K4.17 GROUNDWATER HYDROLOGY

Information on the development and calibration of the groundwater model at the mine site is provided in Section 3.17, Groundwater Hydrology, and Appendix K3.17. Use of the model to predict impacts to groundwater from mine site activities is described in Section 4.17, Groundwater Hydrology. This appendix contains additional technical information regarding the following impact analyses using the groundwater model:

- Input parameters and scenarios used in the model
- Open pit groundwater zones of influence
- Uncertainty analysis
- Groundwater flow and seepage beneath the bulk tailings storage facility (TSF) and main water management pond (WMP)
- Planning for potential upset conditions

K4.17.1 Model Development, Calibration, Input Scenarios, and Uncertainty

The groundwater model has been developed over a number of years, currently contains 12 layers, and is presented in a comprehensive report by BGC (2019a). The model was subsequently updated in a series of memoranda by BGC (2019b, d, j) to simulate active dewatering in the open pit, improve representations of the WMPs and pyritic TSF, more accurately represent conceptual drainage and seepage control measures at the bulk TSF, and reflect minor updates in the general arrangement of mine site facilities.

The groundwater model analysis considered a range of scenarios that evaluated variability in hydrogeologic properties and model boundary conditions. Model parameters representing hydraulic conductivity, streambed hydraulic conductivity, sediment thickness, fault hydraulic conductivity, bulk TSF properties, and recharge were varied by amounts representative of possible field condition variability. For example, hydraulic conductivity values measured in the weathered bedrock zone vary in the general vicinity by about five orders of magnitude (Table K3.17-2), and the weathered and fractured bedrock zone is known to be a pervasive aquifer in the area (Figure 3.17-3).

A summary of sensitivity analyses initially conducted on the model by BGC (2019a) is presented in Table K4.17-1. A review of these revealed that one of the largest sources of model uncertainty is the hydraulic conductivity of bedrock, both weathered and competent bedrock. The wide range of field-measured values of hydraulic conductivity supports this finding. Therefore, the uncertainty of the groundwater model results was re-evaluated by running numerous model simulations with both high K (K × 10 = scenario S7) and low K (K × 0.1 = scenario S8) values of hydraulic conductivity for all bedrock units. The high K scenario further contained in-pit and perimeter wells for the end of mining (to maximize predicted groundwater production), and the low K scenario included no wells at the end of mining (to minimize predicted groundwater production).

Revised groundwater flow estimates for the base case and high and low K scenarios are provided in Table K4.17-2. These conditions produced relatively high and low quantities of groundwater flow to the pit/dewatering wells, and are considered to reasonably bracket probable actual conditions at the site. Additional sensitivity analyses conducted on the TSFs and main WMP are discussed later in this appendix. In addition to affecting groundwater inflow to the pit, variations in the parameters also result in different zones of influence. The results of the high K and low K scenario simulations are propagated through other related impact predictions of this EIS: water treatment plant (WTP) sizing (Section 4.18, Water and Sediment Quality), wetland impacts (Section 4.22, Wetlands and Other Waters/Aquatic Sites), and changes to streamflow values (Section 4.16, Surface Water Hydrology).

Table K4.17-1: Initial Sensitivity Simulations Results for End of Mining Conditions

Scenario	Description	Open Pit Groundwater Extraction (US gpm)	Bulk TSF Seepage (US gpm)	Baseflow Reduction (%)			Effect on Predictive Results
				NFK	SFK	UTC	
S0	Base Case	980	630	14	7	0.7	-
S1	Unconsolidated sediments K × 10	1,300	1,700	20	14	3.5	Significant
S2	Unconsolidated sediments K × 0.1	740	500	12	5	0.0	Significant
S3	Weathered bedrock K × 10	1,300	1,000	15	7	1.5	Significant
S4	Weathered bedrock K × 0.1	820	590	13	7	0.5	Significant
S5	Competent bedrock K × 10	2,900	1,200	13	7	4.3	Significant
S6	Competent bedrock K × 0.1	700	610	14	7	0.4	Significant
S7	Bedrock K × 10	3,000	1,700	14	7	4.8	Significant
S8	Bedrock K × 0.1	600	570	13	7	0.4	Significant
S9	Recharge × 1.5	1,100	750	14	7	0.8	Significant
S10	Recharge × 0.5	680	540	13	7	0.6	Significant
S11	Streambed K × 10	980	630	13	7	0.7	Insignificant
S12	Streambed K × 0.1	980	630	15	7	0.7	Insignificant
S13	Unconsolidated sediments thickness × 1.25	980	630	13	7	0.7	Insignificant
S14	Unconsolidated sediments thickness × 0.75	980	630	14	7	0.7	Insignificant
S15	High K faults	2,600	630	14	7	5.8	Significant
S16	Low K faults	960	630	14	7	0.7	Insignificant
S17	Bulk TSF tailings K increased by a factor of 10	980	1,800	14	7	0.7	Significant
S18	Bulk TSF tailings K decreased by factor of 100	980	320	14	7	0.7	Significant
S19	Bulk TSF pond increase to 2,270 acres (920 ha) water level at 1,700 feet	980	780	14	7	0.7	Significant
S20	Bulk TSF tailings saturated with water level ranging from 1,690 feet to 1,720 feet	980	5,300	14	7	0.7	Significant

Notes:
All simulation results for the scenario without pumping wells.
NFK, SFK, and UTC baseflow reduction reported above gaging stations NK100A1, SK100B1, and UT100D, respectively
gpm = gallons per minute
ha = hectares
NFK = North Fork Koktuli
SFK = South Fork Koktuli
TSF = tailings storage facility
US = United States
UTC = Upper Talarik Creek
Source: BGC 2019a, Table 9-4

Table K4.17-2: Range of Revised Sensitivity Results for High and Low K Scenarios Used in Subsequent Modeling, End of Mining

Scenario	Description	Open Pit Groundwater Extraction (US gpm)	Bulk TSF Seepage with Drainage Updates[1] (US gpm)
S0	Base Case	1,500[2]	770
S7	Bedrock K × 10	4,300[2]	770
S8	Bedrock K × 0.1	600[3]	640

Notes:
[1]Conceptual drainage improvements, including foundation preparation, underdrains, embankment toe ditches, chimney and blanket drains at main embankment, seepage control at south embankment, and tailings segregation zones (BGC 2019j)
[2]Base case and S7 (high K) scenarios based on pit groundwater extraction with dewatering wells to provide conservative (high) range of pumping and drawdown effects (BGC 2019j)
[3]S8 scenario (low K) based on pit groundwater extraction without wells to provide low range of pumping and drawdown effects (BGC 2019a)
gpm = gallons per minute
TSF = tailings storage facility
US = United States
Sources: BGC 2019a, j, m, o

K4.17.2 Pit Zone of Influence

K4.17.2.1 Operations

Under base-case conditions (i.e., the calibrated model with in-pit and dewatering wells), most of the zone of influence from dewatering the pit is in the SFK watershed, with areas extending into upper tributary watersheds of the UTC watershed. The pit zone of influence also merges with zones of influence surrounding the pyritic TSF and open pit WMP (Figure 4.17-2). Modeled drawdown/mounding results for low K and high K bedrock scenarios at the end of operations are shown on Figure K4.17-1 and Figure K4.17-2, respectively.

The reduction in groundwater discharge to nearby headwaters catchments under two sensitivity analysis scenarios (the high K and low K scenarios) was also modeled (BGC 2019o). These analyses were conducted by evaluating predicted changes in base flow at stream segments (the downstream end of which are termed radial nodes) at all streams surrounding the mine pit that would be affected. Under the high K scenario (the broadest area of those simulated, Figure K4.17-2), the largest changes are found to occur in drainages removed during mining, while other drainages show reductions ranging from 0 to 0.6 cubic foot per second (cfs) compared to baseline conditions. Table K4.17-3 and Table K4.17-4 show modeled changes in streamflow for the base case (S0) and high K scenario (S7), respectively. Modeled streamflow reductions for the low K scenario (S8) for the non-mined-out segments were less than for the base-case scenario.

K4.17.2.2 Closure and Post-Closure

The predicted rate of lake-level rise in the pit lake at closure in relation to pit backfill is shown on Figure K4.18-6. Once the lake level reaches an elevation of 890 feet above mean sea level (amsl) (known as the Maximum Managed, or MM elevation), pumping of water from the lake would commence to maintain the lake as a groundwater discharge-type lake and create hydraulic containment. The conceptual basis for groundwater discharge lakes was developed by Winter (1976) and discussed further by Webster et al. (2012). A modeled groundwater flow system configuration is shown in Figure 4.17-6 and Figure 4.17-8. These figures show that the hydraulic heads in the groundwater system surrounding and beneath the pit lake would be higher than the MM pit lake elevation of 890 feet amsl. Simulations were performed for both high K and low K lake sediment (tailings and waste rock backfill) scenarios (BGC 2019n). Groundwater levels would be monitored during closure and post-closure to determine whether the MM elevation needs to be adjusted to prevent groundwater outflow from the pit (Knight Piésold 2018n). The groundwater inflow rate to the pit would gradually decrease during the first 20 years of closure as the pit lake level rises. The long-term steady-state average annual groundwater inflow to the pit during post-closure is estimated to be about 800 gallons per minute (about 1.8 cfs) (BGC 2019a).

Table K4.17-3: Summary of Radial Node Baseflow Reduction Analysis: Scenario S0

Watershed	Radial Node	Baseline Baseflow (cfs)	Baseflow Reduction (cfs)		Comment
			End-of-Mining	Post-Closure	
South Fork Koktuli River	SFK1	1.1	1.1	1.1	Mined out during open pit development
	SFK2	0.9	0.9	0.9	Mined out during open pit development
	SFK3	0.8	0.8	0.04	Removed during mine development, re-established at closure
	SFK4	0.6	0.2	0.04	-
	SFK5	0.3	0.0	0.0	-
	SFK6	0.5	0.01	0.0	-
	SFK7	0.6	0.0	0.0	-
	SFK8	3.1	0.0	0.01	-
	SFK9	2.8	0.0	0.0	-
North Fork Koktuli River	NFK1	1.8	1.8	0.6	Removed during mine development, re-established at closure
	NFK2	0.05	0.05	0.0	Removed during development, re-established at closure
Upper Talarik Creek	UTC1	0.0	0.0	0.0	-
	UTC2	0.7	0.3	0.1	-
	UTC3	0.03	0.0	0.0	-
	UTC4	0.1	0.0	0.0	-
	UTC5	0.1	0.0	0.0	-
	UTC6	0.4	0.01	0.0	-
	UTC7	0.2	0.0	0.0	-
	UTC8	0.6	0.0	0.0	-
	UTC9	0.3	0.0	0.0	-
	UTC10	2.3	0.0	0.0	-

Notes:
Predicted baseflow reduction less than 0.01 cubic foot per second (cfs) reported as 0.0 cfs
cfs = cubic foot per second

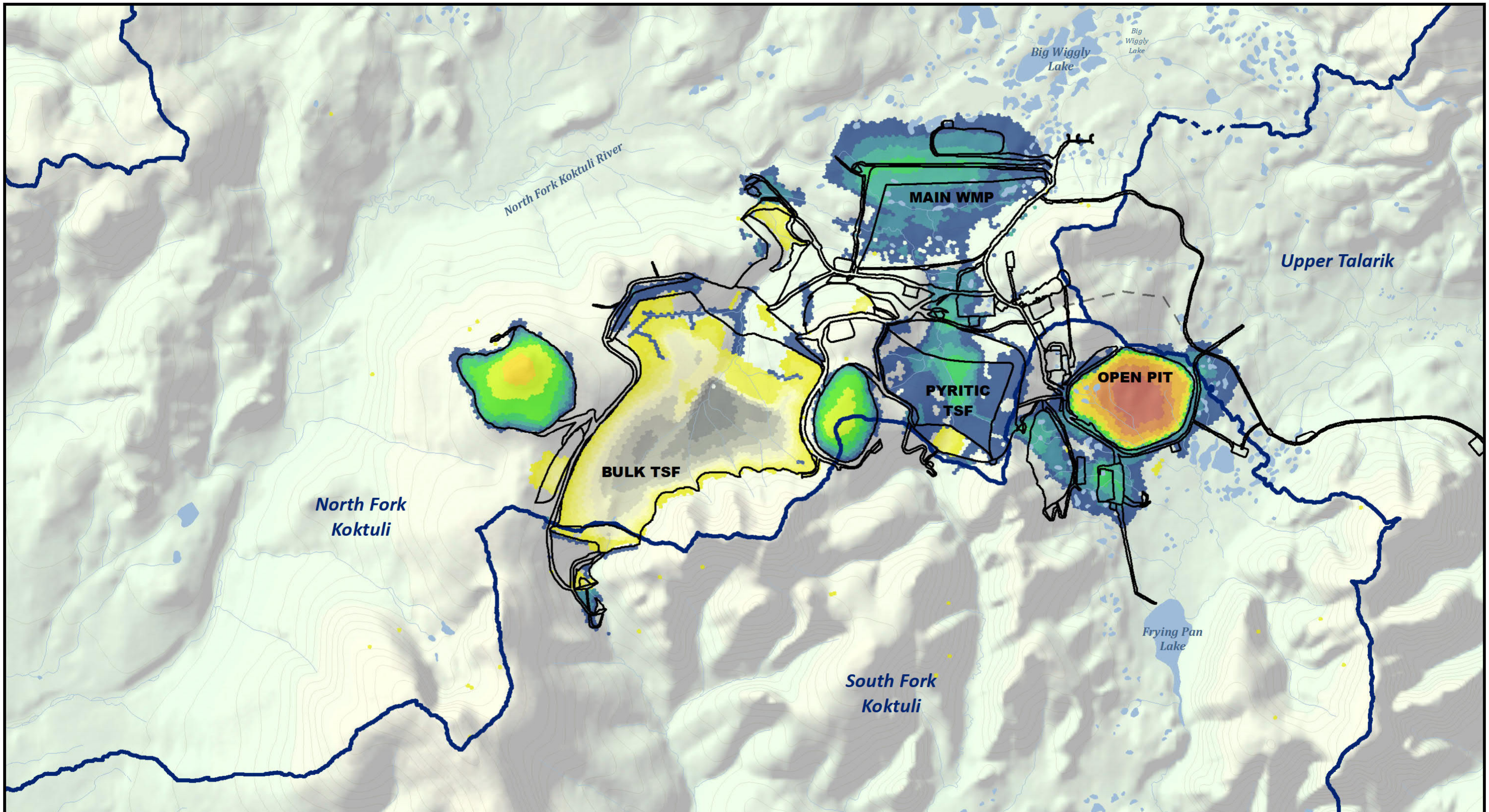
Source: BGC 2019o, Table 2

Table K4.17-4: Summary of Radial Node Baseflow Reduction Analysis: Scenario S7 (high K)

Watershed	Radial Node	Baseline Baseflow (cfs)	Baseflow Reduction (cfs)		Comment
			End-of-Mining	Post-Closure	
South Fork Koktuli River	SFK1	1.2	1.2	1.2	Mined out during open pit development
	SFK2	0.9	0.9	0.9	Mined out during open pit development
	SFK3	0.8	0.8	0.3	Removed during mine development, reestablished at closure
	SFK4	0.7	0.4	0.2	-
	SFK5	0.6	0.05	0.0	-
	SFK6	0.5	0.05	0.0	-
	SFK7	0.8	0.04	0.0	-
	SFK8	4.1	0.4	0.1	-
	SFK9	2.9	0.0	0.0	-
North Fork Koktuli River	NFK1	1.8	1.8	0.8	Removed during mine development, re-established at closure
	NFK2	0.07	0.07	0.05	Removed during mine development, re-established at closure
Upper Talarik Creek	UTC1	0.0	0.0	0.0	-
	UTC2	0.9	0.6	0.3	-
	UTC3	0.08	0.02	0.0	-
	UTC4	0.2	0.05	0.01	-
	UTC5	0.2	0.04	0.01	-
	UTC6	0.6	0.09	0.02	-
	UTC7	0.2	0.01	0.0	-
	UTC8	0.6	0.01	0.0	-
	UTC9	0.3	0.0	0.0	-
	UTC10	2.6	0.0	0.0	-

Notes:
Predicted baseflow reduction less than 0.01 cubic foot per second (cfs) reported as 0.0 cfs
cfs = cubic foot per second

Source: BGC 2019o, Table 3



Sources: PLP 2019-RFI153; BGC 2019d

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0.5 0 0.5 1
Miles

Drawdown
High: 1618 ft
Low: 3 ft

Mounding
High: 398 ft
Low: 3 ft

Major Basin Watershed Divide
Divide Absent
Divide Present

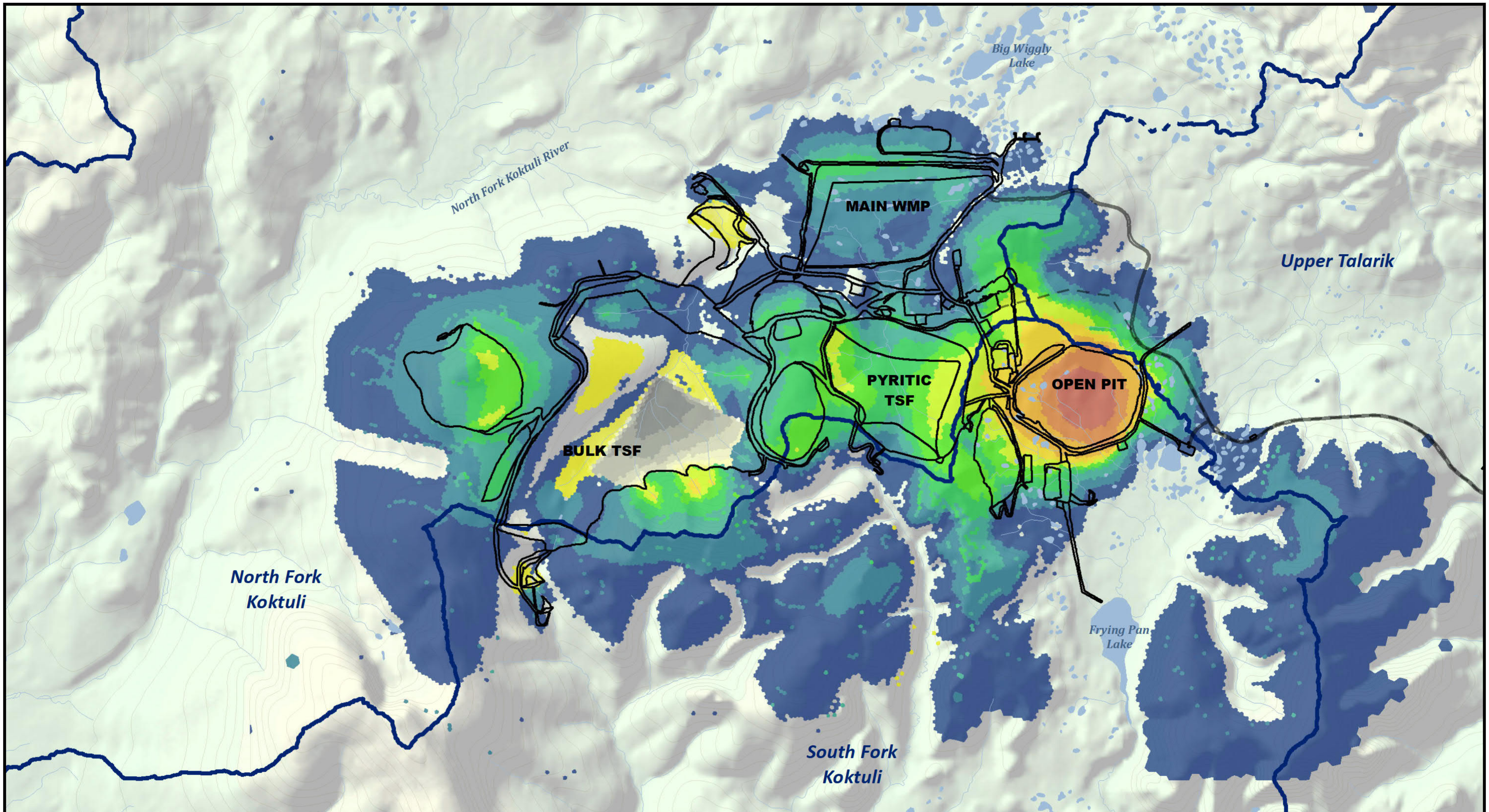
Alternative 1a
Natural Gas Pipeline
Mine Site

Other Features
River/Stream
Lake/Pond
100' Contour (Existing)

SCENARIO S8 (LOW K) END-OF-MINING SIMULATED DRAWDOWN AND MOUNDING: WATER TABLE

PEBBLE PROJECT EIS

FIGURE K4.17-1



Sources: PLP 2019-RFI153; BGC 2019d

US Army Corps of Engineers

0.5 0 0.5 1

Miles

Drawdown
High: 1618 ft
Low: 3 ft

Mounding
High: 398 ft
Low: 3 ft

Major Basin Watershed Divide
Divide Absent
Divide Present

Alternative 1a
Natural Gas Pipeline
Mine Site

Other Features
River/Stream
Lake/Pond
100' Contour (Existing)

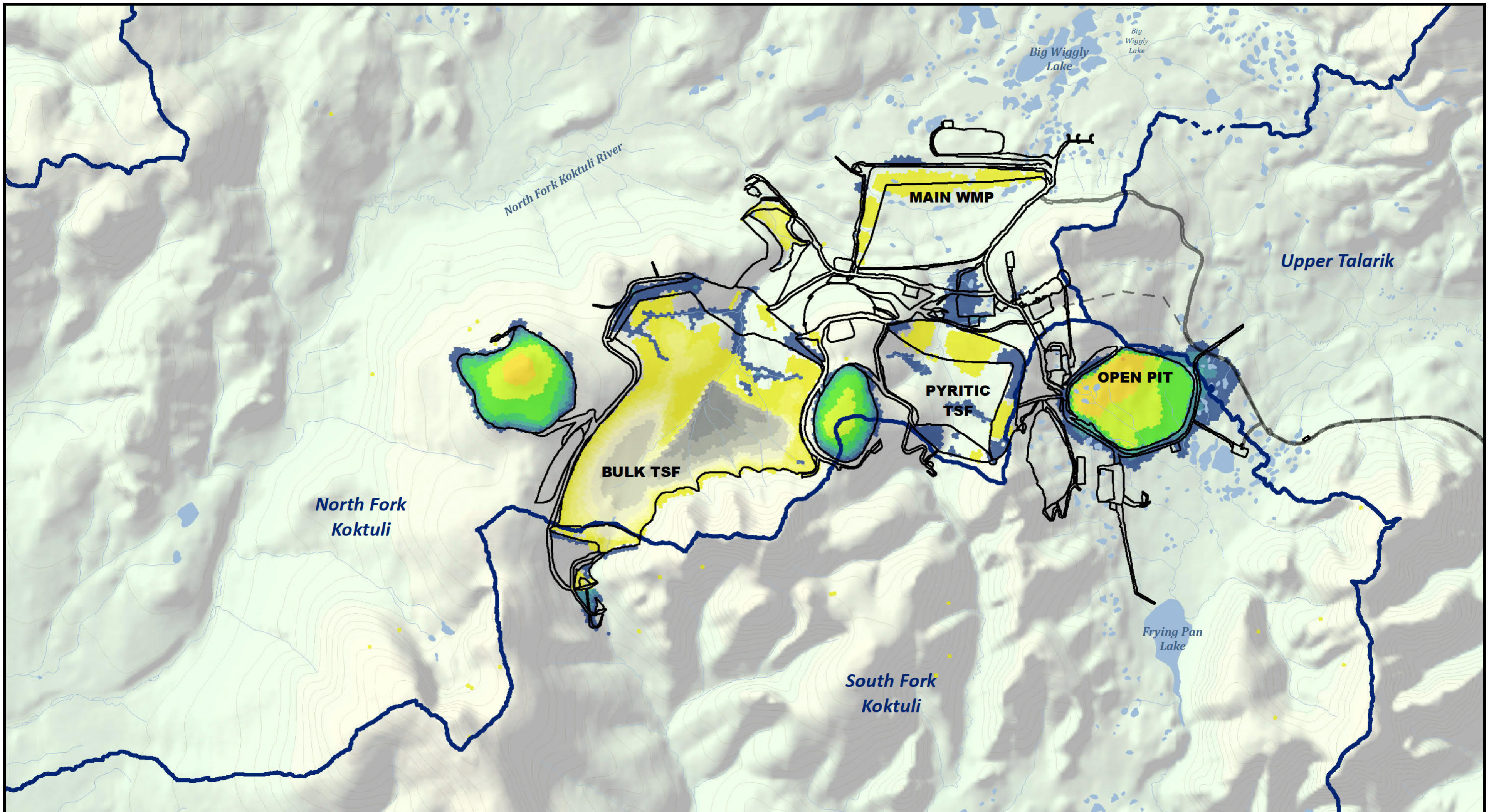
SCENARIO S7 (HIGH K) END-OF-MINING SIMULATED DRAWDOWN AND MOUNDING: WATER TABLE

Similar to operations, the post-closure model results for the low K and high K scenarios show smaller and larger, respectively, zones of influence around the lake compared to the base-case model (Figure K4.17-3 and Figure K4.17-4). The zone of influence surrounding the pit lake is projected to extend more than 1.5 miles northwest of the pit lake under the high K scenario. Other projected changes to the water table associated with the rock quarries and the bulk TSF are also shown. For these simulations, the main WMP and the pyritic TSF and their respective underdrain systems were assumed to have been removed.

To test the modeled pit capture zone against field data, a comparison was conducted of the projected hydraulic head at the bottom of the pit lake (which would be equal to the elevation of the lake surface, assuming static, fresh, and isothermal water in the lake) and hydraulic head data collected at deep monitoring well WB-1, approximately 3,000 feet east of the pit. The land surface elevation at the well site is approximately 935 feet amsl. Water levels measured at multiple depths up to 4,000 feet deep between 2006 and 2012 were almost all less than 25 feet below land surface (Schlumberger 2015a: Appendix 8.1K), meaning that the hydraulic head (at most depths, see below) was at an elevation of more than 910 feet amsl, compared to the not-to-exceed lake elevation (head) of 900 feet. This means that the deeper groundwater levels had a higher head than the lake would have, and that deep groundwater below the pit bottom would flow upwards toward the bottom of the lake. The exception to these measurements is that three water-level measuring locations between depths of 3,800 and 4,000 feet exhibited heads between 25 and 35.7 feet below ground surface between 2009 and 2012. Largely because well WB-1 was drilled 3,000 feet from the pit location, these deeper values do not change the conclusion that the not-to-exceed lake elevation of 900 feet amsl would achieve hydraulic containment of the pit lake capture zone, and groundwater beneath the lake would flow towards the lake.

The hydraulic head data described above can also be used to evaluate uncertainty of the groundwater model. Figure 4.17-6 illustrates that the modeled hydraulic head at an elevation of approximately -3,000 feet amsl near the WB-1 well location during post-closure is expected to be more than 100 feet higher than measured heads at that location. As a result of the uncertainty related to the differences between modeled and measured values of hydraulic head, additional monitoring regarding the actual groundwater conditions (values of hydraulic head) at depth below the pit or near the pit lake are included in Table 5-2 and Appendix M1.0, Mitigation Assessment, to confirm or revise model findings and water pumping plans as needed; and to confirm that hydraulic containment would be maintained.

An important aspect of planning for long-term pumping of water from the pit lake to maintain hydraulic containment is to plan for possible upset conditions that could interfere with planned pumping. The model was used to evaluate various sensitivity analysis scenarios under which the pit lake may be more likely to lose hydraulic containment should the lake level rise (BGC 2019i). The most sensitive scenario was S15, in which faults were simulated as high hydraulic conductivity zones. This simulation (Figure K4.17-5) showed that even under these conditions, the lake would not lose hydraulic containment until the lake level rose to approximately 950 feet amsl, approximately 50 feet above the not-to-exceed level of 900 feet amsl.



Sources: PLP 2019-RFI153; BGC 2019d

US Army Corps of Engineers

0.5 0 0.5 1

Miles

Drawdown
High: 1618 ft
Low: 3 ft

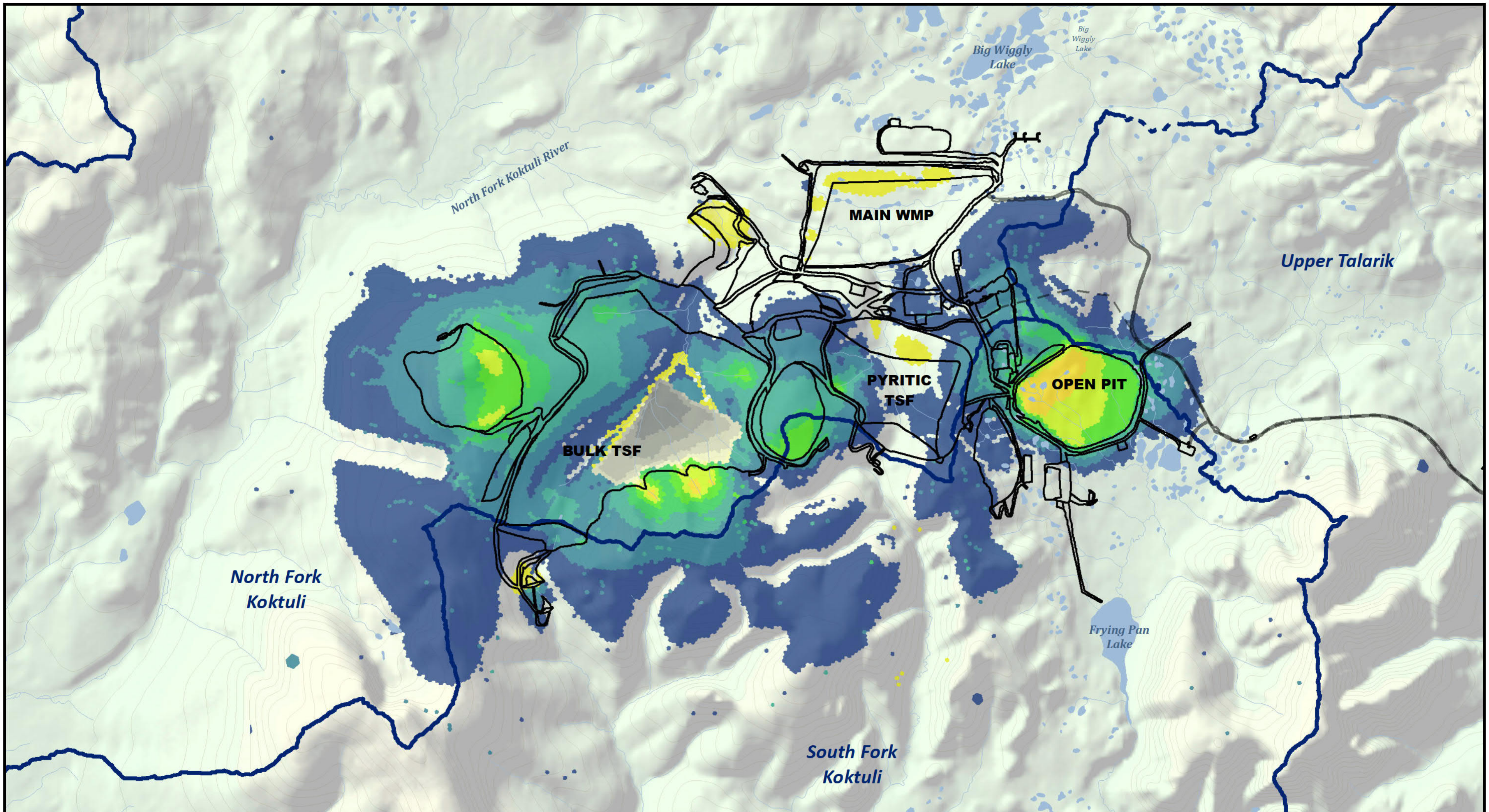
Mounding
High: 398 ft
Low: 3 ft

Major Basin Watershed Divide
Divide Absent
Divide Present

Alternative 1a
Natural Gas Pipeline
Mine Site

Other Features
River/Stream
Lake/Pond
100' Contour (Existing)

SCENARIO S8 (LOW K) POST-CLOSURE SIMULATED DRAWDOWN AND MOUNDING: WATER TABLE



Sources: PLP 2019-RFI153; BGC 2019d

US Army Corps of Engineers

0.5 0 0.5 1
Miles

Drawdown
High: 1618 ft
Low: 3 ft

Mounding
High: 398 ft
Low: 3 ft

Major Basin Watershed Divide
Divide Absent
Divide Present

Alternative 1a
Natural Gas Pipeline
Mine Site

Other Features
River/Stream
Lake/Pond
100' Contour (Existing)

SCENARIO S7 (HIGH K) POST-CLOSURE SIMULATED DRAWDOWN AND MOUNDING: WATER TABLE

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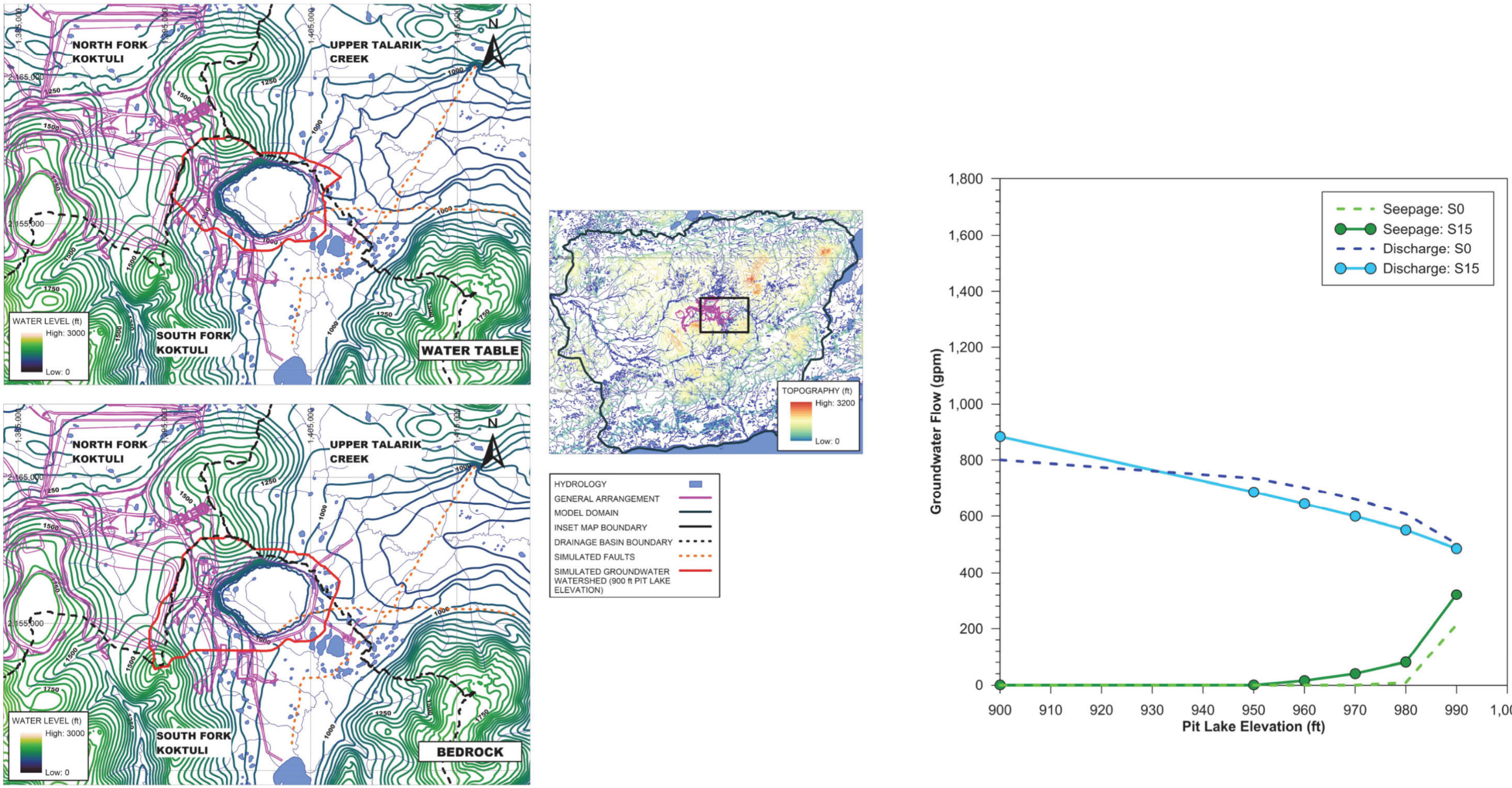
FIGURE K4.17-4



Source: BGC 2019i

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SIMULATED GROUNDWATER SEEPAGE (OUTFLOW) AND GROUNDWATER DISCHARGE (INFLOW) FROM/TO THE PIT LAKE UNDER VARIOUS PIT LAKE ELEVATION ASSUMPTIONS FOR THE S15 (HIGH K FAULT) SCENARIO

PEBBLE PROJECT EIS

FIGURE K4.17-5

Section 4.17, Groundwater Hydrology, explains that it would take approximately 1 year for the pit lake to rise 50 feet in the event of complete failure of pumping of water from the pit lake for any reason, and assuming a similar rate of lake-level rise as projected under late-closure conditions. Failure of simple mechanical systems such as pumps, valves, and pipes could likely be repaired within that timeframe.

Other conditions that could prevent planned operation of the water treatment plant (WTP) facilities without major modification include:

- Underestimation of net precipitation as a result of climate irregularities, multiple back-to-back flood events, or climate change
- Increased groundwater inflow to the pit lake through fractures or faults compared to currently predicted amounts
- Increases in levels of salinity or other parameters in the water of the pit lake that require different water treatment methodologies than planned or implemented

These conditions would typically be foreseeable, and develop with long lead times; therefore, any necessary upgrades to the water treatment facilities would likely have sufficient lead time to be addressed. Monitoring of pit lake levels and water quality conducted in post-closure (PLP 2019-RFI 135) would enable predictions of these conditions and adjustments to post-closure WTP operations if necessary. Recommendations are also included in Appendix M1.0, Mitigation Assessment, for update of the groundwater model every 5 years in closure to refine predictions of lake level rise as a result of climate change or increased fracture flows.

Some low-probability events are possible during post-closure. It is important to consider these because according to probability theory, events considered low probability in any given year become more likely under long-term timeframes. Such events could include:

- Failure of a portion of the pit wall could result in destratification and mixing of the pit lake water, and a need to treat water with higher concentrations of dissolved constituents than planned.
- Occurrence of a major earthquake that could alter groundwater flow patterns and change the conditions under which hydraulic containment would be maintained. One potential response to such a condition would be to pump and treat more water from the lake, resulting in lower lake levels to re-establish hydraulic containment.
- Sudden failure of one or more major components of the water treatment plant, possibly related to the remote location, extreme weather, deterioration, malfunction, human error, or unforeseen conditions.

Fully addressing these conditions within a 1-year timeframe could be challenging, because of the expected need to design, obtain regulatory approval, and procure and construct the needed infrastructure, possibly under difficult seasonal conditions. Therefore, recommendations are included in Appendix M1.0, Mitigation Assessment, for consideration of the above types of failure scenarios during planning, design, and approval of WTP processes.

K4.17.3 Seepage from Tailings Storage Facilities and Main Water Management Pond

Bulk TSF—Groundwater model sensitivity analyses were performed under a variety of conditions to evaluate potential escapement of groundwater from the bulk TSF (BGC 2019a, d).

Scenarios modeled were:

- S1: Unconsolidated sediments K increased by factor of 10
- S2: Unconsolidated sediments K decreased by factor of 10
- S7: Bedrock K increased by factor of 10
- S8: Bedrock K decreased by factor of 10
- S15: Faults simulated as high K features
- S16: Faults simulated as low K features
- S17: Bulk TSF tailings K increased by a factor of 10
- S18: Bulk TSF tailings K decreased by a factor of 10
- S20: Bulk TSF tailings saturated with water level ranging from 1,700 feet to 1,720 feet
- S25: Bulk TSF tailings groundwater recharge rate increased to 15 inches per year (in/yr)
- S26: Bulk TSF coarse tailings saturated
- S27: Coarse tailings lateral extent increased to 3,600 feet
- S28: Coarse tailings lateral extent decreased to 1,000 feet
- S29: Coarse tailings extent increased to 3,600 feet with Bulk TSF coarse tailings saturated
- S30: Coarse tailings extent decreased to 1,000 feet with Bulk TSF coarse tailings saturated

Particle tracking simulations were conducted for each end-of-mining sensitivity simulation. Particle tracking results showed that under all scenarios except one (Scenario S7), essentially all particles released report to a seepage collection pond (SCP). Scenario S7 exhibited flow bypassing the SCPs (Figure K4.17-6) as a result of groundwater flow bypassing perimeter ditches and underdrains through deeper bedrock flow paths. Scenario S7 was performed using a high hydraulic conductivity (K) scenario for bedrock, and the resulting simulation showed that baseline groundwater levels were poorly represented; the quality of the calibration had deteriorated; and that flow of particles past both SCPs is considered improbable (BGC 2019d). Localized areas of elevated bedrock K are likely, and further site characterization, hydraulic testing, and model simulations to support future stages of design in the vicinity of the bulk TSF have been added as suggested mitigation to Appendix M1.0, Mitigation Assessment.

The potential influence of a mapped fault (see Figure 3.17-1) along the western margin of the bulk TSF was investigated (BGC 2019l). As summarized by BGC (2019l):

> Available hydrogeologic data (e.g., hydraulic conductivity and groundwater levels) suggest that the fault does not have a controlling effect on groundwater flow. Results of baseline simulations further indicate that bedrock hydraulic properties in the vicinity of the fault may be similar to the surrounding bedrock. Nevertheless, results of predictive simulations for end-of-mining and post-closure conditions indicate that a fault along the western margin of the Bulk TSF could influence seepage pathways from the facility if the K of the faulted bedrock is sufficiently high.

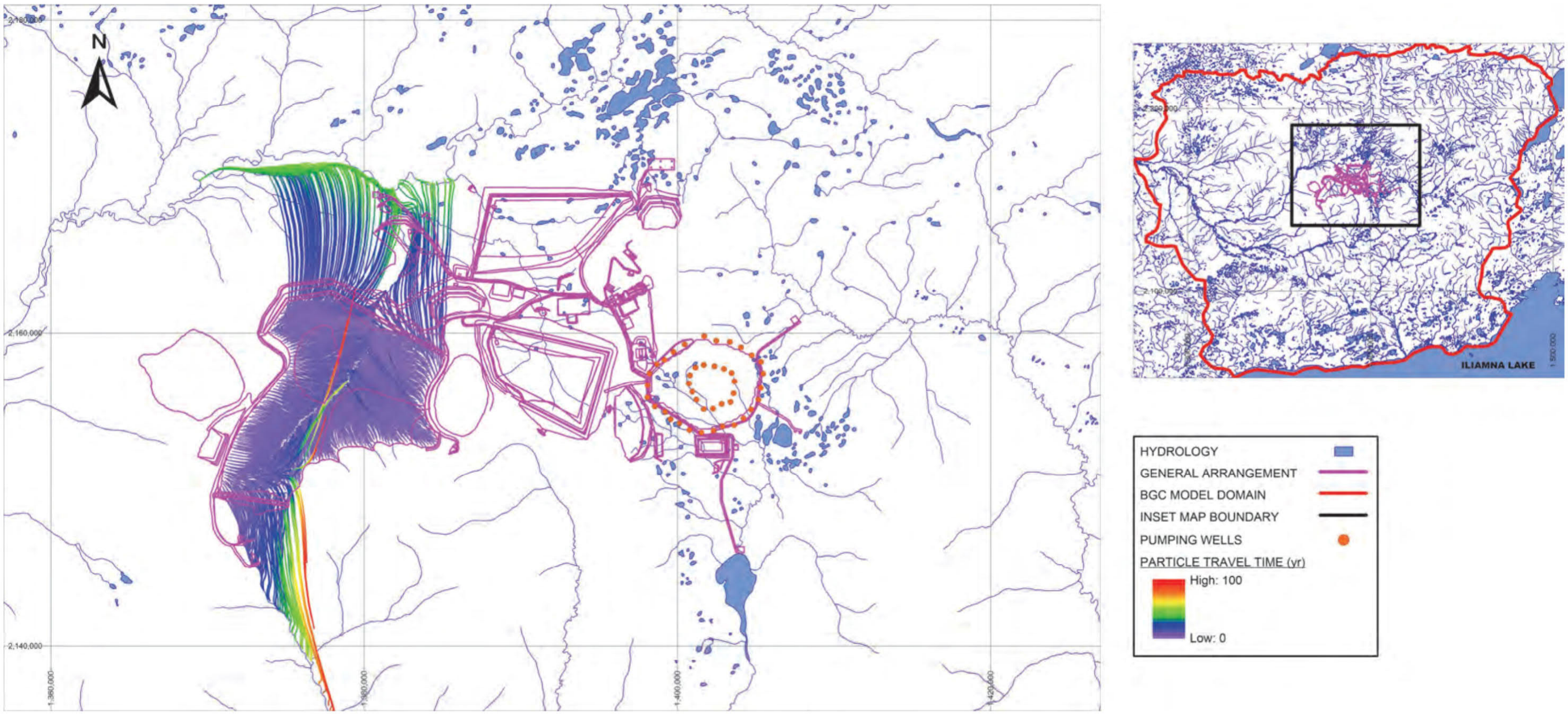
The location of the fault and a particle tracking analysis are shown in Figure K4.17-7. Other simulations with less-permeable fault assumptions resulted in no loss of containment of groundwater flow. For the simulation shown in Figure K4.17-7, the simulated bulk TSF fault is predicted to result in a depression in groundwater levels that is not evident from available groundwater level observations. Also, the magnitudes of computed residuals (i.e., difference between observed and simulated values) are greater than for the base case, indicating this scenario results in a poorer representation of the hydrogeologic system. For example, the largest residuals are predicted for the scenario shown in Figure K4.17-7, where groundwater levels are underpredicted by up to 400 feet, suggesting that the simulation may be a poor representation of groundwater flow in the area of the fault.

Further hydrogeologic data collection at future stages of project design to characterize the hydraulic properties of the bedrock in the vicinity of this interpreted fault to allow for design of appropriate mitigation (e.g., grouting, partial liner placed over the fault trace, seepage collection wells) is recommended. This mitigation measure is included in Appendix M1.0, Mitigation Assessment, and has been adopted by PLP as shown in Table 5-2.

Main WMP—The groundwater model results for the main WMP indicate that groundwater levels would be lowered by several tens of feet in the area surrounding the facility due to the liner blocking natural recharge from reaching groundwater, and the effects of the underdrain and water collection and pumping system on shallow groundwater levels (BGC 2019c). Like the pyritic TSF, removing the main WMP after closure would allow natural recharge to be re-established and groundwater elevations to recover during post-closure.

The model was also used to predict the fate of liner leakage. Total leakage through the liners beneath the main WMP and the pyritic TSF was assumed to be 16 gallons per minute (gpm), and leakage through the liner beneath the open pit WMP was assumed to be 1.6 gpm because it is smaller (BGC 2019a), Contact water that leaks to shallow groundwater would be captured by the underdrain, sump, pumping, and treatment system, creating an area of hydraulic containment surrounding the main WMP.

Implementation of the monitoring plan (PLP 2019g) and associated groundwater monitoring would be used to confirm hydraulic containment of contact water from the main WMP (see Chapter 5, Mitigation). Prior to decommissioning of the main WMP seepage collection system, the quality of water collected by the system would be determined to meet appropriate water quality criteria, and the monitoring/pumpback wells would continue to operate as long as required to intercept potential leakage (Knight Piésold 2018b, n).



Source: BGC 2019d

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PARTICLE TRACKING RESULTS: SENSITIVITY SCENARIO S7 (HIGH K BEDROCK)

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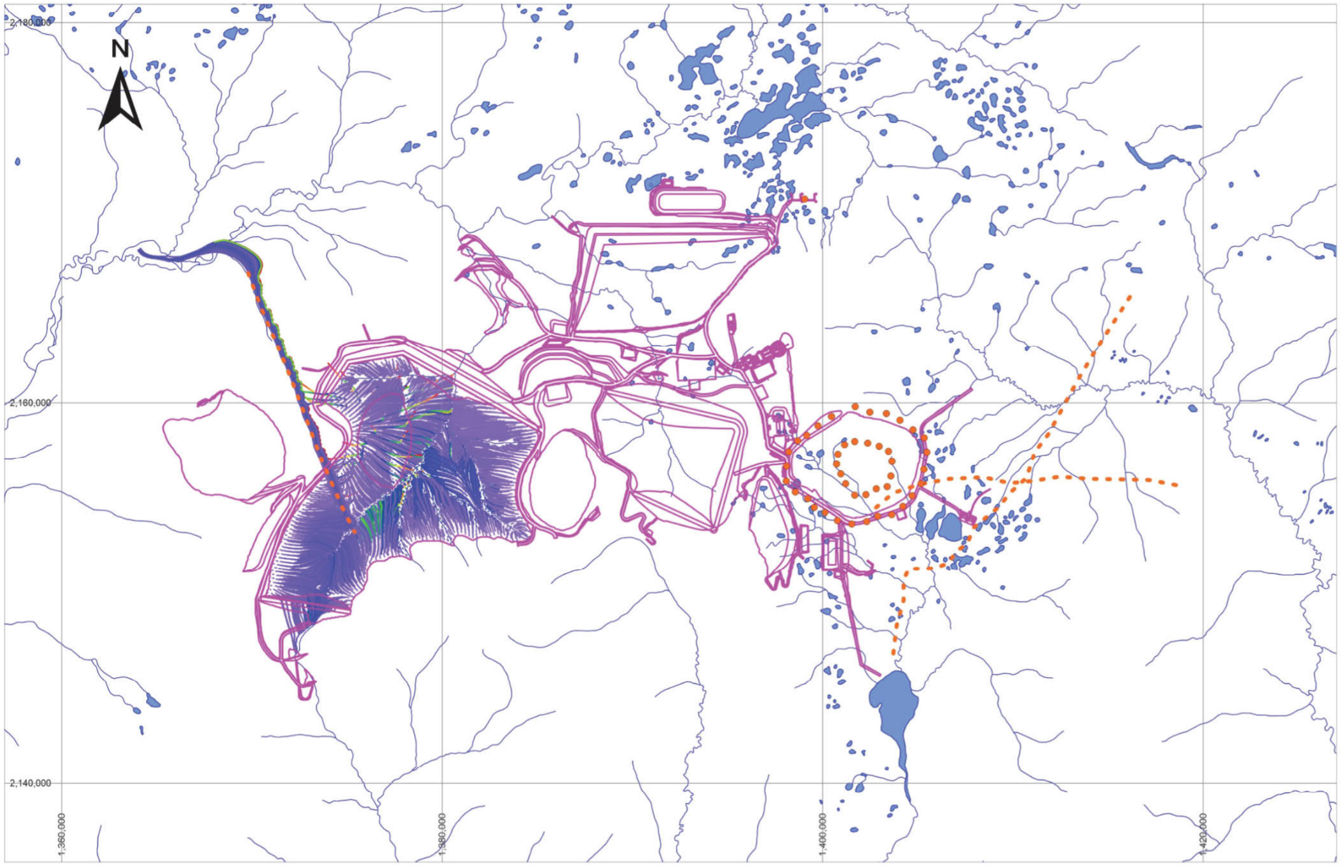
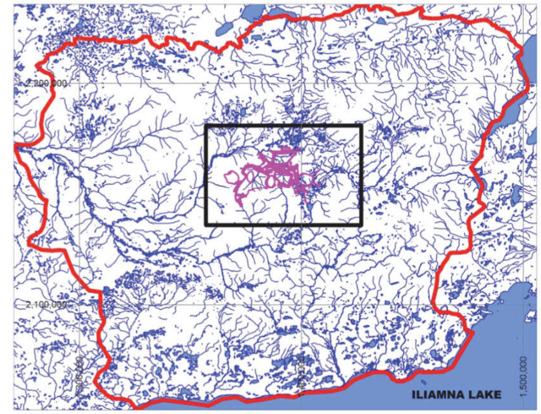
FIGURE K4.17-6





HYDROLOGY
GENERAL ARRANGEMENT
BGC MODEL DOMAIN
INSET MAP BOUNDARY
PUMPING WELLS
SIMULATED FAULTS
PARTICLE TRAVEL TIME (yr)
High: 100
Low: 0

Source: BGC 2019l

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END-OF-MINING PARTICLE TRACKING RESULTS FOR HIGH K FAULT NEAR BULK TSF SCENARIO