Dump Water Quality Estimates for Anvil Range Mining Complex

Report Prepared for

Deloitte & Touche Inc.

Interim Receiver of Anvil Range Mining Corporation

Report Prepared by

SRK Consulting
Engineers and Scientists

December 2003

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Deloitte & Touche Inc.

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SRK Project Number 1CD003.34

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Compiled by: Endorsed by:

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1 Scope of Report

This report presents estimates of contaminant concentrations in seepage and drainage from the waste rock and ore dumps at the Anvil Range Mining Complex. The estimates were derived from the results of geochemical studies reported elsewhere (SRK Draft Report 1CD003.11.610, December 2003), and therefore represent the most current understanding of the site geochemistry. Estimates are presented for current and future conditions.

The estimates presented herein will be updated in January 2004, once results become available from an ongoing review of the dump water balances. Appendices will also be added to the report in January 2004. The appendices will present supporting calculations and analyses.

2 Background

2.1 Background of the Project

This project was initially conceived in program planning sessions carried out in 2002. At that time, the program of geochemical studies referred to above was being initiated, and it was recognized that the end result of the geochemical studies would be estimates of contaminant concentrations in water from the waste and ore dumps. However, it was decided that the process of developing the estimates could be better managed as a separate project.

The project was further discussed at the June 2003 planning workshop (Deloitte & Touche 2003). A detailed scope of work for development of the water quality estimates was presented in a letter from SRK to Deloitte & Touche, dated September 8, 2003. The scope of work was authorized later in September 2003.

2.2 Project Objectives

The primary objective of the project was to develop estimates of contaminant concentrations in water draining from the waste and or dumps at the Faro, Vangorda and Grum Mines. The estimates are to provide a basis for assessing water collection and treatment needs, and/or downstream water quality impacts.

Secondary objectives of the project were to incorporate the latest information from the geochemical testing program, and to present the estimates in a simple and transparent form that would allow for easy modification by people assessing various closure measures.

2.3 Project Team

The estimates presented herein were developed by Stephen Day, P.Geo., Kelly Sexsmith, P.Geo. and John Chapman, P.Eng. Those individuals were responsible for the geochemical studies referred to above, and have previously developed water quality estimates for waste rock and ore at over 50 mine sites. Daryl Hockley, P.Eng. provided project review.

3 Methods

The work program for this project began with a review of data from geochemical testing program to identify the best methodology for estimating current and future water quality. Generally speaking, there are three ways to develop such estimates:

- *A priori* estimates based on comparison to experience elsewhere;
- Empirical estimates based on water quality measured through site seep surveys;
- Mechanistic predictions based on measurements of key parameters and processes

The first method was rejected because it is inferior to the others in cases such as this, where site geochemistry and seepage data are available. The second and third methods were both examined in detail and it was concluded that there are enough data available to support either method. However, the second method better meets the objective of providing results in a form that is transparent and easy for others to modify in future.

The second method was therefore adopted for the estimates presented herein. The steps in the second method are discussed in more detail in the following section. Results from the third method will be presented in appendices and used only to provide support for some of the choices made in the application of the second method.

4 Program Results

Results of the project are presented in Tables 1 through 4. Tables 1 and 2 deal with current and future conditions, respectively, in the Faro waste and ore dumps. Table 3 and 4 deal with current and future conditions in both the Vangorda and Grum areas. Table 5 summarizes the rationale used in going from the "current" estimates for each area to the respective "future" estimates.

Each table consists of five parts that lead to estimates of contaminant concentrations and loads in water draining from each waste rock or ore dump.

- Part 1 of each table presents summaries of contaminant concentrations measured in seeps from the relevant waste and ore dumps. The geochemical testing report presents the raw seepage data and the reasons for grouping seeps into a limited number of representative types.
- Part 2 of each table defines the water types that are to be used in the subsequent calculations. The selection is made from the Part 1 table.
- Part 3 of each table shows the proportion of each dump (or dump sector) that is assumed to produce water of each type. In some of the "current condition" cases, a single seep was clearly representative of the entire drainage from a dump. However, in most cases, the assignment of drainage type proportions needed to be based on a

combination of results from the geochemical testing program and earlier inventories of rock types.

- Part 4 of each table calculates the estimates of contaminant concentrations in drainage from each dump (or dump sector). The estimates of contaminant concentrations are weighted averages of the Part 2 concentrations, with the weighting obtained from the proportions shown in Part 3.

- Part 5 of each table calculates the estimated annual loading of contaminants from each dump (or dump sector). The loading estimates are derived by multiplying the average concentrations by assumed infiltration rates and plan areas. Infiltration rates are currently set at 45% of mean annual precipitation, but will be revised when results of the dump water balance are available. Estimates of plan areas were taken from Robertson GeoConsultants (1996), but need to be updated using results of the new topographic mapping.

All of the above steps are completed in an Excel workbook. The workbook is set up to allow easy modification by others. Copies of the workbook are available upon request.

At this time, no distinction is made between water that exits the dumps as surface seepage and water that infiltrates to groundwater. That distinction will be needed to assess collection requirements and/or impacts, and will be made once results of the dump water balance project are available.

Also at this time, the estimates deal only with the current geometry of the dumps. The calculations are set up to easily incorporate the effects of dump re-sloping and/or covers, and this step will be completed once results of the current assessments of cover performance are available.

5 Conclusions and Recommendations

This project has resulted in water quality estimates that reflect the most current understanding of the geochemistry of waste and ore dumps at the Anvil Range Mining Complex. The estimates are developed in a “user-friendly” format, that will allow for easy modifications to assess various closure measures.

The current draft form of the estimates needs to be updated once results from the dump water balance and dump cover assessments are available. It is expected that this update will be completed in January 2004. Results from the “third method” assessments referred to in Section 3 will also be compiled and made available in January 2004.

6 References

SRK, 2003. Geochemical Studies of Waste Rock at the Anvil Range Mining Complex, SRK Draft Report 1CD003.11.610 prepared for Deloitte and Touche Inc., December 2003.

Deloitte & Touche 2003. Anvil Range Mine Complex Closure Planning Workshop June 2003, Deloitte & Touche Inc. report prepared for the Type II Mines Project Office, October 2003.

Integrated Comprehensive Abandonment and Reclamation Plan, Robertson GeoConsultants Inc., November, 1996

SRK Report Distribution Record

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Table 1. Faro Current

Part 1 - Input seepage water quality summary from site data
Updated Statistics (from Kelly)

Type	Statistic	pH	Acidity	Alk	Cl	SO4	Ca	Mg	K	Na	Al	Cd	Co	Cu	Fe	Pb	Mn	Ni	Zn
Faro Type 1	Average	7.3	14	185	1.6	722	154	114	6.5	29	0.2	0.01	0.01	0.01	0.03	0.06	0.11	0.06	2.5
	Median	7.2	15	190.5	1.6	493	145	86	4.0	7.5	0.2	0.01	0.01	0.01	0.03	0.05	0.05	0.05	2.0
	Min	6.6	3	112	0.5	266	82.2	27	3.0	4.0	0.2	0.01	0.01	0.01	0.03	0.05	0.005	0.05	0.17
	Max	8.1	29	242	2.7	2470	263	378	24	122	0.2	0.01	0.01	0.01	0.03	0.15	0.422	0.09	5.3
	N	16	16	16	16	16	16	16	16	16	16	16	16	16	16	16	16	16	16
Faro Type 2 Waste	Average	6.7	51	137	1.6	1701	288	231	7.9	16	0.3	0.03	0.052	0.04	1.9	0.06	4.9	0.17	26
	Median	6.8	46	71.5	1.3	1425	227	177	8.0	11	0.2	0.02	0.045	0.01	0.12	0.05	2.8	0.12	26
	Min	5.8	15	4	0.5	334	49.1	37	2.0	3.0	0.2	0.01	0.01	0.01	0.03	0.05	0.037	0.05	3.9
	Max	7.3	115	407	4.6	3860	628	584	15	122	1.6	0.09	0.15	0.5	20.2	0.23	19	0.6	51
	N	26	26	26	26	26	26	26	26	26	26	26	26	26	26	26	26	26	26
Faro Type 2 Ore	Average	6.5	601	242	12	3783	491	505	13	49	0.4	0.16	0.41	0.08	33	0.10	44	0.61	261
	Median	6.4	477	319.5	15	4285	529	635	14	54	0.4	0.07	0.45	0.05	31.95	0.075	49.5	0.63	221
	Min	6.2	37	13	0.7	962	272	51	7.0	11	0.2	0.01	0.03	0.01	0.09	0.05	3.84	0.05	13.7
	Max	7.0	2160	350	17.5	4600	576	694	17	69	0.6	0.62	0.53	0.3	89.9	0.2	54	0.9	595
	N	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10
Faro Type 3 Waste	Average	3.9	968	16	3.1	1614	173	161	6.4	7.5	15	0.16	0.30	2	76	0.36	10	0.56	109
	Median	3.4	177	1	0.60	1170	239	104	5.0	4.0	4.1	0.08	0.20	0.58	3.91	0.08	3.79	0.24	46.7
	Min	2.6	27	1	0.50	69	6.45	3.8	2.0	2.0	0.2	0.01	0.01	0.03	0.03	0.05	0.161	0.05	2.2
	Max	5.9	8750	92	23.8	4780	410	504	14	36	73	0.85	1.5	8.06	416	1.6	64.3	3.2	751
	N	17	17	17	17	17	17	17	17	17	17	17	17	17	17	17	17	17	17
Faro Type 3 Ore	Average	3.4	14470	6	126	17107	305	727	39	44	207	6.5	5.0	92	2773	1.5	388	3.9	4260
	Median	2.5	6550	1	2.9	7490	268	235	20	46	71	6.9	1.7	7.8	1040	1.78	125	1.5	2260
	Min	2.2	227	1	0.50	700	107	38.8	2.0	2.0	0.2	0.12	0.080	0.14	1.3	0.3	5.7	0.08	128
	Max	6.0	49500	31	1050	59000	504	3210	100	100	986	15.5	20	559	15100	3.0	2360	15	10900
	N	11	11	11	11	11	11	11	11	11	11	11	11	11	11	11	11	11	11
Others (average only)	FD04	2.4	30970	1.00	342	35523	378	1655	73	73	502	10	11	187	6748	2	936	7.7	6930
	FD05/06	7.2	12	204	1.9	462	133	95	3.9	6.9	0.20	0.010	0.010	0.010	0.030	0.05	0.044	0.05	2.2
	FD14	7.6	16	111	0.77	2050	211	283	18	121	0.20	0.013	0.013	0.027	0.317	0.05	0.14	0.07	6.0
	FD19	7.1	85	398	2.1	3680	601	558	10	20	0.25	0.013	0.055	0.038	0.785	0.063	18	0.31	45
	FD37	2.4	11700	1.0	0.50	14850	242	273	31	31	94	11.3	4.0	127	1410	1.3	149	4.1	6985
	FD40	4.3	98	10	0.57	386	42	46	2.0	2.7	2.8	0.05	0.09	0.37	2.2	0.08	2.3	0.093	35

Part 2 - Select representative Seepage Types
Cut and paste rows from above

Seeapge Type	Selection	pH	Acidity	Alk	Cl	SO4	Ca	Mg	K	Na	Al	Cd	Co	Cu	Fe	Pb	Mn	Ni	Zn
F1	Average	7.3	14	185	1.6	722	154	114	6.5	29	0.2	0.01	0.01	0.01	0.03	0.06	0.11	0.06	2.5
F2 Waste	Average	6.7	51	137	1.6	1701	288	231	7.9	16	0.3	0.03	0.052	0.04	1.9	0.06	4.9	0.17	26
F2 Ore	Average	6.5	601	242	12	3783	491	505	13	49	0.4	0.16	0.41	0.08	33	0.10	44	0.61	261
F3 Waste	Average	3.9	968	16	3.1	1614	173	161	6.4	7.5	15	0.16	0.30	2	76	0.36	10	0.56	109
F3 Ore	Average	3.4	14470	6	126	17107	305	727	39	44	207	6.5	5.0	92	2773	1.5	388	3.9	4260
Other 1	FD04	2.4	30970	1.00	342	35523	378	1655	73	73	502	10	11	187	6748	2	936	7.7	6930
Other 2	FD05/06	7.2	12	204	1.9	462	133	95	3.9	6.9	0.20	0.010	0.010	0.010	0.030	0.05	0.044	0.05	2.2
Other 3	FD14	7.6	16	111	0.77	2050	211	283	18	121	0.20	0.013	0.013	0.027	0.317	0.05	0.14	0.07	6.0
Other 4	FD19	7.1	85	398	2.1	3680	601	558	10	20	0.25	0.013	0.055	0.038	0.785	0.063	18	0.31	45
Other 5	FD37	2.4	11700	1.0	0.50	14850	242	273	31	31	94	11.3	4.0	127	1410	1.3	149	4.1	6985
Other 6	FD40	4.3	98	10	0.57	386	42	46	2.0	2.7	2.8	0.05	0.09	0.37	2.2	0.08	2.3	0.093	35

Table 1. Faro Current

Part 3 - Assign Seepage Types to each source area
Input fractions of seepage represented by each type

Source	Code	Current Seep Types (as fraction)												
		F1	F2 Waste	F2 Ore	F3 Waste	F3-ore	Other 1	Other 2	Other 3	Other 4	Other 5	Other 6	Check	Certainty
Faro Valley North	FVN				1								1.0	known
Faro Valley South	FVS				1								1.0	known
Medium Grade Stockpile	MGSP										1		1.0	known
Crusher Stockpile	CHSP					1							1.0	estimated
Oxide Fines Stockpile	OXSP						1						1.0	known
Low Grade Stockpile A	LGSPA					1							1.0	estimated
Upper Northwest Dump	NWU	0.7	0.2		0.1								1.0	estimated
Middle Northwest Dump	NWM	0.7	0.2		0.1								1.0	estimated
Lower Northwest Dump	NWL									1			1.0	known
Mt. Mungly West	MMW				1								1.0	estimated
Mt. Mungly East	MME				1								1.0	estimated
Fuel Tank Dump W	FTW				1								1.0	estimated
Fuel Tank Dump E	FTE		1										1.0	estimated
Upper Parking Lot Dump	UPL	0.95	0.05										1.0	known
Lower Parking Lot Dump	LPL	0.9	0.1										1.0	estimated
Stock Piles Base	SPB		1										1.0	estimated
Southwest Pit Wall Dump	SWPWD				1								1.0	estimated
Low Grade Stockpile C	LGSPC					1							1.0	estimated
Main East Sulphide Cell	MESC				1								1.0	estimated
Intermediate Dump Sulphide Ce	IDSC				1								1.0	estimated
Ranch Dump	RD	0.5	0.5										1.0	estimated
Ramp Zone Dump	RZD								1				1.0	known
Main Dump West	MDW	0.1	0.8		0.1								1.0	estimated
Main Dump East	MDE	0.4	0.4		0.2								1.0	estimated
Intermediate Dump	ID	0.5	0.3		0.2								1.0	estimated
Outer Haul Road West	OHRW	0.5	0.5										1.0	estimated
Outer Haul Road East	OHRE	0.3	0.7										1.0	estimated
Lower Northeast sulphide cell	NELS				1								1.0	estimated
Outer Northeast Dump	NEO	0.5	0.5										1.0	estimated
Zone II West	ZIIW		0.9		0.1								1.0	estimated
Zone II East	ZIIE		0.9		0.1								1.0	estimated
Lower Northeast Dump	NEL							1					1.0	known
Upper Northeast Dump	NEU							1					1.0	known

Supporting information

Proportion of rock types					Tonnage	Average
sulphides	schist	calc-sil	intru	Till	tonnes	Height (m)
15%	50%	10%	15%	10%	3,514,050	13
0%	65%	0%	30%	5%	607,166	9
100%	0%	0%	0%	0%		
100%	0%	0%	0%	0%		
100%	0%	0%	0%	0%	322,670	8
100%	0%	0%	0%	0%	911,004	16
7%	15%	8%	65%	5%	2,665,666	10
10%	30%	40%	15%	5%	5,723,496	18
8%	37%	30%	15%	10%	6,558,132	31
50%	10%	20%	0%	20%	251,854	6
30%	40%	20%	10%	0%	882,728	13
100%	0%	0%	0%	0%	86,616	5
2%	60%	35%	3%	0%	2,479,776	13
5%	25%	70%	0%	0%	2,222,854	21
10%	5%	85%	0%	0%	677,080	10
0%	70%	10%	0%	20%	2,832,056	16
45%	50%	0%	5%	0%	1,619,962	10
100%	0%	0%	0%	0%	786,068	11
100%	0%	0%	0%	0%	12,606,018	**78**
100%	0%	0%	0%	0%	11,512,005	**62**
5%	85%	0%	10%	0%	525,194	6
2%	30%	68%	0%	0%	2,182,144	18
10%	75%	10%	0%	5%	25,133,886	57
15%	40%	35%	5%	5%	55,063,032	78
20%	20%	54%	1%	5%	40,810,467	62
2%	78%	10%	10%	0%	12,570,922	34
10%	70%	0%	5%	15%	4,481,826	26
100%					1,361,794	39
0%	40%	40%	10%	10%	198,422	8
10%	50%	20%	10%	10%	6,006,008	34
0%	75%	20%	5%	0%	16,304,844	65
5%	30%	30%	10%	25%	21,166,698	39
5%	25%	30%	10%	30%	15,785,560	31

Table 1. Faro Current

Part 4 - Water Quality Estimates
Calculations are automatic

Source	Code	pH	Acidity mg/L	Alk mg/L	Cl mg/L	SO4 mg/L	Ca mg/L	Mg mg/L	K mg/L	Na mg/L	Al mg/L	Cd mg/L	Co mg/L	Cu mg/L	Fe mg/L	Pb mg/L	Mn mg/L	Ni mg/L	Zn mg/L
Faro Valley North	FVN		968	16	3.1	1614	173	161	6	8	14.8	0.16	0.30	2.05	76.33	0.36	9.98	0.56	109.5
Faro Valley South	FVS		968	16	3	1614	173	161	6	8	15	0.16	0.30	2	76	0.36	10	0.56	109
Medium Grade Stockpile	MGSP		11700	1	1	14850	242	273	31	31	94	11.30	4.02	127	1410	1.30	149	4.09	6985
Crusher Stockpile	CHSP		14470	6	126	17107	305	727	39	44	207	6.48	4.97	92	2773	1.48	388	3.88	4260
Oxide Fines Stockpile	OXSP		30970	1	342	35523	378	1655	73	73	502	9.65	10.62	187	6748	2.08	936	7.70	6930
Low Grade Stockpile A	LGSPA		14470	6	126	17107	305	727	39	44	207	6.48	4.97	92	2773	1.48	388	3.88	4260
Upper Northwest Dump	NWU		117	158	2	1007	182	143	7	24	2	0.03	0.05	0	8	0.09	2	0.13	18
Middle Northwest Dump	NWM		117	158	2	1007	182	143	7	24	2	0.03	0.05	0	8	0.09	2	0.13	18
Lower Northwest Dump	NWL		85	398	2	3680	601	558	10	20	0	0.01	0.06	0	1	0.06	18	0.31	45
Mt. Mungly West	MMW		968	16	3	1614	173	161	6	8	15	0.16	0.30	2	76	0.36	10	0.56	109
Mt. Mungly East	MME		968	16	3	1614	173	161	6	8	15	0.16	0.30	2	76	0.36	10	0.56	109
Fuel Tank Dump W	FTW		968	16	3	1614	173	161	6	8	15	0.16	0.30	2	76	0.36	10	0.56	109
Fuel Tank Dump E	FTE		51	137	2	1701	288	231	8	16	0	0.03	0.05	0	2	0.06	5	0.17	26
Upper Parking Lot Dump	UPL		16	182	2	771	160	120	7	28	0	0.01	0.01	0	0	0.06	0	0.06	4
Lower Parking Lot Dump	LPL		18	180	2	820	167	126	7	28	0	0.01	0.01	0	0	0.06	1	0.07	5
Stock Piles Base	SPB		51	137	2	1701	288	231	8	16	0	0.03	0.05	0	2	0.06	5	0.17	26
Southwest Pit Wall Dump	SWPWD		968	16	3	1614	173	161	6	8	15	0.16	0.30	2	76	0.36	10	0.56	109
Low Grade Stockpile C	LGSPC		14470	6	126	17107	305	727	39	44	207	6.48	4.97	92	2773	1.48	388	3.88	4260
Main East Sulphide Cell	MESC		968	16	3	1614	173	161	6	8	15	0.16	0.30	2	76	0.36	10	0.56	109
Intermediate Dump Sulphide Ce	IDSC		968	16	3	1614	173	161	6	8	15	0.16	0.30	2	76	0.36	10	0.56	109
Ranch Dump	RD		33	161	2	1212	221	173	7	22	0	0.02	0.03	0	1	0.06	3	0.11	14
Ramp Zone Dump	RZD		16	111	1	2050	211	283	18	121	0	0.01	0.01	0	0	0.05	0	0.07	6
Main Dump West	MDW		139	130	2	1595	263	213	8	16	2	0.04	0.07	0	9	0.09	5	0.19	32
Main Dump East	MDE		220	132	2	1292	211	171	7	19	3	0.05	0.08	0	16	0.12	4	0.20	33
Intermediate Dump	ID		216	137	2	1194	198	159	7	21	3	0.05	0.08	0	16	0.12	4	0.19	31
Outer Haul Road West	OHRW		33	161	2	1212	221	173	7	22	0	0.02	0.03	0	1	0.06	3	0.11	14
Outer Haul Road East	OHRE		40	152	2	1408	248	196	7	20	0	0.02	0.04	0	1	0.06	3	0.13	19
Lower Northeast sulphide cell	NELS		968	16	3	1614	173	161	6	8	15	0.16	0.30	2	76	0.36	10	0.56	109
Outer Northeast Dump	NEO		33	161	2	1212	221	173	7	22	0	0.02	0.03	0	1	0.06	3	0.11	14
Zone II West	ZIIW		143	125	2	1693	276	224	8	15	2	0.04	0.08	0	9	0.09	5	0.20	34
Zone II East	ZIIE		143	125	2	1693	276	224	8	15	2	0.04	0.08	0	9	0.09	5	0.20	34
Lower Northeast Dump	NEL		12	204	2	462	133	95	4	7	0	0.01	0.01	0	0	0.05	0	0.05	2
Upper Northeast Dump	NEU		12	204	2	462	133	95	4	7	0	0.01	0.01	0	0	0.05	0	0.05	2

Table 1. Faro Current

Part 5 - Load Estimates

Enter infiltration rates as percentage of Mean Annual Precipitation (see Project 1CD001.33)

Mean Annual Precipitation = 288 mm

Source	Code	Inf. %MAP	Acidity kg/yr	Alk kg/yr	Cl kg/yr	SO4 kg/yr	Ca kg/yr	Mg kg/yr	K kg/yr	Na kg/yr	Al kg/yr	Cd kg/yr	Co kg/yr	Cu kg/yr	Fe kg/yr	Pb kg/yr	Mn kg/yr	Ni kg/yr	Zn kg/yr	**Supporting information** Area m2	Catchmet
Faro Valley North	FVN	45%	17,049	277	54	28,423	3,049	2,842	113	133	260	2.8	5.3	36.1	1,344	6.4	176	9.8	1,928	135,869	F1
Faro Valley South	FVS	45%	4,091	66	13	6,821	732	682	27	32	62	0.7	1.3	8.7	323	1.5	42	2.4	463	32,605	
Medium Grade Stockpile	MGSP	45%	51,402	4	2	65,241	1,063	1,197	136	136	413	49.6	17.6	555.8	6,195	5.7	655	17.9	30,687	33,899	F2
Crusher Stockpile	CHSP	45%	42,976	16	374	50,809	906	2,159	116	131	616	19.3	14.8	273.7	8,235	4.4	1,153	11.5	12,651	22,917	
Oxide Fines Stockpile	OXSP	45%	83,457	3	922	95,725	1,018	4,460	195	195	1,352	26.0	28.6	503.2	18,183	5.6	2,522	20.7	18,675	20,793	
Low Grade Stockpile A	LGSPA	45%	55,045	21	478	65,079	1,161	2,766	148	168	789	24.7	18.9	350.6	10,548	5.6	1,477	14.8	16,204	29,353	
Upper Northwest Dump	NWU	45%	1,953	2,644	30	16,821	3,046	2,380	113	404	28	0.5	0.8	3.7	134	1.5	34	2.1	298	128,833	
Middle Northwest Dump	NWM	45%	2,396	3,244	36	20,638	3,737	2,920	139	495	34	0.6	1.0	4.5	165	1.8	42	2.6	365	158,069	
Lower Northwest Dump	NWL	45%	1,167	5,443	29	50,389	8,233	7,640	130	267	3	0.2	0.8	0.5	11	0.9	243	4.2	619	105,653	
Mt. Mungly West	MMW	45%	2,546	41	8	4,244	455	424	17	20	39	0.4	0.8	5.4	201	1.0	26	1.5	288	20,287	
Mt. Mungly East	MME	45%	4,283	69	14	7,140	766	714	28	33	65	0.7	1.3	9.1	338	1.6	44	2.5	484	34,130	
Fuel Tank Dump W	FTW	45%	1,051	17	3	1,751	188	175	7	8	16	0.2	0.3	2.2	83	0.4	11	0.6	119	8,372	
Fuel Tank Dump E	FTE	45%	638	1,725	21	21,363	3,613	2,905	99	199	3	0.4	0.7	0.6	24	0.8	62	2.1	323	96,879	
Upper Parking Lot Dump	UPL	45%	112	1,269	11	5,370	1,116	838	46	197	1	0.1	0.1	0.1	1	0.4	2	0.4	25	53,716	
Lower Parking Lot Dump	LPL	45%	76	763	7	3,479	709	535	28	117	1	0.1	0.1	0.1	1	0.2	3	0.3	20	32,724	
Stock Piles Base	SPB	45%	601	1,625	19	20,121	3,403	2,736	94	188	3	0.4	0.6	0.5	22	0.8	59	2.0	304	91,250	
Southwest Pit Wall Dump	SWPWD	45%	9,825	159	31	16,379	1,757	1,638	65	76	150	1.6	3.0	20.8	775	3.7	101	5.7	1,111	78,294	F3
Low Grade Stockpile C	LGSPC	45%	64,766	25	563	76,572	1,366	3,254	175	197	928	29.0	22.2	412.5	12,411	6.6	1,737	17.4	19,066	34,537	
Main East Sulphide Cell	MESC	45%	10,140	164	32	16,905	1,814	1,690	67	79	155	1.7	3.1	21.5	799	3.8	104	5.8	1,147	80,808	
Intermediate Dump Sulphide Co	IDSC	45%	11,650	189	37	19,422	2,084	1,942	77	91	178	1.9	3.6	24.7	918	4.4	120	6.7	1,317	92,839	
Ranch Dump	RD	45%	178	883	9	6,645	1,210	948	40	123	1	0.1	0.2	0.1	5	0.3	14	0.6	77	42,305	
Ramp Zone Dump	RZD	45%	122	870	6	16,011	1,645	2,208	141	945	2	0.1	0.1	0.2	2	0.4	1	0.5	47	60,265	
Main Dump West	MDW	45%	3,977	3,720	51	45,650	7,525	6,087	218	468	49	1.2	2.1	6.9	262	2.7	142	5.5	910	220,861	
Main Dump East	MDE	45%	10,115	6,077	88	59,504	9,724	7,855	325	895	145	2.2	3.9	19.9	738	5.6	185	9.2	1,528	355,257	
Intermediate Dump	ID	45%	9,200	5,823	82	50,873	8,424	6,768	294	883	134	1.9	3.4	18.2	675	5.1	151	8.0	1,314	328,624	
Outer Haul Road West	OHRW	45%	789	3,902	40	29,363	5,347	4,189	175	543	6	0.5	0.8	0.7	23	1.5	61	2.7	342	186,942	
Outer Haul Road East	OHRE	45%	448	1,702	18	15,808	2,780	2,204	84	222	3	0.3	0.4	0.4	15	0.7	39	1.5	211	86,644	
Lower Northeast sulphide cell	NELS	45%	2,191	36	7	3,652	392	365	15	17	33	0.4	0.7	4.6	173	0.8	23	1.3	248	17,459	F4
Outer Northeast Dump	NEO	45%	54	267	3	2,008	366	287	12	37	0	0.0	0.1	0.0	2	0.1	4	0.2	23	12,787	
Zone II West	ZIIW	45%	1,650	1,450	21	19,594	3,198	2,597	90	174	20	0.5	0.9	2.8	108	1.1	63	2.4	395	89,315	
Zone II East	ZIIE	45%	2,330	2,047	29	27,660	4,515	3,666	127	246	28	0.7	1.3	4.0	153	1.5	89	3.3	557	126,084	
Lower Northeast Dump	NEL	45%	440	7,220	67	16,355	4,687	3,362	136	243	7	0.4	0.4	0.4	1	1.8	2	1.9	76	272,892	
Upper Northeast Dump	NEU	45%	410	6,728	62	15,241	4,368	3,133	127	226	7	0.3	0.3	0.3	1	1.6	1	1.7	71	254,309	

Table 2. Faro Future

Part 1 - Input seepage water quality summary from site data
Updated Statistics (from Kelly)

Type	Stat	pH	Acidity	Alk	Cl	SO4	Ca	Mg	K	Na	Al	Cd	Co	Cu	Fe	Pb	Mn	Ni	Zn
Faro Type 1	Average	7.3	14	185	1.6	722	154	114	6.5	29	0.2	0.01	0.01	0.01	0.03	0.06	0.11	0.06	2.5
	Median	7.2	15	190.5	1.6	493	145	86	4.0	7.5	0.2	0.01	0.01	0.01	0.03	0.05	0.05	0.05	2.0
	Min	6.6	3	112	0.5	266	82.2	27	3.0	4.0	0.2	0.01	0.01	0.01	0.03	0.05	0.005	0.05	0.17
	Max	8.1	29	242	2.7	2470	263	378	24	122	0.2	0.01	0.01	0.01	0.03	0.15	0.422	0.09	5.3
	N	16	16	16	16	16	16	16	16	16	16	16	16	16	16	16	16	16	16
Faro Type 2 Waste	Average	6.7	51	137	1.6	1701	288	231	7.9	16	0.3	0.03	0.052	0.04	1.9	0.06	4.9	0.17	26
	Median	6.8	46	71.5	1.3	1425	227	177	8.0	11	0.2	0.02	0.045	0.01	0.12	0.05	2.8	0.12	26
	Min	5.8	15	4	0.5	334	49.1	37	2.0	3.0	0.2	0.01	0.01	0.01	0.03	0.05	0.037	0.05	3.9
	Max	7.3	115	407	4.6	3860	628	584	15	122	1.6	0.09	0.15	0.5	20.2	0.23	19	0.6	51
	N	26	26	26	26	26	26	26	26	26	26	26	26	26	26	26	26	26	26
Faro Type 2 Ore	Average	6.5	601	242	12	3783	491	505	13	49	0.4	0.16	0.41	0.08	33	0.10	44	0.61	261
	Median	6.4	477	319.5	15	4285	529	635	14	54	0.4	0.07	0.45	0.05	31.95	0.075	49.5	0.63	221
	Min	6.2	37	13	0.7	962	272	51	7.0	11	0.2	0.01	0.03	0.01	0.09	0.05	3.84	0.05	13.7
	Max	7.0	2160	350	17.5	4600	576	694	17	69	0.6	0.62	0.53	0.3	89.9	0.2	54	0.9	595
	N	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10
Faro Type 3 Waste	Average	3.9	968	16	3.1	1614	173	161	6.4	7.5	15	0.16	0.30	2	76	0.36	10	0.56	109
	Median	3.4	177	1	0.60	1170	239	104	5.0	4.0	4.1	0.08	0.20	0.58	3.91	0.08	3.79	0.24	46.7
	Min	2.6	27	1	0.50	69	6.45	3.8	2.0	2.0	0.2	0.01	0.01	0.03	0.03	0.05	0.161	0.05	2.2
	Max	5.9	8750	92	23.8	4780	410	504	14	36	73	0.85	1.5	8.06	416	1.6	64.3	3.2	751
	N	17	17	17	17	17	17	17	17	17	17	17	17	17	17	17	17	17	17
Faro Type 3 Ore	Average	3.4	14470	6	126	17107	305	727	39	44	207	6.5	5.0	92	2773	1.5	388	3.9	4260
	Median	2.5	6550	1	2.9	7490	268	235	20	46	71	6.9	1.7	7.8	1040	1.78	125	1.5	2260
	Min	2.2	227	1	0.50	700	107	38.8	2.0	2.0	0.2	0.12	0.080	0.14	1.3	0.3	5.7	0.08	128
	Max	6.0	49500	31	1050	59000	504	3210	100	100	986	15.5	20	559	15100	3.0	2360	15	10900
	N	11	11	11	11	11	11	11	11	11	11	11	11	11	11	11	11	11	11
Others (average only)	FD04	2.4	30970	1.00	342	35523	378	1655	73	73	502	10	11	187	6748	2	936	7.7	6930
	FD05/06	7.2	12	204	1.9	462	133	95	3.9	6.9	0.20	0.010	0.010	0.010	0.030	0.05	0.044	0.05	2.2
	FD14	7.6	16	111	0.77	2050	211	283	18	121	0.20	0.013	0.013	0.027	0.317	0.05	0.14	0.07	6.0
	FD19	7.1	85	398	2.1	3680	601	558	10	20	0.25	0.013	0.055	0.038	0.785	0.063	18	0.31	45
	FD37	2.4	11700	1.0	0.50	14850	242	273	31	31	94	11.3	4.0	127	1410	1.3	149	4.1	6985
	FD40	4.3	98	10	0.57	386	42	46	2.0	2.7	2.8	0.05	0.09	0.37	2.2	0.08	2.3	0.093	35

Part 2 - Select representative Seepage Types
Cut and paste rows from above

Seeapge Type	Selection	pH	Acidity	Alk	Cl	SO4	Ca	Mg	K	Na	Al	Cd	Co	Cu	Fe	Pb	Mn	Ni	Zn
F1	Average	7.3	14	185	1.6	722	154	114	6.5	29	0.2	0.01	0.01	0.01	0.03	0.06	0.11	0.06	2.5
F2 Waste	Average	6.7	51	137	1.6	1701	288	231	7.9	16	0.3	0.03	0.052	0.04	1.9	0.06	4.9	0.17	26
F2 Ore	Average	6.5	601	242	12	3783	491	505	13	49	0.4	0.16	0.41	0.08	33	0.10	44	0.61	261
F3 Waste	Average	3.9	968	16	3.1	1614	173	161	6.4	7.5	15	0.16	0.30	2	76	0.36	10	0.56	109
F3 Ore	Average	3.4	14470	6	126	17107	305	727	39	44	207	6.5	5.0	92	2773	1.5	388	3.9	4260
Other 1	FD04	2.4	30970	1.00	342	35523	378	1655	73	73	502	10	11	187	6748	2	936	7.7	6930
Other 2	FD05/06	7.2	12	204	1.9	462	133	95	3.9	6.9	0.20	0.010	0.010	0.010	0.030	0.05	0.044	0.05	2.2
Other 3	FD14	7.6	16	111	0.77	2050	211	283	18	121	0.20	0.013	0.013	0.027	0.317	0.05	0.14	0.07	6.0
Other 4	FD19	7.1	85	398	2.1	3680	601	558	10	20	0.25	0.013	0.055	0.038	0.785	0.063	18	0.31	45
Other 5	FD37	2.4	11700	1.0	0.50	14850	242	273	31	31	94	11.3	4.0	127	1410	1.3	149	4.1	6985
Other 6	FD40	4.3	98	10	0.57	386	42	46	2.0	2.7	2.8	0.05	0.09	0.37	2.2	0.08	2.3	0.093	35

Table 2. Faro Future

Part 3 - Assign Seepage Types to each source area
Input fractions of seepage represented by each type

Source	Code	Current Seep Types (as fraction)												
		F1	F2 Waste	F2 Ore	F3 Waste	F3-ore	Other 1	Other 2	Other 3	Other 4	Other 5	Other 6	Check	Certainty
Faro Valley North	FVN				1								1.0	known
Faro Valley South	FVS				1								1.0	known
Medium Grade Stockpile	MGSP										1		1.0	known
Crusher Stockpile	CHSP					1							1.0	estimated
Oxide Fines Stockpile	OXSP						1						1.0	known
Low Grade Stockpile A	LGSPA					1							1.0	estimated
Upper Northwest Dump	NWU	0.7	0.2		0.1								1.0	estimated
Middle Northwest Dump	NWM	0.7	0.2		0.1								1.0	estimated
Lower Northwest Dump	NWL									1			1.0	known
Mt. Mungly West	MMW				1								1.0	estimated
Mt. Mungly East	MME				1								1.0	estimated
Fuel Tank Dump W	FTW				1								1.0	estimated
Fuel Tank Dump E	FTE		1										1.0	estimated
Upper Parking Lot Dump	UPL	0.7	0.3										1.0	estimated
Lower Parking Lot Dump	LPL	0.85	0.15										1.0	estimated
Stock Piles Base	SPB		1										1.0	estimated
Southwest Pit Wall Dump	SWPWD				1								1.0	estimated
Low Grade Stockpile C	LGSPC					1							1.0	estimated
Main East Sulphide Cell	MESC				1								1.0	estimated
Intermediate Dump Sulphide C	IDSC				1								1.0	estimated
Ranch Dump	RD		0.9		0.1								1.0	estimated
Ramp Zone Dump	RZD		1										1.0	known
Main Dump West	MDW		0.6		0.4								1.0	estimated
Main Dump East	MDE	0.2	0.4		0.4								1.0	estimated
Intermediate Dump	ID	0.2	0.5		0.3								1.0	estimated
Outer Haul Road West	OHRW	0.2	0.5		0.3								1.0	estimated
Outer Haul Road East	OHRE	0.2	0.4		0.4								1.0	estimated
Lower Northeast sulphide cell	NELS				1								1.0	estimated
Outer Northeast Dump	NEO	0.5	0.3		0.2								1.0	estimated
Zone II West	ZIIW		0.7		0.3								1.0	estimated
Zone II East	ZIIE		0.7		0.3								1.0	estimated
Lower Northeast Dump	NEL	0.7	0.3										1.0	known
Upper Northeast Dump	NEU	0.7	0.3										1.0	known

Supporting information

Proportion of rock types					Tonnage	Average
sulphides	schist	calc-sil	intru	Till	tonnes	Height (m)
15%	50%	10%	15%	10%	3,514,050	13
0%	65%	0%	30%	5%	607,166	9
100%	0%	0%	0%	0%		
100%	0%	0%	0%	0%		
100%	0%	0%	0%	0%	322,670	8
100%	0%	0%	0%	0%	911,004	16
7%	15%	8%	65%	5%	2,665,666	10
10%	30%	40%	15%	5%	5,723,496	18
8%	37%	30%	15%	10%	6,558,132	31
50%	10%	20%	0%	20%	251,854	6
30%	40%	20%	10%	0%	882,728	13
100%	0%	0%	0%	0%	86,616	5
2%	60%	35%	3%	0%	2,479,776	13
5%	25%	70%	0%	0%	2,222,854	21
10%	5%	85%	0%	0%	677,080	10
0%	70%	10%	0%	20%	2,832,056	16
45%	50%	0%	5%	0%	1,619,962	10
100%	0%	0%	0%	0%	786,068	11
100%	0%	0%	0%	0%	12,606,018	**78**
100%	0%	0%	0%	0%	11,512,005	**62**
5%	85%	0%	10%	0%	525,194	6
2%	30%	68%	0%	0%	2,182,144	18
10%	75%	10%	0%	5%	25,133,886	57
15%	40%	35%	5%	5%	55,063,032	78
20%	20%	54%	1%	5%	40,810,467	62
2%	78%	10%	10%	0%	12,570,922	34
10%	70%	0%	5%	15%	4,481,826	26
100%					1,361,794	39
0%	40%	40%	10%	10%	198,422	8
10%	50%	20%	10%	10%	6,006,008	34
0%	75%	20%	5%	0%	16,304,844	65
5%	30%	30%	10%	25%	21,166,698	39
5%	25%	30%	10%	30%	15,785,560	31

Table 2. Faro Future

Part 4 - Water Quality Estimates
Calculations are automatic

Source	Code	pH	Acidity mg/L	Alk mg/L	Cl mg/L	SO4 mg/L	Ca mg/L	Mg mg/L	K mg/L	Na mg/L	Al mg/L	Cd mg/L	Co mg/L	Cu mg/L	Fe mg/L	Pb mg/L	Mn mg/L	Ni mg/L	Zn mg/L
Faro Valley North	FVN		968	16	3.1	1614	173	161	6	8	14.8	0.16	0.30	2.05	76.33	0.36	9.98	0.56	109.5
Faro Valley South	FVS		968	16	3	1614	173	161	6	8	15	0.16	0.30	2	76	0.36	10	0.56	109
Medium Grade Stockpile	MGSP		11700	1	1	14850	242	273	31	31	94	11.30	4.02	127	1410	1.30	149	4.09	6985
Crusher Stockpile	CHSP		14470	6	126	17107	305	727	39	44	207	6.48	4.97	92	2773	1.48	388	3.88	4260
Oxide Fines Stockpile	OXSP		30970	1	342	35523	378	1655	73	73	502	9.65	10.62	187	6748	2.08	936	7.70	6930
Low Grade Stockpile A	LGSPA		14470	6	126	17107	305	727	39	44	207	6.48	4.97	92	2773	1.48	388	3.88	4260
Upper Northwest Dump	NWU		117	158	2	1007	182	143	7	24	2	0.03	0.05	0	8	0.09	2	0.13	18
Middle Northwest Dump	NWM		117	158	2	1007	182	143	7	24	2	0.03	0.05	0	8	0.09	2	0.13	18
Lower Northwest Dump	NWL		85	398	2	3680	601	558	10	20	0	0.01	0.06	0	1	0.06	18	0.31	45
Mt. Mungly West	MMW		968	16	3	1614	173	161	6	8	15	0.16	0.30	2	76	0.36	10	0.56	109
Mt. Mungly East	MME		968	16	3	1614	173	161	6	8	15	0.16	0.30	2	76	0.36	10	0.56	109
Fuel Tank Dump W	FTW		968	16	3	1614	173	161	6	8	15	0.16	0.30	2	76	0.36	10	0.56	109
Fuel Tank Dump E	FTE		51	137	2	1701	288	231	8	16	0	0.03	0.05	0	2	0.06	5	0.17	26
Upper Parking Lot Dump	UPL		25	171	2	1016	194	150	7	25	0	0.02	0.02	0	1	0.06	2	0.09	9
Lower Parking Lot Dump	LPL		20	178	2	869	174	132	7	27	0	0.01	0.02	0	0	0.06	1	0.07	6
Stock Piles Base	SPB		51	137	2	1701	288	231	8	16	0	0.03	0.05	0	2	0.06	5	0.17	26
Southwest Pit Wall Dump	SWPWD		968	16	3	1614	173	161	6	8	15	0.16	0.30	2	76	0.36	10	0.56	109
Low Grade Stockpile C	LGSPC		14470	6	126	17107	305	727	39	44	207	6.48	4.97	92	2773	1.48	388	3.88	4260
Main East Sulphide Cell	MESC		968	16	3	1614	173	161	6	8	15	0.16	0.30	2	76	0.36	10	0.56	109
Intermediate Dump Sulphide C	IDSC		968	16	3	1614	173	161	6	8	15	0.16	0.30	2	76	0.36	10	0.56	109
Ranch Dump	RD		143	125	2	1693	276	224	8	15	2	0.04	0.08	0	9	0.09	5	0.20	34
Ramp Zone Dump	RZD		51	137	2	1701	288	231	8	16	0	0.03	0.05	0	2	0.06	5	0.17	26
Main Dump West	MDW		418	89	2	1667	242	203	7	13	6	0.08	0.15	1	32	0.18	7	0.32	59
Main Dump East	MDE		410	98	2	1471	215	180	7	15	6	0.08	0.14	1	31	0.18	6	0.30	55
Intermediate Dump	ID		319	110	2	1479	227	187	7	16	5	0.06	0.12	1	24	0.15	5	0.26	46
Outer Haul Road West	OHRW		319	110	2	1479	227	187	7	16	5	0.06	0.12	1	24	0.15	5	0.26	46
Outer Haul Road East	OHRE		410	98	2	1471	215	180	7	15	6	0.08	0.14	1	31	0.18	6	0.30	55
Lower Northeast sulphide cell	NELS		968	16	3	1614	173	161	6	8	15	0.16	0.30	2	76	0.36	10	0.56	109
Outer Northeast Dump	NEO		216	137	2	1194	198	159	7	21	3	0.05	0.08	0	16	0.12	4	0.19	31
Zone II West	ZIIW		326	101	2	1675	253	210	7	13	5	0.07	0.13	1	24	0.15	6	0.28	51
Zone II East	ZIIE		326	101	2	1675	253	210	7	13	5	0.07	0.13	1	24	0.15	6	0.28	51
Lower Northeast Dump	NEL		25	171	2	1016	194	150	7	25	0	0.02	0.02	0	1	0.06	2	0.09	9
Upper Northeast Dump	NEU		25	171	2	1016	194	150	7	25	0	0.02	0.02	0	1	0.06	2	0.09	9

Table 2. Faro Future

Part 5 - Load Estimates

Enter infiltration rates as percentage of Mean Annual Precipitation (see Project 1CD001.33)

Mean Annual Precipitation = 288 mm

Source	Code	Inf. %MAP	Acidity kg/yr	Alk kg/yr	Cl kg/yr	SO4 kg/yr	Ca kg/yr	Mg kg/yr	K kg/yr	Na kg/yr	Al kg/yr	Cd kg/yr	Co kg/yr	Cu kg/yr	Fe kg/yr	Pb kg/yr	Mn kg/yr	Ni kg/yr	Zn kg/yr	**Supporting information** Area m2	Catchmet
Faro Valley North	FVN	45%	17,049	277	54	28,423	3,049	2,842	113	133	260	2.8	5.3	36.1	1,344	6.4	176	9.8	1,928	135,869	F1
Faro Valley South	FVS	45%	4,091	66	13	6,821	732	682	27	32	62	0.7	1.3	8.7	323	1.5	42	2.4	463	32,605	
Medium Grade Stockpile	MGSP	45%	51,402	4	2	65,241	1,063	1,197	136	136	413	49.6	17.6	555.8	6,195	5.7	655	17.9	30,687	33,899	F2
Crusher Stockpile	CHSP	45%	42,976	16	374	50,809	906	2,159	116	131	616	19.3	14.8	273.7	8,235	4.4	1,153	11.5	12,651	22,917	
Oxide Fines Stockpile	OXSP	45%	83,457	3	922	95,725	1,018	4,460	195	195	1,352	26.0	28.6	503.2	18,183	5.6	2,522	20.7	18,675	20,793	
Low Grade Stockpile A	LGSPA	45%	55,045	21	478	65,079	1,161	2,766	148	168	789	24.7	18.9	350.6	10,548	5.6	1,477	14.8	16,204	29,353	
Upper Northwest Dump	NWU	45%	1,953	2,644	30	16,821	3,046	2,380	113	404	28	0.5	0.8	3.7	134	1.5	34	2.1	298	128,833	
Middle Northwest Dump	NWM	45%	2,396	3,244	36	20,638	3,737	2,920	139	495	34	0.6	1.0	4.5	165	1.8	42	2.6	365	158,069	
Lower Northwest Dump	NWL	45%	1,167	5,443	29	50,389	8,233	7,640	130	267	3	0.2	0.8	0.5	11	0.9	243	4.2	619	105,653	
Mt. Mungly West	MMW	45%	2,546	41	8	4,244	455	424	17	20	39	0.4	0.8	5.4	201	1.0	26	1.5	288	20,287	
Mt. Mungly East	MME	45%	4,283	69	14	7,140	766	714	28	33	65	0.7	1.3	9.1	338	1.6	44	2.5	484	34,130	
Fuel Tank Dump W	FTW	45%	1,051	17	3	1,751	188	175	7	8	16	0.2	0.3	2.2	83	0.4	11	0.6	119	8,372	
Fuel Tank Dump E	FTE	45%	638	1,725	21	21,363	3,613	2,905	99	199	3	0.4	0.7	0.6	24	0.8	62	2.1	323	96,879	
Upper Parking Lot Dump	UPL	45%	176	1,187	11	7,074	1,350	1,041	48	174	2	0.1	0.2	0.1	4	0.4	11	0.6	66	53,716	
Lower Parking Lot Dump	LPL	45%	84	753	7	3,687	737	560	28	114	1	0.1	0.1	0.1	1	0.2	4	0.3	25	32,724	
Stock Piles Base	SPB	45%	601	1,625	19	20,121	3,403	2,736	94	188	3	0.4	0.6	0.5	22	0.8	59	2.0	304	91,250	
Southwest Pit Wall Dump	SWPWD	45%	9,825	159	31	16,379	1,757	1,638	65	76	150	1.6	3.0	20.8	775	3.7	101	5.7	1,111	78,294	F3
Low Grade Stockpile C	LGSPC	45%	64,766	25	563	76,572	1,366	3,254	175	197	928	29.0	22.2	412.5	12,411	6.6	1,737	17.4	19,066	34,537	
Main East Sulphide Cell	MESC	45%	10,140	164	32	16,905	1,814	1,690	67	79	155	1.7	3.1	21.5	799	3.8	104	5.8	1,147	80,808	
Intermediate Dump Sulphide Cc	IDSC	45%	11,650	189	37	19,422	2,084	1,942	77	91	178	1.9	3.6	24.7	918	4.4	120	6.7	1,317	92,839	
Ranch Dump	RD	45%	782	687	10	9,281	1,515	1,230	43	83	9	0.2	0.4	1.3	51	0.5	30	1.1	187	42,305	
Ramp Zone Dump	RZD	45%	397	1,073	13	13,289	2,248	1,807	62	124	2	0.2	0.4	0.3	15	0.5	39	1.3	201	60,265	
Main Dump West	MDW	45%	11,959	2,540	63	47,703	6,925	5,821	209	359	174	2.3	4.3	24.2	906	5.3	199	9.2	1,696	220,861	
Main Dump East	MDE	45%	18,899	4,521	102	67,715	9,904	8,287	324	698	279	3.6	6.6	38.7	1,441	8.4	276	13.8	2,513	355,257	
Intermediate Dump	ID	45%	13,575	4,700	88	63,010	9,649	7,964	306	681	196	2.8	5.0	27.2	1,016	6.5	234	11.1	1,968	328,624	
Outer Haul Road West	OHRW	45%	7,722	2,674	50	35,844	5,489	4,530	174	387	112	1.6	2.9	15.5	578	3.7	133	6.3	1,120	186,942	
Outer Haul Road East	OHRE	45%	4,609	1,103	25	16,515	2,415	2,021	79	170	68	0.9	1.6	9.4	351	2.0	67	3.4	613	86,644	
Lower Northeast sulphide cell	NELS	45%	2,191	36	7	3,652	392	365	15	17	33	0.4	0.7	4.6	173	0.8	23	1.3	248	17,459	F4
Outer Northeast Dump	NEO	45%	358	227	3	1,980	328	263	11	34	5	0.1	0.1	0.7	26	0.2	6	0.3	51	12,787	
Zone II West	ZIIW	45%	3,774	1,168	24	19,392	2,933	2,435	86	155	54	0.8	1.5	7.5	280	1.8	75	3.3	589	89,315	
Zone II East	ZIIE	45%	5,328	1,649	34	27,375	4,140	3,437	122	219	76	1.1	2.1	10.6	396	2.5	105	4.6	831	126,084	
Lower Northeast Dump	NEL	45%	892	6,030	58	35,938	6,858	5,288	245	885	8	0.6	0.8	0.7	21	2.1	55	3.1	334	272,892	
Upper Northeast Dump	NEU	45%	832	5,620	54	33,491	6,391	4,928	228	825	7	0.5	0.7	0.7	19	1.9	51	2.9	312	254,309	

Table 3. Vangorda-Grum Current

Part 1 - Input seepage water quality summary from site data
Updated Statistics (from JTC)

Type	Statistic	pH	Acidity	Alk	Cl	SO4	Ca	Mg	K	Na	Al	Cd	Co	Cu	Fe	Pb	Mn	Ni	Zn
Vangorda/Grum Type 1a	Average	7.46	10	325	1.6	255	137	56	2.4	2.6	0.20	0.01	0.01	0.01	0.03	0.05	0.16	0.05	0.009
	Median	7.47	6.0	338	1.7	313	153	64	2.0	3.0	0.20	0.01	0.01	0.01	0.03	0.05	0.005	0.05	0.005
	Min	7.85	1.0	186	0.50	7.0	45	24	2.0	2.0	0.20	0.01	0.01	0.01	0.03	0.05	0.005	0.05	0.005
	Max	6.87	40	405	2.5	575	219	81	4.0	4.0	0.20	0.01	0.01	0.01	0.03	0.05	1.9	0.07	0.028
	N	13	13	13	13	13	13	13	13	13	13	13	13	13	13	13	13	13	13
Vangorda/Grum Type 1b	Average	7.29	23	526	2.1	1093	323	205	7.1	10	0.20	0.01	0.01	0.01	0.03	0.05	0.10	0.38	3.0
	Median	7.31	19	546	2.2	1165	337	210	7.0	11	0.20	0.01	0.01	0.01	0.03	0.05	0.056	0.38	2.7
	Min	7.84	1.0	278	0.90	593	201	108	3.0	4.0	0.20	0.01	0.01	0.01	0.03	0.05	0.005	0.22	1.7
	Max	6.67	69	700	2.8	1350	380	347	10	16	0.20	0.01	0.03	0.01	0.03	0.05	0.43	0.59	5.1
	N	18	18	18	18	18	18	18	18	18	18	18	18	18	18	18	18	18	18
Vangorda/GrumType 2	Average	6.44	352	134	0.77	2878	351	374	9.0	8.2	0.28	0.11	1.4	0.01	40	0.08	67	2.6	184
	Median	6.34	203	144	0.60	2785	399	389	11	10	0.20	0.09	0.85	0.01	2.9	0.09	39	2.0	107
	Min	7.08	53	27	0.50	766	199	54	2.0	2.0	0.20	0.05	0.06	0.01	0.03	0.05	3.7	0.14	23
	Max	6.03	755	289	1.3	4440	436	602	13	13	0.40	0.28	3.0	0.02	127	0.10	139	5.3	412
	N	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10
Vangorda/Grum Type 3	Average	4.08	6279	26	1.4	15482	432	1624	12	8.7	40	3.5	9.5	29	706	1.0	996	8.0	2948
	Median	3.67	2550	3.0	0.50	13100	445	721	10	4.0	14	1.2	6.0	0.69	243	0.70	232	7.0	1650
	Min	6.21	581	1.0	0.50	2470	196	105	4.0	4.0	0.40	0.45	0.75	0.07	0.12	0.10	18	1.1	352
	Max	2.55	16500	160	11	33400	528	3490	20	20	339	8.5	22	180	3040	2.5	2600	17	6990
	N	13	13	13	13	13	13	13	7	7	12	13	13	7	13	7	13	13	13
Faro Type 2 Waste	Average	6.7	51	137	1.6	1701	288	231	7.9	16	0.3	0.03	0.052	0.04	1.9	0.06	4.9	0.17	26
	Median	6.8	46	71.5	1.3	1425	227	177	8.0	11	0.2	0.02	0.045	0.01	0.12	0.05	2.8	0.12	26
	Min	5.8	15	4	0.5	334	49.1	37	2.0	3.0	0.2	0.01	0.01	0.01	0.03	0.05	0.037	0.05	3.9
	Max	7.3	115	407	4.6	3860	628	584	15	122	1.6	0.09	0.15	0.5	20.2	0.23	19	0.6	51
	N	26	26	26	26	26	26	26	26	26	26	26	26	26	26	26	26	26	26
Faro Type 3 Waste	Average	3.9	968	16	3.1	1614	173	161	6.4	7.5	15	0.16	0.30	2	76	0.36	10	0.56	109
	Median	3.4	177	1	0.60	1170	239	104	5.0	4.0	4.1	0.08	0.20	0.58	3.91	0.08	3.79	0.24	46.7
	Min	2.6	27	1	0.50	69	6.45	3.8	2.0	2.0	0.2	0.01	0.01	0.03	0.03	0.05	0.161	0.05	2.2
	Max	5.9	8750	92	23.8	4780	410	504	14	36	73	0.85	1.5	8.06	416	1.6	64.3	3.2	751
	N	17	17	17	17	17	17	17	17	17	17	17	17	17	17	17	17	17	17
Other																			

Part 2 - Select representative Seepage Types
Cut and paste rows from above

Seeapge Type	Selection	pH	Acidity	Alk	Cl	SO4	Ca	Mg	K	Na	Al	Cd	Co	Cu	Fe	Pb	Mn	Ni	Zn
G1a	Average	7.5	10	325	1.6	255	137	56	2.4	3	0.2	0.01	0.01	0.01	0.03	0.05	0.16	0.05	0.0
G1b	Average	7.3	23	526	2.1	1093	323	205	7.1	10	0.2	0.01	0.011	0.01	0.0	0.05	0.1	0.38	3
V2	Average	6.4	352	134	1	2878	351	374	9	8	0.3	0.11	1.37	0.01	40	0.08	67	2.57	184
V3	Average	4.1	6279	26	1.4	15482	432	1624	11.6	8.7	40	3.53	9.52	29	706	1.03	996	8.03	2948
F2waste	Average	6.7	51	137	2	1701	288	231	8	16	0.3	0.03	0.05	0.04	2	0.06	5	0.2	26
F3waste	Average	3.9	968	16	3	1614	173	161	6	8	15	0.2	0.3	2.1	76	0.36	10	0.6	109
Other 6	0	0.0	0	0	0.00	0	0	0	0.0	0.0	0.0	0.00	0.00	0.00	0.0	0.00	0.0	0.000	0

Part 3 - Assign Seepage Types to each source area
Input fractions of seepage represented by each type

Source	Code	Current Seep Types (as fraction)												
		G1a	G1b	V2	V3	F2waste	F3waste	Other 2	Other 3	Other 4	Other 5	Other 6	Check	Certainty
Grum Main Sulphide Cell	G1-S		1										1.0	
Grum Main Dump	G1-B		1										1.0	
Grum Southwest Dump	G2	1											1.0	
Overburden Dump	G3-O	1											1.0	
Vangorda Main Sulphide Cell	V1-S				1								1.0	
Vangorda Main Dump	V1-B			0.8	0.2								1.0	
Barite Dump	V2				1								1.0	
Overburden Dump	V3-O		0.9	0.1									1.0	

Supporting information

Proportion of rock types					Tonnage	Average
sulphides	Non-Calc Phyl	Calc Phyl	OB	Empty	tonnes	Height (m)
100%					2,000,000	6
	15%	85%			13,000,000	15
	15%	85%			13,000,000	10
			100%			0
100%					2,600,000	14
	91%	9%			5,400,000	8
	100%				225,000	13
			100%		-	0

Table 3. Vangorda-Grum Current

Part 4 - Water Quality Estimates
Calculations are automatic

Source	Code	pH	Acidity mg/L	Alk mg/L	Cl mg/L	SO4 mg/L	Ca mg/L	Mg mg/L	K mg/L	Na mg/L	Al mg/L	Cd mg/L	Co mg/L	Cu mg/L	Fe mg/L	Pb mg/L	Mn mg/L	Ni mg/L	Zn mg/L
Grum Main Sulphide Cell	G1-S		23	526	2	1093	323	205	7	10	0	0.01	0.01	0	0	0.05	0	0.38	3
Grum Main Dump	G1-B		23	526	2	1093	323	205	7	10	0	0.01	0.01	0	0	0.05	0	0.38	3
Grum Southwest Dump	G2		10	325	2	255	137	56	2	3	0	0.01	0.01	0	0	0.05	0	0.05	0
Overburden Dump	G3-O		10	325	2	255	137	56	2	3	0	0.01	0.01	0	0	0.05	0	0.05	0
Vangorda Main Sulphide Cell	V1-S		6279	26	1	15482	432	1624	12	9	40	3.53	9.52	29	706	1.03	996	8.03	2948
Vangorda Main Dump	V1-B		1537	112	1	5399	367	624	10	8	8	0.79	3.00	6	173	0.27	253	3.66	737
Barite Dump	V2		6279	26	1	15482	432	1624	12	9	40	3.53	9.52	29	706	1.03	996	8.03	2948
Overburden Dump	V3-O		56	487	2	1272	326	222	7	10	0	0.02	0.15	0	4	0.05	7	0.60	21

Part 5 - Load Estimates
Enter infiltration rates as percentage of Mean Annual Precipitation (see Project 1CD001.33)
Grum MAP = 350 mm
Vangorda MAP = 460 mm

Supporting information

Source	Code	Inf. %MAP	Acidity kg/yr	Alk kg/yr	Cl kg/yr	SO4 kg/yr	Ca kg/yr	Mg kg/yr	K kg/yr	Na kg/yr	Al kg/yr	Cd kg/yr	Co kg/yr	Cu kg/yr	Fe kg/yr	Pb kg/yr	Mn kg/yr	Ni kg/yr	Zn kg/yr
Grum Main Sulphide Cell	G1-S	45%	652	14,918	60	30,996	9,170	5,824	202	295	6	0.3	0.3	0.3	1	1.4	3	10.8	84
Grum Main Dump	G1-B	45%	1,611	36,866	148	76,596	22,660	14,393	498	728	14	0.7	0.8	0.7	2	3.5	7	26.6	208
Grum Southwest Dump	G2	45%	1,045	33,429	169	26,283	14,090	5,764	245	269	21	1.0	1.0	1.0	3	5.1	16	5.3	1
Overburden Dump	G3-O	45%	737	23,579	119	18,538	9,938	4,065	173	190	15	0.7	0.7	0.7	2	3.6	11	3.7	1
Vangorda Main Sulphide Cell	V1-S	45%	119,568	486	27	294,845	8,230	30,936	220	166	761	67.2	181.3	550.1	13,440	19.6	18,971	152.9	56,151
Vangorda Main Dump	V1-B	45%	104,169	7,595	61	365,876	24,882	42,302	645	563	557	53.6	203.2	392.3	11,756	18.1	17,152	248.1	49,951
Barite Dump	V2	45%	11,437	47	3	28,203	787	2,959	21	16	73	6.4	17.3	52.6	1,286	1.9	1,815	14.6	5,371
Overburden Dump	V3-O	45%	529	4,612	19	12,045	3,089	2,106	69	96	2	0.2	1.4	0.1	39	0.5	65	5.7	200

Area m2	Catchment
180,000	
444,810	
653,228	
460,740	
92,000	
327,397	
8,800	
45,755	

Table 4. Vangorda-Grum Future

Part 1 - Input seepage water quality summary from site data
Updated Statistics (from JTC)

Type	Statistic	pH	Acidity	Alk	Cl	SO4	Ca	Mg	K	Na	Al	Cd	Co	Cu	Fe	Pb	Mn	Ni	Zn
Vangorda/Grum Type 1a	Average	7.46	10	325	1.6	255	137	56	2.4	2.6	0.20	0.01	0.01	0.01	0.03	0.05	0.16	0.05	0.009
	Median	7.47	6.0	338	1.7	313	153	64	2.0	3.0	0.20	0.01	0.01	0.01	0.03	0.05	0.005	0.05	0.005
	Min	7.85	1.0	186	0.50	7.0	45	24	2.0	2.0	0.20	0.01	0.01	0.01	0.03	0.05	0.005	0.05	0.005
	Max	6.87	40	405	2.5	575	219	81	4.0	4.0	0.20	0.01	0.01	0.01	0.03	0.05	1.9	0.07	0.028
	N	13	13	13	13	13	13	13	13	13	13	13	13	13	13	13	13	13	13
Vangorda/Grum Type 1b	Average	7.29	23	526	2.1	1093	323	205	7.1	10	0.20	0.01	0.01	0.01	0.03	0.05	0.10	0.38	3.0
	Median	7.31	19	546	2.2	1165	337	210	7.0	11	0.20	0.01	0.01	0.01	0.03	0.05	0.056	0.38	2.7
	Min	7.84	1.0	278	0.90	593	201	108	3.0	4.0	0.20	0.01	0.01	0.01	0.03	0.05	0.005	0.22	1.7
	Max	6.67	69	700	2.8	1350	380	347	10	16	0.20	0.01	0.03	0.01	0.03	0.05	0.43	0.59	5.1
	N	18	18	18	18	18	18	18	18	18	18	18	18	18	18	18	18	18	18
Vangorda/GrumType 2	Average	6.44	352	134	0.77	2878	351	374	9.0	8.2	0.28	0.11	1.4	0.01	40	0.08	67	2.6	184
	Median	6.34	203	144	0.60	2785	399	389	11	10	0.20	0.09	0.85	0.01	2.9	0.09	39	2.0	107
	Min	7.08	53	27	0.50	766	199	54	2.0	2.0	0.20	0.05	0.06	0.01	0.03	0.05	3.7	0.14	23
	Max	6.03	755	289	1.3	4440	436	602	13	13	0.40	0.28	3.0	0.02	127	0.10	139	5.3	412
	N	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10
Vangorda/Grum Type 3	Average	4.08	6279	26	1.4	15482	432	1624	12	8.7	40	3.5	9.5	29	706	1.0	996	8.0	2948
	Median	3.67	2550	3.0	0.50	13100	445	721	10	4.0	14	1.2	6.0	0.69	243	0.70	232	7.0	1650
	Min	6.21	581	1.0	0.50	2470	196	105	4.0	4.0	0.40	0.45	0.75	0.07	0.12	0.10	18	1.1	352
	Max	2.55	16500	160	11	33400	528	3490	20	20	339	8.5	22	180	3040	2.5	2600	17	6990
	N	13	13	13	13	13	13	13	7	7	12	13	13	7	13	7	13	13	13
Faro Type 2 Waste	Average	6.7	51	137	1.6	1701	288	231	7.9	16	0.3	0.03	0.052	0.04	1.9	0.06	4.9	0.17	26
	Median	6.8	46	71.5	1.3	1425	227	177	8.0	11	0.2	0.02	0.045	0.01	0.12	0.05	2.8	0.12	26
	Min	5.8	15	4	0.5	334	49.1	37	2.0	3.0	0.2	0.01	0.01	0.01	0.03	0.05	0.037	0.05	3.9
	Max	7.3	115	407	4.6	3860	628	584	15	122	1.6	0.09	0.15	0.5	20.2	0.23	19	0.6	51
	N	26	26	26	26	26	26	26	26	26	26	26	26	26	26	26	26	26	26
Faro Type 3 Waste	Average	3.9	968	16	3.1	1614	173	161	6.4	7.5	15	0.16	0.30	2	76	0.36	10	0.56	109
	Median	3.4	177	1	0.60	1170	239	104	5.0	4.0	4.1	0.08	0.20	0.58	3.91	0.08	3.79	0.24	46.7
	Min	2.6	27	1	0.50	69	6.45	3.8	2.0	2.0	0.2	0.01	0.01	0.03	0.03	0.05	0.161	0.05	2.2
	Max	5.9	8750	92	23.8	4780	410	504	14	36	73	0.85	1.5	8.06	416	1.6	64.3	3.2	751
	N	17	17	17	17	17	17	17	17	17	17	17	17	17	17	17	17	17	17
Other																			

Part 2 - Select representative Seepage Types
Cut and paste rows from above

Seeapge Type	Selection	pH	Acidity	Alk	Cl	SO4	Ca	Mg	K	Na	Al	Cd	Co	Cu	Fe	Pb	Mn	Ni	Zn
G1a	Average	7.5	10	325	1.6	255	137	56	2.4	3	0.2	0.01	0.01	0.01	0.03	0.05	0.16	0.05	0.0
G1b	Average	7.3	23	526	2.1	1093	323	205	7.1	10	0.2	0.01	0.011	0.01	0.0	0.05	0.1	0.38	3
V2	Average	6.4	352	134	1	2878	351	374	9	8	0.3	0.11	1.37	0.01	40	0.08	67	2.57	184
V3	Average	4.1	6279	26	1.4	15482	432	1624	11.6	8.7	40	3.53	9.52	29	706	1.03	996	8.03	2948
F2waste	Average	6.7	51	137	2	1701	288	231	8	16	0.3	0.03	0.05	0.04	2	0.06	5	0.2	26
F3waste	Average	3.9	968	16	3	1614	173	161	6	8	15	0.2	0.3	2.1	76	0.36	10	0.6	109
Other 6	0	0.0	0	0	0.00	0	0	0	0.0	0.0	0.0	0.00	0.00	0.00	0.0	0.00	0.0	0.000	0

Part 3 - Assign Seepage Types to each source area
Input fractions of seepage represented by each type

Source	Code	Current Seep Types (as fraction)												
		G1a	G1b	V2	V3	F2waste	F3waste	Other 2	Other 3	Other 4	Other 5	Other 6	Check	Certainty
Grum Main Sulphide Cell	G1-S						1						1.0	moderate
Grum Main Dump	G1-B		1										1.0	high
Grum Southwest Dump	G2	0.7	0.3										1.0	moderate
Overburden Dump	G3-O	1											1.0	low
Vangorda Main Sulphide Cell	V1-S				1								1.0	high
Vangorda Main Dump	V1-B			0.5	0.5								1.0	moderate
Barite Dump	V2				1								1.0	high
Overburden Dump	V3-O		0.9	0.1									1.0	low

Supporting information

Proportion of rock types					Tonnage	Average
sulphides	Non-Calc Phyl	Calc Phyl	OB	Empty	tonnes	Height (m)
100%					2,000,000	6
	15%	85%			13,000,000	15
	15%	85%			13,000,000	10
			100%			0
100%					2,600,000	14
	91%	9%			5,400,000	8
	100%				225,000	13
			100%		-	0

Table 4. Vangorda-Grum Future

Part 4 - Water Quality Estimates
Calculations are automatic

Source	Code	pH	Acidity mg/L	Alk mg/L	Cl mg/L	SO4 mg/L	Ca mg/L	Mg mg/L	K mg/L	Na mg/L	Al mg/L	Cd mg/L	Co mg/L	Cu mg/L	Fe mg/L	Pb mg/L	Mn mg/L	Ni mg/L	Zn mg/L
Grum Main Sulphide Cell	G1-S		968	16	3	1614	173	161	6	8	15	0.16	0.30	2	76	0.36	10	0.56	109
Grum Main Dump	G1-B		23	526	2	1093	323	205	7	10	0	0.01	0.01	0	0	0.05	0	0.38	3
Grum Southwest Dump	G2		14	385	2	507	193	101	4	5	0	0.01	0.01	0	0	0.05	0	0.15	1
Overburden Dump	G3-O		10	325	2	255	137	56	2	3	0	0.01	0.01	0	0	0.05	0	0.05	0
Vangorda Main Sulphide Cell	V1-S		6279	26	1	15482	432	1624	12	9	40	3.53	9.52	29	706	1.03	996	8.03	2948
Vangorda Main Dump	V1-B		3315	80	1	9180	392	999	10	8	20	1.82	5.44	14	373	0.55	532	5.30	1566
Barite Dump	V2		6279	26	1	15482	432	1624	12	9	40	3.53	9.52	29	706	1.03	996	8.03	2948
Overburden Dump	V3-O		56	487	2	1272	326	222	7	10	0	0.02	0.15	0	4	0.05	7	0.60	21

Part 5 - Load Estimates
Enter infiltration rates as percentage of Mean Annual Precipitation (see Project 1CD001.33)
Grum MAP = 350 mm
Vangorda MAP = 460 mm

Source	Code	Inf. %MAP	Acidity kg/yr	Alk kg/yr	Cl kg/yr	SO4 kg/yr	Ca kg/yr	Mg kg/yr	K kg/yr	Na kg/yr	Al kg/yr	Cd kg/yr	Co kg/yr	Cu kg/yr	Fe kg/yr	Pb kg/yr	Mn kg/yr	Ni kg/yr	Zn kg/yr
Grum Main Sulphide Cell	G1-S	45%	27,449	445	87	45,762	4,909	4,576	182	213	419	4.5	8.5	58.1	2,164	10.3	283	15.8	3,104
Grum Main Dump	G1-B	45%	1,611	36,866	148	76,596	22,660	14,393	498	728	14	0.7	0.8	0.7	2	3.5	7	26.6	208
Grum Southwest Dump	G2	45%	1,441	39,642	183	52,144	19,846	10,376	391	509	21	1.0	1.1	1.0	3	5.1	15	15.4	92
Overburden Dump	G3-O	45%	737	23,579	119	18,538	9,938	4,065	173	190	15	0.7	0.7	0.7	2	3.6	11	3.7	1
Vangorda Main Sulphide Cell	V1-S	45%	119,568	486	27	294,845	8,230	30,936	220	166	761	67.2	181.3	550.1	13,440	19.6	18,971	152.9	56,151
Vangorda Main Dump	V1-B	45%	224,670	5,396	74	622,143	26,534	67,723	697	573	1,364	123.2	368.9	979.3	25,282	37.5	36,036	359.1	106,152
Barite Dump	V2	45%	11,437	47	3	28,203	787	2,959	21	16	73	6.4	17.3	52.6	1,286	1.9	1,815	14.6	5,371
Overburden Dump	V3-O	45%	529	4,612	19	12,045	3,089	2,106	69	96	2	0.2	1.4	0.1	39	0.5	65	5.7	200

Supporting information

Area m2	Catchment
180,000	
444,810	
653,228	
460,740	
92,000	
327,397	
8,800	
45,755	