JERICHO PROJECT SCENARIO TRADEOFF MATRIX

No.	Phase	Activity	Alternative	Receiving Waterbody (s)	Env Control Cost	Water Quality Outcome Positive	Water Quality Outcome Negative
1a	Construction	PKCA Construction	Drain fully	Long Lake, Str C3, Lake C3	Moderate	None	Some potential for elevated sediments in water from lake; est. 50% pump out without settling to remove sediment.
1b			Partially drain	Long Lake, Str C3, Lake C3	Moderate	See 1a	Less potential for elevated sediments because water left in lake
2a		Water intake	Causeway	Carat Lake	Moderate	Less sedimentation than buried pipe because less disturbance of lake bottom during construction. Mine rock will be used.	Zero sedimentation not possible, some construction related sediment; some effect on water circulation
2b			Buried pipe	Carat Lake	High	Water circulation not affected - Lake currents not obstructed however water intake draw point will impact circulation the same for both options	Construction of trench for pipeline will cause heavy sediment loads even with silt curtains. The handling and disposal of lake bottom sediments creates additional environmental issues
3a		Waste rock dump locations	Dumps 1 & 2	Carat Lake	Moderate; winter const	None	Sediment settled in pond; any ammonia should be absorbed by tundra before Carat Lake. Pump to PKCA if does not meet water licence criteria
3b			Dump 3	Carat Lake and Lake C1	Moderate; winter const	None	See 3a
3c			KIA proposal - Holubec	Str C1 and Carat Lake	Moderate; winter const	None	See 3a
4a		Stream C1 Diversion	Naturalize	Str C1 and Carat Lake	High	Transport clean water around open pit	More sedimentation potential from first flush because longer channel in overburden; potential to destablize due to fish habiat configuration
4b			Conduit	Str C1 and Carat Lake	Moderate	See 4a	Sedimentation from first flush; greater structure stability
5a	Operation	Fine PK storage	Long Lake	Long Lake; Stream C3; Lake C3; Carat Lake	High	Provides treatment of raw PK and mine water Provides storage capacity for all water effluents not meeting discharge criteria	Increase in TDS, some metals, ammonia and possibly phosphorus over background.
5b			Rescan alternatives (1997)	Lynne, Key, Pocket, Contwoyto lakes	High	Provides treatment of raw PK and mine water. Not as high in basin, higher catchment area, lower concentration, same loading	Analysis of water quality effects not done; by analogy similar effects as 5a. Volume of water to treat higher.
5c			KIA proposal - Holubec	Lake C1, Str C1; Carat Lake	High	See 5b	Increase in TDS, some metals, ammonia and possibly phosphorus over background in Stream C1 and Carat Lk from seepage
6a		Stream C1 Diversion	Naturalize	Str C1 and Carat Lk	Moderate	Clean water diversion from pit area	Sedimentation potential; higher than shorter channel; mitigation through management
6b			Conduit	Str C1 and Carat Lk	Low	See 6a	Sedimentation potential; mitigation through management
7a		PKCA Discharge Scenarios	Base Case: Discharge to Str C3 Base Case Operation	Long Lake; Stream C3; Lake C3; Carat Lake	Moderate	Reduction in ammonia, metals, phosphorus; CCME met in Lake C3 in most cases, Carat Lake in all cases	Some potential for loading in Lake C3 and Carat Lake but not above site specific chronic concentrations.
7b			Scenario B: Hold water for 1 year and discharge to Str C3;	Long Lake; Stream C3; Lake C3; Carat Lake	Moderate	Prevents higher concentrations of ammonia, metals, phosphorus being discharged; CCME met in Lake C3; no direct discharge to receiving water if water quality does not meet discharge criteria. Allows time for mitigating plan such as spray irrigation to be developed	Pilot tests for spray irrigation will be controlled so as not to result in negative impacts to Lake C3.

CHO PROJECT SCENARIO TRADEOFF MATRIX

Phase	Activity	Alternative	Mitigation	Conclusion
Construction	PKCA Construction	Drain fully	Settle prior to final discharge to Stream C3	50 - 75% of water will need treatment to reduce TSS.
		Partially drain	Settle prior to final discharge to Stream C3	Preferred; less high TSS water to treat
	Water intake	Causeway	Enhance causeway margins to create fish habitat. Clean rock used for construction; coarse rock on outer shell	Permanent foot print; habitat loss can be fully mitigated (see NNLP) Preferred Option
		Buried pipe	Silt fence during construction	High volume of high TSS water to mitigate or treat on land Requires fish screen and has higher operational and environmental risk during construction and operations
	Waste rock dump locations	Dumps 1 & 2	Mine water management; monitor and direct discharge to fundra or pump to PKCA . Dump design to drain to pit sumps during initial operation to allow for monitoring of water quality.	Less surface disturbance; more compact design Preferred option
		Dump 3	See 3a	Water management more complicated; only partial storage requirement met.
		KIA proposal - Holubec	Pump back seepage and runoff to PKCA; mine water management	Effects fish habitat unlike preferred option
	Stream C1 Diversion	Naturalize	Minimize sedimentation silt fences; winter construction. Stream C1 kept intact until 3rd year of operation therefore Adaptations of site experience to construction is possible. Run of mine granite available for slope protection and channel enhancements.	Provides more mitigation for lost fish habitat
		Conduit	See 4a	Less sedimentation and potential maintenance requirements
Operation	Fine PK storage	Long Lake	See 1a	Lower environmental impact than alternatives. Preferred option
		Rescan alternatives (1997)	See 1a	Higher environmental impact; additional storage not required
		KIA proposal - Holubec	See 1a	Requires EIS to be redone; higher environmental impact.
	Stream C1 Diversion	Naturalize	Minimize sedimentation with washed fill and silt fences; winter construction Defer installation of channel until 3rd year of operations	See 4a
		Conduit	See 6a	See 4b
	PKCA Discharge Scenarios	Base Case: Discharge to Str C3 Base Case Operation	Compensation plan for fish habitat effects. PKCA storage capacity of water is mitigation	Depends on water quality analyses and AEMP results
		Scenario B: Hold water for 1 year and discharge to Str C3;	See 7a. Containing water in PKCA for 1year would mitigate quality impact.	See 7a

No.	Phase	Activity	Alternative	Receiving Waterbody (s)	Env Control Cost	Water Quality Outcome Positive	Water Quality Outcome Negative
7c			Scenario C: Hold water for 2 years	Long Lake; Stream C3; Lake C3; Carat Lake	Moderate	No direct discharge to receiving water during 2 year period if water quality does not meet discharge criteria. Allows time for mitigating plan such as spray irrigation to be developed	Same as Scenario B.
8a	Post-closure	Stream C1 Diversion	Re-direct part of Stream C1 to pit	Stream C1	Moderate	Some of water flow in lower section of Stream C1 maintained.	Pit water quality will (may) affect lower Stream C1; quality depends on whether pit used for treatment or not. Water quality won't be known with certainty until after several years of monitoring during operation.
8b			Redirect all of Stream C1 into pit	Stream C1	Moderate	None	See 8a
8c			Maintain diversion	Stream C1	High	Pit water quality does not affect lower Stream C1. Water flow in lower section of Stream C1 maintained.	Potential for sedimentation; mitigation through maintenance
9a		End pit fill	Rapidly fill pit	Stream C1, Carat Lake	Moderate	None	Loss of treatment potentially required for mine runoff resulting in contaminant export or need to treat
9b			Let pit fill over 15 - 20 years	Stream C1, Carat Lake	Low	Pit acts as storage/treatment facility while filling	None
10a		End pit discharge	Pit overflow to open channel	Carat Lake	High	Pit will act as settling pond for sediment and provide reservoir to hold water for extended period of time until water quality stabilizes.	Metals may be at chronic levels and would affect Carat Lake
10b			Pit overflow to Stream C1	Stream C1, Carat Lake	Low	See 110a	Metals may be at chronic levels and would affect Stream C1 and Carat lake
10c			Pit overflow to Carat Lake diffuser	Crat Lake	High	See 10a; Stream C1 unaffected by any water quality issues associated with the closure pit	See 12a
11a		Stream C1 Flows	Flows maintained at natural levels with diversion until pit fills, then flow returned to pre-mining drainage pattern	Stream C1, Carat Lake	Moderate	None	None
11b			Flows maintained in perpetuity by diversion	Stream C1, Carat Lake	High	None	None
11c			Flows cut off until pit filled by redirecting stream to pre-mining drainage pattern on closure; no diversion	Stream C1, Carat Lake	Moderate	None	Water quality may be degraded over pre-mining due to contaminants in the pit
12a		End pit use	End pit lake fish habitat	Pit	Moderate	Pit water quality would be at CCME guidelines	Pit water quality may be unsuitable for fish use depending on quality of water directed to pit. Under some discharge scearios pit lake water may be unsuitable.
12b			End pit lake treatment facility	Pit	High	Improve water quality, particularly metals	Some metals will likely remain above natural background (e.g., copper)
12c			End pit lake no treatment	Pit	Low	Sediment settling	No change of runoff except settling of sediment
	Costs	Low	Less than $20,000				
		Medium	$20,000 to $100,000				
		High	More than $100,000				

Phase	Activity	Alternative	Mitigation	Conclusion
		Scenario C: Hold water for 2 years	See 7a. Containing and storing water in PKCA for 2 years would mitigate water quality impacts	See 7a
Post-closure	Stream C1 Diversion	Re-direct part of Stream C1 to pit	Maintains base flows of Stream C1 downstream of diversion	Open question for operations. Pit filling options to be addressed and adapted during life of mine and closure plans
		Redirect all of Stream C1 into pit	None for fish habitat or flows	See 8a
		Maintain diversion	Maintains near-natural flows of Stream C1 downstream of diversion	See 8a
	End pit fill	Rapidly fill pit	Meter pump rates to minimize effects on Carat Lake drawdown	Negates using pit for treatment post closure. Open question for operations.
		Let pit fill over 15 - 20 years	Allows pit to be used as a storage and treatment facility until it fills substantially reducing ammonia and providing reduction of metals from freeze back effects in dumps	The best option from an environmental view but increases closure costs and moves costs out several years.
	End pit discharge	Pit overflow to open channel	Prevents water of lower quality entering Stream C1 and potentially negatively affecting fish	See 8a
		Pit overflow to Stream C1	Returns lower Stream C1 flows to pre-mining condition	See 8a
		Pit overflow to Carat Lake diffuser	See 10a	See 8a
	Stream C1 Flows	Flows maintained at natural levels with diversion until pit fills, then flow returned to pre-mining drainage pattern	Maintains flows in lower Sream C1; maintains fish habitat and opportunity for use	See 8a
		Flows maintained in perpetuity by diversion	Maintains flows in lower Sream C1; maintains fish habitat and opportunity for use	See 8a
		Flows cut off until pit filled by redirecting stream to pre-mining drainage pattern on closure; no diversion	None	See 8a
	End pit use	End pit lake fish habitat	If viable (**predicted under some conditions that may not to be due to water quality concerns**) could provide for fish habitat compensation	See 8a
		End pit lake treatment facility	Water quality treatment prior to discharge to Carat Lake	See 8a
		End pit lake no treatment	Settle sediments and increase holding time for mine area runoff	See 8a
Costs	Low	Less than $20,000		
	Medium	$20,000 to $100,000		
	High	More than $100,000		