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Greens Creek Final Environmental Impact Statement

Admiralty Island National Monument, Alaska

Proposed Noranda Mining, Inc. Project

Greens Creek Final Environmental Impact Statement
Errata

Page 2-20 (last paragraph)	-	Change to: ...option for each of the six non-fixed components.
Page 2-45 and 2-46	-	Page numbering reversed.
Page 2-46 (4th paragraph)	-	Change to: This settled material would be hauled to an area within the tailings pond.
Page 2-60 (4th paragraph)	-	Change to: Since the Cannery Muskeg tailings pond eliminates a total of 0.3 acres (direct and potential) anadromous fish habitat, loss is equivalent...
Page 3-22 (last paragraph)	-	Change to: ...related to seven cabins in the inlet...
Page 4-28 and 4-29	-	Change 6.4 miles of pipeline to 7.4 miles
Page 4-31	-	Second sentence should read - Table 4-1 (page 4-8)...
Page 4-32	-	Change 6.4 miles of road to 7.4 miles.

RECORD OF DECISION
GREENS CREEK MINING PROJECT
FINAL ENVIRONMENTAL IMPACT STATEMENT
ADMIRALTY ISLAND NATIONAL MONUMENT
USDA - FOREST SERVICE
TONGASS NATIONAL FOREST - CHATHAM AREA

Based on the analysis and evaluation in the Final Environmental Impact Statement for the Greens Creek Mining Project it is my decision to adopt Alternative 6. This Alternative will be used in the development of a detailed operating plan for the project. The effluent discharge site, while identified in the Preferred Alternative, is located outside the jurisdiction of the Forest Service and requires a certification of compliance with Alaska Water Quality Standards (ADEC) and a National Pollution Discharge Elimination Permit (EPA). The Chatham Straits discharge site was selected based on a lack of definitive data regarding potential biological effects within Hawk Inlet and the absence of discharge standards from ADEC at the time of this decision. It is recognized that the Hawk Inlet sill discharge site is technically and economically preferred. If, at a future date, the permitting agencies are satisfied that potential biological effects have been identified and/or that no significant deterioration of the biological community will occur, the Forest Service will not oppose effluent discharge at the Hawk Inlet sill site displayed in this EIS. Discharge at any other sites would require additional analysis and review.

Nine alternatives were evaluated, including the No Action Alternative which would not allow development of the project. The range of alternatives addressed all major issues but was limited by the location of the mine and major shipping facility, both of which are at fixed locations. The eight action alternatives differ from each other in the type and location of various project components such as employee housing, on and off island transportation, milling facilities, tailings pond, and effluent discharge.

The selected alternative is consistent with direction provided by the Alaska National Interest Lands Conservation Act (ANILCA) for development within the Monument, and with the Tongass Land Management Plan (TLMP) for development on non-monument land on the Juneau Ranger District. This alternative is the environmentally preferred alternative and will provide the best combination of physical, biological, social and economic benefits. It also contains the most practical means to reduce or minimize environmental effects. Alternative 6 is consistent with the standards and criteria set forth in the State of Alaska Coastal Management Program (ACMP).

Alternative 6 was selected because it met all evaluation criteria at an acceptable or better level. Alternatives which best addressed an individual criteria also addressed other criteria at an unacceptable level. Alternatives 1, 3 and 8 minimize road construction and house mine employees at the cannery but result in moderate to very high impacts on wildlife, recreation, subsistence and monument values. In addition, Alternative 3 is highly complex and costly and poses a moderate threat to Greens Creek. Alternative 5 best addresses monument and fisheries criteria, but represents a moderate impact or threat to wildlife, recreation and the marine environment in Hawk Inlet. Alternative 4 best addresses wildlife, recreation and subsistence criteria but meets monument criteria at the lowest level and poses a threat to the greatest area of Greens Creek fish habitat. Alternatives 2, 6 and 7 are similar with the exception of a single component. Alternative 2 results in effluent discharge within Hawk Inlet. Since discharge standards are not available and biologic effects of the discharge have not been verified this was considered the least desirable of the two discharge sites. Location of the milling facility at the tailings pond in Alternative 7 increased impacts to wildlife, recreation and subsistence.

The Final Environmental Impact Statement, the Project Operating Plan and other required permits and approvals will guide the development and operation of the project and will provide reasonable and specific mitigation, monitoring and reclamation requirements. The following is a partial summary of the major assumptions and mitigation, monitoring and reclamation measures identified in the FEIS. Specific details will be included in the Operating Plan.

ASSUMPTIONS

1. The projected mine life based on proven ore reserves is 11 years. This EIS anticipated additional reserves and utilized a mine life of 15-17 years. The tailings disposal site and other facilities are designed for a 15-17 year mine life.

2. Detailed plans and specifications for all engineered structures or facilities will be completed by a licensed engineer and submitted to the Forest Service for review and approval prior to any construction activity.

3. Noranda will develop detailed mitigation, monitoring and reclamation plans as part of the final Operating Plan. The reclamation plan will include all areas on National Forest land disturbed by the project.

4. A "Spill Prevention and Control Countermeasures Plan" which addresses storage of petroleum products and contingency provisions for coping with emergency spill situations will be prepared by Noranda and reviewed by EPA prior to utilization of the storage facilities.

5. Noranda will comply with all State and Federal requirements for safety, health and environmental protection.

6. No Noranda employees will be permanently housed on Admiralty Island following construction.

7. A special use permit will be issued for the Young Bay to the cannery road. The road will be permitted for exclusive use by Noranda vehicles on company business. No use of the road by private vehicles will be allowed. Any modification of this permit will require review and approval by the Forest Service.

MITIGATION

1. Fisheries habitat destroyed by construction of the cannery muskeg tailings pond will be mitigated by removal, by Noranda, of a fish barrier on Greens Creek at R.M. 3.5.

2. Construction of the tailings slurry line will consist of a 5-6 inch slurry pipe enclosed in a 24 inch corrugated metal pipe (CMP).

3. During construction, runoff from all disturbed areas will be routed through sedimentation ponds.

4. Solid waste will be incinerated. The area around the incinerator will be fenced.

5. The use of explosives and other construction activity will be adjusted to insure compliance with the Bald Eagle Protection Act.

6. Noranda will insure that all employees transported to Admiralty Island by the company will be returned to Juneau by the company at the end of their shift.

7. Noranda will not allow employees to transport guns, traps or fishing equipment to Admiralty Island on company transportation. Only security personnel will have access to firearms for emergency wildlife confrontations.

8. The Young Bay to Cannery road will only be used for transfer of Noranda employees on company business. Any other use of this road will require a formal revision of the special use permit.

MONITORING

Noranda will be responsible for all monitoring unless otherwise noted below.

1. A spawning gravel monitoring program will verify the predicted effects of sediment additions, the functionality of settling ponds and the recovery period for any short term, unavoidable fine sediment additions to Zinc Creek and Greens Creek. The program will continue for 2 full years following completion of construction.

2. Fisheries mitigation measures will be monitored for 3 years following installation to determine their effectiveness.

3. Bald Eagle monitoring will be conducted by the Fish and Wildlife Service, with assistance from Noranda to insure compliance with the Bald Eagle Protection Act. Monitoring will continue for 2 full years following completion of construction.

4. Brown bears in the project area will be monitored to insure that projected effects on bear densities, movements and habitat use patterns are verified. Monitoring will be conducted by Alaska Department of Fish and Game with assistance from Noranda and will continue for 2 full years following completion of construction.

5. A freshwater monitoring program will continue for the life of the mine and will include sample sites in Big Sore, Greens, and Zinc Creeks and other locations as necessary. Noranda will be responsible for the majority of this program with limited assistance from the Forest Service.

6. Groundwater monitoring wells will be drilled above and below the tailings ponds and will be monitored through the reclamation phase.

7. Analysis of metal concentrations in the tissue of freshwater fish will be made annually and will continue for a minimum of 3 years following construction.

8. Sediment samples will be taken in receiving streams to monitor the sediment removal efficiency of sedimentation ponds. This will continue through the first 2 years of operation.

9. A marine water quality program will be developed subject to the approval of EPA and ADEC to insure compliance with the terms of the NPDES permit.

10. Representative samples of marine indicator species will be taken annually to monitor shellfish tissue for metals and hydrocarbons.

RECLAMATION

1. Reclamation within the monument will be to as near a natural condition as practicable. This will include sealing mine openings, restoring original surface drainage, removal of all structures, recontouring where possible and revegetating all disturbed areas.

2. Reclamation requirements on the non-monument portion of the project area will be determined by the most current TLMP revision at the time of mine closure.

3. Reclamation of docking facilities at Young Bay and Hawk Inlet are outside the jurisdiction of the Forest Service.

This decision is subject to administrative review (appeal) pursuant to 36 CFR 211.19. Project implementation will occur no sooner than 30 days from the date of this Record of Decision.

William P. Gee
WILLIAM P. GEE
Forest Supervisor

January 21, 1983
DATE

Final Environmental Impact Statement
Greens Creek
Admiralty Island, Alaska
January 1983

Lead Agency: USDA Forest Service

Responsible Official:

William P. Gee, Supervisor
Tongass National Forest, Chatham Area

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Abstract:

The action to be considered by the Forest Service is the approval of a development plan for the proposed Greens Creek Project, a zinc, lead, silver, and gold underground mine in Southeast Alaska. Most of the project would be located within Admiralty Island National Monument, but outside the wilderness boundary. Eight project alternatives and a No Action Alternative were considered. Rationale is given for why some options were eliminated from consideration and why the Preferred Alternative was selected. The Preferred Alternative, Alternative 6, incorporates employee housing in Juneau, a road from Young Bay to the mine service area, a mill at the mine service area, the Cannery Muskeg tailings pond site, and a Chatham Strait effluent discharge point.

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SUMMARY

The action to be considered by the United States Department of Agriculture Forest Service in this Final Environmental Impact Statement (EIS) is the approval of a development plan for Noranda Mining, Inc.'s proposed Greens Creek Project. The project involves a zinc, lead, silver, and gold underground mine on Admiralty Island, in Southeast Alaska.

The Tongass National Forest, Chatham Area, is responsible for the administration and management of Admiralty Island. A 1978 Presidential Proclamation established Admiralty Island National Monument. The Alaska National Interest Lands Conservation Act of 1980 (ANILCA) designated most of the monument as Wilderness. The majority of the proposed project area is within the monument, however, none of the project would fall within the Wilderness Area.

ANILCA, in Section 503(f)(2)(A), permits any holder of a valid mining claim in the monument to carry out mining activities, as long as those activities are compatible to the maximum extent feasible, with the purposes for which the monument was established.

LOCATION

The project area is approximately 18 miles southwest of Juneau, Alaska. Greens Creek drains into Hawk Inlet, which is on the northwest shore of Admiralty Island. Noranda's seven validated mining claims are in Section 9, of T44S, R66E, Copper River Meridian.

PROJECT HISTORY

1974-1976: Mineral claims were staked in the Greens Creek area by the Pan Sound Joint Venture.

1978: Greens Creek claims were put into a development category; Pan Sound was dissolved and replaced by Greens Creek Joint Venture, which includes Marietta Resources International, Exalas Resources Corporation, Texas Gas Exploration, Noranda Exploration, and Bristol Bay Resources, Inc.

1979: The Forest Service filed a Notice of Intent to prepare an EIS on the proposed Greens Creek Project.

1980: The Forest Service released a scoping document describing the issues of concern to the public relative to the Greens Creek project. The Forest Service determined that Noranda has valid mineral discoveries on seven lode mining claims in the Greens Creek watershed.

1981: The Chatham Area Forest Supervisor appointed an interdisciplinary team (IDT) responsible for following the National Environmental Policy Act (NEPA) process, conducting and monitoring the environmental analysis, and preparing the EIS.

ISSUES AND CONCERNS

At public meetings, the following issues were identified:

Development in Admiralty Island National Monument

Although ANILCA permits the holders of valid mining claims to carry out activities related to the exercise of rights under those claims, the development of a mine within a National Monument is still a local and national issue.

Decreasing Recreation Opportunities or Increasing Competition

Any development that would increase the competition for diminishing, dispersed recreational opportunities would be of concern.

Maintaining Existing Quality and Quantity of Fishery Habitat

A number of laws and policies mandate the maintenance of fishery habitat. Therefore, the decision process must consider the protection of fresh and saltwater quality and the protection of spawning and rearing habitat.

Maintaining the Quality and Quantity of Wildlife Habitat and Minimizing Impacts on Wildlife

Any negative impacts on wildlife, especially brown bear, Bald Eagles, and Sitka black-tailed deer, would generate significant public opposition.

Maintaining the Quality and Quantity of Water

This project has the potential for the degradation of freshwater systems in the project area. Potential problems are: increased sediment loads in project area streams from disturbed areas; alteration of streamflow rates that could in turn affect fish habitat; and degradation of surface and/or groundwater through acid mine drainage, heavy metal and trace element leachates, and the addition of reagent chemicals.

Marine Environment

Effluent discharge or shipping activity associated with the project has the potential for degrading the quality of the marine environment.

Technical Feasibility

The concern here is that components of the project identified for detailed consideration are technologically feasible. If components of the project or mitigation measures become extremely complex, higher capital and operating costs and increased risk of failure could result.

Economic Feasibility

Economic feasibilty relates operational constraints to environmental and monument values. The concern here is that the final selected alternative be economically feasible.

Impacts on Juneau

Although not within the jurisdiction of Forest Service responsibilities, the impact on Juneau's housing market from the possible housing of non-local Noranda employees, and the possible construction of additional docking and support facilities in or near Auke Bay are two project-related concerns.

PROJECT COMPONENTS, OPTIONS, AND ALTERNATIVES

Components

The six project components that, when combined, form an alternative are:

1) Location of employee housing

2) Method of employee transport to Admiralty Island

3) Method of employee transport on Admiralty Island

4) Location of mill site

5) Location of tailings disposal site

6) Location of effluent discharge site

The location of two project components, the mine service area, and the Hawk Inlet docking facility are fixed; regardless of which alternative is selected, those components would remain the same.

Options

Options are those methods by which each component could be accomplished. The options considered in forming alternatives were:

Employee Housing.

In Juneau

In a campsite on Admiralty Island

Employee Transportation to Admiralty Island

Boat

Employee Transportation on Admiralty Island

Road from Young Bay to the cannery

Road from the cannery to the mine service area

Aerial tramway from cannery to the mine service area

Location of Mill Site

Mine Service Area

Tailings Pond

Tailings Pond Sites

North Hawk Inlet

Cannery Muskeg

Football Field

Effluent Discharge Sites

Saltwater discharge south of the Hawk Inlet sill

Saltwater discharge in Chatham Strait

Alternatives

Alternatives were formed by grouping one option from each component to develop a complete alternative "package."

The Forest Service considered eight project alternatives and a No Action Alternative.

Alternative 6: Forest Service Preferred Alternative

Juneau housing

Crew boat to Young Bay

Road from Young Bay to cannery

Cannery Muskeg tailings pond

Road from cannery to mine service area

Mill at mine service area

Chatham Strait effluent discharge site

No Action Alternative

Alternative 1

Camp housing

Cannery Muskeg tailings pond

Road from cannery to mine service area

Mill at mine service area

Chatham Strait effluent discharge site

Alternative 2

Juneau housing

Crew boat to Young Bay

Road from Young Bay to cannery

Cannery Muskeg tailings pond

Alternative 2 continued

Road from cannery to mine service area

Mill at mine service area

Hawk Inlet sill effluent discharge site

Alternative 3

Camp housing

Cannery Muskeg tailings pond

Mill at tailings pond

Aerial tramway to and from mine service area

Chatham Strait effluent discharge site

Alternative 4

Juneau housing

Crew boat to Young Bay

Road from Young Bay to cannery

Road from cannery to mine service area

Football Field tailings pond

Mill at tailings pond

Chatham Strait effluent discharge site

Alternative 5

Juneau housing

Crew boat to Young Bay

Road from Young Bay to cannery

Road from cannery to mine service area

North Hawk Inlet tailings pond

Mill at mine service area

Hawk Inlet sill effluent discharge site

Alternative 7

Juneau housing

Crew boat to Young Bay

Road from Young Bay to cannery

Cannery Muskeg tailings pond

Road from cannery to mine service area

Mill near Cannery Muskeg tailings pond

Chatham Strait effluent discharge site

Alternative 8

Camp housing

Road from cannery to mine service area

Cannery Muskeg tailings pond

Mill at tailings pond

Chatham Strait effluent discharge site

EVALUATION OF ALTERNATIVES

The Forest Service IDT developed the criteria by which alternatives were evaluated, based on the issues established in the public scoping process.

Based on estimated environmental effects and a comparison of alternatives with evaluation criteria, (see Table 2-3), the Forest Service has identified Alternative 6 as the Forest Service Preferred Alternative. Alternative 6 was selected because it addressed all criteria at an acceptable or better level.

All alternatives which met individual criteria at the highest level met other criteria at a low or unacceptable level. The camp at the cannery (Alternatives 1, 3, and 8) and the Hawk Inlet sill effluent discharge site (Alternatives 2 and 5) met one or more criteria at an undesirable level. Those five alternatives were then excluded from further consideration as a preferred alternative.

Alternative 4 was excluded because it has a greater consequence from low level threats to fish habitat from a tailings pond failure and met the monument criteria at the least desirable level.

Alternatives 6 and 7 were the same, with the exception of where the mill would be located. Alternative 7 was excluded because increased activity at the tailings pond/mill site and the increased volume of truck traffic addressed the wildlife, recreation, and subsistence criteria at a less desirable level than Alternative 6.

PREFERRED ALTERNATIVE

Fisheries Mitigation Locating the tailings pond at the Cannery Muskeg site would directly eliminate 0.2 acres of anadromous fish spawning and rearing habitat in "Tributary Creek". Flows would be permanently reduced in "Tributary Creek" by 50 percent; low flows would be reduced 60 to 70 percent. Flows would be reduced in lower Zinc Creek by 3 percent; low flows would be reduced by 20 to 30 percent. Flow reduction will result in an additional 0.1 acre loss.

Replacement of habitat lost in the project area on a one to one basis requires at least 0.3 acres of anadromous fish habitat be provided to maintain current production for project area streams.

Noranda has agreed to modify the waterfall barrier at RM 3.5 on Greens Creek. This represents a change from the Draft Environmental Impact Statement (DEIS) which is detailed below. Modification of that barrier would provide access to at least 1 acre of unused anadromous fish spawning and rearing habitat.

In the DEIS flow augmentation in "Tributary Creek" and barrier removal in Zinc Creek were to have been initiated during construction. The Greens Creek barrier modification was scheduled near the end of mining operations. Ongoing feasibility work indicated that flow augmentation would be technically infeasible. The Zinc Creek barrier removal is feasible but will not be necessary since full habitat replacement can be obtained from the Greens Creek barrier modification project.

Fisheries Monitoring A spawning gravel monitoring program has been initiated to verify the predicted effects of sediment additions, the functionality of the settling pond system, and the recovery period for any short-term, unavoidable fine sediment additions to Zinc Creek and Greens Creek. Mitigation measures will be monitored for effectiveness and functionality.

Wildlife Monitoring A monitoring plan for Bald Eagles and brown bear will be developed by Noranda and approved by the Forest Service as part of the project Operating Plan. Monitoring of those species will be conducted during construction and for 2 years of operation.

Bald Eagle nest sites will be monitored to insure compliance with the Bald Eagle Protection Act. Should conflicts arise during monitoring, mitigation measures may include timing of construction, reducing the level of construction activity in proximity to nests, and providing topographic and vegetative screening.

Brown bears in the project area will be monitored to ensure that effects on bear densities, movements, and habitat use patterns are verified.

Water Quality Monitoring The purpose of the water quality monitoring program is to determine compliance with applicable state and federal water quality standards. Noranda will develop a plan to be approved by the Forest Service and other permitting agencies.

PREFERRED ALTERNATIVE

Environmental Consequences

Development of the mine service area and diversion of site runoff would reduce surface flows to Greens Creek by slightly less than 1 percent. Water collected from the mining workings would result in reduced water flows to Big Sore and Greens Creek. During low flow periods, the intercepted flow could represent up to 7 percent of upper Greens Creek flow.

Increases in temperatures of Streams 1 and 2 in the mine service area would be expected during low flows of July and August. A slight temperature increase could be observed in upper Greens Creek.

Construction of the mine service area, the access road to the mine portal, the bridge over Greens Creek, and the mill site would result in short term, unavoidable, and localized increases in turbidity and organic detritus introduced into Greens Creek and Stream 2.

During construction of the docking facilities at the cannery, a portion of the existing pilings and debris would be removed. That would result in the transient disruption of sediments within the dock area. Epibenthic organisms would be temporarily displaced but the displacement would not cause juvenile salmonid mortality due to the small area impacted relative to other areas in Hawk Inlet.

The development of the Cannery Muskeg tailings pond would require the diversion of a major portion of "Tributary Creek." Average flows would be reduced by 50 percent; low flows would be reduced by 60 to 70 percent. Flows to lower Zinc Creek would be reduced by 3 percent; low flows in lower Zinc Creek would be reduced by 20 to 30 percent.

The failure of the tailings slurry line could, under a worst-case scenario, directly affect water quality in Greens, Zinc, and "Tributary" Creeks. The consequence of a spill would be limited, since the quality of the liquid portion of the slurry and drainage water would be below acute fish toxicity levels, although above EPA/ADEC discharge standards.

Chemical constituents in the slurry (in particular sodium cyanide) would cause a significant, short term effect on fish and wildlife if the slurry reached an active stream channel.

A permanent fisheries habitat loss of 0.3 acres of "Tributary Creek" would occur. That loss would mean a direct brown bear habitat loss of 4 percent of available primary stream habitat in the project area.

The development of the road system would displace some deer hunting and would alter the current hunting experience. Those hunters who wanted a roadless hunting experience would most likely find substitute areas. Public vehicular access will be restricted on the road system to avoid impacts on wildlife.

A total of 477 acres of vegetation would be disturbed by Alternative 6. Reclamation opportunities are rated as good, but some rock faces at the quarry sites would remain exposed.

The Young Bay dock would not meet the inventoried retention Visual Quality Objective (VQO). Other components of Alternative 6 would meet the VQO's if mitigation measures were incorporated in planning, design, and reclamation.

SECTION I
PURPOSE OF AND NEED FOR ACTION

This Final Environmental Impact Statement (FEIS) considers the Noranda Mining, Inc. proposal to develop a mining operation near Greens Creek, on Admiralty Island, in Southeast Alaska. The project area is located about 18 miles southwest of Juneau, adjacent to Hawk Inlet. The proposed project involves a zinc, lead, silver, and gold underground mine, with an anticipated production of 800 tons of ore being milled per day.

The USDA Forest Service, Tongass National Forest, Chatham Area, is the agency responsible for the administration and management of Admiralty Island. The proposed Greens Creek Project falls within two separate management entities: Admiralty Island National Monument (Management Area C22), and the Juneau Ranger District (Management Area C21).

A Presidential Proclamation established the Admiralty Island National Monument in 1978. The Alaska National Interest Lands Conservation Act of 1980 (ANILCA) designated most of the monument as Wilderness. A portion of the proposed project area, including the mine site, is within the monument, but is not in the Wilderness Area.

ANILCA, in Section 503(c), provides that the monument (C22) "shall be managed by the Secretary of Agriculture as units of the National Forest System to protect objects of ecological, cultural, geological, historical, prehistorical, and scientific interest."

A 10-year management plan for Admiralty Island National Monument Wilderness is being completed. The plan will include a compilation of resource data, a discussion of issues and opportunities, management philosophy, and the goals and objectives of management.

The Tongass Land Management Plan (TLMP) assigns the proposed project area between Young Bay and the cannery on Hawk Inlet (C21), a Land Use Designation (LUD) III. The area is to be managed to provide a combination of both amenity and commodity values; the goal of LUD III management is to achieve compatibility among competing resource uses.

LOCATION

Greens Creek drains into Hawk Inlet, which is located along the northwest shore of Admiralty Island. Noranda's validated mining claims are in section 9, of T44S, R66E, Copper River Meridian. See Figure 1-1.

Regional Location Map

GREENS CREEK PROJECT EIS

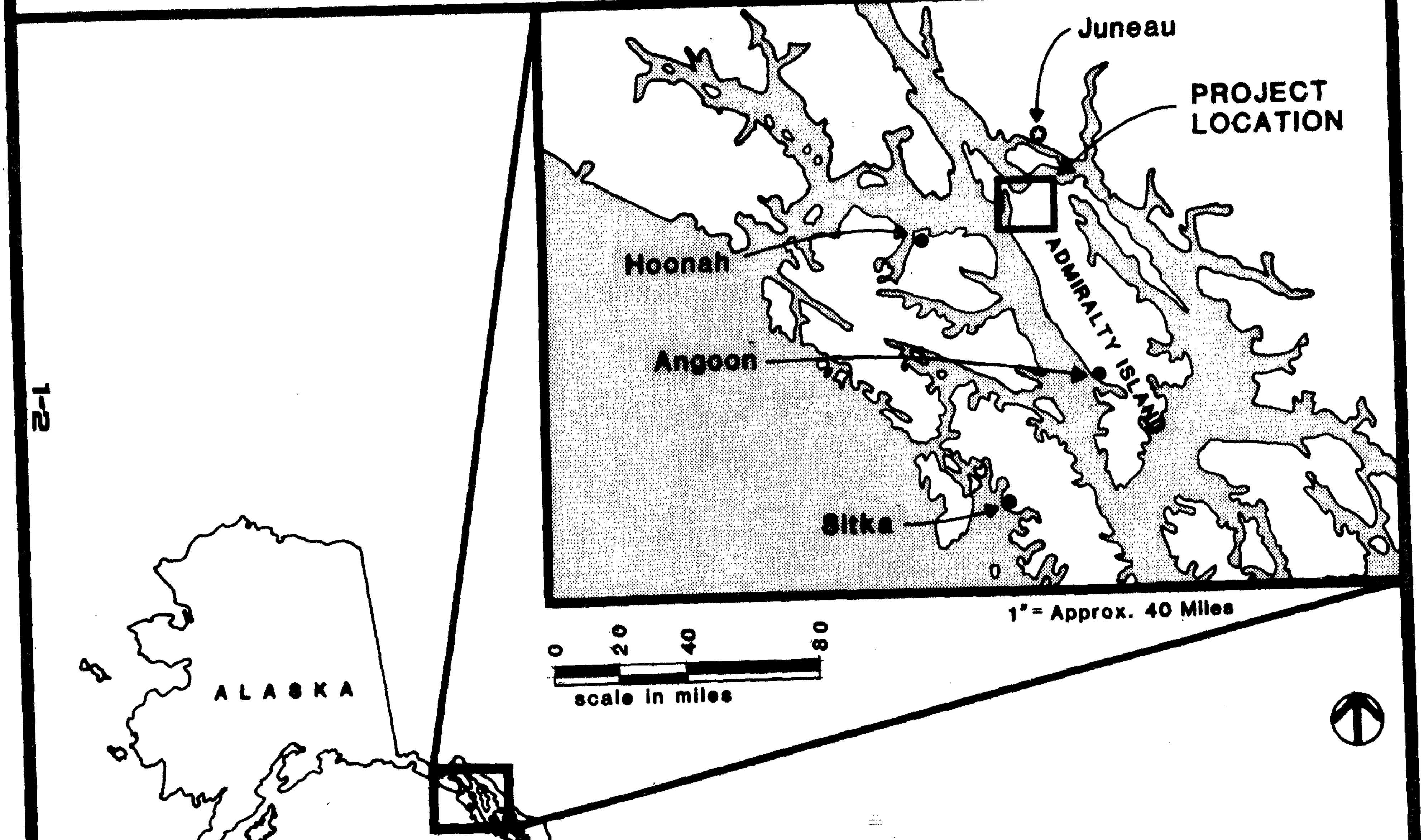


FIGURE 1-1

PROPOSED FEDERAL ACTION

The action to be considered by the Forest Service in this EIS is the approval of a development plan for the proposed Greens Creek Project. The responsible official is the Forest Supervisor of the Tongass National Forest, Chatham Area.

Under the General Mining Law of 1872, as amended, prospectors may search for mineral deposits on the 140 million acres of National Forest set up by proclamation from the public domain. A prospector, upon discovering a valuable mineral deposit, may locate a mining claim. After meeting specific requirements of the law, including confirmation of the discovery of a valuable mineral deposit, a claimant may obtain legal title (patent) to the surface and mineral rights on the claim.

The legal authority for mining in Admiralty Island National Monument is found in Section 503 (f)(2)(A) of ANILCA. Any holder of a valid mining claim in the monument is permitted to carry out mining activities, as long as those activities are compatible, to the maximum extent feasible, with the purposes for which the monument was established.

ANILCA's emphasis on environmental protection underscores the importance of a systematic review of all significant direct and indirect environmental impacts associated with development of the proposed mine. Specific decisions to be made by the Forest Service are:

- Form of access, if any, from Young Bay to Hawk Inlet.
- Issuance of a special-use permit for water supply or for other support facilities on National Forest land at the cannery site.
- Route and type of access from Hawk Inlet to the mine and/or mill site.
- Location of the mill site.
- Location of water sources and waste treatment facilities at the mill site.
- Location of transmission line, water line, and slurry line from the mine and/or mill site to Hawk Inlet.
- Location of tailings disposal and excess water treatment facilities.
- Public access provisions, if any.
- The approval of a plan for monitoring potential impacts.
- Approval of a reclamation plan for the areas impacted by the mining operation.

PROJECT HISTORY

In early 1973, the Pan Sound Joint Venture was formed to conduct a base metal exploration program in Southeast Alaska. The companies originally involved were Marietta Resources International, Exalas Resources Corporation, Texas Gas Exploration, and Noranda Exploration. From 1974 through 1976, geological studies concentrated on areas where stream sediment sampling indicated high base metal anomalies on Admiralty Island. Claims were staked, and detailed exploration, including surface drilling, began in the Greens Creek area. Lode claims (approximately 21 acres each) were staked in two large blocks: The Tom claims (122 claims) and the Big Sore claims (318 claims). Of these claims, seven have been determined to be valid at this time. Additional claims may be declared valid in the future. In addition, a total of 138 millsite claims of 5 acres each were filed in 1978 on possible mine-related surface activity sites. Figure 1-2 illustrates claim locations.

In 1976, Noranda Exploration assumed responsibility as operator for the field operations phase of the project and managed all initial work at Greens Creek. In early 1978, the Greens Creek claims were put into a development category and the Pan Sound Joint Venture was dissolved. Its legal successor, the Greens Creek Joint Venture, which included the four original companies plus Bristol Bay Resources, Inc., was formed to develop the property.

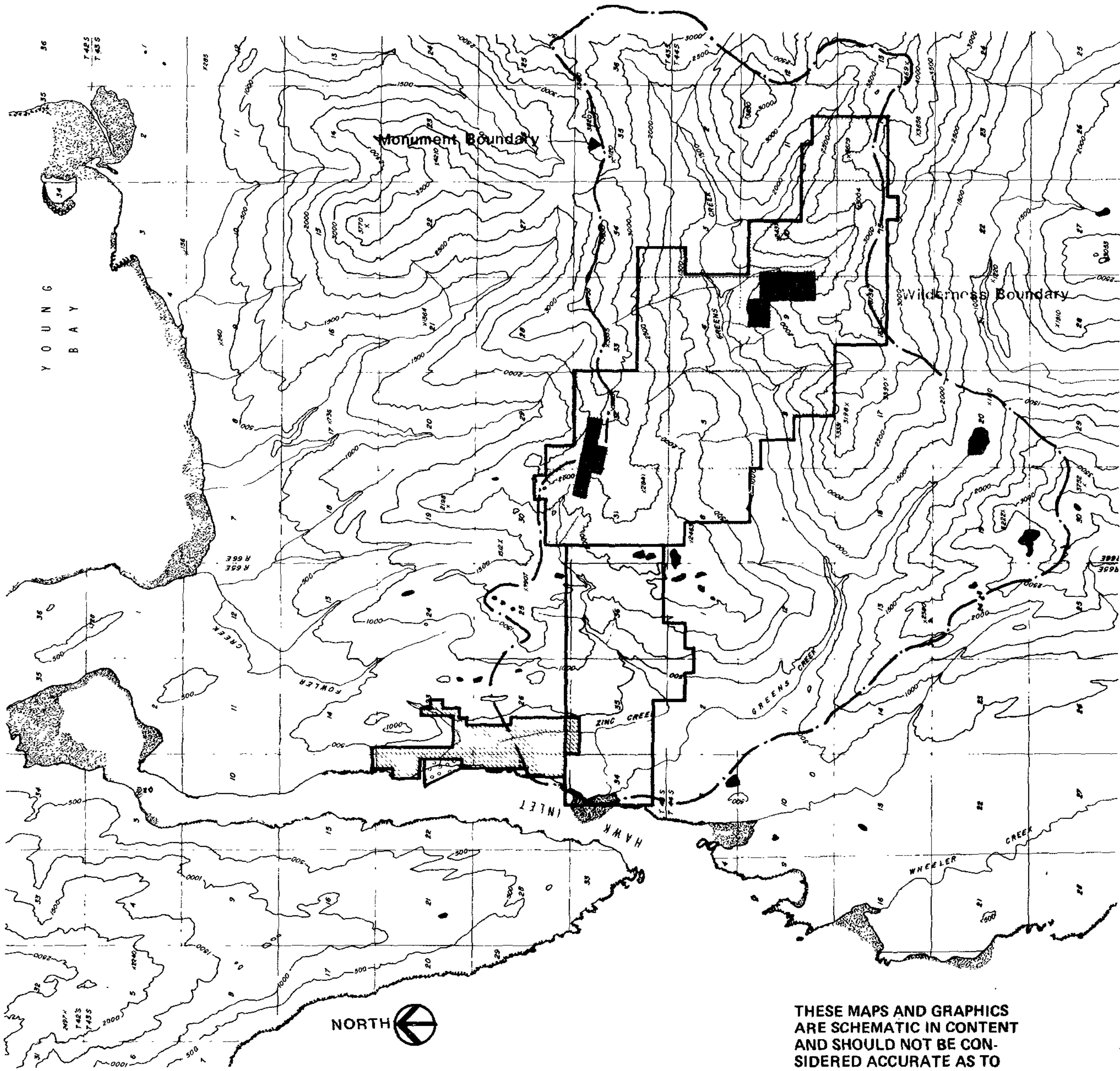
During 1978, extensive underground diamond drilling and environmental baseline studies were begun. To date, the entirely helicopter-supported exploration program has completed a 4,224-foot adit, which has provided the means for delineating the orebody. Additional access to the orebody has been gained by means of a 600-foot cross-cut from the existing adit into the ore zone.

On November 16, 1979, the Forest Service filed a Notice of Intent to prepare an EIS on the proposed Greens Creek Project. Public meetings were held in Juneau and Angoon to determine issues and concerns associated with the project. In February 1980, the agency released a scoping document that described the issues identified at those meetings. The February document was characterized as draft and the comment period was left open, to encourage public input.

On November 20, 1980, the Forest Service determined that Noranda had valid mineral discoveries on seven lode mining claims in the Greens Creek watershed.

In January of 1981, Noranda Mining, Inc. assumed control as operator of the Greens Creek Project. Noranda Mining acts as the manager and representative for the Greens Creek Joint Venture. All permitting activities and the ultimate responsibility for operation of the Greens Creek Project will be held by Noranda Mining, Inc.

GREENS CREEK PROJECT EIS



BIG SORE LODE CLAIMS (UNPERFECTED)

BIG SORE MILL SITE CLAIMS (UNPERFECTED)

TOM LODE CLAIMS (UNPERFECTED)

BIG SORE LODE CLAIMS (VALID)

EXISTING PATENTED LAND IN GREENS CREEK.

PRIVATE LAND AT THE CANNERY, INCLUDING TIDELANDS.

THESE MAPS AND GRAPHICS ARE SCHEMATIC IN CONTENT AND SHOULD NOT BE CONSIDERED ACCURATE AS TO SPECIFIC LOCATIONS.

Land Tenure

Figure 1-2

A Forest Service interdisciplinary team (IDT) and a team leader were designated by the Chatham Area Forest Supervisor in 1981. The team is responsible for following and recording the National Environmental Policy Act (NEPA) process, conducting and monitoring the environmental analysis and preparing the EIS. A geologist, civil engineer, fisheries biologist, hydrologist, and wildlife biologist are members of the core IDT. A support team composed of the Admiralty Island National Monument Manager, an archeologist, botanist, economist, editor, forester, geologist, landscape architect, soil scientist and planning officer assist the IDT.

ISSUES, CONCERNS, OBJECTIVES, AND OPPORTUNITIES

Issue 1: Development in Admiralty Island National Monument

Management objectives for the monument prescribed in ANILCA are to "protect objects of ecological, cultural, geological, historic, prehistoric and scientific interest." Although ANILCA permits the holders of valid mining claims to carry out activities related to the exercise of rights under those claims, the development of a mine within a national monument is still a local and national issue.

If viable alternatives exist that locate mine developments outside of the monument, in the LUD III areas, they should be favored. In addition, management objectives for the proposed project area within the monument, call for reclamation to as near natural conditions as feasible.

Issue 2: Decreasing Recreation Opportunities or Increasing Competition

The recreation issue is one of an increasing Juneau population and increasing competition for diminishing, dispersed recreational opportunities. Any development that increases recreation competition or decreases recreation opportunities would be of concern.

Hawk Inlet provides a protected, year-round moorage. The area receives the greatest recreational use in late summer and fall; the peak use occurs from September to mid-December, deer hunting season. Other recreational activities include duck hunting, bear hunting, salt and freshwater fishing, trapping, crabbing, clamming, beach combing, and hiking. There are 12 private cabins along the coast of the inlet.

Young Bay is a popular recreation destination for the Juneau area population. Fishing and hiking in summer and deer hunting in fall are the primary recreational activities that occur in the area.

Access to Young Bay and Hawk Inlet is by boat and by both wheeled and float equipped aircraft.

Issue 3: Maintaining Existing Quality and Quantity of Fishery Habitat

A number of laws and policies mandate the maintenance of fishery habitat. Section 505(a) of ANILCA highlights that concern in relation to mining activities "... to maintain habitats, to the maximum extent feasible, of anadromous fish and other foodfish, and to maintain the present and continued productivity of such habitat..." Therefore, the decision process must consider the protection of fresh and salt water quality and the protection of spawning and rearing habitat.

Issue 4: Maintaining the Quality and Quantity of Wildlife Habitat and Minimizing Impacts on Wildlife

Any adverse impacts on wildlife, especially brown bears, Bald Eagles, and Sitka black-tailed deer, would generate significant public opposition.

Specific wildlife concerns are:

- Direct habitat loss, due to physical change.

- Indirect habitat loss, due to increased human activity.

- Water quality degradation, resulting in contamination of the biological community.

Issue 5: Maintaining the Quality and Quantity of Water

This project has the potential for the degradation of freshwater systems in the project area. Potential problems associated with the project are:

- Increased sediment loads in project area streams from disturbed areas.

- Alteration of streamflow rates that could in turn affect fish habitat.

- Degradation of surface and/or ground water through acid mine drainage, heavy metal and trace element leachates, and the addition of reagent chemicals.

Issue 6: Marine Environment

Any degration of marine water quality, due to effluent discharge or shipping activity associated with the project, would be an issue.

Issue 7: Technical Feasibility

If components of the project or mitigation measures become extremely complex, higher capital and operating costs and increased risk of failure could result. Technical feasibility would then become an issue.

Issue 8: Economic Feasibility

If the costs of project components or mitigation requirements exceed reasonable or practical limits, economic feasibility would become an issue.

Issue 9: Impacts on Juneau

While decisions relating to project components outside National Forest boundaries are not the direct responsibility of the Forest Service, they are closely related to the selection of the Preferred Alternative and need to be taken into consideration.

The impact on Juneau's housing market from the possible housing of non-local Noranda employees and the possible construction of additional docking and support facilities in or near Auke Bay are two public concerns.

OPPORTUNITIES

Throughout the EIS process, the IDT has been identifying opportunities--possible actions, measures, or treatments--that may be taken to address the issues associated with the Greens Creek Project. Particular attention has been given to mitigation measures.

OTHER PERMITS, LICENSES, AND APPROVAL

Before construction and operation of the Greens Creek Project could begin, Greens Creek Joint Venture must obtain additional permits. Some of the major permits necessary are:

State of Alaska - Department of Natural Resources (ADNR):

- Tideland Permit and Lease
- Water Rights Permit

State of Alaska - Department of Environmental Conservation (ADEC):

- Solid Waste Disposal Permit
- Certification of Compliance with Alaska Water Quality Standards

State of Alaska - Department of Fish & Game (ADF&G):

- Specification of stream crossing structures for all fish streams under AS 1605;16.05.840

- Review and approve, alter, or reject all activities which may affect anadromous fish streams under AS 1605;16.05.870

- Review and recommend compliance with Alaska Coastal Zone Management Program

U. S. Environmental Protection Agency (EPA):

- National Pollution Discharge Elimination Permit (NPDES) (As required for sediment pond, domestic waste, and tailings pond discharges).

- Review of a Spill Prevention Control and Countermeasure Plan (SPCC), if requested.

- Prevention of Significant Deterioration permit (PSD)

U. S. Corps of Engineers: (Administrative actions regarding these permits will not take place until expiration of the 30-day waiting period following the filing of the FEIS with the EPA.)

- Approval of the discharge of dredged or fill materials into waters under Section 404 of the Clean Water Act.

- Approval of the construction of structures or work in navigable water of the United States under Section 10 of the Rivers and Harbors Act of 1899. This includes fisheries barrier modification projects.

U. S. Forest Service:

- Appropriate Forest Service permits and approval to implement this selected alternative (Record of Decision) after release of the Final Environmental Impact Statement (FEIS).

The body of this FEIS is subdivided into six main sections. Section I explains the purpose and need for the proposed action; it identifies issues and concerns relevant to the proposal. Section II evaluates all reasonable alternatives, discusses why some alternatives were eliminated from detailed study, outlines mitigation measures, monitoring plans, and reclamation plans, and describes the evaluation of the alternatives. In Section II, the Preferred Alternative is identified and the rationale for its selection is given. Section III describes the environment potentially affected by the proposed project. Section IV describes the environmental consequences (the effects) of implementing each alternative. Section IV forms the scientific and analytic basis for the comparison of the alternatives. Section VI describes the consultation with others process. Section VII includes public response to the DEIS. Appendix material includes a listing of references.

SECTION II
ALTERNATIVES INCLUDING THE PROPOSED ACTION

PROPOSED DEVELOPMENT

The first step in the Greens Creek Project planning process was to identify those components that would remain constant throughout the alternative evaluation process. To meet ANILCA's intent to allow operation of the mine, certain elements of the project must be included in the development plan. These elements include the construction of a mine portal (access to the underground workings), service areas, milling (mineral concentrating) facilities, shipping facilities, wastewater treatment, waste rock disposal, office and warehouse space, water supply systems, and operating labor. The method of developing these project elements is defined to a certain extent by the location of the orebody, topographic constraints, existing facilities, or mining needs.

Milling of the ore would result in the production of lead and zinc concentrates that would be transported off-site for further processing. The mine would produce approximately 800 tons per day of ore and 300 tons per day of waste rock. The waste rock, where possible, would be used to backfill mined-out areas.

Tailings (waste from the milling process) would be disposed of in an on-land tailings pond and as backfill in mined-out areas. Wastewater would be treated before being discharged to receiving waters. Depending on the alternative chosen, the project would employ between 225 to 315 full-time workers, with about 25 of those in training positions. The life of the known ore reserves is 11 years. Noranda is presently using 15 to 17 years for the life of the operation for planning purposes.

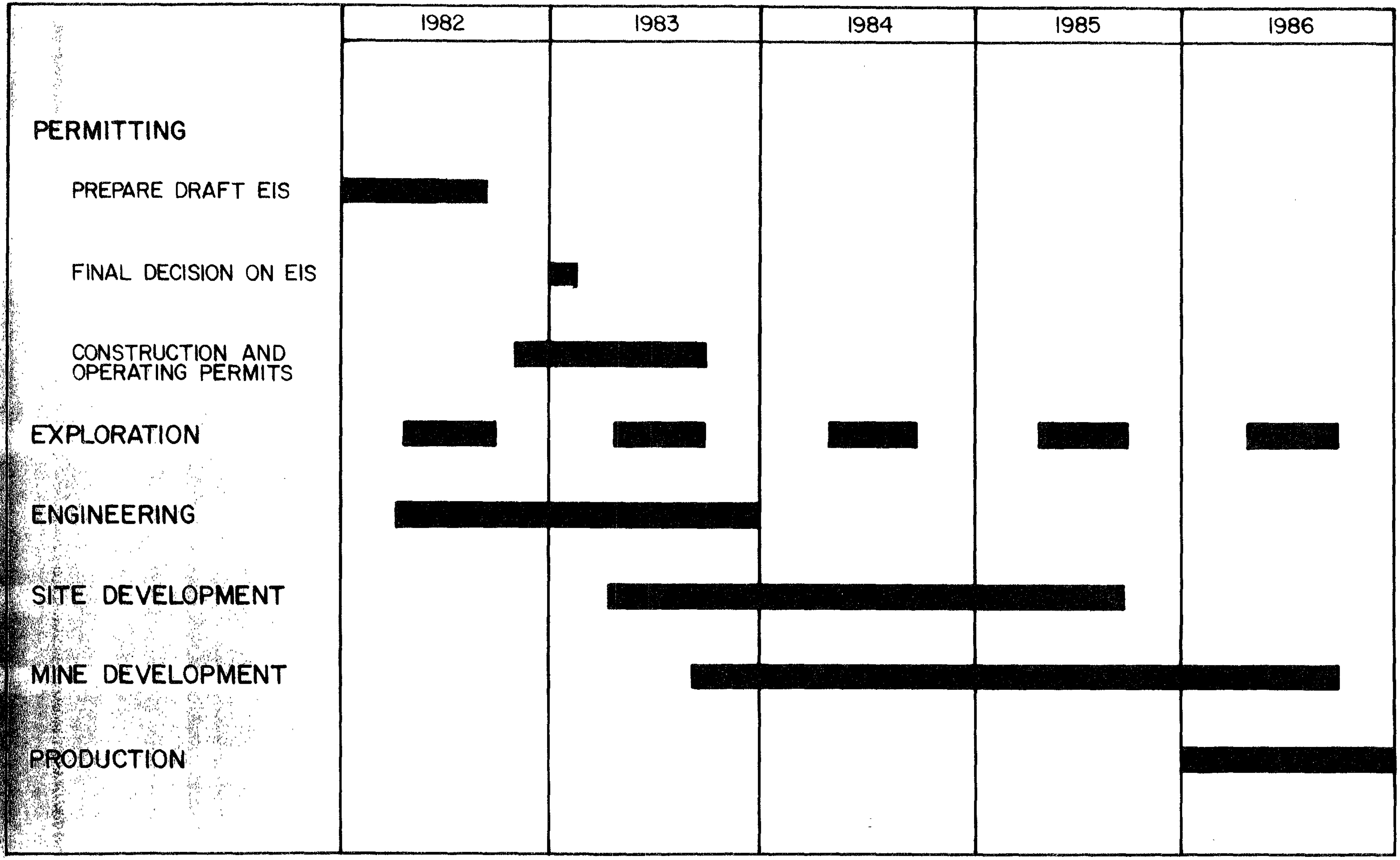
The development of the Greens Creek Mine would require approximately 3 years for final planning, design, and construction from the time of permit approval. Assuming that all required local, State, and Federal permits are granted by early spring of 1983, construction could begin in the same year. Initial mining and milling could begin by the end of 1985 and would require a minimum of 8 to 12 months to bring the project into full production. Figure 2-1 reviews the schedule of development.

FACILITIES AND PROCESSES

Method of Mining

Mining methods would incorporate rubber-tired, load-haul-dump diesel equipment. Underground access to the mining areas would be by means of ramps or other suitable underground workings such as tunnels and internal shafts. Mined-out zones would be filled with waste rock and tailings to form working foundations for subsequent mining. Because of the size and shape of the orebody, there would be a physical limit to the amount of

GREENS CREEK PROJECT EIS



DEVELOPMENT SCHEDULE

ore that could be removed within a given time period. It has been determined that 800 tons of ore per day would be a reasonable production figure.

Mine Service Area

At present, site development plans include a portal (mine entrance) on the south side of Greens Creek, at an elevation of 950 feet, and a mine service area immediately adjacent, on the north side of Greens Creek. Access to the underground workings from the mine service area would be provided by a bridge across Greens Creek. For a detailed description of construction, see Mitigation Measures.

The mine service area would consist of equipment maintenance and repair facilities, mine backfill plant, power plant, fuel storage tanks, locker and shower rooms, ore and waste rock storage, and a general supply warehouse.

Method of Milling

The project would use a selective flotation milling process to concentrate valuable minerals. The flotation process would consist of three major steps: size reduction, mineral concentration, and moisture reduction of the concentrate.

Size reduction involves crushing ore from the mine in jaw and cone crushers similar to the types used in the production of road base material at a rock quarry. Ore would enter the crushing plant at a diameter of 12-inches or smaller and leave in the one-half inch size range. From the crushing plant, the ore would be conveyed to a grinding mill that would reduce the ore size further and produce a slurry.

The ore slurry would then be transported in pipes or launders to flotation cells or tanks, where valuable minerals would be separated from waste materials in a froth flotation process. The ore minerals in this case would be sulfides of lead, zinc, silver, and uncombined gold. Waste would include various silicate, carbonate, and sulfide minerals. The valuable minerals adhere to air bubbles that rise to the surface of the tank and are removed. To make the process work efficiently it would be necessary to add air and various reagents to the tanks. This would allow the bubbling or frothing action to float different ore minerals selectively, so that metal concentrates could be produced. The concentrator would recover about 90 percent of various valuable minerals and would separate more than 90 percent of the waste rock from the concentrate. No reduction of sulfides to base metals or other changes in the chemical composition of ore minerals would take place in the concentrator or at the project site.

Following separation of the ore minerals from waste rock, the concentrate slurry would be piped to a thickener tank where the water content would be reduced. The thickened slurry would be filtered to remove most of the remaining water and the concentrate would be ready for shipment to an off-site smelter.

Transport of Ore/Tailings/Mine Drainage Water

Once ore was removed from underground, it would either go to a mill at the mine service area, or be transported by 35-ton truck or tram car to a mill at a tailings pond.

If the ore was milled at the mine service area, tailings would be transported by slurry line to the tailings pond. The tailings would travel in a 5- to 6-inch pipe that would be enclosed in a 24-inch corrugated metal pipe (CMP) conduit. The CMP would also transport mine drainage water and would run adjacent to the road. The CMP would act as a backup to contain and transport slurry to the tailings pond in the event of a slurry line break. This double-pipe system would be the primary method used to prevent damage resulting from a slurry line failure. The risk of failure would be considered small.

If the mill is located at a tailings pond, the tailings would be discharged directly into the pond.

Tailings Pond Area

Tailings ponds would use natural and man-made structures to contain mill waste. The waste would consist of a sand/silt slurry and would contain 20 to 40 percent solids by weight. The liquid portion would consist of excess processing water, dissolved minerals, and uncombined reagents. The slurry would be discharged into the tailings pond, where solid particles would settle out. Excess water would undergo treatment in the pond by settling and chemical precipitation, and would then be decanted for possible additional treatment and discharge.

Concentrate Handling

About 160 tons of zinc concentrate and 100 tons of lead concentrate would be produced per day. Concentrate would be transported from the mill to storage facilities near the dock three to five times per week. Sufficient concentrate storage area would be available at the mill to allow storage during bad weather, or when the roads were unsafe. Storage facilities at the mill would be covered to prevent concentrate loss.

After storing between 1 to 4 weeks of production in an enclosed building at the dock, the concentrates would be transported by a covered conveyor incorporating a telescoping feeder system to ocean-going barges or ships.

Major Docking Facilities

The major docking facilities for the project would be located on private land in Hawk Inlet on the site of the old cannery. The new cargo dock would be about 600 feet long and supported by pilings. It is expected that a maximum of five shiploads of supplies or concentrates would be traveling in and out of Hawk Inlet each month.

Maintenance Facilities

The project would require maintenance, warehouse, and office facilities.

Fuel Storage

All fuel would be stored above ground, away from major stream courses and water bodies, in covered steel tanks. In the event of a ruptured tank, the contents of the tanks would be contained by dikes constructed in compliance with Federal oil pollution prevention regulations (40 CFR pt. 112). Storage tanks at the cannery would be sized to hold a 40-day supply of fuel (approximately 400,000 gallons of fuel). An additional 400,000 gallons of fuel would be stored at the mine service area, if the mill is located at the mine service area. If the mill is located at the tailings pond, approximately 350,000 gallons of fuel would be stored at the mill and 150,000 gallons at the mine service area. The Environmental Protection Agency will be asked to review a Spill Prevention, Control, and Countermeasure Plan prior to utilization of the storage facilities. Current EPA policy requires approval of the plan if a spill actually occurs.

Fire Protection System

The fire protection system would be designed to meet applicable fire codes and the requirements of Noranda's insurance underwriter. In general, each site would have an underground water distribution network, with fire hydrants at the required distance from buildings and other structures. The source of water for the fire system would vary for each site.

Water Supply

Domestic water demand would be less than 2 gallons per minute (gpm) at each site and would be obtained from infiltration wells adjacent to Greens and Cannery Creeks. Water for the milling process (250 gallons per minute) would be obtained from clean mine drainage water and from wells.

Communications

Portable radios would be used for communication with mobile units and ground personnel. A local telephone system would connect the mine, mill, tailings pond, and the cannery. A microwave communication link would be established to Juneau, with repeater sites located on northern Admiralty Island. The site would consist of a helicopter pad, a support building, and a microwave tower.

The actual microwave site has not yet been determined. A separate environmental assessment will be prepared when a special-use permit application is filed for a specific site.

Workforce

Initial mining would involve developing access to the orebody. A nucleus of experienced hard-rock miners and supervisors would be hired from outside the local area. Mine development would allow for the training of future miners hired from the local workforce.

A total of about 225 to 315 full-time employees would comprise the project workforce. The projected mine/mill workforce breakdown is:

Miners/Mill Operators	50 percent
Mechanics/Electricians	15 percent
Support	15 percent
Supervisory/Management	20 percent

Wastewater

The first priority, during initial construction, would be the installation of wastewater treatment systems for domestic waste generated at the cannery and for control of sediment in runoff waters from development of the mine service area. Portable toilet units would be used at remote temporary sites.

Mine ditch drainage water would be treated to remove oils and grease and routed with site runoff through multiple sedimentation ponds. Depending upon the project alternative, wastewater would then be piped to the tailings pond for further treatment or treated on site and disposed into Greens Creek.

Wastewater from the mill process would be routed to the tailings pond. Chemicals added during the milling process would aid in precipitation of dissolved metals and the settling of suspended solids.

Excess water in the tailings pond could possibly receive additional treatment and, if needed, filtration prior to discharge into receiving waters.

PROJECT COMPONENTS/OPTIONS/ALTERNATIVES

A component is an essential element to the operation of the mine activity. The six project components that, when combined, form an alternative are:

- Location of employee housing
- Method of employee transport to Admiralty Island
- Method of employee transport on Admiralty Island
- Location of millsite
- Tailings disposal site
- Effluent discharge site

Options are those methods or locations by which each component of the project could be accomplished. For example, under location of employee housing, three options were initially considered: a campsite on Admiralty Island; a townsite on Admiralty Island; and housing in Juneau.

An alternative is a grouping of options (one for each of the six components) into a functional system.

OPTIONS INITIALLY CONSIDERED, INCLUDING THOSE ELIMINATED

The identification of options was undertaken in a two-step process. In Step 1, for each component, the IDT and associated agencies identified a full range of options to be considered in the environmental review process. For some components, certain options were eliminated from further consideration based on technical or environmental requirements. In Step 2, on-site investigations and/or studies were conducted to analyze each option in greater detail. More detailed technical, environmental, and economic data from these investigations was used to determine which options to retain or eliminate.

Housing

Options considered were:

- Housing of employees exclusively in Juneau

- Development of a campsite at the existing cannery

- Development of a townsite at the existing cannery

Each of these options was retained in the Step 1 analysis for further consideration.

In the Step 2 analysis, the IDT determined that the townsite would have significant adverse environmental effects. Further, the campsite option generally addressed the same issues as the townsite (possible impacts to Juneau from housing non-local employees there, and possible impacts to wildlife from construction of a road), but represented somewhat reduced environmental effects. Therefore, the townsite was eliminated from further consideration.

Transportation to Admiralty Island

Options considered were:

- Boat to Hawk Inlet

- Boat to Young Bay

- Fixed-wing float plane

- Fixed-wing wheeled plane

- Helicopter

- Hydrofoil craft

This component assumes the movement of the entire workforce on a shift basis. The Step 1 review eliminated fixed-wing wheeled planes from further study because of the need for an all-weather, 24-hour landing field in the Hawk Inlet area. Hydrofoils were eliminated because of their potential for injury to marine life, operational limitations in Southeast Alaska, and maintenance problems. Although recent hydrofoil demonstrations throughout Southeast Alaska have made the use of this craft appear attractive, documented operational restrictions indicate that weather and conditions in Chatham Strait would greatly reduce the effectiveness of this vessel under the time constraints imposed by shift operation.

During Step 2, the float plane and helicopter options were eliminated from further study. The float plane option was considered technically infeasible because landings could not be made during severe weather conditions or darkness. At scheduled departure times of 7:00 a.m. and 5:00 p.m., float planes would be inoperable an estimated 150 days per year, and could never be operated at the midnight shift change. Helicopters were eliminated from further study because of the estimated 138 days per year they would be inoperable due to weather. Boat transport from Juneau around Mansfield Peninsula to Hawk Inlet would take 3 to 4.5 hours per trip and was not considered feasible on a shift basis.

Transportation on Admiralty Island

Options considered were:

- Railroad from Young Bay to the cannery
- Road from Young Bay to the cannery
- Cog railroad from Young Bay to the cannery
- Cog railroad from the cannery to the mine service area
- Road from the cannery to the mine service area
- An aerial tram system from the Cannery Muskeg tailings pond to the mine service area

In Step 1 both cog railroad options were eliminated from further consideration because they would follow essentially the same route as a road, they represented a high level of technical complexity, and did not offer any substantial environmental benefits over the road option.

In Step 2 the rail option from Young Bay to the cannery was eliminated from further study because it did not represent a reduction in potential environmental impacts when compared to a road. In addition, it represented a substantial reduction in the flexibility for transporting workers.

Several road locations from Young Bay to the cannery were examined. They were:

- a route paralleling Hawk Inlet
- a route paralleling Fowler Creek
- an inland route following the Cannery Creek drainage.

Subsequent field analysis determined the preferred road location, which is a combination of portions of all three of those routes.

Mill Site Location

Options considered were:

- The mine service area

- The tailings pond

- Mounted on a barge and located at the cannery

Each option was retained during the Step 1 review. Step 2 eliminated the barge mounted mill, since the other mill options would all be situated on areas already disturbed. The barge option would also require considerable dredging and would present potential water quality hazards to Hawk Inlet.

Tailings Disposal Site

Options considered were:

- On land, in a tailings pond

- In the marine environment

Step 1 analysis indicated marine tailings disposal could be accomplished by construction of a tailings slurry line extending from the mill to Hawk Inlet or Chatham Strait. Tailings would then be dispersed into deep water. However, marine disposal was eliminated from further study due to environmental problems, known public objections, and the availability of adequate on-land disposal sites.

Step 2 analysis of potential on-land pond sites included:

- Identification of those physical features within the project area that would limit development of an impoundment

- Identification of potential sites

- Review of potential sites in greater detail and elimination of sites not meeting project needs

- Identification of feasible sites

In the identification of limiting features, constraint areas were mapped and 11 sites were identified. Two additional sites that did not fully meet the criteria were added to insure a full range of options. See Figure 2-2.

A technical feasibility analysis identified seven sites as feasible:

1) Young Bay Trail

2) North Hawk Inlet

3) Fowler Creek

4) Cannery Muskeg

5) Zinc Creek

6) Football Field

7) Piledriver Cove

The IDT then evaluated these sites against the following eight issues:

- Construction on National Monument lands

- Reduction of fish habitat

- Deterioration of water quality

- Effects upon the marine environment

- Reduction of wildlife habitat

- Effect upon recreation

- Economic feasibility

- Technical feasibility

Three levels of effect were established for each issue: small, moderate, and large. Each IDT specialist then developed a process to determine the level of effect of each option. No attempt was made to rate the various issues against one another. The sole purpose of this procedure was to determine how the seven tailing pond options rated for each of the issues. Table 2-1 summarizes the ratings as determined by

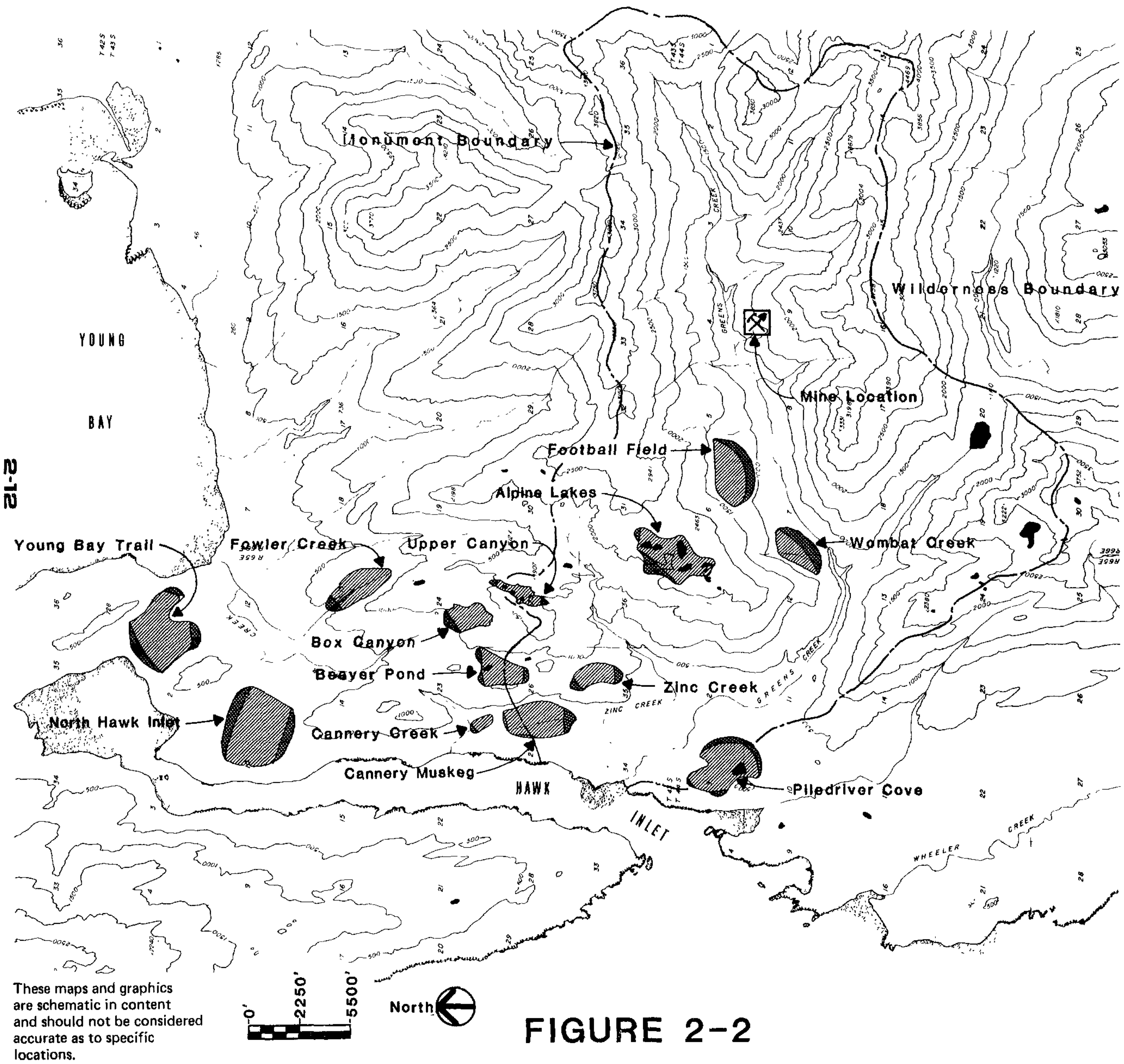


FIGURE 2-2

Preliminary Tailings Pond Options

TABLE 2-1
SUMMARY OF RATING OF TAILINGS POND SITES

Issue	Small Effect	Moderate Effect	Large Effect
Monument	1-2-3		4-5-6-7
Fish Habitat	1-2-5-6-7		3-4
Water Quality	1-2	4-7	3-5-6
Marine Environment	3-5-6	2-4	1-7
Wildlife Habitat	3-5-6	4	1-2-7
Recreation	3-6	5	1-2-4-7
Economics	4	7	1-2-3-5-6
Technical Feasibility	4-7	5-6	1-2-3

1-Young Bay Trail

2-North Hawk Inlet

3-Fowler Creek

4-Cannery Muskeg

5-Zinc Creek

6-Football Field

7-Piledriver Cove

the specialists. Note that the numbers presented in the table represent the number designation for each of the seven tailing pond sites.

Table 2-1 shows that several tailings pond sites affect essentially the same issues. Thus, some sites could be eliminated from future study without reducing the ability of the site-selection process to address the important issues. For example, Sites 1 and 2 appear together in Table 2-1 in all but one issue. Development of those sites would have similar impacts upon the eight issues; one site could be eliminated and the process still retain the ability to address all the critical issues. Similarly, Sites 5 and 6 appear together in all but one issue.

In analyzing Sites 1 and 2 (Young Bay Trail and North Hawk Inlet), the IDT agreed that North Hawk Inlet site had less potential for environmental impact. Therefore, the Young Bay Trail, Site 1, was eliminated from further study. Similarly, the IDT agreed that Site 5, Zinc Creek, should be eliminated from further study due to the cumulative impacts resulting from that site's development.

Site 3, Fowler Creek, always appeared in Table 2-1 accompanied by other sites. It could also be eliminated from future study without affecting the range or distribution of effects represented by the remaining options.

Table 2-2 summarizes the effects of ratings following elimination of Sites 1, 3, and 5.

Analysis of the four remaining sites (North Hawk Inlet, Cannery Muskeg, Football Field, and Piledriver Cove) indicated that Site 7, Piledriver Cove, was more environmentally sensitive than the other three options. On that basis, the Piledriver Cove option was eliminated. At the end of Step 2, the three options that were left for the formulation of alternatives were:

Site 2 - North Hawk Inlet

Site 4 - Cannery Muskeg

Site 6 - Football Field

TABLE 2-2

SUMMARY OF RATING OF TAILINGS POND SITES

STEP 2

Issue	Small Effect	Moderate Effect	Large Effect
Monument	2		4-6-7
Fish Habitat	2-6-7		4
Water Quality	2	4-7	6
Marine Environment	6	2-4	7
Wildlife Habitat	6	4	2-7
Recreation	6		2-4-7
Economics	4	7	2-6
Technical Feasibility	4-7	6	2

2-North Hawk Inlet

4-Cannery Muskeg

6-Football Field

7-Piledriver Cove

Effluent Discharge Site

Options considered were:

- Freshwater discharge
- Marine discharge, near the cannery
- Marine discharge, at Hawk Inlet sill
- Marine discharge, in Chatham Strait

The general water quality criteria used to evaluate potential discharge sites were: all discharge is to avoid freshwater drainage systems; and marine discharge sites must have sufficient mixing. The freshwater site was eliminated because it did not meet the first criteria. Hydrographic data indicated that the cannery discharge site had a high effluent buildup level compared to either a sill discharge site or a Hawk Point discharge site (150 hours at the cannery; 50 to 60 hours at the sill; 10 to 20 hours at Hawk Point). Because of this difference and the lack of data concerning biological effects within Hawk Inlet, the cannery site was eliminated. At that time, Noranda representatives indicated that if a discharge at the sill were selected, the company's preferred location would be outside the sill. The two marine discharge sites that were retained are illustrated in Figure 2-3.

OPTIONS USED TO FORM ALTERNATIVES

Housing

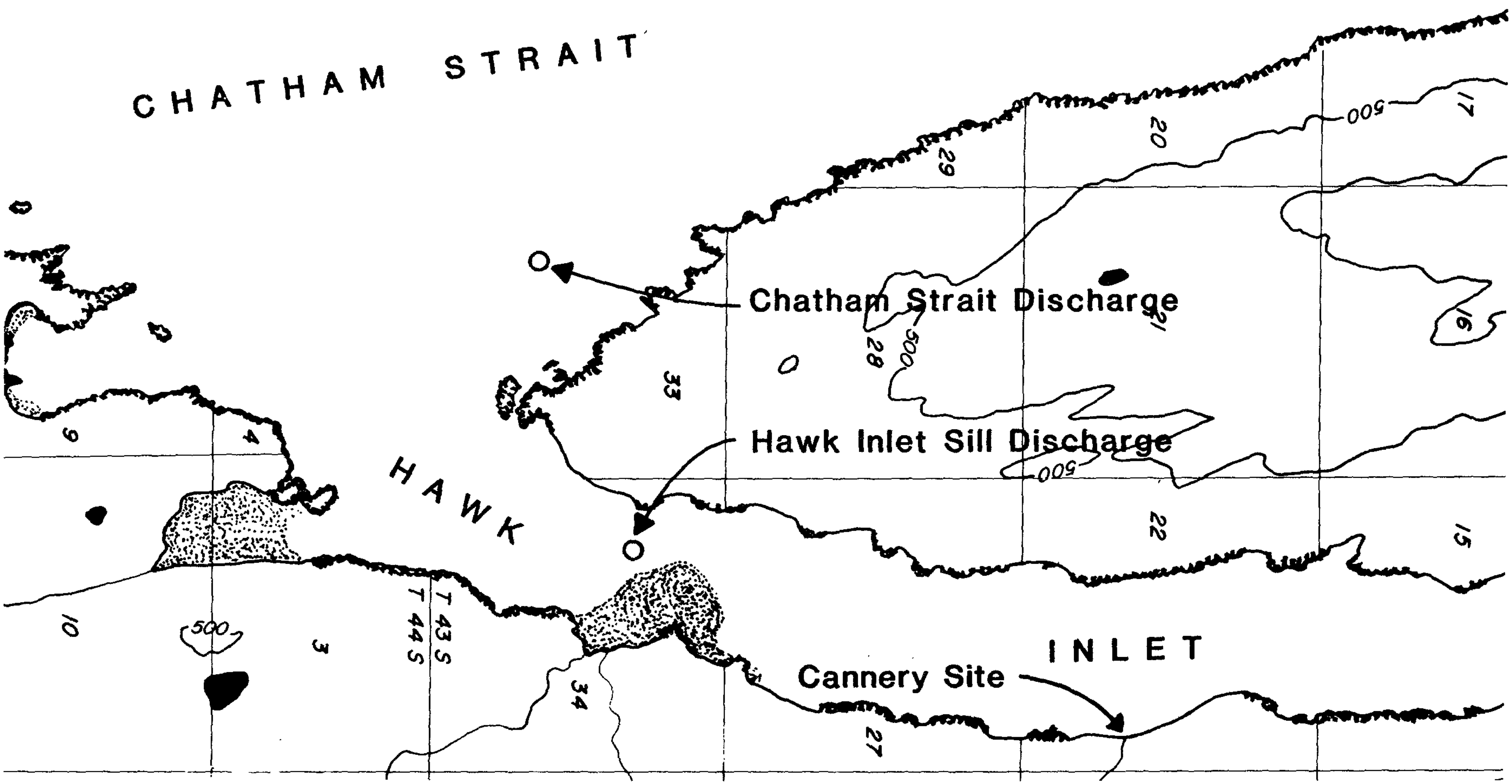
Housing in Juneau This option would require daily transport of employees to and from Admiralty Island. A dock at Young Bay and a road to the cannery would be required to provide access to the mine facilities. Upgrading of existing facilities at the cannery would be necessary for emergency housing during those times when employees could not be removed from the island, usually because of weather conditions.

This option assumes no employees would be permanently housed on Admiralty Island. Noranda has agreed with this assumption.

Housing at the cannery Under this option, a year round campsite with sleeping quarters, a cafeteria, and recreation areas would be established to house about 225 employees. This would require expansion of housing facilities on to National Forest lands under a special-use permit. Working shifts would likely be 6 days on and 1 day off.

Potential Treated Water Disposal Sites

GREENS CREEK PROJECT EIS



These maps and graphics are schematic in content and should not be considered accurate as to specific locations.

0 1/2 1
Scale In Miles

North

Figure 2-3

Transportation to Admiralty Island

Boat A crew-type boat with a capacity for about 160 people would be used to transport employees from Auke Bay to Young Bay. Travel time to Young Bay would be about 35 to 45 minutes each way. A small pedestrian dock would be constructed at Young Bay to off-load employees.

See Figure 2-4 for the conceptual layout of the proposed Auke Bay docking facility.

Transportation on Admiralty Island

Road from Young Bay to the cannery This road would be a restricted, minimum-use facility for transporting employees from Young Bay to the work sites. The road would be 16 feet wide, including shoulders, and would be considered a one-lane road. The road would be about 5 miles long with a maximum grade of 10 percent. It is assumed in this EIS that this road will be permitted for exclusive use by Noranda.

Road from the cannery to the mine site The road would be 16 feet wide. If the mill was located at the mine service area, a CMP would run along the side of the road for a total roadway width of 27 feet. If the mill was located at the tailings pond, the road would be 18 feet wide to accommodate ore hauling trucks.

Aerial tram system The tram would connect the Cannery Muskeg tailings pond with the mine service area. It would consist of two separate double jig-back tramway systems, joined at a midway transfer station. Each of the individual sections would consist of two tramway cars, with one traveling upward, the other traveling downward.

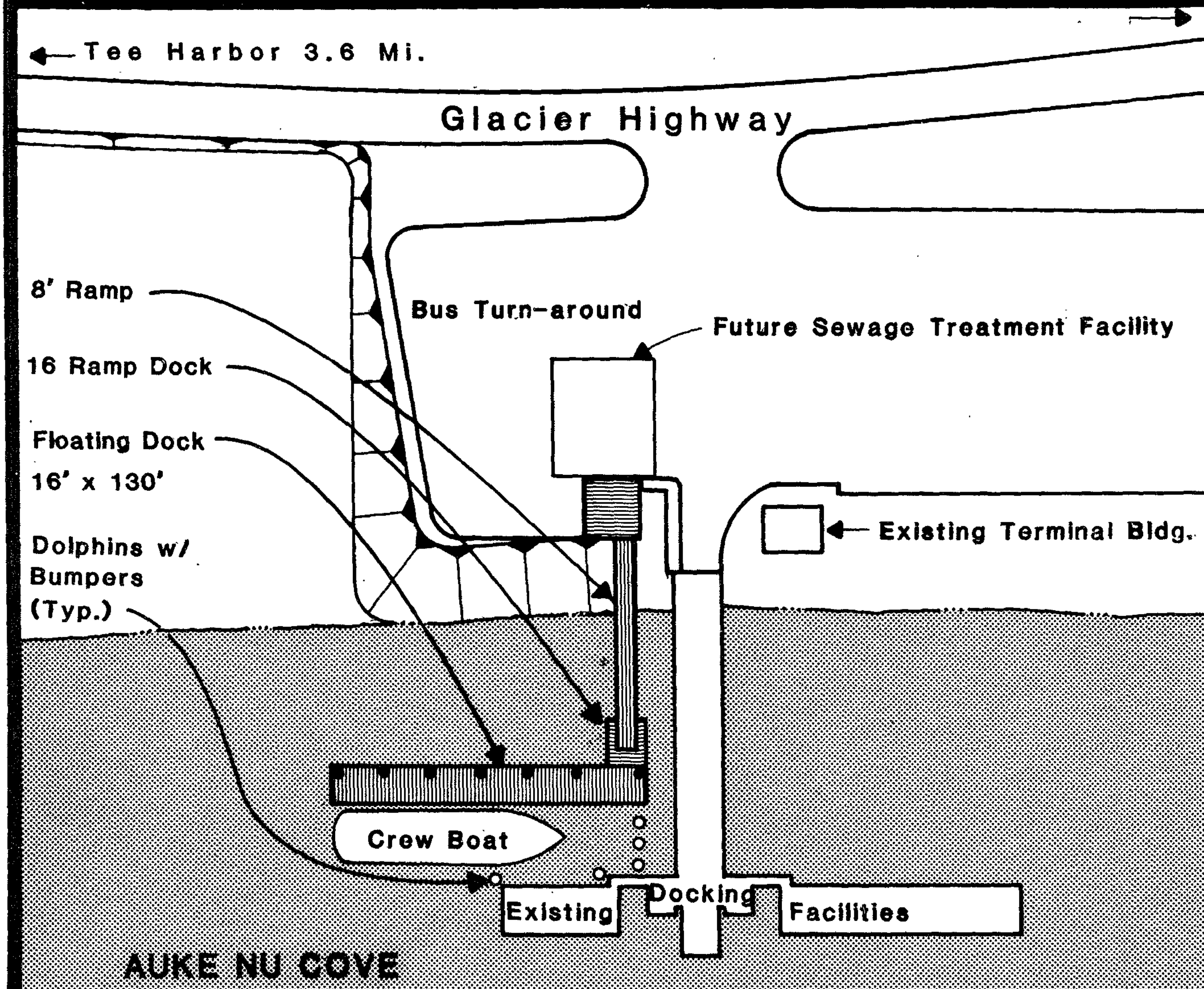
Personnel would be carried in combination cars that would have a capacity of 10 tons of ore, or 20 passengers. There would be eight towers, the highest of which would be 280 feet.

Millsite

Mill at the mine service area The mill would be adjacent to the area developed for supporting underground operations. The mill facility itself would require one additional acre in the mine service area. Tailings would be transported from the mill to the tailings pond by slurry pipeline.

GREENS CREEK PROJECT EIS

Proposed Docking Facility- Auke Bay Ferry Terminal



- Noranda Conceptualization

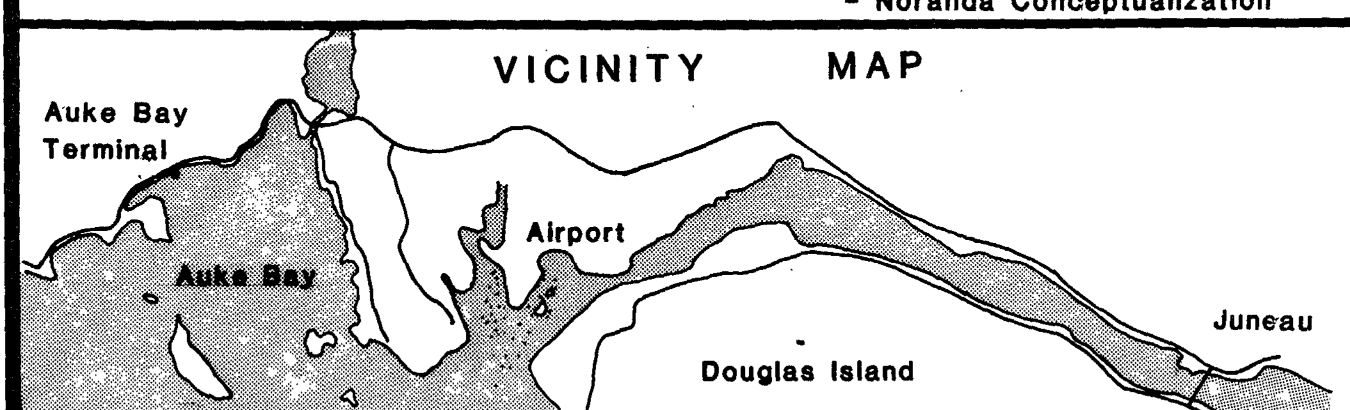


Figure 2-4

Mill at the tailings pond The mill would be adjacent to the tailings pond. This option would require separate power generation facilities and additional workers at the site. Ore would be hauled to the site by truck or tram cars.

Tailings Pond Site

Football Field This site would be located approximately 2 miles from the mine, on the north side of the Greens Creek valley, at an elevation of 1,440 feet.

Cannery Muskeg This site would be located approximately 1 mile south of the cannery at an elevation of 150 feet. It would be about 7 miles from the mine site.

North Hawk Inlet This site would be located approximately 2.5 miles north of the cannery at an elevation of 142 feet. It would be about 11 miles from the mine.

Effluent Discharge Sites

Treatment and discharge at the Hawk Inlet sill This site would discharge effluent at a point south of the Hawk Inlet sill.

Treatment and discharge in Chatham Strait This site would require the construction of an effluent line across Hawk Inlet with a discharge point northwest of Hawk Point. Some blasting of rock along the Hawk Point shoreline would be required for this site. The line would be placed either in the intertidal zone or be a submarine line to a point near Hawk Point where it would be placed on land.

Fixed Components
The docking facility at the cannery and the mine service area are fixed components; their location is the same in all alternatives.

DESCRIPTION OF ALTERNATIVES

Eight project alternatives and a "No Action Alternative" were developed to be considered in this Environmental Impact Statement.

Each alternative was composed of one option from each of the five non-fixed components, plus the two fixed components. Figure 2-5 identifies the project components, the options, and the final alternatives.

Project Alternatives and Individual Options

GREENS CREEK PROJECT EIS

Alternatives	Project Components	Housing		Transport					Mill Site			Tailing Pond			Wastewater Discharge		
				To Island		On Island											
	Project Options	Off Island – Juneau	On Island – Private Land at Cannery	Aircraft or Boat to Hawk Inlet	Boat to Young Bay	Road–Young Bay to Cannery	Road–Cannery to Mine Site	Tram–Cannery to Mine Site	Cannery Muskeg Tailings Pond	Mine Service Area	Football Field Tailings Pond	Cannery Muskeg	Football Field	North Hawk Inlet		Marine – Hawk Inlet Sill	Chatham Strait
1	Camp facilities, Cannery tailings pond, mill at mine & Chatham Strait discharge.		■	■			■			■		■					■
2	Housing in Juneau, Cannery tailings pond, mill at mine, road to Young Bay from mine & Hawk Inlet discharge.	■			■	■	■			■		■				■	
3	Camp facilities, Cannery tailings pond, tram, mill at tailings pond & Chatham Strait discharge.		■	■				■	■			■					■
4	Housing in Juneau, Football field tailings pond, mill at tailings pond & Chatham Strait discharge.	■			■	■	■				■		■				■
5	Housing in Juneau, North Hawk Inlet tailings pond, mill at mine & Hawk Inlet discharge.	■			■	■	■			■				■		■	
6	Housing in Juneau, Cannery tailings pond, mill at mine & Chatham Strait discharge.	■			■	■	■			■		■					■
7	Housing in Juneau, Cannery tailings pond, mill at tailings pond & Chatham Strait discharge.	■			■	■	■		■			■					■
8	Camp facilities, Cannery tailings pond, mill at tailings pond & Chatham Strait discharge.		■	■			■		■			■					■
	No Action																

FIGURE 2-5

In analyzing the remaining options, it was determined that some options were mutually exclusive, thereby eliminating them from consideration when developing certain alternatives. For example, development of a tram would not allow installation of a slurry pipeline or wastewater pipeline because there would be no road on which to build or permit access to the pipeline. Therefore, for the tram option, the mill must be at the tailings pond and wastewater from the mine service area must be discharged into Greens Creek.

No Action Alternative

In this document, the No Action Alternative is defined as no project on National Forest land. The No Action Alternative can be used as a baseline to which other alternatives are compared.

The No Action Alternative would involve Forest Service denial of any development plan for the Greens Creek Project on the National Forest. However, the Alaska National Interest Conservation Act of 1980 (ANILCA) in Section 503 (f)(2)(A) provides that:

> any person who is the holder of a valid mining claim on public lands located within the boundaries of the monuments, shall be permitted to carry out activities related to exercise of rights under such claim in accordance with reasonable regulations promulgated by the Secretary....

Section 503 (i)(1) of ANILCA, with the direct reference to Greens Creek, provides that holders of valid mining claims are entitled to a lease on National Forest land for use in connection with milling of minerals extracted from claims located within the monument. It is recognized that a decision to implement the No Action Alternative would, therefore, be in conflict with ANILCA.

The northern portion of the proposed project area, from Young Bay to the cannery, is within Management Area C21. The Tongass Land Management Plan (TLMP) assigns that area a Land Use Designation (LUD) III; the area is to be managed to provide a combination of amenity and commodity values. The No Action Alternative for the Greens Creek Project in the LUD III area is not in conflict with TLMP directives; no development associated with the proposed project would take place in Management Area C21 under the No Action Alternative.

Alternative 1

This alternative would house employees in a year-round camp for mining project personnel only. The camp would be located partially on National Forest land, adjacent to privately-owned land at the cannery. There would be no housing established in Juneau. Off-island transportation would be by boat or plane directly to Hawk Inlet. Transportation from the cannery to the mine service area would be by road. The mill would be located at the mine service area and tailings would be transported to the Cannery Muskeg tailings pond by slurry pipeline. Effluent would be transported from the pond by pipeline and discharged into Chatham Strait. A dock and marina would be available for the recreational use of the employees. Figures 2-6 and 2-7 illustrate this alternative.

Number of Employees: 225

Location of Employee Housing: Campsite

Number of Structures in Campsite: 42

Location of Mill: Mine service area

Miles of Roadway: 9.5

Width of Road: 16 feet

Width of Subgrade: 27 feet

Type of Domestic Wastewater Treatment: Secondary

Water Source: Underground workings, infiltration wells

Tailings Pond: Cannery Muskeg

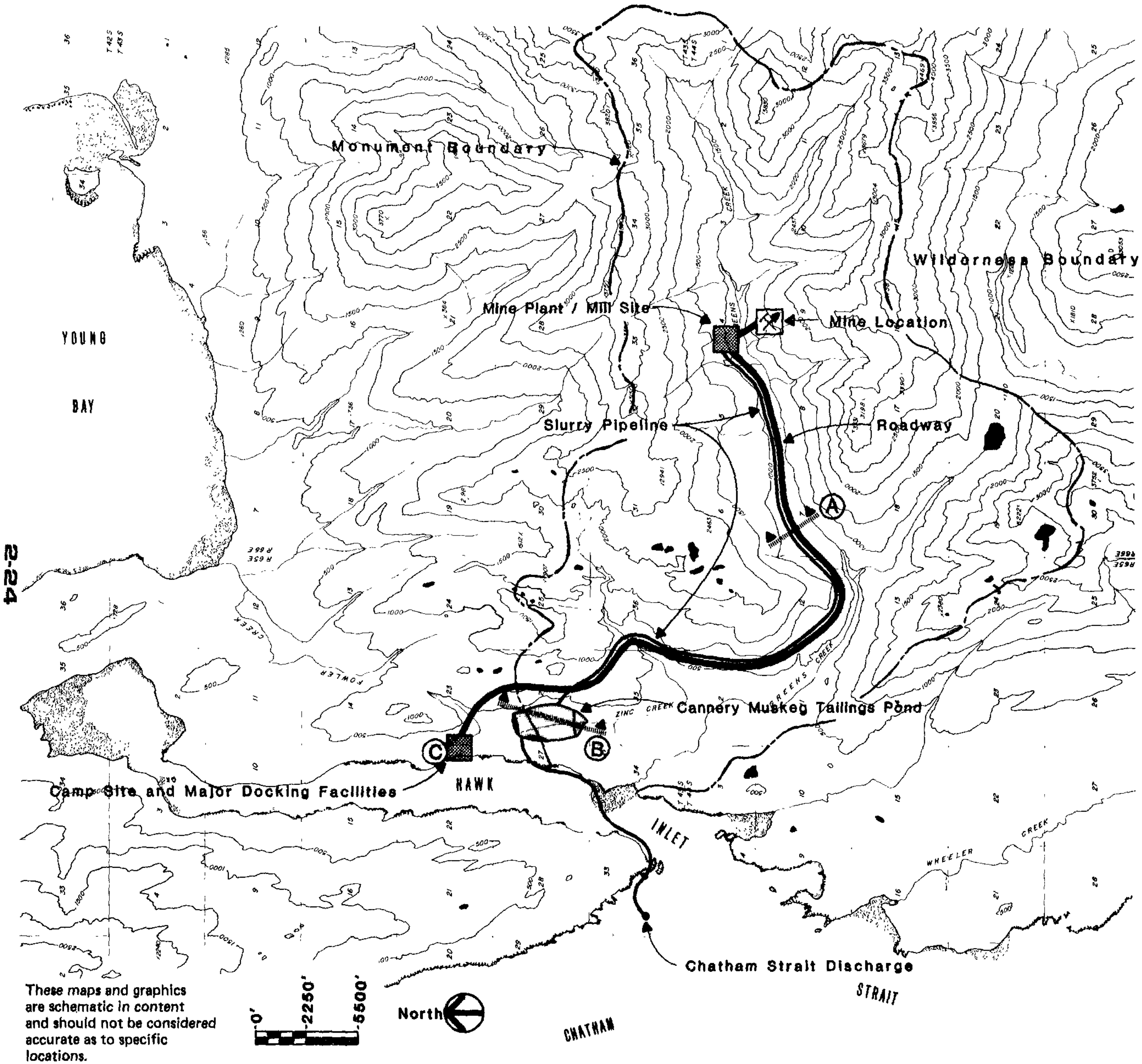
Height of Embankment: 80 feet

Tailings Pond Capacity: 3.4 million cubic yards

Amount of Fill: 0.76 million cubic yards

Crest Length: 950 feet

Total Disturbed Area: 150 acres

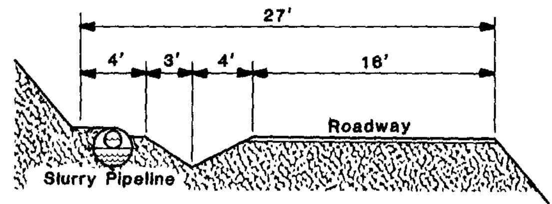


These maps and graphics are schematic in content and should not be considered accurate as to specific locations.

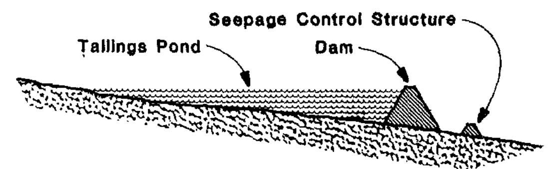
GREENS CREEK PROJECT EIS

Representational Graphics

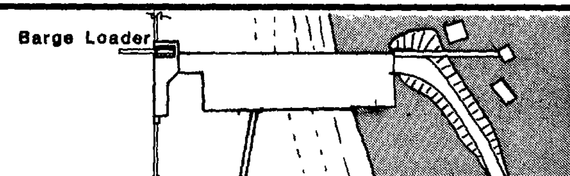
- Noranda Conceptualization



Ⓐ Typical Roadway Section
Not To Scale



Ⓑ Cannery Muskeg Tailings Pond
Exaggerated Vertical Scale

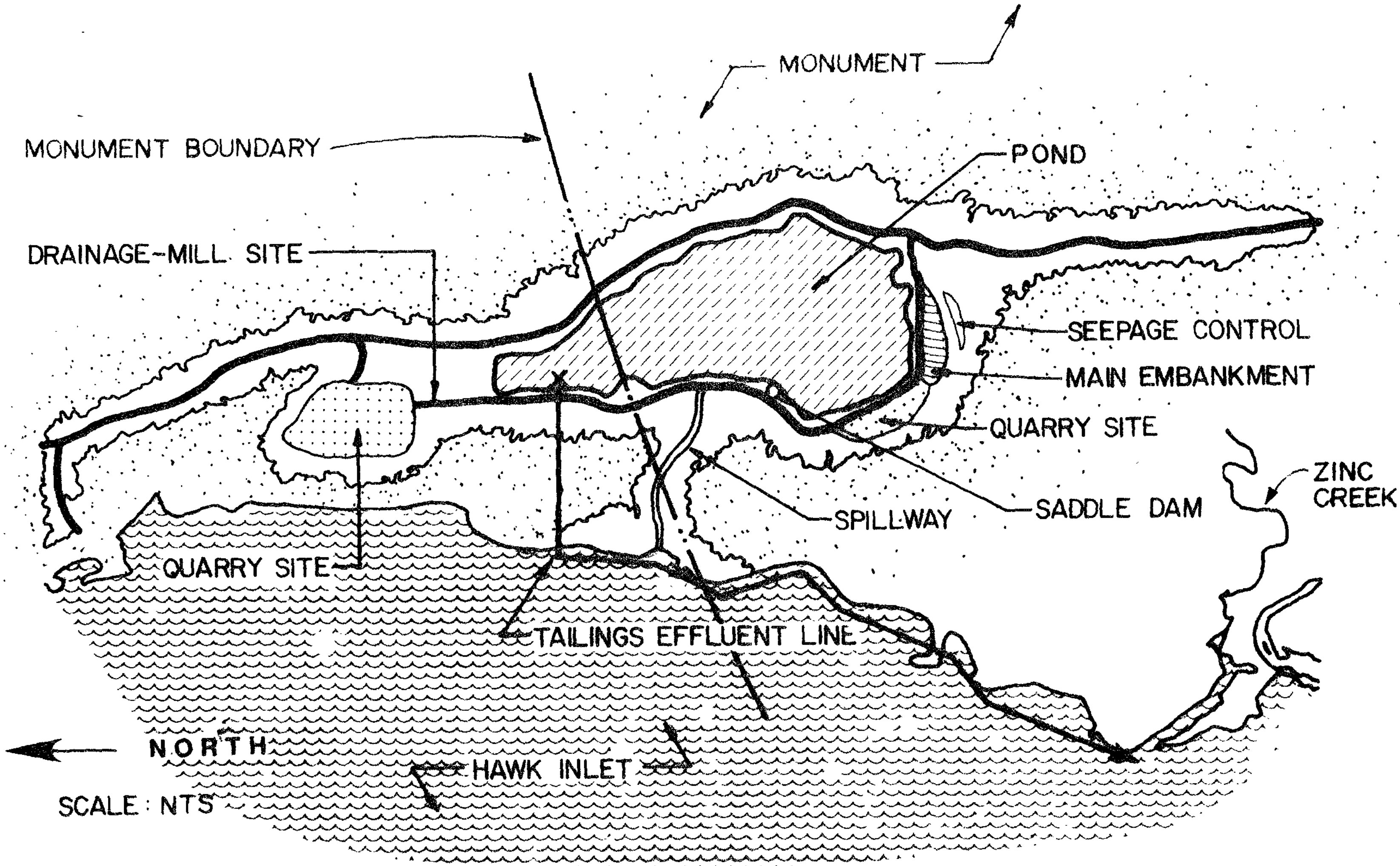


Ⓒ Hawk Inlet Loading Dock
Not To Scale

Cross Section - Location and Direction

Alternative No. 1

FIGURE 2-6



CANNERY MUSKEG TAILINGS POND SITE

These maps and graphics are schematic in content and should not be considered accurate as to specific locations.

FIGURE 2-7

Alternative 1 continued

Surface Area of Pond: 93 acres

Extreme Rainfall Event Overflow Location: Lower Hawk Inlet

Major Docking Facility: Hawk Inlet cannery

Piling-supported Loading Dock Length: 600 feet

Small Boat Moorage: 40 units

Amount of Fill: Less than 10,000 cubic yards

Power Source: Diesel generators

Slurry Line: 7.5 miles, gravity flow

Effluent Discharge Site: Chatham Strait

Total Acreage Affected: 404

Alternative 2

This alternative would house employees in Juneau. Employees would be bused from assorted pick-up points in Juneau to and from the Auke Bay ferry terminal and then transported by boat to a dock in Young Bay. Employees would be transported on Admiralty Island by bus to the cannery and then to the various work stations. The mill would be located at the mine service area. Tailings would be transported via slurry pipeline to the Cannery Muskeg tailings pond site. Effluent would be transported by pipeline to a discharge site at the Hawk Inlet sill. Figure 2-8 illustrates Alternative 2.

Number of Employees: 315

Location of Employee Housing: Juneau

Location of Mill: Mine service area

Young Bay Docking Facility:

Type of Breakwater: Rubble

Length of Dock: 150 feet

Amount of Fill: Less than 30,000 cubic yards

Miles of Roadway: 14.8

Width of Road: 16 feet

Width of Subgrade: 27 feet

Type of Domestic Wastewater Treatment: Secondary

Water Supply Source: Underground workings, infiltration wells

Tailings Pond: Cannery Muskeg, See Alternative 1

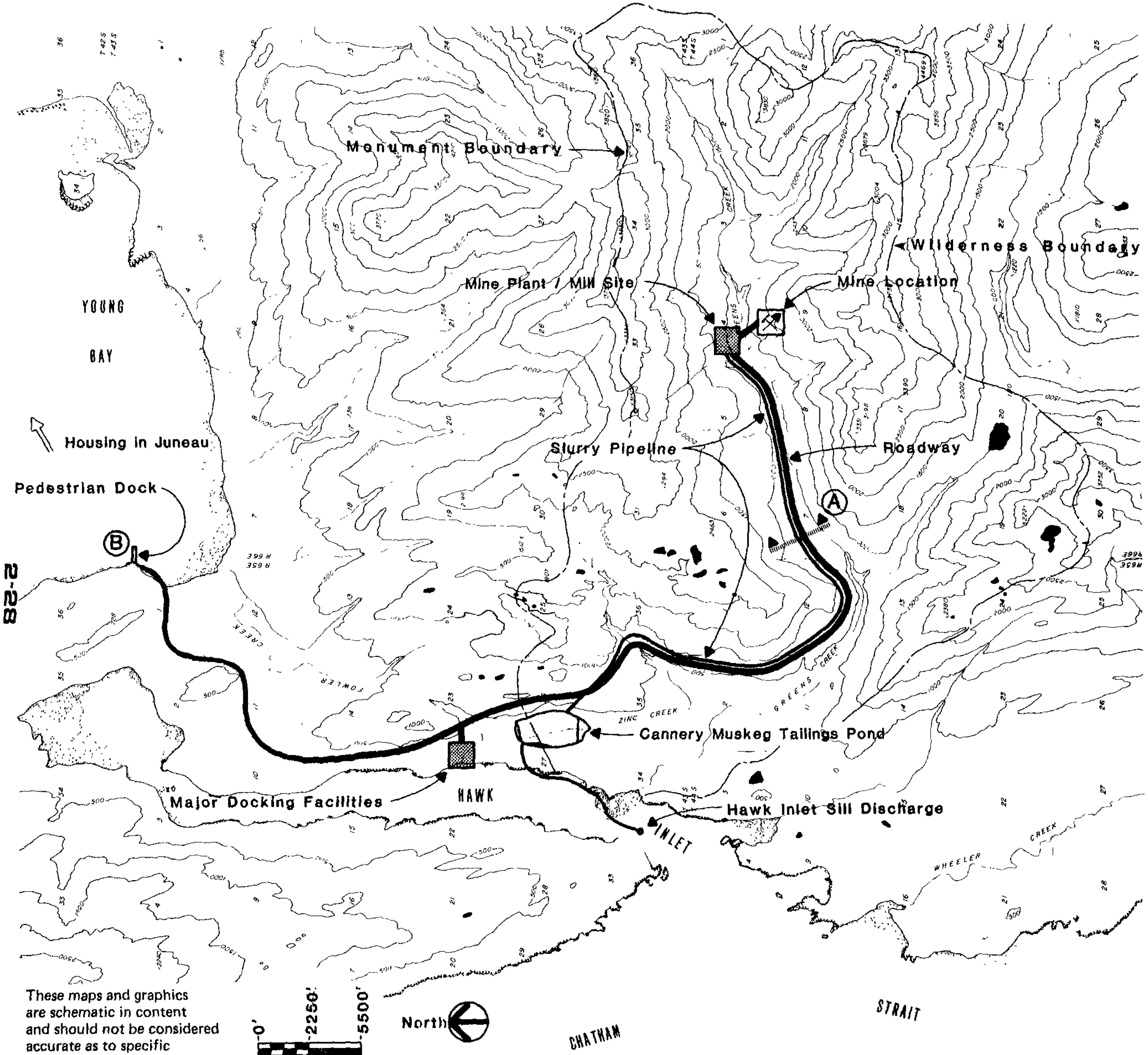
Major Docking Facility: Hawk Inlet cannery, See Alternative 1

Power Source: Diesel generators

Slurry Line: 7.5 miles, gravity flow

Effluent Discharge Site: Hawk Inlet sill

Total Acreage Affected: 477

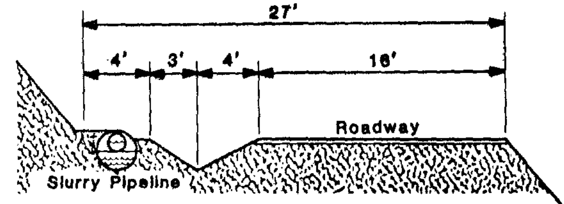


These maps and graphics are schematic in content and should not be considered accurate as to specific locations.

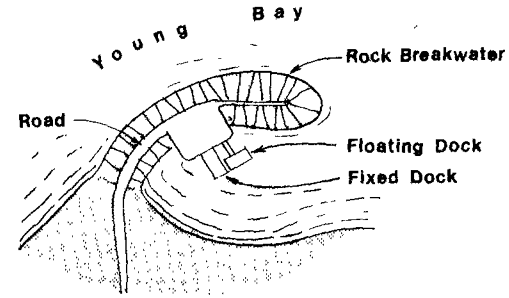
GREENS CREEK PROJECT EIS

Representational Graphics

- Noranda Conceptualization



Ⓐ Typical Roadway Section
Not To Scale



Ⓑ Pedestrian Dock
No Scale

▲……▲ Cross Section - Location and Direction

Alternative No. 2

FIGURE 2-8

Alternative 3

This alternative would house employees at a year-round camp at the cannery, with boat transport of employees to Hawk Inlet. Employee access to the mine from the cannery would be provided by aerial tramway. The tram would also carry ore from the mine to the mill located at the Cannery Muskeg tailings pond. Effluent would be discharged at the Chatham Strait site. Figure 2-9 illustrates Alternative 3.

Number of Employees: 225

Location of Employee Housing: Campsite

Number of Units in Campsite: 42

Number of Towers: 8

Height of Towers: 280 feet maximum

Length of Tram: 5.1 miles

Location of Mill: Adjacent to the Cannery Muskeg tailings pond

Method of Ore Transport: Tram buckets from the mine service area

Miles of Roadway: 2.5 miles

Type of Domestic Wastewater Treatment: Secondary

Wastewater Disposal: Mine service area wastewater to Greens Creek

Effluent Discharge Site: Chatham Strait.

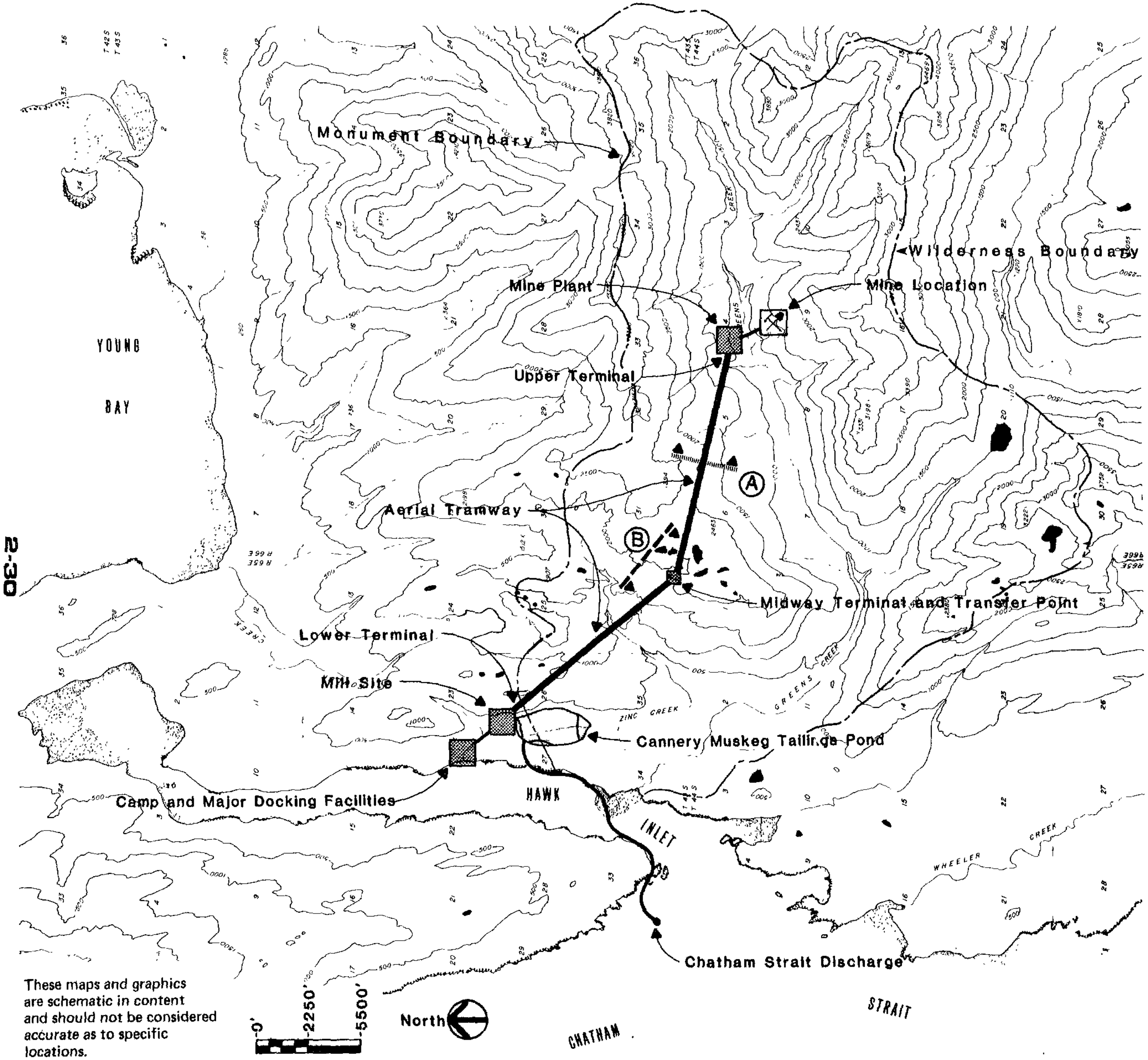
Tailings Pond: Cannery Muskeg, See Alternative 1

Major Docking Facility: Hawk Inlet cannery, See Alternative 1

Power Source: Diesel generators

Slurry Line: None

Total Acreage Disturbed: 333



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GREENS CREEK PROJECT EIS

Representational Graphics

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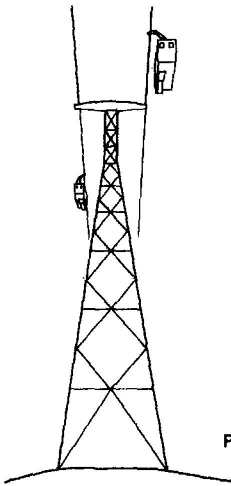
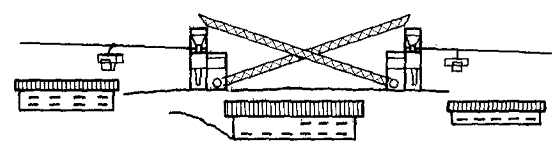


Tramway Layout and Design Based On Greens Creek Joint Venture Aerial Tramway, An Updated Preliminary Engineering Study and Cost Estimate, Bechtel Civil and Minerals, Inc. Sept.,1981

(A) Aerial Tramway
Not To Scale



(B) Transfer Point
Not To Scale

▲▲ Cross Section – Location and Direction
▲–▲ Elevation – Direction

Alternative No. 3

FIGURE 2-9

Alternative 4

Under this alternative employees would be housed in Juneau and bused to the Auke Bay ferry terminal. Personnel would be transported by boat to Young Bay and then bused to work stations. Ore would be transported from the mine to the mill at the Football Field tailings pond by truck. Mine service area wastewater would be pumped uphill to the tailings pond. Wastewater would be transported along the road, then discharged in Chatham Strait. Figures 2-10 and 2-11 illustrate this alternative.

Number of Employees: 315

Location of Employee Housing: Juneau

Young Bay Docking Facility: See Alternative 2

Location of Mill: Football Field Tailings Pond

Method of Ore Transport: 35 ton trucks

Miles of Road: 16.0

Width of Road from the Mine Service Area to the Mill: 18 feet

Type of Domestic Wastewater Treatment: Secondary

Tailings Pond: Football Field

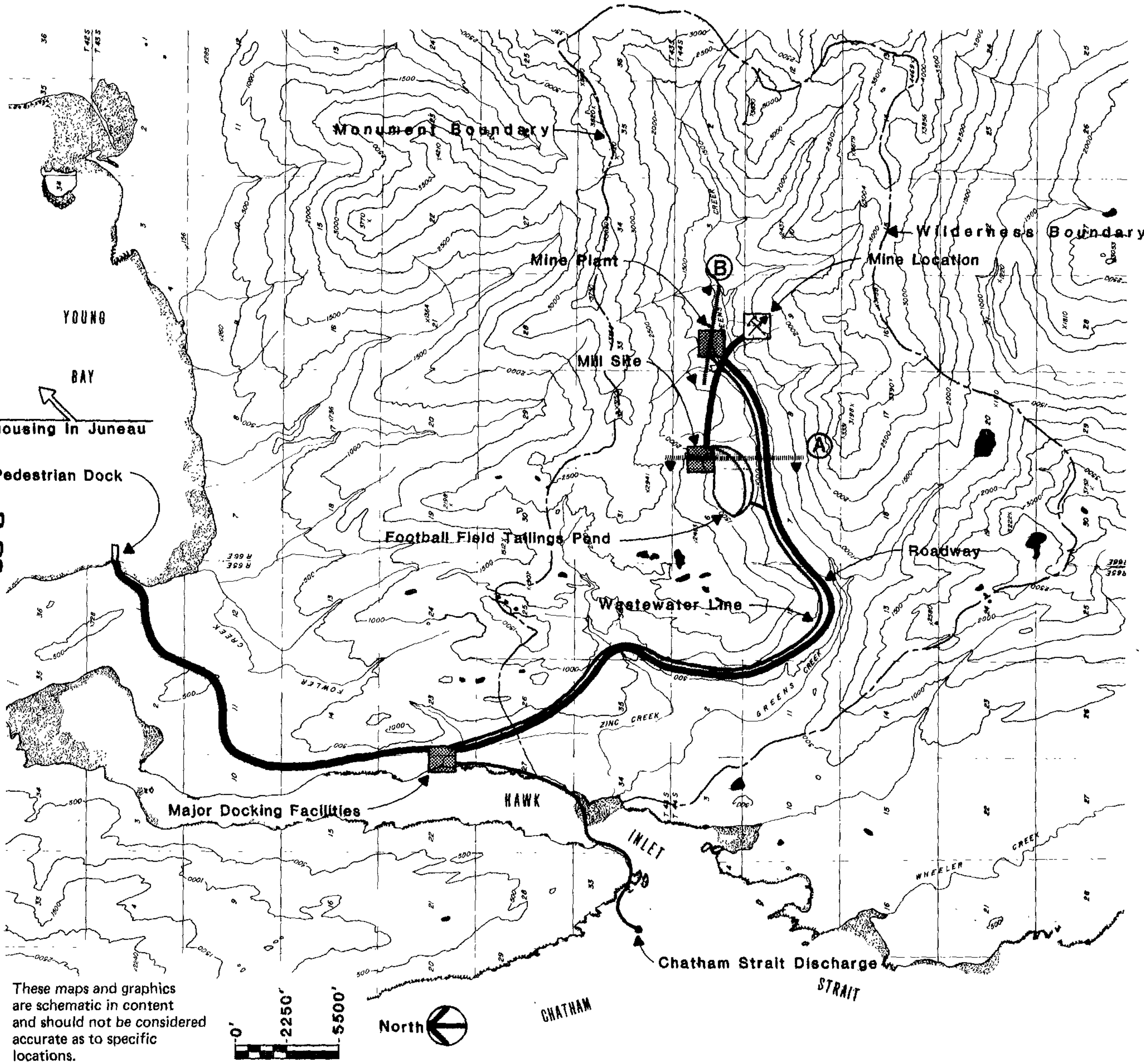
- Height of Embankment: 106 feet
- Tailings Pond Capacity: 3.4 million cubic yards
- Amount of Fill: 3.12 million cubic yards
- Crest Length: 3,500 feet
- Total Disturbed Area: 163 acres
- Surface Area of Pond: 45 acres
- Extreme Rainfall Event Overflow Location: Upper Greens Creek

Slurry Line: None

Effluent Discharge Site: Chatham Strait

Power Supply: Diesel generators

Total Acreage Affected: 520



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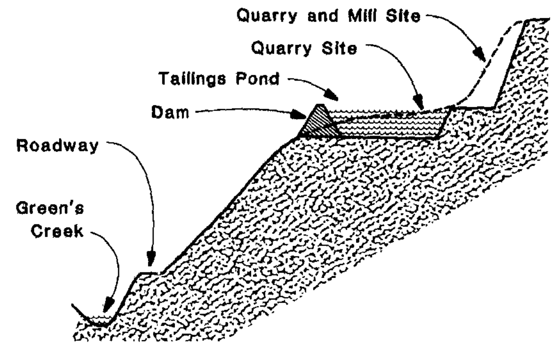
GREENS CREEK PROJECT EIS

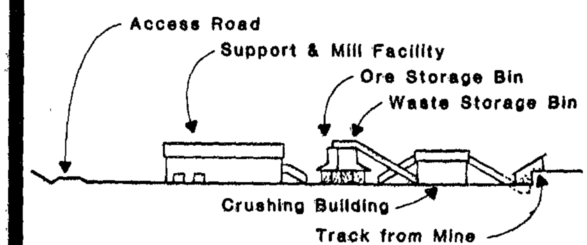
Representational Graphics

- Noranda Conceptualization



Ⓐ Football Field Tailings Pond

Exaggerated Vertical Scale



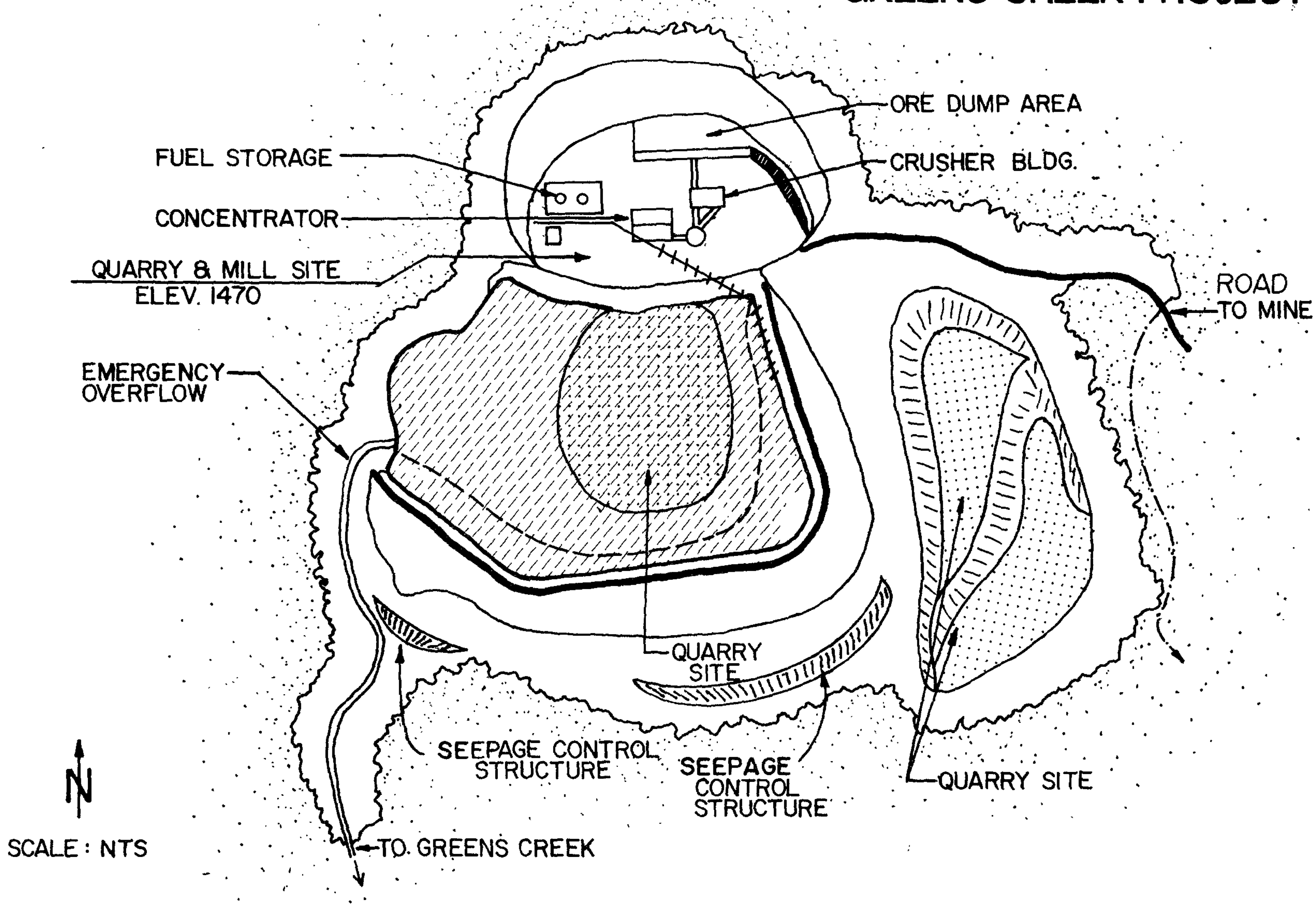
Ⓑ Section at Mine Plant

Not to Scale

Cross Section - Location and Direction

Alternative No. 4

FIGURE 2-10



FOOTBALL FIELD TAILINGS POND SITE

These maps and graphics are schematic in content and should not be considered accurate as to specific locations.

FIGURE 2-11

Alternative 5

Under this alternative, employees would be housed in Juneau and bused to the Auke Bay ferry terminal. Personnel would be transported by boat to Young Bay. From Young Bay they would be transported by bus to various work stations. The mill would be located at the mine service area and tailings would be transported via slurry pipeline to the North Hawk Inlet tailings pond site. A pump station would be required to transport the tailings to the pond site. The effluent would be discharged at the Hawk Inlet sill. Figures 2-12 and 2-13 illustrate Alternative 5.

Number of Employees: 315

Location of Employee Housing: Juneau

Location of Mill: Mine service area

Young Bay Docking Facility: See Alternative 2

Type of Domestic Wastewater Treatment: Secondary

Water Supply Source: Underground workings, infiltration wells

Miles of Road: 14.8

Width of Road: 16 feet

Width of Subgrade: 27 feet

Tailings Pond: North Hawk Inlet

Height of Embankment: 47 and 33 feet (2 embankments)

Tailings Pond Capacity: 3.4 million cubic yards

Amount of Fill: 1.35 million cubic yards

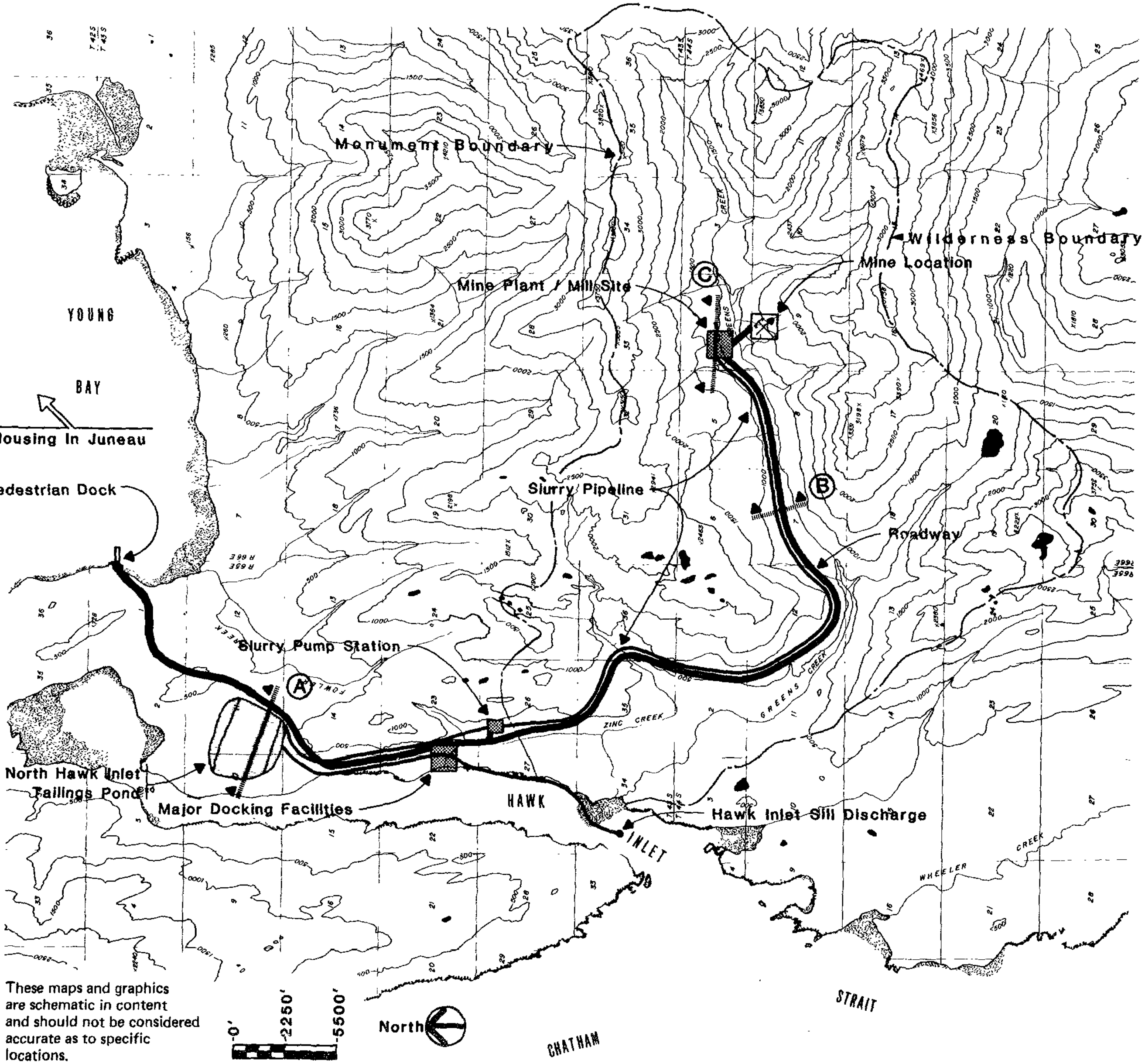
Crest Length: 4,200 feet

Surface Area of Pond: 126 acres

Total Disturbed Area: 270 acres

Extreme Rainfall Event Overflow Location: Upper Hawk Inlet

Slurry Line: 10 miles, pumping station



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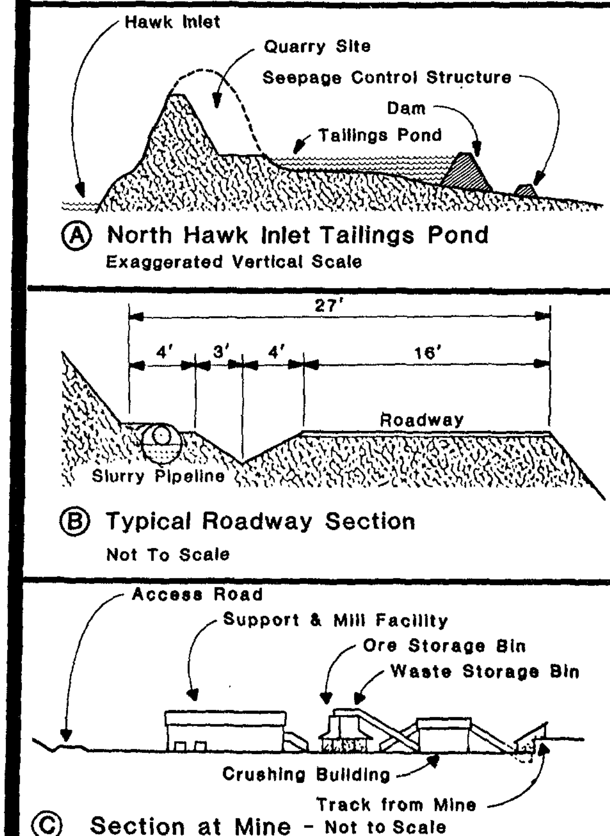
GREENS CREEK PROJECT EIS

Representational Graphics

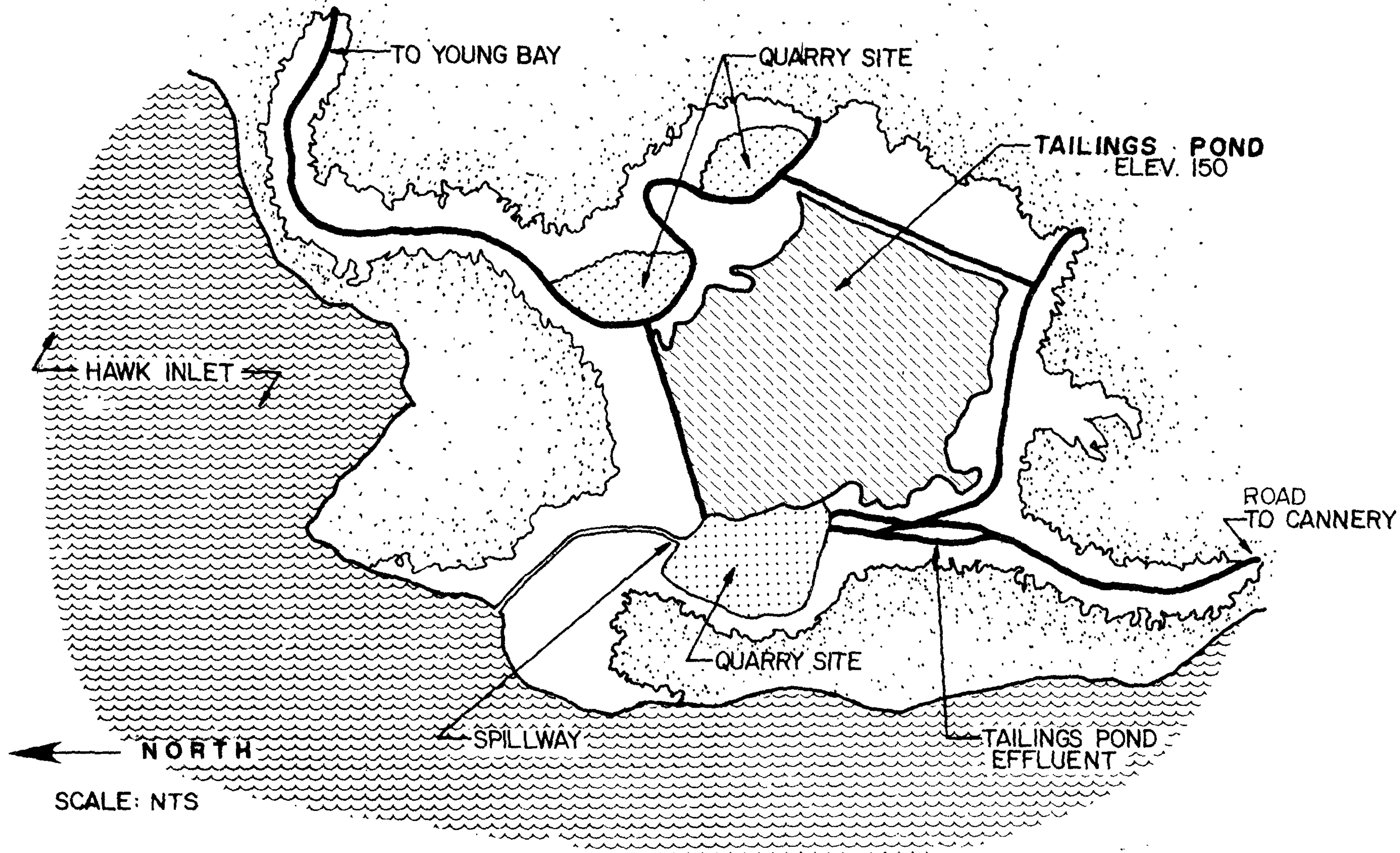
- Noranda Conceptualization



Cross Section - Location and Direction

Alternative No. 5

FIGURE 2-12



NORTH HAWK INLET TAILINGS POND SITE

These maps and graphics are schematic in content and should not be considered accurate as to specific locations.

Figure 2-13

Alternative 5 continued

Effluent Discharge Site: Hawk Inlet sill

Power Source: Diesel generators

Major Docking Facility: Hawk Inlet cannery, See Alternative 1

Total Acreage Affected: 597

Alternative 6

This is the Forest Service Preferred Alternative. This alternative would house employees in Juneau. Employees would be bused from points in Juneau to and from the Auke Bay ferry terminal. They would travel by boat to Young Bay. Once on Admiralty Island, employees would be transported by bus to various work stations. The mill would be located at the mine service area. Tailings would be transported via slurry pipeline to the Cannery Muskeg tailings pond. Effluent would be transported by pipeline to a discharge site in Chatham Strait. Figure 2-14 illustrates this alternative.

Number of Employees: 315

Location of Employee Housing: Juneau

Location of Mill: Mine service area

Young Bay Docking Facility: See Alternative 2

Miles of Roadway: 14.8

Width of Road: 16 feet

Width of Subgrade: 27 feet

Type of Domestic Wastewater Treatment: Secondary

Water Supply Source: Underground workings, infiltration wells

Tailings Pond: Cannery Muskeg, see Alternative 1

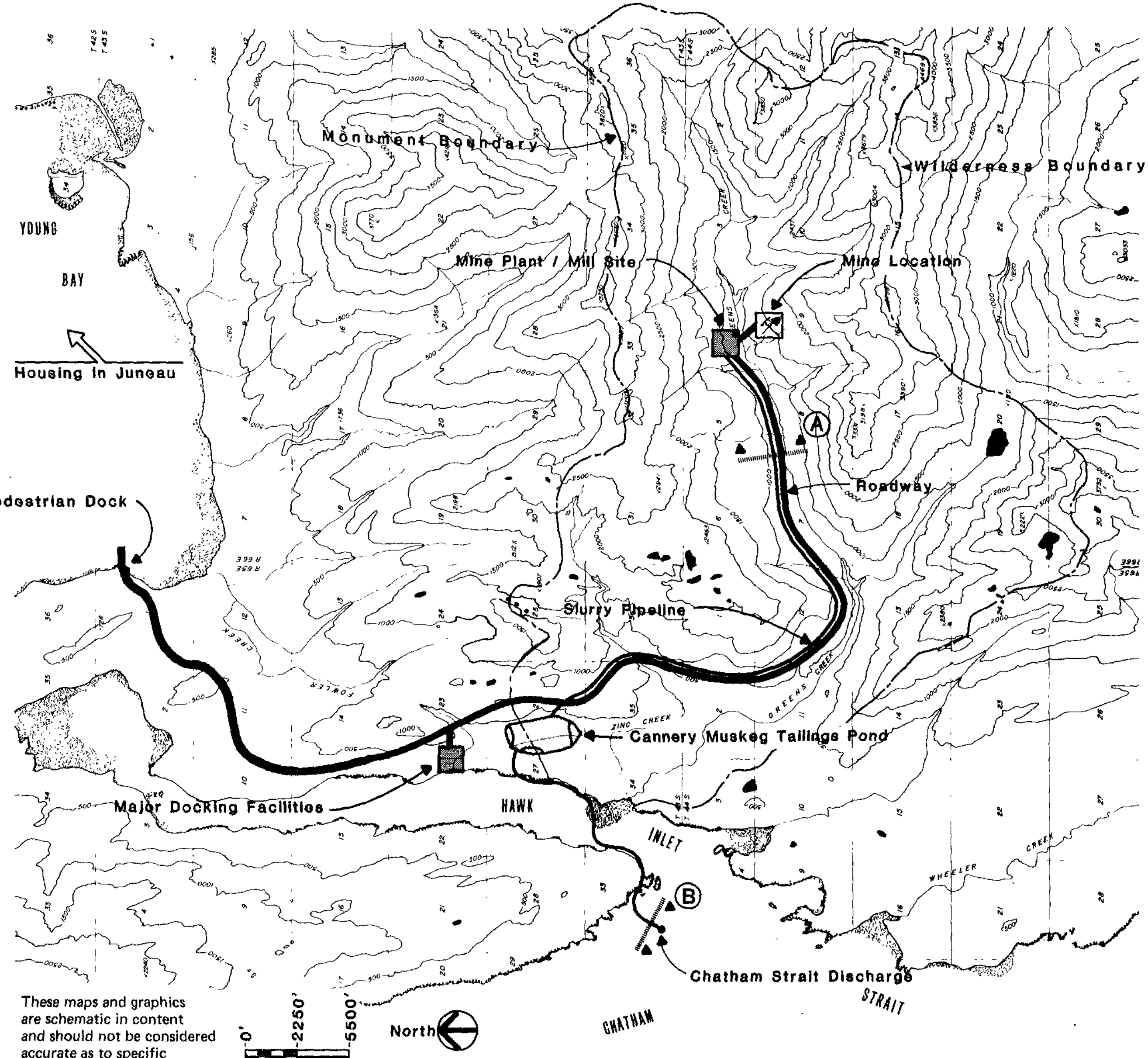
Major Docking Facility: Hawk Inlet cannery, see Alternative 1

Power Source: Diesel generators

Slurry Line: 7.5 miles, gravity flow

Effluent Discharge Site: Chatham Strait

Total Acreage Affected: 490



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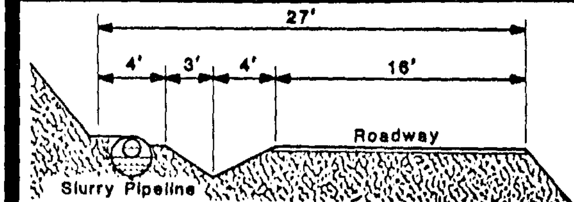
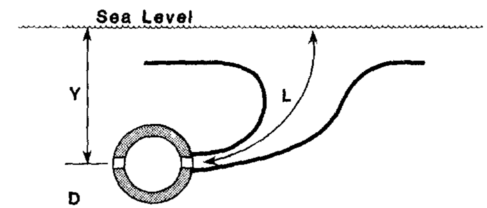
GREENS CREEK PROJECT EIS

Representational Graphics

- Noranda Conceptualization



Ⓐ Typical Roadway Section
Not To Scale



D Port Diameter 2 1/4" (total six ports)
Y Average Depth 40'
L Mixing Length 50'

Ⓑ Section - Discharge Diffuser
Not To Scale

Cross Section - Location & Direction

Alternative No. 6
FIGURE 2-14

Alternative 7

This alternative would house employees in Juneau. Employees would be bused from various points in Juneau to and from the Auke Bay ferry terminal. They would travel to Young Bay by boat. Once employees arrived at Young Bay, they would be transported by bus to the various work stations. The mill would be located at the Cannery Muskeg tailings pond site. Ore would be transported via 35-ton trucks to the mill at the tailings pond site. Approximately 23 round trips per day would be required. Effluent would be transported by pipeline from the tailings pond to the Chatham Strait discharge site. Figure 2-15 illustrates this alternative.

Number of Employees: 315

Location of Employee Housing: Juneau

Location of the Mill: Adjacent to Cannery Muskeg tailings pond

Young Bay Docking Facility: See Alternative 2

Miles of Roadway: 14.8

Width of Road: 16 feet (Young Bay to cannery) and 18 feet (from mine to mill)

Width of Subgrade: 27 feet and 29 feet

Type of Domestic Wastewater Treatment: Secondary

Water Supply Source: Underground workings, infiltration wells

Tailings Pond: Cannery Muskeg, see Alternative 1

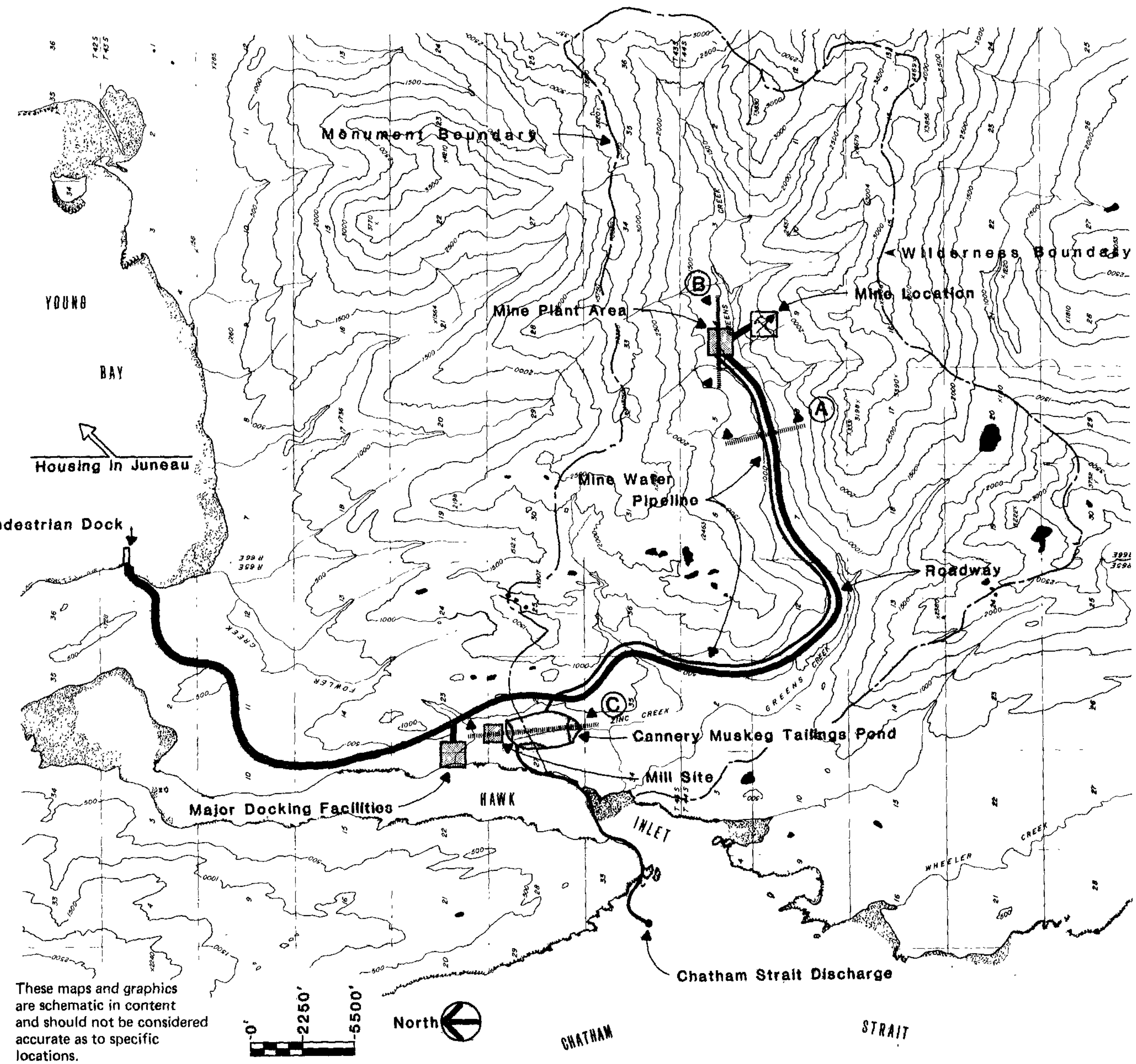
Major Docking Facility: Hawk Inlet cannery, see Alternative 1

Power Source: Diesel generators

Slurry Line: 7.5 miles, gravity flow

Effluent Discharge Site: Chatham Strait

Total Acreage Affected: 492



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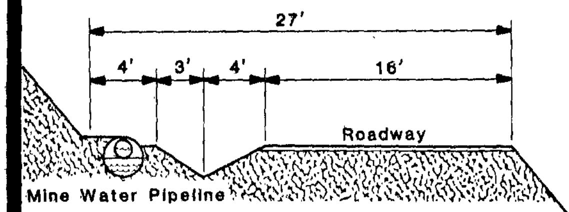
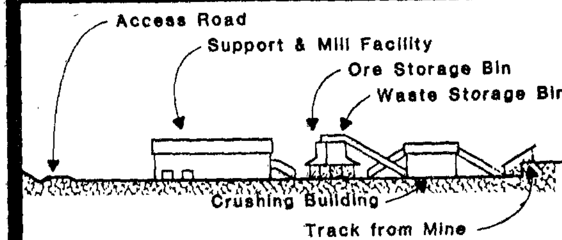
GREENS CREEK PROJECT EIS

Representational Graphics

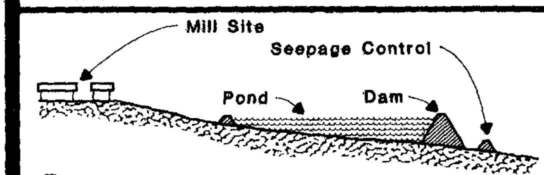
- Noranda Conceptualization



Ⓐ Typical Roadway Section
Not To Scale



Ⓑ Section at Mine Plant
Not to Scale



Ⓒ Mill At Tailings Pond
Not To Scale

Cross Section
- Location & Direction

Alternative No. 7

FIGURE 2-15

Alternative 8

This alternative would house employees in a year-round camp, located partially on National Forest land adjacent to privately-owned land at the cannery. There would be no permanent housing in Juneau established by Noranda for project employees. Off-island transportation would be directly to Hawk Inlet. Transportation from the cannery to the mine service area would be by bus. The mill would be located at the Cannery Muskeg tailings pond; ore would be transported to the mill by 35-ton truck. The mine wastewater pipeline would be located along the access road. Effluent would be transported by pipeline from the tailings pond to the Chatham Strait discharge site. Figure 2-16 illustrates this alternative.

Number of Employees: 225

Location of Employee Housing: Campsite

Number of Structures in Campsite: 42

Location of Mill: Adjacent to Cannery Muskeg tailings pond

Miles of Roadway: 9.5

Width of Road: 18 feet

Width of Subgrade: 29 feet

Type of Domestic Wastewater Treatment: Secondary

Water Source: Underground workings, infiltration wells

Tailings Pond: Cannery Muskeg, see Alternative 1

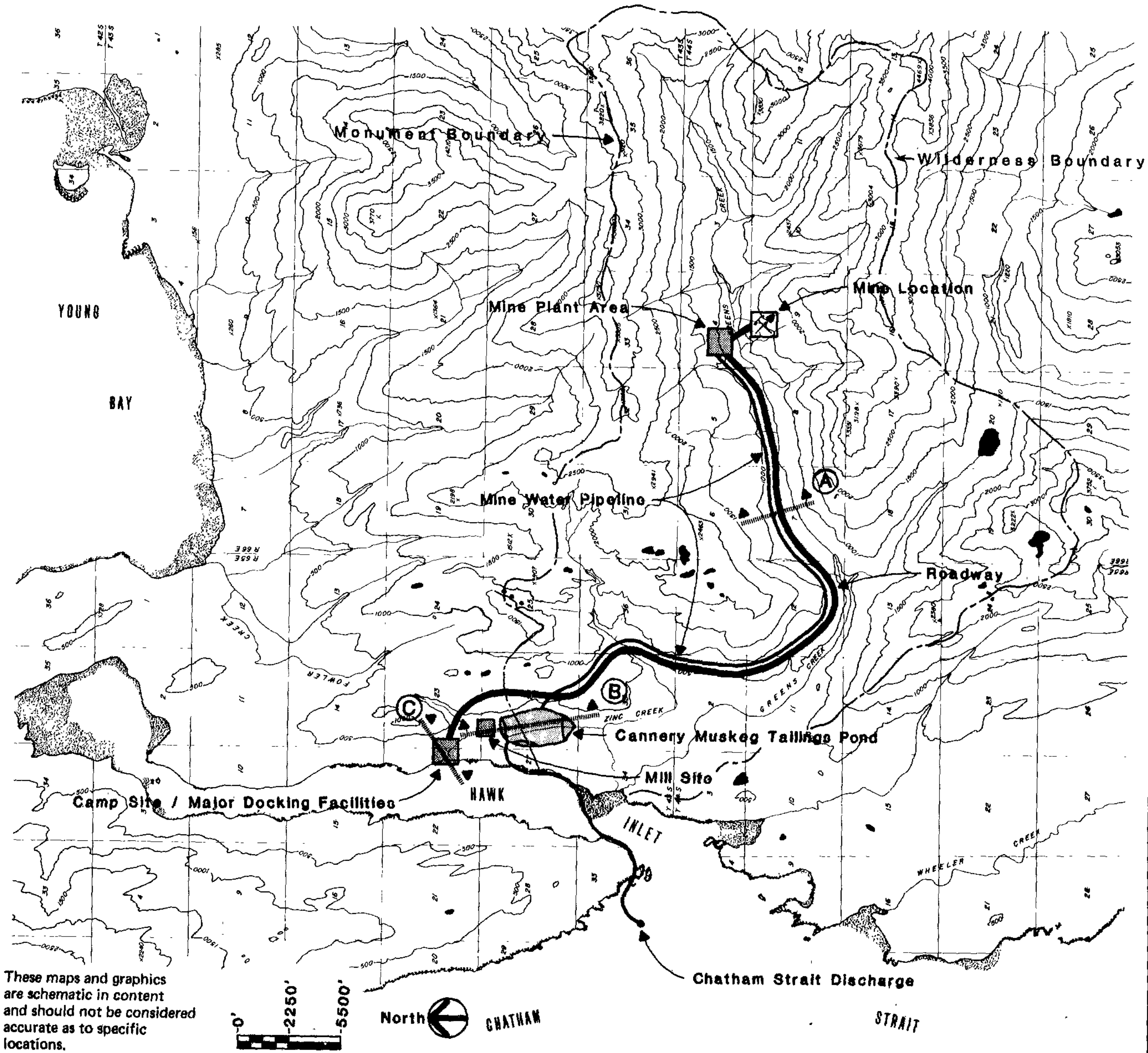
Major Docking Facility: Hawk Inlet cannery, see Alternative 1

Power Source: Diesel generators

Slurry Line: 7.5 miles, gravity flow

Effluent Discharge Site: Chatham Strait

Total Acreage Affected: 404



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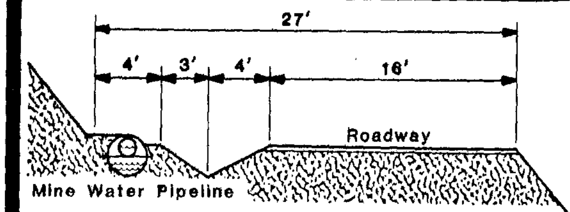
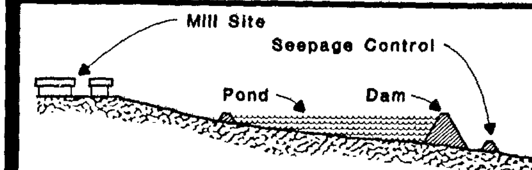
Representational Graphics

-Noranda Conceptualization



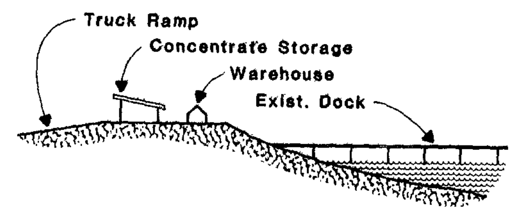
Ⓐ Typical Roadway Section

Not To Scale



Ⓑ Mill At Tailings Pond

Not To Scale



Ⓒ Section at Cannery Site

Not To Scale

▲ ▲ Cross Section
- Location & Direction

Alternative No. 8

FIGURE 2-16

MITIGATION MEASURES COMMON TO ALL ALTERNATIVES

The development of the mine service area, tailings pond access road, and loading dock site require a sequence of construction events. To coordinate facility construction activities with water quality control, all construction activities, such as grading and earthwork, would incorporate surface drainage control requirements, access and transportation requirements, and erosion control measures.

All working areas with sedimentation ponds in use would incorporate systems, such as pumps on floating platforms or backhoes, that would be capable of removing sediment buildup, when necessary, for transfer to the tailings pond.

As part of the Operating Plan, an erosion control and water quality contingency plan will be developed that will include the road activities (construction, maintenance, etc.). This plan will include site specific slope stability considerations and mitigation measures, and a water monitoring plan that will test the effectiveness of these measures.

Construction of access roads, tailings pond, pipelines, etc., would be in accordance with mitigation and monitoring plans acceptable to the Forest Service, and would take into account procedures recommended by the Fish and Wildlife Service for reducing the potential for disturbance to eagles. Mitigation measures may include timing of construction, reducing the level of construction activity in proximity to nests, providing topographic and vegetative screening, and noise reduction.

Mine Service Area

The initial step in the mine service area construction sequence would be to establish a central equipment landing on the north side of Greens Creek. This would involve the removal and clearing of all vegetation from several acres that would be used for helicopter delivery of earth-moving equipment. This equipment would be used to develop a pre-mine staging work area that would act as the starting point for subsequent construction activities. This cleared area would eventually be used for the mine service area facilities.

A sedimentation pond and a system of channels to collect all surface runoff from disturbed areas would be constructed immediately adjacent to the staging area, during the ground clearing and grading phases of the area's development. Surface runoff that would normally enter the disturbed area would be intercepted and diverted around the staging area by means of a berm and trench system. The pond would remain as part of the sedimentation control system during mine operation.

The next stage of development would consist of construction of a temporary log bridge over Greens Creek to the mine portal (south side). A sedimentation pond would be constructed on the south side of Greens Creek to receive surface runoff from the lower portal development area. This pond would act as a temporary sediment control measure, until the permanent bridge and sediment control settling ponds were built. The access road leading to the existing upper portal mine area would also drain to the south side sedimentation pond. The permanent bridge would carry mine and portal area runoff from the south side of Greens Creek to the permanent sedimentation control systems on the north side of Greens Creek, at the mine service area; thus preventing runoff from entering Greens Creek.

The waste rock and overburden storage site would have surface diversion berms to intercept runoff from undisturbed areas and divert it around the site into natural drainage swales. A large sedimentation pond would be constructed in the southwest corner of the overburden storage site. This pond, in addition to the pond constructed earlier near the mine plant, would comprise the sedimentation control system for site runoff from the entire mine service area.

Once the main access road from the cannery to the mine service area is constructed, larger equipment could reach the site and construction of buildings and permanent bridge spans could proceed. After setting the permanent bridge spans, the temporary timber bridge would be removed and the abutment areas reclaimed and revegetated. Completion of the permanent bridge would allow full development work to proceed at the lower portal. At that time a grit, oil, and grease separator would be installed above the mine plant sedimentation pond to receive mine floor drainage. Completion of the tailings pond and pipeline connecting the mine service area to the tailings pond would complete the site runoff and mine floor drainage system. These waters would be routed by CMP to the tailings pond for additional treatment.

Access Roads

Roads for the project would be constructed to Forest Service standards for arterial roads.

Access roads will be kept a minimum of 100 feet from any known cultural resource.

Generally, the roads would be located away from streams and would avoid unnecessary locations parallel to streams. Crossings would be perpendicular to the stream's alignment. Roads would be routed around muskeg areas, where practical, and would include a buffer zone around all bodies of water. Roads would be located where possible away from beaches to protect coastal wildlife habitat. Road widths would be of minimim size, compatible with safe operation. The use of snowblowing equipment to eliminate snow berms would minimize impacts on deer movements during periods of heavy snowfall.

The Forest Service will issue special-use permits for the road system, that will limit the use of the road to Noranda's vehicles, traveling on company business only. No private vehicles will be permitted on the road. In addition, it is assumed that the road from the cannery to the Young Bay dock will only be used for the transport of personnel.

Where possible, the roads would avoid areas considered to be unstable. Where slopes of 60 percent or greater are encountered, the road would be fully benched, ditched, and all excavated material from the cut would be backhauled, to be used as quarry reclamation material, as road building material, or stored for use as mine backfill. Quarry sites would be graded to blend with surrounding terrain and revegetated according to prescribed Forest Service requirements or as outlined later in this section. Sedimentation ponds would be built at waste sites to control runoff until vegetation was well established.

Depending on the alternative selected, from two to seven quarries would be required in addition to a major quarry for embankment construction.

Quarry material would be required for road and embankment construction, as well as mine backfill. Reclamation of quarry sites using waste material from the road would be practiced, where possible. In all cases, runoff from quarries would be routed through appropriately-sized sedimentation ponds that would be maintained until the reclamation program became effective.

Cross-road culverts would be spaced to minimize accumulation of water and to prevent water from traveling long distances downgrade in roadside ditches. The roadbed would be crowned in certain locations to permit low velocity, non-concentrated drainage into vegetation. These culvert discharge points would be located away from existing drainages.

Energy dissipators constructed of logs or rocks would be installed at each cross-road culvert, to begin the water flow spreading and energy reduction processes. Below the dissipators, runoff would be directed into bark bales or sphagnum moss held in place by fabric silt fences. In areas where the road grade was steep, coarse material or check dams will be used as necessary to line steep slopes or channels to act as energy dissipators.

The road grade would be engineered for safe hauling, while minimizing the erosion of surface material. Where possible, road surfaces would be sloped away from stream crossings to prevent sediment from directly entering the water. As a rule, only 50 to 100 feet of roadside ditch would drain toward a stream crossing. In order to avoid erosion of fill material, the size of the culverts and bridges would be adequate to pass a 50- to 100-year flood event.

Where fish constraints require bridging rather than culverts, abutments would be located outside the active stream channel. Work activities would be designed to minimize disturbance of flowing water. It might also be necessary to temporarily divert smaller stream flows through culverts to prevent excess generation of suspended sediment and turbidity during construction.

Disturbed areas along the road would be reclaimed using prescribed Forest Service techniques. Upon completion of construction, the entire road would be surveyed for potential erosion problems, and appropriate corrective action would be taken to minimize these effects. Periodic maintenance of the culvert inlets and removal of soil slumps from the ditchline would be performed to protect water quality.

Tailings Pond

Diversion canals around the construction zone would be installed to limit the flow of water through disturbed areas. A sedimentation pond would be built below the pond to collect sediment produced by construction activities. Muskeg peat would be excavated, with a dragline or other suitable means, and moved to a location uphill of the tailings dam. The peat would be placed in a manner that would create an upstream dam to filter water flow from other construction activities. Routine removal of settled material in the ponds would be required. This settled sediment would be pumped or hauled to an area within the pond.

An additional tailings pond sediment load would be created if material was excavated for the dam foundation. Excavated material would be placed in the upper reaches of the tailing pond area. Drainage from this excavated material would have a high sediment load, due to its silty clay content. Vegetation between the waste dump area and the sedimentation pond area would be used for sediment settling and filtration prior to collection of runoff in the downstream sedimentation pond. Downstream sediment control facilities will be required until the tailings pond dam was finished and its downstream side was revegetated.

Cannery Dock Facility

The first activity at the old cannery site would be the installation of an interim wastewater treatment facility and associated outfall. A sedimentation pond would be required to collect surface runoff.

Overflow from the pond would share the outfall used for domestic waste dispersion for flows up to the 10-year/24-hour event. Flows beyond that rate would discharge from the sedimentation pond directly to the surface of Hawk Inlet.

The docking facility would require piling installation and a small amount of fill material at the dock/shore interface.

During production, an enclosed telescoping boom conveyor would be used to transport concentrates from the shore storage area directly into the holds of the ships. Concentrate spilled from the conveyor belt would be collected at the bottom of the enclosure and returned to shore for reloading.

Solid Waste Disposal

In order to minimize wildlife attraction, solid combustible wastes, including food residues associated with a campsite, would be collected on a daily basis at each major activity area and taken to a well-fenced, bear-proof incinerator, where the waste would be burned. The incinerator would meet air pollution standards for particulate emissions. Residues from the incinerator would be disposed of in the tailings pond during operation. Prior to tailings pond construction, residue will either be stored or buried.

Effluent Discharge

Wastewater disposal would be treated in a multi-phased approach. Mine ditch water would be treated to remove oil, grease, and sediments, then routed to surface runoff sediment ponds before additional treatment in the tailings pond and discharge to the marine environment. Domestic wastewater from the various sites would undergo secondary treatment before direct discharge. Mill wastewater would be combined with excess mine drainage, runoff, and water in the tailings pond. Chemicals added during milling would react to precipitate metals and assist in settling sediments in the pond. Additional treatment of effluent will be provided if discharge water is found not to meet standards outlined in the NPDES permit.

MITIGATION MEASURES SPECIFIC TO SOME ALTERNATIVES

Tailings Slurry Pipeline - Alternatives 1, 2, 4, 5, and 6

The tailings slurry pipeline would be placed on the uphill side of the access road from the mine site to the tailings pond. It would be placed inside a CMP and partially buried beside the road. This double-walled pipeline system would provide protection against tailings leaks and associated spillage.

Cannery Facility - Alternatives 2, 4, 5, 6, and 7

Less than 1 additional acre would be disturbed at the cannery in upgrading existing bunkhouse facilities for emergency housing for those times when employees could not be removed from the island. Under such conditions, a maximum of 160 workers might remain at the cannery site for 2 to 3 days. Many employees would likely work overtime shifts and others would be staying indoors due to the bad weather, creating no undue disturbance to wildlife. There would be no employees permanently housed within the project area following the completion of construction. Noranda has agreed to implement a "no guns or traps" restriction for anyone traveling to and from the project area by company boat, thus eliminating increased hunting and trapping pressure by project personnel.

Young Bay Personnel Dock - Alternatives 2, 4, 5, 6, and 7

Construction of the Young Bay personnel dock would require a sedimentation pond to collect runoff from the cleared and graded area.

Since docking facilities would be located below mean high tide, the State of Alaska, rather than the Forest Service, would have authority over those structures. Noranda has stated that private boats would not be permitted to use those facilities, except under emergency conditions. The Alaska Department of Natural Resources is the agency responsible for issuing tidelands permits.

Fishery Resources at the Cannery Muskeg Tailings Pond - Alternatives 1, 2, 3, 6, 7, and 8

If an alternative incorporating the Cannery Muskeg tailings pond was selected, one to one replacement of lost fishery habitat will be required. That is mandated under ANILCA 505(a). The assumptions made concerning mitigation are: 1) the developer will carry out all design and construction and evaluation of the work for effectiveness; 2) that undertakings in this regard will be reviewed and approved by the Forest Service and ADF&G as part of the Operating Plan; 3) replacement will be within the general project area; and 4) whatever program is accomplished, it will provide long term replacement for unavoidable losses to the fishery.

Noranda has indicated they will modify the barrier at RM 3.5 on Greens Creek to allow access to at least 1 acre of currently unused anadromous fish habitat. Passage and utilization of new habitat will be determined through a 3-year post project monitoring program. Annual inspections and periodic maintenance will ensure functionality through the life of the mining operation.

Employee Housing and Transportation - Alternatives 2, 4, 5, 6, and 7

If the Juneau housing option was selected, it would place added pressure on the already existing shortage of housing and rental units. If the shortage continues, Noranda proposes to participate in the construction of rental units for Noranda employees.

If project employees are housed in Juneau and transported on a daily basis to the project area, the proposed docking site on the mainland would be adjacent to the Auke Bay ferry dock. Since the Auke Bay ferry terminal area has limited parking, Noranda proposes to provide a bus service for workers to and from the ferry terminal from different locations in Juneau and the Mendenhall Valley.

MITIGATION AND MONITORING SPECIFIC TO ALTERNATIVE 6-THE PREFERRED ALTERNATIVE

Fisheries Mitigation

Locating the tailings pond at the Cannery Muskeg site would permanently eliminate 2,700 feet of "Tributary Creek" or about 0.2 acres of anadromous fish spawning and rearing habitat. Flows will be permanently reduced in "Tributary Creek" by 50 percent (60 to 70 percent at low flow) and by 3 percent (20 to 30 percent at low flow) in lower Zinc Creek. The total habitat loss would be approximately 0.3 acres. This equates to 4 percent of the available habitat in Zinc Creek and 1 percent of the available habitat in Greens Creek.

To offset long term, unavoidable production losses to the anadromous fishery of the project area, Noranda has agreed to a mitigation program that would replace lost habitat. Currently, a modification of the waterfall barrier at RM 3.5 on Greens Creek is being developed. Preliminary analysis indicates that creation of at least five jump pools will allow adult migrating salmon to pass the barrier. This will make available about 2 miles of habitat which contain at least 1 acre of useable habitat not currently being utilized by anadromous fish for spawning or rearing. This will replace all habitat lost as a result of implementing this alternative.

Adult salmon and char have been observed trying to negotiate this barrier. Preproject baseline studies have indicated the presence of spawning and rearing habitat above the barrier. Noranda has estimated that as many as 250 pairs of adult salmon can utilize the habitat above this barrier.

The mitigation program was not presented in this form in the DEIS. In the DEIS flow augmentation and a small barrier removal on Zinc Creek were to be undertaken immediately, with the Greens Creek barrier modification scheduled for near the end of mining operations. Further study of the flow augmentation program showed that it was technically marginal because freezing would prevent augmentation of winter low flows without a substantially protected piping system. Furthermore, the 256-acre watershed that was to produce the additional flows was discovered to already flow into "Tributary Creek", making the proposal impossible to complete.

The Zinc Creek barrier removal has been found to be feasible. However, it may require a fishpass as opposed to blasting step pools or inserting gabion weirs. It and the unnamed stream draining Pristine Pond will be held in reserve as contingency mitigation measures. They will only be considered if one to one habitat replacement cannot be accomplished by the Greens Creek barrier modification program.

Noranda is currently completing preliminary feasibility studies on the Greens Creek barrier modification project. Engineering design and construction standards will be approved by the Forest Service and ADF&G as a part of the Operating Plan. Construction would begin as soon as the necessary permits are approved and the road to the mine is completed. The road is necessary to facilitate equipment access to the site. Following completion of the barrier modification, monitoring will take place for 3 years to insure its effectiveness. Annual maintenance will be required.

MONITORING REQUIREMENTS

Fisheries Monitoring - Spawning Gravel

The gravel monitoring program is designed to verify the predicted effects of sediment additions, the functionality of the settling pond system, and the recovery period for any short term, unavoidable fine sediment additions to Zinc Creek and Greens Creek. Although results from current research on fine sediment accumulation in spawning gravel beds is unclear as to the exact degree of impact on anadromous salmonid production, many recent research programs have shown that significant impacts can occur. Decreased egg survival and obstruction of emerging fry are two of those impacts. The project design has addressed these impacts in a number of ways: construction timing, settling ponds, and well-designed road runoff systems. However, it will not be clear that these items are working as planned unless they are verified through monitoring.

The monitoring program, to be conducted by Noranda and analyzed by the Forest Service, is designed for a 12-inch diameter McNeil coring device with plunger and resuspended sediment trapping accessories. Data acquisition will follow a pattern, so samples will reflect seasons of the year, various locations in a stream, and the cross section of the stream channel at the sample site. The data to be analyzed will be shown as percent fines by weight in the sample, the geometric mean of the sample, and the sorting coefficient. All of these measurements have been equated by past research to anadromous fish survival until emergence. If there is a change greater than 25 percent of preproject conditions, the Forest Service will initiate a search to determine the source of the change. If project components are involved, the company will be required to correct the problem. The search will also determine whether short term sediment additions are significant, and the time necessary for recovery. This monitoring program began in 1982 and will continue for 2 full years following completion of construction.

Monitoring of Fisheries Mitigation Measures

All mitigation measures will be monitored by Noranda for 3 full years following their completion to determine effectiveness and their continued functionality. Effectiveness will be measured in terms of how well the mitigation project meets the expected result of one to one replacement. Functionality will be assured through semiannual maintenance checks and carrying out any necessary repairs. All details of the monitoring program will be incorporated into the project Operating Plan.

Electro fishing, fish counts, or spawning utilization surveys will be conducted to determine the viability and effectiveness of mitigation measures. The program will be continued for a minimum of 3 years after completion of mitigation projects.

Wildlife Monitoring

A monitoring plan for Bald Eagles and brown bear will be developed by Noranda and approved by the Forest Service as part of the project Operating Plan. Monitoring of these species will be conducted during construction and for at least 2 years of operation.

Bald Eagle nest sites will be monitored to insure compliance with the Bald Eagle Protection Act. Nest sites in Hawk Inlet will be checked in April to determine nesting activity and in July to determine nesting success. This represents a minimum monitoring level. Additional monitoring requirements will be incorporated in the Operating Plan for nests that are active during construction. Eagle monitoring will be conducted by the Fish and Wildlife Service, with assistance from Noranda.

Brown bears will be monitored to ensure compliance with ANILCA; to document and verify the effects on the brown bear population; and to provide basic information that can be used during construction and operation to identify sources of possible impacts and subsequent mitigation measures. Bear monitoring will be conducted by ADF&G, with assistance from Noranda.

The brown bear on Admiralty Island is an acknowledged object of "ecological, cultural, historical, and scientific interest." Historically, the presence of large numbers of brown bears on Admiralty Island contributed to the island being placed in monument status.

Since information was not available to establish a baseline from which to predict possible effects on the bear population, Noranda and ADF&G initiated a cost-share study in Greens Creek in 1981. The purpose of this effort was to establish baseline information on bear densities, movements, and habitat utilization. In addition, the effects of project implementation on those parameters is to be measured. While information is just now becoming available, the full benefits of this information will not be derived until project development and operation has begun.

Two areas of major concern exist in reference to the projects possible effect on the brown bear population. A segment of the population is expected to be attracted to human activity areas. Those bears will likely be trapped and transported to another area or be destroyed. Another segment of the population is expected to leave the project area and attempt to relocate in other areas (or habitats) on the island. This could result in mortality to that segment of the population. The actual extent of mortality or the effect on the bear population cannot be determined at this time. The bear population will continue to be monitored through 2 years of operation as described by Schoen (1982)[1/] and Martin (1982)[2/]

1/John Shoen, Brown Bear Habitat Preferences and Brown Bear Logging and Mining Relationships in Southeast Alaska. ADF&G. 1982.

2/Jon Martin, Wildlife Monitoring Memo. Forest Service. 1982.

Freshwater Quality Monitoring - Surface Water

Noranda will develop a monitoring plan that will be approved by the Forest Service and other permitting agencies. Sample sites to be monitored are:

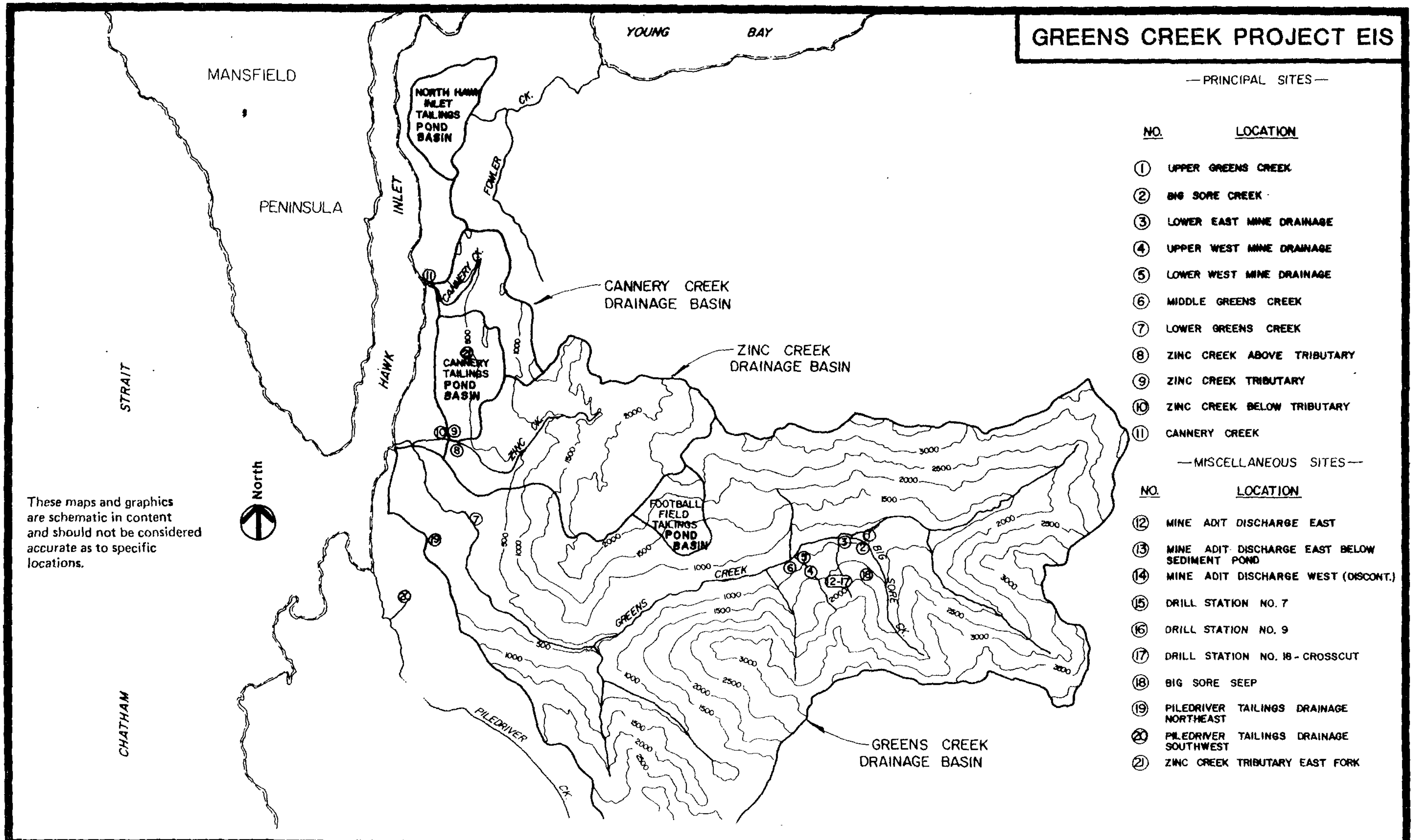
- Big Sore Creek
- Upper Greens Creek
- Middle Greens Creek
- Lower Greens Creek
- Zinc Creek above tailings pond
- Zinc Creek tributary at tailings pond
- Zinc Creek below the confluence with "Tributary Creek"
- Runoff from wastepile at mine site

Other sample sites that will be monitored as needed are:

- Upper west mine drainage
- Lower west mine drainage
- Lower east mine drainage
- Streams 1 and 2 at the mine site
- Cannery Creek
- Upper "Tributary Creek"
- Tailings pond
- Flow monitoring of tailings line inflow/outflow

See Figure 2-17 for a display of these sites.

There would be continuous flow monitoring of lower Greens Creek, upper Zinc Creek, the mine service area sedimentation pond discharge, and the tailings pond marine discharge. Sampling at the upper (exploration) mine portal would end when this flow was diverted to the mine service area sedimentation pond. Monitoring at the mine service area and the tailings pond would begin when those facilities were constructed. Monitoring during reclamation would be necessary only on Greens Creek,



Water Quality and Flow Monitoring Sites

Figure 2-17

Zinc Creek, and "Tributary Creek", if no water quality problems have been detected.

Additional stations will be monitored through the construction phase of the project to assess the effectiveness of sediment control measures. These stations may include all settling ponds and major stream systems along the road corridor.

Field measurements will include stage or water level, flow, temperature, pH, and conductivity.

Laboratory measurements will include tests for concentrations of:

- Dissolved and total metals or metalloids--arsenic, cadmium, chromium, copper, iron, lead, manganese, mercury, nickel, selenium, silver, and zinc.

- Chemical compounds--ammonia, hydrogen cyanide, orthophosphate, nitrate, nitrite, sulfate, total Kjeldhal nitrogen, and total phosphorous.

- Other parameters--alkalinity, calcium, and magnesium, hardness, oil and grease, pH, settlable solids, suspended solids, total dissolved solids, total organic carbon, and turbidity.

Sampling frequency will be developed in the monitoring plan as part of the Operating Plan.

Ground Water Quality Monitoring

Water quality monitoring wells will be drilled upslope and downslope from the tailings pond. Downslope locations will be chosen to detect potential seepage. These wells will be monitored monthly during construction and the first year of operation, semiannually through the remainder of operations and the first 3 years of reclamation, and annually for 2 additional years. Water quality parameters will be the same as specified for surface water, except that analysis of oil and grease, settlable solids, suspended solids, and turbidity would not be required.

Freshwater Aquatic Biota Monitoring

Heavy metal tissue burden analysis will be measured annually for fish species in freshwater. This analysis will be conducted in conjunction with the analysis of heavy metals in the water column. The program will continue for the life of the mining operation.

Suspended Sediment Monitoring

Sediment samples would be collected annually in Zinc Creek and in the Stream 1 and Stream 2 mine service area drainages near Greens Creek. Monitoring will continue during construction and through the first 2 years of operation.

Sampling of sedimentation ponds will be conducted twice a month when active construction is underway. Inflow and outflow water samples will be analyzed for suspended solids and turbidity to determine sediment removal efficiency.

Marine Water Quality Monitoring

A marine water quality monitoring plan is required as part of the discharge permit process and is subject to approval by EPA. The proposed monitoring plan includes three marine water quality monitoring locations (at the head of Hawk Inlet, near the cannery dock, and outside Greens Creek delta) to be sampled quarterly both during the construction and operational phases of the project. A fourth site in Young Bay would be monitored only during dock construction. Water quality monitoring parameters will be for dissolved metals only, as listed for freshwater, with the addition of analysis for hydrocarbons including oil and grease.

Water quality standards are currently being reassessed by ADEC and specific standards are not available. Monitoring requirements will be designed to insure compliance with applicable standards.

Marine Aquatic Biota Monitoring

Representative samples of indicator species of mussels, clams, and crabs will be taken annually during construction and operational phases near the cannery dock, near the Greens Creek delta, and within the tailings pond discharge mixing zone (if a mixing zone is allowed by ADEC). Shellfish tissues will be analyzed for metals and hydrocarbons. Benthic communities will be sampled annually during construction and operation in five intertidal locations: the head of Hawk Inlet, near the cannery, Greens Creek delta, outside Hawk Inlet, and the tailings pond discharge site.

CONTINGENCY PLAN

A contingency plan will be developed as part of the Operating Plan. The contingency plan will contain action measures that will be implemented in the event of unexpected resource damage or threat of damage. This plan may include measures in addition to those mandated by Federal and State regulations.

RECLAMATION PLAN

The purpose of reclamation is to return as much of the disturbed areas in the monument as possible to pre-project conditions and to reclaim non-monument areas as required to ensure protection of resources. Specific reclamations requirements for non-monument areas will be determined at the time of project completions. The reclamation plan must be part of the Operating Plan.

Reclamation practices that have been developed in other mining areas would be expected to work successfully for the Greens Creek project. However, some revegetation experiments will be conducted during the mining operations to determine optimum soil preparation, plant species, planting practices, and fertilizers for the range of soils, slopes, and microclimates present in the disturbed project area. Field test plots will be established and evaluated prior to reclamation.

A survey of soil types has been completed on all areas affected by the project, to determine reclamation suitability. There are no known metal or salt substances that would be deleterious to plant growth. Plant nutrients are low, indicating that fertilizers may be required to facilitate revegetation.

The general sequence of the reclamation process will be:

- Removal and stockpiling of topsoil (where possible) before construction.
- Removal of buildings, pavement, roads, bridges, and culverts at end of project.
- Regrading, to the extent feasible, to blend with natural contours and original drainage systems.
- Topsoil replacement with soil amendments, as required.
- Reseeding with appropriate grass and forest species.
- Mulch and fertilizer application as required.

- Maintenance of erosion controls, such as sedimentation ponds, until grass cover develops.

- Maintenance and repair of reseeded areas until vegetation is established.

Mine Closure

During mining operations the mined-out ore zone will be backfilled with a mixture of cemented waste rock and tailings. At completion of mining activities all adits and ventilation raises to the surface will be permanently sealed by the placement of concrete plugs. See Figure 2-18. Under these conditions the mine workings will flood, with the water level eventually reaching fractures exposed to the surface. Rain or snowmelt infiltrating the subsoil above the mined-out area will essentially return to flow paths in existence prior to mining activities.

The water quality in Greens Creek will be maintained at the pre-mining level since the amount of exposure or contact time with metal compounds would be similar to that existing prior to mining.

Tailings Pond

Tailings pond reclamation would remove free water from the settled tailings. The area would then be revegetated using suitable grasses and trees, such as red fescue, hemlock, Sitka spruce, and alder. If required for plant growth, additional soil or rock materials would be deposited on the surface of the tailings.

The surface of the tailings pond will be sloped slightly to direct runoff away from existing streams. The dam crest will be left at least 3 feet above the tailings to prevent any possiblility of runoff over the dam.

Upper Portal (Exploration Adit) Area

A portion of the existing waste pile will be used as mine backfill during operations. Other areas at this site will be reclaimed during the first years of operation to test the suitability of proposed reclamation methods.

Mine Service Area/Quarry Sites

After buildings and foundations are removed, all areas will be recontoured to restore, to the maximum extent possible, the original drainage systems. The areas will be revegetated with grass and indigenous forest species.

TABLE 2-3
EVALUATION CRITERIA MATRIX

CRITERIA	ALTERNATIVE 1	ALTERNATIVE 2	ALTERNATIVE 3	ALTERNATIVE 4	ALTERNATIVE 5	ALTERNATIVE 6	ALTERNATIVE 7	ALTERNATIVE 8
TECHNICAL/ ECONOMIC								
A. Minimize technical complexity	MOD. COMPLEXITY	LOW COMPLEXITY	HIGH COMPLEXITY	MOD. COMPLEXITY	MOD. COMPLEXITY	MOD. COMPLEXITY	MOD. COMPLEXITY	MOD. COMPLEXITY
B. Minimize costs	$585,140,000	$557,890,000	$701,540,000	$618,650,000	$585,390,000	$559,460,000	$610,540,000	$631,230,000
MONUMENT VALUES								
A. Locate development outside of monument	Meets criteria at moderate level	Meets criteria at moderate level	Meets criteria at a high level slightly lower than Alt. 5	Meets criteria at lowest level	Best meets criteria	Meets criteria at moderate level	Meets criteria at moderate level	Meets criteria at moderate level
B. Maximize reclamation potential to pre-project conditions	AVERAGE POTENTIAL	AVERAGE POTENTIAL	AVERAGE POTENTIAL	LEAST POTENTIAL	HIGHEST POTENTIAL	AVERAGE POTENTIAL	AVERAGE POTENTIAL	AVERAGE POTENTIAL
SUBSISTENCE								
A. Minimize disruption to	SOME DISRUPTION (high)	SOME DISRUPTION (low)	MOST DISRUPTIVE	LEAST DISTRUPTIVE	SOME DISRUPTION (high)	SOME DISRUPTION (low)	SOME DISRUPTION (high)	MOST DISTRUPTIVE
FISH & WATER								
A. Maintain existing habitat	Direct habitat loss = 0.2 acres	Direct habitat loss = 0.2 acres	Direct habitat loss = 0.2 acres	No direct habitat loss	No direct habitat loss	Direct habitat loss = 0.2 acres	Direct habitat loss = 0.2 acres	Direct Habitat loss = 0.2 acres
B. Minimize threat to habitat sedimentation, chemical, and trace element contamination	LOW THREAT	LOW THREAT	MODERATE THREAT	LOW THREAT	LOW THREAT	LOW THREAT	LOW THREAT	LOW THREAT

CRITERIA	ALTERNATIVE 1	ALTERNATIVE 2	ALTERNATIVE 3	ALTERNATIVE 4	ALTERNATIVE 5	ALTERNATIVE 6	ALTERNATIVE 7	ALTERNATIVE 8
WILDLIFE								
A. Minimize direct loss brown bear	Permanent loss - 4% of primary stream habitat in project area	Permanent loss - 4% of primary stream habitat in project area	Permanent loss - 4% of primary stream habit in project area	No direct habitat loss	No direct habitat loss	Permanent loss - 4% of primary stream habitat in project area	Permanent loss - 4% of primary stream habit in project area	Permanent loss - 4% of primary stream habitat in project area
B. Minimize indirect brown bear habitat loss due to human activity	HIGH LOSS	MODERATE LOSS	HIGH LOSS	LEAST LOSS	MODERATE LOSS	MODERATE LOSS	MODERATE LOSS	HIGHEST LOSS
C. Minimize risk of potential disturbance to Bald Eagle nests	HIGH POTENTIAL	HIGH POTENTIAL	HIGHEST POTENTIAL	LOW POTENTIAL	LOWEST POTENTIAL	HIGH POTENTIAL	HIGH POTENTIAL	HIGH POTENTIAL
RECREATION								
A. Minimize concentration of activity in high value hunting areas	MODERATELY HIGH IMPACT	MODERATELY LOW IMPACT	MOST IMPACT	LOWEST IMPACT	MODERATELY LOW IMPACT	MODERATELY LOW IMPACT	MODERATELY HIGH IMPACT	MOST IMPACT
MARINE								
A. Minimize potential of chemical and heavy metal accumulation in Hawk Inlet	LOW POTENTIAL	MOD. POTENTIAL	LOW POTENTIAL	LOW POTENTIAL	MOD. POTENTIAL	LOW POTENTIAL	LOW POTENTIAL	LOW POTENTIAL

Alternative 4 also threatens all of Greens Creek because of designed flood discharge into Greens Creek from the Football Field tailings pond and the consequences of an embankment failure. Because a road to the mine is included in this alternative, a worst case mass failure in upper Zinc Creek would also threaten most of Zinc Creek.

Based on threat to habitat, Alternatives 3 and 4 are nearly equivalent. When direct habitat loss and potential threat to habitat are considered together, Alternative 5 is the most desirable alternative and Alternative 3 is the least desirable.

Wildlife

Wildlife impacts were evaluated in terms of direct and indirect loss of brown bear habitat and the risk of potential disturbance to Bald Eagle nesting sites.

A direct loss of primary stream habitat would occur in those alternatives with the Cannery Muskeg tailings pond. That loss represents about 4 percent of available primary stream habitat in the area. No direct loss of habitat would occur in Alternatives 4 and 5.

Indirect loss of bear habitat would occur with all alternatives. This loss is estimated in terms of levels or concentration of human activity.

Alternatives with the camp option (Alternatives 1, 3, and 8) would produce the greatest indirect impacts on bear because of the opportunity for the employees to disperse throughout a large area in their leisure time. Both bear mortality and bear displacement would be expected with alternatives that include the camp option. Alternatives 2, 4, 5, 6, and 7 (Juneau housing alternatives) would result primarily in bear displacement.

Because of the high level of activity associated with the mill, and the continuous truck transport of ore from the mine to the mill at the Cannery Muskeg tailings pond, Alternatives 7 and 8 would produce additional high indirect habitat losses due to activity.

Alternatives 2, 5, and 6 would result in moderate, and essentially equivalent, indirect habitat losses.

Because the Football Field tailings pond is located away from high wildlife use areas, Alternative 4 would result in the lowest amount of indirect brown bear habitat loss.

The Bald Eagle, including its nesting sites, are protected by the Bald Eagle Protection Act. Alternatives were evaluated in terms of how close components of each alternative would be to nesting sites, and the type and level of activity that would occur during construction and operation.

All alternatives include components near enough to nest sites to pose a risk of potential disturbance. The number of nests at risk vary from a total of ten in Alternatives 4, 6, and 7, nine nests in Alternatives 1, 3, and 8, and four nests in Alternatives 2 and 5.

Six nests are located near Hawk Point and could potentially be affected by construction of the effluent line to Chatham Strait (Alternatives 1, 3, 4, 6, 7, and 8). Construction will be scheduled around the nesting period and the risk of potential disturbance to these six nests is low.

Three nests are located near the Cannery Muskeg tailings pond (Alternatives 1, 2, 3, 6, 7, and 8). Since construction activity would be at a high level, the risk of potential disturbance to these three nests is high during construction. The use of explosives is of major concern within 0.5 miles of the nest trees. The risk of potential disturbance to these nests is low during operation.

One nest is located near the proposed dock facility at Young Bay (Alternatives 2, 4, 5, 6, and 7). Mitigation measures during construction will minimize the risk of disturbance. Daily activity during operation creates a moderate risk of potential disturbance to that nest.

Alternatives 4 and 5 pose the least risk of potential disturbance to Bald Eagles.

Alternative 4 meets both brown bear and Bald Eagle criteria at a high level and from a wildlife standpoint is the most desirable alternative.

Recreation

Recreation baseline studies have established that at least 845 visitor days of use occur in Hawk Inlet and Young Bay annually. About two-thirds of that use occurred from October through November. While many recreation activities occur in the project area, deer hunting was judged to attract the greatest amount of use, and was therefore used as the indicator by which to differentiate alternatives.

Alternatives were evaluated in terms of the number of facilities and/or the level of activity each alternative would focus in high value hunting areas. High value areas were defined as lands 500 feet or lower in elevation, extending 0.5 to 1 mile inland from the beach, and adjacent to cabins, anchorages, or wheeled plane landing sites.

The location of the tailings pond, the type of employee transportation on Admiralty Island, the location of the mill, and the location of employee housing were considered to be the components that would have the greatest impact on recreational deer hunting.

In evaluating options, the road from the cannery to the mine would travel a short distance through a high value area, and as the road went inland, through a medium value area. A medium level of impact was assigned to that option. Alternatives 1, 2, 4, 5, 6, 7, and 8 have the cannery to mine road option.

The Young Bay to cannery road was assigned a high level of impact, in recognition of its potentially high impact to hunting opportunities. Alternatives 2, 4, 5, 6, and 7 have the Young Bay road option.

The campsite, due to the wide spread influence of its occupants, was assigned an extra high level of impact. Alternatives 1, 3, and 8 have the campsite option.

The Football Field tailings pond, because of its location in a low value hunting area, was assigned a low level of impact. Alternative 4 has the Football Field tailings pond option.

Both the Cannery Muskeg and the North Hawk Inlet tailings ponds are located in high value hunting areas; they were each assiged a high level of impact. Alternatives 1, 2, 3, 6, 7, and 8 have either the Cannery Muskeg or the North Hawk Inlet tailings pond.

Alternative 4 would have the least impact on recreation, since only a portion of the road system would be located in a high value hunting area. It is the most desirable alternative in terms of recreation.

Alternatives 2, 5, and 6 would locate the tailings pond and the Young Bay road in high value hunting areas. Because the activity levels associated with those components are lower, the alternatives were given a more desirable rating. Alternatives 2 and 6 are essentially equivalent. Alternative 5 is slightly less desirable than Alternatives 2 or 6 because the North Hawk Inlet tailings pond would be located close to recreational cabins.

Alternatives 1 and 7 were considered to be not as desirable. Alternative 1 would have the camp and the Cannery Muskeg tailings pond. Alternative 7 would have the Cannery Muskeg tailings pond the Young Bay road, and the mill at the tailings pond.

Alternatives 3 and 8 were considered to be the least desirable, since they would locate the camp facilities, the mill, and the Cannery Muskeg tailings pond within high value hunting areas.

Subsistence

The limited amount of information available suggests that deer hunting is currently one of the primary subsistence activities carried out in the project area. It is the only subsistence activity identified where effects are anticipated by the project. The evaluation of alternatives for subsistence parallels that for recreation because deer hunting was used as the indicator for recreation.

The location of the tailings pond, the type of employee transportation on Admiralty Island, the location of the mill, and the location of employee housing were considered to be the components that would have the greatest impact on deer hunting.

The road from the cannery to the mine would travel a short distance thorough a high value habitat area and as the road went inland through a medium value area. A medium level of impact was assigned to that option. Alternative 1, 2, 4, 5, 6, 7, and 8 have the cannery to the mine road option.

The Young Bay to cannery road was assigned a high level of impact from a recreational hunting perspective. This impact on subsistence would probably be somewhat less than that for recreational hunting as available information suggests that subsistence deer hunting is confined to the west side of the island. Alternatives 2, 4, 5, 6, and 7 have the Young Bay road option.

The campsite, due to the wide spread of influence of its occupants, was assigned an extra high level of impact. Alternatives 1, 3, and 8 have the campsite option.

The Football Field tailings pond, because of its location in a low value hunting area, was assigned a low level of impact. Alternative 4 has the Football Field tailings pond option.

Both the Cannery Muskeg and the North Hawk Inlet tailings ponds are located in high value hunting areas; they were assigned a high level of impact. Alternatives 1, 2, 3, 6, 7, and 8 have either the Cannery Muskeg or the North Hawk Inlet tailings pond.

Alternative 4 would have the least impact on subsistence, since only a portion of the road system would be located in a high value hunting area. It is the most desirable alternative in terms of subsistence.

Alternatives 2, 5, and 6 would locate the tailings pond and the Young Bay road in high value hunting areas. Because of the activity levels associated with those components are lower, the alternatives were given a more desirable rating. Alternatives 2, 5, and 6 are essentially equivalent in terms of subsistence impacts.

Alternatives 1 and 7 were considered to be not as desirable. Alternative 1 would have the camp and the Cannery Muskeg tailings pond. Alternative 7 would have the Cannery Muskeg tailings pond and the Young Bay road and the mill at the tailings pond.

Alternatives 3 and 8 were considered to be the least desirable since they would locate the camp facilities, the mill, and the Cannery Muskeg tailings pond in high value hunting areas.

Monument Values

Alternatives were evaluated in terms of the presence of project components within the monument, and on the potential for reclamation of impacted areas to pre-project conditions.

Alternative 5 was determined to be the most desirable alternative, because a major component, the tailings pond would be outside the monument boundary near North Hawk Inlet.

Alternative 3 meets the monument values criteria at a slightly lower level than Alternative 5. Although the Cannery Muskeg tailings pond could not be completely reclaimed, the tram corridor could, over time, be returned to pre-project condition.

Alternatives 1, 2, 6, 7, and 8 each include a tailings pond, and the road to the mine within the monument. All five alternatives were identified as having a moderate level of impact on monument values.

Alternative 4 was determined to be the least desirable alternative because it required the most road construction within the monument, and an extensive quarry excavation to construct the Football Field tailings pond. After reclamation, large portions of the quarry faces would still be visible.

Marine Environment

Alternatives were evaluated in terms of potential risk of chemical and heavy metal accumulation in Hawk Inlet. Potential sources of pollutants are effluent discharge, tailings pond seepage, and embankment failure.

Effluent discharge at the Hawk Inlet sill was viewed as the less desirable of the two discharge sites because discharge at the sill would result in higher equilibrium levels of pollutants in the inlet. Because sublethal effects have not been determined for marine biota and because Hawk Inlet is a salmon nursery area and supports a commercial crab and shrimp fishery, the site with the lower equilibrium metal levels would be the most desirable. A mathematical model developed by Noranda indicates a lower effluent buildup for a Chatham Strait discharge site.

Because seepage from or failure of the North Hawk Inlet tailings pond (in a worst case scenario) would introduce pollutants into the portion of Hawk Inlet with the worst flushing characteristics, and because it includes the Hawk Inlet sill discharge site, Alternative 5 was determined to be the least desirable alternative in terms of potential impact to the marine environment.

Alternatives 1, 3, 4, 6, 7, and 8 were considered to be nearly equivalent in potential risk to the marine environment. The risk is considered low.

The effect of camp-related activities make Alternatives 1, 3, and 8 slightly less desirable in terms of effects on the marine environment because of the greater volume of sewage and petroleum residues (from the marina) introduced into Hawk Inlet.

Technical Complexity and Economics

All alternatives were determined to be technically feasible. Technical complexity was evaluated in terms of ease of construction, ease of operation, and likelihood of disruption of operation due to system failure.

The components that were determined to be technically complex were: the camp facility, the Chatham Strait effluent discharge site, the tram, the Football Field tailings pond, and the slurry pumping system.

Alternative 2 contains no technically complex components and was determined to be the least complex alternative.

Alternative 3 contains three technically complex components (camp, tram, and Chatham Strait discharge); it was determined to be the most complex alternative.

Alternative 4, because of potential construction and operational difficulties with the tailings pond and the Chatham Strait discharge site, was determined to be the second most complex alternative.

Alternatives 1, 5, 6, 7, and 8 were identified as essentially equivalent in terms of complexity. Although the complex components differ in those five alternatives, all five were considered moderately complex.

Because there was insufficient data to complete a detailed cost-benefit analysis, costs were presented in terms of total capital and operational costs to Noranda, including cost of reclamation.

No alternatives were eliminated based on economic feasibility, and all alternatives would result in equivalent mineral production. High levels of costs were assigned to the tram, the camp, ore transportation by truck, the slurry pumping system, and the operational costs of the Football Field and the North Hawk Inlet tailings ponds. Moderate levels of costs were assigned to Football Field and North Hawk Inlet tailings pond construction, Chatham Strait discharge site construction and operation, and construction and operation of a slurry pumping facility.

The difference in cost between Alternative 2, which had the lowest construction and operation costs, and Alternative 3, which had the highest construction and operation costs, was $143,650,000.

IDENTIFICATION OF THE FOREST SERVICE PREFERRED ALTERNATIVE

Based on estimated environmental effects and a comparison of alternatives with evaluation criteria, Alternative 6 has been identified as the Forest Service Preferred Alternative. Alternative 6 was selected because it addressed all criteria at an acceptable or better level.

All alternatives which met individual criteria at a highest level also met other criteria at a low or unacceptable level. Both a permanent camp facility at the cannery (Alternatives 1, 3, and 8) and an effluent discharge point within Hawk Inlet (Alternatives 2 and 5) addressed one or more criteria at an undesirable level. Elimination of these alternatives left Alternatives 4, 6, and 7 to be considered. Alternative 4 was eliminated because it contains the greatest consequence from low level threats to fish habitat and met the monument criteria at the least desirable level. Alternatives 6 and 7 were identical, with the exception of the location of the mill facility. Alternative 7 was eliminated because increased activity at the tailings pond/mill site and the increased volume of truck traffic addressed the wildlife, recreation, and subsistence criteria at a less desirable level than Alternative 6.

ALASKA COASTAL MANAGEMENT PLAN CONSISTENCY DETERMINATION

The State of Alaska Coastal Management Program sets forth the standards and criteria for consistency determination. While Federal lands are excluded from the coastal zone, Sections 307(c)(1) and (c)(2) of the Coastal Zone Management Act state respectively:

> "Each federal agency conducting or supporting activities directly affecting the coastal zone shall conduct or support those activities in a manner which is, to the maximum extent practicable, consistent with approved state management programs,: and
>
> "Any federal agency which shall undertake any development project in the coastal zone of a state shall insure that the project is, to the maximum extent practicable, consistent with approved state management programs".

In this section the Alaska Coastal Management Plan (ACMP) standards and criteria are examined and compared with the Preferred Alternative to determine consistency with the State program.

1. Consistency with Major Uses and Activities - In the Alaska Coastal Management Program, nine major uses and activities requiring consistency determination are identified. These activities are:

a. Coastal development
b. Geophysical hazard areas
c. Recreation
d. Energy facilities
e. Transportation and utilities
f. Fish and seafood processing
g. Timber harvest and processing (Alaska Forest Practices Act)
h. Mining and mineral processing
i. Subsistence

Activities included in this project constitute all the above activities except activity f. In the following, the Preferred Alternative is described in terms of consistency with the state standards.

Standard - 6AAC 80.040 Coastal Development

The Young Bay dock and dock facilities at Hawk Inlet are identified as coastal development. The use of these dock facilities has been determined to be necessary and consistent with ACMP standards for the following reasons: 1) This is a water dependent use, and 2) construction methods will be consistent with parts 320-323, title 33, Code of Federal Regulations.

Standard - 6AAC 80.050 Geophysical Hazard Areas

Access roads included in this alternative cross several areas identified as susceptible to mass failure. This represents the only practicable location. Design and construction constraints are included to minimize the risk of failure.

The Chatham Straits fault is located within 5 miles of the site. All embankments and structures are designed for an earthquake exceeding the maximum intensity recorded on this fault.

No person will be permanently housed in the project area and, with the exception of the road, no faciltıes are located in or below areas of geophysical risk. The Preferred Alternative is therefore consistent with this standard.

Standard - 6AAC 80.060 Recreation

Although this is not a recreation-oriented activity, recreation is being considered since some impact to existing recreational use is unavoidable. Activity at major facility locations at Hawk Inlet and immediately adjacent to road corridors will result in a replacement of recreationists desiring an undeveloped setting by those who will tolerate or who actually desire a more developed setting. Since no net loss of recreational opportunity is anticipated, the Preferred Alternative is consistent with this standard.

Standard - 6AAC 80.070 Energy Facilities

The Preferred Alternative includes two major fuel storage facilities. A 400,000 gallon storage facility and a suitable transfer mechanism for discharging from barges will be located adjacent to and upland of the Hawk Inlet docking facility. An additional 400,000 gallons will be stored at the mine service area, near major fuel consuming activities, and resupplied by truck from the dock storage facility. A Spill Prevention and Control Countermeasure Plan (SPCC) will be prepared and reviewed by EPA prior to use of the facility. Siting, construction, and control measures are consistent with this standard.

Standard - 6ACC 80.080 Transportation and Utilities

The transportation system for this alternative, except in accessing dock facilities, has been sited inland from beaches. Portions of roads potentially visible from beaches incorporate vegetative screening to minimize impacts. This activity is consistent with ACMP standards.

Standard - Alaska Forest Practices Act

The Preferred Alternative, which includes removal of right-of-way timber, is consistent with this standard.

Standard - 6ACC 80.110 Mining and Mineral Processing

Noranda's Greens Creek Project is a subsurface mining operation. It is specifically addressed in ANILCA and the Preferred Alternative is designed to minimize conflict with surrounding land uses and existing activity. A total of 6 to 7 quarry sites will be developed for construction of the road, embankments and dock facilities. Forest Service requirements for the development, use, and reclamation of these sites are more strict, but consistent with those outlined in the Alaska Coastal Management Plan.

Standard - 6AAC 80.120 Subsistence

The Hawk Inlet area receives limited subsistence use from nearby rural communities. Subsistence was included as an evaluation criteria in response to public concern over subsistence. Evaluation of alternatives indicated that the Preferred Alternative will have no significant effect on existing or traditional subsistence use in the project area and is consistent with this standard.

2. Consistency with Habitat Standards

Standard - 6AAC 80.130 Habitats

Habitats in the coastal area which are subject to the Alaska Coastal Management Program include:

1. Offshore areas
2. Estuaries
3. Wetlands and tideflats
4. Rocky islands and seacliffs
5. Barrier islands and lagoons
6. Exposed high energy coasts
7. Rivers, streams and lakes
8. Important upland habitat

Of these habitats the Forest Service has identified the following five habitats as being potentially impacted and has evaluated them for consistency.

OFFSHORE AREAS - The Hawk Inlet and Young Bay dock facilities and the effluent discharge system will be constructed within the offshore area. The Hawk Inlet dock will consist of renovation and additions to existing facilities and will not produce significant additional impacts. The Young Bay dock will consist of a rock fill breakwater and small dock facility covering approximately 9000 square yards of cobble and sand habitat. This represents a small percentage of available habitat and will contribute additional rocky habitat to replace that which is covered. These sites have been reviewed by Alaska Department of Fish and Game, National Marine Fisheries Service and Fish and Wildlife Service. The effluent discharge system will disturb an insignificant amount of offshore habitat which will quickly re-establish itself. Effluent quality must conform to the criteria established in the NPDES permit. The Preferred Alternative minimizes impacts to marine habitats and will not adversely impact the States' sport, commercial or subsistency fishery.

ESTUARIES - With the exception of dock facilities and the effluent discharge system the Preferred Alternative has no impact on estuaries. Utilization of docking facilities is designed to maximize protection of estuarine values to the extent practicable. The Chatham Straits discharge site is the most desirable site which was considered feasible in terms of minimizing potential effects to Hawk Inlet.

WETLANDS - The dock facilities, tailings pond, and portions of the road system occupy wetland areas. No unique habitat is destroyed and, with the exception of the tailings pond site, design constraints will maintain adequate flow, nutrient and oxygen levels. The value of the wetlands covered by the tailings pond lies primarily in its contribution to fisheries and brown bear habitat. Mitigation included in the Preferred Alternative will totally replace the lost habitat. Leachate from the pond will be monitored but is not expected to be a significant or persistent problem.

RIVERS, STREAM, AND LAKES - With the exception of the stream covered by the tailings pond no significant impact to rivers, streams or lakes has been identified for the Preferred Alternative. The habitat lost in this stream will be replaced by proposed mitigation measures.

IMPORTANT UPLAND HABITAT - Impacts to key deer, brown bear and Bald Eagle habitat have been evaluated. Monitoring requirements have been established for brown bear and Bald Eagles. The Preferred Alternative incorporates all feasible and prudent measures to protect this habitat while meeting other goals and objectives.

Standard - 6AAC 80.140 Air, Land and Water Quality

No significant change in air quality will occur. Both marine and freshwater quality were used as evaluation criteria. The Preferred Alternative will meet all Alaska Department of Environmental Conservation standards for treatment and discharge. Standards for land will be met.

Standard - 6AAC 80.150 Historic, Prehistoric and Archaeological

The project areas has been surveyed in compliance with applicable State and Forest Service requirements (Section 106, National Historic Preservation Act, 1966 and Executive Order 11593). Two prehistoric and one historic site (cannery) were identified and reported to the State Historic Preservation Officer. One prehistoric site has been determined to be not significant and decisions are pending regarding the other two. Regardless of the decision, the Preferred Alternative includes sufficient flexibility to insure no significant impacts to the other prehistoric site on Federal land. The disposition of the historical site (cannery) is at the discretion of the Greens Creek Joint Venture.

Conclusion

In this analysis the Forest Service has determined that the Preferred Alternative meets the ACMP standards to the maximum extent practicable. In addition, all feasible and prudent steps to maximize conformance with the ACMP have been taken.

SECTION III
AFFECTED ENVIRONMENT

This chapter describes those environments in the Greens Creek Project area that may be affected by construction and operation of the proposed mining facility. Environmental investigations were initiated in the spring of 1978. The collection of some data is continuing in 1983.

The major thrust of the environmental studies has been to develop background information. A comprehensive effort was also made to obtain and incorporate information from state and federal agencies.

Major study areas for environmental investigations included:

- The eastern shore of Hawk Inlet (particularly lower elevations) from the head of the inlet to Piledriver Cove.

- Hawk Inlet marine environment.

- Greens Creek stream valley area and delta zone.

- Young Bay and the lower Mansfield Peninsula area.

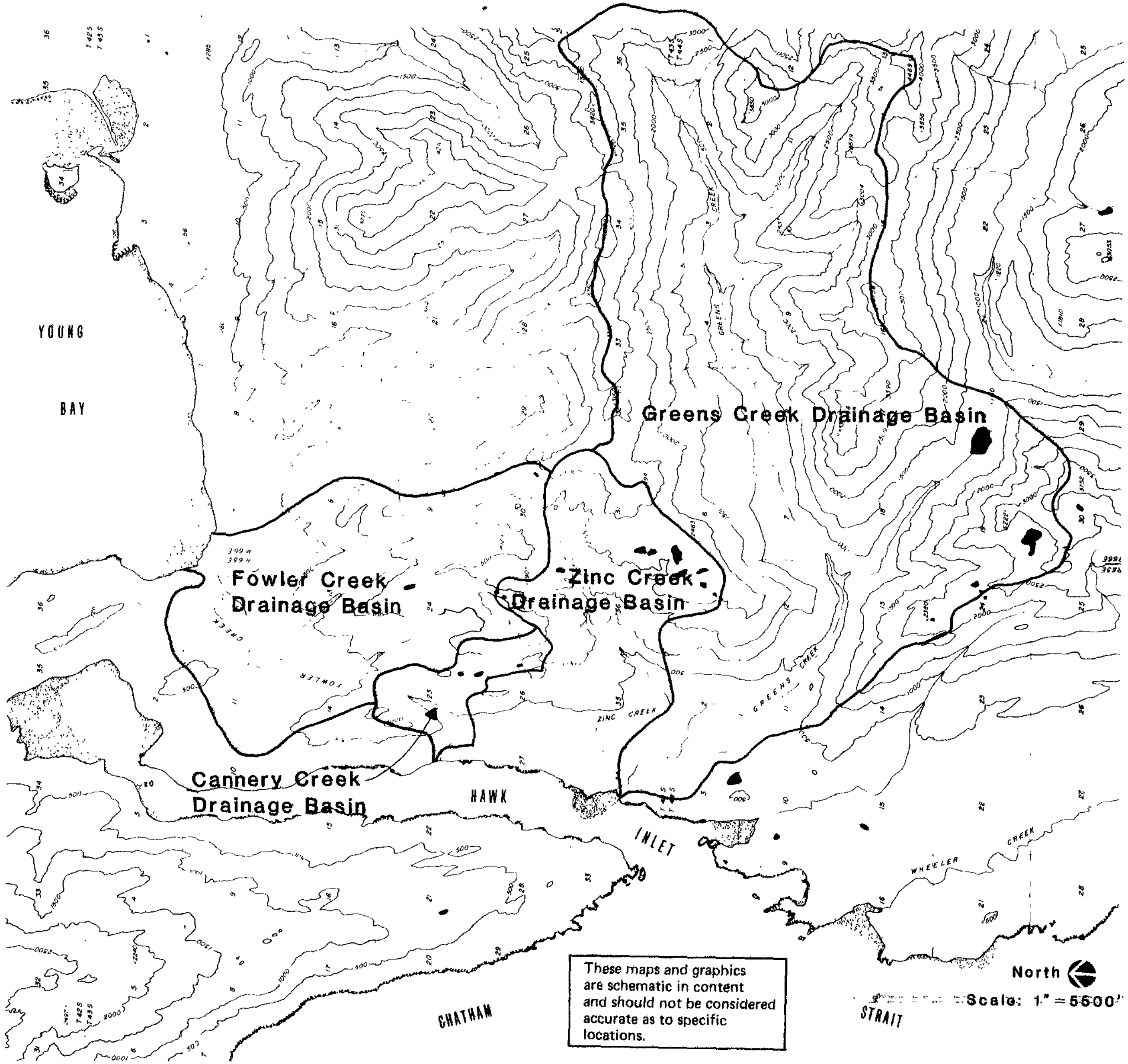
- General area of the orebody.

Environmental field studies, literature surveys, and mapping have been documented in technical reports. Appendix A of this document is a list of available technical reports on file with the Forest Service in the Chatham Area's Supervisor's Office in Sitka, and at the Admiralty National Monument Office in the Juneau Ranger District Office in Juneau.

SURFACE WATER HYDROLOGY
(Reference 7, 8, 27, 28, 29, 30, 31, 34, 35, 36, 37, see Appendix A)

The catchment area for Greens Creek is 23.5 square miles and includes the site of the proposed mine. Adjacent to and north of Greens Creek is the Zinc Creek drainage basin, which has an area of 4.7 square miles. See Figure 3-1. A small channel connects the two streams near their mouths. The predicted total water yield for both creeks flowing into Hawk Inlet is 120,000 acre-feet per year. Annual average flow at Hawk Inlet is 170 cubic feet per second (cfs). Low flows in Greens Creek occur during mid-winter and late summer, with annual average monthly minimum flows of 40 cfs at the mouth and 20 cfs upstream at the project area. A high-flow monthly average of 200 cfs near the mouth of Greens Creek results from the snowmelt in May and June. High rainfall in the fall results in another mean monthly flow peak of 250 cfs during October.

GREENS CREEK PROJECT EIS



Drainage Basins Figure 3-1

Greens Creek Project

GROUND WATER HYDROLOGY AND QUALITY
(Reference 7, 8, 31, 32, 33)

The amount and distribution of ground water depends on the geology of the area and is tied closely to the amount of precipitation and runoff, particularly at the mine site. The primary sources of ground water include: surface recharge that percolates through fracture systems in bedrock, infiltration of runoff into surface soils, and percolation from muskeg depressions.

There are relatively small quantities of ground water contained in the bedrock formations at the mine site. Ground water flows are closely associated with surface flows and subsurface fractured areas. Studies indicate there is no regional aquifer system existing in the mine area. Ground water movement in the area parallels topographic slopes toward Greens Creek and Big Sore Creek and surfaces as seeps or springs on the slopes, or in the creek channels. Flows from the Big Sore seep and inflows to the exploration adit result from near-surface water flow, along fractures or faults. Existing flows from the Big Sore seep and other seeps in the ore zone area travel only a short distance on the surface before reentering the ground and flowing subsurface to Big Sore Creek.

Large quantities of shallow ground water are present in the lower elevation muskeg areas, due to the combination of high precipitation and slow drainage. Drainage is impeded by a silty clay layer underlying the muskegs. Ground water samples in the mine area were collected from the Big Sore seep and three locations within the exploration adit. These samples are representative of water that has been in contact with the ore. This ore zone ground water, when compared to Greens Creek, is characterized by high concentrations of total dissolved solids, sulfate, and metals, and an increase in alkalinity and hardness values. Cadmium and zinc concentrations exceed EPA water quality criteria for aquatic life in all samples. Concentrations of chromium, copper, lead, mercury, and silver would exceed the criteria where the ground water has had longer contact times with the orebody.

Ground water samples taken from clay deposits in the coastal muskegs exceeded EPA water quality criteria for aquatic life for arsenic, cadmium, chromium, copper, iron, lead, nickel, silver, and zinc. These high concentrations probably result from the low permeabilities of the clays and the resulting lengthy residence time of the ground water. The high concentration of dissolved metals in the clays indicate that they were probably derived from the weathering of rocks similar to those surrounding the orebody.

FRESHWATER QUALITY
(Reference 7, 8, 27, 28, 29, 30, 31, 32, 33, 34, 35, 36, 37)

Greens Creek and its tributaries are generally characterized as high-quality waters of low alkalinity and hardness. Most water quality parameters have low values and dissolved metal concentrations are frequently near or below laboratory detection limits. The water quality and flow monitoring sites are shown in Figure 2-19.

Greens Creek has a very high natural sediment load for a non-glacial stream system. The average annual suspended load is estimated to be 9,400 tons per year[1/]. Average annual bedload movement is estimated to range from 4,400 tons per year (Forest Service estimate) to 16,000 tons per year[2/]. Thus, the average total load is estimated to be between 14,000 (USFS) and 26,000 tons per year (Noranda estimate). These ranges are 10 to 20 times higher than rates reported by the Forest Service in several other Southeast Alaska streams for which data is available[3/]. The majority of Greens Creek sediment is believed to originate from numerous landslides, some of which are streamside.

Insufficient data were available for total sediment load computations in Zinc Creek. However, judging by its geomorphologic characteristics, Zinc Creek's total sediment load is expected to be much less than Greens Creek.

Upper Greens Creek and Big Sore Creek

Located above 1,000 feet in elevation, these streams have the highest quality waters of streams found in the project area. Naturally occurring metal concentrations that exceed EPA recommended water quality criteria for aquatic life have been detected in these streams include mercury, silver, and cadmium. During storm periods, suspended solids and turbidity exceed recommended ADEC drinking water criteria.

East and West Mine Drainages

Drainage from these two minor tributaries originates in part from surface runoff, and in part from the exploration adit water discharge. Some of this water seeps through waste rock and ore stockpiles remaining from exploration activities. Consequently, concentrations of some dissolved metals are higher than those found in the upper Greens Creek area. Concentrations of chromium, copper, and nickel are quite similar to those in upper Greens Creek. Iron, manganese, nitrate, and sulfate

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1/Reference 29

2/ibid

3/USDA Forest Service, Draft EIS: Road Access and Bulk Sampling at U.S. Borax Quartz Hill Molybdenum Claims, Tongass National Forest, 1982 levels range from 2 to 4 times the concentrations in upper Greens Creek, but do not exceed EPA criteria for aquatic life. Concentrations of mercury, zinc, silver, and possibly cadmium are somewhat elevated, and in some cases, exceed recommended EPA criteria for protection of aquatic life. These two drainages do not contribute excessive suspended solids or affect turbidity levels and are too small and steep to contain fish. There has been no significant increase in chemical substances in Greens Creek downstream of the inflows of these small streams.

Middle and Lower Greens Creek

When compared to the upper Greens Creek surface water quality, this zone shows increased background levels of total dissolved solids, chlorides, sulfate, iron, manganese, and sodium. The concentration of these substances range from 10 to 20 percent higher than the upper watershed. Cadmium, mercury, and silver continue to exceed EPA recommended criteria for aquatic life in this area of the drainage.

No consistent pattern of chemical indicators has been determined from data collected from monitoring stations in lower Greens Creek. Some elevated levels can be attributed to the marine influence (sodium chloride), while others must be attributed to the natural erosion of the known orebody and other undiscovered mineral deposits.

Zinc Creek

Zinc Creek was named for the unusually high concentrations of zinc found in its sediment. This creek and "Tributary Creek," maintain very high levels of tannins, lignins, and total organic carbon, exceeding the maximum color criteria established for drinking water. In addition, these two creeks have high levels of arsenic, zinc, and aluminum, but do not exceed EPA water quality criteria for aquatic life for those parameters. Iron and selenium levels exceeding the EPA aquatic life criteria were found in "Tributary Creek". The highest oil and grease levels encountered in the project area were found in Zinc Creek. These levels may be partially attributed to the decomposition of spawned-out salmon that utilize Zinc Creek as a primary spawning area.

Cannery Creek

Cannery Creek shows high levels of color and organic carbon similar to Zinc Creek. These levels are attributed to the large proportion of muskeg found in this drainage basin. In addition, Cannery Creek has high levels of iron, manganese, selenium, and aluminum.

MARINE WATER QUALITY
(Reference 7, 8, 38, 39, 40, 41, 42, 43, 44, 45)

Measurements near the cannery indicated that concentrations of inorganic nutrients were either low or below detection limits at the surface but increased to a depth of 27 fathoms (162 feet). High surface nitrate and iron values near the mouth of Hawk Inlet were attributed to the influx of fresh water from Greens Creek. Concentrations of inorganic nutrients were comparable to those observed at Auke Bay near Juneau, with levels of those nutrients increasing slightly toward the mouth of the inlet. Total iron, however, decreased toward the mouth of the inlet and with depth. Limited ongoing baseline marine water quality studies show that metal concentrations in Hawk Inlet and outside the sill vary, with location, from below detection limits to near acute levels (for lead). Most measurements outside the sill approach average world ocean quality. Additional discussion of heavy metal distribution in Hawk Inlet water and biota is presented on page 3-13 (Metal Concentrations in Biota).

FRESHWATER BIOLOGY
(Reference 5, 6, 7, 8, 28)

Six streams in the project area were studied: Greens Creek, Zinc Creek, "Tributary Creek", Cannery Creek, Young Bay tributary, and Fowler Creek tributary. Benthic community data is only available for Greens, Zinc, and Cannery Creeks.

Greens Creek is a coastal stream, with headwaters arising east of the mouth of Hawk Inlet at a maximum elevation of 4,650 feet (Eagle Peak) and descending to sea level over the course of about 10 miles. Zinc Creek enters Hawk Inlet via a channel running parallel to Greens Creek near the mouth. However, a connecting channel between these streams near their mouths allows discharge from Greens Creek into Zinc Creek. It is apparent that Zinc and Greens Creeks periodically change their channels and exchange flows over time, as a function of the depositional processes that continue to form the delta area.

The 2.7 percent average gradient of Greens Creek includes two major sets of waterfalls. The lower falls, consisting of several vertical drops of 3 to 10 feet (with a total drop of 20 feet), is approximately 4 miles upstream from the mouth. The channel at the falls is confined within steep rock walls for about 250 feet. The second falls, 1 mile farther upstream, is 3 to 10 feet high and unconfined. Numerous log jams from windfalls obstruct the stream above those falls.

Stream bottom material in Greens Creek ranges from uncompacted deep sand near the mouth, to pebble/cobble, with some sand, upstream. Because there are few pools, and periodic floods flush the stream bed, silted areas rarely occur. Water depth in some pools varies from 6 inches to 10 feet. Current velocities vary from 1 foot per second to greater than 3 feet per second.

Greens Creek, below the lower falls, provides good to excellent spawning habitat for pink salmon (Oncorhynchus gorbusha), chum salmon (O. keta), coho salmon (O. kisutch), and Dolly Varden char (Salvelinus malma). Rearing habitat for juvenile coho salmon and Dolly Varden char is generally fair to good, with good to excellent habitat occurring in stream sections where the channel has become highly braided.

Zinc Creek has a much lower discharge volume and contains much finer sediments than Greens Creek. Zinc Creek meanders through a flat meadow area at low elevations for much of its length, and its water is tea-colored from muskeg drainage. An anadromous fish migration barrier exists at approximately river mile (RM) 2.2 on Zinc Creek. Zinc Creek provides excellent to good rearing habitat for coho salmon and Dolly Varden char. The lower reaches of Zinc Creek provide good to excellent spawning habitat for pink and chum salmon, and good spawning habitat for coho salmon, Dolly Varden char, and anadromous cutthroat trout (Salmo clarki). Excellent coho salmon rearing habitat is also provided by certain brackish water pools and tributaries near the mouth of Zinc Creek on the delta.

A small tributary enters Zinc Creek at approximately RM 0.8. This stream originates in the hills, roughly 2 miles north of the Zinc Creek mainstream, and generally flows south. The lower 5,600 feet of "Tributary Creek" is accessible to anadromous salmonids, either as adults or juveniles. This stream is deeply colored by tannic leachates from muskeg areas to the north and west. The stream is narrow and deeply incised and pools are not abundant. The gradient is generally low, averaging less than 2 percent. The downstream half of the stream provides good rearing habitat for coho salmon, Dolly Varden char, and cutthroat trout. Limited spawning habitat is available and supports a small population of coho and pink salmon spawners.

Cannery Creek, a stream devoid of anadromous fish, originates at an elevation of about 2,940 feet, and flows into the water supply reservoir for the cannery before dropping to sea level approximately 100 feet below. It contains two major barriers to fish migration: first, a 15-foot-high waterfall over bedrock, located behind the cannery site 50 feet from the high tide line at the mouth; and second, a water reservoir dam about 0.6 miles from the mouth. Between the waterfall and the reservoir bottom materials are primarily cobble, with occasional outcropping of bedrock. Water depth varies from 0.1 to 1.0 feet. No spawning habitat or good rearing habitat for salmonid fishes is present.

A small, unnamed stream drains a large beaver pond and muskeg and enters Young Bay about one-quarter mile north of the mouth of Fowler Creek. Below the beaver impoundment, the stream flows for about 200 feet between two low hills before passing over a gravel-cobble beach into Young Bay. The bottom material size in this stream ranges from small cobbles to small gravels with sand. There are a few small pools in the flowing part of the stream that provide fair to good rearing habitat for juvenile salmonids. The beaver pond and marsh occupy several acres and could provide good to excellent rearing habitat for juvenile salmonids. A small amount of spawning gravel is available above the first beaver pond.

Fowler Creek flows generally northward into Young Bay. This 7 square mile watershed supports a productive anadromous salmonid fishery. Qualitative sampling of the lower reaches indicated spawning use by pink, chum, and coho salmon and anadromous Dolly Varden char. Coho salmon utilize the slow water areas associated with debris for rearing. Resident fish use by Dolly Varden char, cutthroat trout, and sculpins was also observed.

Two small tributaries draining marshy, beaver impounded areas to the west of the main stem of lower Fowler Creek showed no utilization by rearing juvenile salmonids. Resident fish may utilize the pool areas behind beaver dams but were not observed.

Benthic invertebrate studies indicated that Zinc, Greens, and Cannery Creeks were inhabited by diverse fauna and flora, characteristic of unpolluted waters. Mayflies and stoneflies were the most abundant macroinvertebrates, followed by dipterans and caddisflies. Oligochaeles were present intermittently.

MARINE AQUATIC BIOLOGY
(Reference 7, 8, 28, 39, 40, 43)

Physical/Chemical Characteristics

Hawk Inlet is a narrow fjord on the northwestern portion of Admiralty Island. The inlet extends 7 miles north from Chatham Strait and ends in a tidal mudflat estuary about 0.6 miles in diameter. The midchannel depth ranges from 35 feet at the sill near the mouth, to 250 feet in the mid-portion of the inlet. Six minor tributaries enter the western margin of the inlet; the largest tributary, Greens Creek, enters from the east, just inside the sill. Annual freshwater discharge from Greens Creek and the other tributaries peaks in September/October (from precipitation) and in May/June (from snowmelt). Near the mouth of the inlet there is a large delta formed by glacial activity and by riverborne sediments of Greens Creek. Young Bay is located on the northern portion of Admiralty Island, directly east of the head of Hawk Inlet. A narrow isthmus, about 1.5 miles wide, separates the two water bodies.

The bathymetry of Hawk Inlet consists of a narrow basin, partially separated from Chatham Strait by a relatively shallow sill that includes a delta at the mouth of Greens Creek. The narrow channel connecting Hawk Inlet to Chatham Strait, located between the tip of the Greens Creek delta and the western shore of Hawk Inlet, has a minimum low tide depth of 35 feet.

The bathymetry of Young Bay has characteristics similar to the northeast shoreline of Admiralty Island. The bottom slopes gradually for several hundred feet from shore, then increases rapidly from 40 to 80 degrees. Shorelines of Young Bay are exposed to moderate wave action from Stevens Passage and tend to be composed of rock, cobble, or gravel. Five streams discharge into Young Bay; the largest is Fowler Creek. A coarse sandy beach exists near the mouth of Fowler Creek.

The large tidal variation (maximum 26 feet), and the presence of the shallow Greens Creek delta, strongly influence circulation patterns near the mouth of Hawk Inlet. Shoreline irregularities, such as small coves along the rocky shoreline of the inlet, create localized eddies. In Hawk Inlet, the highest velocity currents (2 to 3 feet per second) occur at the Greens Creek sill, on flooding tides, in the surface waters of the narrow channel (1,000 feet in width). A large eddy occurs in the broad central region of the inlet, near the site of the cannery where maximum currents are about one-half of those at the sill. At the cannery, currents on the western shore generally move in a southward direction, and currents on the eastern shore tend to be directed northward during all phases of the tide. Through Hawk Inlet, current velocities decrease with depth; currents at depths of 100 feet are negligible, usually less than 10 percent of surface values.

Current patterns at Hawk Point and the entrance to Chatham Strait are complex but velocities still decrease with depth. In the channel at the entrance of Hawk Inlet, current direction and magnitudes are similar to those observed in the narrow channel at the delta. However, at the entrance to Chatham Strait, significant east/west as well as north/south currents occur, depending upon specific location. In Chatham Strait north of the entrance to Hawk Inlet, currents have significant longshore (east/west) components and do not decrease as much with depth as in Hawk Inlet.

Salinity and temperature profiles in Hawk Inlet indicate that the water is well mixed. None of the data indicate the presence of strong discontinuities, although salinity increased from 2 to 5 parts per thousand to a depth of at least 50 feet over a period of 4 to 5 days. Salinity patterns in the inlet do not significantly fluctuate with the seasons or with tidal stage. Although currents at depths greater than 100 feet are small, mixing into deeper layers is apparently sufficient to prevent the development of oxygen deficient conditions in bottom waters. Data collected in August 1981 indicated that the salinity of Young Bay waters is slightly lower than that of Hawk Inlet, at least on some occasions.

No true estuarine environment exists at the mouth of Greens and Zinc Creeks or within Hawk Inlet. Although tidal influence extends up both creeks as far as 0.6 miles from their point of discharge into the inlet at low tide, the transition from salt to fresh water is abrupt. Freshwater discharges from Greens Creek are much less dense than the marine waters in Hawk Inlet, and they generally form a shallow freshwater lens at the surface until they are dispersed.

A continuous dye release study conducted during August 1980[4/] provided information on the residence time and exchange rates of conservative substances released into Hawk Inlet. These data show that there is relatively good exchange of tidal water for a body of water like Hawk Inlet.

Two water samples were taken at the mouth of Hawk Inlet to characterize the existing chemical composition. For most elements Hawk Inlet water is similar to "normal" seawater.[5/] However, silver, lead, and copper may be slightly higher than suggested criteria for aquatic life.[6/] Analytical techniques used on these samples were questioned by ADEC. A procedure has now been developed using three independent labs (including EPA and ADEC) to verify seawater chemistry.

Subtidal Habitats and Biota

The major subtidal benthic (bottom) habitats that occur are sands, muddy sands, muds, and rocks. Submerged sands primarily occur near the Greens Creek delta. This habitat contains large amounts of cobble and gravel; in areas where current velocities are high, sediments are frequently scoured to bedrock. Muddy-sand habitats occur primarily at the extreme northern end of Hawk Inlet. Submerged muddy-sand habitats also frequently contain relatively large amounts of cobble and gravel.

Submerged muds occupy the central region of Hawk Inlet and contain large amounts of organic material. Submerged rocky habitats occur along the margins of the basin.

4/Reference 38

5/Environment Canada, Water Quality Source Book - A Guide to Water Quality Parameters. Vol. 1, 1979.

6/Of the three sets of samples taken, lead and copper levels varied greatly.

In general, in hard-bottom subtidal areas, anemones, large snails, sea urchins, starfishes, sea cucumbers, sponges, bryzoans, and a wide variety of algae are dominant. King, Tanner, and Dungeness crabs, as well as a variety of edible shrimp, are also found in the hard bottom subtidal habitats. Those habitats in Hawk Inlet and Chatham Strait are typical in species composition and relative abundance to hard-bottom habitats of the region and are composed of more species than rocky intertidal benthic communities.

Soft-bottom subtidal benthic habitats are dominated by annelid worms, mussels, clams, and small crustaceans; annelid worms are generally the most abundant. The composition of subtidal soft-bottom habitats in Hawk Inlet and Young Bay depends upon physical properties of the sediments.

These communities in Hawk Inlet contain more species than intertidal benthic communities and are similar to subtidal benthic communities reported to occur along Northeast Pacific coasts.

The soft- and hard-bottom subtidal benthic communities of Young Bay and Chatham Strait are similar to those of Hawk Inlet, except the communities in the Young Bay/Chatham Strait areas contain a greater variety and a greater abundance of biota adapted to moderate wave action.

Fisheries
(References 5, 6, 7, 8, 28)

Data on Hawk Inlet fisheries were obtained from investigations conducted jointly by the Fish and Wildlife Service and the National Marine Fisheries Service (NMFS). Otter trawl and gill net surveys indicated the presence of several commercial fish species: halibut, flathead, yellow-fin, and rock sole; arrowtooth and starry flounder; and Pacific cod. Noncommercial species present included whitespotted and masked greenling, shortfin eelpout, snake prickleback, sturgeon poacher, staghorn, great and spiny head sculpin, Pacific sandlance, daubed shanny, and copper rockfish. Although use of the inlet by either spawning or overwintering herring populations has not been documented, NMFS personnel from the Auke Bay Laboratory reported that they had seen schools of herring in spawning condition in the inlet during the spring. Although data are not available for Young Bay, the fish community would be expected to be similar.

Anadromous species spawning in Greens and Zinc Creeks stage in the lower portion of the inlet before migrating upstream. However, the exact timing and magnitude of these seasonal aggregations are not documented. Anadromous fish runs occurring in Fowler Creek stage in Young Bay before their spring migration.

Beds of bull kelp occur along the western shore of the entrance to Hawk Inlet and along the shore of Chatham Strait, north of the mouth of Hawk Inlet. Bull kelp does not occur below a depth of about 35 feet. A second major kelp bed occurs near the head of Hawk Inlet.

The intensity of subsistence, sport, and commercial fishing in the vicinity of Hawk Inlet is not well documented. (Sport fishing is discussed in the recreation section.) Occasional commercial halibut fishing in the area yielded some large catches during 1914 to 1976, when the cannery was open. Since that time little commercial halibut fishing appears to have taken place in the area. Commercial tender vessels occasionally use Hawk Inlet as a mooring site. Some commercial crab and shrimp fishing activity exists in the inlet[7]. Several species of edible shrimp have been collected in the central portion of the inlet and scallops have been taken near the sill. Clams are not frequently harvested because they are potentially toxic due to "red tide" algae blooms.

Pink and chum salmon juveniles utilize Hawk Inlet and Young Bay during the initial marine phase of their life cycle. No abundance or distribution data is available for the project area. However, a relatively large population can be assumed, based on known adult escapement data from streams feeding into Young Bay and Hawk Inlet. Large numbers of juveniles have been noted by NFMS personnel working on other studies within the inlet.[8]

Exact migratory patterns and feeding areas are unknown. Published observations show migration is not directly from freshwater streams to the open ocean. Rather, a period of about 40 days is spent in saltwater, near the stream of origin. During that time, juveniles feed on epibenthic organisms: small, marine crustaceans living in near-shore areas, close to the bottom. Accumulations of pink and chum juveniles would be expected to occupy sheltered areas (bays and coves) and other near-shore areas of the intertidal and subtidal zone that have cover, soft bottoms, and low current velocities. This type of habitat is more common in Hawk Inlet, particularly in the north end, than in Young Bay.

A generalized migratory pattern can be assumed that shows the fish moving predominantly seaward. In the case of Hawk Inlet, that would be through the sill area to Chatham Strait. At Young Bay the movement would be toward Stephens Passage.

Subsistence foods taken from the area include: salmon, halibut, flat fishes, cod, king crab, Tanner crab, Dungeness crab, mussels, clams, and shrimp.

7/Bill Hughes, Fish and Wildlife Service biologist, personal communication, 3/20/82.

8/Herb Jaenicke, National Marine Fisheries Service biologist, Auke Bay Laboratory, letter dated 12/8/81.

Metal Concentrations in Biota
(Reference 39, 40, 41)

This section has been changed from the DEIS. Discrepancies in the data presentation did not allow an accurate description of the metal concentrations in Hawk Inlet. More scientifically accurate data, not available for the DEIS, has been included to verify the situation. Comparative data from Auke Bay, Alaska, (a nearby marine environment) has become available and is included in Table 3-1. This did not examine all of the 10 metals analyzed for Hawk Inlet. It contains data from a control site, classified as unpolluted, and the Auke Bay marina, classified as developed.

The metal content of Hawk Inlet sediments and of tissues of selected marine species has been analyzed. No metals data is currently available for the Hawk Point area of Chatham Strait. Species analyzed for tissue metal burden include polychaetes (segmented worms), which are bottom burrowing predators; mussels, which are immobile filter feeders; clams, which are burrowing, semi-immobile filter feeders; coho salmon smolts, which are plankton feeders in their early salt water stage; and halibut, which are bottom dwelling predators. Auke Bay data is available only for sediments and mussels.

The ten metals analyzed are silver (Ag), arsenic (As), cadmium (Cd), chromium (Cr), copper (Cu), mercury (Hg), manganese (Mn), nickel (Ni), lead (Pb), selenium (Se), and zinc (Zn). Table 3-1 indicates the current conditions of Hawk Inlet and compares it to a nearby unpolluted area and a nearby developed area.

Sediment data indicate that chromium, copper, manganese, lead, and zinc are found in high concentrations in the inlet. With the exception of lead and chromium the higher values compare favorably with an unpolluted area of Auke Bay. Lead is a major constituent of the ore deposits in the area. Chromium may also be in the area ore deposits but is not in the orebody analyzed for the Greens Creek Project. Zinc, while slightly higher than the nearby unpolluted area, is not within the range considered polluted. Generally the sediments are indicative of an unpolluted area; high lead and chromium levels reflect the mineral composition of the land area draining into Hawk Inlet.

Marine organism data indicates that differential concentration of elements are occurring within the inlet. This follows the pattern of the organisms particular habitat preference. Polychaetes show higher concentrations of arsenic, copper, and zinc. Mussels have higher concentrations of cadmium, mercury, and manganese. Clams have metal concentrations similar to both. All marine bottom dwellers show high levels of silver in their tissues.

Marine benthic organisms in general reflect the metal concentrations in the sediments with one exception. Silver, which is low in sediments, is high in tissue samples. The higher levels of chromium, copper, manganese, lead, and zinc are reflected in the tissue burden of bottom dwelling immobile organisms.

A comparison of Auke Bay mussels and Hawk Inlet mussels indicates that mussels in a developed environment are accumulating zinc and cadmium. Mussels in the unpolluted environment generally have similar tissue values to Hawk Inlet mussels, with the exception of lead and zinc. The latter reflects a higher environmental level at Hawk Inlet.

TABLE 3-1

HEAVY METAL CONCENTRATIONS IN SEDIMENTS AND TISSUES OF MARINE ORGANISMS FROM HAWK INLET AND AUKE BAY, ALASKA

Subject-location	Number samples	Elements (ppm dry wt. or ug/g dry wt.)										
		Ag	As	Cd	Cr	Cu	Hg	Mn	Ni	Pb	Se	Zn
Sediments-Hawk Inlet (Reference 39)	4	0.25	9.7-12.6	0.25	83.8-130	21.8-31.3	0.02-0.04	N/A	18-58.5	22.5-90.3	0.6-0.9	78-136
Sediments-Hawk Inlet (Reference 40)	4	0.14-0.39	13-24	0.15-1.0	14-60	17-39	0.049-0.35	240-370	17-43	4.8-19.0	0.028-1.7	50-110
Sediments-Auke Bay (control)[1]	3	N/A	N/A	3.2-3.8	37-47	31-37	N/A	N/A	55-73	2-6	N/A	83-88
Sediments-Auke Bay (marina)[1]	3	N/A	N/A	2.0-3.8	85-110	54-82	N/A	N/A	71-92	6-11	N/A	155-230
Polychaetes-Hawk Inlet (Reference 28)	5	2.5-8.3	2.6-3.9	0.49-1.2	2.7-4.3	11-14	0.011-0.012	9.7-14	2.5-3.6	0.63-0.89	0.67-1.5	180-230
Mussels-Hawk Inlet (Reference 28)	5	1.5-6.0[2]	1.0-1.7	6.0-7.0	3.7-9.8	7.5-8.5	0.25-0.73	23-36	2.7-3.3	0.54-1.1	0.50-1.0	120-140
Mussels-Hawk Inlet (Reference 40)	5	5.5-11.0	2.9-4.1	3.7-14.0	0.84-2.1	5.7-8.1	0.049-0.10	6.4-14.0	0.50-2.10	0.33-1.50	1.8-2.8	76-120
Mussels-Auke Bay (control)[1]	3	N/A	N/A	2.7-4.4	0.4-0.8	9.0-18.0	N/A	N/A	2.8-4.8	0.06-0.07	N/A	51-73
Mussels-Auke Bay (marina)[1]	3	N/A	N/A	1.9-2.1	0.9	7.9-12.0	N/A	N/A	4.4-5.2	0.05-0.07	N/A	67-83
Clam-Hawk Inlet (Reference 40)	5	2.4-21.0	1.9-3.5	0.40-1.4	1.1-1.7	10-22	0.041-0.071	7.4-23.0	0.96-2.9	0.28-0.74	2.9-4.7	48-140
Coho smolt-Hawk Inlet (Reference 40)	5	0.28-0.86	5.3-11.0	0.10-0.14	0.2-0.77	2.5-3.8	0.095-1.14	14.0-23.0	0.35-0.69	0.19-0.41	1.3-1.6	140-190
Halibut-Hawk Inlet (Reference 39)	2	0.07-0.11	.025-.051	.014-.033	0.28-0.31	0.50-0.65	0.01-0.07	N/A	0.37-0.95	0.43-0.62	0.05-0.096	4.0-5.1

1/ Auke Bay Laboratory, unpublished data from Alaska Department of Transportation studies of Auke Bay, Alaska, letter dated November 3, 1982.

2/ The value for silver included an outlier of 20 ppm which was deleted from further analysis.

The data available for fish indicates coho smolts are accumulating mercury and zinc in greater concentrations than that found in sediments. Coho exhibit higher concentrations of all elements (except chromium, nickel, and lead) than that found in tissues of halibut, probably as a result of their rearing time in freshwater around the stream inlet. Halibut do not exhibit high concentrations in most elements. This may be indicative of their mobility. It can be concluded from halibut data that biomagnification through the food chain is probably not occurring at Hawk Inlet.

WILDLIFE
(Reference 7, 8, 46, 47, 48)

Wildlife potentially present or actually observed on Admiralty Island, or in the marine waters adjacent to the island, includes 39 species of mammals, 220 species of birds, and 4 species of amphibians. The following six species or species/groups can be considered particularly important because of their prominence in the Hawk Inlet/Young Bay area: brown bear, Sitka black-tailed deer, Bald Eagles, waterfowl/shore birds, furbearers, and marine mammals.

Brown Bear - Ursus arctos

The brown bear probably achieves higher populations on Admiralty Island than anywhere else in Southeast Alaska. While virtually all of the project area is bear habitat, three specific habitats are of primary importance to brown bear. These are the coastal beach fringes, grass meadows, and adjacent forest used during the spring and early summer; the creek bottoms and adjacent banks and forest from tidewater upstream to the limit of salmon spawning during mid to late summer; and the denning areas used during the winter. Figure 3-2 shows the location of these habitat types within the project area.

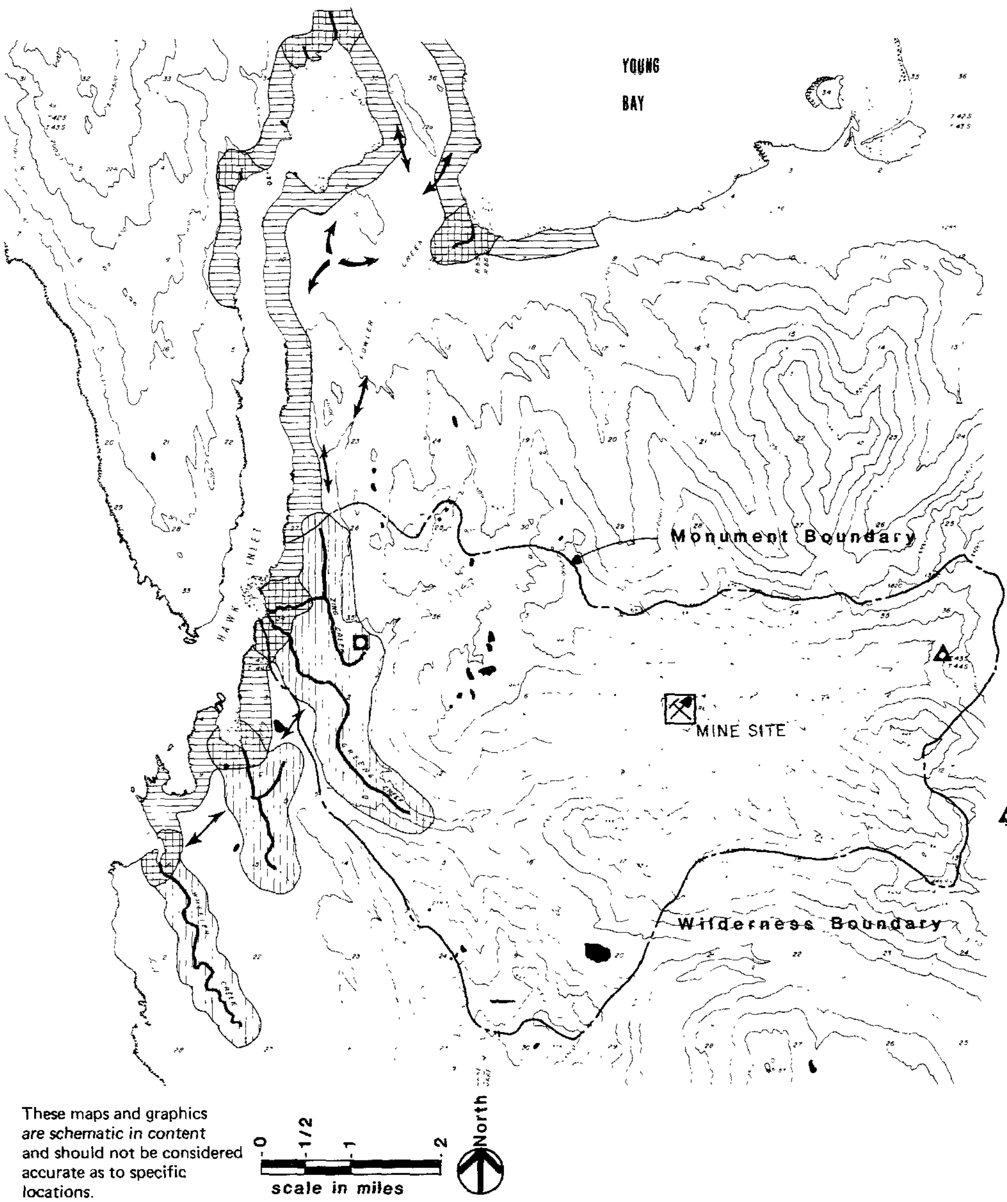
Beginning in early May and extending until approximately mid-June, the coastal beach fringe and grass meadows provide food and cover for bears. The important food items during this period include grasses, sedges, forbs, carrion, and available marine organisms.

Of great importance to brown bear from approximately mid-July until mid-September are the creek bottoms and adjacent banks and forest. Spawning salmon provide a major part of many bear's summer food. Remains of bear-eaten salmon carcasses can be found from tidewater to as far upstream as the salmon spawn. Between feedings the bears may move up to 1,200 feet or more away from the creeks.

One alpine denning area was positively identified within the Greens Creek watershed and several others were identified just outside the watershed. While scattered and difficult to find, good denning areas are important to brown bears. The recently initiated Alaska Fish and Game Department collaring study has begun to furnish accurate information on denning locations within and near the project area. Data gathered to this point indicate that bears tagged in the alpine areas during the study are denning above 2,500-foot elevation, primarily outside the project area.

Brown Bear Habitat Distribution

GREENS CREEK PROJECT EIS



These maps and graphics *are schematic in content* and should not be considered accurate as to specific locations.

COASTAL BEACH FRINGES, GRASS MEADOWS & ADJACENT FOREST

CREEK BOTTOMS & ADJACENT BANKS & FOREST USED BY BEARS FEEDING UPON SPAWNING SALMON

POSSIBLE BEAR DENNING AREA

IDENTIFIED BEAR DENNING AREA

MAJOR NON-STREAM CORRIDOR MOVEMENT ROUTES

REFERENCE: TERRA NORD. 1981. EFFECTS OF IMPLEMENTATION, WILDLIFE IMPACTS, GREENS CREEK PROJECT.

FIGURE 3-2

Sitka Black-Tailed Deer - *Odocoileus hemionus sitkensis*

About two-thirds of a sample population of radio-collared deer on Admiralty Island made distinct seasonal migrations between winter and summer ranges. The remaining deer showed substantial overlap between winter and summer ranges. While many deer may make the classically described seasonal movements from winter range in the lower elevation coastal old-growth forests, to summer range in the sub-alpine and alpine areas, and return to lower elevations again the following winter, a substantial number of deer apparently do not move to the alpine areas but remain at the lower elevations in the forest throughout the year.

The high volume old-growth forest areas below 1,000 feet are clearly of importance to deer, particularly during the critical winter period. Of particular importance are south or west facing slopes that have the *Cornus/Vaccinium/Rubus/Coptis* understory association. Figure 3-3 shows the relatively important deer winter habitat within the project area.

Bald Eagle - *Haliaectus leucocephalus*

Admiralty Island supports the highest documented density of breeding Bald Eagles in North America. Thirty-one eagle nests sites have been identified in the project area. Figure 3-4 shows the location of 24 of the eagle nest sites.

Waterfowl/Shorebirds

The area of primary significance to waterfowl is the estuary at the head of Hawk Inlet. It is used throughout the summer by many species of divers and dabblers, and is an important resting area for dabblers during fall and spring migrations. The estuary and associated mudflats are also extensively used by shorebirds, gulls, and eagles. The triangle-shaped area at the mouth of Hawk Inlet that includes Piledriver Cove, Hawk Point, and the Greens Creek/Zinc Creek delta also has relatively high use by waterfowl and other birds. A third area of importance is the southern portion of Young Bay.

The grass meadow areas near the mouths of Greens and Zinc Creeks and other creeks in the project area provide habitat for many species of shorebirds and waterfowl during summer and fall. Harlequin ducks may use the Greens Creek meadow area for breeding. Dabbling ducks, primarily pintails, are common in still water areas in the Greens Creek and Fowler Creek meadows in late summer and fall. Ponds and beaver impoundments in the project area are used for feeding and resting by migrating waterfowl and probably for breeding. Figure 3-5 shows important waterfowl habitat within the project area.

Deer Habitat Distribution GREENS CREEK PROJECT EIS

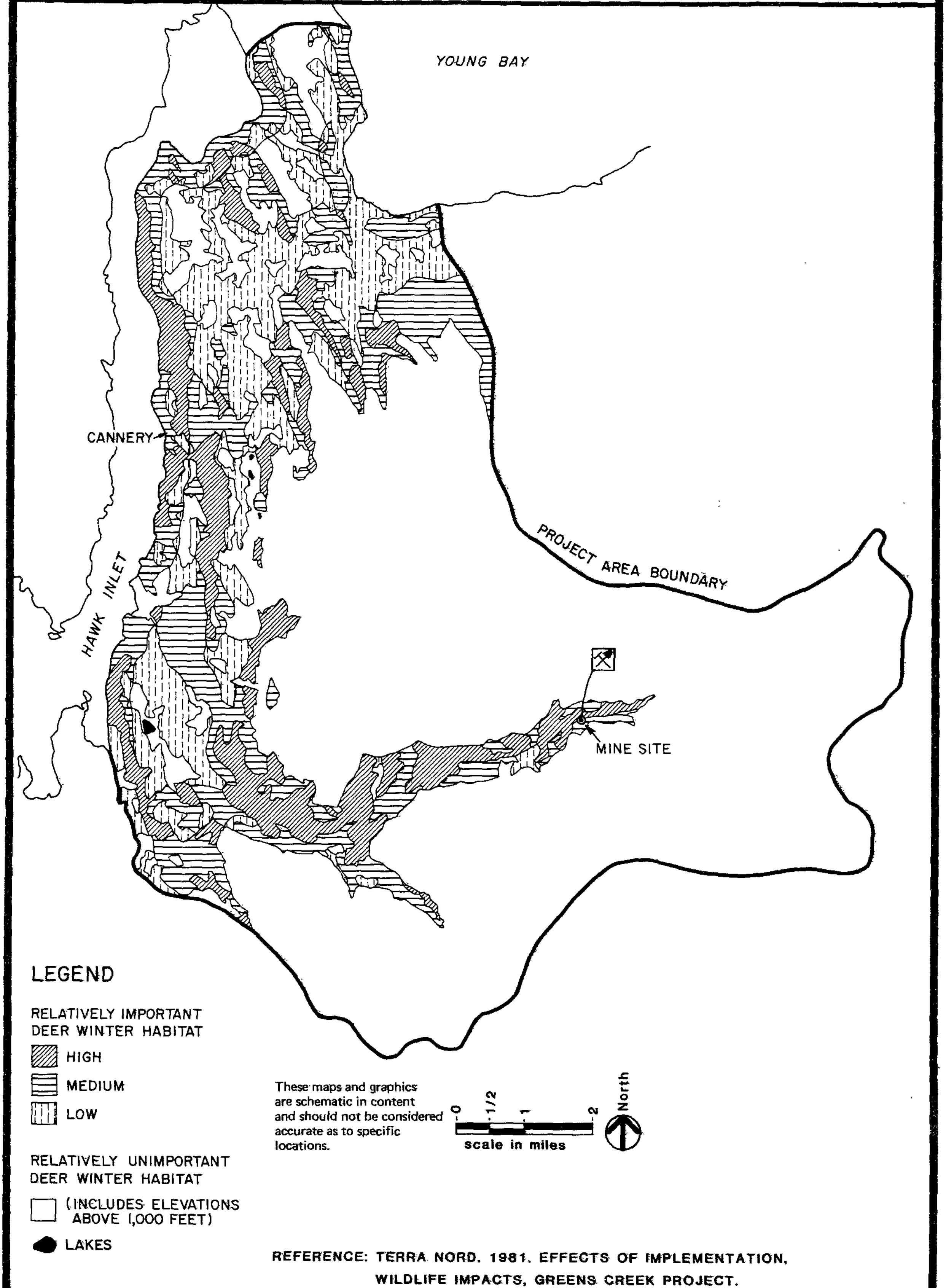
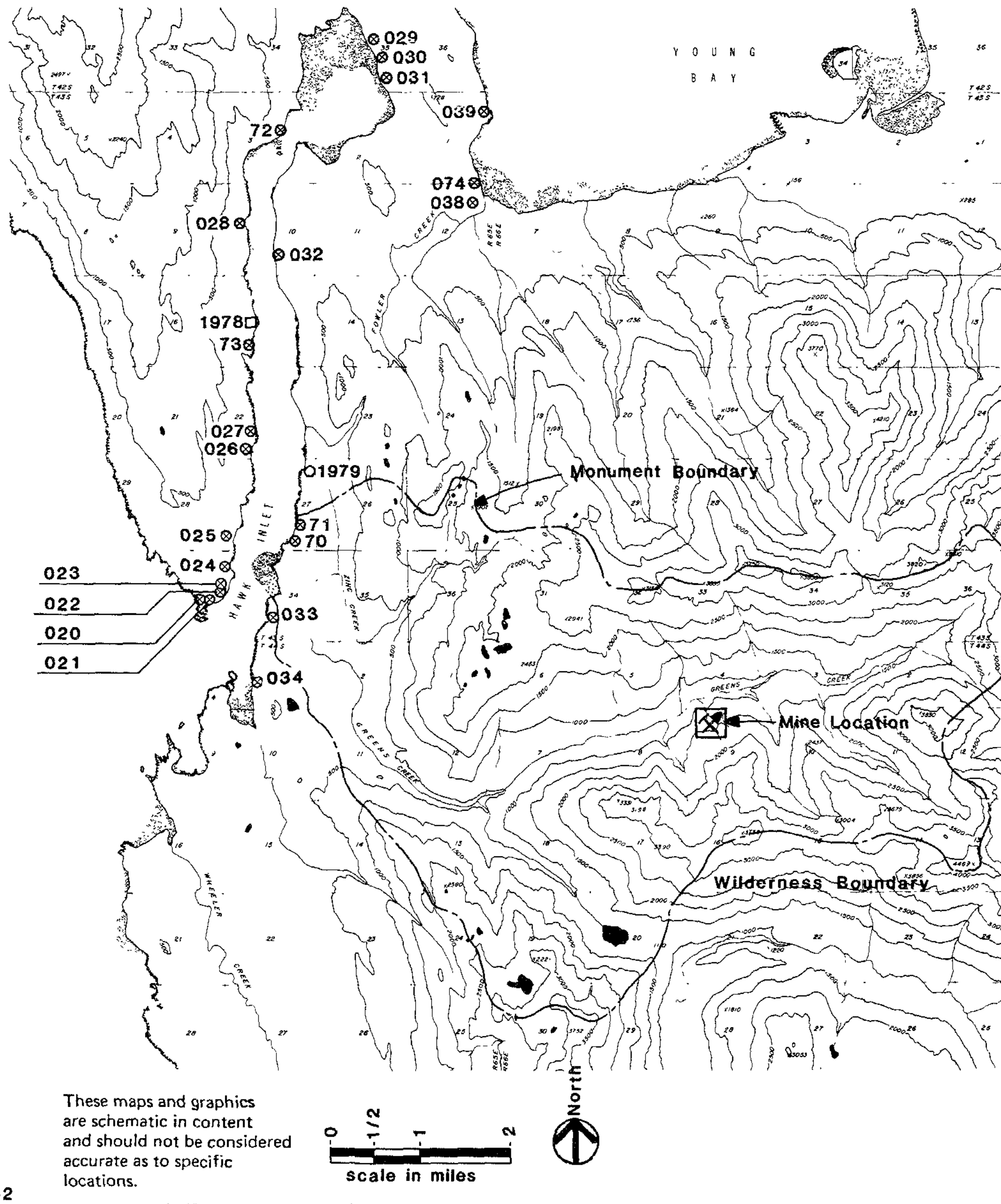


FIGURE 3-3

Bald Eagle Nest Tree Sites

GREENS CREEK
PROJECT EIS



These maps and graphics are schematic in content and should not be considered accurate as to specific locations.

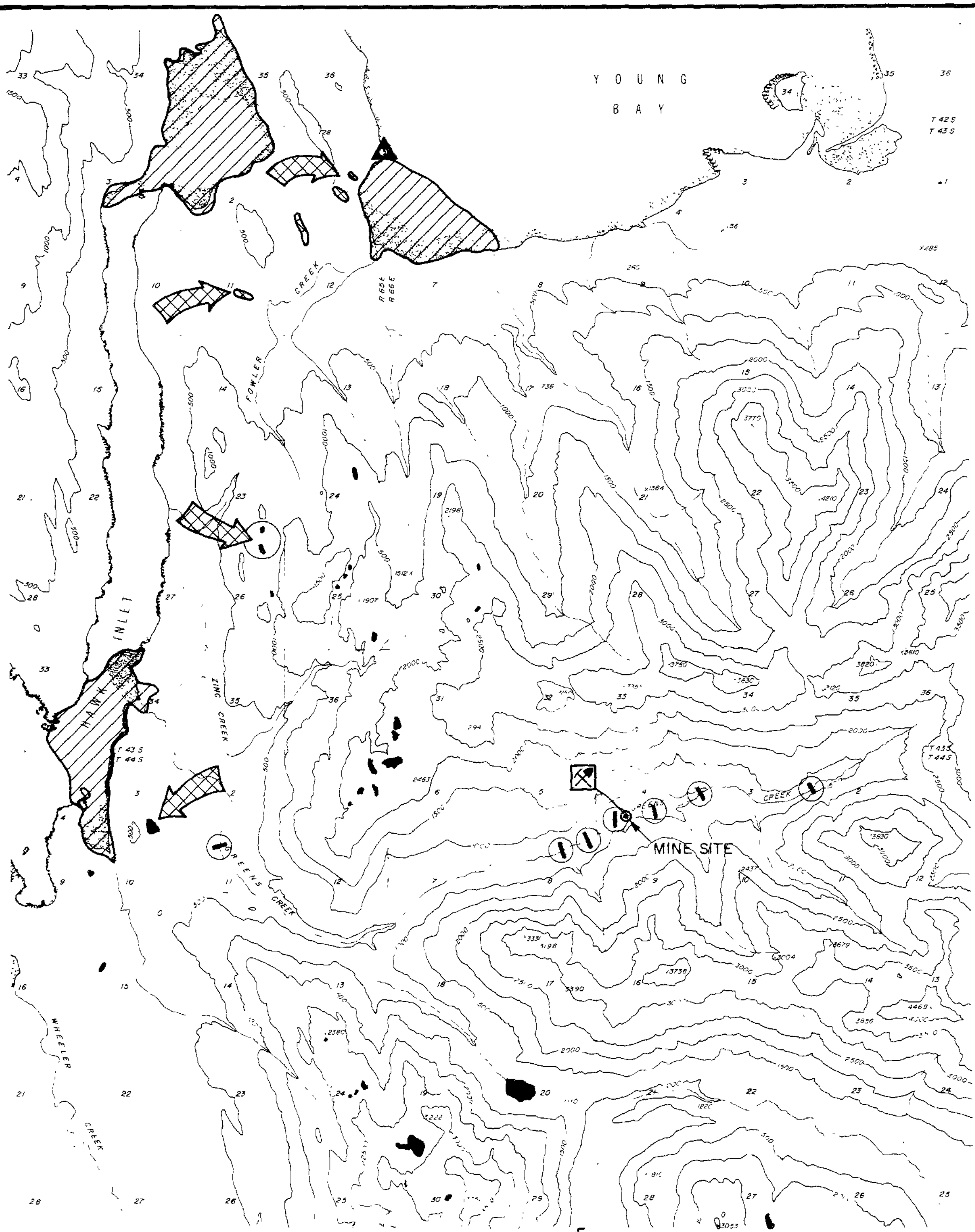
20-42
70-75 ⊗ U.S. FISH & WILDLIFE SERVICE IDENTIFIED SITES
1978 □ VTN RECORDED ADDITIONAL SITE
1979 ○ IEC RECORDED ADDITIONAL SITE

REFERENCE: INTERNATIONAL ENVIRONMENTAL CONSULTANTS 1980. WILDLIFE BASELINE STUDIES, GREENS CREEK PROJECT.

FIGURE 3-4

Major Waterfowl and Furbearer Use

GREENS CREEK PROJECT EIS



These maps and graphics are schematic in content and should not be considered accurate as to specific locations.

0 1/2 1 2
scale in miles

North

FIGURE 3-5

IMPORTANT WATERFOWL HABITAT

BEAVER IMPOUNDMENT

MAJOR BEAVER ACTIVITY

OTTER DENNING SITE

IMPORTANT WATERFOWL AND BEAVER HABITAT

REFERENCE: TERRA NORD. 1981. EFFECTS OF IMPLEMENTATION WILDLIFE IMPACTS, GREENS CREEK PROJECT.

Furbearers

Furbearers found on Admiralty Island include marten (Martes americana), mink (Mustela vision), river otter (Lutra canadensis), and beaver (Castor canadensis). The latter three species are all aquatically oriented; the marten occupies climax coniferous forests. All species are year-round residents of the Hawk Inlet, Greens Creek, and Young Bay areas. Figure 3-5 shows the major identified furbearer activity sites within the project area.

Densities of furbearers in the project area are not known, nor is the extent of trapping activity known. River otter and mink are frequently observed in the vicinity of the cannery and along the shores of Hawk Inlet and Young Bay. Beaver lodges are present in the pond serving as a water source for the cannery, as well as several other small ponds and the upper tributaries of several creeks, including Greens Creek.

The drainages of Greens and Zinc Creeks and the shoreline of Hawk Inlet are prime habitat for mink and river otter. The spruce-hemlock forest that dominates the project area is typical marten habitat.

Marine Mammals

Several species of marine mammals occur in the vicinity of Hawk Inlet. Harbor seals (Phoca vitulina) and harbor porpoises (Phocoena phocena) are particularly common in summer.

The three species of whales commonly encountered in Southeast Alaska are: Hump-backed whales (Megaptera novaeangliae); Minke whales (Balaenoptera acutorostrata); and Gray whales (Eschrichtius robustus). Additional species of whales that may be encountered in Southeast Alaska include: Fin whales (B. physalus); Sei whales (B. borealis); Bairds bottle-nosed whales (Berardius bairdii); Goose-beaked whales (Ziphius cavirostris); Sperm whales (Physeter catoden); and Killer whales (Orcinus orca).

Other marine mammals known to occur in Southeast Alaska include fur seals (Callorhinus ursinus), Stellar sea lions (Eumetopias jubata), two additional species of porpoises, and the sea otter (Enhydra lutris), which has been reported in Chatham Strait near Hawk Inlet. General field investigations suggest that marine mammal occurrence in Stephens Passage and Chatham Strait is typical of that found throughout the marine waters of Southeast Alaska, but larger marine mammals are probably less abundant within Hawk Inlet itself due to the shallow sill at the mouth of Greens Creek.

Threatened or Endangered Species

The only endangered species known to be found in the project area is the humpback whale (*Megaptera novaeangliae*). These whales would most likely pass the project area in Stephens Passage or Chatham Strait. Although these whales have been seen in the area, it is doubtful they would enter shallow, restricted areas such as Hawk Inlet with any regularity.

The Bald Eagle and brown bear, while threatened or endangered in other parts of North America, are not so designated in Southeast Alaska.

Two species of Peregrine Falcon (*Falco peregrinus anatum* and *F.p. tundrensis*) could migrate through the Greens Creek Project area; both are on the Federal Threatened and Endangered Species List.

RECREATION
(Reference 7, 8, 12, 13, 14)

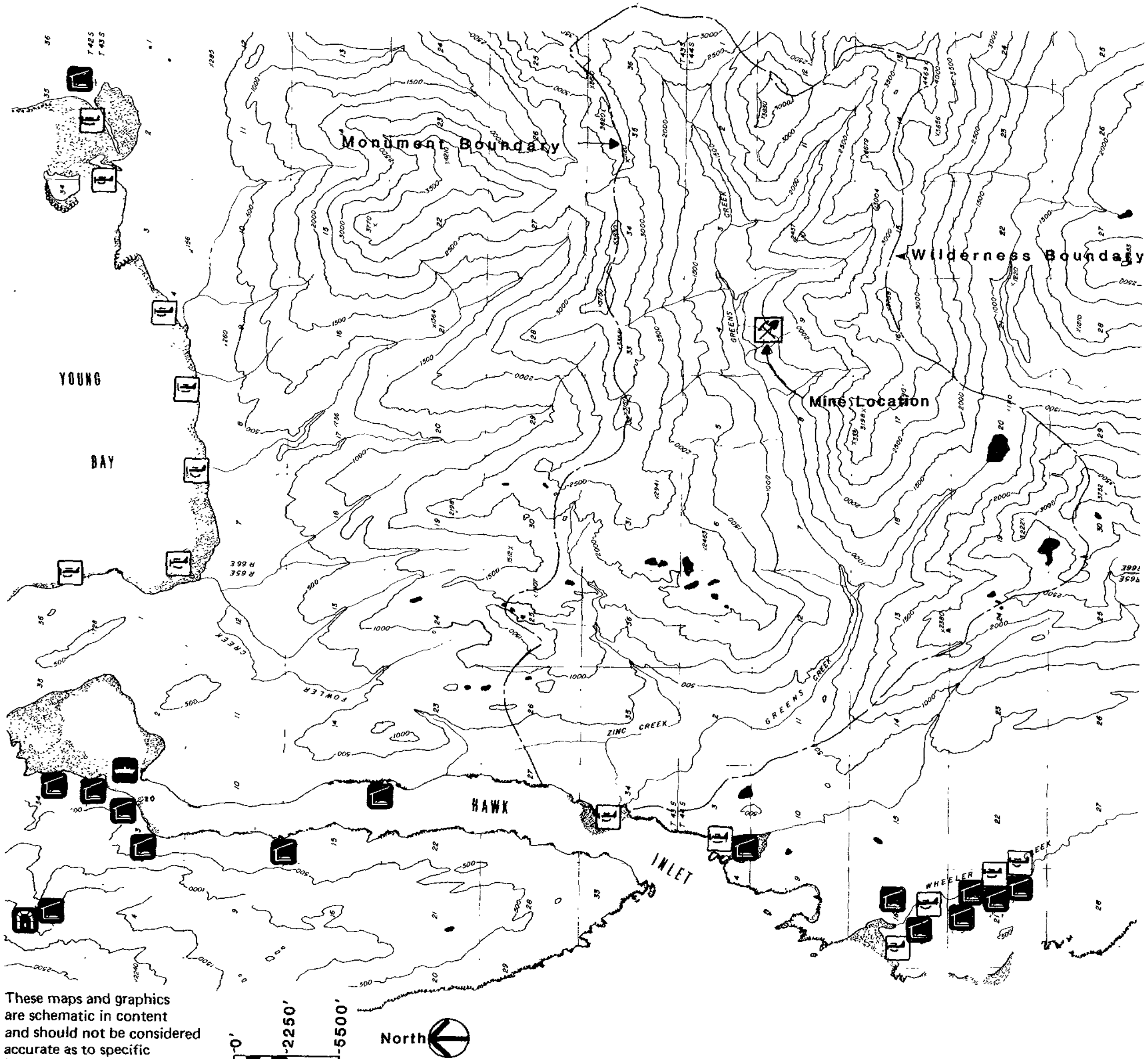
The population centers nearest to the project area are Juneau, Hoonah, and Angoon. Residents of these communities are the most likely recreation users of the project area. Alaska Public Survey (APS) results indicate Juneau residents are the predominate users.

Dominant recreation activities in the Greens Creek project area are hunting, trapping, and saltwater fishing. Trapping occurs along the shores of Hawk Inlet; one or two trappers have been reported in the winter.

Hawk Inlet receives its largest recreational use during the deer-hunting season. In the summer months the inlet provides a protected moorage for sailboats, cabin cruisers, and commercial fishing boats. Hawk Inlet and Young Bay beaches also provide suitable landing space for wheeled aircraft. Young Bay recreational use is generally related to day trip activities, while Hawk Inlet is used for overnight trips.

The commercial pilots that were contacted (Reference 14) reported transporting recreationists to Hawk Inlet for a total of 530 user days. The shore of Young Bay provides excellent beach landing for wheeled aircraft. The pilots interviewed reported transporting recreationists to Young Bay for a total of 315 user days.

Some of the recreational activity in Hawk Inlet is related to the six cabins in the inlet and six cabins at Wheeler Creek. These users/owners use the area for various activities, averaging 110 to 150 user days per year. Comments from owners/users indicate there may be at least as many people using Hawk Inlet without direct cabin access, as there are users who stay in cabins. See Figure 3-6.



These maps and graphics are schematic in content and should not be considered accurate as to specific locations.

GREENS CREEK PROJECT EIS

Legend

- Proposed Mine
- Beach Landing
- Cabins
- Moorage
- Existing Mine

Reference: Conner Sorenson, 1982 Recreation Baseline For Greens Creek Project Supplemental Information

FIGURE 3-6

Survey of Recreational Use

Specific information on deer hunting in the project area is not available. The Alaska Department of Fish and Game harvest code area 04-11 includes Young Bay, Hawk Inlet, Mansfield Peninsula, Seymour Canal, and Glass Peninsula. Results from the Department's 1980 deer hunting survey indicates 704 hunters used area 04-11. Six hundred ninety-five deer were taken and 3,090 hunter days effort was expended. General estimates show that 4, 6, 16, 46, and 29 percent of the harvest is taken in August, September, October, November, and December, respectively.

From the Alaska Department of Fish and Game bear sealing records, the numbers of brown bears shot by sport hunters in the Hawk Inlet area are shown below. Figures in parenthesis represent the number of bears taken in all of the northern Admiralty Island, which includes Seymour Canal, Glass Peninsula, and Mansfield Peninsula.

1971 - 2 (7)	1976 - 1 (15)
1972 - 0 (9)	1977 - 3 (13)
1973 - 6 (12)	1978 - 0 (9)
1974 - 3 (12)	1979 - 1 (2)
1975 - 5 (14)	1980 - 0 (8)

This data shows an average of 3.2 bears per year taken in the project area from 1971 to 1975, and 1.0 bears per year taken from 1976 to 1980. This represented 30 and 11 percent, respectively, of the bear harvested from all of northern Admiralty Island.

The Alaska Department of Fish and Game believes a few people hunt ducks in Hawk Inlet during mid-October. These people use large cabin cruiser type vessels to reach Hawk Inlet and stay for several days.

The furbearers trapped in the area are mink, marten, and river otter. There are no records available that indicate efforts or harvests of mink or marten. Annual sealing records show that approximately 10 river otters are taken from the northern portion of Admiralty Island, including the northern end of Seymour Canal.

SUBSISTENCE
(Reference 13)

Section 803 of ANILCA defines subsistence use as:

> The customary and traditional uses by rural Alaska residents of wild, renewable resources for direct personal or family consumption as food, shelter, fuel, clothing, tools, or transportation; for the making and selling of handicraft articles out of the nonedible byproducts of fish and wildlife resources taken for personal or family consumption; for barter, or sharing for personal or family consumption; and for customary trade.

Subsistence communities near the project area are Angoon, 44 miles to the south, Funter Bay, 10 miles to the north, and Hoonah, 28 miles to the west. Little documentation exists regarding the levels of historic subsistence use in Hawk Inlet. Subsistence use patterns on Admiralty Island and elsewhere in Southeast Alaska are now being studied by the Subsistence Division of ADF&G.

Residents of Angoon engage in subsistence hunting, fishing, and food gathering activities all along the west side of Admiralty Island including some use of Hawk Inlet. Subsistence foods collected include deer, seal, salmon, halibut, flat fishes, cod, herring, kelp and other seaweed, sea urchins, sea cucumber, king crab, Tanner crab, Dungeness crab, mussels, clams, octopus, and more recently shrimp. The most intensive subsistence seasons are summer and fall.

Villagers from Angoon travel in nine large commercial fishing vessels that make about two subsistence trips a year, carrying two to eight hunters each to specifically subsistence hunt deer. Both deer and seal are also subsistence hunted while those same boats are engaged in commercial fishing activities.[9/]

There are over 70 small skiffs in Angoon, used by residents for subsistence activities. While participating in subsistence gathering activities, villagers travel along the northwest coast of Admiralty Island. One of the areas that provide some protection from storms is Hawk Inlet.

Hoonah residents have also used Hawk Inlet for fishing and other purposes. However, no specific data is available on the amount and the extent of Hoonah subsistence use of the area. No data is available on subsistence use of the area by Funter Bay residents.

VEGETATION
(Reference 7, 8, 20, 21, 22, 23, 23a)

The vegetation of the study area is dominated by spruce-hemlock forest (*Picea sitchensis*, *Tsuga heterophylla*). The shrub layer generally consists of blueberry (*Vaccinium alaskaense* or *V. ovalifolium*), huckleberry (*V. parvifolium*), rusty menziesia (*Menziesia ferruginea*), and devil's club (*Oplopanax horridum*). Common ground cover plants are: trailing raspberry (*Rubus pedatus*), bunchberry (*Cornus canadensis*), foamflower (*Tiarella trifoliata*), and twisted stalk (*Streptopus* spp.). Various cryptogams carpet the forest floor; mosses are dominant, but liverworts and lichens are also abundant.

[9/]Gabriel George, Alaska Department of Fish and Game, Subsistence Division. Notes on subsistence use, 4/8/82.

Muskeg plant communities, typical of those throughout Southeast Alaska, cover about 4 percent of the study area. These poorly drained, non-forested areas are covered with a mat of mosses (Sphagnum moss is most abundant) interspersed with lichens. Common vascular plants include ericaceous shrubs, sedges (Carex spp.), tufted clubrush (Scirpus caespitosus), sundew (Drosera rotundifolia), trifoliate goldthread (Coptis trifolia), Lapland cornel (Cornus suecica), and swamp gentian (Gentiana douglasiana). Small pools occur frequently in muskegs. The most obvious plants growing in these pools are yellow pondlily (Nuphar polysepalum) and burreed (Sparganium spp.). Trees are small and widely spaced. Lodgepole pine (Pinus contorta) is the most common. Western hemlock and mountain hemlock (Tsuga mertensiana) also occur, ranging from small reclining shrubs to stunted trees.

Alpine tundra communities occupy about 20 percent of the project area. Most of the alpine tundra communities can be grouped into herbaceous meadows, alpine heaths, rock outcrops, and cliffs. Subalpine forests and meadows occur at the interface between the forested communities and the alpine tundra.

Several riparian and maritime plant communities are represented in the Hawk Inlet vicinity. Riparian vegetation is characterized by alder (Alnus spp.), goat's beard (Aruncus sylvester), graminoids, ferns, and currants (Ribes spp.). The predominant plants from Piledriver Cove to the mouth of Greens Creek from low to high tide are: Lyngbye sedge (Carex lyngbyei), goosetongue (Plantago maritima), hairgrass (Deschampsia spp.), cinquefoil (Potentilla anserina), bluejoint grass (Calamagrostos canadensis var. langsdorffii), and beachrye (Elymus mollis). These same plants occur along the narrow, coastal meadow-beach ecotone.

Coastal meadows (upper beach meadows) are found between the beach rye zone and the forest. These meadows have a grassy, (numerous grass taxa) scraggly appearance. Some of the common plants are: yarrow (Achillea millefolium), bedstraw (Galium spp.), starwort (Stellaria spp.), and ferns. These meadows are enlivened by some of our most colorful wildflowers: red, orange, and yellow paintbrush (Castilleja spp.), western columbine (Aquilegia formosa), cow parsnip (Heracleum lanatum), buttercups (Ranunuclus spp.), beach pea (Lathyrus japonicus), and chocolate lily (Fritillaria camschatcensis). A fringe of Oregon crabapple (Malus fusca), alder, devil's club, and blueberries occur along the border of the meadow and the forest.

Of the 41 sensitive plants listed for the Tongass National Forest, five of these are listed as "taxa currently under review" in the most recent listing of Endangered and Threatened Wildlife and Plants (Federal Register, December 15, 1980). Field studies for threatened and endangered plants have been conducted in the muskegs and along the beach-forest ecotone. The beach-forest ecotone would be the habitat most likely to support sensitive plants. After field studies, none of those plants have been observed.

TIMBER

Timber resources within the project area are typically hemlock-spruce old growth forest that ranges from stands of non-commercial scrub to good quality stands with 30,000 to 50,000 board feet per acre. Forested lands are interspersed with muskegs and other non-forest lands such as alpine and avalanche paths. Timber within Admiralty Island National Monument (Management Area C22) is classified as "unregulated" since timber within the monument is not included in the Tongass National Forest timber management base. Timber within the Juneau Ranger District (Management Area C21) is classified as "regulated" and is included in the timber management base. The proposed mining project does not include plans for commercial timber sales, other than for timber that will be removed as a part of mine development.

The timber information presented in Table 3-2 was extracted from the Tongass Land Management Plan resource inventory data base.

TABLE 3-2
TIMBER RESOURCE

Management Area C21
VCU 128C-Hawk Inlet (14,319 Acres)

Timber Land Classification(1)	No. of acres	Percent of total
CFL	8,111	56.65
Non-CFL	3,311	23.12
Non-Forest	2,897	20.23

Volume Class (BDFT/acre)	No. of acres	Percent of CFL
Under 8,000	497	6.12
8,000-20,000	1,821	22.45
20,000-30,000	4,056	50.00
30,000-50,000	1,738	21.43
Over 50,000	0	0

Site Index(2)	No. of acres	Percent of CFL
Low (55-85)	1,655	20.41
Medium (85-115	4,552	56.12
High (115-150)	1,904	23.47

(1) CFL (Commercial Forest Land): is forest land capable of growing stands containing 8,000 board feet of timber per acre; that is economically accessible now or in the foreseeable future; and is not withdrawn from timber utilization.

Non-CFL (Non-Commercial Forest Land): is forest land incapable of producing usable industrial wood because of adverse site conditions or withdrawn for specified purposes.

Non-Forest: are lands not qualifying as forest lands. Includes glaciers, icefields, permanent brush fields, muskegs less than 10 percent stocked with trees, and alpine areas.

(2) Site Index is a rating of the timber growing productivity potential based on the capability of the soil and other characteristics of the site. Three levels are used: high, medium, and low.

TABLE 3-2 (Continued)

Management Area C21
VCU 131C-Young Bay (5,871 Acres)

Timber Land Classification(1)	No. of acres	Percent of total
CFL	5,036	85.70
Non-CFL	755	12.85
Non-Forest	84	1.43

Volume Class (BDFT/acre)	No. of acres	Percent of CFL
Under 8,000	84	1.67
8,000-20,000	1,091	21.67
20,000-30,000	2,602	51.67
30,000-50,000	1,259	25.00
Over 50,000	0	0

Site Index(2)	No. of acres	Percent of CFL
Low (55-85)	672	13.33
Medium (85-115	2,854	56.67
High (115-150)	1,511	30.00

TABLE 3-2 (Continued)

Management Area C21
VCU 144C-Green's Creek (17,224 Acres)

This VCU is classified as National Monument (non-Wilderness) and timber resources are not available for harvest under normal commercial sales programs. Figures represented as CFL are for comparison purposes only.

Timber Land Classification(1)	No. of acres	Percent of total
CFL	11,174	64.87
Non-CFL	1,227	7.12
Non-Forest	4,823	28.00

Volume Class (BDFT/acre)	No. of acres	Percent of CFL
Under 8,000	65	0.58
8,000-20,000	2,713	24.28
20,000-30,000	5,038	45.09
30,000-50,000	3,294	29.48
Over 50,000	65	0.58

Site Index(2)	No. of acres	Percent of CFL
Low (55-85)	1,421	12.72
Medium (85-115	5,103	45.66
High (115-150)	4,650	41.62

Merchantable timber to be removed as a result of developing access and mining and milling facilities would be cruised, appraised, and sold under regulation 36 CFR 223.1(h).

GEOTECHNICAL ASPECTS
(Reference 7, 8, 11)

Soils

Soils in the area are largely a result of the movement of glaciers that covered the area 5,000 to 10,000 years ago, and from erosion of glacial deposits since then.

Soil types in the project area vary considerably, depending upon their distance from Hawk Inlet and major streams. Inlet soils are derived from glacial deposits that have been weathered by the ocean; the soils are thick, silty, and granular. Occasional peat deposits are interspersed with the soil, especially in the muskeg areas. Bedrock underlies the entire area.

Near lower Zinc and Greens Creek, alluvial (materials deposited by streams) and colluvial (materials eroded from slopes) soils are present. The upstream areas of Greens Creek are mostly underlain by glacial deposits or bedrock. Near the stream, these deposits are covered by alluvial soils, and further away and upslope, by colluvial soils. The top layer is a mat of peat and vegetatively-produced organic soils. Together these soil layers can be up to 10 feet thick. As the upstream terrain becomes more and more rugged, crushed rock from slides and bedrock outcrops are more frequently interspersed with the soils.

Geology

Admiralty Island, one of many islands comprising the Alexander Archipelago, is located within a geologically active belt bordering western North America. Sedimentary, metamorphic, and igneous rocks, ranging in age from Devonian to Quaternary outcrop on Admiralty Island. Overall, little is known of the geology which is complicated, and largely obscured by a capping of soil, talus, and thick vegetation.

Greens Creek Valley Geologic Setting

Despite few rock exposures, the knowledge of geological features of the Greens Creek valley area (including the mine site and tailings pond locations) has improved over the past several years as a result of field mapping, geochemical studies, and drill cores.

The oldest rocks underlying the project area represent an accumulation of sediments that were deposited in a Paleozoic basin. These rocks are now weakly metamorphosed equivalents of shale, siltstone, limestone, and abundant volcanic products. Overlying the Paleozoic rocks are a sequence of Triassic volcanic and sedimentary rocks. These are exposed on the high ridges around the Greens Creek valley.

Young (Quarternary) unconsolidated deposits of alluvium, glacial debris, clays, and talus are irregularly distributed throughout the area.

Ore Deposit

The Greens Creek orebody is a small, but richly mineralized, silver-gold-lead-zinc-copper deposit hosted in sedimentary rocks of marine origin. It may have been produced from subaqueous volcanic springs. Generally, the ore found in the Greens Creek deposit forms a relatively simple and essentially continuous, stratiform mineral horizon. It is approximately tabular in shape and steeply dipping with dips ranging from 50 to 70 degrees to the southwest. The orebody appears to be overturned from its original position during deposition. Country rocks overlying the deposit are volcanic tuffites, and sediments. Underlying the deposit is carbonaceous argillite rock. The main metal-bearing minerals are, in order of decreasing abundance: pyrite (FeS_2), sphalerite (ZnS), galena (PbS), Chalcopyrite ($CuFeS_2$), silver-bearing minerals of the tetrahedrite tennanite series ($[Cu, Fe, Ag]_{12}$ $[Sb,As]_4S_{13}$), and native gold.

Drilling has indicated probable ore reserves exceeding three million tons. Because of variable topographic relief, the surface expression (outcrop) of the deposit varies in elevation from 1,800 to 2,100 feet. The ore zone likely continues below the 1,000-foot elevation, which is the lowest extent of the present drill information.

Seismicity

Two major faults are located to the west of the mine site. They are:

- The Fairweather/Queen Charlotte Fault system that passes within approximately 70 miles of the project site. Major earthquakes have occurred on this fault system.

- The Chatham Strait Fault is located 5 miles from the project site, but has not undergone identifiable geologic displacement in recent history.

On the basis of preliminary interpretations, there is a 0.2 percent chance per year that an earthquake, with a magnitude of 7.0 or greater on the Richter scale, could occur on the two regional fault systems. The scale indicates 1.5 as the smallest earthquake that can be felt, 4.5 would cause slight damage, and 8.5 would be devastating.

AIR QUALITY
(Reference 1, 2, 7, 8)

The project site is characterized by abundant precipitation. Frequent and intense storms moving across the Gulf of Alaska are typical during fall and early winter. Fog and rain, especially at higher elevations, are common.

The mean annual precipitation at the Juneau Airport is 53 inches. On-site precipitation and runoff data for 1979 indicates that rainfall levels near Hawk Inlet are similar to those at Juneau, but precipitation at the mine site is about 90 inches per year.

Topography has a large influence on wind patterns in Southeast Alaska. At Hawk Inlet, winds are channeled by the terrain, producing strong southwesterly winds in summer and northeasterly winds in winter. In the Greens Creek valley drainage, winds from the high terrain produce a frequent, although weak, easterly component.

The nearest sources of atmospheric contaminants are in Juneau, 18 miles northeast of the site. There are no ambient air quality monitoring stations in the vicinity of the project. The closest regional air quality monitor is located at the Juneau Municipal Building.

Although no measurement of particulates has been made in the project area, levels are expected to be lower than observed in Juneau. Since no major local sources exist, levels of other pollutants are expected to be similar to those of other remote locations. The Forest Service suggests the use of the following levels for remote areas: 30 to 40 micrograms per meters cubed for particulates, 0.01 part per million (ppm) for nitrogen oxides, 20 micrograms per meter cubed for sulfur dioxide, 1 ppm for carbon monoxide (EPA guidelines for monitoring PSD, 1978).

VISUAL RESOURCES
(Reference 7, 8, 23, 24, 25)

Admiralty Island offers natural rugged scenery composed of high ridges with alpine tundra, steep cliffs with slides and avalanche tracks, mountain slopes densely covered with conifers, and lowlands of conifers, with pocket clearings of meadows, muskegs, and lakes. The project area includes the densely forested Greens Creek drainage and the level plains and foothills along Hawk Inlet, which are also forested, but have numerous small clearings. Evidence of human alteration within the project area is limited to the fire-gutted cannery facility on Hawk Inlet.

Visual Quality Objectives (VQO's) are management goals applied to National Forest land by the Forest Service. They are based on viewing distance, viewer sensitivity, and landscape variety. VQO's are briefly defined as:

P - Preservation: Permits ecological changes only, applies to wilderness areas and other special classified areas.

R - Retention: Permits management activities that are not visually evident; requires immediate reduction of contrast by reclamation activities.

PR- Partial Retention: Management activities are visible but are visually subordinate to the natural landscape. Requires immediate reduction of contrast by reclamation activities.

M - Modification: Modifications must borrow from natural patterns but they may visually dominate the landscape. Reclamation should occur within the first year.

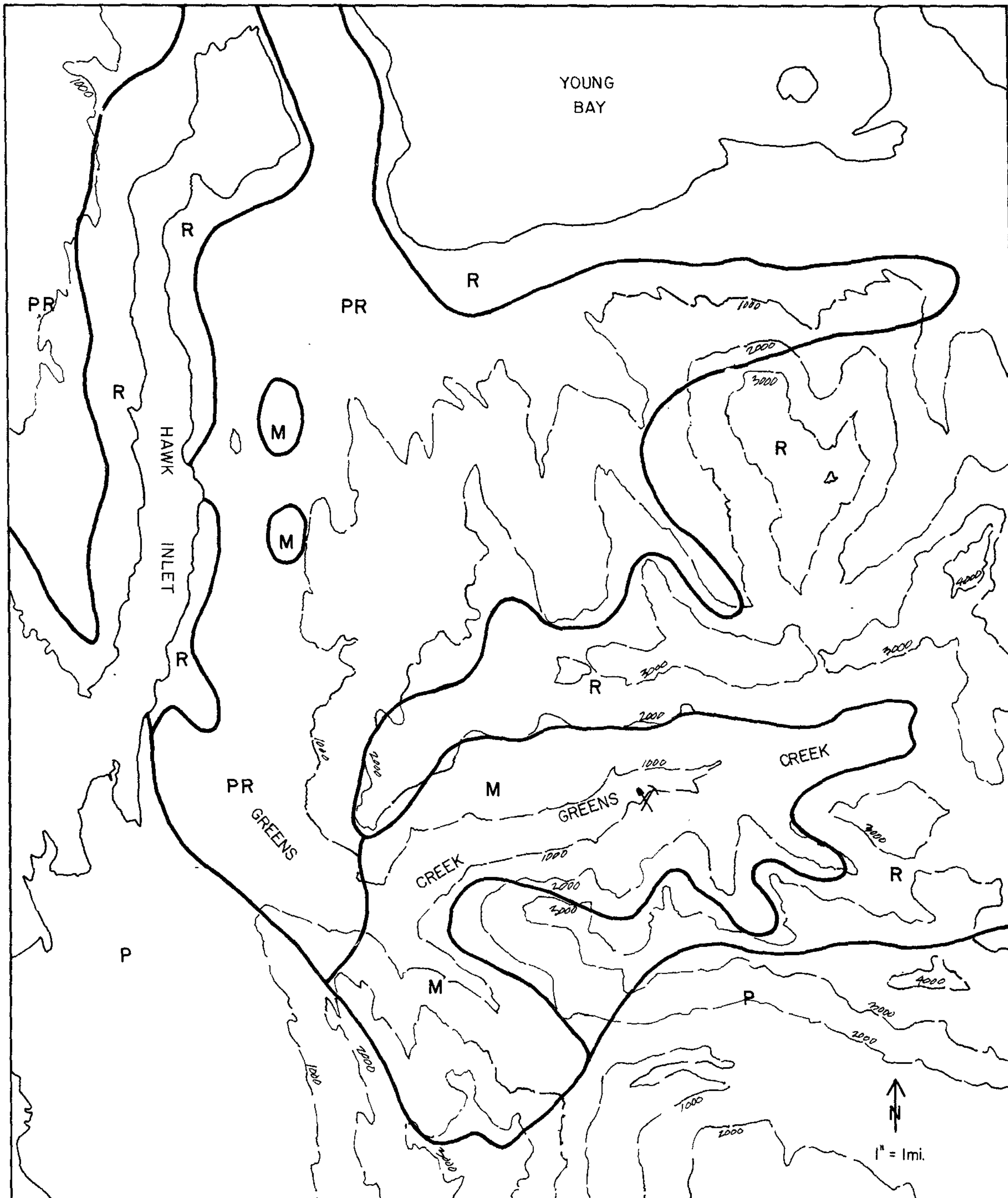
See Figure 3-7 for the inventoried VQO's in the project area.

Distances measured from primary viewer locations along major travel routes are divided into: foreground (usually limited to 0.5 miles from shore, but for this project extended to 1 mile), middleground (3 to 5 miles from view) and background.

Sensitivity levels are a measure of the scenic interest of the viewer. High sensitivity areas include all those directly visible to a scenery-oriented audience from primary travel routes and water bodies. Medium sensitivity areas include all those observed from primary travel routes, along which the viewers are not primarily concerned with scenic qualities (less than one-quarter of the viewers), as well as all areas observed from secondary travel routes. Low sensitivity areas include those visible from secondary routes by viewers, less than one-quarter of which have a major concern for scenic qualities.

Variety class is a measure of the scenic quality of an area. The distinctive variety class includes scenery of the highest quality. The common variety class is that scenery which predominates throughout an area and includes areas with good, but less than outstanding, scenery. The minimal class includes the common, nondistinctive areas of low topographic relief, as well as areas heavily impacted by man.

The Admiralty Island shoreline and the ridgelines are considered as having distinctive visual variety. The remainder of the site has common variety class except for the cannery itself, which has been altered because of past human activities and is a minimal variety class.



LEGEND

P - PRESERVATION

R - RETENTION

PR - PARTIAL RETENTION

M - MODIFICATION

GREENS CREEK PROJECT EIS

INVENTORIED VISUAL QUALITY OBJECTIVES

FIGURE 3-7

NOISE
(Reference 7, 8)

From 1914 until 1976, the cannery may have generated significant noise; but today, manmade noise is very limited in this remote and rugged area. Some of the sources of noise in the project area are light aircraft passing over Hawk Inlet, a small diesel generator at the cannery site, helicopters flying to and from the exploration in Greens Creek mine, boats in Hawk Inlet, and firearms discharged by hunters. Natural sources of noise include wildlife, wind, rain, creek rapids, and wave breaking.

Data from similar locations indicate that the natural noise levels could vary from a very low 15 decibels (dBA) to about 45 dBA. With the exception of a caretaker employed by Noranda at the cannery, there are no permanent residents closer than Douglas Island, 12 miles north, and Pack Greek, 17 miles southeast.

CULTURAL RESOURCES
(Reference 3, 4, 7, 8)

The cultural resource study of the Greens Creek area conducted in 1979 included a literature search and a field survey. The entire project area was surveyed by air. The core impact area, from the cannery to just beyond Piledriver Cove, and on both sides of Greens Creek to river mile 2.0, was examined by the survey team on foot. No prehistoric sites were found along lower Greens Creek, and no sites of any period have been found at the mine site.

Two prehistoric sites have been found within the general project area. These sites are located along the east shore of Hawk Inlet and in an area adjacent to Young Bay. The first site, located on a beach bedrock outcrop, is composed of black soil with charcoal, fragmented clam and mussell shells, and fire-cracked rock. The surface extent is not more than 35 feet north-south by 15 feet east-west, as indicated by soil probes, although additional deposits could be present in dips and hollows in the bedrock. The depth, up to 3 feet at the beach exposure, decreases to 4 inches at 10 feet away from the beach. Maximum elevation is approximately 25 feet above high tide at the top of the bedrock on which this site rests.

The site is badly disturbed by the roots of large conifers that riddle the site completely, and by considerable erosion at the beach edge. The small size of the midden deposit suggests that this was a campsite and not a major village. Its actual age has not been determined, but the presence of shellfish remains would suggest that it is younger than 5,000 years since no such remains have been found in coastal Alaska and British Columbia sites older than that. The advanced decomposition of some of the shells suggests, on the other hand, that the site may be older than the immediate prehistoric period.

The second area, located adjacent to southwestern Young Bay, actually has two sites. A trapper's cabin was found adjacent to an unnamed creek entering Young Bay. The general condition of the structure, plus the associated artifacts, suggest occupation between 1920 and 1940. A prehistoric midden was also found in the same general area. The midden occupies a beach ridge and suggests some antiquity. It appears that this corner of Admiralty Island is being uplifted and that the older sites are located furthest from the beach. The site is made up of fire-cracked rock and shell fragments.

Non-native use of the eastern shore of Hawk Inlet from the cannery to Piledriver Cove was primarily at the cannery itself and secondarily for cabins and fishing and hunting camps. The cannery was originally constructed in 1911 by the Hawk Fish Company. In 1975 the name was changed to Peter Pan Seafoods, Inc. In May 1976, most of the cannery burned; the charred and rusted foundations exist there today. The remaining buildings are owned by the Bristol Bay Native Corporation.

SOCIOECONOMICS
(Reference 7, 8, 15, 16, 17)

During the period of 1906 through 1957, lode gold and salmon were the basis of the economy of Southeast Alaska. With the closing of the Alaska-Juneau mine in 1944, the mineral industry lost its economic importance. The timber industry has grown steadily since 1954, when the first pulp mill was established in Ketchikan. The timber industry is currently one of the major employers in Southeast Alaska.

There is evidence from the Alaska Public Survey (APS) that environmental factors are relatively more important than economic considerations in why Southeast Alaskans came to, or stayed in the region.[10/] Findings of the APS data are based on data taken from 1,255 hour long interviews conducted in the spring of 1979. Useable interviews were completed at about 7.5 percent of all households in Southeast Alaska.

Residents questioned in the survey ranked being close to a wilderness environment, recreation opportunities, and the ability to be self-reliant as the three most important reasons for living in Southeast Alaska.

Recent arrivals in the region (those who have lived here less than 5 years) ranked a challenging job and a chance to start something new as more important reasons for living in the Southeast Alaska then did long time residents. Two possible interpretations of those findings exist. Newcomers could come to the region for employment, but only those who appreciated the region's environmental assets would remain. The values of the population would therefore remain unchanged.

[10/] William Alves, Residents and Resources: Findings of the Alaska Public Survey on the Importance of Natural Resources to the Quality of the Life in Southeast Alaska, 1980.

Another possible interpretation would be if newcomers with those attitudes remained in the area, a general shift in attitudes toward economic development and environmental factors would occur.

Juneau, Angoon, and Hoonah were studied to assess the socioeconomic impact of the Greens Creek Project.

The City and Borough of Juneau are within 18 miles of the proposed project site. Juneau is accessible only by air or water. The Juneau area population was 21,080 in 1981.[11/]

A statewide initiative passed in 1974 to relocate the capital in Willow, northeast of Anchorage, has not yet been implemented. Residents voted in November 1982 not to fund a capital site move.

Juneau, as Alaska's capital, is heavily dependent upon government employment for its economic stability. State and federal jobs accounted for 57 percent of Juneau's employment; state government alone comprised 37 percent of all employment. Juneau typically has a higher per capita income, and a lower unemployment rate (an average of 7.6 percent in 1981)[12/] than the rest of the state.

Of the 10,430 people employed in Juneau in 1979, 5,966 persons were employed by state, federal, and local government. The retail trade employed 1,367; service occupations employed 1,277; and 333 were employed in construction.

Historically, the Juneau housing market has been characterized by high costs and low vacancy rates. Rental vacancy rates are virtually zero percent.[13/] An estimated minimum vacancy rate of 3 to 4 percent would be necessary to provide some choice in housing. Some people in Juneau live on boats because of the scarcity and high cost of conventional housing.

Police protection for Juneau is provided by both the Juneau Police Department and the State Public Safety Division (Alaska State Troopers). The ratio of state troopers to population in Juneau is 1 to 1200; the statewide ratio is 1 to 1500.

Fire protection is provided by 34 paid employees and by about 130 volunteers. Reservoir water storage capacity has been determined to be adequate to handle an increase in population. The number of the fire hydrants and the size and location of pipes has been identified as a problem in some subdivisions.

[11/]Alaska Department of Labor, Alaska Population Overview, 1981.

[12/]Brit Harvey, Alaska Department of Labor, personal communication, 5/6/82.

[13/]John Annand, City and Borough of Juneau, personal communication, 5/6/82.

The City and Borough of Juneau maintains all roads within the Borough, except for major highways, which are constructed and maintained by the state. Some traffic congestion exists in the Mendenhall Valley, where most of the recent subdivision activity has occurred.

Juneau has both a property and a sales tax. For fiscal year 1980-81, the levy rates ranged from $3.23 to $7.74 per $1,000 in the service areas. Assessed valuation has increased an average annual rate of 21 percent from 1974 to 1981, due largely to population growth and price inflation of property.

The sales tax on retail sales and personal and business services, is 1 percent throughout the City and Borough. An additional 2 percent sales tax is levied in the Juneau-Douglas service areas.

During the 1979-80 school year, the Juneau school district enrollment was 4,232. The 10 schools in the district have a capacity of 4,980 students. The student/teacher ratio is 25 to 1 in the elementary schools and 27 to 1 in the secondary schools. The present enrollment in the Glacier Valley Elementary is 584 students with an optimum capacity of 550 and a maximum capacity of 600. Auke Bay Elementary has 604 students with the same optimum and maximum capacity as Glacier Valley Elementary School.

A new elementary school is planned for completion by the fall of 1984 for the 1984-85 school year. The present enrollment of junior high students is 560, with a maximum capacity of 600 students. Juneau has one high school with a present enrollment of 860 students and a maximum capacity of 1,000 students. An expansion of the high school to be completed for the 1984-85 school year would increase the capacity to 1,500 students.

Angoon, a Tlingit Indian village of 445 people, is located on southwest Admiralty Island. Subsistence activities and community ties are extremely important to Angoon residents. A traditional lifestyle has existed in Angoon for hundreds of years and most residents would like to see it continue.

Angoon residents rely heavily on subsistence to compensate for an average 20 percent unemployment rate and an average per capita income of $6,000. Salmon fishing, a highly seasonal industry, is Angoon's primary cash economic activity.

Hoonah is located on Chichagof Island, about 20 miles west of the proposed project site. It is a Tlingit Indian village of 800 people. Hoonah's economic history reflects a gradual transition from the traditional subsistence lifestyles, to that of a cash economy, primarily dependent upon commercial fishing and government employment.

Many Hoonah villagers are involved in subsistence activities; they occasionally make trips to Hawk Inlet. Many residents seem to favor industrial development in Southeast Alaska because they see a need for a more diversified economy.

LAND USE

The project area is undeveloped, with the exception of the cannery site in Hawk Inlet. Much of the previous land use has focused on cannery activities and recreation.

Historically, the Tlingit culture has used Admiralty Island for subsistence purposes. Tlingit households have built smoke houses close to fishing streams near Hawk Inlet, to process fish.

Four land management classifications exist around the project area: privately-owned land (the cannery site); multiple-use lands (LUD III) managed under the Tongass Land Management Plan; Admiralty Island National Monument (non-Wilderness); and Admiralty Island National Monument Wilderness.

SECTION IV
ENVIRONMENTAL CONSEQUENCES

This section is the scientific and analytic basis for the comparison of the alternatives. Where possiblẽ, potential impacts have been quantified. When this was not possible, qualitative descriptions of effects are provided to identify differences in magnitude, significance, or duration among alternatives.

Impacts are reviewed under two major time periods: construction and full operation. Construction impacts have been assessed with consideration to mitigation measures and special construction practices. Impacts which address the operational phase of the project have been based on a time 2 years into the full operation of the project.

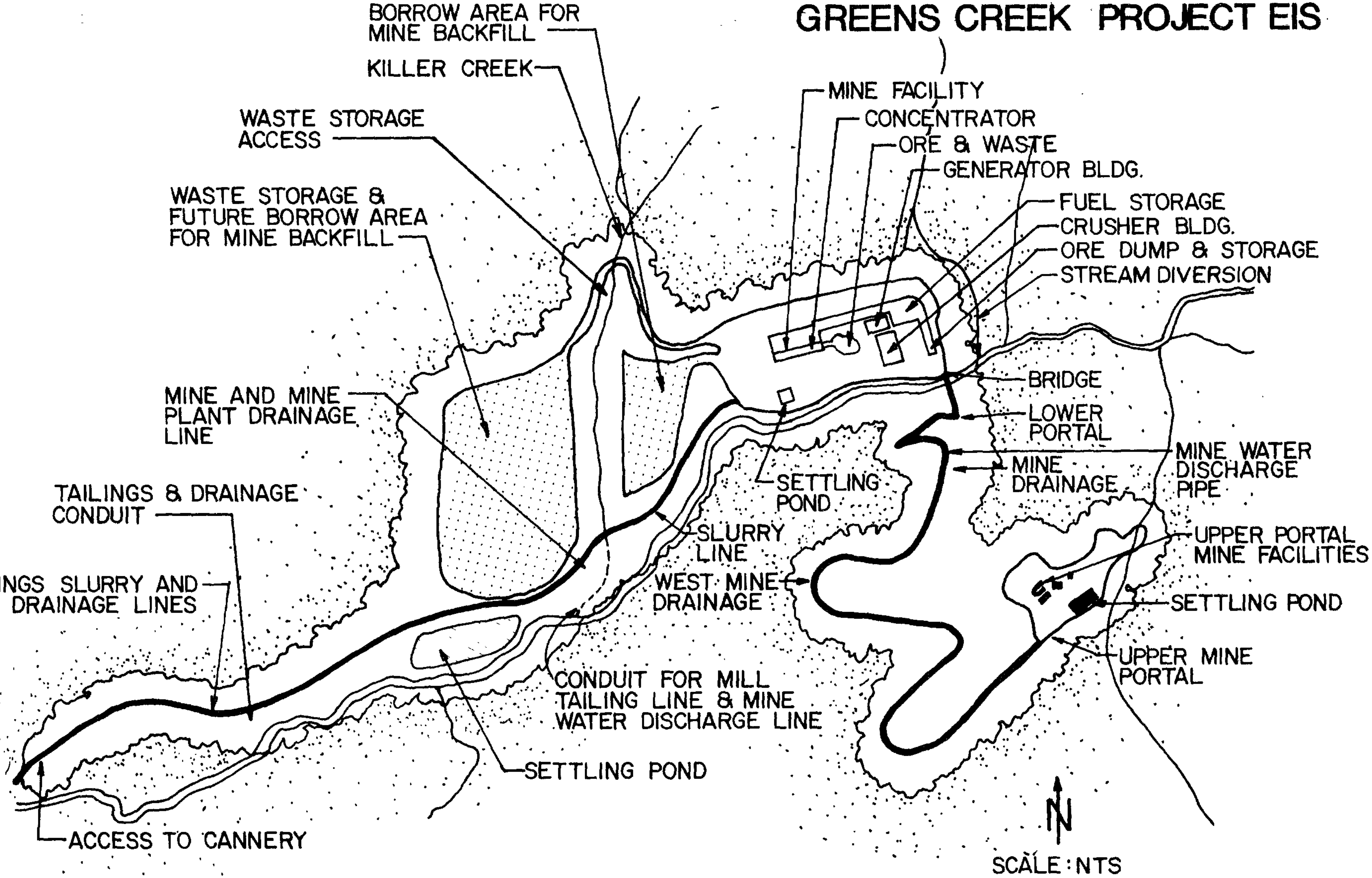
Effects or impacts are addressed individually, by discipline, to allow direct comparison of alternatives. If alternatives have the same level of impact as one previously discussed, the reader may be referred to previous discussions.

Two major components of the project are common to all alternatives: the mine and mine service area on upper Greens Creek; and the facility at the cannery, located on private land adjacent to Hawk Inlet. These areas are discussed separately because they represent components of the project that are not dependent upon selection of the Preferred Alternative and are not open to alternative development because their locations are fixed.

FIXED COMPONENTS - COMMON TO ALL ALTERNATIVES

The first fixed component of the project includes the orebody and directly related support facilities in the mine service area. These facilities would be located at a mine service area on the north side of Greens Creek, opposite the lower mine entrance, at an elevation of approximately 950 feet. The service area would consist of: a 14-acre mine plant site with shops for equipment maintenance and repair, power generation equipment, sand backfill plant, fuel storage tanks, change rooms, and a general supply warehouse; and a 43-acre space for waste rock storage. See Figure 4-1.

The second fixed project component is the private land at the site of the 70-year old cannery. Approximately 38 acres are owned by Greens Creek Joint Venture including 21 acres of tide and submerged lands. Present facilities include bunkhouses, warehouses, several homes, float dock, fuel storage facilities, gravity water system, a direct sewage outfall, and a diesel generator.



MINE PLANT SITE

These maps and graphics are schematic in content and should not be considered accurate as to specific locations.

FIGURE 4-1

Figure 4-2 illustrates the facilities to be developed at the cannery. Included in those facilities is a dock that would serve as the major shipping and receiving point for the project. This area would also serve as a storage location for ore concentrates, fuel, and other mine-related supplies when they are initially off-loaded from supply ships. During the construction phase, bunkhouses would be used to house construction workers.

SURFACE WATER HYDROLOGY
(Reference 7, 8, 27, 28, 29, 30, 31, 34, 35, 36, 37-see Appendix A)

Mine Service Area

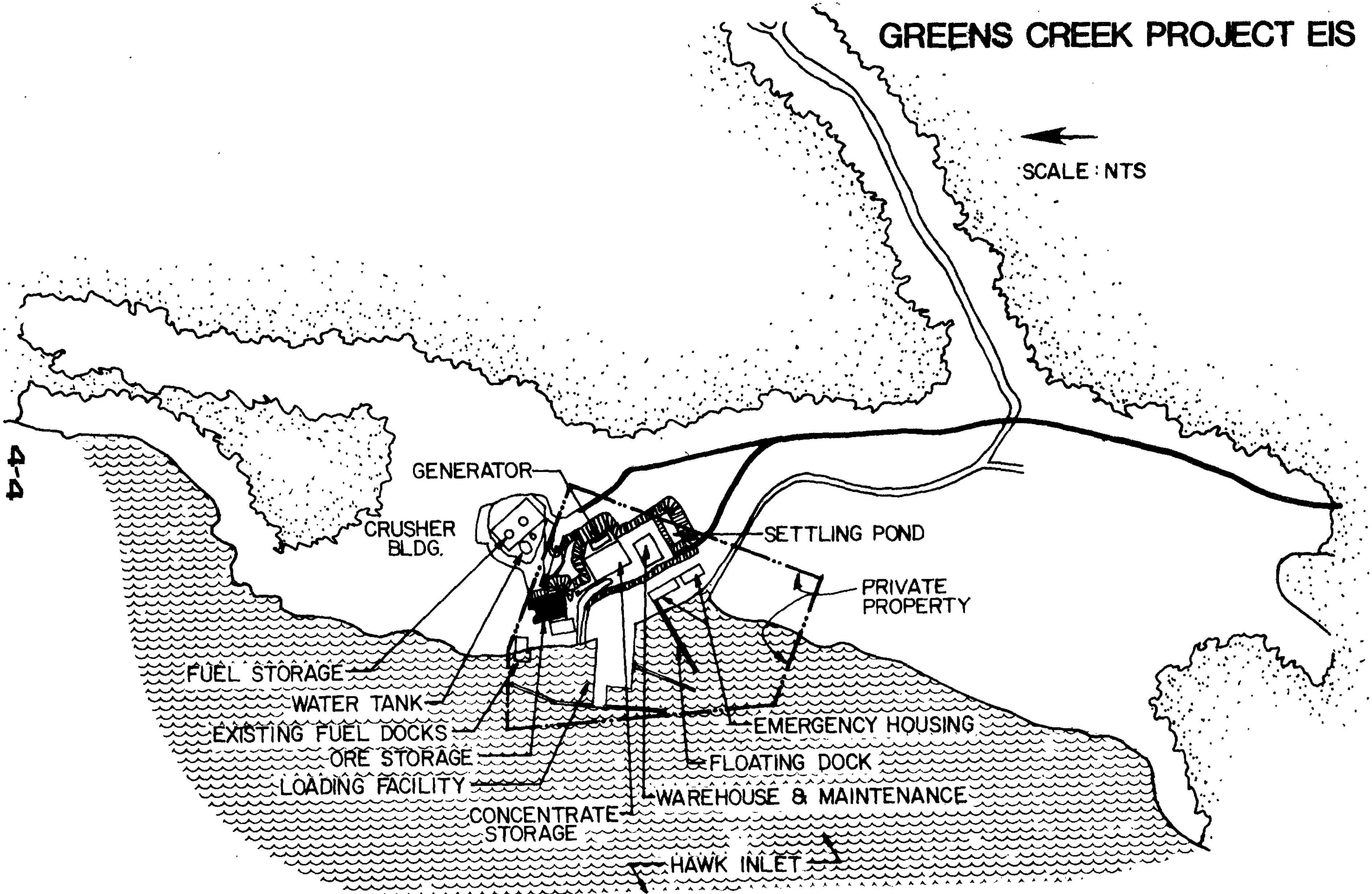
Two small drainages to Greens Creek pass through this area. They have been designated as streams 1 and 2. Stream 1, the larger stream on the west side, has an annual average flow of 3.8 cubic feet per second (cfs) and a low flow of 0.1 cfs. Stream 2 has an average annual flow of 0.7 cfs and a low flow of zero.

Stream 1 would be left in its natural channel. Space on either side of the stream would be used for waste rock storage and future borrow sites for mine backfill. Waste rock dikes along the stream banks would contain the 100-year flood event of approximately 300 cfs to prevent flooding of the storage areas.

Stream 2, which crosses the east side of the mine service area, would be re-routed further east or piped through a culvert. The diversion channel of this stream would be sized to carry all flows up to the 100-year event.

Diversion ditches on the uphill side of the cleared area would direct natural hillside runoff to the drainages. Diversion ditches on the downhill side of the cleared slopes and alongside a dike by Greens Creek would route contaminated runoff to a large sedimentation pond in the southwest corner. The dike would offer protection from Greens Creek flooding.

Surface runoff from the mine plant site (approximately 14 acres) would approach 100 percent of the precipitation due to the buildings and ground compaction by vehicles. The sedimentation pond would be sized to retain all runoff from waste storage, mine plant, and mine portal for events up to the 24-hour/10-year event. From the pond, runoff would be piped to the tailings pond in those alternatives that propose road access. Those ponds would also provide sediment removal during the construction phase. An oil and grease separation facility would be located above the smaller pond to treat runoff from areas where oil and grease would be in regular use.



HAWK INLET LOADING FACILITY

FIGURE 4-2

These maps and graphics are schematic in content and should not be considered accurate as to specific locations.

Development of the mine service area and diversion of site runoff to the tailings pond would reduce surface flows into Greens Creek by slightly less than 1 percent. Reduction in low flows would also be less than 1 percent, proportional to the reductions in infiltration to ground water caused by development.

Private Land Area - Cannery

Development of the docking and support facility at the cannery would not require the alteration of stream courses. Cannery Creek is the only stream that passes through the site, and it would be bridged to allow access to facilities south of the creek. Diversion ditches on the uphill side of the cleared lands would divert natural runoff away from disturbed areas. The area would be graded to allow drainage to be collected in a sedimentation pond designed to contain the 24-hour/10-year storm runoff volume. Surface runoff from the developed area would increase by 5 to 10 times due to the increased impervious area of buildings, roads, and vehicle access areas. The increased runoff would not have any effect on freshwater stream flows, since it would not enter Cannery Creek. The sedimentation pond outlet would discharge into Hawk Inlet.

GROUND WATER HYDROLOGY AND QUALITY
(Reference 7, 8, 31, 32, 33)

Mine Service Area

Ground water from underground mine workings would be collected by ditches and piped to the mine service area for use either as process water for the mill or pretreated in a sedimentation pond and piped to the tailings pond for further treatment. Water for domestic use (approximately 2 gpm) would be obtained from water-bearing sediments adjacent to Greens Creek. This amount would be a negligible portion of the Greens Creek flow even during the estimated mean annual low flow of 4 to 5 cfs (usually in winter). Water collected from the mine workings would result in a reduced water flow in Big Sore and Greens Creeks (a reduction of 150 to 1,000 gpm). These intercepted flows would be approximately 0.5 percent of the 110 cfs mean annual flow in Greens Creek. During low flow time periods, the intercepted flow may represent up to 7 percent of upper Greens Creek's flow. Water diversions would not significantly affect flows in Greens Creek and would not affect fishery resources.

Impacts to ground water quality would be insignificant. Water infiltrating the underground workings (the mine) would be captured and directed to the sedimentation pond and treated similarly to surface water. Some minor amounts of ground water might originate from the mine area wastepiles. This ground water would have increased concentrations of total dissolved solids and sulfate, but effects on Greens Creek would not be measurable due to high dilution ratios (greater than 1:68).

Private Land Area - Cannery

The cannery dock area does not have a significant underground aquifer. Impacts on ground water quality would be insignificant. Surface runoff would be collected and treated, reducing the potential for infiltration. Water infiltrating into the ground water system would be expected to be of higher quality than existing levels assumed to be contaminated by sea water. No degradation of the ground water system would be expected during construction. No risk to ground water from concentrate spills would occur if they are cleaned up in a reasonable time.

GEOLOGIC HAZARDS
(Reference 7, 8)

Mine Service Area

The proposed mine portal and bridge abutment is located on the south side of Greens Creek, in an area of steep and highly unstable slopes. During the initial period of construction in and around the portal, special construction techniques would be required to maintain the stability of the hillside. Small local translational slides of the surface soil mantle may occur during construction, but these should be easily controlled. Long term stability of the portal should not be a problem since a concrete structure would be constructed as far as necessary both into and outside of the mine adit resulting in stable underground excavations and external slopes.

Following completion of construction, the risk of a damaging slope failure would be low. If the mine water drainage lines and/or bridge abutment suffers significant damage, the consequence of failure would be moderate because of the impact on Greens Creek. The actual impact of a major slide on Greens Creek would be very significant locally because of the large amounts of soil, rock, and drainage water that would enter the creek. A major impact to Greens Creek as a whole would not occur because mine drainage water would be diluted well below acute toxicity levels.

The mine service area, which is located on the north side of Greens Creek, is in an area of gentle and stable slopes. A low risk of slope failure is assigned to this site. If a major slide occurred, drainage patterns would be disrupted and there would be a chance that fuel and chemical reagents would be released. Short term impacts on Greens Creek would be great if those substances reached the stream.

Private Land Area - Cannery

The cannery dock area consists of moderately stable slopes. Development of the dock and other facilities (with the exception of the camp option) would not result in an increase in risk of slope failure.

FRESHWATER QUALITY
(Reference 7, 8, 27, 28, 29, 30, 31, 32, 33, 34, 35, 36, 37)

Mine Service Area

During construction, overflow from the sedimentation pond would be discharged into Greens Creek. Excess turbidity in the outflow would be controlled, if needed, by installation of a flocculation system. After construction, overflow from the sedimentation pond would only occur in events exceeding the 24-hour/10-year recurrence.

During overflow conditions sedimentation pond water going into Greens Creek would be diluted by a minimum of 1:68. The 1:68 figure is the ratio of the site area to the area of the Greens Creek watershed above this location. Table 4-1 compares sedimentation pond overflows, Greens Creek flow, mixed flow, and water quality criteria for selected water quality parameters.

Considering the accuracy of the measurements as described in Standard Methods for the Examination of Water and Wastewater,1/ no significant increases in concentration for mixed flow would be observed for most parameters. There would be some increases in mixed flow concentrations for manganese, zinc, total dissolved solids and sulfate, but aquatic life data, as outlined in EPA ambient water quality criteria, would not be exceeded. There was no high flow data available in this area of Greens Creek for turbidity and suspended solids. However, data from lower Greens Creek indicates that turbidity and suspended solid concentrations in middle Greens Creek during overflow events would be very high and would not be measurably affected by sedimentation pond overflow. Overflows from the sedimentation pond would be very fine sediments. They would already have been subjected to a settling time greater than any naturally occurring in Greens Creek. Therefore, they would flush through the creek without deposition in spawning gravels.

Potential pollutants would include chemicals used in the milling process such as sodium cyanide, copper sulphate, and other inorganic and organic salts. Fuel, hydraulic fluid, cement, and other materials would be used and stored in the mine and mine service area. Although those materials would be carefully transported, stored, and used, the potential for spillage exists. The probability of the various materials entering the stream and causing environmental damage would be low due to on-site drainage control and provisions for sedimentation. In addition, all site runoff would be directed to the tailings pond for treatment and detoxification except in Alternative 3, where the treated pond water is discharged directly into Greens Creek.

Increases in stream temperature can be expected in streams 1 and 2 during low flows of July and August. Stream 2 may contribute up to 15 percent of upper Greens creek flow during this period. A slight temperature increase may be observed in upper Greens Creek near the project area. However, it would be expected to recover quickly and not cause a significant impact.

1/ American Public Health Association et al., Standard Methods for the Examination of Water and Wastewater. 14th Edition, 1976.

TABLE 4-1

SEDIMENTATION POND OVERFLOWS

Water Quality Parameter (mg/l)(4)	Mine Service Area Site Sedimentation Pond	Existing Water Quality Greens Creek at Mine Service Area	Mixed Flow	Environmental Protection Agency Ambient Freshwater Quality Criteria for Aquatic Life-Long Term
Toxic Metals and Metalloids				
Aluminum (Al)	.1	.09	.090	.1-
Arsenic (As)	.005	.001	.001	---
Barium (Ba)	.03	.01	.01	---
Boron (B)	.08	.05	.05	1.0
Cadmium (Cd)	.002	.0002	.0002	.000012 (3)
Chromium (Cr) (1)	.005	.003	.003	.00029
Copper (Cu)	.006	.004	.004	.0056
Iron (Fe)	.2	.06	.06	.3
Lead (Pb)	.01	.005	.005	.00075
Manganese (Mn)	.4	.006	.012	---
Mercury (Hg)	.0005	.0002	.0002	.00000057 (3)
Molybdenum (Mo)	.02	.02	.02	.5
Nickle (Ni)	.01	.005	.005	.056
Selenium (Se)	.01	.001	.001	.035
Silver (Ag)	.001	.0008	.0008	.00012
Zinc (Zn)	.3	.01	.014	.047
Other Selected Parameters				
Alkalinity ($CaCO_3$)	176.	45.	47.	---
Hardness ($CaCO_3$)	290.	60.	63.	---
pH (units)	7.4	7.7	7.7	6.5-9.0
Oil and grease (hydrocarbons)	6.6	1.1	1.2	---
Suspended solids	330.	5.02 (2)	9.7	---
Turbidity (NTU)	32.	2.0 (2)	2.4	---
Total dissolved solids	510.	80.	86.	---
Sulfate (SO_4)	250.	12.	15.	---

(1) Criteria is for hexavalent chromium, not trivalent chromium.
(2) Observed values much higher for higher flows, 1,010 mg/l for SS, 195 NTU turbidity.
(3) Existing Greens Creek water quality concentrations may meet or exceed aquatic life maximum value criteria.
(4) Milligrams per liter (mg/l).

Private Land Area - Cannery

Vehicle-generated sediment would contaminate surface runoff from the facility area. Drainage ditches just above the high tide line would direct runoff into a sedimentation pond designed to hold the 10-year/24-hour storm runoff volume. Sedimentation pond overflow would enter Hawk Inlet and is discussed in the marine water quality section.

MARINE WATER QUALITY
(Reference 7, 8, 38, 39, 40, 41, 42, 43, 44, 45)

Mine Service Area

This area has no direct link to the marine environment; development of this area would have no direct impact to marine water quality. Indirect impact through the Greens Creek system would be unmeasurable in Hawk Inlet.

Private Land Area - Cannery

Wastewater from the dock and storage facilities would consist of runoff and domestic waste. Domestic waste would be treated by secondary methods and discharged offshore from the cannery into Hawk Inlet. The treatment plant and outfall would be installed during the first stages of project construction to provide treatment for wastewater from construction crews. The 2,000 to 4,000 gallons per day of domestic wastewater produced would be equivalent to flows from 5 to 10 households. Discharge of secondary effluent would meet all requirements. Surface runoff would be treated by sedimentation ponds and discharged with treated domestic waste. Concentrate handling at the dock would be by enclosed conveyor system from the loading point to the ship's hold. Spills into the marine environment would be unlikely.

FRESHWATER BIOLOGY
(Reference 5, 6, 7, 8, 28)

Mine Service Area

Construction of the mine service area, the access road to the mine portal, the bridge over Greens Creek and the mill site (Alternatives 1, 2, 4, 5, and 6 only) would result in some short term, unavoidable impact on Greens Creek and its biological community. The primary short term effects would be those related to construction of the mine access road, the bridge over Greens Creek, and site preparation for the mine service area. Those impacts would consist of temporary and localized increases in turbidity and organic detritus introduced into Greens Creek and stream 2. Although stream 1 passes through the area, it would not be disturbed. The effect on water quality from site preparation would be minimized through the use of settling ponds.

Short term turbidity increases in Greens Creek may be severe enough during certain phases of construction to cause temporary displacement of fish and aquatic invertebrates downstream. No productive anadromous fish habitat would be directly affected because all live streams would be protected by vegetative buffers where practical and routing of runoff through settling ponds. Neither of the two small streams in the mine service area contain productive fish habitat; both are very small and shallow. The lower 300 feet of stream 2 would be rerouted in a diversion channel and enter Greens Creek upstream of its present location. This would modify or eliminate the low quality char rearing habitat currently there.

Private Land Area - Cannery

Upgrading of the existing cannery facilities would require the removal or reconstruction of buildings already on the site. These activities would result in some soil disturbance and introduction of minor quantities of fine materials into the littoral zone along the shore of Hawk Inlet near the cannery. Since very little of the land on which the housing would be situated drains into Cannery Creek itself, no effects on the stream are expected.

MARINE AQUATIC BIOLOGY
(Reference 7, 8, 28, 39, 40, 43)

Mine Service Area

This area is indirectly linked with the marine environment through Greens Creek. Sedimentation pond overflows would cause small additions of fine sediments to enter the marine environment. Once in Hawk Inlet, flushing action would tend to disperse them. The net effect of this addition would be unmeasurable.

Private Land - Cannery

The area planned for new dock structures would be approximately 1.3 acres, of which approximately 0.5 acres would be in intertidal sand habitat and 0.8 acres in deep water mud habitat. These areas represent less than 5 and 1 percent, respectively, of existing intertidal sand and deepwater mud habitats in Hawk Inlet.

During construction of docking facilities, a portion of the existing pilings and debris would be removed. This activity would result in the transient disruption of sediments within the 1.3 acre area. No permanent alterations of bottom sediments would occur, and benthic organisms such as polychaete worms and clams, would not be seriously affected by sediment disruption. Epibenthic organisms, such as harpaticoid copepods, (important food items for juvenile salmonids) would be temporarily displaced from the area. Recolonization should occur within a short time after disruption. The displacement would not cause juvenile salmonids mortality, due to the small area impacted relative to other areas in Hawk Inlet.

Pilings and debris removed would be replaced by new structures within the water column. As observed with other similar marine facilities, new pilings, especially concrete, would be recolonized by marine organisms within a few years; treated wood pilings may take longer. The attraction of existing pilings and structures to schooling fish would be duplicated or improved by new structures. Therefore, use of the area by juvenile fish would not be disrupted in the long term.

Marine construction at the cannery would involve only piling removal and piledriving, with no dredging. Analysis of a cannery sediment sample has shown only trace levels of polychlorobiphenyl (PCB) present, so PCB's would not be released as a result of this activity. Disturbance of sediments due to pile removal and piledriving would be minimal, and significant release of hydrocarbons from sediments would not occur. Any releases from this construction activity would be flushed from the site. No persistent adverse biological impacts would occur.

Existing data show that the cannery site has no special resource value compared to other areas or habitat types in Hawk Inlet. Less than 5 percent of comparable habitat types would be affected by this project.

WILDLIFE
(Reference 7, 8, 46, 47, 48)

Mine Service Area

Approximately 57 acres of direct habitat loss would occur from construction of the mine service area.

The site is not located in an area of particular importance to any of the wildlife species reviewed for this project. It is of virtually no importance to Bald Eagles, waterfowl, or marine mammals. Bear and deer moving between the coastal lowlands and the high alpine areas would sense noise and activity and will avoid the facility. Marten would likely avoid the area adjacent to the mine service area.

Efficient garbage disposal practices would discourage wildlife attraction. Dumpster containers would be bear-proofed and serviced at appropriate intervals. All garbage would be incinerated with ash residues disposed of in the tailings pond.

The relatively small area involved should not pose any significant physical or behavioral barriers to animal movements. Construction activities would cause animals to avoid the area until the noise and activity levels drop to those of on-going operation. The animal avoidance zone would then decrease in size but would still exist.

Private Land Area - Cannery

Approximately 14 acres of land at the cannery would be disturbed during construction of facilities. Noise and activity would have an impact on animal use. While activities at the cannery (when it was in operation) reached a high level during summer months, this project would produce lower activity levels throughout the year.

The site does not nor would it pose a physical barrier to animal movements. Construction noise and activity will undoubtedly cause animals to avoid the area and could affect movements between the cannery and the first ridges until construction is complete.

VEGETATION
(Reference 7, 8, 20, 21, 22, 23)

Mine Service Area

Approximately 57 acres of spruce/hemlock forest would be removed and replaced by buildings, waste rock storage, vehicle staging areas, and grass. Field investigations conducted in 1982 indicated that no rare or endangered plant species were in the area.

Private Land Area - Cannery

Approximately 14 acres of spruce/hemlock forest and beach grasses would be removed and replaced by buildings and vehicle access areas. Field investigations conducted in 1982 indicated that no rare or endangered plant species were in the area.

VISUAL RESOURCES
(Reference 7, 8, 23, 24, 25)

Mine Service Area

The mine service area is located within a zone inventoried under the modification visual quality objective. Under this VQO, activities may visually dominate the original characteristic landscape. However, activities of vegetative and land form alteration must borrow from naturally established form, line, color, or texture so completely and at such a scale that its visual characteristics are those of natural occurrences within the surrounding area or character type. Activities which are predominately introduction of facilities such as buildings, signs, roads, etc., should borrow naturally established form, line, color, and texture so that its visual characteristics are compatible with the natural surroundings. The site is considered to have moderate ability to absorb visual changes and the creek zone is considered of special value to viewers on the site.

The visual changes associated with development include tree removal, earthwork, and construction of buildings. Corridor clearing of trees would be necessary to construct the road from the upper mine portal to the main (lower) portal.

Development of the mine service area would not cause a significant visual impact. Proposed changes would be visible, primarily from aircraft and ridgetops above Greens Creek, but they would not dominate the natural landscape. The expected changes would be consistent with the modification management objective.

Private Land Area - Cannery

The cannery site, due to the fire-gutted structures, receives a minimal variety class rating. However, since the site is located within the foreground viewing distance of Sensitivity Level 1 passing boats and aircraft, the inventoried visual quality objective for the site becomes partial retention. Under this VQO, activities should remain visually subordinate to the characteristic landscape.

The visual impact of the proposed changes would not be significant. The changes would be small in area, affecting only the present cannery site.

The general level of contrast and interest now found on the site would not change for the viewer in a passing boat or aircraft, or for the recreationist on the site. Although visible, the expected changes would not increase the level of contrast and would be consistent with the partial retention management objective.

NOISE
(Reference 7, 8)

Mine Service Area

Table 4-2 shows the major sources of noise associated with the continuous operation of the mine service area facilities. The location of the mine service area in Greens Creek valley limits the distance and direction of significant noise propagation. Noise from the mine service area would not extend beyond the ridge tops to the north and south 1 to 2 miles away. On the ridge tops, noise from the mine operations would be audible on calm days, but probably not noticeable in wind or rain conditions. The ridges would act as noise barriers and would prevent noise propagation further to the south, north, or east.

TABLE 4-2

MINE SERVICE AREA NOISE SOURCES

Source	Sound Pressure Level 1/
3-2200 kw diesel electric generators at 50 feet	98 dBA
Diesel powered mine equipment at 50 feet	87 dBA
Ventilation fan at 50 feet	102 dBA
Haulage trucks at 50 feet	90 dBA
Mill crushers at 50 feet	95 dBA
Combined sound pressure level at 50 feet	104 dBA
Combined sound pressure level at 1000 feet (line of sight)	78 dBA
Combined sound pressure level at 1000 feet in forest	68 dBA
Combined sound pressure level at closest ridge top to north	52 dBA
Combined sound pressure level at closest ridge top to south	50 dBA

1/ dBA are from the A-weighted decibel scale which simulates noise intensity levels perceived by the human ear.

Private Land Area - Cannery

Table 4-3 lists the major sources of noise associated with the cannery dock facility. Noises from the cannery facilities could be perceived at low levels in most of lower Hawk Inlet. At distances over a mile from the cannery dock facility noise levels would be similar in intensity to rain, wind, and breaking waves. Noise propagation into the forest would not extend past the first low ridges 0.5 miles to the east.

CULTURAL RESOURCES
(Reference 3, 4, 7, 8)

Mine Service Area

No prehistoric cultural resources have been identified in this area.

Private Land Area - Cannery

No prehistoric cultural resources have been identified in this area. One historical site (the cannery) has been identified.

PROJECT ALTERNATIVES

See Figure 2-6 for summary descriptions of the alternatives.

TABLE 4-3

PRIVATE LAND CANNERY FACILITY NOISE SOURCES

Source	Sound Pressure Level[1/]
500 kw diesel electric generator at 50 feet	85 dBA
Concentrate loading system	80 dBA
Passenger vehicles	60 dBA
Combined sound pressure level at 50 feet	86 dBA
Combined sound pressure level at 1000 feet (line of sight)	58 dBA
Combined sound pressure level at 1000 feet in forest	48 dBA
Combined sound pressure level at 8000 feet in Hawk Inlet	42 dBA

1/ dBA are from A-weighted decibel scale which simulates noise intensity levels perceived by the human ear.

SURFACE WATER HYDROLOGY
(Reference 7, 8, 27, 28, 29, 30, 31, 34, 35, 36, 37)

No Action Alternative

Under the No Action Alternative, the current natural processes would continue; no direct affect on surface water hydrology would be expected.

Alternative 1

Development of a campsite at the cannery would increase surface runoff due to the increased impervious area. Drainage would be collected in a sedimentation pond, designed to contain the 24-hour/10-year storm runoff volume.

Construction of the road from the cannery to the mine service area would have an insignificant effect on stream courses along the proposed route. Small or transitory drainage courses would pass under the road in culverts. Surface and sub-surface runoff would be intercepted by the road and rerouted a few hundred feet before being allowed to proceed downhill. Bridges that crossed major streams, especially Zinc and Greens Creeks, would be constructed to minimize the impact on existing banks or channel beds. Surface flow from road runoff would be slightly concentrated at culvert crossings; however, flow spreading devices and natural infiltration of runoff through vegetation and subsoil below the culvert crossings would prevent serious erosion results from overland flow to streams.

Location of the mill at the mine would cause no significant impact above that associated with development of the mine service area.

The development of the mine service area would influence surface water flow patterns. Precipitation, runoff, and snowmelt on the mine service area and mine portal areas would be intercepted, collected, and directed to the tailings pond for treatment and eventual marine disposal.

The development of the Cannery Muskeg tailings pond would require the diversion of a major portion of the runoff presently flowing into "Tributary Creek." This would reduce flows into "Tributary Creek" by 50 percent, based on the reduction in runoff area. Flow measurements taken in March 1982 indicate that a 60 to 70 percent reduction would be more likely for low flows. Rerouting of flows from 100 acres would permanently reduce flows in lower Zinc Creek by 3 percent, based on the percent reduction of runoff area. Low flows in lower Zinc Creek would be reduced 20 to 30 percent.

Storm runoff events exceeding 100-year/180-day recurrence would cause the tailing pond to overflow into Hawk Inlet through a designed overflow channel. To act as a point of reference, a 1000-year storm was used to calculate potential overflows. Overflow during the 1000-year event would be 83 cfs.

Alternative 2

Impacts of the road from Young Bay to the cannery on surface water hydrology would be unmeasurable. The road crosses level terrain; therefore, mass wasting is not a problem. Road segments and quarries near Fowler Creek are designed to minimize runoff and the effects of road-related sediment. Impacts to surface water hydrology from other project components are the same as Alternative 1.

Alternative 3

The tram system and location of the mill at the Cannery Muskeg tailings pond would cause no measurable impacts to surface water hydrology other than impacts outlined in Alternative 1.

Development of a tram system without a road access would require that wastewater collected at the mine site be treated and discharged directly into Greens Creek. Failure of this treatment system would result in an increase of some heavy metals in Greens Creek that would exceed ADEC water standards, but be less than toxic levels. Using lime precipitation and flocculation treatment, slight increases of heavy metals and trace elements would be expected.[2/]

Alternative 4

There are no existing major streams in the Football Field tailings pond area. Surface and subsurface flows from the 0.4 square mile area above the Football Field tailings pond have a mean annual discharge of 1.9 cfs and would be diverted around the pond area. Diversion channels would be sized to carry the 100-year event. During extreme conditions, water in the diversion channel could enter the tailings pond. During a storm of greater intensity than the 100-year event, effluent from the tailings pond would spill into Greens Creek. The overflow would be 100 cfs during a 1,000-year event.

There would be no additional impact from placing the mill adjacent to the Football Field tailings pond.

Other impacts are the same as Alternative 2.

2/ Reference 38

Alternative 5

Impacts of this alternative are essentially the same as Alternative 2, except for the North Hawk Inlet tailings pond.

No significant diversion of surface flow would be required under this alternative since there are no surface streams in the North Hawk Inlet tailings pond area. Storm events exceeding a 100-year recurrence would cause tailings pond water to overflow into the upper portion of Hawk Inlet. Overflow in a 1,000-year event would be 279 cfs.

Alternative 6

The impacts from this alternative would be essentially the same as those for Alternative 2.

Alternative 7

The impacts from this alternative would be essentially the same as those for Alternative 2. Location of the mill at the Cannery Muskeg tailings pond would cause no additional impact to surface water hydrology.

Alternative 8

The impacts from this alternative would be essentially the same as those for Alternative 1. Location of the mill at the Cannery Muskeg tailings pond would cause no additional impact to surface water hydrology.

GROUND WATER HYDROLOGY AND QUALITY
(Reference 7, 8, 31, 32, 33)

Specific information has been gathered on subsurface characteristics at the Cannery Muskeg tailings pond site and qualitative assumptions have been made for the Football Field and North Hawk Inlet sites. Ground water quality in the latter two sites was estimated from the physical geology of the areas, topographic similarities with the Cannery Muskeg site, and the presence of muskeg.

No Action Alternative

Under the No Action Alternative, the current natural process would continue; no direct affect on ground water hydrology would be expected.

Alternative 1

Hydrological impacts from development of a campsite at the cannery would be small, because the cannery area does not have a significant underground aquifer. The campsite would, however, reduce infiltration of precipitation and snowmelt to the ground water system. Impacts to ground water quality would also be insignificant. Water infiltrating into the ground water system may be of quality similar to existing levels.

The road from the cannery to the mine service area would have no significant impact to ground water hydrology or quality.

Impacts from location of the mill at the mine service area would be an insignificant addition to those for the mine service area development.

Development of the mine service area would reduce infiltration to the ground water system. This reduction is not significant.

Based upon the hydrogeology seepage analysis and with proper design, seepage from the Cannery Muskeg tailings pond would not cause significant ground water changes. However, some changes in ground water flow would occur during initial dam construction and operation. During the first 3 to 5 years of the project operation, ground water flows would increase slightly above existing levels. Later, settling of the impoundment structure and cementing of the mill tailings would slowly reduce flows. Existing ground water quality is poor when compared to surface water.

During the initial period of flow, a portion of the increased ground water would be collected in a seepage control dam and returned to the tailings pond. Upon reclamation of the project, seepage from the pond would not significantly degrade water quality, due to the extremely low seepage rates.

Alternative 2

There would be no significant impact from Juneau housing or the road from Young Bay to the cannery to ground water hydrology. Other impacts would be essentially the same as for Alternative 1.

Alternative 3

Impacts of this alternative are essentially the same as Alternative 1.

Alternative 4

The impacts would be similar to Alternative 1 except for the mill and tailings pond locations at the Football Field site.

Detailed geotechnical data is not available for this site. Subsurface conditions are assumed to be similar to conditions at the Cannery Muskeg site where data is available. Because of a greater embankment length and height, potential for seepage will be greater than for the Cannery Muskeg site. If seepage is controlled to reasonable rates (less than 20 gpm), it would have no measurable effect on existing ground water quality.

Following reclamation, seepage rates from the impoundment would be similar to or less than operational rates.

Location of the mill at the Football Field tailings pond would cause no significant additional impacts above those caused by the tailings pond itself.

Alternative 5

The impacts would be similar to Alternative 2 except for location of the tailings pond at the North Hawk Inlet site.

The flow rate and water quality of ground water seepage from the North Hawk Inlet impoundment was assumed to be similar to that for the Cannery Muskeg impoundment site. Most seepage from the North Hawk Inlet site would enter a tributary of Fowler Creek with the same general ground water quality changes as described for the Cannery Muskeg tailings pond in Alternative 1. Although the total of embankment length would be greater than the Cannery Muskeg dam, lower hydrostatic head would tend to offset this effect, resulting in similar seepage characteristics to those of the Cannery Muskeg tailings pond. The greater dam length and flat terrain would result in less success in the collection of seepage.

Alternative 6

The impacts of this alternative would be the same as Alternative 2.

Alternative 7

The impacts of this alternative would be the same as Alternative 2.

Alternative 8

The impacts of this alternative would be the same as Alternative 1.

GEOLOGIC HAZARDS
(Reference 7, 8)

Geologic hazards considered in this section include slope failure, road instability, and dam failure, resulting from natural occurrences such as earthquakes and extreme precipitation events. These factors are considered when selecting and designing tailings pond sites and other earth structures.

Tailings Pond

In evaluating the risk associated with the development of individual impoundment sites, four major criteria were considered: embankment stability, flood events, seepage, and consequences of failure. Embankment stability is determined by how the structure would perform under both static and dynamic loads. All embankments would be designed to the same factor of safety and would therefore, have the same designed risk of failure. The statistical probability of a failure due to factors not included in the design is low; the statistical risk, however, increases as the length, height, and complexity increases.

All embankments would be designed for an earthquake intensity of Richter magnitude 7.0 and a maximum acceleration of 0.3 gravity. Those parameters were derived from research and analysis of recorded earthquakes on fault systems in the vicinity of Admiralty Island. The largest recorded earthquake on the Chatham Strait Fault was of magnitude 4.8 on the Richter scale. For the Denali Fault to the north, the largest recorded earthquake was of magnitude 6.5. The Chatham Strait Fault passes within 5 miles of the mine site and would be the most likely source of a damaging earthquake, if one were to occur.

Stability of the impoundment is related to the type of material used in the construction and the controls provided to insure that construction was accomplished in accordance with design. For all alternatives, embankment construction would be carefully supervised and controlled, resulting in lower risk of failure.

Potential runoff from extreme precipitation events was an important consideration in evaluating risks associated with an impoundment. The pond would be designed to withstand the probable maximum flood (PMF) without overtopping or otherwise destroying the embankment. Ponds would be designed to retain the 100-year/180-day recurrence flood without use of the spillway. Runoff that exceeded the design storm would cause water to be released from the pond, through the spillway. The possibility of the destruction of the embankment due to a precipitation event is extremely low.

Seepage from a tailings ponds is a function of the permeability of the embankment and pond bottom, depth of water in the pond (hydrostatic head), and the permeable surface area. While all embankments are designed with an impermeable core to minimize seepage, it is likely that some seepage will occur.

Consequence of failure of a tailings ponds would depend on site characteristics, but a few general considerations are true for all options. Tailings ponds do not retain extremely large quantities of water. A dam failure would result in a relatively small outflow. Following original deposition in the pond, tailings settle out and become dense and partially cemented, which would allow only a small portion of the tailings to actually leave the pond. It would be highly unlikely, even in a severe earthquake, that all of the solid tailings would become liquified and flow out of a failed embankment, but this worst-case scenario of total overflow has been adopted for evaluation of the consequences of failure of each pond.

The nature of tailings is an important consideration in evaluating risk. The Greens Creek mill tailings material would be similar to the glacial flour deposits common in the Greens Creek watershed and throughout Southeast Alaska, except that pH would be higher and they would contain greater concentrations of insoluble metal sulfides, particularly iron sulfide. The major consequence of a tailings dam failure would be short term impact on spawning habitat. Within a few years natural sediment transport processes in the streams would remove the fine tailings material from the spawning gravels. If a natural disaster such as flood or earthquake was the cause of the failure, the streams would simultaneously be severely impacted by landslides and other sediment sources. Under these conditions, the worst impacts of an impoundment failure would probably be restricted to the immediate downstream vicinity of the dam.

It should be noted that this discussion considers potential impacts under worst-case circumstances. The assignment of risk must be considered in relative terms. Risk of failure for any of the proposed tailings pond sites should be considered extremely low, due to the construction practices proposed for this project.

No Action Alternative

Under the No Action Alternative, current natural processes would continue; no direct affect on geologic hazards would be expected.

Alternative 1

Risk of failure of the Cannery Muskeg tailings pond would be very low. Failure would occur only as the result of an extreme event that exceeded the criteria used to design the impoundment. The risk of failure as a result of flooding is low due to the design of the spillway. Precipitation which exceeds the 100-year/180-day event would result in flow through the spillway, directly to Hawk Inlet, but no damage to the impoundment.

Because of impermeable clays, bedrock, and embankment that bound the pond and the low hydrostatic head and short length of dam, this site has a low potential for seepage. If seepage rates develop that are high enough to impact "Tributary Creek", seepage can be collected and returned to the pond. Because of the low seepage rates expected from the pond, risk of potential damage to the structure resulting from seepage would be very low.

The risk of total failure of the tailings pond is extremely low. However, if such a failure did occur and if the pond tailings were reslurried (worst-case analysis), the major portion of tailings would move approximately 2,000 feet downstream from the embankment. This estimate was based on the slope of the natural ground and an assumed slope of tailings of 2.5°. Erosion of the tailings would continue until the dam was reconstructed and the recovery of the spilled tailings was completed. It would not be possible to recover all of the tailings, and local changes in the character of "Tributary Creek" would be noticeable. Most changes would be short term. The effect on spawning and rearing habitat in "Tributary Creek" is discussed under Freshwater Biology. Because of the stable chemical nature of the tailings, it was estimated that no significant increase in levels of metal ions would occur. There are no human habitations or work places in the failure path, so the risk to human life or injury would be considered very low.

Following reclamation there would be no pond existing behind the embankment and the tailings would be well consolidated and partially cemented. The risk of failure following reclamation would be extremely slight. Because of the consolidated condition of the tailings and absence of free water, the consequence of failure would be small.

In general, the risk and consequence of failure of this site are low.

Two areas of oversteepened slopes would be crossed by the road from the cannery to the mine service area. The potential for soil mass wasting, with some sediment delivered to adjacent streams, is high. A major slope failure would increase sediment levels in streams, create operational delays and could potentially rupture the mill tailings line.

The proposed mine portal site is located in an area of steep and unstable slopes. Mass wasting of soil and debris would occur during initial construction with a high probability of delivery into Greens Creek. Following construction this risk would be low.

Alternative 2

The Cannery Muskeg tailings pond would have the same level of risk and consequence of failure as Alternative 1.

The road from the cannery to Young Bay would cross an area of steep, unstable slopes with a high potential for soil mass wasting. A slope failure in this area would not impact any streams, but would create operational delays.

Effects on slope stability of the road from the cannery to the mine service area and the mine portal would be the same as those described for Alternative 1.

Alternative 3

This alternative would have the same level of risk and consequence of failure as Alternative 1.

The aerial tramway would have a minimum impact on slope stability and should not increase the mass wasting potential over the natural rate.

Alternative 4

Risk of dam failure at the Football Field site is low. A major slope cut above the pond could potentially cause a major slide into the pond. The risk of the major slide occurring is low to moderate. A major slide across the mill site could result in the pond filling with soil and debris, with the embankment being overtopped as a result.

Risk of seepage from the pond is low to moderate because of the long embankment and relatively high hydrostatic head. Because of site topography, excess seepage would be difficult to collect and return to the pond. Assumed permeability conditions are similar to those at the Cannery Muskeg site.

Precipitation that exceeded the 100-year/180-day event would be routed through a designed spillway into Greens Creek. The dam freeboard and spillway would be designed for the PMF with no damage to the impoundment. Risk of serious damage resulting from a flood would be very low since the pond does not block a major stream course or intercept flow from a large tributary basin.

Assuming a massive failure of the embankment and complete mobilization of tailings, the majority of the tailings would reach Greens Creek because of the steep hillside between the dam and creek. It would be difficult or impossible to restabilize the site and return any portion of the tailings to the pond because of the steep and inaccessible hillside. Local changes in the vegetation and water courses (including Greens Creek) would occur, although most changes would be short to moderate term.

There would be no human habitation directly below the dam, although the access road would pass between the dam and creek. Because of the difficulty in restoring the site, the direct impact on Greens Creek, and the effect on the access road, a low to moderate risk was assigned to the consequence of failure.

It should be noted that an extreme earthquake event causing a pond failure would have a similar impact on slopes and other natural features. Although a dam failure would be a significant impact, it could likely be overshadowed by the other landslides associated with the event.

In general, the risk and consequence of failure for the Football Field site would be low to moderate.

Effects on slope stability of the road from Young Bay to the mine service area and the portal area would be the same as those described for Alternative 2. The large cut associated with the quarry for the Football Field tailings pond would create a high potential for mass wasting on that slope.

Alternative 5

Risk of structural failure of the North Hawk Inlet tailings pond would be low during an extreme earthquake event.

Seepage from the impoundment would be a low risk hazard. Permeabilities are assumed to be similar to those at the Cannery Muskeg site. To an extent, the relatively low hydrostatic head offsets the increased seepage potential resulting from long embankments. Seepage that did occur would impact the north end of Hawk Inlet and the Fowler Creek drainage. A seepage collection system would be difficult to operate effectively because of the relatively flat, poorly drained muskeg located at the toe of the dams. Risk of potential damage to the structure resulting from seepage is considered low.

Risk of serious damage resulting from a flood would be very low since the pond does not block a major stream course or control flow from a large tributary basin. If the 100-year/180-day design storm is exceeded, excess water would flow across the spillway, directly into the north end of Hawk Inlet.

The consequence of failure for the North Hawk Inlet tailings pond would be low to moderate. Assuming a massive failure of the east embankment, the majority of tailings would end up in the beaver ponds and tributary streams to Fowler Creek. It would be possible to cleanup a large portion of such a spill; however, the effect on spawning and rearing habitats would continue for a period of 2 to 10 years until sufficient flushing could take place to cleanup the ponds and waterways. Failure of the west embankment would result in most of the tailings being transported to the north end of Hawk Inlet. It would be difficult to cleanup more than the small amount deposited between the dam and the inlet. Because of the poor tidal flushing characteristics of that portion of the inlet, any effects produced by this material would be long term.

Any extreme earthquake event that caused a pond failure, would have a similar impact on slopes and other natural features. Although a dam failure could have a significant impact, especially on the north part of the inlet, it would seem relatively minor compared to the impacts of other natural consequences associated with the event. In general, the risk and consequence and failure for the North Hawk Inlet impoundment would be low.

Effects on slope stability would be the same as described for Alternative 2.

Alternative 6

This alternative would have the same levels of risk and consequences of failure as Alternative 2.

Effects on slope stability would be the same as described for Alternative 2.

Alternative 7

This alternative would have the same levels of risk and consequences of failure as Alternative 2.

Effects on slope stability would be the same as described for Alternative 2.

Alternative 8

This alternative would have the same levels of risk and consequences of failure as Alternative 2.

Effects on slope stability would be the same as described for Alternative 2.

FRESHWATER QUALITY
(Reference 7, 8, 19, 27, 28, 29, 30, 31, 32, 33, 34, 35, 36, 37)

No Action Alternative

Under the No Action Alternative, the current natural processes would continue; no direct affect on freshwater quality would be expected.

Alternative 1

Location of the mill at the mine service area would create no additional impacts other than those for the mine service area development.

The campsite at the cannery would have no impact on freshwater quality. The only freshwater stream, Cannery Creek, would be kept isolated from all potential runoff from the developed area.

During project operation, flows from the waste storage area, mine service area, mine portals, mill, and minor amounts of domestic wastewater would be stored in the Cannery Muskeg tailings pond and treated. Overflows would occur from storms in excess of a 100-year event and would enter Hawk Inlet. An analysis was made of a possible overtopping from a 1,000-year event in order to assess potential changes in water quality (see Marine Water Quality).

Because of the surface drainage control methods to be used in the vicinity of stream crossings, it was estimated that direct runoff into the stream would require a break within 100 feet of a stream. With five sensitive stream crossings identified in the 6.4 miles of pipeline, a direct spill into a freshwater stream could occur only over 1,000 feet (200 feet per crossing), or 3 percent of the length of the slurry line.

Toxic chemicals and fuel would be hauled by truck to the mill site from the shiploading facility at the cannery. Concentrates would be hauled by truck from the mill area to the shiploading facility. Total daily road use was estimated to be 30 round trips. Of this total, five trips would be for hauling concentrate from the mill to the cannery with a backhaul of materials. Twelve trips would be by crew buses, two trips with fuel, five trips for material haulage, and six trips for miscellaneous inspection and administration.

The most significant toxic chemical used in the mill would be sodium cyanide which, if spilled directly into a live stream, could cause a short-term, major impact on fish and wildlife. An oil spill into a live freshwater stream would also have an impact on fish and wildlife. Spillage into a freshwater stream of other reagents used in the milling process would cause less impact than sodium cyanide, but could still cause an impact. If reagent spills were to occur away from direct contact with freshwater streams, the impact would be major in the local area of the spill, but would have no affect on the Greens Creek or Zinc Creek systems. A direct spill of any toxic substance directly into a freshwater stream during spawning or emergence could cause the loss of an entire year class of fish in downstream areas.

Between the cannery shiploading facility and the mine service area, (8.1 miles), there would be six road crossings of live streams. Design standards are such that direct runoff would reach a stream only if a spill occurred within 100 feet of a stream. The length of roadway where a spill would have a direct stream impact would be 1,200 feet, or 2.8 percent of the total roadway length. Other factors that would mitigate the risk and effects of a spill include approved reinforced shipping containers, weather constraints for shipping reagents, load-quantity limitations for reagents such as sodium cyanide, and an effective spill prevention and control plan. Taking these factors into consideration, the potential for a significant impact is low.

The road corridor from the cannery to the mine site would have the potential to generate large quantities of fluvial sediment. Both Greens and Zinc Creeks would be subject to additional sediment input from accelerated surface erosion and mass failures.

The potential for sediment production would be minimized through revegetation, road design, road location, and high standards of construction, which are discussed in other sections.

A sediment production model[3/] was used to estimate sediment production from the road corridor. The model predicted increases in sediment for Greens Creek of 10 to 20 percent the first year and 7 to 12 percent each year the road is in use. The relatively low sediment increases are generally attributed to Greens Creek high natural sediment load. Consequently, these projected increases are considered to be within the natural variability of Greens Creek and would not be a significant impact. Based on observations in the Greens Creek watershed, a number of existing major slide areas continually provide large quantities of sediment to Greens Creek.

Background sediment data for Zinc Creek was not available for comparative analysis. The road corridor in the Zinc Creek drainage crosses a high risk area for a mass failure. The sediment model estimates up to a 170 percent increase in sediment. The slide potential could be reduced with engineering design constraints and road location.

The probability of a major slope failure that could completely eradicate a section of the road from the cannery to the mine service area would be low. Sediment produced by a road-induced slide of this magnitude would result in significant stream degradation and would rupture the tailings slurry line. Typically, a major slope failure would occur during extreme precipitation events or an earthquake.

Location of the mill at the mine service area would require a 6.4-mile, partially buried tailings slurry line from the mill to the tailings pond. In the event of a slurry line failure, shutoff systems would be activated. The failure of both the slurry line and the CMP could, under a worst-case situation, directly affect water quality in Greens, Zinc, and "Tributary" Creeks. The impact of a slurry spill would be minimized if the line failure occurred away from cross drainages, since sediments in the slurry would settle and be filtered by area vegetation. The risk of failure is low.

3/ Tongass National Forest, Chatham Area. Draft Guide for Predicting Sediment Yield from Forested Watersheds. 1982.

In a worst-case failure of the slurry and mine water pipeline, the maximum amount of tailings that could be released before system shutoff is about 40,000 gallons, or 70 tons of solid tailings material. The quantity would be less if the break occurred closer to the mine. Mine drainage water would be released at a maximum rate of 2,000 gpm until a temporary pipe could be installed. Installation of the temporary pipe could normally be accomplished within 4 hours. During this period, the mine water could be settled, treated, and released directly to Greens Creek at the mine site. Such emergency treatment would provide water quality well within acute toxic limits for aquatic life. This discharge would not produce a serious long term threat to aquatic life, if repairs were completed within a few days.

Alternative 2

Impacts to freshwater quality from housing employees in Juneau would be insignificant. The road from the cannery to Young Bay traverses flat terrain, or would be located away from streams and would not be expected to have a significant impact to freshwater systems. All other impacts would be the same as Alternative 1.

Alternative 3

The tram system and location of the mill at the Cannery Muskeg tailings pond would cause no significant impacts to freshwater quality. Other impacts, except for those associated with the mine service area, would be the same as Alternative 1. No road access to the mine or a slurry line is included in this alternative.

The sedimentation pond at the mine service area would discharge into Greens Creek in all runoff events, since there would be no effluent pipeline to the Cannery Muskeg tailings pond. A typical concentration of total suspended solids would be 330 milligrams per liter (mg/l) for sedimentation pond discharge to Greens Creek from the mine service area.

For an average annual flow from 80 acres (0.4 cfs) there would be an average suspended sediment load of 120 tons per year. This load is 0.4 percent of the suspended sediment load in Greens Creek. This increase would represent an unmeasurable impact on Greens Creek water quality and could be reduced even further by additional flocculants.

Domestic waste from the mine service area would be treated in a package plant, with the sewage sludge shipped out by tram. Mine water would be treated at the mine service area sedimentation pond. Addition of lime and polymer flocculants would be necessary to precipitate toxic metals. Failure of this water treatment system would raise metal concentrations in Greens Creek while repairs were being made to the system. Metal concentrations would be below 96 hour LC_{50}, but above EPA and ADEC proposed criteria for aquatic life.

Alternative 4

The impacts from this alternative are similar to Alternative 1 except for the location of the mill and tailings pond at the Football Field which eliminates the slurry pipeline. An effluent pipeline from the tailings pond to a discharge site would still parallel the road.

In storm events exceeding a 100-year occurrence, Football Field tailings pond water would overflow into Greens Creek. Table 4-5 (page 4-36) compares tailings water to Greens Creek water, mixed water, and the maximum value water quality criteria for aquatic life in a 1,000 year runoff event. The concentration of metals goes up slightly, but would not exceed EPA 1980 criteria. Cadmium and mercury may already exceed the EPA criteria in Greens Creek. Mixed water quality for chromium, lead, nickel, and silver could not be calculated since the laboratory analysis reached its lowest detection limit for those metals. Assuming that the concentration was at the lower detection limit, the EPA 1980 water quality criteria would not be exceeded.

Potential toxic chemicals, fuel, and ore concentrate spillage impacts would be the same as Alternative 1.

The road between the cannery shiploading facility and the Football Field tailings pond and mill would be 9.6 miles long and involve eight stream crossings. Since direct runoff would reach a stream only if a spill occurred within 100 feet of a stream crossing, the length of roadway where a spill would have a direct stream impact would be 1,600 feet, or 2.8 percent of the total roadway length.

All hazards described for Alternative 1 would be present for this alternative, except that the effects of a ruptured slurry line and 80 percent of the mine water line would not be present. However, risk of rupture of the tailings pond effluent line would be present. Tailings pond effluent would pose a lesser hazard since the water would be treated to meet marine discharge standards. In addition, the surge capacity of the tailings pond would allow at least 30 days detention storage without release of any effluent to Greens Creek through the spillway.

The mill site, which would be located at the Football Field tailings pond, is located on the floor of a quarry site excavated from a steep hillside. A moderate to high risk of failure would exist at this site. Environmental effects would be small; the pond would catch any toxic material from the site. A major slide across the mill site, however, could result in filling of the pond with soil and rock debris; overtopping of the embankment could result.

Alternative 5

The impacts of this alternative to freshwater quality are similar to those of Alternative 2 except the tailings pond would be located at the North Hawk Inlet site. That site does not present additional significant potential impacts to freshwater quality with the exception that seepage or dam failure may impact Fowler Creek instead of Cannery Creek..

The tailings slurry line from the mill to the pond site would be built in the same manner as described in Alternative 1. It would be 10 miles long and would require a booster pump station for the last 2 to 4 miles. The requirement to pump tailings would increase the potential for slurry line failure because of the possibility of the line plugging. The failure of the slurry line could, under a worst-case situation, directly affect water quality in Greens, Zinc, "Tributary," or Cannery Creeks. The specific nature of water quality degradation would not be possible to predict accurately; however, the potential for slurry line failure increases with the additional length of pipeline. Since direct runoff to a stream would only take place if the break occurred within 100 feet of the stream, with eight stream crossings, a direct spill from the pipeline into freshwater streams could occur only over 1,600 feet, or 3 percent of the length of the slurry line.

Alternative 6

The effects of this alternative would be similar to Alternative 2.

Alternative 7

The effects of this alternative would be similar to Alternative 2, except that the risk of a chemical spill into the freshwater environment would be very low, and there would be the additional risk of an ore spill.

There would be no tailings slurry pipeline with Alternative 7. A 12- to 14-inch corrugated metal pipeline (CMP) for mine and site drainage water would follow the roadway to the tailings pond and would cross five streams. The quality of drainage water would not meet EPA standards for disposal directly to freshwater streams, but the concentration of metals would be below acute toxic levels for fish. A direct spill from the pipeline into freshwater streams could occur only over 1,000 feet, or 3 percent of the length of the pipeline. Because of the mine water quality and the dilution of wastewater with surface water, impacts are considered insignificant.

Haulage on the roadway from the cannery loading facility would be the same as that discussed in Alternative 1, except that the majority of toxic chemicals, fuel, and the ore concentrates would be transported between the cannery and the mill at the Cannery Muskeg tailings pond. In this road segment only one live stream (Cannery Creek) would be crossed. The remaining materials, which would include fuel and explosives, would continue the remaining distance to the mine. Ore would be hauled by truck from the mine to the mill. Only in 3 percent of the 6.4 mile road haul would an accident deposit ore directly into the creek.

Alternative 8

The effects of this alternative would be similar to Alternative 1, except for those associated with the mill at the Cannery Muskeg tailings pond. Effects of the mill location would be the same as Alternative 7.

MARINE WATER QUALITY
(Reference 7, 8, 38, 39, 40, 41, 42, 43, 44, 45)

For each alternative, treated water would be discharged from the tailings pond through a pipeline to the marine environment. This water originates as mill waste, domestic waste, mine drainage, runoff from the various project sites, and precipitation on the tailings pond. It is anticipated that this flow would average 1200 gpm.

EPA has established discharge standards for the milling process that would be used at the Greens Creek Project. These "in-the-pipe" standards set numerical limits for suspended solids and various metals that are of concern. Pilot test work performed on the milling process and tailings pond simulation indicates that effluent quality would meet or be better than the EPA "in-the-pipe" standards. ADEC has proposed marine water quality standards for discharge from the tailings pond. The proposed values are based on toxicity studies of various marine species, drinking water standards, EPA water quality criteria, and background seawater concentrations.

ADEC is currently reassessing their water quality standards. At the time this document goes to print, ADEC's standards do not allow the creation of a mixing zone for any substance that bioaccumulates. Metals and compounds present in the discharge may occur in forms that could bioaccumulate in aquatic organisms. A mixing zone may be prohibited by State law for this project.

Table 4-4 lists the EPA "in-the-pipe" standards, summarizes measurements to date of background seawater quality, and the proposed ADEC receiving water standards. Criteria for copper, lead, and silver are based on measured background concentrations in seawater near the mouth of Hawk Inlet.

For each alternative, treated wastewater would be discharged from the tailings pond through a pipeline into the marine environment. A diffuser would be installed at the end of the pipeline to aid in the dilution of the effluent with marine waters.

Initial mixing from the diffuser port is a direct function of energy in the discharged flow upon release from the port. A high energy (high exit velocity) discharge would result in turbulent mixing with surrounding water. As proposed in the conceptual diffuser design (Figure 4-3) this turbulent zone (initial jet dilution zone) would consist of an area of 200 feet by 500 feet by approximately 40 feet deep. Table 4-5 presents a comparison of concentration increases at the limits of this zone against ambient seawater quality and proposed ADEC criteria (24-hour averages).

TABLE 4-4

PROPOSED STANDARDS AND BACKGROUND
SEAWATER QUALITY

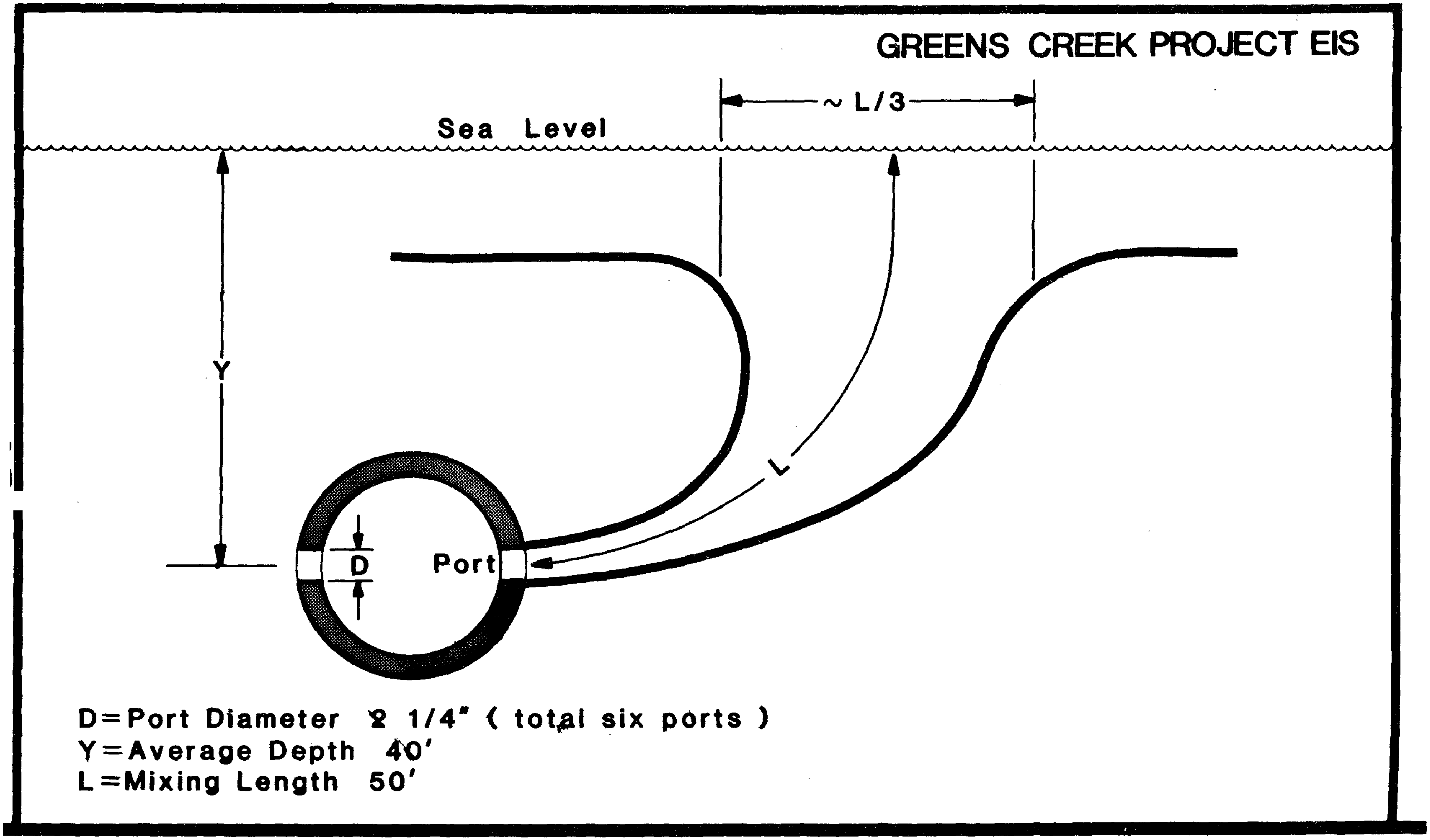
Paremeter	U.S. EPA "In-the-Pipe" Standards (1)	Background Seawater Quality (2)	Proposed ADEC Receiving Water Standards (3)
TSS	20	---	---
Cu	0.15	.006 - .015	.015 (.004)
Zn	0.5	.005	.058
Pb	0.3	.006 - .008	.008 (.007)
Hg	0.001	.0005	.000025
Cd	0.05	.0002	.01
As	(0.1)	.0009	.005
Cr	(0.1)	.002 - .014	.018
Ni	(0.1)	.008	.007
Se	(0.1)	.0005 - .006	.01
Ag	(0.1)	.004	.004 (.0023)

(1) These values are based on EPA discharge requirements from the Federal Register 40 CFR 440 for effluent from mining and milling operations using the flotation process. For the values in parenthesis, no EPA criteria exist. 0.1 mg/l was used as a conservative value based upon pilot studies which indicate that a better quality effluent is likely.

(2) Background seawater quality is based on two samples taken at the mouth of Hawk Inlet. Samples collected in 1982 reported copper and lead values much lower than displayed. Due to the large variability in marine water quality reported and comments from other agencies, the Hawk Inlet water qualify needs to be better defined before any conclusion can be drawn on the effluents effects on water quality.

(3) Values in parenthesis are ADEC standards based on toxicity and drinking water standards. Background seawater quality is higher for these metals and has been proposed as the ADEC standard.

The analysis of seawater samples is subject to numerous interferences that raise the lower limits of quantification.



Definition Sketch For Turbulent Jet Mixing Analysis With A Diffuser

Figure 4-3 **Green's Creek Project**

TABLE 4-5
PROJECTED CONCENTRATION AT EDGE OF INITIAL DILUTION ZONE

Parameter	Background Seawater (3) (mg/l)(1)	Assumed Discharge Quality(2) (mg/l)	Receiving Water Edge of Initial Dilution Zone (4)(5) Hawk Inlet Sill (mg/l)	Chatham Strait (mg/l)	Proposed ADEC Standards (mg/l)
TSS (Total Suspended Solids)	---	20	---	---	---
Cu	.006-.015	.15	.00656-.0155	.0069-.0158	.004*
Zn	.005	.5	.0069	.0081	.058
Pb	.006-.008	.3	.0072-.0091	.0078-.0098	.007*
Hg	.0005	.001	.000502	.000503	.000025*
Cd	.0002	.05	.0004	.00051	.005
As	.0009	.1	.0013	.0016	.005
Cr	.002-.014	.1	.00238-.0143	.0025-.015	.018
Ni	.008	.1	.00836	.00858	.007*
Se	.0005-.006	.1	.00089-.00636	.0011-.0066	.010
Ag	.004	.1	.0044	.0046	.0023*
Total Cyanide			See Table 4-6		
Free Cyanide			See Table 4-6		

(1) Milligrams per liter (mg/l)
(2) 1,200 gpm design discharge rate.
(3) Background seawater quality based on two samples collected in Hawk Inlet. Samples collected in 1982 reported copper and lead values much lower than displayed. Due to the large variability in marine water quality reported and comments from other agencies the Hawk Inlet water quality needs to be better defined before any conclusion can be drawn on the effluents effect on water quality.
(4) Steady-state concentrations for Hawk Inlet water based upon dilution into the upper 50-feet of the inlet depth, since most mixing is limited to that depth. This is a conservative approach since some mixing with greater depth would occur. Sixty hours build-up for Hawk Inlet Discharge, 20 hours build-up for Chatham Strait discharge at steady-state.
(5) Initial dilution ratios for Hawk Inlet sill discharge 265:1, for Chatham Strait discharge 160:1.

* Background seawater quality may exceed the proposed ADEC standards.

REFERENCE 44.

Effluent quality within the discharge pipe is assumed to meet EPA standards for mill water discharge. Based on this comparison, effluent concentrations at the edge of the initial jet dilution zone are below ADEC proposed criteria for aquatic life, with the exception of copper, lead, and silver. Concentrations of these three metals are slightly higher than ambient seawater in Hawk Inlet. This difference is within the limits of analytical error.

While the chemistry of the average effluent is known, the variability and chemical behavior of heavy metals and trace elements in saltwater is unknown and impossible to determine without extensive state-of-the-art research.

A freshwater discharge, mixing with seawater, would rise until densities approximately balanced. The initial turbulent mixing and the mixing that occurs during rising of the discharge produces initial dilution. For a freshwater discharge of 1200 gpm at an assumed 40-foot depth, using the diffuser described, an initial dilution of up to 140 parts of receiving water to one part discharge water would be expected.

No Action Alternative

Under the No Action Alternative, the current natural processes would continue; no direct affect on marine water quality would be expected.

Alternative 1

Based on the available data the effect of the Chatham Strait discharge location on marine water quality is considered to be insignificant.

No dye release studies were conducted at this site, however, current velocity measurements were made in September 1981. Tidal velocities recorded at the Hawk Point stations indicate some effluent would enter Hawk Inlet. An extrapolation of the dye study to include this tidal data indicates that, at equilibrium, the equivalent of 10 to 20 hours of effluent discharge will accumulate and remain in Hawk Inlet for the life of the project. Table 4-6 illustrates discharge buildup in Hawk Inlet for the two discharge options.

Under this alternative the Cannery Muskeg tailings pond would overflow into the lower portion of Hawk Inlet during extreme rainfall events. Water quality of overflows would be similar to normal tailing pond discharge. See Table 4-7. The overflow would enter Hawk Inlet through a designed spillway as a point source between the cannery and the Greens Creek delta. The overflow would be of short duration (up to 6 hours), and localized water quality degradation would occur during the overflow. Proposed ADEC standards would be exceeded during the overflow. Mathematical modeling indicates that flushing of such an isolated, short duration spill would be at least 95 percent complete within 60 hours after the spill. Localized dilution would proceed more rapidly. The impact of such an event would be insignificant due to the short duration and dilution from runoff waters.

TABLE 4-6
AVERAGE CONCENTRATION IN HAWK INLET WATER
RESULTING FROM DISCHARGE

Parameter	Assumed Discharge Quality(1) (mg/l)	Background Seawater(2) (mg/l)	Average Quality After Discharge (3)(4) for Discharge at Hawk Inlet Sill (mg/l)	for Discharge at Chatham Strait (mg/l)	Proposed ADEC Regulations (mg/l)
TSS	20	-----	------	------	-----
Cu	.15	.006-.015	.006025-.015025	.0060082-.0150082	.004*
Zn	.5	.005	.00508	.005027	.058
Pb	.3	.006-.008	.00605-.00805	.006016-.008016	.007*
Hg	.001	.0005	.0005002	.000500055	.000025*
Cd	.05	.0002	.000208	.0002027	.005
As	.1	.0009	.000916	.0009055	.005
Cr	.1	.002-.014	.002016-.014016	.0020055-.0140055	.018
Ni	.1	.008	.008016	.0080055	.007*
Se	.1	.0005-.006	.000516-.006016	.0005055-.0060055	.010
Ag	.1	.004	.004016	.0040055	.0023*
Total Cyanide	.2 (5)		(5)		
Free Cyanide	.2 (5)		(5)		

(1) 1,200 gpm design discharge rate.
(2) Background seawater quality based upon two series of samples in Hawk Inlet area. Samples collected in 1982 reported copper and lead values much lower than displayed. Due to the large variability in marine water quality reported and comments from other agencies the Hawk Inlet water quality needs to be better defined before any conclusion can be drawn on the effluents effect on water quality.
(3) Steady-state concentrations for Hawk Inlet water based upon dilution into the upper 50 feet of the inlet depth since most mixing is limited to that depth. This is a conservative approach since some mixing with greater depth would occur. Sixty hours buildup for Hawk Inlet discharge, 20 hours buildup for Chatham Strait discharge at steady-state.
(4) Increases projected above background as a result of the discharge shown underlined.
(5) After initial dilution, free cyanide levels are expected to be less than .0002 mg/l and the average levels in the inlet are expected to be at least 1000 times less than that value. Reference 34, 43.

* Background seawater quality may exceed the proposed ADEC standards.

REFERENCE 44.

TABLE 4-7

WATER QUALITY OF MINE DISCHARGES COMPARED TO WATER QUALITY CRITERIA

Water Quality Parameter (mg/l)(4)	Upper Level Inflows Picked Up For Mill Process Water	Discharge From 950' Level Portal	Seepage Along Surface Ore Zone	Water Quality Criteria For Drinking Water	Water Quality Criteria For Salmonids	Notes
EXPECTED FLOW	50-200 gpm	50-900 gpm	150 gpm			
Toxic Metals and Metalloids						
Al	.05	.02	.1	---	.1	(1)
As	.02	.01	.02	(2)	.05	(2)
Ba	.02	.02	.02	1.	---	
B	.05	.05	.15	1.	1.0	
Cd	.01	.005	.02	.010	.00012	
Cr	.002	.003	.003	.05	.00029	(3)
Cu	.005	.005	.015	1.	.0056	
Fe	.2	.1	2.5	.3	.3	
Pb	.01	.01	.05	.05	.00075	
Mn	.1	.3	.2	.05	---	
Hg	.001	.001	.001	.000144	.00000057	
Mo	.01	.01	.02	.5	.5	
Ni	.01	.01	.02	.0134	.056	
Se	.005	.005	.005	.010	.035	
Ag	.0001	.0001	.002	.050	.00012	
Zn	.06	.3	.6	5.	.047	

(1) Not an EPA criteria.
(2) Alaska standard is .05 mg/l. EPA does not permit any detectible arsenic in drinking water.
(3) Chromium from natural sources is normally in trivalent form. In an oxidizing environment it gradually changes to hexavalent chromium.
(4) Milligrams per liter (mg/l).

Alternative 2

Based on available data, the effect of a Hawk Inlet sill discharge location on marine water quality is considered to be insignificant.

The average heavy metal and trace chemical concentrations within all of Hawk Inlet would be higher than for a Chatham Strait discharge since under steady state conditions more discharge would be accumulated in Hawk Inlet (50-60 hours of discharge). Table 4-5 illustrates this buildup. Even with the buildup, however, the effects of the discharge upon average Hawk Inlet water quality would not be detectable.

Alternative 3

This alternative would have the same impact as Alternative 1.

Alternative 4

This alternative would have the same impact as Alternative 1, with the exception that tailings pond overflows would be routed into upper Greens Creek and then into the marine environment. Refer to the Surface Water Quality section for a discussion of those impacts.

Alternative 5

This alternative would have the same effect as Alternative 2 in terms of effluent discharge. Tailings pond overflows from the North Hawk Inlet pond, under extreme rainfall events, would spill into upper Hawk Inlet.

Water quality of overflows would be similar to normal tailings pond discharge (see Table 4-4). The overflow would be routed to Hawk Inlet through a spillway as a point source at the upper end of Hawk Inlet. The overflow would be of short duration, ranging up to 6 hours. Localized water quality degradation would occur during the overflow. Proposed ADEC water quality criteria would be exceeded during overflow. Dye studies indicate that upper Hawk Inlet has poor flushing characteristics.

Mathematical modeling indicates that such an isolated, short duration spill would require approximately 200 hours to attain 95 percent flushing after the spill. Localized dilution would proceed more rapidly. Detention time in the upper inlet waters, however, could be significant.

Alternative 6

This alternative would have the same effect as Alternative 1.

Alternative 7

This alternative would have the same effect as Alternative 1.

Alternative 8

This alternative would have the same effect as Alternative 1.

FRESHWATER BIOLOGY
(Reference 5, 6, 7, 8, 28)

No Action Alternative

As the Juneau area population increases, increased pressure on the sport fishery would be expected.

Alternative 1

The roadway from the mine service area to the Cannery Muskeg tailings disposal site would be constructed and maintained according to Forest Service standards for construction of arterial roads. All bridge abutments and footings would be placed out of the floodplain or protected from erosion and placed to minimize debris accumulation. Some local increases in turbidity and sediment availability would be anticipated at stream crossings, but disturbed soils would be stabilized and revegetated. Sediment increases are expected to be both minor and temporary although temporary displacement of aquatic invertebrates and some resident fish downstream in Zinc Creek and Greens Creek may result. Sediment increases are not expected to be large enough to degrade downstream productive riffle areas through siltation or to smother aquatic invertebrates.

Under normal operating conditions, the slurry pipeline system is not expected to influence the aquatic environment. In the event of a total conduit failure (precipitated by a landslide or other catastrophic event), material from the CMP system could enter live streams. If a catastrophic failure were to occur, it would probably take place during heavy precipitation and high stream flows. Since the amount of material that might enter any live stream would be small compared to discharge, the effects on the aquatic environment, although significant, would be short term, and masked by the effects of the catastrophic failure.

Locating the tailings disposal area at the Cannery Muskeg site would eliminate 2,700 feet of the 5,600 feet of "Tributary Creek" presently accessible to anadromous fishes. Permanent flow reductions eliminate another 30 percent of the remaining stream. Fish using that reach of stream include Dolly Varden char, cutthroat trout, pink salmon, coho salmon (especially juveniles) and sculpin. Good spawning habitat in "Tributary Creek" is limited to about 15 to 20 square yards. The chief value of the stream is as rearing habitat for those fish with freshwater rearing phases. Since the production of those species depends upon survival to the smolt stage, effects on their productive capacity can be measured in terms of habitat for yearling and older juveniles. Based on electrofishing studies and habitat evaluation conducted in 1981, slightly less than three-fourths of the available rearing habitat for coho or older juvenile anadromous salmonids would be directly eliminated by implementation of this alternative. This amounts to a productive capacity of about 350 juveniles for each species (Dolly Varden char, cutthroat trout, and coho salmon). Put into perspective for the system, the estimated productive capacity for all of "Tributary Creek" represents approximately 3.5 percent of the Zinc Creek run and about 0.9 percent of the run for the Greens Creek/Zinc Creek system.

Based on an assessment of habitat quality for cutthroat trout, results of quantitative population estimates for "Tributary Creek," and qualitative electrofishing efforts for Zinc Creek, it is expected that a similar percent reduction in the stream's productive capacity would be realized for cutthroat. For Dolly Varden char, the proportional reduction in the system's productive capacity is expected to be smaller than 0.4 percent.

Since pink salmon do not have a freshwater rearing phase, effects on productive capacity for this species can be measured in terms of spawning habitat. Observations made in 1981 indicated that a maximum of about 250 adult pinks entered "Tributary Creek" and that about 160 fish moved upstream of the proposed dam site. Another 30 fish would be prevented from spawning due to flow reduction. In 1981, an estimated 12,300 pink salmon escaped to Zinc Creek and at least 45,000 fish escaped into Greens Creek. Based on the limited availability of spawning habitat and a greater vulnerability to bear predation in "Tributary Creek" than in either of the larger streams, it is estimated that 1.5 percent of the productive capacity for the Zinc Creek run, or about 0.4 percent of the Greens Creek/Zinc Creek system run, would be lost due to the implementation of this alternative.

Mitigation measures proposed for this alternative would result in at least an equivalent replacement of lost habitat. The net effect of mitigation for this alternative might be an increase in total fish habitat for the Zinc/Greens Creek system.

Renovation of the cannery area would involve a significant amount of disturbance of the land and would produce some short term increases in turbidity and surface runoff. Surface runoff would not enter any freshwater bodies.

Depending on the intensity of human use of the surrounding area for leisure time activities, spontaneous development of foot trails in the Cannery Creek watershed could occur. Presence of foot trails is not expected to have a discernible effect on fish resources. The effects of the camp on biological resources in Cannery Creek are expected to be minor. A significant amount of leisure time fishing can be expected to occur around those streams with harvestable populations of pink and coho salmon and Dolly Varden char (Zinc Creek, Greens Creek, Piledriver Creek, Wheeler Creek, and possibly two or more of the unnamed creeks at the north end of Hawk Inlet). Although the levels of recreational harvest are impossible to predict, the possibility exists that excessive harvest could cause a reduction in anadromous adult escapements.

Alternative 2

The configuration of the mine to cannery road, slurry pipeline, and tailings pond elements of Alternative 2 are the same as for Alternative 1. Consequently, expected effects on the freshwater environment and associated biota would be the same.

The Young Bay to cannery road would have to cross the upper portion of two tributaries to Fowler Creek. Crossings of perennial streams would be accomplished with bridges or culverts, utilizing appropriate safeguards to minimize increases in turbidity. Minor, short term unavoidable local increases in turbidity would probably occur during construction. Since no fish resources exist in these small streams, no direct effects on fish populations would occur in Fowler Creek.

The road between the dock at Young Bay and the cannery would cross the unnamed tributary to Young Bay near its mouth, downstream of a beaver pond and marsh. The crossing would have no effect on the stream or its biological resources except for some possible minor and biologically insignificant increases in turbidity during construction.

Alternative 3

In Alternative 3, the tailings pond and camp facility options are the same as Alternative 1. The mill would be located at the Cannery Muskeg tailings pond. Construction of the tailings pond would cause a permanent, unavoidable loss of habitat in "Tributary" and Zinc Creeks, due to displacement and flow reduction. Mitigation measures would result in at least replacement of lost habitat.

Impacts of the tailings pond and camp on aquatic habitats and associated biota would be substantially the same as those associated with in Alternative 1.

Because no cannery to mine service area road would be constructed under this alternative, a wasterwater line would be infeasible. In Alternative 3, treated mine water drainage would be released directly into Greens Creek. In the event of failure of the treatment plant, untreated mine water would enter Greens Creek. The discharge would have levels of zinc that were below acute toxicity levels, but higher than EPA/ADEC criteria for aquatic life. The effect on aquatic biota would be minor.

Alternative 4

The road from the mine site to the Football Field tailings pond would have a similar effect on freshwater biota as the road between the mine and tailings pond described in Alternative 1. Because of the greater length of the road, some risk of increased turbidity to Greens Creek is associated with this alternative.

A slurry line is not included in this alternative. A failure of the tailings effluent pipeline, due to a landslide or some other catastrophic event, would result in the release of that water into local streams, probably Greens Creek. The quantity of water released would be small and would be quickly diluted by Greens Creek. The effects of such an event would be minor and of a short duration.

Alternative 5

The configuration of the road from the mine site to the cannery and from the cannery to Young Bay is substantially the same as the road routes in Alternative 2.

Implementation of this alternative would result in reduced flow in a major tributary to Fowler Creek. This tributary contains no fish resources; therefore, no direct effects on productive capacity for fish, either resident Dolly Varden char or anadromous fish, would occur. The reduction in flow of the main stem of Fowler Creek would be small, and no significant effect on the productive capacity of Fowler Creek would be anticipated. The tailings slurry and mine drainage water, as described in Alternative 1, would have to be pumped from a point near the Cannery Creek crossing, to the North Hawk Inlet tailings pond site. This would present some risk of failure. If the failure occurred over or near a live stream, some significant short term effects on water quality and biological resources would be expected.

Alternative 6

The overall configuration of this alternative is the same as Alternative 2, except for the location of the marine discharge. Effects of implementation of this alternative on the freshwater environment and associated biota would be identical to those described for Alternative 2.

Alternative 7

The overall configuration of this alternative is similar to that of Alternative 2, except that the mill would be located near the Cannery Muskeg tailings pond site and effluent would be discharged in Chatham Strait. The effects of implementation on the freshwater environment and associated biota would be the same as in Alternative 2. The location of the mill near the Cannery Muskeg tailings pond would result in increased sediment production due to the truck hauling of ore. The effect of this sediment increase is expected to be minor.

Alternative 8

The overall configuration of this alternative is the same as Alternative 1, except the mill would be located near the Cannery Muskeg tailings pond and effluent would be discharged in Chatham Strait. The expected effects of Alternative 8 on freshwater biology would be the same as Alternative 1. No significant effects are anticipated due to location of the mill at the Cannery Muskeg tailings pond.

MARINE AQUATIC BIOLOGY
(Reference 7, 8, 28, 39, 40, 43)

A review of several aspects of toxicity of metals to aquatic biota is necessary to clarify the basis for the impact assessments presented below.

Environmental regulations dealing with toxic substances in aquatic systems generally address the concentrations of these substances allowed for water. Allowable concentrations are usually based on known effects on human health or levels found from laboratory studies to be acutely toxic to aquatic organisms. The most widely used measure for such studies is the 96-hour LC_{50}, (the concentration of that substance that results in the death of 50 percent of the test organisms within 96 hours).

Allowable concentrations for regulatory purposes are often set at a conservative fraction of an established LC_{50} value (e.g., one one-hundredth application factor) as in the case of the proposed ADEC water quality criteria applied to the Greens Creek project. Attainment of these criteria is generally considered to be sufficient to ensure protection of the biota exposed to the effluent.

LC_{50} values for metals are derived from laboratory tests using measured quantities of metals introduced as salts into solution. They thus represent the response of the organism to metals present in ionic form in solution. They are not relevant to the issue of whether enhanced metal levels in tissues or organisms would occur or what would be the effects of those increased levels. No direct relationship can be established between LC_{50} concentrations for a metal and the tissue levels that a healthy organism can sustain in the field. Evaluated tissue levels in organisms may indicate high environmental levels. Some scientists feel this may indicate that a population is being stressed. Synergistic effects, (the effect of two metals together) in some cases has been shown to lower the LC_{50} concentrations documented for a single metal. The effects on marine organisms is not known at this time and cannot be determined without significant research.

Levels of metals found in tissues of organisms may originally have been in solution in the water, in particulate form suspended in the water, or in prey organisms consumed by the organism being studied. Organisms present in undisturbed systems normally carry elevated levels of some metals in their tissues. Increases in tissue metal levels are often observed with no lethal or sublethal effects occurring. However, organisms with increased metal levels in their tissues may be stressed. Additional increases in metal levels may cause the organism to lose its ability to detoxify the metals because all of the organisms storage sites are full. Only some species of metals are actually toxic. In the case of lead, studies have shown that only 50 percent of the lead that may result in the effluent would actually be toxic. The other 50 percent is in a form that is not harmful.

Species such as crabs, halibut, and adult salmon may not experience increased tissue metal content because they are mobile and seasonally migratory. They would not consistently feed in the small area used as a mixing zone where elevated metal levels would occur. As a result, significant bioaccumulation is not likely to occur in the short term.

Organisms chronically exposed to effluent would be those sessile forms close to the discharge point. Kelp tissue has been shown to have an affinity for lead and copper in the laboratory, but bioaccumulation rates in a natural environment are not known. Shellfish species (mussels and clams) may increase their metal burdens to some degree as has generally been observed in bivalve populations existing near sources of metals pollution. Literature based on laboratory studies of species other than those found in Hawk Inlet suggests that sublethal effects to organisms (e.g., larval deformation, reduced reproductive capability) can occur, but metal concentrations producing those effects tend to be higher than the project values discussed here. Data are not available regarding sublethal effects for the particular species that occur in Hawk Inlet.

In summary, bioaccumulation of metals in organisms occurs naturally in the pristine environment, as is evidenced by tissue burden data collected in Hawk Inlet. Organisms are capable of physiologically regulating metals within a certain range of ambient values. The proposed discharge would result in small increases over ambient metal concentrations, and the largest of these small increases would only occur over a limited area close to the discharge point.

No Action Alternative

Under the No Action Alternative, the current natural processes would continue; no significant affect on marine aquatic biology would be expected.

Alternative 1

The construction of a camp facility would have three potential impacts on marine biota: increased sedimentation as a result of runoff from the extensive area occupied by buildings, discharge relating to sewage disposal, and disturbance of marine sediments.

Due to sediment control measures, sediment in runoff would not significantly affect marine organisms. Outflow from runoff settling ponds would be discharged through the outfall of the sewage treatment plant at a depth greater than 20 feet. Benthic substrates at such depths consist of silts and clays. Any sediments discharged there would settle very quickly due to low current velocities at those depths and not alter the nature or resource value of such habitat.

The proposed sewage treatment facility for the cannery includes secondary treatment. The low anticipated discharge flow (less than 4,000 gallons per day), secondary treatment, and offshore discharge would result in no detectable alteration of water quality or adjacent benthic habitat and communities.

To install a discharge pipe for a Chatham Strait discharge, some blasting of rock along the Hawk Point shoreline would be required, and a total of about 3,000 square meters of intertidal area would be affected. Because of the resilient nature of rocky intertidal fauna, disrupted shoreline areas would be recolonized within a year or two and no persistent biological impact would occur.

The equilibrium buildup of effluent in Hawk Inlet resulting from a Chatham Strait discharge is 10 to 20 hours. This is the steady state conditions predicted by the calibrated flushing model built from 1980 and 1981 dye studies and extrapolated to Chatham Strait. Effects on marine biota are not known; however, accumulation over time represents a higher potential for effect than no accumulation. This is also true for the case of tailings pond overtopping.

Mortalities of organisms including sensitive larvae, such as Dungeness crabs should not occur. Residence time of plankton (including planktonic larvae) in the discharge vicinity would be much less than 96 hours, due to tidal flushing, further minimizing probability of mortalities.

Alternative 2

The proposed Young Bay docking facility would include a rockfill breakwater with approximately 6,000 square yards of intertidal and subtidal cobble habitat being covered by the pier and breakwater, and approximately 3,200 square yards of subtidal sand habitat being covered by the breakwater. The amount of subtidal sand habitat displaced represents less than 5 percent of that habitat type occurring over the 440 yard segment of the shoreline involved. Clams and polychaetes in that area would be replaced by species such as mussels and barnacles. Overall change in forage value of biota to fish species would be minimal.

The upgrading of the dock at the Auke Bay ferry terminal would not significantly affect marine organisms, since this area has previously been impacted by the existing dock. No concentration of aquatic resource species occur, and the projected environmental changes would not decrease the value of the area as habitat.

Mortalities of resident organisms, including planktonic larvae, would not occur. Tidal velocities at the Hawk Inlet sill are high, insuring that time of exposure to maximal effluent levels would be short, further minimizing the probability of mortality. The high velocities also result in high shear forces, which limit the dispersion of the effluent plume across the mouth of the inlet. Data on avoidance behavior of juvenile salmonids is unknown. Literature on adult Atlantic salmon suggests that the effluent plume would not block migratory movement of salmon in and out of the inlet. Even if some avoidance did occur, the restricted lateral dispersion of the plume would permit normal migratory movements.

Steady state conditions predicted using the calibrated model indicate 50-60 hours of effluent buildup in Hawk Inlet. Although no specific effect on marine biota is known, the consensus among State and Federal agency biologists indicates the longer buildup represents a higher potential threat to organisms within the inlet. Effects of overtopping the tailings pond are the same as Alternative 1.

Alternative 3

Impacts to the marine aquatic biota due to effluent discharge would be the same as Alternative 1. Other impacts are the same as Alternative 2.

Alternative 4

Marine impacts of this alternative from the Young Bay docking facility are discussed under Alternative 2 and the Chatham Strait discharge are discussed under Alternative 1. Marine impacts from overtopping of the tailings pond would be insignificant.

Alternative 5

Marine impacts of this alternative would be the same as discussed for Alternative 2, except that effluent buildup from North Hawk Inlet tailings pond overtopping would represent a higher potential threat because of the poor flushing characteristics and long retention time in upper Hawk Inlet.

Alternative 6

Marine impacts of this alternative would be the same as discussed for Alternative 4.

Alternative 7

Marine impacts of this alternative would be the same as discussed for Alternative 4.

Alternative 8

Marine impacts would the the same as those discussed for Alternative 1.

WILDLIFE
(Reference 7, 8, 46, 47, 48)

No Action Alternative

An increase in population would likely lead to an increase in hunting pressure. The TLMP revision in 1990 may schedule independent timber sales in Management Area C21. If those areas are harvested, some reduction in wildlife habitat on North Admirality Island would occur.

Alternative 1

The road from the cannery to the mine service area would cause direct habitat loss for its entire length. Approximately 177 acres would be disturbed by the road and borrow pits. The road would not cause direct habitat loss for eagles, waterfowl, or marine mammals. While having some direct impact upon marten, the primary direct habitat loss would be to deer, and to a more limited extent, bear. Total deer habitat loss would occur for 163 acres (approximately 92 percent of the length of the road), but as a percentage of total important deer winter habitat within the project area (approximately 11,000 acres) the loss would be small (1.5 percent). The amount of direct habitat loss impact upon bears is more difficult to determine since the road would not directly disturb any primary bear habitat, such as salmon streams, beach fringe areas, or grass meadows.

The indirect habitat loss from traffic activity along the road would have no substantive impact upon eagles, waterfowl, marine mammals, or most furbearers. Bear, deer, and marten would avoid the road and adjacent areas to varying degrees. Of those three species, deer would probably be the least affected. For deer, some low level impacts would occur from direct mortality due to vehicular traffic. Low level impacts would also occur due to indirect mortality caused by harassment and subsequent reduction of critical energy reserves over the life of the project. The degree to which bears would be affected cannot be accurately estimated, but some avoidance may occur.

Road construction would produce noise and activity disturbance throughout its entire length, causing wildlife to avoid the general area. Following completion, this zone of influence would likely decrease.

The Cannery Muskeg tailings pond site would make about 150 acres unusable to wildlife. This site is unimportant habitat for marine mammals and waterfowl, and of relatively moderate importance for deer, eagles, and furbearers. It is important bear habitat, largely because bear feed upon salmon in "Tributary Creek."

Construction of the pond would take most of two construction seasons (May through October) and would cause significant local disturbance and avoidance. This avoidance zone would decrease following the completion of construction. The location of the pond would displace north/south deer and bear movements in the "Tributary Creek" drainage.

The pond's contours would not cause animals to become entrapped. Except for a radius of 150 feet around the tailings outfall where the pH of the pond would approach 10.5, the pH would be between 8 and 9. This would not kill any animals entering the pond, but would irritate mucous membranes and discourage animals from returning. The indirect impact of tailings pond operation would be low. Ongoing operation would be relatively passive in nature, generating little noise or human activity.

An additional direct habitat loss of approximately 6 acres would be due to the campsite at the cannery facility. The indirect habitat loss for the surrounding project area would be high. The sheer magnitude of activity associated with a year-round camp of 225 people would be significant. The noise from increased use of roads, boats, machines, and air traffic would affect wildlife and cause their movement out of the immediate area. Movement patterns, particularly the north/south movements of bear and deer east of the cannery between the inlet and the first ridges would likely be most affected.

Workers at the campsite would also cause a substantial increase in hunting and trapping pressure upon wildlife. These activities would require additional State and Federal agency management and monitoring of the Hawk Inlet area.

Impacts associated with construction of the housing facilities would be moderate. Earthmoving, piledriving, and other construction activities would affect wildlife, probably causing movement further away from the site, until work was completed.

The presence of the mill at the mine service area would cause little additional impact. During construction of the mill, noise or activity impacts would not increase significantly above those impacts for construction of the other facilities at that site.

The wastewater treatment facility, buried discharge pipeline, and Chatham Strait outfall would cause little direct habitat loss. The passive nature of the facility and pipeline would cause little indirect habitat loss through noise or activity disturbance. Construction noise and activity would cause animal avoidance and would probably affect animal movements. Construction of the discharge line would occur outside the eagle nesting period to minimize the risk of potential disturbance.

Alternative 2

This alternative would have the same level of impact as Alternative 1 for the tailings pond and mill locations, and for the road from the cannery to the mine service area.

Less than one additional acre would be disturbed at the cannery in upgrading the existing bunkhouse facilities. The additional indirect construction impacts for upgrading the bunkhouse facilities would be minimal when compared to the other construction activities that would occur at the cannery site such as the construction of storage and docking facilities.

Direct habitat loss from construction of the Young Bay dock, involving uplands, tidelands, and submerged lands, would be about 4 acres.

The Young Bay to cannery road would disturb approximately 86 acres. It would not cause any direct habitat loss for eagles, waterfowl, or marine mammals. While having some direct impact upon marten, the primary direct habitat loss would affect deer and, to a more limited extent, bear. Deer winter habitat loss would be complete for 49 acres, about 57 percent of the length of the road. As a percentage of total important deer winter habitat within the project area (approximately 11,000 acres) the loss would be small--about 0.45 percent.

The road would not directly disturb primary bear habitat such as salmon streams, beach fringe areas, grass meadows, or known denning areas.

The indirect effects of traffic activity along the road would be similar to the effects for the cannery to mine service area road described in Alternative 1, except traffic volumes would be lower.

Construction of the Young Bay dock and road would produce noise and activity disturbance throughout their entire length, causing wildlife to avoid the general area. Following completion of dock and road construction, wildlife would likely return to the area surrounding the road corridor and the dock.

The wastewater treatment facility, buried discharge pipeline, and Hawk Inlet sill effluent discharge site outfall would cause little direct habitat loss. The passive nature of the facility and pipeline would cause little indirect habitat loss through noise or activity disturbance. Construction noise and activity would cause animal avoidance and would probably affect animal movements. Once construction was completed, animals would likely return to the area.

The potential impact from the project upon humpback whales (the only known threatened or endangered species in the project area) would be small. Boats varying in size and length presently use the Auke Bay to Young Bay route throughout the year. There have been no known direct collisions between whales and boats longer than 50 feet in the area. The existing frequency of boat traffic in Auke Bay and Stephens Passage (State ferries, commercial fishing craft, pleasure boats, etc.) is high during different times of the year. If a crew boat were to travel round-trip between Auke Bay and Young Bay three times per day, there would be a slight, unquantifiable increase in risk to humpback whales from a boat collision. There is no evidence at this time that humpback whales are being disturbed by existing levels and types of marine traffic in the area. The Forest Service has determined that this is not an action which may affect threatened or endangered species or their habitats under regulations implementing Section 7 of the Endangered Species Act.

Alternative 3

Impacts from the tailings pond at the Cannery Muskeg site, and for a Chatham Strait effluent discharge site would be similar to Alternative 1. The impacts from the campsite would be somewhat reduced because there is no road from the cannery to the mine portal with this alternative.

An estimated 100 acres would be disturbed by the tramway components. Direct habitat loss would be approximately 6.3 acres for all the tower and transfer sites associated with the tram. All potential windfall trees would be cut within a radius of approximately 200 feet of each tower or depot structure. An undetermined number of potential windfall trees would be cut along the route wherever they could threaten the cables or a passing cablecar.

Construction of the tram system would not cause any direct habitat loss for eagles, waterfowl, or marine mammals. It would have some direct impact upon marten. Since most of the tram would be above 1,000 feet in elevation, direct impact upon deer winter habitat would be small. Impacts upon bear habitat would be similarly small.

Ongoing maintenance and operation of the tram system would cause no substantial indirect habitat loss for eagles, waterfowl, marine mammals, or most furbearers. Movements of tram vehicles might cause bear, marten, and possibly deer, to initially avoid the tram corridor, but wildlife would probably accommodate to the movements to a large extent. The tram system would eliminate many human/wildlife encounters between the mine service area and the cannery.

The tram system would not pose a physical barrier to animal movements, but movements across and along the corridor could be affected. The towers and cables would pose a collision threat to eagles. The degree of risk cannot be predicted.

During the approximately one construction season it would take to construct the system, wildlife would tend to avoid a substantial portion of the project area because of the high level of noise/activity. After construction, most species would likely return to the project area.

Placement of the mill at the Cannery Muskeg tailings pond site would cause no additional direct habitat loss above that caused by construction of the tailings pond itself. Construction of the mill would likely increase animal avoidance of the site, but animal movements would not be significantly impacted by addition of the mill to the tailings pond.

<u>Alternative 4</u>

The effects of this alternative would be the same as Alternative 2, except those effects related to the Chatham Strait effluent discharge site (see Alternative 1) and the location of the tailings pond.

Construction of the Football Field tailings pond, including rock quarries, cleared areas, and the additional 1.3 miles of road would cause a direct habitat loss of 163 acres. This area is of no importance to eagles, waterfowl, and marine mammals. It is of relatively low importance to bear, deer, and furbearers. Overall direct and indirect habitat losses, would be low from construction and operation of both the tailings pond and the mill at the Football Field site.

Alternative 5

The impacts of a road from the cannery to the mine, and the mill at the mine service area would be the same as for Alternative 1. Impacts from the Young Bay to cannery road, and the Juneau housing would be the same as Alternative 2.

Construction of the North Hawk Inlet tailings pond, including rock quarries and cleared areas, would disturb 270 acres. The area is of no importance to marine mammals, and of relatively low importance to eagles. It is of relatively moderate importance to bear, deer, waterfowl, amd furbearers. A pump station to move the tailings slurry would be needed near the Cannery Creek road crossing and would create an additional noise/activity disturbance. The overall direct and indirect habitat losses and construction impacts would be relatively moderate from construction and operation of the tailings pond at this site.

Alternative 6

The effects of this alternative would be similar to Alternative 2, except the effect of the Chatham Strait effluent discharge site would be the same as Alternative 1.

Alternative 7

The effects of this alternative would be similar to Alternative 2, except those for the Chatham Strait effluent discharge site (Alternative 1) and for the location of the mill at the tailings pond (Alternative 3).

Placement of the mill at the Cannery Muskeg tailing pond would cause no additional direct loss of habitat, since the mill would be located in a quarry site used for construction of the tailings pond. Some indirect habitat loss would occur from the additional noise and activity at the mill. An increase in human/wildlife encounters at the tailings pond would occur. Ore would be carried from the mine to the mill in trucks. This noise and activity disturbance would be significant, causing increased avoidance of the road corridor and increased vehicular/wildlife contact. This would particularly impact bear, marten, and during severe winters, deer. Impacts upon animal movements would not be significantly increased over those caused by the location and construction of the tailings pond.

Alternative 8

Effects of this alternative would be similar to Alternative 1, except for the location of the mill at the tailings pond that would be similar to Alternative 7.

RECREATION
(Reference 7, 8, 12, 13, 14)

No Action Alternative

An increase in the recreational use of the project area is expected as development in the Juneau area displaces recreationists from other areas. An increase in population would be expected to lead to increased competition among recreationists.

Alternative 1

During leisure time hours, employees housed at the camp would be free to recreate. Increased competition for available fish and wildlife would occur in the Hawk Inlet area as a result of increased hunting and fishing activity by Noranda employees. State Fish and Game regulations will protect species from overharvest. Those species sensitive to human intrusion, i.e., nesting birds, brown bears, etc., would most likely be impacted by the increased human use of the undeveloped area adjacent to the project.

The effects of the increased use would extend from the Young Bay area, throughout Hawk Inlet, to the Piledriver Cove and Wheeler Creek areas. Those areas would be reached by private boats, which would be moored at limited docking facilities provided by Noranda at the cannery.

Indirect effects to the recreation resource from the campsite option would be from the impacts associated with general human habitation of the area. Wildlife/human encounters would increase.

This alternative would produce the greatest level of impact to current recreation opportunities in the Hawk Inlet and adjacent coastline areas by increasing hunting and fishing competition, increasing human activity, and increasing wildlife disturbance by project development and operation.

Alternative 1 would result in little or no change from the current recreation opportunities in Young Bay.

Alternative 2

In the long term, hunting pressure in the area is anticipated to increase as population in the Juneau area increases. The existence of a roadless and generally undeveloped recreation experience would be replaced by a developed setting.

In this alternative, the kinds of impacts resulting from workers recreating at the project site, as found in the previous alternative, would not occur.

The development of the Young Bay dock and the road from Young Bay to the cannery would alter the current hunting experience. Those hunters who tolerate roads or are attracted by roads would hunt the area. Those hunters who wanted a roadless experience would most likely find substitute areas.

The lower portion of the cannery to mine road and the Cannery Muskeg tailings pond would displace some existing deer hunting. The mine site occurs in an area that currently receives little hunting use and would result in little direct impact.

The overall impacts to recreation from Alternative 2 are less than Alternative 1.

Alternative 3

Recreational impacts for this alternative are similar to those for Alternative 1, due to the presence of the campsite. Additional major impacts to wildlife would occur during construction of the tram, primarily related to increased noise/activity levels.

Alternative 3 was given the least desirable rating.

Alternative 4

Recreational impacts for Alternative 4 are similar to, but less than, those for Alternative 2 because the Football Field tailings pond would be located in a low value hunting area.

This alternative was given the most desirable rating.

Alternative 5

Recreational impacts from Alternative 5 are similar to those for Alternative 2. Locating the tailings pond at North Hawk Inlet would slightly increase the total impact to recreation because it would be near some recreational cabins.

This alternative was given a slightly less desirable rating than Alternative 2.

Alternative 6

Effects of this alternative would be similar to Alternative 2.

Alternative 7

Effects of this alternative would be similar to Alternative 2, however, the effects of the millsite option led Alternative 7 to be given a not as desirable rating.

Alternative 8

Because of the impacts to recreation associated with locating the mill at the Cannery Muskeg tailings pond, the campsite, and the Cannery Muskeg tailings pond, this alternative was given the least desirable rating.

SUBSISTENCE
(Reference 13)

The environmental consequences of each alternative were determined by examining how each alternative would affect high value deer hunting areas. These areas were considered to be lower than 500 feet in elevation, 0.5 to 1 mile inland from the beach, and near landing sites and anchorages.

It was considered that the location of the tailings pond, the type of employee transportation on Admiralty, the location of the mill, and the location of employee housing were the components of each alternative that would have the greatest affects on deer hunting opportunities.

No Action Alternative

The primary subsistence species in the project area has been identified as Sitka black-tailed deer. Any trend that would have an impact on the deer population would, in turn, impact subsistence use. An increase in the Juneau area population would be expected to increase hunting pressure on the deer population.

Alternative 1

The major subsistence impact would be the increased number of human/wildlife ecounters and the significantly increased hunting pressures due to the presence of a year-round 225-worker camp in Hawk Inlet. There would be some high levels of disruption to subsistence opportunities from this alternative.

Alternative 2

Increased public access non vehicular, if available to upper Hawk Inlet from construction of the Young Bay to cannery road, could create some competition for subsistence resources. There would be some low levels of disruption to subsistence from this alternative.

Alternative 3

This alternative would create the most disruption to subsistence activities because the tailings pond, and the mill at the tailings pond would be located in high value hunting areas and the year-round campsite would increase hunting pressure.

Alternative 4

The Football Field tailings pond site has low hunting value and is located 3.5 miles from the coast, at an elevation of over 1400 feet; thus it is away from any usual subsistence use areas. This alternative would pose the least disruption to subsistence.

Alternative 5

The effects of this alternative would be similar to Alternative 2. There would be some low levels of disruption to subsistence activities from this alternative.

Alternative 6

The effects of this alternative would be similar to Alternative 2.

Alternative 7

Because of the impacts from the cannery to mine road, the Cannery Muskeg tailings pond, and the location of the mill at the tailings pond, this alternative would pose some high levels of disruption to subsistence activities.

Alternative 8

Because of the cannery to mine road, the Cannery Muskeg tailings pond, the campsite, and locating the mill at the tailings pond, this alternative would be the most disruptive to subsistence activities.

VEGETATION
(Reference 7, 8, 20, 21, 22, 23)

No Action Alternative

Under the No Action Alternative, the current management direction for utilization of the project area would not change.

Alternative 1

A total of 404 acres would be disturbed under this alternative.

Construction of the campsite at the cannery would disturb about 20 acres of spruce/hemlock forest and shoreline vegetation. The road corridor between the cannery and the mine service area would remove 177 acres of spruce/hemlock forest and muskeg. The Cannery Muskeg tailings pond would be cleared of 150 acres; 67 acres would be muskeg, 83 acres would be spruce/hemlock forest. The mine service area would disturb 57 acres.

Alternative 2

A total of 477 acres would be disturbed under Alternative 2.

The breakdown of that acreage is: 57 acres at the mine service area; 177 acres along the road from the mine to the cannery; 6 acres at the cannery for emergency housing; 150 acres for the Cannery Muskeg tailings pond; 86 acres of spruce/hemlock forest and muskeg along the road from the cannery to Young Bay; and 1 acre of shoreline vegetation at the Young Bay dock.

Alternative 3

A total of 327 acres would be disturbed under Alternative 3.

The breakdown of that acreage is: 57 acres at the mine service area; 100 acres of spruce/hemlock forest would be disturbed by the tramway components; 20 acres of spruce/hemlock forest and shoreline vegetation at the campsite; 150 acres of spruce/hemlock forest and muskeg at the Cannery Muskeg tailings pond.

Alternative 4

A total of 521 acres would be disturbed under Alternative 4.

The breakdown of that acreage is: 57 acres at the mine service area; 31 acres along the road from the mine to the mill at the tailings pond; 163 acres at the Football Field tailings pond; 177 acres along the mine to the cannery road; 6 acres for emergency housing at the cannery; 86 acres along the cannery to Young Bay dock; and 1 acre of shoreline vegetation at the Young Bay dock.

Alternative 5

A total of 597 acres would be disturbed under Alternative 5.

The breakdown of that acreage is: 57 acres at the mine site; 177 acres of forest and muskeg along the mine to cannery road; 6 acres at the cannery for emergency housing; 86 acres of forest and muskeg along the cannery to Young Bay road; 270 acres at the North Hawk Inlet tailings pond; and 1 acre of shoreline vegetation at the Young Bay dock.

Alternative 6

Alternative 6 would disturb 477 acres; the same number of acres that would be disturbed by Alternative 2.

Alternative 7

Alternative 7 would disturb 477 acres; the same number of acres that would be disturbed by Alternative 2.

Alternative 8

Alternative 8 would disturb 404 acres; the same number of acres that would be disturbed by Alternative 1.

TIMBER

Impacts on the timber resource are one time impacts of a long-range character. Areas developed as a part of the project would be removed from timber production for the life of the mine and the time required for rehabilitation and regrowth. The effects of implementing the various alternatives are based on the amount of road construction required, assuming an average road clearing limit of 66 feet. Clearings for the mine service area, tailings pond, and quarries were also considered. Timber volume estimates are based on data extracted from Forest Service timber type maps, developed in 1977 as a part of TLMP. Final acreage and volume will be verified when the roads are designed and slope staked, and a cruise completed. That will occur when the Final Forest Service Preferred Alternative is selected. The term commercial forest land is used here in reference to volume and site class only. It does not infer anticipated commercial use of that timber.

See Table 4-8 for a summary of the timber volume removed for each alternative.

No Action Alternative

Under the No Action Alternative, the current management direction for utilization of the project area would not change.

Alternative 1

An estimated 142 acres of commercial timber land, with an estimated yield of 3 to 5 million board feet, would be cleared under this Alternative. Of that volume, approximately 86 percent would be cut from the monument.

Alternative 2

An estimated 180 acres of commercial timber land, with an estimated yield of 4 to 6.5 million board feet, would be cleared under this Alternative. Of that volume, approximately 75 percent would be cut on the monument.

TABLE 4-8

ESTIMATED CLEARING REQUIREMENTS

ALT.	TOTAL CFL ACRES REMOVED	ACRES JRD	ACRES ANM	TOTAL VOLUME REMOVED MBF	VOLUME JRD MBF	VOLUME ANM MBF
1	142	23.2	118.8	3,198-5,174	429-748	2,769-4,426
2	180	51.6	128.4	3,946-6,448	953-1,664	2,993-4,784
3	112	15.0	97.0	2,523-4,098	277-484	2,261-3,614
4	200	51.6	148.4	4,412-7,193	953-1,664	3,459-5,529
5	180	51.6	128.4	3,946-6,448	953-1,664	2,993-4,784
6	180	51.6	128.4	3,946-6,448	953-1,664	2,993-4,784
7	180	51.6	128.4	3,946-6,448	953-1,664	2,993-4,784
8	142	23.2	118.8	3,198-5,174	429-748	2,769-4,426

CFL - Commercial forest land

JRD - Juneau Ranger District

ANM - Admiralty National Monument

MBF - Thousand board feet

Alternative 3

An estimated 112 acres of commercial timber land, with an estimated yield of 2.5 to 4 million board feet, would be cleared to allow development of facilities. Of that volume, approximately 90 percent would be cut on the monument. Restoration of the cleared tramway area to timber production would require the least time and cost of all the alternatives. This alternative would also require the least amount of clearing.

Alternative 4

An estimated 200 acres of commercial timber land, with an estimated yield of 4.5 to 7 million board feet, would be cleared under this alternative. Of this volume approximately 78 percent would be on the monument. This alternative would require the most clearing.

Alternative 5

The effects of this alternative to the timber resource would be the same as Alternative 2.

Alternative 6

The effects of this alternative to the timber resource would be the same as Alternative 2.

Alternative 7

The effects of this alternative to the timber resource would be the same as Alternative 2.

Alternative 8

The effects of this alternative to the timber resource would be the same as Alternative 1.

AIR QUALITY
(Reference 1, 2, 7, 8)

No Action Alternative

Under the No Action Alternative, current air quality levels would be expected to remain the same.

Alternative 1

Projected increases in ground-level concentrations of dust and sulfur dioxide resulting from the proposed mining and milling operations would be less than 10 percent of the corresponding federal ambient air quality standard. Small amounts of road dust might be raised during extended dry periods. No significant adverse impacts on air quality or on the flora or fauna in and around the project area would be anticipated.

Alternative 2

The effects of this alternative would be similar to Alternative 1.

Alternative 3

Power generation equipment would be split between the mine site and the Cannery Muskeg tailings pond area. Projected increases in concentrations of all pollutants at both the mine and mill location amount to less than 10 percent of the corresponding ambient air quality standard. No significant adverse impacts on air quality would be anticipated.

Alternative 4

Maximum increases in ground-level concentrations of all pollutants would occur on the elevated terrain west of the Football Field tailings site. Smaller increases would occur at the mine site. In each case, projected increases for sulfur dioxide and total solid particulates would be less than 7 percent of the corresponding federal ambient air quality standards.

The projected increase in annual average ground-level concentration for nitrogen oxides represents 34 percent of the federal ambient air quality standard. Small amounts of road dust might be produced during dry periods.

Alternative 5

Effects of this alternative would be similar to Alternative 1.

Alternative 6

Effects of this alternative would be similar to Alternative 2.

Alternative 7

Effects of this alternative would be similar to Alternative 3. In addition, because of truck transport of ore to the mill at the Cannery Muskeg tailings pond, additional road dust and vehicular emissions would occur. This is not expected to exceed federal ambient air quality standards.

Alternative 8

Effects of this alternative would be similar to Alternative 7.

VISUAL RESOURCES
(Reference 7, 8, 23, 24, 25)

No Action Alternative

Under the No Action Alternative, current natural processes would continue; no significant affect on the visual resource would be expected to occur.

The TLMP revision in 1990 may schedule timber sales on the Mansfield Peninsula; the visual resource could then be altered.

Alternative 1

All proposed facilities would be located in inventoried partial retention VQO areas. The cannery dock facility, the cannery to mine service road, and the mill at the mine service area all would meet the VQO. The campsite would meet the VQO, as long as facilities were designed to reduce impacts below the significant level. The Cannery Muskeg tailings pond would meet the VQO only if reclamation takes place in a timely manner. Substantial mitigating design measures would be necessary to achieve the partial retention VQO there.

Alternative 2

All components of this alternative would be located in inventoried partial retention VQO areas, except the Young Bay dock. That dock area would be in a retention VQO area. The dock area has a distinctive variety class rating, and is located in the foreground of a high sensitivity area.

The Young Bay dock would not meet the VQO unless major mitigation measures were incorporated in the design. The Young Bay to cannery road would meet the VQO as long as mitigation measures were incorporated in planning, design, and reclamation.

The impacts from the cannery dock, Cannery Muskeg tailings pond, the cannery to mine road, and the mill at the mine site, would be the same as Alternative 1.

Alternative 3

The tram system would pass through areas with inventoried partial retention and retention VQO's. Primarily because the tram towers would have a significant impact, the tram system would not be able to meet the retention VQO.

Locating the mill at the cannery would meet the VQO if substantial mitigation measures were carried out in its design.

The impacts of the cannery dock, the Cannery Muskeg tailings ponds, and the campsite, would be the same as Alternative 1.

Alternative 4

The Football Field tailings pond and the mill site are located in an area of common visual variety, in the background of a low sensitivity location. It would fall within a inventoried modification VQO area and would meet that VQO.

The impacts from the Young Bay dock and the Young Bay to cannery road would be the same as Alternative 2.

The impacts from the cannery dock and the road from the cannery to the mine service area would be the same as Alternative 1.

Alternative 5

The North Hawk Inlet tailings pond area would be located in an inventoried partial retention VQO. The area has a common variety rating, and is located in the foreground of a medium sensitivity area. Locating the tailings pond at the North Hawk Inlet site would not meet the partial retention VQO due to the quantity of earthwork visible.

The Young Bay dock, the Young Bay to cannery road, the cannery to mine road, and the mill at the mine service area would be the same as Alternative 2.

Alternative 6

The impacts from the Young Bay dock and the Young Bay to cannery road would be the same as for Alternative 2.

The impacts from the Cannery Muskeg tailings pond, the road from the cannery to the mine, and the mill at the mine service area would be the same as for Alternative 1.

Alternative 7

The Cannery Muskeg tailings pond and the cannery to mine road would be the same as Alternative 1.

The Young Bay dock and the Young Bay to cannery road would be the same as Alternative 2.

The mill at the Cannery Muskeg tailings pond would be the same as Alternative 3.

Alternative 8

The mill at the Cannery Muskeg tailings pond would be the same as Alternative 3.

All other components would be the same as for Alternative 1.

NOISE
(Reference 7, 8)

No Action Alternative

Under the No Action Alternative current noise levels would be expected to remain the same.

Alternative 1

Noise during construction would come from heavy earth-moving equipment, blasting, chain saws, and helicopters and would occur mostly during the construction season. Noise levels would be essentially equivalent to noise levels generated during operation by haul trucks and mine equipment. The maximum noise levels would move with the road building crew, affecting different areas along the routes.

The presence of the campsite at the cannery would add typical residential noises (shouts, radios, etc.), in the range of 50 to 60 dBA. Noise intensity from the diesel electric generator would be about 100 dBA at 50 feet. Noise associated with operations at the Cannery Muskeg tailings pond would be from vehicles used for shift changes and inspections. Small gasoline powered passenger vehicles traveling at low speeds, on gravel roads, would have noise intensities of 50 to 60 dBA.

The concentrate-hauling trucks would have maximum noise intensities of 90 dBA at 50 feet. This noise would be generated about 10 times daily during daylight hours. Noise from the trucks would be perceived above natural background noise, such as rain and wind, for 2 to 3 miles in line of sight distances and for 1 to 1.5 miles in the forest. Other smaller trucks and passenger buses would generate lower noise levels, at a maximum of 85 dBA, 20 to 25 round-trips daily. The increase in noise would not be considered significant for this alternative.

Alternative 2

Elimination of the camp and the noise associated with a camp would not result in noise intensities being significantly different from Alternative 1.

Alternative 3

This alternative would have no vehicle-generated noise. The tram operation would be generally quiet. The diesel-electric generators would have to be situated at the jig-back transfer station on the ridge top. With a noise intensity of 100 dBA at 50 feet, a continuous low intensity, low frequency sound would be perceived in all open areas for several miles. Location of the mill at the Cannery Muskeg tailings pond would increase noise concentrations in that area.

Alternative 4

Location of the tailings pond at the Football Field site would not result in noise intensities being significantly different from Alternative 1.

Alternative 5

The location of the tailings pond at North Hawk Inlet site would not result in noise intensities being significantly different from Alternative 1.

Alternative 6

This alternative would have the same effect as Alternative 2.

Alternative 7

Location of the mill at the Cannery Muskeg tailings pond would increase noise concentrations in that area and along the proposed road corridor. Ore trucks would make about 35 trips per day. Noise levels would be increased along the proposed road corridor and at the Cannery Muskeg tailings pond.

Alternative 8

This alternative would have the same effect as Alternative 7.

CULTURAL RESOURCES
(References 3, 4, 7, 8)

One prehistoric site has been identified that could be impacted by the proposed development. The site is located near an unnamed creek, adjacent to Young Bay.

No Action Alternative

Under the No Action Alternative, the cultural resource would not be affected.

Alternative 1

This alternative would have no effect on historic or prehistoric resources.

Alternative 2

The road will be routed to come no closer than 100 feet to the site, thereby mitigating any potential adverse effects. The site, which is composed of a shell midden and fire-cracked rock, is above the high-tide boundary. A small beaver pond restricts the area of access that the road could transverse. Potential mitigation proposed consists of routing the road around the site. A detailed archeological investigation was conducted during the 1982 field season to determine the boundary, depth, and significance of the site. No action will be taken without consultation with the State Historic Preservation Officer and, if needed, the Advisory Council on Historic Preservation.

Alternative 3

This alternative would have the same level of impact as Alternative 1.

Alternative 4

This alternative would have the same level of impact as Alternative 2.

Alternative 5

This alternative would have the same level of impact as Alternative 2.

Alternative 6

This alternative would have the same level of impact as Alternative 2.

Alternative 7

This alternative would have the same level of impact as Alternative 2.

Alternative 8

This alternative would have the same level of impact as Alternative 1.

SOCIOECONOMICS
(References 7, 8, 15, 16, 17)

The current issues, as expressed by Juneau, focus on a desire to diversify its economy, the lack of rental housing, and the diminishing supply of dispersed recreation opportunities.

The recreation portion of this Environmental Consequences section addresses the potential effects of the project on recreational opportunities. Some of that assessment is repeated here to better describe the total potential effect on Juneau. The emphasis of the socioeconomic section focuses on the available housing and economic diversification issues.1

Potential impacts on community services such as schools, police protection, etc., have not surfaced as significant issues in the community. The City and Borough planning staff believe that if Noranda employees were to be housed in Juneau, the increased demand on services could be accommodated. The Juneau Comprehensive Plan has assumed an increase of 300 jobs in the community due to the Noranda project and has incorporated the additional community service needs resulting from that increase in the plan.

Assuming the development period occurs from 1983 to 1985, the construction labor force would begin at about 40 workers in June 1983, and peak at 200 in mid-1984. Average employment would be 60 for 3 months in 1983, 160 for 9 months in 1984, and 190 for 12 months in 1985. About 50 percent of the development workforce would come from the study area. Most local workers would come from Juneau, but Angoon and Hoonah would also be possible sources. By June 1985, the development workers would be able to live in Juneau and travel daily to the project under those alternatives having the Juneau housing option.

Some secondary employment would be expected during the construction phase because of increased demand for goods and services. The number of secondary employees generated would be small, principally because construction employees would be on the island 5 to 6 days per week, and they would spend a relatively small proportion of their wages in Juneau. Assuming an employment multiplier of 0.2 secondary employees for each direct construction employee, 12 (3 months in 1983), 32 (9 months in 1984), and 38 (12 months in 1985) secondary employees would be added to the local economy. It seems likely all secondary employees would be local.

The employment impact during development would be as follows:

	Total Employed	Non-local Employees	Local Employees
1983 (3 months)	72	30	42
1984 (9 months)	192	80	112
1985 (12 months)	216	90	126

The increase in population, assuming a population/employment ratio of 1.25 as in 1980, would likely be approximately 38 (3 months in 1983), 100 (9 months in 1984), and 112 persons in 1985.

No Action Alternative

The No Action Alternative would preclude the hiring of approximately 150 people from the Juneau area to fill project jobs. Opportunities for jobs from secondary employment would also be lost. The opportunity for Juneau to diversify its economy would have to be met by other segments of the economy.

Alternative 1

Under this alternative, employees would be housed on Admiralty Island in an employees only camp. No individual residences would be built on the island. It has been assumed that approximately 50 percent of the employees needed (115 workers) under this alternative would be drawn from the local economy. Because of the campsite option in this alternative, a high employee turnover rate (300 percent per year) is also expected to occur.

Many of the employees might retain residences and families in other areas. Employees who enter the local community and wish to rent housing in Juneau would affect the existing shortage of housing units. The 1981 rental vacancy rate in Juneau was virtually zero percent; a minimum vacancy rate of 3 to 4 percent would be necessary to provide some choice in housing.

This alternative would decrease the dispersed recreation opportunities by the presence of project employees hunting and fishing during their leisure time in the Hawk Inlet area.

Total Noranda payroll during operation would be $11.7 million per year (in 1981 dollars). Based on estimated personal outings and considering the local multiplier effect, total spending in Juneau is estimated at $4.3 million annually.

Alternative 2

This alternative would house employees in Juneau, and Noranda would transport them daily to and from the project area. A total of 315 people would be employed, with 275 full time employees and the remainder in training status.

Under Alternative 2, Noranda estimates that approximately 50 percent of the workforce, or 158 persons, would be hired locally. Total employment associated with operation of the mine, including primary and secondary employment, would be approximately 643 persons. Therefore, if 158 persons are recruited from outside of the study area, the number of new jobs for local residents would be 485. Assuming the level of unemployment remain near the 1981 level, the population would increase only slightly.

The total Noranda payroll which would be directly attributable to the Greens Creek project would be approximately $15 million per year; estimated to be about 4 percent of the Juneau payroll in 1986. Most of this income would be expected to be spent locally. Additional local income would result from the multiplier effect of spending and respending. Based on estimated personal outlays of Noranda employees at a local spending multiplier of 1.3, a total spending in Juneau of $19.5 million annually would be a result of the project. This alternative would result in the greatest economic benefits to Juneau.

Government fiscal impacts would be reflected in increases in tax revenues from property and sales taxes. Property tax revenues would increase as the assessed value of the borough property rises with more building of residences and commercial structures. Sales tax revenues would rise with the increased level of spending.

Tax revenues would be expected to increase by around $1 million per year in 1981 dollars. This estimate is based on annual payroll, the multiplier effect, and the relationship of tax payments to payroll in 1981. The anticipated level of tax revenues would be more than sufficient to meet increased costs of government.

Public facilities such as sewage treatment facilities, fire protection, police protection, and hospitals should not be measurably affected by this alternative.

The implementation of this alternative would be expected to increase demand for owner-occupied homes. Noranda plans to supply rental units by 1985, if the need exists. Analysis indicates approximately 85 rental units would be required to house mining personnel.

Public facilities that would be impacted by the increased population include schools, roads, and parking. About 158 workers could be drawn from outside the community. Of that 158, about 60 percent (95 workers) would be married, with children. Assuming 1.4 children per household, 133 children would enter the school system.

By busing employees, no significant increase to traffic volumes should occur.

Dispersed recreation opportunities would be reduced by project development. Housing employees in Juneau would mean that those employees who wished to pursue dispersed recreation would do so in equal competition with the rest of the Juneau population.

Alternative 3

This alternative would have the same impacts as Alternative 1.

Alternative 4

This alternative would have the same impacts as Alternative 2.

Alternative 5

This alternative would have the same impacts as Alternative 2.

Alternative 6

This alternative would have the same impacts as Alternative 2.

Alternative 7

This alternative would have the same impacts as Alternative 2.

Alternative 8

This alternative would have the same impacts as Alternative 1.

OPERATIONAL EFFICIENCY

Various factors influence the operation of a mine, including the spatial distribution and grade of orebodies, the technology used, access, environmental protection measures, workforce morale, and safety. Tradeoffs and mitigation measures made between these factors in developing alternate operating plans must be reasonable and feasible.

Major factors which affect the operating efficiency of this type of mining project include:

1. Degree of complexity of the mining/milling systems.

2. Morale and job satisfaction of the labor force. The operation of a project such as the Greens Creek mine requires trained, experienced personnel in order to achieve any reasonable degree of production. An average period of 6 months is considered a minimum length of time to properly train employees, and 1 year is an industry standard expected for allowing an employee to reach full production capabilities.

Factors that would influence the period an employee works with a project are important considerations in the overall operation of the mine. Extended periods away from families, and complexity of the mining process influence worker satisfaction. Worker job satisfaction is critical to the efficient operation of a mining project.

3. Employee safety. State and federal laws mandate the safe operation of mining projects. All portions of the project are subject to these regulations. However, the mining company has considerable latitude in determining details of the mining methods, transportation systems, mill process, etc.

Alternative 1

With the mill located at the mine site, coordination of the project would require less supervisory personnel. Power generation facilities would be in one location, reducing duplication of electrical systems. Employees would be located in one specific area, which would significantly aid in coordination of activities when emergencies arise.

The location of the mill and the tailings pond, connected by a gravity operated slurry line, represent an efficient method of ore processing and tailings transport.

Housing employees in a camp could cause significant labor problems. Under similar situations in which a camp was used, a 300 percent annual employee turnover rate was not unusual. High turnover rates reduce the efficiency of the operation and the quality of workers which would normally be hired.

Construction of the outfall would create some difficulties related to the laying of the underwater pipeline and anchoring of the diffuser. Operation of the system would be similar to that for the Hawk Inlet sill discharge point, except that the risk of failure of the line is greater due to the line length and crossing conditions in Hawk Inlet. This line location would also result in a slight risk of disruption as a result of boats dragging anchors across the line.

Alternative 2

A 30 percent annual employee turnover would be projected for this alternative. Review of other comparable mining operations indicates that turnover is relatively low when employees live in a family environment. Low levels of employee turnover can significantly increase the productive efficiency of the mine.

The housing of employees in Juneau would require daily transport to and from the island. Bad weather could limit or eliminate some shift changes which would have some effect upon the operation of the mine. Noranda has assumed that at least one shift change would not be possible 12 days per year.

Noranda considers the sill discharge site to be the most efficient of the two sites considered.

Alternative 3

The location of a mill, away from the mine, would require the duplication of power generation facilities and the need for additional supervisory and service personnel. The transfer of ore by tram to the mill site would create a number of operational problems. The mill would be run on a continuous basis. Interruption of the ore supply for periods longer than ore stockpiles make up would require the mill to be shut down.

The tram system included in this alternative would present the greatest difficulty in the operation of the mine. The tram limits the flexibility (ability to efficiently react to changing conditions) of the mining operation to transport supplies, employees, and ore. As it is envisioned for this project, the tram would be one of the longest jig-back systems in the world without a road connecting both ends of the system.

The tram system could not be operated when wind gusts exceeded 50 mph which is estimated to occur about 100 days per year.

Alternative 4

This alternative would present certain operational difficulties related to the operation of the mill away from the mine. It would require truck haulage of ore 1.3 miles from the mine to the mill. Wastewater from all sources would be pumped uphill to the tailings pond and backfill material needed for the underground mining activities would be slurried back to the mine. The complexity of the mining operation would be significantly increased under this alternative. All other aspects of this alternative would be similar to Alternative 2.

Alternative 5

The operation of the mine/mill complex would have the same problems or constraints discussed under Alternative 2.

This alternative would have a slurry line that would require a pump station, because the tailings pond would be higher in elevation than part of the pipeline route.

The potential for plugging of a tailings line with a sag point and pump station would be greater than with a continuous gravity feed system. If the line became plugged, considerable time and effort would be required to reopen the line. A plugged line also increases the risk of line failure. It should be noted that the actual potential for line breakage would be very small; however, the potential is greatest for this alternative.

Alternative 6

Most aspects of this alternative would be the same as Alternative 2, with the exception of the effluent discharge point in Chatham Strait which is discussed in Alternative 1.

Alternative 7

This alternative would be subject to the same constraints as found in other alternatives with the mill located away from the mine. Ore would have to be trucked downhill from the mine site, to the mill, located at the Cannery Muskeg tailings pond. Coarse tailings material would then have to be trucked back to the mine site to be used in the mine workings as backfill. Operational problems related to locating a mill remote from the mine are further discussed in Alternative 3. Other effects are similar to Alternative 2. The Chatham Strait discharge site is discussed in Alternative 1.

Alternative 8

Alternative 3 discusses operational constraints associated with development of a mill at the Cannery Muskeg tailing pond. Other effects are similar to Alternative 1.

COST ANALYSIS

Capital and operating costs for each alternative have been estimated for an 11-year operating life of the mine, which represents the known life of the orebody. These costs have been summarized in Table 4-9.

For purposes of this evaluation, economic considerations are limited to a display of costs by various categories. These costs are based on 1981 prices and increased at an annual rate of 10 percent to take into account future inflation. Since each alternative has a different projected stream of costs, a present value calculation has been made for each alternative at a 15 percent discount rate. This allows for an equal comparison of alternatives having different cost streams.

Due to the very competitive nature of the mining industry, reliable revenue projections to evaluate the economic project benefits were not attainable. This was especially true for gold and silver, where international speculation on the economic well-being of worldwide markets is a major factor influencing prices. Consequently, the economic feasibility of each alternative is not explicity evaluated. The alternatives considered presented a range of economic, environmental, and social trade-offs. All alternatives are assumed to be feasible and attainable.

Alternative 1

Important factors contributing to total costs include the high cost of operating the camp and the high cost of the Chatham Strait discharge site. The most significant cost is the operation of the camp which currently ranges between $35 to $40 per man per day. The total number of workers under this alternative is relatively small, but the actual payroll is moderate because of the long work week, overtime pay, and cost for training as a result of the high anticipated turnover of employees.

TABLE 4-9
PRESENT VALUE COST SUMMARY

	Alternative 1		Alternative 2		Alternative 3		Alternative 4		Alternative 5		Alternative 6		Alternative 7		Alternative 8	
	Cap.	Op.	Cap.	Op.	Cap.	Op.	Cap.	Op.	Cap.	Op.	Cap.	Op.	Cap.	Op.	Cap.	Op.
Mine/Mill Facilities	81,940	41,860	81,940	41,860	107,110	59,300	99,650	60,050	81,940	41,860	81,940	41,860	107,110	59,300	107,110	59,300
Tailings Pond	14,370	2,370	14,370	2,370	11,910	1,120	32,830	9,220	28,620	14,210	14,370	2,370	11,910	1,120	11,910	1,120
On-site Transport	3,570	6,980	6,080	10,470	55,050	36,130	6,080	10,470	6,080	10,470	6,080	10,470	7,800	20,930	5,300	17,440
Housing and Off-Site Transport	6,280	41,240	9,520	11,210	6,280	41,240	9,520	11,210	9,520	11,210	9,520	11,210	9,520	11,210	6,280	41,240
Pond Effluent Outfall	2,420	190	850	190	2,420	190	2,420	190	850	190	2,420	190	2,420	190	2,420	190
Reclamation	5,920	0	6,030	0	5,290	0	4,010	0	7,440	0	6,030	0	6,030	0	5,920	0
Other Costs	37,920	335,080	37,920	335,080	37,920	335,080	37,920	335,080	37,920	335,080	37,920	335,080	37,920	335,080	37,920	335,080
Sum of Present Value Costs	152,420	427,720	156,710	401,801	225,980	473,060	192,430	426,220	172,370	413,020	158,280	401,180	182,710	427,830	176,860	454,370
Total Present Value Cost	$580,140		$557,890		$699,040		$618,650		$585,390		$559,460		$610,540		$631,230	

Notes:

(1) All costs are reported in thousands of dollars (U. S.), escalated at 10% per year to the year of expenditure and discounted to the first year of production and reported as present value cost. Costs were estimated in January 1982.

(2) The reported costs are based on the best current estimates available.

(3) "Other" costs represent administrative and operating costs which are not included under any of the specific line items and are assumed to be constant for all alternatives. Actual mining costs are included in this category.

(4) The first column for each alternative is the estimated capital cost and the second column is the estimated operating expense.

Alternative 2

The important factor contributing to the overall cost is the high cost of transporting employees between Juneau and the cannery. The total workforce under this alternative is relatively high, but the actual payroll is moderate because of the standard work week, minimum overtime, and anticipated low turnover of employees.

Alternative 3

Important factors contributing to the costs associated with this alternative include the capital and operating cost of the aerial tramway, the high cost of operating the camp, and the cost of constructing the Chatham Strait discharge.

Use of a tramway for transport of ore, fuel, supplies, and personnel would be expensive in both front-end capital (construction) and on-going operating costs. Because the purpose of considering the tram option was to eliminate road construction in the Greens Creek valley, it was assumed that construction of the tramway would be done exclusively with helicopters. Separation of the mining and milling operation would require duplication of facilities and personnel.

In addition to capital expenditure, the tramway would be expensive to operate. Because of the limited carrying capacity of the tram cars, it would take two hours to transfer each shift. This would result in productivity losses that are reflected in the estimates as added labor cost.

A water treatment plant would be required in order to dispose of mine drainage and mine site runoff into Greens Creek. Treated plant sludge would have to be dried before shipping it on the tram for disposal elsewhere. The estimated cost for water treatment is reflected in the mine/mill facilities cost.

Alternative 4

Factors contributing to the cost of this alternative include constructing the tailings pond at the Football Field, construction of the mill at the tailings pond, and the cost of discharging effluent into Chatham Strait. The Chatham Strait discharge was discussed in Alternative 1, and the separate mill was discussed in Alternative 3. A 1.3-mile haul road would have to be constructed from the mine to the mill. Seepage control facilities and spillway construction would be expensive. Reclamation of the quarry site north of the pond would not be feasible because of the steep rock faces.

Alternative 5

The important factors contributing to the overall cost of this alternative are the cost of the slurry line and pump stations required to move tailings from the the cannery to the tailings pond site. High costs would also result from pumping effluent from the tailings pond to the Hawk Inlet sill discharge point. Pumping mill tailings and pond effluent results in high energy consumption that must be generated on site.

Alternative 6

Factors contributing to the cost of this alternative include the cost of the Chatham Strait discharge, see Alternative 1. All other factors are the same as for Alternative 2.

Alternative 7

Factors contributing to the cost of this alternative include the cost of the Chatham Strait discharge and the cost of constructing and operating physically separate mine and mill plants. All other factors are the same as for Alternative 2.

Alternative 8

Factors contributing to the cost of this alternative include the high cost of constructing and operating separate mine and mill plant facilities. All other factors are the same as for Alternative 1.

RECLAMATION POTENTIAL
(Reference 10)

Underground workings, mine service area, and the private land area would also be subject to reclamation, but are independent of the alternatives and are discussed in Section II.

Alternative 1

The major elements of the project requiring reclamation under this alternative would be the Cannery Muskeg tailings pond site and the road from the cannery to the mine service area. The total area that this alternative would disturb would be about 404 acres, including 384 acres of monument lands. Reclamation of the road would be accomplished through tilling the surface, recontouring where feasible, and revegetation. Bridges and culverts would be removed, water bars installed, and natural drainage restored before revegetation was undertaken.

Quarry sites for the road and tailings pond would be recontoured and revegetated where possible. At the completion of the reclamation phase, however, some areas where blasting of steep rock faces was done for quarry sites or road construction would remain exposed.

The tailings pond reclamation would remove free water from the settled tailings. The area would then be revegetated using suitable grasses and trees, such as red fescue, hemlock, Sitka spruce, and alder. If required for plant growth, additional soil or rock materials would be deposited on the surface of the tailings.

Reclamation opportunities for this alternative are rated good; the majority of the project area would be reclaimed. Long term impacts to the project site would include some exposed steep rock faces. Monument lands would resemble their present character after revegetation was completed and following 15 to 20 years of regrowth.

Alternative 2

This alternative would generally have the same opportunity for reclamation as Alternative 1. The only modification would be the addition of reclamation of the cannery to Young Bay road, if required by the Forest Service, and docking facilities in Young Bay.

Total land disturbance would be approximately 477 acres, with 384 acres in the monument. The feasibility of reclaiming this road and dock would be good. At the end of reclamation the dock could be completely removed, with only remnants of a breakwater remaining in Young Bay. The reclamation procedures for the Young Bay road would be the same as procedures described in Alternative 1. Final disposition of facilities below mean high tide will be determined by the terms of the State tidelands permits (ADNR).

Alternative 3

This alternative would disturb a total of 327 acres of land, including 313 acres within the monument. The reclamation potential of this alternative would be good, since there would be only limited roads requiring reclamation. Reclamation of the tram would require removal of towers and the transfer stations. At the completion of the reclamation phase, little indication of the transportation system would remain. Other aspects of reclamation would be similar to Alternative 2.

Alternative 4

This alternative would disturb a total of 521 acres, including 416 acres within the monument. The construction of the Football Field tailings pond site would require a 65-acre quarry that would be located on the hillside area, directly north of the pond. The rock materials used in dam construction would be quarried by the development of benches with steeply sloping walls. Full reclamation of the quarry would be very difficult. The steep quarry rock backslopes would be technically impossible to restore. Revegetation of the quarry floor would be accomplished with replacement of topsoil and planting.

The Football Field quarry site would be visible from within the Greens Creek valley after reclamation. The reclamation potential of other aspects of this alternative, such as roads and the tailings pond, are considered to be good. The overall reclamation potential of this alternative is considered moderate.

Alternative 5

This alternative would disturb approximately 597 acres of land, including 234 acres within the monument.

The reclamation potential of this alternative is similar to Alternative 2. The North Hawk Inlet tailings pond site could be reclaimed, as could the adjacent quarry site.

Alternative 6

Reclamation potentials of this alternative would be similar to Alternative 2.

Alternative 7

Reclamation potentials of this alternative would be similar to Alternative 2. This alternative would disturb a total of approximately 470 acres, including 386 acres within the monument.

Alternative 8

Reclamation potentials of this alternative would be similar to Alternative 1. This alternative would disturb a total of 406 acres, including 386 acres within the monument.

SECTION V
LIST OF PREPARERS

Core IDT - Forest Service

Name	Title	Section Responsibility	Experience
Charles Holstine (BS Degree)	Fisheries Biologist,	Freshwater/Marine Aquatic Biology	5.5 years
Joseph Kennedy (BS Degree)	Civil Engineer	Technical/Economic	11 years
Steven Lundeen (AA Degree)	Hydrologist	Surface water/ Groundwater	8.5 years
Jon Martin (BS Degree)	Wildlife Biologist	Wildlife	4 years
Dennis Rogers (MS Degree)	Geologist	Team Leader/ Geologic Hazards	8.5 years

Support Team - Forest Service

Ron Baer - Geologist
Helen Castillo - Admiralty Island National Monument Manager
Stan Davis - Archeologist
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Charlotte Humphrey - Word Processing
Jane Hurst - Word Processing
Jan Roach Lerum - Editor
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Additional information was contributed by:

Noranda Mining, Inc.
Aquatec
Bechtel Civil and Minerals, Inc.
Bierly and Associates, Inc.
International Environmental Consultants, Inc.
Ott Water Engineers
Martin Marietta Corp.
R and M Consultants, Inc.
Terra Nord Consultants

SECTION VI
CONSULTATION WITH OTHERS

The Forest Service, in its capacity as lead agency, conducted an extensive public and interagency consultation and coordination program throughout the development of the DEIS. The U.S. Army Corps of Engineers and the Environmental Protection Agency participated as cooperating agencies as defined in 40 CFR 1510.6 because of their administration of federal permit programs (NPDES, PSD, CWA). Federal, state and local involvement in the process are documented in Table 6-1. In addition, all baseline documents were routed to the appropriate agencies for review and comment.

During the second quarter of 1979 the Forest Service contacted a number of organizations to act as an informal advisory group in formulating a list of issues, concerns and opportunities. A briefing paper was prepared by the Forest Service and reviewed by the group at a July 31, 1979 meeting.

Based on this meeting a revised issue paper was developed and distributed during December 1979. Also during December 1979, a public workshop was held in Juneau to review the draft scoping document and solicit public response. Written comments were incorporated into a final draft and distributed in February 1980. Additional public response was requested. This document formed the basis for the scoping effort.

Two public meetings were held in Juneau during 1981 and 1982. On September 16, 1982, a meeting was held with members of the environmental community to provide an update on the status of the DEIS and to present a detailed description of alternative components. A similar meeting with other concerned groups was held on February 3, 1982 in Juneau. Public meetings were held in Juneau and Angoon in September 1982 following the release of the DEIS.

TABLE 6-1
Federal and State Involvement
Meetings Held and Number of People Attending

	Forest Service	EPA	USFWS	NMFS	COE	OG-DPDP	ADF&G	ADCED-OMD	ADNR	ADEC	City of Juneau	Village of Angoon	Noranda Mining Inc.
Review of Options (08/19/81)	7			2	1		1			2			4
Review of Options (08/20/81)	9	1	1	1	1		1			1			4
Planning Criteria (08/27/81)	9		1							2			1
Range of Options (09/03/81)	6			1									3
On Site Review (09/15/81)	1	7											1
Dye Study Results (09/16/81)	4	1	1				1			4			4
Wetland Discussion (09/24/81)	1	1			2								1
Angoon Public Meeting (10/01/81)	3											25	2
Socioeconomic Discussion (11/04/81)	2										1		2
Marine Tailings Disposal (11/05/81)	4		1	3			2		1	5			
Environmental Effects (11/17/81)	8	1	1		1		1			1			7
Environmental Effects (11/18/81)	8	1	2		2		1			1			7
Environmental Effects (11/19/81)	8	1	1		1		1			1			7
Range of Alternatives (12/17/81)	6		1					1					3
Range of Alternatives (12/18/81)	6		1	1			1	1		1			3
Mitigation (01/07/82)	3		1	1			1						3
Effects Analysis (03/03/82)	11	1	2	1			7	2	1	2	1		6
Effects Analysis (03/04/82)	9		1	1			4	1		1			5

ABBREVIATIONS USED IN TABLE 6-1

EPA	Environmental Protection Agency
USFWS	United States Fish and Wildlife Service
NMFS	National Marine Fisheries Service
COE	Corps of Engineers
OG-DPDP	Office of the Governor - Division of Policy, Development and Planning
ADF&G	Alaska Department of Fish & Game
ADCED-OMD	Alaska Department of Commerce & Economic Development - Office of Mineral Development
ADNR	Alaska Department of Natural Resources
ADEC	Alaska Department of Environmental Conservation

FINAL ENVIRONMENTAL IMPACT STATEMENT DISTRIBUTION LIST

Presented below is a list of agencies to which the DEIS and FEIS were sent. A complete mailing list, including individuals, is available at the Admiralty Island National Monument office in Juneau.

Federal Agencies

Environmental Protection Agency
United States Department of Health and Welfare
United States Department of Housing and Urban Development
United States Department of Labor
United States Department of Energy
General Services Administration
Interstate Commerce Commission
United States Department of Transportation
United States Coast Guard
Water Resources Council
Federal Energy Regulatory Commission
Federal Highway Administration
Federal Aviation Administration
Pacific NW River Basins Commission
United States Department of Agriculture, Forest Service
United State Department of Commerce
National Oceanic and Atmospheric Administration
National Marine Fisheries Service
United States Department of Defense
Army Corps of Engineers, Alaska District
Advisory Council on Historic Preservation
United States Department of the Interior
- Bureau of Land Management
- Bureau of Mines
- Fish and Wildlife Service
- Geological Survey

Alaska State Agencies (through State Conservation System Unit Coordinator)

Department of Fish and Game
Department of Natural Resources
Department of Transportation and Public Facilities
Department of Environmental Conservation
Department of Administration
Department of Commerce and Economic Development
Department of Community and Regional Affairs
Department of Education
Department of Health and Social Services
Department of Labor
Department of Law
Department of Military Affairs
Department of Public Safety
Department of Revenue
Division of Fish and Wildlife Protection
Division of Policy Development and Planning
Office of History and Archeology
Alaska Power Authority

Local Communities

Village of Angoon
City of Hoonah
City of Juneau
City of Sitka

Congressional Delegation

Honorable Ted Stevens - United States Senate
Honorable Frank H. Murkowski - United States Senate
Honorable Don Young - House of Representatives

SECTION VII

PUBLIC RESPONSE TO DEIS

Public Involvement:
A 60 day period for public review and comment was provided for this document. Copies were mailed to those individuals and groups who expressed an interest in the project, on August 18, 1982. At the same time, local newspapers carried announcements of the document's availability. Public meetings were advertised locally and held in Juneau on September 28 and in Angoon on September 29, 1982. The purpose of the meetings was to answer questions about the document and the project. The Juneau meeting was well attended by representatives of State and Federal Agencies, but attendance by the general public was light. At the Angoon meeting, private citizens were in the majority. Though the comment period ended on October 18, 1982, comments were accepted through November 15.

Response Origins:
Public involvement efforts engendered 34 written responses. Of the 34 total responses, 10 were from out of state; the remaining 24 were from within Alaska, with 13 from Juneau, 8 from Anchorage, and 3 from Ketchikan. Five of the out-of-state responses came from Washington D.C., 2 were from California, 2 from Washington State, and one from Georgia.

Only 4 responses were from individuals. Thirteen were from Federal agencies and 5 from State agencies. Five responses came from business/industry, 1 was from a sportsmen's group, 4 were from conservation groups, 1 was from a City government, and 1 was from a Native corporation.

The Comments:

As responses were received each one was given a consecutive number (written in the upper left-hand corner and circled). To enable tracking of comments listed in this summary back to the responses from which they came, this consecutive number is listed in parenthesis after each listed comment.

Three of the responses had no comment, except to say in essence that nothing in the DEIS came under the scope of their authority.

Alternative Preferences:

Of the 31 responses that had comments, 13 expressed an alternative preference. One response stated a perference for Alternative 1, but wanted housing in Juneau for Noranda employees. Two respondents preferred Alternative 2, two stated a preference for either Alternative 2 or Alternative 6, one selected Alternative 4, and seven respondents chose Alternative 6, and one chose Alternative 7. One response requested that all alternatives requiring construction of Young Bays-Hawk Inlet road be rejected. Their comments, by alternative, follow:

Alternative 1:

- The Sierra Club prefers Alternative No. 1 as the most environmentally acceptable alternative with the workers housed in Juneau. We recognize this alternative may not be realistic without the Youngs Bay Road. If the Youngs Bay road is developed, stringent policies and restrictions must be developed for the use and management of the road in the Final EIS. (29)

Alternative 2:

- While Alternative 6 is very similar to Alternative 2, the data presented did not justify the additional $2 million capital expense to move the effluent discharge point from the Hawk Inlet sill to Chatham Stait. If No. 2 is unacceptable, our choice would be No. 6. (10, 18, 32)

Either Alternative 2 or Alternative 6:

- The two preferred Alternatives No. 2 and No. 6, appear to be feasible concepts. These alternatives appear to have the necessary features to protect, and maintain, the quality and quantity of the various resource values of the area that may be influenced by the Greens Creek project. It appears that the impacts of the effluent discharge at the two sites and the degree of risk . . . varies slightly. Because of . . . potential effects . . . there is need for more information as regards impacts, degree of risk, and economic consequences of both effluent discharge sites. If more information becomes available, we may support a specific alternative. (19)

Alternative 4:

- Alternative 4 would place the mill site and tailings disposal site at the "Football field", away from sensitive fishery resources, and eliminate the need to mitigate for the lost habitat. The DEIS justifies elimination of the "football field" alternative on the basis that the tailings impoundment may fail and allow the tailings to flow into Greens Creek. However . . . the possibility of failure is described as remote or low (p. 4-33) and there appears to be no greater risk with the "football field" than with the other alternatives. The impacts (of an impoundment failure) to wildlife--especially brown bear--would be significantly greater at the USFS preferred site, while development of the "football field" would have negligible effects. (21)

Alternative 6:

- With the (effluent discharge) data presented in the DEIS, an accurate effects determination cannot be made for either (discharge) location.

However, with the information available to us at this time, we concur with the selection of Alternative 6 as the Preferred Alternative. (9)

- I would support your selection of Alternative 6. As it is laid out, there should be little if any disruption or degradation of either the mining opportunity or the scenic and wildlife values of the National Forest. (12)

- We believe this alternative best balances mine development with water resource protection, wildlife protection, and protection of monument values. (13)

- We believe that Alternative 6 best addresses the major concerns we have on the project's impact on Admiralty Island and Juneau. (15)

- We feel the preferred alternative is the best means to minimize adverse impacts on the area. (16)

- The State of Alaska recommends that Alternative 6 be adopted by the USDA Forest Service. This Alternative incorporates the State's preferred options for employee housing in Juneau, mill location at the mine site and effluent discharge in Chatham Strait. (34)

Alternative 7:

- Overall we favor Alternative No. 7 (Requested by ADF&G). (28)

Dominant Issues:

The 3 most often mentioned issues were the effluent disposal site, a perceived lack of enough information about the effects of the effluent disposal sites; and the Young Bay to Hawk Inlet road.

Of the 31 responses that had comments, 14 discussed the effluent disposal site, with 7 of these mentioning that they would have liked to see more information and data on the subject. Six respondents preferred the Chatham Strait disposal site. One respondent preferred the Chatham Strait site over Hawk Inlet, but felt that the "football field" proposal was the best option (see comments on page 2 under Alternative 4 heading). Four of those who discussed the effluent disposal matter preferred the Hawk Inlet site, and 3 others felt there was not enough information to decide the best effluent disposal site.

Seven respondents discussed the Young Bay to Hawk Inlet road. Three discussed both effluent disposal and the road. Comments on the dominant issues follow:

Supporting Chatham Strait Effluent Disposal:

- . . . we concur with the ADEC and USDA Forest Service preference for the location of the diffuser in Chatham Strait, where dispersion of the effluent plane will likely be more rapid and widespread than at the Hawk Inlet sill. This option will also minimize possible accumulation of toxic materials in Hawk Inlet. (25)

- The tailings outfall should remain in Chatham Strait. No one knows what impact mine discharge water will have on organisms living in Hawk Inlet. To prevent Hawk Inlet from becoming a giant experiment, the USDA Forest Service should continue its position supporting the discharge site in Chatham Strait. Hawk Inlet is far too important and productive to gamble with. (23)

- Effluent from tailing ponds should be discharged into Chatham Strait. (16)

- . . . we believe that Chatham Strait should receive all discharge. We do not believe that Hawk Inlet should be usd for this purpose. (13)

- We support the selection of the Chatham Strait effluent discharge over either the sill or the cannery discharges. To assist you in documenting this selection, we recommend incorporating the following material into the language of the EIS. Selection of a Chatham Strait discharge will greatly reduce the chance of sublethal chronic effects on fish and invertebrates in Hawk Inlet. Furthermore, the rocky, deep areas surrounding the effluent discharge in Chatham Strait are much less productive than the shallow nursery areas of Hawk Inlet, and potential impacts are, therefore, much lower. Although the USDA Forest Service indicates the developer can meet ADEC standards for discharge at any of the sites if they are allowed a mixing zone, the ADEC standards consider each heavy metal singly. The effluent will be a mixture of a number of heavy metals. The safety factors for each heavy metal are, therefore, much lower, since synergistic or at least additive toxicity have been shown to occur for a number of the metals. Therefore, it is important that the effluent be discharged in Chatham Strait. (21)

- Chatham Strait is a larger and deeper receiving water body than Hawk Inlet and is further away from the mouth of Greens Creek, a rearing area for salmon. At discharge equilibrium, there will be smaller increases in concentrations of heavy metals. Presently the State's water quality standards do not allow a mixing zone for discharges of heavy metals but draft regulations are being reviewed and revised. It is not possible at this time to determine if a discharge site at Hawk Inlet or Chatham Strait will meet the standards of these regulations. The Chatham Strait location would have more construction related impacts. These impacts would, however, be short term. (34)

- The cost of constructing the effluent discharge system to the discharge point in Chatham Strait is a major consideration. This represents a significant project cost during initial construction and must be weighed against the long-term environmental effects to marine receiving waters due to effluent discharge. Protection of water quality is a critical issue given the long-term nature of the project and content of the discharge. While Hawk Inlet has not been excluded from further evaluation, the Chatham Strait discharge point presents the best alternative for protection of water quality over the life of the project and is, therefore, the best choice. (34)

- Page 2-80: We concur with the assessment of higher risk associated with the Hawk Inlet sill effluent discharge site. We strongly support the Chatham Strait discharge site. (34)

<u>Supporting Hawk Inlet Effluent Disposal</u>:

- (See also discussion under Alternative 2, p. 2)

- The evaluation of the Hawk Inlet vs. the Chatham Strait disposal sites has seemed to focus on only one parameter, retention time of effluent in Hawk Inlet. However, there are a number of other parameters which should be more closely considered in the evaluation. (24)

- The resulting water quality, when emitted from the pipe, is the same at each site. Concentrations in the initial mixing zone would be somewhat higher at the Chatham Strait site than at the Hawk Inlet site because of poorer mixing at the Chatham Strait site, although in both cases water quality would be at or below proposed ADEC water quality standards for chronic toxicity to fish. The value of the biological resource is similar for both locations, although the Hawk Point site may be more sensitive to initial dilution concentrations due to the proximity of kelp beds and poorer initial dilution. Although the average concentration of effluent within Hawk Inlet is slightly less for a Hawk Point discharge than for a sill discharge, the average metal concentration increases in the Inlet are so small that the risk is insignificant for either site. The sites in terms of difference of water quality are not directly measurable through normal lab techniques; however, the land based impacts and economic constraints are sizeable.

  The outfall would have to cross a portion of Hawk Inlet which is at times used by boats during . . . heavy seas and for some fishing activity. The potential for dragging a boat anchor across the tailings line under these conditions is greater for Chatham Strait for a sill discharge.

  The construction impacts to nesting Bald Eagles is greater at the Chatham Strait discharge location than for any other portion of the project.

The economic impact with extension of the tailings pond line to Hawk Point (Chatham Strait) is significant.

It is requested that the selection of a Chatham Strait discharge site over a Hawk Inlet sill discharge site be reconsidered, but that publications of the final EIS not be delayed under any circumstances. (24)

- Our recommended solution to the effluent disposal question would include (1) disposal of the effluent through a diffuser located 40 feet deep in a well-mixed marine environment, and (2) meeting the water quality required by the NPDES permit. The information in the Draft EIS indicates that the Hawk Inlet sill discharge would satisfy both of these requirements. (6)

Not Enough Information to Decide Best Effluent Disposal Site:

- It is somewhat deficient with respect to the treatment of potential impacts of effluent discharges into the marine environment.

  The fate of these (potentially hazardous materials) upon entering seawater is only superficially considered; there is no compelling documentation set forth that harmful accumulations of toxic materials will not develop in the vicinity of the diffuser and in Hawk Inlet.

  The limited sampling, dye studies, and circulation modeling done thus far seem insignificant to conclude that no significant accumulations (of toxic material) will occur. (25)

- With the data presented in the DEIS, an accurate effects determination cannot be made for either location. (9)

- . . . recent information developed by the FS and the project sponsor and not contained in the DEIS suggests that additional analysis is needed before the FS can identify the best marine site for the impoundment wastewater discharge. (14)

Young Bay to Hawk Inlet Road:

- In spite of the many assurances in this DEIS that this road will be used only for transportation to and from Hawk Inlet, it would be naive to believe that vehicles at Hawk Inlet would not be used to transport workers to the Young Bay (east) side of the island. These individuals would be in direct competition with deer hunters, for example, who boated over from Juneau. Similarly, some Juneauites would be disposed to carry bicycles or motorcycles to Young Bay where they, in turn, would compete with other hunters on foot. We don't feel these impacts have been adequately reflected in your display matrix (p. 2-72). We, in short, are very opposed to development of this road. We recognize that Hawk Inlet, once used by many Juneauites for recreational hunting, will be lost to us during the course of Noranda's activities. We also recognize that the northwest coast of Admiralty from Cube Cove to Funter Bay will become an unattractive area for Juneau recreational hunters because of competing pressures exerted by Noranda people at Hawk Inlet. Without a road between Young Bay and Hawk Inlet, we feel the impacts of Noranda's activities will pretty much be confined to the west side of the island (hunters from Hawk Inlet would be unlikely to traverse the island).

An additional cost, if a road is built from Young Bay to Hawk Inlet, would be the loss of some and degradation of much of the locally available deer hunting opportunities for Juneau residents, Juneau-based Noranda employees and their families. This is a cost that can not be mitigated, and it is a cost that we feel Juneauites should not have to bear.

. . . we respectfully request that those Alternatives requiring construction of a Young Bay to Hawk Inlet road be rejected. (11)

- Although necessary, the road from Young Bay to Hawk Inlet could be a source of problems unless carefully managed. This road should be permitted for Noranda's exclusive use, with a guard located a the Young Bay end to limit use. After mining operations end, reclamation of the road should be required. (16)

- Our greatest concern lies with the road from Young Bay to the cannery. This road has the potential for increasing access from east Mansfield to the west and from the mine site to hunting access on the east. Concern over increased access from people at the mine site to prime hunting sites on east Mansfield prompted the State Department of Fish and Game to support a no road alternative. While no road would protect the east Mansfield hunting areas, a 300 person live-in camp at Hawk Inlet would do more overall damage to the values of the National Monument.

  The concerns about this road, however, are very real and SEACC feels strongly that our non-opposition to the road hinges on several stipulations in the Special Use Permit:

  1. The road be permitted for Noranda's exclusive use for the transport of personnel to and from the Young Bay dock.

  2. The road <u>not</u> be used by Noranda employees to access east Mansfield for recreation and hunting purposes. "No Motor Vehicles" must be strictly enforced with strong fines.

  3. A full time guard be posted at <u>both</u> ends of the road to enforce these stipulations. Install gates if needed.

4. The road be completely removed upon closing down the project. Noranda paid to put the road in; they should be able to pull it out.

5. All traces of the docking facility in Young Bay be removed.

We would like to see the permit stipulations address the following points: 1) The road will be constructed within design criteria for (a) no heavy equipment use, and (b) a one lane road for bus transport only with a minimum of turnouts. 2) The width of the right-of-way clearance needs to be an absolute minimum. 3) Any change in the permit status after it is issued must be made public for review. 4) The debris from road construction (stumps, etc.) needs to be disposed of in a sightly manner. We request a draft copy of the Young Bay to Cannery Road Special Use Permit for our review before the final permit is agreed to and signed. (23)

- We also believe that the road access permit for Young Bay to the Cannery should contain a clause restricting access to only Noranda employees. This area is already a popular recreation attraction and will become more congested as mine development proceeds. Limiting access on this road will help alleviate the recreational pressure this area will receive in the future. In addition, it will help protect subsistence use of the area. (13)

- The Sierra Club prefers no road from Young Bay to the cannery. The road development is probably more of a threat to the environment of the northern portion of Admiralty Island than the actual mining operation. If the road is developed the uses should be strictly limited to mining activities with careful monitoring. Activities permitted on the road should be specific so proper enforcement actions may be taken if violations occur. We offer the following suggestions: (1) Use of recreational vehicles must be prohibited on the road. (2) the road should not be used as a vehicle to establish timber harvest in the area, and (3) the roadbed and surrounding area must be completely rehabilitated back to its orginal state at the termination of mining activities. (29)

- Activities associated with the Juneau housing option would include a docking facility at Young Bay and a roadway from Young Bay to the cannery site. Construction of these access facilities will have impacts on recreational use patterns in Young Bay and northward along the east side of Mansfield Peninsula. Sport hunting pressure in Juneau and local environs has increased over the years and more hunters are using northern Admiralty and Young Bay for sport hunting. The quality of hunting, for those who enjoy the sport in a wilderness setting, would be impacted through the advent of a road as well as by increased hunting pressure from Hawk Inlet. Some impacts to deer migrations could occur due to vehicular traffic and creation of snow berms during snow removal operations. However, berms could be minimized through alternate snow removal methods. (34)

- A road may also provide access for sport fishing at Young Bay from Hawk Inlet. User groups from both Juneau and Hawk Inlet areas could have significant impacts to the fisheries resource from overutilization. In addition, the existence of a road could increase the potential for logging and other development activities. (34)

- The alternative of providing personnel access at the mine site by use of heavy modern fixed wing turbine powered aircraft has not been adequately addressed. Additional areas of consideration should include: (A) Reliability of access: New generation 35-50 seat twin turboprop aircraft, when outfitted with state-of-the-art navigational and landing aids, will be able to operate with virtually a 100% completion rate, even given the relative inclemencies of the coastal maritime climate at these latitudes. The Hawk Inlet/Greens Creek area provides an excellent approach and departure basin for instrumentation by microwave landing systems. (B) Cost of Access: The comparisons of all inclusive costs of access by air vs. access by highway/waterway might possibly show that air access is a more economical, though technically more complex, form of access.

  . . . my review finds the Greens Creek DEIS remiss by its failure to properly address minesite/millsite access by modern heavy turboprop aircraft. The cursory dismissal of this . . . approach reflects one which would typify an analysis by those lacking expertise in the aviation planning arena. (5)

- In the range of alternatives dismissed from further review, a hydrofoil around Mansfield to Hawk Inlet was dismissed because of "Potential for injury to marinelife, operational limitations, and maintenance problems." Given the State Department of Transportation's recent testing of a Boeing jetfoil, this option needs more explanation before it can be dismissed. A one line dismissal is far too inadequate for what seems to be a viable option. (23)

Other Issues and Comments:

Other issues and public comments are listed alphabetically. General comments are listed first under each heading. Specific comments (those which refer to a certain page or paragraph in the document) follow the general comments.

Access:

- (see also comments on Young Bay-Hawk Inlet Road, p. 6-7)

- Page XII, paragraph 2, Access: Noranda would like to restate its desire to have the road closed for all purposes with the exceptions of mine-related needs. (24)

Air Quality:

- Page 1-10: "New Source Air Quality Permit" under U.S. Environmental Protection Agency should be changed to PSD (Prevention of Significant Deterioration) Permit.

  Page 3-36, last paragraph: The "grams per meter cubed" should be "micrograms per meter cubed." (EPA Guidelines for Monitoring PSD, 1978). (14)

Concentrate Handling:

- Page 2-6, Concentrate Handling: It is not clear if the concentrate storage area at the mill site is covered. If not, what provisions are being taken to prevent spillage? (9)

- Page 2-6, Concentrate Handling: "Zinc Carbonate Concentrate." The word "carbonate" should be eliminated. (24)

Eagles, Eagle Nests:

- Page X of the summary, page 2-50, and page 2-53 indicate differing levels of mitigation for potential construction effects to eagles. Statements have been made that "Construction of access roads would be timed to eliminate the risk of potential impact to Bald Eagles." (page 2-50) and "Construction of tailings ponds would be timed to eliminate the risk of potential impact to Bald Eagles." (page 2-53). The above quotations imply that regulating construction timing is the only method of properly providing for the protection of bald eagles. For this reason, it is requested that the above quotations be deleted and that wording such as the following be incorporated into the appropriate sections of the final environmental impact statement: "Construction of access roads (tailings pond, pipelines, etc.) would be done in accordance with mitigation and monitoring plans acceptable to the USDA Forest Service, taking into account procedures recommended by the U.S. Fish and Wildlife Service for reducing the potential for disturbance to bald eagles. Mitigation measures may include timing of construction, reducing the level of construction activity in proximity to nests, providing of topographic and vegetative screening, and reduction of noise." (24)

- Page 4-72, paragraph 2: The USFS (Region 10) and the FWS have a "Memorandum of Understanding" dated 11/14/78 that the USFS will maintain at least a 330-foot radius buffer around each nest tree. It is our understanding that

  the docking and support facilities at Young Bay may encroach on this recommended buffer. If this is the case, the EIS should fully address this situation and provide the rationale for the necessity for any encroachment and measures to mitigate any adverse impacts. (21)

Effluent Discharge:

(see also comments under Alternative Preference and Dominant Issues, p. 2-6 and under Water Quality and Fish, Fisheries, and Marine Life in this alphabetized listing)

- Page 2-17, Effluent Discharge: One of the initial major disposal points was the cannery discharge. The DEIS makes no mention of this discharge point other than on pages 4-49 where Table 4-5 has water quality values. The final EIS should have a clear discussion of how and why this site was eliminated. (24)

Effluent Treatment:

- Page 2-54: It is anticipated that an acceptable level of treatment will be achieved in the tailings pond. Additional treatment of effluent will only be provided if it is found not to meet NPDES standards. (24)

Fish, Fisheries, Marine Life:

(see also comments under Water Quality in this alphabetized listing)

- Page IX, Fisheries Mitigation: The relative significance of fishery habitat loss should be clearly defined. (24)

- Page 2-56, paragraph 5, Fisheries Mitigation: We find this section lacks the necessary supporting documentation to provide the readers and decision makers with a clear understanding of the fisheries mitigation program. For example:

  1. There is no methodology presented which establishes the gains and losses in productivity, i.e., "Seventy percent," "remaining 30 percent lost production," and "additional 20 to 30 percent."

  2. The program lacks the necessary provisions for preproject baseline studies to determine the feasibility of the measure suggested, e.g., water quality parameters (including temperature and heavy metal analysis), substrate suitability, flow conditions for spawning access and outmigrants.

  To correct these deficiencies, we recommend that:

  1. Detailed methodologies, assumptions, etc., regarding the fisheries mitigation measures be presented in the EIS.

  2. A detailed preproject baseline study be implemented immediately to ascertain the feasibility of the mitigation measures. We recommend that this study be scoped and approved by appropriate State and Federal resource agencies. (21)

- Page 2-56 et seq: We are doubtful about the accuracy of the statement that "Seventy percent of the unavoidably lost anadromous fisheries production will be replaced through flow augmentation and habitat enhancement in the remaining portion of 'Tributary Creek.'" That assumption implies no degradation of water quality from roadside runoff, nor spills, etc. which might affect production. (34)

- Page 2-60, Monitoring Requirements: We suggest that the monitoring program be expanded to include water temperature, intra-gravel, as well as in the water column. (21)

- Page 2-66, Freshwater Aquatic Biota (Monitoring): Tissue analysis of Dolly Varden trout on an annual basis and fish counts during the summer do not constitute adequate monitoring of freshwater acquatic biota. At a minimum, such a program must include determinations of fecundity and egg viability, as well as evaluating the food supply supporting the fishery. A minimum food supply evaluation program could be achieved by monitoring the benthic biota at the sampling locations in spring and early summer. (21)

- Page 3-8/9: The fisheries portion omitted any information on fish in the Fowler Creek tributaries crossed by the proposed road. (34)

- Page 3-11, Marine Aquatic Biology: Since the preferred alternative calls for a discharge in Chatham Strait, some discussion of the aquatic biology in this area should be included. (34)

- Page 3-15, Fish and Fisheries Management: To our knowledge, the white spotted greenling, masked greenling, and shortfin eelpout have no commercial value. The two greenling species are caught by sport fishermen but the eelpout has no value as a sport fish. (9)

- Page 3-17, Metal Concentration in Biota: The range of values, not only averages, of metal concentrations in the organisms should be given. Even though the references are given, we recommend expansion of this section to include detailed data, i.e., the ten species of fish analyzed and the ten metals that were measured. The NMPS Auke Bay lab is currently collecting metal concentrations data in selected marine species for the Auke Bay area. We recommend that these data be obtained, if available in time, for comparison. (9)

- Page 3-26, Marine Mammals: The eight species of whales found in Southeast Alaska should be listed. (9)

- Page 3-26: We have observed humpback whales in Hawk Inlet. This has previously been transmitted to Noranda's wildlife consultant. (34)

- Page 4-63, paragraph 2, Marine Aquatic Biology: While it is true that salmon, king crab, and to a certain extent halibut are migratory, it is not true that they will not be exposed to heavy metals. Salmon species such as the pinks and the chum spend a large proportion of their early life history in estuarine areas such as Hawk Inlet. They would, therfore, be exposed to the heavy metals for a number of months before they leave the inlet. Crabs such as the Dungeness are not highly migratory and may remain in the inlet throughout their life history. Halibut may also spend several years in shallow inlets before migrating to deeper waters. A commercial shrimp fishery is also present in Hawk Inlet, and the shrimp are not migratory and would be exposed to the heavy metals throughout their life history. Therefore, many of the biota in the inlet will be exposed to the heavy metals during significant portions of their life history and bio-accumulation of heavy metals might be expected to occur. (21)

- Page 4-72, last paragraph: The DEIS states "The potential impact from the project upon humpback whales . . . would be small. We concur that there is no evidence at this time that humpback whales are being disturbed by existing levels and types of marine traffic in the area. However, Section 7 of the Endangered Species Act of 1973 requires all impacts to the species; immediate, ongoing, and potential, be identified. If the determination is one of "no affect" to the species, it should be so stated. (9)

Gender Specific Words:

- Page 1-5, second to last paragraph: Change spokesman to "representative."
- Page 2-5, last paragraph: Change manmade to "constructed."
- Page 2-8, Manpower heading: Change it to "Workforce."
- Page 3-39, last paragraph: Change manmade to "human" and in the next sentence strike manmade and start the sentence with "Sources."1/

Geodetic Control Survey Monuments:

- Geodetic control survey monuments may be located in the proposed project area. If there is any planned activity which will disturb or destroy these monuments, National Ocean Survey requires not less than 90 days' notification in advance of such activity, in order to plan for their relocation. NOS recommends that funding for this project include the cost of any relocation required for NOS monuments. (26)

Historic Places Register, Greens Creek Eligibility:

- Concerning inclusion in the National Register of the Greens Creek Midden (AHRS site JUN-090), we concur with your determination that the site is not eligible . . . (7)

1/ From FS interoffice memo, A. Warner to H. Castillo, 9/30/82.

Housing:

- Approximately 300 people would comprise the Noranda workforce. It is anticipated that half of the workforce, about 150 employees, would be hired locally. The housing of an additional 150 people plus their families would have an impact on housing and service demands in Juneau. However, the State and local governments agree that Juneau would be able to accommodate these needs by the time Noranda is operational. Development of a campsite at Hawk Inlet may not significantly lessen impacts to Juneau as families of the mine workers would probably live in Juneau. Quality of life for workers and their families housed in Juneau would be significantly different due to the large infrastructure and service system available. The City and Borough of Juneau strongly supports this option.

  Estimated capital costs for the Juneau housing option including the road, dock and other access facilities would be $10,061,000 with annual operating and maintenance costs of $5,473,000. Estimated capital costs for the construction of the campsite would be $6,548,000, with annual operating and maintenance costs of $8,935,000 (all figures are in 1981 dollars). While initial capital costs for the Juneau housing option are higher, the annual cost is $3,462,000 less than the campsite alternative. Over the 15+ years of Noranda's project, the campsite alternative could cost approximately an additional 52.5 million dollars (1981 dollars.)

  The camp could develop the economic, social and political structure of a permanent community. The State does not encourage development of new settlements in remote areas when infrastructure needs can be fulfilled by an existing community. Exclusive of the possibility of a permanent community, the temporary facility still has the potential of becoming a new center of recreational use which will conflict with existing recreational uses at Hawk Inlet and areas in the proximity to the camp.

  The presence of a camp facility at Hawk Inlet will increase the project related impacts at this site. Changes to existing recreational use patterns with resultant pressure on fisheries and wildlife resources will occur. However, restricting camp development and employee recreational activities to minimize negative impacts could result in restrictions on employee lifestyle and other negative effects on employee well-being and is not feasible. (34)

- Our major concern is that no permanent camp or housing be allowed at the site encompassed by this project but instead personnel should be transported by boat daily to and from the work area. (28)

- You should be reminded that any housing units or job opportunities generated by this project must be available on a nondiscriminatory basis. (33)

- The report correctly assumes that if the capital moves, there will be plenty of housing available in the Juneau area. If it does not move, then the mining company, Noranda, will supply rental units, approximately 85. Because the employees will be in the $23,000 to $25,000 annual wage range, there is a possibility that some might qualify for Section 8 rental housing. Some, however, might prefer to own their own homes or mobile homes. When development actually occurs, presumably Noranda would make a more definitive study of the housing situation. (30)

Hunting, Trapping Competition:

(see also comments under Young Bay to Hawk Inlet Road, pages 6 and 7 of this summary.)

- We also believe Noranda company policy should not allow firearms in the (the project) area or on transport vessels by Noranda personnel. No hunting or fishing should be allowed in the project area by Noranda personnel either on or off duty. We feel this will reduce competition with local resident subsistence and sport hunters and fishermen for limited resources. Also we believe that no type of motorized vehicles should be allowed on Noranda roads outside of company business. We are also opposed to having Noranda employee boats docked at Noranda floats either at Young Bay or Hawk Inlet that could be used as a base for personal hunting and fishing. This would cause direct competition with resident subsistence and sport hunters and fishermen for limited fish and wildlife resources. (28)

- Page 4-71 et seq: We appreciate and support the "no guns and traps" policy for Noranda employees under the Juneau housing option. Concern has also been expressed toward personal boats, fishing gear, etc. We would appreciate discussion of those items in the document. (34)

Mill Site Location:

- Mill locations at the mine site and at the tailings pond site were considered. The mill location at the mine site would require a slurry line parallel to Greens Creek. The slurry line would be contained within a culvert which would also house the water line. This alternative presents the potential of a line break and introduction of waste into a productive drainage. Reagents would also have to be transported to the mine site and a potential does exist that reagents could enter Greens Creek should a vehicle accident occur. However, the possibility of these accidental occurances is considered to be very remote. Mine water and site runoff will require treatment to meet water quality standards. The sediment pond incorporated into the mill site near the slurry line to the tailings pond will provide an effective means of controlling these wastes. Environmental impacts will occur during construction and placement of the line, but these impacts would be short term and could be lessened through responsible construction techniques. (34)

- The mill location at the tailings pond would require that raw ore be transported from the mine to the mill location. Negative impacts associated with continued vehicle movement (road erosion, noise disturbance to wildlife) would occur and would result in increased operational cost to Noranda and indirect habitat losses. This location would, however, confine the storage transport and use of reagents and petrochemicals to a smaller area. (34)

- The mill site locations at the mine presents the possibility of waste introduction into water sources with direct resultant losses of habitat. The double-walled containment of the slurry line plus constant monitoring and inspection of the line would however, reduce this risk to a remote possibility. Reagent transport if conducted in a responsible manner, would reduce accidental spills to a remote possibility also. Indirect loss of habitat will occur as result of increased road activity from ore transport as well as increased operational costs. The State's preferred option would be to reduce the indirect habitat impacts by us of a slurry line, minimize associated operational dollars and take advantage of additional control of mine wastes offered by location of the sediment pond at the mine site. (34)

Mining in the Monument:

- There is no reference in the document to the 1872 Mining Law. Legal reference should be made to it, since it is the legal basis for Noranda's right to locate mining claims. (22)

- Regarding the method of milling, there seems to be a contradiction. At the beginning of one paragraph you speak of "producing a lead-carbonate concentrate." Later on, you state that "ore will not be changed in chemical compostion." (22)

- The Southeast Alaska Conservation Council remains firm in its position that the Greens Creek project is not compatible with the purposes for which the Admiralty Island National Monument was created. We strongly oppose the construction of this project. However, language in the Alaska Lands Act seems to allow this project to be built provided it is compatible with the purposes for which the Monument was established. (23)

- I wish to advise you of my firm opposition to the project, as it will decimate this still unique natural area. (27)

- I have just risked indigestion reading with my lunch the plan to bring to its knees Admiralty Island, one of the great wild places. I believe you intend to do the best possible, but there is no best when you create a great open sore on the land and tend it by hundreds of intruding humans. (1)

Mitigation/Monitoring/Rehabilitation:

- The Draft EIS only provides general provisions for contingency and mitigation plans. These plans must be prepared in final form for inclusion in the Special Use Permit for the project prior to that permit being signed. Contingency plans should be as detailed as existing fire plans and be drawn up for reagent and other chemical spills, oil spills, tailings pipe rupture, tailings impoundment rupture, break-down in sediment ponds, and other potentially hazardous situations. We request drafts of these contingency and mitigation plans and of the Special Use Permit for the project. (23)

- The Draft EIS is unclear on the monitoring program that will be in place during the construction phase. Since frequent blasting will occur and large amounts of earth (will be) moved, this phase has the potential for a high percentage of unplanned impacts. The only way this can be detected and mitigated is to have a well established monitoring system in place before <u>any</u> work begins. (23)

- The monitoring program statements are very general. The environmental statement should clearly define objectives, frequencies, and consequences. Does the monitoring serve a useful operational purpose or is it oriented toward research? (6)

- All monitoring requirements contained in the final EIS may have public scrutiny that will require faithful compliance. Therefore, we should insure that monitoring results have value commensurate with their costs. (6)

- The Final EIS should specify how rehabilitation will be carried out in the area to place it back into its "orignal" state. The following concerns should be addressed: (a) Mitigation of habitat loss from the tailngs pond area. (b) What measures will be taken to rehabilitate road area back to their "original" state. (c) Specific measures to rehabilitate the mining site. (d) Contingency plans for fisheries rehabilitation. What actions will be taken if tailings ponds or mining activities cause severe habitat damage. (29)

- Additional mitigation measures such as restricting the use of docks and the access road to protect personnel must be addressed as well as road closure, dock removal, and site rehabilitation at the project's termination. We understand that Noranda intends to restrict hunting and fishing by employees transported to Admiralty on the crew boat. (34)

- Page 2-50: Under mitigation measures common to all alternatives the statement is made that "Roads would be located away from beaches to protect the coastal wildlife habitat." The proposed Hawk Inlet/Young Bay road is routed for about 1-1/2 miles adjacent to the Hawk Inlet beach in an area identified as prime deer winter range by both the USDA Forest Service and the Alaska Department of Fish and Game. Although we recognize that some tradeoff exist between that location and one inland, south of the ridge, that portion of the proposed road is not located "away from beaches" and does conflict with prime deer winter range. (34)

- Page 2-60 et seq: The State supports the fisheries and wildlife monitoring programs proposed for mine development and operation. Of special concern to us are the measures to be taken should significant effects be documented through the monitoring program. For bears for instance, we recognize that avoidance alterations in movement patterns, as a function of disturbance, may not be easily mitigated. However, bear attraction to Noranda sites may be effectively handled in a variety of ways. Eagle nest monitoring is desirable, however, we are unsure about reasonable operational which might be developed to mitigate disturbance effects on eagle nests. (34)

- Page 2-67: In light of the above, we would like to help the USDA Forest Service develop a contingency plan of action measures to respond to potential resource damage or threat of damage engendered by mine construction and operation. (34)

- Page 2-67, Marine Aquatic Biota: The State will assure a monitoring program is incorporated into the permit for a marine discharge. We have been working with Noranda on the design of the monitoring program. In addition to the biota program we feel that sediment sampling for heavy metals will be important. (34)

- We feel that a dye tracer study done at the selected discharge site a depth would be a helpful check of the accuracy of the model used to predict the behavior of the discharge. (34)

- Page 2-71: Removal and reclamation of the proposed access road to the Young Bay dock is an item of substantial concern to the State. We believe the presence of the breakwater and road will alter recreational use patterns in this area. The decision should be further addressed. (34)

No Action Alternative:

- Your evaluation of the No Action Alternative falls short of what 503 (f) (2) (A) says. The quote on page 2-24 continues by stating "to assure that such activities are compatible, to the maximum extent feasible, with the purposes for which the monuments were created." While this statement doesn't preclude development of the mine, it does set forth a very important point that isn't discussed in the Draft EIS. Any activity that occurs within the Monument boundaries must be compatible "to the maximum extent feasible" with monument purposes. Maximizing protection for monument values is much different than minimizing impacts. This general philosophy needs to be carried beyond the EIS and in the development state of the mine. (23)

Permits, Licenses, Approval:

- The State anticipates that adoption of Alternative 6 by the USDA Forest Service if modified by certain mitigating measures, would be consistent with ACMP. The Forest Service is preparing a consistency determination that will be reviewed by this office as part of the FEIS and decision notice. In order for the State to concur with your consistency determination, the document must be sent 90 days prior to final approval of the federal activity as per CFR 930.34. (34)

- As stated in Section I of the DEIS, a State of Alaska Certificate of Reasonable Assurance for water quality and a Certification of Consistency with the Alaska Coastal Management Program are being sought from the State of Alaska. It should be noted that these two permits will need to be "in hand" prior to this District taking any administrative action, as per 33 CFR 320.4(j). (31)

- Page 1-9, Other permits, licenses and approval, Solid Waste Disposal Permit: The State had been working with the USDA Forest Service and Noranda on solid waste generated from the construction of the access road and associated quarries. It is our understanding that Noranda will prepare a report on road spoils to be included in the road plans and specifications. We propose to review the report and inspect the sites on the ground and make our comments to the USDA Forest Service. We feel that we will not need to issue a solid waste management permit for these activities. We will, however, issue a solid waste management permit for camp garbage and construction wastes. (34)

- Certification of Compliance with Alaska Water Quality Standards. Under section 401 of the Clean Water Act, the Department of Environmental Conservation reviews federal wastewater disposal permits (NPDES) to insure that they are in compliance with our water quality standards. Likewise, for activities requiring dredge or fill operations in wetlands, our department reviews the Corps of Engineers public notice to certify that the proposed activity will be in compliance with our water quality standards. (34)

- Page 1-10: The authority and responsibility of the State are inadequately presented. The State may specify stream crossing structures for non-anadroumous streams, and also review and approve, reject or alter activities which might affect anadroumous streams. Further the State analyzes the biological effects of coastal development in relation to the Alaska Coastal Management Program Standards. (34)

- Information provided in the subject DEIS appears to contain the data that is necessary for consideration during the Corps' permitting process, thereby lending itself for adoption as outlined by section 1506.3 of the Council on Environmental Quality (CEQ) final regulations implementing the procedural provisions of the National Environmental Policy Act (NEPA). However, clarification should be provided for the following area of concern during the continued EIS process. (31)

- On page 1-10, Section I, Other Permits, Licenses, and Approval, reference is made to regulatory authority of the Corps of Engineers. This paragraph should be rewritten so as to clearly delineate, to the reader, the jurisdictional responsibility which the Corps has over the proposed activity. The discharge of dredged or fill material into waters of the United States comes under section 404 of the Clean Water Act (CWA). Structures or work in or affecting navigable waters of the United States requires a permit from the Corps pursuant to Section 10 of the River and Harbor Act of 1899. It should be further noted that final administrative actions to be taken, with regard to Corps' permits, will not take place until expiration of the 30 day waiting period following the filing of the final EIS with the Environmental Protection Agency (EPA). (31)

- Page 2-7: We strongly support the fuel storage permit conditions identified; especially the construction of dikes around tanks, and storage away from stream courses and water bodies. (34)

- Page 4-12: The domestic waste treatment plant will be subject to an NPDES permit. Again, to prevent delays, Noranda should apply for the permit at least six months before construction starts. (14)

Pesticides and Herbicides:

- The Final EIS should discuss the effects of the proposed action on mosquito or other vector populations, their potential health threats to workers, proposed vector control measures that may be used, kinds and volumes of pesticides that may be used, and anticipated application procedures.

  As part of the vegetation clearing procedures and subsequent maintenance effort, will any chemical control measures be used? If so, what herbicides will be used and how will they be applied? (20)

Power Sources:

- We note that the draft is silent on volume of diesel fuel for electric power generation as well as alternative power sources. To overcome this deficiency, we suggest that discussions be included setting out the amounts of diesel fuel anticipated to be used and storage systems descriptions as well as details on alternative electric power sources such as potential Juneau-Hoonah transmission line, wood fuel, coal, or wind. (17)

Recreation:

- Page 1-6: Decreased recreational opportunity is listed as an issue which the IDT addressed. Brown bear hunting and trapping are recreational uses which occur in the Hawk Inlet area and which were not identified in Issue 2. (34)

- Page 1-7: The analysis of recreational use is biased in favor of aircraft access users. Thus the level of use is probably higher than reported, especially for areas easily reached by skiff from Juneau. (34)

- Page 4-71 et seq: We appreciate and support the "no guns and traps" policy for Noranda employees under the Juneau housing option. Concern has also been expressed toward personal boats, fishing gear, etc. We would appreciate discussion of those items in the document. (34)

Socioeconomic:

- An issue that is of major concern to the City and Borough of Juneau is the diversification of our local enconomy. Presently, the main employment base is federal, state, and local government. Development of a mine in the Juneau area would be desirable to the CBJ from the standpoint of deversifying the employment base. (15)

- Pages 3-42-3-45: The statements seem to be accurate with the exception of accepting the longstanding figure of virtually zero percent vacancy in housing. (30)

  From periodic postal vacancy surveys conducted in Juneau the past two years, single family housing in May 1982 has a 0.8 percent vacancy and multifamily was 0.7 percent, with mobile homes only 0.1 percent. There is always some turnover in even the tightest housing markets. It is also recognized that some people in Juneau live on boats because of the high cost of conventional housing. (30)

  The estimates of secondary employment, using a low multiplier of 0.2, appear too high. If the mine uses two shifts, or even three, there will be a small secondary effect, but whether even 300 employees, some hired locally, and a fair share with families, will have a significant effect on secondary employment seems doubtful. (30)

- Page 3-44: It is expected that 1982 revenues from the sales tax will be reduced from 1981 levels by 3.2% because of " declining employment." There has not been declining employment in Juneau from 1981 to 1982. Although the movement of sales tax revenues may not be necessary to note in the DEIS, what has occurred is that strong collection efforts and solid growth in the Juneau economy have been partially offset by the removal of the tax on the residential rental income (mid-1981) and the increased ratio of business in the Mendenhall Glacier Valley area (where sales tax is lower). (34)

- Page 4-1: Some impacts will proceed beyond the construction and operational stages, particularly in recreation and subsistence. The analysis is defective if it does not consider these aspects. A part of that concern relates to development of the cannery area and the increase in patented land in Hawk Inlet which may be developed for an array of alternate uses. (34)

- Page 4-20: On whether it will be a final vote on the capital move issue. If the vote is "move" it will be final. If the vote is for the capital to stay in Juneau, the leaders associated with the effort to relocate have publicly stated that there would be another vote, a continuing effort, the people of the Cook Inlet Basin would not stand for it to remain so far distant. (34)

- Page 4-93: A multiplier of .2 secondary employees to each primary employee probably is understated. The most commonly accepted U.S. average multiplier exceeds 3.0. In Alaska, it is recognized to be about half of that. (34)

- Page 4-96: The income multiplier (multiplier effect of spending and respending) at 2.0, when applied to a $15 million payroll is stated in the DEIS as $16.9 million. (34)

- The impact on the economy of Juneau would be strong and it will be positive. The use of the multiplier for both employment and income understate this positive effect, they are inaccurately applied in the DEIS. (34)

Spills, Spill Prevention:

- The Draft EIS mentions above-ground fuel storage tanks. Although an oil spill prevention control plan will be prepared, the Final EIS should also address the safety aspects of the above-ground tank locations in relation to work areas. (20)

- Page 1-10: The "Spill Prevention, Control, and Countermeasure Plan," shall be prepared within six months after the date the facility begins operation. It is not required that this plan be prepared prior to beginning operation. (24)

- Page 4-55, paragraph 2: The flow augmentation collection channel would run along the access road prism before it diverted to Tributory Creek. In addition to the higher levels of turbidity and sediment from the road being introduced into the water, there would be an increased possibility that an oil or toxic chemical spill on the road system would be directly introduced into the flow augmentation channel and transported downstream to Tributory Creek and lower Zinc Creek. The results of such a spill could have severe impacts on the fishery. There would also be chronic, unavoidable low level roadside pollution from the operation of heavy equipment and trucks. These effects should be addressed in the EIS. (21)

- EPA will be glad to review the proposed Spill Prevention Control, and Countermeasure Plan (SPCC Plan) upon request and provide comments where appropriate. However, the FEIS should note that EPA does not approve such plan prior to facility construction and operation as noted on pages 1-10 and 2-7 of the DEIS. The current agency policy is to require such approval if a spill actually occurs. (14)

Structures:

- Page 2-31: The number of structures for a Juneau commute option needs to be identified. Will any new buildings be constructed? (23)

Subsistence:

- The Environmental Consequences section includes an evaluation of impacts on subsistence activities. Both Alternative 6 and 8 appear to have the least effect on subsistence resources. These alternatives provide for the housing of workers in Juneau with daily boat trips to Young Bay and a road connecting Young Bay to Hawk Inlet. (34)

- The communities of Hoonah and Angoon have expressed concern that the possibility of workers being housed at a camp facility at Hawk Inlet would cause potential impacts on their lifestyle including subsistence hunting and fishing. However, the latter is protected under State and Federal law should it become an issue. (34)

- Page 2-79: The analysis of subsistence effects is inaccurate and incomplete and does not reflect the substantial input the Subsistence Division of the Alaska Department of Fish and Game has made during DEIS development. Although sport or subsistence hunting are both consumptive uses of wild rsources, there are economic, social and legal differences between them. Deer hunting is <u>not</u> the only subsisitence activity in Hawk Inlet. (34)

- Juneau residents are not subsistence users under State and Federal legal definitions. Therefore, the subsistence effects analysis should be directed at residents of Angoon, Hoonah and Funter Bay. This portion of the document will have to be rewritten to be correct. We encourage further discussions with the Subsistence Division staff prior to redrafting it. (34)

- Page 3-30: A brief description of the subsistence activities in the vicinity of Hawk Inlet is presented which is based on information our office provided. The way the information is presented, however, downplays the use of Hawk Inlet for subsistence activities. For example, it notes that commercial fishing vessels make two subsistence trips a year, but does not indicate that these trips are to hunt deer or that while these same boats are engaged in commercial fishing activities, both deer and seal are hunted for subsistence purposes. (34)

Visual Quality Objectives:

- I question the application of VQO's as discussed on pages 3-37 to anything outside the Monument. It should not be based on "evidence of human alteration." After all, the area is not a "wilderness." Based on tourist activity, pictures painted by noted artists, landing points and so on, there is a great deal of interest in canneries, old or new, docks, settlements, cabins, and any sign of human alteration, especially if it has been abandoned. Are you making policy or implementing it? (12)

- It is too bad that the widom of Congress called for monument status for the mine area, an area with no special monument characteristics, VQO's or otherwise. It will only result in more costs and less benefits for both sides of the issue. Is there any hope that this boundary could be changed? (12)

Water Quality:

(see also comments under Alternative Preferences and Dominant Issues, p. 2-6 and under Effluent Discharge and Fish, Fisheries, and Marine Life in this alphabetized listing)

- Based on engineering design work completed following preparation of the Draft EIS, some additional data regarding dilution and costs is now available. The data is included in a report by Ott Water Engineers titled "Wastewater Discharge--Outfall Location Evaluation," dated September, 1982. (24)

- The explanation of development in the mine service area and overburden storage area before the tailings pipe is installed and working refers to sediment ponds set up to catch the construction runoff. Where does the water go after it leaves these sediment ponds? Is there any plan to treat this water for removal of grease and oil that will undoubtedly find its way into the runoff? Water leaving these sediment ponds must be treated for removal of grit, grease, and oil. These sediment ponds must be closely monitored for compliance with State water quality regulations. (23)

- Table 2-2, page 2-18: The ratings for the effect on water quality of tailings pond sites in Cannery Muskeg and Piledriver Cove are missing. (23)

- Page 2-51: If effluent discharges from the quarry sediment ponds enter receiving waters, they will require NPDES Permits. To prevent untimely delays, the USDA Forest Service should advise Noranda to apply for the necessary permits well before road construction begins. (14)

- Page 2-80, paragraph 2, Marine Environment: The sentence, "In addition, sublethal effects within the inlet have not been established" is unclear. We believe what was meant is that due to heavy metals in the effluent and their concentration in the marine waters of Hawk Inlet, sublethal "chronic effects" may occur. (21)

- Page 3-13, last paragraph, Physical/Chemical Characteristics: Elevated levels of silver, lead, and copper in marine waters are not normal. (21)

- Page 3-17, paragraph 2, Metals Concentrations in Biota: The high concentrations of zinc and copper in organisms from Hawk Inlet are not a result of these elements being physiologically required by the biota. The higher levels found in organisms in Hawk Inlet are instead a reflection of the higher levels of these elements in the environment. (21)

- Page 3-18, paragraphs 2 and 3: Metals Concentrations in Biota: Cadmium and mercury concentrations in the biota should be presented, and should be related to effects on biota, not in humans, since the concentrations may be quite different. (21)

- Page 4-4, paragraph 3, sentence 1: It would be more appropriate if "mine" were changed to "mill." (14)

- Page 4-5 and 4-6 indicate that all discharge points would have an insignificant impact upon marine water quality. Your discussion of Alternative 2 (page 4-53) says: "Based on available data, the effect of a Hawk Inlet sill discharge location on marine water quality is considered to be insignificant." (6)

- The discussion on Marine Aquatic Biology, pages 4-61 through 4-66, points out that for regulatory purposes, allowable concentrations of toxic substances are often set at a conservative fraction of LC50 values, as in the case of the proposed ADEC water quality criteria applied to the Greens Creek project. Also, your summary points out that "The proposed discharge would result in small increases over ambient metal concentrations, and the largest of these small increases would only occur over a limited area close to the discharge point." Certainly these small increases cannot begin to offset the buffer of "conservative fractions" used to establish the water quality criteria mentioned previously. Therefore, the statement on page 4-66: "Although no specific effect on marine biota is known, the consensus among State and Federal agency biologists indicates the longer buildup represents a higher potential threat to organisms within the inlet" does not have sufficient technical backup to warrant the recommendation for Chatham Strait discharge. (6)

- Page 4-36: The statement is made that, for freshwater quality, "Location of the mill at the mine plant would create no additional impacts other than those for the mine service area development." As stated previously, we disagree, because of the increaed potential for the introduction of undesirable pollutants into Greens Creek. (34)

- Page 4-38, Freshwater Quality: A spill of any toxic material during spawning or during the period when the fish are emerging would be very detrimental. A large spill could wipe out a whole year of fish in a stream. (21)

- Page 4-45, paragraph 1, Marine Water Quality: The anticipated average flow of 600 GPM seems very low, even accounting for some recycling, which is not mentioned. We calculate that the average annual flow should be between 1200 and 2000 GPM. (21)

- Page 4-45, Marine Water Quality: In order to characterize the water quality at the mouth of Hawk Inlet, samples should be taken throughout the inlet and the most sensitive method of analysis used. We recommend samples be taken at least seasonally and at various tidal stages. (21)

- Page 4-46: Confidence limits and baseline data should be established before the NPDES Permit is issued. EPA believes that it is not appropriate to use the NPDES monitoring stipulations to establish baseline data as suggested in footnote No. 2. (14)

- Page 4-46, Table 4-4, Proposed Standards and Background: It should be noted that methods are available to quantify heavy metals concentrations in marine waters at much lower concentrations than those presented in this table. The claim that the proposed ADEC standards exceed the background concentrations in Hawk Inlet because the contractor could not measure the heavy metals at that concentration is, therefore, invalid. (21)

- Page 4-46, Proposed Standards and Background Seawater Quality: Since background levels may change with further analysis, receiving water standards for Cu, Hg, Pb, Ni and Ag might be termed as the numerical standards or background "whichever is greater". We are working with Noranda and EPA to set up a program where marine water samples are run by at least three different labs. Hopefully, this will give us more reliable background levels. Our decision to certify a discharge point will consider whether background data is usable to detect potential problems at the discharge site. (34)

- Page 4-47: The turbulent mixing zone is proposed to be 200 feet by 500 feet at the effluent discharge site. We are concerned as to the effects this discharge might have on migrating fish and/or fishing activity at the Chatham Discharge point. This area is currently targeted by trollers and seiners and was once the site of a "million dollar" fishtrap because of fish concentrations off the point. (34)

- Pages 4-49 and 4-51, Tables 4-5 and 4-6: Under footnote 2/ "EPA quality criteria" should probalby be "EPA Effluent Guidelines." Under parameters, "Total Dissolved Solids" should probably be "Suspended Solids." (14)

- Page 4-62, paragraph 2, Marine Aquatic Biology: A number of the proposed ADEC standards do not come from the application of a factor to the LC50 value, but from the EPA Ambient Water Qualtiy Criteria. These criteria were developed taking both acute and chronic data into consideration where the data was available. However, it should be noted that these standards were developed for each element singly and cannot be applied where several toxic elements are mixed in an effluent. (21)

- Page 4-62, paragraph 3, Marine Aquatic Biology: Although it is generally true that the concentration of a heavy metal in an organism may not be related to the concentration of that metal that is acutely toxic, high concentrations of heavy metals in organisms generally indicate high environmental levels of heavy metals and may indicate a population that is being stressed. (21)

- Synergistic and/or additive effects of heavy metals in solution are well documented. The application of these effects to marine organisms is not well documented, but there is no reason to suspect that it would be different from that of freshwater organisms. (21)

- Page 4-62, parargraph 4, Marine Acquatic Biology: While it is true that elevated levels of some metals may occur without lethal or sublethal effects, the elevated levels are an indication of stress, in that the introduction of more of a metal or a different metal may overload the animals' ability to detoxify the metals, because all of the storage sites are already loaded. (21)

- Page 4-63, pragraph 3, Marine Aquatic Biology: It is true that the concentrations of metals that, if considered singly, are proprosed in the effluent may not affect the biota, but the impact of the metals in combination may cause sublethal effects. (21)

Wetlands:

- The following comments pertain to the guidelines as authorized by Section 404(b) (1) of the CWA and defined by 40 CFR 230.

    1. Section II, Affected Environment, should provide the reader with a comprehensive description of wetlands within Corps jurisdiction which will be impacted. This description should include a map, the type and quantity of fill material to be used, and the function and relative productivity of each wetland either directly or indirectly affected.

2. As part of this section's evaluation there should be a detailed accounting of the benthic communities, both freshwater and marine, to be affected. This is to include, but not necessarily be limited to, "crustaceans, mollusks, insects, annelids, planktonic organisms, and the plants and animals on which they feed and depend upon for their needs" (40 CFR 230,31(a)).

In order to facilitate review, it is recommended that the above areas of concern be presented as individual evaluations and labeled appropriately. This approach should also be taken in Section IV, Environmental Consequences. (31)

Wildlife:

- Page 1-7: The maintenance of deer habitat is identified as a key component of Issue 4, yet is not included in the wildlife effects analysis for selection of a preferred alternative. This is a substantive change. (34)

- Page 2-56: The solid waste disposal program is a reasonable one and is supported by the State. Additional bear/human conflicts can be avoided by fencing the Mine Service Area and/or proposed campsite so as to exclude bears and mustelids which might be attracted to food or food wastes. (34)

- Page 2-75: Evaluation criteria for wildlife effects were too narrow. As stated earlier, deer impacts were not included. Only brown bear habitat and eagle nest sites were considered. Similarly, project effects will probably occur for furbearers, scavenger birds, waterfowl and seabirds as well. Although some aspects of these effects relate to recreational or subsistence uses, habitat loss and animal displacement are inevitable. (34)

- Loss of "brown bear primary stream habitat: through construction of the Cannery tailings pond is quantified as "4% of that available" in the area. No qualitative effects are estimated. Not only does the tailings pond area serve as feeding/resting habitat, but it is a main travel corridor as well. "Percent of available habitat" is a technique used by Noranda throughout their effects analysis which may be of some value, but which can be misleading. (34)

- Page 2-75 et seq: The evaluation of wildlife impacts for bear and eagles alone, led to the omission of a significant impact which has been identified by the Alaska Department of Fish and Game. (34)

- The road from Young Bay to the Hawk Inlet cannery presents problems not attributable to overutilization of deer or furbearer resources because of increased access for hunters and trappers. Rather, we see the road in time of deep snow, as being a serious impediment to deer in their daily and seasonal travels from the beach fringe to inland timber stands. This concept is not mentioned in the Summary on pages XI AND XII, though it was articulated to Terra Nord, the wildlife consultants retained by Noranda. (34)

- Page 3-18: We question the figure stated of " . . . 39 species of mammals . . . " on or adjacent to the island. (34)

- Page 4-68: We question whether " . . . bear and marten are less tolerant of human activity than deer." Also, as stated earlier, we disagree with the statement that "The road should not act as a physical barrier to animal movements, even during periods of heavy snowfall since snowblowing equipment would eliminate snow berms." (34)

SECTION VII

PUBLIC RESPONSE TO DEIS

1. Barbara Curtis Horton, Pasadena, CA
2. Office of Assistant Secretary of Defense
3. Soil Conservation Service, Anchorage, AK
4. Equal Employment Opportunity Commission
5. Edmund A. Cahill, Jr., Juneau, AK
6. Memo
7. Alaska Department of Natural Resources, Division of Parks
8. Alaska Department of Natural Resources,Division of Parks
9. National Marine Fisheries Service
10. N. C. Machinery Co., Ketchikan, AK
11. Territorial Sportsmen, Inc., Juneau, AK
12. Bear Creek Mining Co., Anchorage, AK
13. The Wilderness Society, Juneau, AK
14. Environmental Protection Agency, Seattle, WA
15. City and Borough of Juneau
16. Alaska Center for the Environment
17. Department of Energy, Juneau, AK
18. N. C. Machinery Co., Ketchikan, AK
19. Sealaska Corp., Juneau, AK
20. Department of Health and Human Services, Atlanta, GA
21. Department of the Interior, Anchorage, AK
22. Memo
23. Southeast Alaska Conservation Council
24. Noranda Mining, Inc., Juneau, AK
25. National Oceanic and Atmospheric Administration, OMPA
26. National Oceanic and Atmospheric Administration
27. John R. Swanson, Berkley, CA
28. Philip L. Gray and Carol J. Gray, Juneau, AK
29. Sierra Club, Alaska Chapter
30. Department of Housing and Urban Development, Anchorage, AK
31. Department of the Army, Corps of Engineers, Anchorage, AK
32. N. C. Machinery Co., Ketchikan, AK
33. Department of Agriculture, Office of Minority Affairs
34. State of Alaska

(1)

Mr. William P. Gee, Forest Supervisor
Tongas National Forest, Chatham Area

Dear Mr. Gee:

I have just risked indigestion reading with my lunch the plans to bring to its knees, Admiralty Island, one of the great wild places. I believe that you intend to do the best possible, but there is no best when you create a great open sore on the land and tend it by hundreds of intruding humans.

So long as Interior and Agriculture are led by two citizens outstanding in their stupidity and shortsightedness little can be done, But never fear, Congress already gives some signs of having had enough. Perhaps your job will be made easier again. In the meantime do your best for the land intrusted to your care--not because its "ours" because it isn't--it is a particularly choice piece of matter moving through space, perhaps even the only such rare and wonderful piece in this enormous universe.

Sincerely,

Barbara Curtis Horton

Barbara Curtis Horton
1869 Pasadena G.en Road
Pasadena, Ca. 91107

7-31

Aug 29, 1982

P.S. Perhaps you better remove me from your list—at least for such great books as is here before me. I don't like to think of the Alaska trees it costs to print

Such a 'book' fascinating of the area
full of what is beautiful & pristine.

(2)

OFFICE OF THE ASSISTANT SECRETARY OF DEFENSE

WASHINGTON, D.C. 20301

MANPOWER,
RESERVE AFFAIRS
AND LOGISTICS

15 SEP 1982

Mr. William P. Gee
Forest Supervisor
Tongass National Forest, Chatham Area
P.O. Box 1980
Sitka, Alaska 99835

Dear Mr. Gee:

This is in reply to your request for Department of Defense comments on the draft environmental impact statement for the proposed Noranda Mining, Inc. development on Admiralty Island, Alaska.

We have no military activities in the area that we would expect to be impacted by the proposed action. We, therefore, have no comments on the proposal. The US Army Corps of Engineers (Civil Works) has received your mailing under separate cover and will respond as appropriate for matters under their special purview, such as Section 404 permits.

Thank you for the opportunity to review this document.

Sincerely,

John G. Leach, for

Donald K. Emig, Ph.D., P.E.
Director, Environmental Policy

3

United States Department of Agriculture

Soil Conservation Service

Professional Center - Suite 129
2221 East Northern Lights Boulevard
Anchorage, AK 99504 (907) 276-4246

September 16, 1982

William P. Gee, Forest Supervisor
Tongass National Forest, Chatham Area
P.O. Box 1980
Sitka, Alaska 99835

Dear Mr. Gee:

The Soil Conservation Service has reviewed the Green Creek Draft Environmental Impact Statement and has no comments.

Weymeth E. Long
State Conservationist

cc: Peter Meyers, Chief, Soil Conservation Service, USDA, Washington, D.C.

EQUAL EMPLOYMENT OPPORTUNITY COMMISSION
WASHINGTON, D.C. 20506

OFFICE OF THE
GENERAL COUNSEL

September 22, 1982

Mr. William P. Gee
Forest Supevisor
Tongass National Forest,
Chatah Area
P.O. Box 1980
Sitka, Alaska 99835

RE: Umpqua National Forest Land Management Plan and Greens Creek Draft Environmental Impact Statement

Dear Mr. Gee:

The above referenced documents have been reviewed as requested. We find no issues reviewable under the statutes administered by this Commission. Therefore, we are returning the draft materials.

Sincerely,

Michael N. Martinez

Michael N. Martinez
General Counsel (Acting)

EQUAL EMPLOYMENT OPPORTUNITY COMMISSION
WASHINGTON, D.C. 20506

SEP 21 1982

MEMORANDUM

TO: Michael N. Martinez MNM
General Counsel (Acting)

FROM: Nicholas M. Inzeo NMI by SST
Acting Associate General Counsel
Legal Counsel Division

SUBJECT: Umpqua National Forest Land Management Plan and Greens Creek Draft Environmental Impact Statement

The above referenced documents have been reviewed as requested. We find no issues reviewable under the statutes administered by this Commission.

(5)

P.O. BOX 1605
JUNEAU, ALASKA 99801
SEPTEMBER 28, 1982

DEAR MR. GEE:

I HAVE REVIEWED THE GREENS CREEK DRAFT ENVIRONMENTAL IMPACT STATEMENT AND FIND THE DOCUMENT LACKING IN ITS TREATMENT OF SEVERAL PERTINENT ASPECTS OF THIS PROJECT DEVELOPMENT. SPECIFICALLY, THESE AREAS OF INADEQUATE TREATMENT OR OMISSION ARE:

1.) THE ALTERNATE OF PROVIDING PERSONNEL ACCESS
1. AT THE MINE SITE BY USE OF HEAVY MODERN FIXED WING TURBINE POWERED AIRCRAFT HAS NOT BEEN ADEQUATELY ADDRESSED. ADDITIONAL AREAS OF CONSIDERATION SHOULD INCLUDE:

A.) RELIABILITY OF ACCESS. NEW GENERATION 35-50 SEAT TWIN TURBOPROP AIRCRAFT, WHEN OUTFITTED WITH STATE-OF-THE-ART AIR NAVIGATION AND LANDING AIDS, WILL BE ABLE TO OPERATE WITH VIRTUALLY A 100% COMPLETION RATE, EVEN GIVEN THE RELATIVE INCLEMENCIES OF THE COASTAL MARITIME CLIMATE AT THESE LATITUDES. THE HAWK INLET/GREENS CREEK AREA PROVIDES AN EXCELLENT APPROACH

AND DEPARTURE BASIN FOR INSTRUMENTATION BY MICROWAVE LANDING SYSTEMS.

2 B.) COST OF ACCESS. THE COMPARISONS OF ALL INCLUSIVE COSTS OF ACCESS BY AIR VS ACCESS BY HIGHWAY / WATERWAY MIGHT POSSIBLY SHOW THAT AIR ACCESS IS A MORE ECONOMICAL, THOUGH TECHNICALLY MORE COMPLEX, FORM OF ACCESS. COMPREHENSIVE DEVELOPMENT, MAINTENANCE, AND USER COST SCHEDULES MUST CONSIDER SUCH ITEMS AS:

3 — THE COST OF TRAVEL TIME FOR THE 150 PERSONS PER SHIFT FROM JUNEAU TO THE MINE SITE, AND VIS-A-VIS.

4 — THE COST (ENVIRONMENTALLY AND ECONOMICALLY) OF CREATING NEW MARINE TERMINALS IN JUNEAU AND YOUNGS BAY; OF A ROAD SYSTEM WHICH WILL PROVIDE ACCESS TO THE GENERAL POPULATION BASE OF JUNEAU TO AREAS OF ADMIRALTY NOT NOW ACCESSABLE BY VEHICLE; OF ROAD IMPROVEMENTS TO THE PUBLIC WHEN NON-MINE RELATED ACTIVITIES PRESSURE DOT/PF TO WIDEN AND REALIGN THE ROADWAY; OF THE DIFFERENCE IN

PAGE 3
EDWARD A. CAHILL, JR

COSTS THAT RELATIVE REALISTIC RELIABILIT[Y]
OF AIR VS. ROAD/WATER TRANSPORT
— THE COST OF ALL LANDSIDE - AIRSIDE - WATERSIDE AND RELATED DEVELOPMENTS FOR AIR VS. OTHER MODES.

5 — THE BENEFIT TO ADJACENT LANDOWNERS PROJECTED THROUGH THE ORE DEPOSIT LIFE OF AIR VS. ROAD/WATER ACCESS.

6 — THE IMPACT OF ROAD ACCESS RELATIVE T[O] EXISTING FISH AND GAME HABITAT, AND INCREASED HUNTING PRESSURES, ETC THAT ROAD ACCESS WILL INTRODUCE.
— MANAGEMENT PLAN AND ATTENDENT ENFORC[EMENT] COSTS TO RESTRICT ACCESS ROAD AND MARI[NE] TERMINAL USE TO MINING RELATED ACTIVITIES

7 — COST CONSIDERATIONS INVOLVED IN PROVIDING OVERNIGHT ACCOMODATION FOR SHIFT CHANGE IN THE EVENT SURFACE/AIR ACCESS TO THE MINE IS NOT POSSIBLE. ALSO, PLACEMENT OF THESE FACILITIES.

— THE IMPACT, AND ATTENDENT COSTS, OF THE PROPOSED DEVELOPMENT ON EXISTING VARIOUS MODAL TRANSPORTATION SYSTEMS IN THE JUNEAU AREA. BY THE VARIOUS CONSIDERED ALTERNATIVES OF MINE ACCESS

IN SUMMARY, MY REVIEW FINDS THE GREENS CREEK DRAFT ENVIRONMENTAL STATEMENT REMISS BY ITS FAILURE TO PROPERLY ADDRESS MINESITE/MILLSITE ACCESS BY MODERN ~~HEAVY~~ TURBOPROP AIRCRAFT. THE CURSORY DISMISSAL OF THIS MODAL APPROACH REFLECTS ONE WHICH WOULD TYPLIFY AN ANALYSIS BY THOSE LACKING EXPERTISE IN THE AVIATION PLANNING ARENA.

I WOULD APPRECIATE A COPY OF THE RESPONSE TO THESE COMMENTS, AND WOULD LIKE TO BE PLACED ON THE MAILING LIST FOR ANY FUTURE GREEN'S CREEK DOCUMENTS. THANK YOU.

SINCERELY,

EDWARD A. CAHILL, JR.

Response 5

1. The use of large fixed wing, wheeled aircraft (30 - 50 passenger) was considered during the initial screening of options from which to construct alternatives. This option was examined but eliminated from further consideration (DEIS page 2-10) based on both environmental and technical concerns.

It was assumed that the use of land based aircraft (Convair 580 or DeHaviland -7) was technically feasible and could provide a relatively high level of dependability. With a state-of-the art microwave landing system this would be comparable in reliability to a boat system. Recent information has indicated that because of approach constraints at the Juneau Airport this system would not significantly reduce allowable minimums. The risk to personnel would, however, be greater when operating the aircraft under marginal conditions.

The use of this type of aircraft under minimum conditions would require construction of a runway with a length of 3,500 - 5,000 feet. Suitable sites are available only on the north end of the project area between Young Bay and Hawk Inlet. This location would require a road system nearly as extensive as a complete road system to Young Bay and would require considerable additional construction. Because a great deal of concern has been expressed regarding wildlife impacts within this area the additional disturbance was considered undesirable.

2. Cost effectiveness was considered but was not used as a key evaluation criteria since insufficient data was available for a complete economic analysis.

3. Travel time would not be significantly reduced using aircraft since 2-3 trips (30 minutes each way) would be required as opposed to 1 boat trip to affect a shift change.

Initial impacts would be greater for construction of a landing facility and associated road system. Assuming a runway with minimum dimensions of 4,500 feet by 100 feet, approximately 450,000 square feet (10.3 acres) would be disturbed and approximately 83,300 cubic yards of fill would have to be obtained from quarries near the site. Operational impacts would be far greater (6-9 take-offs and landings per day) than from vehicular traffic to and from a dock facility.

4. The capital cost of a boat/dock/road transportation system is approximately $4.2 million including docking facilities at Auke Bay. The minimum cost of two twin engine, turbo powered aircraft (Convair 580) including microwave landing systems at both terminals, a runway and terminal facilities on Admiralty Island, and a road system to the cannery is approximately $7.4 million.

5. It is an assumption of this EIS that any transportation system considered (aircraft or boat/road) would be for the exclusive use of Noranda and not available to the general public or adjacent landowners.

Backup aircraft would have to be available for those times when the primary aircraft was unavailable. Approximately 2 days of down time for maintenance would be required for each 100 hours of operation (approximately 2 weeks).

Maintenance costs for an aircraft system are considerably higher than for a boat system.

6. The Alaska Department of Fish and Game and Forest Service wildlife biologists are very concerned about effects on wildlife due to road related activities. Constraints on the road design and use are meant to address these concerns. Additional ground disturbance and higher levels of activity would not be acceptable.

7. Regardless of the type of transportation, emergency housing facilities will be required. These facilities will be provided by upgrading existing facilities on private land at the Hawk Inlet Cannery.

8. Impacts on existing Juneau transportation systems is discussed under socioeconomic effects. Other than the construction of a terminal facility at Auke Bay, the impacts to Juneau would be comparable.

(6A)

United States Department of Agriculture

Forest Service

RO CHATHAM OCT - 7 1982

Dennis Rogers

Reply to: 1950 Forest Service National Environmental Policy Act

Date: OCT 0 5 1982

Subject: Greens Creek Draft Environmental Impact Statement

To: Forest Supervisor, Chatham Area

copies sent 10/13/82 R.P.

This letter is a correction to the original letter dated October 4.

We have reviewed the subject document and offer the following comments.

I. Effluent Disposal Point

We are concerned that the discussion and data contained in the draft EIS do not support a recommendation to use the Chatham Strait Discharge over the Hawk Inlet Sill Discharge or the Cannery Site Discharge. (The Cannery Site Discharge was not requested by Noranda Mining, Inc., and will not be discussed.)

Tables 4-5 and 4-6 indicate that all discharge points would have an insignificant impact upon marine water quality. Your discussion of Alternative 2 on page 4-53 says:

> "Based on available data, the effect of a Hawk Inlet Sill Discharge location on marine water quality is considered to be insignificant."

The discussion on Marine Aquatic Biology, pages 4-61 thru 4-66, points out that for regulatory purposes, allowable concentrations of toxic substances are often set at a conservative fraction of LC50 values as in the case of the proposed ADEC water quality criteria applied to the Greens Creek project. Also your summary points out that "The proposed discharge would result in small increases over ambient metal concentrations, and the largest of these small increases would only occur over a limited area close to the discharge point." Certainly these small increases cannot begin to offset the buffer of "conservative fractions" used to establish the water quality criteria mentioned previously. Therefore, the statement on page 4-66;

> "Although no specific effect on marine biota is known, the consensus among State and Federal agency biologists indicates the longer build-up represents higher potential threat to organisms within the inlet."

does not have sufficient technical backup to warrant the recommendation for a Chatham Strait discharge.

Our recommended solution to the effluent disposal question would include (1) disposal of the effluent thru a diffuser located 40 feet deep in a well mixed marine environment, and (2) meet the water quality criteria required by the NPDES permit. The information in the Draft EIS indicates that the Hawk Inlet Sill Discharge would satisfy both of these requirements.

II. Monitoring Requirements

The monitoring program statements are very general. The environmental statement should clearly define objectives, frequencies, and consequences. Does the monitoring serve a useful operational purpose or is it oriented towards research?

All monitoring requirements contained in the final EIS may have public scrutiny that will require faithful compliance. Therefore, we should insure that monitoring results have value commensurate with their costs.

MILFORD G. JONES
Director of Engineering
and Aviation Management

cc:

M. Jones

(1)

STATE OF ALASKA

DEPARTMENT OF NATURAL RESOURCES

DIVISION OF PARKS

JAY S. HAMMOND, GOVERNOR

619 WAREHOUSE DR., SUITE 210
ANCHORAGE, ALASKA 99501

PHONE: 274-4676

September 23, 1982

File No: 3440 (Forest Service)
1130-1-1

William P. Gee, Forest Supervisor
Tongass National Forest, Chatham Area
P.O. Box 1980
Sitka, Alaska 99835

Dear Mr. Gee:

We have recently reviewed the information provided to us concerning the eligibility for inclusion in the National Register of Historic Places of the Greens Creek Midden (AHRS site JUN-090).

We concur with your determination that the site is "Not Eligible" for the following reasons:

1) It has been tested but yielded very few artifacts.

2) Its primary scientific value is in its age, location and faunal content. This data is already in hand, or will be available shortly.

3) Much of the site is already lost and the remainder faces imminent destruction by erosion and tree fall.

4) This type of site is not unique.

Please contact us should you have any questions.

Sincerely,

Judith E. Marquez
Director

Timothy A. Smith, DEPUTY

By: Ty L. Dilliplane
FOR: State Historic Preservation Officer

TAS/jdg

CHATHAM
SEP 30 1982

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Henni Rogers
9

STATE OF ALASKA

JAY S. HAMMOND, GOVERNOR

DEPARTMENT OF NATURAL RESOURCES

DIVISION OF PARKS

619 WAREHOUSE DR., SUITE 210
ANCHORAGE, ALASKA 99501

PHONE: 274-4676

September 17, 1982

File No. 1130-1-1

William P. Gee
Forest Supervisor
Tongass National Forest, Chatham Area
P.O.Box 1980
Sitka, AK 99835

Subject: DEIS Greens Creek, Admiralty Island National Monument, Proposed Noranda Mining Project.

Dear Mr. Gee:

We have reviewed the subject proposal and would like to offer the following comments:

STATE HISTORIC PRESERVATION OFFICER

We agree with the conclusions and recommendations in this Draft Environmental Impact Statement. We look forward to working with the Forest Service on any needed mitigation should alternative 2,4,5, 6 or 7 be selected.

Ty L. Dilliplane
State Historic Preservation Officer

STATE PARK PLANNING

The proposed action is consistent with the Alaska Coastal Management Program's recreation standard.

LAND & WATER CONSERVATION FUND GRANT PROGRAM

No comment.

Sincerely,

Judith E. Marquez for
Director

JM/blh

CHATHAM
SEP 27 1982

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

(9)

October 8, 1982

William P. Gee
Forest Supervisor
Tongass National Forest, Chatham Area
P.O. Box 1980
Sitka, Alaska 99835

Dear Mr. Gee:

The National Marine Fisheries Service (NMFS) has reviewed the Greens Creek Draft Environmental Impact Statement and offers the following comments for your consideration.

General Comments

The DEIS adequately covers most of the project's potential adverse effects upon resources under our purview.

Alternatives 2 and 6 are similar except for the location of the tailings pond discharge line. A discharge line located in Hawk Inlet (Alternative 2) could be extremely detrimental if the aquatic organisms residing there are near their maximum tolerance level. The existing elevated metal concentrations within Hawk Inlet give rise to this concern. On the other hand, metals added to Chatham Strait (Alternative 6) could have an adverse effect on resident aquatic organisms, especially if natural metal concentrations are significantly less than those in the effluent. With the data presented in the DEIS, an accurate effects determination can not be made for either location. However, with the information available to us at this time, we concur with the selection of Alternative 6 as the preferred alternative.

Specific Comments

1 Page 2-6, Concentrate Handling. It is not clear if the concentrate storage area at the mill site is covered. If not, what provisions are being taken to prevent spillage.

2 Page 2-7, Water Supply. A domestic water supply of two gallons per minute for 200-300 workers seems too low.

3 Page 3-15, Fish and Fisheries Managment. To our knowledge, the white spotted greenling, masked greenling, and shortfin eelpout have no commercial value. The two greenling species are caught by sport fisherman but the eelpout has no value as a sport fish.

4 Page 3-16, paragraph 1, last sentence. Some clams are harvested even though there is the potential for paralytic shellfish poisoning. This sentence also conflicts with paragraph 3, page 3-17, which lists clams as a subsistence food item.

5 Page 3-17, Metal Concentrations in Biota. The range of values, not only averages, of metal concentrations in the organisms should be given. Even though the references are given, we recommend expansion of this section to include detailed data, i.e., the ten species of fish analyzed and the ten metals that were measured.

The NMFS' Auke Bay Laboratory is currently collecting metal concentrations data in selected marine species for the Auke Bay area. We recommend these data be obtained, if available in time, for comparison.

6 Page 3-26, Marine Mammals. The eight species of whales found in southeast Alaska should be listed.

7 Page 4-72, last paragraph. The DEIS states "The potential impact from the project upon humpback whales... would be small." We concur that there is no evidence, at this time, that humpback whales are being disturbed by existing levels and types of marine traffic in the area. However, Section 7 of the Endangered Species Act of 1973 requires all impacts to the species; immediate, ongoing, and potential, be identified. If the determination is one of "no effect" to the species it should be so stated.

We appreciate the opportunity to review this draft document.

Sincerely,

James W. Brooks

for Robert W. McVey
Director, Alaska Region

Response

1. All concentrate storage facilities and transportation systems (conveyors, trucks, and containers) will be covered and/or designed to prevent spillage.

2. Two gallons per minute at each site (or 4 gallons per minute total) would be more than adequate for a crew of 80 with the Juneau housing alternative. A camp alternative would require closer to 10 gallons per minute which would be equivalent to 50 gallons per person per day. These figures were developed from the following sources: Water Supply and Sewage, E. W. Steele; Water Supply Engineering, Ann Arbor Science; and, Water Resources Engineering, R. C. Linsley and J. B. Franzini.

3. These changes have been made in the text.

4. This has been changed in the text.

5. This entire section has been rewritten to clarify the baseline condition and to reflect new data not available at the time the DEIS was published. The Auke Bay data now appears in this section. Detailed results are available in References 39, 40, and 41.

6. The species of whales found in Southeast Alaska have been listed on page 3-22.

7. The determination of no effect has been stated in the text.

126 Washington Street
P.O. Box 7358, Ketchikan, Alaska 99901
(907) 255-6111

10

N C MACHINERY CO.

October 8, 1982

Mr. William P. Gee
Forest Supervisor
Tongass National Forest, Chatham Area
P.O. Box 1980
Sitka, Alaska 99833

RE: Greens Creek Draft Environmental Impact Statement

Dear Mr. Gee:

After reviewing the draft E.I.S., we are supportive of Alternate #2 over all others. While Alternate #6 is very similar to #2, the data presented did not justify the additional $2 million dollar capital expense to move the effluent discharge point from the Hawk Inlet sill to Chatham Strait. If #2 is unacceptable, our second choice would be alternate #6.

The IDT staff and Noranda Mining Inc. are to be complimented on the quality of this E.I.S. It is the best written and offers the clearest, simple explanations on the alternatives offered of any E.I.S. I've ever read. Thanks for providing the opportunity to comment.

Sincerely yours,

Errol Champion
Southeast Alaska Manager

EC:js

Corporate Headquarters P.O. Box 3562 Seattle, Wa 98124 • *Branches* Chehalis Mt Vernon Seattle, Seattle *(Lift Trucks)*, Tacoma *(Lift Trucks)*, Anchorage, Anchorage *(Lift Trucks)*, Fairbanks, Juneau, Ketchikan N C Marine 2500 Westlake N., Seattle, Wa 98109, N C Engine Power 16711 West Valley Hwy Seattle, Wa 98188

(11)

Territorial Sportsmen, Inc.
P.O. Box 761
Juneau, Alaska 99802

October 6, 1982

Dennis Rogers cc
Jan Lerum cc
Helen Castillo cc

Forest Supervisor
P. O. Box 1980
Sitka, Alaska 99835

Dear Mr. Gee:

The Territorial Sportsmen recognizes the inevitability of Noranda developments at Hawk Inlet, and are pleased at the tremendous amount of effort that has gone into protecting the environment of North Admiralty. However, we do have one major concern with Alternatives 2 and 4-7 presented in Greens Creek DEIS. As you have indicated, North Admiralty Island is very extensively used by Juneauites for recreational fishing and hunting at present. Predictably, as nearby Douglas Island and Shelter Island are developed and the Juneau population swells, the importance of North Admiralty to local recreational hunters will increase greatly. The road from Youngs Bay to Hawk Inlet, by providing access from the Hawk Inlet side of the Island, will extenuate this problem.

In spite of the many assurances in this DEIS that this road will be used only for transportation to and from Hawk Inlet, it would be naive
1 to believe that vehicles at Hawk Inlet would not be used to transport workers to the Youngs Bay (east) side of the Island. These individuals would be in direct competition with deer hunters, for example, who boated over from Juneau. Similarly, some Juneauites would be disposed to carry bicycles or motor cycles to Youngs Bay where they, in turn, would compete with other hunters on foot. We don't feel these impacts have been adequately reflected in your display matrix (p. 2-72). We in short, are very opposed to development of this road. We recognize that Hawk Inlet, once used by many Juneauites for recreational hunting, will be lost to us during the course of Noranda's activities. We also recognize that the northwest coast of Admiralty from Cube Cove to Funter Bay will also become an unattractive area for Juneau area recreational hunters because of competing pressures exerted by Noranda people at Hawk Inlet. Without a road between Youngs Bay and Hawk Inlet we feel that the impacts of Noranda's activities will pretty

much be confined to the west side of the Island (hunters from Hawk Inlet would be unlikely to traverse the Island).

A development such as that proposed by Noranda can yield many benefits to a community like Juneau. Likewise, there will be some major costs to the community associated with an increase in population resulting from the project. An additional cost, if a road is built from Youngs Bay to Hawk Inlet, would be the loss of some and degradation of much of the locally available deer hunting opportunities for Juneauites, including Juneau-based Noranda employees and their families. This is a cost that can not be mitigated, and it is a cost that we do not feel Juneauites should have to bear.

Many, if not most, of the people who reside in Alaska live here because of the opportunities for outdoor recreation. Hunting and fishing are deeply ingrained in our lifestyles, and we feel strongly that opportunities to hunt and fish should be protected for us and future generations. Therefore, we respectfully request that those Alternatives requiring construction of a Youngs Bay to Hawk Inlet road be rejected.

Thank you.

Very truly yours,

A. W. "Bud" Boddy, President
Territorial Sportsmen, Inc.

cc: Commissioner Skoog, Fish and Game
Director Souby, DPDP
John Sandor, USFS
D. McKnight, Game
Jim Stratton, SEAC
Editor, Juneau Empire

Response

1. The Forest Service Preferred Alternative incorporates employee housing in Juneau and assumes that no employee of Noranda will be permanently housed on Admiralty Island. Noranda has agreed that none of their employees will be permitted to hunt or fish during working hours and all employees transported by company boat to Admiralty Island will be returned to Juneau at the end of their shift. Only security personel will have firearms, for emergency encounters with wildlife. Neither Noranda nor the Forest Service has the authority to prevent off-duty employees from returning to the island from Juneau for recreational purposes.

The Forest Service intends to issue special-use permits for the road system which will limit the use of the road to Noranda vehicles on company business only. No private vehicles will be permitted on the road. Details of specific closure methods and security will be developed during the permitting process.

It was determined by the IDT that the impacts to recreational deer hunting on the east and west side of the island would be greatest under those alternatives with a permanent camp in Hawk Inlet. Potentially 225 employees could use their privately owned boats to travel to upper Hawk Inlet to deer hunt. It would be an easy walk to any area that would potentially be opened up by the road. Your concerns regarding the evaluation matrix (Table 2-3) have been addressed under the recreation section of the matrix. The process used to develop the ratings is described in Section II and is documented in the files at the Admiralty Island National Monument office in Juneau.

Since docking facilties are located below mean high tide, the Alaska Department of Natural Resources is responsible for issuing a tidelands lease for these structures. This lease should address construction, utilization, and reclamation. The Forest Service has no authority over those structures.

Noranda has stated that private boats will not be permitted to use these facilities except under emergency conditions.

A reclamation plan will be developed as part of the Operating Plan. Final disposition of the road from the cannery to Young Bay will be determined by the most current TLMP revision at the termination of the project.

(12)

Bear Creek Mining Company
Exploration Division of Kennecott Corporation

Anchorage Office

October 12, 1982

Mr. William P. Gee
Forest Supervisor
Tongass National Forest, Chatham Area
P. O. Box 1980
Sitka, Alaska 99835

Re: Greens Creek Draft Environmental Impact Statement

Dear Mr. Gee:

I have reviewed the above Statement and feel that you have done a good job evaluating the technical factors involved in this mine development program. As laid out in your preferred alternative, Alternative 6, there should be little if any disruption or degradation of either the mining opportunity or the scenic and wildlife values of the National Forest. I would support your selection of Alternative 6.

1 I question the application of VQO's as discussed on pages 3-37 to anything outside the Monument. It should not be based on "evidence of human alteration," after all, the area is not a "wilderness". Based on tourist activity, pictures painted by noted artists, landing points and so on, there is a great deal of interest in cannerys, old or new, docks, settlements, cabins and any sign of human alteration, especially if it has been abandoned. You are forcing on the public a wilderness ethic they do not seek. Are you making policy or implementing it?

It is too bad that the wisdom of Congress called for monument status for the mine area, an area with no special monument characteristics, VQO's or otherwise. It will only result in more costs and less benefits for both sides of the issue. Is there any hope that this boundary could be changed?

Sincerely,

R. C. Babcock, Jr.
Vice President and Manager, Alaska

RCB:reg

1111 DOWLING ROAD • ANCHORAGE, ALASKA 99502 • PHONE: (907) 344-1522 • TELECOPIER: (907) 344-0433

Response

1. The Forest Service is charged by Congress with the task of managing the many resources available on all National Forest lands. All resources require a management system designed to provide for the protection of the resource in areas where protection is deemed necessary and use of the resource, with proper constraints, where this is applicable. A management system for any resource must be designed with the flexibility to be integrated with other resource management systems to allow for compatible multiple use administration by the governing agency. The Forest Service has developed such a management system for the visual resource on all National Forest lands.

The visual management system recognizes that other resource management practices, though scientifically correct, do not always produce visually acceptable landscapes. It provides for different degrees of acceptable alteration of the natural landscapes based on the importance of aesthetics. The degree of alteration is measured in terms of visual contrast with the surrounding natural landscapes. Visual Quality Objectives, or VQO's, are simply the standards by which to measure those contrasts. In designated National Monument and Wilderness areas the system does indeed promote a natural appearing landscape character. However, this does not preclude development within these areas, especially where certain activities such as the Greens Creek project are permitted, but rather provides for them to be designed in a manner sensitive to the special aesthetic values found in the surrounding landscape. The system is not designed to promote a pristine wilderness appearance. On the contrary, in many areas management activities may dominate the surrounding characteristic landscape and still be visually acceptable under the system.

The Forest Service does not believe that the visual management system forces a wilderness ethic upon the public. The system was, in fact, developed in response to the public's concern over the appearance of all our National Forest lands.

(13

THE WILDERNESS SOCIETY

October 11, 1982

Mr. William P. Gee
Forest Supervisor
Tongass National Forest
Chatham Area
P.O. Box 1980
Sitka, Alaska 99835

Dear Mr. Gee:

The Wilderness Society appreciates the opportunity to comment on the Greens Creek Draft Environmental Impact Statement. We support the preferred alternative as requested by the Alaska Department of Environmental Conservation. We believe this alternative best balances mine development with water resource protection, wildlife protection, and protection of Monument values. In particular, we believe that Chatham Strait should receive all discharge. We do not believe that Hawk Inlet should be used for this purpose. We also believe that the road access permit for Young's Bay to the Cannery should contain a clause restricting access to only Noranda employees. This area is already a popular recreational attraction and will become more congested as mine development proceeds. Limiting access on this road will help alleviate the recreational pressure this area will receive in the future. In addition, it will help protect subsistence use of the area.

Thankyou for the opportunity to comment on this plan.

Sincerely,

Thomas S. Robinson

ALASKA FIELD OFFICE
419-6TH STREET, SUITE 321, JUNEAU, ALASKA 99801
(907) 586-4284

(14)

U.S. ENVIRONMENTAL PROTECTION AGENCY
REGION X
1200 SIXTH AVENUE
SEATTLE, WASHINGTON 98101

REPLY TO ATTN OF: M/S 443

OCT 13 1982

Dennis Rogers cc
Jan Lerdan cc
Helen Castillo cc

William P. Gee, Forest Supervisor
Tongass National Forest, Chatham Area
P. O. Box 1980
Sitka, Alaska 99835

RE: Greens Creek Project Draft Environmental Impact Statement (DEIS) Admiralty Island National Monument Alaska, Noranda Mining Project.

Dear Mr. Gee:

The Environmental Protection Agency (EPA) has reviewed the above DEIS. It appears to be adequate to support the decision making of the U.S. Forest Service (FS) and other Federal agencies. However, recent information developed by the FS and the project sponsor and not contained in the DEIS suggests that additional analysis is needed before the FS can identify the best marine site for the impoundment wastewater discharge. More detailed comments are provided below and in the attachment to this letter.

Evaluation of Alternative Disposal Sites

At a recent meeting (September 27, 1982) attended by the FS, EPA, and the project sponsor, uncertainty was surfaced regarding an environmentally preferable marine site for effluent disposal i.e., Hawk Inlet or Chatham Straits. The DEIS identifies Chatham Straits as the preferred alternative, but provides limited supporting rationale.

The additional rationale discussed at our meeting should be presented in the final EIS to allow for a wider review. This presentation should indicate what factors in this rationale are supported by empirical evidence and which factors were used conservatively due to insufficient empirical data. Additionally, a quantitative description of the resources at risk from outfall alignment and waste discharge in both the Hawk Inlet and Chatham Straits zones of impact should be provided in the final EIS. At the September 27 meeting, we agreed that more of this type of empirical information is available and will be important in determining which disposal site is preferable.

New Alternatives

New alternatives not mentioned in the DEIS were discussed at the September 27 meeting. They represent a significant change in the original proposal. If Noranda wishes to pursue these new alternatives, EPA suggests a supplement to the DEIS would be the most efficient way to disclose this to the public and allow for their thorough evaluation.

EPA has rated this DEIS LO-2 (Lack of Objections, Insufficent Information) for the following reasons:

1) Information now available, but not presented in the DEIS, (i.e. productivity in Hawk Inlet and Chatham Straits), is important to the decisions that the Forest Service and the Corps of Engineers must make on the discharge site.

2) Additional outfall alignment alternatives now being considered significantly change the original cost analysis and the potential biological impacts.

We appreciated the opportunity to review this EIS and to discuss the potential impacts of the project with the EIS Team. If you would like to discuss our comments and suggestions please contact Dick Thiel, Chief of the Environmental Evaluation Branch at (206) 442-1728 or (FTS) 399-1728.

Sincerely,

John R. Spencer
Regional Administrator

Attachment

cc: Ron Kriezenbeck, AOO
Dick Stokes, ADEC

Attachment

EPA's Detailed Comments On:

Greens Creek Project DEIS

Permits - Water Quality

1 Page 2-51; If effluent discharges from the quarry sediment ponds enter receiving waters, they will require NPDES Permits. To prevent untimely delays, the Forest Service should advise Noranda to apply for the necesary permits well before road construction begins.

2 Page 4-12; The domestic waste treatment plant will be subject to a NPDES Permit. Again, to prevent delays, Noranda should apply for the permit at least six months before construction starts.

3 Page 4-46; Confidence limits and baseline data should be established before the NPDES permit is issued. EPA believes that it is not appropriate to use the NPDES monitoring stipulations to establish baseline data as suggested in footnote 2/

4 Page 4-4; (Third paragraph, first sentence); It would be more appropriate if "mine" were changed to "mill."

5 Page 4-49 and 4-51, (Tables 4-5 and 4-6); Under footnote 2/ "EPA quality criteria" should probably be "EPA Effluent Guidelines." Under parameters, "Total Dissolved Solids" should probably be "Suspended Solids."

Air Quality - Permits

6 Page 1-10; "New Source Air Quality Permit" under U.S. Environmental Protection Agency should be changed to PSD (Prevention of Significant Deterioration) Permit.

7 Page 3-36, (last paragraph); The "grams per meter cubed" should be "micrograms per meter cubed" (EPA Guidelines for Monitoring PSD, 1978).

Solid and Hazardous Waste Management

8 EPA will be glad to review the proposed Spill Prevention, Control, and Countermeasure Plan (SPCC plan) upon request and provide comments where appropriate. However, the FEIS should note that EPA does not approve such plans prior to facility construction and operation as noted on pages 1-10 and 2-7 of the DEIS. The current agency policy is to require such approval if a spill actually occurs.

Response

1. & 2. We concur that effluent discharged from sediment ponds would require NPDES Permits. Additionally, all domestic waste discharged separately from other mining discharge would require NPDES Permits.

3. To ensure baseline monitoring will be meaningful and applicable for monitoring the proposed discharge, all sample sites, sampling depths, sampling techniques, and analytical techniques need to be the same as those required in NPDES Permits. While we agree the NPDES monitoring stipulations may not be appropriate for outlining baseline data collection, the EPA and ADEC need to work with Noranda to develop a monitoring plan that will yield useful data for issuing the permit and monitoring the discharge.

4. This has been changed in the text.

5. Tables 4-5 and 4-6 have been revised in the FEIS.

6. This has been changed in the text.

7. This has been changed in the text.

8. The text has been modified to indicate that the EPA will be asked to review a SPCC Plan prior to use of the fuel storage facility.

Dennis Kogus (15)

THE CITY AND BOROUGH OF JUNEAU

CAPITAL OF ALASKA

155 SOUTH SEWARD ST. JUNEAU, ALASKA 99801

PLANNING DEPARTMENT (907) 586-3300

October 15, 1982

RECEIVED

OCT 19 1982

William P. Gee, Forest Supervisor
Tongass National Forest, Chatham Area
Post Office Box 1980
Sitka, Alaska 99835

SUBJECT: Greens Creek Draft Environmental Impact Statement

Dear Mr. Gee:

The City and Borough of Juneau Planning Department has reviewed the Greens Creek Draft Environmental Impact Statement and offers the following comments.

An issue that is of major concern to the City and Borough of Juneau is the diversification of our local economy. Presently, the main employment base is federal, state, and local government. Development of a mine in the Juneau area would be desirable to the CBJ from the standpoint of diversifying the employment base.

Our studies indicate that every basic employment sector job, such as mining, will create one (1) additional job in the secondary service employment sector. For this reason, the development of the mine will certainly be an important factor in our employment base. However, the benefit will only realized with the development of one (1) of the alternatives which allow for housing of the mine workers in Juneau (Alternatives 2, 4, 5, 6, and 7).

We believe that Alternative 6, best addresses the major concerns we have on the projects impact on Admiralty Island and Juneau.

The statement is unusually detailed and it is obvious in reviewing it that a great deal of consideration and sensitivity were built into the process. I believe that your staff should be commended for their thoughtfullness and thoroughness.

We hope that these comments are useful to you in making a decision on this project. Thank you for the opportunity to participate in the planning process.

Sincerely,

Thomas J. Peterson, PP, AICP
Planning Director

TJP:SG:phl

16

Alaska Center for the Environment
1069 W. 6th Avenue
Anchorage, Alaska 99501 274-3621

October 18, 1982

Chatham Area
Tongass National Forest
P.O. Box 1980
Sitka, Alaska 99835

Dear Friends:

We would like to offer comments on the Greens Creek Draft EIS for the proposed Noranda mining operations on Admiralty Island. Our 600 members are extremely concerned about protection of Admiralty Island, which was one of our highest priorities in the Alaska Lands Act.

We feel the preferred alternative is the best means to minimize adverse impacts in the area. Although necessary, the road from Young Bay to Hawk Inlet
1 could be a source of problems unless carefully managed. This road should be permitted for Noranda's exclusive use, with a guard located at the Young Bay end to limit use. After mining operations end, reclamation of the road should be required.

Effluent from tailing ponds should be discharged into Chatham Strait: monitoring of water quality should be stringently conducted.

Any changes proposed for the permit should be given public review before a decision is made.

We appreciate this opportunity to offer our comments on the proposed mining operations.

Sincerely,

Mary Whitemore Core

Mary Whitemore Core
Co-Director

Response

1. Please refer to the Forest Service Response to Comment 1, letter 11, from The Territorial Sportsmen.

(17)

Department Of Energy
Alaska Power Administration
P.O. Box 50
Juneau, Alaska 99802

OCT 14 1982

October 14, 1982

Mr. William P. Gee
Forest Supervisor
Tongass National Forest, Chatham Area
P.O. Box 1980
Sitka, Alaska 99835

Dear Mr. Gee:

We have the Greens Creek Draft Environmental Impact Statement for the proposed Noranda Mining, Inc. development on Admiralty Island, Alaska and appreciate the opportunity to comment on it.

1 We note that the draft is silent on volume of diesel fuel for electric power generation as well as alternative power sources. To overcome this deficiency, we suggest that discussions be included setting out the amounts of diesel fuel anticipated to be used and storage systems descrip-
2 tions, as well as details on alternative electric power sources such as the potential Juneau-Hoonah transmission line, wood fuel, coal, or wind.

Sincerely,

Robert J. Cross
Administrator

CHATHAM
OCT 20 1982

Response

1. Discussion of fuel volumes and storage facilities has been expanded in the text.

2. The Hoonah to Juneau transmission line is a major environmental, economic, and political decision entirely separate from the proposed mining project. Since the decision on a transmission line will be made outside the Forest Service, the IDT did not believe the transmission line should be considered in an alternative. If the Hoonah to Juneau transmission line was the electric energy source for this project a backup diesel system would be required for environmental protection and worker safety. A backup diesel system would be nearly equivalent to the proposed generating system. Wood was not considered as an electric generating fuel because its use would result in the disturbance and logging of additional areas. Coal fired generation was not discussed by the IDT. State-of-the-art technologies, such as wind generation, were not considered by the IDT because of the question of technical feasibility.

126 Washington Street
P.O. Box 7358, Ketchikan, Alaska 99901
(907) 255-6111

18

N C MACHINERY CO.

October 14, 1982

Mr. William P. Gee
Forest Supervisor
Tongass National Forest, Chatham Area
P.O. Box 1980
Sitka, Alaska 99833

Ref: Greens Creek Draft Environmental Impact Statement

Dear Mr. Gee:

After reviewing the draft Environmental Impact Statement, I feel that I would have to be supportive of alternate #2 over the other seven alternatives. I feel that the added expense to move the effluent discharge point from the Hawk Inlet sill to the Chatham Strait is not justified by the data presented. If #2 is unacceptable, I feel that alternate #6 would be the next best.

Larry R. Ladd

Larry R. Ladd
Southeast Alaska Sales Manager

OCT 19 1982

FS

YOUR CATERPILLAR DEALER

Corporate Headquarters P O Box 3562 Seattle, Wa 98124 • Branches Chehalis Mt Vernon Seattle, Seattle (Lift Trucks), Tacoma (Lift Trucks), Anchorage, Anchorage (Lift Trucks), Fairbanks, Juneau, Ketchikan N C Marine 2500 Westlake N , Seattle, Wa 98109, N C Engine Power 16711 West Valley Hwy Seattle, Wa 98188

(14)

October 15, 1982

Mr. William P. Gee
Forest Supervisor
Tongass National Forest
Chatham Area
Post Office Box 1980
Sitka, Alaska 99835

Dear Mr. Gee:

Sealaska Corporation has reviewed the Greens Creek Draft Environmental Impact Statement. This document lists the fisheries, wildlife, cultural, economic, esthetic, and other values of the Greens Creek Project area, and possible impacts of the various development alternatives. The document appears to have been carefully prepared and appears to encompass all subjects of concern to the project and the Admiralty Island National Monument.

The two preferred alternatives #2 and #6 appear to be feasible concepts. These alternatives appear to have the necessary features to protect, and maintain, the quality and quantity of the various resource values of the area that may be influenced by the Greens Creek Project.

These two alternatives differ only in the specific location of the effluent discharge site. The Noranda preferred alternative site for effluent discharge (#2) is at the Hawk Inlet site. The U.S. Forest Service preferred alternative site for effluent discharge (#6) is at Chatham Strait.

It appears that the impacts of the effluent discharge at the two sites and the degree of risk of the effluent discharge at both sites vary slightly. Because of the potential effects to fisheries and other marine values by the effluent discharge site there is a need for more information as regards the impacts, degree of risk and economic consequences of both sites for effluent discharge. With such information the best possible effluent discharge site could be determined.

SEALASKA CORPORATION ONE Sealaska Plaza, Suite 400, Juneau, Alaska 99801 Phone (907) 586-1512

Based on the currently available information Sealaska Corporation supports the selection of either alternative #6 (U.S. Forest Service preferred alternative) or alternative #2 (Noranda preferred alternative). If more information becomes available, Sealaska Corporation may support a specific alternative that best meets the needs of both the Greens Creek Project development and protection of the other Admiralty Island National Monument resources.

Thank you for this opportunity to comment.

Sincerely,

SEALASKA CORPORATION

Robert W. Loescher
Vice President, Resource
Management

RWL/RW:rj

cc: Goldbelt, Inc.
Kootznoowoo, Inc.
Huna Totem Corporation
Shee-Atika, Inc.
Miles Murphy, Mayor - Hoonah
Richard George, Mayor - Angoon
William Overstreet, Mayor - Juneau
Juneau Alaska Native Brotherhood
Tlingit and Haida Central Council
John Sandor, USFS
John Katz, DNR
Ernst Mueller, DEC
Michael Chittick
Marlene Johnson
Joe Wilson
Al Kookesh
Byron I. Mallott

(20)

DEPARTMENT OF HEALTH & HUMAN SERVICES

Public Health Service

Centers for Disease Control
Atlanta GA 30333
(404) 262-6649

CHATHAM
OCT 18 1982

FS		PUR	
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TIM		B&F	
S&W		CCS	
F&W		SRD	
PLN	WWu	HRD	
R&L		JRD	
YWC		MM	

October 14, 1982

Mr. William P. Gee
Forest Supervisor
Tongass National Forest, Chatham Area
P.O. Box 1980
Sitka, Alaska 99835

Dear Mr. Gee:

We have reviewed the Draft Environmental Impact Statement (EIS) for Greens Creek, Admiralty Island National Monument, Noranda Mining Project. We are responding on behalf of the U.S. Public Health Service.

1 The Draft EIS does not address mosquito or other vector populations. The Final EIS should discuss the effects of the proposed action on mosquito or other vector populations, their potential health threats to workers, proposed vector control measures that may be used, kinds and volumes of pesticides that may be used, and anticipated application procedures.

2 As part of the vegetation clearing procedures and subsequent maintenance effort, will any chemical control measures be used? If so, what herbicides will be used and how will they be applied?

3 The Draft EIS mentions above-ground fuel storage tanks. Although an oil spill prevention control plan will be prepared, the Final EIS should also address the safety aspects of the above-ground tank locations in relation to work areas.

4 The domestic water supply for this project is indicated as being taken from water-bearing sediments adjacent to Greens Creek. A discussion of the water treatment and disinfection procedures that will be followed prior to domestic use should be included in the Final EIS.

Thank you for the opportunity to review this EIS. Please send us a copy of the Final EIS when it becomes available. If you should have any questions about our comments, please contact Mr. Lee Tate of my staff at FTS 236-6649.

Sincerely yours,

for Chester L. Tate, Jr.

Frank S. Lisella, Ph.D.
Chief, Environmental Affairs Group
Environmental Health Services Division
Center for Environmental Health

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GER DISTRICT

Response

1. Mosquito and other vector populations are very typical for Southeast Alaska. Noranda is not planning any vector control measures nor is the use of pesticides anticipated. Because the vector problem is typical and because no vector control is planned, discussion of vectors has not been included in the FEIS.

2. The use of herbicides is not planned.

3. A discussion of fuel storage facilities and spill prevention has been added to the text in Section II.

4. Discussion of water treatment and disinfection has not been included in the FEIS. Exact water treatment methods will not be known until the water source has been developed and the water can be tested.

(21)

United States Department of the Interior

OFFICE OF THE SECRETARY

P. O. Box 120
Anchorage, Alaska 99510

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October 15, 1982

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OCT 19 1982
CHATHAM
SITKA RANGER DISTRICT

Dennis Rogers TC
Jacheren TC
Helen Castillo

William P. Gee
Forest Supervisor
Tongass National Forest, Chatham Area
P.O. Box 1980
Sitka, Alaska 99835

Dear Mr. Gee:

We have reviewed the Draft Environmental Impact Statement (DEIS) on the Greens Creek Project, Noranda Mining Company, Admiralty Island National Monument, Alaska and offer the following comments for your consideration.

General Comments

We are concerned, that the most practicable alternative that would cause the least adverse impact to fish and wildlife values was not fully evaluated. The selection of Alternative 6 in the DEIS as the preferred alternative places the tailings pond in Tributary Creek and the mill site
1 directly adjacent to Greens Creek. The tailings would cover and destroy much of Tributary Creek. The anadromous fishery values of Tributary Creek are documented in the DEIS. The selection of Alternative 4 would place the mill site and tailings disposal site at the "football field" away from sensitive fishery resources and eliminate the need to mitigate for the lost habitat. Although the developer is willing to provide mitigation, we believe it would be preferable to maintain the quality of the existing habitat in the National Monument if a practicable alternative exists which would minimize this loss of habitat.

For the most part, the DEIS justifies the elimination of the "football field" alternative on the basis that the tailings impoundment may fail and allow the tailings to flow into Greens Creek downslope of the site. However, throughout the DEIS the possibility of failure is described as remote or low (see geotechnical section, page 4-33) and there appears to be no greater risk involved in development of the "football field" than with the other alternatives. The "football field" is located about one-half mile from Greens Creek in a perched muskeg, whereas the U.S. Forest Service (USFS) preferred alternative is located in Tributary Creek immediately upstream of its confluence with Zinc Creek. An impoundment failure here would represent an immediate threat to downstream fishery resources. The impacts to wildlife--especially brown bear--would be significantly greater at the USFS preferred site, while development of the "football field" would have negligible effects.

The DEIS presents no data or rationale that the "football field" disposal site could not be developed in a manner that would reasonable assure the structural integrity of the impoundment. The U.S. Fish & Wildlife Service (FWS) previously requested that detailed geotechnical information be obtained for the site. To our knowledge, this was not accomplished (ref. page 4-27), and decisions regarding the stability of the site remain speculative.

We support the selection of the Chatham Strait effluent discharge over either the sill or cannery discharges. To assist you in documenting this selection, we recommend incorporating the following material into the language of the EIS. Selection of a Chatham Strait discharge will greatly reduce the chance of sublethal chronic effects on fish and invertebrates in the Hawk Inlet. Furthermore, the rocky, deep areas surrounding the effluent discharge in Chatham Strait are much less productive than the shallow nursery areas of Hawk Inlet and potential impacts are, therefore, much lower. Although the USFS indicates the developer can meet Alaska Department of Environmental Conservation (ADEC) standards for discharge at any of the sites if they are allowed a mixing zone, the ADEC standards were developed from Environmental Protection Agency (EPA) criteria which consider each heavy metal singly. The effluent will be a mixture of a number of heavy metals. The safety factors for each heavy metal are, therefore, much lower since synergistic or at least additive toxicity have been shown to occur for a number of the metals. Therefore, it is important that the effluent be discharged in Chatham Strait.

Specific Comments

2 Page 2-41, Fig. 2-14: Fig. 2-14 is incorrectly titled "Football Field..."; it should read "North Hawk Inlet..."

3 Page 2-56, para. 5, Fishery Mitigation: We find this section lacks the necessary supporting documentation to provide the readers and decision makers with a clear understanding of the fisheries mitigation program. For example:

1. there is no methodology presented which establishes the gains and losses in productivity, i.e., "Seventy percent," "remaining 30 percent lost production," and "additional 20 to 30 percent."

2. The program lacks the necessary provisions for preproject baseline studies to determine the feasibility of the measures suggested, e.g., water quality parameters (including temperature and heavy metal analysis), substrate suitability, flow conditions for spawning access and outmigrants.

To correct these deficiencies, we recommend that:

4 1. detailed methodologies, assumptions, etc. regarding the fisheries mitigation measures be presented in the EIS; and

2. a detailed preproject baseline study be implemented immediately to ascertain the feasibility of the mitigation measures. We recommend that this study be scoped and approved by appropriate State and Federal resource agencies.

5 Page 2-60, Monitoring Requirements: We suggest that the monitoring program be expanded to include water temperature, intra-gravel, as well as in the water column.

6 Page 2-66, Freshwater Aquatic Biota (Monitoring): Tissue analysis of Dolly Varden trout on an annual basis and fish counts during the summer do not constitute adequate monitoring of freshwater aquatic biota. At a minimum, such a program must include determinations of fecundity and egg viability, as well as evaluating the food supply supporting the fishery. A minimum food supply evaluation program could be achieved by monitoring the benthic biota at the sampling locations in the spring and early summer. We suggest that the final EIS be amended to reflect a minimum aquatic biota monitoring program.

7 Page 2-80, para. 2, Marine Environment: The sentence "In addition, sublethal effects within the inlet have not been established." is unclear. We believe what was meant is that due to the heavy metals in the effluent and their concentration in the marine waters of Hawk Inlet, sublethal "chronic effects" may occur.

8 Page 3-13, last para., Physical/Chemical Characteristics: Elevated levels of silver, lead, and copper in marine waters are not normal.

9 Page 3-17, para. 2, Metals Concentrations in Biota: The high concentrations of zinc and copper in organisms from Hawk Inlet are not a result of these elements being physiologically required by the biota. The higher levels found in organisms in Hawk Inlet are instead, a reflection of the higher levels of these elements in the environment.

10 Page 3-18, para. 2 and 3, Metals Concentrations in Biota: Cadmium and mercury concentrations in the biota should be presented and should be related to effects on biota, not in humans, since the concentrations may be quite different.

11 Page 4-38, Freshwater Quality: A spill of any toxic material during spawning or during the period when the fish are emerging would be very detrimental. A large spill could wipe out a whole year class of fish in a stream.

12 Page 4-45, para. 1, Marine Water Quality: The anticipated average flow of 600 GPM seems very low, even accounting for some recycling, which is not mentioned. We calculate that the average annual flow should be between 1200 and 2000 GPM.

13 Page 4-45, para 4, Marine Water Quality: In order to characterize the water quality at the mouth of Hawk Inlet, samples should be taken through-

out the inlet and the most sensitive method of analysis used. We recommend samples be taken at least seasonally and at various tidal stages.

14 Page 4-46, Table 4-4, Proposed Standards and Background: It should be noted that methods are available to quantify heavy metals concentrations in marine waters at much lower concentrations than those presented in this table. The claim that the proposed ADEC standards exceed the background concentrations in Hawk Inlet because the contractor could not measure the heavy metals at that concentration is, therefore, invalid.

15 Page 4-55, para. 2: The flow augmentation collection channel would run along the access road prism before it is diverted to Tributary Creek. In addition to the higher levels of turbidity and sediment from the road being introduced into the water, there would be an increased possibility that an oil or toxic chemical spill on the road system would be directly introduced into the flow augmentation channel and transported downstream to Tributary Creek and lower Zinc Creek. The results of such a spill could have severe impacts on the fishery. There would also be chronic, unavoidable low level roadside pollution from the operation of heavy equipment and trucks. These effects should be addressed in the EIS.

16 Page 4-62, para. 2, Marine Aquatic Biology: A number of the proposed ADEC standards do not come from the application of a factor to the LC_{50} value, but from the EPA Ambient Water Quality Criteria. These criteria were developed taking both acute and chronic data into consideration where the data was available. However, it should be noted that these standards were developed for each element singly and cannot be applied where several toxic elements are mixed in an effluent.

17 Page 4-62, para. 3, Marine Aquatic Biology: Although it is generally true that the concentration of a heavy metal in an organism may not be related to the concentration of that metal that is acutely toxic, high concentrations of heavy metals in organisms generally indicate high environmental levels of heavy metals and may indicate a population that is being stressed.

18 Synergistic and/or additive effects of heavy metals in solution are well documented. The application of these effects to marine organisms is not well documented, but there is no reason to suspect that it would be different from that of freshwater organisms.

19 Page 4-62, para. 4, Marine Aquatic Biology: While it is true that elevated levels of some metals may occur without lethal or sublethal effects, the elevated levels are an indication of stress, in that the introduction of more of a metal or a different metal may overload the animals' ability to detoxify the metals, because all of the storage sites are already loaded.

20 Page 4-63, para. 2, Marine Aquatic Biology: While it is true that salmon, king crab, and to a certain extent, halibut are migratory, it is not true that they will not be exposed to heavy metals. Salmon species such as the pinks (Oncorhynchus gorbuscha) and the chum salmon (O. keta) spend a large proportion of their early life history in estuarine areas such as Hawk

Inlet. They would, therefore, be exposed to the heavy metals for a number of months before they leave the inlet. Crabs such as the Dungeness crabs (Cancer magister), a commercial species, are not highly migratory and may remain in the inlet throughout their life history. Halibut may also spend several years in shallow inlets before migrating to deeper marine waters. A commercial shrimp fishery is also present in Hawk Inlet and the shrimp are not migratory and would be exposed to the heavy metals through their life history. Therefore, many of the biota in the inlet will be exposed to the heavy metals during significant portions of their life history and bioaccumulation of heavy metals might be expected to occur.

21 Page 4-63, para. 3, Marine Aquatic Biology: It is true that the concentrations of metals that, if considered singly, are proposed in the effluent may not affect the biota, but the impact of the metals in combination may cause sublethal effects.

22 Page 4-72, para. 2: The USFS (Region 10) and the FWS have a "Memorandum of Understanding" dated 11/14/78 that the USFS will maintain at least a 330-foot radius buffer around each nest tree. It is our understanding that the docking and support facilities an Young Bay may encroach on this recommended buffer. If this is the case, the EIS should fully address this situation and provide the rationale for the necessity for any encroachment and measure to mitigate any adverse impacts.

Summary Comments

We have identified several weaknesses and deficiencies within the DEIS, primarily dealing with equitable treatment of alternative disposal sites; a clearly defined and coordinated fishery mitigation plan; and adequate baseline and post project monitoring programs. Provided that these deficiencies are corrected in the final EIS, we will not have any objection to the issuance of Federal permits associated with this proposal.

We appreciate the opportunity to review and comment on this document.

Sincerely,

Paul D. Gates
Regional Environmental Officer

21

Response

1. Direct loss of fisheries habitat was included in the evaluation of alternatives. Alternative 5 was the most desirable alternative for freshwater fisheries and water quality (DEIS page 2-75) because it had no direct habitat loss and no consequences to the freshwater environment associated with a worst case dam failure. Alternative 5 was later eliminated from consideration because it posed a moderate threat to marine biota and marine water quality. That threat was based on the North Hawk Inlet tailings ponds proximity to upper Hawk Inlet, which has been shown to have poor flushing characteristics.

Alternative 4 was eliminated based on the consequence of the low level threat of a tailings dam failure. If the Football Field tailings dam failed, all of Greens Creek would be threatened. The consequence of that failure would be that 21 acres of anadromous fish habitat would be affected.

For Alternative 6, the Preferred Alternative, a dam failure would threaten the remainder of "Tributary Creek" and Zinc Creek, below the confluence of the two streams. The consequence of that failure would be that 2.6 acres of anadromous fish habitat would be affected. In the final analysis, direct loss of 0.3 acres, with a potential low threat to 2.6 additional acres, was traded off against no direct loss, with a potential low threat to 21 acres. A detailed account of the evaluation of alternatives for fish and water quality criteria is available at the Admiralty Island National Monument Office in Juneau. A clarification of the evaluation process to reflect consequence has been included in the text.

The impact to wildlife from selection of the Cannery Muskeg tailings pond was considered in the DEIS (pages 2-75 to 2-77). Alternative 4 was selected as the Preferred Alternative for the wildlife issue. However, when all evaluation criteria were applied, Alternative 4 was eliminated due to the threat to Greens Creek (a low threat to 21 acres) and because it was least desirable under the monument values issue (more development in monument, with poor reclamation potential). Alternative 6, although not the most preferred alternative in terms of fisheries or wildlife, represents the alternative that best meets all of the evaluation criteria.

2. Figure 2-14 is correctly labeled as the North Hawk Inlet tailings pond in subsequent printings of the DEIS.

3. This section has been rewritten because the flow augmentation program has proven to be technically infeasible. Noranda has agreed to implement the Greens Creek barrier modification project as soon as practicable after the

road to the mine is constructed, subject to Forest Service and ADF&G approval. Methodology that establishes gains and losses in acres of habitat is now displayed in the FEIS. Production losses in terms of number of fish was displayed in the DEIS on pages 4-55 to 4-57. Baseline data on habitat suitability was collected by Dr. James Buell and can be found in Reference 5.

4. The detailed methodology for mitigation will be presented in the Operating Plan. This will include engineering design and construction standards. Assumptions associated with mitigation are now displayed in the FEIS.

The preliminary feasibility of the proposed mitigation measure has been determined by Dr. James Buell, Noranda fishery consultant, and Forest Service fisheries personnel. The responsiblity for final feasibility determination of the project lies with the developer and will be presented in the Operating Plan. Interested State and Federal agencies will be able to review that plan for engineering design. Monitoring of mitigation will determine its effectiveness and whether further work is necessary to accomplish one to one replacement of habitat lost due to implementation of the Preferred Alternative.

5. Temperature measurement of the water column is already part of the monitoring plan and was listed in the DEIS on page 2-65. The only intra-gravel temperature reductions anticipated that will affect fisheries are in "Tributary Creek" as a result of reduced flow. The IDT believes that once the tailings dam is constructed, monitoring of intra-gravel temperature would not lead to workable project modifications that would alleviate the problem.

6. Your suggestions concerning a freshwater aquatic biota monitoring program reflect a concern for chronic, sub-lethal effects upon the freshwater fish community within the project area. This is a valid concern when the discharge of effluents occurs in freshwater. Effluent from the Greens Creek project will be brought to the tailings pond, settled, and discharged into the marine environment. Metals in freshwater are anticipated to remain at current levels. A monitoring program to ascertain this effect is required and is described on pages 2-62 and 2-63 of the DEIS. The additional measurement of heavy metal tissue burden in freshwater fishes (particularly Dolly Varden char) in conjunction with the water quality measurements will indicate if a change from the natural state has occurred.

The program you have suggested goes beyond the current state-of-the-art for monitoring and would better be classified as research. This is because it would require experimentation in the laboratory to determine the chronic, sub-lethal metal levels and metal combinations necessary to cause an effect. It would also involve significant data collection on comparable systems to establish natural variability.

The fish counts referred to on page 2-66 of the DEIS are to determine viability of the mitigation measures and were not meant to measure effects on the freshwater environment. The fish count program has been removed from the water quality section but is shown for the mitigation section of the FEIS.

7. This paragraph has been rewritten in the FEIS. The meaning of the paragraph is that because sub-lethal heavy metal levels have not been determined through research, and because Hawk Inlet is a salmon nursery area and commercial crab and shrimp fishery, it does not seem prudent to expose that resource to an additional stress.

8. Wording to reflect your input has been inserted in the FEIS.

9. & 10. This entire section has been rewritten to clarify the baseline condition and to reflect new data available since the DEIS was published. Detailed results are available in References 39, 40, and 41.

11. Your comments have been incorporated into the discussion to reflect a potential worst case scenario.

12. The text has been changed to reflect an anticipated average flow of 1200 gallons per minute. Noranda has used the 1200 gpm average discharge for their final effluent analysis in Reference 44.

13. Noranda and ADEC have outlined a marine water monitoring program for Hawk Inlet in Reference 44.

14. Refer to Footnote 2 in Table 4-4. Samples taken by Noranda after the DEIS was published showed much lower concentrations for some metals. However, only additional samples taken and analyzed by ADEC, EPA, and Noranda's contract laboratory will answer this concern. Currently, those agencies are planning a split water sampling trip, in which quality control checks will be run using more than one laboratory.

15. The flow augmentation proposal has been deleted. The effects of the new situation are now found in this section.

16. Synergistic effects were part of the rationale for suggesting a Chatham Strait discharge.

17. The text has been changed to indicate that high environmental heavy metal levels can indicate a stressed population has been added.

18. Although it is true synergistic/additive effects are documented, the LC_{50} levels are variable. This is probably the reason the synergistic levels have not been set by EPA.

The IDT has been unable to substantiate the relationship between freshwater and saltwater effects. Agency specialists have also not been able to verify synergistic effects in the marine environment. The IDT believes it cannot determine effects without specific LC_{50} data on marine organisms and that significant research would be necessary prior to a definitive effects analysis.

19. Elevated levels of metals can indicate stress in an organism as you have noted. However, it is not clear that this indicates a stressed community. Wording to reflect your input has been inserted in the FEIS.

20. This paragraph has been rewritten to reflect some of your input. The meaning of the paragraph is that within the mixing zone near the diffuser site where the highest concentrations of heavy metals will occur, the species mentioned will not likely bioaccumulate due to their migratory ability. The concern you have is with Hawk Inlet where residence time is long for some animal species. No data is available on the long term concentrations of heavy metals in the inlet. Results from a mathematical model seem to indicate that a longer residence time will occur at one discharge point than the other. This may indicate that a higher risk of bioaccumulation by organisms is possible with a discharge site within the inlet.

21. The IDT has not been able to substantiate the sub-lethal effects of metals singularly or in combination in the marine environment.

22. The location of the Young Bay dock facility has been moved and is now approximately 500 feet from eagle nest tree number 039.

23

Southeast Alaska Conservation Council
BOX 1692, JUNEAU, ALASKA 99802 907-586-6942

SEACC

LYNN CANAL CONSERVATION
Haines, Alaska

JUNEAU GROUP SIERRA CLUB
Juneau, Alaska

SITKA GROUP SIERRA CLUB
Sitka, Alaska

PETERSBURG CONSERVATION SOCIETY
Petersburg, Alaska

SITKA CONSERVATION SOCIETY
Sitka, Alaska

STIKINE CONSERVATION SOCIETY
Wrangell, Alaska

TAKU CHAPTER ACS
Juneau, Alaska

TONGASS CONSERVATION SOCIETY
Ketchikan, Alaska

October 18, 1982

William P. Gee
Forest Supervisor
Chatham Area
U.S. Forest Service
P.O. Box 1980
Sitka, AK 99835

Dear Mr. Gee:

The Southeast Alaska Conservation Council remains firm in its position that the Green Creek project is not compatible with the purposes for which the Admirality Island National Monument was created. We strongly oppose the construction of this project.

However, language in the Alaska Lands Act seems to allow this project to be built provided it is compatible with the purposes for which the Monument was established. While this compatability is in question, we feel the preferred alternative as identified in the Draft EIS does the least environmental damage to the Monument. We agree with this alternative given several provisions.

Our greatest concern lies with the road from Young Bay to the cannery. This road has the potential for increasing access from east Mansfield to the west and from the mine site to hunting access on the east. Concern over increased access from people at the mine site to prime hunting sites on east Mansfield prompted the State Department of Fish and Game to support a no road alternative. While no road would protect the east Mansfield hunting areas, a 300 person live-in camp in Hawk Inlet would do more overall damage to the values of the National Monument.

The concerns about this road, however, are very real and SEACC feels very strongly that our non opposition to the road hinges on several stipulations in the Special Use Permit:

1 1.) The road be permitted for Noranda's exculsive use for the transport of personnel to and from the Young Bay dock.

2 2.) The road will <u>not</u> be used by Noranda employees to access east Mansfield for recreation and hunting purposes. "No motor vechiles" must be strictly enforced with strong fines.

3 3.) A full time guard be posted at both ends of the road to enforce these stipulations. Install gates if needed.

4 4.) The road be completely removed upon closing down the project. Noranda paid to put the road in, they should be able to pull it out.

5 5.) All traces of the docking facility in Young Bay be removed.

We request a draft copy of the Young Bay to Cannery Road Special Use Permit for our review before the final permit is agreed to and signed.

The Draft EIS only provides general provisions for contingency and mitigation plans. These plans must be prepared in final form for inclusion in the Special Use Permit for the project prior to that permit being signed. Contingency plans should be as detailed as existing fire plans
6 and be drawn up for reagent and other chemical spills, oil spills, tailings pipe rupture, tailings impoundment rupture, breakdown in sediment ponds and other potentially hazardous situation. We request drafts of these contingency and mitigation plans and of the Special Use Permit for the project.

The tailings outfall should remain in Chatham Strait. No one knows what impact mine discharge water will have on organisms living in Hawk Inlet. To prevent Hawk Inlet form becoming a giant experiment, the Forest Servic should continue its position supporting the discharge site in Chatham Strait. Hawk Inlet is too important and productive to gamble with.

Your evaluation of the No Action Alternative falls short of that Section 503 (f)(2)(A) says. The quote on page 2-24 continues by stating "to assure that such activities are compatible, to the maximum extent feasible, with the purposes for which the monuments were created." While this statement doesn't preclude development of the mine, it does set forth a very important point that isn't discussed in Draft EIS. Any activity that
7 occurs within the Monument boundaries must be compatible "to the maximum extent feasible" with monument purposes. Maximizing protection for monument values is much different than minimizing impacts. This general philosophy needs to be carried beyond the EIS and into the development stage of the mine.

The Draft EIS is unclear on the monitoring program that will be in place
8 during the construction phase. Since frequent blasting will occur and large amounts of earth moved, this phase has the potential for a high percentage of unplanned impacts. The only way this can be detected and mitigated is to have a well established monitoring systems in place before any work begins.

In the range of alternatives dismissed from further review, a hydrofoil
9 arounf Mansfield to Hawk Inlet was dismissed because of "Potential for injury to marine life, operational limitations and maintenance problems. Given the State Department of Transportation's recent testing of a Boeing

jetfoil, this option needs more explanation before it can be dismissed. A one line dismissal is far too inadequate for what seems to be a viable option.

10 The explanation of development in the mine service area and overburden storage area before the tailings pipe is installed and working refers to sediment ponds set up to catch the construction runoff. Where does the water go after it leaves these sediment ponds? Is there any plan to treat this water for removal of grease and oil that will undoubtedly find its way into the runoff? Water leaving these sediment ponds must be treated for removal of grit, grease and oil. These sediment ponds must be closely monitored for compliance with state water quality regulations.

11 In Table 2-2 on page 2-18, the ratings for the effect on water quality of tailings pond sites in Cannery Muskeg and Piledriver Cove are missing.

12 On Page 2-31, the number of structures for a Juneau commute option needs to be identified. Will any new buildings be constructed?

SEACC remains watchful of the Green's Creek development. We are committed to seeing the least environmental harm come to the Monument as a result of this mine.

Thank you for the opportunity to comment.

Sincerely,

James F. Stratton
Executive Director

JS/ps

Response

1. The Forest Service intends to issue a special-use permit for this road which will limit vehicular use of the road to Noranda's vehicles on company business only.

2. Noranda has agreed that a condition of employment for their construction and operational personnel will be that no firearms or fishing gear will be taken to Admiralty Island on company transportation. Employees arriving on the island by company transportation will be returned to Juneau at the end of the work shift. The Forest Service Preferred Alternative assumes no employees will be permanently housed on the island during the operational phase.

3. Specific requirements of the special-use permit will be developed prior to issuing the permit.

4. The analysis of the Forest Service Preferred Alternative assumes the decision regarding the final disposition of the road will be based on the most current TLMP revision at the close of mining operations.

5. The Forest Service has no direct control over facilities located below mean high tide. While Noranda has indicated an intent to remove those docking facilities at the end of the project, the final disposition of those facilities will be determined by the terms of the tideland permit issued through ADNR.

6. A detailed presentation of monitoring, mitigation, reclamation, and contingency plans will be required as part of the Operating Plan required from Noranda.

7. All alternatives were evaluated against criteria addressing monument values (see Table 2-3). This criteria favored those alternatives that located project components outside of the monument and/or alternatives that contained components that could be readily reclaimed to pre-project conditions. This criteria addresses the maximizing of protection of monument values and minimizing of impacts to the monument.

8. All monitoring programs are designed to be in place prior to the begining of construction. Monitoring of spawning gravel, water quality, brown bear activity, and Bald Eagle nest sites is currently underway and will continue for a minimum of 2 years after construction. Some monitoring programs will continue through the life of the project.

Intensive water quality monitoring is planned during the construction phase of this project. The monitoring will include suspended sediment, and stream gravel in Zinc and Greens Creek. Sediment pond discharge will be monitored for suspended sediment levels. The details of the monitoring plan will be included in the Operating Plan and work schedule which Noranda will submit to the Forest Service.

9. The discussion of operational constraints has been expanded. A more detailed feasibility analysis is available in the EIS planning file located at the Admiralty Island National Monument Office in Juneau (memo from Noranda Mining, Inc., 1-21-82). This analysis considered a 150-passenger Boeing hydrofoil and identified wave height, visibility, icing, fuel consumption, capital costs, safety, impacts on marine life, and high maintenance requirements as major operational problems.

10. Please refer to page 2-8 of the DEIS.

11. Those ratings have been included in Table 2-2.

12. Please refer to figure 2-4.

Southeast Alaska Conservation Council
BOX 1692, JUNEAU, ALASKA 99802 907-586-6942

23P

SEACC

LYNN CANAL CONSERVATION
Haines, Alaska

JUNEAU GROUP SIERRA CLUB
Juneau, Alaska

SITKA GROUP SIERRA CLUB
Sitka, Alaska

PETERSBURG CONSERVATION SOCIETY
Petersburg, Alaska

SITKA CONSERVATION SOCIETY
Sitka, Alaska

STIKINE CONSERVATION SOCIETY
Wrangell, Alaska

TAKU CHAPTER ACS
Juneau, Alaska

TONGASS CONSERVATION SOCIETY
Ketchikan, Alaska

November 3, 1982

Dennis Rogers
Noranda IDT Leader
U.S. Forest Service
Box 1980
Sitka, AK 99835

Dear Dennis,

In addition to the stipulations for the Young Bay to Hawk Inlet road identified in our comments to the Draft EIS filed on October 18, we would like to see the permit stipulations address the following points:

1. The road will be constructed within design criteria for:
   a. no heavy equipment use
   b. a one lane road for bus transport only with a minimum of turnouts
2. The width of the right-of-way clearance needs to be an absolute minimum.
3. Any change in the permit status after it is issued must be made public for their review.
4. The debris from road construction (stumps, etc.) needs to be disposed of in a sightly manner.

Thanks for your help and consideration.

Sincerely,

J. Stratton

Jim Stratton
Executive Director

cc: DPDP
Noranda
ADFG
Monument staff
DEC

(24)

noranda

Noranda Mining Inc.
Greens Creek Project
P.O. Box 2277
Juneau, Alaska 99803
(907) 789-4171

October 19, 1982

Mr. William P. Gee, Forest Supervisor
Tongass National Forest, Chatham Area
Post Office Box 1980
Sitka, Alaska 99835

Dear Mr. Gee:

Presented below are Noranda Mining's comments on the draft EIS for the Greens Creek project. In general, Noranda feels the Forest Service has done an excellent job in administering the environmental review process. The process which the IDT has undertaken to assess environmental impacts and prepare the EIS in a politically sensitive situation has been exceptional.

In the detailed review of the draft EIS Noranda has identified several major areas of concern. Those areas of concern are listed below:

1 1. Page X of the summary, page 2-50, and page 2-53 indicate differing levels of mitigation for potential construction effects to eagles. Statements have been made that "Construction of access roads would be timed to eliminate the risk of potential impact to Bald Eagles" (page 2-50), and "Construction of tailings ponds would be timed to eliminate the risk of potential impact to Bald Eagles" (page 2-53).

The above quotations imply that regulating construction timing is the only method of properly providing for the protection of bald eagles. For this reason, it is requested that the above quotations be deleted and that wording such as the following be incorporated into the appropriate sections of the final environmental impact statements:

> "Construction of access roads (tailings pond, pipelines, etc.) would be done in accordance with mitigation and monitoring plans acceptable to the U.S. Forest Service, and taking into account procedures recommended by the U.S. Fish and Wildlife Service, for reducing the potential for disturbance to eagles. Mitigation measures may include timing of construction, reducing the level of construction activity in proximity to nests, providing of topographic and vegetative screening, and reduction of noise."

2. On pages 2-72 and 2-80 of the alternatives evaluation section
Noranda has concerns as to the method used in the evaluation
and selection of the wastewater disposal site. The evaluation
of the Hawk Inlet vs. the Chatham Strait disposal points has
seemed to focus on only one parameter, retention time of effluent
2 in Hawk Inlet. However, there are a number of other parameters
which should be more closely considered in the evaluation.

The resulting water quality, when emitted from the pipe, is the
same at each site. Concentrations in the initial mixing zone
would be somewhat higher at the Chatham Strait site than at the
Hawk Inlet site because of poorer mixing at the Chatham Strait
site, although in both cases water quality would be at or below
proposed ADEC water quality standards for chronic toxicity to fish.
The value of the biologic resource is similar for both locations
although the Hawk Point site may be more sensitve to initial
3 dilution concentrations due to the proximity of kelp beds and
poorer initial dilution. Although the average concentration of
effluent within Hawk Inlet is slightly less for a Hawk Point
discharge than for a sill discharge, the average metal concen-
tration increases in the Inlet are so small (less than 1% of the
background level of sea water for lead) that the risk is insig-
nificant for either site. The sites in terms of difference of
water quality are not directly measurable through normal labora-
tory techniques; however, the land based impacts and economic
constraints are sizeable.

The outfall line would have to cross a portion of Hawk Inlet which
4 is at times used by boats during occurrence of heavy seas and for
some fishing activity. The potential for dragging a boat anchor
across the tailings line under these conditions is greater for
Chatham Strait than for a sill discharge.

5 The construction impacts to nesting Bald Eagles is greater at
the Chatham Strait discharge location than for any other portion
of the project.

The economic impact associated with extension of the tailings pond
line to Hawk Point (Chatham Strait) is significant.

Based on engineering design work completed following preparation of the Draft EIS, some additional data regarding dilution and costs
6 is now available. The data is included in a report by Ott Water Engineers titled "Wastewater Discharge--Outfall Location Evaluation", dated September 1982, which accompanies these comments.

It is requested that the selection of a Chatham Strait discharge
7 site over a Hawk Inlet sill discharge site be reconsidered, but that publication of the final environmental impact statement not be delayed under any circumstances.

Because background studies and analyses have considered other potential disposal sites, such as the Cannery Area and a point inside the Hawk Inlet sill, the final environmental impact statement should make it clear that such alternative sites fall within the range of proposed actions considered by the Forest Service. It is recognized that if a discharge site other than Chatham Strait or a point outside the Hawk Inlet sill is sought by Noranda, that additional environmental documentation may be in order regarding outfall locations. It is also requested that a clear rationale as to how the preferred alternative was selected, specifically as it relates to wastewater outfall, be included in
8 the FEIS.

9 3. Page IX under the topic heading "Fishery Mitigation", the relative significance of fishery habitat loss should be clearly defined.

10 4. Page XII, paragraph 2, "access." Noranda would like to restate its desire to have the road closed for all purposes with the exception of mine-related needs.

11 5. Page 2-6. "Concentrate Handling," "Zinc Carbonate Concentrate." The word "carbonate" should be eliminated.

12 6. Page 2-17 "Effluent Discharge." One of the initial major disposal points was the cannery discharge. The DEIS makes no mention of this discharge point other than on pages 4-49 where Table 4-5 has water quality values. The final EIS should have a clear discussion of how and <u>why</u> this site was eliminated.

13 7. Page 2-54. It is anticipated that an acceptable level of treatment will be achieved in the tailings pond. Additional treatment of effluent will only be provided if it is found not to meet NPDES standards.

14 8. Page 1-10. The "Spill Prevention, Control and Countermeasures Plan," shall be prepared within six months after the date the facility begins operation. It is not required that this plan be prepared prior to beginning operation.

15 9. Page A-2. Reference 14 should be "Cobb, William E."

16 10. Page A-3. References 29, 30, 31 and 32 were authored by "Martin Marietta Corporation - Environmental Center." Reference 33 should read "Ott Water Engineers."

Thank you for the opportunity to respond to the DEIS.

Sincerely,

Peter W. Richardson
Project Manager
NORANDA MINING INC.
Greens Creek Joint Venture Project

PWR/als
Enclosures

Response

1. Your recommended wording has been incorporated into the text. The statements on DEIS page 2-50 and 2-53 have been deleted.

2. Other agencies had concerns regarding confidence levels of other data presented to the IDT. Those concerns centered around the dye study and marine water quality data.

3. Noranda has not established whether there is a difference in the effects on communities from different discharge sites. No new data has been presented that established new baseline metals levels in sediments or tissues of organisms at the Chatham Strait site. In this regard the IDT evaluation remains the same: because specific effects are not known and because there is a lower effluent buildup level for effluent discharged at the Chatham Strait site, that site is the environmentally preferred site.

4. These concerns are noted in the text. While either site is subject to some risk of failure due to dragging anchors, the risk is lower at the sill site. The risk is considered to be very low for either site.

5. This statement is incorrect. The potential for construction impacts to nesting Bald Eagles is greater for those nests near the Cannery Muskeg tailings pond. The IDT has assumed throughout the process the Chatham Strait effluent discharge line would be constructed outside the critical nesting period, while the construction period for the tailings pond could not be adjusted since it would take two complete field seasons to finish construction.

6. The additional report and information have been added to the support file (Reference 44) and, where appropriate, have been incorporated into the FEIS.

7. Additional IDT consideration of the merits of the two discharge sites were made during the IDT meetings held on November 7, and December 7, 1982.

8. Discussion of discharge sites considered but eliminated has been added to the FEIS. Additional explanation of the rationale used to select the Chatham Strait discharge site has been included in the FEIS. Both the rationale used and the discharge site selected have been supported through the EIS review process by a majority of the involved resource and regulatory State and Federal agencies. Refer to Section VI Consultation with Others for a list of agencies involved in the review.

9. & 10. These comments refer to the summary, which is intended to provide only a broad overview of the project. Both fishery habitat and road access are discussed in the body of the text.

11. This correction has been made in the text.

12. The effluent discharge site discussion in Section II has been expanded to include why the cannery discharge site was eliminated from further consideration.

13. & 14. These comments have been incorporated in the text.

15. & 16. These corrections have been made to Appendix A - References.

UNITED STATES DEPARTMENT OF COMMERCE
National Oceanic and Atmospheric Administration
Washington, D.C. 20230

OFFICE OF THE ADMINISTRATOR

October 15, 1982

Mr. William P. Gee
Forest Supervisor
Tongass National Forest, Chatham Area
P.O. Box 1980
Sitka, Alaska 99835

Dear Mr. Gee,

This is in reference to your draft environmental impact statement entitled "Proposed Noranda Mining Project, Admiralty Island National Monument." The enclosed comments from the National Oceanic and Atmospheric Administration are forwarded for your consideration.

Thank you for giving us an opportunity to provide these comments, which we hope will be of assistance to you. We would appreciate receiving one copy of the final environmental impact statement.

Sincerely,

David Cottingham
for
Joyce M. Wood
Director
Office of Ecology and Conservation

Enclosure: Memos from: Robert Rollins, National Ocean Survey
Lawrence Swanson, Office of Marine Pollution Assessment
Robert McVey, National Marine Fisheries Service

(2D)

OMPA Comments on the Proposed Noranda
Mining Project DEIS

The subject DEIS is a well-done document displaying generally thorough consideration of the issues arising as a consequence of the proposed mining development. However, it is somewhat deficient with respect to the treatment of potential impacts of effluent discharges into the marine environment. The DEIS states that some 600 gallons per minute of treated effluent will be discharged through a diffuser located either on a sill at the entrance to Hawk Inlet or near Hawk Point on Chatham Strait. The effluent will contain a number of potentially hazardous materials, including metals such as copper, zinc, lead, cadinium, arsenic, chromium, nickel and selenium. The fate of these materials upon entering seawater is only superficially considered; there is no compelling documentation set forth that harmful accumulations of toxic materials will not develop in the vicinity of the diffuser and in Hawk Inlet. 1

Results of studies of marine drilling fluid discharges and sewage outfalls indicate that metals (cadmium, mercury, chromium, copper and zinc) do accumulate in the sediments surrounding the discharge and that these metals are available to the benthos. Accumulations of nickel have been reported in crabs and chromium, silver, copper, and zinc have been documented in scallops collected near sewage outfalls along the California coast (Young et al., 1978).

The potential for bioaccumulation of trace metals by biota clearly exists; however, little is known of the physiological or ecological impact of such bioaccumulation. It is probable that organisms have natural detoxification systems, which afford a measure of protection from unnatural accumulations of certain metals. One such system involves a protein called metallotbionein (Brown et. al., 1977), which can store excesses of essential metals such as copper and zinc, and also bind limited quantities of nonessential and toxic metals such as cadmium. Unfortunately, to date there is little information on the maximum quantities of toxic metals that can be assimilated by tissues of marine organisms before the binding capacity of metallothionein-like proteins is exceeded, and the metals spill over into high molecular weight protein pools where they may poison enzyme systems.

2 On the basis of the above, we concur with the ADEC and Forest Service preference for the location of the diffuser in Chatham Strait, where dispersion of the effluent plane will likely be more rapid and widespread than at the Hawk Inlet bill. This option will also minimize possible accumulation to toxic materials in Hawk Inlet. Also, we recommend periodic sampling of water and sediments in the vicinity of the diffuser and inside the inlet to determine whether harmful accummulation of toxic materials are occurring as a result of the effluent discharge. The limited sampling, dye studies, and circulation modeling done thus far seem insignificant to conclude that no significant accummulations will occur.

Response

1. Neither the DEIS or the FEIS states there would be no impact near the diffuser or in the mixing zone. A mixing zone implies that degradation of water quality will occur in a define area.

2. Noranda's and ADEC's proposed water monitoring includes sediment sampling in the area of the diffuser. Refer to Reference 44.

UNITED STATES DEPARTMENT OF COMMERCE
National Oceanic and Atmospheric Administration
NATIONAL OCEAN SURVEY
Rockville, Md. 20852

20

OCT 6 1982

C52x6:JVZ

TO: PP/EC - Joyce M. Wood

FROM: C5 - Robert B. Rollins

SUBJECT: DEIS 8209.09 - Greens Creek, Admiralty Island National Monument, Alaska, Proposed Noranda Mining Project

The subject statement has been reviewed within the areas of the National Ocean Survey's (NOS) responsibility and expertise, and in terms of the impact of the proposed action on NOS activities and projects.

Geodetic control survey monuments may be located in the proposed project area. If there is any planned activity which will disturb or destroy these monuments, NOS requires not less than 90 days' notification in advance of such activity in order to plan for their relocation. NOS recommends that funding for this project includes the cost of any relocation required for NOS monuments. For further information about these monuments, please contact Mr. John Spencer, Director, National Geodetic Information Center (C18), or Mr. Charles Novak, Chief, Network Maintenance Branch (C172), at 6001 Executive Boulevard, Rockville, Maryland 20852.

JOHN R. SWANSON
P. O. Box 922
Berke' Calif. 94701

(27)

Oct. 15, 1982.

Mr. William P. Dee
Forest Supervisor
Tongass National Forest, Chatham Area
Sitka, Alaska 99835

Dear Mr. Dee:

Please accept my comments, as follows, concerning the Greens Creek Draft Environmental Impact Statement, Proposed Noranda Mining Project, Admiralty Island National Monument.

Once again I wish to advise you of my firm opposition to this project as it will ultimately decimate this still unique natural area, the Greens Creek region, an area containing important wilderness, wildlife, fish, botanic and scenic resources, as well as cultural resources of interest.

This mining project's road system, mill and mine area, piping of tailings, tailings ponds, discharge of tailings (water) into Chatham Strait and dock construction and use all to destroy much of North west Admiralty Island

and with the prospect of a permanent road with logging along the Young Bay to connecting road most frightening as it will mean that all of this North west Admiralty Island will become a commercial resources yard rather than a properly managed natural area.

Please, then, deny such mining project and, rather, manage this entire Greens Creek unit as a permanent area to be included within the Admiralty Island Wilderness.

We simply can no longer afford to devastate our land and water resources, as our natural land and water areas are now nearly extinct in this world of expansive industrialization - urbanization.

Let us as responsible citizens save Admiralty Island by affording the entire island area full wilderness status including Greens Creek, Young Bay and Mansfield Peninsula

and to include this entire island in the Admiralty Island National Wilderness Park, a unit of some 1,000,000 acres, including a water buffer - zone. And all of such area added to our National Wilderness Preservation System

without any surface or sub - surface development at present or in the future.

A true and lasting refuge for Man and for all life on this planet.

For when we save wilderness, we save America!

Sincerely,

John R. Swanson

John R. Swanson
P.O. Box 922
Berkeley, California
94701

October 15, 1982

Mr. William P. Gee
Forest Supervisor
Tongass National Forest
Chatham Area
Sitka, AK 99835

Dear Mr. Gee

Please accept my comments as follows concerning the Greens Creek Draft Environmental Impact Statement; Proposed Noranda Mining Project; Admiralty Island National Monument.

Once again I wish to advise you of my firm opposition to this project as it will certainly decimate this still unique natural area, the Greens Creek region. An area containing important wilderness, wildlife, fish, botanic, and scenic resources as well as cultural resources of interest. This mining projects road system, mill and mine area, piping of tailings, tailings pond, discharge of tailings (water) into Chatham Strait and docks construction and use. All to destroy much of Northwest Admiralty Island.

And with the prospect of a permanent road with logging along the Young Bay to cannery road most frightening as it will mean that all of this Northwest Admiralty Island will become a commercial resources yard rather than a properly managed natural area.

Please then deny such mining prospect and rather managed this entire Greens Creek unit as a primary area to be included within the Admiralty Island Wilderness. We simply can no longer afford to devastate our land and water resources, as our natural land use water areas are now nearly extinct in this world of excessive industrialization-urbanization. Let us as responsible citizens save Admiralty Island be affording the entire island area full wilderness status including Greens Creek, Young Bay, and Mansfield Peninsula.

And to include this entire area island in the Admiralty Island National Wilderness Park, a unit of some 1,300,000 acres including a water buffer zone, and all of such an area added to our National Wilderness Preservation System.

Without any surface or sub-surface development at present or in the future. A true and lasting refuge for man and for all life on this planet.

For when we save Wilderness, we save America!

Sincerely,

John R. Swanson

(28)

4410 N. Douglas Hwy.
Juneau, Alaska 99801
October 18, 1982

William P. Gee
Forest Supervisor
Tongass National Forest, Chatham Area
P.O. Box 1980
Sitka, Alaska 99835

Dear Mr. Gee:

This letter includes our comments on the Greens Creek Draft Environmental Impact Statement for the proposed Noranda Mining, Inc. development on Admiralty Island, Alaska.

Overall we favor Alternative#7 (Requested by ADF&G) that includes 1. Juneau housing, 2. Crew boat to Youngs Bay, 3. Road from Youngs Bay to cannery, 4. Cannery Muskeg tailings pond, 5. Road from cannery to mine service area, 6. Mill at Cannery Muskeg tailings pond, 7. Chatham Strait effluent discharge site.

Our major concern is that no permanent camp or housing
1 be allowed at the site encompased by this project but instead
personnel should be transported by boat daily to and from the work area. We also believe Noranda company policy should not allow firearms in this area or on transport vessels by Noranda personnel. No hunting or fishing should be allowed in the project area by Noranda personnel either on or off duty. We feel this will reduce competition with local resident subsistence and sport hunters and fishermen for limited resources. Also we believe that no type of motorized vehicles should be allowed on Noranda roads outside of company business. We are also opposed to having Noranda employee boats docked at Noranda floats at either Youngs Bay or Hawk Inlet that could be used as a base for personal hunting and fishing. This would cause direct competition with resident subsistence and sport hunters and fishermen for limited fish and wildlife resources..

Thank you for including our comments in the planning for this project.

Sincerely,
Phillip L. Gray
Carol J. Gray
Phillip L. Gray
Carol J. Gray

cc: Noranda

Response

1. Please refer to the response to comment 1, Letter 11, from the Territorial Sportsmen.

(24)

SIERRA CLUB
Alaska Chapter

SIERRA CLUB MDCCCXCII

MEMORANDUM

TO: William P. Gee, Forest Supervisor, Tongass National Forest
FROM: Juneau Group, Sierra Club
DATE: October 18, 1982
RE: Greens Creek Draft Environmental Impact Statement

Our major concerns with the Greens Creek mining development center on the protection of Youngs Bay, to minimize road construction, and to assure the area is rehabilitated back to its "original" state when mining activities terminate.

1. Concentrate all development in the mine/Hawk Inlet cannery area. All activities should take place within this area to minimize adverse impacts.

2. In order to protect the integrity of the Youngs Bay area, we urge that only the absolute minimum development occur in this area.

3. The Sierra Club prefers no road from Youngs Bay to the cannery. The road development is probably more of a threat to the environment of the northern portion of Admiralty Island than the actual mining operation. If the road is developed the uses should be strictly limited to mining activities with careful monitoring. Activities permitted on the road should be specific so proper enforcement actions may be taken if violations occur. The Sierra Club offers the following suggestions:

1 (a) Use of recreational vehicles must be prohibited on the road.
(b) The road should not be used as a vehicle to establish timber harvest in the area.
2 (c) The roadbed and surrounding area must be completely rehabilitated back to its original state at the termination of mining activities.

4. The Final EIS should specify how rehabilitation will be carried out in the area to place it back into its "original" state. The following concerns should be addressed:

3 (a) Mitigation of habitat loss from the tailings pond area.
4 (b) What measures will be taken to rehabilitate road areas back to their "original" state?
5 (c) Specific measures to rehabilitate the mining site.
6 (d) Contingency plans for fisheries rehabilitation. What actions will be taken if tailings ponds or mining activities cause severe habitat damage?

"Not blind opposition to progress, but opposition to blind progress."

The Sierra Club recognizes the Youngs Bay road and the location of housing as the two most difficult and controversial issues facing the development of the Greens Creek mining operation.

The Sierra Club prefers Alternative #1 as the most environmentally acceptable alternative with the workers housed in Juneau. We recognize this alternative may not be realistic without the Youngs Bay Road. If
7 the Youngs Bay road is developed, stringent policies and restrictions must be developed for the road's use and management in the Final EIS.

To summarize, the following five points constitute the Sierra Club's position:

--Housing in Juneau
--Cannery Tailings Pond
--Mill at Mine Site
--Chatham Strait Discharge
--No Road to Youngs Bay.

Thank you for this opportunity to comment.

Response

1. & 2. Use of the road will be limited to Noranda vehicles, on company business only.

3. Mitigation of fishery habitat losses from the location of the tailings pond is described in Section II.

4. Road areas cannot be completely returned to their original state. Rehabilitation measures were discussed in the DEIS on pages 2-52, 2-67 to 2-71, and 4-107. Rehabilitation will include removal of structures (culverts, bridges, etc.), shaping for drainage and consistency with remaining natural topography, and revegetation with native plants.

5. Refer to DEIS pages 2-67 to 2-71 and to the response to comment 4 above.

6. Specific rehabilitation actions will be dealt with on a case-by-case basis. It can be assumed that losses from a chronic or accidental failure will first be handled by correcting the cause of the failure. Regulatory agencies, including the Forest Service, will recommend specific rehabilitation measures. Contingency plans will be a part of the Operating Plan, and were referred to on 2-67 of the DEIS.

7. Provisions for road use will be described in the special use permit.

DEPARTMENT OF HOUSING AND URBAN DEVELOPMENT
SEATTLE REGIONAL OFFICE
ARCADE PLAZA BUILDING, 1321 SECOND AVENUE
SEATTLE, WASHINGTON 98101

REGION X

IN REPLY REFER TO:

OCT 27 1982

Mr. William P. Gee
Forest Supervisor
Tongass National Forest
Chatham Area
P.O. Box 1980
Sitka, AK 99835

Dear Mr. Gee:

SUBJECT: Greens Creek Draft
Environmental Impact Statement

We have reviewed your draft and conclude that your proposed action will not have a significant impact in our areas of concern.

Our Anchorage Office Economist has reviewed the statement and his comments are enclosed for your consideration.

Thank you for the opportunity to comment.

Sincerely,

Terrence R. Duvernay Deputy R.A.
for William Y. Nishimura
Regional Administrator

Enclosure

cc: John Duffy, HUD Anchorage

AREA OFFICES
Portland, Oregon - Seattle, Washington - Anchorage, Alaska

DEPARTMENT OF HOUSING AND URBAN DEVELOPMENT
ANCHORAGE AREA OFFICE
701 C STREET, BOX 64
ANCHORAGE, ALASKA 99513

REGION X

IN REPLY REFER TO:

October 13, 1982

MEMORANDUM FOR: Ken Bowring, Environmental Clearance Officer, 10.1SS

FROM: E. Allen Robinson, Area Economist, 10.1M

SUBJECT: DEIS - Greens Creek, Admiralty Island, Alaska

At your request I have reviewed the subject report prepared by the U.S. Forest Service. I have no objection to the Service's recommendation to use Alternative 6 which would depend upon employee housing in the Juneau area. A few comments are made below:

<u>Economic Impact</u>. Most of the economic comments in the report are
1 on pages 3-42--45. They seem to be accurate with the exception of accepting the longstanding figure of virtually zero percent vacncy in housing. From periodic postal vacancy surveys conducted in Juneau the past two years, single family housing in May 1982 had a 0.8 percent vacancy and multifamily was 0.7 percent, with mobile homes only 0.1 percent. There is always some turnover in even the tightest housing markets. It is also recognized that some people in Juneau live on boats because of the high cost of
2 conventional housing.

The estimates of secondary employment, using a low multiplier of 0.2,
3 appear too high. If the mine uses two shifts, or even three, there will be a small secondary effect,but whether even 300 employees, some hired locally, and a fair share with families, will have a significant effect on secondary employment seems doubtful.

<u>Housing</u>. The report correctly assumes that if the capital moves, there will be plenty of housing available in the Juneau area. If it does not move, then the mining company, Noranda, will supply rental units. approximately 85. Because the employees will be in the $23,000 to $25,000 annual wage range, there is a possibility that some might qualify for Section 8 rental housing. Some, however, might prefer to own their own homes or mobile homes. When development actually occurs, presumably Noranda would make a more definiive study of the housing situation.

In my review I phoned the Forest Service's Economist, Joseph Mehrkins, who was listed among the report preparers on page 5-1. He indicated that the Noranda consortium interested in this mine believes they have about 20 yeras
4 ore supply, it seems to be mostly gold which is the big attraction, less lead, zinc, and silver whose prices are now depressed, and there is no evident objection from coservationists.

cc: 10.1H Gordon, Lutton, Wright
10.1HDV Young
10SM Shih

Response

1. Please refer to Footnote 13 on DEIS page 3-43, where that "virtually zero percent" figure is referenced.

2. This comment has been incorporated in the text.

3. A detailed discussion of the derivation of this multiplier is discussed later in the section. Please refer to response 22, letter 34, from the State.

4. The principal mineral of interest in the Greens Creek project is silver. The life of the known ore reserve is 11 years; Noranda is presently using 15 to 17 years for the life of the operation for planning purposes.

(31)

DEPARTMENT OF THE ARMY
ALASKA DISTRICT, CORPS OF ENGINEERS
P.O. BOX 7002
ANCHORAGE, ALASKA 99510

REPLY TO
ATTENTION OF:

NPAEN-PL-EN

29 OCT 1982

William P. Gee
Forest Supervisor
Tongass National Forest,
Chatham Area
P.O. Box 1980
Sitka, Alaska 99833

Dear Mr. Gee:

Thank you for the opportunity to review the Draft Environmental Impact Statement (DEIS) for the "Greens Creek Proposed Noranda Mining Project, Admiralty Island National Monument, Alaska," Alaska Region Administrative Document 107.

The Corps' interest in the proposed activity is primarily directed toward the possible impacts on water resources and navigability. Regulation by the Corps is under Section 404 of the Clean Water Act and Section 10 of the River and Harbor Act of 1899, respectively. The nature of the project, the sensitivity of the impacted environment, and the extent of activities that are under Corps' authority require that the Corps of Engineers complete or adopt an Environmental Impact Statement (EIS) prior to permit decisions.

Information provided in the subject DEIS appears to contain the data that are necessary for consideration during the Corps' permitting process, thereby lending itself for adoption as outlined by section 1506.3 of the Council on Environmental Quality (CEQ) final regulations implementing the precedural provisions of the National Environmental Policy Act (NEPA). However, clarification should be provided for the following areas of concern during the continued EIS process.

1) <u>Specific:</u>

On page 1-10, Section I, <u>Other Permits, Licenses, and Approval</u>,
1 reference is made to regulatory authority of the Corps of Engineers. This

paragraph should be rewritten so as to clearly delineate, to the reader, the jurisdictional responsibility which the Corps has over the proposed activity. The discharge of dredged or fill material into waters of the United States comes under section 404 of the Clean Water Act (CWA). Structures or work in or affecting navigable waters of the United States requires a permit from the Corps pursuant to Section 10 of the River and Harbor Act of 1899. It should be further noted that final administrative actions to be taken, with regard to Corps' permits, will not take place until expiration of the 30 day waiting period following the filing of the final EIS with the Environmental Protection Agency (EPA).

2) General:

The following comments pertain to the guidelines as authorized by section 404(b)(1) of the CWA and defined by 40 CFR 230.

a. Section II, Affected Environment, should provide the reader with a comprehensive description of wetlands within Corps jurisdiction which will be
2 impacted. This description should include a map, the type and quantity of fill material to be used, and the function and relative productivity of each wetland either directly or indirectly affected.

b. As part of this section's evaluation there should be a detailed accounting of the benthic communities, both freshwater and marine, to be affected. This is to include, but not necessarily be limited to,
3 "crustaceans, mollusks, insects, annelids, planktonic organisms, and the plants and animals on which they feed and depend upon for their needs" (40 CFR 230.31(a)).

In order to facilitate review, it is recommended that the above areas of concern be presented as individual evaluations and labeled appropriately. This approach should also be taken in Section IV, Environmental Consequences.

As stated in Section I of the DEIS, a State of Alaska Certificate of Reasonable Assurance for water quality and a Certification of Consistency with the Alaska Coastal Management Program are being sought from the State of Alaska. It should also be noted that these two permits will need to be "in hand" prior to this District taking any administrative action, as per 33 CFR 320.4(j).

NPAEN-PL-EN
Mr. William P. Gee

2 9 OCT 1982

We look forward to continued coordination throughout the EIS process. If I can be of further assistance, please contact me. If further details are desired by your staff, contact can be made with Mr. Richard J. Gutleber of our Environmental Resources Section at (907) 552-2572. Inquiries pertaining to the Corps' regulatory program should be directed to Mr. Larry Reeder, Regulatory Functions Branch, (907) 552-4942.

Sincerely,

HARLAN E. MOORE
Chief, Engineering Division

Response

1. This paragraph has been rewritten in the FEIS.

2. Both a general and detailed description of wetland vegetation is presented in Sections II and IV. Additional information can be found in Reference 21, 22, 23. Details concerning construction volumes and exact construction limits will not be available until surveys and designs are complete.

3. A detailed accounting of the benthic communities of freshwater and marine ecosystems can be found in Reference 6, 39, 40, 41 and 43. The DEIS, on page 3-44, summarizes the subtidal habitats and biota. Brief benthic community summaries have been added to the freshwater biology section of the FEIS as you requested.

126 Washington Street
P.O. Box 7358, Ketchikan, Alaska 99901
(907) 255-6111

(32)

N C MACHINERY CO.

November 2, 1982

Mr. William P. Gee
Forest Supervisor
Tongass National Forest, Chatham Area
P.O. Box 1980
Sitka, Alaska 99833

Re: Greens Creek Draft Environmmental Impact Statement

Dear Mr. Gee:

After reviewing the draft E.I.S., we are supportive of Alternate #2 over all others. While Alternate #6 is very similar to #2, the data presented did not justify the additional $2 million dollar capital expense to move the effluent discharge point from the Hawk Inlet sill to Chatham Strait. If #2 is unacceptable, our second choice would be alternate #6.

Thank you for providing the opportunity to comment.

Sincerely,

Don Pierce

Don Pierce
PSSR

NOV -

Corporate Headquarters P O Box 3562 Seattle, Wa 98124 • *Branches* Chehalis Mt Vernon Seattle, Seattle *(Lift Trucks)*, Tacoma *(Lift Trucks)*, Anchorage, Anchorage *(Lift Trucks)* Fairbanks, Juneau Ketchikan, N C Marine 2500 Westlake N., Seattle Wa. 98109, N C Engine Power 16711 West Valley Hwy Seattle, Wa 98188

Elena

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United States
Department of
Agriculture

Office of
the Secretary

Office of
Minority Affairs

Washington, D.C.
20250

19 OCT 1982

SUBJECT: Green Creek Draft Environmental Impact Statement for the proposed Noranda Mining, Inc., Admiralty Island, Alaska

THRU: R. Max Peterson
Chief
Forest Service

TO: William P. Gee
Forest Supervisor
Forest Service

We have reviewed the draft Environmental Impact Statement for the proposed Noranda Mining Project and determined that there is no civil rights impact involved. However, you should be reminded that any housing units or job opportunities generated by this project must be available on a nondiscriminatory basis.

Isidoro Rodriguez

ISIDORO RODRIGUEZ
Director

FOREST SERVICE
RECEIVED

OCT 22 1982

OFFICE OF THE CHIEF

(34)

STATE OF ALASKA

JAY S. HAMMOND, Governor

OFFICE OF THE GOVERNOR

DIVISION OF POLICY DEVELOPMENT AND PLANNING
GOVERNMENTAL COORDINATION UNIT

POUCH AW (MS - 0165)
JUNEAU, ALASKA 99811
PHONE: (907) 465-3562

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November 5, 1982

Mr. William P. Gee
Forest Supervisor
Chatham Area
Tongass National Forest
P.O. Box 1980
Sitka, Alaska 99835

Dear Mr. Gee:

The State of Alaska appreciates the opportunity to review the Greens Creek Draft Environmental Impact Statement for the proposed Noranda Mining Project. Comments were received from the Alaska Departments of Fish and Game, Environmental Conservation, Community and Regional Affairs, Labor, Commerce and Economic Development, and Natural Resources. This letter is a synthesis of agency input and constitutes the State's response for purposes of both the Office of Management and Budget Circular A-95 review and the Alaska Coastal Management Program (ACMP) advisory consistency review. We look forward to receiving the final Environmental Impact Statement and hope that you will be able to address the comments contained in this letter.

The following central issues were considered in depth and form the basis for the State's selected alternative.

Effluent Discharge Point

Effluent discharge points at Hawk Inlet and Chatham Strait were evaluated. Chatham Strait is a larger and deeper receiving water body than Hawk Inlet and is further away from the mouth of Greens Creek, a rearing area for salmon. At discharge equilibrium, there will be smaller increases in concentrations of heavy metals. Presently the State's water quality standards do not allow a mixing zone for discharges of heavy metals but draft regulations are being reviewed and revised. It is not possible at this time to determine if a discharge site at Hawk Inlet or Chatham Strait will meet the standards of these regulations. The Chatham Strait location would have more construction related impacts. These impacts would, however, be short-term.

The cost of constructing the effluent discharge system to the discharge point in Chatham Strait is a major consideration. This represents a significant project cost during initial construction and must be weighed against the long-term environmental effects to marine receiving waters due to effluent discharge. Protection of water quality is a critical issue given the long term nature of the project and content of the discharge. While Hawk Inlet has not been excluded from further evaluation, the Chatham Strait discharge point presents the best alternative for protection of water quality over the life of the project and is, therefore, the best choice.

Mill Site Location

Mill locations at the mine site and at the tailings pond site were considered. The mill location at the mine site would require a slurry line parallel to Greens Creek. The slurry line would be contained within a culvert which would also house the water line. This alternative presents the potential of a line break and introduction of waste into a productive drainage. Reagents would also have to be transported to the mine site and a potential does exist that reagents could enter Greens Creek should a vehicle accident occur. However, the possibility of these accidental occurances is considered to be very remote. Mine water and site runoff will require treatment to meet water quality standards. The sediment pond incorporated into the mill site near the slurry line to the tailings pond will provide an effective means of controlling these wastes. Environmental impacts will occur during construction and placement of the line, but these impacts would be short term and could be lessened through responsible construction techniques.

The mill location at the tailings pond would require that raw ore be transported from the mine to the mill location. Negative impacts associated with continued vehicle movement (road erosion, noise disturbance to wildlife) would occur and would result in increased operational cost to Noranda and indirect habitat losses. This location would, however, confine the storage transport and use of reagents and petrochemicals to a smaller area.

The mill site location at the mine presents the possibility of waste introduction into water sources with direct resultant losses of habitat. The double-walled containment of the slurry line plus constant monitoring and inspection of the line would however, reduce this risk to a remote possibility. Reagent transport if conducted in a responsible manner, would reduce accidental spills to a remote possibility also. Indirect loss of habitat will occur as a result of increased road activity from ore transport as well as increased operational costs. The State's preferred option would be to reduce the indirect habitat impacts by use of a slurry line, minimize associated operational dollars and take advantage of additional control of mine wastes offered by loction of the sediment pond at the mine site.

Housing

Housing employees in Juneau or development of a camp at the existing cannery site were considered as options. Activities associated with the Juneau housing option would include a docking facility at Young Bay and a roadway from Young Bay to the cannery site. Construction of these access facilities will have impacts on recreational use patterns in Young Bay and northward along the east side of Mansfield Peninsula. Sport hunting pressure in Juneau and local environs has increased over the years and more hunters are using northern Admiralty and Young Bay for sport hunting. The quality of hunting, for those who enjoy the sport in a wilderness setting, would be impacted through the advent of a road as well as by increased hunting pressure from Hawk Inlet. Some impacts to deer migrations could occur due to vehicular traffic and creation of snow berms during snow removal operations. However, berms could be minimized through alternate snow removal methods.

A road may also provide access for sport fishing at Young Bay from Hawk Inlet. User groups from both Juneau and Hawk Inlet areas could have significant impacts to the fisheries resource from overutilization. In addition, the existence of a road could increase the potential for logging and other development activities.

Approximately 300 people would comprise the workforce for Noranda. It is anticipated that half of the workforce, about 150 employees, would be hired locally. The housing of an additional 150 people plus their families would have an impact on housing and service demands in Juneau. However, the State and local governments agree that Juneau would be able to accomodate these needs by the time Noranda is operational. Development of a campsite at Hawk Inlet may not significantly lessen impacts to Juneau as families of the mine workers would probably live in Juneau. Quality of life for workers and their families housed in Juneau would be significantly different due to the large infrastructure and service system available. The City and Borough of Juneau strongly supports this option.

Estimated capital costs for the Juneau housing option including the road, dock and other access facilities would be $10,061,000 with annual operating and maintenance costs of $5,473,000. Estimated capital costs for the construction of the campsite would be $6,548,000 with annual operating and maintenance costs of $8,935,000 (all figures are in 1981 dollars). While initial capital costs for the Juneau housing option are higher, the annual cost is $3,462,000 less than the campsite alternative. Over the 15+ years of Noranda's project, the campsite alternative could cost approximately an additional 52.5 million dollars (1981 dollars.)

The communities of Hoonah and Angoon have expressed concern that the possibility of workers being housed at a camp facility at Hawk Inlet would cause potential impacts on their lifestyle including subsistence hunting and fishing. However, the latter is protected under State and federal law should it become an issue.

The camp could develop the economic, social and political structure of a permanent community. The State does not encourage development of new settlements in remote areas when infrastructure needs can be fulfilled by an existing community. Exclusive of the possibility of a permanent community, the temporary facility still has the potential of becoming a new center of recreational use which will conflict with existing recreational uses at Hawk Inlet and areas in proximity to the camp.

The presence of a camp facility at Hawk Inlet will increase the project related impacts at this site. Changes to existing recreational use patterns with resultant pressures on fisheries and wildlife resources will occur. However, restricting camp development and employee recreational activities to minimize negative impacts could result in restrictions on employee lifestyle and other negative effects on employee well-being and is not feasible.

To summarize, in developing the State's position, we considered the following concerns: (1) the potential socioeconomic impacts on Juneau residents, (2) the potential habitat degradation associated with the construction of the road or camp, (3) the various negative impacts on the fish and wildlife resources, including recreational use, (4) the capital and operating cost Noranda would face with either option, (5) the living conditions of potential employees, (6) the possible impacts on the lifestyle of Hoonah and Angoon residents, and (7) the potential establishment of a community in Hawk Inlet some 15+ years hence. While we acknowledge that there will be negative impacts on the habitat, fish and wildlife resources and the recreational opportunities of Juneau area residents, we feel that Alternative 6 represents the best choice after weighing the above factors.

Recommendations

The State of Alaska recommends that Alternative 6 be adopted by the Forest Service. This Alternative incorporates the State's preferred options for employee housing in Juneau, mill location at the mine site and effluent discharge in Chatham Strait. Additional mitigation measures such as restricting the use of docks and the access road to project personnel must be addressed as well as road closure, dock removal and site rehabilitation at the project's termination. We understand that Noranda intends to restrict hunting and fishing by employees transported to Admiralty on the crewboat.

The attached page specific recommendations should also be addressed in the final environmental impact statement.

Advisory comments regarding Consistency with the Alaska Coastal Management Program

The State anticipates that adoption of Alternative 6 by the Forest Service if modified by certain mitigating measures, would be consistent with the ACMP. The Forest Service is preparing a consistency determination that will be reviewed by this office as part of the FEIS and decision notice.

In order for the State to concur with your consistency determination, the document must be sent 90 days prior to final approval of the federal activity as per CFR 930.34.

We thank the Forest Service for their continued cooperation with the State during this review and also wish to express our appreciation to Noranda Mining, Inc. Noranda has been most cooperative in supplying needed information, accomodating State reviewers and responding in a timely and open manner.

Sincerely,

Dorothy Douglas

for Wendy Wolf
State-Federal Coordinator

Attachment

cc: Richard Reed, ADF&G
Bruce Baker, ADF&G
Deputy Commissioner Collinsworth, ADF&G
Randy Bayliss, ADEC
Steve Haavig, ADEC
Commissioner Mueller, ADEC
Jim Kohler, CRA
Commissioner McAnerney, DC&RA
Commissioner Orbeck, DOL
Jim Deagen, DCED
Commissioner, Webber, DCED
Mark Wittow, DNR
Helen Castillo, USFS
Peter Richardson, Noranda

Page-Specific Comments

Page 1-6:

1 Decreased recreational opportunity is listed as an issue which the IDT addressed. Brown bear hunting and trapping are recreational uses which occur in the Hawk Inlet area and which were not identified in Issue 2.

Page 1-7:

The analysis of recreational use is biased in favor of aircraft access users. Thus the level of use is probably higher than reported, especially for areas easily reached by skiff from Juneau.

Page 1-7:

2 The maintenance of deer habitat is identified as a key component of Issue 4, yet is not included in the wildlife effects analysis for selection of a preferred alternative. This is a substantive change.

Page 1-9:

Other permits, licenses and approval.

Solid Waste Disposal Permit. The State had been working with the Forest Service and Noranda on solid waste generated from the construction of the access road and associated quarries. It is our understanding that Noranda will prepare a report on road spoils to be included in the road plans and specifications. We propose to review the report and inspect the sites on the ground and make our comments to the Forest Service. We feel that we will not need to issue a solid waste management permit for these activities. We will, however, issue a solid waste management permit for camp garbage and construction wastes.

Certification of Compliance with Alaska Water Quality Standards. Under section 401 of the Clean Water Act, the Department of Environmental Conservation reviews federal wastewater disposal permits (NPDES) to insure that they are in compliance with our water quality standards. Likewise, for activities requiring dredge or fill operations in wetlands, our department reviews the Corps of Engineers public notice to certify that the proposed activity will be in compliance with our water quality standards.

Page 1-10:

3 The authority and responsibility of the State are inadequately presented. The State may specify stream crossing structures for non-anadromous streams, and also review and approve, reject or alter activities

which might affect anadromous streams. Further the State analyzes the biological effects of coastal development in relation to the Alaska Coastal Management Program Standards.

Page 2-7: We strongly support the fuel storage permit conditions identified; especially the construction of dikes around tanks, and storage away from stream courses and water bodies.

Page 2-50: **4** Under mitigation measures common to all alternatives, the statement is made that "Roads would be located away from beaches to protect coastal wildife habitat." The proposed Hawk Inlet/Young Bay road is routed for about 1 1/2 miles adjacent to the Hawk Inlet beach in an area identified as prime deer winter range by both the U.S. Forest Service and the Alaska Department of Fish and Game. Although we recognize that some tradeoffs exist between that location and one inland, south of the ridge, that portion of the proposed road is not located "...away from beaches..." and does conflict with prime deer winter range.

Page 2-56: **5** The solid waste disposal program is a reasonable one and is supported by the State. Additional bear/human conflicts can be avoided by fencing the Mine Service Area and/or proposed Campsite so as to exclude bears and mustelids which might be attracted to food or food wastes.

Page 2-56 et seq: **6** We are doubtful about the accuracy of the statement that "Seventy percent of the unavoidably lost anadromous fisheries production will be replaced through flow augmentation and habitat enhancement in the remaining portion of "Tributary Creek." That assumption implies no degradation of water quality from roadside runoff, nor spills etc. which might affect production.

Page 2-60 et seq: **7** The State supports the fisheries and wildlife monitoring programs proposed for mine development and operation. Of special concern to us are the measures to be taken should significant effects be documented through the monitoring program. For bears for instance, we recognize that avoidance alterations in movement patterns, as a function of disturbance, may not be easily mitigated. However, bear attraction to Noranda sites may be effectively handled in a variety of ways. Eagle nest monitoring is desirable, however, we are unsure about reasonable operational changes which might be developed to mitigate disturbance effects on eagle nests.

Page 2-67: In light of the above, we would like to help the U.S. Forest Service develop a contingency plan of action measures to respond to potential resource damage or threat of damage engendered by mine construction and operation.

Page 2-67: Marine Aquatic Biota

The State will assure a monitoring program is incorporated into the permit for a marine discharge. We have been working with Noranda on the design of the monitoring program. In addition to the biota program we feel that sediment sampling for heavy metals will be important.

We feel a dye tracer study done at the selected discharge site at depth would be a helpful check of the accuracy of the model used to predict the behavior of the discharge.

Page 2-71: Removal and reclamation of the proposed access road to the Young Bay dock is an item of substantial concern to the State. We believe the presence of the breakwater and road will alter recreational use patterns in this area. The decision should be further addressed

Page 2-75: Evaluation criteria for wildlife effects were too narrow. As stated earlier, deer impacts were not included.

8

Only brown bear habitat and eagle nest sites were considered. Similarly, project effects will probably occur for furbearers, scavenger birds, waterfowl and sea birds as well. Although some aspects of these effects relate to recreational or subsistence uses, habitat loss and animal displacement are inevitable.

Loss of "brown bear primary stream habitat: through construction of the Cannery tailings pond is quantified as "4% of that available" in the area. No qualitative effects are estimated. Not only does the tailings pond area serve as feeding/resting habitat, but it is a main travel corridor as well. "Percent of available habitat" is a technique used by Noranda throughout their effects analysis which may be of some value, but which can be misleading.

Page 2-75 et seq: The evaluation of wildlife impacts for bear and eagles alone, led to the omission of a significant impact which has been identified by the Alaska Department of Fish and Game.

9

The road from Young Bay to the Hawk Inlet cannery presents problems not attributable to overutilization of deer or furbearer resources because of increased access for hunters and trappers. Rather, we see the road in time of deep snow, as being a serious impediment to deer in their daily and seasonal travels from the beach fringe to inland timber stands. This concept is not mentioned in the Summary on pages xi and xii, though it was articulated to Terra Nord, the wildlife consultants retained by Noranda.

Page 2-79: The analysis of subsistence effects is inaccurate and incomplete and does not reflect the substantial input the Subsistence Division of the Alaska Department of Fish and Game has made during DEIS development. Although sport or subsistence hunting are both consumptive uses of wild resources, there are economic, social and legal differences between them. Deer hunting is not the only subsistence activity in Hawk Inlet.

10

Juneau residents are not subsistence users under State and Federal legal definitions. Therefore, the subsistence effects analysis should be directed at residents of Angoon, Hoonah and Funter Bay. This portion of the document will have to be redone to be correct. We encourage further discussions with the Subsistence Division staff prior to redrafting it.

Page 2-80: We concur with the assessment of higher risk associated with the Hawk Inlet still effluent discharge site. We strongly support the Chatham Strait discharge site.

Page 3-8/9: The fisheries portion omitted any information on fish in the Fowler Creek tributaries crossed by the proposed road.

11

Page 3-11: Marine Aquatic Biology

12

Since the preferred alternative calls for a discharge in Chatham Strait, some discussion of the aquatic biology in this area should be included.

Page 3-18: We question the figure stated of "...39 species of mammals..." on or adjacent to the island.

13

Page 3-26:

14

We have observed humpback whales in Hawk Inlet. This has previously been transmitted to Noranda's wildlife consultant.

Page 3-30:

15

On page 3-30, a brief description of the subsistence activities in the vicinity of Hawk Inlet is presented which is based on information our office provided. The way the information is presented, however, downplays the use of Hawk Inlet for subsistence activities. For example, it notes that commercial fishing vessels make two subsistence trips a year, but does not indicate that these trips are to hunt deer or that while these same boats are engaged in commercial fishing activities, both deer and seal area hunted for subsistence purposes.

Page 3-44:

16

"It is expected that 1982 revenues from the sales tax will be reduced from 1981 levels by 3.2% because of decling employment." There has not been declining employment in Juneau from 1981 to 1982. Although the movement of sales tax revenues may not be necessary to note in the DEIS, what has occurred is that strong collection efforts and solid growth in the Juneau economy have been partially offset by the removal of the tax on the residential rental income (mid-1981) and the increased ratio of business in the Mendenhall Glacier Valley area (where sales tax is lower).

Page 4-1:

Some impacts will proceed beyond the construction and operational stages, particularly in recreation and subsistence. The analysis is defective if it does not consider these aspects. A part of that concern relates to development of the cannery area and the increase in patented land in Hawk Inlet which may be developed for an array of alternate uses.

Page 4-20:

17

On whether it will be a final vote on the capital move issue. If the vote is "move" it will be final. If the vote is for the capital to say in Juneau, the leaders associated with the effort to relocate have publicly stated that there would be another vote, a continuing effort, the people of the Cook Inlet Basin would not stand for it to remain so far distant.

Page 4-36:

The statement is made that, for freshwater quality, "Location of the mill at the mine plant would create no additional impacts other than those for the mine service area development." As stated previously, we disagree, because of the increased potential for the introduction of undesirable pollutants into Greens Creek.

Page 4-46: Proposed Standards and Background Seawater Quality.

Since background levels may change with further analysis, receiving water standards for Cu, Hg, Pb, Ni and Ag might be termed as the numerical standards or background "whichever is greater". We are working with Noranda and EPA to set up a program where marine water samples are run by at least three different labs. Hopefully, this will give us more reliable background levels. Our decision to certify a discharge point will consider whether background data is usable to detect potential problems at the discharge site.

Page 4-47:
18
The turbulent mixing zone is proposed to be 200 feet by 500 feet at the effluent discharge site. We are concerned as to the effects this discharge might have on migrating fish and/or fishing activity at the Chatham Discharge point. This area is currently targeted by trollers and seiners and was once the site of a "million dollar" fishtrap because of fish concentrations off the point.

Page 4-68:
19
We question whether "...bear and marten are less tolerant of human activity than deer." Also, as stated earlier, we disagree with the statement that "The road should not act as a physical barrier to animal movements, even during periods of heavy snowfall since snowblowing equipment would eliminate snow berms."

Page 4-71 et seq:
20
We appreciate and support the "no guns and traps" policy for Noranda employees under the Juneau housing option. Concern has also been expressed toward personal boats, fishing gear, etc... We would appreciate discussion of those items in the document.

The Environmental Consequences section includes an evaluation of impacts on subsistence activities. Both Alternative 6 and 8 appear to have the least effect on subsistence resources. These alternatives provide for the housing of workers in Juneau with daily boat trips to Young Bay and a road connecting Young Bay to Hawk Inlet.

Page 4-93:
21
A multiplier of .2 secondary employees to each primary employee probably is understated. The most commonly accepted U.S. average multiplier exceeds 3.0. In Alaska, it is recognized to be about half of that.

Page 4-96:
22

The income multiplier (multiplier effect of spending and respending) at 2.0, when applied to a $15 million payroll is stated in the DEIS as $16.9 million.

The impact on the economy of Juneau would be strong and it will be positive. The use of the multiplier for both employment and income understate this positive effect, they are inaccurately applied in the DEIS.

Response

1. Brown bear hunting and trapping have been included in the discussion of Issue 2.

2. The issue statements were developed prior to the development of the alternatives and the determination of environmental consequences. Following the analysis of effects, it was determined that deer habitat degradation would not occur at a significant level. The evaluation criteria included only what the IDT believed to be major areas of potential impacts.

3. This has been changed in the FEIS to reflect ADF&G's responsibility and authority.

4. The statement was changed to: "Roads would be located, where possible, away from beaches ..." The location of the road in relation to the coastal wildlife habitat environment is of major concern to the IDT. The IDT evaluated all possible road locations and determined the corridor displayed in the DEIS provided the best possible location. Initially, the road was located adjacent to upper Hawk Inlet. Following IDT analysis, the road was relocated to avoid that portion of coastal wildlife habitat.

5. Presently, there are no plans to fence human activity areas. However, if bear/human conflicts develop into a significant problem, fencing may be a solution. Methods of resolving those conflicts will be covered in the Contingency Plan, which will be a part of the Operating Plan.

6. The flow augmentation proposal has been deleted. Mitigation measures discussed in Section II now reflect the new situation. No assumptions pertaining to effects other than direct loss of habitat are involved in that discussion.

7. The Forest Service is also concerned about the measures to be taken should significant effects be identified by the monitoring program. The contingency plan included in the Operating Plan will present those measures in detail. The IDT is open to innovative ideas for dealing with contingencies. The corrective measures for eagles currently being considered involve varying the size, frequency, and location of blasts at the quarry site around the critical nesting period. These measures are being coordiated with Fish and Wildlife Service eagle specialists.

8. The ultimate reclamation or disposition of the Young Bay to cannery road cannot be determined at this time. The most current TLMP revision at the termination of the project will determine reclamation requirements.

9. The evaluation criteria, by definition, only include the major areas of impact as identified in Section IV, Environmental Consequences. It was determined that impacts to deer habitat would be insignificant. The IDT did recognize that impacts to the deer population from overharvest could be significant. Since that impact is more directly related to deer hunting (the recreation evaluation criteria) it was covered in the recreation discussion.

Potential effects on furbearers, waterfowl, seabirds, and scavenger birds were likewise not considered to be significant and therefore not included in the evaluation criteria.

The "4 percent of that available" was used in the evaluation matrix as an indicator of relative significance for bear habitat lost. Other effects (qualitative) are discussed in Section IV. The IDT recognizes that the actual effect on the bear population resulting from this habitat loss is speculative and therefore this discussion is limited. Recognizing the need for information on brown bear, Noranda and ADF&G cooperatively initiated a study on Greens Creek to establish baseline information and to monitor the effects of project construction and operation.

10. Deer habitat alteration or loss represents an insignificant impact (49 acres of the total 11,000 acreas of deer winter habitat) due to the road from Young Bay to the cannery. Of the 49 acres, 23 acres are considered usable habitat during heavy snow accumulation periods. The 23 acres represents 1.4 miles of road and assumes that a 140 foot wide corridor would be unusable to deer during a hard winter. The actual road corridor would be about 40 feet wide. This section of road is not located in a deer migration corridor. Snow along this 1.4 miles of road would be moved by snow blower to the downside of the road, which is located on a 75 percent slope. Deer would be able to move freely to the road, but could move downhill across the road only with some difficulty. Deer would not be able to move freely uphill during periods of high snow accumulation. During high snow accumulation periods deer would either be restricted to the 200 acres of high value winter habitat below the road and adjacent to the beach or they would have the option to move along the beach at low tide to other winter habitats.

The major concern of the IDT and the public to date has been the potential for the overharvest of the deer populations and the changing hunter experience along the road. The IDT addressed only this potential impact in its evaluation of alternatives. The summary is intended only to present a broad overview of the proposed project.

11. This section has been rewritten to include this information.

12. This has been corrected in the FEIS.

13. Detailed information on the Hawk Point area of Chatham Strait can be found in Reference 43. The section you refer to is a summary of information available in supporting documents.

14. Please refer to Reference 46, page 10.

15. Page 3-26 of the DEIS recognizes that humpback whales could be present in the area.

16. This section has been expanded in the FEIS.

17. This sentence has been omitted from the FEIS.

18. The wording of this section has been changed in the FEIS to reflect the results of the November 1982 election.

19. The IDT was able to determine that avoidance behavior by adult salmon can occur, but that extremely high concentrations of metals are involved. This was documented in a study of adult Atlantic salmon in a freshwater environment. It is not known if that phenomenon will occur at the Chatham Strait site. However, based on the concentrations of heavy metals in the effluent and their dispersion in the water column, it is not anticipated to occur. The diffuser will be marked by a buoy to prevent snagging of fishing gear.

20. The statement "bear and marten are less tolerant ..." has been omitted. The statement concerning the road has been changed.

21. Noranda has agreed that none of their employees will be permitted to hunt or fish during working hours and all employees transported by company boat to Admiralty Island will be returned to Juneau at the end of their shift. Dock facilities in Hawk Inlet and Young Bay will not be available for moorage of personal boats.

Alternative 8 includes the camp option; Alternative 7 includes the housing in Juneau option.

22. Please refer to the response to comment 3, Letter 30, from the Department of Housing and Urban Development.

23. The approach used by Noranda in developing the Socioeconomic Baseline Report was unorthodox but acceptable. The multipliers provide the net indirect/induced employment component, not total employment. For example, if total employment was 120 and this included the direct employment of 100, then 100 x 0.2 equals 20 indirect and induced jobs. In conventional terms the total employment multiplier would be displayed as 1.2. A review of Noranda's baseline (March 3, 1982) by the IDT Economist indicated that multipliers of 0.4-0.6 during mine construction and 0.2-0.3 during operation were appropriate. In conventional terms this corresponds to employment multipliers of 1.4-1.6 and 1.2-1.3 respectively. Thus we agree that a multiplier near 1.5 is correct.

The income multiplier of 2.0 is in error. As calculated from figures in the baseline report this multiplier should be 1.3, with a resultant total spending of $19.5 million.

INDEX

GLOSSARY

adit - A nearly horizontal passage from the surface by which a mine is entered and dewatered.

anadromous - Fish that migrate from the sea up a river to spawn.

argillite - Rocks composed of clay minerals or having a notable portion of clay in their composition.

bathymetry - The measurement of the depth of the ocean.

commercial forest land (CFL) - Forest land which is producing or capable of producing a minumum of 8,000 board feet per acre that is economically accessible now or in the foreseeable future.

country rocks - A general term applied to the rock surrounding and penetrated by mineral veins; in a wider sense applied to the rocks invaded by and surrounding an igneous intrusion.

epibenthos - Those animals and plants living on the sea bottom between the low tide level and a depth of 100 fathoms. Some juvenile salmonids feed on epibenthic organisms.

freeboard - The verticle distance between the top of an embankment and the water surface.

gabion - A wire basket filled with rocks to act as a foundation stream control channel control structure or retaining wall.

hydrostatic head - The height of a verticle column of water, the weight of which, if of unit cross section, is equal to the hydrostatic pressure (the pressure exerted by the water at any given point in a body of water at rest) at a point.

igneous - Rocks formed by solidification from a molten or partially molten state.

indirect habitat loss - The effective loss of habitat through noise/activity disturbances or human/animal encounters which alter an area such that wildlife will not use it.

littoral zone - 1. Strictly, a zone bounded by high and low tide levels. 2. Loosely, a zone related to the shore, extending to some arbitrary shallow depth of water.

LC 50 (96 hour) - The concentration of that substance that results in the death of 50 percent of the test organisms within 96 hours.

metamorphic - Rocks which have formed in the solid state in response to pronounced changes of temperatures, pressure, and chemical environment.

midden - A soil that contains evidence of past human occupation such as fish and mammal bone, marine shell,charcoal, ash, stone, and fine soil.

mine portal - The surface entrance to a mine, particularly to a tunnel or adit.

sedimentary - Rocks formed of sediment, especially 1) clastic rocks, such as sandstone, shales, conglomerates, etc. and 2) rocks formed by precipitation from solution such as rock salt or from secretions of organisms such as limestone.

site index class - Rating of timber growing productivity potential based on capability of the soil and other characteristics of the site. Three levels are used: high, medium, and low.

sub grade - The surface produced by grading and compacting natural soil to support a pavement structure.

synergistic effect - A phenomenon whereby lethal concentration of a substance is lowered when in association with another substance or group of substances.

translational slide - Refers to movement along fault planes or surfaces.

user (visitor) days - The presence of one person for 12 hours or any equivalent combination (two people for 6 hours, etc.) that equals 12 visitor-hours.

Visual Quality Objectives (VQO) - Management goals applied to the landscape by the Forest Service. They are based on distance, sensitivity level, and visual variety. They describe a different degree of acceptable alteration of the natural landscape based upon the importance of the visual resource.

waste rock - The rock that is excavated in the mining process that is not processed in the mill.

APPENDIX A
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