Appendix E

Calibration of Mass-Balance Model for Embarrass River Watersheds for Surface Water Runoff Water Quality

Embarrass River Model - Calibration to Baseline Water Quality Data Parameter: Silver

-			
	surface water flow into PM-12	Q_s12 =	12.60 (cfs)
Ita	surface water flow into PM-13	Q_s13 =	56.01 (cfs)
Data	Babbitt WWTP discharge	Q_sBab =	0.33 (cfs)
≥	Area 5 Pit NW discharge	Q_spit =	1.99 (cfs)
Flow	LTVSMC Tailings Basin seepage	Q_fs =	4.00 (cfs)
ш т т	Hydrometallurgical Residue Cells Liner Leakage	Q_rrs =	0.00 (cfs)
Input	ground water flow into PM-12	Q_g12 =	0.86 (cfs)
<u> </u>	ground water flow into PM-13	Q_g13 =	4.21 (cfs)
m.	concentration of surface water into PM-12	C_s12 =	0.11 (µg/l)
Data	concentration of surface water into PM-13	C s13 =	0.11 (µg/l)
	concentration of WWTP discharge	C sBab =	0.11 (µg/l)
atic	concentration of Area 5 Pit NW discharge	C_spit =	0.16 (µg/l)
Lt.			
ce	concentration of LTVSMC Tailings Basin seepage	C_fs =	0.1 (µg/l)
on	concentration of Hydrometallurgical Residue Cells Liner Leakage	C_rrs =	0
nput Concentration	concentration of ground water flow into PM-12	C_g12 =	0.008 (µg/l)
idu	concentration of ground water flow into PM-13	C_g13 =	0.008 (µg/l)
		3.5	
_ p	flow in river at PM-12	Q_r12 =	13.79 (cfs)
Water Balance	flow in river at PM-13	Q_r13 =	80.00 (cfs)
Ba	flow check	Q_ck =	80.00 (cfs)
		<u>. </u>	· · ·
	mass flux of surface water into PM-12	M_s12 =	39 (µg/s)
	mass flux of surface water into PM-13	M_S12 = M_S13 =	174 (μg/s)
đ	mass flux of Babbitt WWTP	$M_srs = M_srs =$	1 (µg/s)
	concentration of Area 5 Pit NW discharge	M_spit =	9 (µg/s)
latior Flux	concentration of LTVSMC Tailings Basin seepage	$M_spit =$ M_fs =	11 (µg/s)
Ца	concentration of Hydrometallurgical Residue Cells Liner Leakage	M_rrs =	0 (µg/s)
ICL	mass flux of ground water into PM-12	M_g12 =	0 (µg/s)
Calculation of Mass Flux	mass flux of ground water into PM-13	M_g13 =	1 (µg/s)
		m_g10 =	· (µ9/0)
e	mass flux in river at PM-12	M_r12 =	40 (µg/s)
ss and		M_112 =	+0 (μg/3)
Mass Balance	mean flux in river at DM 10	M #10	000 (117/2)
∠ Ш	mass flux in river at PM-13	M_r13 =	236 (µg/s)
		1	
uo			
äti			
ate ntr	concentration in river at PM-12	C_r12 =	0.10 (µg/l)
Calculated Concentration			
alc			
00	concentration in river at PM-13	C_r13 =	0.10 (μg/l)
uc			
Observed Concentration			
Observed Concentra	Observed concentration in river at PM-12	Į	ND (0.2) (µg/l)
en cel			
sq	Observed concentration in river at PM-13		
			ND (0.2) (µg/l)

Embarrass River Model - Calibration to Baseline Water Quality Data Parameter: Aluminum

	surface water flow into PM-12	Q_s12 =	12.60	(cfs)
ta	surface water flow into PM-13	Q_s13 =	56.01	(cfs)
nput Flow Data	Babbitt WWTP discharge	Q_sBab =	0.33	(cfs)
3	Area 5 Pit NW discharge	Q_spit =	1.99	(cfs)
Ó	LTVSMC Tailings Basin seepage	Q_fs =	4.00	
	Hydrometallurgical Residue Cells Liner Leakage	Q_rrs =	0.00	
nd	ground water flow into PM-12	Q_g12 =	0.86	
<u> </u>	ground water flow into PM-13	Q_g13 =	4.21	(cfs)
	concentration of surface water into PM-12	C_s12 =	0.12	(mg/l)
ata	concentration of surface water into PM-13	C s13 =	0.12	(mg/l)
	concentration of WWTP discharge	C_sBab =		(mg/l)
atic	concentration of Area 5 Pit NW discharge	C_spit =	0.01325	
intr		$C_fs =$	1.5788	
JCe	concentration of LTVSMC Tailings Basin seepage			
Lo Co	concentration of Hydrometallurgical Residue Cells Liner Leakage	C_rrs =	0	(mg/l)
nput Concentration Data	concentration of ground water flow into PM-12	C_g12 =	0.025	(mg/l)
dul	concentration of ground water flow into PM-13	C_g13 =	0.025	(mg/l)
ė	flow in river at PM-12	Q_r12 =	13.79	(cfs)
Water Balance	flow in river at PM-13	Q_r13 =	80.00	
Na Sal	flow check	Q_ck =	80.00	· /
			00.00	(010)
			(0)	(())
	mass flux of surface water into PM-12	M_s12 =		(mg/l)
<u>ب</u>	mass flux of surface water into PM-13	M_s13 =		(mg/l)
0	mass flux of Babbitt WWTP	M_sBab =		(mg/l)
latior Flux	concentration of Area 5 Pit NW discharge	M_spit =	1	(mg/l)
E lat	concentration of LTVSMC Tailings Basin seepage	M_fs =		(mg/l)
ss ss	concentration of Hydrometallurgical Residue Cells Liner Leakage	M_rrs =		(mg/l)
Calculation of Mass Flux	mass flux of ground water into PM-12	M_g12 =	1	(mg/l)
02	mass flux of ground water into PM-13	M_g13 =	3	(mg/l)
e	mass flux in river at PM-12	M_r12 =	15	(mg/s)
Mass Balance	111000 110 111 11VET ALT 1VI-12	<u>ivi_i i z =</u>	40	(119/5)
Mass Balan	mass flux in river at PM-13	M_r13 =	417	(mg/s)
	ווומסט וועג ווו וועכו מנד ועו־דט	<u></u> =	41/	(mg/s)
-		1		
ed	concentration in river at DM 10	0 110	0.114	(ma/l)
ate	concentration in river at PM-12	C_r12 =	0.114	(111g/1)
cul				
Calculated Concentration	concentration in viver at DM 10	0 110	0.404	(ma c; /l)
00	concentration in river at PM-13	C_r13 =	0.184	(mg/l)
			•	
<u>on</u>				
drati	Observed concentration in river at DM 10		0.000	(ma/l)
ve	Observed concentration in river at PM-12		0.099	(mg/l)
ser Ice				
Observed Concentration	Observed concentration in river at PM-13		0.192	(ma/l)
00	Observed Concentration III Tiver at FIVI-15	I	0.192	(mg/l)

Parameter: Arsenic

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Area 5 Pit NW discharge Q. spit 1.39 (cfs) Hydrometallurgical Residue Cells Liner Leakage Q. rrs 0.00 (cfs) ground water flow into PM-12 Q. g12 0.86 (cfs) ground water flow into PM-13 Q. g13 4.21 (cfs) concentration of surface water into PM-12 C. s12 0.75 (µg/l) concentration of surface water into PM-13 C. s13 0.75 (µg/l) concentration of surface water into PM-12 C. s13 0.75 (µg/l) concentration of surface water into PM-12 C. s13 0.75 (µg/l) concentration of surface water into PM-13 C. s13 0.75 (µg/l) concentration of Hydrometallurgical Residue Cells Liner Leakage C. rrs 0 concentration of ground water flow into PM-13 C. g12 2.73 (µg/l) concentration of ground water flow into PM-13 C. g13 2.73 (µg/l) concentration of ground water flow into PM-13 Q. g13 2.73 (µg/l) concentration of ground water flow into PM-13 C. g13 2.73 (µg/l) concentration of ground water flow into PM-13 Q. g14 2.88 (µg/s) mass flux of surface water into PM-12 M s12		surface water flow into PM-12	Q_s12 =	12.60	(cfs)
Area 5 Pit NW discharge Q. spit 1.39 (cfs) Hydrometallurgical Residue Cells Liner Leakage Q. rrs 0.00 (cfs) ground water flow into PM-12 Q. g12 0.86 (cfs) ground water flow into PM-13 Q. g13 4.21 (cfs) concentration of surface water into PM-12 C. s12 0.75 (µg/l) concentration of surface water into PM-13 C. s13 0.75 (µg/l) concentration of surface water into PM-12 C. s13 0.75 (µg/l) concentration of surface water into PM-12 C. s13 0.75 (µg/l) concentration of surface water into PM-13 C. s13 0.75 (µg/l) concentration of Hydrometallurgical Residue Cells Liner Leakage C. rrs 0 concentration of ground water flow into PM-13 C. g12 2.73 (µg/l) concentration of ground water flow into PM-13 C. g13 2.73 (µg/l) concentration of ground water flow into PM-13 Q. g13 2.73 (µg/l) concentration of ground water flow into PM-13 C. g13 2.73 (µg/l) concentration of ground water flow into PM-13 Q. g14 2.88 (µg/s) mass flux of surface water into PM-12 M s12	ង	surface water flow into PM-13		56.01	(cfs)
Area 5 Pit NW discharge Q. spit 1.39 (cfs) Hydrometallurgical Residue Cells Liner Leakage Q. rrs 0.00 (cfs) ground water flow into PM-12 Q. g12 0.86 (cfs) ground water flow into PM-13 Q. g13 4.21 (cfs) concentration of surface water into PM-12 C. s12 0.75 (µg/l) concentration of surface water into PM-13 C. s13 0.75 (µg/l) concentration of surface water into PM-12 C. s13 0.75 (µg/l) concentration of surface water into PM-12 C. s13 0.75 (µg/l) concentration of surface water into PM-13 C. s13 0.75 (µg/l) concentration of Hydrometallurgical Residue Cells Liner Leakage C. rrs 0 concentration of ground water flow into PM-13 C. g12 2.73 (µg/l) concentration of ground water flow into PM-13 C. g13 2.73 (µg/l) concentration of ground water flow into PM-13 Q. g13 2.73 (µg/l) concentration of ground water flow into PM-13 C. g13 2.73 (µg/l) concentration of ground water flow into PM-13 Q. g14 2.88 (µg/s) mass flux of surface water into PM-12 M s12	Da	Babbitt WWTP discharge	Q_sBab =	0.33	(cfs)
Q- Trys.Mc Tailings Basin seepage Q. fs = 4.00 (cfs) Qrund water flow into PM-12 Q. g12 = 0.86 (cfs) Qrund water flow into PM-13 ground water flow into PM-13 Q. g13 = 4.21 ((cfs) concentration of surface water into PM-13 Q. g13 = 4.21 ((cfs) concentration of surface water into PM-13 C. s12 = 0.75 (µg/l) concentration of surface water into PM-13 C. s13 = 0.75 (µg/l) concentration of surface water into PM-13 C. s13 = 0.75 (µg/l) concentration of Area 5 Pit NW discharge C. spit = 1.325 (µg/l) concentration of Hydrometallurgical Residue Cells Liner Leakage C. rrs = 0 concentration of ground water flow into PM-12 C. g12 = 2.73 (µg/l) concentration of ground water flow into PM-13 C. g13 = 2.73 (µg/l) concentration of ground water flow into PM-12 Q. r12 = 1.3.79 (cfs) flow in river at PM-12 Q. r12 = 1.3.79 (cfs) mass flux of surface water into PM-12 M. s12 = 268 (µg/s) mass flux of surface water into PM-12 M. s12 = 108 (µg/s) mass flux of surface water into PM-12 M. s12 =		Area 5 Pit NW discharge	Q_spit =	1.99	(cfs)
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$ \begin{array}{ c c c c c c c c c c c c c c c c c c c$	alculated Mass Calculation of Water oncentration Balance Mass Flux Balance Input Concentration Data Input Flow Data			0.86	(cfs)
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$ \begin{array}{ c c c c c c c c c c c c c c c c c c c$	Ö	concentration of surface water into PM-13	C_s13 =	0.75	(µg/l)
$ \begin{array}{ c c c c c c c c c c c c c c c c c c c$	ы	concentration of WWTP discharge	C_sBab =	0.75	(µg/l)
$ \begin{array}{ c c c c c c c c c c c c c c c c c c c$	ratio	concentration of Area 5 Pit NW discharge	C_spit =		
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$ \begin{array}{ c c c c c } \hline \end{tabular} \end{tabular} \end{tabular} \\ \hline \end{tabular} \end{tabular} \end{tabular} \end{tabular} \\ \hline \end{tabular} \end{tabular} \end{tabular} \\ \hline \end{tabular} tabular$					
	ے م ع	flow in river at PM-12	Q_r12 =	13.79	(cfs)
	ateı ılan	flow in river at PM-13	Q_r13 =	80.00	(cfs)
$\begin{tabular}{ c c c c c } \hline \end{tabular} & \begin{tabular}{ c c c c c c c } \hline \end{tabular} & \begin{tabular}{ c c c c c c c c } \hline \end{tabular} & \begin{tabular}{ c c c c c c c c c c c c c c c c c c c$	≥ ¤	flow check	Q_ck =	80.00	(cfs)
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$\begin{tabular}{ c c c c c } \hline \end{tabular} & \begin{tabular}{ c c c c c c c } \hline \end{tabular} & \begin{tabular}{ c c c c c c c c } \hline \end{tabular} & \begin{tabular}{ c c c c c c c c c c c c c c c c c c c$		mass flux of surface water into PM-12	M s12 =	268	(ua/s)
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M_r12 = 341 (µg/s) M_r13 = 2258 (µg/s) Mass flux in river at PM-13 M_r13 = 2258 (µg/s) Mass flux in river at PM-13 C_r12 = 0.87 (µg/l) Concentration in river at PM-13 C_r13 = 1.00 (µg/l) Mass flux in river at PM-13 C_r13 = 1.00 (µg/l) Mass flux in river at PM-13 C_r13 = 1.00 (µg/l) Mass flux in river at PM-13 Mass flux in river at PM-13 Mass flux in river at PM-13 Mass flux in river at PM-13 Mass flux in river at PM-13 Mass flux in river at PM-13 Mass flux in river at PM-13 Mass flux in river at PM-13 Mass flux in river at PM-13 Mass flux in river at PM-13 Mass flux in river at PM-13 Mass flux in river at PM-13 Mass flux in river at PM-13 Mass flux in river at PM-13 Mass flux in river at PM-13 Mass flux in river at PM-12 Mass flux in river at PM-12 Mass flux in river at PM-12 Mass flux in river at PM-12 Mass flux in river at PM-12 Mass flux in river at PM-12 Mass flux in river at PM-12 Mass flux in river at PM-12 Mass flux in river at PM-12 Mass flux in river at PM-12 Mass flux in river at PM-12 Mass flux in river at PM-13 Mass flux in river at PM-12	oť				
M_r12 = 341 (µg/s) M_r13 = 2258 (µg/s) Mass flux in river at PM-13 M_r13 = 2258 (µg/s) Mass flux in river at PM-13 C_r12 = 0.87 (µg/l) Concentration in river at PM-13 C_r13 = 1.00 (µg/l) Mass flux in river at PM-13 C_r13 = 1.00 (µg/l) Mass flux in river at PM-13 C_r13 = 1.00 (µg/l) Mass flux in river at PM-13 Mass flux in river at PM-13 Mass flux in river at PM-13 Mass flux in river at PM-13 Mass flux in river at PM-13 Mass flux in river at PM-13 Mass flux in river at PM-13 Mass flux in river at PM-13 Mass flux in river at PM-13 Mass flux in river at PM-13 Mass flux in river at PM-13 Mass flux in river at PM-13 Mass flux in river at PM-13 Mass flux in river at PM-13 Mass flux in river at PM-13 Mass flux in river at PM-12 Mass flux in river at PM-12 Mass flux in river at PM-12 Mass flux in river at PM-12 Mass flux in river at PM-12 Mass flux in river at PM-12 Mass flux in river at PM-12 Mass flux in river at PM-12 Mass flux in river at PM-12 Mass flux in river at PM-12 Mass flux in river at PM-12 Mass flux in river at PM-13 Mass flux in river at PM-12	ц Ц				
M_r12 = 341 (µg/s) M_r13 = 2258 (µg/s) Mass flux in river at PM-13 M_r13 = 2258 (µg/s) Mass flux in river at PM-13 C_r12 = 0.87 (µg/l) Concentration in river at PM-13 C_r13 = 1.00 (µg/l) Mass flux in river at PM-13 C_r13 = 1.00 (µg/l) Mass flux in river at PM-13 C_r13 = 1.00 (µg/l) Mass flux in river at PM-13 Mass flux in river at PM-13 Mass flux in river at PM-13 Mass flux in river at PM-13 Mass flux in river at PM-13 Mass flux in river at PM-13 Mass flux in river at PM-13 Mass flux in river at PM-13 Mass flux in river at PM-13 Mass flux in river at PM-13 Mass flux in river at PM-13 Mass flux in river at PM-13 Mass flux in river at PM-13 Mass flux in river at PM-13 Mass flux in river at PM-13 Mass flux in river at PM-12 Mass flux in river at PM-12 Mass flux in river at PM-12 Mass flux in river at PM-12 Mass flux in river at PM-12 Mass flux in river at PM-12 Mass flux in river at PM-12 Mass flux in river at PM-12 Mass flux in river at PM-12 Mass flux in river at PM-12 Mass flux in river at PM-12 Mass flux in river at PM-13 Mass flux in river at PM-12	li ci				
M_r12 = 341 (µg/s) M_r13 = 2258 (µg/s) Mass flux in river at PM-13 M_r13 = 2258 (µg/s) Mass flux in river at PM-13 C_r12 = 0.87 (µg/l) Concentration in river at PM-13 C_r13 = 1.00 (µg/l) Mass flux in river at PM-13 C_r13 = 1.00 (µg/l) Mass flux in river at PM-13 C_r13 = 1.00 (µg/l) Mass flux in river at PM-13 Mass flux in river at PM-13 Mass flux in river at PM-13 Mass flux in river at PM-13 Mass flux in river at PM-13 Mass flux in river at PM-13 Mass flux in river at PM-13 Mass flux in river at PM-13 Mass flux in river at PM-13 Mass flux in river at PM-13 Mass flux in river at PM-13 Mass flux in river at PM-13 Mass flux in river at PM-13 Mass flux in river at PM-13 Mass flux in river at PM-13 Mass flux in river at PM-12 Mass flux in river at PM-12 Mass flux in river at PM-12 Mass flux in river at PM-12 Mass flux in river at PM-12 Mass flux in river at PM-12 Mass flux in river at PM-12 Mass flux in river at PM-12 Mass flux in river at PM-12 Mass flux in river at PM-12 Mass flux in river at PM-12 Mass flux in river at PM-13 Mass flux in river at PM-12	ы Пари		_		
M_r12 = 341 (µg/s) M_r13 = 2258 (µg/s) Mass flux in river at PM-13 M_r13 = 2258 (µg/s) Mass flux in river at PM-13 C_r12 = 0.87 (µg/l) Concentration in river at PM-13 C_r13 = 1.00 (µg/l) Mass flux in river at PM-13 C_r13 = 1.00 (µg/l) Mass flux in river at PM-13 C_r13 = 1.00 (µg/l) Mass flux in river at PM-13 Mass flux in river at PM-13 Mass flux in river at PM-13 Mass flux in river at PM-13 Mass flux in river at PM-13 Mass flux in river at PM-13 Mass flux in river at PM-13 Mass flux in river at PM-13 Mass flux in river at PM-13 Mass flux in river at PM-13 Mass flux in river at PM-13 Mass flux in river at PM-13 Mass flux in river at PM-13 Mass flux in river at PM-13 Mass flux in river at PM-13 Mass flux in river at PM-12 Mass flux in river at PM-12 Mass flux in river at PM-12 Mass flux in river at PM-12 Mass flux in river at PM-12 Mass flux in river at PM-12 Mass flux in river at PM-12 Mass flux in river at PM-12 Mass flux in river at PM-12 Mass flux in river at PM-12 Mass flux in river at PM-12 Mass flux in river at PM-13 Mass flux in river at PM-12	ass				
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$\frac{c_r r 2}{c_r r 2} = \frac{0.87}{(\mu g/l)}$	~ ~ ~		9 . 9	020	\I""""/
$\frac{c_r r 2}{c_r r 2} = \frac{0.87}{(\mu g/l)}$					
$\frac{c_r r 2}{c_r r 2} = \frac{0.87}{(\mu g/l)}$	90	mass flux in river at PM-12	M r12 =	341	(ua/s)
$\frac{c_r r 2}{c_r r 2} = \frac{0.87}{(\mu g/l)}$	ss and			140	(Mg/ J)
$\frac{c_r r 2}{c_r r 2} = \frac{0.87}{(\mu g/l)}$	/las tals	mana flux in viver at DM 10	M =10	0050	(110/-)
$\frac{c_r r 2}{c_r r 2} = \frac{0.87}{(\mu g/l)}$	20	mass flux in river at PM-13	IVI_r13 =	2258	(µg/s)
Observed concentration in river at PM-12 ND (2) (µg/l)					
Observed concentration in river at PM-12 ND (2) (µg/l)	L L L				
Observed concentration in river at PM-12 ND (2) (µg/l)	atio				
Observed concentration in river at PM-12 ND (2) (µg/l)	itre	concentration in river at PM-12	C_r12 =	0.87	(µg/l)
Observed concentration in river at PM-12 ND (2) (µg/l)	ula ien				
Observed concentration in river at PM-12 ND (2) (µg/l)					
Observed concentration in river at PM-12 [µg/l]	ပိပိ	concentration in river at PM-13	C r13 =	1.00	(µg/l)
Observed concentration in river at PM-12 ND (2) (µg/l) Observed concentration in river at PM-13 ND (2) (µg/l)			. —		
Observed concentration in river at PM-12 ND (2) (µg/l) Observed concentration in river at PM-13 ND (2) (µg/l)	C				
Observed concentration in river at PM-12 ND (2) (μg/l) Observed concentration in river at PM-13 ND (2) (μg/l)	io		1		
O D Observed concentration in river at PM-13 (µg/l)	d rat	Observed concentration in river at PM 12			(110/1)
O Observed concentration in river at PM-13 ND (2) (μg/l)	ve int		+	ND(2)	(µg/I)
ÖÖÖODbserved concentration in river at PM-13 ND (2) (μg/l)	ser CG		1		
	š Š	Observed concentration is river at PM 12			(110/1)
	00			ND (2)	(µg/i)

Parameter: Boron

	surface water flow into PM-12	Q_s12 =	12.60	(cfs)
ta	surface water flow into PM-13	Q_s13 =	56.01	(cfs)
Da	Babbitt WWTP discharge	Q_sBab =	0.33	(cfs)
3	Area 5 Pit NW discharge	Q_spit =	1.99	(cfs)
Surface v Surface v Babitit V Area 5 P LTVSMC Hydrome Ground w Parance Parance	LTVSMC Tailings Basin seepage	Q_fs =	4.00	(cfs)
	Hydrometallurgical Residue Cells Liner Leakage	Q_rrs =	0.00	(cfs)
	ground water flow into PM-12	Q_g12 =	0.86	(cfs)
느	ground water flow into PM-13	Q_g13 =	4.21	(cfs)
		T		
b D	concentration of surface water into PM-12	C_s12 =	27	(µg/l)
Dati	concentration of surface water into PM-13	C s13 =	27	(µg/l)
		_		
tio	concentration of WWTP discharge	C_sBab =		(µg/l)
itra	concentration of Area 5 Pit NW discharge	C_spit =	131.5	(µg/l)
Sen	concentration of LTVSMC Tailings Basin seepage	C_fs =	330	(µg/l)
ouc	concentration of Hydrometallurgical Residue Cells Liner Leakage	C_rrs =	0	
nt O	concentration of ground water flow into PM-12	C_g12 =	21.2	(µg/l)
dul	concentration of ground water flow into PM-13	C_g13 =	21.2	(µg/l)
Q	flow in river at PM-12	Q r12 =	13.79	(cfs)
ter anc	flow in river at PM-13	Q_r13 =	80.00	· · /
Bal Bal	flow check	 Q_ck =	80.00	
		<u>u</u>		(0.0)
	mass flux of surface water into PM-12	M_s12 =	9631	(µg/s)
	mass flux of surface water into PM-13	M_s12 =	42794	
ď	mass flux of Babbitt WWTP	$M_sBab =$		(µg/s) (µg/s)
с ,	concentration of Area 5 Pit NW discharge	M_spit =		(µg/s) (µg/s)
ic ti	concentration of LTVSMC Tailings Basin seepage	M fs =	37356	
Б П	concentration of Hydrometallurgical Residue Cells Liner Leakage	M_rrs =		(µg/s)
ass ass	mass flux of ground water into PM-12	M_g12 =		(µg/s)
S S	mass flux of ground water into PM-13	M_g13 =		(µg/s)
		_3 -		(F. 3 , -7
Ce C	mass flux in river at PM-12	M r12 =	10399	(ua/s)
ss ano				(rg, c)
Aa: 3ala	mass flux in river at PM-13	M r13 =	100481	(un/e)
		IM_110 -	100-01	(µg/3)
uo				
ati			60 6 4	(. (I)
ntr ate	concentration in river at PM-12	C_r12 =	26.64	(µg/l)
ce sul		1		
alc				<i>(</i>)
00	concentration in river at PM-13	C_r13 =	44.38	(µg/l)
		T		
L L				
atic				
ed	Observed concentration in river at PM-12		ND (35)	(µg/l)
erv				
bse onc		1		
ŌŎ	Observed concentration in river at PM-13		44.3	(µg/l)

Parameter: Barium

	surface water flow into PM-12	Q_s12 =	11.54	(cfs)
ta	surface water flow into PM-13	Q_s13 =	50.77	(cfs)
Data	Babbitt WWTP discharge	Q_sBab =	0.33	(cfs)
	Area 5 Pit NW discharge	Q_spit =	1.99	(cfs)
put Flov	LTVSMC Tailings Basin seepage	Q_fs =	4.00	(cfs)
	Hydrometallurgical Residue Cells Liner Leakage	Q_rrs =	0.00	(cfs)
nd	ground water flow into PM-12	Q_g12 =	0.86	(cfs)
<u> </u>	ground water flow into PM-13	Q_g13 =	4.21	(cfs)
		T		
ъ С	concentration of surface water into PM-12	C_s12 =	16	(µg/l)
)ati	concentration of surface water into PM-13	C s13 =	16	(µg/l)
		_		
tio	concentration of WWTP discharge	C_sBab =	16	(µg/l)
trai	concentration of Area 5 Pit NW discharge	C_spit =	4.4	(µg/l)
cen	concentration of LTVSMC Tailings Basin seepage	C_fs =	92.98	(µg/l)
ouo	concentration of Hydrometallurgical Residue Cells Liner Leakage	C_rrs =	0	
nput Concentration Data	concentration of ground water flow into PM-12	C_g12 =	68.1	(µg/l)
du	concentration of ground water flow into PM-13	C_g13 =	68.1	(µg/l)
		0	50.1	AF 37 7
	flow in river at PM 12	0 112	10 70	(ofo)
Water Balance	flow in river at PM-12	Q_r12 =	12.73	· · /
Water Balane	flow in river at PM-13	Q_r13 =	73.70	
<u> </u>	flow check	Q_ck =	73.70	(cts)
	mass flux of surface water into PM-12	M_s12 =	5225	
	mass flux of surface water into PM-13	M_s13 =	22989	(µg/s)
of	mass flux of Babbitt WWTP	M_sBab =	149	(µg/s)
Б ×	concentration of Area 5 Pit NW discharge	M_spit =		(µg/s)
Calculation of Mass Flux	concentration of LTVSMC Tailings Basin seepage	M_fs =	10525	
Calcul. Mass I	concentration of Hydrometallurgical Residue Cells Liner Leakage	M_rrs =		(µg/s)
alc las	mass flux of ground water into PM-12	M_g12 =		(µg/s)
O≥	mass flux of ground water into PM-13	M_g13 =	8114	(µg/s)
(h)				
Mass Balance	mass flux in river at PM-12	M_r12 =	7032	(µg/s)
Mass Balan				
В В	mass flux in river at PM-13	M_r13 =	48908	(µg/s)
ے د				
tio T				
tec tra	concentration in river at PM-12	C_r12 =	19.52	(µg/l)
Calculated Concentration		1		
LC LC				
ပိပိ	concentration in river at PM-13	C_r13 =	23.45	(µg/l)
				Ar 9 7
_ _				
tior		1		
irat	Observed concentration in river at PM-12		15.50	(µg/l)
ent Snt			10.00	(P9/1)
Observed Concentration				
Θ Θ	Observed concentration in river at PM-13		27.80	(µg/l)
		1		Ar 9 7

Parameter: Beryllium

	surface water flow into PM-12	Q_s12 =	12.60	(cfs)
Data	surface water flow into PM-13	Q_s13 =		(cfs)
Da	Babbitt WWTP discharge	Q_sBab =	0.33	
3	Area 5 Pit NW discharge	Q_spit =	1.99	(cfs)
nput Flow	LTVSMC Tailings Basin seepage	Q_fs =	4.00	(cfs)
Ш. Т.	Hydrometallurgical Residue Cells Liner Leakage	Q_rrs =	0.00	(cfs)
nd	ground water flow into PM-12	Q_g12 =	0.86	(cfs)
<u> </u>	ground water flow into PM-13	Q_g13 =	4.21	(cfs)
	concentration of surface water into PM-12	C s12 =	0.1	(µg/l)
Data				
	concentration of surface water into PM-13	C_s13 =	0.1	(µg/l)
E E	concentration of WWTP discharge	C sBab =	0.1	(µg/l)
atic	• •			
itra	concentration of Area 5 Pit NW discharge	C_spit =	0.1	(µg/l)
e	concentration of LTVSMC Tailings Basin seepage	C_fs =	0.75	(µg/l)
ou	concentration of Hydrometallurgical Residue Cells Liner Leakage	C_rrs =	0	
nput Concentration	concentration of ground water flow into PM-12	C_g12 =	0.023	(ua/l)
Inc	Concentration of ground water now into FWF12	0_912 =	0.023	(µg/I)
Ē	concentration of ground water flow into PM-13	C_g13 =	0.023	(µg/l)
(J)	flow in river at PM-12	Q_r12 =	13.79	(cfs)
Water Balance	flow in river at PM-13	Q_112 =	80.00	
Water Balanc		_		
<u> </u>	flow check	Q_ck =	80.00	(cts)
	mass flux of surface water into PM-12	M_s12 =	36	(µg/s)
	mass flux of surface water into PM-13	M_s13 =	158	(µg/s)
oť	mass flux of Babbitt WWTP	M_sBab =	1	(µg/s)
Б×	concentration of Area 5 Pit NW discharge	M_spit =	6	(µg/s)
latior Flux	concentration of LTVSMC Tailings Basin seepage	M_fs =	85	(µg/s)
s F	concentration of Hydrometallurgical Residue Cells Liner Leakage	M_rrs =		(µg/s)
Calculation of Mass Flux	mass flux of ground water into PM-12	 Mg12 =	1	(µg/s)
ΰž	mass flux of ground water into PM-13	M_g13 =	3	(µg/s)
e	mass flux in river at PM-12	M r12 =	37	(µg/s)
ss			57	(mg; 0)
Mass Balance				
2 0	mass flux in river at PM-13	M_r13 =	289	(µg/s)
		-		
Ę				
Calculated Concentration				
tra	concentration in river at PM-12	C_r12 =	0.10	(µg/l)
Calculated Concentrat		1 -		Ar 9 7
jo n				
Dol 0	concentration in river at PM-13	C_r13 =	0.12	(µg/l)
		0_110 =	0.13	(P9/I)
uo				
atic				
ed	Observed concentration in river at PM-12		ND (0.2)	(µg/l)
Sic Sic				
ω Ο				
S L				
Observed Concentration	Observed concentration in river at PM-13		ND (0.2)	(µg/l)

Parameter: Calcium

	surface water flow into PM-12	Q_s12 =	12.60	(cfs)
ta	surface water flow into PM-13	Q_s13 =	56.01	· /
Dai	Babbitt WWTP discharge	Q_sBab =	0.33	<u>,</u>
>	Area 5 Pit NW discharge	Q_spit =	1.99	. /
<u> 0</u>	LTVSMC Tailings Basin seepage	Q_fs =	4.00	(cfs)
LL t	Hydrometallurgical Residue Cells Liner Leakage	Q_rrs =	0.00	
Calculated Mass Calculation of Water Concentration Balance Mass Flux Balance Input Concentration Data Input Flow Data	ground water flow into PM-12	Q_g12 =	0.86	(cfs)
	ground water flow into PM-13	Q_g13 =	4.21	(cfs)
	concentration of surface water into PM-12	C_s12 =	15	(mg/l)
ata				
	concentration of surface water into PM-13	C_s13 =		(mg/l)
uo	concentration of WWTP discharge	C_sBab =	15	(mg/l)
trati	concentration of Area 5 Pit NW discharge	C_spit =	95.35	(mg/l)
eu	concentration of LTVSMC Tailings Basin seepage	C_fs =	59.78	(mg/l)
onc	concentration of Hydrometallurgical Residue Cells Liner Leakage	C_rrs =	0	- /
nt C	concentration of ground water flow into PM-12	C_g12 =	19	(mg/l)
dul	concentration of ground water flow into PM-13	C_g13 =	19	(mg/l)
E				
ğ	flow in river at PM-12	Q_r12 =	13.79	(cfs)
and and	flow in river at PM-13	 Q_r13 =	80.00	
Ba Ba	flow check	Q_ck =	80.00	(cfs)
		. —		· /
	mass flux of surface water into PM-12	M_s12 =	5350	(µg/s)
	mass flux of surface water into PM-13	M_s13 =	23774	
of	mass flux of Babbitt WWTP	M_sBab =		(mg/s)
Ę ~	concentration of Area 5 Pit NW discharge	M_spit =		(mg/s)
ILUX	concentration of LTVSMC Tailings Basin seepage	M fs =		(mg/s)
ule B T S	concentration of Hydrometallurgical Residue Cells Liner Leakage	M_rrs =		(mg/s)
alcass	mass flux of ground water into PM-12	M_g12 =		(mg/s)
ΰຶຶ	mass flux of ground water into PM-13	M_g13 =		(mg/s)
ICe	mass flux in river at PM-12	M_r12 =	<u>595</u> 3	(mg/s)
tss lan				
Ma Ba	mass flux in river at PM-12 mass flux in river at PM-13	M r13 =	44128	(mg/s)
	<u> </u>			\ <u>3</u> -7
ior				
ed rat	concentration in river at PM-12	C_r12 =	15.25	(ma/l)
lat ent		0_112 =	15.25	(119/1)
o al	concentration in river at PM-13	C r12	10.40	(mg/l)
		C_r13 =	19.49	(iiig/l)
_				
ion				
drati	Observed concentration in viver at DM 10		10.4	(mc/l)
ve	Observed concentration in river at PM-12	+	13.4	(mg/l)
ser ice				
Observed Concentration	Observed concentration in river at PM-13		10.0	(mg/l)
00	Observed Concentration in river at FIVE 13		19.9	(119/1)

Parameter: Cadmium

	surface water flow into PM-12	Q_s12 =	12.60	
Ita	surface water flow into PM-13	Q_s13 =	56.01	
Da	Babbitt WWTP discharge	Q_sBab =	0.33	(cfs)
3	Area 5 Pit NW discharge	Q_spit =	1.99	(cfs)
L L	LTVSMC Tailings Basin seepage	Q_fs =	4.00	
Щ. Т	Hydrometallurgical Residue Cells Liner Leakage	Q_rrs =	0.00	(cfs)
nd	ground water flow into PM-12	Q_g12 =	0.86	(cfs)
<u> </u>	ground water flow into PM-13	Q_g13 =	4.21	(cfs)
	concentration of surface water into PM-12	C s12 =	0.08	(ua/l)
Data		_		
õ	concentration of surface water into PM-13	C_s13 =	0.08	(µg/l)
L L	concentration of WWTP discharge	C_sBab =	0.08	(µq/l)
atic		_		
Itra	concentration of Area 5 Pit NW discharge	C_spit =		(µg/l)
Ser	concentration of LTVSMC Tailings Basin seepage	C_fs =	0.188	(µg/l)
ouo	concentration of Hydrometallurgical Residue Cells Liner Leakage	C_rrs =	0	
nput Concentration	concentration of ground water flow into PM-12	C_g12 =	0.3	(µg/l)
du	concentration of ground water flow into PM-13	C_g13 =	0.3	(µg/l)
				u 9 1
Water Balance	flow in river at PM-12	Q_r12 =	13.79	· /
Water Balanc	flow in river at PM-13	Q_r13 =	80.00	
2 m	flow check	Q_ck =	80.00	(cfs)
	mass flux of surface water into PM-12	M s12 =	29	(µg/s)
	mass flux of surface water into PM-13	M s13 =		(µg/s)
of	mass flux of Babbitt WWTP	M sBab =		(µg/s)
Calculation of Mass Flux	concentration of Area 5 Pit NW discharge	M_spit =		(µg/s)
latior Flux	concentration of LTVSMC Tailings Basin seepage	M fs =		(µg/s)
е е п	concentration of Hydrometallurgical Residue Cells Liner Leakage	M_rrs =		(µg/s)
alci	mass flux of ground water into PM-12	M_g12 =		(µg/s)
Calcul Mass	mass flux of ground water into PM-13	M_g13 =		(µg/s)
		_9 -		(1. 2)
			1	
e	mass flux in river at PM-12	M r12 =	27	(µg/s)
sis	11123 112 111 11VET ALT IVI-12	IVI_I I Z =	37	(µg/5)
Mass Balance				
Σä	mass flux in river at PM-13	M_r13 =	226	(µg/s)
2				
달 _				
tra	concentration in river at PM-12	C r12 =	0.09	(µg/l)
Calculated Concentration		1	5.00	λr σ' '/
Ca	concentration in river at PM-13	C r13 =	0.10	(ua/l)
		0_110 =	0.10	(49/1)
		1		
uo				
atio				
ed	Observed concentration in river at PM-12		ND (0.2)	(µg/l)
Observed Concentration				
n sé				
9 0				
Co Co	Observed concentration in river at PM-13		ND (0.2)	(µg/l)

Embarrass River Model - Calibration to Baseline Water Quality Data Parameter: Chloride

-				
	surface water flow into PM-12	Q_s12 =	12.60	
ta	surface water flow into PM-13	Q_s13 =	56.01	
Da	Babbitt WWTP discharge	Q_sBab =	0.33	(cfs)
3	Area 5 Pit NW discharge	Q_spit =	1.99	(cfs)
Ó	LTVSMC Tailings Basin seepage	Q_fs =	4.00	(cfs)
Щ. Ц.	Hydrometallurgical Residue Cells Liner Leakage	Q_rrs =	0.00	(cfs)
Calculation of Water Mass Flux Baland	ground water flow into PM-12	Q g12 =	0.86	(cfs)
드	ground water flow into PM-13	Q_g13 =	4.21	(cfs)
	-			
	concentration of surface water into PM-12	C_s12 =	6.5	(mg/l)
ata				
Ď	concentration of surface water into PM-13	C_s13 =	6.5	(mg/l)
<u>io</u>	concentration of WWTP discharge	C_sBab =	6.5	(mg/l)
trat	concentration of Area 5 Pit NW discharge	C_spit =	5.95	(mg/l)
ieu	concentration of LTVSMC Tailings Basin seepage	C_fs =	21.54	(mg/l)
ouc	concentration of Hydrometallurgical Residue Cells Liner Leakage	C_rrs =	0	(mg/l)
Ŭ	concentration of ground water flow into PM-12	C_g12 =	1.8	(mg/l)
ndı				
<u> </u>	concentration of ground water flow into PM-13	C_g13 =	1.8	(mg/l)
r o	flow in river at PM-12	Q_r12 =	13.79	· · ·
ate ılar	flow in river at PM-13	Q_r13 =	80.00	(cfs)
≥ ¤	flow check	Q_ck =	80.00	(cfs)
	•	•		
	mass flux of surface water into PM-12	M s12 =	2319	(ma/l)
	mass flux of surface water into PM-13	M_s13 =	10302	
ď	mass flux of Babbitt WWTP	$M_sBab =$		(mg/l)
	concentration of Area 5 Pit NW discharge	M_spit =		(mg/l)
rx ti	concentration of LTVSMC Tailings Basin seepage	M_spit = $M fs =$	2438	(mg/l)
<u> </u>	concentration of Hydrometallurgical Residue Cells Liner Leakage	M_rrs =		(mg/l)
ss ss	mass flux of ground water into PM-12	$M_g12 =$		(mg/l)
Cal Va	mass flux of ground water into PM-12 mass flux of ground water into PM-13	$M_{g13} =$		(mg/l)
02	mass hux of ground water into PWI-13	$M_g13 =$	214	(mg/i)
		T		
e e	mass flux in river at PM-12	M r12 =	2400	(mg/s)
ss		1112 =	2423	(119/5)
Mass Balan	and the free of DM 40		4 4 -	
2 0	mass flux in river at PM-13	M_r13 =	15713	(mg/s)
	[r		
ч				
ati				,
ate	concentration in river at PM-12	C_r12 =	6.21	(mg/l)
suls cer				
Calculated Concentration				
ŰŐ	concentration in river at PM-13	C_r13 =	6.94	(mg/l)
		-		
uo				
d ati	Observed concentration in river at DM 10		4.40	(ma a /l)
ut je	Observed concentration in river at PM-12		4.49	(mg/l)
		1		
ien Ce				
Observed Concentration	Observed concentration in river at PM-13		6.98	(mg/l)

Parameter:	Cobalt
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	surface water flow into PM-12	Q_s12 =	12.60	(cfs)
Data	surface water flow into PM-13	Q_s13 =	56.01	(cfs)
Da	Babbitt WWTP discharge	Q_sBab =	0.33	(cfs)
>	Area 5 Pit NW discharge	Q_spit =	1.99	(cfs)
Ó	LTVSMC Tailings Basin seepage	Q_fs =	4.00	(cfs)
<u></u>	Hydrometallurgical Residue Cells Liner Leakage	Q rrs =	0.00	(cfs)
put Concentration Data	ground water flow into PM-12	Q_g12 =	0.86	(cfs)
드	ground water flow into PM-13	Q_g13 =	4.21	(cfs)
	-			
	concentration of surface water into PM-12	C_s12 =	0.6	(µg/l)
ata				
ő	concentration of surface water into PM-13	C_s13 =	0.6	(µg/l)
5	concentration of WWTP discharge	C sBab =	0.6	(µg/l)
atic	2			
ltr:	concentration of Area 5 Pit NW discharge	C_spit =		(µg/l)
er le	concentration of LTVSMC Tailings Basin seepage	C_fs =	1.556	(µg/l)
ouo	concentration of Hydrometallurgical Residue Cells Liner Leakage	C_rrs =	0	(µg/l)
nt O	concentration of ground water flow into PM-12	C_g12 =	1.1	(µg/l)
dul	concentration of ground water flow into PM-13	C_g13 =	1.1	(µg/l)
	, , , , , , , , , , , , , , , , , , ,			
	flow in river at DM 10	0 =10	10 70	(of a)
Water Balance	flow in river at PM-12	Q_r12 =	13.79	· · ·
Water Balano	flow in river at PM-13	Q_r13 =	80.00	
≤ m	flow check	Q_ck =	80.00	(cfs)
	mass flux of surface water into PM-12	M_s12 =	214	(µg/s)
	mass flux of surface water into PM-13	M_s13 =	951	(µg/s)
oť	mass flux of Babbitt WWTP	M sBab =		(µg/s)
5 ×	concentration of Area 5 Pit NW discharge	M_spit =		(µg/s)
latior Flux	concentration of LTVSMC Tailings Basin seepage	M fs =	176	(µg/s)
ен с Н	concentration of Hydrometallurgical Residue Cells Liner Leakage	M rrs =		(µg/s)
Calculation of Mass Flux	mass flux of ground water into PM-12	 M_g12 =		(µg/s)
ΰຶຶ	mass flux of ground water into PM-13	M_g13 =		(µg/s)
	5	0		
e	mass flux in river at PM-12	M r12 =	246	(µg/s)
SS				(rg, c)
Mass Balance	man flux is since at DM 40	M	1500	(
20	mass flux in river at PM-13	M_r13 =	1533	(µg/s)
L L				
atio				
tec	concentration in river at PM-12	C_r12 =	0.63	(µg/l)
Calculated Concentration				
LC IC				
ပိပိ	concentration in river at PM-13	C r13 =	0.68	(µg/l)
		1	0.00	\I‴Ə′ '/
-				
lo				
J ati			0.50	(. m
ntr /ec	Observed concentration in river at PM-12		0.58	(µg/l)
en ce				
Observed Concentration				
00	Observed concentration in river at PM-13		ND (1)	(µg/l)

Parameter: Copper

	surface water flow into PM-12	Q_s12 =	12.60	(cfs)
ta	surface water flow into PM-13	Q_s13 =	56.01	(cfs)
Da	Babbitt WWTP discharge	Q_sBab =	0.33	(cfs)
	Area 5 Pit NW discharge	Q_spit =	1.99	(cfs)
0	LTVSMC Tailings Basin seepage	Q_fs =	4.00	(cfs)
	Hydrometallurgical Residue Cells Liner Leakage	Q_rrs =	0.00	(cfs)
lass Calculation of Water Mass Flux Balance Input Concentration Data Input Flow Data	ground water flow into PM-12	Q_g12 =	0.86	
Ē	ground water flow into PM-13	Q_g13 =	4.21	
	••			
	concentration of surface water into PM-12	C_s12 =	15	(µg/l)
Ita		_		
Da	concentration of surface water into PM-13	C_s13 =	1.5	(µg/l)
Ę	concentration of WWTP discharge	C sBab =	1.5	(µg/l)
tic				
itra	concentration of Area 5 Pit NW discharge	C_spit =	3.45	(µg/l)
e	concentration of LTVSMC Tailings Basin seepage	C_fs =	4.555	(µg/l)
ouc	concentration of Hydrometallurgical Residue Cells Liner Leakage	C_rrs =	0	(µg/l)
ö				
put	concentration of ground water flow into PM-12	C_g12 =	4	(µg/l)
<u> </u>	concentration of ground water flow into PM-13	C_g13 =	4	(µg/l)
Φ	flow in river at PM-12	Q_r12 =	13.79	(cfs)
ter anc	flow in river at PM-13	Q_r13 =	80.00	· · ·
Vat 3ala	flow check		80.00	
		Q_ck =	80.00	(CIS)
	mass flux of surface water into PM-12	M_s12 =		(µg/s)
	mass flux of surface water into PM-13	M_s13 =	2377	
ō	mass flux of Babbitt WWTP	M_sBab =		(µg/s)
u S S	concentration of Area 5 Pit NW discharge	M_spit =		(µg/s)
El ati	concentration of LTVSMC Tailings Basin seepage	M_fs =		(µg/s)
	concentration of Hydrometallurgical Residue Cells Liner Leakage	M_rrs =		(µg/s)
alc	mass flux of ground water into PM-12	M_g12 =		(µg/s)
S C	mass flux of ground water into PM-13	M_g13 =	477	(µg/s)
6				
Ce Ce	mass flux in river at PM-12	M_r12 =	646	(µg/s)
ss				- /
Vla 3al	mass flux in river at PM-13	M_r13 =	4210	(un/e)
		<u> w_10 =</u>	7210	(49/3)
		-		
uo				
atio				
ate	concentration in river at PM-12	C_r12 =	1.66	(µg/l)
Calculated Concentration				
ပိပိ	concentration in river at PM-13	C_r13 =	1.86	(µg/l)
d rat	Observed concentration in river at DM 10		1 50	(110/1)
e ve	Observed concentration in river at PM-12		1.53	(µg/l)
• • • • •				
ë ë				
bsei				/ m
Observed Concentration	Observed concentration in river at PM-13		2.00	(µg/l)

Embarrass River Model - Calibration to Baseline Water Quality Data Parameter: Fluoride

-				
	surface water flow into PM-12	Q_s12 =	12.60	
ta	surface water flow into PM-13	Q_s13 =	56.01	(cfs)
nput Flow Data	Babbitt WWTP discharge	Q_sBab =	0.33	(cfs)
≥	Area 5 Pit NW discharge	Q_spit =	1.99	
<u>Ó</u>	LTVSMC Tailings Basin seepage	Q_fs =	4.00	
보	Hydrometallurgical Residue Cells Liner Leakage	Q_rrs =	0.00	<u> </u>
nd	ground water flow into PM-12	Q_g12 =	0.86	
<u> </u>	ground water flow into PM-13	Q_g13 =	4.21	(cfs)
T. T.	concentration of surface water into PM-12	C_s12 =	0.2	(mg/l)
Data	concentration of ourface water into DM 12			
	concentration of surface water into PM-13	C_s13 =		(mg/l)
tion	concentration of WWTP discharge	C_sBab =	0.2	(mg/l)
tral	concentration of Area 5 Pit NW discharge	C_spit =	0.125	(mg/l)
Cen	concentration of LTVSMC Tailings Basin seepage	C_fs =	1.55	(mg/l)
ouo	concentration of Hydrometallurgical Residue Cells Liner Leakage	C_rrs =	0	(mg/l)
nput Concentration	concentration of ground water flow into PM-12	C_g12 =	0.385	(mg/l)
ndu	¥			
=	concentration of ground water flow into PM-13	C_g13 =	0.385	(119/1)
			<u>г</u>	
୍ଞ	flow in river at PM-12	Q_r12 =	13.79	(cfs)
Water Balance	flow in river at PM-13	Q_r13 =	80.00	(cfs)
Ba	flow check	Q_ck =	80.00	(cfs)
				(0.0)
	mass flux of surface water into PM-12	M s12 =	71	(mg/l)
	mass flux of surface water into PM-13	M_s13 =		(mg/l) (mg/l)
đ	mass flux of Babbitt WWTP	$M_sBab =$		(mg/l) (mg/l)
	concentration of Area 5 Pit NW discharge	M_spit =		(mg/l) (mg/l)
atior Flux	concentration of LTVSMC Tailings Basin seepage	M_spit = $M fs =$	175	(mg/l)
Па	concentration of Hydrometallurgical Residue Cells Liner Leakage	M_rrs =		(mg/l)
Calculation of Mass Flux	mass flux of ground water into PM-12	M_g12 =		(mg/l)
Calcul Mass	mass flux of ground water into PM-13	M_g12 =		(mg/l)
		M_g10 =	40	(1119/1)
e	mass flux in river at PM-12	M r12 =	83	(mg/s)
Mass Balance			00	(119/3)
Mass Balan	made flux in river at PM 19	M r10	<u></u>	(mc/c)
∠ Ш	mass flux in river at PM-13	M_r13 =	628	(mg/s)
uo				
ed ati	encoderation in view of DM 40	0	0.04	(
ate ntr	concentration in river at PM-12	C_r12 =	0.21	(mg/l)
Calculated Concentration				
alc				,
00	concentration in river at PM-13	C_r13 =	0.28	(mg/l)
		1		
uo				
J ati	Observed some starting is given at DM 40		0.40	(
vec	Observed concentration in river at PM-12		0.10	(mg/l)
ser				
Observed Concentration	Observed concentration in river at PM-13		0.20	(ma/l)
	Observed Concentration III fiver at Pivi-13	1	0.39	(mg/l)

Iron

Embarrass River Model - Calibration to Baseline Water Quality Data

Parameter: Iron

	surface water flow into PM-12	Q_s12 =	1.01	
Data	surface water flow into PM-13	Q_s13 =	0.72	. ,
	Babbitt WWTP discharge	Q_sBab =	0.33	
≥ S	Area 5 Pit NW discharge	Q_spit =	0.26	
음	LTVSMC Tailings Basin seepage	Q_fs =	4.00	
- T	Hydrometallurgical Residue Cells Liner Leakage	Q_rrs =	0.00	
nput Flow	ground water flow into PM-12	Q_g12 =	0.86	
	ground water flow into PM-13	Q_g13 =	4.21	(cfs)
		0		((I)
ta	concentration of surface water into PM-12	C_s12 =	2.9	(mg/l)
Data	concentration of surface water into PM-13	C_s13 =	2.9	(mg/l)
ion	concentration of WWTP discharge	C_sBab =	2.9	(mg/l)
trat	concentration of Area 5 Pit NW discharge	C_spit =	0.038	(mg/l)
cen	concentration of LTVSMC Tailings Basin seepage	C_fs =	4.594	(mg/l)
ouo	concentration of Hydrometallurgical Residue Cells Liner Leakage	C_rrs =	0	(mg/l)
nput Concentration	concentration of ground water flow into PM-12	C_g12 =	0.035	(mg/l)
Idu	concentration of ground water flow into PM-13	C_g13 =	0.035	(mg/l)
				、 し /
ø	flow in river at PM-12	Q_r12 =	2.20	(cfs)
Water Balance	flow in river at PM-13	Q_r13 =	11.39	
Wa Bal	flow check	 Q_ck =	11.39	
<u>i</u>				(<i>'</i> /
	mass flux of surface water into PM-12	M s12 =	83	(mg/l)
	mass flux of surface water into PM-13	M_s13 =		(mg/l)
of	mass flux of Babbitt WWTP	M_sBab =		(mg/l)
E ×	concentration of Area 5 Pit NW discharge	M_spit =		(mg/l)
atior Flux	concentration of LTVSMC Tailings Basin seepage	M_fs =		(mg/l)
s F	concentration of Hydrometallurgical Residue Cells Liner Leakage	M_rrs =	0	(mg/l)
Calculation of Mass Flux	mass flux of ground water into PM-12	M_g12 =		(mg/l)
ΰΣ	mass flux of ground water into PM-13	M_g13 =	4	(mg/l)
	I	1		
e O	mass flux in river at DM 10	M r10	444	(mc/c)
Mass Balance	mass flux in river at PM-12	M_r12 =	111	(mg/s)
Mass Balan	mass flux in river at PM-13	M_r13 =	604	(mg/s)
	11100 10x 11 1100 at 1 11-10	IW_110 =	094	(119/5)
2				
tio _				
tra	concentration in river at PM-12	C r12 =	1.78	(mg/l)
Calculated Concentration				<u>, 9</u> .)
alct				
ပိပိ	concentration in river at PM-13	C_r13 =	2.15	(mg/l)
uo				
Observed Concentration	Observed concentration in river at PM-12		2.26	(mg/l)
Observed Concentra			2.20	(mg/1)
se				
ပိပိ	Observed concentration in river at PM-13		1.70	(mg/l)

Embarrass River Model - Calibration to Baseline Water Quality Data Parameter: Hardness

	surface water flow into PM-12	Q_s12 =	12.60	
Ita	surface water flow into PM-13	Q_s13 =	56.01	
Da	Babbitt WWTP discharge	Q_sBab =	0.33	(cfs)
	Area 5 Pit NW discharge	Q_spit =	1.99	
음	LTVSMC Tailings Basin seepage	Q_fs =	4.00	
ut F	Hydrometallurgical Residue Cells Liner Leakage	Q_rrs =	0.00	<u> </u>
b	ground water flow into PM-12	Q_g12 =	0.86	<u> </u>
-	ground water flow into PM-13	Q_g13 =	4.21	(cfs)
ធ	concentration of surface water into PM-12	C_s12 =	70	(mg/l)
Dai	concentration of surface water into PM-13	C_s13 =	70	(mg/l)
ion	concentration of WWTP discharge	C_sBab =	70	(mg/l)
trat	concentration of Area 5 Pit NW discharge	C_spit =	942.7	(mg/l)
sen	concentration of LTVSMC Tailings Basin seepage	C_fs =	436.6	(mg/l)
ono	concentration of Hydrometallurgical Residue Cells Liner Leakage	C_rrs =	0	(mg/l)
nput Concentration Data	concentration of ground water flow into PM-12	C_g12 =	87.5	(mg/l)
lnpu	concentration of ground water flow into PM-13	C_g13 =		(mg/l)
ð	flow in river at PM-12	Q r12 =	13.79	(cfs)
žĭ	flow in river at PM-13	 Q_r13 =	80.00	
Na Bal	flow check	Q_ck =	80.00	· · ·
			00.00	(010)
	mass flux of surface water into PM-12	M s12 =	24969	(ma/l)
	mass flux of surface water into PM-13	M_s12 =	110947	
	mass flux of Babbitt WWTP	$M_srs =$ M_sBab =		(mg/l)
_	concentration of Area 5 Pit NW discharge	M_spit =	53090	
atior Flux	concentration of LTVSMC Tailings Basin seepage	M_spit = $M fs =$	49423	
ла Г	concentration of Hydrometallurgical Residue Cells Liner Leakage	M_rrs =		(mg/l)
llcu	mass flux of ground water into PM-12	M_g12 =	2130	
Calcul Mass	mass flux of ground water into PM-13	M_g13 =	10425	(mg/l)
• =		<u>m_gro =</u>	10120	(
Mass Balance	mass flux in river at PM-12	M_r12 =	27752	(mg/s)
Mass Balan				
∑ä	mass flux in river at PM-13	M_r13 =	251638	(mg/s)
		1		
uo				
ati				,
ate	concentration in river at PM-12	C_r12 =	71.09	(mg/l)
Calculated Concentration				
alc				
00	concentration in river at PM-13	C_r13 =	111.15	(mg/l)
Observed Concentration				
ed tra	Observed concentration in river at PM-12		53.66	(mg/l)
Observed Concentre				
ω ο				
sc				

Parameter: Magnesium

	surface water flow into PM-12	Q_s12 =	12.60 (cfs)
ta	surface water flow into PM-13	Q_s13 =	56.01 (cfs)
Data	Babbitt WWTP discharge	Q_sBab =	0.33 (cfs)
	Area 5 Pit NW discharge	Q_spit =	1.99 (cfs)
nput Flow	LTVSMC Tailings Basin seepage	Q_fs =	4.00 (cfs)
L L	Hydrometallurgical Residue Cells Liner Leakage	 Q_rrs =	0.00 (cfs)
DT1	ground water flow into PM-12	 Q_g12 =	0.86 (cfs)
<u>Ľ</u>	ground water flow into PM-13	Q_g13 =	4.21 (cfs)
2			
	concentration of surface water into PM-12	C_s12 =	5.9 (mg/l)
ıta		_	
õ	concentration of surface water into PM-13	C_s13 =	5.9 (mg/l)
5	concentration of WWTP discharge	C_sBab =	5.9 (mg/l)
atic			
ntre	concentration of Area 5 Pit NW discharge	C_spit =	271 (mg/l)
Cel	concentration of LTVSMC Tailings Basin seepage	C_fs =	69.97 (mg/l)
on	concentration of Hydrometallurgical Residue Cells Liner Leakage	C_rrs =	0
nput Concentration Data	concentration of ground water flow into PM-12	C_g12 =	10.65 (mg/l)
id u	concentration of ground water flow into PM-13	C_g13 =	10.65 (mg/l)
_		0_910 -	10.00 (119/1)
_ e	flow in river at PM-12	Q_r12 =	13.79 (cfs)
Water Balance	flow in river at PM-13	Q_r13 =	80.00 (cfs)
≥ ä	flow check	Q_ck =	80.00 (cfs)
	mass flux of surface water into PM-12	M_s12 =	2105 (µg/s)
	mass flux of surface water into PM-13	M_s13 =	9351 (mg/s)
of	mass flux of Babbitt WWTP	M_sBab =	55 (mg/s)
Ę ,	concentration of Area 5 Pit NW discharge	M_spit =	15262 (mg/s)
latior Flux	concentration of LTVSMC Tailings Basin seepage	M fs =	7921 (mg/s)
<u>п</u>	concentration of Hydrometallurgical Residue Cells Liner Leakage	M rrs =	0 (mg/s)
Calculation of Mass Flux	mass flux of ground water into PM-12	M_g12 =	259 (mg/s)
Aa Aa	mass flux of ground water into PM-13	M_g13 =	1269 (mg/s)
02		M_g10 =	1200 (mg/0)
e	mass flux in river at PM-12	M r12 =	2419 (mg/s)
si su		<u></u>	2+13 (IIIg/S)
Mass Balance			
2 0	mass flux in river at PM-13	M_r13 =	36221 (mg/s)
		1	-
L L			
atic		1	
tree	concentration in river at PM-12	C_r12 =	6.20 (mg/l)
ula ten			
Calculated Concentration		1	
ပိပိ	concentration in river at PM-13	C_r13 =	16.00 (mg/l)
	·	-	
۲ ۲			
tio			
rai	Observed concentration in river at PM-12		6.2 (mg/l)
ente		1	0.2 (119/1)
sei			
Observed Concentration	Observed concentration in river at PM-13		15.9 (mg/l)
00	Cuserved concentration in river at FIVE 13	1	13.8 (IIIg/I)

Parameter: Manganese

	surface water flow into PM-12	Q_s12 =	0.00 (cfs)
ta	surface water flow into PM-13	Q_s13 =	0.00 (cfs)
Data	Babbitt WWTP discharge	Q sBab =	0.33 (cfs)
~	Area 5 Pit NW discharge	Q_spit =	0.26 (cfs)
<u>0</u>	LTVSMC Tailings Basin seepage	Q_fs =	4.00 (cfs)
nput Flow	Hydrometallurgical Residue Cells Liner Leakage	Q rrs =	0.00 (cfs)
inc	ground water flow into PM-12	 Q_g12 =	0.86 (cfs)
lu	ground water flow into PM-13	Q_g13 =	4.21 (cfs)
	concentration of surface water into PM-12	C_s12 =	0.3 (mg/l)
Data			
Ő	concentration of surface water into PM-13	C_s13 =	0.3 (mg/l)
Ľ	concentration of WWTP discharge	C sBab =	0.3 (mg/l)
atic	2		
htra	concentration of Area 5 Pit NW discharge	C_spit =	0.65 (mg/l)
Ser	concentration of LTVSMC Tailings Basin seepage	C_fs =	1.183 (mg/l)
onc	concentration of Hydrometallurgical Residue Cells Liner Leakage	C_rrs =	0
nput Concentration	concentration of ground water flow into PM-12	C_g12 =	0.188 (mg/l)
du	concentration of ground water flow into PM-13	C_g13 =	0.188 (mg/l)
	.		
Water Balance	flow in river at PM-12	Q_r12 =	1.91 (cfs)
Water Balano	flow in river at PM-13	Q_r13 =	9.66 (cfs)
Bi ≪	flow check	Q_ck =	9.66 (cfs)
	mass flux of surface water into PM-12	M_s12 =	0 (µg/s)
	mass flux of surface water into PM-13	M_s13 =	0 (mg/s)
of	mass flux of Babbitt WWTP	M_sBab =	3 (mg/s)
E X	concentration of Area 5 Pit NW discharge	M_spit =	5 (mg/s)
	concentration of LTVSMC Tailings Basin seepage	M fs =	134 (mg/s)
elu E T s	concentration of Hydrometallurgical Residue Cells Liner Leakage	M rrs =	0 (mg/s)
Calcul Mass I	mass flux of ground water into PM-12	 Mg12 =	5 (mg/s)
ΰຶຶ	mass flux of ground water into PM-13	M_g13 =	22 (mg/s)
	5	0	
e	mass flux in river at PM-12	M r12 =	7 (mg/s)
ss an		<u> </u>	. (<i>g</i> , 5)
Mass Balance	maga flux in river at DM 12	M =10	160 (mar/c)
∠ □	mass flux in river at PM-13	M_r13 =	168 (mg/s)
		1	
UC			
d atic			
ntra	concentration in river at PM-12	C_r12 =	0.14 (mg/l)
Calculated Concentration			
alci			
ပိပိ	concentration in river at PM-13	C_r13 =	0.62 (mg/l)
		. –	
<u> </u>			
tion			
d	Observed concentration in river at PM-12		0.34 (mg/l)
ve ∍nt		1	0.0+(((1)g/1)
<u> </u>			
se JC			
Observed Concentration	Observed concentration in river at PM-13		0.20 (mg/l)

Parameter: Sodium

	surface water flow into PM-12	Q_s12 =	12.60	(cfs)
ta	surface water flow into PM-13	Q_s13 =	56.01	(cfs)
Data	Babbitt WWTP discharge	Q_sBab =	0.33	(cfs)
>	Area 5 Pit NW discharge	Q_spit =	1.99	(cfs)
nput Flow	LTVSMC Tailings Basin seepage	Q_fs =	4.00	(cfs)
L L	Hydrometallurgical Residue Cells Liner Leakage	Q_rrs =	0.00	(cfs)
	ground water flow into PM-12	Q_g12 =	0.86	(cfs)
Ē	ground water flow into PM-13	Q_g13 =	4.21	(cfs)
	concentration of surface water into PM-12	C_s12 =	6.0	(mg/l)
Data				
	concentration of surface water into PM-13	C_s13 =	6.0	(mg/l)
5	concentration of WWTP discharge	C sBab =	6.0	(mg/l)
ratic	concentration of Area 5 Pit NW discharge	C_spit =	119.5	
ant		C fs =	44.31	
LC M	concentration of LTVSMC Tailings Basin seepage			(IIIg/I)
Sor	concentration of Hydrometallurgical Residue Cells Liner Leakage	C_rrs =	0	
nput Concentration	concentration of ground water flow into PM-12	C_g12 =	4.9	(mg/l)
dul	concentration of ground water flow into PM-13	C_g13 =	4.9	(mg/l)
				····
		0.10	10 70	(()
nce r	flow in river at PM-12 flow in river at PM-13 flow check	Q_r12 =	13.79	
Water Balano	flow in river at PM-13	Q_r13 =	80.00	
2 2	flow check	Q_ck =	80.00	(cfs)
	mass flux of surface water into PM-12	M_s12 =	2140	(µg/s)
	mass flux of surface water into PM-13	M_s13 =	9510	(mg/s)
of	mass flux of Babbitt WWTP	M_sBab =	56	(mg/s)
Б×	concentration of Area 5 Pit NW discharge	M_spit =	6730	(mg/s)
atior Flux	concentration of LTVSMC Tailings Basin seepage	M fs =		(mg/s)
s Hol	concentration of Hydrometallurgical Residue Cells Liner Leakage	M_rrs =	0	(mg/s)
Calculation of Mass Flux	mass flux of ground water into PM-12	M_g12 =	119	(mg/s)
ΰΞ	mass flux of ground water into PM-13	M_g13 =	584	(mg/s)
ce	mass flux in river at PM-12	M_r12 =	2315	(mg/s)
ss an		1		、 U - /
Mass Balan	mass flux in river at PM-12 mass flux in river at PM-13	M r13 =	24155	(ma/a)
	111233 1124 111 11741 at F 19-13	IVI_I I 3 =	24100	(119/5)
		1		
uo				
ati				
ate	concentration in river at PM-12	C_r12 =	5.93	(mg/l)
Calculated Concentration				
alc				
ΰŭ	concentration in river at PM-13	C_r13 =	10.67	(mg/l)
Ę				
tio				
) tra	Observed concentration in river at PM-12		3.0	(mg/l)
Observed Concentration		1	0.0	(··· ʒ/··/
se				
80	Observed concentration in river at PM-13	1	127	(mg/l)
00				

Parameter:	Nickel
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	surface water flow into PM-12	Q_s12 =	12.60	<u>`</u>
ata	surface water flow into PM-13	Q_s13 =	56.01	
ũ	Babbitt WWTP discharge	Q_sBab =	0.33	
nput Flow Data	Area 5 Pit NW discharge	Q_spit =	1.99	· /
Ę	LTVSMC Tailings Basin seepage	Q_fs =	4.00	<u>`</u>
rt	Hydrometallurgical Residue Cells Liner Leakage ground water flow into PM-12	Q_rrs =	0.00	
du	ground water flow into PM-12 ground water flow into PM-13	Q_g12 = Q_g13 =	0.86	(cis) (cfs)
	ground water now into r W-15	Q_915 =	4.21	(05)
	concentration of surface water into PM-12	C s12 =	1.0	(µg/l)
Data		_		
De	concentration of surface water into PM-13	C_s13 =	1.2	(µg/l)
uo	concentration of WWTP discharge	C_sBab =	1.2	(µg/l)
rati	concentration of Area 5 Pit NW discharge	C_spit =	5.2	(µg/l)
ent	concentration of LTVSMC Tailings Basin seepage	C_fs =		(µg/l)
onc	concentration of Hydrometallurgical Residue Cells Liner Leakage	C_rrs =		(µg/l)
nput Concentration	concentration of ground water flow into PM-12	C_g12 =		(µg/l)
ndu				
	concentration of ground water flow into PM-13	C_g13 =	1	(µg/l)
r Sce	flow in river at PM-12	Q_r12 =	13.79	(cfs)
Water Balance	flow in river at PM-13	Q_r13 =	80.00	(cfs)
B: K	flow check	Q_ck =	80.00	(cfs)
	mass flux of surface water into PM-12	M_s12 =		(µg/s)
Ţ	mass flux of surface water into PM-13	M_s13 =	1902	
Ö	mass flux of Babbitt WWTP	M_sBab =		(µg/s)
latior Flux	concentration of Area 5 Pit NW discharge	M_spit =		(µg/s)
Calculation of Mass Flux	concentration of LTVSMC Tailings Basin seepage	M_fs =		(µg/s)
Calcul Mass	concentration of Hydrometallurgical Residue Cells Liner Leakage	M_rrs =		(µg/s)
Cal Va	mass flux of ground water into PM-12 mass flux of ground water into PM-13	M_g12 = M_g13 =		(µg/s) (µg/s)
02	mass hux of ground water into FM-13	w_g13 =	034	(µg/s)
e	mass flux in river at PM-12	M r12 =	610	(µg/s)
ss				(1° 3 ° -/
Mass Balance	mass flux in river at PM-13	M_r13 =	4417	(µg/s)
				\1° 3 ° [−] /
_ ح				
tio				
tec tra	concentration in river at PM-12	C_r12 =	1.6	(µg/l)
ulat en				
Calculated Concentration				
ပိပိ	concentration in river at PM-13	C_r13 =	2.0	(µg/l)
nc				
atic				
/ed ntra	Observed concentration in river at PM-12		1.9	(µg/l)
⊂ ⊡				
e c				
Observed Concentration	Observed concentration in river at PM-13		2.1	(µg/l)

Parameter: Lead

	surface water flow into PM-12	Q_s12 =	12.60	(cfs)
ក្ន	surface water flow into PM-13	Q_s13 =	56.01	
Dat	Babbitt WWTP discharge	Q_sBab =	0.33	
2	Area 5 Pit NW discharge	Q_spit =	1.99	
nput Flow Data	LTVSMC Tailings Basin seepage	Q_fs =	4.00	
Щ. Т	Hydrometallurgical Residue Cells Liner Leakage	Q_rrs =	0.00	(cfs)
nd	ground water flow into PM-12	Q_g12 =	0.86	(cfs)
니	ground water flow into PM-13	Q_g13 =	4.21	(cfs)
_	concentration of surface water into PM-12	C_s12 =	0.15	(µg/l)
Data				
Ő	concentration of surface water into PM-13	C_s13 =	0.15	(µg/l)
uo	concentration of WWTP discharge	C_sBab =	0.15	(µg/l)
trati	concentration of Area 5 Pit NW discharge	C_spit =	0.3	(µg/l)
en	concentration of LTVSMC Tailings Basin seepage	C_fs =	1.2	(µg/l)
ouc.	concentration of Hydrometallurgical Residue Cells Liner Leakage	C rrs =	0	(1-9-7
nput Concentration	concentration of ground water flow into PM-12	C_g12 =		(µg/l)
Indi				
<u> </u>	concentration of ground water flow into PM-13	C_g13 =	1.2	(µg/l)
		1		
. e	flow in river at PM-12	Q_r12 =	13.79	(cfs)
Water Balance	flow in river at PM-13	Q_r13 =	80.00	(cfs)
Ba S	flow check	Q_ck =	80.00	(cfs)
		-		
	mass flux of surface water into PM-12	M_s12 =	54	(µg/s)
	mass flux of surface water into PM-13	M_s13 =		(µg/s)
of	mass flux of Babbitt WWTP	M_sBab =		(µg/s)
Ę ×	concentration of Area 5 Pit NW discharge	M_spit =		(µg/s)
latior Flux	concentration of LTVSMC Tailings Basin seepage	M fs =		(µg/s)
s H a	concentration of Hydrometallurgical Residue Cells Liner Leakage	M_rrs =		(µg/s)
Calculation of Mass Flux	mass flux of ground water into PM-12	M_g12 =	29	(µg/s)
ΰΞ	mass flux of ground water into PM-13	M_g13 =	143	(µg/s)
		-		
ICe	mass flux in river at PM-12	M_r12 =	84	(µg/s)
lss lan				
Mass Balance	mass flux in river at PM-13	M r13 =	618	(µg/s)
		101_10 -	010	(P9/9/
uo				
ati			0.00	(
ate ntr	concentration in river at PM-12	C_r12 =	0.22	(µg/l)
Calculated Concentration				
alc				
00	concentration in river at PM-13	C_r13 =	0.27	(µg/l)
		•		
L L				
atio				
ed	Observed concentration in river at PM-12		ND (0.30)	(µg/l)
er v				
Dbserved Concentration				
ŌŎ	Observed concentration in river at PM-13		0.27	(µg/l)

Parameter: Antimony

	surface water flow into PM-12	Q_s12 =	12.60	<u>, ,</u>
Data	surface water flow into PM-13	Q_s13 =	56.01	<u>, ,</u>
Da	Babbitt WWTP discharge	Q_sBab =	0.33	
3	Area 5 Pit NW discharge	Q_spit =	1.99	<u>, ,</u>
nput Flow	LTVSMC Tailings Basin seepage	Q_fs =	4.00	
<u>ل</u> ــــــــــــــــــــــــــــــــــــ	Hydrometallurgical Residue Cells Liner Leakage	Q_rrs =	0.00	<u>, ,</u>
nd	ground water flow into PM-12	Q_g12 =	0.86	
L L	ground water flow into PM-13	Q_g13 =	4.21	(cfs)
л л	concentration of surface water into PM-12	C_s12 =	0.04	(µg/l)
Data	concentration of surface water into PM-13	C_s13 =	0.04	(µg/l)
Б	concentration of WWTP discharge	C_sBab =	0.04	(µg/l)
rati	concentration of Area 5 Pit NW discharge	C_spit =	0.25	(µg/l)
cent	concentration of LTVSMC Tailings Basin seepage	C_fs =	0.25	
ouo	concentration of Hydrometallurgical Residue Cells Liner Leakage	C_rrs =	0	
nput Concentration	concentration of ground water flow into PM-12	C_g12 =	1.5	(µg/l)
Idul	concentration of ground water flow into PM-13	C_g13 =	1.5	(µg/l)
ġ.	flow in river at PM-12	Q_r12 =	13.79	(cfs)
Water Balance	flow in river at PM-13	 Q_r13 =	80.00	<i>、</i> /
Wa Bal	flow check	 Q_ck =	80.00	.
	mass flux of surface water into PM-12	M s12 =	14	(µg/s)
	mass flux of surface water into PM-13	M s13 =		(µg/s)
of	mass flux of Babbitt WWTP	M_sBab =		(µg/s)
E ×	concentration of Area 5 Pit NW discharge	M_spit =		(µg/s)
latior Flux	concentration of LTVSMC Tailings Basin seepage	M_fs =		(µg/s)
ula 5 F	concentration of Hydrometallurgical Residue Cells Liner Leakage	M_rrs =		(µg/s)
Calculation of Mass Flux	mass flux of ground water into PM-12	M_g12 =		(µg/s)
ΰĔ	mass flux of ground water into PM-13	M_g13 =		(µg/s)
		-		
0				
ICe	mass flux in river at PM-12	M_r12 =	51	(µg/s)
lss lan				
Mass Balance	mass flux in river at PM-13	M r13 =	336	(µg/s)
		<u> </u>		(r*3,°)
ior				
ed rat	concentration in river at PM-12	C_r12 =	0.13	(110/1)
Calculated Concentration	CUNCENTIALIUN IN NVELAL FIVI-12	0_112 =	0.13	(µg/I)
cul				
o al	concentration in vivor at DM 10	0 -10	0.45	(
00	concentration in river at PM-13	C_r13 =	0.15	(µg/I)
Observed Concentration				
ط ati				(
vec ntr	Observed concentration in river at PM-12	+	ND (0.3)	(µg/l)
en ce				
Observed Concentra				
00	Observed concentration in river at PM-13		ND (0.3)	(µg/l)

Parameter: Selenium

	surface water flow into PM-12	Q_s12 =	12.60	
ata	surface water flow into PM-13	Q_s13 =	56.01	
Da	Babbitt WWTP discharge	Q_sBab =	0.33	<u>, </u>
≥ ≥	Area 5 Pit NW discharge	Q_spit =	1.99	<u>, </u>
nput Flow Data	LTVSMC Tailings Basin seepage	Q_fs =	4.00	
- F	Hydrometallurgical Residue Cells Liner Leakage	Q_rrs =	0.00	
ום של	ground water flow into PM-12	Q_g12 =	0.86	
=	ground water flow into PM-13	Q_g13 =	4.21	(CIS)
				((1)
ta	concentration of surface water into PM-12	C_s12 =	0.3	(µg/l)
Data	concentration of surface water into PM-13	C_s13 =	0.3	(µg/l)
u	concentration of WWTP discharge	C_sBab =	0.3	(µg/l)
atic	concentration of Area 5 Pit NW discharge	C_spit =		(µg/l)
entr	-	C_fs =		
JCe	concentration of LTVSMC Tailings Basin seepage		1.09	(µg/i)
Cor	concentration of Hydrometallurgical Residue Cells Liner Leakage	C_rrs =	0	
nput Concentration	concentration of ground water flow into PM-12	C_g12 =	2.95	(µg/l)
dul	concentration of ground water flow into PM-13	C_g13 =	2.95	(µg/l)
			I	
(h)	flow in river at PM-12	Q r12 =	13.79	(cfs)
Water Balance		_		
Water Balanc	flow in river at PM-13	Q_r13 =	80.00	
> m	flow check	Q_ck =	80.00	(CfS)
	mass flux of surface water into PM-12	M_s12 =		(µg/s)
<u> </u>	mass flux of surface water into PM-13	M_s13 =		(µg/s)
Ö	mass flux of Babbitt WWTP	M_sBab =		(µg/s)
jo X	concentration of Area 5 Pit NW discharge	M_spit =		(µg/s)
Calculation of Mass Flux	concentration of LTVSMC Tailings Basin seepage	M_fs =		(µg/s)
Calcul Mass	concentration of Hydrometallurgical Residue Cells Liner Leakage	M_rrs =		(µg/s)
la: la:	mass flux of ground water into PM-12	M_g12 =		(µg/s)
02	mass flux of ground water into PM-13	M_g13 =	351	(µg/s)
				
e	mass flux in river at PM-12	M r10	100	(110/0)
Mass Balance		M_r12 =	182	(µg/s)
Mass Balan			(000	, , , ,
20	mass flux in river at PM-13	M_r13 =	1222	(µg/s)
		1		
чо				
ati	Design of the second DM 40		0.47	(())
ate ntr	concentration in river at PM-12	C_r12 =	0.47	(µg/l)
ce				
Calculated Concentration	concentration in vivor et DM 40	0	0.54	(11 ~ /1)
00	concentration in river at PM-13	C_r13 =	0.54	(µg/I)
uo				
ati	Observed concentration in river at DM 10			(u.g./l)
0 3	Observed concentration in river at PM-12		ND (1)	(µg/l)
ved intra				
served				
Observed Concentration	Observed concentration in river at PM-13		ND (1)	(µg/l)

Parameter: Sulfate

	surface water flow into PM-12	Q_s12 =	12.60	(cfs)
Ita	surface water flow into PM-13	Q_s13 =	56.01	(cfs)
Data	Babbitt WWTP discharge	Q_sBab =	0.33	
2	Area 5 Pit NW discharge	Q_spit =	1.99	\ /
nput Flow	LTVSMC Tailings Basin seepage	Q_fs =	4.00	\ /
H H	Hydrometallurgical Residue Cells Liner Leakage	Q_rrs =	0.00	()
ק	ground water flow into PM-12	Q_g12 =	0.86	\ /
-	ground water flow into PM-13	Q_g13 =	4.21	(cfs)
	concentration of ourfoco uniter into DM 10	0 10	4	(mag at /l)
ita	concentration of surface water into PM-12	C_s12 =	4	(mg/l)
Data	concentration of surface water into PM-13	C_s13 =	4	(mg/l)
uo	concentration of WWTP discharge	C_sBab =	4	(mg/l)
trati	concentration of Area 5 Pit NW discharge	C_spit =	1046.3	(mg/l)
ent	concentration of LTVSMC Tailings Basin seepage	C_fs =	152.4	(mg/l)
ouc	concentration of Hydrometallurgical Residue Cells Liner Leakage	C_rrs =	0	
nput Concentration	concentration of ground water flow into PM-12	C_g12 =	8.5	(mg/l)
du	concentration of ground water flow into PM-13	C_g13 =	8.5	(mg/l)
	· · · · · · · · · · · · · · · · · · ·			
Q	flow in river at PM-12	Q r12 =	13.79	(cfs)
Water Balance	flow in river at PM-13	Q r13 =	80.00	
Water Balane	flow check	Q_ck =	80.00	
		u_0	00100	(0.0)
	mass flux of surface water into PM-12	M_s12 =	1427	(µg/s)
	mass flux of surface water into PM-13	M_s13 =		(mg/s)
of	mass flux of Babbitt WWTP	M_sBab =		(mg/s)
E ×	concentration of Area 5 Pit NW discharge	M_spit =	58924	
Calculation of Mass Flux	concentration of LTVSMC Tailings Basin seepage	M fs =	17252	
ен с Н	concentration of Hydrometallurgical Residue Cells Liner Leakage	M rrs =		(mg/s)
Calcul Mass I	mass flux of ground water into PM-12	 M_g12 =		(mg/s)
ΰΞ	mass flux of ground water into PM-13	M_g13 =		(mg/s)
		_		
Ð				
uc s	mass flux in river at PM-12	M_r12 =	1671	(mg/s)
Mass Balan				
Σã	mass flux in river at PM-12 mass flux in river at PM-13	M_r13 =	85200	(mg/s)
Lo				
ati				(A)
ate ntr	concentration in river at PM-12	C_r12 =	4.3	(mg/l)
Calculated Concentration				
alc				<i>,</i>
00	concentration in river at PM-13	C_r13 =	37.6	(mg/l)
ion		1		
d rat	Observed concentration in river at PM-12		47	(mg/l)
ent		1	4.7	('''9/')
Observed Concentration				
පී පී	Observed concentration in river at PM-13		36.1	(mg/l)
				/

Parameter: Thallium

	surface water flow into PM-12	Q_s12 =	12.60	(cfs)		
nput Flow Data	surface water flow into PM-13	Q_s13 =	56.01	\ /		
	Babbitt WWTP discharge	Q_sBab =	0.33	\ /		
	Area 5 Pit NW discharge	Q_spit =	1.99	\ /		
	LTVSMC Tailings Basin seepage	Q_fs =	4.00	\ /		
	Hydrometallurgical Residue Cells Liner Leakage	Q_rrs =	0.00	· /		
d d	ground water flow into PM-12	Q_g12 =	0.86	\ /		
	ground water flow into PM-13	Q_g13 =	4.21	(cfs)		
				<i>(</i>		
nput Concentration Data	concentration of surface water into PM-12	C_s12 =	0.2	(mg/l)		
	concentration of surface water into PM-13	C_s13 =	0.2	(mg/l)		
	concentration of WWTP discharge	C_sBab =	0.2	(mg/l)		
	concentration of Area 5 Pit NW discharge	C_spit =		(mg/l)		
enti	concentration of LTVSMC Tailings Basin seepage	C_fs =		(mg/l)		
ouc.	concentration of Hydrometallurgical Residue Cells Liner Leakage	C rrs =	0	(
t	concentration of ground water flow into PM-12	C_g12 =	0.004	(ma/l)		
ndı						
<u> </u>	concentration of ground water flow into PM-13	C_g13 =	0.004	(mg/l)		
Water Balance	flow in river at PM-12	Q_r12 =	13.79	· · ·		
Water Balano	flow in river at PM-13	Q_r13 =	80.00			
	flow check	Q_ck =	80.00	(cfs)		
Calculation of Mass Flux	mass flux of surface water into PM-12	M_s12 =	71	(µg/s)		
	mass flux of surface water into PM-13	M_s13 =		(mg/s)		
	mass flux of Babbitt WWTP	M_sBab =		(mg/s)		
	concentration of Area 5 Pit NW discharge	M_spit =		(mg/s)		
	concentration of LTVSMC Tailings Basin seepage	M_fs =		(mg/s)		
	concentration of Hydrometallurgical Residue Cells Liner Leakage	M_rrs =		(mg/s)		
tal 1a:	mass flux of ground water into PM-12	M_g12 =		(mg/s)		
UΣ	mass flux of ground water into PM-13	M_g13 =	0	(mg/s)		
e	mass flux in river at PM-12	M r12 =	72	(mg/s)		
ss anc	הומס המא הדרועכו מנד ועודוב		13	(119/5)		
Mass Balan	mass flux in river at PM-12 mass flux in river at PM-13	M r12	447	(ma/a)		
∠ Ш	Inass nux in nver al Fivi-13	M_r13 =	44/	(mg/s)		
Calculated Concentration						
	concentration in vivor at DM 10	0 -10	0.40	(100 ct /l)		
ate	concentration in river at PM-12	C_r12 =	0.19	(mg/l)		
Calculated Concentral						
on tail			0.00	(I N		
00	concentration in river at PM-13	C_r13 =	0.20	(mg/l)		
u						
ati	Observed concentration in river at DM 10			(ug/l)		
vec	Observed concentration in river at PM-12		ND (0.4)	(µg/l)		
ser						
Observed Concentration	Observed concentration in river at PM-13		ND (0.4)	(µg/l)		
		<u>I</u>		\M9''		

Embarrass River Model - Calibration to Baseline Water Quality Data Parameter: Zinc

surface water flow into PM-12	Q_s12 =	12.60	(cfs)			
	Q_s13 =	56.01	<u>, ,</u>			
surface water flow into PM-13 Babbitt WWTP discharge	Q_sBab =	0.33				
Area 5 Pit NW discharge	Q_spit =	1.99				
Area 5 Pit NW discharge LTVSMC Tailings Basin seepage Hydrometallurgical Residue Cells Liner Leakage ground water flow into PM-12 cround water flow into PM-13	Q_fs =	4.00				
Hydrometallurgical Residue Cells Liner Leakage	Q_rrs =	0.00				
ground water flow into PM-12	Q_g12 =	0.86				
ground water flow into PM-13	Q_g13 =	4.21	(CIS)			
concentration of surface water into PM-12	C_s12 =	16	(ug/l)			
			(µg/l)			
concentration of surface water into PM-13	C_s13 =	16	(µg/l)			
E concentration of WWTP discharge	C_sBab =	16	(µg/l)			
concentration of Area 5 Pit NW discharge	C_spit =	3	(µg/l)			
concentration of LTVSMC Tailings Basin seepage	C_fs =	14.35	(µg/l)			
concentration of Hydrometallurgical Residue Cells Liner Leakage	C_rrs =	0				
concentration of WWTP discharge concentration of Area 5 Pit NW discharge concentration of LTVSMC Tailings Basin seepage concentration of Hydrometallurgical Residue Cells Liner Leakage concentration of ground water flow into PM-12 concentration of ground water flow into PM-13	C_g12 =	11.5	(µg/l)			
concentration of ground water flow into PM-13	C_g13 =	11.5				
g flow in river at PM-12	Q_r12 =	13.79	(cfs)			
flow in river at PM-12 flow in river at PM-13 flow check	Q_r13 =	80.00	(cfs)			
flow check	Q_ck =	80.00	(cfs)			
	•	<u></u>				
mass flux of surface water into PM-12	M_s12 =	5707	(µg/s)			
mass flux of surface water into PM-13	M_s13 =	25359	(µg/s)			
To mass flux of Babbitt WWTP	M_sBab =	149	(µg/s)			
\sim concentration of Area 5 Pit NW discharge	M_spit =	169	(µg/s)			
concentration of Area 5 Pit NW discharge	M_fs =	1624	(µg/s)			
mass flux of Babbitt WWTP concentration of Area 5 Pit NW discharge concentration of LTVSMC Tailings Basin seepage concentration of Hydrometallurgical Residue Cells Liner Leakage mass flux of ground water into PM-12 mass flux of ground water into PM-13	M_rrs =		(µg/s)			
Concentration of Hydrometallurgical Residue Cells Liner Leakage mass flux of ground water into PM-12 mass flux of ground water into PM-13	M_g12 =		(µg/s)			
$\ddot{O} \ge$ mass flux of ground water into PM-13	M_g13 =	1370	(µg/s)			
mass flux in river at PM-12	M r12 =	6137	(nu/e)			
		0107	(MB/3)			
mass flux in river at PM-12 mass flux in river at PM-13	M r13 =	34659	(110/6)			
	IVI_I I 3 =	54059	(µy/5)			
concentration in river at PM-12						
concentration in river at PM-12	C r12 =	15.72	(ua/l)			
		10.72	\ I'' 3 ′ '/			
concentration in river at PM-12						
	C_r13 =	15.31	(µg/l)			
O O concentration in river at PM-13						
O O concentration in river at PM-13						
		18.3	(µg/l)			
		18.3	(µg/l)			
		18.3				