SRK Consulting (Canada) Inc.
2200–1066 West Hastings Street
Vancouver, BC V6E 3X2

T: +1.604.681.4196
F: +1.604.687.5532

vancouver@srk.com
www.srk.com

4Memo

To:	John Roberts	**Client:**	TMAC Resources Inc.
From:	Sarah Portelance Tom Sharp	**Project No:**	1CT022.001.410
Cc:	Maritz Rykaart, SRK	**Date:**	December 2, 2014
Subject:	Hope Bay Project: Madrid Advanced Exploration Project Water Quality Prediction		

1 Introduction

TMAC Resources Inc. is currently in the process of constructing their Doris North Project (Project) in the Kitikmeot region of Nunavut, Canada. Mining and processing the Doris North deposit is currently permitted under Nunavut Water Board Water Licence No. 2AM-DOH1323 and Nunavut Impact Review Board Project Certificate No. 3. In addition to the permitted mining activities, TMAC wishes to begin the Madrid Advanced Exploration Project at the Madrid North and Madrid South deposits. This bulk exploration project includes the development of underground workings to access two deposits to collect 50,000 tonne and 55,000 tonne ore samples from Madrid North and Madrid South, respectively. This ore is to be transported to the Doris North mill for processing, with tailings deposited to the Doris North Tailings Impoundment Area (TIA). The underground development work to access these deposits will produce waste rock that will be stored above ground. The ore deposits at Madrid South are located in talik (outside of permafrost) so the underground workings in this area may intercept groundwater. The Madrid North deposit is located in permafrost and the underground workings are not expected to intercept groundwater. Groundwater and contact water from the mining operations and waste rock piles will need to be managed.

SRK (2014a) describes the water management strategy for the Madrid Advanced Exploration Project. Contact water from mine operations, waste rock piles and ore stockpiles will be collected in Pollution Control ponds. Intercepted groundwater at Madrid South will also be collected and contained in the Pollution Control ponds. All contact water that does not meet discharge criteria will be hauled by trucks and disposed of in the Doris North TIA during the Madrid Advanced Exploration Program. When the Madrid Advanced Exploration Program is completed, the waste rock piles will be covered with a geomembrane and capped with a protective layer of crushed rock. The Pollution Control ponds will be breached and site runoff will flow onto the tundra.

This memorandum describes how the discharge of water and milling of the bulk sample from the Madrid Advanced Exploration Project at the Doris North processing facilities may affect the TIA water quality while ore from Doris North (300,000 tonnes) is being processed.

Table 1 summarizes the project milestones used in the water and load balance model. The Madrid Advanced Exploration Program ends in Year 6 when the Madrid South bulk sample milling is complete.

Table 1: Summary of Milestones in the Water and Load Balance Model

Mine Date Description	Start	End
Mill load from Doris North	Year 3 (April)	Year 4 (April)
Madrid North bulk sampling (mining)	Year 3 (April)	Year 4 (November)
Madrid South bulk sampling (mining)	Year 4 (December)	Year 6 (April)
Underground Dewatering (Madrid South)	Year 5 (August)	Year 6 (April)
Madrid North Mill Load	Year 4 (May)	Year 4 (June)
Madrid South Mill Load	Year 6 (February)	Year 6 (April)
Decommissioning of bulk sample sites	Year 6 (May)	Year 7 (April)
Bulk sample site pollution control ponds breached	Year 7 (April)	Year 7 (April)

Source: \\VAN-SVR0\Projects\01_SITES\Hope.Bay\1CT022.001_2014 Hope Bay Ongoing Support\410_Preparation of Submission (Patch 14, Wolverine & Madrid)\Water Quality Prediction\Model\Madrid_Doris_SB_SPB_Rev7.gsm

2 Water and Load Balance Description

The water and load balance integrates dissolved constituent concentrations and flow rates to predict water quality during operations and closure. This mass balance predicts water quality in the TIA and in Doris Creek downstream of the TIA discharge point.

Model inputs for Doris North mining and mineral processing were not modified from the existing water and load balance model presented in the Water Quality Model Report (SRK 2011) included in the Doris North Mine Modifications and Related Amendments to Project Certificate No. 003 and Type A Water Licence No. 2AM-DOH1323 (TMAC 2013). The model was run on a monthly time step for a period of 300 months (25 years). A Monte Carlo simulation of 100 realizations was used to stochastically vary annual precipitation to model a range of possible climate and runoff conditions.

2.1 Model Components

The following components are included in the water and load balance to predict water quality in the TIA when the Doris North ore is milled (as permitted by Nunavut Water Board Water Licence No. 2AM-DOH1323 and Nunavut Impact Review Board Project Certificate No. 3) and the bulk samples are collected from Madrid North and Madrid South:

- Tail Lake watershed runoff and direct precipitation to the TIA;
- Runoff from the waste rock piles at Doris North (640,845 tonnes), Madrid South (225,000 tonnes), and Madrid North (285,000 tonnes);
- Runoff from the bulk sample ore stockpiles;
- Doris North, Madrid South and Madrid North contact water from surface infrastructure pads and all-weather roads;

- Treated mill tailings discharged to the TIA for Doris North (300,000 tonnes), Madrid North (50,000 tonnes), and Madrid South (55,000 tonnes) at a milling rate of 800 tpd;
- Treated sewage effluent discharge to the TIA for a Doris North camp of 360 people (includes 70 people for Madrid North and South developed sequentially);
- Saline groundwater inflows (500 m^3/d during the Madrid South Bulk Sample, SRK 2014b);
- Saline drilling fluids (6.7 m^3/d during Doris North, Madrid South and Madrid North underground mining at a rate of 185 kg/m^3 of $CaCl_2$);
- Ammonium nitrate fuel oil (ANFO) residuals on waste rock, quarried rock, ore and mine water (groundwater);
- Salinity release to the TIA from permafrost thawing along shores of the TIA. Incorporated in the model at closure during water level drawdown; and
- Degradation of cyanide destruction products to ammonia.

2.2 Water Balance Summary

Figure 1 illustrates the water balance for Doris North, Madrid South and Madrid North. The preferred option for managing and treating excess contact water at Madrid North and Madrid South is to transport water collected in the Pollution Control ponds to the TIA. Table 2 provides a summary of the total catchment areas included in the water balance model.

Table 2: Catchment Area Summary

Catchment Area		Size (ha)
Upstream Tail Lake Catchment Area		450
Doris North Mine Area[1]		21.2
Madrid North Mine Area (Collection Pond)	Total Area	9.4
	Waste Rock / Ore Stockpile	3.3
	Mine Site Fill	1.3
	Natural Catchment[2]	4.8
Madrid South Mine Area 1 (Collection Pond 1)	Total Area	3.4
	Mine Site Fill	0.8
	Natural Catchment[2]	2.6
Madrid South Mine Area 2 (Collection Pond 2)	Total Area	8.6
	Waste Rock / Ore Stockpile	4.8
	Mine Site Fill	1.3
	Natural Catchment[2]	2.5

Source: \\VAN-SVR0\Projects\01_SITES\Hope.Bay\1CT022.001_2014 Hope Bay Ongoing Support\410_Preparation of Submission (Patch 14, Wolverine & Madrid)\Water Quality Prediction\Model\Bulk_Sample_Model_Results.xlsx

Notes:

[1] Includes the total area flowing to the sedimentation pond and pollution control pond with the clean water diversion in place.
[2] Includes pond surface areas.

As described previously, inter-annual climatic variability is modelled using a Monte Carlo simulation. Table 3 summarizes average, wet and dry year runoff for Madrid South and Madrid North. Average runoff volumes are based on the average annual rainfall year (229 mm, SRK 2011). The wet annual runoff volume represents an annual runoff with a 20-year return period interval or a 5% chance of exceeding in a given year. The dry scenario represents the annual runoff with a 20-year return period interval for a 5% chance of not exceeding in a given year.

Table 3: Madrid South and Madrid North Runoff Volumes. Units are m^3/year.

Mine Location	Runoff Source	Dry Year	Average Year	Wet Year
		5th Percentile	50th Percentile	95th Percentile
Madrid North (Collection Pond)	Total Area	16,169	21,384	30,946
	Waste Rock Pile / Ore Stockpile	5,676	7,507	10,864
	Surface Infrastructure Pads and All-Weather Roads	2,236	2,957	4,280
	Undisturbed Ground	8,257	10,920	15,802
Madrid South (Collection Pond 1)	Total Area	3,520	4,655	6,737
	Surface Infrastructure Pads and All-Weather Roads	828	1,095	1,585
	Undisturbed Ground	2,692	3,560	5,152
Madrid South (Collection Pond 2)	Total Area	8,904	11,775	17,040
	Waste Rock Pile / Ore Stockpile	4,969	6,572	9,510
	Surface Infrastructure Pads and All-Weather Roads	1,346	1,780	2,576
	Undisturbed Ground	2,589	3,423	4,954

Source: \\VAN-SVR0\Projects\01_SITES\Hope.Bay\1CT022.001_2014 Hope Bay Ongoing Support\410_Preparation of Submission (Patch 14, Wolverine & Madrid)\Water Quality Prediction\Model\Bulk_Sample_Model_Results.xlsx

Contact water collected in the Pollution Control ponds will continuously be hauled to the TIA by trucks with a 50 m^3 capacity. Table 4 provides a summary of peak truck traffic and monthly volumes of water transported to the TIA. The total number of trucks summarized in Table 4 represents the peak daily round trips. Peak traffic will typically occur during freshet (June) where peak traffic during Madrid South mining occurs during the open water season when groundwater is intercepted.

For a wet hydrological condition (95th percentile), the peak truck traffic during Madrid North mining and Madrid South mining (during groundwater inflows) was estimated at 11 and 12 trucks/day respectively.

Table 4: Bulk Sample Water Management Contact Water Volumes for Dry, Average and Wet Hydrologic Conditions.

Phase	Month	Year	Madrid North Bulk Sample			Madrid South Bulk Sample		
			5th	50th	95th	5th	50th	95th
Madrid North Mining	4	3	0	0	0	0	0	0
	5	3	0	0	0	0	0	0
	6	3	8,586	11,546	16,204	0	0	0
	7	3	4,047	5,442	7,638	0	0	0
	8	3	1,254	1,686	2,366	0	0	0
	9	3	1,571	2,113	2,965	0	0	0
	10	3	417	555	779	0	0	0
	11	3	0	0	0	0	0	0
	12	3	0	0	0	0	0	0
	1	4	0	0	0	0	0	0
	2	4	0	0	0	0	0	0
	3	4	0	0	0	0	0	0
	4	4	0	0	0	0	0	0
	5	4	0	0	0	0	0	0
	6	4	8,135	11,592	16,741	0	0	0
	7	4	3,834	5,464	7,891	0	0	0
	8	4	1,188	1,693	2,445	0	0	0
	9	4	1,489	2,121	3,064	0	0	0
	10	4	391	557	805	0	0	0
	11	4	0	0	0	0	0	0
Madrid South Mining	12	4	0	0	0	0	0	0
	1	5	0	0	0	0	0	0
	2	5	0	0	0	0	0	0
	3	5	0	0	0	0	0	0
	4	5	0	0	0	0	0	0
	5	5	0	0	0	0	0	0
	6	5	8,748	11,569	16,741	6,721	8,888	12,863
	7	5	4,123	5,453	7,891	3,168	4,190	6,063
Madrid South Mining in Talik	8	5	1,277	1,689	2,445	16,200	16,517	17,097
	9	5	1,601	2,117	3,064	16,449	16,845	17,573
	10	5	420	556	805	15,542	15,646	15,837
	11	5	0	0	0	15,219	15,219	15,219
	12	5	0	0	0	15219	15,219	15,219
	1	6	0	0	0	15,219	15,219	15,219
	2	6	0	0	0	15,219	15,219	15,219
	3	6	0	0	0	15,219	15,219	1,5219

Phase	Month	Year	Madrid North Bulk Sample			Madrid South Bulk Sample		
			5th	50th	95th	5th	50th	95th
	4	6	0	0	0	15,219	15,219	15,219
Closure	5	6	0	0	0	0	0	0
	6	6	8,667	11,612	16,204	6,659	8,922	12,450
	7	6	4,085	5,473	7,638	3,139	4,205	5,868
	8	6	1,266	1,696	2,366	972.4	1,303	1,818
	9	6	1,586	2,125	2,965	1,219	1,633	2,278
	10	6	417	559	779	320	429	598
	11	6	0	0	0	0	0	0
	12	6	0	0	0	0	0	0
	1	7	0	0	0	0	0	0
	2	7	0	0	0	0	0	0
	3	7	0	0	0	0	0	0
	4	7	0	0	0	0	0	0
Peak Volume (m^3/month)			8,748	11,612	16,741	16,449	16,845	17,573
Peak Daily Truck Traffic (trucks/day)			6	8	11	11	11	12

Source: Z:\01_SITES\Hope.Bay\1CT022.001_2014 Hope Bay Ongoing Support\410_Preparation of Submission (Patch 14, Wolverine & Madrid)\Water Quality Prediction\Model\Bulk_Sample_Model_Results.xlsx

2.3 Water Quality Inputs

Constituent loads from waste rock, ore and site rockfill (used in surface infrastructure pad construction) are a function of source terms and the total tonnage. Table 5 summarizes waste rock and site rockfill tonnages used in the load balance. Source terms for waste rock and ore at Madrid North and Madrid South are based on current geochemical testing.

Table 5: Total Waste Rock and Surface Rock Summary

Mine Phase	Total Waste Rock and Ore (tonne)	Total Rock Used to Construct Pads for Infrastructure (tonne)
Doris North	640,845[1]	923,835
Madrid South	225,000	62,806[2]
Madrid North	285,000	37,605[2]

Source: \\VAN-SVR0\Projects\01_SITES\Hope.Bay\1CT022.001_2014 Hope Bay Ongoing Support\410_Preparation of Submission (Patch 14, Wolverine & Madrid)\Water Quality Prediction\Model\Madrid_Doris_SB_SPB_Rev7.gsm

Notes:

[1] total Doris North waste rock is 1,095,000 tonne, where 65% of tonnes mined (454,155) backfilled
[2] Assumed an average 1.5 m depth and 1.98 tonne/m^3 density

Mass dependent source terms for Madrid South and Madrid North waste rock and surface infrastructure rockfill are shown in Table 6. A surface area correction factor of 0.3 and a release factor of 40% were used to estimate net release rates (SRK 2011). Leaching of drilling brine and ANFO residue from the waste rock were also included in the model. The rate salt and ANFO residue rinse from waste rock was calculated assuming 40% of the salt and ANFO residue mass present is released from the rock annually. Blast residue volumes are based on data reported in a

study on ammonium nitrate dissolution rates for the Diavik Diamond Mine in Northwest Territories. The method to estimate salinity releases and nitrogen nutrient loading rates is described in the Water Quality Model Report (SRK 2011).

Background concentrations for Doris Creek are based on water quality data obtained in 2004 to 2006 and 2011 to 2013 from compliance monitoring point, TL-2 in Doris Creek. Concentrations for upstream runoff into Tail Lake are based on compliance monitoring point, TL-1, data from 2004 to 2006 before site runoff collected in the Sedimentation and Pollution Control ponds was trucked to Tail Lake. Median monthly concentrations during open water season were used. When results were below the method detection limit, the detection limit was used. Table 7 summarizes background monthly concentrations used in the model during the open water season.

Table 8 provides mill effluent water quality for processed ore from Doris North and Madrid Advanced Exploration Project Bulk Samples. The Madrid North tailings solution chemistry is based on Naartok samples collected and analyzed by Newmont Metallurgical Services. No metallurgical testing of Madrid South ore has been conducted to date. The results of Naartok ore testing were also used for the Madrid South predictions. Further descriptions and other inputs and source terms included in the model are described in the Doris North Mine Modification Report (TMAC 2013).

Table 6: Input Source Terms (mg/kg/week)

Parameter	Mine Area Surface Rock*	Doris North Waste Rock	Madrid South Waste Rock	Madrid North Waste Rock
Sulphate	0.86	23.2	0.8	4.5
Aluminum Al	0.025	0.013	0.015	0.02
Antimony Sb	0.00012	0.02172	0.00033	0.00045
Arsenic As	0.00058	0.00049	0.039	0.067
Barium Ba	0.00008	0.00109	0.00032	0.00022
Beryllium Be	0.000115	0.000543	0.000005	0.000010
Bismuth Bi	0.000115	0.0217218	0.0000023	0.0000083
Boron B	0.006	0.011	0.023	0.022
Cadmium Cd	0.0000288	0.0000002	0.0000023	0.0000034
Calcium Ca	1.5	4.7	2.2	3.0
Chromium Cr	0.000115	0.001086	0.000046	0.000062
Cobalt Co	0.00012	0.00109	0.0005	0.0003
Copper Cu	0.00015	0.00043	0.00026	0.00027
Iron Fe	0.0058	0.0033	0.0014	0.0050
Lead Pb	0.00011500	0.00021722	0.0000225	0.000026
Lithium Li	0.00012	0.00109	0.00026	0.00036
Magnesium Mg	0.15	2.18	1.14	1.30
Manganese Mn	0.0001	0.0029	0.002	0.002
Mercury Hg	0.0000023	0.0000004	0.000001	0.0000039
Molybdenum Mo	0.000001	0.00022	0.00014	0.0002
Nickel Ni	0.00013	0.00217	0.00034	0.0016
Phosphorus P	0.0173	0.0326	0.0018	0.0033
Potassium K	0.04	0.45	0.34	0.29
Selenium Se	0.000115	0.000002	0.000055	0.000076
Silicon Si	0.28	0.18	0.15	0.20
Silver Ag	0.000039	0.000043	0.000002	0.000004
Sodium Na	0.04	0.22	0.29	0.39
Strontium Sr	0.0008	0.0058	0.0064	0.0062
Thallium Tl	0.0000115	0.0000004	0.0000009	0.0000065
Tin Sn	0.00012	0.00326	0.00006	0.00002
Titanium Ti	0.00012	0.00109	0.00023	0.00023
Vanadium V	0.00023	0.00326	0.00017	0.00047
Zinc Zn	0.00058	0.00374	0.00036	0.00033

Source: \\VAN-SVR0\Projects\01_SITES\Hope.Bay\1CT022.001_2014 Hope Bay Ongoing Support\410_Preparation of Submission (Patch 14, Wolverine & Madrid)\Water Quality Prediction\Model\Bulk_Sample_Model_Results.xlsx

Note: * Mine fill source terms for Madrid North and Madrid South based on source terms developed for the Doris North source terms (SRK 2011).

Table 7: Background Water Quality Inputs

Parameter	Tail Lake Background Concentrations (TL-1)					Doris Creek Background Concentrations (TL-2)				
	June	July	August	September	October	June	July	August	September	October
TDS	110	80	90	105	105	128.5	145.5	142	154.75	145
TSS	1	1	1.5	2	2	3	3.5	3	3	3
Total_CN	0.001	0.001	0.001	0.002	0.002	0.003	0.003	0.003	0.003	0.001
Sulphate	3	3	3	3.25	3.25	3.5	3	2.75	2.84	3
Chloride	30.1	30	37	37	37	49	63	62	62	63
Ammonia_N	0.008	0.008	0.007	0.008	0.008	0.029	0.033	0.031	0.029	0.008
Nitrate_N	0.005	0.006	0.005	0.006	0.006	0.028	0.028	0.028	0.028	0.005
Nitirite_N	0.001	0.001	0.001	0.002	0.002	0.026	0.026	0.026	0.026	0.001
Alkalinity	28	29	30	25	25	26	27	28	28	28
Ortho_P	0.002	0.002	0.002	0.002	0.002	0.0009	0.0009	0.0009	0.0009	0.0008
Phosphate_P	0.008	0.006	0.006	0.004	0.004	0.02	0.023	0.026	0.025	0.027
TOC	6	5	5	5	5	5	5	5	5	5
Hardness	33	34	41	38	38	36	46	46	49	45
Aluminum	0	0	0	0	0.016	0.057	0.055	0.05	0.05	0.048
Antimony	0.00001	0.00001	0.00001	0.00001	0.00001	0.00021	0.00021	0.00021	0.00021	0.00001
Arsenic	0.00024	0.00026	0.00033	0.00023	0.00023	0.00039	0.0004	0.00044	0.00041	0.00042
Barium	0.0021	0.002	0.0031	0.0023	0.0023	0.0031	0.0033	0.003	0.0033	0.003
Boron	0.014	0.015	0.015	0.013	0.013	0.035	0.036	0.036	0.036	0.022
Cadmium	0.000002	0.000003	0.000002	0.000002	0.000002	0.000006	0.000006	0.000006	0.000006	0.000002
Calcium	6.09	6.13	7.58	6.54	6.54	6.33	8.32	7.74	7.95	7.35
Chromium	0.000248	0.000158	0.00025	0.0002215	0.0002215	0.00066	0.00062	0.00065	0.0006	0.00019
Cobalt	0.00002	0.00005	0.00008	0.00006	0.00006	0.001	0.001	0.001	0.001	0.0001
Copper	0.0009	0.0008	0.0007	0.0007	0.0007	0.0014	0.0015	0.0014	0.0015	0.0014
Iron	0.042	0.089	0.404	0.068	0.068	0.093	0.14	0.094	0.123	0.09
Lead	0.00003	0.00005	0.00006	0.00001	0.00001	0.000073	0.000078	0.000109	0.000068	0.000035
Magnesium	4.63	4.63	5.59	4.59	4.59	4.84	6.15	6.11	6.13	6.37
Manganese	0.001	0.002	0.008	0.002	0.002	0.013	0.021	0.017	0.021	0.01

Parameter	Tail Lake Background Concentrations (TL-1)					Doris Creek Background Concentrations (TL-2)				
	June	July	August	September	October	June	July	August	September	October
Molybdenum	0.0001	0.00007	0.00007	0.00007	0.00007	0.00256	0.00257	0.00257	0.00257	0.00014
Nickel	0.00052	0.00051	0.00051	0.00043	0.00043	0.0012	0.0013	0.0012	0.0012	0.0004
Potassium	1.58	1.35	1.48	1.84	1.84	1.91	2.28	2.11	2.26	2.34
Selenium	0.0004	0.00042	0.00062	0.00046	0.00046	0.00059	0.00061	0.00062	0.00076	0.00076
Silver	0.000001	0.000002	0.000001	0.000001	0.000001	0.000011	0.00001	0.00001	0.00001	0.000001
Sodium	15.7	16	18.6	18.1	18.1	24	30.75	29.98	30.47	32.13
Strontium	0.025	0.027	0.034	0.029	0.029	0.035	0.039	0.039	0.04	0.04
Thallium	0.000006	0.000014	0.000002	0.000002	0.000002	0.000059	0.000061	0.000055	0.000052	0.000003
Tin	0.00003	0.00004	0.00004	0.00003	0.00003	0.02502	0.02506	0.02502	0.02502	0.00003
Uranium	0.00001	0.00001	0.00001	0.00001	0.00001	0.000064	0.000066	0.000068	0.000066	0.000032
Vanadium	0.0004	0.0001	0.00008	0.00001	0.00001	0.00079	0.00056	0.00057	0.00056	0.00012
Zinc	0.0054	0.0021	0.0026	0.0024	0.0024	0.0027	0.0028	0.0034	0.003	0.0017

Table 8: Mill Effluent Water Quality Concentrations (mg/L)

Parameter	Doris North	Maximum (North/Central/Connector)	Madrid Bulk Samples* (Naartok)
Nitrate as N	0.23	0.74	0.28
Nitrite as N	0.09	0.28	3.85
Sulphate	137	137	55
Aluminum Al	0.12	0.59	0.05
Antimony Sb	0.08	0.08	0.04
Arsenic As	0.007	0.007	0.404
Barium Ba	0.008	0.13	0.01
Beryllium Be	0.001	0.001	0.01
Bismuth Bi	0.00	0.00	0.00
Boron B	0.194	0.27	0.66
Cadmium Cd	0.00015	0.0007	0.0000
Calcium Ca	400	400	400
Chromium Cr	0.020	0.024	0.001
Cobalt Co	0.095	0.10	0.36
Copper Cu	0.023	0.64	0.07
Iron Fe	1.51	2.79	1.06
Lead Pb	0.0002	0.01	0.00
Lithium Li	0.013	0.01	0.00
Magnesium Mg	7.4	35.3	46.3
Manganese Mn	0.009	0.14	0.04
Mercury Hg	0.0001	0.0001	0.00
Molybdenum Mo	0.045	0.12	0.16
Nickel Ni	0.243	0.24	0.03
Phosphorus P	0.97	1.20	0.27
Potassium K	54	54	42
Selenium Se	0.011	0.025	0.064
Silicon Si	3.90	3.90	2.48
Silver Ag	0.0011	0.0474	0.0002
Sodium Na	1918	1918	437
Strontium Sr	0.204	0.30	0.29
Thallium Tl	0.0004	0.0004	0.0001
Tin Sn	0.050	0.05	0.05
Titanium Ti	0.099	0.099	0.05
Vanadium V	0.006	0.006	0.023
Zinc Zn	0.50	0.50	0.50

Source: \\VAN-SVR0\Projects\01_SITES\Hope.Bay\1CT022.001_2014 Hope Bay Ongoing Support\410_Preparation of Submission (Patch 14, Wolverine & Madrid)\Water Quality Prediction\Model\Mill Effluent WQ.xlsx

Note: * Mill effluent for Madrid Bulk Samples based on Naartok samples (Croall and Bucknam 2011).

2.4 Water Management Constraints

The Madrid Advanced Exploration Project water management plan defines the water management strategy used in the water quality model (SRK 2014a).

The following key components were applied to the water management strategy during operations and closure:

- The TIA will discharge seasonally to Doris Creek until end of closure.
- The maximum discharge from the TIA to Doris Creek is limited to 10% of background flow in Doris Creek.
- Discharge from the TIA must meet the water quality objectives in the water licence.
- Doris Creek downstream of the discharge must meet water quality objectives in the water licence.
- The maximum water elevation during operations is 32.5 m when concentrations in the TIA meet discharge objectives and is 33.5 m when concentrations exceed discharge objectives.
- The minimum depth of water cover is 4 m above the surface of tailings during operations and closure to prevent re-suspension of sediments.

3 Water Quality Predictions

The median and 95th percentiles of maximum concentrations for discharge water quality of the TIA during operations and closure were predicted. The 95th percentile of concentrations represent the maximum concentration expected in the TIA based on 100 realizations for a range of hydrological conditions.

A monthly discharge timing window (June to October) during open water season was applied to ensure modelled TIA discharges met water quality targets during operations and closure as specified in the Water Licence for the Doris North Project (NWB No. 2AM-DOH1323). As described in the Water Licence Part G, Items 28 and 30, all water discharged from the TIA (end-of-pipe) cannot exceed specified effluent quality limits and during periods of discharge, water quality in Doris Creek cannot exceed the greater of the background water quality at the time of discharge or specified limits.

Enough water must be stored in the TIA to dilute the chloride load from Madrid South groundwater. Discharge from the TIA to Doris Creek can only start when mining progresses into the Madrid South talik. If water is discharged prior to this, there is insufficient dilution in the TIA for the discharge to meet water quality guidelines in Doris Creek. The maximum water quality predictions for Madrid North and Madrid South and guidelines for parameters of concern during operations and closure are presented in Table 9.

Table 9: Water Quality Results

Parameter	Effluent Limits Item 28	Max TIA Discharge Concentration		Doris Creek Limits Item 30	Doris Creek Concentration	
		Median	95th Percentile		Median	95th Percentile
TDS		1800	1900		290	310
Free_CN		0.000005	0.000005	0.005	0.002	0.002
Total_CN	1	0.0001	0.0001	0.01	0.003	0.003
WAD_CN		0.0003	0.0003		0.002	0.002
SCN		14	15		1	1
Sulphate		82	89		10	11
Chloride		790	860	150	130	140
Ammonia_N		0.2	0.2	1.5	0.05	0.05
Nitrate_N		1.8	1.9	2.9	0.2	0.2
Nitirite_N		0.2	0.2	0.06	0.04	0.04
Alkalinity		71	76		32	32
Hardness		400	430		78	80
Aluminum		0.2	0.3	0.1	0.07	0.07
Antimony		0.03	0.03		0.002	0.003
Arsenic	0.5	0.05	0.05	0.005	0.005	0.005
Barium		0.008	0.008		0.004	0.004
Beryllium		0.0009	0.001		0.0005	0.0005
Boron		0.1	0.2		0.04	0.05
Cadmium		0.0001	0.0001	0.00002	0.00001	0.00001
Calcium		300	330		34	36
Chromium		0.003	0.003	0.001	0.0008	0.0008
Cobalt		0.01	0.01		0.002	0.002
Copper	0.3	0.004	0.005	0.002	0.002	0.002
Iron		0.4	0.4	0.3	0.2	0.2
Lead	0.2	0.0006	0.0006	0.001	0.0001	0.0001
Manganese		0.05	0.06		0.02	0.02
Mercury		0.00002	0.00003	0.00003	0.00001	0.00001
Molybdenum		0.006	0.007	0.07	0.003	0.003
Nickel	0.5	0.02	0.02	0.03	0.003	0.003
Selenium		0.002	0.003	0.001	0.0009	0.0009
Silver		0.0002	0.0002	0.0001	0.00003	0.00003
Thallium		0.00006	0.00007	0.0008	0.00006	0.00006
Uranium		0.0003	0.0003		0.00008	0.00008
Zinc	0.5	0.05	0.05	0.0350	0.007	0.007

Source: \\VAN-SVR0\Projects\01_SITES\Hope.Bay\1CT022.001_2014 Hope Bay Ongoing Support\410_Preparation of Submission (Patch 14, Wolverine & Madrid)\Water Quality Prediction\Model\Mill Effluent WQ.xlsx

The water and load balance model predicts that by restricting discharges until the start of underground mining in Madrid South (August Year 5), predicted water quality meets discharge limits.

Figure 2 illustrates the predicted maximum (95th percentile) and minimum (5th percentile) water levels in the TIA during operations and closure. As noted above, water is not released during operations to provide additional dilution in the TIA prior to discharging to Doris Creek. The maximum (95th percentile) elevation modelled during operations was determined to be approximately 32.40 m amsl. The water elevation at closure is the natural Tail Lake elevation of 28.3 masl and provides a minimum water cover of 4.0 m above the deposited tailings (321,961m^3, 24.36 m amsl).

Arsenic levels in the TIA discharge determine the number of years required for water quality in the TIA to meet water licence limits to directly discharge to Doris Creek. Figure 3 illustrates that it would take approximately 15 years after the end of Madrid South bulk sampling (modelled month 250) before the 95th percentile arsenic levels in the TIA decrease below 0.005 mg/L during open water season (June to October). This is assuming that arsenic concentrations in the Bulk Sample Mill effluent are similar to Naartok metallurgical testing.

Additional metallurgical testing is underway to verify the concentrations in the tailings slurry. The model will be updated with these results as they become available. If the initial results significantly differ from the results used for these predictions, TMAC will prepare a contingency plan to address managing mill effluent.

4 Conclusion

The effect of managing and discharging excess collected contact water in the Madrid South and Madrid North Pollution Control ponds to the Doris North Project TIA was evaluated. Water balance and water quality modelling indicate that the water level in the TIA and water quality objectives in the water licence (2AM-DOH1323) can be met for the Madrid Advanced Exploration Project.

5 References

Croall J. and Bucknam C. 2011. Estimated Final Tailings Solution Chemistry. Excel Spreadsheet – MillEffluent.xlsx.

SRK Consulting (Canada) Inc. 2011. Water Quality Model, Hope Bay Project, Nunavut, Canada. Report prepared for Hope Bay Mining Ltd., North Vancouver, BC. Project No. 1CH008.047. November 2011.

SRK Consulting Inc. 2005. Tail Lake Water Quality Model, Doris North Project, Hope Bay, Nunavut, Canada. Report prepared for Miramar Hope Bay Limited, Project No. 1CM014.006. October 2005.

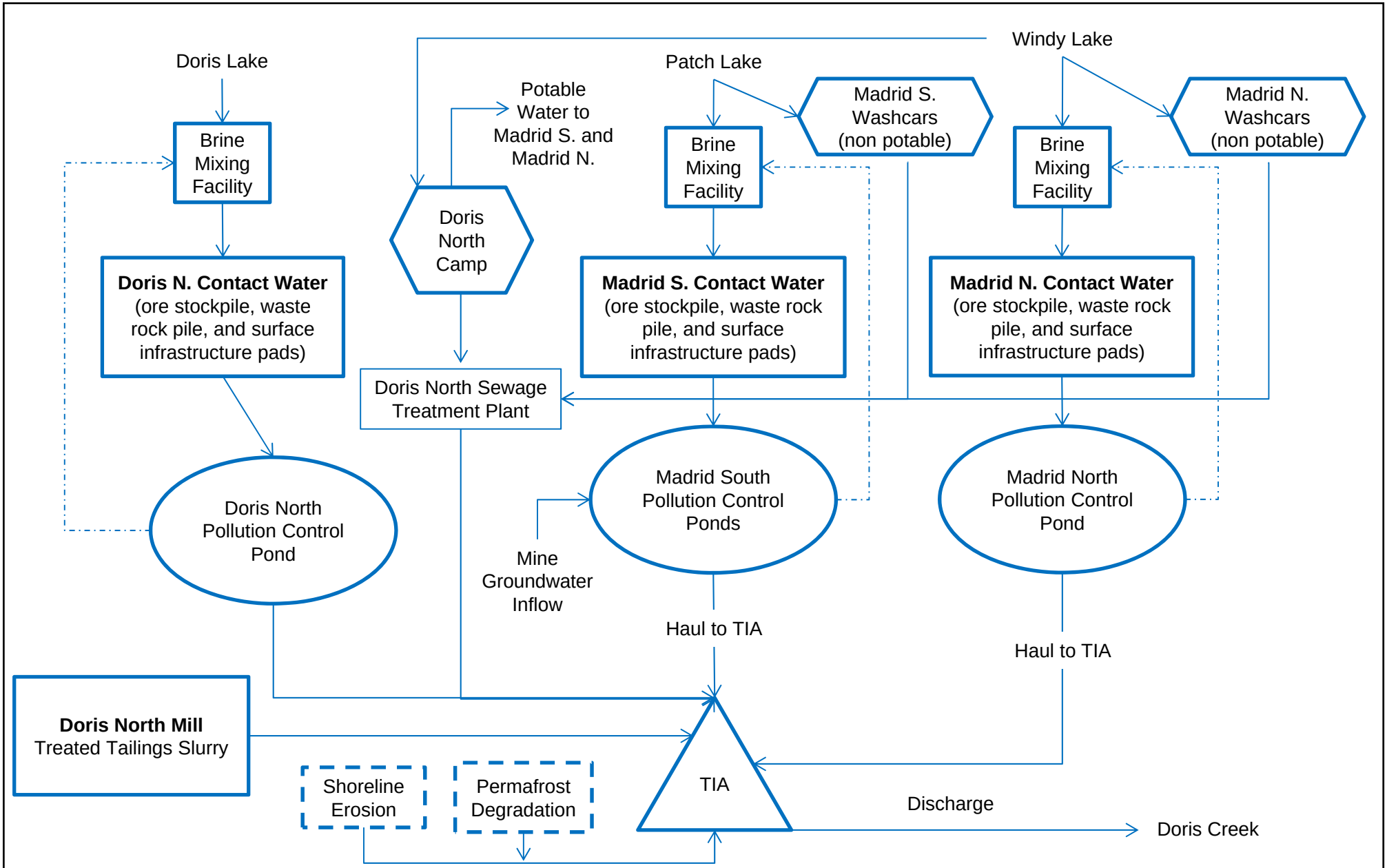
SRK Consulting Inc. 2007. Water Quality Model, Doris North Project, Hope Bay, Nunavut, Canada. Report prepared for Miramar Hope Bay Limited, Project No. 1CM014.008. March 2007.

SRK Consulting, Inc. 2014a. Madrid Advanced Exploration Project Water Management Plan. Report prepared for TMAC, Project No. 1CT022.001.410. October 2014.

SRK Consulting, Inc. 2014b. Hope Bay: Madrid Advanced Exploration Project: Underground Inflow Estimates. Memo prepared for TMAC, Project No. 1CT022.001.410. October 2014.

TMAC Resources Inc. 2013. Doris North Mine Modifications and Related Amendments to Project Certificate No. 003 and Type A Water Licence No. 2AM-DoH1323, November 2013.

Figures



srk consulting

TMAC RESOURCES

Madrid Advanced Exploration Project
Water Quality Prediction

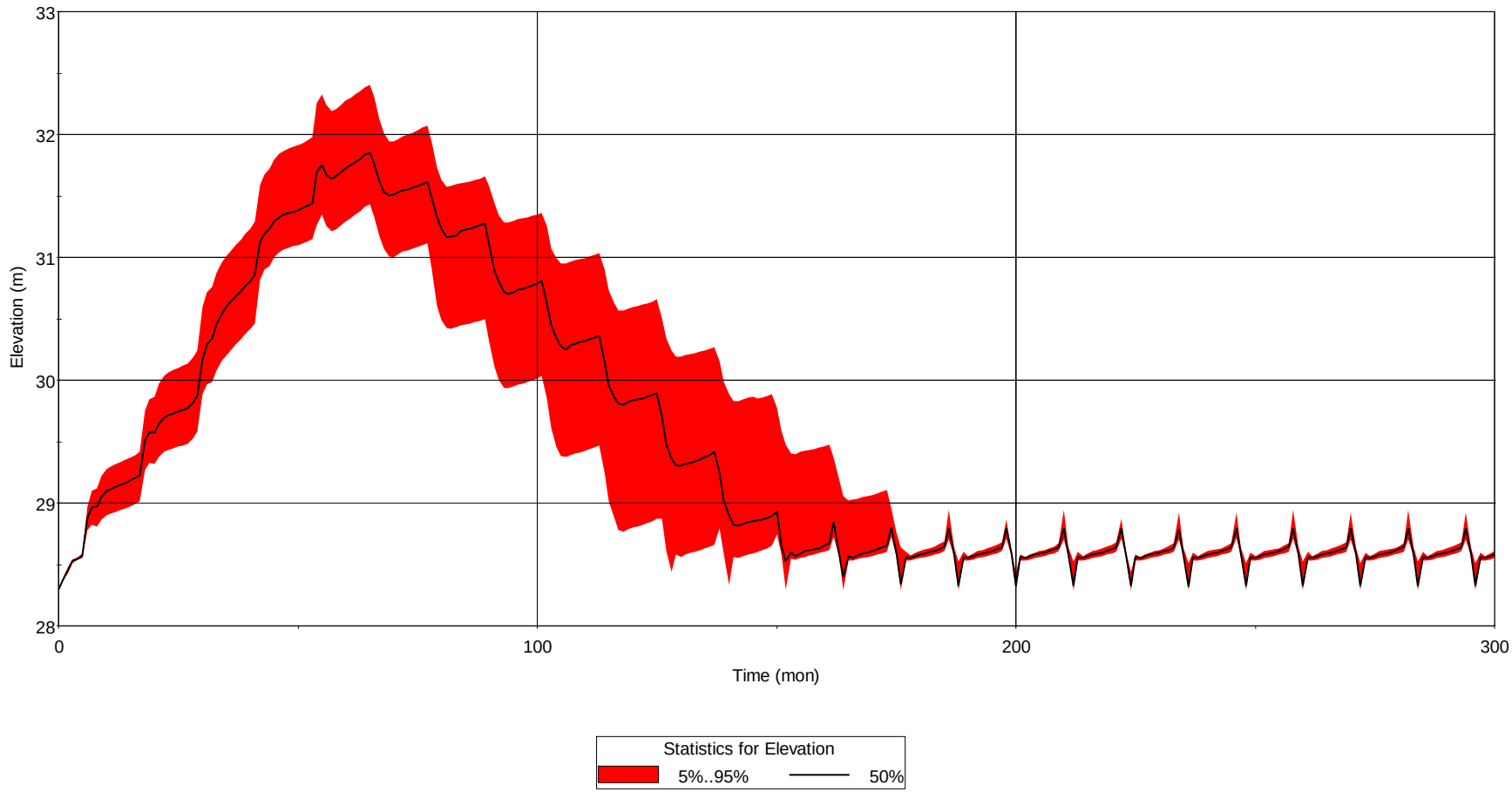
Water Management Schematic

Job No: 1CT022.000.410

Filename: Figure 1 Water Balance Schematic_SPB_lw.pptxx

Hope Bay Project

Date:	Approved:	Figure:
November 2014	SPB	1



srk consulting

MAC RESOURCES

Madrid Advanced Exploration Project
Water Quality Prediction

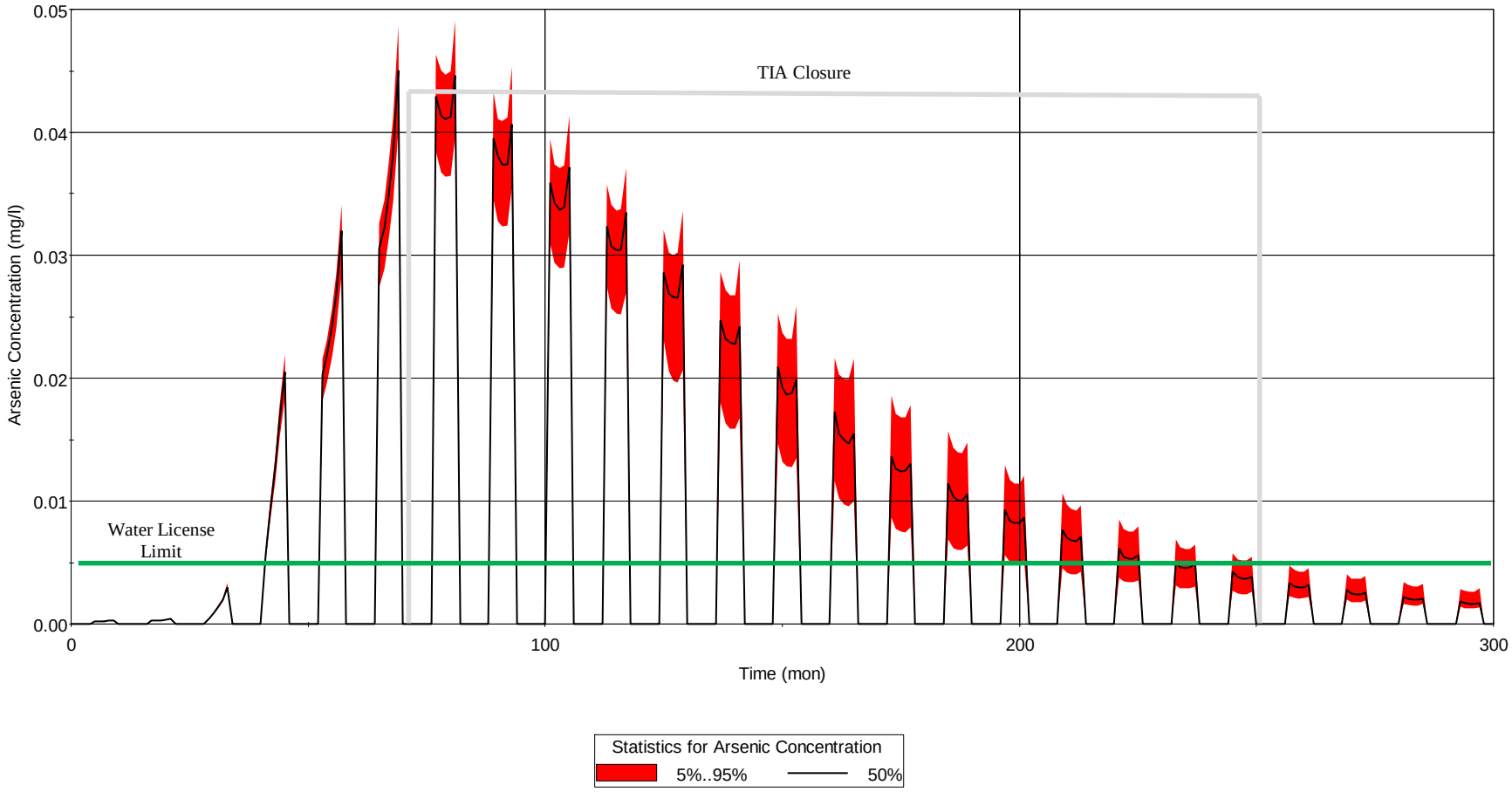
Tail Lake Water Elevation

Job No: 1CT022.000.410

Filename: Figure 2 Tail Lake Water Elevation.pptx

Hope Bay Project

Date:	Approved:	Figure:
November 2014	SPB	**2**



srk consulting	MAC RESOURCES	Madrid Advanced Exploration Project Water Quality Prediction
		Tail Lake Arsenic Concentration
Job No: 1CT022.000.410 Filename: Figure 3 Arsenic Concentration.pptx	Hope Bay Project	Date: November 2014 / Approved: SPB / Figure: **3**