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Observations on the Environmental Monitoring and Surveillance of the Alyeska or Trans-Alaska Pipeline



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OBSERVATIONS ON THE ENVIRONMENTAL
MONITORING AND SURVEILLANCE OF THE
ALYESKA OR TRANS-ALASKA PIPELINE

by

D.G. Wright

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This is the fourth Manuscript Report
from the Western Region, Winnipeg

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ABSTRACT

Wright, D.G. 1978. Observations on the environmental monitoring and surveillance of the Alyeska or Trans-Alaska Pipeline. Can. Fish. Mar. Serv. MS Rep 1451: iv + 26 p.

Following the discovery of crude oil at Prudhoe Bay, Alaska in January, 1968, an oil industry consortium, Alyeska Pipeline Service Company, proceeded to develop and construct a 1,290 km hot oil pipeline to the port of Valdez on Prince William Sound. A description of the pipeline and many of the environmental problems associated with its construction is presented. Monitoring and surveillance of the construction of the pipeline was undertaken by the Joint (State/Federal) Fish and Wildlife Advisory Team. Observations on the organizational structure and effectiveness of the team are given. The report includes a series of notes and recommendations considered relevant to the design of any pipeline surveillance agency which may be required in Canada.

Key words: Arctic zone; environmental effects; resource conservation; pipelines; oil industry; petroleum; oil spills; environmental legislation.

RESUME

Wright, D.G. 1978. Observations on the environmental monitoring and surveillance of the Alyeska or Trans-Alaska Pipeline. Can. Fish. Mar. Serv. MS Rep 1451: iv + 26 p.

A la suite de la découverte, en janvier, 1968, de pétrole brut dans la Prudhoe Bay, en Alaska, un consortium industriel, l'Alyeska Pipeline Service Company, a procédé à la mise au point et à la construction d'un oléoduc chauffé de 1290 km, jusqu'au port de Valdez, sur le Prince William Sound. Nous présentons une description de l'oléoduc et des nombreux problèmes environnementaux entraînés par sa construction. Le contrôle de la construction a été pris en charge par le Joint (State/Federal) Fish and Wildlife Advisory Team. Des observations sont fournies sur l'organisation et l'efficacité du groupe. Le rapport comprend une série de notes et de recommandations jugées utiles pour l'établissement, le cas échéant, d'un organisme de contrôle au Canada.

Mots clés: Arctique; effets environnementaux; conservation de ressources; pipelines; industrie pétrolière; pétrole; déversements d'hydrocarbures; législation environnementale.

INTRODUCTION

Parliamentary and presidential approval has been given to a proposal to construct a 107 cm diameter pipeline in order to transport natural gas from the Prudhoe Bay field on the Alaska north slope to markets in the lower 48 states of the United States of America. The route would parallel the Alyeska Oil Pipeline from Prudhoe Bay to Fairbanks and then follow the Alaska and Klondike highways through Alaska, the Yukon and British Columbia. At Fort Nelson, B.C. it would join an existing system and continue to the U.S. border (Fig. 1). Gas reserves in the Mackenzie Delta/Beaufort Sea area could be brought to consumers in southern Canada by means of a lateral pipeline constructed along the Dempster Highway right-of-way and connecting to the Alaska Highway Pipeline, as recommended by the National Energy Board (NEB 1977). In addition, an application has been filed with the NEB by Polar Gas to construct a natural gas pipeline from the islands of the Arctic Archipelago, down the west coast of Hudson Bay through Manitoba and northwestern Ontario to meet with the existing Trans-Canada Pipeline at Longlac, Ontario (Fig. 2).

Fisheries and Marine Service has been very active in the review of northern pipeline proposals and will play an important role in the monitoring and surveillance of any pipeline construction. In order to better appreciate some of the environmental and administrative problems associated with the construction of large diameter pipelines in northern areas, a delegation of Fisheries and Marine Service personnel went to Alaska in June 1976 to observe construction of the Alyeska or Trans-Alaska Pipeline and to meet with the joint (State/Federal) Fish and Wildlife Advisory Team (JFWAT) regarding environmental monitoring of the project.

Although there have been previous visits to the project by several Canadian delegations, most were undertaken in late winter when it was difficult to observe the environmental effects caused by construction, especially those problems associated with fish and fish habitat. For this reason, the present delegation's inspection was carried out in early June.

The following report describes some of the fisheries habitat problems encountered during pipeline construction and provides observations and suggestions for the design of a surveillance agency for Canada, since it is assumed that such an agency will be required in the very near future.

PROJECT DESCRIPTION - ALYESKA PIPELINE

PROJECT BACKGROUND

Oil was discovered at Prudhoe Bay on the north slope of Alaska in January 1968. The field comprises the largest single deposit of conventional petroleum in the United States and is estimated to contain 9.6 billion barrels of recoverable crude oil as well as 26 trillion cubic feet of associated natural gas.

A consortium of three oil companies (Atlantic

Richfield Co., Humble Oil and British Petroleum) announced a plan to construct a pipeline in February 1969, and a right-of-way permit was requested from the U.S. Bureau of Land Management on June 1, 1969, just before passage of the National Environmental Policy Act (NEPA) by Congress in December 1969. This act requires any agency of the U.S. Federal Government to publish a detailed environmental impact statement resulting from any actions authorized by that agency.

Legal action was filed by three private conservation organizations (the Wilderness Society, the Friends of the Earth and the Environmental Defence Fund, Inc.) against the Secretary of the Interior in March of 1970. These organizations claimed that the provisions of the National Environmental Policy Act had not been complied with. As a result of this action a preliminary injunction was granted in April 1970, which restrained the secretary from issuing permits for construction of the pipeline until the requirements set forth in NEPA were satisfied.

The Secretary of the Interior issued a final environmental impact statement in March 1972 and in May announced his intention to issue construction permits. The U.S. District Court for the District of Columbia ruled that the impact statement satisfied NEPA and lifted the injunction. However, the decision was appealed by the environmental groups concerned on the grounds that the secretary's permit had exceeded the width of the right-of-way permitted under the Mineral Leasing Act of 1920. The result was that on February 9, 1973 the Court of Appeals reversed the District Court's ruling and ordered the District Court to reinstate the injunction.

Congress enacted Public Law 93-153 on November 16, 1973, amending the Mineral Leasing Act of 1920 to increase the width of the right-of-way that the Secretary of the Interior could authorize, thus permitting construction of the Trans-Alaska Pipeline.

On January 23, 1974, the Secretary of the Interior and the owner companies signed an agreement and grant of right-of-way for the pipeline. The State of Alaska and the owner companies signed a right-of-way lease covering state-owned lands on May 3, 1974. Both federal and state right-of-way agreements included stipulations designed to afford maximum protection to the environment. To ensure compliance with these stipulations, the Department of the Interior and the State of Alaska set up organizations to review the design of the pipeline system and to monitor its implementation. Out of this monitoring organization evolved the Joint (State/Federal) Fish and Wildlife Advisory Team (JFWAT).

The permittee companies formed the Alyeska Pipeline Service Company as their common agent for designing and constructing the pipeline system. Ownership of Alyeska is divided between SOHIO Pipeline, 33.34%, BP Pipeline, 15.48%, ARCO Pipeline Co. 21%, Exxon Pipeline Co. 5%, Union Alaska Pipeline Co., 1.66%, Phillips Petroleum Co., 1.66% and Ameranda Hess Corp., 1.5%.

Construction of the pipeline officially began on April 29, 1974, culminating in the final tie-in June 1977. Oil began to flow from the north slope wells on June 20, 1977.

THE PIPELINE

The Trans-Alaska Pipeline consists of 1290 km of 122 cm pipe which extends from Prudhoe Bay on Alaska's north slope to the ice-free harbour of Port Valdez on Prince William Sound in the south (Fig. 3). The system is designed to operate initially with eight pumping stations and have a delivery rate of 1.2 million barrels of oil per day. Four additional pump stations can be brought on line to give the pipeline an ultimate capacity of 2 million barrels of oil per day.

To facilitate the movement of materials north of the Yukon River, the Alyeska Pipeline Service Company (Alyeska) constructed a 580 km, 8.5 m wide, gravel-surfaced haul road parallel to the pipeline route. Construction was completed in October 1975 with Alyeska serving as a contractor for the State of Alaska. On completion of the pipeline, the haul road was turned over to the State of Alaska and became part of the state highway system.

The work necessitated the building of 28 construction camps along the route. In addition, three permanent and eight temporary airfields were constructed near camps to support construction and maintenance of the pipeline system.

CONSTRUCTION MODES

Oil comes from the ground at temperatures of up to 82° C. Heat generated by pumping and friction within the pipeline maintains the oil temperature at between 54 and 60° C. Since the pipeline traverses a considerable amount of permafrost and since a conventionally constructed hot oil pipeline could melt the permafrost and result in severe damage to the environment and ultimate failure of the pipeline, the pipeline has been built in three modes: conventional burial; above ground; and refrigerated burial (Fig. 4).

Conventional burial

In areas where the substrate consists of bedrock, thaw stable or thawed soil, the pipe is buried in a conventional manner, as is done with most pipelines throughout the world (Fig. 5).

Slightly over half (655 km) of the pipeline is installed conventionally. Burial depths range from 1 m minimum cover above the top of the pipe to depths which are occasionally greater than 3.7 m depending upon the pipe configuration, terrain and soil properties.

Above ground

In sections of the route where melting of the permafrost might create soil stability problems, the line has been covered with 10 cm of resin impregnated fiberglass insulation, jacketed with galvanized steel. The insulated pipe is mounted on a cross beam installed between 2 vertical support members (VSMs) which are embedded in the ground at 18.3 m intervals. To prevent thawing around the VSMs, special non-mechanical and self-operating thermal devices have been installed inside the member where required (Fig. 6). These devices consist of metal tubes filled with a refrigerant which evaporates and condenses,

thereby chilling the ground whenever the ground temperature exceeds the air temperature. The frozen soil between the supports is overlain with gravel pads. In some sections, an additional layer of plastic foam insulation has been used.

To compensate for expansion and contraction of above-ground pipe, the line has been built in a flexible zig-zag configuration which converts expansion of the pipe into sideways movement (Fig. 7). In these sections, the pipe has been secured in a shoe and saddle assembly, allowing it to freely slide on the cross beam (Fig. 4).

Refrigerated burial

Three short buried sections of the pipeline, totalling 11 km in length, are insulated with 8 cm of polyurethane foam covered with a fiberglass jacket and continually cooled by special refrigeration pipes placed in the permafrost beneath the line (Fig. 8). This mode of construction is used where the pipe could block the movements of migrating caribou if installed above ground.

RIVERS AND STREAMS

The pipeline crosses more than 800 streams and roughly parallels the flood plain channels of 5 large rivers. Crossings were constructed either in the above-ground or buried modes (Figs. 9, 10). However, at 13 crossings, the pipe is supported on special bridges (Fig. 11). At buried crossings the pipe is jacketed with 12 cm of concrete or is weighted with concrete saddles each weighing about 8.2 tonnes. The pipe must be buried a minimum of 1.5 m below the stream bed. Because of bed erosion at design flood stage it was necessary at some sites to bury the pipe at depths of up to 4.5 m below the deepest point in the stream channel.

TERMINAL FACILITIES

The southern terminal of the pipeline is situated on the south shore of Valdez Arm, across from Port Valdez. Oil received from Prudhoe Bay is stored in tanks until it can be loaded, by gravity flow, aboard tankers for shipment to outside markets (Figs. 12, 13). The 400 ha terminal site includes storage tanks, docks, tanker loading and ballast water treatment facilities; power plant and vapor control facilities; fire control, oil spill contingency equipment and the pipeline operations centre (Fig. 14). Site elevation ensures that all critical equipment, storage tanks, buildings and other facilities are out of the range of statistically probable seismic waves (tsunamis).

Initially, 18 tanks have been erected, with a storage capacity for approximately 8 days flow of oil at an initial delivery rate of 1.2 million barrels per day. As the pipeline approaches its full capacity of 2 million barrels per day, tankage will be increased to 32 units. The storage tanks are 76 m in diameter and 19 m high and are constructed of concrete and welded steel with a cone roof. Each has a storage capacity of 510,000 barrels of oil (Fig. 15). The tanks are sited in pairs within containment dikes with a capacity equal to 110 percent of the total volume

Table 1. Physical size of tankers transporting oil from Port Valdez.

Ship	Tonnage dwt	Length m	Draft m
ARCO Juneau	120,585	269	15.8
ARCO Sag R.	70,356	247	13.3
SHELL unnamed	188,000	290	18.1

of both tanks plus an additional 0.6 m allowance for surface water.

Four berths which permit the simultaneous loading of four tankers have been built in the first phase of development. Three of these are affixed to the shore and supported on drilled pilings. The fourth is a floating berth. Each is designed to accommodate tankers in excess of 165,000 dwt. An indication of the physical size of ships that will use the facilities is presented in the above table (Table 1).

Ships can be loaded at the rate of up to 110,000 barrels per hour, giving the average ship a turnaround time of about 36 hours. This includes ballast discharge, docking and undocking, loading oil, transfer of supplies, documentation and other port activities.

Environmental protection measures

Ballast water treatment

All oily ballast water from the holds of incoming tankers is pumped ashore for treatment before being discharged into the Port of Valdez. Ballast water is treated in a four-step process (Fig. 16). This system utilizes primary separation, chemical coagulation, dissolved air flotation and pH adjustment to reduce the concentration of oil in the effluent to less than 8 ppm as required by the U.S. Environmental Protection Agency (EPA) and the State of Alaska, Department of Environmental Conservation (DEC).

In the primary separation stage, ballast water is pumped into one of these 430,000 barrel storage tanks where it is held so that free oil can float to the surface and be removed by skimmer. Skimmed water is discharged into an air-flotation basin where a coagulant (alum) and a polyelectrolyte is mixed with it and forms particles of oil and chemical (floc). Pressurized air is added to the mixture, causing the floc to rise to the surface where it is skimmed. Solids and grit settle to the basin bottom. After floated and settled solids are removed, ballast water is pH adjusted and then transferred to a holding reservoir for final quality control tests. If the treated water fails to meet the standards, it is returned to the treatment facility. Otherwise, it is discharged into the sea at a depth of 60-114 m between 213 and 320 m offshore to assure maximum mixing with sea water. Oil recovered in the process is recycled into oil storage tanks at the terminal. Sludge is dewatered and disposed of in a manner specified by EPA and DEC.

Vapor-recovery

A special vapor-control and recovery system was installed at the terminal to prevent oil vapors from escaping into the atmosphere from storage tanks. The cone-roof storage tanks are blanketed with inert flue gas from the terminal's power plant. This method also reduces the danger of fire within the storage tanks. Flue gas from boilers is scrubbed and cooled and then compressed into the open space above the crude oil in the tanks as it is being withdrawn for loading.

When the tanks are being filled with oil from the pipeline, displaced gas and oil vapors are burned in one of four high temperature incinerators and the inert gases transferred to tanks being emptied.

FISH AND FISH HABITAT PROBLEMS ASSOCIATED WITH CONSTRUCTION OF THE ALYESKA PIPELINE

During the tour, many problems concerning fish and fish habitat were observed or described to the delegation by accompanying JFWAT personnel.

IMPROPER ALIGNMENT

One of the worst examples of environmental abuse occurred in August 1974 during construction of the haul road in the upper Dietrich River area below Chandalar Camp. In this region, the canyon and flood plain are so narrow that there was difficulty in locating the haul road in relation to the eventual pipeline alignment. The situation was compounded by two environmental concerns, one being the occurrence of the northernmost stand of spruce along the pipeline corridor (an unique ecological anomaly) and the other being the presence of a resident Arctic grayling (*Thymallus arcticus*) population in the river.

The JFWAT biologists had worked with the pipeline company and the Alaska Department of Highways to ensure that road construction did not impinge upon either the forest or the natural meander pattern of the river or alter the "pool-to-riffle ratio" so important for migrating grayling.

On returning to the area following a two-day leave, biologists discovered that the contractor had rechanneled several thousand feet of the riverbed and was constructing the haul road down the middle of the flood plain. The altered river could carve a new channel through the spruce stand but, to date this has not occurred. However migrating fish have not been able to ascend above the lowest 300 meters of the rechanneled area.

Another alignment problem was observed in this same area. Despite recommendations from JFWAT, Alyeska proposed to construct the pipeline through the middle of one of the major overwintering areas for grayling on the Dietrich River (Fig. 17). At the time of our observation, the work pad had been constructed and vertical-support members were in place to the water's edge, awaiting freeze-up for continuation of the work. In addition, a near vertical face approximately 6 m high has been carved out of the ice-rich river bank to allow construction of the work pad. Some solifluction was already in evidence and many erosional problems were foreseen if no remedial measures were undertaken.

It was only after much negotiation that JFWAT was able to persuade Alyeska to reroute the pipeline so as not to disturb the overwintering area.

Near Glennallen, we observed the effects of improper alignment and improper drainage control. In this situation, meltwater from a small glacier flowed down the right-of-way of a buried section of the pipeline and deposited silt into an important salmon spawning and nursery area on the Little Tonsina River (Fig. 18).

LOW WATER CROSSINGS

Misapplied southern technology was also evident in the use of low-water crossings (LWC) (Fig. 19). These LWCs were essentially mimics of West Texas type fords, meant to speed construction of the work pad across streams and to allow limited movement of equipment through flowing water without the bother of culvert installation. JFWAT agreed to the construction of a few such crossings on a trial basis but many were built and nearly all failed because of the presence of ice-rich soils underlying thin gravel veneers and also because of heavy traffic loads or high runoff. As a result, streams were silted, fish passage was blocked, equipment got stuck and construction was delayed.

CULVERTS AND BRIDGES

It was quite evident from our inspection that Alyeska's first priority was to build a pipeline and that matters of environmental protection came a distant second, as witnessed by the company's resistance to recommendations from JFWAT for bridges rather than culverts, or large culverts in preference to small ones (Fig. 20). The following serves as a case history. Despite JFWAT's recommendation for a bridge on the haul road across Marion Creek, near Prospect Camp, Alyeska installed a culvert which was under-designed and blocked fish (salmon) migrations. It subsequently washed out. JFWAT recommended replacement of the washed out culvert with a bridge but Alyeska instead installed two culverts. After a near washout and yet another recommendation for a bridge, Alyeska installed three large culverts and constructed a fishway (Fig. 21). Despite an expenditure approaching one million dollars, migratory fish were still denied passage, as the velocity differential between the stream and the fishway was so great that fish could not locate the fishway. Since the completion of the pipeline

and the decrease in haul road use, Alyeska have installed a permanent bridge permitting unrestricted fish passage. Had this been done during the initial construction of the haul road, as had been recommended by JFWAT, a considerable saving would have been realized, and two years of interrupted fish migration would have been prevented.

DRAINAGE AND EROSION CONTROL

Inadequate drainage control was evident at many locations along the haul road and several near washouts were observed (Fig. 22). Sheet drainage and inadequate culverting to alleviate the situation is a big problem and will require continual surveillance. Inadequate design of the haul road caused many problems. The reason for this inadequacy was probably that design review responsibility for the haul road lay largely outside the purview of either the Alaska Pipeline office, the federal regulatory agency or the state pipeline coordinator's office and construction was well under way by the time JFWAT was mobilized. Had JFWAT been fully operational early in the project, several important changes in route alignment and drainage control might have been implemented. The shortsightedness and concern for the immediate job (construction of the pipeline) by Alyeska is evident in that culverts were designed to accommodate the one-in-five-year flood level only. In contrast, guidelines for highway construction in northern Canada stipulate that culverts should be designed to accommodate the one-in-fifty-year flood level.

RIVER TRAINING STRUCTURES

In many stretches of the alignment in which burial of the pipeline in active flood plains was required, many river training structures were observed. These are structures used to alter the direction of river flow or to contain it within a particular location. River training works can also be used to arrest the normal process of the migration of channel meanders in order to provide a stable river-crossing site and to prevent future meanders or other channel changes on the flood plain. Dr. David Norton, formerly with JFWAT and now a research manager with Alaska Outer Continental Shelf Project, described the problem eloquently in his presentation to Mr. Justice Berger's Mackenzie Valley Pipeline Inquiry. Dr. Norton stated that:

'Alyeska chose shallow burial and extensive groins and dikes rather than deep burial without these river training structures. Such structures are particularly unattractive, altering as they are designed to do the "will" of stream habitats. So we (JFWAT) took an active interest in this design feature, and were told in ever so strong language how vastly more expensive deep pipe burial was than shallow burial with river training structures. When we asked if the costs of constantly inspecting, maintaining and replacing dikes, groins, gabions and so forth had been figured into the cost effectiveness analysis, we got no consistent answers at all. Only after much probing did we get a hint that resorting to

river entrainment structures requiring maintenance during the operating life of the pipeline might be viewed as a tax shelter by Alyeska. The consortium expected a considerable tax write-off in the future through claiming maintenance expenses.'

BORROW MATERIAL SITES

Gravel requirements for construction of the pipeline have been enormous. The original estimate for gravel put forth in 1969, based on totally buried construction and using conventional pipeline procedures, was for 12.2 million cubic metres of material. Because of the necessity to construct a road and work pad, estimates for gravel rose to 51.6 million cubic metres in the 1972 Final Environmental Impact Statement. As of February 29, 1976, a total of 56.3 million cubic metres of gravel had been used in construction.

Granular material was obtained from 280 materials sites along the pipeline route. Haul distances of 6.5 km or less were found to be economically efficient during construction and haul distances of 13-16 km or less are planned for ongoing maintenance of the pipeline system. Alluvial deposits in the flood plains of the major river valleys in or near the pipeline alignment have been important sources of gravel for construction. Approximately 50% of the material has come from the flood plain and 50% from upland sites (Fig. 23). In general, despite the number of materials sites, few problems were encountered (Fig. 24, 25). Mining plans had to be submitted to JFWAT and to the Bureau of Land Management (BLM) for approval and all upland sites must be revegetated. An exception to this was the development of an upland site which has resulted in a negative aesthetic impact. Alyeska had requested a permit to open a materials site on the lower slopes of Sukapak Mountain, in the Brooks Range (Fig. 26). An authorization to begin the operation was given by the Alaska Pipeline office before BLM, the official approval agency, had reviewed the plans. BLM rejected the application on the grounds that Sukapak Mountain was one of the most scenic vistas along the pipeline route and should be left in its natural state. However, the rejection occurred after Alyeska had constructed an access road and opened the pit. The road and gravel pit have considerable negative visual impact and it will take quite some time and cost to restore the area to some semblance of its former aesthetic state.

OIL SPILLS

There have been many fuel oil spills during the course of construction. Some of the more severe of these have been at camps constructed prior to the granting of court injunctions in 1969. For example, a spill which occurred at Prospect Camp during the winter of 1975-76 was still being recovered and burned at the time of our inspection. The camp had been constructed on the bank of the Jim River without the 100 m buffer strip stipulated for later camps. During the winter of 1975-76, a fuel oil line buried in the gravel pad ruptured, and some 190,000 L of fuel was spilled. The leak went undetected until spring thaw, when an oil slick appeared on the

river. Booms were placed in the river and the oil was skimmed off and burned (Figs. 27, 28). Seepage from the gravel pad was still continuing in June, 1976.

In another instance, a fuel spill, again emanating from a leak in the camp heating system, was discovered at Galbraith Lake Camp on February 7, 1975. It was estimated that the spill was 400 L or less. However, when the ground thawed in June of 1975, oil began to seep from the gravel into a creek and into Galbraith Lake. The actual amount of the fuel spilled was not determined but estimates run as high as 250,000 L.

Similar incidents occurred at Toolik Camp where 7,500-9,000 L of fuel oil surfaced down slope of the camp and destroyed approximately 4.5 ha of tundra, and at Franklin Buffs Camp where approximately 110,000 L of oil from a ruptured fuel line contaminated about 2 ha of adjacent tundra.

WASTE WATER TREATMENT

Waste water effluents from camp sewage treatment plants must comply with standards set by the State of Alaska, Department of Environmental Conservation and be approved by the United States Environmental Protection Agency. These require an 85% reduction of both the biological oxygen demand (BOD) and suspended solids.

Because of inexperience in designing and operating these facilities, Alyeska has not consistently met the objectives. When a facility fails to meet the accepted standards for three consecutive weeks, the remedy has been to remove 10% of the camp population until the plant meets the permit requirements.

The impact of waste water discharges on Arctic and sub-arctic streams is not known. However, Mr. E.W. Shallock of the EPA Environmental Research Laboratory at Fairbanks stated that many of the streams and rivers in Alaska are subject to critically low concentrations of dissolved oxygen in winter in the natural state. Waste water effluents could exacerbate the natural situation and produce an even greater oxygen sag resulting in a greater stress on overwintering fish populations, already experiencing an environmental extreme.

MONITORING AND SURVEILLANCE OF THE ALYESKA PIPELINE - THE JOINT (STATE/FEDERAL) FISH AND WILDLIFE ADVISORY TEAM

ORGANIZATION

The construction surveillance mechanism for the Alyeska Pipeline involved three principle organizations: the State Pipeline Coordinators Office (SPCO) which is responsible for the 1/3 of the right-of-way across state land; the Alaska Pipeline Office (APO) responsible for the 2/3 of the right-of-way that crosses federal land; and the Joint (State/Federal) Fish and Wildlife Advisory Team (JFWAT) that serves both APO and SPCO in recommending measures to prevent or minimize environmental damage.

Biological surveillance by JFWAT involved

three principal steps.

- 1) Design review, in which JFWAT biologists and engineers recommended acceptance, modification or rejection of design elements submitted by Alyeska through SPCO and APO in the form of "notice-to-proceed" applications,
- 2) Field surveillance, in which biologists checked on the implementation of all features of the project that might affect fish and wildlife, and
- 3) Technical evaluation in which the actual effectiveness of key design elements was studied to see if the recommended measures had the desired effect of protecting critical resources. Technical evaluation has been conducted to assess the acceptance of the pipeline by moose and caribou populations and the effects on spawning beds and fish reproduction. A description of the technical evaluation projects is given in Appendix 1.

Review of the project design in the period August 1974 - December 1975 produced some 1,500 written items of advice. Virtually all of these involved habitat protection and 80% of these pertained to the aquatic environment.

Staff for the team came primarily from the U.S. Fish and Wildlife Service, Department of the Interior and from the Alaska Department of Fish and Game. The positions were not seconded to the organization but were established as term positions for the duration of the project (April 1974 - November 1977). At full complement, JFWAT had a staff of 33. Following completion of major construction, the staff was reduced to 17 in August 1976. This remaining group's responsibilities were:

- 1) to provide surveillance coverage during the construction of the pump stations and terminal, and to oversee revegetation and rehabilitation;
- 2) to provide staff for the completion of technical evaluation projects and the preparation of project summary reports, and
- 3) to provide technical staff for the review of the Oil Spill Contingency Plan.

The team was subsequently disbanded in December 1977. Surveillance and monitoring requirements are now the responsibility of the Pipeline Surveillance Team under the Habitat Protection Section of the Alaska Department of Fish and Game.

It was generally felt that the level of staffing was adequate for the purpose, although it was our impression that additional staff were needed for technical evaluation projects (i.e. follow-up studies as opposed to day-to-day provision of professional advice).

The team approach was effective in bringing together state and federal staff, the former bringing to the team valuable local knowledge of the resource and the latter contributing a wider experience and a broader perspective. Both federal and state members of the team retained a

reporting relationship to their respective parent agencies although agency affiliations were played down in favour of a team approach. The combination of state and federal biologists in one location with a single administrative structure proved to be more efficient than running the surveillance team through its parent agencies. Where the stipulations for grant of right-of-way were not adequate to safeguard fish and wildlife resources, JFWAT biologists could apply either state or federal statutes and regulations to cover the oversight. The application of pre-existing state and federal authority to various situations proved to be the most important facet of JFWAT. One of the most powerful pieces of legislation which could be brought to bear was Alaska Statutes Title 16 which empowered the Commissioner of Fish and Game to regulate virtually any activity that could alter the physical and chemical environment of fish streams. When lease stipulations fell short in their protective powers, Title 16 was applied as a second line of defence, regardless of whether the land was federally, state or otherwise owned.

Despite the success of JFWAT three major shortcomings were identified. As a result of these, the team did not have sufficient authority to carry out all of the tasks of which its professionals were quite capable of performing. First, the team had "advisory" status only and state and federal pipeline offices were not bound to heed JFWAT's concerns. Second, JFWAT was not mobilized as early as it should have been, in time, for example, to influence major alignment decisions. The construction of the haul road was largely outside the purview of the pipeline offices and was well under way by the time JFWAT was created. Had the team been mobilized by January 1974 rather than some 6-10 months later, some primary design decisions could have been beneficially changed. Third, as pointed out in an earlier section, JFWAT should have been given a broader mandate to cover air and water quality surveillance. This would have required the addition to JFWAT of professionals from the state Department of Environmental Conservation, the federal Environmental Protection Agency and the United States Geological Survey.

Much of the team's time was devoted to the correction of the shortcomings both in environmental stipulations and in Alyeska's own quality control efforts. It was apparent that, in future, time devoted to the development of a good set of enforceable stipulations would be time well spent. Similarly, it is essential that there must be a mechanism to exert pressure on the permittee to ensure that construction is completed according to the approved design specifications.

STAFF

It was essential that the team be comprised of experienced personnel, preferably with a background in environmental impact work. Because of the heavy initial workload (i.e. design review) there was no time for inexperienced people to learn the job. The majority of professional staff was recruited at the Master's and Ph.D. level. This was important in order for the team to establish credibility with APO, SPCO and Alyeska early in the exercise. This could only be

accomplished with mature and highly competent staff.

Field surveillance was undertaken on a seven-day-a-week basis. Two biologists were assigned to each section, spending ten days in the field and ten days in headquarters, with four of the latter as off-duty time. Regular briefing sessions were essential to maintain a continuity between each section and between field and headquarters staff.

There is little doubt that the advisory team established a reputation for its dedication and "esprit de corps". However, in the later stages of its existence the team experienced problems as a result of the "term" nature of the positions. Staff were inevitably looking for new positions before the job was completed. Federal staff were guaranteed positions on completion of the task but these may have been anywhere within the agency and not necessarily attractive to the incumbent. State staff could not be offered such assurance of continued employment.

FUNDING

All expenses of the team that were the result of work performed and that would not have been necessary in the absence of the project were reimbursed by the permittee. This ensured that team staff received good logistics support in the field as far as accommodation, food and vehicles were concerned.

PUBLIC CONTACT

The team issued weekly surveillance reports, including summaries of all advice and recommendations issued. These were readily accessible to public interest groups through the State Pipeline Coordinator's office. Concern was expressed from several sources as to the power vested in the field engineers of the Alaska Pipeline Office and the State Pipeline Coordinator's Office. Advisory Team staff felt that this public link acted as a useful checking mechanism or monitor which helped to ensure recognition of environmental issues.

OBSERVATIONS AND RECOMMENDATIONS

The following are a series of observations and recommendations primarily related to the organizational structure of JFWAT, which have arisen from discussions with Alaska staff and from notes taken on the apparent effectiveness of the Advisory Team by the present delegation. These are considered to be relevant to the design of any pipeline surveillance agency which may be required in Canada.

1. The staff complement employed in Alaska appeared to be adequate for the task, i.e. fish and wildlife surveillance. It was evident that the number of aquatic habitat problems greatly exceeded the terrestrial and, therefore, the staff complement should reflect this.

There would appear to be a need for

additional work in the area of follow-up or technical evaluation. The objective of this work should be to assess the effectiveness of the corrective measures or design features recommended so that these could be further modified where necessary and the results applied to future pipeline problems.

2. Experience suggests that an additional key individual on the team would be a field coordinator who could travel freely in the field and strengthen the link between headquarters and field personnel. Excellent communications are essential to the effectiveness of the team.

It was essential that the team management retain a flexibility to move staff around, particularly in the early stages, so that personalities could be matched with situations for maximum effectiveness.

3. It was essential that high quality experienced staff be employed for this work, to ensure both effectiveness and credibility. This could be a difficult task in Canada, which at present has a relatively small pool from which to draw. One possibility which should be considered to alleviate this situation is that of utilizing some of the Alaska expertise and experience. There was considerable interest expressed by the Alaskan biologists we met concerning the possibilities of work on a Canadian pipeline. It would be worth investigating whether an exchange or contract arrangement could be developed to employ a number of the U.S. environmental staff on a Canadian pipeline project.
4. It should be noted that a major weakness in the Canadian situation is the absence of an established corps of field management staff, such as the State of Alaska has. Thus to handle additional resource problems the Fisheries and Marine Service may find it necessary to augment both its enforcement and its fishery management staff.
5. The approach to staffing should be carefully reviewed. A team cannot afford to lose key staff because of the tenuous nature of term appointments.
6. The prime focus of the Alaska Advisory Team has been habitat protection. The effectiveness of a Canadian surveillance team would be enhanced if it included a capability for air and water quality surveillance, both of which are essential ingredients in habitat protection. For similar reasons a capability for pollutant spill control should be included. The resultant unit would become an environmental and habitat protection unit.
7. There was noticeable concern and resentment that the Fish and Wildlife Team was purely advisory and has little direct "clout". It was suggested from several sources that a high level of authority should be accorded to the team and that some veto power should be included. However, there is always concern that progress will be delayed if such authority is given. In the delegation's opinion we would have serious doubts about the

validity of such a concern since such authority is usually treated with respect and rarely used except when really necessary.

8. In our view the team could usefully be strengthened by having one man at its head rather than a two-man committee-type arrangement.
9. There was some resentment evident because all key field positions with the Alaska Pipeline office and State Pipeline Coordinator's office were automatically engineers. In our opinion it would certainly seem that the key government position on each section should be filled by a first-class administrator (decision-maker). Whether he be engineer, biologist or otherwise is irrelevant.
10. In view of the above points (i.e. 7, 8 and 9) we suggest that serious consideration should be given to the proposal outlined by Norton in his testimony before Mr. Justice Berger's Mackenzie Valley Pipeline Inquiry. In this he recommends separation of the three conflicting missions into (1) an Environmental Team, (2) a Pipeline Integrity Team (integrity, engineering, aesthetics) and (3) a Pipeline Coordination Team (permits, logistics, etc.). Each must exist at a similar level and have the authority to selectively or completely shut down construction by enforcement of stipulations or by prosecution through legislation. This proposal has merit but needs more careful consideration before it can be considered viable.
11. Similar to the above, or as a possible alternative, the team requires some sort of an appeal mechanism. If it is not satisfied with a particular decision that it feels is of sufficient importance, a mechanism should be developed which could ensure an objective review without causing undue delay to the project. The only line of appeal open to the Alaska team was via Washington, a lengthy procedure involving authority divorced from the scene of the action.
12. Two features appear to be essential to the success of an environmental surveillance team. The first is a good set of stipulations. There is little doubt that Canada can develop a set which is more specific and precise in the light of the Alaska experience. They should also be made more enforceable.

Secondly, the team must be established at as early a date as possible. It should have time to get established so that it is in a position to devote its energies to the many inevitable requests for design change which will occur in the early stages of construction. Similarly, the greatest potential for environmentally damaging accidents and mistakes will exist in these early phases.
13. It is evident that a relatively small team can be an effective surveillance unit. The key to its effectiveness would appear to lie in the following:

- (1) fully qualified and experienced staff;
- (2) a dedication to the task;
- (3) a relative absence of interagency and interprofessional rivalries/jealousies, and
- (4) an integrated "team" approach that depends upon good internal communication.

ACKNOWLEDGMENTS

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REFERENCES

- National Energy Board. 1977. Reasons for decision - Northern Pipelines. Dept. of Supply & Services. Canada. Ottawa.

APPENDIX 1: TECHNICAL EVALUATION PROJECTS
UNDERTAKEN BY THE JOINT (STATE/FEDERAL)
FISH AND WILDLIFE ADVISORY TEAM

Of the seven technical evaluation projects initiated under the auspices of JFWAT, five were managed by the state and two by the federal contingent. These projects included:

1. Effects of the Trans-Alaska Pipeline on caribou movements (state):

Study areas and vegetation plots were delineated near Toolik, Wiseman and Sourdough. Caribou were captured along the pipeline right-of-way and were fitted with radio transmitter collars or tagged. Movements of caribou are monitored continuously wherever special pipeline designs have been developed for caribou passage. Monitoring will be required for several years following pipeline construction to determine if the requirement for free passage for caribou has been satisfactorily accommodated.

2. Effects of the Trans-Alaska Pipeline on moose movements (state):

Study areas have been identified in the Copper River basin. Moose movements across the pipeline corridor are being delineated. Twenty moose were fitted with radio collars and 143 have been marked with color-coded canvas collars. Electronic counting devices were installed at selected locations where elevated pipe was installed to meet passage criteria for moose. Monitoring will be required for several years to determine if free passage for moose has been provided by the design of the facilities.

3. Stream quality environmental baselines at pipeline crossings (federal):

Emphasis has been placed on sediment analysis as it relates to spawning and rearing habitat. Frozen cores have been collected from selected streams before and after construction. Data analysis and habitat change evaluations are being accomplished on a continuous basis and, depending on findings, could be completed 1-2 years following completion of the last river crossing. Project completion will be dependent on analysis of data and the need to provide post-construction baseline data for several years to determine if mitigation proposed by JFWAT was successful.

4. Gulkana-Lowe River drainage technical evaluation project (state):

A mitigation plan for the rechannelization of the Canyon Slough complex (a tributary to the Lowe River) was developed by JFWAT, eliminating 14 of the 17 proposed pipeline crossings of this stream. Post construction evaluations to determine the rate of reestablishment and utilization of the channelized area by fisheries resources are being conducted.

Salmon spawning areas have been delineated on the Little Tonsina River, necessitating the

relocation of one and elimination of two pipeline crossings. Post-construction studies are being conducted to determine fish species, abundance, timing and location of spawning areas. Pre-construction studies of the Gulkana River and selected tributaries to determine fish migration, timing, abundance and distribution are being followed up by post-construction studies to determine the success of mitigation measures proposed by JFWAT.

5. Tanana-Salcha River drainage technical evaluation progress (state):

The objectives of this project are to assess the impact of buried crossing construction on the fishery resources of the Tanana and Salcha rivers and several clear-water tributaries. Water quality during actual in-stream construction and its effects on downstream fishery resources were monitored.

Post-construction surveys are being conducted to determine distribution and abundance of fishery resources near crossing areas.

6. Koyukuk-Dietrich River drainage technical evaluation project (state-federal):

The objectives of this project are to determine the effects of river training structures and pipeline construction on fishery habitat and fish production in the Middle Fork of the Koyukuk and Dietrich rivers.

The methods used to achieve these objectives are:

- a) A pre-construction assessment of fish resources and critical fish habitat.
- b) A post-construction assessment of fish resources and fish habitat lost to pipeline construction.
- c) This information is being used in the formulation of recommendations for mitigation to be required of the Alyeska Pipeline Service Company.
- d) Similar information is being gathered on other streams as deemed necessary.

7. Subtidal evaluation and the effects of terminal construction on Port Valdez (federal):

The objectives of this project are to determine the effects of terminal construction and operation on the subtidal benthic community of Port Valdez.

APPENDIX 2: TECHNICAL REPORTS RESULTING
FROM JOINT FISH AND WILDLIFE TEAM
SURVEILLANCE AND MONITORING ACTIVITIES

In order to document the history and advances in technical knowledge resulting from JFWAT activities, the following reports are being published. Copies of these reports can be obtained from:

Pipeline Surveillance Team
Habitat Protection Section
Alaska Department of Fish and Game
Suite 217
430 W. 7th Avenue
Anchorage, Alaska 99501

These reports include the following:

1. History of the Joint State/Federal Fish and Wildlife Advisory Tream 1974-77.
2. Evaluation Report. The interagency approach to environmental surveillance.
3. Evaluation Report. Trans-Alaska Pipeline environmental stipulations.
4. Evaluation Report. Effects of low water crossings on fish habitat.
5. Evaluation Report. Effects of river training structures on fish habitat.
6. Evaluation Report. Culverts and fish passage, Trans-Alaska Pipeline.
7. Evaluation Report. Special pipeline structures for moose passage.
8. Evaluation Report. Special pipeline structures for caribou passage.
9. Evaluation Report. Effects of pipeline construction on the Lowe River fish populations.
10. Evaluation Report. Effects on pipeline construction on the Little Tonsina River fish population.
11. Evaluation Report. Effects of pipeline on the Gulkana River fish population.
12. Evaluation Report. Effects of pipeline construction on the Tanana River fish population.
13. Evaluation Report. Effects of pipeline construction on the Salcha River fish population.
14. Evaluation Report. Endangered species protection along the Trans-Alaska Pipeline.
15. Evaluation Report. Sediment analysis a basis for measuring fish habitat change during pipeline construction.
16. Port Valdez Subtidal Studies. Bimonthly reports extending through terminal construction completion.
17. Wildlife Atlas. Trans-Alaska Pipeline.
18. Catalog of Water Bodies in the Oil Pipeline corridor.
19. List of streams and other water bodies along the Trans-Alaska Pipeline Route.
20. Evaluation Report. Environmental Quality Assurance - quality control Trans-Alaska Pipeline.

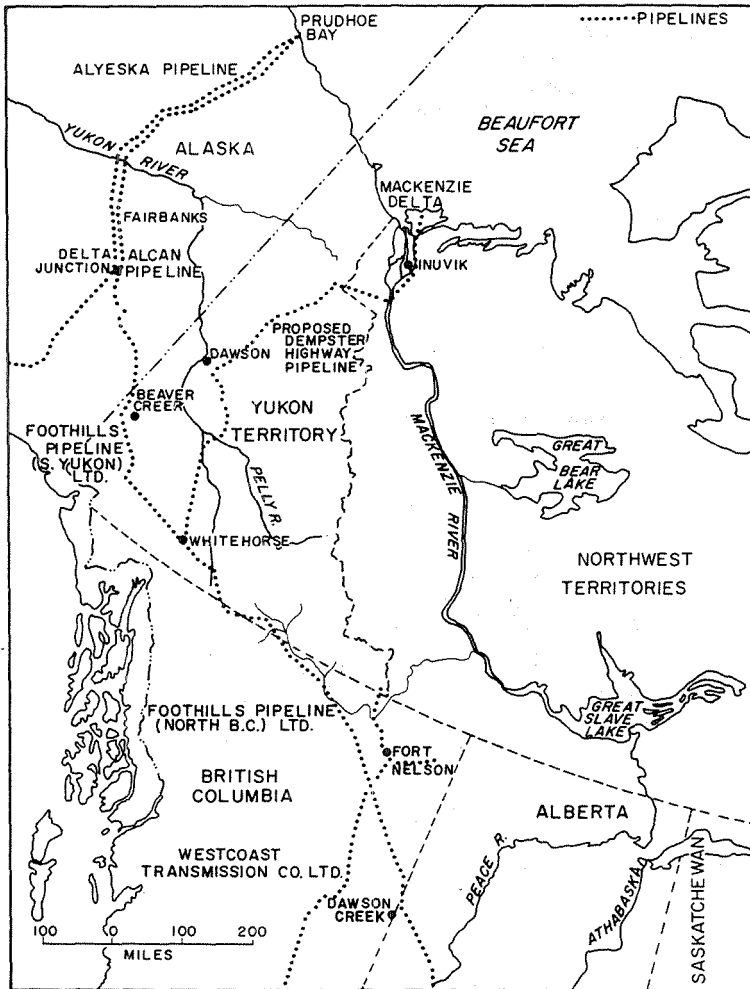


Fig. 1. Route map of the Alaska Highway Gas Pipeline.

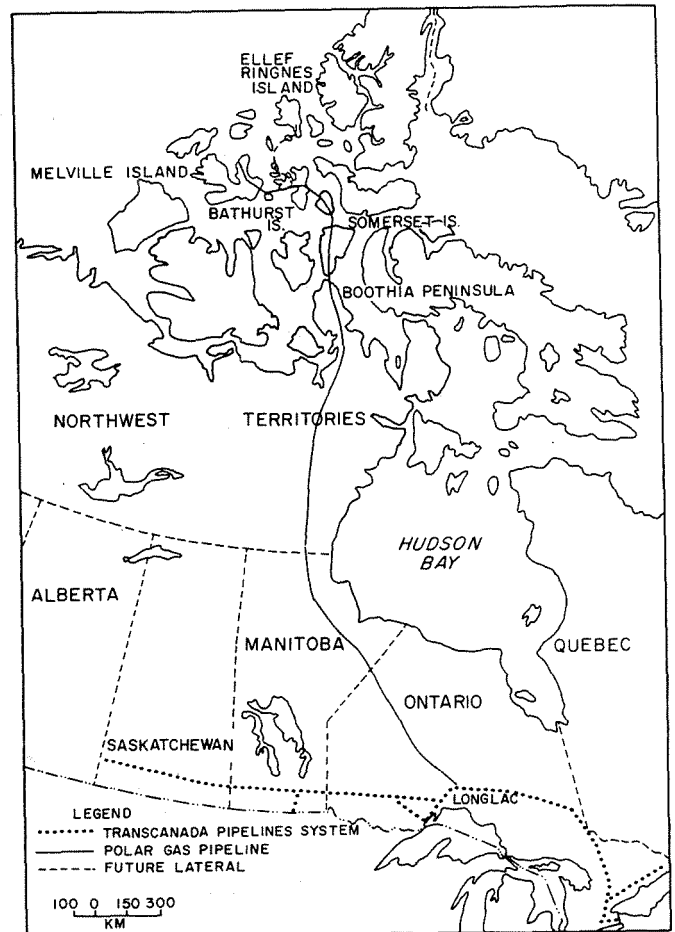


Fig. 2. Route map of the Polar Gas Pipeline.

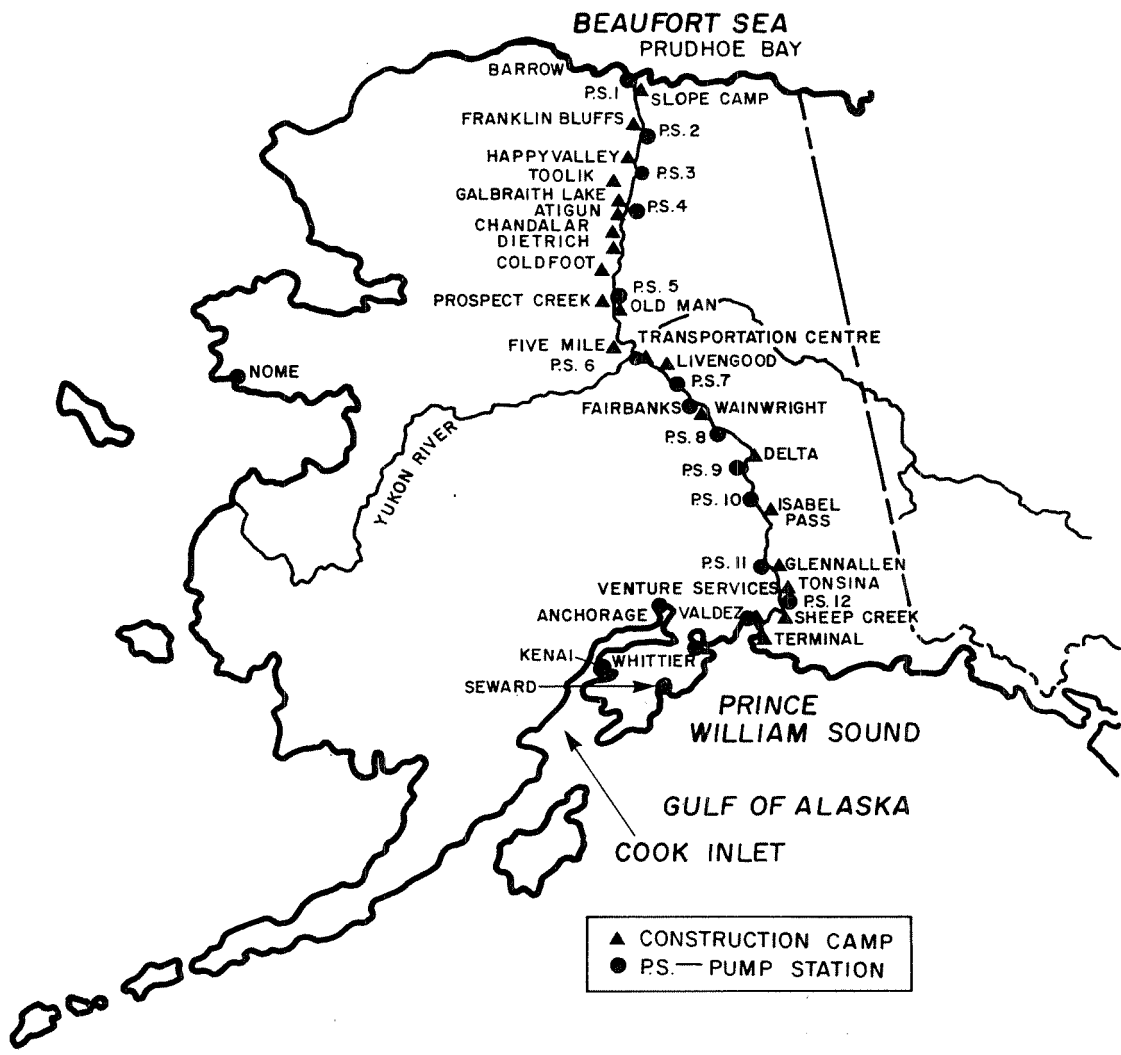
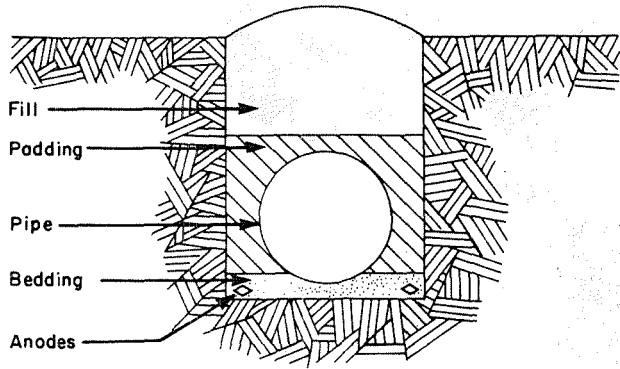
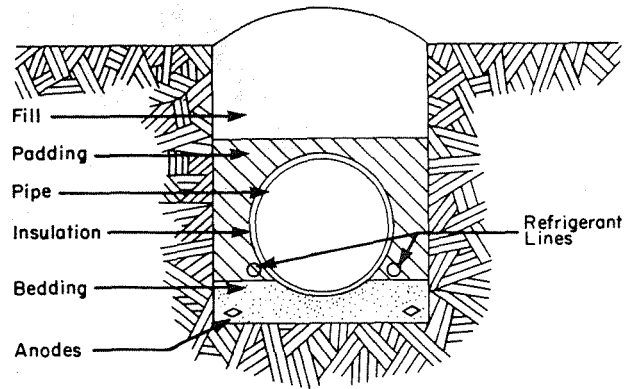


Fig. 3. Route map of the Alyeska or Trans-Alaska Pipeline.

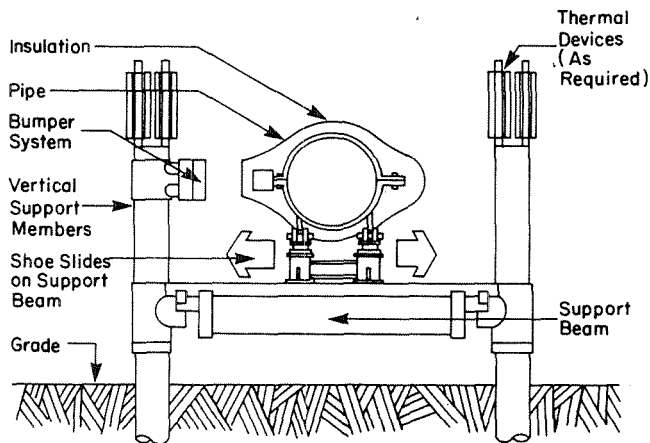
Conventional Bury



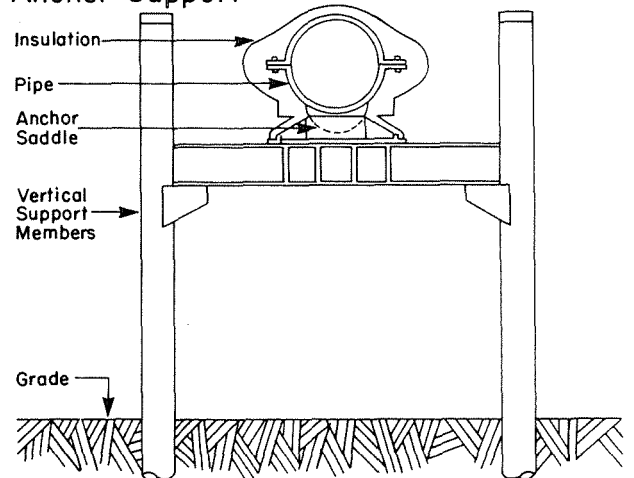
Special Bury



Conventional Elevated



Anchor Support



TYPICAL ZIGZAG CONFIGURATION

Supporting Spacing 50' to 70'

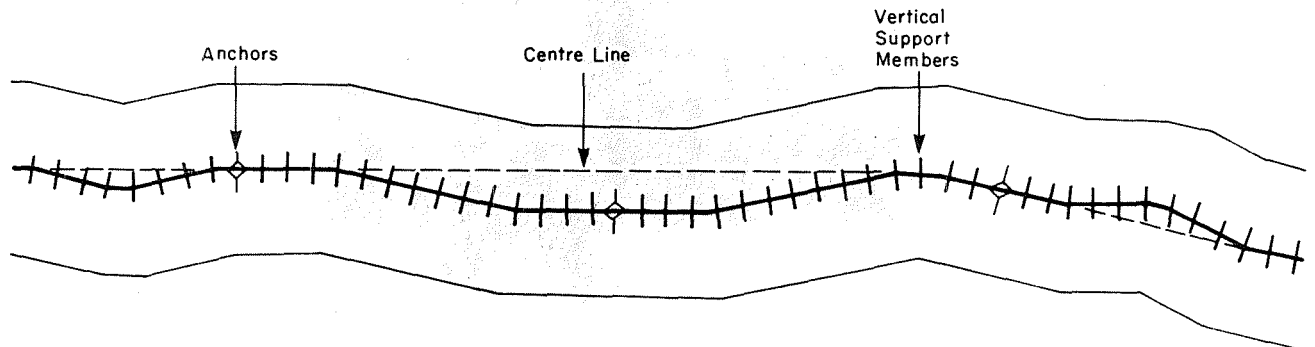


Fig. 4. Modes of construction used on the Alyeska Pipeline.



Fig. 5. Preparation of trench for buried segment of the pipeline.

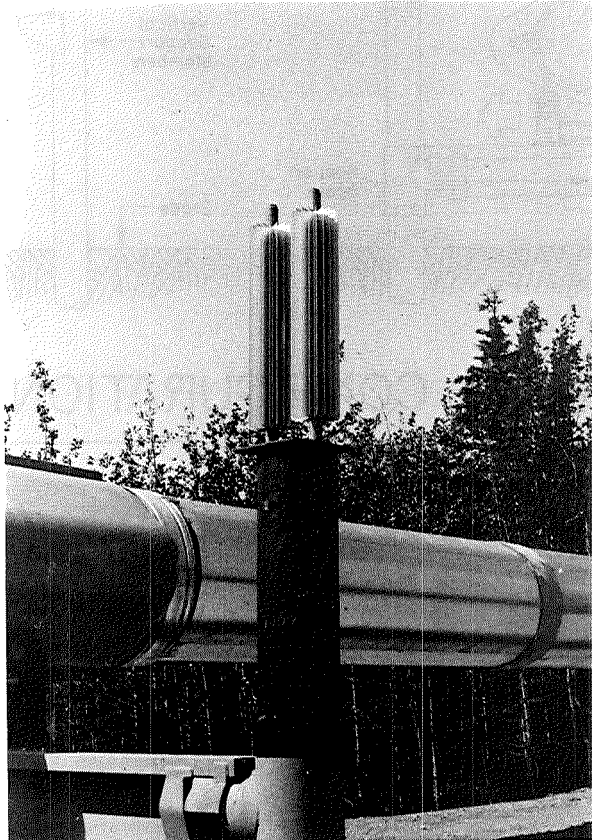


Fig. 6. Above-ground mode showing vertical support members (VSMs) thermal radiators and galvanized covering.



Fig. 7. Zigzag configuration of above-ground selection of pipeline (left) and haul road, Yukon River area.

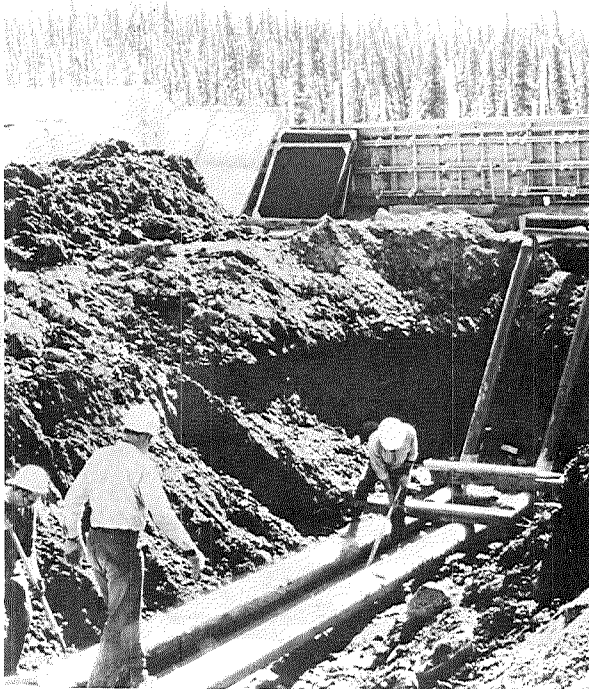


Fig. 8. Installation of brine pipes on refrigerated burial segment of pipeline, Glennallen area.

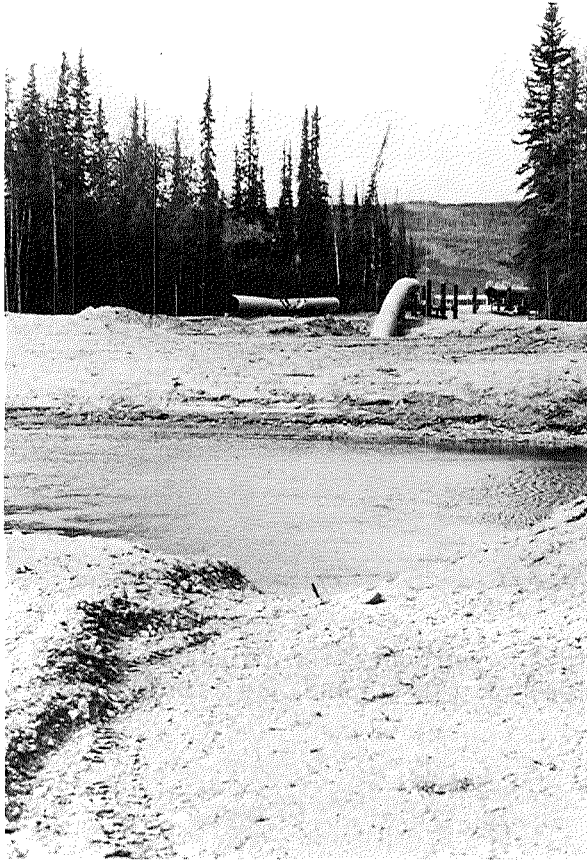


Fig. 9. Descent of pipeline beneath Chatinika River, near Fairbanks



Fig. 10. Chatinika River crossing, near Fairbanks. Note logs used as riprap and erosion of river bank after only four months.

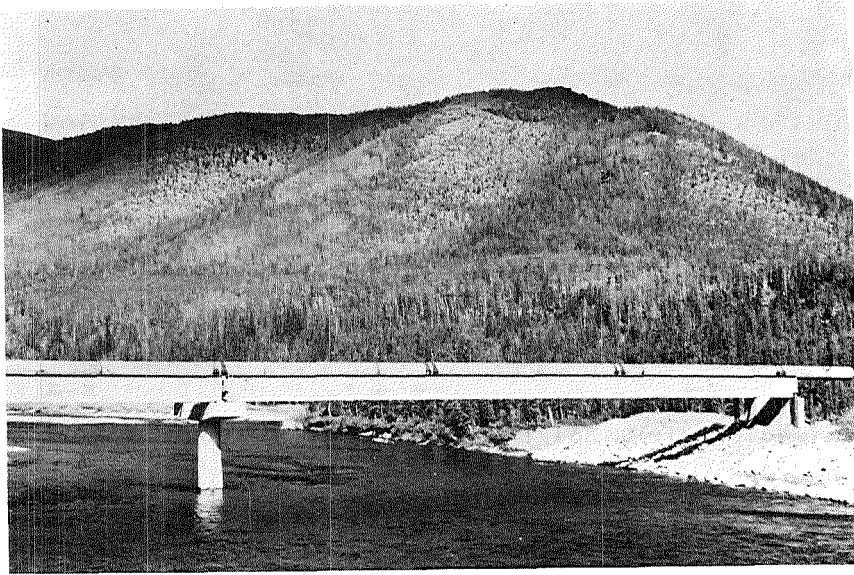


Fig. 11. Bridged crossing of the Koyakuk River, Brooks Range



Fig. 12. Valdez Terminal from small boat harbour at Port Valdez.



Fig. 13. Construction in progress at Valdez Terminal, June 1976

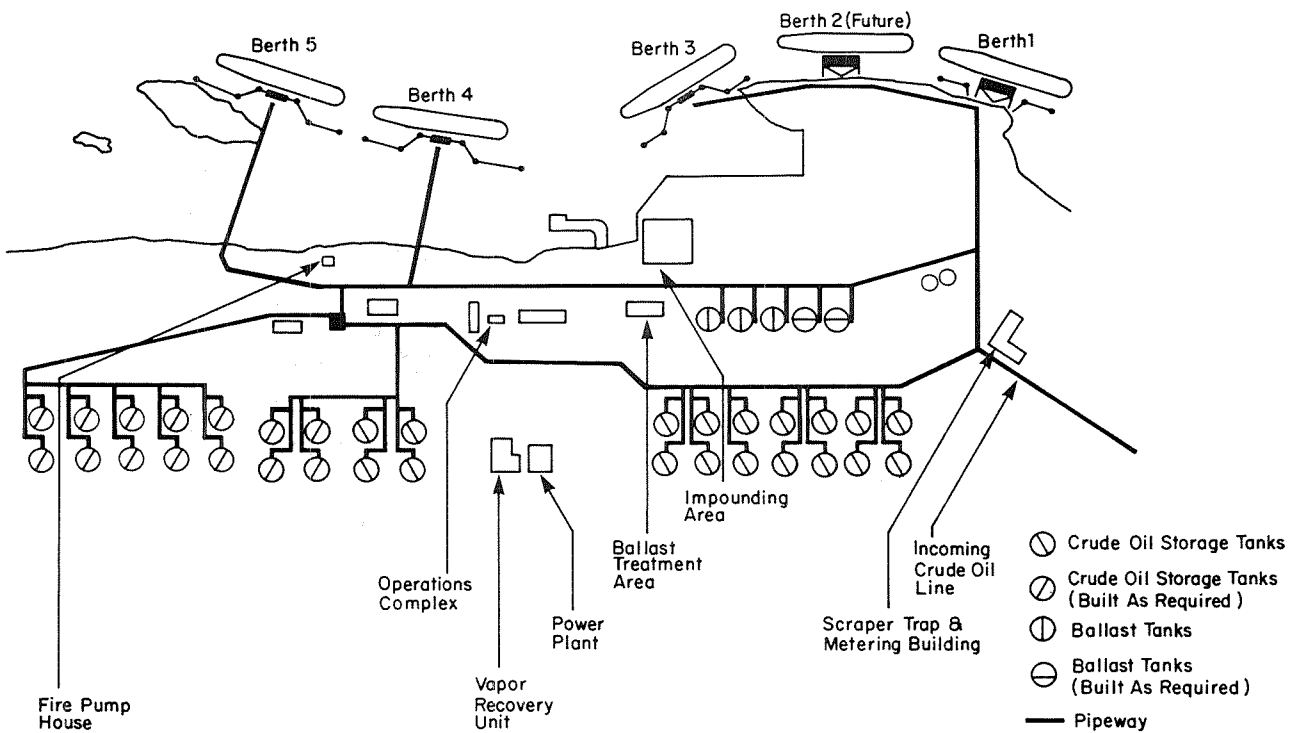


Fig. 14. Schematic of Valdez Terminal at maximum development

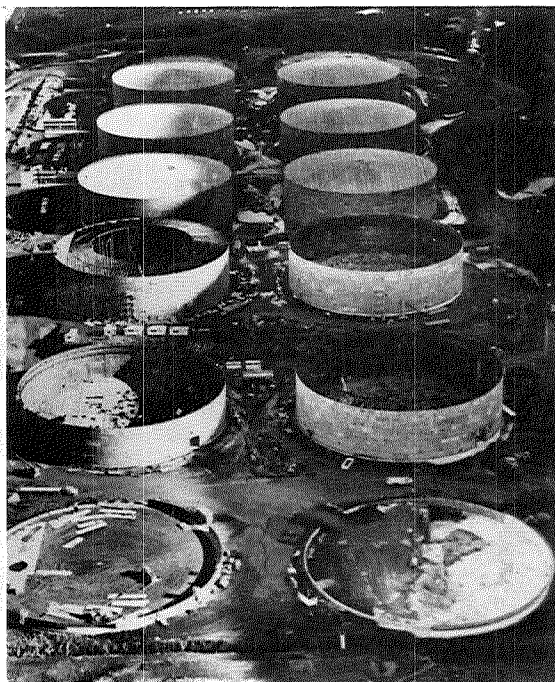


Fig. 15. Fabrication of oil storage tanks, Valdez Terminal. Note size of tanks relative to service vehicles.

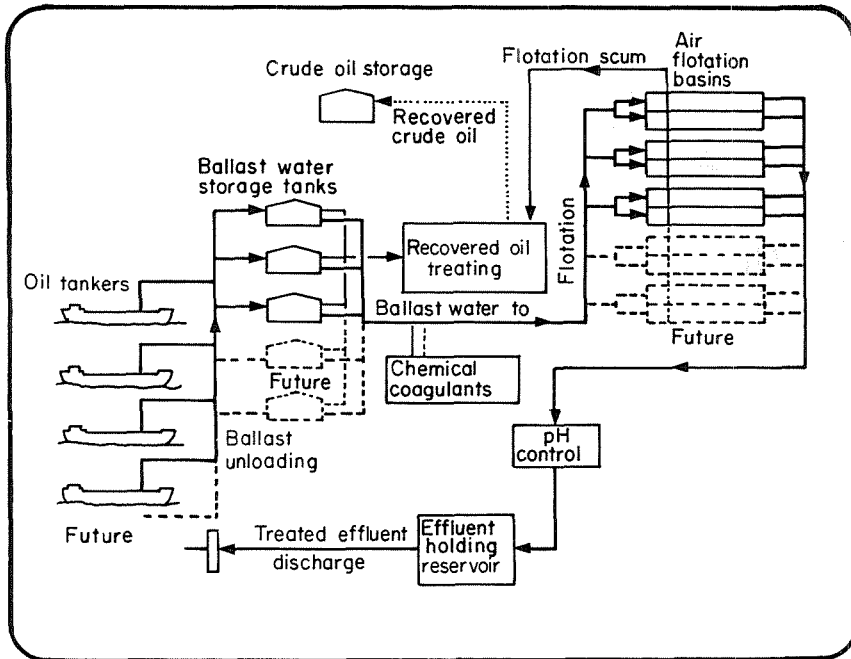


Fig. 16. Schematic of oily ballast water treatment facility at Valdez Terminal.



Fig. 17. Vertical-support-members in place to bank of Dietrich River. Pipeline was scheduled to be built through prime grayling overwintering area until JFWAT intervention.



Fig. 18. Improper alignment of pipeline resulting in flow of glacial meltwater along right-of-way and the deposit of silt in an important salmon and nursery area on the Little Tonsina River.



Fig. 19. Low-water-crossing of small grayling stream, Brooks Range area.

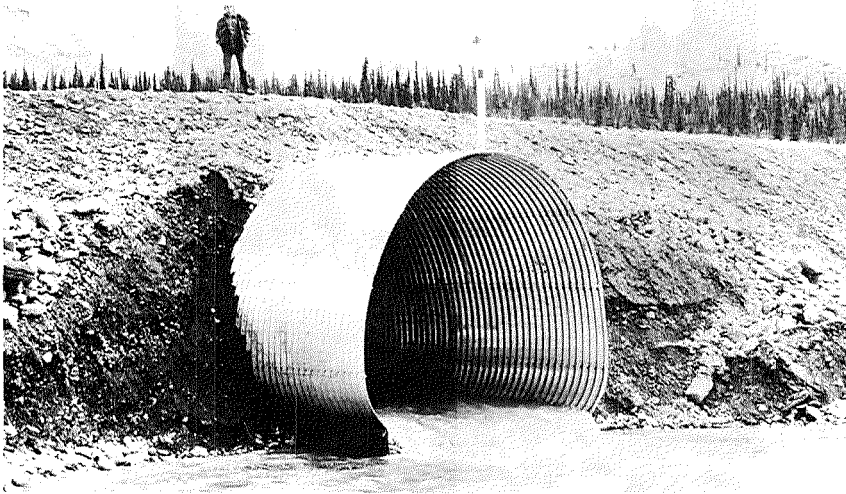


Fig. 20. An improper culvert design which has resulted in a blockage to migratory fish.



Fig. 21. Marion Creek culverts and fishway.



Fig. 22. Inadequate side slope drainage will result in failure of haul road.



Fig. 23. A typical flood plain materials site, Brooks Range area.



Fig. 24. Rehabilitated materials site, Brooks Range area. Note rechanneled stream and bank stabilization. Area is to be revegetated.



Fig. 25. Reseeding of materials site, Brooks Range area.

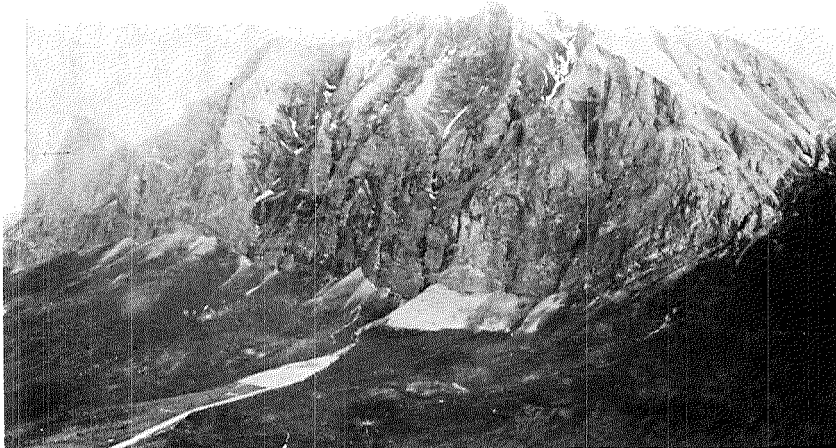


Fig. 26. Materials site on talus slope, Sukapak Mountain, Brooks Range.



Fig. 27. Oil spill containment booms in Jim River, Prospect Camp.

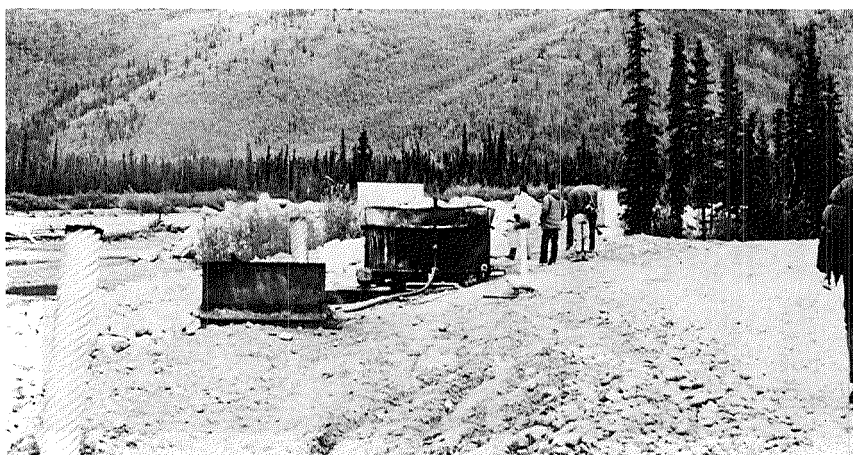


Fig. 28. Oil spill skimming and incineration, Prospect Camp

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