Memorandum

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Subject:	Water Balance and Water Quality Modelling related to the Jay Project- UPDATED	

1. INTRODUCTION

The development of Jay Project will extend the life of the Ekati Diamond Mine. One management option being considered is for Fine Processed Kimberlite (FPK) produced during the mining of the Jay Pipe to be discharged into the exhausted Panda and Koala open pits and underground workings. This has the potential to impact water quality in the Long Lake Containment Facility (LLCF) and downstream lakes by:

- Extending the lifetime of mining operations at the Ekati Diamond Mine.
- Requiring reclaim water to be pumped from the LLCF while Panda and Koala pit lakes are being filled with FPK.
- Discharging excess supernatant water from Panda and Koala pit lakes into Cell D of the LLCF.

An update to existing water balance and water quality models of the LLCF and downstream lakes and Panda and Koala pit lakes (Rescan 2012 and 2013) was completed to assess two aspects of the Jay Project that could impact water quality at the Ekati Diamond Mine:

1. The infilling of Panda and Koala pits with FPK from the Jay Pipe; and
2. The effect of development of the Jay Project on water quality in the LLCF and lakes downstream of the LLCF (to Slipper Lake).

In this updated version, the Jay Project is modelled to 2030 (10 years) instead of 2037.

2. MODELLING APPROACH

A water balance and water quality model of the LLCF and the chain of lakes lying between the LLCF and Lac de Gras has been developed, tested and used for predicting future water quality at the Ekati Diamond Mine. Full details of the model are provided in Rescan (2012). Ongoing (unpublished) modelling work considers the evolution of water quality in the LLCF and downstream during the closure period when discharge of mine water to the LLCF ceases.

Models that consider the infilling of exhausted pits at the Ekati Diamond Mine during closure have also been developed (Rescan 2013). The modelling work undertaken in Rescan (2013) included mass balance modelling approaches and more complex multi-layer models representing the formation of stratification in the infilling pit lakes at closure.

The model developed to incorporate the Jay Project builds on the work undertaken in Rescan (2012) and Rescan (2013) and links a mass balance model of Panda and Koala pits to the water balance and water quality model of the LLCF and downstream lakes. In this way predictions of the timing of infilling and water quality in Panda and Koala pits can be made, linking the impact of discharging FPK to Panda and Koala pits to predictions of water quality and water quantity in the LLCF.

The model does not consider detailed multi-layered modelling of Panda or Koala pit lakes. During infilling of the pits with FPK, layering is not expected to form because the deposition of FPK solids would be expected to breakdown any stratification forming in free water above the solids. This is an assumption based on calculations of energy imparted by water entering pit lakes (Rescan 2013).

3. MODEL SET-UP AND ASSUMPTIONS

3.1 Overview and Timescales

The model considers the management option whereby FPK slurry produced during the mining of the Jay Project will be discharged into Panda and Koala pits and underground workings. The general timescale to be considered is summarized in Table 3.1-1. The model Base Case assumes that solids will be discharged equally (50:50) into each of the Koala and Panda pits.

Table 3.1-1. Development Time Scale to be Considered in the Koala Watershed Model

Dates	Description of Model Inputs
To end 2019	Modelled in Rescan (2012). This includes accounting for future development of Pigeon Pit and the infilling of Beartooth Pit with FPK and underground water.
Begin 2020	No Process Plant Discharge (PPD) or FPK slurry to the LLCF; instead PPD and FPK to Panda and Koala pits. Reclaim water to be drawn from LLCF until water level in Panda and Koala and/or Beartooth pits reaches operating level (if ever).
2030	End of discharge of PPD to Panda and Koala pits.
Once Panda and Koala pit reaches operating level	Reclaim water drawn from Panda and Koala pit lakes. Excess water to LLCF.
2030	End of operations.
2030 - 2130	Closure Period.

The modelling work focusses on the operational period at the Ekati Diamond Mine, i.e., until 2030 with development of the Jay Pipe; however, the model runs were continued for up to 100 years after the end of operations to provide input into a larger scale modelling study of Lac de Gras. Closure modelling for the exhausted pits at the Ekati Diamond Mine has been reported in detail in Rescan (2013). Closure modelling work for the LLCF has not been reported in detail and is part of an ongoing modelling study.

The water balance and water quality model for the LLCF and downstream lakes contains components that simulate:

- Mine water outflows to LLCF during operations including FPK supernatant, underground water and sump water;
- LLCF, including sub-models of Cells C, D and E;
- Lakes lying between LLCF and Lac de Gras;
- Infilling of Beartooth Pit with mine water and FPK; and
- Pit lake inflows during closure.

Details of the model inputs and modelling approaches of this complex model are described in detail in Rescan (2012). An overview of closure modelling for the LLCF is provided in Section 3.6.

The Panda and Koala pits will be filled through a combination of the following:

- FPK solids and supernatant;
- Natural runoff entering the pits from adjacent watershed areas;
- Groundwater inflows; and
- Precipitation on pit lake surface as the pit lakes fill.

Key losses from the pits will be:

- Water pumped from the pit lake for reclaim or to LLCF to create additional storage for solids; and
- Evaporation from pit lake surface.

Modelling of the infilling of Panda and Koala pits with water are described in Rescan (2013). However, as this memo considers all open pits at the Ekati Diamond Mine, details of model inputs related to Panda and Koala pits are presented in Sections 3.2 to 3.7.

Flows from the LLCF model to the Panda and Koala pits models are generally one way, i.e., from the LLCF to the open pits. It is assumed that FPK (solids and supernatant water) will not be allowed to spill from the pit lake. An appropriate freeboard between the FPK water level and spill level will be calculated based on the volume of surface water runoff able to enter the pit lake during an extreme rainfall event. If the water level approaches the freeboard to the spill level, the assumption is that water will be pumped to the LLCF or to the Process Plant in lieu of reclaim water from the LLCF.

3.2 Key Physical Data for Panda and Koala Pits

Open pit mining at Panda and Koala pits began in 1999, and was completed in 2003 at Panda Pit and in 2005 in Koala Pit. Underground mining was completed in Panda Underground between 2005 and 2010 and mining was initiated in Koala Underground in 2004 and is ongoing. The general relationships between the open pit and underground workings at Panda and Koala are provided in Figure 3.2-1. The underground workings are linked at depth through tunnels created to allow access to underground operations.

Pit volume/level and surface area/level curves were developed for Panda and Koala/Koala North pits based on analysis of available GIS data for the open pits. These curves were extrapolated to depth into the underground workings based on estimated final depths of the workings and underground volumes. General physical details for Panda and Koala pits and underground workings are provided in Table 3.2-1, with the storage/elevation curves summarized in Table 3.2-2.

Table 3.2-1. Key Physical Data for Panda and Koala/Koala North Pit Lakes

Pit	Max Expected Diameter (m)	Max Open Pit Surface Area (m^2)	Expected Volume Open Pit to Spill Point (m^3)	Estimated Area of Pit Walls above the Full Pit Lake (m^2)
Koala/Koala North				
Koala Pit	700	380,000	38,900,000 [a]	9,800
Koala Underground	-	-	5,300,000	-
Koala North	270	50,000	1,450,000	2,000
Koala North Underground	-	-	650,000	-
Panda				
Panda Pit	650	328,000	39,310,000 [a]	8,000
Panda Underground	-	-	1,800,000	-

[a] *Total volume including underground workings.*

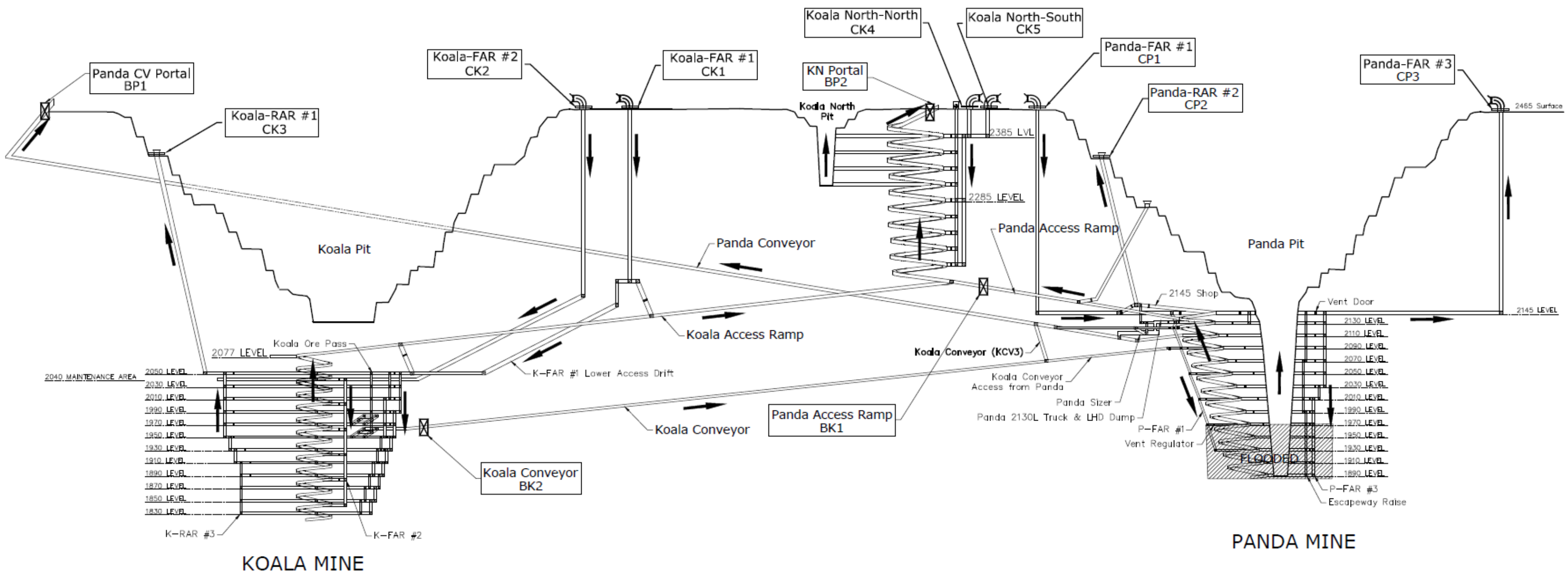


Figure 3.2-1. Schematic of Layout of Panda and Koala pits and Underground Workings

Table 3.2-2. Storage/Elevation/Area Curves for Panda and Koala Pit Lakes

Panda			Koala		
Elevation (masl)	Pit Lake Area (m²)	Volume (m³)	Elevation (masl)	Pit Lake Area (m²)	Volume (m³)
170	12,873	1,880,565 [a]			
180	16,502	2,023,567			
190	20,577	2,209,280			
200	26,933	2,445,914			
210	33,975	2,739,625	210	2,248	5,302,514 [b]
220	37,776	3,100,566	220	8,351	5,365,461
230	41,235	3,495,322	230	16,311	5,488,346
240	52,988	3,939,300	240	30,263	5,694,607
250	64,164	4,530,309	250	38,084	6,048,163
260	69,707	5,200,127	260	43,748	6,458,169
270	79,350	5,928,555	270	54,680	6,928,563
280	91,203	6,800,717	280	60,353	7,512,212
290	96,523	7,737,811	290	64,271	8,134,665
300	112,926	8,747,894	300	75,923	8,816,837
310	121,314	9,929,216	310	90,277	9,667,554
320	127,445	11,170,037	320	102,905	10,630,999
330	143,927	12,487,504	330	120,535	11,727,547
340	152,559	13,985,134	340	132,399	13,008,401
350	159,611	15,542,629	350	140,090	14,371,053
360	178,075	17,185,014	360	153,797	15,819,321
370	190,757	19,057,348	370	165,370	17,433,868
380	199,250	21,003,937	380	174,175	19,128,216
390	217,653	23,047,972	390	189,491	20,916,527
400	228,306	25,289,925	400	205,750	22,931,860
410	239,910	27,625,569	410	230,160	25,096,785
420	260,155	30,085,421	420	258,331	27,529,084
430	278,037	32,800,923	430	289,882	30,313,235
440	294,070	35,653,092	440	331,024	33,401,920
450	316,763	38,695,581	450	432,525	36,936,886
459	345,268	41,671,243	454	522,378	38,859,102

masl- meters above sea level.
[a] *Includes 1,800,000 m³ for underground workings below this level.*
[b] *Includes 5,300,000 m³ for underground workings below this level.*

The current Interim Closure Research Plan (ICRP) for Koala and Panda pits envisages that the pits and underground operations will be flooded to produce a pit lake (BHP Billiton 2011). Because of the connections between underground workings in Panda and Koala pits the water levels within Panda and Koala pit lakes would be expected to be the same during infilling and post-filling with a hydrostatic balance between the pit lakes maintained by the open tunnels. However, if the tunnels are filled with FPK, it is unclear whether a hydraulic connection will continue to exist between the pit lakes, either through the FPK or through fractures in the rock between the two open pits. The Base Case model assumes there is a connection.

The natural catchment areas providing runoff into Panda and Koala pits are shown in Figure 3.2-2, with information summarized in Table 3.2-3. Each pit is surrounded by land that slopes towards the pit lakes, including a Waste Rock Storage Areas (WRSA).

Table 3.2-3. Hydrological Connections for Panda and Koala/Koala North Pit Lakes

Pit	Inflowing Watershed Area, during operations (m^2)	Inflowing Pit	Outflows to	Full Pit Lake Spill Elevation (masl)
Panda				
Pit Area	328,000	None	Koala/Koala North pit	453.4
Natural Catchment Area	471,000			
WRSA	220,000			
Koala/Koala North				
Pit Area	508,000	Panda pit	Kodiak Lake	453.4
Natural Catchment Area	943,000			
WRSA	660,000			

masl- meters above sea level

3.3 FPK Solids and Slurry

Observed FPK and reclaim discharge data are summarized in Table 3.3-1 and were used to extrapolate to future FPK and reclaim flow rates.

Based on data presented in Table 3.3-1, around 4.3 Mt of kimberlite ore has been processed annually. Of this, between 40% and 70% of the ore is discharged to the LLCF as FPK (< 0.5 mm), the remaining (coarser) being deposited at WRSAs. The Ekati Diamond Mine plan considered in Rescan (2012) for water quality predictions to the end of mine life, suggests that the tonnage of ore processed will increase to around 4.9 Mt from 2010 to the end of mine life. However, in the last four years (2010 to 2013) the observed tonnages were slightly lower than this estimate at an average of 4.5 Mt.

The observed data suggest that the FPK slurry is around 17% solids by volume. Based on drilling investigation data completed by EBA in 2006 an average dry density value of 1.35 t/m^3 for consolidated LLCF tailings can be obtained. Using the average dry density and an average

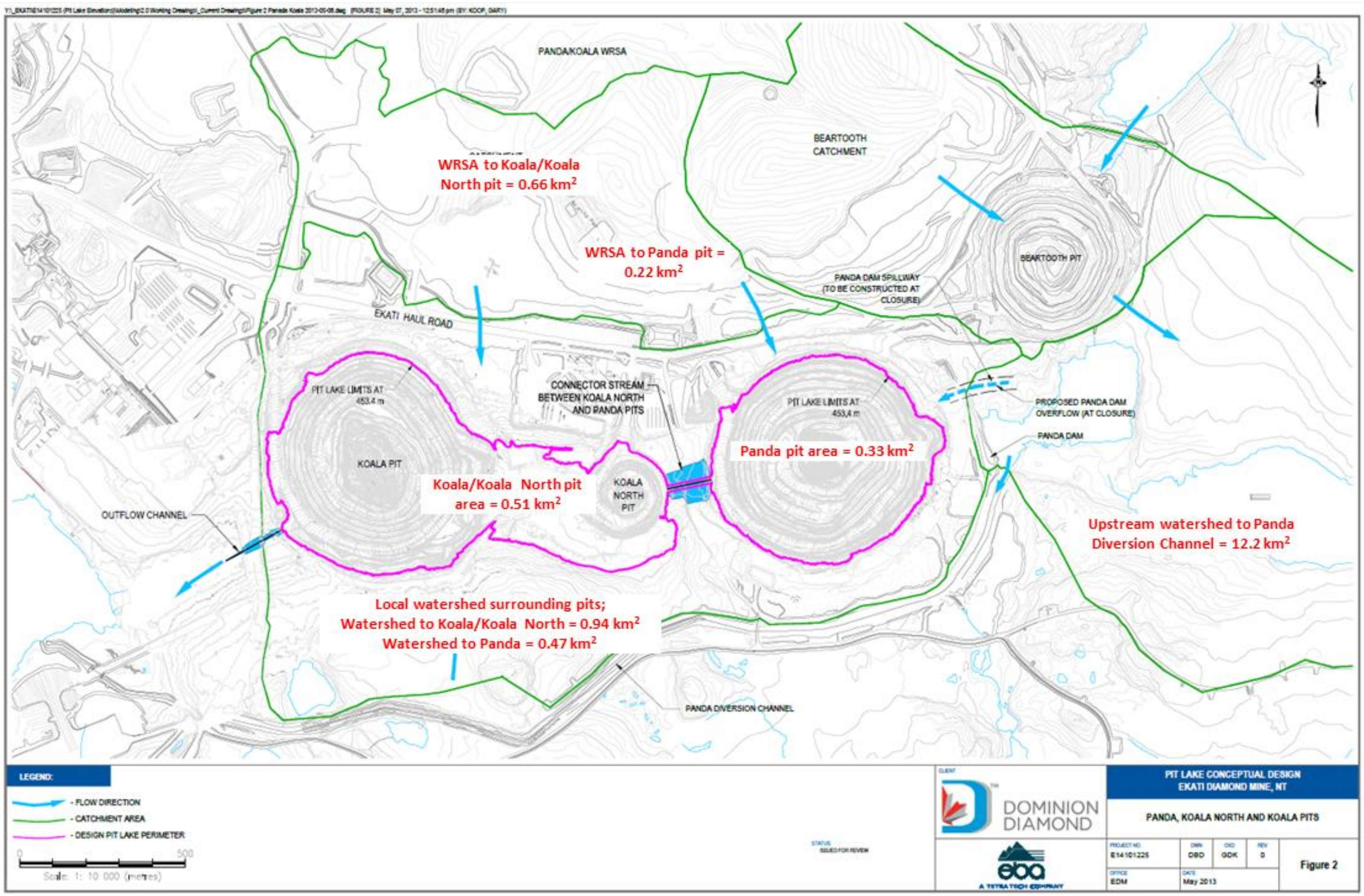


Figure 3.2-2. Catchments flowing into Panda and Koala/Koala North pits

kimberlite solids density of 2.72 t/m3 a consolidated tailings solids by volume of around 50% was calculated.

Thus the pit infilling models were run assuming the following:

- 6.0 Mm3 of FPK is sent to Koala and Panda pits annually, based on the long-term average for the period 2000 to 2013;
- On discharge the FPK is 16.9% solids by volume;
- On consolidation the FPK is 50% solids by volume; and
- The annual average reclaim volume is 4.6 Mm^3/year, based on observed data. The model assumes that reclaim is pumped from the LLCF, until the time that water levels in Koala and Panda pits reach to within a calculated freeboard of the spill level. At that point reclaim will be pumped from Koala and Panda pits.

Table 3.3-1. Observed FPK and Reclaim Discharge Data

Year	Ore Processed (tonnes)	Coarse kimberlite rejects (tonnes)	[a]% Ore is FPK to LLCF or Beartooth Pit	Total Solids To LLCF or Beartooth Pit (m^3)	Process Plant FPK Discharge (m^3)	% solids by volume in FPK Slurry	Reclaim Water (m^3)	Reclaim as % of water by volume in FPK Slurry
1999 [b]	1,861,576	494,511	73	506,320	-	-	2,559,278	-
2000	3,013,489	824,182	73	817,259	-	-	4,392,644	-
2001	3,310,930	879,832	73	900,407	-	-	4,581,661	-
2002	3,794,841	1,224,990	68	951,797	-	-	4,389,158	-
2003	4,447,795	1,589,200	64	1,058,739	-	-	4,580,418	-
2004	4,519,871	2,245,853	50	842,229	-	-	5,158,936	-
2005	4,430,414	2,251,052	49	807,171	-	-	5,139,299	-
2006	4,497,852	2,545,347	43	1,171,382	6,312,800	18.6	4,877,592	95
2007	4,331,604	2,362,071	45	1,181,980	6,232,998	19.0	4,297,647	85
2008	4,342,047	2,572,637	41	1,126,112	5,873,065	19.2	4,163,717	88
2009	5,097,630	2,962,168	42	1,328,140	6,358,323	20.9	4,663,563	93
2010	4,895,973	2,681,903	45	1,145,649	5,912,439	19.4	4,464,189	94
2011	4,599,849	2,934,767	36	853,651	5,757,734	14.8	4,424,903	90
2012	4,247,234	2,796,091	34	587,069	5,813,445	10.1	4,584,886	88
2013	4,099,622	2,630,743	36	777,075	5,975,555	13.0	4,640,771	89
[c]***Average***	***4,259,225***	***2,178,631***	***50***	***967,761***	***6,029,545***	**16.9**	***4,597,099***	**90.3**

Dashes indicate data not included in calculation.
[a]*The percentage of all kimerberlite reject that is FPK, the rest is coarse kimberlite that is sent to the waste rock dumps.*
[b]*Data up to end of June 1999 only. Data from 1999 excluded from averages.*
[c]*Average of 2000 to 2013, where data available.*

It is assumed that discharges to Koala and Panda pits will begin in 2020 and will continue until the end of the Jay Project in 2030.

It is assumed that other mine water (sump and sewage) that does not pass through the Process Plant will continue to be discharged into the LLCF.

3.4 Natural Inflows to Pit Lakes

3.4.1 Hydrological and Meteorological Data

Hydrological and meteorological parameters used in the model were based on observations at the Ekati Diamond Mine obtained as part of the Aquatic Effects Monitoring Program (AEMP) and the Air Quality Monitoring Program. The values presented below are based on a review of data up to 2009 and the values have been used in a number of recent modelling studies, including Rescan (2012 and 2013).

Return period precipitation estimates for the Ekati Diamond Mine site are summarized in Table 3.4-1.

Table 3.4-1. Ekati Diamond Mine Return Period Precipitation Estimates

Return Period	[a]Annual Precipitation (mm)
1 in 100 dry year	234
1 in 50 dry year	242
1 in 20 dry year	256
1 in 10 dry year	270
Average year	338
1 in 10 wet year	451
1 in 20 wet year	495
1 in 50 wet year	554
1 in 100 wet year	598

[a] *Return period analysis was undertaken based on on-site Koala Meteorological Station data supplemented by Environment Canada Lupin data. For the period 1994 to 2009 data from Koala Meteorological Station were used. For the period 1982 to 1994 Lupin data were used scaled by the average ratio of Koala and Lupin annual precipitation totals for the period of overlapping data (1994 to 2005). This gives a combined dataset of 28 years.*

Annual flow rates for watersheds within the study area are calculated using Equation (1) below:

$$(1)\ \textit{Total Annual Flow } (m^3/year) = \textit{Total Annual Precipitation } (m/year) \times \textit{Runoff Coefficient} \times \textit{Watershed Area } (m^2)$$

Equation (1) is applicable for all types of watersheds (e.g., natural, disturbed by mining activities, pit walls) with the value of the runoff coefficient varying for each watershed type, as per Table 3.4-2.

Monthly inflows are modelled as in Equation (2) below.

$$\text{(2) Average Monthly Inflow (m}^3\text{/month)} = \text{Total Annual Flow Volume (m}^3\text{)} \times \text{Proportion of Annual Flow Occurring in Month (/month)}$$

Annual net inflows due to precipitation on, and evaporation from, the surface of a pit lake are based on Equation (3) below:

$$\text{(3) Annual Net Flow to Lake Surface (m}^3\text{/year)} = \text{(Total Annual Precipitation (m/year) – Total Annual Evaporation (m/year))} \times \text{Lake Area (m}^2\text{)}$$

Table 3.4-2. Runoff Coefficients for Different Watersheds/Source Areas

Input	Runoff Coefficient	Comment
Natural catchments	0.5	Value based on average of all observed stream flow data.
Disturbed catchments	0.5	Insufficient data to allow different value for disturbed versus natural watersheds.
Runoff on pit walls	0.85	Tested/calibrated against observed sump flow data (Rescan 2013).
Waste Rock Storage Area (WRSA)	0.2	Tested/calibrated against observed runoff rates from Misery WRSA.
Precipitation on lake surface	1	Losses from lakes due to evaporation are accounted separately.

Constant runoff coefficients are used within the models for all years.

Monthly precipitation and evaporation totals modelled as Equation (4) below.

$$\text{(4) Average Monthly Inflow/Outflow (m}^3\text{/mon)} = \text{[(Total Annual Precipitation (m)} \times \text{Proportion of Effective Precipitation Occurring in Month (/month))} - \text{(Total Annual Evaporation (m)} \times \text{Proportion Evaporation Occurring in Month (/month)]} \times \text{Lake Area (m}^2\text{)}$$

The monthly distribution of the annual totals is provided in Table 3.4-3. An “effective” precipitation monthly distribution is also provided in Table 3.4-3, which reflects the impact of snowmelt and rainfall on the lake surface. All precipitation falling in the winter months is assumed to be snow, and snow melts during May and June. Thus, the winter monthly percentages equal zero (i.e., precipitation is stored as snow) and the high monthly percentages in May and June reflect snowmelt.

Table 3.4-3. Estimates of Ekati Monthly Precipitation, Runoff and Evaporation

	Percentage by Month (%)						
Variable	May	Jun	Jul	Aug	Sep	Oct	Total
Effective Precipitation[1]	5	55	9	21	6	4	100
Runoff[2]	7	53	23	8	8	1	100
Evaporation[3]	0	40	30	22	7	1	100

[1] *Based on Ekati data from 2004 to 2009, assuming that precipitation in winter is retained as snow and melts during freshet.*
[2] *Based on the Ekati Diamond Mine stream flow data from 1994 to 2009.*
[3] *Based on observed the Ekati Diamond Mine data from 2004 to 2007.*

3.4.2 *Groundwater*

Most of the Ekati Diamond Mine area is underlain by permafrost, which can extend to around 300 to 500 m depth. Typically pits that do not extend below the permafrost zone experience no groundwater inflows. However, some of the open pits, including Panda and Koala pits, extend to a depth that groundwater inflows can occur. Underground workings also extend below the permafrost and receive groundwater inflows.

Between 2004 and 2012 observed annual average flow rates from the Panda and Koala underground ranged between 9.6 L/s to 17.8 L/s, with an average of 13.7 L/s over these years (Rescan 2012). The Base Case groundwater inflow rate to Panda and Koala pits is based on the average of the observed data.

The groundwater flow rates described above are for an open pit and underground workings that are not filled with FPK or water. A key question is how the groundwater flow rates will vary over time as the pit lakes fill. The Base Case model run assumes that groundwater inflows tend to zero (linearly from the maximum rate to zero) as the pits fills.

The assumption above does not consider the impact of FPK solids filling the underground workings and the base of the pit. The FPK solids may 'seal' the bottom of the pit lake to some extent, limiting or preventing groundwater inflows once the FPK solids have filled to a certain depth in the pit lake. Hence, groundwater inflow rates may decrease to zero more quickly than considered in the Base Case run.

3.5 Water Quality Inputs for Panda and Koala Pits

The sources of key water quality inputs to Panda and Koala pit lakes as they fill are summarized in Table 3.5-1.

The model assumes that most water quality variables are conservative and do not decay or react over time. The exceptions to this assumption are nutrients (ammonia, nitrate, nitrite and phosphate) that are modelled using a first order decay function to account for losses as these water quality variables are cycled by organisms (i.e., taken up by living plankton and released by decaying plankton) in natural water bodies or volatilized at the lake surface (i.e., ammonia) (Table 3.5-2). The decay rates for these nutrients were calibrated in Rescan (2012) and the calibrated values are used in the current model.

During infilling the water quality model assumes that free water sitting above the FPK will be fully mixed. This is considered a reasonable assumption given the energy imparted by the inflowing FPK slurry.

Table 3.5-1. Natural Inflows and Outflows to Panda and Koala Pits

Water Quality Input	Source
Natural Runoff	AEMP water quality sampling program. Values are constant over time.
Quality of rainfall falling on pit walls	Pit wall runoff predictions in Rescan (2012). Values are constant over time Although water quality is constant over time, the area of pit wall exposed will vary over time as the pit lake fills.
Underground Water	Based on analysis of underground water data from recent samples obtained for discharge stream to Beartooth pit (i.e., prior to FPK discharge). Values are constant over time.
FPK Supernatant Water	Based on methods used for LLCF water quality modelling work and summarized in Rescan (2012). For this work historical Process Plant Discharge water quality data were analyzed and statistical distributions were developed for each water quality variable. In the model inputs for each month are varied stochastically by selecting values from the statistical distributions.
Leaching from FPK solids	The model assumes that FPK solids are submerged, so there is no oxidization of FPK. It is also assumed that there are no reactions within pore water of submerged FPK.

Table 3.5-2. Calibrated Decay Rates for Non-conservative Water Quality Variables

Variable	Calibrated Half-life for Water Quality Variable[1]
Phosphate	11.1 months
Nitrate	No decay
Nitrite	8.3 months
Ammonia	4.2 months

[1]*First Order decay equation: Concentration at Time t = Initial Concentration x* $(0.5)^{t/half\text{-}life}$

The water quality variables modelled in the current model, incorporating the Jay Project, included a similar suite of water quality variables considered in Rescan (2012) and Rescan (2013):

- Aluminum
- Ammonia-N
- Antimony
- Arsenic
- Barium
- Boron
- Cadmium
- Calcium
- Chloride
- Chromium

- Copper
- Iron
- Lead
- Manganese
- Magnesium
- Molybdenum
- Nickel
- Nitrate-N
- Nitrite-N
- Phosphate-P
- Potassium
- Selenium
- Strontium
- Sodium
- Sulphate
- Total Dissolved Solids (TDS)
- Uranium
- Vanadium
- Zinc

The selected water quality variables are those that have Water Quality Benchmarks (i.e., a concentration above which risk of adverse effects may become elevated) and those required for the calculation of density and salinity within the pit lakes (e.g., TDS). All water quality variables are considered in the LLCF and downstream lakes model, however nitrite-N and uranium are not considered in the Panda and Koala model as there are no predictions for these variables for key inputs (e.g., pit wall runoff) as outlined in Rescan (2013).

3.6 Closure Modelling for Panda and Koala Pits and the LLCF

At mine closure it is assumed that excess supernatant water in Panda and Koala pits is pumped to the LLCF, lowering water levels in the pit lakes to a level 30 m below the spill level. The pits are then refilled through pumping of natural lake water to the pit, to provide a 30 m thick freshwater cap above the remaining supernatant and freshwater solids. This is consistent with the closure approach for exhausted pits in the ICRP. It is assumed that water is discharged at 0.2 m^3/s into each of Panda and Koala pit lakes for 5 months a year (June to October), equivalent to 2.6 $Mm^3/year$ into each pit. Calculations indicate the two pits are infilled around 4 years after the beginning of pumping.

At mine closure discharge of mine solids and mine water will cease. At this time (and prior to closure) exposed FPK beaches will be reclaimed by being covered by rock (non- or low-reactivity rock) and vegetation. During closure, spillways will be created in the dykes between Cells C and D, between Cells D and E and in the ice-core dam at the downstream end of Cell E. As a result, there will be a free through-flow of water within the LLCF, with no control of discharges from the facility. The hydrology of the LLCF will return close to natural pre-development conditions. With no additional discharge of mine waters to the LLCF during closure water quality in the facility will be expected to improve through dilution with natural runoff and precipitation. There are expected to be some loadings from water expelled from the FPK pile as it freezes and through seepage of water through the FPK, but these loadings will decrease over time. The LLCF water balance and water quality model was set-up to model the closure layout in terms of hydrology and water quality loadings

3.7 Summary of inputs

A summary of key model inputs is provided in Table 3.7-1 for the modelled Base Case.

Table 3.7-1. Summary of Key Model Inputs and Assumptions

Model Parameter	Base Case Methodology
WATER BALANCE	
Surface Water Inflows	Average annual precipitation and evaporation in every year, divided into monthly totals based on Table 3.4-3. Catchment areas and runoff coefficients as per Tables 3.2-3 and 3.4-2.
Groundwater to Panda and Koala pits	Base Case inputs are based on average of recorded pumped flow data from Panda and Koala underground workings 14 L/s. Base Case assumes groundwater inflow rate tends to zero as pit lakes fill, i.e., the FPK does not seal groundwater inflows.
Storage in Panda and Koala pits	Pit lakes fill over time according to water balance and storage/elevation curve for each pit lake.
Full water level	453.4 m
Subsurface Connections between Pit Lakes	Hydraulic connectivity assumed, so water levels in pit lakes will be the same as they fill. Water transfers will take place between pit lakes to maintain same water level.
Other Mine Water	Sump and sewage produced within the mine site assumed to be discharged to LLCF.
Annual Reclaim Volume	4.6 Mm^3/year, taken from LLCF Cell D until water level in Panda and Koala pits reaches spill level minus freeboard.
LLCF inflows	Consistent with assumptions in Rescan (2012)
Flows from LLCF to downstream lakes	During operations outflows are assumed to be pumped from Cell E to Leslie Lake with monthly distribution consistent with that during operations. At closure assumed that spillway is placed in ice-core dam and there is free flow from LLCF to Leslie Lake.
Inputs to pits during closure	Once FPK ceases to be pumped to pits, water levels in the pits will be lowered to a level 30 m below the spill level. The pits will then be filled through pumping of fresh water from donor lakes as per ICRP
SOLIDS BALANCE	
Annual FPK slurry to pit lakes	6.0 Mm^3/year
Water Content of FPK	On discharge FPK is 16.9% solids by volume. On consolidation FPK is 50% solids by volume.
Split between Panda and Koala	Assumed to be 50:50 spilt between pit lakes.

(continued)

Table 3.7-1. Summary of Key Model Inputs and Assumptions (complete)

Model Parameter	Base Case Methodology
SOLIDS BALANCE (continued)	
Timetable for Infilling	It is assumed that FPK discharges to Panda and Koala will begin in 2020 and last for 17 years.
WATER QUALITY	
Natural runoff directly entering pit lake from upstream watersheds	Assumed equal to typical natural stream water from AEMP dataset.
Pumped water from source lakes	Assumed to be natural lake water from AEMP dataset.
Leaching from pit walls	Water quality data based on median of observed Panda and Koala sump water quality. Values constant over time.
FPK Supernatant	Zero, assumption from geochemical analyses is that waste rock and walls are flushed of available leach product on an annual basis, so no additional loading is available at submergence.
Leaching from submerged pit walls /FPK	Zero, once walls are submerged there is zero additional loading.
Leaching from sub-aerially exposed FPK	Assumed zero.
Groundwater	Average underground water quality data for water being pumped from underground workings to Beartooth Pit.
Chemical Reactions/Decay of Parameters	All parameters are assumed conservative and inert except for nutrients.
Inputs during closure	It is assumed that Panda and Koala pit lakes will have freshwater cap (30 m) over FPK solids and supernatant. It is assumed that mine water discharges to LLCF cease at closure and there are inputs from seepage from FPK pile and loadings released as FPK pile freezes.

4. MODEL RESULTS

4.1 Panda and Koala Pit Infilling Model

4.1.1 Water Balance

4.1.1.1 Freeboard Calculation

Water within the infilling Panda and Koala pits will not be allowed to spill from the pits during operations. This was completed to ensure the water level will be maintained below the spill level of the pits plus an appropriate freeboard.

Based on the local catchment flowing to the Panda and Koala pits hydrological calculations indicate that:

- Volume of water during a 1 in 100 year 24-hour extreme rainfall event (72.9 mm) is predicted to be 190,000 m^3;
- Volume of water during an average year is predicted to be 340,000 m^3; and
- Volume of water during 1 in 100 year extreme wet year is predicted to be 790,000 m^3.

The spill level of Koala Pit is 453.4 masl. Based on the storage curves in Table 3.2-2, the top 1 m of the pit (from level 452.4 to 453.4 masl) has a volume of 810,000 m^3. The top 2 m has a volume of 1,600,000 m^3.

Based on these calculations a freeboard of 2 m would be sufficient to prevent overtopping of Panda and Koala pits even during some extreme hydrological events.

4.1.1.2 Water Level Predictions

Predicted mass balance results for Panda and Koala pits for the Base Case are provided in Figure 4.1-1. The results are presented as a single, averaged, solids and water level for the two pits because the pits are assumed linked at depth and storage/elevation curves are similar for the two pits (Figure 4.1-1).

The results indicate that solids never reach the critical level of 30 m below the spill level. Supernatant water does rise above the 30 m level, but does not reach the 2 m freeboard from the spill level of the pits. As a result, the model predicts there is no need to pump any supernatant water from the Panda/Koala pits during operations for the Base Case. At the end of operations, the water level is predicted to be greater than the critical 30 m level thus water is pumped from the pits to the LLCF, providing space for the filling of the pit lakes with a freshwater cap during closure. Assuming a pumping rate of 0.3 m^3/s during open water season months it is assumed that the pumping of water from the pit to the LLCF will take around 3 to 4 years.

During closure, and once the water level in the Panda/Koala pit lakes have been pumped to a level 30 m below the spill level, a freshwater cap will then be placed on top of the supernatant. The water level will rise up to the spill level and will then remain close to the spill level depending on the natural water balance at the pit lake surface (i.e., balance of runoff, precipitation and evaporation). The time to rise will depend on the pumped infilling rate. It is assumed in the model that infilling begins in 2034/2035, as soon as water levels in the pits have fallen to 30 m below the spill level.

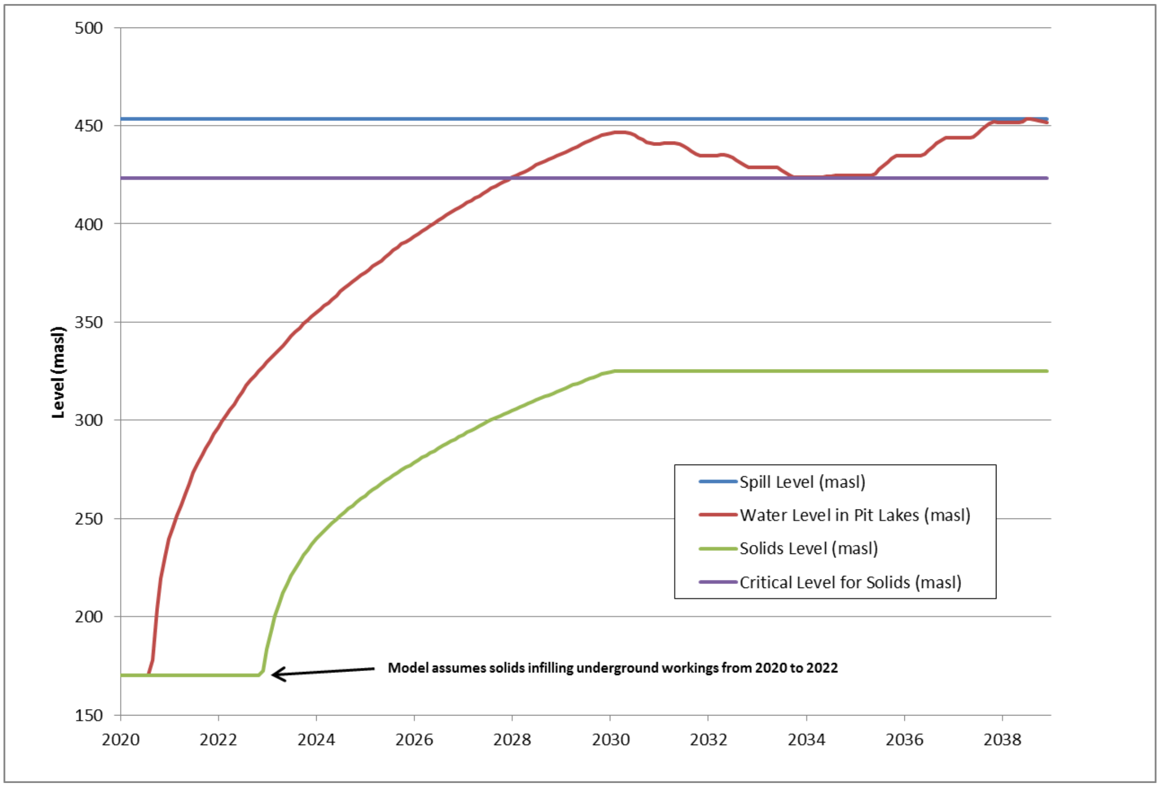


Figure 4.1-1. Predicted solid and water levels in Panda and Koala Pits

4.1.2 Water Quality

Results of the water quality predictions in Panda and Koala pits show an initial spike in concentrations reflecting an initial inflow of tailing supernatant to the Panda and Koala pits (data not shown). Over time the water quality is predicted to improve as pit walls are submerged removing a source of loadings and as natural runoff tends to dilute the supernatant. For all variables an approximate steady state (relatively constant concentration) is reached by around 2025 to 2030 when loadings from supernatant are balanced by natural inflows (assuming average precipitation in every year) and there is a buffering to change within the water body. At the end of operations much of the excess water in the pits is pumped out to drawdown the water to a point 30 m below the spill point and the Panda and Koala pits are then filled with natural lake water, resulting in a decrease in concentration as the Panda and Koala pits are filled.

Water quality predictions after closure are dependent on the volume of supernatant water left within the infilled Panda and Koala pits prior to infilling with natural lake water and the extent to which the water will be layered once the Panda and Koala pit lakes are infilled.

The Base Case simulation considers a scenario where a significant volume of supernatant water remains in the Panda and Koala pits at closure, i.e., difference between critical level and actual solids level in Figure 4.1-1. If more of this water were pumped out and replaced by lake water, the concentrations in the full pit lakes would be substantially less.

Multi-layered pit lake modelling undertaken in Rescan (2013) indicated that due to density differences within some pit lakes, and resulting from ice melt processes in the upper layers of pit lakes, the quality of water in the surface layer in pit lakes at the Ekati Diamond Mine is likely to be of relatively good quality irrespective of the quality of water in the pit lakes at depth. The placing of a fresh water cap at the top of pit lakes was predicted to result in water quality in the surface layers of pit lakes that would meet Water Quality Benchmark values as defined in Rescan (2012).

An assessment of these uncertainties on pit lake water quality and detailed modelling of Panda and Koala pit lakes is beyond the scope of this assessment and is considered in ongoing closure modelling studies.

4.2 LLCF and Downstream Lakes Model

4.2.1 Water Balance

Predicted monthly flow volumes at Slipper Lake are presented in Figure 4.2-1 (Appendix 1). As the model is run for average flow conditions in every year, the predicted monthly flows are constant over time during three main flow periods:

1. Pre-Jay Project when FPK is discharged to the LLCF;
2. During Jay Project when FPK is discharged to Panda and Koala pits; and
3. Post-closure when flows return close to natural/baseline conditions.

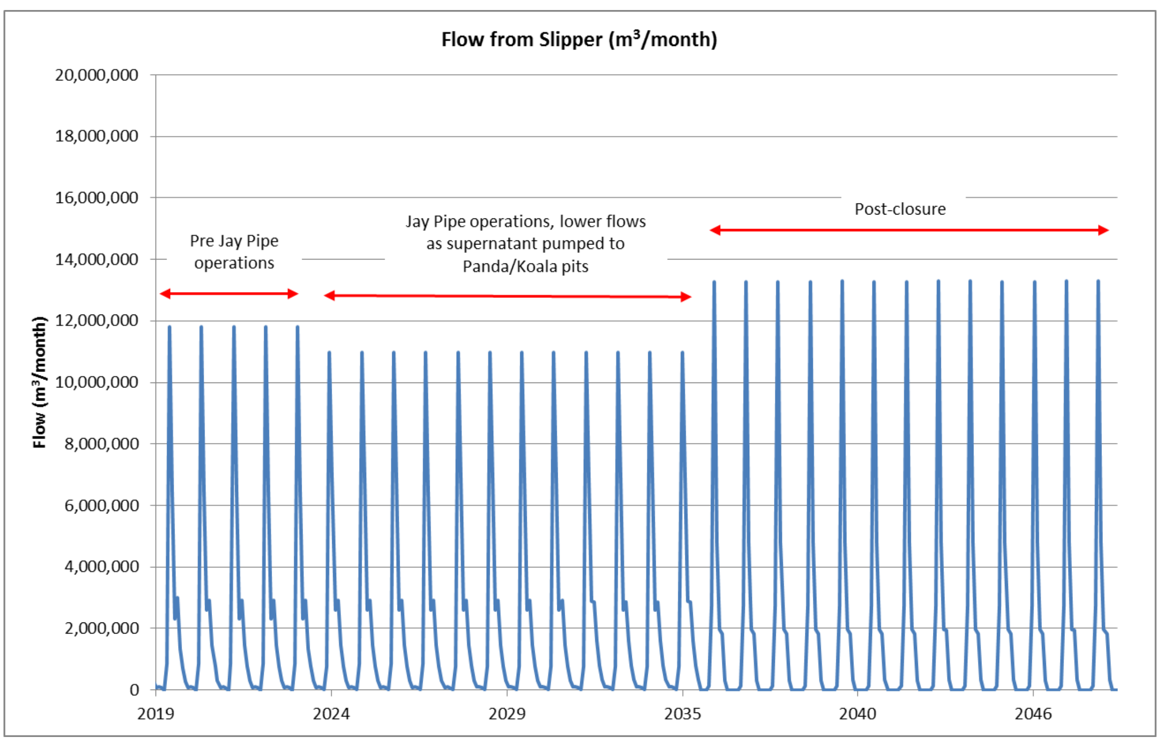
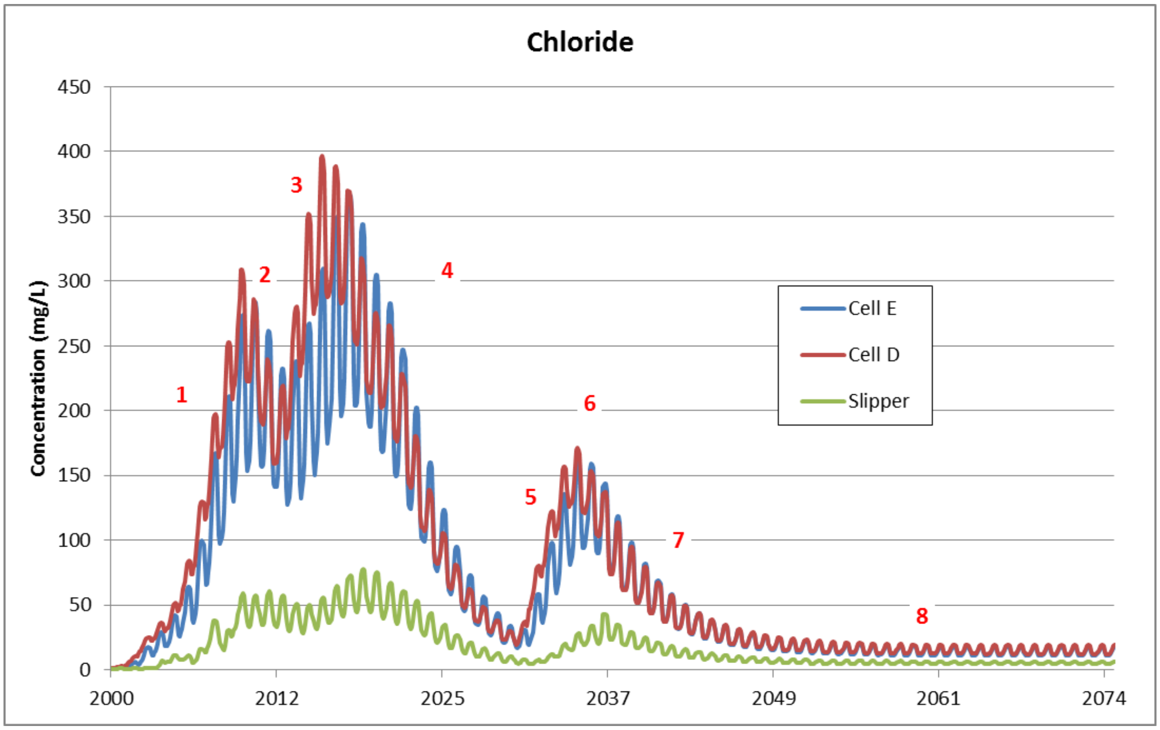


Figure 4.2-1. Prediction of Monthly Flows from Slipper Lake

4.2.2 *Water Quality*

The predicted water quality in Cells D and E of the LLCF and Slipper Lake followed a similar pattern (data not shown) for which a general interpretation is provided in Figure 4.2-2.

Generally, peak concentrations in the LLCF are predicted to occur prior to the discharge of supernatant from Jay Pipe to Panda and Koala pits. Concentrations in the LLCF during the Jay Project are not predicted to exceed concentrations at around 2020, associated with pumping of excess water from Beartooth Pit to the LLCF. The predicted peak concentrations during the model run are similar to those presented in Rescan (2012) and as a result, the operation of Jay Pipe with discharge of FPK solids to Panda and Koala pit does not affect the key conclusions of Rescan (2012).



KEY TO WATER QUALITY PREDICTION GRAPHS

1 - Rising concentrations from baseline conditions as Process Plant Discharge (PPD) enters LLCF

2 - Falling concentration as underground water and FPK is sent to Beartooth pit

3 - Rising concentrations as water is pumped from Beartooth pit to LLCF

4 - Falling concentrations as PPD enters Panda/Koala and there is no pumping from Panda/Koala back to the LLCF, i.e., water levels in pit lake are more than 60 m from spill point

5 - Rising concentrations as excess water from Panda/Koala is pumped to LLCF.

6 - Concentrations stabilise and model assumes there are three years of pumping, post-deposition of FPK in Panda/Koala to reduce water level in Panda/Koala to point 30 m below spill point. Water is pumped to LLCF.

7 - Concentrations decrease in closure period as all pumping of mine water to LLCF ceases.

8 - Concentrations continue to fall at lower rate towards steady state consistent with post-closure state.

Figure 4.2-2. Key Responses in Water Quality as Predicted in the LLCF (Cells E and D) and Slipper Lake.

5. UNCERTAINTIES

The modelling work presented in this note is based on a Base Case model scenario that corresponds to the current best estimate of operations and model inputs during the lifetime and closure of the Ekati Diamond Mine. Most variables and parameters are sourced from analysis of observed data at the Ekati Diamond Mine and are considered robust estimates. However, even for robust estimates there will still be uncertainties. As a result, there are a number of uncertainties associated with model inputs and model predictions. As with the development of the main pits, and later the Beartooth Pit, life of mine model predictions can be further refined based on observed monitoring data collected during for the Jay Project development.

6. SUMMARY

This technical note provides details of inputs, assumptions and results of a linked water balance and water quality prediction model of the LLCF, downstream lakes and Panda and Koala pits. The model was used to predict the impact of discharging FPK from Jay Project into Panda and Koala pits on water quality in the LLCF and the infilled pits. Model results were provided as inputs to a wider study of the impact of the Jay Project on water quality in Lac de Gras.

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ERM Rescan

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— Appendix 1 —

Predicted Monthly Flows from Slipper Lake

Appendix 1. Predicted Monthly Flows from Slipper Lake.

Date	Flow from Slipper (m^3/month)	Date	Flow from Slipper (m^3/month)	Date	Flow from Slipper (m^3/month)
May 2000	1,086,880	Nov 2003	896,336	May 2007	531,830
Jun 2000	14,786,803	Dec 2003	356,919	Jun 2007	8,577,232
Jul 2000	7,258,126	Jan 2004	1,037,263	Jul 2007	4,781,526
Aug 2000	2,872,738	Feb 2004	1,136,976	Aug 2007	1,765,240
Sep 2000	2,934,497	Mar 2004	667,302	Sep 2007	2,351,658
Oct 2000	987,357	Apr 2004	0	Oct 2007	1,358,742
Nov 2000	1,198,831	May 2004	558,849	Nov 2007	760,326
Dec 2000	134,841	Jun 2004	7,304,308	Dec 2007	0
Jan 2001	0	Jul 2004	3,586,783	Jan 2008	0
Feb 2001	0	Aug 2004	957,965	Feb 2008	0
Mar 2001	0	Sep 2004	2,246,001	Mar 2008	0
Apr 2001	74,736	Oct 2004	1,640,411	Apr 2008	0
May 2001	1,086,020	Nov 2004	859,412	May 2008	905,233
Jun 2001	14,386,011	Dec 2004	1,260,078	Jun 2008	11,955,557
Jul 2001	7,382,440	Jan 2005	14,903	Jul 2008	4,794,112
Aug 2001	1,914,272	Feb 2005	0	Aug 2008	1,755,697
Sep 2001	3,172,157	Mar 2005	0	Sep 2008	4,382,929
Oct 2001	1,323,113	Apr 2005	0	Oct 2008	1,725,586
Nov 2001	58,717	May 2005	782,042	Nov 2008	1,365,383
Dec 2001	0	Jun 2005	13,404,819	Dec 2008	729,489
Jan 2002	0	Jul 2005	4,113,277	Jan 2009	42,857
Feb 2002	0	Aug 2005	1,171,052	Feb 2009	0
Mar 2002	0	Sep 2005	3,119,852	Mar 2009	0
Apr 2002	41,006	Oct 2005	201,834	Apr 2009	0
May 2002	578,173	Nov 2005	0	May 2009	618,578
Jun 2002	7,574,468	Dec 2005	0	Jun 2009	8,050,872
Jul 2002	3,310,262	Jan 2006	0	Jul 2009	4,652,101
Aug 2002	2,094,289	Feb 2006	0	Aug 2009	2,008,705
Sep 2002	1,359,785	Mar 2006	0	Sep 2009	2,679,481
Oct 2002	623,075	Apr 2006	0	Oct 2009	1,519,000
Nov 2002	815,587	May 2006	1,351,222	Nov 2009	154,315
Dec 2002	0	Jun 2006	19,611,418	Dec 2009	170,679
Jan 2003	0	Jul 2006	9,003,709	Jan 2010	70,294
Feb 2003	0	Aug 2006	2,167,269	Feb 2010	118,847
Mar 2003	0	Sep 2006	3,985,950	Mar 2010	61,624
Apr 2003	43,886	Oct 2006	1,595,697	Apr 2010	0
May 2003	644,079	Nov 2006	1,310,861	May 2010	901,731
Jun 2003	8,277,907	Dec 2006	704,027	Jun 2010	12,647,950
Jul 2003	3,678,979	Jan 2007	2,103	Jul 2010	5,960,767
Aug 2003	1,249,410	Feb 2007	0	Aug 2010	2,036,732
Sep 2003	2,319,938	Mar 2007	0	Sep 2010	2,994,096
Oct 2003	1,630,865	Apr 2007	0	Oct 2010	1,327,989

(continued)

Appendix 1. Predicted Monthly Flows from Slipper Lake. (continued)

Date	Flow from Slipper (m^3/month)	Date	Flow from Slipper (m^3/month)	Date	Flow from Slipper (m^3/month)
Nov 2010	714,744	Apr 2014	4,402	Sep 2017	2,994,096
Dec 2010	277,309	May 2014	901,731	Oct 2017	1,327,989
Jan 2011	74,829	Jun 2014	11,808,934	Nov 2017	714,744
Feb 2011	118,847	Jul 2014	6,438,423	Dec 2017	277,309
Mar 2011	61,624	Aug 2014	2,317,020	Jan 2018	88,035
Apr 2011	0	Sep 2014	2,994,096	Feb 2018	114,445
May 2011	901,731	Oct 2014	1,327,989	Mar 2018	66,026
Jun 2011	12,647,950	Nov 2014	714,744	Apr 2018	4,402
Jul 2011	5,960,767	Dec 2014	277,309	May 2018	837,322
Aug 2011	2,036,732	Jan 2015	74,829	Jun 2018	11,808,934
Sep 2011	2,994,096	Feb 2015	118,847	Jul 2018	6,438,423
Oct 2011	1,194,162	Mar 2015	61,624	Aug 2018	2,317,020
Nov 2011	714,744	Apr 2015	4,402	Sep 2018	2,994,096
Dec 2011	277,309	May 2015	901,731	Oct 2018	1,327,989
Jan 2012	74,829	Jun 2015	11,808,934	Nov 2018	714,744
Feb 2012	118,847	Jul 2015	5,960,767	Dec 2018	277,309
Mar 2012	61,624	Aug 2015	2,317,020	Jan 2019	88,035
Apr 2012	4,402	Sep 2015	2,994,096	Feb 2019	114,445
May 2012	837,322	Oct 2015	1,327,989	Mar 2019	66,026
Jun 2012	11,808,934	Nov 2015	714,744	Apr 2019	4,402
Jul 2012	6,438,423	Dec 2015	277,309	May 2019	837,322
Aug 2012	2,317,020	Jan 2016	74,829	Jun 2019	11,808,934
Sep 2012	2,994,096	Feb 2016	118,847	Jul 2019	6,438,423
Oct 2012	1,327,989	Mar 2016	66,026	Aug 2019	2,317,020
Nov 2012	714,744	Apr 2016	4,402	Sep 2019	2,994,096
Dec 2012	277,309	May 2016	837,322	Oct 2019	1,327,989
Jan 2013	74,829	Jun 2016	11,808,934	Nov 2019	714,744
Feb 2013	114,445	Jul 2016	6,438,423	Dec 2019	277,309
Mar 2013	61,624	Aug 2016	2,317,020	Jan 2020	74,829
Apr 2013	4,402	Sep 2016	2,994,096	Feb 2020	114,445
May 2013	901,731	Oct 2016	1,327,989	Mar 2020	66,026
Jun 2013	11,808,934	Nov 2016	751,622	Apr 2020	4,402
Jul 2013	6,438,423	Dec 2016	277,309	May 2020	837,322
Aug 2013	2,317,020	Jan 2017	88,035	Jun 2020	11,808,934
Sep 2013	2,994,096	Feb 2017	114,445	Jul 2020	6,438,423
Oct 2013	1,327,989	Mar 2017	66,026	Aug 2020	2,597,308
Nov 2013	714,744	Apr 2017	4,402	Sep 2020	2,920,452
Dec 2013	277,309	May 2017	837,322	Oct 2020	1,461,816
Jan 2014	74,829	Jun 2017	11,808,934	Nov 2020	751,622
Feb 2014	118,847	Jul 2017	6,438,423	Dec 2020	308,121
Mar 2014	61,624	Aug 2017	2,317,020	Jan 2021	88,035

(continued)

Appendix 1. Predicted Monthly Flows from Slipper Lake. (continued)

Date	Flow from Slipper (m^3/month)	Date	Flow from Slipper (m^3/month)	Date	Flow from Slipper (m^3/month)
Feb 2021	114,445	Nov 2024	751,622	Aug 2028	2,597,308
Mar 2021	66,026	Dec 2024	308,121	Sep 2028	2,920,452
Apr 2021	4,402	Jan 2025	88,035	Oct 2028	1,461,816
May 2021	837,322	Feb 2025	110,043	Nov 2028	788,501
Jun 2021	11,808,934	Mar 2025	66,026	Dec 2028	308,121
Jul 2021	6,438,423	Apr 2025	8,803	Jan 2029	101,240
Aug 2021	2,317,020	May 2025	837,322	Feb 2029	110,043
Sep 2021	2,920,452	Jun 2025	10,969,919	Mar 2029	70,428
Oct 2021	1,461,816	Jul 2025	6,916,079	Apr 2029	8,803
Nov 2021	751,622	Aug 2025	2,597,308	May 2029	772,912
Dec 2021	308,121	Sep 2025	2,920,452	Jun 2029	10,969,919
Jan 2022	88,035	Oct 2025	1,461,816	Jul 2029	6,916,079
Feb 2022	114,445	Nov 2025	751,622	Aug 2029	2,597,308
Mar 2022	66,026	Dec 2025	308,121	Sep 2029	2,920,452
Apr 2022	4,402	Jan 2026	88,035	Oct 2029	1,461,816
May 2022	837,322	Feb 2026	114,445	Nov 2029	751,622
Jun 2022	11,808,934	Mar 2026	66,026	Dec 2029	308,121
Jul 2022	6,438,423	Apr 2026	8,803	Jan 2030	101,240
Aug 2022	2,317,020	May 2026	837,322	Feb 2030	110,043
Sep 2022	2,920,452	Jun 2026	10,969,919	Mar 2030	70,428
Oct 2022	1,461,816	Jul 2026	6,916,079	Apr 2030	8,803
Nov 2022	751,622	Aug 2026	2,597,308	May 2030	772,912
Dec 2022	308,121	Sep 2026	2,920,452	Jun 2030	10,969,919
Jan 2023	88,035	Oct 2026	1,461,816	Jul 2030	6,916,079
Feb 2023	114,445	Nov 2026	751,622	Aug 2030	2,597,308
Mar 2023	66,026	Dec 2026	308,121	Sep 2030	2,920,452
Apr 2023	4,402	Jan 2027	88,035	Oct 2030	1,461,816
May 2023	837,322	Feb 2027	114,445	Nov 2030	751,622
Jun 2023	11,808,934	Mar 2027	66,026	Dec 2030	308,121
Jul 2023	6,438,423	Apr 2027	8,803	Jan 2031	101,240
Aug 2023	2,317,020	May 2027	837,322	Feb 2031	110,043
Sep 2023	2,920,452	Jun 2027	10,969,919	Mar 2031	70,428
Oct 2023	1,327,989	Jul 2027	6,438,423	Apr 2031	8,803
Nov 2023	751,622	Aug 2027	2,597,308	May 2031	772,912
Dec 2023	308,121	Sep 2027	2,920,452	Jun 2031	10,969,919
Jan 2024	88,035	Oct 2027	1,461,816	Jul 2031	6,916,079
Feb 2024	114,445	Nov 2027	751,622	Aug 2031	2,597,308
Mar 2024	66,026	Dec 2027	308,121	Sep 2031	2,920,452
Apr 2024	8,803	Jan 2028	88,035	Oct 2031	1,461,816
May 2024	772,912	Feb 2028	114,445	Nov 2031	751,622
Jun 2024	10,969,919	Mar 2028	70,428	Dec 2031	308,121
Jul 2024	6,916,079	Apr 2028	8,803	Jan 2032	101,240
Aug 2024	2,597,308	May 2028	772,912	Feb 2032	110,043
Sep 2024	2,920,452	Jun 2028	10,969,919	Mar 2032	70,428
Oct 2024	1,461,816	Jul 2028	6,916,079	Apr 2032	8,803

(continued)

Appendix 1. Predicted Monthly Flows from Slipper Lake. (continued)

Date	Flow from Slipper (m^3/month)	Date	Flow from Slipper (m^3/month)	Date	Flow from Slipper (m^3/month)
May 2032	772,912	Aug 2036	1,974,182	Nov 2040	5,018
Jun 2032	10,969,919	Sep 2036	1,834,520	Dec 2040	37
Jul 2032	6,916,079	Oct 2036	320,061	Jan 2041	0
Aug 2032	2,877,597	Nov 2036	4,218	Feb 2041	0
Sep 2032	2,846,809	Dec 2036	31	Mar 2041	0
Oct 2032	1,595,643	Jan 2037	0	Apr 2041	130,099
Nov 2032	788,501	Feb 2037	0	May 2041	2,711,145
Dec 2032	338,933	Mar 2037	0	Jun 2041	13,279,939
Jan 2033	101,240	Apr 2037	130,099	Jul 2041	4,776,410
Feb 2033	110,043	May 2037	2,711,145	Aug 2041	1,975,891
Mar 2033	70,428	Jun 2037	13,279,939	Sep 2041	1,834,669
Apr 2033	8,803	Jul 2037	4,776,410	Oct 2041	342,402
May 2033	772,912	Aug 2037	1,974,182	Nov 2041	5,018
Jun 2033	10,969,919	Sep 2037	1,834,520	Dec 2041	37
Jul 2033	6,916,079	Oct 2037	320,061	Jan 2042	0
Aug 2033	2,597,308	Nov 2037	4,218	Feb 2042	0
Sep 2033	2,846,809	Dec 2037	31	Mar 2042	0
Oct 2033	1,595,643	Jan 2038	0	Apr 2042	130,099
Nov 2033	788,501	Feb 2038	0	May 2042	2,711,145
Dec 2033	338,933	Mar 2038	0	Jun 2042	13,279,939
Jan 2034	101,240	Apr 2038	130,099	Jul 2042	4,776,410
Feb 2034	110,043	May 2038	2,711,145	Aug 2042	1,974,182
Mar 2034	70,428	Jun 2038	13,279,939	Sep 2042	1,834,520
Apr 2034	8,803	Jul 2038	4,776,410	Oct 2042	320,061
May 2034	772,912	Aug 2038	1,974,182	Nov 2042	4,218
Jun 2034	10,969,919	Sep 2038	1,834,520	Dec 2042	31
Jul 2034	6,916,079	Oct 2038	320,061	Jan 2043	0
Aug 2034	2,597,308	Nov 2038	4,218	Feb 2043	0
Sep 2034	2,846,809	Dec 2038	31	Mar 2043	0
Oct 2034	1,595,643	Jan 2039	0	Apr 2043	129,044
Nov 2034	788,501	Feb 2039	0	May 2043	2,708,546
Dec 2034	338,933	Mar 2039	0	Jun 2043	13,300,000
Jan 2035	101,240	Apr 2039	130,099	Jul 2043	4,782,594
Feb 2035	110,043	May 2039	2,711,145	Aug 2043	1,975,891
Mar 2035	70,428	Jun 2039	13,279,939	Sep 2043	1,946,620
Apr 2035	8,803	Jul 2039	4,776,410	Oct 2043	343,668
May 2035	772,912	Aug 2039	1,974,182	Nov 2043	5,025
Jun 2035	10,969,919	Sep 2039	1,834,520	Dec 2043	37
Jul 2035	6,916,079	Oct 2039	320,061	Jan 2044	0
Aug 2035	2,877,597	Nov 2039	4,218	Feb 2044	0
Sep 2035	2,846,809	Dec 2039	31	Mar 2044	0
Oct 2035	1,595,643	Jan 2040	0	Apr 2044	129,044
Nov 2035	788,501	Feb 2040	0	May 2044	2,708,546
Dec 2035	338,933	Mar 2040	0	Jun 2044	13,300,000
Jan 2036	0	Apr 2040	129,044	Jul 2044	4,782,594
Feb 2036	0	May 2040	2,708,546	Aug 2044	1,975,891
Mar 2036	0	Jun 2040	13,300,000	Sep 2044	1,834,669
Apr 2036	130,099	Jul 2040	4,782,594	Oct 2044	342,402
May 2036	2,711,145	Aug 2040	1,975,891	Nov 2044	5,018
Jun 2036	13,279,939	Sep 2040	1,834,669	Dec 2044	37
Jul 2036	4,776,410	Oct 2040	342,402	Jan 2045	0

(continued)

Appendix 1. Predicted Monthly Flows from Slipper Lake. (continued)

Date	Flow from Slipper (m^3/month)	Date	Flow from Slipper (m^3/month)	Date	Flow from Slipper (m^3/month)
Feb 2045	0	Apr 2049	130,099	Jun 2053	13,300,000
Mar 2045	0	May 2049	2,711,145	Jul 2053	4,782,594
Apr 2045	130,099	Jun 2049	13,300,000	Aug 2053	1,975,891
May 2045	2,711,145	Jul 2049	4,782,594	Sep 2053	1,834,669
Jun 2045	13,279,939	Aug 2049	1,975,891	Oct 2053	342,402
Jul 2045	4,776,410	Sep 2049	1,834,669	Nov 2053	5,018
Aug 2045	1,975,891	Oct 2049	342,402	Dec 2053	37
Sep 2045	1,834,669	Nov 2049	5,018	Jan 2054	0
Oct 2045	342,402	Dec 2049	37	Feb 2054	0
Nov 2045	5,018	Jan 2050	0	Mar 2054	0
Dec 2045	37	Feb 2050	0	Apr 2054	130,099
Jan 2046	0	Mar 2050	0	May 2054	2,711,145
Feb 2046	0	Apr 2050	130,099	Jun 2054	13,279,939
Mar 2046	0	May 2050	2,711,145	Jul 2054	4,776,410
Apr 2046	130,099	Jun 2050	13,279,939	Aug 2054	1,974,182
May 2046	2,711,145	Jul 2050	4,776,410	Sep 2054	1,834,520
Jun 2046	13,279,939	Aug 2050	1,974,182	Oct 2054	320,061
Jul 2046	4,776,410	Sep 2050	1,834,520	Nov 2054	4,218
Aug 2046	1,974,182	Oct 2050	320,061	Dec 2054	31
Sep 2046	1,834,520	Nov 2050	4,218	Jan 2055	0
Oct 2046	320,061	Dec 2050	31	Feb 2055	0
Nov 2046	4,218	Jan 2051	0	Mar 2055	0
Dec 2046	31	Feb 2051	0	Apr 2055	129,044
Jan 2047	0	Mar 2051	0	May 2055	2,708,546
Feb 2047	0	Apr 2051	129,044	Jun 2055	13,300,000
Mar 2047	0	May 2051	2,708,546	Jul 2055	4,996,360
Apr 2047	129,044	Jun 2051	13,300,000	Aug 2055	1,976,216
May 2047	2,708,546	Jul 2051	4,782,594	Sep 2055	1,946,620
Jun 2047	13,300,000	Aug 2051	1,975,891	Oct 2055	343,668
Jul 2047	4,782,594	Sep 2051	1,946,620	Nov 2055	5,025
Aug 2047	1,975,891	Oct 2051	343,668	Dec 2055	37
Sep 2047	1,946,620	Nov 2051	5,025	Jan 2056	0
Oct 2047	343,668	Dec 2051	37	Feb 2056	0
Nov 2047	5,025	Jan 2052	0	Mar 2056	0
Dec 2047	37	Feb 2052	0	Apr 2056	129,044
Jan 2048	0	Mar 2052	0	May 2056	2,708,546
Feb 2048	0	Apr 2052	129,044	Jun 2056	13,300,000
Mar 2048	0	May 2052	2,708,546	Jul 2056	4,782,594
Apr 2048	129,044	Jun 2052	13,300,000	Aug 2056	1,975,891
May 2048	2,708,546	Jul 2052	4,782,594	Sep 2056	1,834,669
Jun 2048	13,300,000	Aug 2052	1,975,891	Oct 2056	342,402
Jul 2048	4,782,594	Sep 2052	1,834,669	Nov 2056	5,018
Aug 2048	1,975,891	Oct 2052	342,402	Dec 2056	37
Sep 2048	1,834,669	Nov 2052	5,018	Jan 2057	0
Oct 2048	342,402	Dec 2052	37	Feb 2057	0
Nov 2048	5,018	Jan 2053	0	Mar 2057	0
Dec 2048	37	Feb 2053	0	Apr 2057	130,099
Jan 2049	0	Mar 2053	0	May 2057	2,711,145
Feb 2049	0	Apr 2053	130,099	Jun 2057	13,300,000
Mar 2049	0	May 2053	2,711,145	Jul 2057	4,782,594

(continued)

Appendix 1. Predicted Monthly Flows from Slipper Lake. (continued)

Date	Flow from Slipper (m^3/month)	Date	Flow from Slipper (m^3/month)	Date	Flow from Slipper (m^3/month)
Aug 2057	1,975,891	Oct 2061	342,402	Dec 2065	37
Sep 2057	1,834,669	Nov 2061	5,018	Jan 2066	0
Oct 2057	342,402	Dec 2061	37	Feb 2066	0
Nov 2057	5,018	Jan 2062	0	Mar 2066	0
Dec 2057	37	Feb 2062	0	Apr 2066	130,099
Jan 2058	0	Mar 2062	0	May 2066	2,711,145
Feb 2058	0	Apr 2062	130,099	Jun 2066	13,279,939
Mar 2058	0	May 2062	2,711,145	Jul 2066	4,776,410
Apr 2058	130,099	Jun 2062	13,279,939	Aug 2066	1,974,182
May 2058	2,711,145	Jul 2062	4,776,410	Sep 2066	1,834,520
Jun 2058	13,279,939	Aug 2062	1,974,182	Oct 2066	342,402
Jul 2058	4,776,410	Sep 2062	1,834,520	Nov 2066	5,018
Aug 2058	1,974,182	Oct 2062	320,061	Dec 2066	37
Sep 2058	1,834,520	Nov 2062	4,218	Jan 2067	0
Oct 2058	320,061	Dec 2062	31	Feb 2067	0
Nov 2058	4,218	Jan 2063	0	Mar 2067	0
Dec 2058	31	Feb 2063	0	Apr 2067	129,044
Jan 2059	0	Mar 2063	0	May 2067	2,708,546
Feb 2059	0	Apr 2063	129,044	Jun 2067	13,300,000
Mar 2059	0	May 2063	2,708,546	Jul 2067	4,996,360
Apr 2059	129,044	Jun 2063	13,300,000	Aug 2067	1,976,216
May 2059	2,708,546	Jul 2063	4,996,360	Sep 2067	1,946,620
Jun 2059	13,300,000	Aug 2063	1,976,216	Oct 2067	343,668
Jul 2059	4,996,360	Sep 2063	1,946,620	Nov 2067	5,025
Aug 2059	1,976,216	Oct 2063	343,668	Dec 2067	37
Sep 2059	1,946,620	Nov 2063	5,025	Jan 2068	0
Oct 2059	343,668	Dec 2063	37	Feb 2068	0
Nov 2059	5,025	Jan 2064	0	Mar 2068	0
Dec 2059	37	Feb 2064	0	Apr 2068	129,044
Jan 2060	0	Mar 2064	0	May 2068	2,708,546
Feb 2060	0	Apr 2064	129,044	Jun 2068	13,300,000
Mar 2060	0	May 2064	2,708,546	Jul 2068	4,782,594
Apr 2060	129,044	Jun 2064	13,300,000	Aug 2068	1,975,891
May 2060	2,708,546	Jul 2064	4,782,594	Sep 2068	1,834,669
Jun 2060	13,300,000	Aug 2064	1,975,891	Oct 2068	342,402
Jul 2060	4,782,594	Sep 2064	1,834,669	Nov 2068	5,018
Aug 2060	1,975,891	Oct 2064	342,402	Dec 2068	37
Sep 2060	1,834,669	Nov 2064	5,018	Jan 2069	0
Oct 2060	342,402	Dec 2064	37	Feb 2069	0
Nov 2060	5,018	Jan 2065	0	Mar 2069	0
Dec 2060	37	Feb 2065	0	Apr 2069	130,099
Jan 2061	0	Mar 2065	0	May 2069	2,711,145
Feb 2061	0	Apr 2065	130,099	Jun 2069	13,300,000
Mar 2061	0	May 2065	2,711,145	Jul 2069	4,782,594
Apr 2061	130,099	Jun 2065	13,300,000	Aug 2069	1,975,891
May 2061	2,711,145	Jul 2065	4,782,594	Sep 2069	1,834,669
Jun 2061	13,300,000	Aug 2065	1,975,891	Oct 2069	342,402
Jul 2061	4,782,594	Sep 2065	1,834,669	Nov 2069	5,018
Aug 2061	1,975,891	Oct 2065	342,402	Dec 2069	37
Sep 2061	1,834,669	Nov 2065	5,018	Jan 2070	0

(continued)

Appendix 1. Predicted Monthly Flows from Slipper Lake. (continued)

Date	Flow from Slipper (m^3/month)	Date	Flow from Slipper (m^3/month)	Date	Flow from Slipper (m^3/month)
Feb 2070	0	Apr 2074	130,099	Jun 2078	13,279,939
Mar 2070	0	May 2074	2,711,145	Jul 2078	4,776,410
Apr 2070	130,099	Jun 2074	13,279,939	Aug 2078	1,974,182
May 2070	2,711,145	Jul 2074	4,776,410	Sep 2078	1,834,520
Jun 2070	13,279,939	Aug 2074	1,974,182	Oct 2078	342,402
Jul 2070	4,776,410	Sep 2074	1,834,520	Nov 2078	5,018
Aug 2070	1,974,182	Oct 2074	342,402	Dec 2078	37
Sep 2070	1,834,520	Nov 2074	5,018	Jan 2079	0
Oct 2070	342,402	Dec 2074	37	Feb 2079	0
Nov 2070	5,018	Jan 2075	0	Mar 2079	0
Dec 2070	37	Feb 2075	0	Apr 2079	129,044
Jan 2071	0	Mar 2075	0	May 2079	1,887,650
Feb 2071	0	Apr 2075	129,044	Jun 2079	13,284,829
Mar 2071	0	May 2075	2,708,546	Jul 2079	4,996,360
Apr 2071	129,044	Jun 2075	13,300,000	Aug 2079	1,976,216
May 2071	2,708,546	Jul 2075	4,996,360	Sep 2079	1,946,620
Jun 2071	13,300,000	Aug 2075	1,976,216	Oct 2079	343,668
Jul 2071	4,996,360	Sep 2075	1,946,620	Nov 2079	5,025
Aug 2071	1,976,216	Oct 2075	343,668	Dec 2079	37
Sep 2071	1,946,620	Nov 2075	5,025	Jan 2080	0
Oct 2071	343,668	Dec 2075	37	Feb 2080	0
Nov 2071	5,025	Jan 2076	0	Mar 2080	0
Dec 2071	37	Feb 2076	0	Apr 2080	129,044
Jan 2072	0	Mar 2076	0	May 2080	2,708,546
Feb 2072	0	Apr 2076	129,044	Jun 2080	13,300,000
Mar 2072	0	May 2076	2,708,546	Jul 2080	4,782,594
Apr 2072	129,044	Jun 2076	13,300,000	Aug 2080	1,975,891
May 2072	2,708,546	Jul 2076	4,782,594	Sep 2080	1,946,620
Jun 2072	13,300,000	Aug 2076	1,975,891	Oct 2080	343,668
Jul 2072	4,782,594	Sep 2076	1,834,669	Nov 2080	5,025
Aug 2072	1,975,891	Oct 2076	342,402	Dec 2080	37
Sep 2072	1,834,669	Nov 2076	5,018	Jan 2081	0
Oct 2072	342,402	Dec 2076	37	Feb 2081	0
Nov 2072	5,018	Jan 2077	0	Mar 2081	0
Dec 2072	37	Feb 2077	0	Apr 2081	129,044
Jan 2073	0	Mar 2077	0	May 2081	2,708,546
Feb 2073	0	Apr 2077	129,044	Jun 2081	13,300,000
Mar 2073	0	May 2077	2,708,546	Jul 2081	4,782,594
Apr 2073	130,099	Jun 2077	13,300,000	Aug 2081	1,975,891
May 2073	2,711,145	Jul 2077	4,782,594	Sep 2081	1,834,669
Jun 2073	13,300,000	Aug 2077	1,975,891	Oct 2081	342,402
Jul 2073	4,782,594	Sep 2077	1,834,669	Nov 2081	5,018
Aug 2073	1,975,891	Oct 2077	342,402	Dec 2081	37
Sep 2073	1,834,669	Nov 2077	5,018	Jan 2082	0
Oct 2073	342,402	Dec 2077	37	Feb 2082	0
Nov 2073	5,018	Jan 2078	0	Mar 2082	0
Dec 2073	37	Feb 2078	0	Apr 2082	130,099
Jan 2074	0	Mar 2078	0	May 2082	2,711,145
Feb 2074	0	Apr 2078	130,099	Jun 2082	13,279,939
Mar 2074	0	May 2078	2,711,145	Jul 2082	4,776,410

(continued)

Appendix 1. Predicted Monthly Flows from Slipper Lake. (continued)

Date	Flow from Slipper (m^3/month)	Date	Flow from Slipper (m^3/month)	Date	Flow from Slipper (m^3/month)
Aug 2082	1,974,182	Oct 2086	342,402	Dec 2090	37
Sep 2082	1,834,520	Nov 2086	5,018	Jan 2091	0
Oct 2082	342,402	Dec 2086	37	Feb 2091	0
Nov 2082	5,018	Jan 2087	0	Mar 2091	0
Dec 2082	37	Feb 2087	0	Apr 2091	129,044
Jan 2083	0	Mar 2087	0	May 2091	1,887,650
Feb 2083	0	Apr 2087	129,044	Jun 2091	13,284,829
Mar 2083	0	May 2087	1,887,650	Jul 2091	4,996,360
Apr 2083	129,044	Jun 2087	13,284,829	Aug 2091	1,976,216
May 2083	1,887,650	Jul 2087	4,996,360	Sep 2091	1,946,620
Jun 2083	13,284,829	Aug 2087	1,976,216	Oct 2091	343,668
Jul 2083	4,996,360	Sep 2087	1,946,620	Nov 2091	5,025
Aug 2083	1,976,216	Oct 2087	343,668	Dec 2091	37
Sep 2083	1,946,620	Nov 2087	5,025	Jan 2092	0
Oct 2083	343,668	Dec 2087	37	Feb 2092	0
Nov 2083	5,025	Jan 2088	0	Mar 2092	0
Dec 2083	37	Feb 2088	0	Apr 2092	129,044
Jan 2084	0	Mar 2088	0	May 2092	2,708,546
Feb 2084	0	Apr 2088	129,044	Jun 2092	13,300,000
Mar 2084	0	May 2088	2,708,546	Jul 2092	4,782,594
Apr 2084	129,044	Jun 2088	13,300,000	Aug 2092	1,975,891
May 2084	2,708,546	Jul 2088	4,782,594	Sep 2092	1,946,620
Jun 2084	13,300,000	Aug 2088	1,975,891	Oct 2092	343,668
Jul 2084	4,782,594	Sep 2088	1,946,620	Nov 2092	5,025
Aug 2084	1,975,891	Oct 2088	343,668	Dec 2092	37
Sep 2084	1,946,620	Nov 2088	5,025	Jan 2093	0
Oct 2084	343,668	Dec 2088	37	Feb 2093	0
Nov 2084	5,025	Jan 2089	0	Mar 2093	0
Dec 2084	37	Feb 2089	0	Apr 2093	129,044
Jan 2085	0	Mar 2089	0	May 2093	2,708,546
Feb 2085	0	Apr 2089	129,044	Jun 2093	13,300,000
Mar 2085	0	May 2089	2,708,546	Jul 2093	4,782,594
Apr 2085	129,044	Jun 2089	13,300,000	Aug 2093	1,975,891
May 2085	2,708,546	Jul 2089	4,782,594	Sep 2093	1,834,669
Jun 2085	13,300,000	Aug 2089	1,975,891	Oct 2093	342,402
Jul 2085	4,782,594	Sep 2089	1,834,669	Nov 2093	5,018
Aug 2085	1,975,891	Oct 2089	342,402	Dec 2093	37
Sep 2085	1,834,669	Nov 2089	5,018	Jan 2094	0
Oct 2085	342,402	Dec 2089	37	Feb 2094	0
Nov 2085	5,018	Jan 2090	0	Mar 2094	0
Dec 2085	37	Feb 2090	0	Apr 2094	130,099
Jan 2086	0	Mar 2090	0	May 2094	2,711,145
Feb 2086	0	Apr 2090	130,099	Jun 2094	13,279,939
Mar 2086	0	May 2090	2,711,145	Jul 2094	4,776,410
Apr 2086	130,099	Jun 2090	13,279,939	Aug 2094	1,975,891
May 2086	2,711,145	Jul 2090	4,776,410	Sep 2094	1,834,669
Jun 2086	13,279,939	Aug 2090	1,974,182	Oct 2094	342,402
Jul 2086	4,776,410	Sep 2090	1,834,520	Nov 2094	5,018
Aug 2086	1,974,182	Oct 2090	342,402	Dec 2094	37
Sep 2086	1,834,520	Nov 2090	5,018	Jan 2095	0

(continued)

Appendix 1. Predicted Monthly Flows from Slipper Lake. (continued)

Date	Flow from Slipper (m^3/month)	Date	Flow from Slipper (m^3/month)	Date	Flow from Slipper (m^3/month)
Feb 2095	0	Aug 2099	1,976,216	Feb 2104	0
Mar 2095	0	Sep 2099	1,946,620	Mar 2104	0
Apr 2095	129,044	Oct 2099	343,668	Apr 2104	129,044
May 2095	1,887,650	Nov 2099	5,025	May 2104	2,708,546
Jun 2095	13,284,829	Dec 2099	37	Jun 2104	13,300,000
Jul 2095	4,996,360	Jan 2100	0	Jul 2104	4,782,594
Aug 2095	1,976,216	Feb 2100	0	Aug 2104	1,975,891
Sep 2095	1,946,620	Mar 2100	0	Sep 2104	1,946,620
Oct 2095	343,668	Apr 2100	129,044	Oct 2104	343,668
Nov 2095	5,025	May 2100	2,708,546	Nov 2104	5,025
Dec 2095	37	Jun 2100	13,300,000	Dec 2104	37
Jan 2096	0	Jul 2100	4,782,594	Jan 2105	0
Feb 2096	0	Aug 2100	1,975,891	Feb 2105	0
Mar 2096	0	Sep 2100	1,946,620	Mar 2105	0
Apr 2096	129,044	Oct 2100	343,668	Apr 2105	129,044
May 2096	2,708,546	Nov 2100	5,025	May 2105	2,708,546
Jun 2096	13,300,000	Dec 2100	37	Jun 2105	13,300,000
Jul 2096	4,782,594	Jan 2101	0	Jul 2105	4,782,594
Aug 2096	1,975,891	Feb 2101	0	Aug 2105	1,975,891
Sep 2096	1,946,620	Mar 2101	0	Sep 2105	1,834,669
Oct 2096	343,668	Apr 2101	129,044	Oct 2105	342,402
Nov 2096	5,025	May 2101	2,708,546	Nov 2105	5,018
Dec 2096	37	Jun 2101	13,300,000	Dec 2105	37
Jan 2097	0	Jul 2101	4,782,594	Jan 2106	0
Feb 2097	0	Aug 2101	1,975,891	Feb 2106	0
Mar 2097	0	Sep 2101	1,834,669	Mar 2106	0
Apr 2097	129,044	Oct 2101	342,402	Apr 2106	130,099
May 2097	2,708,546	Nov 2101	5,018	May 2106	2,711,145
Jun 2097	13,300,000	Dec 2101	37	Jun 2106	13,300,000
Jul 2097	4,782,594	Jan 2102	0	Jul 2106	4,782,594
Aug 2097	1,975,891	Feb 2102	0	Aug 2106	1,975,891
Sep 2097	1,834,669	Mar 2102	0	Sep 2106	1,834,669
Oct 2097	342,402	Apr 2102	130,099	Oct 2106	342,402
Nov 2097	5,018	May 2102	2,711,145	Nov 2106	5,018
Dec 2097	37	Jun 2102	13,300,000	Dec 2106	37
Jan 2098	0	Jul 2102	4,782,594	Jan 2107	0
Feb 2098	0	Aug 2102	1,975,891	Feb 2107	0
Mar 2098	0	Sep 2102	1,834,669	Mar 2107	0
Apr 2098	130,099	Oct 2102	342,402	Apr 2107	129,044
May 2098	2,711,145	Nov 2102	5,018	May 2107	1,887,650
Jun 2098	13,279,939	Dec 2102	37	Jun 2107	13,284,829
Jul 2098	4,776,410	Jan 2103	0	Jul 2107	4,996,360
Aug 2098	1,975,891	Feb 2103	0	Aug 2107	1,976,216
Sep 2098	1,834,669	Mar 2103	0	Sep 2107	1,946,620
Oct 2098	342,402	Apr 2103	129,044	Oct 2107	343,668
Nov 2098	5,018	May 2103	1,887,650	Nov 2107	5,025
Dec 2098	37	Jun 2103	13,284,829	Dec 2107	37
Jan 2099	0	Jul 2103	4,996,360	Jan 2108	0
Feb 2099	0	Aug 2103	1,976,216	Feb 2108	0
Mar 2099	0	Sep 2103	1,946,620	Mar 2108	0
Apr 2099	129,044	Oct 2103	343,668	Apr 2108	129,044
May 2099	1,887,650	Nov 2103	5,025	May 2108	2,708,546
Jun 2099	13,284,829	Dec 2103	37	Jun 2108	13,300,000
Jul 2099	4,996,360	Jan 2104	0	Jul 2108	4,996,360

(continued)

Appendix 1. Predicted Monthly Flows from Slipper Lake. (complete)

Date	Flow from Slipper (m^3/month)	Date	Flow from Slipper (m^3/month)	Date	Flow from Slipper (m^3/month)
Aug 2108	1,976,216	Mar 2113	0	Oct 2117	342,402
Sep 2108	1,946,620	Apr 2113	129,044	Nov 2117	5,018
Oct 2108	343,668	May 2113	2,708,546	Dec 2117	37
Nov 2108	5,025	Jun 2113	13,300,000	Jan 2118	0
Dec 2108	37	Jul 2113	4,782,594	Feb 2118	0
Jan 2109	0	Aug 2113	1,975,891	Mar 2118	0
Feb 2109	0	Sep 2113	1,834,669	Apr 2118	130,099
Mar 2109	0	Oct 2113	342,402	May 2118	2,711,145
Apr 2109	129,044	Nov 2113	5,018	Jun 2118	13,300,000
May 2109	2,708,546	Dec 2113	37	Jul 2118	4,782,594
Jun 2109	13,300,000	Jan 2114	0	Aug 2118	1,975,891
Jul 2109	4,782,594	Feb 2114	0	Sep 2118	1,834,669
Aug 2109	1,975,891	Mar 2114	0	Oct 2118	342,402
Sep 2109	1,834,669	Apr 2114	130,099	Nov 2118	5,018
Oct 2109	342,402	May 2114	2,711,145	Dec 2118	37
Nov 2109	5,018	Jun 2114	13,300,000		
Dec 2109	37	Jul 2114	4,782,594		
Jan 2110	0	Aug 2114	1,975,891		
Feb 2110	0	Sep 2114	1,834,669		
Mar 2110	0	Oct 2114	342,402		
Apr 2110	130,099	Nov 2114	5,018		
May 2110	2,711,145	Dec 2114	37		
Jun 2110	13,300,000	Jan 2115	0		
Jul 2110	4,782,594	Feb 2115	0		
Aug 2110	1,975,891	Mar 2115	0		
Sep 2110	1,834,669	Apr 2115	129,044		
Oct 2110	342,402	May 2115	1,887,650		
Nov 2110	5,018	Jun 2115	13,284,829		
Dec 2110	37	Jul 2115	4,996,360		
Jan 2111	0	Aug 2115	1,976,216		
Feb 2111	0	Sep 2115	1,946,620		
Mar 2111	0	Oct 2115	343,668		
Apr 2111	129,044	Nov 2115	5,025		
May 2111	1,887,650	Dec 2115	37		
Jun 2111	13,284,829	Jan 2116	0		
Jul 2111	4,996,360	Feb 2116	0		
Aug 2111	1,976,216	Mar 2116	0		
Sep 2111	1,946,620	Apr 2116	129,044		
Oct 2111	343,668	May 2116	2,708,546		
Nov 2111	5,025	Jun 2116	13,300,000		
Dec 2111	37	Jul 2116	4,996,360		
Jan 2112	0	Aug 2116	1,976,216		
Feb 2112	0	Sep 2116	1,946,620		
Mar 2112	0	Oct 2116	343,668		
Apr 2112	129,044	Nov 2116	5,025		
May 2112	2,708,546	Dec 2116	37		
Jun 2112	13,300,000	Jan 2117	0		
Jul 2112	4,996,360	Feb 2117	0		
Aug 2112	1,976,216	Mar 2117	0		
Sep 2112	1,946,620	Apr 2117	129,044		
Oct 2112	343,668	May 2117	2,708,546		
Nov 2112	5,025	Jun 2117	13,300,000		
Dec 2112	37	Jul 2117	4,782,594		
Jan 2113	0	Aug 2117	1,975,891		
Feb 2113	0	Sep 2117	1,834,669		