

Resource	Impact	Alternative A	Alternative B	Alternative C	Alternative D
Water Resources – Surface Water	Stream flow	No changes from current conditions.	Stream flow in Red Dog Creek may be slightly greater than current conditions since additional wastewater can be discharge during times when barium hydroxide is used to lower TDS in the effluent and increase discharge rates.	Changing to marine discharge reduces stream flow in Main Stem Red Dog Creek by 18 to 38 percent during operations. In Ikalukrok Creek average flows would be reduced by less than 5 percent below the confluence with Red Dog Creek.	Same as Alternative C except stream flow reductions continue after closure.
	Water Quality	TDS levels in Main Stem Red Dog Creek reduced to below 172 mg/L. Lower TDS levels in Ikalukrok Creek. No change at Kivalina water supply intake; meets drinking water standards. For metals and cyanide; no change from current conditions.	No change from current conditions for metals, cyanide, and TDS Kivalina water supply intake meets drinking water standards. For DMTS streams, no water quality impacts identified, although additional monitoring is warranted.	Change to marine discharge during operations will decrease TDS concentrations to below water quality standard levels in Red Dog Creek. Lower TDS levels in Ikalukrok Creek. No detectable change in metals or TDS concentrations at Kivalina's water supply. Metals levels in Main Stem Red Dog Creek, which are already above aquatic life standards, will increase, although levels will be lower than pre-mining conditions. Small (less than 10 feet) marine mixing zone around the Chukchi Sea discharge. After closure, same as alternative B. Reduced risk of metal loadings to DMTS streams from dust as compared to other alternatives.	Same as Alternative C during operations; effects continue after closure. Risk of metals loadings from dust along DMTS lower than Alternative B but higher than Alternative C.
	Spills	Spill risk associated with vehicle transport greater than Alternative C but lower than alternatives B and D considering the shorter duration of operations.	Similar to Alternative A, except longer duration of risk.	Lower risk of a truck transport related spill with pipeline. However, a pipeline rupture could have impacts, depending upon location and duration.	Similar to Alternative B.

Resource	Impact	Alternative A	Alternative B	Alternative C	Alternative D
	Water Management	Reverse osmosis treatment system needed until closure and in perpetuity to meet TDS limits. At closure, tailings impoundment and Main Pit used for water management. Water discharge would continue in perpetuity.	Continued use of existing water management and treatment systems with addition of enhanced treatment (barium precipitation) to reduce TDS levels and maintain water balance, as needed. Wet closure involves water management in the Aqqaluk Pit and tailings impoundment. Water quality in tailings impoundment expected to improve over the long term although perpetual treatment and discharge still expected.	Continued use of existing water management system and treatment of tailings impoundment wastewater, except the wastewater would be piped to the port site, combined with treated concentrate wastewater and discharged to the Chukchi Sea. A new treatment plant would be built at the port site for treatment of concentrate wastewater. After dry closure of the tailings impoundment, the wastewater pipeline would be removed with contaminated water managed in the Aqqaluk Pit. Reduced volume of water (compared to other alternatives) would require treatment in perpetuity.	Same as Alternative C during operations with pipeline to ocean; pipeline maintained after closure. Closure plan for impoundment, pits and waste rock stockpiles same as Alternative B.
Water Resources -Groundwater	Groundwater hydrology and quality	Limited and localized impacts on ground water, including loss of permafrost. Pit lake created in Main Pit.	Similar to Alternative A, except Main Pit backfilled and pit lake forms in Aqqaluk Pit.	Same as Alternative B, although permafrost could be restored more quickly under tailings impoundment (with dry closure).	Same as Alternative B.
Vegetation	Acres of Disturbance	28 acres of new disturbance associated with the expansion of the waste rock dump and roads/ditches. Reclamation begins in 2011, including revegetation where practicable.	406.5 acres of new disturbance associated with developing Aqqaluk Deposit including tailings impoundment expansion and new roads/ditches. Closure in 2031, although ongoing reclamation of main waste rock dump when backfilling begins.	Similar to Alternative B with 145 acres of additional disturbance associated with pipeline bench, reclaimed after closure. Stockpiles for the tailings impoundment cover material would affect 80 acres until reclamation was completed.	Similar to Alternative C, except pipeline bench remains after closure. No additional stockpiles would be required for reclamation.
	Dust impacts	Fugitive dust emissions and vegetation impacts, primarily to mosses and lichens, would continue at current levels through 2011.	At mine site, additional dust impacts (changes in species composition/cover) from Aqqaluk Pit development. Along DMTS road, emissions and effects	Same as Alternative B at mine site. Along DMTS road, fugitive emissions greatly reduced by concentrate pipeline. Future metals loadings lowered but effects on previously impacted	Similar to Alternative B except some reductions in fugitive emissions and metal loadings along DMTS road resulting from truck washes.

Resource	Impact	Alternative A	Alternative B	Alternative C	Alternative D
Wetlands	Acres and Types Disturbed	No impacts beyond currently permitted levels.	continue through 2031. Additional 144.9 acres disturbed at mine site. No additional impacts along DMTS road. Loss of function and value minor at regional level.	vegetation uncertain. Same as Alternative B at mine site. 125.5 acres of additional wetlands disturbed by pipeline bench – function may already be affected by fugitive dust. Some level of function would be recovered after closure.	Same as Alternative B at mine site. Same as Alternative C along DMTS road except pipeline bench remains after closure.
Wildlife	Impacts	No impacts beyond current levels, some risk from dust emissions to ptarmigan and small mammals. Localized impacts on beluga whale movements and caribou migration.	Similar in magnitude to Alternative A except longer duration of operational impacts.	Lower risk to ptarmigan and small mammals from reduced dust emissions as compared to alternatives B and D. Reduced caribou mortality as compared to alternatives B and D due to elimination of truck traffic as well as less impact on caribou migration. Localized impacts to beluga due to port activities similar to Alternative B. No impacts to marine mammals from wastewater discharge.	Risk to ptarmigans and small mammals from fugitive dust emissions lower than Alternative B but higher than Alternative C. Impacts on caribou migration and beluga whale movement reduced by road closure and delayed port opening. Caribou migration impact lower than Alternative B, but not as low as Alternative C. Beluga movement impact lower than other action alternatives. No impacts to marine mammals from wastewater discharge.
Aquatic Resources	Freshwater	No change from current conditions. Lowered TDS levels in the discharge will not have an affect on aquatic life. Metals concentrations and arctic grayling spawning in Red Dog Creek are improved compared to pre-mining conditions. Based on current data, no change from current conditions in streams along DMTS road, although	Same as Alternative A. The difference in TDS levels between alternatives would not result in effects on aquatic life downstream. Metals concentrations and arctic grayling spawning in Red Dog Creek are improved compared to pre-mining conditions. Based on current data, no change from current conditions in streams along	Removal of discharge from Red Dog Creek would result in impacts to aquatic life during operations because of increased metal loadings and reduced flow. Water quality will be better than pre-mining conditions but worse than current conditions (except for reduction in TDS levels). No changes in Ikalukrok Creek or Wulik River. No impacts on DMTS road	Same as Alternative C except impacts to Red Dog Creek from the loss of dilution from the outfall would continue after closure. Impacts on aquatic life in DMTS streams the similar to Alternative B although less risk of exposure to concentrate within fugitive dust.

Resource	Impact	Alternative A	Alternative B	Alternative C	Alternative D
		additional monitoring is warranted.	DMTS road, although additional monitoring is warranted.	observed in fish monitoring, but sporadic tissue concentrations above effects levels warrant future monitoring. Any future impacts due to truck traffic less under Alternative C than other alternatives.	
	Marine	No discharges from mining operations and no impacts beyond current conditions.	Same as Alternative A.	Short-term, adverse impacts on algae, invertebrates, and fish during pipeline construction and removal. Construction should be timed to avoid fish migration periods (through Corps' Section 10 permit). Because of limited mixing zone size (10 feet around outfall) and discharge would meet marine water quality standards at edge of mixing zone; no impacts from marine discharge.	Same as Alternative C.
Land Use and Recreation	Land Use	Site reclamation begins in 2011.	Site reclamation begins in 2031.	Similar to Alternative B.	Similar to Alternative B.
	Recreation	No direct impacts on recreational use because of limited access to site. Some visual impacts to hikers and recreationists flying over site on way to destinations.	Similar to Alternative A although development of the Aqqaluk Pit would result in additional disturbance.	Similar to Alternative B, although pipeline bench could slightly increase visual effects.	Similar to Alternative C.

Resource	Impact	Alternative A	Alternative B	Alternative C	Alternative D
Health	Public Health	<p>Existing operations affect presence of caribou and beluga whale in vicinity of Kivalina with some reduction in harvest levels. Harvest change could affect diet and health; therefore, a diet survey is recommended.</p> <p>Adverse impacts related to employment and income could occur with mine closure in 2011. Some benefits from reduced impacts on subsistence, less employee separation, and potential for reduced spread of infectious disease. Effects of contaminant exposure are limited under all alternatives.</p>	<p>Allows for continued mining through 2031 and associated economic and employment benefits with more time to plan for eventual mine closure.</p> <p>Continued effects of dust emissions on some subsistence resources to users in Kivalina. Mine activities have similar effect on subsistence in Kivalina as under current conditions but extend through 2031.</p>	<p>Similar to Alternative B, except subsistence impacts are reduced by lower dust emissions and elimination of concentrate truck traffic (less displacement of caribou).</p>	<p>Similar to Alternative C, although less reduction in dust emissions, subsistence benefits associated with road closure during caribou migration and delayed port opening during whale movement.</p>
	Industrial Health	<p>Current accident rates and worker exposure would continue through 2011. Teck would continue to implement and refine, as necessary, its health and safety program to prevent exposure and monitor worker health.</p>	<p>Current accident rates and worker exposure would continue through 2031. Teck would continue to implement and refine, as necessary, its health and safety program to prevent exposure and monitor worker health.</p>	<p>Similar to Alternative B, except reduced exposure to the contaminants in dust from workers associated with concentrate transport (minor effect).</p>	<p>Similar to Alternative B.</p>
Subsistence	Land Mammals	<p>Mine has not caused effects on overall caribou migration patterns, but localized changes primarily from mine activities (including the DMTS road) have occurred and subsistence harvest has decreased. Such impacts should be greatly decreased after closure with traffic reductions. Effects mitigated by management practices to stop traffic when large-scale caribou herd movement has</p>	<p>Similar in magnitude to Alternative A, except operational impacts would continue through 2031.</p>	<p>Construction of the concentrate pipelines would substantially reduce truck traffic and thereby lessen impacts on caribou and subsistence harvest in terms of displacement.</p>	<p>Closure of the road during the caribou migration may lessen impacts (though not as much as Alternative C) on subsistence by reducing localized displacement of caribou.</p>

Resource	Impact	Alternative A	Alternative B	Alternative C	Alternative D
		right-of-way.			
	Marine Mammals	Localized displacement of beluga whales at port site could be contributing to reduced harvests by Kivalina residents. Impacts from port activity would be eliminated after closure in 2011.	Similar in magnitude to Alternative A except operational impacts continue through 2031.	Similar to Alternative B in terms of port site activity displacing beluga whales. Impacts from construction of the discharge pipeline outfall could be minimized by timing restrictions. Discharge should not affect marine mammals.	Impacts to whale movement and subsistence reduced by closing the port during the annual June beluga whale migration. Impacts related to construction of marine outfall is the same as Alternative C.
	Fugitive Dust	No actual risk identified but perceived contamination of berries leading to changes in use areas and reduced harvest from pre-mining conditions.	Same as Alternative A in magnitude except fugitive emissions continue through 2031.	Reduced fugitive emissions since traffic would be eliminated due to concentrate pipeline could lead to increase in berry harvest and less concern about dust contamination of other resources.	Less dust emissions than alternatives A and B, but more than C. Effects on subsistence uncertain.
Cultural Resources	Effects on historic properties	At mine site, up to 17 sites have been affected by existing activities or will be affected by additional operations through 2011. No sites identified along DMTS road. All effects mitigated by <i>Integrated Plan for the Management of Cultural Resources in the Red Mine Project Areas, 2006 (Integrated Plan)</i> .	Development of Aqqaluk Pit could impact 2 additional sites, direct and indirect effects mitigated by <i>Integrated Plan</i> .	Similar to Alternative B.	Similar to Alternative B.
Transportation	Traffic	Marine and DMTS road traffic continues at current levels through 2011.	Same traffic levels as Alternative A except operational impacts extend through 2031.	Traffic along DMTS road greatly reduced by concentrate pipeline (36 fewer round trips per day by concentrate trucks). Number of diesel fuel trucks also reduced. Traffic greatly reduced compared to alternatives B and C.	Same as Alternative B except reduced fugitive emissions from truck traffic. Also, although same number of trips, traffic frequency per month differs from Alternative B due to road closure during caribou migration.
Noise	Effects on recreational users and wildlife	Infrequent (once per day) blasting would be the primary impact. Could affect	Similar in magnitude to Alternative A except operational effects occur	Similar to Alternative B except pipeline noise would be less than truck traffic on DMTS	Similar to Alternative B except (1) limited noise disturbance along DMTS

Resource	Impact	Alternative A	Alternative B	Alternative C	Alternative D
		the limited number of recreational users and subsistence activities. Noise levels greatly reduced after closure in 2011.	through 2031.	road. Some additional blasting would occur in material borrow sites during bench construction. The additional facilities at the port would result in only a minimal increase in noise levels.	road during caribou migration; and (2) reduced noise at port during high subsistence harvest period for marine mammals.
Socioeconomic Resources	Effects on employment and revenues	<p>Mining would end in 2011 with the reduction from 543 full- and part-time jobs to about 25 required for post-closure activities, including loss of 103 NWAB jobs.</p> <p>Payroll would be reduced from \$45.8 million annually to approximately \$2 million, including \$8.3 million paid to NWAB residents.</p> <p>NANA businesses would forgo \$71.3 million in revenue, other businesses would forgo \$29 million, and the NWAB would forgo \$8 million annually in PILT.</p>	Economic effects of closure described under Alternative A would be delayed until 2031.	Similar to Alternative B, except that approximately \$72 million of NANA royalty payments would be directed instead to pipeline construction costs and approximately 40 transportation-related jobs would be eliminated.	Similar to Alternative B except that approximately \$22 million of NANA royalty payments would be directed instead to the costs of implementing dust control measures and wastewater pipeline.

Table 3 Mitigation Measures by Resource

Resource	Measure	Section	Comment	Authority^a / Likelihood of Implementation
Air	Install truck washes at both ends of the DMTS road.	3.2.4	Applicable to alternatives A and B (included as part of Alternative D).	None / Under evaluation as part of the draft fugitive dust risk management plan; likelihood of implementation uncertain.
Geotechnical Stability	Evaluate dam design prior to final raise to address potential long-term stability concerns.	3.4.2.5	All alternatives.	ADNR's Dam Safety Program / Reviews of dam raises would be conducted under all alternatives.
Water Resources	Use BMPs (e.g., silt fences) at road crossings during construction of pipeline bench to minimize sediment input at DMTS road/pipeline bench stream crossings.	3.5.3.3 and 3.5.3.4	Alternatives C and D.	NPDES Permit (Storm water) / Measure would be required for construction under all alternatives.
	Develop long-term TDS management plan.	3.5.3.2	Applicable to alternatives A and B and included in the draft NPDES permit. Additional TDS control would not be necessary with a marine outfall.	Red Dog Mine NPDES Permit / Included under alternatives A and B; unnecessary with marine discharge (alternatives C and D).
Wetlands	Develop mitigation plan for wetlands loss associated with development of Aqqaluk Deposit and fill to raise tailings dam.	3.8.3.3	Applicable to alternatives B, C, and D.	Section 404 Permit / Mitigation required under Corps regulations. Extent of proposed mitigation for Aqqaluk impacts disclosed in the SEIS although specific mitigation plans for dam raises would be determined in the future.
Wildlife	Continue to implement a hazing program to keep wildlife from using the tailings impoundment and Aqqaluk Pit lake.	3.9.3.2, 3.9.3.3, 3.9.3.3, and 3.9.3.4	All alternatives (applies to tailings impoundment only under Alternative A and Aqqaluk Pit lake under Alternative C).	None / Teck has committed to continuing the current hazing program being implemented voluntarily and will reevaluate the need at closure.
	Construction of marine outfall should avoid conflict with marine mammal use of the area.	3.9.3.4	Applies to alternatives C and D.	Sections 10 and 404 permits / Would be required for construction of the marine outfall under either alternative.
	Construction of pipeline bench should avoid major migratory movements of caribou.	3.9.3.4	Applies to alternatives C and D.	Section 404 Permit / Would be required for construction of the pipeline bench under either alternative.