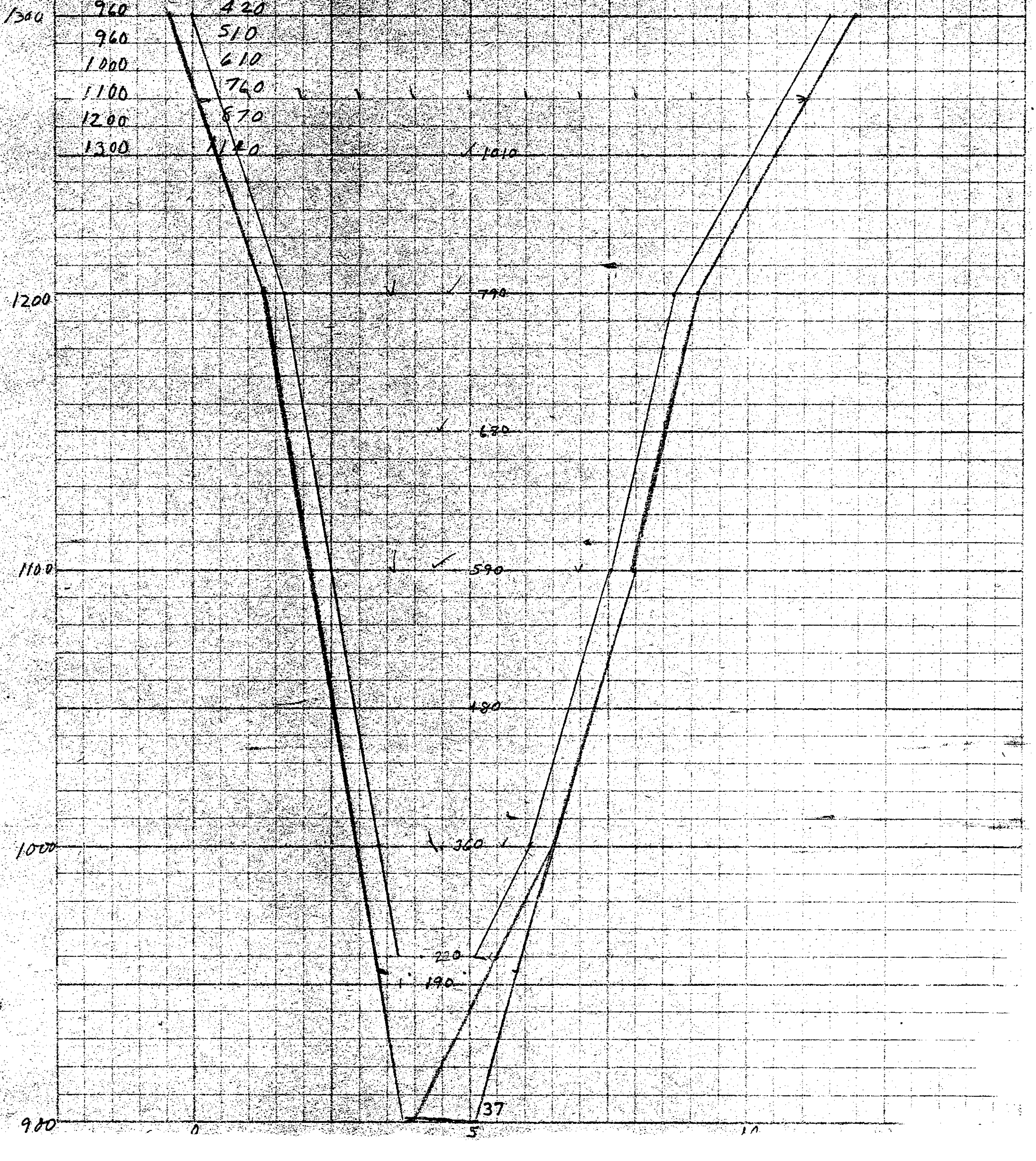
GPO 857747

BY SSt DATE 12/24/64 PROJECT Snow River SHEET No. ____ OF ____

CHKD BY ____ DATE ____ FEATURE Dam x-section JOB No. ____

OFFICE ____ DETAIL ____ FILE No. ____

| Elev | Sta |
|---|---|
| 1300 | 0 |
| 1200 | 170 |
| 1100 | 250 |
| 1000 | 330 |
| 960 | 420 |
| 960 | 510 |
| 1000 | 610 |
| 1100 | 760 |
| 1200 | 870 |
| 1300 | 1140 |



# COMPUTATION SHEET



BY CW DATE ______ PROJECT Snow SHEET No. ______ OF ______
CHKD. BY ______ DATE ______ FEATURE ______ JOB No. ______
OFFICE ______ DETAIL Dam Estimate FILE No. ______

| W.S. El. | Crest El. | $L_1$ | H | El. of $L_2$ | $L_2$ |
|---|---|---|---|---|---|
| 1150 | 1160 | 700 | 260 | 939 | 220 |
| 1200 | 1210 | 820 | 310 | 947 | 240 |
| 1250 | 1260 | 1050 | 360 | 954 | 250 |

W.S. El. 1150, Crest El. 1160, $L_1 = 700$; $H = 260$, $L_2 = 220$

$$V_1 = 2\times10^{-6}(260)^2 220\left[\frac{(260+0.8\times700)^2}{700-220}\right] = 29.75(1400) = 41600 \text{ cuyds}$$

$$V_2 = 4\times10^{-4}(260)700(260+1.1\times700) = 72.8(1030) = \underline{75{,}000 \text{ cuyds}}$$

116,600

Using Takatz Prices

$$F.C. = \frac{116{,}600}{29{,}000}\times4{,}430{,}000\times\frac{34}{50} = \$\underline{12{,}100{,}000}$$

W.S. El. 1200, Crest El. 1210, $L_1 = 820$, $H = 310$, $L_2 = 240$

$$V_1 = 2\times10^{-6}(310)^2 240\left[\frac{(310+0.8\times820)^2}{820-240}\right] = 46.1(1610) = 74100 \text{ cuyds}$$

$$V_2 = 4\times10^{-4}(310)820(310+1.1\times820) = 101.6(1212) = \underline{123200 \text{ cuyds}}$$

197,300 cuyds

Using Takatz Prices

$$F.C. = \frac{197{,}300}{29{,}000}\times4{,}430{,}000\times\frac{32.50}{50} = \$\underline{19{,}580{,}000}$$

W.S. El. 1250 Crest El. 1260 $L_1 = 1050$, $H = 360$, $L_2 = 250$

$$V_1 = 2\times10^{-6}(360)^2 250\left[\frac{(360+0.8\times1050)^2}{1050-250}\right] = 64.8(1800) = 11[illegible]500 \text{ cuyds}$$

$$V_2 = 4\times10^{-4}(360)1050(360+1.1\times1050) = 151(1515) = \underline{2[illegible]}$$

345,000

Using Takatz Prices

$$F.C. = \frac{345{,}000}{29{,}000}\times4{,}430{,}000\times\frac{31.25}{50} = \$\underline{3[illegible]{,}000{,}000}$$

7-1654
(11-58)
Bureau of Reclamation

# COMPUTATION SHEET

GPO 857747

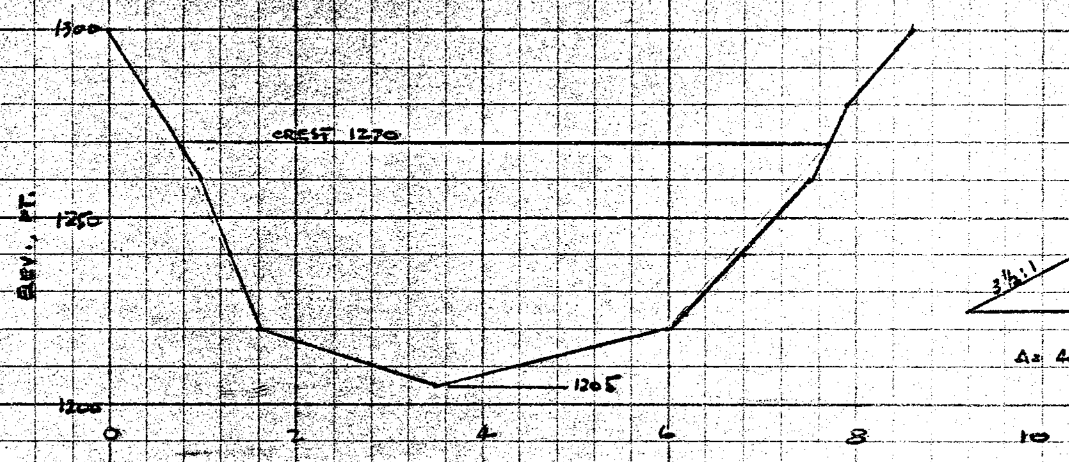
BY CGG DATE 4-5-66 PROJECT SNOW SHEET No. ____ OF ____

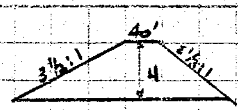
CHKD. BY ____ DATE ____ FEATURE INVENTORY JOB No. ____

OFFICE JUNEAU DETAIL DIKE COST FILE No. ____

DIKE REQUIRED IN SADDLE SE OF DAM. SADDLE ELEV. 1205 (SEE RIVER SHEET).

| ELEV. | STA. |
|---|---|
| 1300 | 0 |
| 1280 | 0+50 |
| 1260 | 1 |
| 1240 | 1+30 |
| 1220 | 1+60 |
| 1205 | 3+50 |
| 1220 | 6+00 |
| 1240 | 6+80 |
| 1260 | 7+50 |
| 1280 | 7+90 |
| 1300 | 8+60 |




A = 40H + 3H²

| STA. | H | 40H | 3H² | AREA | AVE AREA | DISTANCE | VOLUME |
|---|---|---|---|---|---|---|---|
| 0+70 | 0 | 0 | 0 | 0 | | | |
| | | | | | 4750 | 90 | 427,000 |
| 1+60 | 50 | 2000 | 7500 | 9500 | | | |
| | | | | | 12,388 | 190 | 2,390,000 |
| 3+50 | 65 | 2600 | 12,675 | 15,275 | | | |
| | | | | | 12,388 | 250 | 3,140,000 |
| 6+00 | 50 | 2000 | 7500 | 9500 | | | |
| | | | | | 4750 | 170 | 810,000 |
| 7+70 | 0 | 0 | 0 | 0 | | Total (ft³) | 6,767,000 |

FIELD COST = $5.20 x 250,000 = $1,300,000 Total (c.y.) 250,000

7-1654
(24-58)
Bureau of Reclamation

COMPUTATION SHEET

GPO 857747

BY SH DATE 1/14/64 PROJECT Snow ~~River~~ SHEET No. ____ OF ____
CHKD BY ____ DATE ____ FEATURE Tunnel Cost JOB No. ____
OFFICE Res GWL DETAIL Q = 670 FILE No. ____ Penstock L = 2,000

Length = 10,000'

1. Try 12' $h_f = 10 \times 1.7 \times .59 = 10.0'$

Ann. Value Energy Lost = $7.0 \times \frac{670}{11} \times .746 \times 8{,}760 \times .012 = \$33{,}400/yr$ 7.0' extra

$7.0K \therefore K = 4{,}770$

2. Try 11' $h_f = 17 \times 1.0 = \underline{17.0'}$

Energy lost = $11.9 \times 4{,}770 = \underline{\$56{,}800}$ 11.9' extra

3. Try 10' $h_f = 17.0 \times 1.7 = 28.9'$

Annual Tunnel Costs

1. 12' Cost = $10{,}000 \times 1.25 \times 619 \times 1.20 \times 1.05 \times .04 = \$390{,}000/yr$

$= 614K \therefore K = 630$

39,000/yr

2. 11' Cost = $630 \times 557$ = 351,000/yr

33,000/yr

3. 10' Cost = $630 \times 504$ = 318,000/yr

∴ Use 11'

Field Cost = $10{,}000 \times 1.25 \times \cancel{557}$ 420 = \$5,40?,?00 ~~7,000,000~~

7-1654
(11-58)
Bureau of Reclamation

# COMPUTATION SHEET

GPO 837747

BY SSL DATE 1/18/65 PROJECT ~~Snow Basin~~ SHEET No. ____ OF ____

CHKD BY ____ DATE ____ FEATURE Penstock Cost c JOB No. ____

OFFICE Rev Cost DETAIL Summary of Field Costs for 53,000 KW Plant FILE No. ____

A. Penstock (see 8') $h_f = 2{,}000 \times 1.7 \times 4.8 = 16.3'$

Field Cost = 2,000 × 1.20 × 1.25 × 700 × ~~0.9~~ 1.30 = ~~1,900,000~~ 2,740,000 ok

B. Dam = ~~29,900,000~~

C. Tunnel = ~~7,000,000~~

D. Powerplant = ~~7,000,000~~

E. Gen Prop 53,000 × 20 × 1.25 = 1,300,000 ok

F. Roads 3 mi @ 300,000 × 1.25 = 1,100,000 ok

G. Clearing 1,000 × 500 × 1.25 = 600,000 ok

Subtotal = 50,800,000

10% Misc = 5,100,000

$55,900,000

Const Cost = 67,100,000

Invest Cost = 70,500,000

Annual Energy Output = 254,400,000 KWh.

50 yr Value = 29,770

Annual OM&R = 53,000 × 2.25 × 2.40 = $286,000

50 yr Costs

Capital = 70.5 × 4.66 = 329

OM&R = .286 × 117.1 = 34

363

Mill Rate = $\frac{363}{29{,}770}$ = 12.2

All superseded except Penstock c roads & dam & tunnel!

COMPUTATION SHEET



BY Sff. DATE 8/31/65 PROJECT Snow SHEET No. ___ OF ___
CHKD. BY ___ DATE ___ FEATURE Powerplant Costs JOB No. ___
OFFICE Riv GWL DETAIL ___ FILE No. ___

1. 1150 $n = \frac{24.2 \times 535}{\sqrt{\frac{9350}{24.2}} \cdot 19.6} = 661$ use 600

2 units of 9,350 = 18,700

$\frac{KVA}{RPM} = 35$

~~Field Cost = 20 × 1,750,000 = 3,500,000~~
Using Grace Costs
$FC = \frac{1,750}{2040} \times 3,220,000 = \$2,760,000$

2. 1200 $n = \frac{24.9 \times 535}{\sqrt{\frac{21,150}{24.9}} \cdot 29.2} = 456$ use 450

2 units of 21,150 = 42,300

$\frac{KVA}{RPM} = 105$

~~Field Cost = 20 × 3,600,000 = \$7,200,000~~
Using Grace Costs

$F.C. = \frac{3600}{2040} \times 3,220,000 = \$5,680,000$

3. 1250 $n = \frac{25.6 \times 535}{\sqrt{\frac{28,800}{25.6}} \cdot 33.6} = 408$ use 400

2 units of 28,800 = 57,600

$\frac{KVA}{RPM} = 160$

~~Field Cost = 20 × 4,750,000 = \$9,500,000~~

Using Grace Costs

$F.C. = \frac{475}{204} \times 3,220,000 = \$7,490,000$

7-1654
(11-58)
Bureau of Reclamation

# COMPUTATION SHEET

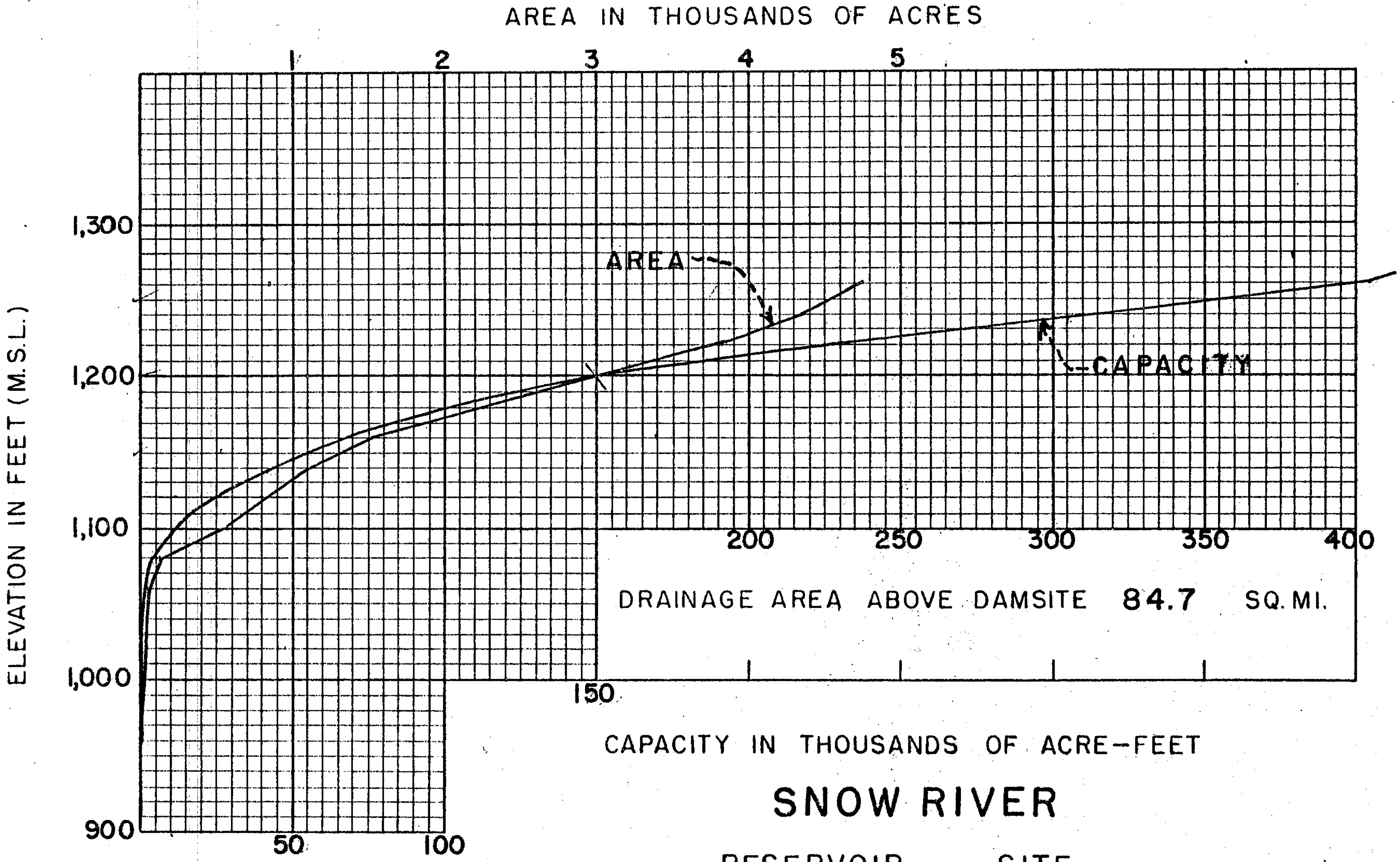
GPO 837747

BY CW DATE ____ PROJECT Snow SHEET No. ____ OF ____
CHKD BY ____ DATE ____ FEATURE ____ JOB No. ____
OFFICE ____ DETAIL Summary FILE No. ____

| | | | |
|---|---|---|---|
| W.S. El. | 1150 | 1200 | 1250 |
| Installed | 18,700 | 42,300 | 57,600 |
| Prime | 10,300 | 23,300 | 31,700 |
| Costs (1000) | | use | |
| Dam (Cowand) | 12,100 | 19,580 | 33,000 |
| Dike (CGL est) | — | — | 1,300 |
| Tunnel (RwSSL est) | 5,400 | 5,400 | 5,400 |
| Penstock (RwSSL est) | 2,740 | 2,740 | 2,740 |
| Powerplant (RwSSL est) | 2,760 | 5,680 | 7,490 |
| Roads (SSL est) | 1,100 | 1,100 | 1,100 |
| Clearing (SSL est) | 400 | 500 | 600 |
| Genprop (SSL est) | 1,300 | 1,300 | 1,400 |
| Sub total | 25,800 | 36,300 | 53,030 |
| 10% Misc. | 2580 | 3630 | 5303 |
| F.C. | 28,380 | 39,930 | 58,333 |
| C.C. | 34,000 | 47,900 | 70,000 |
| CC/inst kw | 1820 | 1133 | 1215 |
| I.C. | | 50,300 | |
| 50 yr. | | 234,000 | |

OM&R 2.25 × 42,300 × 2.90 × 117.1 = 32,400
kw hr/yr
266,400 = 11.15
Energy = 23,300 × 8760 × 117.1 23,900,000

3½% interest 43




# SNOW RIVER

RESERVOIR SITE

ALASKA RECONNAISSANCE

AREA & CAPACITY CURVES

ZERO AREA EL. 960

Seward (B-7)
1964
FROM U.S.G.S. TOPOGRAPHY
SCALE 1: 24,000

7-1654
(11-58)
Bureau of Reclamation

# COMPUTATION SHEET

GPO 857747

BY ______ DATE ______ PROJECT Snake River ______ SHEET No. ______ OF ______
CHKD. BY ______ DATE ______ FEATURE ______ JOB No. ______
OFFICE ______ DETAIL ______ FILE No. ______

Sediment load by Flow-duration method is 1.2 AF/mi²/yr.

84.7 x 1.2 x 50 = 5,100 AF / 50 years -- dissolves
Colorado 300 ppm -- sediment is negligible.

Water Supply ② ① ①/② drainage area

| | Trail R. 181 mi² | Snake R. 99.8 mi² | ①/② |
|---|---|---|---|
| 1948 | 602.2 | | |
| 9 | 523.2 | | |
| 1950 | 605.5 | | |
| 1 | 522.7 | | |
| 2 | 449.1 | | |
| 3 | 811.0 | | |
| 4 | 544.1 | | |
| 5 | 563.6 | | |
| 6 | 469.1 | | |
| 7 | 578.1 | | |
| 8 | 622.0 | | |
| 9 | 509.4 | | |
| 1960 | 597.3 | | |
| 1 | 676.3 | 531.0 | 78.5 |
| 2 | 478.2 | 463.4 | 96.8 |
| 3 | 532.6 | 428.6 | 80.5 |
| 4 | 591.4 | 596.5 | 101.1 |
| 61-64 Tot | 2278.5 | 2019.5 | 88.63 |
| 4 yr | | 505,000 | |
| 48-64 Tot | 9675.8 | | |
| 17-yr Ave | 569.2 | 504.5 | 88.63 |

Assume area at gage is 80 mi²

Runoff at dam = $\frac{84.7}{80} \times 504{,}500 =$
535,000 AF/yr.

Using Records thru 1963, Cooper estimated 490,000 AF/yr
Could increase this to 535,000 based upon above.
Corresponding increase in power production would be
about 5%, and change is not warranted.

ABC 8/26/65

7-1654
(11-58)
Bureau of Reclamation

# COMPUTATION SHEET

GPO 857747

BY ______ DATE ______ PROJECT Snow ______ SHEET No. ______ OF ______
CHKD BY ______ DATE ______ FEATURE ______ JOB No. ______
OFFICE ______ DETAIL ______ FILE No. ______

Ave R.O. is 535,000 AF/yr or 738 cfs.

| | | | |
|---|---|---|---|
| Alternate W.S. | 1150 | 1200 | 1250 |
| Active capacity | 59,000 | 151,000 | 359,000 |
| % regulation | 12.1 | 33.8 | 79.3 |
| % release | 35 | 75 | 97 |
| regulated release AF | 187,000 | 401,000 | 519,000 |
| cfs | 258 | 554 | 716 |
| Ave head (Coopers 12/23/64 comp) | 587 | 620 | 653 |
| Firm KW = 0.0678 Q H | 10,300 | 23,300 | 31,700 |
| Installed KW @ 55% | 18,700 | 42,300 | 57,600 |

Ave of Kenai R & Bradley R. storage release diagram

FORM 7-223A
(JULY 5)
BURE OF RECLAMATION

"2"

14

# HYDROGRAPHIC SCHARGE DATA

Run-off of Snow River near Divide (30-2435) Unit 1000 Ac-ft. Drainage Area 99.8 Sq.Miles

| YEAR | OCT. | NOV. | DEC. | JAN. | FEB. | MAR. | APR. | MAY | JUNE | JULY | AUG. | SEPT. | TOTAL | PERCENT MEAN |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1961 | 34.1 | 8.8 | 6.8 | 7.8 | 5.5 | 3.7 | 3.8 | 43.8 | 76.0 | 124.0 | 111.0 | 105.7 | 531.0 | |
| 1962 | 61.3 | 9.0 | 4.0 | 2.2 | 1.3 | 1.2 | 3.4 | 21.7 | 76.0 | 139.1 | 100.2 | 44.0 | 463.4 | |
| 1963 | 10.1 | 11.9 | 3.8 | 2.7 | 3.1 | 2.2 | 2.0 | 23.4 | 46.4 | 125.4 | 102.9 | 94.7 | 428.6 | |
| 1964 | 30.8 | 5.6 | 5.4 | 3.1 | 1.9 | 1.3 | 2.0 | 9.7 | 92.9 | 117.7 | 121.4 | 204.7 | 596.5 | |
| Total (3) | 102.2 | 26.5 | | | | | | | | | | | | |
| Ave. | 34.1 | 8.8 | | | | | | | | | | | | |
| TOTAL | | | | | | | | | | | | | | |
| MEAN | | | | | | | | | | | | | | |
| PERCENT | | | | | | | | | | | | | | |

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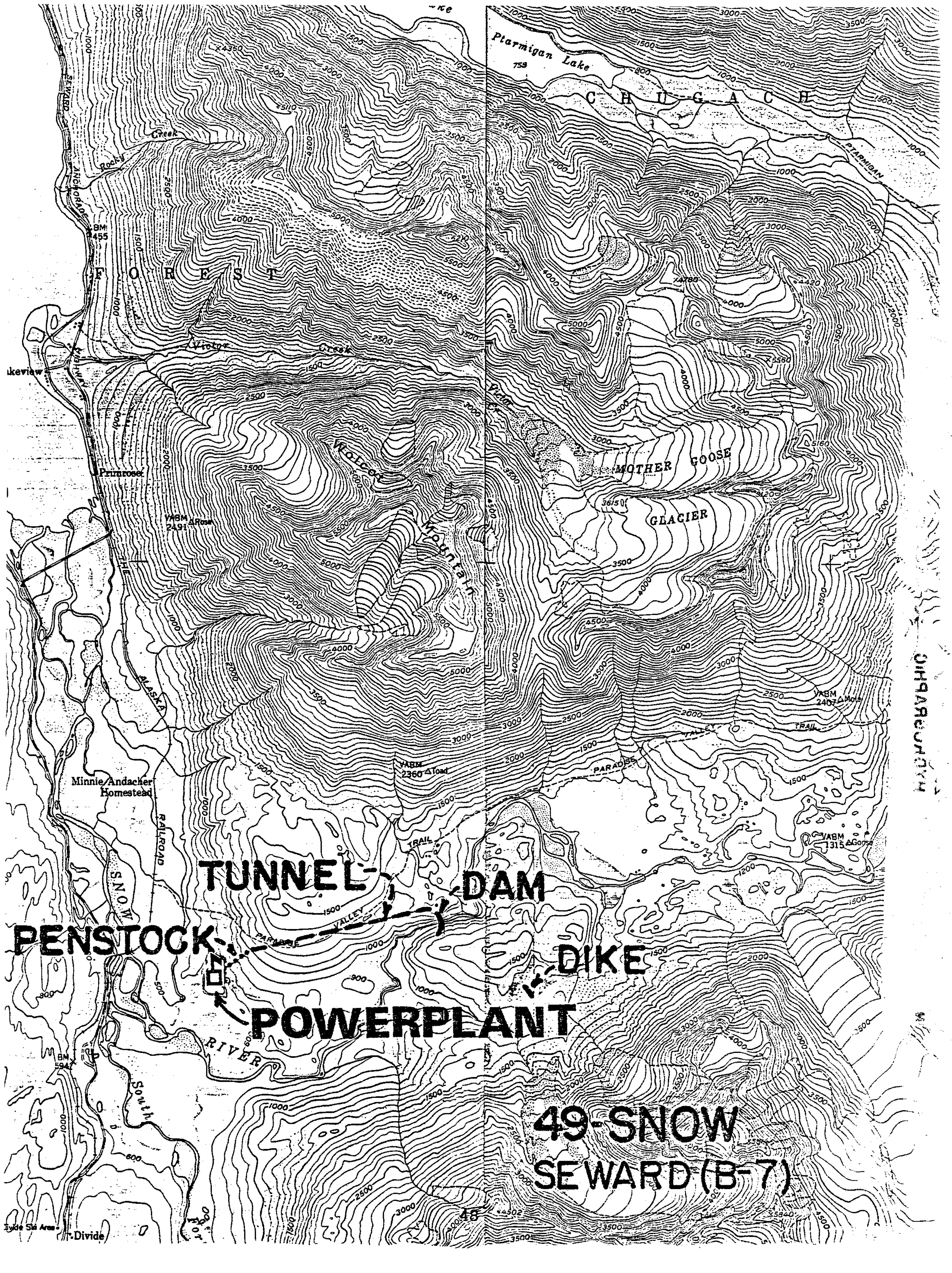
GPO 845247


TUNNEL
DAM
PENSTOCK
DIKE
POWERPLANT
49-SNOW
SEWARD (B-7)
Ptarmigan Lake
CHUGACH
FOREST
Rocky Creek
Victor Creek
MOTHER GOOSE
GLACIER
Primrose
Minnie Andacker Homestead
ALASKA
RAILROAD
SNOW
RIVER
South
PARADISE
VALLEY
TRAIL
Divide

APPENDIX F

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