Table 1. Estimated LTVSMC Tailings Basin seepage for selected parameters calibrated to existing conditions

Parameter	Existing LTVSMC Tailings Basin Seepage			
	Calibration to flows at PM-13 < 10 cfs		Calibration to flows at PM-13 10-20 cfs	
	Pit 5NW Q = 0 cfs	Pit 5NW Q = 0.26 cfs	Pit 5NW Q = 0 cfs	Pit 5NW Q = 0.26 cfs
Ca	1.9	1.4	3.9	3.4
Cl	**4.0**	3.9	1.0	1.0
Cu	--[1]	--[1]	--[1]	--[1]
F	1.7	1.7	6.0 [2]	6.0 [2]
Fe	2.8	2.9	--[1]	--[1]
Mg	1.8	0.3	3.3	2.2
Na	4.2	3.1	2.5	1.8
SO_4	1.6	--[3]	4.0	2.4

[1] Concentrations in river or surface runoff were higher than in Tailings Basin seepage, preventing unique calibration solution

[2] Data may be skewed by a single high value (2.28 mg/L) at PM-13 in November 2006. Omission of this point leads to calibration flows of ~0.8 cfs.

[3] Loading from Pit 5NW is greater than load observed in river at PM-13.

Table 2-1. Low, Average, and High Flows in the Embarrass River at PM-12 and PM-13

Flow[1] (cfs)	Location in Embarrass River	
	PM-12	PM-13
Low	1.19	5.66
Average	13.80	81.53
High	144.35	853.08

[1] Flows include surface water runoff, natural groundwater seepage, and discharges from Babbitt WWTP and Pit 5NW

FOR COMPARISON: RS74B, Draft-02 Values

Flow[1] (cfs)	*Location in Embarrass River*	
	PM-12	*PM-13*
Low	*0.86*	*5.07*
Average	*13.80*	*81.53*
High	*144.35*	*853.08*

[1] Flows include surface water runoff, natural groundwater seepage, and discharges from Babbitt WWTP and Pit 5NW. In RS74B, Draft-02 no discharges from Babbitt WWTP and Pit 5NW were accounted for under low flow conditions.

Table 4-1. Unrecoverable Seepage Flows from the Tailings Basin During Operation and Closure under Tailings Basin - Proposed Action

	October 13, 2008 Memo - Unrecoverable Seepage to Embarrass River Watershed by Source - all flow conditions (gpm)		
	Hydrometallurgical Residue Cells	**Cells 1E & 2E**	**Cell 2W**
Prior to PolyMet Operations (2007)	--	900	895
Year 1	0.468	1430	895
Year 5	6.732	1841	895
Year 8	5.043	2150	895
Year 9	5.956	2360	895
Year 15	7.833	2535	895
Year 20	8.664	2680	895
Closure	0.744	1100	750
Post-Closure	0.744	1100	610

* 900 gpm + 895 gpm = 1795 gpm = 4 cfs

Prior to PolyMet Operations, the flows from Cells 1E & 2E and Cell 2W are calibrated to chloride concentrations measured in the Embarrass River to obtain a seepage of 4 cfs (1,795 gpm) from the combined LTVSMC Tailings Basin.

FOR COMPARISON: RS74B, Draft-02 Values

	RS74B, Draft-02 Unrecoverable Seepage to Embarrass River Watershed by Source - high and average flow (gpm)			***RS74B, Draft-02 Unrecoverable Seepage to Embarrass River Watershed by Source - low flow (gpm)***		
	Hydrometallurgical Residue Cells	***Cells 1E & 2E***	***Cell 2W***	***Hydrometallurgical Residue Cells***	***Cells 1E & 2E***	***Cell 2W***
Prior to PolyMet Operations (2001)	*--*	*900*	*4123*	*--*	*97*	*442*
Year 1	*0.468*	*1430*	*3573*	*0.468*	*154*	*385*
Year 5	*6.732*	*1841*	*3573*	*6.732*	*183*	*355*
Year 8	*5.043*	*2150*	*3573*	*5.043*	*202*	*336*
Year 9	*5.956*	*2360*	*3573*	*5.956*	*214*	*324*
Year 15	*7.833*	*2535*	*3573*	*7.833*	*224*	*315*
Year 20	*8.664*	*2680*	*3573*	*8.664*	*231*	*308*
Closure	*0.744*	*1100*	*1510*	*0.744*	*227*	*312*
Post-Closure	*0.744*	*1100*	*610*	*0.744*	*346*	*192*

Previously in RS74 Draft-01 and Draft-02, it was assumed that the existing flow from Cell 2W was 4,123 gpm (9.2 cfs) for high and average flows based on calibration of 2001 data. For low flows the sum of Cells 1E & 2E and Cell 2W was 1.2 cfs (539 gpm) which had been calibrated to measured sulfate concentrations in the river.

Table 4-4. Unrecoverable Seepage Flows from the Tailings Basin During Operation and Closure for Tailings Basin - Geotechnical Mitigation

	October 13, 2008 Memo - Unrecoverable Seepage to Embarrass River Watershed by Source - all flow conditions (gpm)		
	Hydrometallurgical Residue Cells[1]	**Cells 1E & 2E**	**Cell 2W**
Prior to PolyMet Operations (2007)	--	900	895
Year 1	0.468	1600	895
Year 5	6.732	2260	895
Year 10	7.712	2490	895
Year 15	7.833	2700	895
Year 20	8.664	2900	895
Closure	0.744	777	750
Post-Closure	0.744	777	610

* 900 gpm + 895 gpm = 1795 gpm = 4 cfs

[1]Seepage from Hydrometallurgical Residue Cells is the same for Tailings Basin-Proposed Action and Tailings Basin-Geotechnical Mitigation.
Prior to PolyMet Operations, the flows from Cells 1E & 2E and Cell 2W are calibrated to chloride concentrations measured in the Embarrass River to obtain a seepage of 4 cfs (1,795 gpm) from the combined LTVSMC Tailings Basin.

FOR COMPARISON: RS74B, Draft-02 Values

	RS74B, Draft-02 Unrecoverable Seepage to Embarrass River Watershed by Source - high and average flow (gpm)			***RS74B, Draft-02 Unrecoverable Seepage to Embarrass River Watershed by Source - low flow (gpm)***		
	Hydrometallurgical Residue Cells	***Cells 1E & 2E***	***Cell 2W***	***Hydrometallurgical Residue Cells***	***Cells 1E & 2E***	***Cell 2W***
Prior to PolyMet Operations (2001)	*--*	*900*	*4123*	*--*	*97*	*442*
Year 1	*0.468*	*1600*	*3573*	*0.468*	*167*	*372*
Year 5	*6.732*	*2260*	*3573*	*6.732*	*209*	*330*
Year 10	*7.712*	*2490*	*3573*	*5.043*	*221*	*317*
Year 15	*7.833*	*2700*	*3573*	*7.833*	*232*	*307*
Year 20	*8.664*	*2900*	*3573*	*8.664*	*241*	*297*
Closure	*0.744*	*777*	*1510*	*0.744*	*183*	*356*
Post-Closure	*0.744*	*777*	*610*	*0.744*	*302*	*237*

Previously in RS74 Draft-01 and Draft-02, it was assumed that the existing flow from Cell 2W was 4,123 gpm (9.2 cfs) for high and average flows based on calibration of 2001 data. For low flows the sum of Cells 1E & 2E and Cell 2W was 1.2 cfs (539 gpm) which had been calibrated to measured sulfate concentrations in the river.

Table 5-2. Input Concentrations Used in the Embarrass River Mass-Balance Model

Parameter	Units	Surface Runoff Concentration	Median Groundwater Concentration	Pre-PolyMet Seepage from Cell 2W	Area 5 Pit NW Discharge	*FOR COMPARISON: RS74B, Draft-02 Values* *Surface Runoff Concentration*
Ag	mg/L	0.00011	0.000008	0.0001	0.00016	*0.00011*
Al	mg/L	0.12	0.025	1.5788	0.0133	*0.1*
As	mg/L	0.00075	0.00273	0.002905	0.0013	*0.00075*
B	mg/L	0.027	0.0212	0.33	0.132	*0.012*
Ba	mg/L	0.016	0.0681	0.09298	0.0044	*0.011*
Be	mg/L	0.0001	0.000023	0.00075	0.0001	*0.0001*
Ca	mg/L	15	19	59.78	95.4	*13*
Cd	mg/L	0.00008	0.0003	0.000188	0.0001	*0.00008*
Cl	mg/L	6.5	1.8	21.54	5.95	*10*
Co	mg/L	0.0006	0.0011	0.001556	0.00055	*0.0006*
Cu	mg/L	0.0015	0.004	0.004555	0.0035	*0.0015*
F	mg/L	0.2	0.385	1.55	0.125	*0.1*
Fe	mg/L	2.9	0.035	4.594	0.038	*2.9*
Hardness	mg/L	70	87.5	436.6	943	*70*
K	mg/L	0.6	1.6	7.77	53.8	*3.7*
Mg	mg/L	5.9	10.65	69.97	271	*6*
Mn	mg/L	0.3	0.188	1.183	0.485	*0.3*
Na	mg/L	6	4.9	44.31	120	*6*
Ni	mg/L	0.0012	0.007	0.00688	0.0052	*0.0012*
Pb	mg/L	0.00015	0.0012	0.0012	0.0003	*0*
Sb [1]	mg/L	0.00004	0.0015	0.00025	0.00025	*0.00002*
Se	mg/L	0.0003	0.00295	0.00109	0.0016	*0.0003*
SO_4	mg/L	4	8.5	152.4	1046	*4*
Tl	mg/L	0.0002	0.000004	0.0002	0.0006	*0.0002*
Zn	mg/L	0.016	0.0115	0.01435	0.003	*0.016*

[1] Antimony was not measured in the MPCA or the Copper Nickel Study, therefore the groundwater value from the Partridge River watershed was used for the median groundwater concentration.

Table 5-4. Deterministic water quality predictions at surface water monitoring station PM-12 (mg/L)

Embarrass River PM-12 Tailings Basin - Proposed Action

Low flow conditions

Parameter	Average Measured Conditions	Year 01	Year 05	Year 08	Year 09	Year 15	Year 20	Closure	Post-Closure	Hardness Independent Standard
Ag	0.0001	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.001
Al	0.0983	0.0513	0.0513	0.0513	0.0513	0.0513	0.0513	0.0513	0.0513	0.125
As	0.0010	0.0022	0.0022	0.0022	0.0022	0.0022	0.0022	0.0022	0.0022	0.053
B	0.0175	0.0228	0.0228	0.0228	0.0228	0.0228	0.0228	0.0228	0.0228	0.5
Ba	0.0155	0.0537	0.0537	0.0537	0.0537	0.0537	0.0537	0.0537	0.0537	
Be	0.0001	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	
Ca	13.4	17.9	17.9	17.9	17.9	17.9	17.9	17.9	17.9	
Cd	0.0001	0.0002	0.0002	0.0002	0.0002	0.0002	0.0002	0.0002	0.0002	
Cd-Std	0.0008	0.0010	0.0010	0.0010	0.0010	0.0010	0.0010	0.0010	0.0010	
Cl	4.5	3.1	3.1	3.1	3.1	3.1	3.1	3.1	3.1	230
Co	0.0006	0.0010	0.0010	0.0010	0.0010	0.0010	0.0010	0.0010	0.0010	0.005
Cu	0.0015	0.0033	0.0033	0.0033	0.0033	0.0033	0.0033	0.0033	0.0033	
Cu-Std	0.0062	0.0079	0.0079	0.0079	0.0079	0.0079	0.0079	0.0079	0.0079	
F	0.1000	0.3337	0.3337	0.3337	0.3337	0.3337	0.3337	0.3337	0.3337	
Fe	1.7200	0.8295	0.8295	0.8295	0.8295	0.8295	0.8295	0.8295	0.8295	
Hard	61.7	82.6	82.6	82.6	82.6	82.6	82.6	82.6	82.6	
K	0.8	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	
Mg	6.2	9.3	9.3	9.3	9.3	9.3	9.3	9.3	9.3	
Mn	0.1600	0.2191	0.2191	0.2191	0.2191	0.2191	0.2191	0.2191	0.2191	
Na	3.0	5.2	5.2	5.2	5.2	5.2	5.2	5.2	5.2	
Ni	0.0019	0.0054	0.0054	0.0054	0.0054	0.0054	0.0054	0.0054	0.0054	
Ni-Std	0.0346	0.0444	0.0444	0.0444	0.0444	0.0444	0.0444	0.0444	0.0444	
Pb	0.0002	0.0009	0.0009	0.0009	0.0009	0.0009	0.0009	0.0009	0.0009	
Pb-Std	0.0017	0.0025	0.0025	0.0025	0.0025	0.0025	0.0025	0.0025	0.0025	
Sb	0.0015	0.0011	0.0011	0.0011	0.0011	0.0011	0.0011	0.0011	0.0011	0.031
Se	0.0005	0.0022	0.0022	0.0022	0.0022	0.0022	0.0022	0.0022	0.0022	0.005
SO_4	4.6	7.3	7.3	7.3	7.3	7.3	7.3	7.3	7.3	
Tl	0.0002	0.000058	0.000058	0.000058	0.000058	0.000058	0.000058	0.000058	0.000058	0.00056
Zn	0.0183	0.0127	0.0127	0.0127	0.0127	0.0127	0.0127	0.0127	0.0127	
Zn-Std	0.0704	0.0902	0.0902	0.0902	0.0902	0.0902	0.0902	0.0902	0.0902	

Notes

1) The hardness dependent standards for Cd, Cu, Ni, Pb and Zn are listed below the deterministic water quality predictions for each parameter.
2) Deterministic water quality predictions at PM-12 does not change during mine operation and closure because it is upstream of the tailings basin.
3) Predictions for low flow conditions correspond to surface runoff equal to zero, and groundwater recharge as the only natural flow contribution.

Table 5-5. Deterministic water quality predictions at surface water monitoring station PM-12 (mg/L)

Embarrass River PM-12 Tailings Basin - Proposed Action

Average flow conditions

Parameter	Average Measured Conditions	Year 01	Year 05	Year 08	Year 09	Year 15	Year 20	Closure	Post-Closure	Hardness Independent Standard
Ag	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.001
Al	0.0983	0.1141	0.1141	0.1141	0.1141	0.1141	0.1141	0.1141	0.1141	0.125
As	0.0010	0.0009	0.0009	0.0009	0.0009	0.0009	0.0009	0.0009	0.0009	0.053
B	0.0175	0.0266	0.0266	0.0266	0.0266	0.0266	0.0266	0.0266	0.0266	0.5
Ba	0.0155	0.0192	0.0192	0.0192	0.0192	0.0192	0.0192	0.0192	0.0192	
Be	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	
Ca	13.4	15.2	15.2	15.2	15.2	15.2	15.2	15.2	15.2	
Cd	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	
Cd-Std	0.0008	0.0009	0.0009	0.0009	0.0009	0.0009	0.0009	0.0009	0.0009	
Cl	4.5	6.2	6.2	6.2	6.2	6.2	6.2	6.2	6.2	230
Co	0.0006	0.0006	0.0006	0.0006	0.0006	0.0006	0.0006	0.0006	0.0006	0.005
Cu	0.0015	0.0017	0.0017	0.0017	0.0017	0.0017	0.0017	0.0017	0.0017	
Cu-Std	0.0062	0.0070	0.0070	0.0070	0.0070	0.0070	0.0070	0.0070	0.0070	
F	0.1000	0.2115	0.2115	0.2115	0.2115	0.2115	0.2115	0.2115	0.2115	
Fe	1.7200	2.7215	2.7215	2.7215	2.7215	2.7215	2.7215	2.7215	2.7215	
Hard	61.7	71.1	71.1	71.1	71.1	71.1	71.1	71.1	71.1	
K	0.8	0.6	0.6	0.6	0.7	0.7	0.7	0.6	0.6	
Mg	6.2	6.2	6.2	6.2	6.2	6.2	6.2	6.2	6.2	
Mn	0.1600	0.2930	0.2930	0.2930	0.2930	0.2930	0.2930	0.2930	0.2930	
Na	3.0	5.9	5.9	5.9	5.9	5.9	5.9	5.9	5.9	
Ni	0.0019	0.0016	0.0016	0.0016	0.0016	0.0016	0.0016	0.0016	0.0016	
Ni-Std	0.0346	0.0391	0.0391	0.0391	0.0391	0.0391	0.0391	0.0391	0.0391	
Pb	0.0002	0.0002	0.0002	0.0002	0.0002	0.0002	0.0002	0.0002	0.0002	
Pb-Std	0.0017	0.0021	0.0021	0.0021	0.0021	0.0021	0.0021	0.0021	0.0021	
Sb	0.0015	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.031
Se	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.005
SO_4	4.6	4.3	4.3	4.3	4.3	4.3	4.3	4.3	4.3	
Tl	0.0002	0.0002	0.0002	0.0002	0.0002	0.0002	0.0002	0.0002	0.0002	0.00056
Zn	0.0183	0.0157	0.0157	0.0157	0.0157	0.0157	0.0157	0.0157	0.0157	
Zn-Std	0.0704	0.0794	0.0794	0.0794	0.0794	0.0794	0.0794	0.0794	0.0794	

Notes

1) The hardness dependent standards for Cd, Cu, Ni, Pb and Zn are listed below the deterministic water quality predictions for each parameter.

2) Deterministic water quality predictions at PM-12 does not change during mine operation and closure because it is upstream of the tailings basin.

Table 5-6. Deterministic water quality predictions at surface water monitoring station PM-12 (mg/L)

Embarrass River PM-12 Tailings Basin - Proposed Action

High flow conditions

Parameter	Average Measured Conditions	Year 01	Year 05	Year 08	Year 09	Year 15	Year 20	Closure	Post-Closure	Hardness Independent Standard
Ag	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.001
Al	0.0983	0.1194	0.1194	0.1194	0.1194	0.1194	0.1194	0.1194	0.1194	0.125
As	0.0010	0.0008	0.0008	0.0008	0.0008	0.0008	0.0008	0.0008	0.0008	0.053
B	0.0175	0.0270	0.0270	0.0270	0.0270	0.0270	0.0270	0.0270	0.0270	0.5
Ba	0.0155	0.0163	0.0163	0.0163	0.0163	0.0163	0.0163	0.0163	0.0163	
Be	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	
Ca	13.4	15.0	15.0	15.0	15.0	15.0	15.0	15.0	15.0	
Cd	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	
Cd-Std	0.0008	0.0009	0.0009	0.0009	0.0009	0.0009	0.0009	0.0009	0.0009	
Cl	4.5	6.5	6.5	6.5	6.5	6.5	6.5	6.5	6.5	230
Co	0.0006	0.0006	0.0006	0.0006	0.0006	0.0006	0.0006	0.0006	0.0006	0.005
Cu	0.0015	0.0015	0.0015	0.0015	0.0015	0.0015	0.0015	0.0015	0.0015	
Cu-Std	0.0062	0.0069	0.0069	0.0069	0.0069	0.0069	0.0069	0.0069	0.0069	
F	0.1000	0.2011	0.2011	0.2011	0.2011	0.2011	0.2011	0.2011	0.2011	
Fe	1.7200	2.8829	2.8829	2.8829	2.8829	2.8829	2.8829	2.8829	2.8829	
Hard	61.7	70.1	70.1	70.1	70.1	70.1	70.1	70.1	70.1	
K	0.8	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	
Mg	6.2	5.9	5.9	5.9	5.9	5.9	5.9	5.9	5.9	
Mn	0.1600	0.2993	0.2993	0.2993	0.2993	0.2993	0.2993	0.2993	0.2993	
Na	3.0	6.0	6.0	6.0	6.0	6.0	6.0	6.0	6.0	
Ni	0.0019	0.0012	0.0012	0.0012	0.0012	0.0012	0.0012	0.0012	0.0012	
Ni-Std	0.0346	0.0386	0.0386	0.0386	0.0386	0.0386	0.0386	0.0386	0.0386	
Pb	0.0002	0.0002	0.0002	0.0002	0.0002	0.0002	0.0002	0.0002	0.0002	
Pb-Std	0.0017	0.0020	0.0020	0.0020	0.0020	0.0020	0.0020	0.0020	0.0020	
Sb	0.0015	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.031
Se	0.0005	0.0003	0.0003	0.0003	0.0003	0.0003	0.0003	0.0003	0.0003	0.005
SO_4	4.6	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	
Tl	0.0002	0.0002	0.0002	0.0002	0.0002	0.0002	0.0002	0.0002	0.0002	0.00056
Zn	0.0183	0.0160	0.0160	0.0160	0.0160	0.0160	0.0160	0.0160	0.0160	
Zn-Std	0.0704	0.0785	0.0785	0.0785	0.0785	0.0785	0.0785	0.0785	0.0785	

Notes

1) The hardness dependent standards for Cd, Cu, Ni, Pb and Zn are listed below the deterministic water quality predictions for each parameter.

2) Deterministic water quality predictions at PM-12 does not change during mine operation and closure because it is upstream of the tailings basin.

Table 5-7. Deterministic water quality predictions at surface water monitoring station PM-13 (mg/L)

Embarrass River PM-13 Tailings Basin - Proposed Action

Low flow conditions

Parameter	Average Measured Conditions	Year 01	Year 05	Year 08	Year 09	Year 15	Year 20	Closure	Post-Closure	Hardness Independent Standard
Ag	0.0001	0.0003	0.0003	0.0004	0.0004	0.0005	0.0006	0.0003	0.0003	0.001
Al	0.1916	0.3091	0.3157	0.3053	0.3004	0.4295	0.4069	0.4467	0.4094	0.125
As	0.0010	0.0036	0.0041	0.0043	0.0047	0.0072	0.0078	0.0051	0.0051	0.053
B	0.0443	0.1155	0.1160	0.1192	0.1217	0.1276	0.1356	0.1216	0.1147	0.5
Ba	0.0278	0.0651	0.0632	0.0625	0.0621	0.0457	0.0683	0.0639	0.0629	
Be	0.0001	0.0002	0.0003	0.0003	0.0004	0.0007	0.0007	0.0003	0.0003	
Ca	19.9	36.1	40.7	48.0	50.1	53.4	52.0	38.2	37.5	
Cd	0.0001	0.0002	0.0002	0.0003	0.0003	0.0004	0.0004	0.0003	0.0003	
Cd-Std	0.0015	0.0023	0.0022	0.0022	0.0022	0.0022	0.0023	0.0020	0.0019	
Cl	7.0	10.9	10.7	8.4	8.5	9.1	9.9	6.9	6.4	230
Co	0.0005	0.0012	0.0015	0.0016	0.0017	0.0040	0.0041	0.0012	0.0012	0.005
Cu	0.0020	0.0046	0.0053	0.0058	0.0059	0.0099	0.0111	0.0076	0.0077	
Cu-Std	0.0123	0.0169	0.0168	0.0166	0.0167	0.0168	0.0172	0.0154	0.0150	
F	0.3900	1.8179	1.2235	0.7188	0.6819	0.6185	0.7180	0.4794	0.4441	
Fe	1.2900	0.9520	0.8969	0.8502	0.8219	0.8050	0.7940	1.0707	0.9547	
Hard	143.5	239.4	236.5	231.9	235.3	238.0	246.7	205.7	198.1	
K	2.3	6.2	5.9	5.6	5.8	8.5	8.7	7.0	6.9	
Mg	15.9	38.9	33.2	28.2	27.4	25.3	28.3	29.6	28.3	
Mn	0.1100	0.4114	0.4086	0.3983	0.3911	0.3895	0.4564	0.3917	0.3657	
Na	12.7	32.9	24.9	19.3	20.6	19.3	19.6	16.6	15.7	
Ni	0.0021	0.0075	0.0148	0.0190	0.0208	0.0669	0.0659	0.0088	0.0088	
Ni-Std	0.0708	0.1092	0.1080	0.1063	0.1076	0.1086	0.1120	0.0960	0.0930	
Pb	0.0003	0.0010	0.0010	0.0012	0.0014	0.0013	0.0014	0.0011	0.0011	
Pb-Std	0.0050	0.0097	0.0095	0.0093	0.0095	0.0096	0.0100	0.0080	0.0076	
Sb	0.0015	0.0022	0.0030	0.0038	0.0042	0.0050	0.0051	0.0022	0.0022	0.031
Se	0.0005	0.0019	0.0020	0.0020	0.0020	0.0015	0.0024	0.0022	0.0022	0.005
SO_4	36.1	99.9	111.0	115.4	123.3	156.1	148.6	87.2	85.1	
Tl	0.0002	0.0003	0.0004	0.0004	0.0004	0.0006	0.0005	0.0003	0.0003	0.00056
Zn	0.0123	0.0115	0.0141	0.0187	0.0234	0.0378	0.0336	0.0141	0.0141	
Zn-Std	0.1440	0.2221	0.2198	0.2162	0.2189	0.2210	0.2278	0.1953	0.1892	

Notes

1) The hardness dependent standards for Cd, Cu, Ni, Pb and Zn are listed below the deterministic water quality predictions for each parameter.
2) Predictions for low flow conditions correspond to surface runoff equal to zero, and groundwater recharge as the only natural flow contribution.

Table 5-8. Deterministic water quality predictions at surface water monitoring station PM-13 (mg/L)

Embarrass River PM-13 Tailings Basin - Proposed Action

Average flow conditions

Parameter	Average Measured Conditions	Year 01	Year 05	Year 08	Year 09	Year 15	Year 20	Closure	Post-Closure	Hardness Independent Standard
Ag	0.0001	0.0001	0.0001	0.0001	0.0002	0.0002	0.0002	0.0001	0.0001	0.001
Al	0.1916	0.1415	0.1442	0.1440	0.1442	0.1642	0.1617	0.1552	0.1500	0.125
As	0.0010	0.0011	0.0012	0.0013	0.0013	0.0017	0.0018	0.0013	0.0012	0.053
B	0.0443	0.0401	0.0410	0.0421	0.0428	0.0440	0.0456	0.0399	0.0389	0.5
Ba	0.0278	0.0219	0.0221	0.0223	0.0225	0.0202	0.0237	0.0212	0.0210	
Be	0.0001	0.0001	0.0001	0.0001	0.0001	0.0002	0.0002	0.0001	0.0001	
Ca	19.9	19.2	20.0	21.2	21.7	22.3	22.2	19.3	19.1	
Cd	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	
Cd-Std	0.0015	0.0012	0.0012	0.0012	0.0012	0.0012	0.0013	0.0012	0.0012	
Cl	7.0	7.0	7.1	6.8	6.8	6.9	7.0	6.5	6.5	230
Co	0.0005	0.0007	0.0007	0.0007	0.0008	0.0011	0.0011	0.0007	0.0007	0.005
Cu	0.0020	0.0019	0.0021	0.0021	0.0022	0.0028	0.0030	0.0022	0.0022	
Cu-Std	0.0123	0.0100	0.0101	0.0101	0.0102	0.0103	0.0104	0.0096	0.0095	
F	0.3900	0.4008	0.3360	0.2717	0.2687	0.2610	0.2775	0.2304	0.2256	
Fe	1.2900	2.5993	2.5744	2.5549	2.5417	2.5316	2.5237	2.6332	2.6261	
Hard	143.5	108.6	109.6	109.9	111.1	112.0	113.8	103.1	101.9	
K	2.3	2.4	2.4	2.4	2.4	2.8	2.9	2.4	2.4	
Mg	15.9	15.3	14.8	14.2	14.2	13.9	14.4	14.0	13.8	
Mn	0.1100	0.3176	0.3182	0.3175	0.3169	0.3170	0.3274	0.3142	0.3110	
Na	12.7	11.6	10.8	10.1	10.3	10.2	10.3	9.5	9.4	
Ni	0.0021	0.0021	0.0031	0.0038	0.0041	0.0111	0.0111	0.0021	0.0021	
Ni-Std	0.0708	0.0559	0.0564	0.0565	0.0570	0.0574	0.0582	0.0535	0.0530	
Pb	0.0003	0.0003	0.0003	0.0003	0.0003	0.0003	0.0003	0.0003	0.0003	
Pb-Std	0.0050	0.0035	0.0036	0.0036	0.0036	0.0037	0.0038	0.0033	0.0033	
Sb	0.0015	0.0003	0.0004	0.0006	0.0007	0.0008	0.0008	0.0003	0.0003	0.031
Se	0.0005	0.0005	0.0006	0.0006	0.0006	0.0005	0.0006	0.0005	0.0005	0.005
SO_4	36.1	36.8	38.9	40.1	41.7	46.9	46.2	34.6	34.1	
Tl	0.0002	0.0002	0.0002	0.0002	0.0002	0.0003	0.0003	0.0002	0.0002	0.00056
Zn	0.0123	0.0152	0.0155	0.0161	0.0168	0.0190	0.0184	0.0155	0.0155	
Zn-Std	0.1440	0.1137	0.1146	0.1149	0.1159	0.1167	0.1183	0.1088	0.1077	

Notes

1) The hardness dependent standards for Cd, Cu, Ni, Pb and Zn are listed below the deterministic water quality predictions for each parameter.

Table 5-9. Deterministic water quality predictions at surface water monitoring station PM-13 (mg/L)

Embarrass River PM-13 Tailings Basin - Proposed Action

High flow conditions

Parameter	Average Measured Conditions	Year 01	Year 05	Year 08	Year 09	Year 15	Year 20	Closure	Post-Closure	Hardness Independent Standard
Ag	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.001
Al	0.1916	0.1222	0.1225	0.1225	0.1225	0.1246	0.1243	0.1235	0.1230	0.125
As	0.0010	0.0008	0.0008	0.0008	0.0008	0.0009	0.0009	0.0008	0.0008	0.053
B	0.0443	0.0283	0.0284	0.0285	0.0286	0.0288	0.0289	0.0283	0.0282	0.5
Ba	0.0278	0.0166	0.0166	0.0167	0.0167	0.0164	0.0168	0.0165	0.0165	
Be	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	
Ca	19.9	15.3	15.4	15.5	15.6	15.6	15.6	15.3	15.3	
Cd	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	
Cd-Std	0.0015	0.0009	0.0009	0.0009	0.0009	0.0009	0.0009	0.0009	0.0009	
Cl	7.0	6.6	6.6	6.5	6.5	6.5	6.6	6.5	6.5	230
Co	0.0005	0.0006	0.0006	0.0006	0.0006	0.0007	0.0007	0.0006	0.0006	0.005
Cu	0.0020	0.0015	0.0016	0.0016	0.0016	0.0016	0.0017	0.0016	0.0016	
Cu-Std	0.0123	0.0072	0.0072	0.0072	0.0072	0.0072	0.0073	0.0072	0.0071	
F	0.3900	0.2203	0.2139	0.2074	0.2071	0.2063	0.2081	0.2030	0.2025	
Fe	1.2900	2.8696	2.8668	2.8645	2.8630	2.8618	2.8609	2.8733	2.8727	
Hard	143.5	73.9	74.0	74.1	74.2	74.4	74.6	73.3	73.2	
K	2.3	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	
Mg	15.9	6.9	6.8	6.8	6.8	6.7	6.8	6.7	6.7	
Mn	0.1100	0.3018	0.3019	0.3018	0.3017	0.3018	0.3028	0.3014	0.3011	
Na	12.7	6.6	6.5	6.4	6.4	6.4	6.4	6.3	6.3	
Ni	0.0021	0.0013	0.0014	0.0015	0.0015	0.0022	0.0022	0.0013	0.0013	
Ni-Std	0.0708	0.0404	0.0405	0.0405	0.0405	0.0406	0.0407	0.0401	0.0401	
Pb	0.0003	0.0002	0.0002	0.0002	0.0002	0.0002	0.0002	0.0002	0.0002	
Pb-Std	0.0050	0.0022	0.0022	0.0022	0.0022	0.0022	0.0022	0.0021	0.0021	
Sb	0.0015	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.031
Se	0.0005	0.0003	0.0003	0.0003	0.0003	0.0003	0.0003	0.0003	0.0003	0.005
SO_4	36.1	7.3	7.6	7.7	7.9	8.4	8.4	7.1	7.0	
Tl	0.0002	0.0002	0.0002	0.0002	0.0002	0.0002	0.0002	0.0002	0.0002	0.00056
Zn	0.0123	0.0159	0.0159	0.0160	0.0161	0.0163	0.0163	0.0160	0.0160	
Zn-Std	0.1440	0.0820	0.0822	0.0822	0.0824	0.0825	0.0827	0.0815	0.0814	

Notes

1) The hardness dependent standards for Cd, Cu, Ni, Pb and Zn are listed below the deterministic water quality predictions for each parameter.

Table 5-10. Multiplying Factors for Concentrations of Leachate from PolyMet Tailings Basin (Cell 1E & 2E) and Hydrometallurgical Residue Cells That Would Cause the Embarrass River Water Chemistry Predictions to Exceed the Minnesota Surface Water Quality Standards

Embarrass River

Proposed Action

	Low Flow					Average Flow					High Flow				
Parameter	Standard (mg/L)[1]	Factor	Year	Location	Corresponding SO_4 concentration (mg/L)	Standard (mg/L)[1]	Factor	Year	Location	Corresponding SO_4 concentration (mg/L)	Standard (mg/L)[1]	Factor	Year	Location	Corresponding SO_4 concentration (mg/L)
As	0.0530	7.9	Year 15	PM-13	932.9	0.0530	54.0	Year 15	PM-13	935.3	0.0530	513.0	Year 15	PM-13	897.4
Co	0.0050	1.2	Year 15	PM-13	181.2	0.0050	8.0	Year 15	PM-13	164.6	0.0050	78.0	Year 15	PM-13	142.2
Cu	0.0172	1.7	Year 20	PM-13	220.8	0.0104	6.6	Year 20	PM-13	134.2	0.0073	41.0	Year 20	PM-13	73.8
Ni	0.1192	1.8	Year 15	PM-13	248.5	0.0592	6.0	Year 15	PM-13	131.1	0.0408	40.0	Year 15	PM-13	76.2
Sb	0.0310	6.4	Year 15	PM-13	764.6	0.0310	43.0	Year 15	PM-13	751.0	0.0310	416.0	Year 15	PM-13	729.0

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	Low Flow					Average Flow					High Flow				
Parameter	Standard (mg/L)[1]	Factor	Year	Location	Corresponding SO_4 concentration (mg/L)	Standard (mg/L)[1]	Factor	Year	Location	Corresponding SO_4 concentration (mg/L)	Standard (mg/L)[1]	Factor	Year	Location	Corresponding SO_4 concentration (mg/L)
As	0.0530	9.3	Post-Closure	PM-13	397.5	0.0530	89.0	Year 10	PM-13	1393.3	0.0530	858.0	Year 10	PM-13	1,366.6
Co	0.0050	4.4	Year 20	PM-13	416.5	0.0050	27.9	Year 20	PM-13	415.1	0.0050	267.0	Year 20	PM-13	377.7
Cu	0.0162	2.7	Year 20	PM-13	272.6	0.0102	10.5	Year 20	PM-13	170.0	0.0072	67.0	Year 20	PM-13	99.8
Ni	0.1030	9.2	Year 20	PM-13	823.1	0.0569	32.3	Year 20	PM-13	459.9	0.0406	220.0	Year 20	PM-13	312.4
Sb	0.0310	6.2	Year 10	PM-13	686.7	0.0310	42.3	Year 10	PM-13	678.3	0.0310	409.0	Year 10	PM-13	655.0

[1] As, Co and Sb standards are hardness independent. Cu and Ni standards are hardness dependent and assume that the hardness and standards do not change from Tables 5-7 to 5-9 and Tables 7-4 to 7-6.

Table 5-11. Comparison of concentrations of leachate from PolyMet Tailings Basin (Cell 1E & 2E) and Hydrometallurgical Residue Cells (all occurring concurrently) that would cause Embarrass River water chemistry predictions to exceed the Minnesota surface water quality standards and the "Base Case" concentrations of these mine site features. "Base Case" concentrations are those presented in Tables 5-7 to 5-9 and Tables 7-4 to 7-6.

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As						
Flow/Yield Condition	**Low Flow**		**Average Flow**		**High Flow**	
Year when Standard Exceeded	**Year 15**		**Year 15**		**Year 15**	
Feature	**"Base Case" Concentration (mg/L)**	**Concentration causing exceedance (mg/L)**	**"Base Case" Concentration (mg/L)**	**Concentration causing exceedance (mg/L)**	**"Base Case" Concentration (mg/L)**	**Concentration causing exceedance (mg/L)**
PolyMet Tailings Basin	0.0155	0.123	0.0155	0.838	0.0155	7.959
Hydrometallurgical Residue Cells	0.0040	0.032	0.0040	0.2160	0.0040	2.0520
Factor to Exceed Standard		7.9		54.0		513.0

Co						
Flow/Yield Condition	**Low Flow**		**Average Flow**		**High Flow**	
Year when Standard Exceeded	**Year 15**		**Year 15**		**Year 15**	
Feature	**"Base Case" Concentration (mg/L)**	**Concentration causing exceedance (mg/L)**	**"Base Case" Concentration (mg/L)**	**Concentration causing exceedance (mg/L)**	**"Base Case" Concentration (mg/L)**	**Concentration causing exceedance (mg/L)**
PolyMet Tailings Basin	0.0087	0.010	0.0087	0.069	0.0087	0.676
Hydrometallurgical Residue Cells	0.0050	0.006	0.0050	0.0400	0.0050	0.3900
Factor to Exceed Standard		1.2		8.0		78.0

Cu						
Flow/Yield Condition	**Low Flow**		**Average Flow**		**High Flow**	
Year when Standard Exceeded	**Year 20**		**Year 20**		**Year 20**	
Feature	**"Base Case" Concentration (mg/L)**	**Concentration causing exceedance (mg/L)**	**"Base Case" Concentration (mg/L)**	**Concentration causing exceedance (mg/L)**	**"Base Case" Concentration (mg/L)**	**Concentration causing exceedance (mg/L)**
PolyMet Tailings Basin	0.0202	0.0344	0.0202	0.133	0.0202	0.829
Hydrometallurgical Residue Cells	0.0015	0.0026	0.0015	0.0099	0.0015	0.0615
Factor to Exceed Standard		1.7		6.6		41.0

Ni						
Flow/Yield Condition	**Low Flow**		**Average Flow**		**High Flow**	
Year when Standard Exceeded	**Year 15**		**Year 15**		**Year 15**	
Feature	**"Base Case" Concentration (mg/L)**	**Concentration causing exceedance (mg/L)**	**"Base Case" Concentration (mg/L)**	**Concentration causing exceedance (mg/L)**	**"Base Case" Concentration (mg/L)**	**Concentration causing exceedance (mg/L)**
PolyMet Tailings Basin	0.1537	0.277	0.1537	0.922	0.1537	6.146
Hydrometallurgical Residue Cells	0.0980	0.176	0.0980	0.5880	0.0980	3.9200
Factor to Exceed Standard		1.8		6.0		40.0

Sb						
Flow/Yield Condition	**Low Flow**		**Average Flow**		**High Flow**	
Year when Standard Exceeded	**Year 15**		**Year 15**		**Year 15**	
Feature	**"Base Case" Concentration (mg/L)**	**Concentration causing exceedance (mg/L)**	**"Base Case" Concentration (mg/L)**	**Concentration causing exceedance (mg/L)**	**"Base Case" Concentration (mg/L)**	**Concentration causing exceedance (mg/L)**
PolyMet Tailings Basin	0.0113	0.073	0.0113	0.488	0.0113	4.719
Hydrometallurgical Residue Cells	0.0040	0.026	0.0040	0.1720	0.0040	1.6640
Factor to Exceed Standard		6.4		43.0		416.0

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As						
Flow/Yield Condition	**Low Flow**		**Average Flow**		**High Flow**	
Year when Standard Exceeded	**Post-Closure**		**Year 10**		**Year 10**	
Feature	**"Base Case" Concentration (mg/L)**	**Concentration causing exceedance (mg/L)**	**"Base Case" Concentration (mg/L)**	**Concentration causing exceedance (mg/L)**	**"Base Case" Concentration (mg/L)**	**Concentration causing exceedance (mg/L)**
PolyMet Tailings Basin	0.0279	0.221	0.0094	0.509	0.0094	4.839
Hydrometallurgical Residue Cells	0.0040	0.0316	0.0040	0.2160	0.0040	2.0520
Factor to Exceed Standard		9.3		89.0		858.0

Co						
Flow/Yield Condition	**Low Flow**		**Average Flow**		**High Flow**	
Year when Standard Exceeded	**Year 20**		**Year 20**		**Year 20**	
Feature	**"Base Case" Concentration (mg/L)**	**Concentration causing exceedance (mg/L)**	**"Base Case" Concentration (mg/L)**	**Concentration causing exceedance (mg/L)**	**"Base Case" Concentration (mg/L)**	**Concentration causing exceedance (mg/L)**
PolyMet Tailings Basin	0.0022	0.003	0.0022	0.017	0.0022	0.170
Hydrometallurgical Residue Cells	0.0050	0.0060	0.0050	0.0400	0.0050	0.3900
Factor to Exceed Standard		4.4		27.9		267.0

Cu						
Flow/Yield Condition	**Low Flow**		**Average Flow**		**High Flow**	
Year when Standard Exceeded	**Year 20**		**Year 20**		**Year 20**	
Feature	**"Base Case" Concentration (mg/L)**	**Concentration causing exceedance (mg/L)**	**"Base Case" Concentration (mg/L)**	**Concentration causing exceedance (mg/L)**	**"Base Case" Concentration (mg/L)**	**Concentration causing exceedance (mg/L)**
PolyMet Tailings Basin	0.0114	0.019	0.0114	0.075	0.0114	0.469
Hydrometallurgical Residue Cells	0.0015	0.0026	0.0015	0.0099	0.0015	0.0615
Factor to Exceed Standard		2.7		10.5		67.0

Ni						
Flow/Yield Condition	**Low Flow**		**Average Flow**		**High Flow**	
Year when Standard Exceeded	**Year 20**		**Year 20**		**Year 20**	
Feature	**"Base Case" Concentration (mg/L)**	**Concentration causing exceedance (mg/L)**	**"Base Case" Concentration (mg/L)**	**Concentration causing exceedance (mg/L)**	**"Base Case" Concentration (mg/L)**	**Concentration causing exceedance (mg/L)**
PolyMet Tailings Basin	0.0236	0.042	0.0236	0.141	0.0236	0.943
Hydrometallurgical Residue Cells	0.0980	0.1764	0.0980	0.5880	0.0980	3.9200
Factor to Exceed Standard		9.2		32.3		220.0

Sb						
Flow/Yield Condition	**Low Flow**		**Average Flow**		**High Flow**	
Year when Standard Exceeded	**Year 10**		**Year 10**		**Year 10**	
Feature	**"Base Case" Concentration (mg/L)**	**Concentration causing exceedance (mg/L)**	**"Base Case" Concentration (mg/L)**	**Concentration causing exceedance (mg/L)**	**"Base Case" Concentration (mg/L)**	**Concentration causing exceedance (mg/L)**
PolyMet Tailings Basin	0.0117	0.075	0.0117	0.504	0.0117	4.88
Hydrometallurgical Residue Cells	0.0040	0.0256	0.0040	0.1720	0.0040	1.6640
Factor to Exceed Standard		6.2		42.3		409.0

Table 7-1. Deterministic water quality predictions at surface water monitoring station PM-12 (mg/L)

Embarrass River PM-12 Tailings Basin - Geotechnical Mitigation

Low flow conditions

Parameter	Average Measured Conditions	Year 01	Year 05	Year 10	Year 15	Year 20	Closure	Post-Closure	Hardness Independent Standard
Ag	0.0001	0.00004	0.00004	0.00004	0.00004	0.00004	0.00004	0.00004	0.001
Al	0.0983	0.0513	0.0513	0.0513	0.0513	0.0513	0.0513	0.0513	0.125
As	0.0010	0.0022	0.0022	0.0022	0.0022	0.0022	0.0022	0.0022	0.053
B	0.0175	0.0228	0.0228	0.0228	0.0228	0.0228	0.0228	0.0228	0.5
Ba	0.0155	0.0537	0.0537	0.0537	0.0537	0.0537	0.0537	0.0537	
Be	0.0001	0.00004	0.00004	0.00004	0.00004	0.00004	0.00004	0.00004	
Ca	13.4	17.9	17.9	17.9	17.9	17.9	17.9	17.9	
Cd	0.0001	0.0002	0.0002	0.0002	0.0002	0.0002	0.0002	0.0002	
Cd-Std	0.0008	0.0010	0.0010	0.0010	0.0010	0.0010	0.0010	0.0010	
Cl	4.5	3.1	3.1	3.1	3.1	3.1	3.1	3.1	230
Co	0.0006	0.0010	0.0010	0.0010	0.0010	0.0010	0.0010	0.0010	0.005
Cu	0.0015	0.0033	0.0033	0.0033	0.0033	0.0033	0.0033	0.0033	
Cu-Std	0.0062	0.0079	0.0079	0.0079	0.0079	0.0079	0.0079	0.0079	
F	0.1000	0.3337	0.3337	0.3337	0.3337	0.3337	0.3337	0.3337	
Fe	1.7200	0.8295	0.8295	0.8295	0.8295	0.8295	0.8295	0.8295	
Hard	61.7	82.6	82.6	82.6	82.6	82.6	82.6	82.6	
K	0.8	1.2	1.2	1.2	1.2	1.2	1.2	1.2	
Mg	6.2	9.3	9.3	9.3	9.3	9.3	9.3	9.3	
Mn	0.1600	0.2191	0.2191	0.2191	0.2191	0.2191	0.2191	0.2191	
Na	3.0	5.2	5.2	5.2	5.2	5.2	5.2	5.2	
Ni	0.0019	0.0054	0.0054	0.0054	0.0054	0.0054	0.0054	0.0054	
Ni-Std	0.0346	0.0444	0.0444	0.0444	0.0444	0.0444	0.0444	0.0444	
Pb	0.0002	0.0009	0.0009	0.0009	0.0009	0.0009	0.0009	0.0009	
Pb-Std	0.0017	0.0025	0.0025	0.0025	0.0025	0.0025	0.0025	0.0025	
Sb	0.0015	0.0011	0.0011	0.0011	0.0011	0.0011	0.0011	0.0011	0.031
Se	0.0005	0.0022	0.0022	0.0022	0.0022	0.0022	0.0022	0.0022	0.005
SO_4	4.6	7.3	7.3	7.3	7.3	7.3	7.3	7.3	
Tl	0.0002	0.000058	0.000058	0.000058	0.000058	0.000058	0.000058	0.000058	0.00056
Zn	0.0183	0.0127	0.0127	0.0127	0.0127	0.0127	0.0127	0.0127	
Zn-Std	0.0704	0.0902	0.0902	0.0902	0.0902	0.0902	0.0902	0.0902	

Notes

1) The hardness dependent standards for Cd, Cu, Ni, Pb and Zn are listed below the deterministic water quality predictions for each parameter.
2) Deterministic water quality predictions at PM-12 does not change during mine operation and closure because it is upstream of the tailings ba
3) Predictions for low flow conditions correspond to surface runoff equal to zero, and groundwater recharge as the only natural flow contribution

Table 7-2. Deterministic water quality predictions at surface water monitoring station PM-12 (mg/L)

Embarrass River PM-12 Tailings Basin - Geotechnical Mitigation

Average flow conditions

Parameter	Average Measured Conditions	Year 01	Year 05	Year 10	Year 15	Year 20	Closure	Post-Closure	Hardness Independent Standard
Ag	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.001
Al	0.0983	0.1141	0.1141	0.1141	0.1141	0.1141	0.1141	0.1141	0.125
As	0.0010	0.0009	0.0009	0.0009	0.0009	0.0009	0.0009	0.0009	0.053
B	0.0175	0.0266	0.0266	0.0266	0.0266	0.0266	0.0266	0.0266	0.5
Ba	0.0155	0.0192	0.0192	0.0192	0.0192	0.0192	0.0192	0.0192	
Be	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	
Ca	13.4	15.2	15.2	15.2	15.2	15.2	15.2	15.2	
Cd	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	
Cd-Std	0.0008	0.0009	0.0009	0.0009	0.0009	0.0009	0.0009	0.0009	
Cl	4.5	6.2	6.2	6.2	6.2	6.2	6.2	6.2	230
Co	0.0006	0.0006	0.0006	0.0006	0.0006	0.0006	0.0006	0.0006	0.005
Cu	0.0015	0.0017	0.0017	0.0017	0.0017	0.0017	0.0017	0.0017	
Cu-Std	0.0062	0.0070	0.0070	0.0070	0.0070	0.0070	0.0070	0.0070	
F	0.1000	0.2115	0.2115	0.2115	0.2115	0.2115	0.2115	0.2115	
Fe	1.7200	2.7215	2.7215	2.7215	2.7215	2.7215	2.7215	2.7215	
Hard	61.7	71.1	71.1	71.1	71.1	71.1	71.1	71.1	
K	0.8	0.6	0.6	0.7	0.7	0.7	0.6	0.6	
Mg	6.2	6.2	6.2	6.2	6.2	6.2	6.2	6.2	
Mn	0.1600	0.2930	0.2930	0.2930	0.2930	0.2930	0.2930	0.2930	
Na	3.0	5.9	5.9	5.9	5.9	5.9	5.9	5.9	
Ni	0.0019	0.0016	0.0016	0.0016	0.0016	0.0016	0.0016	0.0016	
Ni-Std	0.0346	0.0391	0.0391	0.0391	0.0391	0.0391	0.0391	0.0391	
Pb	0.0002	0.0002	0.0002	0.0002	0.0002	0.0002	0.0002	0.0002	
Pb-Std	0.0017	0.0021	0.0021	0.0021	0.0021	0.0021	0.0021	0.0021	
Sb	0.0015	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.031
Se	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.005
SO_4	4.6	4.3	4.3	4.3	4.3	4.3	4.3	4.3	
Tl	0.0002	0.0002	0.0002	0.0002	0.0002	0.0002	0.0002	0.0002	0.00056
Zn	0.0183	0.0157	0.0157	0.0157	0.0157	0.0157	0.0157	0.0157	
Zn-Std	0.0704	0.0794	0.0794	0.0794	0.0794	0.0794	0.0794	0.0794	

Notes

1) The hardness dependent standards for Cd, Cu, Ni, Pb and Zn are listed below the deterministic water quality predictions for each parameter.

2) Deterministic water quality predictions at PM-12 does not change during mine operation and closure because it is upstream of the tailings ba

Table 7-3. Deterministic water quality predictions at surface water monitoring station PM-12 (mg/L)

Embarrass River PM-12 Tailings Basin - Geotechnical Mitigation

High flow conditions

Parameter	Average Measured Conditions	Year 01	Year 05	Year 10	Year 15	Year 20	Closure	Post-Closure	Hardness Independent Standard
Ag	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.001
Al	0.0983	0.1194	0.1194	0.1194	0.1194	0.1194	0.1194	0.1194	0.125
As	0.0010	0.0008	0.0008	0.0008	0.0008	0.0008	0.0008	0.0008	0.053
B	0.0175	0.0270	0.0270	0.0270	0.0270	0.0270	0.0270	0.0270	0.5
Ba	0.0155	0.0163	0.0163	0.0163	0.0163	0.0163	0.0163	0.0163	
Be	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	
Ca	13.4	15.0	15.0	15.0	15.0	15.0	15.0	15.0	
Cd	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	
Cd-Std	0.0008	0.0009	0.0009	0.0009	0.0009	0.0009	0.0009	0.0009	
Cl	4.5	6.5	6.5	6.5	6.5	6.5	6.5	6.5	230
Co	0.0006	0.0006	0.0006	0.0006	0.0006	0.0006	0.0006	0.0006	0.005
Cu	0.0015	0.0015	0.0015	0.0015	0.0015	0.0015	0.0015	0.0015	
Cu-Std	0.0062	0.0069	0.0069	0.0069	0.0069	0.0069	0.0069	0.0069	
F	0.1000	0.2011	0.2011	0.2011	0.2011	0.2011	0.2011	0.2011	
Fe	1.7200	2.8829	2.8829	2.8829	2.8829	2.8829	2.8829	2.8829	
Hard	61.7	70.1	70.1	70.1	70.1	70.1	70.1	70.1	
K	0.8	0.6	0.6	0.6	0.6	0.6	0.6	0.6	
Mg	6.2	5.9	5.9	5.9	5.9	5.9	5.9	5.9	
Mn	0.1600	0.2993	0.2993	0.2993	0.2993	0.2993	0.2993	0.2993	
Na	3.0	6.0	6.0	6.0	6.0	6.0	6.0	6.0	
Ni	0.0019	0.0012	0.0012	0.0012	0.0012	0.0012	0.0012	0.0012	
Ni-Std	0.0346	0.0386	0.0386	0.0386	0.0386	0.0386	0.0386	0.0386	
Pb	0.0002	0.00016	0.00016	0.00016	0.00016	0.00016	0.00016	0.00016	
Pb-Std	0.0017	0.0020	0.0020	0.0020	0.0020	0.0020	0.0020	0.0020	
Sb	0.0015	0.00005	0.00005	0.00005	0.00005	0.00005	0.00005	0.00005	0.031
Se	0.0005	0.0003	0.0003	0.0003	0.0003	0.0003	0.0003	0.0003	0.005
SO_4	4.6	4.0	4.0	4.0	4.0	4.0	4.0	4.0	
Tl	0.0002	0.0002	0.0002	0.0002	0.0002	0.0002	0.0002	0.0002	0.00056
Zn	0.0183	0.0160	0.0160	0.0160	0.0160	0.0160	0.0160	0.0160	
Zn-Std	0.0704	0.0785	0.0785	0.0785	0.0785	0.0785	0.0785	0.0785	

Notes

1) The hardness dependent standards for Cd, Cu, Ni, Pb and Zn are listed below the deterministic water quality predictions for each parameter

2) Deterministic water quality predictions at PM-12 does not change during mine operation and closure because it is upstream of the tailings ba

Table 7-4. Deterministic water quality predictions at surface water monitoring station PM-13 (mg/L)

Embarrass River PM-13 Tailings Basin - Geotechnical Mitigation

Low flow conditions

Parameter	Average Measured Conditions	Year 01	Year 05	Year 10	Year 15	Year 20	Closure	Post-Closure	Hardness Independent Standard
Ag	0.0001	0.0003	0.0004	0.0004	0.0004	0.0005	0.0003	0.0003	0.001
Al	0.1916	0.2989	0.2653	0.3038	0.2810	0.2664	0.4273	0.3862	0.125
As	0.0010	0.0040	0.0043	0.0055	0.0049	0.0048	0.0075	0.0076	0.053
B	0.0443	0.1159	0.1184	0.1243	0.1267	0.1299	0.1062	0.0983	0.5
Ba	0.0278	0.0639	0.0623	0.0613	0.0612	0.0627	0.0597	0.0585	
Be	0.0001	0.0003	0.0003	0.0004	0.0003	0.0003	0.0004	0.0004	
Ca	19.9	46.5	50.4	64.1	54.3	47.7	38.1	37.4	
Cd	0.0001	0.0003	0.0003	0.0004	0.0004	0.0004	0.0004	0.0004	
Cd-Std	0.0015	0.0024	0.0026	0.0024	0.0022	0.0021	0.0022	0.0022	
Cl	7.0	10.0	12.5	8.6	8.8	9.0	6.5	5.9	230
Co	0.0005	0.0013	0.0013	0.0014	0.0015	0.0016	0.0015	0.0015	0.005
Cu	0.0020	0.0049	0.0051	0.0053	0.0062	0.0074	0.0059	0.0060	
Cu-Std	0.0123	0.0178	0.0187	0.0178	0.0168	0.0162	0.0168	0.0165	
F	0.3900	1.3809	1.5588	0.6054	0.6268	0.6416	0.7297	0.7004	
Fe	1.2900	0.9198	0.8132	0.7968	0.7704	0.7395	0.9922	0.8639	
Hard	143.5	260.8	283.1	261.3	238.5	223.5	237.4	230.3	
K	2.3	6.3	6.7	6.2	5.7	5.5	8.0	8.0	
Mg	15.9	37.7	38.6	24.8	25.1	25.2	37.6	36.4	
Mn	0.1100	0.3916	0.3737	0.3341	0.3436	0.3558	0.3755	0.3467	
Na	12.7	29.9	32.8	24.6	22.4	20.9	19.7	18.8	
Ni	0.0021	0.0106	0.0117	0.0144	0.0136	0.0145	0.0064	0.0064	
Ni-Std	0.0708	0.1174	0.1258	0.1176	0.1088	0.1030	0.1084	0.1056	
Pb	0.0003	0.0010	0.0010	0.0019	0.0018	0.0017	0.0011	0.0011	
Pb-Std	0.0050	0.0108	0.0120	0.0108	0.0096	0.0089	0.0096	0.0092	
Sb	0.0015	0.0033	0.0038	0.0055	0.0047	0.0046	0.0011	0.0011	0.031
Se	0.0005	0.0019	0.0019	0.0021	0.0020	0.0020	0.0026	0.0026	0.005
SO_4	36.1	116.3	132.8	150.1	135.5	128.6	98.1	96.1	
Tl	0.0002	0.0003	0.0004	0.0005	0.0005	0.0005	0.0001	0.0001	0.00056
Zn	0.0123	0.0141	0.0145	0.0337	0.0361	0.0334	0.0122	0.0121	
Zn-Std	0.1440	0.2388	0.2560	0.2392	0.2214	0.2095	0.2205	0.2149	

Notes

1) The hardness dependent standards for Cd, Cu, Ni, Pb and Zn are listed below the deterministic water quality predictions for each parameter

2) Predictions for low flow conditions correspond to surface runoff equal to zero, and groundwater recharge as the only natural flow contribution

Table 7-5. Deterministic water quality predictions at surface water monitoring station PM-13 (mg/L)

Embarrass River PM-13 Tailings Basin - Geotechnical Mitigation

Average flow conditions

Parameter	Average Measured Conditions	Year 01	Year 05	Year 10	Year 15	Year 20	Closure	Post-Closure	Hardness Independent Standard
Ag	0.0001	0.0001	0.0001	0.0002	0.0002	0.0002	0.0001	0.0001	0.001
Al	0.1916	0.1409	0.1388	0.1452	0.1426	0.1409	0.1506	0.1454	0.125
As	0.0010	0.0012	0.0013	0.0015	0.0014	0.0014	0.0015	0.0015	0.053
B	0.0443	0.0405	0.0422	0.0435	0.0443	0.0452	0.0376	0.0365	0.5
Ba	0.0278	0.0219	0.0224	0.0225	0.0227	0.0231	0.0204	0.0202	
Be	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	
Ca	19.9	20.6	21.7	23.8	22.6	21.7	19.1	19.0	
Cd	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	
Cd-Std	0.0015	0.0012	0.0013	0.0013	0.0012	0.0012	0.0012	0.0012	
Cl	7.0	6.9	7.4	6.8	6.8	6.9	6.5	6.4	230
Co	0.0005	0.0007	0.0007	0.0007	0.0007	0.0008	0.0007	0.0007	0.005
Cu	0.0020	0.0020	0.0021	0.0021	0.0023	0.0025	0.0020	0.0020	
Cu-Std	0.0123	0.0103	0.0107	0.0105	0.0103	0.0102	0.0098	0.0097	
F	0.3900	0.3507	0.3934	0.2587	0.2638	0.2679	0.2550	0.2502	
Fe	1.2900	2.5880	2.5448	2.5323	2.5192	2.5057	2.6381	2.6309	
Hard	143.5	111.9	117.6	115.3	112.6	110.9	105.6	104.4	
K	2.3	2.4	2.5	2.5	2.4	2.4	2.5	2.4	
Mg	15.9	15.3	15.8	13.8	14.0	14.0	14.7	14.5	
Mn	0.1100	0.3155	0.3142	0.3087	0.3102	0.3123	0.3118	0.3086	
Na	12.7	11.3	12.1	11.0	10.7	10.5	9.8	9.6	
Ni	0.0021	0.0025	0.0028	0.0032	0.0032	0.0034	0.0018	0.0018	
Ni-Std	0.0708	0.0574	0.0598	0.0589	0.0577	0.0569	0.0546	0.0541	
Pb	0.0003	0.0003	0.0003	0.0004	0.0004	0.0004	0.0003	0.0002	
Pb-Std	0.0050	0.0037	0.0039	0.0038	0.0037	0.0036	0.0034	0.0034	
Sb	0.0015	0.0005	0.0006	0.0009	0.0008	0.0008	0.0002	0.0002	0.031
Se	0.0005	0.0005	0.0006	0.0006	0.0006	0.0006	0.0006	0.0006	0.005
SO_4	36.1	39.2	42.8	45.9	44.2	43.6	35.3	34.8	
Tl	0.0002	0.0002	0.0002	0.0002	0.0003	0.0003	0.0002	0.0002	0.00056
Zn	0.0123	0.0155	0.0155	0.0184	0.0188	0.0185	0.0153	0.0153	
Zn-Std	0.1440	0.1166	0.1216	0.1196	0.1172	0.1157	0.1110	0.1100	

Notes

1) The hardness dependent standards for Cd, Cu, Ni, Pb and Zn are listed below the deterministic water quality predictions for each parameter

Table 7-6. Deterministic water quality predictions at surface water monitoring station PM-13 (mg/L)

Embarrass River PM-13 Tailings Basin - Geotechnical Mitigation

High flow conditions

Parameter	Average Measured Conditions	Year 01	Year 05	Year 10	Year 15	Year 20	Closure	Post-Closure	Hardness Independent Standard
Ag	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.001
Al	0.1916	0.1221	0.1219	0.1226	0.1223	0.1222	0.1230	0.1225	0.125
As	0.0010	0.0008	0.0008	0.0008	0.0008	0.0008	0.0008	0.0008	0.053
B	0.0443	0.0284	0.0286	0.0287	0.0288	0.0289	0.0280	0.0279	0.5
Ba	0.0278	0.0166	0.0167	0.0167	0.0167	0.0167	0.0164	0.0164	
Be	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	
Ca	19.9	15.4	15.5	15.8	15.6	15.6	15.3	15.3	
Cd	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	
Cd-Std	0.0015	0.0009	0.0009	0.0009	0.0009	0.0009	0.0009	0.0009	
Cl	7.0	6.5	6.6	6.5	6.5	6.5	6.5	6.5	230
Co	0.0005	0.0006	0.0006	0.0006	0.0006	0.0006	0.0006	0.0006	0.005
Cu	0.0020	0.0015	0.0016	0.0016	0.0016	0.0016	0.0016	0.0015	
Cu-Std	0.0123	0.0072	0.0073	0.0073	0.0072	0.0072	0.0072	0.0072	
F	0.3900	0.2153	0.2199	0.2061	0.2066	0.2071	0.2055	0.2050	
Fe	1.2900	2.8684	2.8634	2.8619	2.8604	2.8588	2.8740	2.8734	
Hard	143.5	74.3	74.9	74.7	74.4	74.3	73.5	73.4	
K	2.3	0.8	0.8	0.8	0.8	0.8	0.8	0.8	
Mg	15.9	6.8	6.9	6.7	6.7	6.7	6.8	6.7	
Mn	0.1100	0.3016	0.3015	0.3009	0.3011	0.3013	0.3012	0.3009	
Na	12.7	6.5	6.6	6.5	6.5	6.5	6.4	6.4	
Ni	0.0021	0.0013	0.0014	0.0014	0.0014	0.0014	0.0013	0.0013	
Ni-Std	0.0708	0.0405	0.0408	0.0408	0.0406	0.0406	0.0402	0.0402	
Pb	0.0003	0.00016	0.00016	0.00018	0.00018	0.00018	0.00016	0.00016	
Pb-Std	0.0050	0.0022	0.0022	0.0022	0.0022	0.0022	0.0022	0.0021	
Sb	0.0015	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.031
Se	0.0005	0.0003	0.0003	0.0003	0.0003	0.0003	0.0003	0.0003	0.005
SO_4	36.1	7.6	8.0	8.3	8.2	8.1	7.1	7.0	
Tl	0.0002	0.0002	0.0002	0.0002	0.0002	0.0002	0.0002	0.0002	0.00056
Zn	0.0123	0.0159	0.0160	0.0162	0.0163	0.0163	0.0159	0.0159	
Zn-Std	0.1440	0.0824	0.0830	0.0828	0.0825	0.0824	0.0817	0.0816	

Notes

1) The hardness dependent standards for Cd, Cu, Ni, Pb and Zn are listed below the deterministic water quality predictions for each parameter