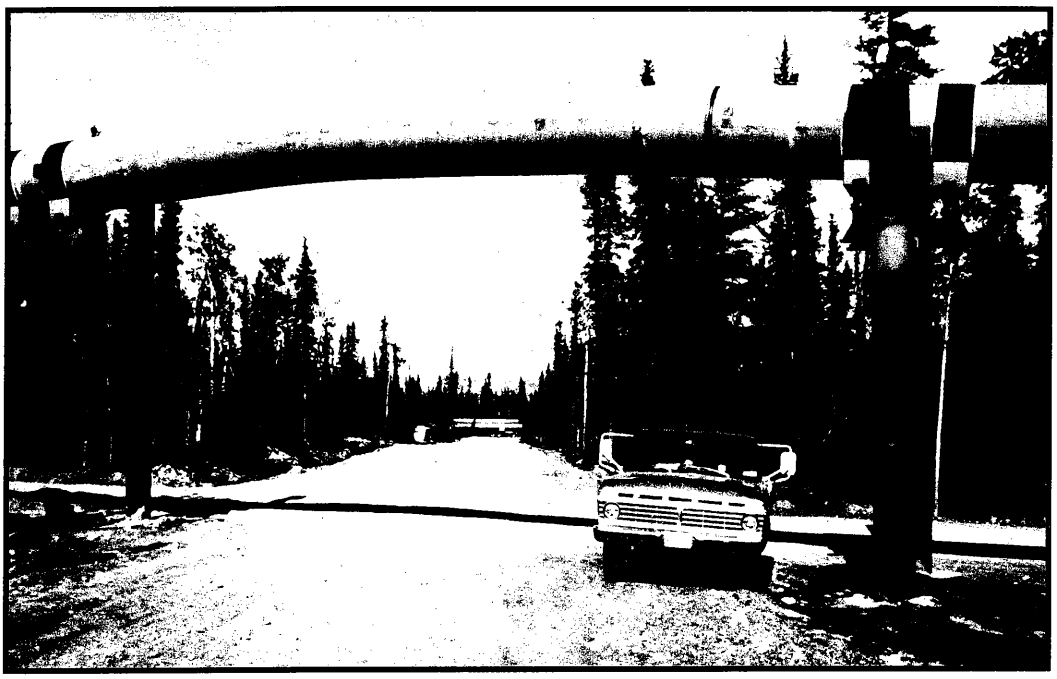
X. CIVIL PROJECTS

NATURAL RESOURCE DEVELOPMENT IN ALASKA

Since the late 19th century, Alaska has inspired a variety of images. When the United States acquired the region in 1867, many Americans envisioned the Far North as a worthless "icebox." This perception quickly gave way to the image of a storehouse of natural resources. By the early 20th century, boosters had promoted Alaska as the "last frontier." This idea, according to historian Peter A. Coates, remained as "frozen and uncompromising as the icebox myth." It also spawned conflicting objectives for the state's natural resources during the modern period. Those in favor of development regarded Alaska as a "cornucopia of wildness so overwhelming and inexhaustible no amount of human effort could alter its essence." Environmentalists, on the other hand, "portrayed Alaska as a pristine and indivisible wilderness, a mental entity as much as geographical reality, which a single act of development — such as TAPS — threatened to violate irrevocably in both a material and, just as importantly, a symbolic sense." Both developers and environmentalists regarded Alaska as their "last chance to do things right."[1]

Alaska's undeveloped natural environment formed the basis of both positions. In planning and constructing its civil projects in the Far North, the Corps was forced to contend with these perceptions. The image of abundance encouraged development, which conflicted with the desire to keep the natural environment inviolate. As a result, many of the Corps' civil projects during the modern period proved to be controversial.



Trans-Alaska Pipeline System.

"THINKING BIG" DURING THE MODERN ERA

The enormous size and scale of Alaska's natural resources continued to inspire grandiose plans in the 1970s and 1980s. "If you don't think big," Colonel Robert Reiner of the Corps explained in 1977, "you don't accomplish big things."[2] Alaska Governor Walter Hickel agreed. "Basically, in the arctic world you have to have big projects," he pointed out.[3] In particular, some Alaskans dreamed of exporting water and hydropower. Among the ideas considered during the modern period was the transport of Alaskan icebergs to the dry areas of the world, where they would be used as free-floating reservoirs. Scientists from the Corps' Cold Regions Research and Engineering Laboratory, based in New Hampshire, helped pioneer the iceberg studies in the mid-1970s.[4]

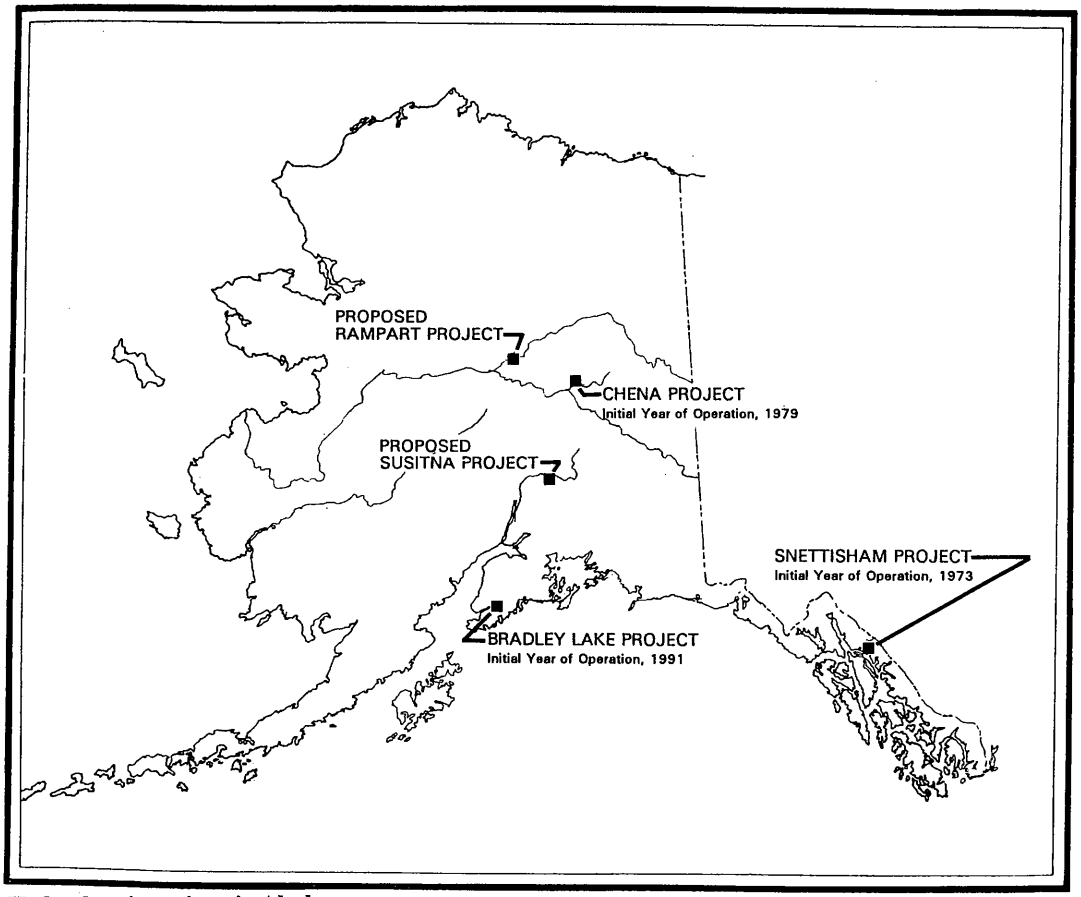
Another idea involved shipping water from Alaska to the Lower 48 and Mexico. During the 1960s, the North American Water and Power Alliance (NAWAPA), as noted, proposed the creation of a 500-mile reservoir stretching from British Columbia to Idaho. By the late 1970s, water and energy shortages had brought a new urgency to the issue. Colonel Reiner conceded that "a project of this scope is mind-boggling to most people. However, that kind of investment would benefit the nation greatly in the long run." Reiner suggested that the

project be completed in increments. Still, Nathan W. Snyder, chief scientist for the California engineering firm that proposed the idea, noted that the "environmental impact of the entire project would be immense." Owing to the protests of environmentalists as well as to the staggering costs, the project did not advance beyond the planning stage.[5]

WATER RESOURCES DEVELOPMENT

Although Alaska offered a variety of natural resources, water remained one of the most attractive during the modern period. As Major General Wesley G. Peel of the North Pacific Division explained in 1978, "Alaska has the greatest hydropower potential of any state."[6] In the 1980s, another Corps official noted that "we've got more lakes, more riverfront, more coastline ... than most of the rest of the states combined. Furthermore, unlike our sister states, we have far more development *ahead* of us than *behind* us."[7] Development of the state's waterways dated from the Flood Control Acts of 1948 and 1950, which authorized the Corps to conduct surveys with a view to navigation and power improvements. At this time the Department of the Interior also funded its own dam-building agency, the Bureau of Reclamation, to study the potential of Alaska's water resources. As noted earlier, to summarize its survey of water resources in the Far North, the Corps produced a series of reports, issued as House Documents, from 1954 to 1964. These reports emphasized the potential for hydroelectric development, particularly on the Yukon River and around Juneau. From the late 1950s to the 1980s, the Corps pursued hydroelectric projects outlined in the reports. In fact, many of the water resources development projects of the period 1975-1992 originated in earlier decades.

The most notable of these included Rampart, Susitna, and Snettisham hydroelectric projects and the Chena River Lakes Flood Control Project. The Rampart and Susitna dams became significant for the controversies they sparked, and they were not constructed. The Snettisham Hydroelectric Project and the Chena River Lakes Flood Control Project were constructed, and served as a source of pride for many Corps employees.[8]



Hydroelectric projects in Alaska.

RAMPART DAM PROPOSAL

The proposal to dam the Yukon River at Rampart Canyon, which had appeared in Alaska before statehood, persisted throughout the 1970s. [For additional information see chapter 6.] Bill Oakes, Chief of Specifications at the Alaska District, recalled that the project continued to be reviewed "from time to time."[9] In 1975, Congress directed that the economic feasibility of the project be restudied.[10] Attitudes within the Corps were diverse. Charles Welling, a retired economist with the Alaska District, denounced the project as "absolutely stupid" and impractical.[11] Other Corps officials, however, suspected that it was "marginally justified." In 1978, Walter B. LaBerge, Acting Secretary of the Army, informed the Senate Committee on Environmental Public Works that "Further consideration of the Rampart Canyon project will be constrained by evolving State and Federal land use and environmental policies." Although the need for power in Alaska continued to increase, he noted that other public and private

projects would meet the immediate needs, with fewer costs and less environmental damage.[12]

SUSITNA HYDROELECTRIC PROJECT

Like the proposal to build Rampart Dam, plans to develop hydropower in the Susitna River Basin were ambitious. "The word for this project," reported the *Fairbanks Daily News-Miner* in 1982, is "Big."[13] As Senator Michael Gravel, a proponent of the project, observed with pride, "it would be built in the shortest period of time, 15 years, of any such project and would be the largest constructed in the free world."[14] Critics, however, viewed the dam proposal as "monstrous."[15] Reactions to the proposed Susitna Hydroelectric Project throughout the 1970s and early 1980s reflected two conflicting objectives for Alaska: to retain the state's sparse population and vast wilderness and to accommodate the growth that some residents viewed as inevitable and desirable. The controversy sparked by this project indicated the continued strength of both positions.

Dam builders found the Susitna River's topography and location especially appealing. The river offered high volumes of water flowing through a deep canyon near Alaska's "railbelt," an area extending from Fairbanks southward through the Kenai Peninsula. This region, linked by the Alaska Railroad, supported three-quarters of the state's population. The Susitna River, moreover, flowed between Alaska's two major cities, Anchorage and Fairbanks. Their populations grew unusually rapidly, increasing 90 percent between 1961 and 1975, primarily owing to the construction of the TAPS.[16] Estimates of future power needs for these cities assumed that the population growth would continue, adding to the appeal of damming the Susitna River.

The Corps' interest in Alaska's railbelt dated from the 1950s, when the agency's survey of water resources projected a power shortage for the Anchorage area. The Bureau of Reclamation, too, studied potential power sites in the Susitna River Basin in 1948, 1952, and 1961. In the early 1960s, this agency recommended construction of two dams and two reservoirs on the Susitna River in Devil Canyon. The Alaska Power Administration (APA) and Kaiser Aluminum also investigated the area's suitability for hydroelectric development.[17] During the 1960s, developers had promoted the Susitna Project as a smaller alternative to Rampart Dam. When plans to develop the Yukon River were shelved, interest in the Susitna River increased.[18]

In 1972, a Senate Works Committee resolution requested that the Alaska District conduct a comprehensive study of potential sites in the railbelt. Accordingly, the Corps reassessed the Susitna Project in a Feasibility Report that recommended construction of two dams: an 885-foot earth-filled structure at Watana, and a 645-foot concrete arch dam at Devil Canyon. The two-dam system would inundate more than 50,000 acres, extending 84 miles upstream. Advantages of the project included the annual production of power equivalent to 15 million barrels of oil and increased access for recreation. The Alaska District hired Jones & Jones, an independent architecture and engineering firm, to evaluate the environmental, aesthetic, and recreational resources of the Susitna River. This study provided background for the EIS, which the Corps publicized and circulated for comment.

In the mid-1970s, the Alaska District encouraged public participation in the evaluation process, as required by NEPA. Corps officials met with agencies and individuals in Fairbanks and Anchorage. "Public involvement is needed in a matter such as this," explained Alaska District Engineer Colonel Charles A. Debelius in 1975. "It involves millions of dollars and affects living and working conditions for years in the future."[19]

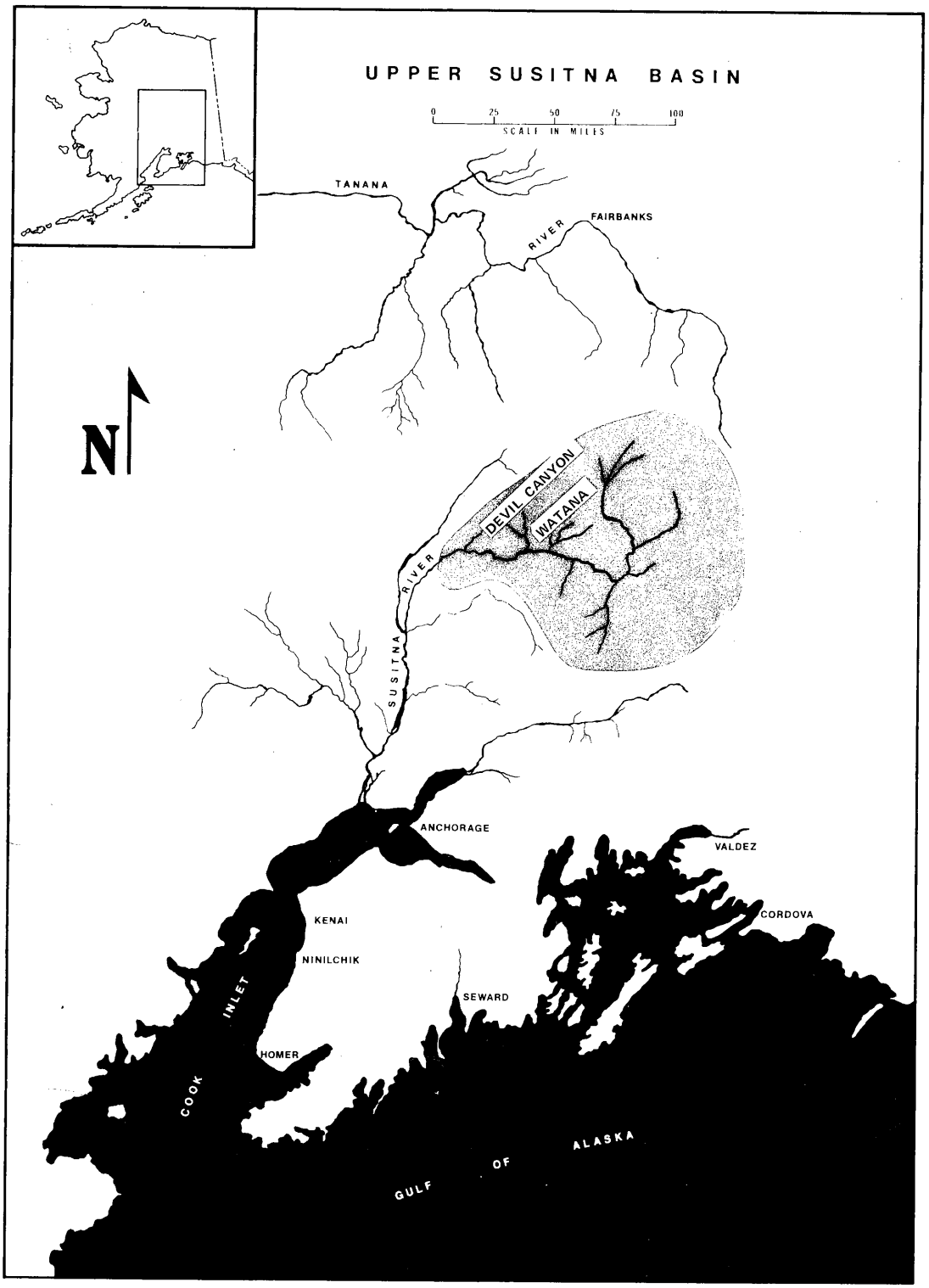
Watana site on Susitna River, 1979.

The public meetings revealed a variety of attitudes. One longtime resident, the owner of a modern house on a homestead claim, explained the advantages of modern conveniences. "I've come a long way in 40 years out of that trapping cabin," he noted, "and I'm pretty much oriented to electricity all the way around."[20] Another public meeting participant, who had promoted Rampart Dam, argued that the Susitna Project was needed in an era of fuel shortages. "Electrical power consumption in the United States," he pointed out, "is [on] a steady curve upward." Echoing a frontier sentiment, he also warned that the citizens of the Far North had endured "exactly enough interference from anybody from the Lower Forty-eight in what we Alaskans want." In summation, he added, "It is none of my business what they do down there, and it is none of their business what we do up here."[21]

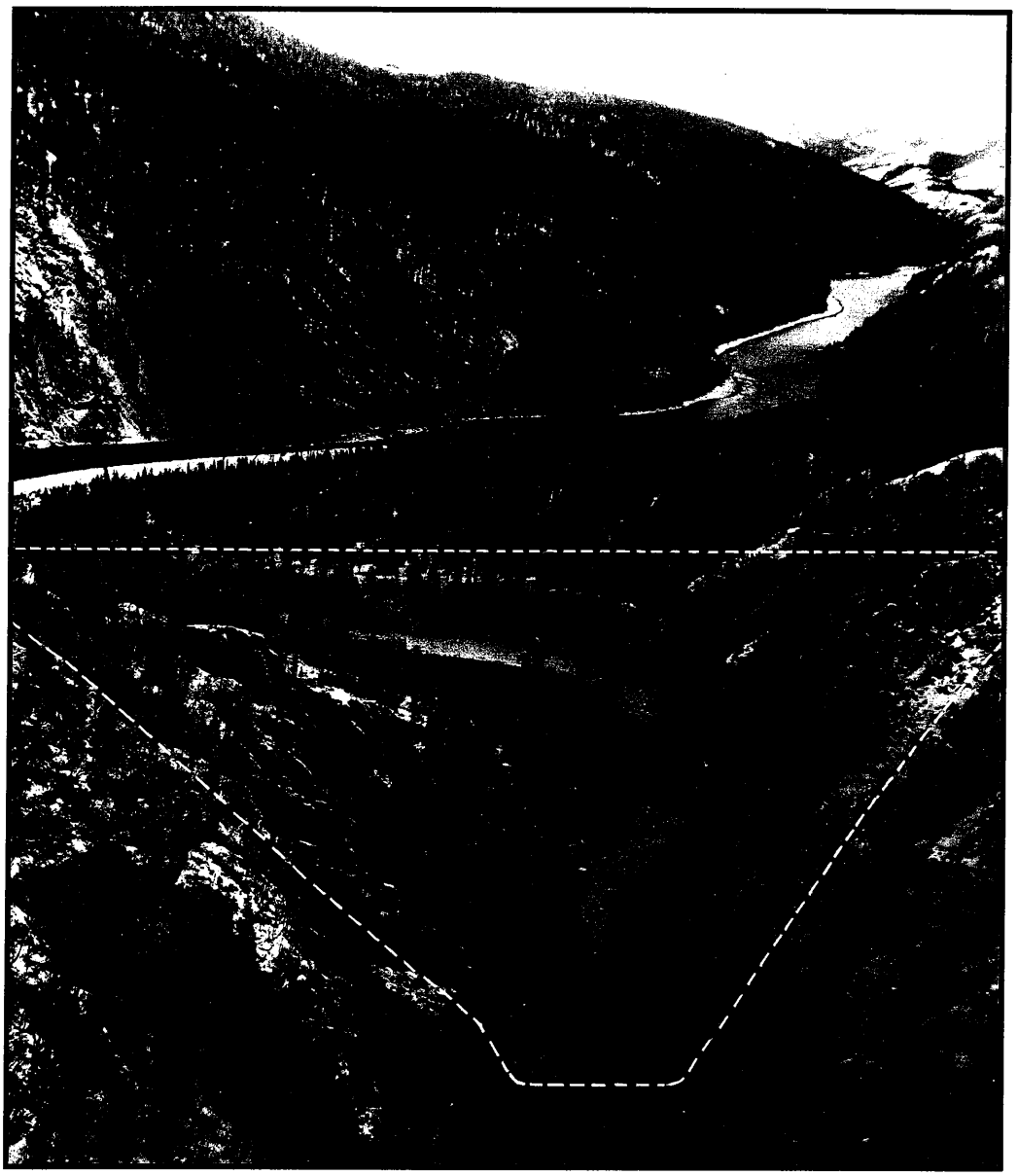
Much of the opposition to the Susitna Project, however, originated in Alaska, where critics questioned the need for more power in the railbelt. Some wished to preserve the qualities — including a relatively small population and undeveloped land — that had initially attracted residents to the Far North. As one observer informed the Corps, "Most Alaskans *are* Alaskans precisely because of the lack of dams, freeways and other ... encroachments."[22] Other residents worried about the effect of the reservoirs on the area's migrating wildlife, including caribou and salmon.[23]

Additional protests focused on the wild and scenic qualities of the Susitna River, which had developed a reputation as "the Mount Everest of kayaking." Opponents also voiced concerns that the dams would be located in one of the most active seismographic regions in the world.[24] Army Engineers in the Alaska District, however, assured residents that "If we find that [dams are] going to endanger lives, no way are we going to build them."[25]

In general, the Corps' compliance with NEPA regulations gained the agency some favor with the environmental community, in Alaska and the Lower 48. "We've been discouraged by past proposals made by the Corps, particularly the Rampart Dam proposal," noted three opponents of the Susitna Project in 1975. "We're more encouraged by the Susitna Dam project, which demonstrates more thorough research and more attention to environmental impacts than the preceding studies."[26] Similarly, protesters recognized that some engineers in the Alaska District had developed "environmental consciousness and conscience."[27]

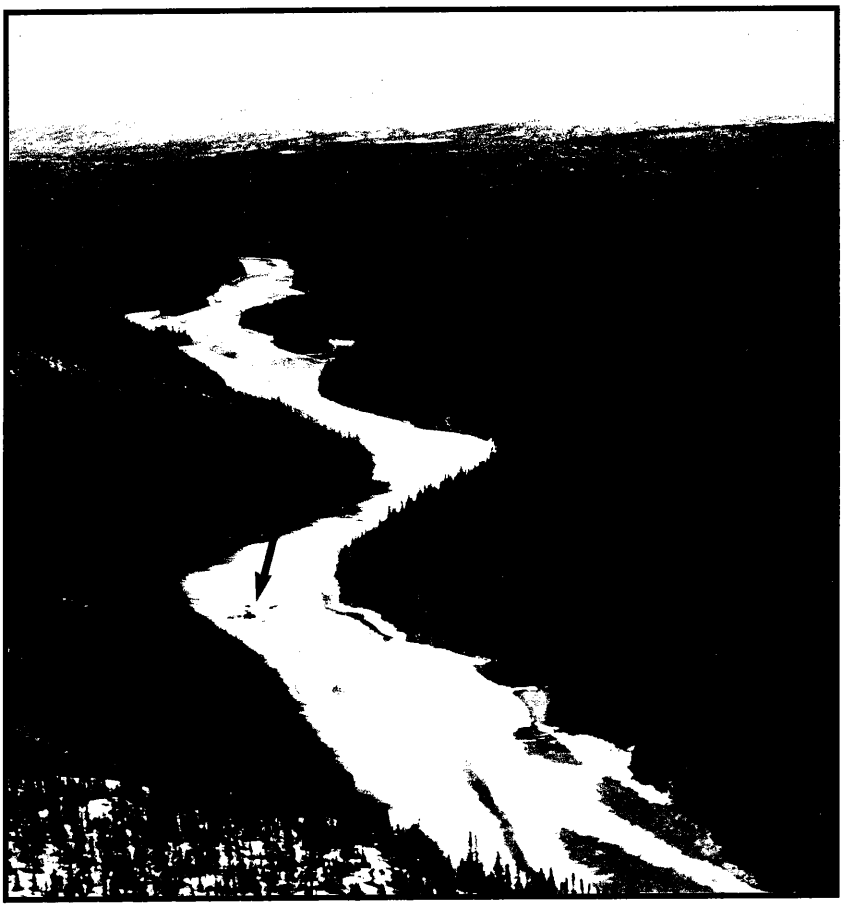


Proposed Susitna Hydroelectric Project.



Proposed dam at Devil Canyon, 1975.

In 1977, the Corps finalized the EIS, which it forwarded to the Office of Management and Budget (OMB). From this point, the project encountered a number of obstacles. The OMB directed the Alaska District to conduct additional investigations of seismic data and the economic effects of the project. To accomplish this task, the Corps reached an agreement with the Bureau of Land Management concerning environmental precautions and archaeological surveys.



Susitna River, looking downstream. Arrow indicates drill site for the proposed dam at Watana.

A series of public meetings marked the onset of negotiations. Afterward, the two agencies developed 18 stipulations for the onsite work, which included archaeological surveying, cooperation with the USFWS to protect endangered and threatened species, and minimizing ground disturbance. Crews were flown to the site, eliminating the need to construct temporary housing. When the ground froze, the Corps used special vehicles equipped with low-pressure tires to avoid damage to the site. Most equipment, however, was delivered by air. In 1978, the Alaska District completed its supplemental report, which it again submitted to the OMB. This report indicated an increase in costs from $1.5 to $2.3 billion.[28]

Additional complications for the Susitna Project stemmed from proposed legislation in the late 1970s to accord wilderness status to much of Alaska's lands. Supported by Secretary of the Interior Cecil B. Andrus, this bill would have withdrawn large sections of wilderness from development and would have designated

the Susitna a Wild and Scenic River. The famous "d(2)" clause of Section 17 of the Alaska Native Claims Settlement Act of 1971 had allowed the federal government to set aside "national interest" lands in the Far North, presenting opportunities for creation of wilderness areas.[29] If the Alaska Wilderness Bill passed, Senator Michael Gravel warned in 1978, "we can kiss the Susitna dam project goodbye."[30] He joined Alaska Congressman Don Young in protesting the proposed withdrawal of the Susitna as a Wild and Scenic River. In their estimation, this waterway flowed through the prime hydroelectric site in Alaska. They pointed out that hydropower provided a clean, renewable resource, and predicted that the railbelt would soon suffer from an energy shortage.[31] "Alaska needs Devil Canyon power," Gravel had argued to the Alaska Legislature in 1976. "We need it built now. This project presents the first meaningful effort to impact favorably our high cost of living."[32]

Opponents of the Susitna Project, including the Alaska Center for the Environment, argued that existing natural gas and coal-fired plants remained sufficient to meet anticipated energy needs. They also charged that the Susitna Project, like Rampart Dam, would produce more energy than Alaskans needed. Some feared that the additional energy would encourage unplanned growth in their state. "Coal has the advantage of providing energy as demand increases," argued one spokesperson for the Alaska Center for the Environment in 1978. "Hydro, on the other hand, supplies a great block of energy all at once. If faced with excess energy, the Alaska Power Authority will have to encourage industry to the area to absorb the excess."[33] Environmental opposition remained so strong that the Water Coalition Review, a group of national organizations, denounced the proposed Susitna Project as one of the worst disasters in water development.[34]

Owing to the Carter Administration's reluctance to fund new water projects, Alaska's politicians and dam promoters encouraged the state, rather than the federal government, to finance hydroelectric development. To that end, Senator Michael Gravel had promoted the Alaska Hydroelectric Power Development Act, which was passed in 1976. This legislation authorized the Corps to serve as a contractor for the state in conducting feasibility studies as well as construction of hydroelectric projects. Alaska then passed legislation authorizing the sale of $8 million in state bonds, to finance the early phase of work on Susitna. In 1978, the Corps completed the final Susitna Plan of Study, and the Alaska Power Authority, a state agency, assumed responsibility for the project.[35] Eric Yould, its

director, did not believe that Alaska could finance the feasibility study on its own. At that time the Internal Revenue Service presented an additional obstacle by opposing the state's plan to use the $8 million as collateral to borrow more funds.[36]


The Anchorage Times

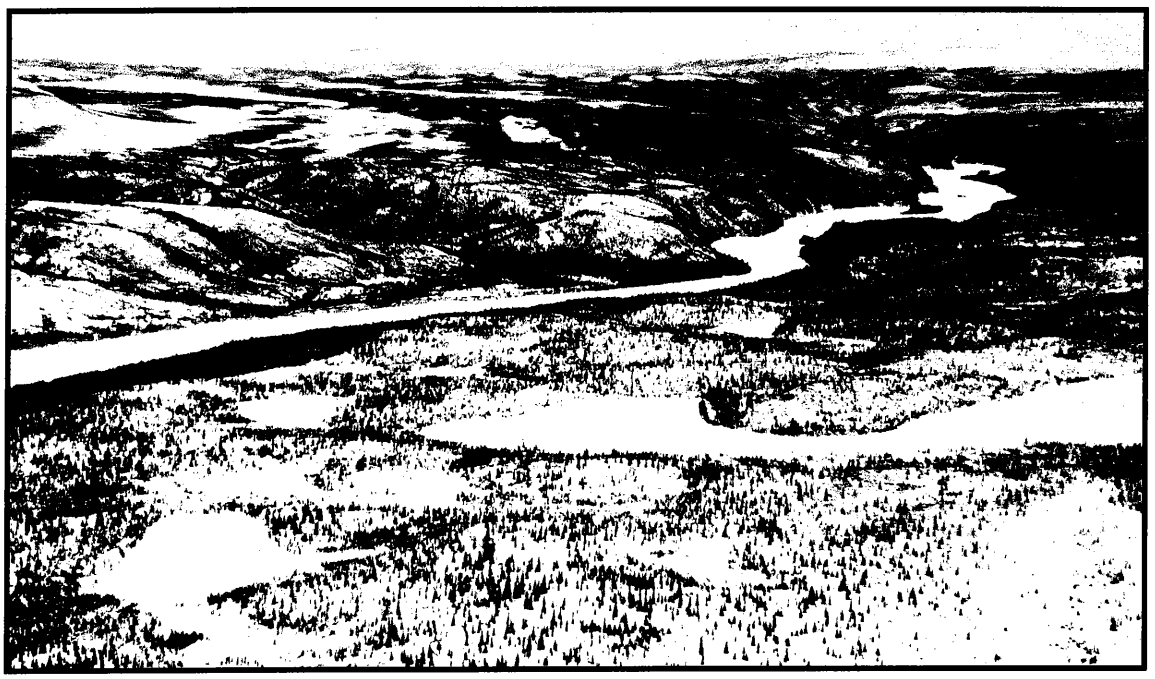
SUSITNA DAM BILL PASSES

Ford Gets Omnibus Measure

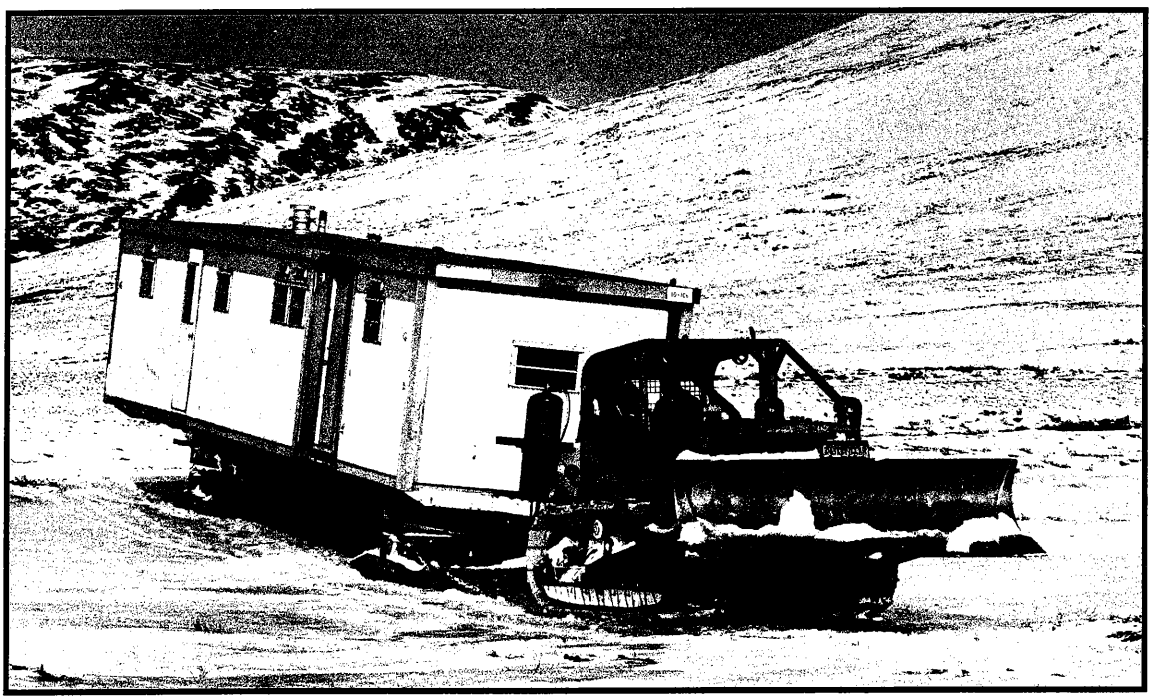
Good Morning

By 1983, Alaska had filed a license application with the Federal Energy Regulatory Commission (FERC). At that time, Susitna became the largest project ever reviewed by this agency. While other hydroelectric projects in the Lower 48 generated more electricity, Susitna remained, according to the *Fairbanks Daily News-Miner*, "the most costly and complex." In 1983, projected expenses for this project totaled $5.2 billion, or $11,500 for every resident of Alaska. Bill Wakefield, a former Corps employee who served as the Susitna Project manager for FERC, pointed out that the proposal to dam the river had retained its "high visibility," or "politically sensitive" nature. Throughout the early 1980s, the project continued to spark disputes between development interests and environmentalists. "Controversy is not unique to this type of project," Wakefield noted, "but the fervor or depth of arguments is."[37] Owing to the considerable expense and controversy, plans to dam the Susitna River remained unauthorized, and in the mid-1980s, the state decided to drop the project.

Eric Marchegiani, a civil engineer with the Alaska Power Authority, recalled that this decision was based for the most part on questions regarding the project's financing. "We were working through other problems," he noted, which included the impacts to the area's fish and caribou populations. The Alaska Power Authority, he pointed out, had consulted with the USFWS, Alaska Department of Fish and Game, and the National Marine Fisheries Service in the development of mitigation measures. He remembered that even environmentalists focused on economic issues in their arguments against the project.[38] Some residents who worked for the Alaska District during its study of the Susitna River remained wistful about the project. As retired Corps economist Charles Welling put it, "Susitna should have been built. Anchorage needs the power."[39]

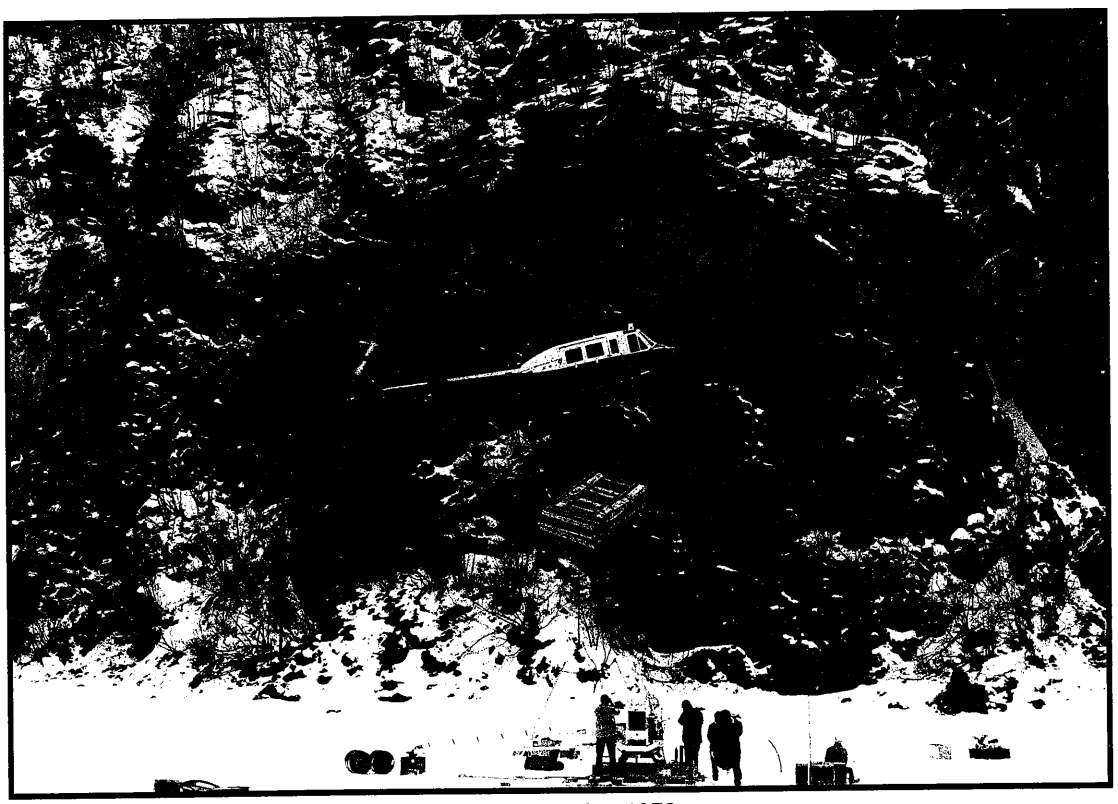


Upper Susitna River.

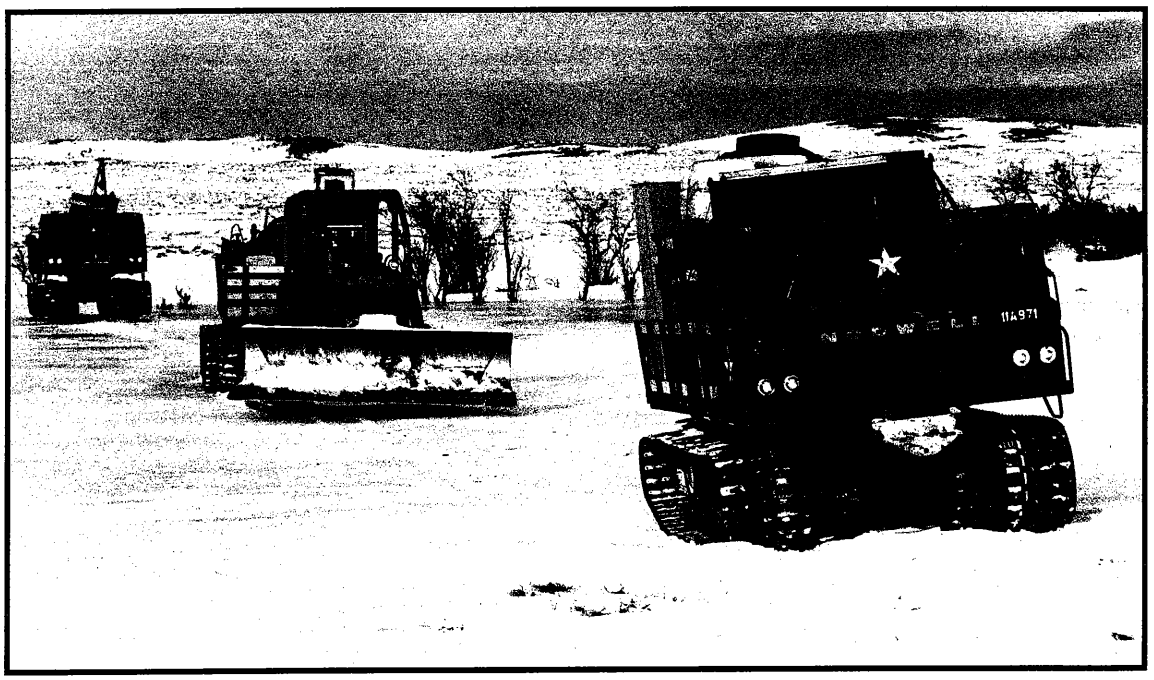


This house trailer, hauled to the work site on a sled, served as an office and emergency shelter.

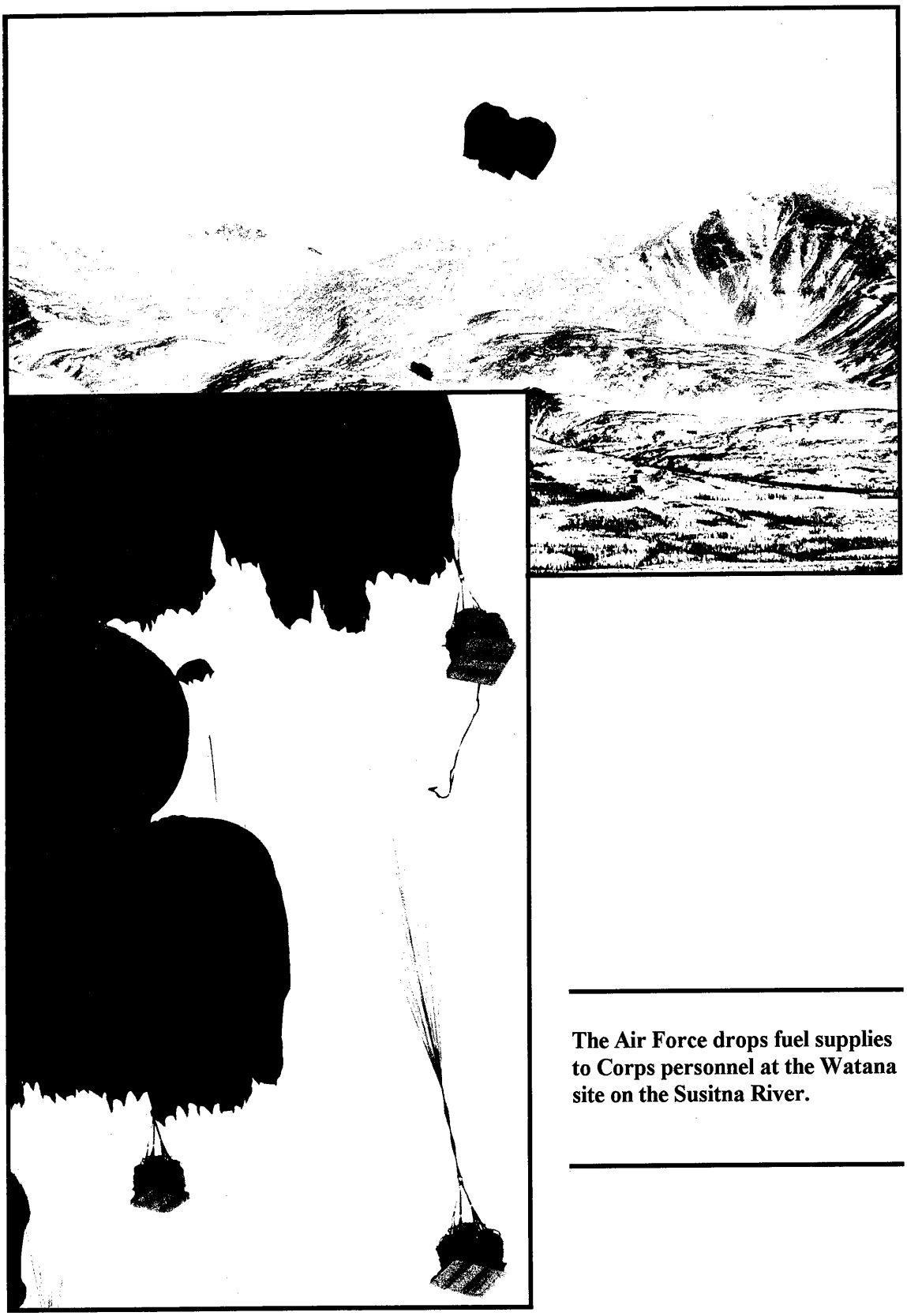
Bill Burgess, Corps Field Representative for the project.



The Corps airlifted lumber to this Watana drilling site, 1978.

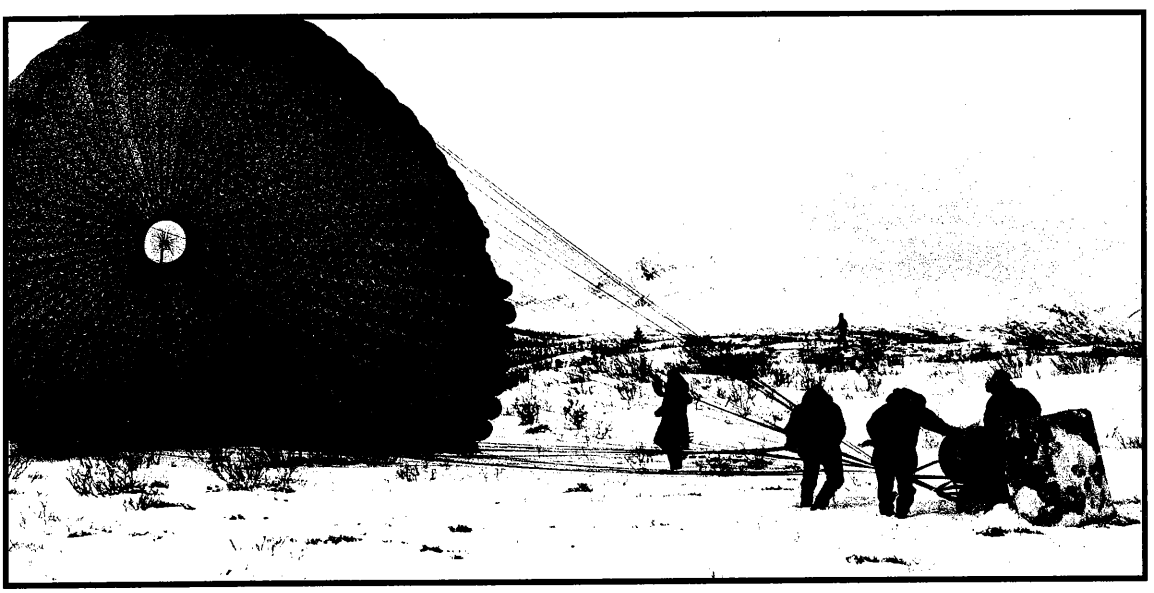


The Corps used Nodwells and bulldozers for geological exploration of the Upper Susitna River. The terrain included frozen lakes and ponds.



The Air Force drops fuel supplies to Corps personnel at the Watana site on the Susitna River.

During March and April, 1978, the Air Force delivered some 18,000 gallons of gasoline and diesel fuel by parachute to the Watana area of the upper Susitna River. The Corps of Engineers used the fuel to power drilling equipment taking rock core samples at the dam site.



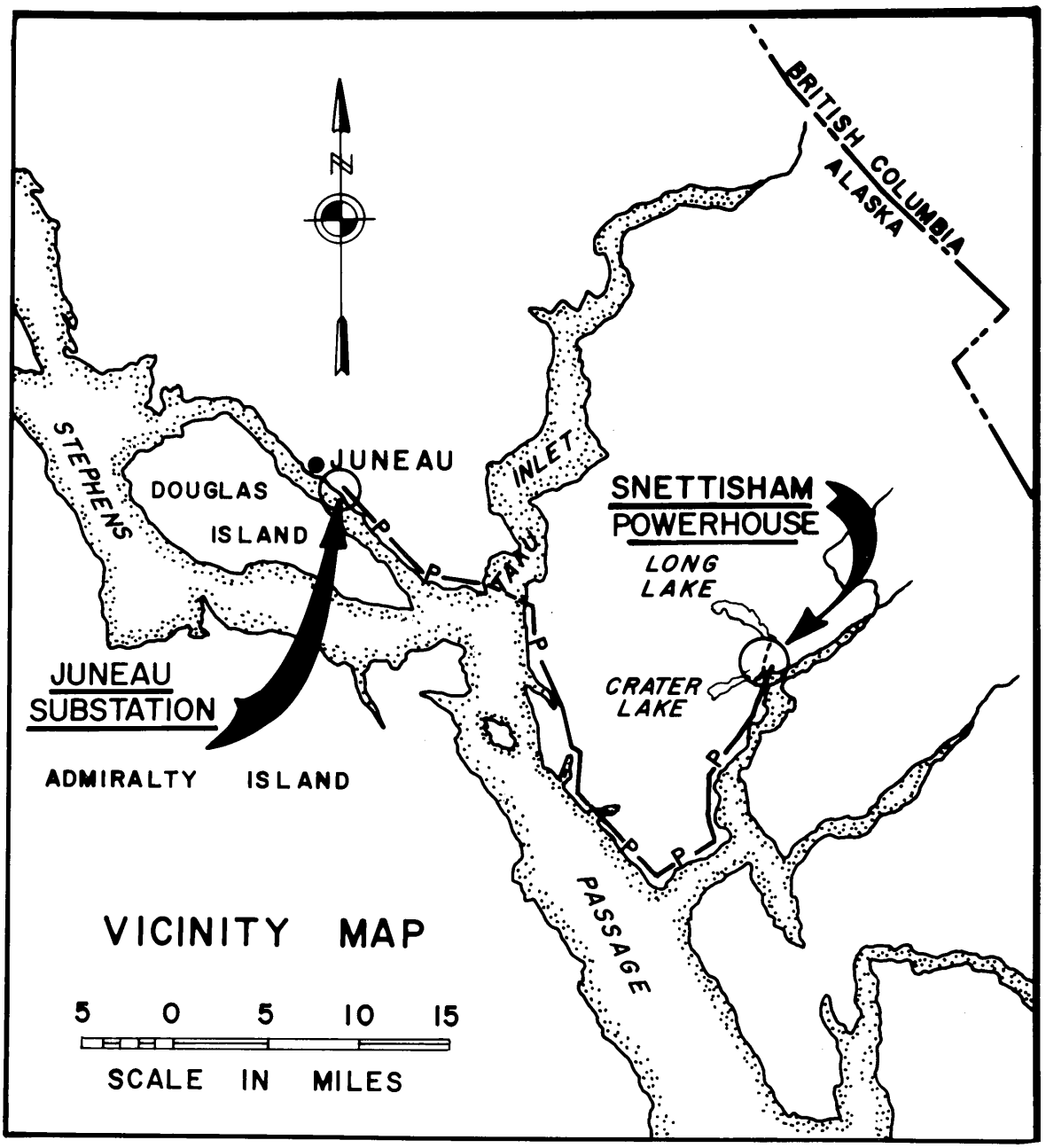
SNETTISHAM HYDROELECTRIC PROJECT

Following completion of the first phase of the Snettisham Project, during the 1970s, the Alaska Power Administration, a federal power marketing agency, assumed responsibility for operation and maintenance. [For additional information see chapter 6.] With the APA's cooperation, the Alaska Department of Fish and Game constructed a salmon hatchery at the Snettisham Project during the mid-1980s. This facility, which utilized water from the tailrace of the Snettisham Project, established an artificial run of several Pacific salmon species, benefitting the area's commercial fishing industry.[40] By 1994, the hatchery had continued to operate successfully.[41]

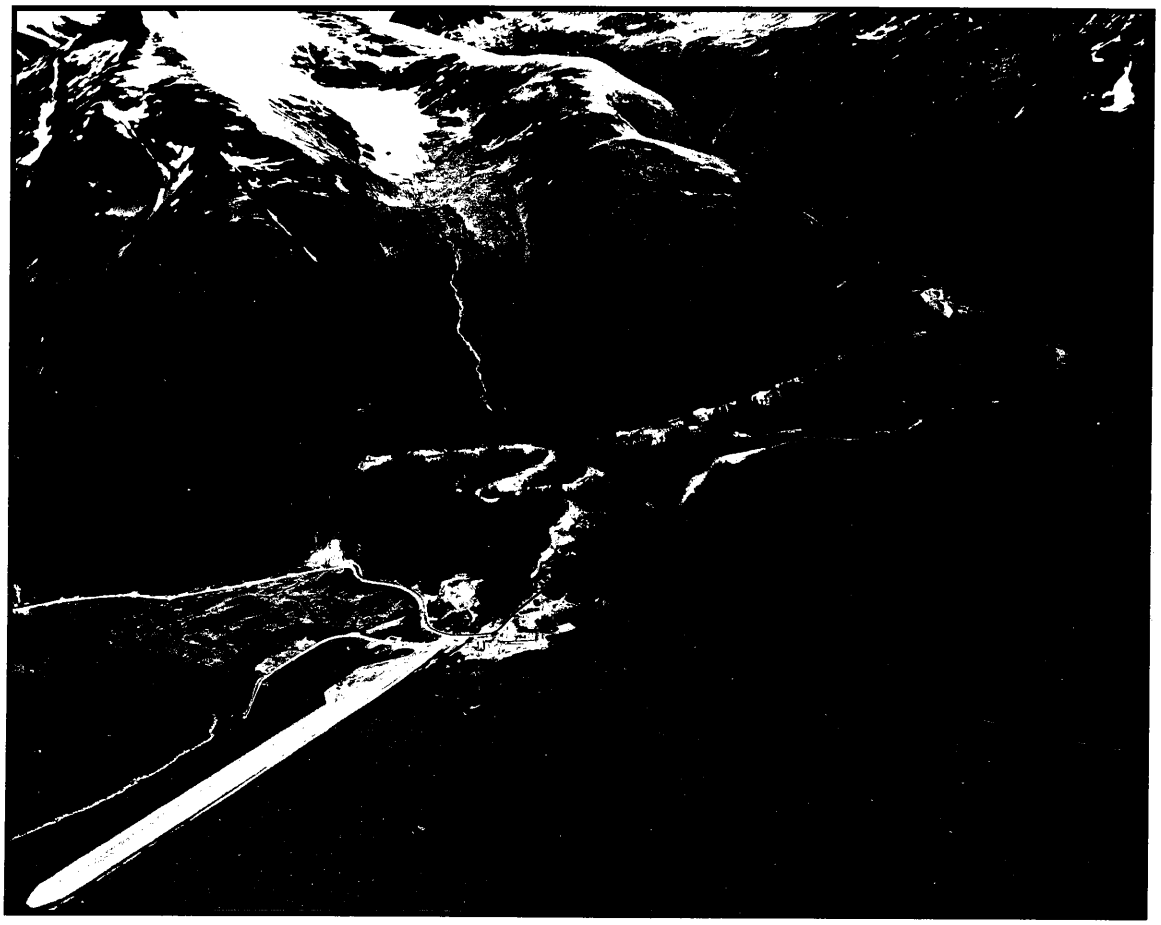
By the early 1980s, the APA had estimated that the Juneau area would need additional energy within five years. Accordingly, the Corps approved the second phase of the Snettisham Project in 1982. At that time, General James W. Van Loben Sels, who reviewed the project for the North Pacific Division, noted that "the project is justified on the basis of economic, social and environmental criteria."[42] Construction on the second phase began in 1984.

Development of Crater Lake involved construction of a 7,820-foot power tunnel of unlined rock, a steel penstock, and the addition of a generator and a turbine to the powerhouse. In tapping Crater Lake, engineers used a different process from that of the first phase. While Long Lake water initially flowed into a diversion tunnel, the Corps tapped Crater Lake directly into the power tunnel.[43]

Because American engineers knew very little about glacial lake taps, the Corps looked to Northern Europe for advice. Finn Kvingan, a Norwegian engineer, designed the lake tap for the second phase of the Snettisham facility, which he patterned after similar projects in his country. "This may be the deepest tap from lake surface to tunnel in the United States," he observed in 1987, "but in Norway this would not be an unusual job." The process involved blasting a plug in the bottom of Crater Lake, allowing water to rush into the power tunnel below. Within two minutes, the torrent of water reached a closed gate, protected from initial pressure by a cushion of snow. During those two minutes advancing water and compressed air collected at the gate, until the air was forced back up the tunnel, equalizing the pressure. The process was much like pouring water into a jar. The snow then melted, becoming part of the water going through the turbines to produce power.[44]



Snettisham Hydroelectric Project.



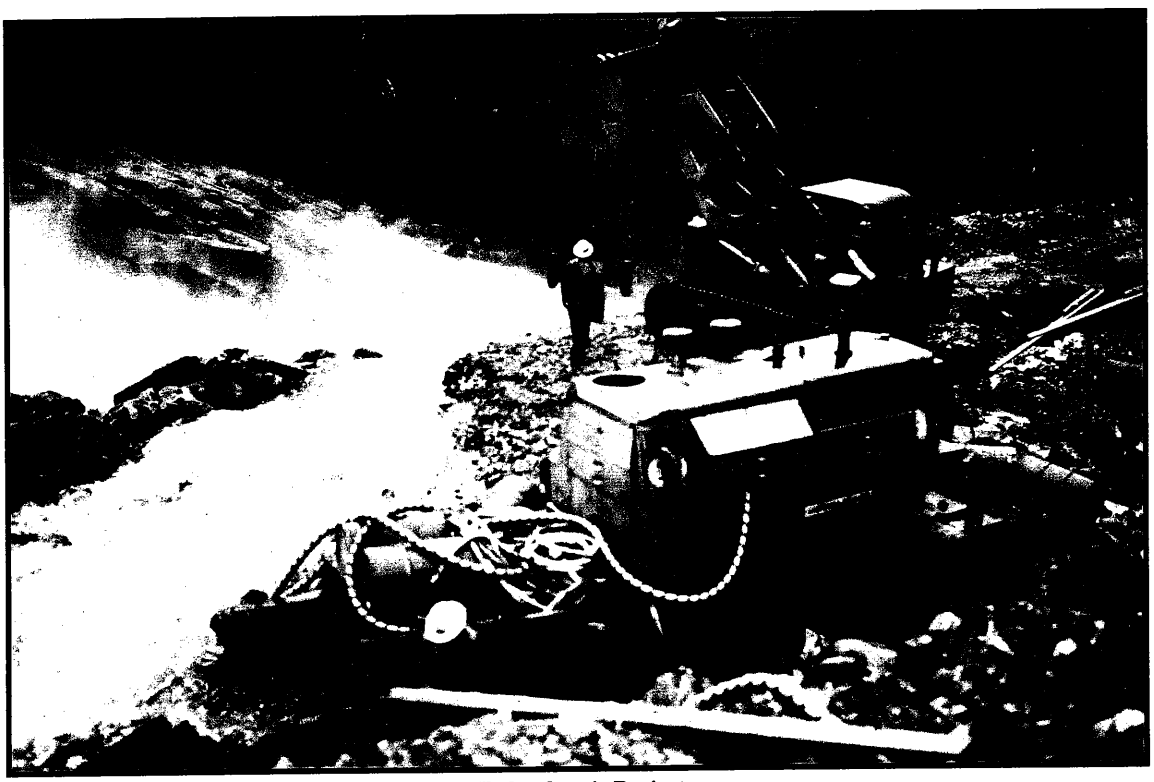
Aerial view of Snettisham Hydroelectric Project.

The Corps completed work on the second phase in 1989, for a total cost of $133,339,550. By that time, the Snettisham Project had supplied nearly 75 percent of the Juneau area's power. Built during a period of economic stagnation in Alaska, the $61-million second phase also became significant for the federal funds it brought to the Far North. During the mid-1980s, when the construction industry in Alaska had slumped, the Corps provided $182 million worth of work, a record amount up to that time, in the state. Throughout this period, the Corps' largest civil works contract often involved construction on the Snettisham Project.[45] Many residents welcomed the jobs the Alaska District provided. "It's good to see any kind of work," *The Anchorage Times* reported in 1987, "any place in Alaska."[46]

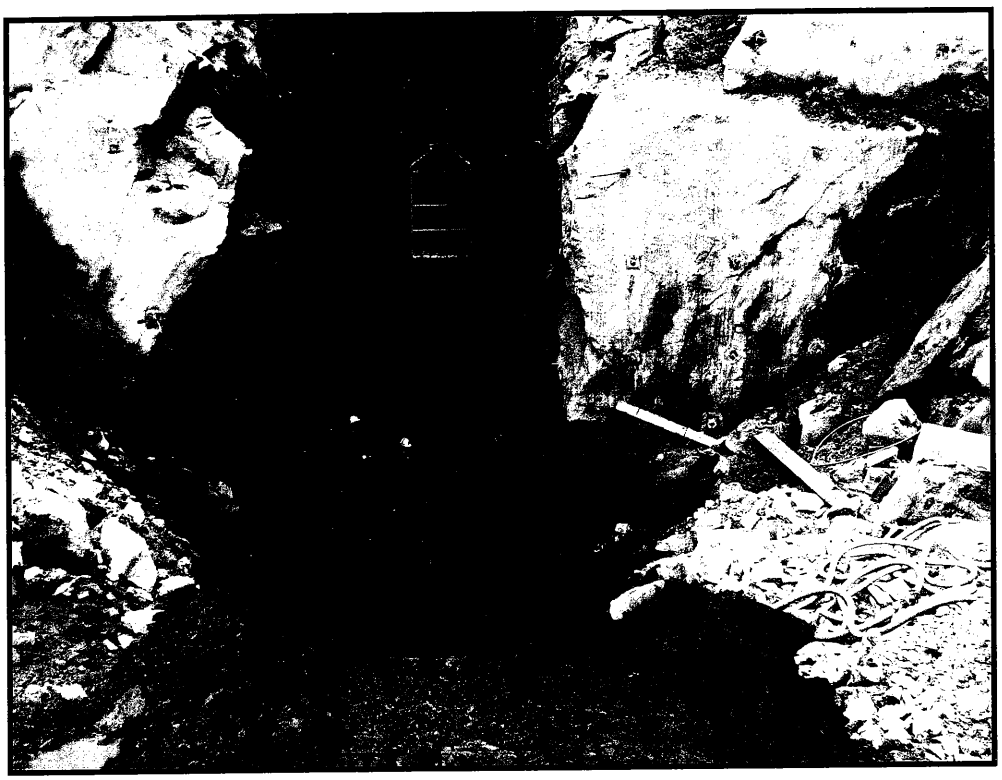
The importance of the Snettisham Project to Alaska's economy reflected the Corps' "essential role" in the state. The Alaska District had become a leader in water resources development in the Far North. General Roy S. Kelley of the

North Pacific Division contended that no private agency could address Alaska's engineering and construction needs, owing in part to the difficulties of recruiting and retaining skilled employees.[47]

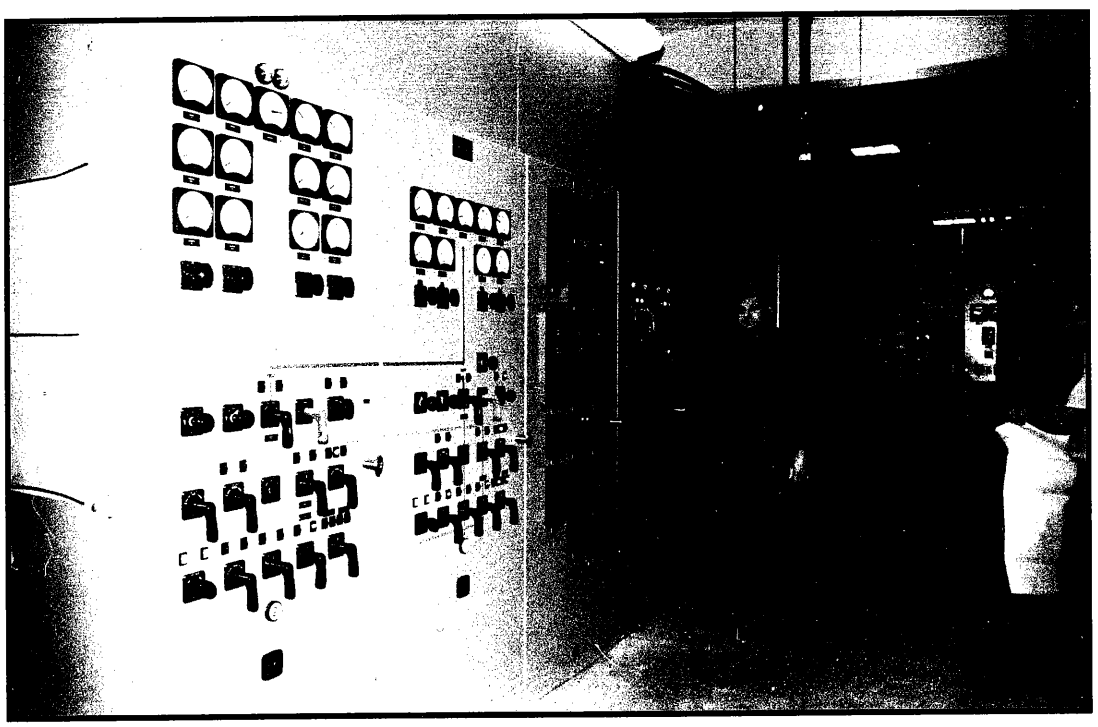
By the early 1990s, the Alaska District had invested nearly 30 years in the Snettisham Project. As noted earlier, many employees regarded its construction as a momentous achievement. "I was quite proud of Snettisham," one Corps economist recalled. "Juneau needed the power, and it needed to be built."[48]



Construction of diversion channel, Snettisham Hydroelectric Project.



Snettisham Hydroelectric Project under construction.



Control panel at Snettisham Hydroelectric Project.

Turbines at Shettisham.

Interior, Powerhouse, Snettisham Hydroelectric Project.

ADDITIONAL HYDROPOWER STUDIES

Although Snettisham remained the Corps' most prominent hydroelectric project in Alaska, the agency also studied Bradley Lake, located on the Kenai Peninsula, for development. Congress authorized this project in 1962, and by 1973 the oil crisis had revived an interest in developing energy sources apart from fossil fuels. During the mid-1970s, the growth in population and business activity on the Kenai Peninsula further increased local power needs. Bradley Lake became part of a long-range investigation of energy sources in the Southcentral Railbelt Area Study. Its objective was to provide power from Fairbanks to the region extending south to the Kenai Peninsula.[49]

In 1980, the Alaska District indicated that meetings had revealed "good public support" for the Bradley Lake Project. Despite high winds, summer field investigations proceeded on schedule that year. Studies included rock sampling, water quality sampling, archaeology, and hydrology. Field crews stayed in Homer, located 28 air miles from the site, commuting by helicopters, as the weather permitted.[50]

Features of the Bradley Lake Project included a dam to block the outlet of Bradley River into the reservoir, a conduit to divert flows from the middle fork of the river into the reservoir, and a complex for power generation, including a lake tap, powerhouse, and tailrace. The state assumed responsibility for the project, which began transmitting power in 1991.[51]

In 1976, Congress also authorized studies to determine the feasibility of installing small hydropower plants (5 megawatts or less) in Alaska. These studies focused on various regions, including the southeast, northwest, northeast, and the Aleutian Islands. Many Alaskan communities depended on fossil fuels to generate electricity. Because the expense of this form of energy increased rapidly during the modern era, development of small hydroelectric power projects seemed an appealing alternative.[52]

Although the Corps organized reconnaissance-level inventory studies of more than 250 communities, only Scammon Bay, an isolated village in the Yukon-Kuskokwim Delta region of southwestern Alaska, and Unalaska, a treeless, mountainous island in the eastern Aleutians, offered the potential for economic feasibility. Remote locations, the high cost of construction, and the winter climate limited application of small hydropower projects in Alaska. Frozen streams would have impeded the efficiency of many of these projects during the winter months, when the power would have been needed most. Also, by the mid-1980s,

federal policy had required that most small hydropower projects be developed locally.[53]

CHENA RIVER LAKES FLOOD CONTROL PROJECT

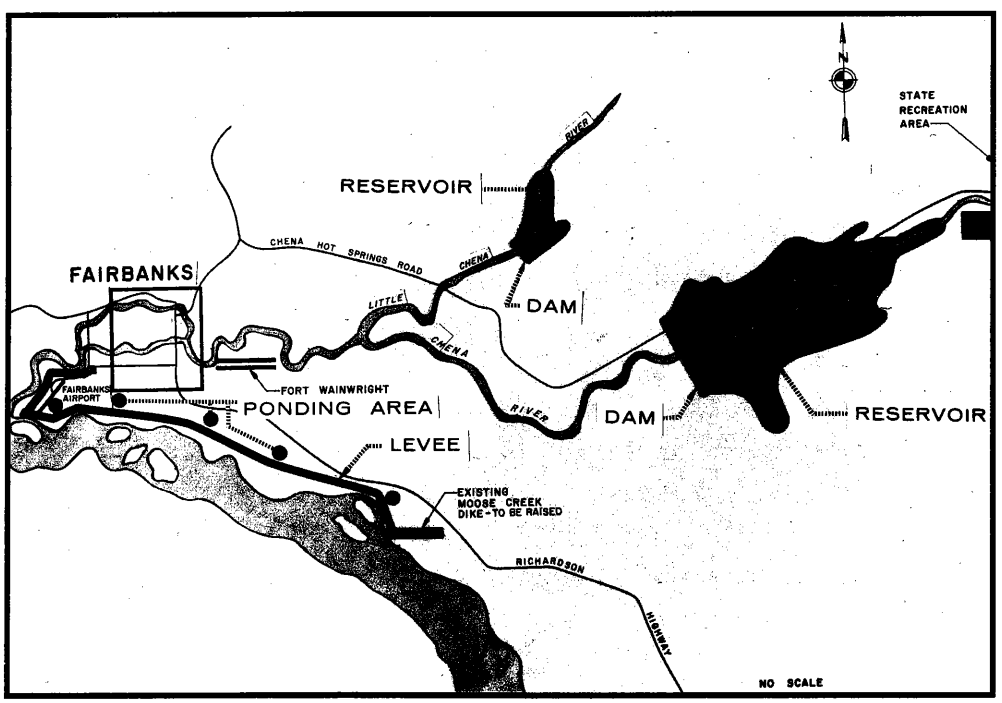
In the summer of 1967, one of the worst disasters in the history of Alaska struck the Fairbanks area. As explained earlier, unusually heavy rains swelled the Chena and Little Chena rivers six feet above their flood stage. [For additional information see chapter 7.] Water poured into downtown Fairbanks and the outlying regions, driving residents to their rooftops and eventually displacing nearly 7,000 people from their homes. Roads, bridges, and railroads washed away, isolating Fairbanks and hindering rescue efforts. Damage estimates totalled more than $80 million. The extensive destruction helped inspire Congress to pass a national flood insurance program. To prevent a disaster of this magnitude from occurring again, the Alaska District proposed the Chena River Lakes Flood Control Project. Its primary purpose was to protect Fairbanks and Fort Wainwright from high waters.[54]

The Flood Control Act of 1958 provided authority for this project. When the flood of 1967 sparked a new sense of urgency, Congress reauthorized it by passing the Flood Control Act of 1968, in accordance with recommendations from the Chief of Engineers. Major components of the project included the Moose Creek Dam and Floodway, the Tanana River Levee, and drainage channels within the protected area. Together, they comprised the largest federal civil works program in the state. The Alaska District joined the Fairbanks North Star Borough in developing the project. While the Corps acquired the lands needed for the dam and floodway, the borough obtained the lands for the levee and drainage channels.[55]

Construction began in 1973, and by 1976, Magnus "Jiggs" Marks, the Corps' resident engineer in Fairbanks, reported that the project was a year ahead of schedule and was "really going well."[56] The Corps awarded much of the work to the Green Construction Company of Des Moines, Iowa, in the largest single contract up to that time in the history of the Alaska District. This firm received $27 million for the second phase of the project, which included extending the dam's foundation. In 1976, the Green Construction Company employed 245 people, who sometimes worked two 10-hour shifts, to complete the job.[57]

One of the most striking features of the project was the Moose Creek Dam on the Chena River. Owing to the large deposit of gravel with patches of permafrost that characterized this area, the Corps determined that a concrete, water-stopping dam would prove too expensive. Instead, the Alaska District recommended construction of a 7-mile earthen dam that diverted water down a floodway. According to one observer, this structure, which resembled a long retaining wall, remained interesting to planners, engineers, and builders, "but to the visitor looking for ... picture-worthy vistas, the Chena Project is no Grand Coulee, Hoover, or Dworshak Dam."[58] In many respects, the Chena Project lacked the glamour of the Snettisham Hydroelectric Plant, with its underground powerhouse, tunnels, and glacial lake taps. As Major Leo Laska, Assistant Resident Engineer for Civil Works, put it, "a long pile of dirt is not an impressive sight." What was impressive about the Chena Project was the large quantities of sand, gravel, and silt employed in its construction. "From an engineer's view," Marks explained, "this is not really a complicated project — just big."[59]

Development of the 7-mile dam and 22-mile levee, built to prevent the river from overflowing, also required considerable labor, which sometimes was conducted in extreme temperatures. During the summer, workers suffered through 92-degree heat. According to Engineer Marks, the weather sometimes "proved a little too much for the field crews laboring in the sun in our famous subarctic."[60] Phil Morrow, who joined a soils crew to study permafrost conditions

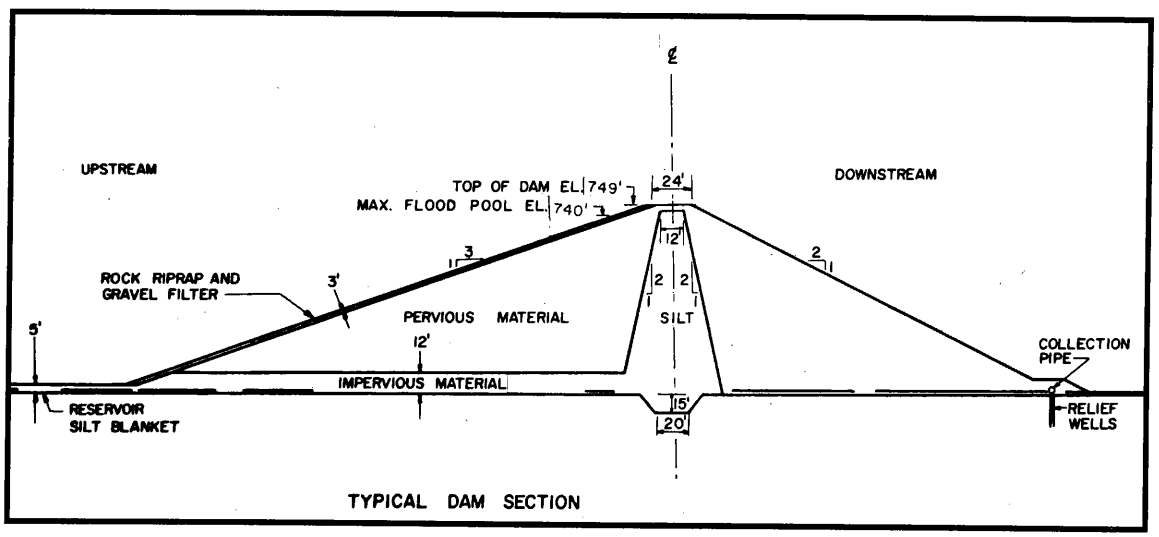


for the Chena Project, recalled braving temperatures of 65 degrees below zero during the winter. "It was rough work," he noted. Still, looking back on the experience in 1993, Morrow mused, "It was more fun than writing at a desk later on ... ."[61]

Construction of the dam and floodway presented several challenges to the Alaska District and the contractors. Natural seepage in the floodplain made the extraction of gravel difficult. To combat this problem, the contractor installed pumps to "dewater" the large gravel pits, piping the excess liquid into the Chena River under conditions monitored by the Environmental Protection Agency.[62]

Additional problems included erosion in the floodway, the long, wide area upstream from the dam. Attempts to control erosion resulted in the implementation of new construction techniques. The Green Construction Company used roller-compacted concrete, which had never been used on a major project in Alaska, to protect the floodway from the scouring action of the Chena and Tanana rivers. Roller-compacted concrete required only a fraction of the water needed for conventional concrete, and consisted of very dry material that could be handled with ordinary earthwork equipment. Accordingly, it provided a less expensive alternative to rock riprap bank protection.[63]

Erosion also became a problem during construction of the levee. When the Tanana River began undermining the bank near a completed section of this structure, the Alaska District decided to reroute the main channel of the stream. Engineers concluded that this diversion project, consisting of a dike and pilot channel, would prove more efficient than rebuilding the levee around the new stream bed, which would require more construction as well as the purchase of



additional private property. Yet the outcome of the rerouting was uncertain. "When you divert a stream as big as the Tanana," observed Dwayne Detamore of the Civil Works Project Office, "you're never sure exactly how it will work."[64]

Development of the Chena Project required relocation of sections of the Alaska Railroad and Richardson Highway that would be inundated. Accordingly, the Alaska District constructed bridges for the rail line and highway in 1977. To assist in this project, the Corps' hydraulic laboratory at Bonneville, Oregon, developed models to study the erosive effects of water passing the bridge piers.[65] Another noteworthy feature of the Chena Project was that its construction coincided with that of the TAPS. The crossing of the two projects was marked by a gravel "hump," where the pipeline remained buried on both sides of the dam.[66]

The Corps completed the $256 million Chena Project in 1979. A key component of the dam and levee system, located about 20 miles east of Fairbanks, was the massive concrete outlet works and flood gates. During normal fluctuations of the Chena River, the outlet works remained open, allowing the natural flow of water. Fish, as well as boats, continued to travel through the open gates. At periods of high water, however, the Corps lowered the flood gates, directing excess water to the Tanana River. In 1987, the Fairbanks North Star Borough assumed responsibility for operation and maintenance of the levee and drainage channels.[67]

The Corps determined that the Chena River could fluctuate up to six times its normal volume — to 12,000 cubic feet per second (cfs) — without causing serious damage. That amount represented considerably less volume than the 64,000 cfs that poured into the Fairbanks area during the disastrous flood of 1967. Measuring devices in the Upper Chena watershed indicated high river flows, which the Corps monitored through a central computer in Anchorage. This system predicted water levels 18 hours before they reached the outlet works.[68]

In addition to monitoring flood conditions, the Corps remained responsible for fish passage through the system. The Chena and Tanana rivers supported a variety of migrating fish, including king and chum salmon, as well as the arctic grayling. During the spring and summer, adult fish journeyed upriver to spawn. Under normal flows, they migrated up the side channels unimpeded. When the Corps lowered the gates during flood conditions, however, fish migrations became blocked. As a solution, the Alaska District developed ladders to assist the fish past the project. Although the Corps had designed and constructed fish

passages for salmon on the Columbia River since the 1930s, biologists knew little during the mid-1970s about the fish inhabiting the Chena and Tanana rivers. "The swimming capabilities of the arctic grayling and its behavior in fish ladders have not been determined yet," explained Bob Wienhold, an Alaska District fisheries biologist at that time. For that reason, the Corps conducted tests at Poplar Grove Creek near Glennallen.[69]

The Corps completed construction of the ladder in 1981. "It was extremely effective from an engineering standpoint," noted John Burns, a fisheries biologist with the Alaska District. Although the Corps initially assumed that one foot of water would be required to operate the ladder, biologists discovered that fish, including large chinook salmon, could pass the facility in as little as six inches of water.[70]

Throughout the early 1980s, Alaska District biologists cooperated with scientists from the USFWS and the Alaska Department of Fish and Game to continue studying the effect of the Chena Project on fish migration. Despite the fish ladder, one source explained, "some interference in migration patterns would be inevitable." Lowering the gates in the early spring, when the breakup of ice increased the potential for flooding, impacted the downstream journey of young fish.[71] "We don't want to operate the gates until we have to," Project Director Frank Erie explained. "The amount of river flow is balanced with the people down-river and the fish and game department."[72] Corps biologists continued to monitor the project to ensure that no fish became trapped in the system.[73] In 1994, the Alaska District planned further studies of juvenile fish migrations with scientists from the University of Alaska in Fairbanks.[74]

Steve Wilson of the Alaska District, Corps of Engineers (at top) worked with agents of the National Marine Fisheries Service and the Alaska Department of Fish and Game to test the efficiency of a fish ladder being considered in the design of the Chena River Flood Control Project near Fairbanks. Wilson was Chief of the District's Environmental Section.

Development of the Chena Project also resulted in the establishment of the Corps' first recreation area in Alaska. By the 1980s, the Corps managed more

than 4,000 recreation areas nationwide. Visitation to these sites remained second only to those of the U.S. Forest Service. In the Far North, however, the Corps was not associated with this activity. "When Alaskans seek recreation," noted one source, "they usually do not call on the Army Corps of Engineers."[75] The Alaska District's involvement in the Chena River Lakes Recreation Area helped change this perception.

Located near the small community of North Pole, the Chena River Lakes Recreation Area opened Memorial Day weekend in 1984. This project, funded jointly by the Alaska District and the Fairbanks North Star Borough, consisted of two parks about two miles apart. Constructed at a cost of $3.37 million, the parks were designed to be used year-round, accommodating 90,000 people annually. As part of this project, the Corps created a 200-acre lake from the large gravel pits used in construction of the Chena Project's earthen dam and levee. The parks offered camping and boating facilities, as well as hiking and running trails, which were operated and maintained by the Fairbanks North Star Borough.[76]

At the outlet works segment of the 100-foot long model of three miles of the Chena River. From the left: Bill Craine of the Alaska District's Hydraulics & Waterways Section; Hugh Smith from the Corps' North Pacific Division office; John Magee, Alaska Department of Fish & Game; Jack Fisher, National Marine Fisheries Service; Milo Bell, consultant to the North Pacific Division; and Al Chanda of the Lab staff. Magee was introducing blue dye into the water to make the flow more visible.

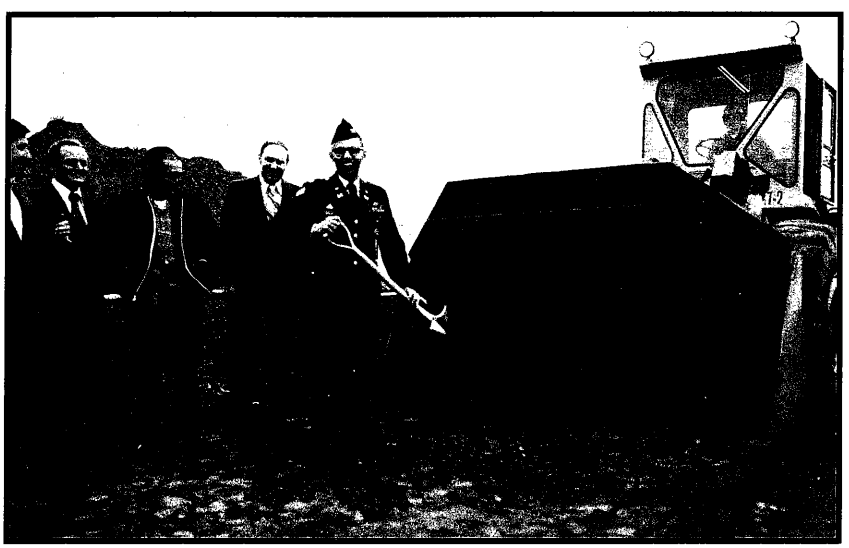
Winter activities included dog mushing, cross-country skiing, and ice skating. Ice fishing in the stocked lakes also became a favorite pastime. During the park's first winter, a small group of visitors caught 31 "and a half" rainbow trout in two hours. Although this was their first time ice fishing at the Chena River Lakes Recreation Area, one of the visitors concluded, "It won't be the last, by God."[77]

So striking was the recreation area's design that the project received an honorable mention for landscape architecture in the Chief of Engineers' environmental awards program. For this evaluation, juries of architects and engineers reviewed 98 other Corps projects worldwide. Praising the recreation area, the

jurors noted, "The big picture is fantastic here. In particular, the new peninsula seems quite handsomely done."[78] The Comanche Corporation, the Corps' contractor for the recreation area, also pronounced the project successful. "It's the prettiest park in the state," beamed Project Supervisor Al Yuhasz. "You have to give the [C]orps credit," he concluded. "They did a pretty good job."[79]

Within six years of its completion, the Chena Project had prevented major flooding. During Memorial Day weekend in 1985, as the Chena and Little Chena rivers swelled with snow melt, the Corps lowered the flood gates. This action resulted in the impoundment of 27,000 acre-feet of water behind the dam — the largest volume since the project became operational in 1979. The Corps estimated that lowering the flood gates in 1985 prevented more than $7 million in property damage.[80]

In 1992, the Alaska District reported that the Chena Project continued to function "just as designed and planned." That year, it prevented up to several feet of water from pouring into downtown Fairbanks. This flood, caused by late runoff and near-record snows in the Upper Chena River Basin, was the third worst on record, exceeded only by the disasters of 1948 and 1967.[81] During the early 1980s, some Fairbanks residents were reassured by the completion of the Chena Project. "Heavy summer rains may revive memories of the 1967 flood," suggested one observer, "but there is little chance of that piece of Fairbanks history repeating itself." Frank Erie, the project director, also remained pleased with the outcome. "It took a long time to put it together," he noted, "but the result is a near perfect project."[82]



Ground breaking ceremony, Chena River Lakes Flood Control Project.

Chena River Lakes Flood Control Project.

NAVIGATION PROJECTS AND SHORELINE EROSION CONTROL

In addition to hydroelectric and flood control facilities, the Corps constructed and expanded small boat harbors throughout the modern period. The agency's involvement in navigation projects dated back nearly 200 years, when rivers and coastal harbors provided the nation's primary means of transportation. By the late 20th century, the system of waterways and harbors maintained by the Corps remained essential to American commerce. From the 1970s through the 1990s, the agency's development of small boat harbors along Alaska's coast also aided the economy of the Far North. As one observer put it, "Harbors are as vital as homes in many Alaska communities."[83] By 1990, the Alaska District had constructed or expanded more than 30 of these facilities.

As noted, the Rivers and Harbors Act of 1960 granted the Corps the authority to plan and construct navigation improvements. The agency's objective was not only to assist in the development of waterborne commerce but also to ensure the safety of coastal communities. In general, the local residents requested the small boat harbors, and Congress authorized and provided the funds. The community

or state then became responsible for the real estate, docks, piers, access roads, and parking. Local interests also provided dredging for the berthing area of the harbor. The Alaska District tackled the planning, survey, design, and contracting for the projects. For many small harbor projects, the Corps developed breakwaters, diversion dikes, channels, and groins. The agency also became responsible for maintenance dredging.[84]

Alaska's distinctive terrain and climate sometimes impeded maintenance of small boat harbors. A severe storm in Nome, for example, damaged the community's waterfront facilities and clogged a channel with debris in 1974. Because of Nome's remote location on the Bering Sea, materials had to be transported by ocean or air. After the storm, the Corps hired a contractor to fly the 12-inch pipeline dredge *Bethel* to Nome.[85] Similarly, at the small boat harbor in Homer, persistent storm conditions and heavy waves prevented the Alaska District from completing its maintenance dredging in 1976. The crew fought rough seas for more than three weeks before retreating. "It was a matter of human safety," explained then-District Engineer Colonel George R. Robertson. "We had to stop our annual dredging when we were about half finished."[86]

Another problem the Corps faced in Alaska was shoreline erosion. In 1974, Congress passed the Shoreline Demonstration Control Act, authorizing the Corps to develop, construct, and demonstrate low-cost methods of shoreline protection. Of the 16 sites chosen for the nationwide program, two were of particular interest to Alaskans: Kotzebue on the Bering Sea and Ninilchik on the Kenai Peninsula. Severe storms and extensive beach erosion at these locations contributed to their selection.[87]

During the late 1970s, the Corps built revetments at Kotzebue and Ninilchik. These structures, placed parallel to the shoreline, dissipated the force of waves striking the beach. At Kotzebue they were fashioned from steel drums filled with gravel, which proved to be an effective, low-cost means of erosion prevention. Kotzebue's cold climate slowed the salt-water corrosion of the structures. The Alaska District also built groins at Kotzebue and Ninilchik. These structures were positioned perpendicular to the beach, to limit the movement of erosive sand and gravel toward the shoreline. Materials employed in their construction ranged from local timber and wire-mesh baskets to plastic bags filled with pillows. In the early 1990s, the Corps continued to monitor and evaluate these structures, providing information about their construction and effectiveness to beach property owners.[88]

WATER RESOURCES DEVELOPMENT ACTS

In summary, the Corps' water resource projects remained diverse during the modern era. Yet legislation in the 1980s and 1990s changed the agency's role in this area. The Water Resources Development Act of 1986, for example, required greater non-federal cost sharing for most water projects. This measure could affect the size and scale of development in the future. As local residents and state agencies assume more responsibility for expenses, development could be scaled back or constructed in increments. Although water resources projects throughout the 1990s will be smaller, Congress hoped that limited federal funds could then be applied to a larger number of them than would have been possible otherwise. This law also ensured that benefits from water resources projects would be used to help pay for construction, operation, and maintenance of projects, such as small boat harbors. Owing to cutbacks in federal spending, proposals for enormous projects, such as the Rampart Dam, did not seem likely for the future, perhaps signalling an end of an era for the Alaska District. Corps officials reported that the Water Resources Development Act of 1986 saved the agency's Civil Works Program from "facing a difficult struggle to maintain a viable program." It helped revitalize the Alaska District to "[gear] up new starts for the years ahead."[89]

In addition to developing water resources, Congress required the Corps to increase its involvement in environmental protection. The Water Resources Development Act of 1986 further authorized the Corps to propose modifications to its existing facilities, many of which were constructed before the 1970s, for "environmental improvement." Alaska District proposals ranged from creating nesting sites for waterfowl to improvements in water quality for fish. The Water Resources Development Act of 1990 added environmental protection as a primary mission of the agency.[90] As Alaska's population grows and the need for water resources development continues, this mission will become increasingly prominent.