Chapter 5 Agency Determination of Preferred Alternative

This chapter builds on the impacts analysis of the individual options and alternatives in Chapter 4. Section 5.1 summarizes the impacts described in Chapter 4 in tabular form. Section 5.2 then describes how those impacts were analyzed to identify EPA's and the cooperating agencies' Environmentally Preferable Alternative and their Preferred Alternative. Finally, Section 5.3 presents the Environmentally Preferable Alternative and the Preferred Alternative in both tabular and graphic formats.

5.1 Impacts Summary

The impacts of the four alternatives are summarized below in tabular form that generally follows the presentation format of Chapter 4. Table 5.1-1 summarizes the impacts of the No Action Alternative and those options that are common to all alternatives. Thus, if the project were not to proceed to development, the impacts in column 1 of Table 5.1-1 would occur. If the project were to proceed to development, the impacts in column 2 would occur, regardless of which alternative were selected.

Table 5.1-2 summarizes the impacts of options that are specific to one of the three action alternatives, but that are not access related. Table 5.1-3 summarizes options that are specific to one of the three action alternatives, and that are access related. The descriptions of impacts assume the recommended mitigation measures would be implemented. Note that as a convention, if a particular option would have no, or only a small, impact on a given resource, it generally is not discussed.

A more detailed analysis of the impacts on each resource was presented in the individual sections of Chapter 4. These tables do not include cumulative impacts, which also are discussed in more detail in the individual sections of Chapter 4. Cumulative impacts were summarized separately in Table 4.19-1.

The reader is urged to refer frequently to Tables 2.5-1, 2.5-2, 2.5-3, and Figure 4.0-1, to understand which options constitute a particular alternative.

Table 5.1-1 Summary of Direct and Indirect Effects of the No Action Alternative and Options Common to All Alternatives

No Action Alternative	Options Common to All Alternatives
4.1 Surface Water Hydrology	
Small impacts on the surface water hydrology of Shaw Creek and its tributaries would occur from Division of Forestry (DOF) road construction and logging. After closure of the existing Pogo exploration adit, impacts on the Goodpaster River in the Pogo claim area would be low.	General mine area. Placement of the dry stack, RTP, mill facilities, and associated water-diversion ditches would result in substantial modification of the surface water hydrology in Liese Creek. These impacts would be localized to Liese Creek, with very small impacts to the Goodpaster River. Impacts on surface water hydrology from other common options would be low.
4.2 Groundwater Hydrology	
No impacts are expected from DOF road construction and logging. After closure of the existing Pogo exploration adit, impacts on ground water in mine area would be low.	General mine area. Dewatering of the mine would have moderate impacts on the groundwater hydrology in the vicinity of the mine and Liese Creek Valley. Installation of an erosion control/drainage blanket prior to constructing the dry stack is not expected to impact the quantity of seepage from the dry stack that would enter the ground water. The overall impacts on groundwater flow in the Goodpaster River Valley would be very low. Impacts on groundwater hydrology from other proposed project components would be low.
4.3 Water Quality	
There would be a potential for fuel spills during DOF road construction and logging, and subsequent impacts on water quality for Shaw Creek and its tributaries. Impacts would be low if proper safeguards were used. Potential for erosion and release of sediments to Shaw Creek and tributaries would be low if proper forestry BMPs were used.	General mine area. Impacts on Liese Creek below the RTP would be low during operations. Installation of an erosion control/drainage blanket prior to constructing the dry stack is not expected to impact either the quantity or quality of the seepage from the dry stack. Following closure, the RTP would be drained and capped with fill overlain with rock as a mitigation measure to protect sediments from erosion. This would reduce potential impacts to a low level. After mine closure, seepage of ground water from the mine would transport dissolved constituents to the slope and valley alluvium. Moderate increases in concentrations could occur for some parameters over the long term of 100 to thousands of years. These impacts would be localized between the mine and the river. Minimal impacts are expected on Goodpaster River water quality. During operations, moderate impacts would occur to water quality in Liese Creek between the tailings dry stack and the RTP from runoff and seepage from the dry stack and mineralized development rock. After closure of the dry stack, water quality would improve. Domestic wastewater would be treated with a single ADEC-approved package sewage treatment plant, and then would be discharged directly to the Goodpaster River. A mixing zone would be required in the river, but it is expected that the discharge would result in low to very low impacts. Air access. Without mitigation, use of the airstrip could result in a large spill that could have a high impact on water quality. With use of planned secondary containment and additional BMPs, the likelihood and severity of spills would be reduced and the overall impact would be low. Use of the airstrip only by the Pogo project would have the smallest potential to affect water quality. The potential for impacts to water quality would increase with more users. At the end of the Pogo Mine life, removing and reclaiming the airstrip would have the least impact and keeping it open for all users would have the highest potential for impacts on water quality due to fuel spills.

Table 5.1-1 Summary of Direct and Indirect Effects of the No Action Alternative and Options Common to All Alternatives

No Action Alternative	Options Common to All Alternatives
4.4 Air Quality	
There would be no major air quality impacts.	General mine area. Construction would cause short-term, localized impacts on soils, vegetation, and visibility in the immediate mine area as a result of fugitive dust. Construction and mine operation equipment and generators would release combustion products locally. These impacts would be low and inconsequential.
4.5 Noise	
No changes of consequence in project area noise levels were projected. Dominant noise sources would continue to include local fixed-wing aircraft and helicopter overflights, existing mining and exploration operations, snow machines and ATVs, USAF aircraft overflights, and heavy truck traffic on the Richardson Highway.	General mine area. Because the distances to noise sensitive receivers in the lower Goodpaster River, Shaw Creek Road, Quartz Lake, Big Delta, and Delta Junction areas would be in excess of 15 miles, initial mine area blasting noise was projected to have no impact in these areas. Once blasting moved underground, there would be no surface impacts. Mine area operational noise would not be audible at sensitive receivers in these areas even under extreme conditions. During initial construction, noise levels on the Goodpaster River between Pogo and Liese creeks were projected to range from 30 to 40 decibels A-weighted (dBA). Mine operational noise levels in this same area were projected to range from 25 to 35 dBA. Because this area is primarily used for recreation, with outboard motors in the summer and snow machines in the winter, noise impacts would be low.
4.6 Wetlands	
Overall wetlands impacts would be minimal. The DOF's proposed timber harvests generally would not include substantial wetland areas, but access roads to the timber likely would. Roads would be built in the Quartz Lake area and along the Shaw Creek Hillside. Both these forestry roads would entail loss of wetlands along an estimated 10 to 20 percent of their lengths. These roads would open up new areas for use by ATVs, which tend to use and damage wetlands.	General mine area. Alternative 3 would require filling 1 more acre of wetland than Alternative 2 at the airstrip. Alternative 4 would require clearing 6 fewer acres of wetlands than Alternative 2 or 3 because a power line would not be built at the mine. Alternative 4 would require filling 12 to 13 more acres of wetlands than Alternative 2 or 3 because of increased storage space needed for a years' fuel and other supplies. Mill, camp, and tailings disposal impacts would be high only in the context of Liese Creek Valley. Impacts of facilities on the Goodpaster Valley floor also would be locally high, with gravel pits providing some wetland benefits if they were to become ponds.
	Alternative
	2 / 3 / 4
	Cut/fill (acres): 152 / 153 / 165
	Clear only (acres): 14 / 14 / 8
4.7 Surface Disturbance	
Approximately 33 acres of surface disturbance presently exist in the mine area. These areas would be reclaimed and revegetated. DOF's eight planned timber sales would disturb approximately 1,313 acres, not including new timber access roads.	General mine area. Approximately 383 acres of disturbance would occur. There would be no substantive differences in disturbance between the alternatives, except for the gravel source option. If gravel were made from crushed mine development rock, as opposed to being mined from gravel pits, 72 fewer acres would be disturbed, leaving a total of approximately 311 acres of disturbance.

Table 5.1-1 Summary of Direct and Indirect Effects of the No Action Alternative and Options Common to All Alternatives

No Action Alternative	Options Common to All Alternatives
4.8 Fish and Aquatic Habitat	
Impacts would be none to low if DOF road construction and logging were conducted with appropriate BMPs.	Air access. Impacts would be low to nonexistent, provided that suggested mitigation measures were implemented. If the airstrip were open to all users, impacts would increase to low to moderate.
4.9 Wildlife	
Impacts generally would be low; they would be high only on a very local basis. Timber harvesting using BMPs could provide some medium- and long-term habitat benefits to species such as moose.	General mine area. Direct habitat loss would be high only on a local mine site basis. Direct impacts on birds and mammals would be high only on a local mine site basis. There would be no high indirect impacts to birds. Moose, brown bears, and marten could experience indirect impacts, but these would be high only on a local mine site basis. There would be minor disruption of large mammal movements because of mine site facilities. Occasional entrapment in the RTP also is a possibility. If garbage were not handled properly, bears likely would have to be killed. Gravel source. Mining gravel, rather than crushing development rock, would cause surface disturbance to an additional approximately 66 acres on the Goodpaster Valley floor. Disturbance generally would be to lower value habitat. And, if the gravel pits were reclaimed as ponds, habitat benefits would accrue. Still, mining gravel would have a moderate local overall habitat impact compared to crushing development rock for gravel. Air access. Removal of the airstrip at mine closure would allow the relatively high-value habitat to begin recovery, and would eliminate continuing indirect habitat impacts from human activities.
4.10 Threatened and Endangered Species	
There would be no impacts on threatened or endangered species, and impacts to sensitive species would be low.	There would be no impacts on threatened or endangered species. Impacts to sensitive species would be high only on a local basis.
4.11 Socioeconomics	
The NMDS would increase employment from ~750 to ~900 jobs by perhaps 2005 or 2006, and Delta area population could stabilize then at approximately 2,100. Existing housing could be tight during NMDS construction, but should be sufficient for operation. The local economy would continue to be based on the military and tourism. Other basic economic activity, including mining, transportation, regional health care, state government, and federal government, would continue to play a role in the local economy. A natural gas pipeline would have only a short-term effect on the area.	Air access. Only airstrip operation and disposition could affect Delta area socioeconomic conditions. If the airstrip were open to other industrial/commercial users or to everyone, it could provide some additional industrial/commercial development and create some new economic activity, population growth, and demand for public services. Removal and reclamation would eliminate this potential.

Table 5.1-1 Summary of Direct and Indirect Effects of the No Action Alternative and Options Common to All Alternatives

No Action Alternative	Options Common to All Alternatives
4.12 Land Use	
Land use changes would occur consistent with current Delta area economic development trends, construction of the NMDS, and possible construction of a natural gas pipeline. New residential, commercial, and industrial activities (housing, lodges, stores, and quarries) would occur in the existing developed Delta area at a level consistent with ongoing needs or other actions in the area. DOF's eight planned timber sales would disturb approximately 1,313 acres in the lower Shaw Creek, Quartz Lake, and Indian Creek areas, not including new timber access roads.	Air access. Closing the airstrip to everyone but the Pogo project could have a major negative effect on potential new commercial and industrial activities, such as mining. Allowing other commercial/industrial users to access the airstrip could provide new service support options for commercial and industrial activities, as well as fly-in recreationists. Removing and reclaiming the airstrip could have a major impact on commercial air operators, recreationists, and potential new mineral development in the area.
4.13 Subsistence	
There would be no or low effects on the availability of subsistence resources. Except for local areas accessed by the DOF planned timber harvest roads in the Shaw Creek Valley and the vicinity of Quartz Lake and Indian Creek, there also would be no or low effects on access to or competition for subsistence resources. In those local areas accessed by the DOF timber harvest roads, there would be moderate effects to access (new transportation corridor) and competition (road users) for important subsistence resources (moose, caribou, waterfowl, and upland birds). These effects on access and competition, however, would be spread out over time because the roads likely would be constructed incrementally.	General mine area. Impacts would be low, except in the immediate mine area where subsistence users would be prohibited from hunting for public safety purposes. This area, however, is small within the context of the overall subsistence use areas for caribou, moose, and upland birds. Competition in the general mine area would not be affected because of the Applicant's no hunting and fishing policy for employees. Recent Upper Tanana Athabaskan caribou and moose subsistence use areas are substantially larger than the footprint of the mine site, and the lack of availability of the mine site for subsistence hunting would not affect the overall pattern of subsistence use because other areas are available for harvesting these species. And, there would not necessarily be any increased effort, cost, and/or risks if subsistence hunters were unable to hunt at the mine site because this location is not a readily accessible area from any community. Inability to hunt at the mine site would be more of a noticeable reduction in opportunity to hunt in a traditional place that was used by one's relatives and ancestors. Thus, it could be construed as a loss of a part of one's homeland for hunting, but not the primary or most used hunting area. Fuel storage. Temporary fuel storage below the 1525 Portal and at the airstrip would not be within the recent subsistence use area for fish; however, recent subsistence fishing areas are located downstream. If contamination from this facility were to cause fish damage, decline, displacement, or contamination, it would affect availability to subsistence fishers. Also, just concerns about contamination could lead to reduced fish consumption because of fear of contaminated resources. Depending on duration and severity, it could have a moderate effect on subsistence fishing uses. While there are substantial other areas available for subsistence fishing and the overall pattern of subsistence uses would not be seriously jeopardized in such an event, the Goodpaster River is a currently used and highly regarded river by descendents and related kin of Athabaskans who used this area traditionally. Air access. For availability, access, and competition criteria, the most restrictive airstrip use and disposition options (airstrip open only to Pogo project use during mine operations and removal and reclamation at the end of mine operations) would have low effects. Conversely, the least restrictive options (airstrip open to everyone during and after mine operations) would have moderate to high subsistence effects.

Table 5.1-1 Summary of Direct and Indirect Effects of the No Action Alternative and Options Common to All Alternatives

No Action Alternative	Options Common to All Alternatives
4.14 Cultural Resources	
Larger developments would be subject to Section 106 review and mitigation stipulations by the SHPO before construction; therefore, impacts would be few. Private land development is not subject to Section 106 review. Gradual increases in land sales, homes, and recreational uses could result in damage to cultural resources as sites were developed. More recreational use would increase the likelihood that surface artifacts would be more vulnerable to looting and other types of damage.	General mine area. Because adherence to cultural-resource protection procedures under CFR 800, Section 106, are the accepted process by which to mitigate impacts to cultural resources, no high impacts to cultural resources are expected from development of these options.
4.15 Visual	
Areas cleared for installation of the NMDS, as well as clearing for related residential, commercial, and industrial land sales and development, would cause long-term impacts on visual resources. Planned timber harvests would change visual quality and scenic integrity, and impacts to backcountry, recreational, and airborne viewers could be high.	Tailings dry stack. Because of the area's low visual absorption capability (VAC) due to slope and topography, distance and duration of the viewpoints would determine the importance of visual impacts of the above ground tailings dry stack. Airborne view impacts would be high. The dry stack likely would be relatively well screened by vegetation from viewers on the Goodpaster River, and impacts would be low. Mill and camp. Goodpaster River recreationists would have obscured foreground and middle-ground views of the mill and camp development and the visual impacts would be low. Airborne viewers would have obscured views of the mill and camp development due to the valley's slope and topography, but impacts could be somewhat higher to airborne viewers desiring a totally primitive experience. Air access. Airstrip use and disposition would have impacts to visual resources and scenic integrity. Backcountry users desiring a nonmotorized experience would see greater aircraft activity, as well as more recreational users, if the airstrip were open to everyone during and after mine operations.
4.16 Recreation	
There would be no major changes to recreational use, except those from the DOF road that would open areas in the Shaw Creek drainage to recreational users. The opening of these areas would have a high impact on existing recreational users in the vicinity of the forestry road, but would be a substantial benefit to prospective recreational users.	Air access. If the airstrip were open to everyone during mine operation, and were to remain open after mine closure, it would be a major benefit to prospective recreational users, particularly to those desiring to hunt, fish, or float the Goodpaster River. This air access would have a low effect on existing recreational users of the mine area because there is presently little recreational use. Recreational cabin owners on the lower Goodpaster River, however, could be affected moderately by floaters and fishers who would float into the lower river past these cabins. This river use would alter the present isolation of the cabins and could cause changes in fishing bag and size limits, as well as an increase in littering and vandalism.

Table 5.1-1 Summary of Direct and Indirect Effects of the No Action Alternative and Options Common to All Alternatives

No Action Alternative	Options Common to All Alternatives
4.17 Safety	
Impacts would be low.	Impacts would be low.
4.18 Technical and Economic Feasibility	
The No Action Alternative is not applicable for the technical and economic feasibility criteria.	Mining gravel versus crushing development rock. Gravel is on the critical path for project construction. It would be needed for two purposes immediately at the start of development; for concrete aggregate for the civil works' foundations in the mine area (water treatment plant, mill, camp, and shop facilities), and as a road topping for mine area roads. Crushing development rock for gravel at this early stage would not be an option. Most of the nonmineralized rock that would be generated from underground would not be available until later in the two-year project development period. Underground mine development must follow completion of the appropriate surface facilities described above. Advancing underground development before beginning the surface civil works isn't possible because you cannot treat mine water without a new water treatment plant, and you cannot have underground development without a shop to maintain the equipment. Thus, from a timing perspective, crushing development rock to make gravel would not be feasible or practicable. From another perspective, experience during the Pogo Mine exploration phase has demonstrated that underground development rock does not make a good traffic surface for high volume roads. At the existing advanced exploration facilities, gravel has been used to top the surface of the high volume roads because the development rock breaks down under traffic loads and becomes mud. Thus, from a technical perspective, crushing development rock to make gravel would not be feasible or practicable. Also, a gravel road topping has helped to reduce sedimentation both on the surface and underground, where reduced sedimentation in the mine sumps has been an important factor in water treatment plant efficiency. Another need for gravel may arise for topping portions of the mine access road. Test work at potential material sites along the proposed Shaw Creek Hillside road alignment has shown the rock in most of the proposed material sites does not conform to ATM T-13 degradation, or to Los Angeles Abrasion ASTM C131-96 specification for coarse abrasion testing of coarse rock. Thus, while the rock from these sites would still be suitable for bulk fill, topping material with sufficient hardness for the road surface would have to be hauled long distances from select material sites. Two of the material sites may contain rock suitable for crushing and use for road topping, and it would be advantageous in some areas for the Applicant to do so rather than haul gravel from the vicinity of the mine. Some of the gravel from the mine area sites, however, could be used for access road topping. Even if nonmineralized development rock were suitable for crushing, which it is not, the direct cost to produce approximately 140,000 cu yd of aggregate for use in the mine area would be approximately three to four times greater than mining pit run gravel by expanding existing borrow pits and developing new ones as proposed by the Applicant. A reasonable cost estimate for pit run gravel at the Pogo site is approximately $4 per cu yd. Thus, crushed development rock would cost between approximately $1.1 million and $1.7 million more than mined gravel (Rowley, 2002a). Mining gravel from existing and new pits versus crushing nonmineralized development rock for gravel would

Table 5.1-1 Summary of Direct and Indirect Effects of the No Action Alternative and Options Common to All Alternatives

No Action Alternative	Options Common to All Alternatives
	disturb approximately 66 more acres. As discussed later, the off-river treatment works was selected as the preferred option for the industrial wastewater discharge component. Because this option would require excavation of approximately 13.1 acres of gravel to create the two ponds, a portion of the overall project's required mine area gravel needs would be met during excavation of the ponds, and the 66-acre total would be reduced to approximately 53 acres. A portion of this disturbance would be to wetlands, and would have moderate impacts. But those impacts would be offset by pond creation in the gravel pits, resulting in negligible overall wetlands impact. Mining gravel would have a moderate local wildlife habitat impact although this, too, would be mitigated somewhat by pond formation. Still, surface mining of gravel would account for approximately 7 percent of the total surface disturbance for the Applicant's Proposed Project.

Table 5.1-2 Summary of Direct and Indirect Effects of Options Specific to Alternatives, but Not Related to Surface Access

Alternative 2 (Power Line and SAS/Injection Wells)	Alternative 3 (Power Line and Direct Discharge to Goodpaster River)	Alternative 4 (On-Site Power and Off-River Treatment Works)
4.1 Surface Water Hydrology		
Unlined tailings facilities. No effect on surface hydrology. Wastewater discharge. Injection of excess water into wells could raise water levels in adjacent sloughs by 2 ft. Overall impacts are expected to be low.	Wastewater discharge. Direct discharge of excess water to the Goodpaster River would increase flow in the river. Managing discharge flows to a ratio of 45:1 (river: discharge) would limit flow increase to approximately 2 percent. This managed discharge would have a low impact.	Wastewater discharge. Discharge via an off-river treatment works would reduce flow in an 1800-ft stretch of the Goodpaster, but a flow of at least 20 cfs would be maintained at all times in this stretch. Even during normal annual winter low flow conditions in the river, there would be enough water to meet wastewater mixing discharge requirements. Downstream of re-entry channel impacts would be the same as for Alternative 2.
4.2 Groundwater Hydrology		
Unlined tailings facilities. Low effect on groundwater hydrology. Wastewater discharge. Injection of excess water into wells or the soil absorption system (SAS) could raise groundwater elevations locally by up to several feet. Overall impacts are expected to be low.	There would be no groundwater impacts.	Same as Alternative 3.
4.3 Water Quality		
Unlined tailings facilities. Low effect on water quality. Wastewater discharge. Projected quality of the water to be discharged from the SAS during operations would not meet discharge criteria for a number of parameters. The inability to meet discharge criteria was considered as having a high impact from a permitting and compliance perspective, and may not be permittable.	Wastewater discharge. Direct discharge to the Goodpaster River with a mixing zone during development and operations would result in low impacts on water quality. The discharge is expected to meet all criteria for all parameters. It is uncertain, however, whether mercury would bioaccumulate to high adverse levels from this discharge; hence, it is uncertain whether a mixing zone could be granted.	On-site power generation. The need to transport approximately 4.2 million gallons of fuel to the mine site annually would result in a moderate to high potential to impact water quality. A major spill could cause a high impact over a large watershed area Wastewater discharge. Discharge to the Goodpaster River via an off-river treatment works during operations would result in low impacts to water quality. The discharge is expected to meet all criteria for all parameters. At 400 gpm residence time would be approximately 24 hours, which would provide ample time to respond to potential upset conditions at the water treatment plant.

Table 5.1-2 Summary of Direct and Indirect Effects of Options Specific to Alternatives, but Not Related to Surface Access

Alternative 2 (Power Line and SAS/Injection Wells)	Alternative 3 (Power Line and Direct Discharge to Goodpaster River)	Alternative 4 (On-Site Power and Off-River Treatment Works)
4.4 Air Quality		
Power line. Low impact in the vicinity of the power generation source near Fairbanks that is operating under an existing air quality permit.	Power line. Same as Alternative 2.	On-site power generation. Would have low impacts on local air quality under permit conditions.
4.5 Noise		
There would be no or low impacts.	Same as Alternative 2.	On-site power generation. Generators would use noise reducing equipment to meet OSHA standards, and would not cause a major addition to the noise levels projected for options common to all alternatives (Table 5.1-1).
4.6 Wetlands		
Power line. Would require clearing and slightly disturbing ground surface of approximately 119 or 158 acres of wetlands and other water bodies, depending on route. Wastewater discharge. Minor SAS impacts at either the airstrip or above Pogo Ridge, but the latter would have greater wetlands acreage impacts. Injection wells. Could have the capacity to increase the groundwater table level, flood swales and otherwise dry sloughs, and create small, scattered, wetland-like areas. There areas likely would be sporadic, and ephemeral, and wetland benefits would be small.	Power line. Same as Alternative 2. Wastewater discharge. No or low impacts from direct discharge to Goodpaster River.	On-site power generation. The need to transport and store ~4.2 million gallons. of diesel fuel annually would substantially increase the risk of spills into wetlands. Also more road traffic would result in increase in dust and sediment-laden road runoff into wetlands. Impact would be minor because of low risk of a substantial spill. Wastewater discharge. Off-river treatment works would have no additional wetland effects beyond those for the gravel pits because it would be constructed in the excavated pits.
4.7 Surface Disturbance		
Power line. 602 or 525 acres of clearing, depending on route. Wastewater discharge. 4.4 acres for the SAS.	Power line. Same as Alternative 2. Wastewater discharge. 0.5 acre for direct discharge to Goodpaster River.	On-site power generation. ~22.7 acres for extra fuel storage (6.1 acres) and laydown area (16.6 acres) to accommodate winter-only access need to store a full year's fuel and supplies. Wastewater discharge. 13.1 acres, but would be constructed in already excavated gravel pits.

Table 5.1-2 Summary of Direct and Indirect Effects of Options Specific to Alternatives, but Not Related to Surface Access

Alternative 2 (Power Line and SAS/Injection Wells)	Alternative 3 (Power Line and Direct Discharge to Goodpaster River)	Alternative 4 (On-Site Power and Off-River Treatment Works)
4.8 Fish and Aquatic Habitat		
SAS. Depending on where the ground water would reach the river, overall impacts to the river's aquatic resources in the long term would be low to moderate, and would be localized.	Direct discharge to Goodpaster. This option would have a high impact on aquatic resources in the immediate vicinity of the diffuser pipe and a low impact outside the mixing zone during normal operations. Process upsets and facility failure could cause impacts. Because the probable frequency of these events is low, and the dilution factor is high, the impacts would be moderate and localized.	On-site power generation. This option would substantially increase risk of accidents during fuel transport and storage that could have moderate to high local impacts, and high impacts to the chinook population if an accident occurred during low winter flows or spawning. Off-river treatment works. This option would have fewer impacts than the other discharge options. Process failures, mine shutdowns, and environmental upsets could be better addressed with this option, considering its storage capability. Because of the low probability of the combination of upset events that would exceed the storage capability and the unknown effects of severe winter weather on the process facilities, impacts would be low to moderate and localized. A minimum flow of 20 cfs would be maintained in the Goodpaster River at all times to provide sufficient flow for fish.
4.9 Wildlife		
Power line. Would require clearing vegetation on approximately 602 or 525 acres, depending on the route. Clearing generally would not destroy vegetative mat. Altered habitat would still provide support to wildlife, although of a different species composition. Habitat impacts, and indirect impacts to birds and mammals, would be high only on a local basis. Birds would experience direct impacts from collisions, but these are expected to be high only on a local basis. Browsing mammals would benefit from the edge effect created by clearing the ROW. This benefit would be of importance only on a local basis. SAS and underground injection. SAS surface disturbance to 4.4 acres would be moderate only on local basis.	Power line. Same as Alternative 2. Direct discharge to Goodpaster. Low impact.	On-site power generation. This option would require an additional ~22.7 acres of surface disturbance for increased diesel fuel storage and laydown area versus clearing vegetation on approximately 602 or 525 acres for a power line, depending on the route. Loss of ~22.7 acres would be moderate and only on a local basis. This option would require ~4.2 million gallons of fuel to be transported to the mine site annually. The transportation of fuel would pose a greater impact risk to wildlife and habitat from spills than would the power line option clearing. There would be only very local high direct or indirect impacts to birds or mammals from this option.

Table 5.1-2 Summary of Direct and Indirect Effects of Options Specific to Alternatives, but Not Related to Surface Access

Alternative 2 (Power Line and SAS/Injection Wells)	Alternative 3 (Power Line and Direct Discharge to Goodpaster River)	Alternative 4 (On-Site Power and Off-River Treatment Works)
		Water discharge. Off-river treatment works would have few additional effects beyond those for the gravel pits because it would be constructed in the excavated pits.
4.10 Threatened and Endangered Species		
Power line. There would be no impacts on threatened or endangered species. For sensitive species, ROW clearing could cause loss of some raptor nest sites, depending on the route. Because portions of both routes would traverse forested habitats, there would be a collision risk for Northern Goshawks.	Power line. Same as Alternative 2.	On-site power generation. There would be no impacts on threatened or endangered species. There would be no power line ROW clearing impacts. Risks from fuel spills from substantial additional fuel transport would be the same as discussed above for wildlife.
4.11 Socioeconomics		
Power line. Greater long-term potential for supporting additional industrial/commercial activity, allowing mine developers or others to enjoy a substantial construction and operation cost savings compared to constructing a new power line or providing on-site generating capacity.	Power line. Same as Alternative 2.	On-site power generation. This option would not provide the greater long-term potential for supporting additional industrial/commercial activities that a power line would.
4.12 Land Use		
Power line. Would benefit potential new commercial and industrial land uses.	Power line. Same as Alternative 2.	On-site power generation. This option could have a high impact on potential commercial and industrial users because mineral development could be slower without a power line to Pogo. Such development would need to haul fuel for on-site generation, or construct a power line.
4.13 Subsistence		
Power line. ROW clearing would create an access corridor for recreational as well as subsistence users, and could increase competition for subsistence resources. Mitigation measures could limit ROW access to some extent. If road use were open to everyone, however, the power line ROW would offer little advantage because it would closely follow the road alignment.	Power line. Same as Alternative 2. Direct discharge to Goodpaster. If this option were to cause impacts on fish and aquatic habitat from process upsets, facility failures, or bioaccumulation, it could lead to the same impacts on subsistence fisheries downstream as described for fuel storage in Table 5.1-1 (Options Common to all Alternatives).	On-site power generation. This option would require greater on-site fuel storage and surface movement of approximately 4.2 million gallons of fuel annually. Storage and movement of fuel would substantially increase the risk of fuel spills at stream crossings and from transfers between tankers and storage tanks, raising the same concerns for downstream impacts to fish, fish habitat, and subsistence fisheries as described in Table 5.1-1 (Options Common to all Alternatives). Off-river treatment works. Same as Alternative 3.

Table 5.1-2 Summary of Direct and Indirect Effects of Options Specific to Alternatives, but Not Related to Surface Access

Alternative 2 (Power Line and SAS/Injection Wells)	Alternative 3 (Power Line and Direct Discharge to Goodpaster River)	Alternative 4 (On-Site Power and Off-River Treatment Works)
		This option would have the capacity to provide up to 24 hours of holding time in case of upset conditions at the water treatment plant.
4.14 Cultural Resources		
Because adherence to cultural-resource protection procedures under CFR 800, Section 106, are the accepted process by which to mitigate impacts to cultural resources, no major impacts to cultural resources are expected.	Same as Alternative 2.	Same as Alternative 2.
4.15 Visual		
Power line. High visual impacts because of the scale, distance, and viewer recognition of power poles compared to on-site power generation.	Power line. Same as Alternative 2.	On-site power generation. This option would require additional 22.7 acres for fuel storage and laydown area at the airstrip. This use of additional acreage would have a low impact on views of recreationists on the Goodpaster River. Impacts would be very substantially less than for a power line.
4.16 Recreation		
Power line. Without mitigation, the cleared power line ROW would provide a benefit of backcountry access for new motorized and nonmotorized recreational users, depending to what extent mitigation measures were implemented to limit access. This increased access, however, would have a high impact on existing recreational users. If road use were open to everyone, however, power line ROW clearing would offer little advantage because it closely follows road alignment.	Power line. Same as Alternative 2.	On-site power generation. This option would cause a small increase in noise and other activity in the vicinity of the mine and access route due to the generators and the additional fuel transportation. This disturbance would have a low to moderate impact on primitive and semi-primitive motorized Recreation Opportunity Spectrum (ROS) classes.
4.17 Safety		
Impacts would be low.	Same as Alternative 2.	Same as Alternative 2.
4.18 Technical and Economic Feasibility		
Tailings dry-stack liner. Permeabilities of the fine-grained dry-stack tailings themselves were not considered to be greatly different than permeabilities of an installed liner system. Also, most seepage that would occur from the dry stack would be captured by the RTP. Still, from strictly a water quality perspective, a lined tailings facility likely would provide some measure of increased impermeability and transmission of drainage to the RTP. From a tailings pile stability	Same as Alternative 2.	Same as Alternative 2.

Table 5.1-2 Summary of Direct and Indirect Effects of Options Specific to Alternatives, but Not Related to Surface Access

Alternative 2 (Power Line and SAS/Injection Wells)	Alternative 3 (Power Line and Direct Discharge to Goodpaster River)	Alternative 4 (On-Site Power and Off-River Treatment Works)
perspective, however, a liner would be more problematic. The original dry-stack tailings pile stability analysis assumed a worst case scenario that included saturation of the general tailings placement zone. It did not include saturation of the shell zone. Placement of an impermeable liner beneath the general placement zone likely would cause saturation of the tailings pile and result in occurrence of the worst case scenario, which was not the design intent. Thus, saturation caused by the impervious liner likely would increase stability risk. Overall, there would be little benefit to water quality from installation of a liner under the dry-stack tailings pile, while there would be increased risk to stability from the liner. Installation of an erosion control/drainage blanket before tailings would be placed in the dry-stack tailings facility was predicted to have no effect on the dry stack's stability, but it would permit clearing and stockpiling of organic and soil growth media to insure a sufficient volume for reclamation. RTP liner. The primary purpose of the RTP would be to capture runoff and seepage from the dry-stack tailings facility consistently, reliably, thoroughly, and predictably, during both mine operations and post closure activities. Seepage from the dry stack would migrate downgradient below the surface, nearer the colluvium/weathered bedrock interface. An effective seepage interception and collection system would be needed to provide appropriate management of this subsurface flow. Given the nature of the flow system that would develop, the most effective interception system would be one perpendicular to the direction of subsurface flow, i.e., a cut-off wall. The proposed RTP dam face liner system and grout curtain would establish an effective interception cut-off wall to collect this seepage. The upstream toe of the dam face liner system would be embedded in a trench in weathered bedrock filled with grout, with a drilled		

Table 5.1-2 Summary of Direct and Indirect Effects of Options Specific to Alternatives, but Not Related to Surface Access

Alternative 2 (Power Line and SAS/Injection Wells)	Alternative 3 (Power Line and Direct Discharge to Goodpaster River)	Alternative 4 (On-Site Power and Off-River Treatment Works)
curtain of pressure-grouted holes extending below the toe through the weathered bedrock layer and into fresh bedrock. ▪ A full liner under the RTP basin would not provide substantially better long term seepage collection and would introduce increased operational and performance risks for a number of reasons, including: ▪ A full basin liner would fail to collect the seepage at issue because the upstream toe of the liner would not have the robust cut-off wall required to collect the subsurface seepage. If such a cut-off wall at the upgradient end of the liner were required, it would follow that another liner upstream of that cut-off wall also would be needed, etc. It is thus a cut-off wall perpendicular to the flow that would be needed to capture seepage, not a liner. ▪ Due to the narrowness of Liese Creek Valley, and its steep slopes, hydrostatic uplifting forces from upwelling ground water beneath the liner could result in long-term liner instability, especially during periods when the RTP reservoir would be drawn down to provide storm surge volume. The nature of Liese Creek Valley geometry is such that a large portion of any full basin liner would be on very steep slopes. The south slopes of the reservoir exceed the maximum slopes recommended for effective liner installation (2.2 to 2.5 H to 1 V). A full basin liner thus would not completely capture the desired seepage and provide the long-term reliability necessary to manage dry-stack seepage. From the economic perspective, if a liner were feasible, a very rough estimate for the cost of a full basin liner under the RPT is approximately $1.5 million.		

Table 5.1-3 Summary of Direct and Indirect Effects of Options Specific to Alternatives, but Related to Surface Access

Alternative 2 (Shaw Creek Hillside)	Alternative 3 (South Ridge Corridor)	Alternative 4 (Shaw Creek Flats Winter-only Access)
4.1 Surface Water Hydrology		
Shaw Creek Hillside all-season road. During and immediately following construction, modifications to surface water hydrology could occur due to increased runoff volumes caused by vegetation removal and soil compaction. Increased flows could be mitigated by using storm water runoff BMPs. Most of the road is at least 1 mile from Shaw Creek, and no surface water hydrologic impacts would occur directly to the creek.	South Ridge all-season road. Six fewer bridges and fewer other stream crossings than for Alternative 2 would be required. Because route would be along the divide between the Shaw Creek and Goodpaster River drainages, the potential for surface water hydrologic impacts, regardless of how minor, might impinge on two watersheds, rather than one. A mitigating condition would be that the separation distance to substantial discrete streams from the road appears to be a half-mile or more.	Winter-only access. Same as Alternative 2, except for the tendency of ice roads to thaw later than surrounding areas, raising potential for blockage or rerouting of runoff flows during breakup. These effects would be localized and temporary.
4.2 Groundwater Hydrology		
No groundwater flow impacts were identified.	Same as Alternative 2.	Same as Alternative 2.
4.3 Water Quality		
Shaw Creek Hillside all-season road. Primary potential impact to water quality would be from a fuel or chemical spill during transport to the mine site. The likelihood of a major release would be low, but the potential impact from a large spill into surface waters would be high. The overall water quality impact of fuel and commodity transport by this access route would be moderate. Road use and disposition. Use by the Pogo project only would have the lowest potential for accidents and subsequent releases. With increased usage, the potential for a release would increase. Continued use after mine closure would cause spill risks to persist.	South Ridge all-season road. The likelihood of a major spill would be moderate, because of the more exposed conditions, ice, higher winds, and greater potential for whiteout conditions in winter. But potential for an individual spill to affect a water body would be lower because of fewer wetlands and the road distance from active drainages. Overall water quality impact of commodity transport by this access route would be moderate. Road use and disposition. Same as Alternative 2.	Winter-only access. Because of the intense use of the road under difficult winter driving conditions, and the route's initial alignment through more wetlands, this option would have a high potential to affect water quality. Road use and disposition. Same as Alternative 2.
4.4 Air Quality		
Shaw Creek Hillside all-season road. There would be no or low impacts. Generation of fugitive dust from the all-season road would have a small effect on adjacent vegetation. Road use. Restricting use of the road during Pogo operation would limit fugitive dust proportionally. Road disposition. If maintained, restricting use would	South Ridge all-season road. Same as Alternative 2. Road use. Same as Alternative 2. Road disposition. Same as Alternative 2.	Winter-only access. Seasonal use of the winter-only access segment would eliminate fugitive dust impacts in lower Shaw Creek Valley, and would reduce them on the all-season road segment because it would be used only in winter.

Table 5.1-3 Summary of Direct and Indirect Effects of Options Specific to Alternatives, but Related to Surface Access

Alternative 2 (Shaw Creek Hillside)	Alternative 3 (South Ridge Corridor)	Alternative 4 (Shaw Creek Flats Winter-only Access)
limit fugitive dust proportionally. If removed and reclaimed, it would eliminate low fugitive dust impacts.		
4.5 Noise		
Shaw Creek Hillside all-season road. No major impacts were identified. Shaw Creek Road egress. Pogo-related impacts to Shaw Creek Road area residences would be low or moderate, with one exception that would be moderate to high. If the Applicant's shift-change bus station were near the TAPS crossing, two residences would experience a moderate to high impact and four would experience a high impact. If the bus station were located on the Richardson Highway, one residences would experience a moderate impact, three a moderate to high impact, and one a high impact. Road use and disposition. Additional traffic noise from allowing everyone to use the road during and after Pogo operations would cause only a small increase in impacts above the Pogo-related level, but would approach a high impact for one residence. Of the disposal options, only removal and reclamation would reduce impacts in a meaningful way.	South Ridge all-season road. No major noise impacts on residents in the Quartz Lake and lower Goodpaster River areas were identified. Road use and disposition. Same as Alternative 2.	Winter-only access. There would be no major noise impacts.
4.6 Wetlands		
Road/power line surface disturbance. All-season road and power line would cut and fill ~120 acres and clear ~158 acres of wetlands, for a total of ~278 acres. Shaw Creek Hillside all-season road. Impacts would be high within each wetland complex through which the road passed, but would be dispersed along 49-mile route and focused on flat wetlands, which are the least valuable wetland type. Effects would be minor in the context of the Shaw Creek and Goodpaster drainages. Shaw Creek/Rosa egress. No impacts. Tenderfoot egress. No impacts. Road use. Use only by Pogo or other industrial or commercial users would cause minor impacts in the context of Shaw and Goodpaster drainages. Use by everyone, particularly unregulated ATVs, would cause moderate impacts.	Road/power line surface disturbance. All-season road and power line would cut and fill ~75 acres and clear ~119 acres of wetlands, for a total of ~194 acres. This acreage would be ~84 fewer acres than Alternatives 2, with ~45 of the acres with less cut and fill. South Ridge all-season road. Same as Alternative 2. Road use. Same as Alternative 2, except road use by everyone would cause only minor impacts because less off-road ATV use in wetlands is expected. Road disposition. Same as Alternative 2, except road use by everyone would cause only minor impacts because less	Road surface disturbance. The winter-only access segment and all-season road segment, with no power line, would cut and fill ~103 acres and clear ~50 acres of wetlands, for a total of ~153 acres. This affected acreage would be ~125 acres and ~41 fewer acres than Alternatives 2 and 3 (including their power lines), respectively. Road/power line surface disturbance. Although Alternative 4 by definition has on-site power generation, the winter-only access option could be paired with a power line as the Preferred Alternative. In that case, the road and power line combined would cut and fill ~135 acres and clear ~211 acres of wetlands, for a total of ~346 acres. This affected acreage would be ~68 and ~152 more acres than Alternatives 2 and 3 (including their power lines), respectively.

Table 5.1-3 Summary of Direct and Indirect Effects of Options Specific to Alternatives, but Related to Surface Access

Alternative 2 (Shaw Creek Hillside)	Alternative 3 (South Ridge Corridor)	Alternative 4 (Shaw Creek Flats Winter-only Access)
Road disposition. Continued use only by industrial or commercial users would cause minor impacts. Use by everyone would cause high impacts in certain localities, but moderate impact within the context of Shaw and Goodpaster drainages. Security gate at Gilles Creek. Same impacts as use by everyone, but moderate impacts would be limited to the area west of Gilles Creek. Power line. Would affect extensive area by clearing, but effects would be only minor because most wetland functions would remain undisturbed or be affected to minor degree; disturbance would be primarily to lower value wetlands; and disturbed areas would be a minimal proportion of wetland resource in the project area. Sutton Creek. As a result of public comments on the DEIS, a new sub-option was considered with the power line following the road corridor over the Shaw Creek / Goodpaster divide rather than up Sutton Creek. Wetlands disturbance in the Sutton Creek segment would total approximately 4 acs. Because the boundaries between wetlands and uplands are more distinct along this route, the power line likely could be sited to avoid some of these wetlands. Wetlands disturbance if the power line were routed adjacent to the road over the divide would total approximately 6 acres. Because the power line would traverse primarily mosaics of wetlands/uplands along this route, wetlands would be more difficult to avoid. While fewer wetlands would be affected by the Sutton Creek route, the absolute difference would be small, and following the road route over the divide would remove all wetlands impacts from the Sutton Creek drainage.	off-road ATV use in wetlands is expected. Power line. Same as Alternative 2.	Winter road/trail construction standards. Under the traditional winter road option, a higher percentage of wetlands would be cleared only down to the organic mat, and would remain wetlands and retain their functions. The perennial winter trail option, however, would cut or fill 24 more acres than the traditional winter road option because its construction method would cut the ground surface. Road use. By its seasonal nature, this alternative would be less likely to promote additional development and cause wetlands impacts in the Shaw Creek, Goodpaster, and adjacent drainages. Once the DOF road eventually reached the lower end of the all-season road segment south of Gilles Creek, however, impacts from road use would be the same as for Alternative 2.
4.7 Surface Disturbance		
Surface access. 770 acres for Shaw Creek Hillside route with Shaw Creek/Rosa egress option. 43 more acres with Tenderfoot egress option (total 813 acres). Power line. 602 acres for Shaw Creek Hillside route.	Surface access. 768 acres for South Ridge route. Power line. 525 acres for South Ridge route.	Surface access. 594 acres for Shaw Creek Flats winter-only access route. Power line. If a power line were paired with winter-only access, 600 acres would be cleared for the Shaw Creek Hillside route.
4.8 Fish and Aquatic Habitat		

Table 5.1-3 Summary of Direct and Indirect Effects of Options Specific to Alternatives, but Related to Surface Access

Alternative 2 (Shaw Creek Hillside)	Alternative 3 (South Ridge Corridor)	Alternative 4 (Shaw Creek Flats Winter-only Access)
Shaw Creek Hillside all-season road. Impacts would be none to low. Road use. Opening route to everyone would raise overall impacts to low to moderate, with increase in direct and indirect impacts due to traffic volume and recreational activities. Motorized boating in low flows on the Goodpaster River could disrupt spawning behavior and dislodge and suffocate eggs. Exhaust emissions pollute water and could disturb riparian habitat by undercutting banks through wake action. The number of boats on the Goodpaster would increase. Road disposition. Maintaining road open to everyone would have same impacts as for road us. Security gate at Gilles Creek. This sub-option would have the same impacts described above for road use by everyone, except the impacts would only occur in the lower two-thirds of Shaw Creek Valley. This option would eliminate impacts from angling and boating on the Goodpaster.	South Ridge all-season road. Same as Alternative 2, except this route would have even fewer impacts because it would require only one stream crossing (Goodpaster River) and completely avoid the Shaw Creek drainage. Road use. Same as Alternative 2. Road disposition. Would differ from Alternative 2 because with no stream crossings other than the Goodpaster, the remove and reclaim option would still allow ATV access to the Goodpaster via cleared ROW for some time following reclamation. Such access likely would result in erosion problems, as shown by historical ATV use.	Winter-only access. Impacts would be higher than for Alternatives 2 and 3 due to risk of accidents during the short winter transportation window, especially fuel spills, at or near stream crossings under severe winter conditions, and particularly on the steep divide between Shaw Creek and Goodpaster drainages. An accident near the upper Shaw Creek or Goodpaster crossings could cause high impacts to overwintering fish during low flows of winter. Road use. This option initially would eliminate road use impacts by the public; however, this condition would last only until the DOF road eventually reached the lower end of the all-season road segment south of Gilles Creek. At that time, impacts from road use would be the same as for Alternative 2, unless public use was restricted.
4.9 Wildlife		
Shaw Creek Hillside all-season road and power line. Habitat. Because the approximately 1,372 combined acres of disturbance would be linear in nature; have low or no impacts on rarer or uncommon habitat classes; are well represented within the project area as well as interior Alaska; would affect few Conservation Priority Index lands; and would have small impacts on high-value habitat for large mammals, the bird and mammal habitat loss for Alternative 2 would not be high. Also, the approximately 602 acres within the power line ROW would only be cleared, with little actual surface disturbance. Birds. Primary direct impacts would be from collisions, and would be high only on a local basis. These impacts likely would be lower than for Alternative 3 because for most of its route in Shaw Creek Valley the power line would be within forest habitats rather than exposed above timberline. If daytime visual markers on the lines were not used for the crossing from Shaw Creek to the	South Ridge all-season road and power line. Habitat. Approximately 1,293 combined acres of disturbance would occur. Habitat impacts would be similar to Alternative 2, and would not be major. This alternative, however, would disturb roughly twice the acreage of high-value habitats for moose, caribou, and brown bear than would Alternative 2. Also, the approximately 525 acres within the power line ROW would only be cleared, with little actual surface disturbance Birds. Direct and indirect impacts on birds would be the same as Alternative 2, except that bird-power line collisions likely would be higher because for approximately 25 miles the power line would be above timberline along the	Winter-only access. Habitat. Approximately 594 acres of disturbance would occur. Habitat impacts would be similar to Alternative 2, and would not be high. This alternative, however, would disturb only approximately 37 acres of high value Conservation Priority Index lands in lower Shaw Creek Valley versus approximately 85 acres for Alternative 2. This alternative also would disturb approximately 54 percent less high value habitat than would Alternative 2. Birds. Direct and indirect impacts would be the same as for Alternative 2. Mammals. Direct impacts from collisions would be more likely to occur than for Alternative 2 because of substantially greater winter traffic, especially if deep snow were to accumulate and cause animals to use the road surface for movements. These impacts would be locally low to moderate, depending on the particular winter.

Table 5.1-3 Summary of Direct and Indirect Effects of Options Specific to Alternatives, but Related to Surface Access

Alternative 2 (Shaw Creek Hillside)	Alternative 3 (South Ridge Corridor)	Alternative 4 (Shaw Creek Flats Winter-only Access)
Goodpaster River, bird collisions would be more likely to occur. There would be no major indirect impacts. Mammals. Primary direct impacts for both small and large mammals would be from vehicle collisions, particularly in winter when the cleared road would be favored for movements by larger animals. This mortality would not be high even on a local basis. If the road were open for use by everyone, this mortality could be high only on a local basis. Indirect impacts would be low for most species. Except for the intense road use period during construction, the road-related noise and activity should have only a small effect on moose in the Shaw Creek Valley rutting area. Brown bears and wolverines likely would avoid the road corridor other than for crossing. This road corridor avoidance would not cause major habitat fragmentation for these species. For marten, however, the road corridor likely would serve as more of an indirect behavioural barrier to movements and could cause some habitat fragmentation. Security gate at Gilles Creek. Impacts would be similar to those described above, except that public use would extend to only the lower two-thirds of Shaw Creek Valley. This reduction of public use would lower collision mortality. Power line route. The sub-option of following the road corridor over the Shaw Creek / Goodpaster divide, rather than separately up Sutton Creek, would have approximately the same habitat impact, but by consolidating the two corridors, as occurs for the large majority of the remainder of this alternative's route, it would remove all wildlife impacts from Sutton Creek with minimal additional impacts adjacent to the road.	South Ridge. Mammals. Indirect impacts generally would be the same as for Alternative 2. This alternative, however, would avoid the moose rutting area in Shaw Creek Valley, and its long run above timberline along the Shaw Creek and Goodpaster divide would not pose the same habitat fragmentation concern for marten as would Alternative 2.	Indirect impacts would be similar to Alternative 2, but would be very small for approximately 9 months of the year when surface access to the mine site would not occur. During the annual winter-only access construction and use period, however, vehicle noise and activity levels would be very high. The noise and activity would cause disturbance to moose and caribou, if they were in the vicinity, at a critical time (mid- and late winter) when energy reserves are low. Road use. This alternative effectively would eliminate road use impacts by the public; however, this condition would last only until the DOF road eventually reached the lower end of the all-season road segment south of Gilles Creek. At that time, impacts from road use would be the same as for Alternative 2, unless public use were restricted.
4.10 Threatened and Endangered Species		
Shaw Creek Hillside all-season road. There would be no impacts on threatened or endangered species. Impacts on sensitive species would be low. Power line. Route would be close to three recently active northern goshawk nests, but would cross relatively little	South Ridge all-season road. There would be no impacts on threatened or endangered species. Impacts on sensitive species would be low. Power line. Route would be close to only	Winter-only access. There would be no impacts on threatened or endangered species. Impacts on sensitive species would be low.

Table 5.1-3 Summary of Direct and Indirect Effects of Options Specific to Alternatives, but Related to Surface Access

Alternative 2 (Shaw Creek Hillside)	Alternative 3 (South Ridge Corridor)	Alternative 4 (Shaw Creek Flats Winter-only Access)
high-value goshawk habitat.	one recently active northern goshawk nest, but would cross substantially more high value goshawk habitat.	
4.11 Socioeconomics		
Shaw Creek Hillside all-season road. With all-season road, more employees could reside in Delta area because work and off-work periods would be shorter and employees would be bused. With winter-only access, employees would work longer periods, have longer off-work periods, and be flown to and from the site, allowing them to live more distant. Between ~100 and 135 of mine's 385 workers would live in Delta area and create another 30 to 40 jobs in local economy. Mine-related population would be between ~260 and 350 (although not all would be new to Delta area) and would have a substantial and positive local effect. Annual mine-related payroll in the Delta area would be between ~$7.2 and $9.4 million. Effects on the local school system likely would be low, with a slight increase in demand for other public services. Effects on the housing market would be high, and generally positive. Local homeowners could expect to see home values rise, and some new construction could be expected. Road use and disposition. If open to industrial and commercial users during and after Pogo operation, the road would increase access for mineral, timber, and other development, creating additional economic activity, population growth, and demand for public services. If open for everyone, the road would create more economic activity. In either case, local socioeconomic effects likely would be low.	South Ridge all-season road. Same as Alternative 2.	Winter-only access. As discussed under Alternative 2, winter-only access would result in fewer local employees. Between ~40 and 80 workers would live in the Delta area and create another 10 to 15 jobs in the local economy. Mine-related population would be between ~100 and 190 (although not all would be new to Delta area) and have a major and positive local effect. Annual mine-related payroll in the Delta area would be between ~$2.8 million and $5.7 million. Other effects would be the same as for Alternative 2.
4.12 Land Use		
Shaw Creek Hillside all-season road. Land use impacts would be low because all uses would be compatible with adopted land use plans. *Existing* land uses, however, could be substantially *changed*. Richardson Hwy. Egress. Shaw Creek/Rosa option would substantially increase existing use of Shaw Creek	South Ridge all-season road. Impacts would be similar to those for Alternative 2, except that the impacts to existing residential and other users near the Richardson Highway would occur in the vicinity of the highway near Quartz Lake,	Winter-only access. Impacts would be similar to those for Alternative 2, except as noted below. Road use. Access would not be as beneficial to potential commercial/industrial users as an all-season road. New mineral and timber activities, and associated commercial land uses, likely would be slower to

Table 5.1-3 Summary of Direct and Indirect Effects of Options Specific to Alternatives, but Related to Surface Access

Alternative 2 (Shaw Creek Hillside)	Alternative 3 (South Ridge Corridor)	Alternative 4 (Shaw Creek Flats Winter-only Access)
Road, while Tenderfoot option would substantially *change* existing land use. Shaw Creek and Richardson Highway areas generally would experience some increase in residential use and development with either option. Road use. Access could substantially benefit new commercial and industrial users. If open to public, the road would provide access to large presently remote areas. Road disposition. Reclaiming the road could be a high impact to new commercial/industrial land uses that occurred because of initial road construction, but existing land uses along Shaw Creek Road would not be substantially affected. If the road were open to the public during project operation, reclaiming would have a high impact on new recreational users and any service businesses that developed to support new backcountry users. Security gate location. Limiting public access to the lower two-thirds of Shaw Creek Valley would substantially reduce likely changes to existing land uses beyond Gilles Creek that would occur if the public were able to use the road to reach the Goodpaster River. DOF road. This road would not be built if the Shaw Creek Hillside all-season road were constructed.	rather than in the Shaw Creek Road area. DOF road. Planned road into the Indian Creek area could cause moderate *changes* in land use, such as timber harvesting in presently uncut areas, but harvests would be compatible with existing land use plans.	develop than with an all-season road. If the road were open to the public, because of its seasonal nature, it would be a benefit to existing residential and recreational users in the Shaw Creek and Goodpaster valleys, including the Goodpaster cabin owners, because users would be able to access the upper reaches of the Shaw Creek and Goodpaster drainages only in winter, which they largely can do now. Trappers, commercial sled dog tour operators, and other backcountry users also would consider winter-only access less of an impact. Potential recreational users, however, would not have increased access to more remote areas during the 9 months when the perennial winter trail would be impassable. DOF road. If the winter-only access option were constructed, the DOF forestry road would be built and eventually would connect with the southern end of the all-season road segment of this winter-only access option. Because the DOF road would be open for public use, all impacts discussed in Alternative 2 likely would occur at least to the point south of Gilles Creek where the roads would connect.

Table 5.1-3 Summary of Direct and Indirect Effects of Options Specific to Alternatives, but Related to Surface Access

Alternative 2 (Shaw Creek Hillside)	Alternative 3 (South Ridge Corridor)	Alternative 4 (Shaw Creek Flats Winter-only Access)
4.13 Subsistence		
Shaw Creek Hillside all-season road. The road itself would have a low effect on the availability of subsistence resources. Road use and disposition. For access and competition criteria, the most restrictive road use and disposition options (road open only to Pogo project use during mine operations, and removal and reclamation at the end of mine operations) would allow the least access into the Shaw Creek and upper Goodpaster River drainages and would have the fewest impacts. Conversely, the least restrictive options (road open to everyone during and after mine operations) would allow the greatest access and would have the most effects. Opening the road even to just other industrial/commercial users would augment the potential for increased access and competition for resources. It would also complicate enforcement of policies designed to restrict competition with existing resource users. Opening the road to everyone would serve to open a currently inaccessible area to the general public. In addition to the Shaw Creek and Goodpaster River drainages, if hunters and recreationists were able to use the road to cross the Goodpaster River, the road use could ease some of the problems of reaching the high country north and northeast of Healy Lake. Restricting road use to the west side of the Goodpaster River, however, would reduce this possibility. To the extent that opening the road to the general public would result in increased use of this area, this option would have the greatest effect on existing subsistence uses by creating substantially increased access and competition in current use areas for key species for a long time period over a potentially large geographic area, resulting in subsistence users needing increased hunting effort, having greater costs, not going to traditional areas as often, and having reduced harvest. This impact would be major within the local and regional context for present-day subsistence hunters who are descendents and related kin of Athabaskans who used	South Ridge all-season road. Same as Alternative 2, except that subsistence use patterns along the South Ridge route are slightly different.	Winter-only access. This alternative would not allow all-season road access to upper Shaw Creek and the mid-Goodpaster River Valley, thus substantially limiting potential subsistence impacts from increased recreational and other subsistence users. The Shaw Creek Flats portion of the route would cross wetlands and recent and traditional subsistence use areas. Any fuel or cyanide accidents on the flats resulting in resource damage, decline, displacement, or contamination would affect availability to subsistence users, and contamination concerns could lead to reduced resource consumption and years of wondering if the resources from the area as well as “downstream” were safe to eat. Although road use by the public could be restricted on the winter-only access segment on Shaw Creek Flats, subsistence impacts from public use would begin to approach those described for Alternative 2 as the DOF road, which would be open to the public, was extended toward Gilles Creek.

Table 5.1-3 Summary of Direct and Indirect Effects of Options Specific to Alternatives, but Related to Surface Access

Alternative 2 (Shaw Creek Hillside)	Alternative 3 (South Ridge Corridor)	Alternative 4 (Shaw Creek Flats Winter-only Access)
this area traditionally. At the same time, the recent subsistence use areas are substantially larger than the immediate area of the all-season road. Traditional users may avoid the area because of the new road and traffic, and this avoidance (or social barrier) likely would increase if the road were open to non-Pogo users. In this sense, the road has the potential to be regarded as a loss of a part of one's homeland for hunting, not necessarily the primary or most used hunting area, but a hunting area that was historically and is currently used. Security gate at Gilles Creek. This sub-option would have the same impacts described above for road use by everyone, except the impacts would only occur in the lower two-thirds of Shaw Creek Valley. Access to the mine vicinity and the potential for sport hunters and other recreationists to use the road to cross the Goodpaster River and ease some of the problems of reaching the high country north and northeast of Healy Lake would not exist. Richardson highway egress. The Tenderfoot option would not provide materially greater access to subsistence resources; thus, there would be little difference in effects between this route and the existing Shaw Creek Road. Power line. Because this route would be very close to the Shaw Creek Hillside all-season road, the increased access impacts of the power line would be of little or no additional consequence.		
4.14 Cultural Resources		
Shaw Creek Hillside all-season road. Because adherence to cultural-resource protection procedures under CFR 800, Section 106, is the accepted process by which to mitigate impacts to cultural resources, no major impacts to cultural resources are expected from direct project development. Road use and disposition. Additional road users would increase the likelihood that surface artifacts would be more vulnerable to looting and other types of damage.	South Ridge all-season road. Same as Alternative 2.	Winter-only access. Same as Alternative 2, except limited seasonal access would decrease human presence considerably and surface artifacts and other cultural resources would be less vulnerable to looting and other types of damage.

Table 5.1-3 Summary of Direct and Indirect Effects of Options Specific to Alternatives, but Related to Surface Access

Alternative 2 (Shaw Creek Hillside)	Alternative 3 (South Ridge Corridor)	Alternative 4 (Shaw Creek Flats Winter-only Access)
4.15 Visual		
Shaw Creek Hillside all-season road and power line. The routes would be along lower elevations of the hillside and would have low impacts on visual resources as viewed from the Richardson Highway. They still would be evident to backcountry users and airborne viewers. Visual impacts would be high to some Shaw Creek Road residents because of the close viewing distance and the substantial contrast to the natural landforms of the hillside. The Goodpaster River Bridge and the power line would have high visual impacts to viewers on the Goodpaster River near the mine site. Richardson highway egress. The Tenderfoot egress option is located in a low VAC area. Development of this option would have moderate to high impacts on the visual resources because of high viewer sensitivity. There would be no impacts with the Shaw Creek Road option. Road use. Impacts would be low from use only by Pogo-related traffic. If other users travel the road, there would be greater disturbances (light and dust) potentially viewable for longer periods. There also would be an increase in vehicle lights during periods of low natural daylight, particularly in winter. Road disposition. Removal and reclamation of the road and power line would have the fewest impacts on visual resources. Current visual appearance would be restored as vegetation reclaimed the corridor. Other options would have an increasing impact in ascending order of industrial/commercial users and open to everyone.	South Ridge all-season road and power line. Because of the more visible higher elevations along the South Ridge slopes, there would be moderate to high impacts on visual resources due to the low VAC, the sensitivity of concerned viewers, and their proximity to foreground, middle-ground, and background views. The impacts to visual resources would be considered high to Goodpaster River cabin owners and Goodpaster River Winter Trail users. These impacts would be inconsistent with the visual guidelines of the Tanana Basin Area Plan (TBAP). The proposed road corridor would not be visible from the elevation of Quartz Lake; however, the power line would be somewhat visible from the lake in the middle ground at a distance of ~2 miles. Road use. Because this alternative would have higher visual impacts than Alternative 2, use by others than the Pogo project would have correspondingly greater impacts than Alternative 2. Road disposition. Same as for Alternative 2, except that because the visual impacts of this alternative would be greater than for Alternative 2, they would remain longer before vegetation obscured them.	Winter-only access. This route on Shaw Creek Flats would not be visible from the Richardson Highway because of the low elevation of the flats and its high VAC. Overall impacts would be low because of the high VAC of the Shaw Creek Flats and hillside areas. Road Use. Use of the winter-only access route by users other than the Pogo project would have low visual impacts because of the nature of a winter-only access and its limited window of operations compared to an all-season road in Alternatives 2 and 3. Road disposition. Impacts for the all-season road segment would be the same as for Alternative 2. The Shaw Creek Flats winter-only access segment simply would not be used again for Pogo purposes and would be available for use by anyone, much as a majority of the route is today.
4.16 Recreation		
Richardson Highway egress. The Shaw Creek/Rosa option would not have high impacts on existing or prospective recreation users. The Tenderfoot option would have a high positive effect on prospective recreational users because this route presently is	Road use and disposition. Same as Alternative 2, except there would be somewhat more impacts on the Goodpaster Valley recreational cabin owners because parts of the access road	Winter-only access. Road use. Because the purpose of winter-only access would be to limit public access to the Shaw Creek and Goodpaster valleys, it would not be open for public use. If use were limited to Pogo-related traffic or other

Table 5.1-3 Summary of Direct and Indirect Effects of Options Specific to Alternatives, but Related to Surface Access

Alternative 2 (Shaw Creek Hillside)	Alternative 3 (South Ridge Corridor)	Alternative 4 (Shaw Creek Flats Winter-only Access)
undeveloped. Road use and disposition. Use by Pogo and other industrial or commercial users only, and removal and reclamation after mine closure, would have a high impact on prospective motorized recreational users, but would not have a high impact on existing recreational users. Permanent access open to everyone would have a high impact on existing recreational users desiring remote and primitive recreational experiences. With access, the Goodpaster River Bridge could become a popular launching site for floaters and fishers and bring them into the lower river and past cabins. This river use could change the present relative isolation of the cabins, and could cause changes in fishing bag and size limits, as well as an increase in littering and vandalism. Security gate location. This sub-option would have the same impacts described above for road use by everyone, except the impacts would only occur in the lower two-thirds of Shaw Creek Valley. Impacts to Goodpaster recreational cabin owners and other existing recreational users north of Gilles Creek would not occur. Potential recreational users, however, would not receive the benefits of easy access to the mid-Goodpaster River	would be visible from the cabins.	industrial/commercial users, it would lower the quality of existing nonmotorized recreational experiences, but this effect would be limited to the area of the road corridor. Because this alternative would reduce new recreational motorized vehicles, it would not affect traditional recreational experiences in the primitive and semi-primitive motorized areas as much. Snow machines still would use traditional routes to access these areas, however. There would be few impacts on recreational cabin owners on the lower Goodpaster River because the Goodpaster River Bridge would not be accessible to floaters and fishers, as would occur for Alternatives 2 and 3. Although road use by the public could be restricted on the winter-only access segment on Shaw Creek Flats, recreational impacts from public use would begin to approach those described for Alternative 2 as the DOF road, which would be open to the public, was extended toward Gilles Creek.
4.17 Safety		
Shaw Creek Road egress. This option would cause some safety risk for the six year-round residences along the road. Overall, mine-related vehicle use would average between 10 and 20 round trips per day. During intense periods of mine construction, traffic would average ~50 vehicles per day. If the Applicant's shift-change bus station were located near the TAPS crossing, there would be two, approximately one-hour periods every 4 days, during each of which up to 180 vehicles would traverse the road. If the bus station were located on the Richardson Highway, the number of vehicles during each of these periods would be reduced to approximately six buses.	South Ridge all-season road. Impacts similar to those for Alternative 2, but somewhat higher because of the greater current traffic level on Quartz Lake Road. In winter, this route would subject traffic to higher winds, drifting snow, and poorer visibility than would the Shaw Creek Hillside all-season route because of its considerably longer segment above timberline.	Winter-only access. Use of winter-only access would require moving large volumes of supplies during a relatively short window under very cold and dark conditions that would be more likely to cause accidents. While the safety risk would be low, it would be tangible and higher than that associated with an all-season road. Road use. If winter-only access were open to everyone, there would be a moderate safety risk. Maintaining traffic control under these conditions just for Pogo project trucks would be a challenge. If other users were to be on the winter road/trail at the same time, the chances of an accident, particularly with a

Table 5.1-3 Summary of Direct and Indirect Effects of Options Specific to Alternatives, but Related to Surface Access

Alternative 2 (Shaw Creek Hillside)	Alternative 3 (South Ridge Corridor)	Alternative 4 (Shaw Creek Flats Winter-only Access)
The former location option would have a higher safety risk along Shaw Creek Road than would the latter location. Shaw Creek Road is relatively narrow at present, but is well maintained and has been improved recently. The State of Alaska has reviewed expected traffic volumes and vehicle sizes, including logging truck traffic from proposed DOF timber sales and shift change traffic, and believes Shaw Creek Road can accommodate this traffic safely. Because the road could be upgraded in the future if necessary, speed limits could be adjusted if appropriate, and the Applicant's policy would be to adhere to all speed limits, the safety risk from Pogo-related traffic would be low. DOT/PF may have to conduct a traffic impacts analysis, in conjunction with issuance of a drive way permit, which may result in specific mitigation measures being required. Tenderfoot egress. This option would have low safety impacts. Its use would eliminate the Shaw Creek Road safety issue. Road use. Opening the road to other users would cause a small increase in the safety risk to residents identified above. The increased risk would be due to more traffic (public and logging operations), and because typical users likely would not be as observant of speed limits as would drivers under specific direction from the Applicant. The safety risk, while increased, would still be low. Road disposition. If the road were to remain open to other users after mine closure, this safety risk would continue. Security gate location. If the road were closed to public use with a security gate near the end of the existing Shaw Creek Road, public use of the road would be very restricted and impacts would be low. If the road were completely open to public use, traffic on Shaw Creek Road would increase substantially, compared to present traffic, and impacts would be increased. A security gate at Gilles Creek likely would reduce public use measurably because it would prevent access to the last half of the road, but traffic still would be considerably		snow machine, would be substantially higher.

Table 5.1-3 Summary of Direct and Indirect Effects of Options Specific to Alternatives, but Related to Surface Access

Alternative 2 (Shaw Creek Hillside)	Alternative 3 (South Ridge Corridor)	Alternative 4 (Shaw Creek Flats Winter-only Access)
higher than if the security gate were located near the end of Shaw Creek Road. Safety impacts, however, still would be low.		
4.18 Technical and Economic Feasibility		
Tenderfoot egress. Although constructible, the route would cross difficult terrain, with poor soils and likely permafrost. Deep incised gullies indicate loess deposits that would require deep side hill cuts. Ascent and decent segments would require 5 to 7 percent grades for approximately 1.5 miles on each side of the ridge. Switchbacks would be required, with several curves having a radius less than the design criterion for 500 ft, and possibly less than the minimum of 300 ft. This option would require construction of an essentially new, ~3.5-mile road to the vicinity of the end of the existing Shaw Creek Road. A reasonable construction cost estimate is ~$2.5 million to 3.0 million to avoid using the existing Shaw Creek Road.	South Ridge all-season road. Soil and topography conditions along the first several miles of this route are difficult. They are characterized by steep slopes, many small drainages, and probable ice-rich soils, compared with good terrain and soil conditions on the Shaw Creek Hillside route. The steep slopes and angular talus in the vicinity of Shaw Creek Dome along the South Ridge route likely would make construction difficult. The elevated and exposed terrain, and severe winds experienced in the Delta region, would make maintenance more difficult and driving more hazardous, especially in blowing snow conditions. This route would be expected to be available for use approximately 10 fewer days than would the Shaw Creek Hillside route.	Winter-only access. Technical feasibility. The focus of this issue is whether annual winter-only access would be feasible for the life of the mine. The Applicant estimates that adequate winter supply window would be absent once in 13 years. Recent data confirming long-term climate warming in central Alaska may mean Applicant's estimate is optimistic. Economic feasibility. Constructing, operating, and reclaiming a remote mine dependent on only 8 to 10 weeks of annual surface access for major resupply, with reliance of air support into a 3,000-ft airstrip for remainder of year, raises many economic feasibility issues. ■ A short window would be available for mobilization of construction equipment and supplies for the development phase, including construction of the all-season road segment. ■ Annual resupply of almost a year's worth of fuel, equipment, and materials would need to occur during 8- to 10-week window. During the rest of the year, the project would be dependent solely on air support susceptible to weather interruptions and capacity constraints. ■ Winter-only access capital costs are estimated at approximately 53 percent higher than all-season road. A year's worth of diesel, propane, cement, reagents, and other materials must be stored. Additional construction costs would be required for air support for personnel, fuel, food, and supplies, as well as for equipment standby rentals while waiting for demobilization the next winter. Extended project and contractor overheads would result. Power line construction would be more expensive because 15 fewer miles of adjacent road would be

Table 5.1-3 Summary of Direct and Indirect Effects of Options Specific to Alternatives, but Related to Surface Access

Alternative 2 (Shaw Creek Hillside)	Alternative 3 (South Ridge Corridor)	Alternative 4 (Shaw Creek Flats Winter-only Access)
		available. ■ Total annualized operating costs are estimated at approximately 118 percent higher than for the all-season road. Freight is estimated to cost approximately 60 percent more per ton. Personnel air transportation costs would be very substantial. Additional rental costs would be incurred for idled shipping containers awaiting next winter's resupply window. Cement would need to be bagged for shipment, rather than handled in bulk. Finance costs for the stored inventory would be incurred. Power line maintenance would be more costly. ■ Winter-only access would add substantial capital and operating costs and increase the project's economic burden, and introduce an unreasonable level of complexity and business risk. ■ This increased economic burden and unreasonable business risk were considered to have a major impact on the project's economic feasibility.

5.2 Identification of the Environmentally Preferable and Preferred Alternatives

In making its Record of Decision (ROD), EPA must identify both an Environmentally Preferable Alternative and a Preferred Alternative. The Environmentally Preferable Alternative "ordinarily, means the alternative that causes the least damage to the biological and physical environment; it also means the alternative which best protects, preserves, and enhances historic, cultural, and natural resources" (CEQ, 1981: Forty most asked questions, no. 6a). The Environmentally Preferable Alternative can be the same as the agency Preferred Alternative or differ in some respects, depending on the analysis in the EIS.

The Preferred Alternative is the alternative EPA and the cooperating agencies believe fulfills the purpose and need of the Proposed Action. As provided for in NEPA and the CEQ NEPA implementing regulations, the Preferred Alternative and the Environmentally Preferable Alternative need not be the same. EPA may take into account various other considerations in choosing its Preferred Alternative, including such factors as the agency's statutory mission and responsibilities and economic, environmental, technical, and social factors (CEQ, 1981: Forty most asked questions, no. 4a).

This section analyzes the impacts summarized in Tables 5.1-1, 5.1-2, and 5.1-3, compares them on an individual component basis, and determines which options should constitute both the Environmentally Preferable Alternative and EPA's and the cooperating agencies' Preferred Alternative.

5.2.1 Options Common to All Alternatives

By definition, the options common to all alternatives would be developed regardless of which of the three actions alternatives were selected. Of the ten project components with options common to all alternatives, eight had no sub-options that differed between the three action alternatives (Table 2.5-1). Two components, however, did have options that would produce different impacts; gravel source, and use and disposition of the airstrip.

Gravel Source

Mining Gravel Versus Crushing Development Rock Gravel is on the critical path for project construction. It would be needed for two purposes immediately at the start of development; for concrete aggregate for the civil works' foundations in the mine area (water treatment plant, mill, camp, and shop facilities), and as a road topping for mine area roads. Crushing development rock for gravel at this early stage would not be an option. Most of the nonmineralized rock that would be generated from underground would not be available until later in the two-year project development period. Underground mine development must follow completion of the appropriate surface facilities described above. Advancing underground development before beginning the surface civil works isn't possible because you cannot treat mine water without a new water treatment plant, and you cannot have underground development without a shop to maintain the equipment. Thus, from a timing perspective, crushing development rock to make gravel would not be feasible or practicable.

From another perspective, experience during the Pogo Mine exploration phase has demonstrated that underground development rock does not make a good traffic surface for high volume roads. At the existing advanced exploration facilities, gravel has been

used to top the surface of the high volume roads because the development rock breaks down under traffic loads and becomes mud. Thus, from a technical perspective, crushing development rock to make gravel would not be feasible or practicable. Also, a gravel road topping has helped to reduce sedimentation both on the surface and underground, where reduced sedimentation in the mine sumps has been an important factor in water treatment plant efficiency.

Another need for gravel may arise for topping portions of the mine access road. Test work at potential material sites along the proposed Shaw Creek Hillside road alignment has shown the rock in most of the proposed material sites does not conform to ATM T-13 degradation, or to Los Angeles Abrasion ASTM C131-96 specification for coarse abrasion testing of coarse rock (Shannon and Wilson, Inc., 1999, 2000). Thus, while the rock from these sites would still be suitable for bulk fill, topping material with sufficient hardness for the road surface would have to be hauled long distances from select material sites. Two of the material sites may contain rock suitable for crushing and use for road topping, and it would be advantageous in some areas for the Applicant to do so rather than haul gravel from the vicinity of the mine. Some of the gravel from the mine area sites, however, could be used for access road topping.

Even if nonmineralized development rock were suitable for crushing, which it is not, the direct cost to produce approximately 140,000 cu yd of aggregate for use in the mine area would be approximately three to four times greater than mining pit run gravel by expanding existing borrow pits and developing new ones as proposed by the Applicant. A reasonable cost estimate for pit run gravel at the Pogo site is approximately $4 per cu yd. Thus, crushed development rock would cost between approximately $1.1 million and $1.7 million more than mined gravel (Rowley, 2002a).

Mining gravel from existing and new pits versus crushing nonmineralized development rock for gravel would disturb approximately 66 more acres. As discussed later, the off-river treatment works was selected as the preferred option for the industrial wastewater discharge component. Because this option would require excavation of approximately 13.1 acres of gravel to create the two ponds, a portion of the overall project‘s required mine area gravel needs would be met during excavation of the ponds, and the 66-acre total would be reduced to approximately 53 acres. A portion of this disturbance would be to wetlands, and would have moderate impacts. But those impacts would be offset by pond creation in the gravel pits, resulting in negligible overall wetlands impact. Mining gravel would have a moderate local wildlife habitat impact although this, too, would be mitigated somewhat by pond formation. Still, surface mining of gravel would account for approximately 7 percent of the total surface disturbance for the Applicant’s Proposed Project.

Summary analysis of these two options indicated that from the timing and technical perspectives, crushing development rock to make gravel would not be feasible or practicable. For the gravel mining option, overall impacts to wetlands and wildlife would be low to moderate on a local basis, with some positive benefits from newly created ponds in the gravel pits. And, construction of the off-river treatment works would require excavating approximately 13.1 acres of gravel in any event, thus lowering the overall mined gravel acreage. Also, gravel mining is a common practice in Alaska and its management and reclamation are well understood by regulatory agencies.

If the crushed development rock option were feasible and practicable, it likely would be considered the Environmentally Preferable Alternative. This option originally was considered as a result of scoping comments, but further analysis of the sequence and timing of project development and when gravel would be needed, as well as the inferior hardness specifications of the crushed rock itself, has shown the crushed development rock option not feasible or practicable. Therefore the option to mine gravel was selected as the Preferred Alternative, and by default also as the Environmentally Preferable Alternative.

Air Access

- **Airstrip Use and Disposition** Direct impacts generally would be low regardless of whether airstrip use were restricted only to the Pogo project or to the Pogo project and other industrial/commercial users. If the airstrip were open for use by everyone during mine operations, however, impacts would be higher for all resources, except new recreational users, who would benefit from increased access.

  With respect to disposition, removal and reclamation of the airstrip would be beneficial to most resources, but would have a negative impact on potential industrial/commercial users as well as recreationists, who would lose access to the mid-Goodpaster River Valley.

  Summary analysis indicated that allowing airstrip use by other industrial/commercial users or everyone during operations would have more impacts than restricting use only to the Pogo project. In a similar manner, removing and reclaiming the airstrip would have fewer impacts on most resources, and the area land use plan does not call for creating access to the mid-Goodpaster River Valley. Therefore, for both the Environmentally Preferable Alternative and the Preferred Alternative, use only by the Pogo project was selected as the airstrip use option, and removal and reclamation was selected as the airstrip disposition option.

5.2.2 Options Specific to Alternatives, but Not Surface Access Related

Three project components had options that were specific to one of the three action alternatives, but were not surface access related (Table 2.5-2).

Tailings Facility Liner

- **Lined Versus Unlined Tailings Dry Stack and RTP** Evaluation of seepage that would occur from unlined surface dry stack and RTP facilities indicated impacts would be low because of the low permeability of both the underlying rock as well as the dry-stack tailings themselves, and the RTP design.

  Dry-stack tailings pile Permeabilities of the fine-grained dry-stack tailings themselves were not considered to be greatly different than permeabilities of an installed liner system. Also, most seepage that would occur from the dry stack would be captured by the RTP. Still, from strictly a water quality perspective, a lined tailings facility likely would provide some measure of increased impermeability and transmission of drainage to the RTP. From a tailings pile stability perspective, however, a liner would be more problematic.

  The original dry-stack tailings pile stability analysis assumed a worst case scenario that included saturation of the general tailings placement zone. It did not include

saturation of the shell zone. Placement of an impermeable liner beneath the general placement zone likely would cause saturation of the tailings pile and result in occurrence of the worst case scenario, which was not the design intent. Thus, saturation caused by the impervious liner likely would increase stability risk.

Because there would be little benefit to water quality from installation of a liner under the dry-stack tailings pile, while there would be increased risk to stability from the liner, the unlined dry stack sub-option was selected as both the Environmentally Preferable Alternative and the Preferred Alternative.

In the Applicant's Proposed Project, there would be no erosion control/drainage blanket installed before tailings would be placed in the dry-stack tailings facility. This blanket was predicted to have no effect on the dry stack's stability, but it would permit clearing and stockpiling of organic and soil growth media to insure a sufficient volume for reclamation. Because of this benefit, inclusion of a erosion control/drainage blanket was selected for both the Environmentally Preferable Alternative and Preferred Alternative.

RTP The primary purpose of the RTP would be to capture runoff and seepage from the dry-stack tailings facility consistently, reliably, thoroughly, and predictably, during both mine operations and post closure activities.

Seepage from the dry stack would migrate downgradient below the surface, nearer the colluvium/weathered bedrock interface. An effective seepage interception and collection system would be needed to provide appropriate management of this subsurface flow. Given the nature of the flow system that would develop, the most effective interception system would be one perpendicular to the direction of subsurface flow, i.e., a cutoff wall.

The proposed RTP dam face liner system and grout curtain would establish an effective interception cutoff wall to collect this seepage. The upstream toe of the dam face liner system would be embedded in a trench in weathered bedrock filled with grout, with a drilled curtain of pressure-grouted holes extending below the toe through the weathered bedrock layer and into fresh bedrock.

A full liner under the RTP basin would not provide substantially better long term seepage collection and would introduce increased operational and performance risks for a number of reasons, including:

- A full basin liner would fail to collect the seepage at issue because the upstream toe of the liner would not have the robust cutoff wall required to collect the subsurface seepage. If such a cutoff wall at the upgradient end of the liner were required, it would follow that another liner upstream of that cutoff wall also would be needed, etc. It is thus a cutoff wall perpendicular to the flow that would be needed to capture seepage, not a liner.
- Due to the narrowness of Liese Creek Valley, and its steep slopes, hydrostatic uplifting forces from upwelling ground water beneath the liner could result in long-term liner instability, especially during periods when the RTP reservoir would be drawn down to provide storm surge volume.
- The nature of Liese Creek Valley geometry is such that a large portion of any full basin liner would be on very steep slopes. The south slopes of the

reservoir exceed the maximum slopes recommended for effective liner installation (2.2 to 2.5 H to 1 V).

Because a full basin liner thus would not completely capture the desired seepage and provide the long-term reliability necessary to manage dry-stack seepage, and because the geometry of the site exceeds recommended slopes for effective installation of a liner, the unlined option was selected for both the Environmentally Preferable Alternative and the Preferred Alternative.

Power Supply

- **Power Line Versus On-site Generation** Analysis indicated the primary issues were surface disturbance from the power line option versus the risk of fuel spills from the on-site generation option. A power line would clear vegetation from approximately 602 or 525 acres, depending on the route. This clearing, however, generally would not damage the vegetative mat. The disturbance caused by additional fuel storage tanks for on-site generation would be approximately 22.7 acres with the winter-only access option.

  On-site generation, however, would require an additional approximately 4.2 million gallons of fuel to be trucked to and stored at the mine site. For five resources (water quality, wetlands, fish, wildlife, and subsistence), the risks of spills from the seven-fold increase in fuel volume that would be trucked to the mine site were considered high.

  From the land use and socioeconomics perspectives, the on-site generation option was inferior because it would not provide the opportunity for power for other potential industrial/commercial users. For recreation, a power line ROW could provide additional backcountry access for new users, depending to what extent mitigation measures were implemented to limit access. Such access, however, would be an impact on existing backcountry users. Only for visual resources was the on-site generation option considered more favorable because a power line would have high visual impacts.

  Summary analysis indicated that, for the majority of resources, the risks from fuel spills during transportation were considered to be considerably more important than the impacts from ROW clearing and the visual impacts of a power line. The impacts from ROW clearing were considered less important because clearing generally would not destroy the vegetative mat, and once the power line were reclaimed, plant succession would eventually return the ROW to approximately its present condition. Visual impacts of a power line were considered less important because power line reclamation would remove the visual impacts of the poles and lines and plant succession would eliminate remaining visual impacts. Thus, the power line was determined to be the option for both the Environmentally Preferable Alternative and the Preferred Alternative.

Water Discharge

Development Phase

- **Underground Injection Wells** The existing water treatment plant at Pogo has discharged treated mine drainage via an injection well at approximately 100 gpm since 1999. Every monthly sample during the four-year period since has met all the permit limits of the existing injection well permit. As the mine workings increase over the first two years of development, however, the amount of water to be discharged could increase to approximately 400 gpm. And, the farther one gets in both space and time from the existing conditions the more potential there would be for mine drainage water

quality to diverge from that observed during the past four years. There would be potential for discharged water to surface in nearby sloughs, and the projected treated water may not meet discharge criteria for three parameters at least some of the time. This would be considered a moderate impact from a permitting and compliance perspective.

- **Direct Discharge to Goodpaster** Treated wastewater would be discharged directly to the Goodpaster River. Water quality at the edge of the mixing zone was projected to meet discharge criteria for all parameters. The impact of this discharge was expected to be low.

  A mixing zone could not be approved if there were potential for mercury to bioaccumulate to significantly adverse levels [18 AAC 70.250 (a)(1)(A)]. It was uncertain whether mercury would bioaccumulate to significantly adverse levels from this discharge; hence, it was uncertain whether a mixing zone could be granted.

- **Off-River Treatment Works** This option was expected to have efficient mixing of treated wastewater, thus meeting criteria for all parameters even at the conservative 95th percentile of the annual maximum. The impact of this discharge was expected to be low.

Summary analysis of the development-phase discharge options determined that for the underground injection wells option, as the development workings expand there would be greater potential that the discharge may not meet criteria for three parameters at least some of the time. This inability to meet discharge criteria was considered a moderate impact from a permitting and compliance perspective. For the direct discharge option, it was unknown whether a mixing zone could be granted because of the lack of certainty about whether mercury would bioaccumulate. In contrast, the off-river treatment works option was expected to have a low impact and more permitting certainty. Thus, the off-river treatment works was determined to be the option for both the Environmentally Preferable Alternative and the Preferred Alternative.

Operations Phase

This subcomponent had the same three options for treated wastewater as for the development phase, plus discharge to an SAS. Impacts from the three options in common with the development phase would be the same as discussed above for the that phase.

- **Soil Absorption System** The influent to the SAS is expected to achieve drinking water standards for the 95th percentile of the annual average for all parameters except nitrate, and is expected to exceed TDS, chloride, sulfate, TKN, and nitrate for the 95th percentile of the annual maximum. The effluent from the SAS is expected to exceed the discharge criteria for the 95th percentile of the annual average based on dissolved and total concentrations for nitrate, cyanide, cadmium, copper, and lead. The 95th percentile of the annual average would also exceed the total recoverable criteria for manganese. For the 95th percentile of the annual maximum, TDS, chloride, sulfate, nickel, and selenium would be exceeded for dissolved and total criteria in addition to those exceeded for the annual average. Manganese would also be exceeded for total criteria only. These additional parameters at the 95th percentile of the annual maximum would likely exceed the discharge criteria less frequently than for the 95th annual average. Because the influent to the SAS and the discharge from the SAS are estimated to exceed the expected discharge criteria for a number of parameters, this discharge was defined as having a high impact from a permitting and compliance perspective, and may not be permittable.

Summary analysis for the operations phase options determined the same impacts as described for the same development phase options, in addition to the high permitting and compliance impact for the SAS option. Thus, in the same manner as for the development phase, the off-river treatment works was determined to be the option for both the Environmentally Preferable Alternative and the Preferred Alternative.

5.2.3 Surface Access-Related Options Specific to Alternatives

Two project components had surface access-related options specific to the three action alternatives: surface access and power line route (Table 2.5-3).

Surface Access

The surface access component had three subcomponents: route, use, and disposition.

Route There were three route options: Shaw Creek Hillside all-season road, South Ridge all-season road, and the Shaw Creek Flats winter-only access.

- **Winter-only Access** In the first step to determine the preferred surface access option, the concept of winter-only access was compared to the all-season road concept. Implementation of each concept would have advantages over the other. From the technical and economic feasibility perspectives, however, the winter-only access concept would not work. Technically, the issue was whether the annual winter-only access option would be feasible during the life of the mine. The Applicant estimated that a winter supply window allowing adequate time would be absent once in 13 years. Independent confirmation of recent long-term climate warming in central Alaska suggested the Applicant's estimate was optimistic.

  From an economic feasibility perspective, constructing, operating, and reclaiming a remote mine dependent on only 8 to 10 weeks of annual surface access for major resupply, with reliance of air support into a 3,000-ft airstrip susceptible to weather interruptions for the remainder of the year, raised many issues. These issues included a short window for mobilization of construction equipment and supplies for the development phase, including construction of the all-season road segment; capital costs estimated to be approximately 53 percent higher than for an all-season road; storage of an entire year's worth of diesel, propane, cement, reagents, and other materials at the mine; and total annualized operating costs estimated to be approximately 118 percent higher than for an all-season road, with freight estimated to cost approximately 60 percent more per ton and with substantial personnel air transportation costs.

  Thus, because winter-only access might not be possible for 1 or more years during the expected mine life, and because it would add substantial capital and operating costs that would increase the project's economic burden, it would introduce an unreasonable level of complexity and business risk. Therefore, this option did not address the purpose and need for the Proposed Action, and could not be considered further for the Preferred Alternative.

- **All-season Road** In the second step to determine the preferred surface access option, the Shaw Creek Hillside all-season route and South Ridge all-season route options were compared. For purposes of the analysis, impacts from the associated power line routes also were considered because, taken as a whole, building both the road and power line in conjunction would substantially reduce total impacts from both

components. Analysis showed each set of options (for the road and power line) to have advantages over the other.

The South Ridge route had advantages in that it would cause approximately 79 fewer acres of total surface disturbance for both the all-season road and power line ROWs, and approximately 45 fewer acres of cuts and fills in wetlands. It also would cross only one stream requiring a bridge (the Goodpaster River), versus seven for the Shaw Creek Hillside route. This route had disadvantages in that soil and topographic conditions would be difficult for construction, and the elevated and exposed terrain would make maintenance more difficult and driving more hazardous, especially in blowing snow conditions. This route also was expected to be available for use approximately 10 fewer days than for the Shaw Creek Hillside route.

The Shaw Creek Hillside route had advantages in that it would disturb roughly half the acreage of high-value habitats for moose, caribou, and brown bear than would the South Ridge route, and bird-power line collisions likely would be fewer because of its more extended length below timberline. Visual impacts also would be fewer than for the South Ridge route because it would be primarily below timberline, and the Shaw Creek Hillside route would not be visible to the recreational cabin owners on the lower Goodpaster River. The Shaw Creek Hillside all-season road, therefore, would be more consistent with the visual guidelines of the TBAP, which call for consideration of visual impacts on the Goodpaster River corridor.

In most cases, these differences in impacts between the two routes were not considered to be high on greater than a local basis, largely because the route corridors would be narrow and linear in character, and because mitigation measures would reduce impacts. For example, the 79 more acres of total surface disturbance for both the all-season road and power line ROWs and the 45 more acres of fills and cuts in wetlands for the Shaw Creek Hillside route would occur over a distance of 49.5 miles. The six additional stream crossings for the Shaw Creek Hillside route all would be made with bridges that would permit free movement of water and fish. Conversely, the greater South Ridge route impacts to high-value wildlife habitat would occur to only a small portion of similar habitats found in the project area.

The overriding difference between the routes, however, was related to land use. Based on the long-term TVSF management plan, the current DOF 5-year timber harvest plan includes an initial forestry road to the Keystone Bluffs area of the state forest, and eventually well up the Shaw Creek Valley to upper Gilles Creek. Therefore, within the expected life of the Pogo Mine, there is a reasonable probability that a public road up to 23 miles long would be constructed very close to the proposed Shaw Creek Hillside all-season road alignment as far as Gilles Creek if the Applicant's proposed road were not constructed. Thus, because there were no major differences in impacts between the two route options that could not be mitigated to some extent, and because constructing the Shaw Creek Hillside route would result in only one road being built into the project area (i.e., not both the South Ridge all-season road and the DOF forestry road), the Shaw Creek Hillside route was determined to be the option for both the Environmentally Preferable Alternative and the Preferred Alternative.

For the Shaw Creek Hillside all-season road option there was an issue of which route would be used to connect the all-season road to the Richardson Highway.

- **Richardson Highway Egress** There were two route sub-options for this road segment: the existing Shaw Creek Road and Tenderfoot.

  For most resources, there were no or only minor differences between the two sub-options. The Shaw Creek Road sub-option had higher noise and safety impacts and would not be as favorable to new recreational users because no new area would be accessed. The Tenderfoot sub-option was determined to have higher visual and cost impacts. Of these, the noise, safety, and cost impacts were judged to be of most importance.

  For the Shaw Creek Road sub-option, both the safety and noise impacts generally were considered low. From the safety perspective, some increased impact would occur, especially if the all-season road were open to use by everyone and the shift change bus station were located near the TAPS crossing. This increased impact, however, could largely be mitigated. From the noise perspective, impacts generally would be low or moderate. If the Applicant's shift change bus station were near the TAPS crossing, however, two residences would experience a moderate to high impact, and four would experience a high impact during short periods of time four days apart. These impacts also could be mitigated to some extent, including locating the bus station on the Richardson Highway.

  Shaw Creek Road is relatively narrow at present, but is well maintained and has been improved recently. The State has reviewed expected traffic volumes and vehicle sizes, including logging truck traffic from proposed DOF timber sales and shift change traffic, and believes Shaw Creek Road can accommodate this traffic safely. Because the road could be upgraded in the future if necessary, speed limits could be adjusted and other mitigation measures implemented as appropriate, and the Applicant's policy would be to adhere to all speed limits, the safety risk from Pogo-related traffic would be low.

  For the Tenderfoot sub-option, the cost of a new, approximately 3.5-mile road was estimated at approximately $2.5 million to $3.0 million. This road would terminate in the vicinity of the end of the existing Shaw Creek Road, which already is a state-maintained road.

  In final analysis, it was determined that it would be unreasonable to build a new road merely to avoid an existing state-maintained road, considering that the Shaw Creek Road noise and safety impacts generally would be low or could be mitigated to make them low.

- **Use** For road use during Pogo project operations, there were three options:

  - **Pogo Project Use Only**
  - **Pogo Project and Other Industrial/Commercial Users**
  - **Use by Everyone**

  For almost all resources, impacts were considered to be low from the regulated use of an all-season road only by the Pogo project, and were considered only marginally higher for additional regulated use by other industrial/commercial users. Impacts from the option with use of the road by everyone were considered generally low for several resources (water and air quality, noise, wildlife, and visual), and moderate for fish. For three resources, however, impacts were considered high.

Because off-road use by ATVs and other vehicles generally is not regulated, a road open to everyone could cause major impacts to wetlands. It also would increase competition for subsistence resources. For existing recreationists, road use by everyone could have a major impact on the quality of their experiences, particularly for cabin owners along the lower Goodpaster River. Conversely, from the perspective of new recreationists, use by everyone would be beneficial because it would provide access to new areas.

In determining its preferred option, the ADNR considered its overall, broad management goals under the TBAP, as well as the more specific management objectives of the TVSF plan. Because (1) the Shaw Creek Hillside route would be both within or immediately adjacent to the state forest in lower Shaw Creek Valley; (2) an objective of the forest plan is to provide public access to forest resources; and (3) state forest roads generally are open to the public; ADNR made a proposed determination that the lower approximately 23 miles of the Shaw Creek Hillside all-season road as far as Gilles Creek would be open to public use during mine life following Pogo project construction, and published that preliminary decision in the DEIS. The proposed determination would have kept the remaining approximately 26 miles of road to the mine open only for use by the Pogo project, and possibly to other industrial/commercial users on a case-by-case basis. Such other use could occur, however, only after a public process and thorough analysis of potential impacts of the proposed uses.

Public and Tribal comments on ADNR's preliminary decision, however, were overwhelming opposed to opening any of the Shaw Creek Hillside all-season road past the end of the existing Shaw Creek Road to the public during the life of the Pogo Mine. ADNR, therefore, is reconsidering its preliminary decision and the EIS team has selected use of the entire mine access road during the life of the mine only by the Pogo project, and by other industrial/commercial users on a case-by-case basis, as the Preferred Alternative for purposes of this final EIS. ADNR will consider whether to adopt this option in its final decision based on its review of, and comments received on, this final EIS. Use of the entire road only by the Pogo project (with no use by other industrial/commercial users) was determined to be the option for the Environmentally Preferable Alternative.

- **Disposition** There were two all-season road disposition options:
  - **Remove and Reclaim the Road**
  - **Maintain the Road**

Results of this analysis were similar to those for the road use options discussed above. The primary difference was that the option for road use during mine operations had a limited time horizon while road disposition following Pogo Mine closure was considered to be permanent. Continued road use only by industrial/commercial users was considered to have low impacts on most resources, although locally high impacts on wetlands and wildlife could happen if major resource developments were to occur.

Leaving the road open to everyone would perpetuate many of the same impacts described in the Chapter 4 alternatives analysis of the option to permit road use by everyone. In addition, it would lead to the cumulative impacts of maintaining an all-season road also described in that chapter. As discussed in Chapter 4, the degree of impacts if the road were to be maintained, particularly cumulative impacts, could be

reduced in large measure by the State of Alaska land use and road management policies.

The probability of another mine or other large resource development occurring in the area prior to Pogo Mine closure is low. The TVSF Management Plan, however, contemplates public use of state forest roads. Therefore, ADNR made a preliminary determination in the DEIS that the ROW authorization for the Shaw Creek Hillside all-season road would require that at Pogo Mine closure the all-season road must be removed and reclaimed from Gilles Creek to the mine site in its entirety, and in a manner that would preclude use by ATVs. The segment from the existing Shaw Creek Road to Gilles Creek, however, would remain open for all users. ADNR could extend the life of the road to the mine site to accommodate other major resource development projects, but only after a public process that would include a thorough analysis of potential impacts of the proposed uses.

Comments on ADNR's preliminary disposition decision strongly favored opening the mine access road as far as Gilles Creek after the life of the mine. Thus, because the TVSF Management Plan contemplates public use of state forest roads, and because there was strong support for public use of the road after the mine's life, public use and retention of the road as far as Gilles Creek was determined to be the Preferred Alternative, while removal and reclamation of the entire all-season road was determined to be the Environmentally Preferable Alternative.

Power Line Route

The power line route component had two options:

- **Shaw Creek Hillside**
- **South Ridge**

Although these two options had different impacts for various resources, a constant throughout the power line route analysis was that the power line route should be the same as the surface access route because, taken as a whole, building both in conjunction would substantially reduce total impacts from both components. Because overall impacts from the surface access route would be substantially greater than those for the power line route, and because neither power line route offered any substantial benefits over the other, once the surface access route was selected, the choice of the corresponding power line route was straightforward. Thus, the Shaw Creek Hillside power line route was determined to be the option for both the Environmentally Preferable Alternative and the Preferred Alternative.

In the Applicant's Proposed Project, the power line would cross the Shaw Creek / Goodpaster divide via Sutton Creek (Figure 2.3-2), to the north and away from the road corridor. As a result of public comments on the DEIS, a new sub-option was considered with the power line following the road corridor over the divide. The road corridor route would have approximately the same direct habitat impact as the Sutton Creek route, and marginally greater wetlands impacts, but would consolidate impacts into one corridor and avoid all impacts to the Sutton Creek drainage. Thus, the road corridor sub-option was selected for both the Environmentally Preferable Alternative and the Preferred Alternative.

5.3 Presentation of the Environmentally Preferable and Preferred Alternatives

Based on the analyses in Section 5.2 immediately above, Tables 5.3-1, 5.3-2, and 5.3-3 present the Environmentally Preferable Alternative, as well as EPA's and the cooperating agencies' Preferred Alternative.

Figure 5.3-1 presents EPA's and the cooperating agencies' Preferred Alternative in graphic form in the same manner as was shown in Figure 4.0-1, except the options that constitute the Preferred Alternative are boldly framed.

The options and sub-options selected for the Environmentally Preferable Alternative and the Preferred Alternative were the same for every project component with the exception of disposition of the Shaw Creek Hillside all-season road. For this subcomponent, the Environmentally Preferable Alternative was complete removal and reclamation of the road. In the Preferred Alternative, disposition of the road was the same as for the Environmentally Preferable Alternative past Gilles Creek. Between the existing Shaw Creek Road and Gilles Creek, however, the road would be maintained for public use following mine closure.

Table 5.3-1 Environmentally Preferable Alternative and Preferred Alternative for the Options Common to All Action Alternatives

Component, Options, and Sub-Options	Environ. Preferable Alternative	Preferred Alternative
Milling Process		
▸ Gravity / flotation / cyanide vat leach1	X	X
Tailings Disposal		
▸ Underground paste backfill	X	X
▸ Surface dry stack and RTP in Liese Creek Valley	X	X
Mill and Camp Location		
▸ Liese Creek Valley	X	X
Development Rock Disposal		
▸ Mineralized rock encapsulated in dry stack	X	X
▸ Nonmineralized rock in dry stack, RTP dam, other construction	X	X
Gravel Source		
▸ Expand existing gravel pits and develop new pits	X	X
▸ Crush nonmineralized development rock		
Construction Camp		
▸ Below existing 1525 Portal in Goodpaster Valley	X	X
Laydown Area		
▸ Permanent below existing 1525 Portal, at airstrip, and at mill	X	X
Water Supply		
Industrial		
▸ Mine drainage	X	X
▸ RTP	X	X
▸ Wells	X	X
Domestic		
▸ Wells	X	X
Water Discharge		
Operations Phase		
▸ Domestic wastewater		
✦ Package treatment plant and direct discharge to river	X	X
Fuel Storage Location		
▸ Temp: 1525 Portal and airstrip. Perm: portal mouth and mill	X	X
Air Access		
▸ 3,000-ft. airstrip in Goodpaster Valley	X	X
Use		
▸ Pogo project only	X	X
▸ Pogo and other industrial / commercial users only		
▸ Everyone		
Disposition		
▸ Remove and reclaim after mine reclamation	X	X
▸ Open for Industrial / commercial resource users only		
▸ Open for everyone		

[1] Underline – Applicant's proposed option or sub-option

Table 5.3-2 Environmentally Preferable Alternative and Preferred Alternative for the Options Specific to Certain Action Alternatives, but Not Related to Surface Access

Component, Options, and Sub-Options	Environ. Preferable Alternative	Preferred Alternative
Tailings Facility Liner		
▶ Surface dry stack and RTP in Liese Creek[1]	X	X
✦ Lined dry stack		
✦ Lined RTP		
✦ Unlined dry stack	X	X
✦ Unlined RTP	X	X
Power Supply		
▶ Power line	X	X
▶ On-site generation		
Water Discharge		
Development Phase		
▶ Underground injection wells		
▶ Direct discharge to Goodpaster River		
▶ Off-river treatment works	X	X
Operations Phase		
▶ Soil absorption system (SAS)		
✦ Goodpaster River Valley adjacent to airstrip		
✦ Saddle above and southeast of Pogo Ridge		
▶ Underground injection wells		
▶ Direct discharge to Goodpaster River		
▶ Off-river treatment works	X	X

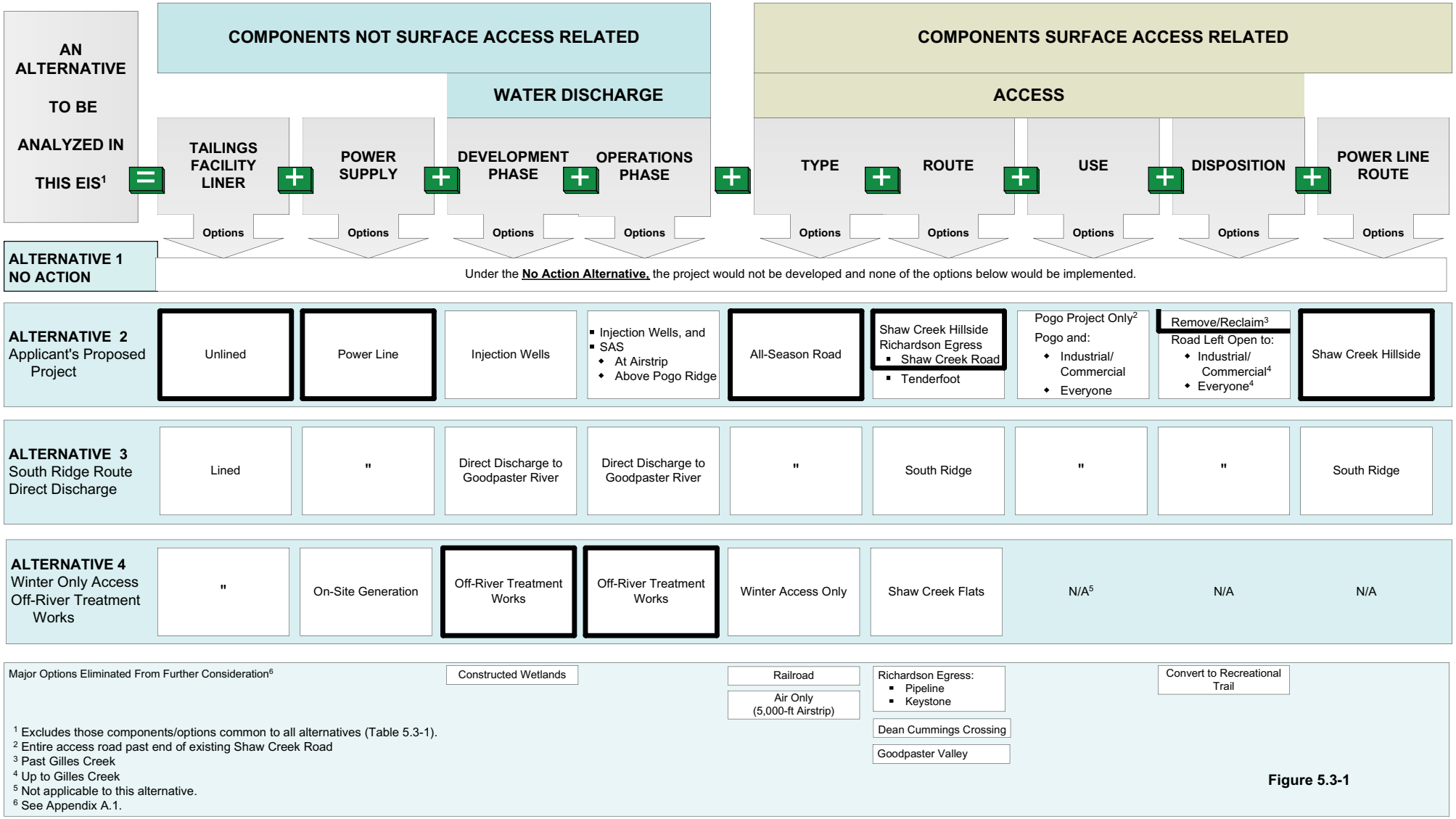
[1] Underline – Applicant's proposed option or sub-option

Table 5.3-3 Environmentally Preferable Alternative and Preferred Alternative for the Options Specific to Certain Action Alternatives that are Related to Surface Access

Component, Options, and Sub-Options	Environ. Preferable Alternative	Preferred Alternative
Surface Access		
Route		
▶ Shaw Creek Hillside all-season road[1]	X	X
✦ Shaw Creek Road egress from Richardson Highway	X	X
✦ New Tenderfoot egress from Richardson Highway		
▶ South Ridge all-season road		
▶ Shaw Creek Flats winter-only access		
✦ Traditional winter road construction standards		
✦ Perennial winter trail construction standards		
Use		
▶ Pogo project only	X	
▶ Pogo and industrial/commercial users		X
▶ Everyone		
✦ Security gate near end of Shaw Creek Road	X	X
✦ Security gate at Gilles Creek		
Disposition		
▶ Remove and reclaim – entirely	X	
▶ Remove and reclaim – past Gilles Creek gate		X
▶ Leave road open as far as Gilles Creek (vs. closed) to:		
✦ Industrial/commercial users	X	
✦ Everyone		X
Power Line Route		
▶ Shaw Creek Hillside	X	X
▶ South Ridge		

[1] Underline – Applicant's proposed option or sub-option

PREFERRED ALTERNATIVE (Shown In Bold Frames)



Major Options Eliminated From Further Consideration[6]

- Constructed Wetlands
- Railroad
- Air Only (5,000-ft Airstrip)
- Richardson Egress:
  - Pipeline
  - Keystone
- Dean Cummings Crossing
- Goodpaster Valley
- Convert to Recreational Trail

[1] Excludes those components/options common to all alternatives (Table 5.3-1).
[2] Entire access road past end of existing Shaw Creek Road
[3] Past Gilles Creek
[4] Up to Gilles Creek
[5] Not applicable to this alternative.
[6] See Appendix A.1.

Figure 5.3-1