Faro Mine Complex
Mine Area Cover Optimization and Landform Engineering

2007/08 Task 26 - FINAL

Prepared for:

Deloitte and Touche Inc.

On behalf of

Faro Mine Closure Planning Office

Prepared by:

SRK Consulting
Engineers and Scientists

Project Reference Number
SRK 1CD003.102

July 2008

Faro Mine Complex

Mine Area Cover Optimization and Landform Engineering

2007/08 Task 26 - FINAL

Deloitte and Touche Inc.

Interim Receiver of Anvil Range Mining Corporation
Suite 1900, 79 Wellington Street West
Toronto, ON M5K 1B9

On behalf of

Faro Mine Closure Planning Office

SRK Consulting (Canada) Inc.
Suite 2200, 1066 West Hastings Street
Vancouver, B.C. V6E 3X2

Tel: 604.681.4196 Fax: 604.687.5532
Email: vancouver@srk.com Web site: www.srk.com

SRK Project Number 1CD003.102

July 2008

Executive Summary

The currently recommended closure options for the Faro and Vangorda/Grum areas require covering of all waste dumps with soil. This document summarizes the results of studies linked to cover design and optimization. General conclusions are provided below.

The cost-benefit analyses contained herein indicate that the construction of “low infiltration covers” on the mine area waste rock piles can result in significant savings in water treatment costs. If the low infiltration covers are constructed on areas that are high strength sources of contaminants, the savings in water treatment costs will be greater than the cost of the covers, and will result in a net savings in overall costs. This finding provides a clear direction for the design of the cover systems for the Faro and Vangorda/Grum areas. All high strength sources, such as sulphide cells and low grade ore stockpiles, should be covered by at least a low infiltration cover.

However, it would be incorrect to conclude that only “rudimentary covers” should be constructed on all other areas, for two reasons. First, the analysis did not account for the other benefits of thicker covers, such as enhanced potential for vegetation diversity. Second, the analyses did not consider the uncertainty in any estimates of future water quality and long-term cover performance. Those uncertainties would, in general, lead to recommendations for more conservative designs, i.e. covers that are better than the economic optimum.

The relocation of high strength sources of contaminants to other parts of the waste rock piles does not lead to compensating savings in water treatment costs. However, the cost-benefit ratio for relocation of the Medium Grade stockpile is close to unity, indicating that relocation of small high strength sources could result in a net savings if all uncertainties were taken into account. Any relocation of the larger sources would need to be justified on the basis of other benefits.

The re-sloping of parts of the dumps to “natural” slopes will be challenging, but analyses show that stable landforms can be designed within the re-sloping constraints. Tools for designing final landforms have been developed, and need to be calibrated with additional field investigations.

The cost-benefit calculations and design tools developed in this project provide a strong basis for further selection of cover and landform designs for each mine area. Other studies of re-vegetation possibilities and cover performance will contribute additional information that will need to be taken into account before final designs are selected.

* * *

Report Title:	Faro Mine Area Cover Optimization and Landform Engineering
Prepared by:	SRK Consulting Project 1CD003.102
Date Submitted:	July 2008
Supersedes:	Letter Report by BGC Engineering Inc., December 2007
Number of Pages:	26/ 58 (Body / Total report)
Number of attachment:	1

Table of Contents

List of Tables

List of Figures

List of Attachments

1 Introduction

The current recommended closure options for the Faro and Vangorda/Grum mine areas include a range of possible cover types, relocation variants, and re-sloping of the waste dumps to stable landforms. This document describes cost-benefit analyses of the cover type and relocation variants. It also assesses requirements for re-sloping and landform stability, and develops landform design tools for the mine area waste dumps. It is expected that the analyses and tools provided herein will provide a basis for the final selection of cover types, relocation variants and landform designs.

2 Cost-Benefit Analysis of Cover Variants

2.1 Methods

An increase to the soil cover thickness over the waste dumps increases the costs of the cover construction, as well as reduces the amount of infiltration through the cover. This reduction in infiltration will reduce the amount of seepage through the dumps, reducing the costs of water treatment over the long term. The objective of this cost-benefit analysis is to determine where the increase in cover thickness will provide an overall savings in total costs.

The soil cover types used in the analyses are the same as those described in Attachment C of the SRK Report "Options for Closure of the Faro Mine Complex" (February 2008). Table 1 below lists and briefly describes the types of soil covers.

Table 1: Types of Soil Covers

Category	Description
No Cover	• Un-covered rock surface allowed to weather and, if possible, re-vegetate naturally.
Rudimentary Covers	• Cover rock with the minimum thickness of soil needed to allow plant growth (0.5 m).
Low Infiltration Covers	• Cover rock with layers of soil to significantly reduce the amount of water entering the surface of the waste. • The cover used in the analysis was a "store and release" cover incorporating a compacted, low permeability, 0.5 m thick layer of till overlain by 1.0 m of uncompacted till.
Very Low Infiltration Covers	• Cover rock with layers of soil and/or synthetic materials to minimize the amount of water entering the surface of the waste. • The cover used in the analysis was a "store and release" cover as above except consisting of 1.0 m of compacted till, overlain by 1.5 m of uncompacted till.

Rudimentary covers were used as the base case for the cover optimization. For each dump area, the incremental cost of upgrading the covers was compared to the incremental benefit of the reduction in the net present value (NPV) of water treatment costs to determine the net benefit.

The following sections describe the methodology and assumptions used to determine each of these cost components. The cover types for each individual dump in the mine areas were then varied to determine the change of the overall NPV. Figures 1 and 2 outline the individual dump areas for the Faro and Vangorda/Grum areas, respectively.

2.2 Water Treatment Costs

Water quality estimates were derived for each scenario using the water quality prediction spreadsheet presented in the pending SRK report for 2007/08 Task 17B, Update Dump Water Quality Predictions. The water quality model allows the user to select a cover thickness for each individual mine area and to generate a set of water quality predictions. For each cover type, the model assumes an infiltration rate and a neutralization potential (NP) depletion rate, as presented in Table 2. In each case, twelve water quality estimates were derived for various years from Years 1 to 1000, to reflect the degradation of the dump water quality over time.

Table 2: Water Quality Model Assumed Cover Properties

Category	Infiltration Rate (% of MAP)	NP Depletion Rate
No Cover	45%	100%
Rudimentary Cover	25%	50%
Low Infiltration Cover	5%	10%
Very Low Infiltration Cover	2%	5%

Infiltration Rate = % of Mean Annual Precipitation (MAP)

The water quality results for the twelve cases from Year 1 to 1000 were then input to the Water Treatment Plant Capital and Operating Cost model spreadsheet, presented in the SRK report 1CD003.054, Water Treatment Requirements for the Anvil Range Site. The primary assumptions for estimating capital and operating costs were:

- Water treatment occurred year round;
- Quicklime will be supplied to the site at a cost of $373 per tonne;
- Flocculant costs of $6,000 per tonne;
- Labour costs of $30 per hour (2 employees, 40hr/week);
- Power costs $0.11 / kWh; and
- 35% overhead rate.

The metal concentrations are calculated independently of pH, but pH is required as an input to the treatment cost model. A pH value of 3, 5 or 7 was assigned to each year based on the sludge generation rate calculated from the metal concentrations, as shown in Figure 3.

In each of the twelve cases, the water quality results generated a capital cost, an operating cost, and the amount of sludge produced for that given year. The capital cost used in the water treatment NPV calculations was the cost for a treatment plant needed to treat the Year 100 flows and water quality.

The total yearly operating cost included a capital replacement cost. The capital replacement cost was assumed to be the cost of the Year 100 plant divided over a period of thirty years.

The Net Present Values were then obtained by interpolating the yearly operating costs for the twelve cases between Years 1 and 1000 and adding the plant capital cost in Year 1. A discount rate of 3% per annum was adopted in all NPV calculations. A summary of the water treatment costs is provided in Attachment 1.

2.3 Sludge Disposal Costs

Cumulative sludge volumes were generated for each water treatment simulation to Year 1000. For the base case simulation, the total sludge volumes generated were 11,350,000 m^3 for the Faro Mine Area and 2,194,000 m^3 for the Vangorda-Grum Mine Area. All sludge volumes generated, even for the rudimentary covers, can be disposed of in the pits. As a result, sludge disposal costs were not included in the cover optimization.

The volume available for sludge in the Faro pit is estimated as 12,000,000 m^3 in the case of complete tailings relocation with the Plug Dam. The decision to construct the Plug Dam is dependant on the alternative chosen for the Rose Creek Tailings Area. If the complete tailings relocation alternative is chosen, the plug dam is required regardless of the sludge volumes. If the partial relocation alternative is chosen, then there is sufficient storage capacity (23,400,000 m^3) for the sludge volumes, even in the base case simulation that the plug dam will not be required.

The volume available for storage in the Grum Pit is estimated to be greater than 7,000,000 m^3, which is significantly larger than the sludge volume generated in the base case simulation.

2.4 Cover Construction Costs

Cover construction costs were prepared for each of the individual dumps. The cover construction costs include relocating and placing cover material from the Grum Overburden Dump plus the cost of compaction as necessary. Table 3 below shows the three cover types as well as the compaction requirements for each cover.

Table 3: Cover Types

Cover Type	Cover Description	Compacted Lift Thickness
Rudimentary Cover	0.5 m of uncompacted till	N/A
Low Infiltration Cover	0.5 m of compacted till overlain by 1.0 m of uncompacted till	0.25 m (2 lifts)
Very Low Infiltration Cover	1.0 m of compacted till overlain by 1.5 m uncompacted till	0.25 m (4 lifts)

2.4.1 Quantities

The thicknesses of each cover type are shown in Table 3 above. The dump areas were obtained from topographical maps. For each dump, areas were obtained for the flat surfaces and the sloped surfaces. All dumps were assumed to be regraded to 3H:1V. The sloped surface areas were assumed to increase by 5% due to the regrading.

2.4.2 Unit Cost Inputs

Equipment Rates

Equipment rates used in the estimates were obtained from the BC Blue Book, an equipment rental rate guide produced by the British Columbia Road Builders & Heavy Construction Association. The equipment rates included ownership, maintenance and repair costs only. The rates do not include operator costs, fuel costs, overhead or profit (these were added in subsequent steps).

Fuel

A fuel cost of $1.30 per litre was used throughout the cost estimate.

Equipment fuel rates used in the estimates were derived based on the equipment horse power, obtained from the Caterpillar Performance Handbook. The equation used to calculate the fuel rate is:

Fuel Rate ($/hr) = HP x FF x Fuel Cost per Liter
where: HP = horsepower
FF = Fuel Factor (Liter/hr/HP)

The fuel factors for each type of equipment represent the average fuel consumed per hour per horsepower. The fuel factors used in determining the fuel costs were as follows:

Table 4: Equipment Fuel Factors

Equipment Type	Fuel Factors (L/hr/HP)	Source
Excavators	0.130	CAT Handbook
Loaders	0.121	CAT Handbook
Dozers	0.135	CAT Handbook
Trucks	0.065	CAT Handbook
Compactors	0.130	CAT Handbook

Labour Rates

Labour rates were obtained from the Yukon Government Fair Wage Schedule published in April 2007.

2.4.3 Relocation Unit Costs

A spreadsheet was prepared to derive the unit costs which followed standard estimation procedures, such as are used by earthwork contractors. The calculations make use of equipment specifications obtained from manufacturer's data, in this case the Caterpillar Handbook. A summary of the relocation unit rates are provided in Attachment 1.

Equipment Selection

For all cover construction and relocation variants, CAT 777 trucks were assumed to be used and loaded by a CAT 992 loader. CAT D11 dozers were assumed to be used to spread material and assist the loader.

In general, relocation unit costs are optimized when enough trucks are used to keep the loader at constant operation with no stand-by time. In some cases, this may result in an optimized truck number greater than the amount of trucks available on-site. For the purpose of this cost estimate, the CAT 777 truck fleet was capped at 8 trucks.

Haul Routes

All cover materials were assumed to originate from the Grum Overburden Dump. For the haul routes to each individual dumps, grades and distances were obtained from topographic plans using existing roads.

Material Properties

The till material properties used in the productivity calculations assumed the following properties:

Table 5: Cover Material Properties

	Bulk Density (Mg/m^3)	Bulking Factor	Excavated Density (Mg/m^3)	Shrinkage Factor	Compacted Density (Mg/m^3)
Till	1.84	1.2	1.53	0.9	2.04

Relocation Unit Rate Calculations

Relocation productivities were calculated using the material properties, haul route characteristics and equipment performance data from the Caterpillar Handbook. The calculations used to convert the productivity estimates and unit rate inputs into relocation rates for each category are:

- Equipment Cost ($/Bank-m^3) is calculated as the sum of the equipment hourly rates divided by the bank material productivity (Bm^3/hr).
- The fuel cost ($/Bm^3) is calculated as the sum of the hourly fuel costs for each piece of equipment divided by the bank material productivity (Bm^3/hr).
- The labor cost ($/Bm^3) is calculated as the sum of the operator rates for each piece of equipment divided by the bank material productivity (Bm^3/hr).
- The man-hours per bank-volume of material moved assumes one operator per piece of equipment and is equal to the sum of pieces equipment used divided by the bank material productivity (Bm^3/hr).
- The Total Bank Unit Rate ($/Bm^3) is equal to the sum of the equipment, fuel and operator costs.

Compaction Costs

Compaction costs were prepared for both flat and sloped surfaces. Compaction was assumed to be completed with a CAT CP563 compactor with a single operator. The productivity (m^2/hr) for the flat surfaces was obtained from equipment performance data from the Caterpillar Handbook. The productivity for the sloped surfaces was assumed to be one half of the flat surface productivity.

The compaction unit rate ($/m^2) for both flat and sloped areas are equal to the sum of the equipment and operator costs divided by the respective productivity (m^2/hr). The compaction cost therefore equals the cover area times the number of compacted lifts times the compaction unit rate.

2.5 Results

Table 6 on the following page provides the results of the cost-benefit analysis. For each dump area, the table lists the incremental costs, incremental benefits and the resulting net benefit for each of the following:

- Upgrading of rudimentary covers to low infiltration covers;
- Upgrading of low infiltration covers to very low infiltration covers; and
- Upgrading of rudimentary covers to very low infiltration covers.

Also listed for each comparison is the benefit-cost ratio (BCR), which is equal to the incremental benefit, divided by the incremental cost. The highlighted cells in the table indicate the upgrades for which the benefits are greater than the costs, i.e. BCR >1.

Table 6: Mine Area Cover Cost-Benefit Results

Variants		Upgrade Rudimentary to Low Infiltration Covers				Upgrade Low Infiltration to Very Low Infiltration Covers				Upgrade Rudimentary to Very Low Infiltration Covers			
		Incremental Cost	Incremental Benefit	Net Benefit	BCR	Incremental Cost	Incremental Benefit	Net Benefit	BCR	Incremental Cost	Incremental Benefit	Net Benefit	BCR
Faro Valley North	FVN	$1,654,000	$235,000	($1,419,000)	0.14	$1,654,000	$19,000	($1,635,000)	0.01	$3,307,000	$254,000	($3,053,000)	0.08
Faro Valley South	FVS	$398,000	$21,000	($377,000)	0.05	$398,000	$6,000	($392,000)	0.02	$795,000	$27,000	($768,000)	0.03
Medium Grade Stockpile	MGSP	$262,000	$334,000	$72,000	1.27	$262,000	$62,000	($200,000)	0.24	$524,000	$396,000	($128,000)	0.76
Crusher Stockpile	CHSP	$264,000	$204,000	($60,000)	0.77	$264,000	$33,000	($231,000)	0.13	$528,000	$237,000	($291,000)	0.45
Oxide Fines Stockpile	OXSP	$410,000	$210,000	($200,000)	0.51	$410,000	$57,000	($353,000)	0.14	$821,000	$267,000	($554,000)	0.33
Low Grade Stockpile A	LGSPA	$361,000	$288,000	($73,000)	0.80	$361,000	$36,000	($325,000)	0.10	$722,000	$324,000	($398,000)	0.45
Upper Northwest Dump	NWU	$1,548,000	$1,000	($1,547,000)	0.00	$1,548,000	$0	($1,548,000)	0.00	$3,097,000	$1,000	($3,096,000)	0.00
Middle Northwest Dump	NWM	$1,896,000	$1,000	($1,895,000)	0.00	$1,896,000	$0	($1,896,000)	0.00	$3,792,000	$1,000	($3,791,000)	0.00
Lower Northwest Dump	NWL	$1,447,000	$2,000	($1,445,000)	0.00	$1,447,000	$0	($1,447,000)	0.00	$2,893,000	$2,000	($2,891,000)	0.00
Mt. Mungly West	MMW	$347,000	$338,000	($9,000)	0.97	$347,000	$1,000	($346,000)	0.00	$694,000	$339,000	($355,000)	0.49
Mt. Mungly East	MME	$544,000	$294,000	($250,000)	0.54	$544,000	$0	($544,000)	0.00	$1,087,000	$294,000	($793,000)	0.27
Fuel Tank Dump W	FTW	$103,000	$0	($103,000)	0.00	$103,000	$0	($103,000)	0.00	$206,000	$0	($206,000)	0.00
Fuel Tank Dump E	FTE	$1,195,000	$21,000	($1,174,000)	0.02	$1,195,000	$0	($1,195,000)	0.00	$2,389,000	$21,000	($2,368,000)	0.01
Upper Parking Lot Dump	UPL	$579,000	$0	($579,000)	0.00	$579,000	$0	($579,000)	0.00	$1,159,000	$0	($1,159,000)	0.00
Lower Parking Lot Dump	LPL	$316,000	$0	($316,000)	0.00	$316,000	$0	($316,000)	0.00	$631,000	$0	($631,000)	0.00
Stock Piles Base	SPB	$920,000	$21,000	($899,000)	0.02	$920,000	$0	($920,000)	0.00	$1,839,000	$21,000	($1,818,000)	0.01
Southwest Pit Wall Dump	SWPWD	$858,000	$1,296,000	$438,000	1.51	$858,000	$3,000	($855,000)	0.00	$1,715,000	$1,299,000	($416,000)	0.76
Low Grade Stockpile C	LGSPC	$400,000	$518,000	$118,000	1.30	$400,000	$99,000	($301,000)	0.25	$800,000	$617,000	($183,000)	0.77
Main East Sulphide Cell	MESC	$849,000	$2,863,000	$2,014,000	3.37	$849,000	$357,000	($492,000)	0.42	$1,698,000	$3,220,000	$1,522,000	1.90
Intermediate Dump Sulphide Cell	IDSC	$890,000	$3,331,000	$2,441,000	3.74	$890,000	$453,000	($437,000)	0.51	$1,781,000	$3,784,000	$2,003,000	2.12
Ranch Dump	RD	$472,000	$1,000	($471,000)	0.00	$472,000	$0	($472,000)	0.00	$943,000	$1,000	($942,000)	0.00
Ramp Zone Dump	RZD	$782,000	$1,000	($781,000)	0.00	$782,000	$0	($782,000)	0.00	$1,565,000	$1,000	($1,564,000)	0.00
Main Dump West	MDW	$2,429,000	$76,000	($2,353,000)	0.03	$2,429,000	$1,000	($2,428,000)	0.00	$4,858,000	$77,000	($4,781,000)	0.02
Main Dump East	MDE	$4,386,000	$121,000	($4,265,000)	0.03	$4,386,000	$2,000	($4,384,000)	0.00	$8,773,000	$123,000	($8,650,000)	0.01
Intermediate Dump	ID	$3,743,000	$95,000	($3,648,000)	0.03	$3,743,000	$2,000	($3,741,000)	0.00	$7,485,000	$97,000	($7,388,000)	0.01
Outer Haul Road West	OHRW	$1,999,000	$1,000	($1,998,000)	0.00	$1,999,000	$0	($1,999,000)	0.00	$3,999,000	$1,000	($3,998,000)	0.00
Outer Haul Road East	OHRE	$892,000	$105,000	($787,000)	0.12	$892,000	$0	($892,000)	0.00	$1,784,000	$105,000	($1,679,000)	0.06
Lower Northeast sulphide cell	NELS	$186,000	$563,000	$377,000	3.03	$186,000	$85,000	($101,000)	0.46	$373,000	$648,000	$275,000	1.74
Outer Northeast Dump	NEO	$198,000	$0	($198,000)	0.00	$198,000	$0	($198,000)	0.00	$396,000	$0	($396,000)	0.00
Zone II West	ZIIW	$967,000	$1,000	($966,000)	0.00	$967,000	$0	($967,000)	0.00	$1,933,000	$1,000	($1,932,000)	0.00
Zone II East	ZIIE	$1,566,000	$1,000	($1,565,000)	0.00	$1,566,000	$0	($1,566,000)	0.00	$3,132,000	$1,000	($3,131,000)	0.00
Lower Northeast Dump	NEL	$3,276,000	$2,000	($3,274,000)	0.00	$3,276,000	$4,000	($3,272,000)	0.00	$6,553,000	$6,000	($6,547,000)	0.00
Upper Northeast Dump	NEU	$3,285,000	$2,000	($3,283,000)	0.00	$3,285,000	$4,000	($3,281,000)	0.00	$6,570,000	$6,000	($6,564,000)	0.00
Grum Main dump Sulphide Cell	G1-S	$431,000	$2,220,000	$1,789,000	5.15	$431,000	$49,000	($382,000)	0.11	$863,000	$2,269,000	$1,406,000	2.63
Grum Dump	G1-B	$5,169,000	$1,008,000	($4,161,000)	0.20	$5,169,000	$149,000	($5,020,000)	0.03	$10,337,000	$1,157,000	($9,180,000)	0.11
Southwest Grum Dump	G2	$828,000	$54,000	($774,000)	0.07	$828,000	$12,000	($816,000)	0.01	$1,655,000	$66,000	($1,589,000)	0.04
Vangorda Main Dump Sulphide Cell	V1-S	$274,000	$2,126,000	$1,852,000	7.76	$274,000	$304,000	$30,000	1.11	$548,000	$2,430,000	$1,882,000	4.43
Vangorda Main Dump	V1-B	$2,042,000	$2,387,000	$345,000	1.17	$2,042,000	$388,000	($1,654,000)	0.19	$4,084,000	$2,775,000	($1,309,000)	0.68
Vangorda Barite Dump	V2	$34,000	$151,000	$117,000	4.44	$34,000	$46,000	$12,000	1.35	$68,000	$197,000	$129,000	2.90

In general, the results show that low infiltration covers pay for themselves in NPV terms when they are applied to higher strength sources, i.e. sources with abundant sulphides. Very low infiltration covers nearly pay for themselves when applied to the very high strength sources.

For the Faro Mine area, for all cases where an increased cover thickness provided a net benefit, the low infiltration cover provided the highest benefit-cost ratio. The upgrading of low infiltration covers to very low infiltration covers did not provide a positive net benefit. However, for all three sulphide cells, the very low infiltration covers provided positive net benefits compared to the rudimentary covers.

In the Vangorda/Grum area, the low infiltration cover provided the highest BCR, with the exception of the Grum Dump and Southwest Grum Dump where all BCR's were less than one (i.e. the rudimentary covers are optimal). Similar to the Faro Mine area, low infiltration covers on the sulphide cells (and barite dump) at Vangorda provided positive net benefits compared to the rudimentary covers.

Figures 1 and 2 plot the locations where upgraded covers provided a net savings in total cost. Areas where the low infiltration covers provide a net savings are shown in green, and areas where the very low infiltration areas show a net savings are shown in blue. In cases where both the low and very low infiltration covers provided a net savings, very low infiltration covers are shown in the figures.

Figure 4 plots an example 50-year cash flow for the upgrading of a rudimentary cover on the Main East Sulphide Cell to a low infiltration cover. The initial cost in year 0 is equal to the cost difference between the rudimentary and low infiltration cover construction ($849,000). The yearly cost savings are due to the yearly savings in the operating cost of the water treatment plant. The undiscounted payback period for this example is 13 years.

Using the cover types illustrated in Figures 1 and 2, Table 7 below lists the total cover construction costs and the associated water treatment NPV for each mine area.

Table 7: Optimized Cover and Water Treatment Costs

Mine Area	Component	Cost
Faro	Cover Cost	$24,384,000
	Water Treatment NPV	$22,107,000
	Total	$46,491,000
Vangorda/Grum	Cover Cost	$7,507,000
	Water Treatment NPV	$13,573,000
	Total	$21,080,000

3 Cost-Benefit Analysis of Relocation Variants

3.1 Methods

Error! Reference source not found. below lists the relocation variants, which compared the costs of covering various dumps in place to the costs of relocation/consolidation to other areas. Each option was evaluated using the methodology described in Section 2.1. For each case, the seepage in the area from which the material was relocated was assumed to not require treatment. In the area to which the material is relocated, the seepage was assumed exhibit the water quality from the host material.

Table 8: Summary of Closure Option Variants

Mine Area	Variant		Option 1	Option 2
Faro	1	Lower Northeast Sulphide Cell	Cover in Place	Relocate to Main Sulphide Cell
	2	Medium Grade Stockpile	Cover in Place	Consolidate and Cover
	3	Faro Valley North Dump	Cover in Place	Relocate to Main Sulphide Cell
Vangorda/Grum	1	Ore Transfer Pad	Cover in Place	Relocate to Grum Sulphide Cell

The Lower Northeast Sulphide Cell variant compares covering the dump in place with a very low infiltration cover versus relocating the cell to the Main Sulphide Cell where a very low infiltration cover is placed and placing a rudimentary cover over the Lower North East Sulphide Cell location.

The Medium Grade Stockpile variant was also originally to include the Crusher Stockpile, Oxide Fines Stockpile and Low Grade Stockpile A, but as the upgrading of these cover areas did not provide a net benefit so they were excluded from the analysis.

The Faro Valley North Dump variant compares covering the dump in place with a rudimentary cover versus relocating the dump to the Main Sulphide Cell and no cover being placed at the Faro Valley North Dump location.

In all cases, relocated materials were assumed to be neutralized with lime at an application rate of 0.017 tonnes $Ca(OH)_2$ per m^3 of relocated material. The lime application rate was previously calculated by SRK as the average lime demand for the waste rock material. Lime was added at a unit rate of $323.81 per tonne of $Ca(OH)_2$.

3.2 Results

Table 9 provides the results of the cost-benefit analysis for the relocation variants. For each variant, the table lists the costs, benefits and the resulting benefit-cost ratio for relocating the materials in each area versus covering in place. The total costs for the relocation options include the cost of relocating the material and lime addition. The benefits of relocating the materials are the reduction in cover costs and the reduction in the water treatment NPV.

Table 9: Closure Option Variant Results

	Costs			Benefits			
Closure Option Variant	**Relocation Cost**	**Lime Addition Cost**	**Total Costs**	**Reduction in Cover Costs**	**Reduction in Water Treatment NPV**	**Total Benefits**	**BCR**
Relocate North East Sulphide Cell to Main Sulphide Cell	$3,743,000	$5,945,000	$9,688,000	$373,000	$30,000	$403,000	0.04
Relocate Medium grade Stockpile to LGSP C	$222,000	$402,000	$624,000	$262,000	$169,000	$431,000	0.69
Relocate Faro Valley Dumps to Main Sulphide Cell	$3,587,000	$5,085,000	$8,672,000	$804,000	$213,000	$1,017,000	0.12

No water treatment costs were able to be derived for relocation of the Ore Transfer Pad. Both closure options for the Vangorda/Grum area call for the top portion (5 m) of one half of the total area to be relocated to the Grum Sulphide Cell (or Vangorda Pit) and rudimentary cover to be constructed. The cost for the cover placement is estimated at $286,060. The cost for the relocation of the pad to the Grum Sulphide Cell is estimated at $2,882,000. Therefore the total cost for relocated the Ore Transfer Pad material is $3,168,060. If the material was to be left in place, the cost for the placement of a very low infiltration cover is estimated at $1,528,000. The difference between these two options is therefore $1,640,060. Based on the results shown in **Error! Reference source not found.**, the water treatment NPV savings for the relocation is unlikely to exceed the difference in the two options presented for the Ore Transfer Pad.

In all cases, relocation leads to an overall increase in total costs.

4 Assessment of Landform Requirements

4.1 Methods

The Anvil Range Mining Complex covers an area of more than 20 km^2. Numerous artificial landforms have been formed over the life of the three mines; most notable ones being the waste rock dumps, the tailings impoundment, and the open-pits (Figure 5).

A diverse list of design issues should be addressed during landform engineering to ensure that landform performance will sustain proposed end land uses and equivalent capability (CEMA-RWG, 2005). Here, two important issues were tackled: re-sloping of current waste rock dump slopes and hydrological considerations for new landforms. Landform engineering principles outlined in the “Faro Landform Design Workshop” held by BGC Engineering in November 22, 2007 were taken as a guide. In addition, the following documents were consulted during the work:

- Landscape Design Checklist, Revised RSDS Government Regulator Version, May 2005, CEMA-RWG Landscape Design Subgroup.

- Letter Report “Opportunities for Landform Design and Landform Grading for the Faro Project”, December 2007, BGC Engineering Inc.

Mine waste rock dumps are present at each of the Faro, Grum, and Vangorda mine areas (Figure 5). A number of zones were selected at each area for re-sloping analysis. Selection of these zones was based on the level of challenge they pose in terms of reclamation. The focus was on potentially more problematic areas. For example, slopes on a steep topography in the vicinity of a creek pose more challenges than a waste dump slope located on a flatter topography away from a creek. A total of 14 zones were generated as examples; six at Faro, three at Grum, and five at Vangorda. A representative section was created for each zone and four different scenarios of re-sloping were considered for each section: 1V:2.5H, 1V:3H, 1V:3.5, and 1V:4H. Crest and toe displacements for each case were calculated and plotted. For each zone, a cost estimate was produced for each re-sloping scenario. The cost estimates assume a CAT D10 type dozer pushing material downslope from the crest. The results of cost estimates are presented in Section 4.2.4.

Surface water management is a factor that has an impact on the design of new landforms. Hydrologic analyses were carried out to identify the characteristics of till slopes and catchments and what they indicate relative to the performance of the new landforms. Air photos were assessed to relate gully formation to slope gradients and slope lengths. Peak 1-in-100 year flows were calculated and channel design requirements were analyzed based on watershed sizes and ground slopes. Certain assumptions had to be made in these analyses. To estimate the effects of water flowing down the re-graded slopes, a curve was generated which describes the relationship between the slope angle and the flow path length associated with the onset of gully formation. Air photos from various locations within the site were analyzed to develop this curve. Details of this analysis are described in Section. 4.3.1. A second curve was developed relating the drainage area to the maximum slope along the flow path, to evaluate whether drainage channels will need to be lined or whether they can simply be vegetated earth channels. Manning’s equation was used in this analysis. The resulting curve and discussion are presented in Section 4.3.2.

4.2 Re-sloping Analysis

A total of 14 slope zones were analyzed. These zones were chosen based on the criteria described earlier. Table 10 gives a list of the selected zones and Figures 6 to 11 show the selected zones at each waste dump site and representative cross section of each zone. Zones selected at Faro are labelled F-1, F-2, etc., zones selected at Grum are labelled G-1 G-2, etc. and zones selected at Vangorda are labelled V-1, V-2, etc.

Table 10: List of Identified Zones for example Landform Engineering

Site	Zone ID	Waste Dump ID	Waste Dump Name	Reference Figure
Faro	F-1	NEU	Upper Northeast Dump	Figure 6 Figure 7
	F-2	NEU	Upper Northeast Dump	
	F-3	NEL	Lower Northeast Dump	
	F-4	Z II E	Zone II East	
	F-5	OHRE, ID	Outer Haul Road East, Intermediate Dump	
	F-6	OHRW	Outer Haul Road West	
Grum	G-1	G1-B	Grum Dump	Figure 8 Figure 9
	G-2	G1-B	Grum Dump	
	G-3	G1-B	Grum Dump	
Vangorda	V-1	V1-B	Vangorda Main Dump	Figure 10 Figure 11
	V-2	V1-B	Vangorda Main Dump	
	V-3	V1-B	Vangorda Main Dump	
	V-4	V1-B	Vangorda Main Dump	
	V-5	V1-B	Vangorda Main Dump	

The zones shown in Table 10 were re-sloped to four different grades (1V:2.5H, 1V:3H, 1V:3.5, and 1V:4H) if the original slope in question was steeper than 1V:2.5H. The following sections describe the re-grading analysis at each site.

4.2.1 Faro

A total of six zones were analyzed at the Faro dump site. The west end of the dump site was the focus as waste rock slopes and the original topography at this end are steep and creeks, including mainly the North Fork of Rose Creek (NFRC), are in close proximity to the dump toe. The zones and corresponding representative sections are labelled F-1 through F-6. Toe and crest displacements required to maintain the four re-sloping scenarios for each zone are shown in Figure 12.

Zone F-1:

Zone F-1 has an original representative slope angle of 30 degrees (1V:1.75H), an original dump height of 88 m, and a crest length of 188 m. Any re-sloping shallower than 1V:3H will move the toe into the east-west extending creek known as the Faro Creek diversion. (Figure 12). A 1V:3H or 1V:2.5H re-sloping can be carried out in this zone.

Zone F-2:

Zone F-2 has an original representative slope angle of 34 degrees (1V:1.5H), an original dump height of 68 m, and a crest length of 221 m (Figures 6 and 7). All re-sloping scenarios are possible at this zone.

Zone F-3:

Zone F-3 has an original representative slope angle of 33 degrees (1V:1.5H), an original dump height of 75 m, and a crest length of 460 m (Figures 6 and 7). All re-sloping scenarios are possible at this zone. However it is likely that the new slope will partially overrun the downstream creek (the NFRC) if a 1V:4H slope is maintained.

Zone F-4:

Zone F-4 has an original representative slope angle of 36 degrees (1V:1.4H), an original dump height of 52 m, and a crest length of 271 m (Figures 6 and 7). A 1V:2.5H or 1V:3H re-sloping is possible in this zone. Any shallower slope than 1V:3H will affect the NFRC unless the whole slope is pushed back.

Zone F-5:

Zone F-5 has an original representative slope angle of 35 degrees (1V:1.4H), an original dump height of 48 m, and a crest length of 400 m (Figures 6 and 7). At this zone re-sloping can be carried out at 1V:2.5H, 1V:3H, and 1V:3.5H. The toe moves right onto the NFRC if a 1V:4H slope is maintained. In addition, for a 1V:4H slope, the zone has to include the upper bench of 20 m of waste rock as well.

Zone F-6:

Zone F-6 has an original representative slope angle of 35 degrees (1V:1.4H), an original dump height of 40 m, and a crest length of 430 m (Figures 6 and 7). At this zone, re-sloping can be carried out at 1V:2.5H, 1V:3H, and 1V:3.5H. The toe reaches the NFRC if a 1V:4H slope is maintained.

4.2.2 Grum

Three zones were analyzed at Grum dump site. The west and southwest edges of the dump site were the focus as there are a number of creeks located close to current waste rock toe locations within this area. Zones and corresponding representative sections are labelled G-1 through G-3. Toe and crest displacements required to maintain the four re-sloping scenarios for each zone are shown in Figure 13.

Zone G-1:

Zone G-1 has an original representative slope angle of 27 degrees (1V:2H), an original dump height of 20 m, and a crest length of 567 m. This zone can be re-sloped to 1V:2.5H, however shallower slope options are not possible unless the slope is pushed back.

Zone G-2:

Zone G-2 has an original representative slope angle of 32 degrees (1V:1.6H), an original dump height of 38 m, and a crest length of 190 m. All of the four re-sloping options are feasible at this zone.

Zone G-3:

Zone G-3 has an original representative slope angle of 33 degrees (1V:1.5H), an original dump height of 28 m, and a crest length of 395 m. Like G-2, all of the four re-sloping options are feasible.

4.2.3 Vangorda

Five zones were analyzed at Vangorda dump site. One of the zones, Zone V-1, coincides with the part of the waste dump where re-sloping had already been carried out for trial waste cover work. This part of the dump has an original slope of 1V:3H. Toe and crest displacements required to maintain the four re-sloping scenarios for each zone (where applicable) are shown in Figure 14.

Zone V-1:

Zone V-1 has an original representative slope angle of 18 degrees (1V:3H), an original dump height of 48 m, and a crest length of 197 m. Re-sloping to 1V:3.5H or 1V:4H is possible without affecting any of the surrounding creeks.

Zone V-2:

Zone V-2 has an original representative slope angle of 20 degrees (1V:2.7H), an original dump height of 60 m, and a crest length of 132 m. Re-sloping to 1V:3H, 1V:3.5H or 1V:4H is possible without affecting any of the surrounding creeks.

Zone V-3:

Zone V-3 has an original representative slope angle of 16 degrees (1V:3.5H), an original dump height of 20 m, and a crest length of 148 m. This zone can be re-sloped to 1V:4H if needed.

Zone V-4:

Zone V-4 has an original representative slope angle of 27 degrees (1V:2H), an original dump height of 18 m, and a crest length of 326 m. This zone can be re-sloped to 1V:2.5H, 1V:3H or 1V:3.5H. It is possible to re-slope this zone such that it combines with Zone V-3 to form a single slope. This can be done if Zone V-4 is re-sloped to 1V:3.5H.

Zone V-5:

Zone V-5 has an original representative slope angle of 19 degrees (1V:2.9H), an original dump height of 16 m, and a crest length of 542 m. This zone can be re-sloped to 1V:3.5H or 1V:4H without impacting any of the creeks.

4.2.4 Landform Grading Cost Estimates

Cost estimates were prepared for re-sloping the identified zones. In the cost estimates, all four re-sloping options were taken into account where possible. It is assumed that a CAT D10 type dozer will re-slope the dump faces by pushing material from the crest down towards the toe area. This process is repeated in layers until the desired slope angle is achieved. There is a material balance between the pushed material on the crest and the deposited material at the toe. Therefore no additional material is required for re-sloping.

For the cost estimate, dozer performance is calculated in terms of hours per unit width of crest, which is then applied to whole crest length along which material will be pushed. The unit rate for the dozer was derived using the same methodology as in Section 2.4.2. Table 11 gives the cost estimate for re-sloping the identified zones.

Table 11: Re-sloping Cost Estimate

Waste Dump Site	Section/ Zone ID	Original Slope (degrees)	Original Height (m)	Crest Length (m)	Dozer Hours for Re-Grading Options (along total crest length)				Cost* (CAD $)			
					1V:2.5H	1V:3H	1V:3.5H	1V:4H	1V:2.5H	1V:3H	1V:3.5H	1V:4H
Faro	F-1	30	88	188	612	1559	2976	5037	$202,000	$515,000	$983,000	$1,664,000
Faro	F-2	34	68	221	580	1220	2106	3277	$191,000	$403,000	$696,000	$1,082,000
Faro	F-3	33	75	460	1431	3138	5549	8805	$473,000	$1,037,000	$1,833,000	$2,908,000
Faro	F-4	36	52	271	407	783	1305	1961	$135,000	$259,000	$431,000	$648,000
Faro	F-5	35	48	400	450	867	1453	2199	$149,000	$286,000	$480,000	$726,000
Faro	F-6	35	40	431	305	562	925	1390	$101,000	$186,000	$306,000	$459,000
Grum	G-1	27	20	567	31	58	89	130	$10,000	$19,000	$29,000	$43,000
Grum	G-2	32	38	190	94	179	300	463	$31,000	$59,000	$99,000	$153,000
Grum	G-3	33	28	395	154	261	413	609	$51,000	$86,000	$136,000	$201,000
Vangorda	V-1	18	48	197	N/A	N/A	69	175	N/A	N/A	$23,000	$58,000
Vangorda	V-2	20	60	132	N/A	43	151	355	N/A	$14,000	$50,000	$117,000
Vangorda	V-3	16	20	148	N/A	N/A	N/A	40	N/A	N/A	N/A	$13,000
Vangorda	V-4	27	18	326	N/A	39	58	84	N/A	$13,000	$19,000	$28,000
Vangorda	V-5	19	16	542	N/A	N/A	8	15	N/A	N/A	$3,000	$5,000
								Total	*$1,342,000*	*$2,877,000*	*$5,087,000*	*$8,105,000*

N/A: Re-grading option not applicable

* Unit rate for a CAT D10 type dozer taken as $330.30 per hour.

4.3 Surface Water Management Analysis

Surface water management is an important aspect of landform engineering. Surface water run-off resulting from storm events has the potential to cause considerable erosion if not managed. The objective of this section is to define surface water management guidelines that can be used in engineering new waste dump landforms at the Faro mine. Analyses made here apply to slopes and watersheds of till cover material.

Two graphical tools were developed to assist landform design from a hydrological viewpoint. The first tool helps identify gully formation (its presence or absence) based on slope angle and maximum overland flow length along the slope face. Photographs from the site (aerial and ground photos) were investigated to develop this graphical tool. The analysis is described in Section 4.3.1. The second graphical tool defines armouring requirements in drainage channels based on watershed size and ground slope. The rational method and Manning's equation were used to develop the relationship. Details of this analysis are presented in Section 4.3.2.

Based on information obtained from the generated graphical tools, a conceptual surface water drainage design is presented (Section 4.3.3).

4.3.1 Photo Analysis

Gully erosion starts to occur when water velocities exceed a threshold value based on covers and vegetation. A graphical tool can be generated which defines gully formation as a function of slope angle and maximum overland path length.

Signs of erosion (namely gullies) on current till slopes were investigated using aerial and surface photographs of the site. Photos taken by helicopter by site staff on 9/06/2004 and ground photographs of till slopes were investigated to search for signs of slope erosion features. Seven photographs were used as distinct examples in generating a relationship for gully formation along Faro till slopes. Six photographs from Grum Till Dump and one photograph from Vangorda Till Slope were analyzed and a gully formation curve was produced. Figure 15 shows the resulting curve based on photographic analysis and Figure 16 shows the seven photographs used in the analysis. It is important to note that the slopes investigated are not vegetated and they are subject to run-off from the catchment above the slope. Due to these reasons, Figure 15 should be used as an estimation tool only.

Gullies were observed on four of the slopes (Photographs 1, 2, and 3 in Figure 16) and no gullies were observed along the rest of the slopes (Photographs 4, 5, 6, and 7 in Figure 16). The photographs confirm that the steeper the slope or longer the flow path (or the combination of the two), the greater are the chances of gully formation. Figure 15 shows that for 1V:3H slopes (33%) the maximum slope length should be kept at 55m to avoid the potential formation of gullies.

The photographic analysis is a poor surrogate for actual field investigation. To confirm and/or improve the graphical tool developed in this report, the till slopes need to be further investigated in the field.

4.3.2 Channel Armouring

The channel armouring requirement is related to the flow velocity of water in the channel. For vegetated channels, typical limiting velocities are 1 to 2 m/s. At velocities higher than 2 m/s, armouring (e.g. rock armour) is required to prevent channel erosion.

A number of watershed scenarios were considered to develop a relationship between watershed size/ground slope and channel armouring needs. For each scenario, the peak 1-in-100 year flow was calculated using the rational method. Intensity data for the calculations was obtained from the Carmacks IDF (Intensity-Duration-Frequency) curve. The peak flows were then converted into velocities assuming a conceptual channel design, and the resulting velocities were checked against limiting values. The watershed scenarios are listed in Table 12.

Table 12: Watershed Scenarios

Slope (%)	Watershed Area (ha)
2	3, 10, 30, 100
5	3, 10, 30, 100
20	1, 3, 5, 7, 9, 10, 100
33	1, 3, 5, 7, 9, 10, 100

There are two assumptions in the analysis:

- The Mannings ‘n’ value was assumed to be 0.05 in all calculations, which is suitable for vegetated channels, but not suitable for armoured channels. However, since the objective of the analysis was to find out the limiting design configuration for vegetated channels, the use of “n=0.05” serves the purpose of the curve in Figure 17.
- A fixed channel geometry was assumed in all analyses. Selection of the channel geometry is arbitrary and for the purposes of this report, the channels were assumed to have a 2-m wide base and 1V:3H side slopes. The depth of flow changes based on other variables (it varied from 0.1m to 0.6m based on scenario).

Watersheds yielding velocities higher than 2 m/s were plotted in the group “Engineered Rock Armor Waterway”, and those with a resulting velocity of 2 m/s or lower were plotted in the group “Engineered Vegetated Waterway”. The resulting curve is shown in Figure 17.

Results show that for 33% slopes (re-sloped dump face slopes) bio-engineered channels will be sufficient if the watersheds are kept below about 5 ha. The new slope faces will need to be divided into sub catchments of 5 ha or less in order to avoid the necessity for armouring in the drainage channels.

If the top surface of the dumps are graded at 2%, there will be no need for armouring channels draining areas of up to 100 ha. If the slope is increased to 5%, channel armouring becomes necessary for catchments of 100 ha or higher. However this may be avoided by building a larger channel than the one assumed here.

4.3.3 Conceptual Drainage Design

For the conceptual drainage design it is assumed that slopes will be re-sloped to 1V:3H (18.4^o). Figure 15 shows that gullies start to occur at an overland flow path of about 55 m along a 1V:3H slope. Therefore if a re-graded slope is longer than 55 m, there should be benches to divert surface water flowing down the slope face. One of the most common areas of erosion is at the crest of slopes. Therefore surface water should be directed away from crests to the extent possible. In addition, berms should be constructed along crests (typically 2 m high) to block any excessive water.

Top surfaces of the re-sloped dumps should be divided into catchments of less than 100 ha so that bio-engineered channels will be sufficient. Top surfaces can be graded to 2% if the size of the watersheds on the top surfaces are kept at a maximum of 100 ha. If 5% re-grading of top surfaces is chosen, the maximum allowable watershed size will be a value between 100 ha and 30 ha. Slope faces of the re-sloped dumps (at 33% slopes) should be divided into catchments of 5 ha or less. This can be achieved by building wavy slope faces as opposed to flat ones.

Figures 18 to 20 show the layout of conceptual drainage channels. The surface water is diverted through the channels and discharged into either an open-pit or nearby creeks.

4.4 Limitations

The example engineered landforms presented in this report do not address all the dumps. Further studies are needed to advance the work presented here to cover all the dumps within the Faro mine complex. The following items are included here as points of further evaluation in detailed design:

- Hydrological analyses presented in this report need field verification through investigation of slopes in the field.
- Although, the slopes are likely to be re-graded to at least 1V:3H (where applicable), it may be acceptable to re-grade the slopes to 1V:2H where only rudimentary covers are required.
- There may be a number of locations where push-down re-grading may be impractical due to extensive pull-back (e.g. above S-wells, northeast side of Low Grade Ore, and Faro dump upstream of rock drain). In the detailed design stage, a comparison and evaluation can be made between the options of a-) not covering these areas, and b-) carrying out extensive pull back.

5 Conclusions

The cost-benefit analyses presented in Section 2 indicate that the construction of “low infiltration covers” on the mine area waste rock piles can result in significant savings in water treatment costs. If the low infiltration covers are constructed on areas that are high strength sources of contaminants, the savings in water treatment costs will be greater than the cost of the covers, and will result in a net savings in overall costs. This finding provides a clear direction for the design of the cover systems for the Faro and Vangorda/Grum areas. All high strength sources, such as sulphide cells and low grade ore stockpiles, should be covered by at least a low infiltration cover.

However, it would be incorrect to conclude that only “rudimentary covers” should be constructed on all other areas, for two reasons. First, the analysis did not account for the other benefits of thicker covers, such as enhanced potential for vegetation diversity. Second, the analyses did not consider the uncertainty in any estimates of future water quality and long-term cover performance. Those uncertainties would in general lead to recommendations for more conservative designs, i.e. covers that are better than the economic optimum.

The Section 3 analyses indicate that relocation of high strength sources of contaminants to other parts of the waste rock piles does not lead to compensating savings in water treatment costs. However, the cost-benefit ratio for relocation of the Medium Grade stockpile is close to unity, indicating that relocation of small high strength sources could result in a net savings if all uncertainties were taken into account. Any relocation of the larger sources would need to be justified on the basis of other benefits.

The Section 4 analysis indicates the difficulty of re-sloping parts of the dumps to “natural” slopes, but also shows that stable landforms can be designed within the re-sloping constraints. Tools for designing final landforms have been developed, and need to be calibrated with additional field investigations.

The cost-benefit calculations and design tools developed in this project provide a strong basis for further selection of cover and landform designs for each mine area. Other studies of re-vegetation possibilities and cover performance will contribute additional information that will need to be taken into account before final designs are selected.

This report, "**Faro Mine Complex- Mine Area Cover Optimization and Landform Engineering, 2007/08 Task 26 - FINAL",** was prepared by SRK Consulting (Canada) Inc.

Prepared by

ORIGINAL SIGNED AND STAMPED

Tayfun Gurdal
Consultant

ORIGINAL SIGNED AND STAMPED

Peter Mikes, E.I.T.
Consultant

Reviewed by

ORIGINAL SIGNED AND STAMPED

Daryl Hockley, P.Eng.
Principal

6 References

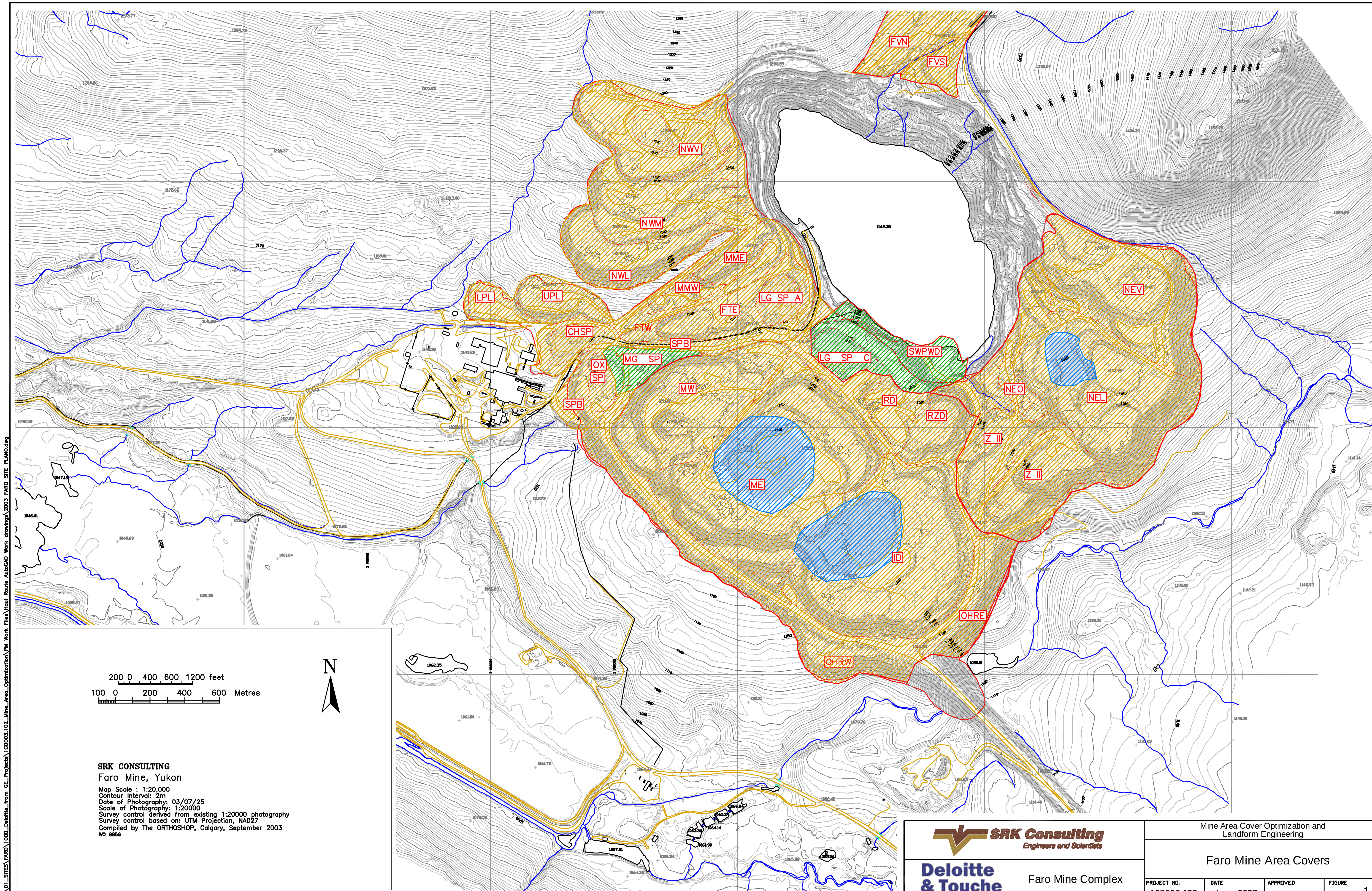
SRK Consulting. 2008. *Options for Closure of the Faro Mine Complex*, Report submitted to INAC and the Yukon Government, on behalf of the Faro Mine Closure Planning Office, February 2008.

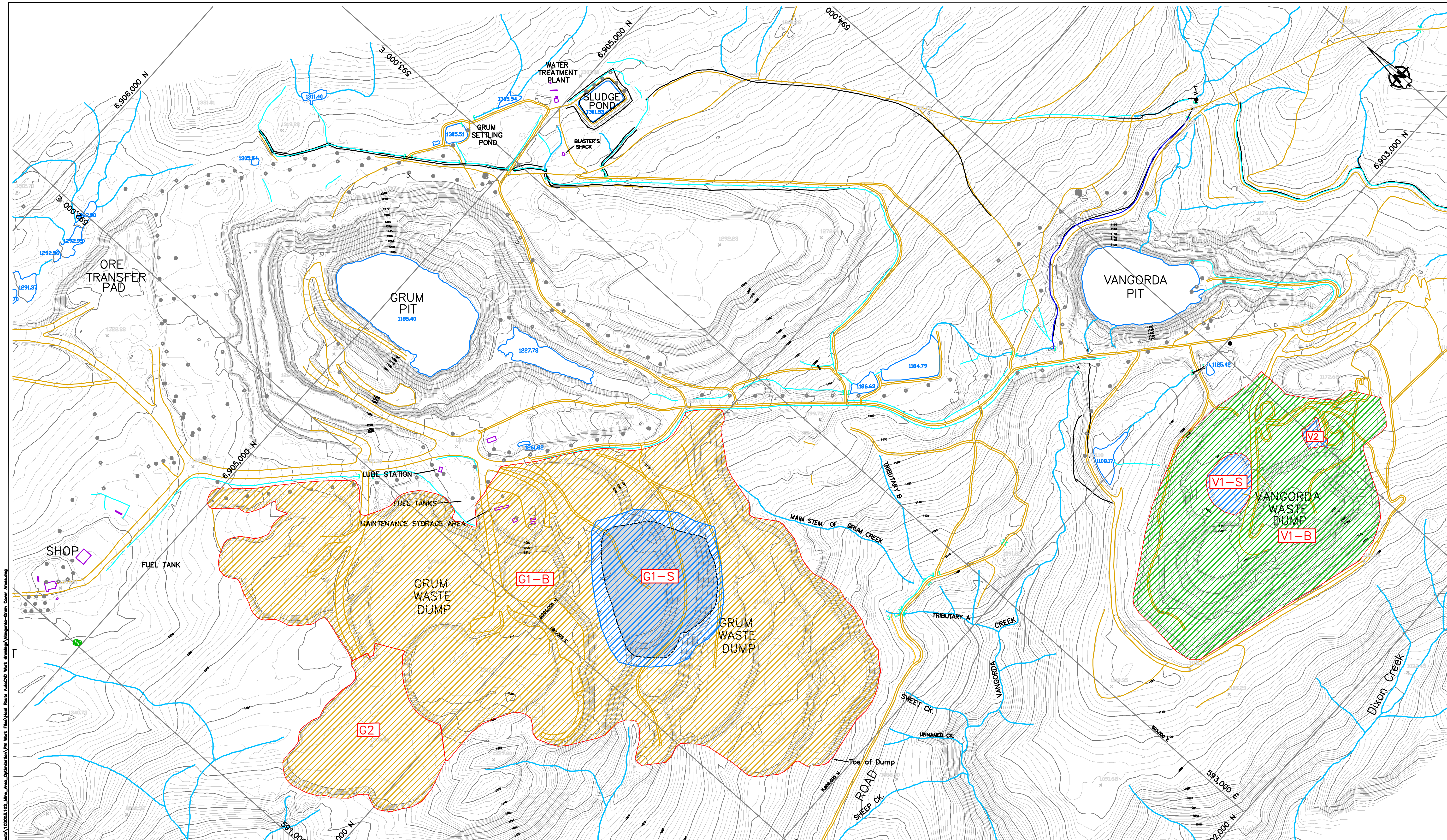
Landscape Design Checklist, Revised RSDS Government Regulator Version, May 2005, CEMA-RWG Landscape Design Subgroup.

Letter Report "Opportunities for Landform Design and Landform Grading for the Faro Project", December 2007, BGC Engineering Inc.

Faro Landform Design Workshop held by BGC Engineering in November 22, 2007.

Figures


FVN
FVS
NWV
NWM
MME
NWL
MMW
LPL
UPL
LG SP A
FTE
FTW
CHSP
SPB
MG SP
OX
SP
SPB
LG SP C
SWPWD
MW
RD
RZD
NEO
NEV
NEL
Z II
Z II
ME
ID
OHRE
OHRW
N
200 0 400 600 1200 feet
100 0 200 400 600 Metres
SRK CONSULTING
Faro Mine, Yukon
Map Scale : 1:20,000
Contour Interval: 2m
Date of Photography: 03/07/25
Scale of Photography: 1:20000
Survey control derived from existing 1:20000 photography
Survey control based on: UTM Projection, NAD27
Compiled by The ORTHOSHOP, Calgary, September 2003
WO 8856
SRK Consulting
Engineers and Scientists
Deloitte & Touche
Faro Mine Complex
Mine Area Cover Optimization and Landform Engineering
Faro Mine Area Covers
PROJECT NO.
1CD003.102
DATE
June 2008
APPROVED
FIGURE
1



Map Scale: 1:5000
Contour Interval: 2m
Date of Photography: 03/07/25
Scale of Photography: 1:20000
Survey control derived from existing 1:20000 photography
Survey control based on: UTM Projection, NAD27
Compiled by The ORTHOSHOP, Calgary, September 2003
WO 8856

0 100 200 300 400 500 600 700 800 900 1000m

SRK Consulting
Engineers and Scientists

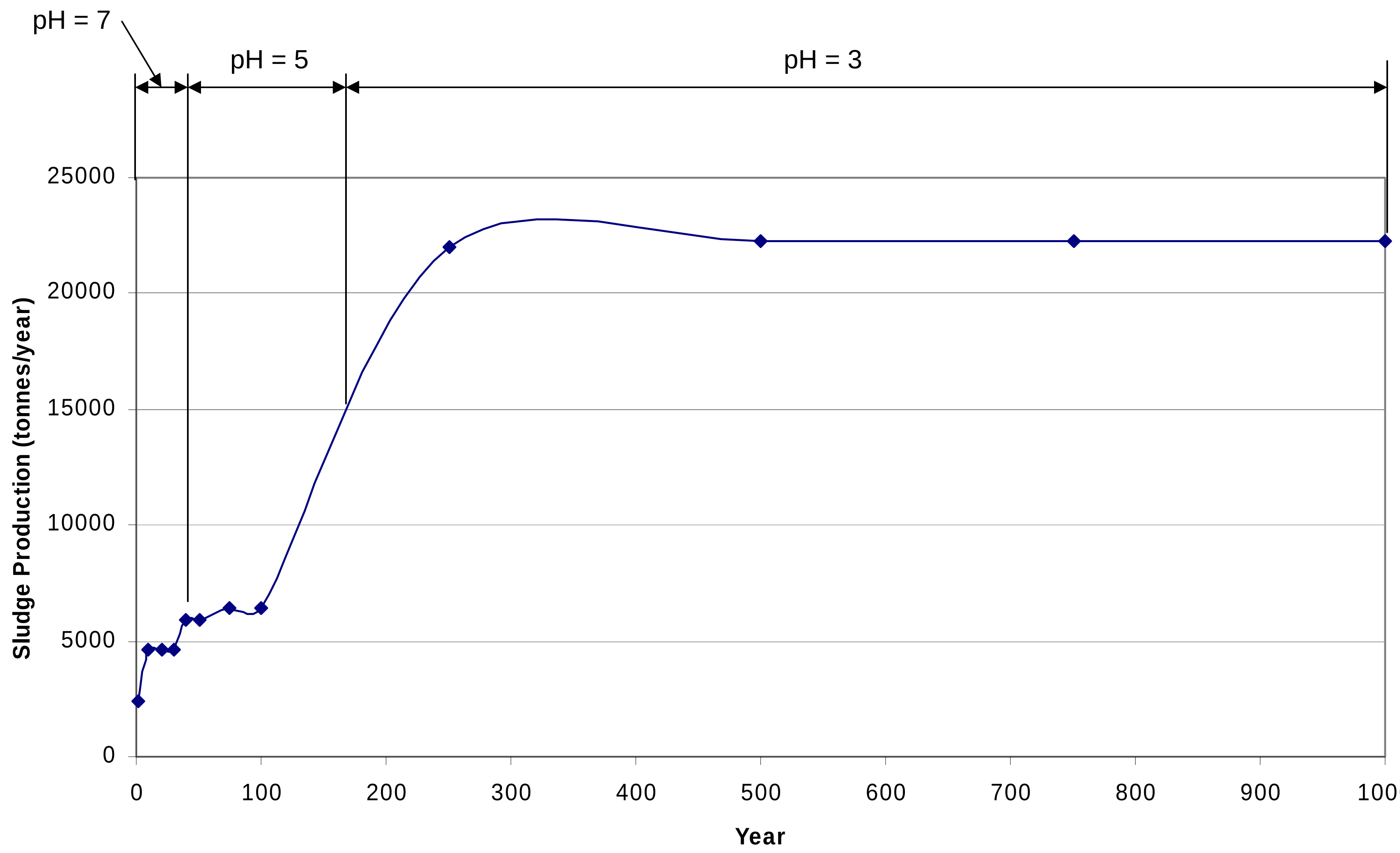
Deloitte & Touche

Faro Mine Complex

Mine Area Cover Optimization and Landform Engineering

Vangorda/Grum Mine
Area Covers

PROJECT NO.	DATE	APPROVED	FIG.
1CD003.102	June 2008		2



SRK Consulting
Engineers and Scientists

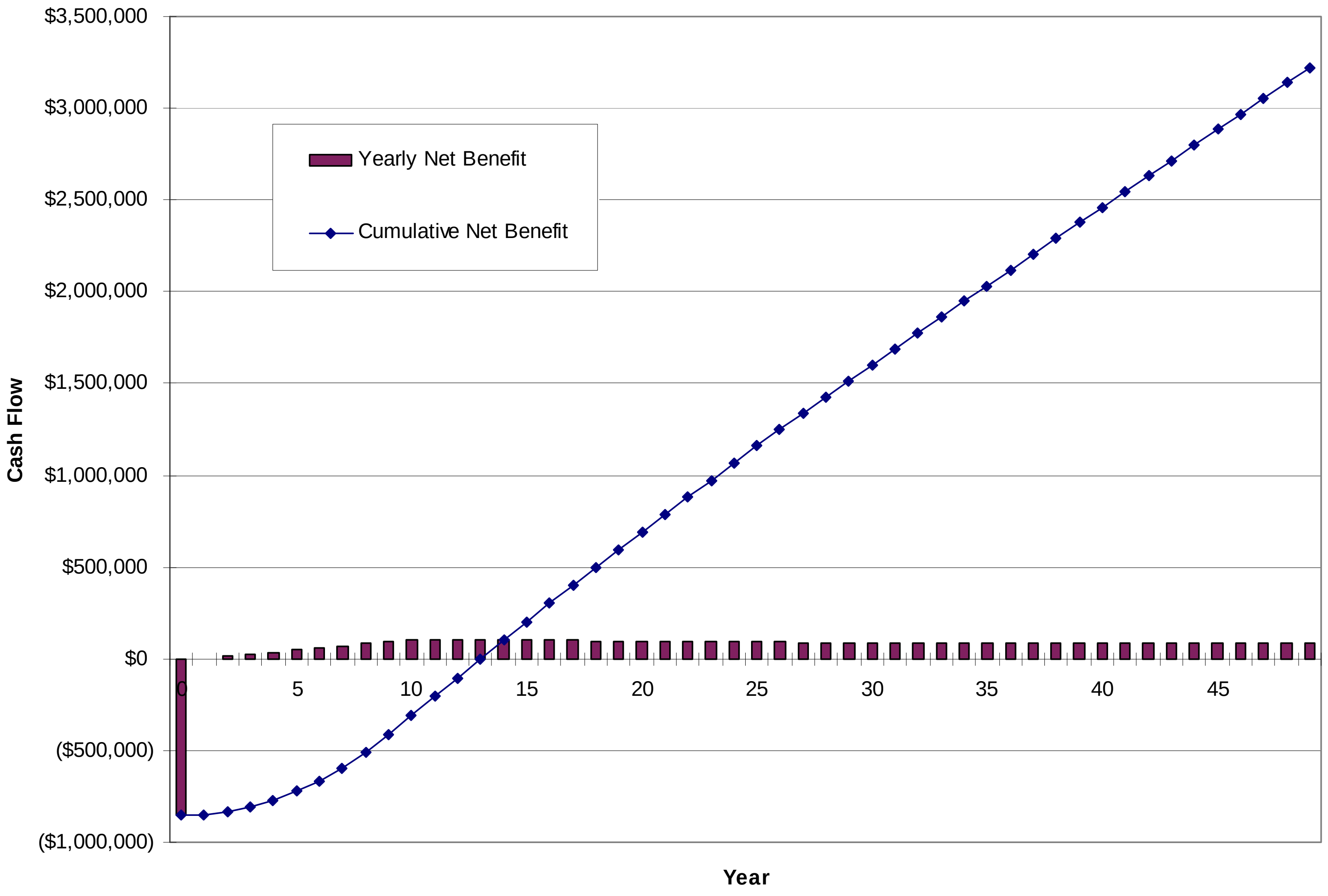
Deloitte & Touche

Faro Mine Complex

Mine Area Cover Optimization and Landform Engineering

pH Determination of Water Quality Estimates

PROJECT:	DATE:	BY:	FIGURE:
1CD003.102	March 2008	PM	3



SRK Consulting
Engineers and Scientists

Deloitte & Touche

Faro Mine Complex

Mine Area Cover Optimization and Landform Engineering

Example Cash Flow – Main East Sulphide Cell Upgraded to a Low Infiltration Cover

PROJECT:	DATE:	BY:	FIGURE::
1CD003.102	March 2008	PM	4

Faro Waste Dumps

Grum Waste Dumps

Vangorda Waste Dumps

Conceptual Only
Not to Scale

SRK Consulting
Engineers and Scientists
Vancouver B.C.

Deloitte & Touche

Mine Area Cover Optimization and Landform Engineering

Faro Mine Waste Dumps

SRK JOB NO.: 1CD003.102

FILE NAME: 1CD003_102-1_a.dwg

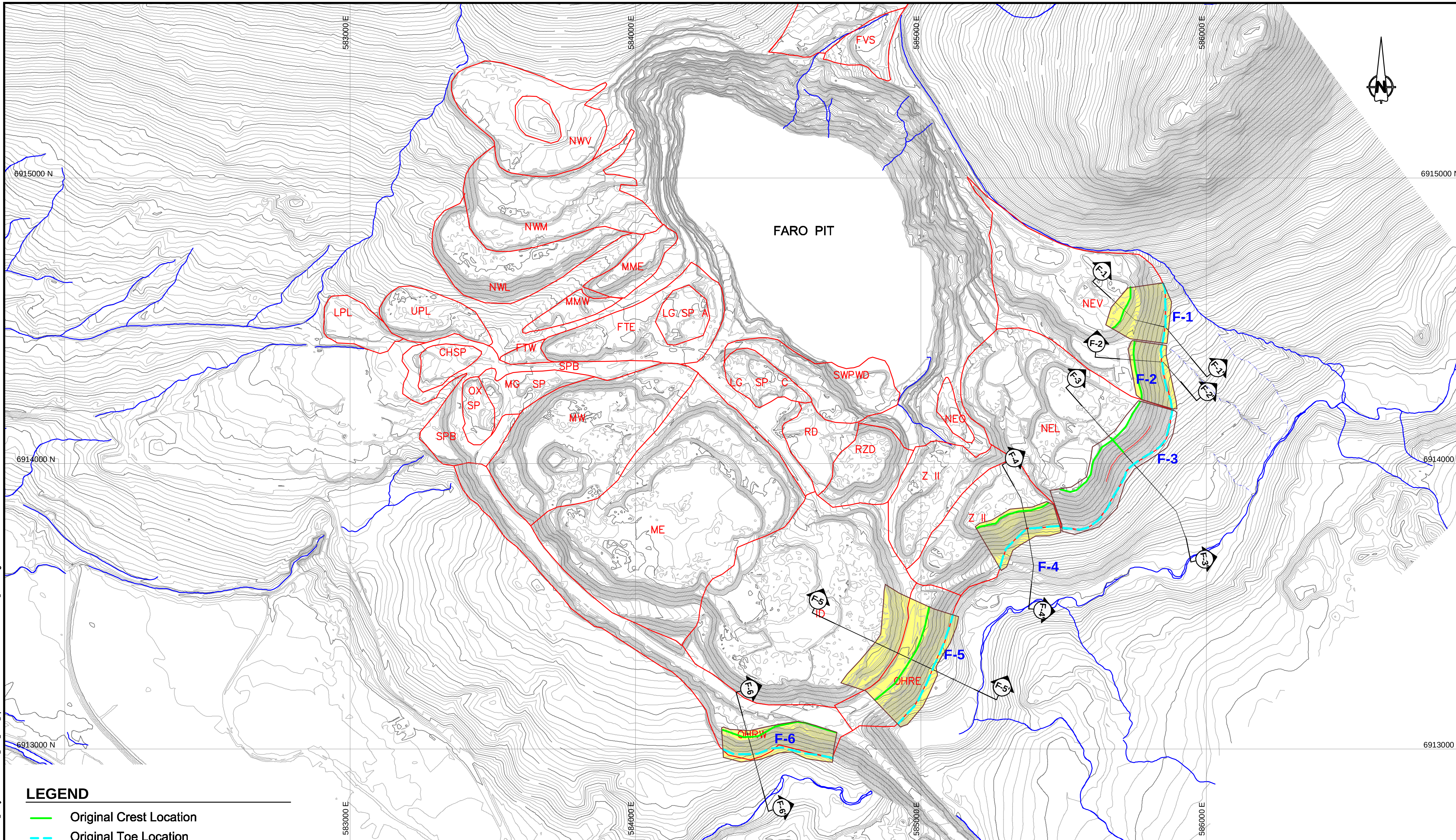
Faro Mine Complex

DATE: June 2008

APPROVED:

FIGURE: 5

J:\01_SITES\FARO\1000_Deloitte_from GE_Projects\1CD003.102_Mine_Area_Optimization\TG Work Files\CAD\1CD003_102-1_a.dwg



LEGEND

- Original Crest Location
- Original Toe Location
- Waste Rock Dump Boundary
- Creek
- Path Formed by Waste Dump Seepage
- F-1 Resloping Zones

0 100 200 300 400 500
Scale in Metres

SRK Consulting
Engineers and Scientists
Vancouver B.C.

SRK JOB NO.: 1CD003.102
FILE NAME: 1CD003_102-2.dwg

Deloitte & Touche

Faro Mine Complex

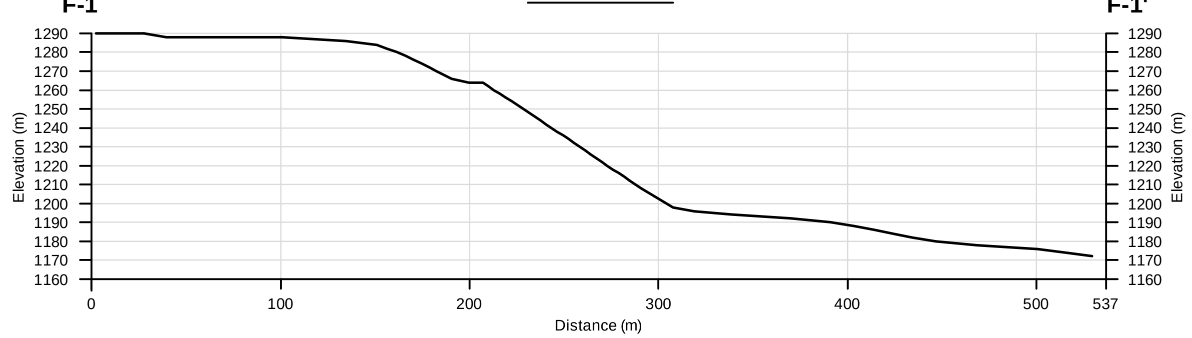
Mine Area Cover Optimization and Landform Engineering

Faro Landform Engineering Zones

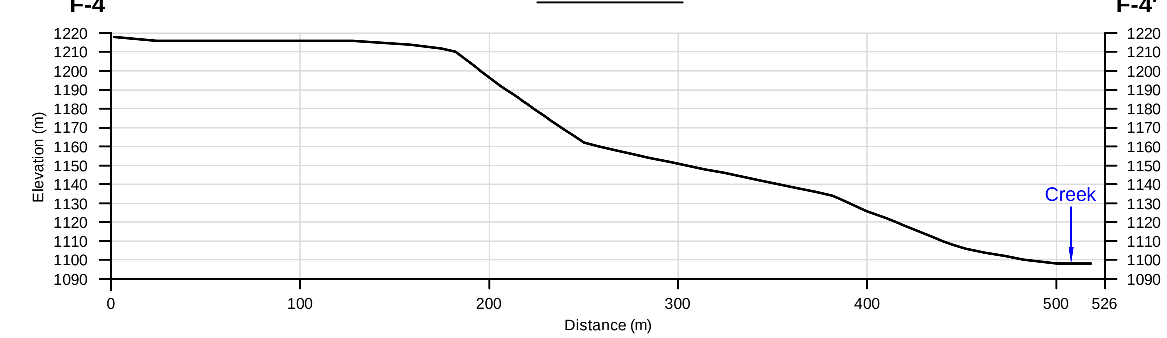
DATE:	APPROVED:	FIGURE:
June 2008		6

J:\01_SITES\FARO\1000_Deloitte_from GE_Projects\1CD003102_Mine_Area_Optimization\TG Work Files\CAD\1CD003_102-2.dwg

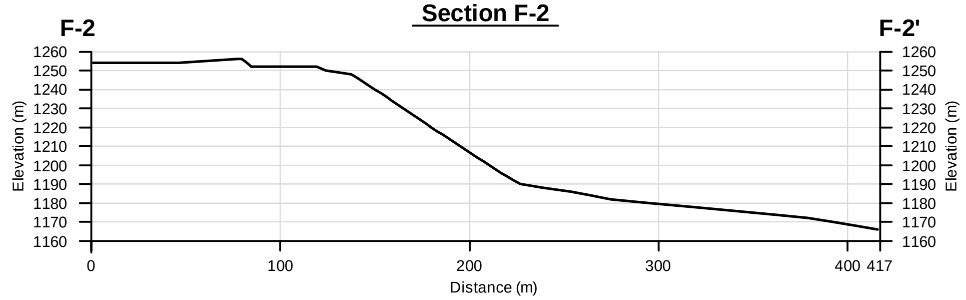
Section F-1



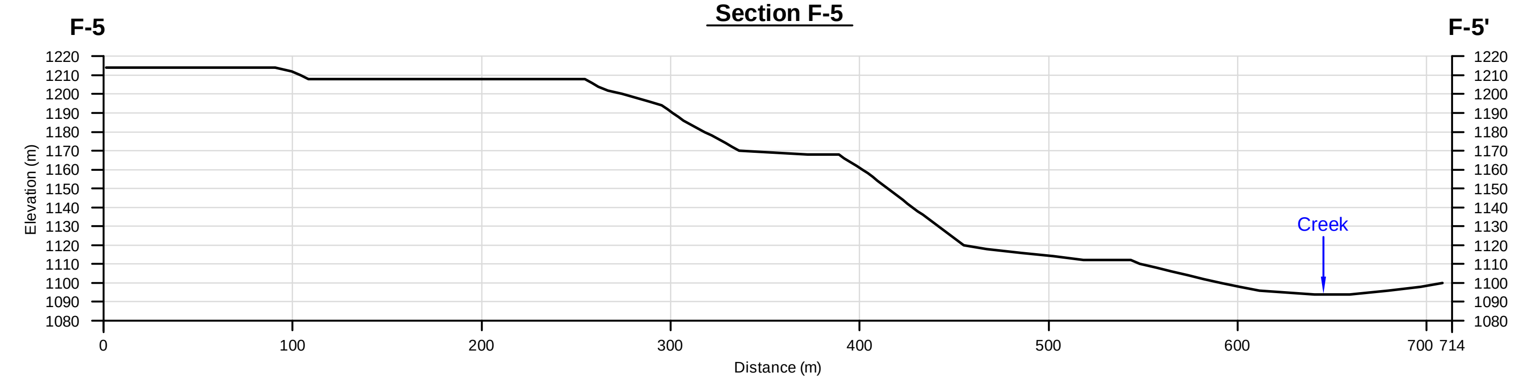
Section F-4



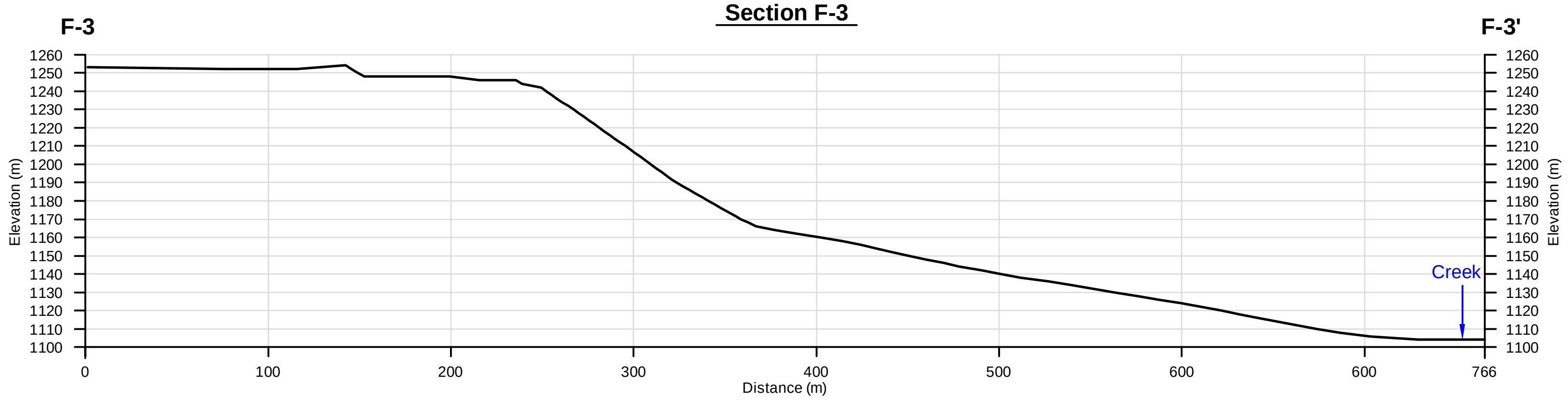
Section F-2



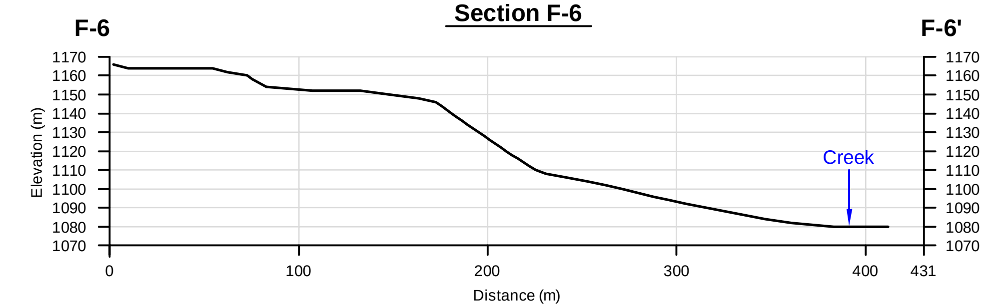
Section F-5



Section F-3



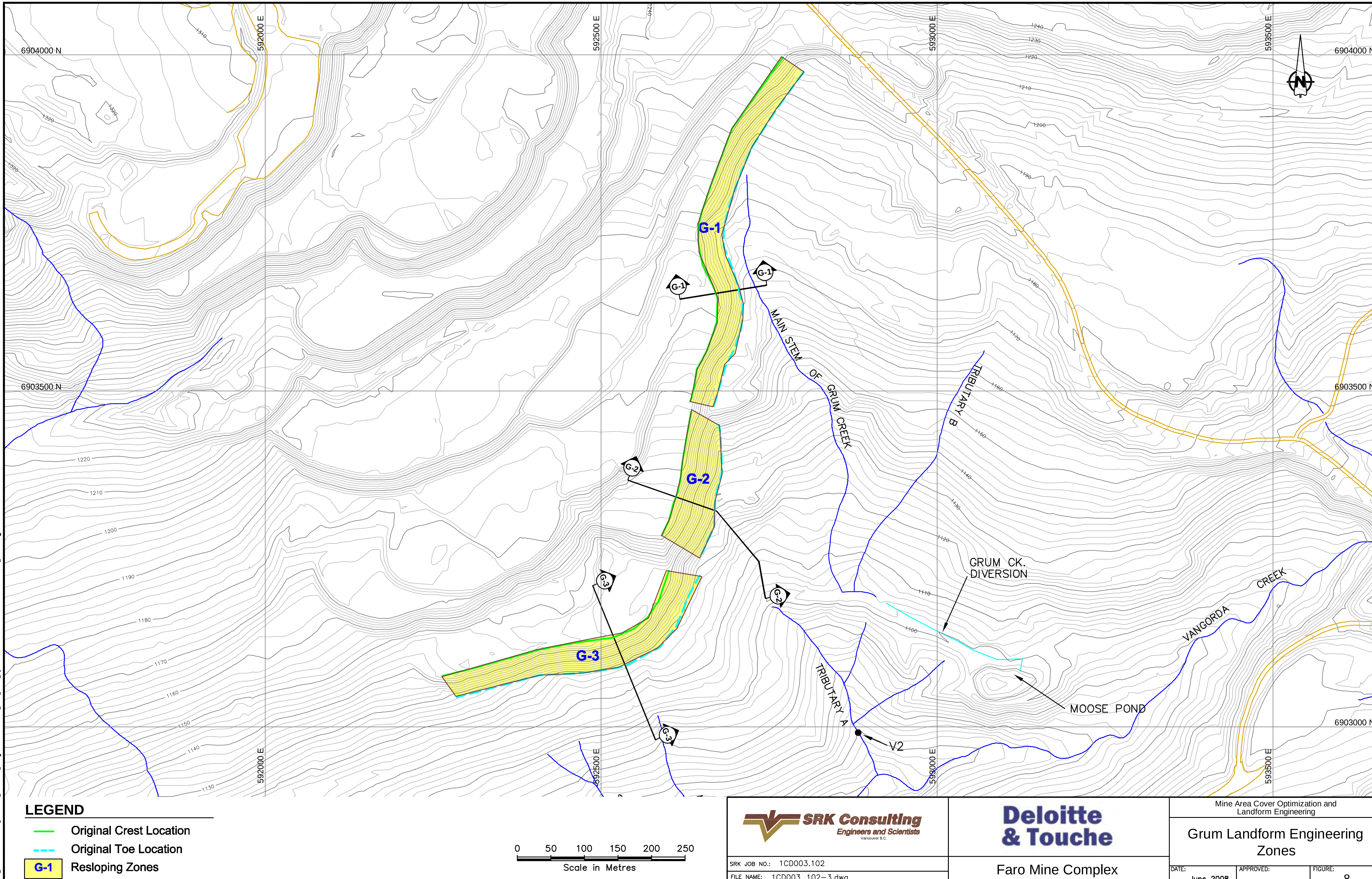
Section F-6



0 30 60 90 120 150
Scale in Metres

SRK Consulting Engineers and Scientists Vancouver B.C.	Deloitte & Touche	Mine Area Cover Optimization and Landform Engineering
SRK JOB NO.: 1CD003.102		Original Sections of Faro Zones
FILE NAME: 1CD003_102-2.dwg	Faro Mine Complex	DATE: June 2008 / APPROVED: / FIGURE: 7

J:\01_SITES\FARO\1000_Deloitte_from GE_Projects\1CD003.102_Mine_Area_Optimization\TG Work Files\CAD\1CD003_102-2.dwg



SRK Consulting
Engineers and Scientists
Vancouver B.C.

Deloitte & Touche

Mine Area Cover Optimization and Landform Engineering

Grum Landform Engineering Zones

SRK JOB NO.: 1CD003.102

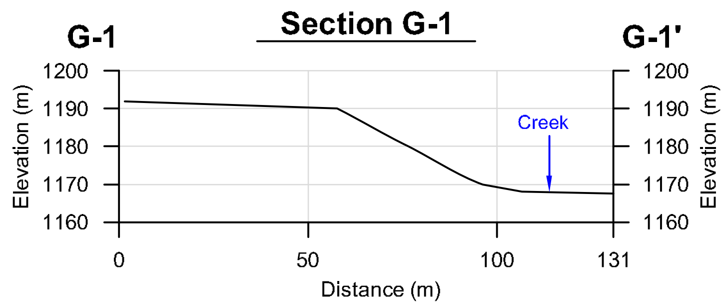
FILE NAME: 1CD003_102-3.dwg

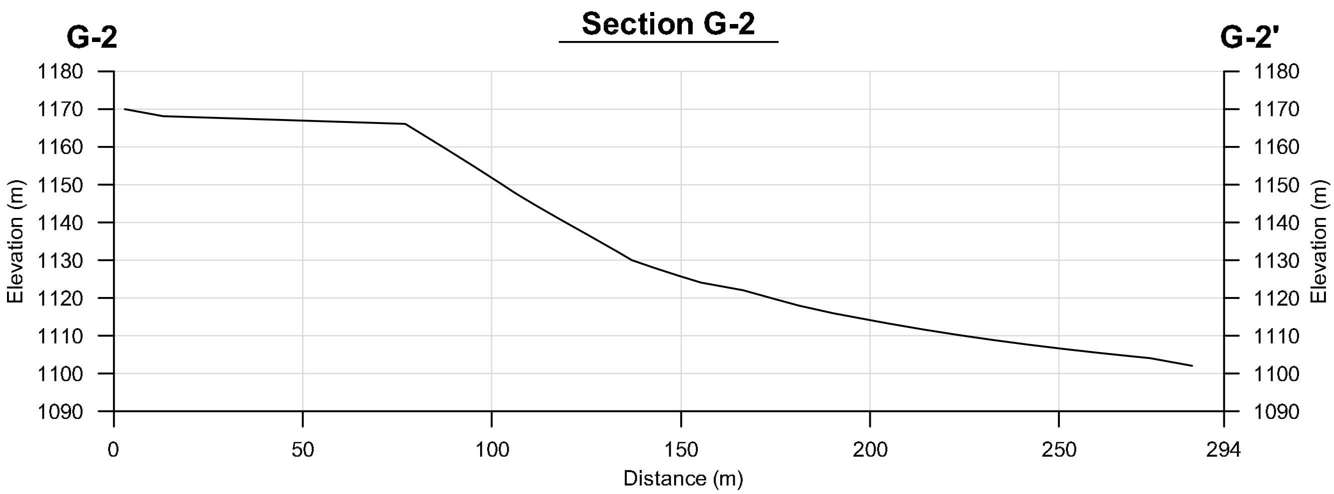
Faro Mine Complex

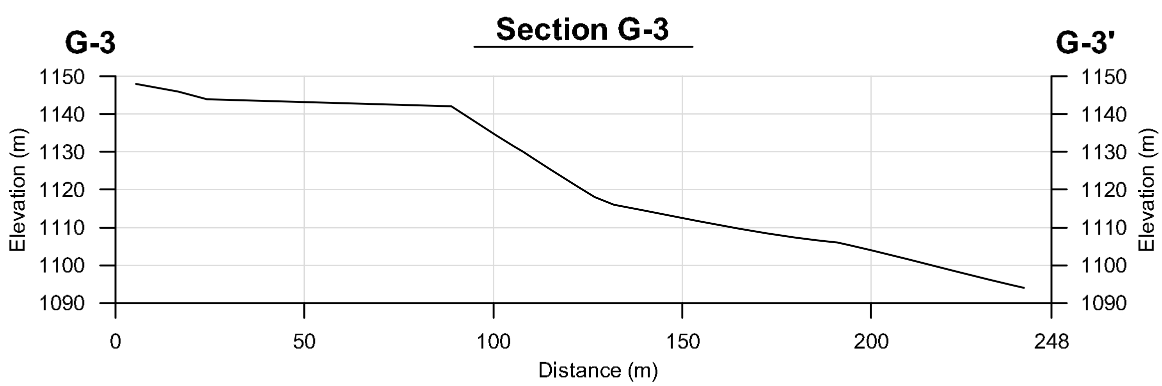
DATE: June 2008

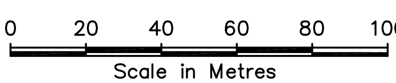
APPROVED:

FIGURE: 8









SRK Consulting
Engineers and Scientists
Vancouver B.C.

Deloitte & Touche

Mine Area Cover Optimization and Landform Engineering

Original Sections of Grum Zones

SRK JOB NO.: 1CD003.102

FILE NAME: 1CD003_102-3.dwg

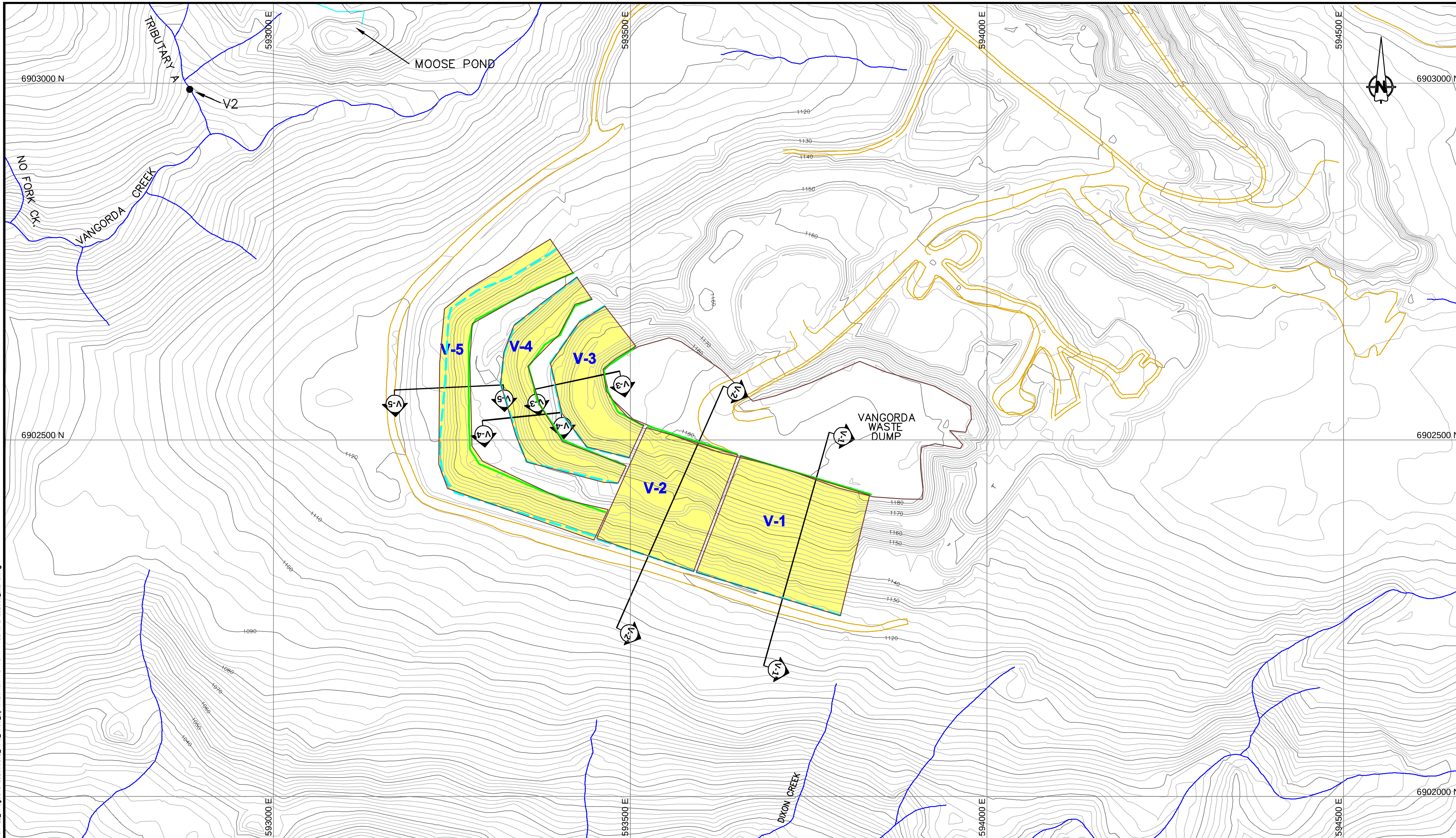
Faro Mine Complex

DATE: June 2008

APPROVED:

FIGURE: 9

J:\01_SITES\FARO\1000_Deloitte_from GE_Projects\1CD003.102_Mine_Area_Optimization\TG Work Files\CAD\1CD003_102-3.dwg



J:\01_SITES\FARO\1000_Deloitte_from GE_Projects\1CD003.102_Mine_Area_Optimization\TG Work Files\CAD\1CD003_102-3.dwg

LEGEND

- Original Crest Location
- Original Toe Location
- V-1 Resloping Zones

0 50 100 150 200 250
Scale in Metres

SRK Consulting
Engineers and Scientists
Vancouver B.C.

SRK JOB NO.: 1CD003.102
FILE NAME: 1CD003_102-3.dwg

Deloitte & Touche

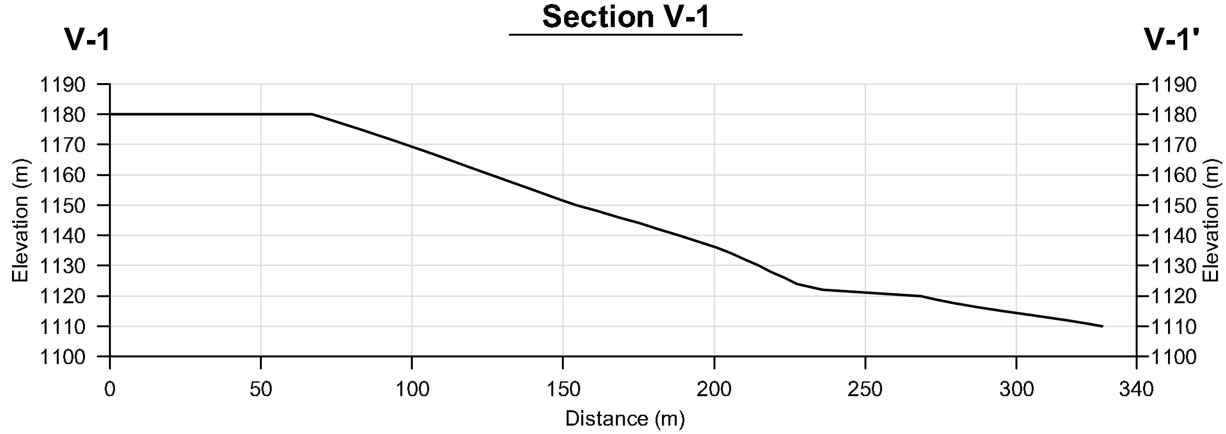
Faro Mine Complex

Mine Area Cover Optimization and Landform Engineering

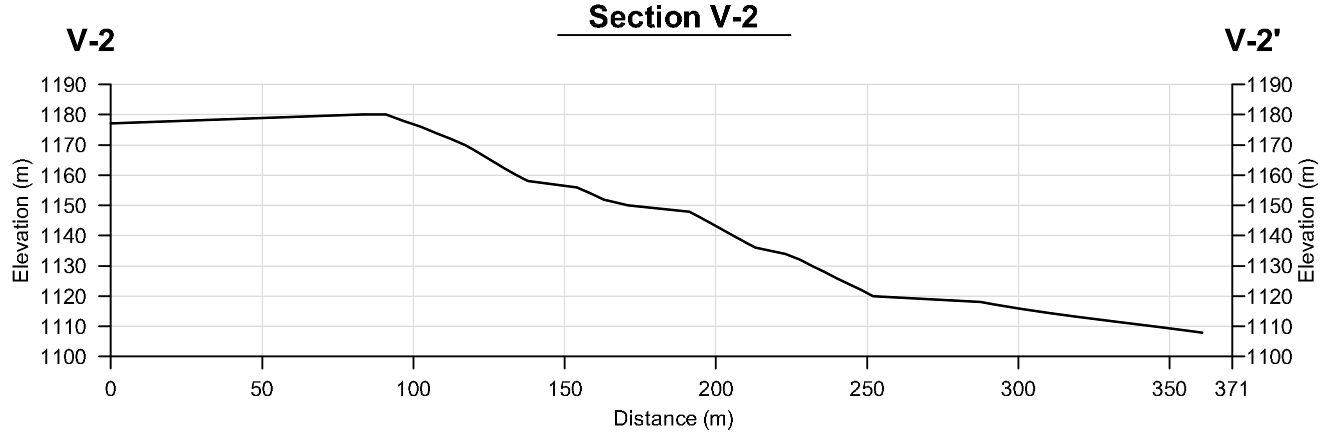
Vangorda Landform Engineering Zones

DATE:	APPROVED:	FIGURE:
June 2008		10

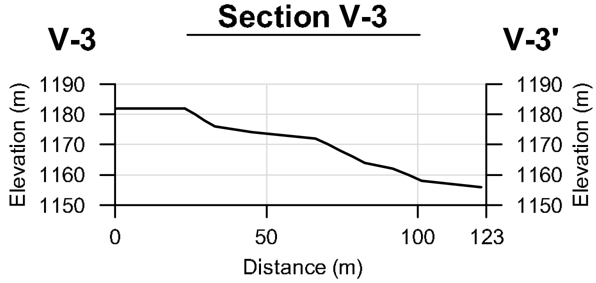
Section V-1



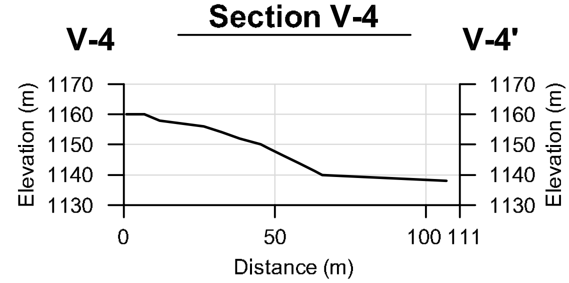
Section V-2



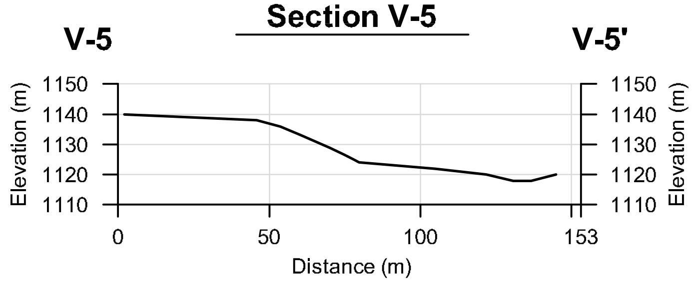
Section V-3

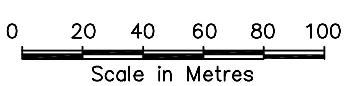


Section V-4



Section V-5





SRK Consulting
Engineers and Scientists
Vancouver B.C.

Deloitte & Touche

Mine Area Cover Optimization and Landform Engineering

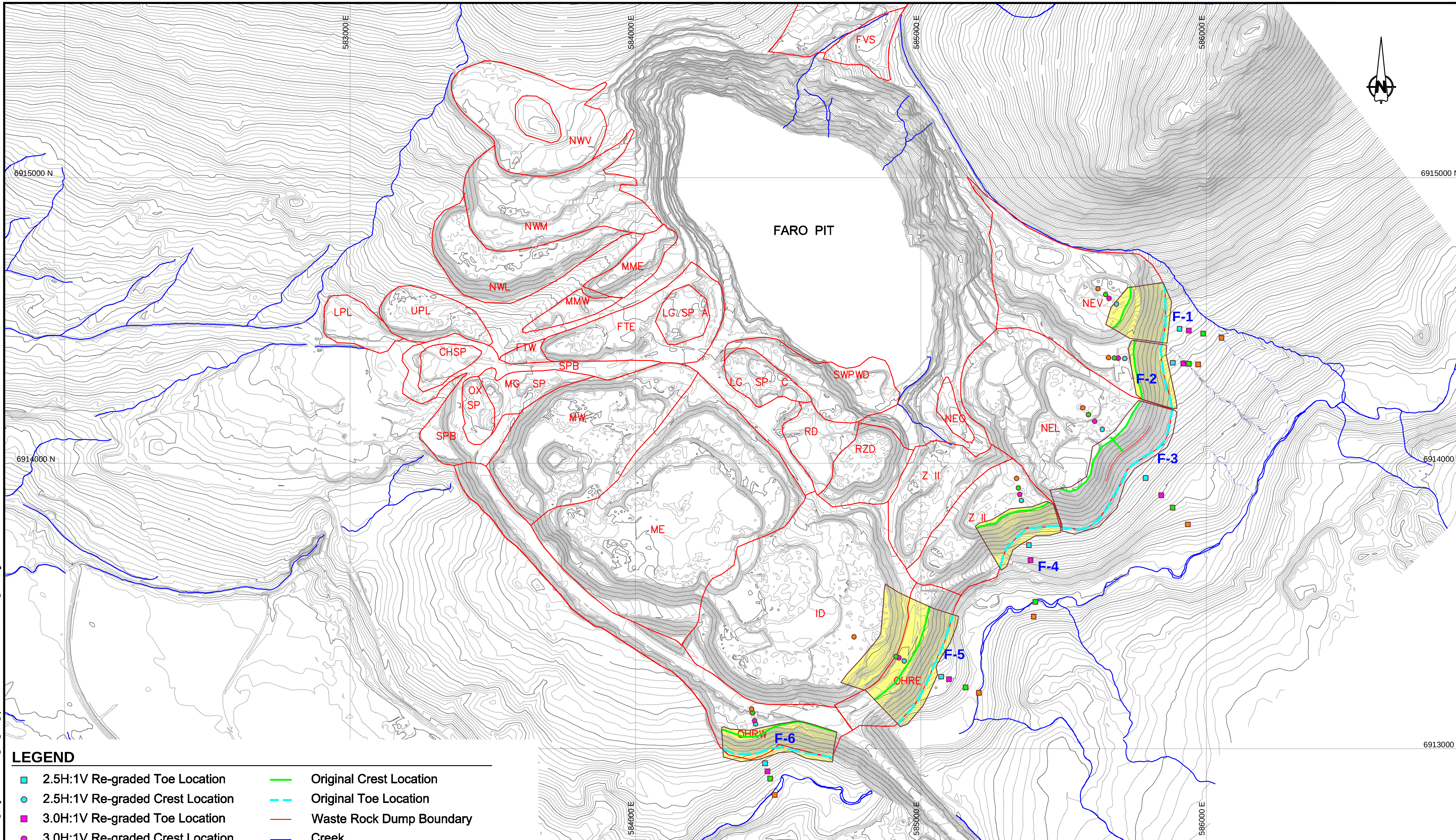
Original Sections of Vangorda Zones

Faro Mine Complex

SRK JOB NO.:	1CD003.102
FILE NAME:	1CD003_102-3.dwg

DATE:	APPROVED:	FIGURE:
June 2008		11

J:\01_SITES\FARO\1000_Deloitte_from GE_Projects\1CD003.102_Mine_Area_Optimization\TG Work Files\CAD\1CD003_102-3.dwg



LEGEND

2.5H:1V Re-graded Toe Location	Original Crest Location
2.5H:1V Re-graded Crest Location	Original Toe Location
3.0H:1V Re-graded Toe Location	Waste Rock Dump Boundary
3.0H:1V Re-graded Crest Location	Creek
3.5H:1V Re-graded Toe Location	Path Formed by Waste Dump Seepage
3.5H:1V Re-graded Crest Location	F-1 Resloping Zones
4.0H:1V Re-graded Toe Location	
4.0H:1V Re-graded Crest Location	

SRK Consulting
Engineers and Scientists
Vancouver B.C.

SRK JOB NO.: 1CD003.102
FILE NAME: 1CD003_102-2.dwg

Deloitte & Touche

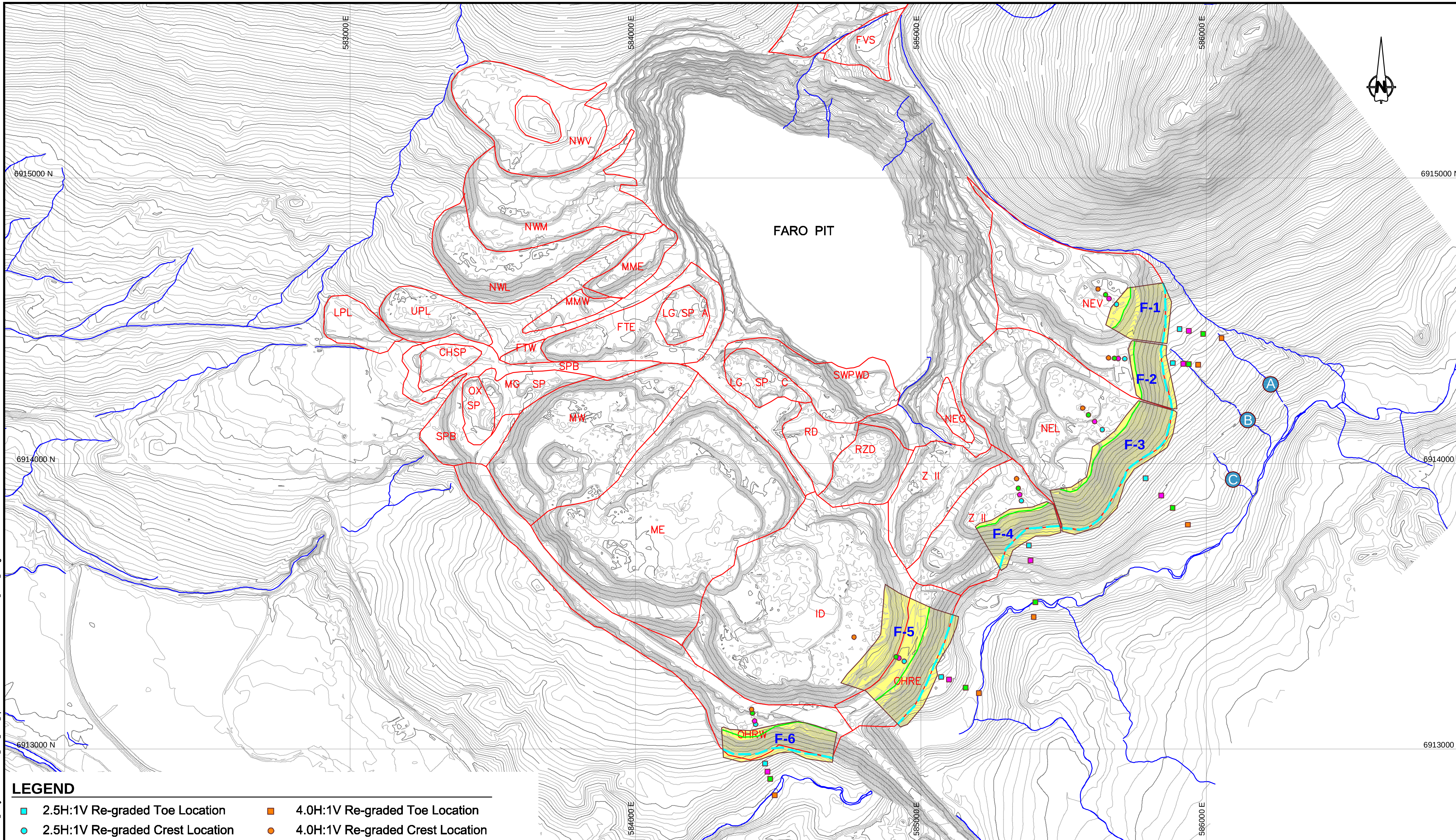
Faro Mine Complex

Mine Area Cover Optimization and Landform Engineering

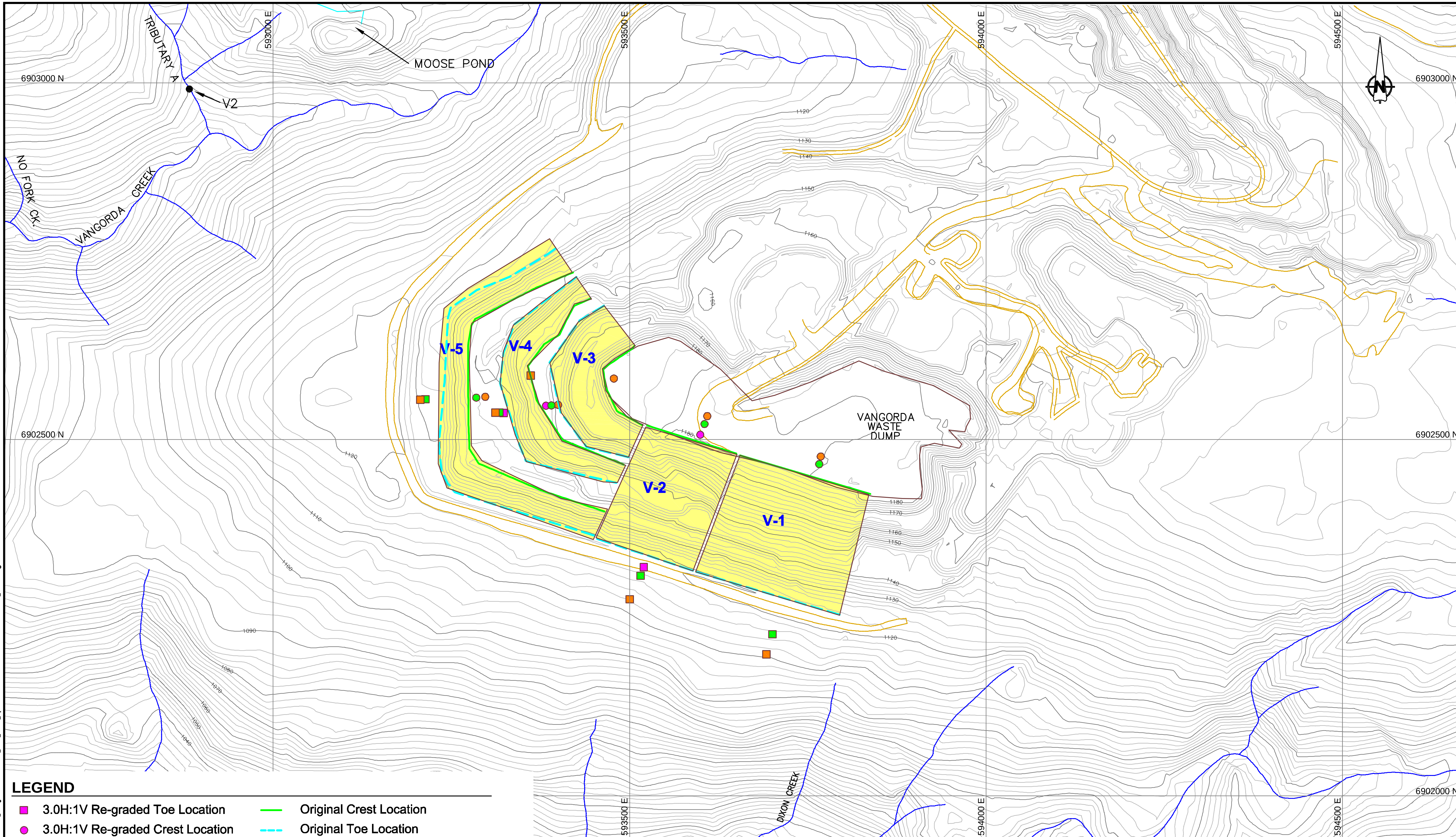
Crest and Toe Displacements for Landform Engineered Faro Dumps

DATE: June 2008
APPROVED:
FIGURE: 12

J:\01_SITES\FARO\1000_Deloitte_from GE_Projects\1CD003.102_Mine_Area_Optimization\TG Work Files\CAD\1CD003_102-2.dwg



SRK Consulting Engineers and Scientists Vancouver B.C.	Deloitte & Touche	Mine Area Cover Optimization and Landform Engineering Crest and Toe Displacements for Landform Engineered Faro Dumps
SRK JOB NO.: 1CD003.102 FILE NAME: 1CD003_102-2_a.dwg	Faro Mine Complex	DATE: May 2008 · APPROVED: · FIGURE: 13



LEGEND

- 3.0H:1V Re-graded Toe Location
- 3.0H:1V Re-graded Crest Location
- 3.5H:1V Re-graded Toe Location
- 3.5H:1V Re-graded Crest Location
- 4.0H:1V Re-graded Toe Location
- 4.0H:1V Re-graded Crest Location
- Original Crest Location
- Original Toe Location
- V-1 Resloping Zones

0 50 100 150 200 250
Scale in Metres

SRK Consulting
Engineers and Scientists
Vancouver B.C.

SRK JOB NO.: 1CD003.102
FILE NAME: 1CD003_102-3.dwg

Deloitte & Touche

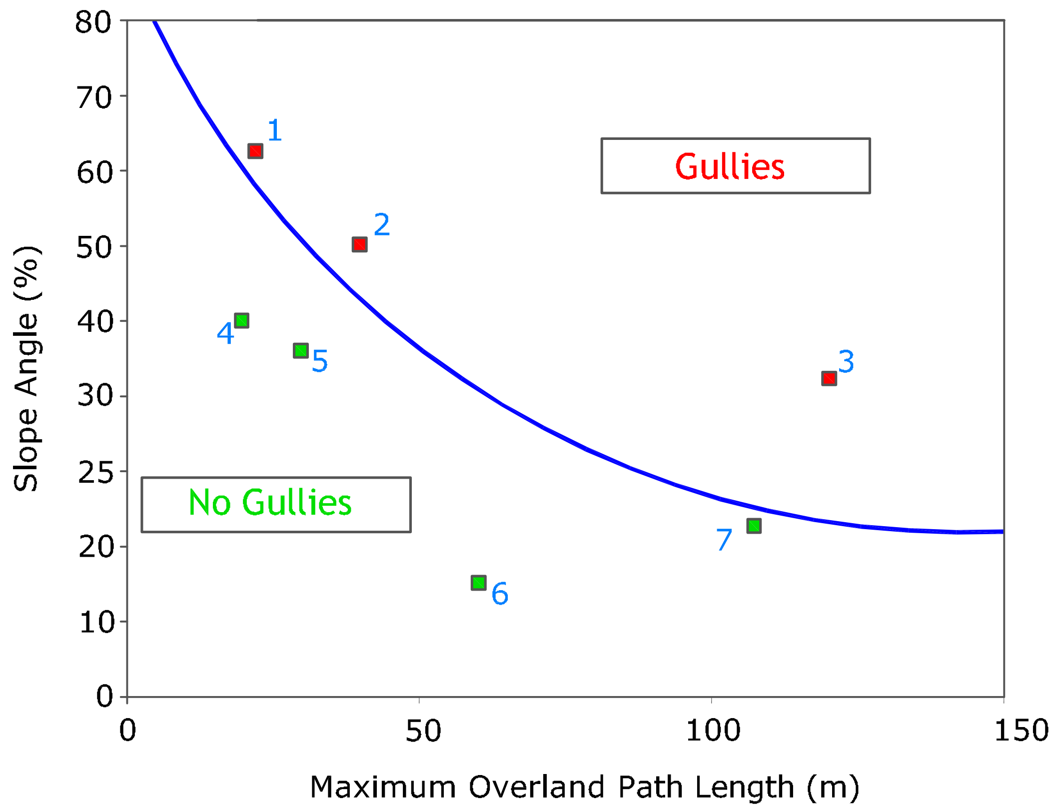
Faro Mine Complex

Mine Area Cover Optimization and Landform Engineering

Crest and Toe Displacements for Landform Engineered Vangorda Dumps

DATE: June 2008
APPROVED:
FIGURE: 14

J:\01_SITES\FARO\1000_Deloitte_from GE_Projects\1CD003.102_Mine_Area_Optimization\TG Work Files\CAD\1CD003_102-3.dwg



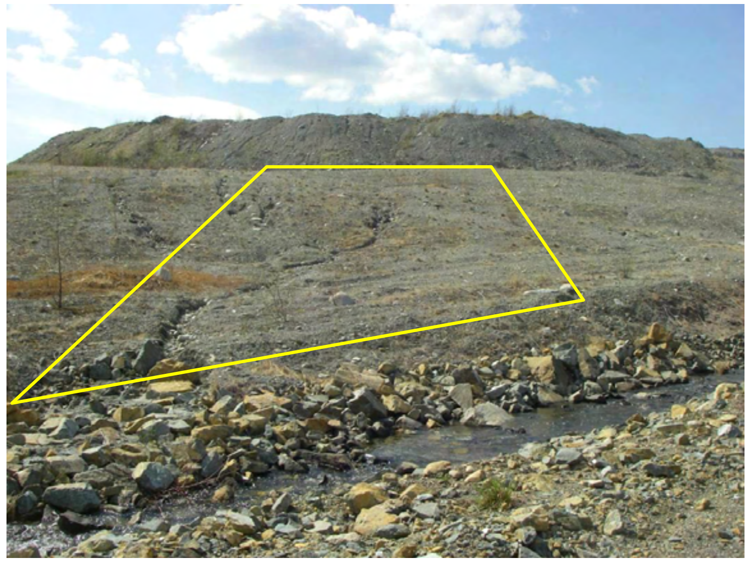
■ Data point representing a slope where no gully formation observed

■ Data point representing a slope where gullies formed

1 Photograph number in Figure 16

SRK Consulting Engineers and Scientists Vancouver B.C.	Deloitte & Touche	Mine Area Cover Optimization and Landform Engineering
		Graphical Tool for Identification of Gully Formation
SRK JOB NO.: 1CD003.102	Faro Mine Complex	DATE: June 2008
FILE NAME: 1CD003_102-4.dwg		APPROVED:
		FIGURE: 15

Photograph 1 - Grum Till Dump



Class: Gully Maximum Overland Flow Path = 24m Slope (%) = 61

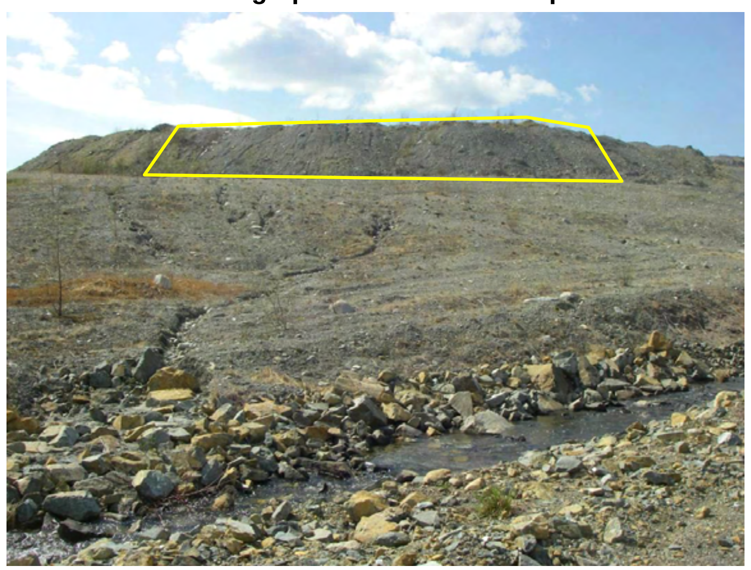
Photograph 2 - Grum Till Dump

Class: Gully Maximum Overland Flow Path = 40m Slope (%) = 50

Photograph 3 - Vangorda Till Slope

Class: Gully Maximum Overland Flow Path = 120m Slope (%) = 33

Photograph 4 - Grum Till Dump

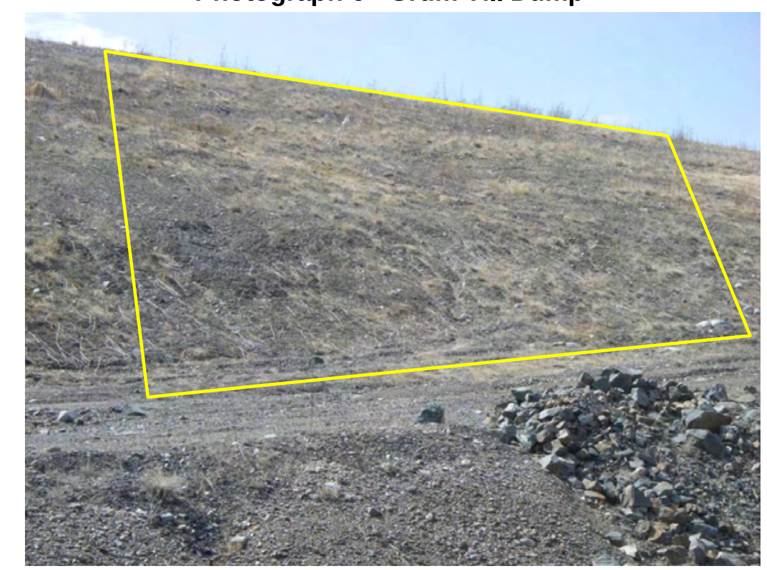


Class: No Gully Maximum Overland Flow Path = 20m Slope (%) = 40

Photograph 5 - Grum Till Dump

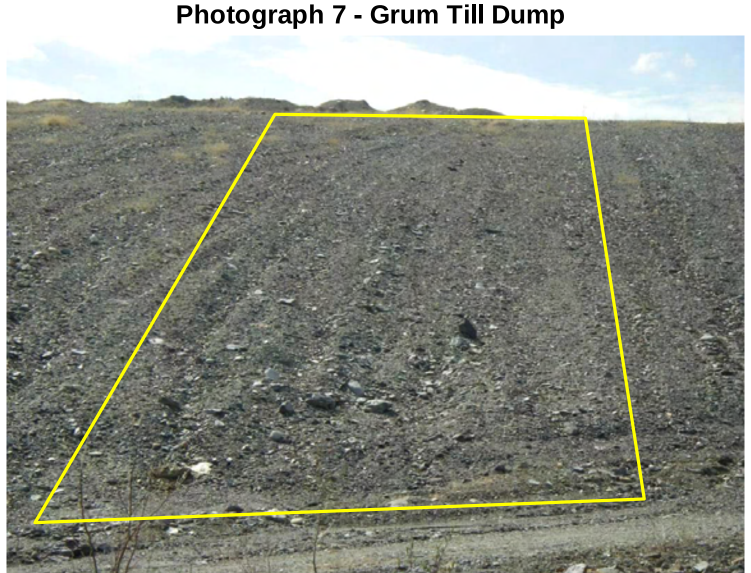
Class: No Gully Maximum Overland Flow Path = 30m Slope (%) = 38

Photograph 6 - Grum Till Dump



Class: No Gully Maximum Overland Flow Path = 60m Slope (%) = 14

Photograph 7 - Grum Till Dump



Class: No Gully Maximum Overland Flow Path = 102m Slope (%) = 22

SRK Consulting
Engineers and Scientists
Vancouver B.C.

SRK JOB NO.: 1CD003.102
FILE NAME: 1CD003_102-4.dwg

Deloitte & Touche

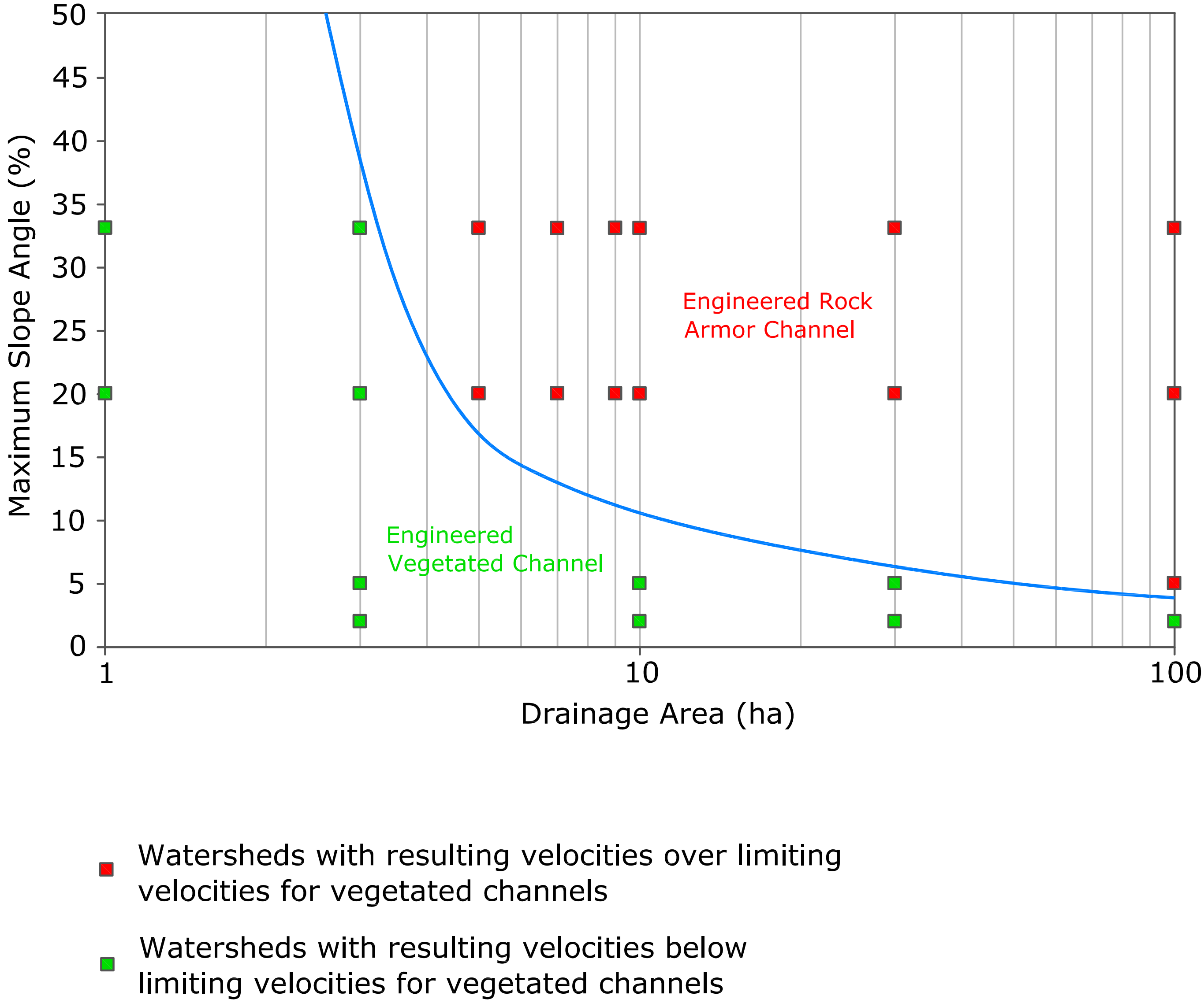
Faro Mine Complex

Mine Area Cover Optimization and Landform Engineering

Grum and Vangorda Till Slope Photographs

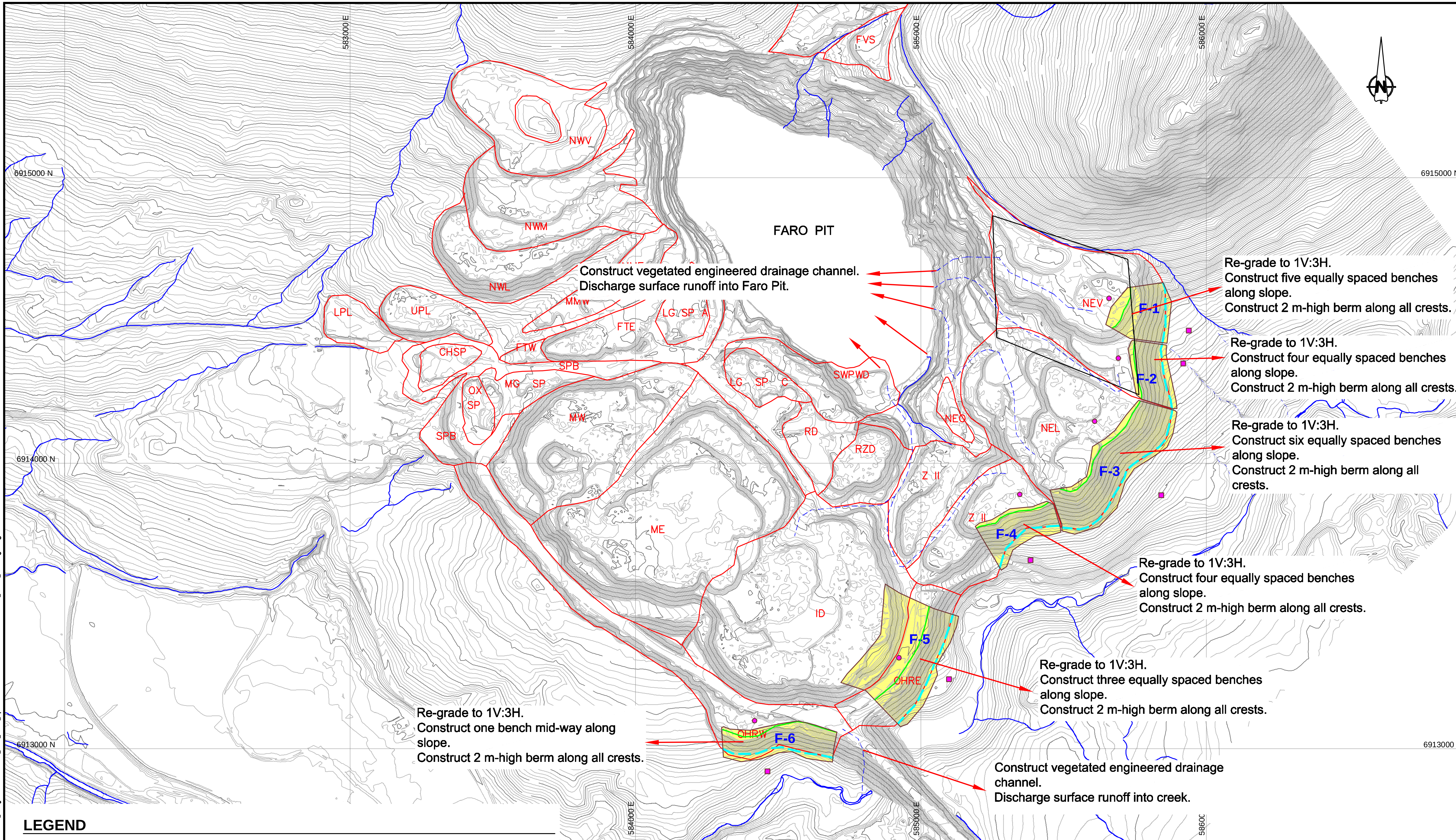
DATE:	APPROVED:	FIGURE:
June 2008		16

J:\01_SITES\FARO\1000_Deloitte_from GE_Projects\1CD003.102_Mine_Area_Optimization\TG Work Files\CAD\1CD003_102-4.dwg



J:\01_SITES\FARO\1000_Deloitte_from GE_Projects\1CD003.102_Mine_Area_Optimization\TG Work Files\CAD\1CD003_102-4.dwg

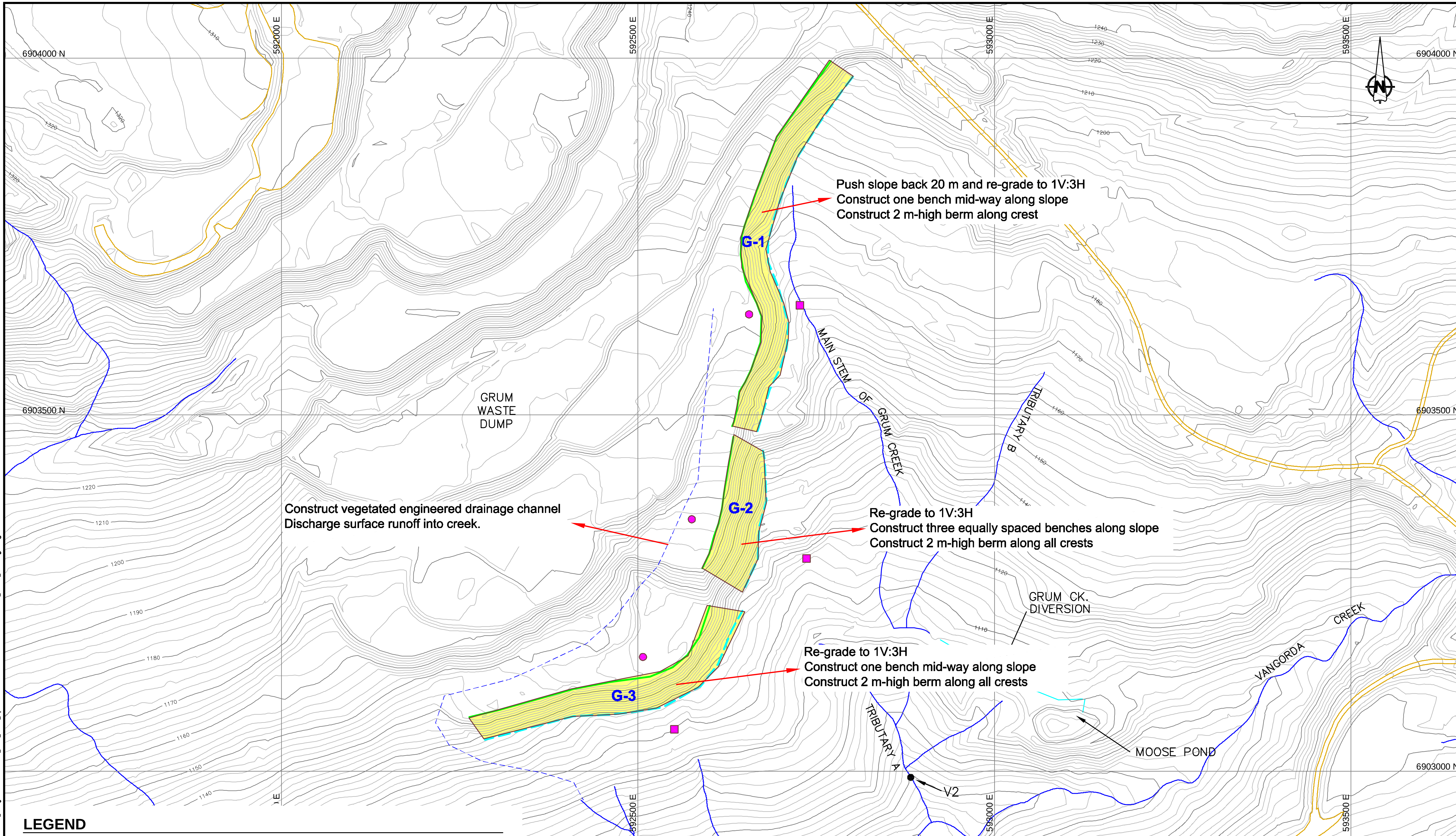
SRK Consulting Engineers and Scientists Vancouver B.C.	Deloitte & Touche	Mine Area Cover Optimization and Landform Engineering
SRK JOB NO.: 1CD003.102	Faro Mine Complex	Graphical Tool for Identification of Channel Armouring Requirement
FILE NAME: 1CD003_102-4.dwg		DATE: June 2008 / APPROVED: / FIGURE: 17



LEGEND

- 3.0H:1V Re-graded Toe Location
- 3.0H:1V Re-graded Crest Location
- Original Crest Location
- Original Toe Location
- Waste Rock Dump Boundary
- Conceptual Drainage Channel
- Path Formed by Waste Dump Seepage
- F-1 Resloping Zones

SRK Consulting Engineers and Scientists Vancouver B.C.	Deloitte & Touche	Mine Area Cover Optimization and Landform Engineering
		Faro Surface Water Management
SRK JOB NO.: 1CD003.102	Faro Mine Complex	DATE: June 2008
FILE NAME: 1CD003_102-2_drainage.dwg		APPROVED:
		FIGURE: 18



LEGEND

- ■ 3.0H:1V Re-graded Toe Location
- ● 3.0H:1V Re-graded Crest Location
- Original Crest Location
- Original Toe Location
- Conceptual Drainage Channel
- G-1 Resloping Zones

0 50 100 150 200 250
Scale in Metres

SRK Consulting
Engineers and Scientists
Vancouver B.C.

SRK JOB NO.: 1CD003.102
FILE NAME: 1CD003_102-3_drainage.dwg

Deloitte & Touche

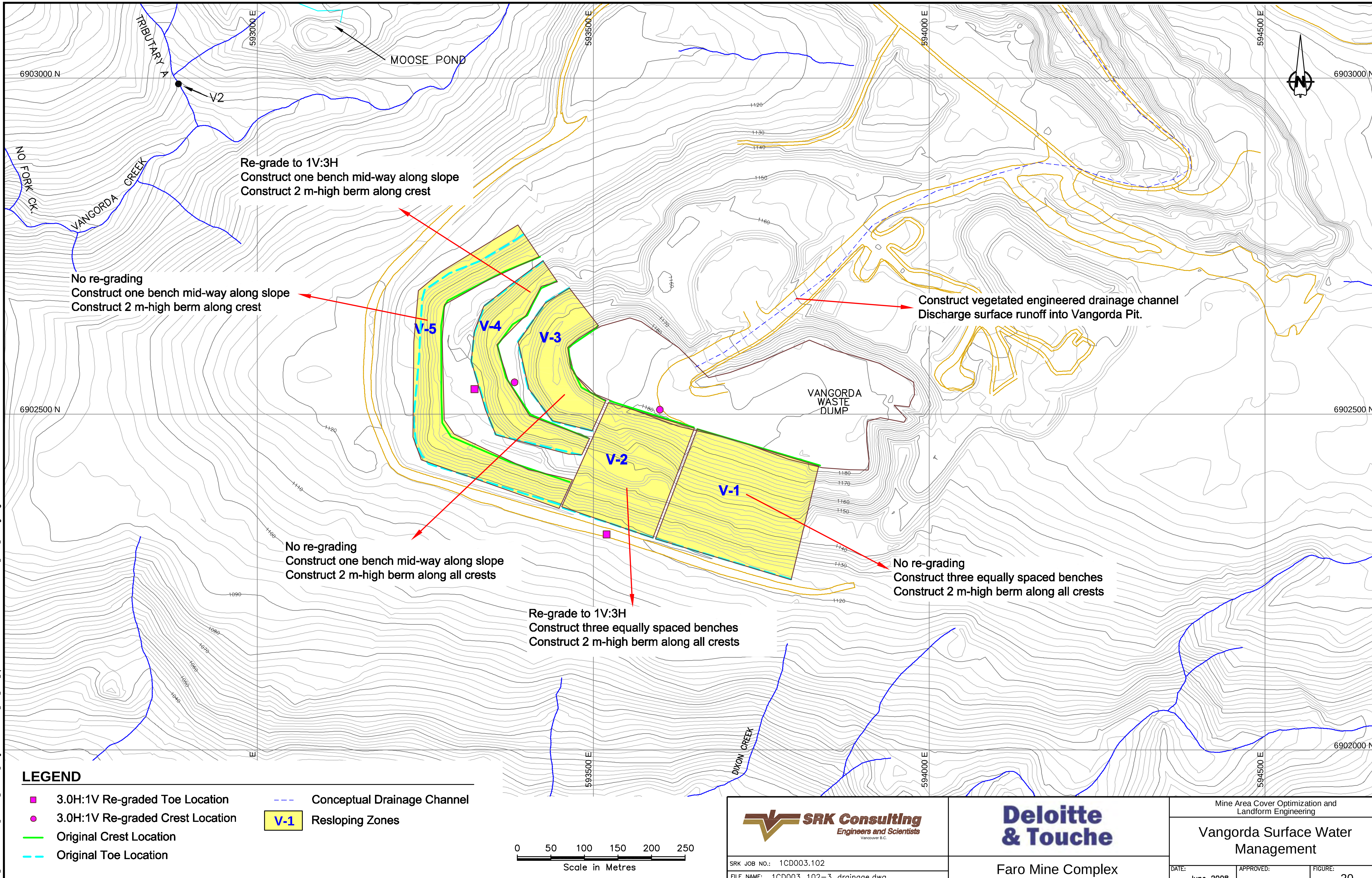
Faro Mine Complex

Mine Area Cover Optimization and Landform Engineering

Grum Surface Water Management

DATE: June 2008
APPROVED:
FIGURE: 19

J:\01_SITES\FARO\1000_Deloitte_from GE_Projects\1CD003.102_Mine_Area_Optimization\TG Work Files\CAD\1CD003_102-3_drainage.dwg



MOOSE POND
TRIBUTARY A
V2
NO FORK CK.
VANGORDA CREEK
6903000 N
6902500 N
6902000 N
593000 E
593500 E
594000 E
594500 E
Re-grade to 1V:3H
Construct one bench mid-way along slope
Construct 2 m-high berm along crest
No re-grading
Construct one bench mid-way along slope
Construct 2 m-high berm along crest
Construct vegetated engineered drainage channel
Discharge surface runoff into Vangorda Pit.
V-5
V-4
V-3
V-2
V-1
VANGORDA WASTE DUMP
No re-grading
Construct one bench mid-way along slope
Construct 2 m-high berm along all crests
No re-grading
Construct three equally spaced benches
Construct 2 m-high berm along all crests
Re-grade to 1V:3H
Construct three equally spaced benches
Construct 2 m-high berm along all crests
DIXON CREEK
LEGEND
3.0H:1V Re-graded Toe Location
3.0H:1V Re-graded Crest Location
Original Crest Location
Original Toe Location
Conceptual Drainage Channel
V-1 Resloping Zones
0 50 100 150 200 250
Scale in Metres
SRK Consulting
Engineers and Scientists
SRK JOB NO.: 1CD003.102
FILE NAME: 1CD003_102-3_drainage.dwg
Deloitte & Touche
Faro Mine Complex
Mine Area Cover Optimization and Landform Engineering
Vangorda Surface Water Management
DATE: June 2008
APPROVED:
FIGURE: 20

Attachment 1
Supporting Tables – Mine Area Cover Optimization

Table 1: Faro Trade-Off Cost Results

Base Case	Water Treatment (NPV)	Cover Construction	TOTAL
Rudimentary Soil Covers Throughout Mine Area	$ 32,159,000	$ 19,013,315	$ 51,172,315

		Water Treatment Costs (NPV)						Cover Placement Costs			TOTAL COSTS			
		No Cover		Low Infiltration Cover		Very Low Infiltration Cover		Cover Cost for Dump						
Variants		Total NPV	Difference	Total NPV	Difference	Total NPV	Difference	Rudimentary Cover	Low Infiltration Cover	Very Low Infiltration Cover	No Cover	Rudimentary Cover	Low Infiltration Cover	Very Low Infiltration Cover
Faro Valley North	FVN	$34,105,000	$1,946,000	$31,924,000	-$235,000	$31,905,000	-$254,000	$804,301	$2,457,911	$4,111,521	$52,314,014	$51,172,315	$52,590,925	$54,225,535
Faro Valley South	FVS	$32,172,000	$13,000	$32,138,000	-$21,000	$32,132,000	-$27,000	$192,945	$590,466	$987,987	$50,992,370	$51,172,315	$51,548,836	$51,940,357
Medium Grade Stockpile	MGSP	$32,590,000	$431,000	$31,825,000	-$334,000	$31,763,000	-$396,000	$127,526	$389,425	$651,324	$51,475,789	$51,172,315	$51,100,214	$51,300,113
Crusher Stockpile	CHSP	$32,442,000	$283,000	$31,955,000	-$204,000	$31,922,000	-$237,000	$127,364	$391,510	$655,657	$51,327,951	$51,172,315	$51,232,461	$51,463,608
Oxide Fines Stockpile	OXSP	$32,461,000	$302,000	$31,949,000	-$210,000	$31,892,000	-$267,000	$195,418	$605,765	$1,016,112	$51,278,897	$51,172,315	$51,372,662	$51,726,010
Low Grade Stockpile A	LGSPA	$32,510,000	$351,000	$31,871,000	-$288,000	$31,835,000	-$324,000	$175,941	$537,124	$898,308	$51,347,374	$51,172,315	$51,245,499	$51,570,683
Upper Northwest Dump	NWU	$32,170,000	$11,000	$32,158,000	-$1,000	$32,158,000	-$1,000	$752,532	$2,300,851	$3,849,171	$50,430,783	$51,172,315	$52,719,635	$54,267,955
Middle Northwest Dump	NWM	$32,165,000	$6,000	$32,158,000	-$1,000	$32,158,000	-$1,000	$918,756	$2,814,586	$4,710,416	$50,259,559	$51,172,315	$53,067,145	$54,962,975
Lower Northwest Dump	NWL	$32,178,000	$19,000	$32,157,000	-$2,000	$32,157,000	-$2,000	$696,734	$2,143,347	$3,589,960	$50,494,581	$51,172,315	$52,616,928	$54,063,541
Mt. Mungly West	MMW	$32,877,000	$718,000	$31,821,000	-$338,000	$31,820,000	-$339,000	$169,009	$515,764	$862,520	$51,721,306	$51,172,315	$51,181,071	$51,526,826
Mt. Mungly East	MME	$32,865,000	$706,000	$31,865,000	-$294,000	$31,865,000	-$294,000	$260,795	$804,395	$1,347,994	$51,617,520	$51,172,315	$51,421,915	$51,965,514
Fuel Tank Dump W	FTW	$32,159,000	$0	$32,159,000	$0	$32,159,000	$0	$50,062	$152,834	$255,606	$51,122,253	$51,172,315	$51,275,087	$51,377,858
Fuel Tank Dump E	FTE	$32,172,000	$13,000	$32,138,000	-$21,000	$32,138,000	-$21,000	$578,079	$1,772,690	$2,967,301	$50,607,236	$51,172,315	$52,345,926	$53,540,536
Upper Parking Lot Dump	UPL	$32,174,000	$15,000	$32,159,000	$0	$32,165,000	$6,000	$280,002	$859,422	$1,438,842	$50,907,313	$51,172,315	$51,751,735	$52,337,155
Lower Parking Lot Dump	LPL	$32,159,000	$0	$32,159,000	$0	$32,159,000	$0	$152,991	$468,657	$784,324	$51,019,324	$51,172,315	$51,487,982	$51,803,648
Stock Piles Base	SPB	$32,172,000	$13,000	$32,138,000	-$21,000	$32,138,000	-$21,000	$444,946	$1,364,520	$2,284,093	$50,740,369	$51,172,315	$52,070,889	$52,990,463
Southwest Pit Wall Dump	SWPWD	$34,829,000	$2,670,000	$30,863,000	-$1,296,000	$30,860,000	-$1,299,000	$411,548	$1,269,241	$2,126,933	$53,430,767	$51,172,315	$50,734,008	$51,588,700
Low Grade Stockpile C	LGSPC	$32,734,000	$575,000	$31,641,000	-$518,000	$31,542,000	-$617,000	$194,738	$594,511	$994,284	$51,552,577	$51,172,315	$51,054,088	$51,354,861
Main East Sulphide Cell	MESC	$34,889,000	$2,730,000	$29,296,000	-$2,863,000	$28,939,000	-$3,220,000	$414,220	$1,263,252	$2,112,284	$53,488,095	$51,172,315	$49,158,347	$49,650,380
Intermediate Dump Sulphide C	IDSC	$35,259,000	$3,100,000	$28,828,000	-$3,331,000	$28,375,000	-$3,784,000	$433,737	$1,323,992	$2,214,247	$53,838,578	$51,172,315	$48,731,570	$49,168,825
Ranch Dump	RD	$32,159,000	$0	$32,158,000	-$1,000	$32,158,000	-$1,000	$229,026	$700,722	$1,172,417	$50,943,289	$51,172,315	$51,643,011	$52,114,706
Ramp Zone Dump	RZD	$32,159,000	$0	$32,158,000	-$1,000	$32,158,000	-$1,000	$375,676	$1,158,048	$1,940,420	$50,796,639	$51,172,315	$51,953,687	$52,736,059
Main Dump West	MDW	$34,091,000	$1,932,000	$32,083,000	-$76,000	$32,082,000	-$77,000	$1,169,336	$3,598,455	$6,027,574	$51,934,979	$51,172,315	$53,525,434	$55,953,553
Main Dump East	MDE	$35,249,000	$3,090,000	$32,038,000	-$121,000	$32,036,000	-$123,000	$2,111,346	$6,497,702	$10,884,058	$52,150,969	$51,172,315	$55,437,671	$59,822,027
Intermediate Dump	ID	$35,038,000	$2,879,000	$32,064,000	-$95,000	$32,062,000	-$97,000	$1,803,069	$5,545,804	$9,288,539	$52,248,246	$51,172,315	$54,820,050	$58,560,785
Outer Haul Road West	OHRW	$32,162,000	$3,000	$32,158,000	-$1,000	$32,158,000	-$1,000	$954,134	$2,953,471	$4,952,808	$50,221,181	$51,172,315	$53,170,652	$55,169,988
Outer Haul Road East	OHRE	$33,379,000	$1,220,000	$32,054,000	-$105,000	$32,054,000	-$105,000	$425,328	$1,317,362	$2,209,396	$51,966,987	$51,172,315	$51,959,349	$52,851,383
Lower Northeast sulphide cell	NELS	$32,747,000	$588,000	$31,596,000	-$563,000	$31,511,000	-$648,000	$90,848	$277,178	$463,507	$51,669,467	$51,172,315	$50,795,645	$50,896,974
Outer Northeast Dump	NEO	$32,159,000	$0	$32,159,000	$0	$32,159,000	$0	$96,515	$294,693	$492,871	$51,075,800	$51,172,315	$51,370,493	$51,568,671
Zone II West	ZIIW	$32,161,000	$2,000	$32,158,000	-$1,000	$32,158,000	-$1,000	$465,465	$1,432,137	$2,398,809	$50,708,850	$51,172,315	$52,137,987	$53,104,660
Zone II East	ZIIE	$32,161,000	$2,000	$32,158,000	-$1,000	$32,158,000	-$1,000	$748,797	$2,314,724	$3,880,652	$50,425,518	$51,172,315	$52,737,242	$54,303,170
Lower Northeast Dump	NEL	$32,127,000	-$32,000	$32,202,000	$43,000	$32,202,000	$43,000	$1,577,999	$4,854,418	$8,130,837	$49,562,316	$51,172,315	$54,491,734	$57,768,153
Upper Northeast Dump	NEU	$32,127,000	-$32,000	$32,192,000	$33,000	$32,207,000	$48,000	$1,584,136	$4,869,376	$8,154,616	$49,556,179	$51,172,315	$54,490,555	$57,790,796
										Soil Cover Thickness (m)	0	0.5	1.5	2.5

Notes
Base Case = Rudimentary Covers throughout Mine Area
Water Treatment Base Case = Total Costs for Rudimentary Covers Throughout Mine Area

Table 2: Vangorda/Grum Trade-Off Cost Results

Base Case	Water Treatment (NPV)	Cover Construction	TOTAL
Rudimentary Soil Covers Throughout Mine Area	$ 19,191,000	$ 4,854,828	$ 24,045,828

		Water Treatment Costs (NPV)						Cover Placement Costs			TOTAL COSTS			
		No Cover		Low Infiltration Cover		Very Low Infiltration Cover		Cover Cost for Dump						
Variants		Total NPV	Difference	Total NPV	Difference	Total NPV	Difference	Rudimentary Cover	Low Infiltration Cover	Very Low Infiltration Cover	No Cover	Rudimentary Cover	Low Infiltration Cover	Very Low Infiltration Cover
Grum Main dump Sulphide Cell	G1-S	$23,426,000	$4,235,000	$16,971,000	-$2,220,000	$16,922,000	-$2,269,000	$194,886	$626,386	$1,057,886	$28,085,942	$24,045,828	$22,257,328	$22,639,828
Grum Dump	G1-B	$20,167,000	$976,000	$18,183,000	-$1,008,000	$18,034,000	-$1,157,000	$2,338,464	$7,507,169	$12,675,874	$22,683,364	$24,045,828	$28,206,533	$33,226,238
Southwest Grum Dump	G2	$19,245,000	$54,000	$19,137,000	-$54,000	$19,125,000	-$66,000	$383,399	$1,211,066	$2,038,732	$23,716,429	$24,045,828	$24,819,494	$25,635,161
Vangorda Main Dump Sulphide Cell	V1-S	$21,142,000	$1,951,000	$17,065,000	-$2,126,000	$16,761,000	-$2,430,000	$126,841	$400,619	$674,397	$25,869,987	$24,045,828	$22,193,606	$22,163,384
Vangorda Main Dump	V1-B	$21,607,000	$2,416,000	$16,804,000	-$2,387,000	$16,416,000	-$2,775,000	$927,129	$2,969,314	$5,011,500	$25,534,699	$24,045,828	$23,701,013	$25,355,199
Vangorda Barite Dump	V2	$19,376,000	$185,000	$19,040,000	-$151,000	$18,994,000	-$197,000	$15,563	$49,788	$84,013	$24,215,265	$24,045,828	$23,929,053	$23,917,278
										Soil Cover Thickness (m):	0	0.5	1.5	2.5

Notes:
Base Case = Rudimentary Covers throughout Mine Area
Water Treatment Base Case = Total Costs for Rudimentary Covers Throughout Mine Area

Table 3: Faro Mine Area Optimized Cover Cost Summary

	Dump		Cover Type	Cost
Cover Placement Cost	Faro Valley North	FVN	Rudimentary	$804,301
	Faro Valley South	FVS	Rudimentary	$192,945
	Medium Grade Stockpile	MGSP	Low Infiltration Cover	$389,425
	Crusher Stockpile	CHSP	Rudimentary	$127,364
	Oxide Fines Stockpile	OXSP	Rudimentary	$195,418
	Low Grade Stockpile A	LGSPA	Rudimentary	$175,941
	Upper Northwest Dump	NWU	Rudimentary	$752,532
	Middle Northwest Dump	NWM	Rudimentary	$918,756
	Lower Northwest Dump	NWL	Rudimentary	$696,734
	Mt. Mungly West	MMW	Rudimentary	$169,009
	Mt. Mungly East	MME	Rudimentary	$260,795
	Fuel Tank Dump W	FTW	Rudimentary	$50,062
	Fuel Tank Dump E	FTE	Rudimentary	$578,079
	Upper Parking Lot Dump	UPL	Rudimentary	$280,002
	Lower Parking Lot Dump	LPL	Rudimentary	$152,991
	Stock Piles Base	SPB	Rudimentary	$444,946
	Southwest Pit Wall Dump	SWPWD	Low Infiltration Cover	$1,269,241
	Low Grade Stockpile C	LGSPC	Low Infiltration Cover	$594,511
	Main East Sulphide Cell	MESC	Very Low Infiltration Cover	$2,112,284
	Intermediate Dump Sulphide Cell	IDSC	Very Low Infiltration Cover	$2,214,247
	Ranch Dump	RD	Rudimentary	$229,026
	Ramp Zone Dump	RZD	Rudimentary	$375,676
	Main Dump West	MDW	Rudimentary	$1,169,336
	Main Dump East	MDE	Rudimentary	$2,111,346
	Intermediate Dump	ID	Rudimentary	$1,803,069
	Outer Haul Road West	OHRW	Rudimentary	$954,134
	Outer Haul Road East	OHRE	Rudimentary	$425,328
	Lower Northeast sulphide cell	NELS	Very Low Infiltration Cover	$463,507
	Outer Northeast Dump	NEO	Rudimentary	$96,515
	Zone II West	ZIIW	Rudimentary	$465,465
	Zone II East	ZIIE	Rudimentary	$748,797
	Lower Northeast Dump	NEL	Rudimentary	$1,577,999
	Upper Northeast Dump	NEU	Rudimentary	$1,584,136
Total Cover Costs:				**$24,383,914**
Water Treatment Cost (NPV):				**$ 22,107,000**
TOTAL COST (NPV):				**$ 46,490,914**

Table 4: Vangorda/Grum Mine Area Optimized Cover Cost Summary

	Dump		Cover Type	Cost
Cover Placement Cost	Grum Main dump Sulphide Cell	G1-S	Very Low Infiltration Cover	$ 1,057,886
	Grum Dump	G1-B	Rudimentary	$ 2,338,464
	Southwest Grum Dump	G2	Rudimentary	$ 383,399
	Vangorda Main Dump Sulphide Cell	V1-S	Very Low Infiltration Cover	$ 674,397
	Vangorda Main Dump	V1-B	Low Infiltration Cover	$ 2,969,314
	Vangorda Barite Dump	V2	Very Low Infiltration Cover	$ 84,013
Total Cover Costs:				**$7,507,473**
Water Treatment Cost (NPV):				**$13,573,000**
TOTAL COST (NPV):				**$ 21,080,473**

Table 5: NPV Water Treatment Result Summary

No.	Site	Sim ID	Capital Cost	NPV Operating Cost	Total NPV Water Treatment	Sludge Volume to Year 500 (m^3)	Sludge Volume to Year 1000 (m^3)	Run Description
1	Faro	No Cover	$4,549,000	$54,701,000	**$59,250,000**	13,765,000	29,769,000	No Covers throughout mine area
2	**Faro**	**Rudimentary**	**$3,045,000**	**$29,114,000**	**$32,159,000**	**4,492,000**	**11,350,000**	**Rudimentary Covers Throughout Mine Area (Base Case)**
3	Faro	SWPWD-NO	$3,086,000	$31,743,000	**$34,829,000**	4,844,000	12,161,000	Rudimentary Covers + No Covers on SWPWD
4	Faro	SWPWD-LI	$2,994,000	$27,869,000	**$30,863,000**	4,190,000	10,617,000	Rudimentary Covers + Low Infiltration on SWPWD
5	Faro	SWPWD-VLI	$2,994,000	$27,866,000	**$30,860,000**	4,143,000	10,513,000	Rudimentary Covers + Very Low Infiltration on SWPWD
6	Faro	UPL-NO	$3,045,000	$29,129,000	**$32,174,000**	4,495,000	11,356,000	Base Case + No cover on ULP
7	Faro	ULP-LI	$3,045,000	$29,114,000	**$32,159,000**	4,490,000	11,344,000	Base Case + Low Infiltration on ULP
8	Faro	ULP-VLI	$3,045,000	$29,120,000	**$32,165,000**	4,489,000	11,343,000	Base Case + Very Low Infiltration on ULP
9	Faro	FVN-NO	$3,193,000	$30,912,000	**$34,105,000**	5,120,000	12,775,000	Base Case + No Cover on FVN
10	Faro	FVN-LI	$3,042,000	$28,882,000	**$31,924,000**	3,934,000	10,040,000	Base Case + Low Infiltration on FVN
11	Faro	FVN-VLI	$3,042,000	$28,863,000	**$31,905,000**	3,933,000	9,914,000	Base Case + Very Low Infiltration on FVN
12	Faro	FVS-NO	$3,045,000	$29,127,000	**$32,172,000**	4,496,000	11,360,000	Base Case + No Cover on FVS
13	Faro	FVS-LI	$3,045,000	$29,093,000	**$32,138,000**	4,487,000	11,338,000	Base Case + Low Infiltration on FVS
14	Faro	FVS-VLI	$3,042,000	$29,090,000	**$32,132,000**	4,486,000	11,336,000	Base Case + Very Low Infiltration on FVS
15	Faro	MGSP-NO	$3,045,000	$29,545,000	**$32,590,000**	4,537,000	11,455,000	Base Case + No Cover on MGSP
16	Faro	MGSP-LI	$3,035,000	$28,790,000	**$31,825,000**	4,448,000	11,245,000	Base Case + Low Infiltration on MGSP
17	Faro	MGSP-VLI	$3,033,000	$28,730,000	**$31,763,000**	4,441,000	11,229,000	Base Case + Very Low Infiltration on MGSP
18	Faro	CHSP-NO	$3,045,000	$29,397,000	**$32,442,000**	4,522,000	11,421,000	Base Case + No Cover on CHSP
19	Faro	CHSP-LI	$3,042,000	$28,913,000	**$31,955,000**	4,462,000	11,279,000	Base Case + Low Infiltration on CHSP
20	Faro	CHSP-VLI	$3,042,000	$28,880,000	**$31,922,000**	4,457,000	11,268,000	Base Case + Very Low Infiltration on CHSP
21	Faro	OXSP-NO	$3,045,000	$29,416,000	**$32,461,000**	4,519,000	11,414,000	Base Case + No Cover on OXSP
22	Faro	OXSP-LI	$3,042,000	$28,907,000	**$31,949,000**	4,465,000	11,285,000	Base Case + Low Infiltration on OXSP
23	Faro	OXSP-VLI	$3,042,000	$28,850,000	**$31,892,000**	4,461,000	11,276,000	Base Case + Very Low Infiltration on OXSP
24	Faro	LGSPA-NO	$3,045,000	$29,465,000	**$32,510,000**	4,531,000	11,441,000	Base Case + No Cover on LGSPA
25	Faro	LGSPA-LI	$3,036,000	$28,835,000	**$31,871,000**	4,454,000	11,259,000	Base Case + Low Infiltration on LGSPA
26	Faro	LGSPA-VLI	$3,035,000	$28,800,000	**$31,835,000**	4,448,000	11,245,000	Base Case + Very Low Infiltration on LGSPA
27	Faro	NWU-NO	$3,045,000	$29,125,000	**$32,170,000**	4,510,000	11,396,000	Base Case + No Cover on NWU
28	Faro	NWU-LI	$3,045,000	$29,113,000	**$32,158,000**	4,475,000	11,301,000	Base Case + Low Infiltration on NWU
29	Faro	NWU-VLI	$3,045,000	$29,113,000	**$32,158,000**	4,474,000	11,297,000	Base Case + Very Low Infiltration on NWU
30	Faro	NWM-NO	$3,045,000	$29,120,000	**$32,165,000**	4,522,000	11,414,000	Base Case + No Cover on NWM
31	Faro	NWM-LI	$3,045,000	$29,113,000	**$32,158,000**	4,476,000	11,294,000	Base Case + Low Infiltration on NWM
32	Faro	NWM-VLI	$3,045,000	$29,113,000	**$32,158,000**	4,475,000	11,291,000	Base Case + Very Low Infiltration on NWM
33	Faro	NWL-NO	$3,045,000	$29,133,000	**$32,178,000**	4,495,000	11,376,000	Base Case + No Cover on NWL
34	Faro	NWL-LI	$3,045,000	$29,112,000	**$32,157,000**	4,476,000	11,318,000	Base Case + Low Infiltration on NWL
35	Faro	NWL-VLI	$3,045,000	$29,112,000	**$32,157,000**	4,473,000	11,307,000	Base Case + Very Low Infiltration on NWL
36	Faro	MMW-NO	$3,059,000	$29,818,000	**$32,877,000**	4,579,000	11,555,000	Base Case + No Cover on MMW
37	Faro	MMW-LI	$3,033,000	$28,788,000	**$31,821,000**	4,409,000	11,148,000	Base Case + Low Infiltration on MMW
38	Faro	MMW-VLI	$3,033,000	$28,787,000	**$31,820,000**	4,396,000	11,117,000	Base Case + Very Low Infiltration on MMW
39	Faro	MME-NO	$3,060,000	$29,805,000	**$32,865,000**	4,636,000	11,694,000	Base Case + No Cover on MME
40	Faro	MME-LI	$3,025,000	$28,840,000	**$31,865,000**	4,345,000	11,002,000	Base Case + Low Infiltration on MME
41	Faro	MME-VLI	$3,025,000	$28,840,000	**$31,865,000**	4,332,000	10,955,000	Base Case + Very Low Infiltration on MME
42	Faro	FTW-NO	$3,045,000	$29,114,000	**$32,159,000**	4,493,000	11,351,000	Base Case + No Cover on FTW
43	Faro	FTW-LI	$3,045,000	$29,114,000	**$32,159,000**	4,491,000	11,348,000	Base Case + Low Infiltration on FTW
44	Faro	FTW-VLI	$3,045,000	$29,114,000	**$32,159,000**	4,491,000	11,348,000	Base Case + Very Low Infiltration on FTW
45	Faro	FTE-NO	$3,045,000	$29,127,000	**$32,172,000**	4,504,000	11,380,000	Base Case + No Cover on FTE
46	Faro	FTE-LI	$3,045,000	$29,093,000	**$32,138,000**	4,481,000	11,320,000	Base Case + Low Infiltration on FTE
47	Faro	FTE-VLI	$3,045,000	$29,093,000	**$32,138,000**	4,480,000	11,317,000	Base Case + Very Low Infiltration on FTE
48	Faro	LPL-NO	$3,045,000	$29,114,000	**$32,159,000**	4,496,000	11,362,000	Base Case + No Cover on LPL
49	Faro	LPL-LI	$3,045,000	$29,114,000	**$32,159,000**	4,490,000	11,342,000	Base Case + Low Infiltration on LPL
50	Faro	LPL-VLI	$3,045,000	$29,114,000	**$32,159,000**	4,490,000	11,341,000	Base Case + Very Low Infiltration on LPL
51	Faro	SPB-NO	$3,045,000	$29,127,000	**$32,172,000**	4,503,000	11,378,000	Base Case + No Cover on SPB
52	Faro	SPB-LI	$3,045,000	$29,093,000	**$32,138,000**	4,482,000	11,322,000	Base Case + Low Infiltration on SPB
53	Faro	SPB-VLI	$3,045,000	$29,093,000	**$32,138,000**	4,481,000	11,318,000	Base Case + Very Low Infiltration on SPB
54	Faro	LGSPC-NO	$3,048,000	$29,686,000	**$32,734,000**	4,560,000	11,510,000	Base Case + No Cover on LPSPC
55	Faro	LGSPC-LI	$3,033,000	$28,608,000	**$31,641,000**	4,424,000	11,189,000	Base Case + Low Infiltration on LGSPC
56	Faro	LGSPC-VLI	$3,033,000	$28,509,000	**$31,542,000**	4,414,000	11,165,000	Base Case + Very Low Infiltration on LGSPC
57	Faro	MESC-NO	$3,086,000	$31,803,000	**$34,889,000**	4,852,000	12,184,000	Base Case + No Cover on MESC
58	Faro	MESC-LI	$3,008,000	$26,288,000	**$29,296,000**	4,182,000	10,597,000	Base Case + Low Infiltration on MESC
59	Faro	MESC-VLI	$2,999,000	$25,940,000	**$28,939,000**	4,138,000	10,493,000	Base Case + Very Low Infiltration on MESC
60	Faro	IDSC-NO	$3,088,000	$32,171,000	**$35,259,000**	4,909,000	12,311,000	Base Case + No Cover on IDSC
61	Faro	IDSC-LI	$2,999,000	$25,829,000	**$28,828,000**	4,138,000	10,494,000	Base Case + Low Infiltration on IDSC
62	Faro	IDSC-VLI	$2,976,000	$25,399,000	**$28,375,000**	4,087,000	10,375,000	Base Case + Very Low Infiltration on IDSC
63	Faro	RD-NO	$3,045,000	$29,114,000	**$32,159,000**	4,498,000	11,365,000	Base Case + No Cover on RD
64	Faro	RD-LI	$3,045,000	$29,113,000	**$32,158,000**	4,486,000	11,333,000	Base Case + Low Infiltration on RD
65	Faro	RD-VLI	$3,045,000	$29,113,000	**$32,158,000**	4,485,000	11,332,000	Base Case + Very Low Infiltration on RD
66	Faro	RZD-NO	$3,045,000	$29,114,000	**$32,159,000**	4,500,000	11,370,000	Base Case + No Cover on RZD
67	Faro	RZD-LI	$3,045,000	$29,113,000	**$32,158,000**	4,484,000	11,330,000	Base Case + Low Infiltration on RZD
68	Faro	RZD-VLI	$3,045,000	$29,113,000	**$32,158,000**	4,483,000	11,327,000	Base Case + Very Low Infiltration on RZD
69	Faro	MDW-NO	$3,315,000	$30,776,000	**$34,091,000**	5,720,000	13,872,000	Base Case + No Cover on MDW
70	Faro	MDW-LI	$3,042,000	$29,041,000	**$32,083,000**	3,669,000	9,202,000	Base Case + Low Infiltration on MDW
71	Faro	MDW-VLI	$3,042,000	$29,040,000	**$32,082,000**	3,667,000	9,131,000	Base Case + Very Low Infiltration on MDW
72	Faro	MDE-NO	$3,475,000	$31,774,000	**$35,249,000**	6,524,000	15,464,000	Base Case + No Cover on MDE
73	Faro	MDE-LI	$3,042,000	$28,996,000	**$32,038,000**	3,176,000	7,932,000	Base Case + Low Infiltration on MDE
74	Faro	MDE-VLI	$3,042,000	$28,994,000	**$32,036,000**	3,174,000	7,819,000	Base Case + Very Low Infiltration on MDE
75	Faro	ID-NO	$3,453,000	$31,585,000	**$35,038,000**	6,366,000	15,149,000	Base Case + No Cover on ID
76	Faro	ID-LI	$3,042,000	$29,022,000	**$32,064,000**	3,273,000	8,183,000	Base Case + Low Infiltration on ID
77	Faro	ID-VLI	$3,042,000	$29,020,000	**$32,062,000**	3,271,000	8,078,000	Base Case + Very Low Infiltration on ID
78	Faro	OHRW-NO	$3,045,000	$29,117,000	**$32,162,000**	4,525,000	11,424,000	Base Case + No Cover on OHRW
79	Faro	OHRW-LI	$3,045,000	$29,113,000	**$32,158,000**	4,473,000	11,286,000	Base Case + Low Infiltration on OHRW
80	Faro	OHRW-VLI	$3,045,000	$29,113,000	**$32,158,000**	4,472,000	11,281,000	Base Case + Very Low Infiltration on OHRW
81	Faro	OHRE-NO	$3,146,000	$30,233,000	**$33,379,000**	4,885,000	12,251,000	Base Case + No Cover on OHRE
82	Faro	OHRE-LI	$3,045,000	$29,009,000	**$32,054,000**	4,131,000	10,491,000	Base Case + Low Infiltration on OHRE
83	Faro	OHRE-VLI	$3,045,000	$29,009,000	**$32,054,000**	4,130,000	10,411,000	Base Case + Very Low Infiltration on OHRE
84	Faro	NELS-NO	$3,054,000	$29,693,000	**$32,747,000**	4,566,000	11,526,000	Base Case + No Cover on NELS
85	Faro	NELS-LI	$3,033,000	$28,563,000	**$31,596,000**	4,420,000	11,176,000	Base Case + Low Infiltration on NELS
86	Faro	NELS-VLI	$3,033,000	$28,478,000	**$31,511,000**	4,410,000	11,150,000	Base Case + Very Low Infiltration on NELS
87	Faro	NEO-NO	$3,045,000	$29,114,000	**$32,159,000**	4,493,000	11,352,000	Base Case + No Cover on NEO
88	Faro	NEO-LI	$3,045,000	$29,114,000	**$32,159,000**	4,491,000	11,347,000	Base Case + Low Infiltration on NEO
89	Faro	NEO-VLI	$3,045,000	$29,114,000	**$32,159,000**	4,491,000	11,347,000	Base Case + Very Low Infiltration on NEO
90	Faro	ZIIW-NO	$3,045,000	$29,116,000	**$32,161,000**	4,506,000	11,384,000	Base Case + No Cover on ZIIW
91	Faro	ZIIW-LI	$3,045,000	$29,113,000	**$32,158,000**	4,478,000	11,312,000	Base Case + Low Infiltration on ZIIW
92	Faro	ZIIW-VLI	$3,045,000	$29,113,000	**$32,158,000**	4,477,000	11,310,000	Base Case + Very Low Infiltration on ZIIW

Table 5: NPV Water Treatment Result Summary

No.	Site	Sim ID	Capital Cost	NPV Operating Cost	Total NPV Water Treatment	Sludge Volume to Year 500 (m^3)	Sludge Volume to Year 1000 (m^3)	Run Description
93	Faro	ZIIE-NO	$3,045,000	$29,116,000	**$32,161,000**	4,502,000	11,376,000	Base Case + No Cover on ZIIE
94	Faro	ZIIE-LI	$3,045,000	$29,113,000	**$32,158,000**	4,482,000	11,324,000	Base Case + Low Infiltration on ZIIE
95	Faro	ZIIE-VLI	$3,045,000	$29,113,000	**$32,158,000**	4,481,000	11,320,000	Base Case + Very Low Infiltration on ZIIE
96	Faro	NEL-NO	$3,042,000	$29,085,000	**$32,127,000**	4,548,000	11,465,000	Base Case + No Cover on NEL
97	Faro	NEL-LI	$3,045,000	$29,157,000	**$32,202,000**	4,467,000	11,255,000	Base Case + Low Infiltration on NEL
98	Faro	NEL-VLI	$3,045,000	$29,157,000	**$32,202,000**	4,466,000	11,251,000	Base Case + Very Low Infiltration on NEL
99	Faro	NEU-NO	$3,042,000	$29,085,000	**$32,127,000**	4,544,000	11,458,000	Base Case + No Cover on NEU
100	Faro	NEU-LI	$3,045,000	$29,147,000	**$32,192,000**	4,469,000	11,261,000	Base Case + Low Infiltration on NEU
101	Faro	NEU-VLI	$3,045,000	$29,162,000	**$32,207,000**	4,467,000	11,257,000	Base Case + Very Low Infiltration on NEU
102								
103	V/G	Rudimentary	$1,656,000	$17,535,000	**$19,191,000**	1,070,000	2,194,000	Base Case (Rudimentary Covers throughout mine area)
104	V/G	G1-S-NO	$1,724,000	$21,702,000	**$23,426,000**	1,648,000	3,337,000	Base Case + No Cover on G1-S
105	V/G	G1-S-LI	$1,569,000	$15,402,000	**$16,971,000**	489,000	1,048,000	Base Case + Low Infiltration on G1-S
106	V/G	G1-S-VLI	$1,569,000	$15,353,000	**$16,922,000**	387,000	862,000	Base Case + Very Low Infiltration on G1-S
107	V/G	G1-B-NO	$1,671,000	$18,496,000	**$20,167,000**	1,325,000	2,706,000	Base Case + No Cover on G1-B
108	V/G	G1-B-LI	$1,640,000	$16,543,000	**$18,183,000**	823,000	1,690,000	Base Case + Low Infiltration on G1-B
109	V/G	G1-B-VLI	$1,636,000	$16,398,000	**$18,034,000**	786,000	1,615,000	Base Case + Very Low Infiltration on G1-B
110	V/G	G2-NO	$1,656,000	$17,589,000	**$19,245,000**	1,095,000	2,246,000	Base Case + No Cover on G2
111	V/G	G2-LI	$1,655,000	$17,482,000	**$19,137,000**	1,045,000	2,142,000	Base Case + Low Infiltration on G2
112	V/G	G2-VLI	$1,655,000	$17,470,000	**$19,125,000**	1,041,000	2,135,000	Base Case + Very Low Infiltration on G2
113	V/G	G3-O-NO	$1,656,000	$17,620,000	**$19,276,000**	1,105,000	2,264,000	Base Case + No Cover on G3-O
114	V/G	G3-O-LI	$1,655,000	$17,490,000	**$19,145,000**	1,036,000	2,125,000	Base Case + Low Infiltration on G3-O
115	V/G	G3-O-VLI	$1,655,000	$17,451,000	**$19,106,000**	1,031,000	2,114,000	Base Case + Very Low Infiltration on G3-O
116	V/G	V1-S-NO	$1,681,000	$19,461,000	**$21,142,000**	1,328,000	2,707,000	Base Case + No Cover on V1-S
117	V/G	V1-S-LI	$1,625,000	$15,440,000	**$17,065,000**	798,000	1,666,000	Base Case + Low Infiltration on V1-S
118	V/G	V1-S-VLI	$1,621,000	$15,140,000	**$16,761,000**	724,000	1,553,000	Base Case + Very Low Infiltration on V1-S
119	V/G	V1-B-NO	$1,686,000	$19,921,000	**$21,607,000**	1,445,000	2,947,000	Base Case + No Cover on V1-B
120	V/G	V1-B-LI	$1,621,000	$15,183,000	**$16,804,000**	710,000	1,455,000	Base Case + Low Infiltration on V1-B
121	V/G	V1-B-VLI	$1,614,000	$14,802,000	**$16,416,000**	656,000	1,345,000	Base Case + Very Low Infiltration on V1-B
122	V/G	V2-NO	$1,656,000	$17,720,000	**$19,376,000**	1,095,000	2,243,000	Base Case + No Cover on V2
123	V/G	V2-LI	$1,655,000	$17,385,000	**$19,040,000**	1,047,000	2,146,000	Base Case + Low Infiltration on V2
124	V/G	V2-VLI	$1,655,000	$17,339,000	**$18,994,000**	1,043,000	2,139,000	Base Case + Very Low Infiltration on V2
125	V/G	V3-O-NO	$1,656,000	$17,581,000	**$19,237,000**	1,081,000	2,215,000	Base Case + No Cover on V3-O
126	V/G	V3-O-LI	$1,655,000	$17,485,000	**$19,140,000**	1,060,000	2,173,000	Base Case + Low Infiltration on V3-O
127	V/G	V3-O-VLI	$1,655,000	$17,485,000	**$19,140,000**	1,059,000	2,170,000	Base Case + Very Low Infiltration on V3-O
128								
129	Faro	FaroOp	$2,823,000	$19,284,000	**$22,107,000**	3,455,000	8,673,000	Faro Optimized Cover Thickness Base Case
130	Faro	FV1-NELS	$2,823,000	$19,254,000	**$22,077,000**	3,449,000	8,659,000	Faro Optimized, relocated NELS
131	Faro	FV2-MGSP	$2,821,000	$19,117,000	**$21,938,000**	3,444,000	8,649,000	Faro Optimized, relocated MGSP
132	Faro	FV3-FV	$2,821,000	$19,073,000	**$21,894,000**	2,909,000	7,294,000	Faro Optimized, relocated Faro Valley Dumps
133								
134	V/G	VG-Op	$1,486,000	$12,087,000	**$13,573,000**	149,000	312,000	Vangorda/Grum Optimized Cover Thicknesses

Table 6: Faro Mine Area Cover Costs

Compaction Cost per sq.m.			
	Flat	$ 0.13	/m2
	Sloped	$ 0.26	/m2

Dump		Areas: Flat Area (m^2)	Areas: Sloped Area (m^2)	Areas: Total Area (m^2)	Material Unit Cost ($/Bm^3)	Rudimentary Cover Material: Thickness (m)	Rudimentary Cover Material: Placement Cost ($)	Low Infiltration Cost Material: Thickness (m)	Low Infiltration Cost Material: Placement Cost ($)	Low Infiltration Cost Compaction: Lifts	Low Infiltration Cost Compaction: Compaction Cost Flat Areas ($)	Low Infiltration Cost Compaction: Compaction Cost Sloped Areas ($)	Low Infiltration Cost: TOTAL	Very Low Infiltration Material: Thickness (m)	Very Low Infiltration Material: Placement Cost ($)	Very Low Infiltration Compaction: Lifts	Very Low Infiltration Compaction: Compaction Cost Flat Areas ($)	Very Low Infiltration Compaction: Compaction Cost Sloped Areas ($)	Very Low Infiltration: TOTAL
Faro Valley North	FVN	108,780	33,035	141,815	$11.34	0.5	$804,301	1.5	$2,412,902	2	$28,002	$17,007	$2,457,911	2.5	$4,021,503	4	$56,003	$34,014	$4,111,521
Faro Valley South	FVS	24,080	10,553	34,634	$11.14	0.5	$192,945	1.5	$578,834	2	$6,199	$5,433	$590,466	2.5	$964,723	4	$12,397	$10,866	$987,987
Medium Grade Stockpile	MGSP	26,600	0	26,600	$9.59	0.5	$127,526	1.5	$382,578	2	$6,847	$0	$389,425	2.5	$637,630	4	$13,694	$0	$651,324
Crusher Stockpile	CHSP	16,081	10,254	26,335	$9.67	0.5	$127,364	1.5	$382,092	2	$4,139	$5,279	$391,510	2.5	$636,820	4	$8,279	$10,558	$655,657
Oxide Fines Stockpile	OXSP	5,900	34,950	40,850	$9.57	0.5	$195,418	1.5	$586,253	2	$1,519	$17,993	$605,765	2.5	$977,088	4	$3,037	$35,987	$1,016,112
Low Grade Stockpile A	LGSPA	36,139	0	36,139	$9.74	0.5	$175,941	1.5	$527,822	2	$9,303	$0	$537,124	2.5	$879,703	4	$18,605	$0	$898,308
Upper Northwest Dump	NWU	97,330	35,357	132,687	$11.34	0.5	$752,532	1.5	$2,257,595	2	$25,054	$18,203	$2,300,851	2.5	$3,762,658	4	$50,108	$36,405	$3,849,171
Middle Northwest Dump	NWM	112,470	57,041	169,511	$10.84	0.5	$918,756	1.5	$2,756,268	2	$28,951	$29,366	$2,814,586	2.5	$4,593,780	4	$57,903	$58,733	$4,710,416
Lower Northwest Dump	NWL	54,436	76,011	130,447	$10.68	0.5	$696,734	1.5	$2,090,201	2	$14,013	$39,133	$2,143,347	2.5	$3,483,669	4	$28,025	$78,266	$3,589,960
Mt. Mungly West	MMW	33,947	0	33,947	$9.96	0.5	$169,009	1.5	$507,026	2	$8,738	$0	$515,764	2.5	$845,043	4	$17,477	$0	$862,520
Mt. Mungly East	MME	15,000	35,250	50,250	$10.38	0.5	$260,795	1.5	$782,386	2	$3,861	$18,148	$804,395	2.5	$1,303,976	4	$7,722	$36,296	$1,347,994
Fuel Tank Dump W	FTW	10,283	0	10,283	$9.74	0.5	$50,062	1.5	$150,187	2	$2,647	$0	$152,834	2.5	$250,312	4	$5,294	$0	$255,606
Fuel Tank Dump E	FTE	82,849	33,264	116,113	$9.96	0.5	$578,079	1.5	$1,734,238	2	$21,327	$17,125	$1,772,690	2.5	$2,890,397	4	$42,653	$34,250	$2,967,301
Upper Parking Lot Dump	UPL	37,819	18,804	56,623	$9.89	0.5	$280,002	1.5	$840,006	2	$9,735	$9,681	$859,422	2.5	$1,400,010	4	$19,471	$19,361	$1,438,842
Lower Parking Lot Dump	LPL	23,974	6,826	30,799	$9.93	0.5	$152,991	1.5	$458,972	2	$6,171	$3,514	$468,657	2.5	$764,954	4	$12,342	$7,028	$784,324
Stock Piles Base	SPB	71,925	21,692	93,618	$9.51	0.5	$444,946	1.5	$1,334,837	2	$18,515	$11,168	$1,364,520	2.5	$2,224,728	4	$37,029	$22,336	$2,284,093
Southwest Pit Wall Dump	SWPWD	41,400	46,500	87,900	$9.36	0.5	$411,548	1.5	$1,234,644	2	$10,657	$23,940	$1,269,241	2.5	$2,057,740	4	$21,314	$47,879	$2,126,933
Low Grade Stockpile C	LGSPC	40,000	0	40,000	$9.74	0.5	$194,738	1.5	$584,214	2	$10,297	$0	$594,511	2.5	$973,691	4	$20,593	$0	$994,284
Main East Sulphide Cell	MESC	80,000	0	80,000	$10.36	0.5	$414,220	1.5	$1,242,659	2	$20,593	$0	$1,263,252	2.5	$2,071,098	4	$41,186	$0	$2,112,284
Intermediate Dump Sulphide Cell	IDSC	88,500	0	88,500	$9.80	0.5	$433,737	1.5	$1,301,211	2	$22,781	$0	$1,323,992	2.5	$2,168,685	4	$45,562	$0	$2,214,247
Ranch Dump	RD	44,000	4,500	48,500	$9.44	0.5	$229,026	1.5	$687,079	2	$11,326	$2,317	$700,722	2.5	$1,145,131	4	$22,653	$4,633	$1,172,417
Ramp Zone Dump	RZD	36,212	42,148	78,360	$9.59	0.5	$375,676	1.5	$1,127,027	2	$9,322	$21,699	$1,158,048	2.5	$1,878,379	4	$18,643	$43,398	$1,940,420
Main Dump West	MDW	112,000	119,684	231,684	$10.09	0.5	$1,169,336	1.5	$3,508,007	2	$28,830	$61,617	$3,598,455	2.5	$5,846,679	4	$57,661	$123,234	$6,027,574
Main Dump East	MDE	168,234	233,783	402,017	$10.50	0.5	$2,111,346	1.5	$6,334,037	2	$43,306	$120,358	$6,497,702	2.5	$10,556,729	4	$86,612	$240,717	$10,884,058
Intermediate Dump	ID	210,069	160,288	370,358	$9.74	0.5	$1,803,069	1.5	$5,409,208	2	$54,075	$82,521	$5,545,804	2.5	$9,015,346	4	$108,150	$165,043	$9,288,539
Outer Haul Road West	OHRW	66,806	143,486	210,292	$9.07	0.5	$954,134	1.5	$2,862,403	2	$17,197	$73,871	$2,953,471	2.5	$4,770,672	4	$34,394	$147,742	$4,952,808
Outer Haul Road East	OHRE	34,083	63,332	97,415	$8.73	0.5	$425,328	1.5	$1,275,983	2	$8,773	$32,605	$1,317,362	2.5	$2,126,639	4	$17,547	$65,211	$2,209,396
Lower Northeast sulphide cell	NELS	18,000	0	18,000	$10.09	0.5	$90,848	1.5	$272,544	2	$4,633	$0	$277,178	2.5	$454,240	4	$9,267	$0	$463,507
Outer Northeast Dump	NEO	20,000	0	20,000	$9.65	0.5	$96,515	1.5	$289,545	2	$5,148	$0	$294,693	2.5	$482,575	4	$10,297	$0	$492,871
Zone II West	ZIIW	65,477	36,689	102,166	$9.11	0.5	$465,465	1.5	$1,396,394	2	$16,855	$18,888	$1,432,137	2.5	$2,327,323	4	$33,710	$37,777	$2,398,809
Zone II East	ZIIE	51,680	106,890	158,570	$9.44	0.5	$748,797	1.5	$2,246,391	2	$13,303	$55,030	$2,314,724	2.5	$3,743,985	4	$26,606	$110,060	$3,880,652
Lower Northeast Dump	NEL	128,812	169,500	298,312	$10.58	0.5	$1,577,999	1.5	$4,733,996	2	$33,158	$87,264	$4,854,418	2.5	$7,889,993	4	$66,316	$174,527	$8,130,837
Upper Northeast Dump	NEU	141,666	156,367	298,032	$10.63	0.5	$1,584,136	1.5	$4,752,407	2	$36,467	$80,502	$4,869,376	2.5	$7,920,678	4	$72,934	$161,005	$8,154,616
TOTALS		**2,104,552**	**1,656,201**	**3,760,753**			**$ 19,013,315**						**$ 58,434,352**						**$ 97,855,389**

Table 7: Vangorda/Grum Mine Area Cover Costs

Compaction Cost per sq.m.	Flat	$ 0.13	/m2
	Sloped	$ 0.26	/m2

						Rudimentary Cover		Low Infiltration Cost						Very Low Infiltration					
		Areas				Material		Material		Compaction				Material		Compaction			
Dump		Flat Area (m^2)	Sloped Area (m^2)	Total Area (m^2)	Material Unit Cost ($/$Bm^3$)	Thickness (m)	Placement Cost ($)	Thickness (m)	Placement Cost ($)	Lifts	Compaction Cost Flat Areas ($)	Compaction Cost Sloped Areas ($)	TOTAL	Thickness (m)	Placement Cost ($)	Lifts	Compaction Cost Flat Areas ($)	Compaction Cost Sloped Areas ($)	TOTAL
Grum Main Sulphide Cell	G1-S	62,800	49,650	112,450	$3.47	0.5	$194,886	1.5	$584,659	2	$16,166	$25,561	$626,386	2.5	$974,432	4	$32,331	$51,123	$1,057,886
Grum Main Dump	G1-B	788,156	561,144	1,349,300	$3.47	0.5	$2,338,464	1.5	$7,015,392	2	$202,883	$288,894	$7,507,169	2.5	$11,692,320	4	$405,766	$577,788	$12,675,874
Grum Southwest Dump	G2	158,444	39,006	197,450	$3.88	0.5	$383,399	1.5	$1,150,198	2	$40,786	$20,081	$1,211,066	2.5	$1,916,997	4	$81,572	$40,163	$2,038,732
Vangorda Main Sulphide Cell	V1-S	39,900	19,085	58,985	$4.30	0.5	$126,841	1.5	$380,523	2	$10,271	$9,825	$400,619	2.5	$634,204	4	$20,542	$19,651	$674,397
Vangorda Main Dump	V1-B	132,225	298,916	431,141	$4.30	0.5	$927,129	1.5	$2,781,387	2	$34,037	$153,891	$2,969,314	2.5	$4,635,645	4	$68,073	$307,782	$5,011,500
Baritic Fines Dump	V2	2,431	4,806	7,237	$4.30	0.5	$15,563	1.5	$46,688	2	$626	$2,474	$49,788	2.5	$77,813	4	$1,252	$4,949	$84,013
Vangorda Pit	VP	300,000	0	300,000	$3.88	0.5	$582,526	1.5	$1,747,577	2	$77,225	$0	$1,824,802	2.5	$2,912,629	4	$154,449	$0	$3,067,078
Ore Transfer Pad	OTP	103,800	43,500	147,300	$3.88	0.5	$286,020	1.5	$858,060	2	$26,720	$22,395	$907,175	2.5	$1,430,101	4	$53,439	$44,790	$1,528,330
TOTALS		**1,587,756**	**1,016,106**	**2,603,862**			**$ 4,854,828**						**$ 15,496,319**						**$ 26,137,810**

Table 8: Closure Option Variant Relocation Costs

Activity	Task	Quantity	Unit	Unit Cost	Activity Total	Subtotals	Source / Comments
CLOSURE COSTS - DIRECT CAPITAL							
Oxide Fines / LGSP							
Consolidate oxide fines						$623,877	
Relocate to Low Grade Stockpile C	Load, haul, dump, spread, compact Medium Grade Stockpile	72,937	m3	$ 3.05	$222,376		
Lime addition	Add lime to waste rock (qnty= tonnes CaOH)	1,240	tonnes	$ 323.81	$401,501		
Deposit in Faro Pit						$654,315	
Relocate to Faro Pit	Load, haul, dump, spread, compact Medium Grade Stockpile	72,937	m3	$ 3.47	$252,813		
Lime addition	Add lime to waste rock (qnty= tonnes CaOH)	1,240	tonnes	$ 323.81	$401,501		
East Sulphide Cell							
Relocate to Main Sulphide Cell						$9,688,636	
Relocate east Cell to Main Sulphide Cell	Load, haul, dump, place, compact	1,080,000	m3	$ 3.47	$3,743,484		
Lime addition	Add lime to waste rock (qnty= tonnes CaOH)	18,360	tonnes	$ 323.81	$5,945,152		
Faro Valley Dumps							
Relocate to Main Sulphide Cell						$8,672,513	
Relocate to Main Sulphide Cell	Load, haul, dump, place, compact	923,760	m3	$ 3.88	$3,587,426		
Lime addition	Add lime to waste rock (qnty= tonnes CaOH)	15,704	tonnes	$ 323.81	$5,085,087		
Ore Transfer Pad							
Relocate to Grum Sulphide Cell						$2,882,010	
Relocate OTP to Main Sulphide Cell	Load, haul, dump, place, compact	321,260	m3	$ 3.47	$1,113,548		
Lime addition	Add lime to waste rock (qnty= tonnes CaOH)	5,461	tonnes	$ 323.81	$1,768,463		
Deposit in Vangorda Pit						$3,150,144	
Relocate OTP to Main Sulphide Cell	Load, haul, dump, place, compact	321,260	m3	$ 4.30	$1,381,682		
Lime addition	Add lime to waste rock (qnty= tonnes CaOH)	5,461	tonnes	$ 323.81	$1,768,463		

Table 9: Relocation Unit Costs

Relocation Productivity (Lm3/hr) obtained from 'Master_Waste_Rock_Relocation' spreadsheet, using the equipment, route and other parameters listed below

FUEL COST: $1.30 /L

							Productivities		Unit Rates						Labour Details		Equipment Used							
																	Loaders		Trucks			Dozers		
																	$148.57	$55.57	$132.58	$92.94	$19.83	$190.62	$186.64	$101.50
																	$125.84	$36.97	$79.26	$28.73	$15.21	$149.18	$100.04	$54.41
Cost Code	Area	Activity	Material	Source	Destination	Distance (1-way)	Loose (Lm^3/hr)	Bank (Bm^3/hr)	Total Loose Unit Rate ($/m^3)	Total Bank Unit Rate ($/m3)	Manhours (hrs/Bm3)	Labor Cost ($/Bm3)	Equipment Cost ($/Bm3)	Fuel Cost ($/Bm3)	Heavy Equipment Operators	Light Equipment Operators	CAT 992D	CAT 966F	CAT 777	CAT D350	STD 10yd^3	CAT D11	CAT D10	CAT D8
R.001	Faro North	Load, Haul, Dump, Spread	Till	Vangorda Overburden Dump	FVN	17.27	388	277	$8.10	$11.34	0.040	$ 1.79	$ 5.74	$ 3.82	3	8	1		8			2		
R.002		Load, Haul, Dump, Spread	Till	Vangorda Overburden Dump	FVS	17.06	395	282	$7.96	$11.14	0.039	$ 1.75	$ 5.64	$ 3.75	3	8	1		8			2		
R.003	Faro West	Load, Haul, Dump, Spread	Till	Vangorda Overburden Dump	MGSP	15.23	459	328	$6.85	$9.59	0.034	$ 1.51	$ 4.85	$ 3.23	3	8	1		8			2		
R.004		Load, Haul, Dump, Spread	Till	Vangorda Overburden Dump	CHSP	15.43	455	325	$6.91	$9.67	0.034	$ 1.52	$ 4.89	$ 3.26	3	8	1		8			2		
R.005		Load, Haul, Dump, Spread	Till	Vangorda Overburden Dump	OXSP	15.17	460	329	$6.83	$9.57	0.033	$ 1.51	$ 4.84	$ 3.22	3	8	1		8			2		
R.006		Load, Haul, Dump, Spread	Till	Vangorda Overburden Dump	LGSPA	15.33	452	323	$6.95	$9.74	0.034	$ 1.53	$ 4.93	$ 3.28	3	8	1		8			2		
R.007		Load, Haul, Dump, Spread	Till	Vangorda Overburden Dump	NWU	17.22	388	277	$8.10	$11.34	0.040	$ 1.79	$ 5.74	$ 3.82	3	8	1		8			2		
R.008		Load, Haul, Dump, Spread	Till	Vangorda Overburden Dump	NWM	16.54	406	290	$7.74	$10.84	0.038	$ 1.71	$ 5.48	$ 3.65	3	8	1		8			2		
R.009		Load, Haul, Dump, Spread	Till	Vangorda Overburden Dump	NWL	16.62	412	294	$7.63	$10.68	0.037	$ 1.68	$ 5.40	$ 3.60	3	8	1		8			2		
R.010		Load, Haul, Dump, Spread	Till	Vangorda Overburden Dump	MMW	15.81	442	316	$7.11	$9.96	0.035	$ 1.57	$ 5.04	$ 3.35	3	8	1		8			2		
R.011		Load, Haul, Dump, Spread	Till	Vangorda Overburden Dump	MME	16.18	424	303	$7.41	$10.38	0.036	$ 1.63	$ 5.25	$ 3.49	3	8	1		8			2		
R.012		Load, Haul, Dump, Spread	Till	Vangorda Overburden Dump	FTW	15.46	452	323	$6.95	$9.74	0.034	$ 1.53	$ 4.93	$ 3.28	3	8	1		8			2		
R.013		Load, Haul, Dump, Spread	Till	Vangorda Overburden Dump	FTE	15.81	442	316	$7.11	$9.96	0.035	$ 1.57	$ 5.04	$ 3.35	3	8	1		8			2		
R.014		Load, Haul, Dump, Spread	Till	Vangorda Overburden Dump	UPL	15.66	445	318	$7.06	$9.89	0.035	$ 1.56	$ 5.00	$ 3.33	3	8	1		8			2		
R.015		Load, Haul, Dump, Spread	Till	Vangorda Overburden Dump	LPL	15.86	443	316	$7.10	$9.93	0.035	$ 1.56	$ 5.03	$ 3.34	3	8	1		8			2		
R.016		Load, Haul, Dump, Spread	Till	Vangorda Overburden Dump	SPB	15.14	463	331	$6.79	$9.51	0.033	$ 1.50	$ 4.81	$ 3.20	3	8	1		8			2		
R.017	Faro South East	Load, Haul, Dump, Spread	Till	Vangorda Overburden Dump	SWPWD	14.76	470	336	$6.69	$9.36	0.033	$ 1.47	$ 4.74	$ 3.15	3	8	1		8			2		
R.018		Load, Haul, Dump, Spread	Till	Vangorda Overburden Dump	LGSPC	15.18	452	323	$6.95	$9.74	0.034	$ 1.53	$ 4.93	$ 3.28	3	8	1		8			2		
R.019		Load, Haul, Dump, Spread	Till	Vangorda Overburden Dump	MESC	16.1	425	304	$7.40	$10.36	0.036	$ 1.63	$ 5.24	$ 3.49	3	8	1		8			2		
R.020		Load, Haul, Dump, Spread	Till	Vangorda Overburden Dump	IDSC	15.23	449	321	$7.00	$9.80	0.034	$ 1.54	$ 4.96	$ 3.30	3	8	1		8			2		
R.021		Load, Haul, Dump, Spread	Till	Vangorda Overburden Dump	RD	14.88	466	333	$6.75	$9.44	0.033	$ 1.49	$ 4.78	$ 3.18	3	8	1		8			2		
R.022		Load, Haul, Dump, Spread	Till	Vangorda Overburden Dump	RZD	15.01	459	328	$6.85	$9.59	0.034	$ 1.51	$ 4.85	$ 3.23	3	8	1		8			2		
R.023		Load, Haul, Dump, Spread	Till	Vangorda Overburden Dump	MDW	15.78	436	311	$7.21	$10.09	0.035	$ 1.59	$ 5.11	$ 3.40	3	8	1		8			2		
R.024		Load, Haul, Dump, Spread	Till	Vangorda Overburden Dump	MDE	16.28	419	299	$7.50	$10.50	0.037	$ 1.65	$ 5.31	$ 3.54	3	8	1		8			2		
R.025		Load, Haul, Dump, Spread	Till	Vangorda Overburden Dump	ID	15.25	452	323	$6.95	$9.74	0.034	$ 1.53	$ 4.93	$ 3.28	3	8	1		8			2		
R.026		Load, Haul, Dump, Spread	Till	Vangorda Overburden Dump	OHRW	14.4	485	346	$6.48	$9.07	0.032	$ 1.43	$ 4.59	$ 3.05	3	8	1		8			2		
R.027		Load, Haul, Dump, Spread	Till	Vangorda Overburden Dump	OHRE	13.75	504	360	$6.24	$8.73	0.031	$ 1.37	$ 4.42	$ 2.94	3	8	1		8			2		
R.028	Faro North East	Load, Haul, Dump, Spread	Till	Vangorda Overburden Dump	NELS	15.7	436	311	$7.21	$10.09	0.035	$ 1.59	$ 5.11	$ 3.40	3	8	1		8			2		
R.029		Load, Haul, Dump, Spread	Till	Vangorda Overburden Dump	NEO	15.18	456	326	$6.89	$9.65	0.034	$ 1.52	$ 4.88	$ 3.25	3	8	1		8			2		
R.030		Load, Haul, Dump, Spread	Till	Vangorda Overburden Dump	ZIIW	14.29	483	345	$6.51	$9.11	0.032	$ 1.43	$ 4.61	$ 3.07	3	8	1		8			2		
R.031		Load, Haul, Dump, Spread	Till	Vangorda Overburden Dump	ZIIE	14.69	466	333	$6.75	$9.44	0.033	$ 1.49	$ 4.78	$ 3.18	3	8	1		8			2		
R.032		Load, Haul, Dump, Spread	Till	Vangorda Overburden Dump	NEL	16.38	416	297	$7.56	$10.58	0.037	$ 1.67	$ 5.35	$ 3.56	3	8	1		8			2		
R.033		Load, Haul, Dump, Spread	Till	Vangorda Overburden Dump	NEU	16.23	414	296	$7.59	$10.63	0.037	$ 1.67	$ 5.38	$ 3.58	3	8	1		8			2		
R.034	Grum	Load, Haul, Dump, Spread	Till	Vangorda Overburden Dump	Grum Main Sulphide Cell	2.08	857	612	$2.48	$3.47	0.011	$ 0.52	$ 1.73	$ 1.21	3	4	1		4			2		
R.035		Load, Haul, Dump, Spread	Till	Vangorda Overburden Dump	Grum Main Dump	2.05	857	612	$2.48	$3.47	0.011	$ 0.52	$ 1.73	$ 1.21	3	4	1		4			2		
R.036		Load, Haul, Dump, Spread	Till	Vangorda Overburden Dump	Grum Southwest Dump	2.94	857	612	$2.77	$3.88	0.013	$ 0.59	$ 1.95	$ 1.34	3	5	1		5			2		
R.037	Vangorda	Load, Haul, Dump, Spread	Till	Vangorda Overburden Dump	Vangorda Main Sulphide Cell	3.59	857	612	$3.07	$4.30	0.015	$ 0.67	$ 2.17	$ 1.47	3	6	1		6			2		
R.038		Load, Haul, Dump, Spread	Till	Vangorda Overburden Dump	Vangorda Main Dump	3.91	857	612	$3.07	$4.30	0.015	$ 0.67	$ 2.17	$ 1.47	3	6	1		6			2		
R.039		Load, Haul, Dump, Spread	Till	Vangorda Overburden Dump	Baritic Fines Dump	3.56	857	612	$3.07	$4.30	0.015	$ 0.67	$ 2.17	$ 1.47	3	6	1		6			2		
R.040		Load, Haul, Dump, Spread	Till	Vangorda Overburden Dump	Vangorda Pit	2.65	857	612	$2.77	$3.88	0.013	$ 0.59	$ 1.95	$ 1.34	3	5	1		5			2		
R.041	OTP	Load, Haul, Dump, Spread	Till	Vangorda Overburden Dump	Ore Transfer Pad	3.15	857	612	$2.77	$3.88	0.013	$ 0.59	$ 1.95	$ 1.34	3	5	1		5			2		
R.042	CLOSURE OPTION VARIANTS																							
R.043	Faro	Load, Haul, Dump, Spread	Till	Faro East Sulphide Cell	Faro Main Sulphide Cell	2.195	857	612	$2.48	$3.47	0.011	$ 0.52	$ 1.73	$ 1.21	3	4	1		4			2		
R.044		Load, Haul, Dump, Spread	Till	LGO & Oxide Fines	Consolidate at LGSP C	1.3	857	612	$2.18	$3.05	0.010	$ 0.45	$ 1.52	$ 1.08	3	3	1		3			2		
R.045		Load, Haul, Dump, Spread	Till	LGO & Oxide Fines	Faro Pit	1.9	857	612	$2.48	$3.47	0.011	$ 0.52	$ 1.73	$ 1.21	3	4	1		4			2		
R.046		Load, Haul, Dump, Spread	Till	Faro Valley Dump	Faro Main Sulphide Cell	2.96	857	612	$2.77	$3.88	0.013	$ 0.59	$ 1.95	$ 1.34	3	5	1		5			2		
R.047	Vangorda Grum	Load, Haul, Dump, Spread	Till	Ore Transfer Pad	Vangorda Pit	4.8	857	612	$3.07	$4.30	0.015	$ 0.67	$ 2.17	$ 1.47	3	6	1		6			2		
R.048		Load, Haul, Dump, Spread	Till	Ore Transfer Pad	Grum Sulphide Cell	2.28	857	612	$2.48	$3.47	0.011	$ 0.52	$ 1.73	$ 1.21	3	4	1		4			2		

Material Properties

Assumed Material Properties	Bulk density Mg/m3	Bulking Factor	Excavated Density Mg/m3	Shrinkage Factor	Compacted Density Mg/m3
Clay - Natural	2.02	1.20	1.68	0.90	2.24
Earth	1.90	1.25	1.52	0.95	2.00
Gravels	2.17	1.10	1.97	0.97	2.24
Misc.	2.00	1.00	2.00	1.00	2.00
Rip-Rap	3.00	1.20	2.50	1.00	3.00
Sands	1.90	1.10	1.73	0.90	2.11
Sand & Gravel	2.23	1.10	2.02	1.00	2.23
Sludge/Tailings	4.00	1.40	2.86	0.90	4.44
Top Soil	1.37	1.40	0.98	1.10	1.25
Till	1.84	1.20	1.53	0.90	2.04
Waste Rock	2.10	1.10	1.91	1.00	2.10

Haul Route Information

	Segment 1		Segment 2		Segment 3		Segment 4		Segment 5		Segment 6		Segment 7	
Cost Code	Grade (%)	Distance (km)	Grade (%)	Distance (km)	Grade (%)	Distance (km)	Grade (%)	Distance (km)	Grade (%)	Distance (km)	Grade (%)	Distance (km)	Grade (%)	Distance (km)
R.001	-6.7	0.9	2.4	2.7	-1.4	9.7	2.5	1.26	7.5	1.22	1.5	1.49		
R.002	-6.7	0.9	2.4	2.7	-1.4	9.7	2.5	1.26	7.5	1.22	0.6	1.28		
R.003	-6.7	0.9	2.4	2.7	-1.4	9.7	0.6	1.62	2	0.31				
R.004	-6.7	0.9	2.4	2.7	-1.4	9.7	0.6	1.62	-0.7	0.51				
R.005	-6.7	0.9	2.4	2.7	-1.4	9.7	0.6	1.62	4	0.25				
R.006	-6.7	0.9	2.4	2.7	-1.4	9.7	0.8	0.88	7.6	0.3	-0.8	0.74	5	0.11
R.007	-6.7	0.9	2.4	2.7	-1.4	9.7	0.5	2	9.7	1	1	0.61	8.7	0.31
R.008	-6.7	0.9	2.4	2.7	-1.4	9.7	0.5	2	8.7	0.7	12	0.29	0	0.25
R.009	-6.7	0.9	2.4	2.7	-1.4	9.7	0.5	2	8.7	0.7	1.9	0.62		
R.010	-6.7	0.9	2.4	2.7	-1.4	9.7	0.5	2	3.7	0.51				
R.011	-6.7	0.9	2.4	2.7	-1.4	9.7	0.5	2	8.7	0.7	0	0.18		
R.012	-6.7	0.9	2.4	2.7	-1.4	9.7	0.5	2	6.9	0.16				
R.013	-6.7	0.9	2.4	2.7	-1.4	9.7	0.5	2	3.7	0.51				
R.014	-6.7	0.9	2.4	2.7	-1.4	9.7	0.5	2	5.8	0.36				
R.015	-6.7	0.9	2.4	2.7	-1.4	9.7	0.5	2	-2.6	0.34	1.8	0.22		
R.016	-6.7	0.9	2.4	2.7	-1.4	9.7	0.6	1.62	0.9	0.22				
R.017	-6.7	0.9	2.4	2.7	-1.4	9.7	2.9	0.62	-3	0.84				
R.018	-6.7	0.9	2.4	2.7	-1.4	9.7	2.9	0.62	-3.5	0.26	4.5	0.49	2.9	0.51
R.019	-6.7	0.9	2.4	2.7	-1.4	9.7	0.8	0.88	7	0.3	0	0.6	5	1.02
R.020	-6.7	0.9	2.4	2.7	-1.4	9.7	0.8	0.88	7.1	0.57	3	0.48		
R.021	-6.7	0.9	2.4	2.7	-1.4	9.7	0.8	0.88	4.5	0.49	0	0.21		
R.022	-6.7	0.9	2.4	2.7	-1.4	9.7	0.8	0.88	4.5	0.49	4.4	0.34		
R.023	-6.7	0.9	2.4	2.7	-1.4	9.7	0.8	0.88	7	0.3	0	0.6	4.3	0.7
R.024	-6.7	0.9	2.4	2.7	-1.4	9.7	0.8	0.88	7	0.3	0	0.6	5	1.2
R.025	-6.7	0.9	2.4	2.7	-1.4	9.7	0.8	0.88	7.1	0.57	0	0.5		
R.026	-6.7	0.9	2.4	2.7	-1.4	9.7	0.6	1.1						
R.027	-6.7	0.9	2.4	2.7	-1.4	9.7	3.1	0.45						
R.028	-6.7	0.9	2.4	2.7	-1.4	9.7	2.9	0.62	1.2	1.26	9.4	0.32	0	0.2
R.029	-6.7	0.9	2.4	2.7	-1.4	9.7	2.9	0.62	1.2	1.26				
R.030	-6.7	0.9	2.4	2.7	-1.4	9.7	2.9	0.62	2.7	0.37				
R.031	-6.7	0.9	2.4	2.7	-1.4	9.7	2.9	0.62	6.5	0.57	0	0.2		
R.032	-6.7	0.9	2.4	2.7	-1.4	9.7	2.9	0.62	1.2	1.26	7	0.8	0	0.4
R.033	-6.7	0.9	2.4	2.7	-1.4	9.7	2.5	1.26	7.5	1.22	0	0.45		
R.034	-3	0.35	-8	0.6	7.5	0.53	0	0.6						
R.035	-3	0.35	-8	0.6	6	1.1								
R.036	-3	0.35	-8	0.6	4.3	1.69	0	0.3						
R.037	-3	0.35	-8	0.6	-6.2	1.5	0	0.48	4.3	0.53	0	0.13		
R.038	-3	0.35	-8	0.6	-6.2	1.5	0	0.48	5.3	0.68	0	0.3		
R.039	-3	0.35	-8	0.6	-6.2	1.5	0	0.48	3.2	0.63				
R.040	-3	0.35	-8	0.6	-6.2	1.5	0	0.2						
R.041	-3	0.35	-8	0.6	6	1.6	0	0.6						
R.042														
R.043	0	0.175	-8	0.45	-2	0.51	0	0.26	8	0.6	0	0.2		
R.044	2.5	1.3												
R.045	-5	0.2	0	0.3	-5	1.4								
R.046	-2	1.4	-2	0.5	0	0.26	8	0.6	0	0.2				
R.047	0	0.6	-6	3	0	0.6	-8	0.6						
R.048	0	0.55	-6	1.2	-3	0.53								

Table 10: Mine Area Dump Cover Areas

Area		Flat Surfaces Surface Area (m^2)	Original Slope Surfaces Surface Area (m^2)	Re-graded Slope Surfaces Surface Area (m^2)	Side Slope (after re-grade)	Total Area (m^2)
FARO						
Faro Valley North	FVN	108,780	22,023	33,035	3 H:1V	141,815
Faro Valley South	FVS	24,080	7,036	10,553	3 H:1V	34,634
Medium Grade Stockpile	MGSP	26,600	0	0	3 H:1V	26,600
Crusher Stockpile	CHSP	16,081	6,836	10,254	3 H:1V	26,335
Oxide Fines Stockpile	OXSP	5,900	23,300	34,950	3 H:1V	40,850
Low Grade Stockpile A	LGSPA	36,139	0	0	3 H:1V	36,139
Upper Northwest Dump	NWU	97,330	23,571	35,357	3 H:1V	132,687
Middle Northwest Dump	NWM	112,470	38,027	57,041	3 H:1V	169,511
Lower Northwest Dump	NWL	54,436	50,674	76,011	3 H:1V	130,447
Mt. Mungly West	MMW	33,947	0	0	3 H:1V	33,947
Mt. Mungly East	MME	15,000	23,500	35,250	3 H:1V	50,250
Fuel Tank Dump W	FTW	10,283	0	0	3 H:1V	10,283
Fuel Tank Dump E	FTE	82,849	22,176	33,264	3 H:1V	116,113
Upper Parking Lot Dump	UPL	37,819	12,536	18,804	3 H:1V	56,623
Lower Parking Lot Dump	LPL	23,974	4,550	6,826	3 H:1V	30,799
Stock Piles Base	SPB	71,925	14,462	21,692	3 H:1V	93,618
Southwest Pit Wall Dump	SWPWD	41,400	31,000	46,500	3 H:1V	87,900
Low Grade Stockpile C	LGSPC	40,000	0	0	3 H:1V	40,000
Main East Sulphide Cell	MESC	80,000	0	0	3 H:1V	80,000
Intermediate Dump Sulphide Cell	IDSC	88,500	0	0	3 H:1V	88,500
Ranch Dump	RD	44,000	3,000	4,500	3 H:1V	48,500
Ramp Zone Dump	RZD	36,212	28,099	42,148	3 H:1V	78,360
Main Dump West	MDW	112,000	79,789	119,684	3 H:1V	231,684
Main Dump East	MDE	168,234	155,855	233,783	3 H:1V	402,017
Intermediate Dump	ID	210,069	106,859	160,288	3 H:1V	370,358
Outer Haul Road West	OHRW	66,806	95,657	143,486	3 H:1V	210,292
Outer Haul Road East	OHRE	34,083	42,222	63,332	3 H:1V	97,415
Lower Northeast sulphide cell	NELS	18,000	0	0	3 H:1V	18,000
Outer Northeast Dump	NEO	20,000	0	0	3 H:1V	20,000
Zone II West	ZIIW	65,477	24,459	36,689	3 H:1V	102,166
Zone II East	ZIIE	51,680	71,260	106,890	3 H:1V	158,570
Lower Northeast Dump	NEL	128,812	113,000	169,500	3 H:1V	298,312
Upper Northeast Dump	NEU	141,666	104,244	156,367	3 H:1V	298,032
TOTAL		2,104,552	1,104,134	1,656,201		3,760,753
VANGORDA/GRUM						
Grum Main Sulphide Cell	G1-S	62,800	33,100	49,650	3 H:1V	112,450
Grum Main Dump	G1-B	788,156	374,096	561,144	3 H:1V	1,349,300
Grum Southwest Dump	G2	158,444	26,004	39,006	3 H:1V	197,450
Vangorda Main Sulphide Cell	V1-S	39,900	12,723	19,085	3 H:1V	58,985
Vangorda Main Dump	V1-B	132,225	199,277	298,916	3 H:1V	431,141
Baritic Fines Dump	V2	2,431	3,204	4,806	3 H:1V	7,237
Vangorda Pit	VP	300,000	0	0	3 H:1V	300,000
Ore Transfer Pad	OTP	103,800	29,000	43,500	3 H:1V	147,300
TOTAL						