Faro Mine
Care and Maintenance Project
Faro, Yukon

Electrical Assessment Report

Prepared for:

Denison Environmental Services
Box 280
Faro, Yukon YOB 1K0
Attn: Roy Morrell

Prepared by:

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28 December 2009

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Cover Letter

December 27, 2009

Faro Care and Maintenance Project
Box 280
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Attention: **Mr. Roy Morrell**
Site Manager – Faro Care and Maintenance Project

Dear Mr. Morrell,

Re: Faro Mine Complex – Electrical Assessment

Enclosed please find our final report titled 'Faro Mine Care and Maintenance Project – Electrical Assessment – 2009'.

This final report reflects comments received subsequent to submission of our draft report. We have examined in detail the conditions of each of the areas of concern and in our report present recommendations for remediation. You will find that our recommendations are constructed in such a sway as to address the issues identified with long term cost effective solutions.

Cost estimates have formed a major component of the recommendations. Our estimates are based upon our assessment of the problems and based upon previous work conducted in the Faro area. Our intention is to provide direction and a work plan outline so that that immediate work plans, detailed engineering, or design build projects can be initiated.

We are confidant that our work will be to your satisfaction and thank you again for the opportunity to provide this service. Should you have any questions or concerns, or require further clarification please do not hesitate to contact the Ross at 867-668-6888, 867-334-1936 or by email at dorward@ieee.org

Sincerely,

Dorward Engineering Services
Ross Dorward, P.Eng.

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1.0 Introduction

Mining activities in the Faro area ceased in 1998. After a period of receivership, control of the mine complex passed to the Yukon Government's (YG) Department of Energy, Mines and Resources. YG has awarded a contract to Denison Environmental Services (DES) to provide care and maintenance services at the site.

For on going care and maintenance work, there is a need for electrical power to the entire site. In managing the environmental and health and safety aspects of the site electrical changes need to be considered. These changes affect both short and long term planning improvements for care and maintenance as well as how future reclamation and site rehabilitation projects need to be addressed.

In order to assess the current conditions and make recommendations DES contracted Dorward Engineering Services Ltd. to conduct an electrical assessment of the site.

The requested scope of work for the electrical assessment includes five (5) proposed improvements that require investigation with respect to extension of the electrical distribution system. They are:

- Intermediate Tailings Pond (ITP) – electrical service.
- S – Well pump station – electrical service.
- Emergency Treatment Area (ETA) - upgrade electrical service
- Proposed Grum V-15 Pumping Station – electrical service.
- Shop/Warehouse – re route electrical to re-establish service.

As well the consultant was asked to investigate the following specifics:

- Mill Treatment System – Assess redundancies and suggest options
- Electrical Demand Estimate of Consumption
- Energy Use - Cost
- Substation Tie Breaker
- Mine Distribution System
    - Grum 69 kV Substation
    - Mill Medium (5 kV) Voltage Switches
    - Faro Pit Transformer
    - General Maintenance
- Single Line Diagram
- Electrical Safety Issues

2.0 Electrical Service – General

Electrical energy is distributed throughout the Faro plant and adjacent site by an extensive 5 kV volt distribution system. Since pumping requirements on the site vary it is recommended that power line extensions be sized with sufficient capacity for changes in the near future.

In order to provide flexibility it is recommended that the 5 kV systems be extended to new pumping sites. For example if a #2 aluminum conductor steel reinforced (ACSR) cable is chosen as a standard the new lines will support up to 1000 HP at most sites.

2.1 Electrical Service to the Intermediate Tailing Pond

The lift pump at the intermediate tailings pond (ITP) is currently a diesel driven unit. Fuel and maintenance costs are of concern. During operations the pump incurs a cost of approximately $75 per day for maintenance service and consumes a significant amount of fuel.

In order to reduce operating costs and provide more reliable operations it is recommended that the pump be converted to electrical supply. In order to supply electrical energy to the site it is proposed that a 5 kV transmission line be extended from the mill area to the ITP. This line should also extend to and have sufficient capacity for future pumps that may be required at the Cross Valley Dam (CVD) site. At this time transformers with a capacity of 500 HP will be installed at the ITP. No Transformers will be installed at the CVD as the exact pumping requirement is unknown.

Work Plan as Follows:

- Engineering costs
- Approximately 2600 Meters of 5kV Line (1900m +700m)
- 500 HP transformer bank at ITP site.
- Allowance for 100 HP at CVD – no transformer bank this time
- Line breaks and fusing

Estimated that the cost of this work: $180,000.

Proposed routing of the line is indicated as ITP and CVD dam on figure 1.2 Appendix A.

2.2 Electrical Service to the S- Well Pump Station

The well and booster pumps at the S-well site are currently operated at 600 volts; with power supplied from a portable 62.5 kVA generator unit. Winter operation is the norm.

The engineer was asked to investigate two options for providing power from the grid. The first option investigated was the installation of a drop from the adjacent 69 kV Grum line. The second option was to extend the existing 5 kV Z2 line which is an extension of the Faro Pit Line.

Discussions with contractors active with 69 kV transmission line work indicate that an overhead structure to provide a power drop from the 69 kV Grum line is not possible and that the power drop would require the construction of a grade level substation. Costs for a grade level substation are estimated to be in the range of $200,000 to $300,000.

For this reason as well as for infrastructure standardization it is recommended that the S- well location be energized by extension of the 5 kV Z2 line.

Work Plan as Follows:

- Engineering costs
- Approximately 750 Meters of 5kV Line
- 100 HP transformer bank at S-well generator house
- Line breaks and fusing

- Secondary (600V) connections
- Re-vamp existing distribution for utility supply

Estimated that the cost of this line including transformers and secondary connections: $65,000.

Proposed routing of the 5 kV line extension is indicated as S-Well on the site plan figure 1.2 Appendix A.

Since pumping at the S-well is critical and year round it is recommended that the need for back up power be assessed. The existing generator could be reused as a backup power source however extensive upgrading will be required to the housing structure in order to provide cost effective winter operations.

Based on a possible double in horsepower at the well site a 40 to 60 KW unit is recommended. This unit can be provided turn key in a winter ready enclosure.

Work Plan as Follows:

- Engineering
- Winter ready skid mount enclosure with R40 roof, R20 walls, R20 floor
- 40 to 60 kW generator
- Integral automatic fuel system
- Integral automatic ventilation system
- Automatic transfer switch
- 600 volt distribution
- Shipping and install

Estimated cost of an enclosed unit: $160,000.00.

2.3 Electrical Service to the Emergency Tailings Area (ETA)

600 volt electrical service is provided to this area via a #6 AWG copper SOW cable run down the hill from the 4160 volt yard distribution. The line provides power for a 30 HP and a 5 HP pump. The existing cable installation is temporary as SOW cable does not meet minimum code requirements for a permanent installation.

It is expected that up to 100 HP permanent capacity for pumping to the Faro pit will be required in the future. In order to achieve this and to correct the code violation, an upgrade of the electrical supply is required.

Two options warrant consideration for upgrading power to the site:

- Option one consists of replacing the existing 600 volt SOW cable with a larger armored Teck cable suitable for the increased HP. It is recommended that the cable be buried. Work plan as follows:
    - Engineering
    - Install approximately 200 Meters of Teck cable
    - Cover by others
    - 600 Volt connections, either end

- Option two extends the 5 kV overhead distribution system. Work plan as follows:

    - Engineering
    - Install approximately 200 meters of overhead line to the site
    - Line breaks and fusing
    - Relocate existing transformer bank to the site
    - Provide 600 Volt connections to existing distribution at site

Both options carry a similar cost in the $30,000 to $40,000 range. However, for standardization, reliability and increased capacity the 5 kV line extension is the recommended option for this site.

Proposed routing of the 5 kV line extension is indicated as ETA on the site plan figure 1.2 Appendix A.

2.4 Electrical Service to the Proposed Grum V-15 Pumping Station

There is currently no power available at this site. It is recommended that 5 kV Grum distribution be extended to this area. HP requirement has not been determined but assuming a #2 conductor there will be capacity in excess of expected requirements.

Work plan as follows:

- Engineering
- Approximately 700 Meters of 5kV Line
- Line breaks and fusing
- Transformer bank costs not included (load not determined)
- Line breaks and fusing

Estimated that the cost of this line excluding transformers and secondary connections: $70,000.

Proposed routing of the 5 kV line extension is indicated as V-15 Option #1 and Option #2 on the site plan figure 2 Appendix A.

2.5 Electrical Service to the Shop

While the mine was operating, a 5 kV distribution line was routed via conveyor tunnels through to the crusher building and then overhead to the shop and warehouse building. The tunnels have since become inundated by water and electricity is no longer available from this routing..

It is recommended that the entrance line be re-routed to the north east of the crusher building to tie into the Faro pit line. It is recommended that the line be routed as far from the crusher building as possible so that during demolition of the crusher building sufficient clearance exists between the demolition site and the power line.

Work plan as follows:

- Engineering
- Approximately 400 Meters of 5kV Line
- Line breaks and fusing
- 5kV connections at shop

Estimated cost: $35,000.

Proposed routing of the 5 kV line extension is indicated as SHOP on the site plan figure 1.2 Appendix A.

3.0 Evaluation of the Mill Water Treatment System

The seasonal mill water treatment system utilizes the former mill tankage for lime introduction and mixing as well as the addition of thickeners for precipitating metals. It is expected that the plant will continue operations in the current configuration in the short term. For the purpose of this report, short term is considered to be a period of up to ten years.

The mill treatment operation utilizes a small portion of an extensive mill electrical system and there are transformers operating inefficiently under small loads.

In many locations 5 kV substations are energized for the sake of one or two motors or 120/208 panels. Operating this way is inefficient as core losses are a constant regardless of loads.

In order to save energy, simplify operations and improve safety it is recommended that the various Motor Control Centres (MCC's) in use be consolidated and supplied from one or two substations.

Depending upon the outcome of further engineering it may be possible to complete this work in house with the present workforce. Otherwise a detailed work plan can be developed and a contractor can be hired. It is expected that outside contractor(s) would work under the daily supervision of the site electrician.

Work plan as follows:

- Engineering
- Decommission redundant 5 kV equipment
- Combine required MCC feeders to single transformer
- Re-route motor feeders to selected MCC's
- Test all cables/equipment and provide reports
- Provide revised single line diagram and site labels.

A preliminary engineering/construction budget of $150,000 could be set at this time.

As Built layout drawings of the MCC rooms have been prepared and are attached in Appendix "D"

4.0 Energy Use

4.1 Estimate of Consumption

Formal estimates of consumption are not available at this time. Information was provided to the engineer by the client for the purpose of estimating consumption. The information provided to date has been assembled into an Annual Cost Worksheet which is attached in Appendix B.

Denison staff have committed to providing additional information required in order to complete the annual cost worksheet.

The following list of comments is provided for consideration for potential cost effective conservation measures:

- Pumping Operations
    - Most of the electrical energy used on the site is utilised by electric motors involved with pumping, transfer and treatment operations.
    - Changes to the entire pumping system are ongoing. Energy efficiency should be considered with every operational change implemented.
- Water Treatment
    - The existing mine ore processing plant (mill) is being utilized to treat the majority of the contaminated water on site. A large number of the motors in use are oversized and are operating inefficiently
    - Investment in equipment replacement is not expected to produce significant savings given the ten year or less life expectancy of the plant
- Lighting systems
    - Repair/replace lighting systems site wide
    - De-energize redundant transformers and ballasts in the mill.
    - Install automatic lighting controls site wide i.e. photocells/motion sensors
- Heating systems
    - Upgrade insulation for heated areas of the plant and outbuildings
    - Upgrade insulation on piping systems utilized in the winter months

The savings realized by performing these tasks should be considered as part of a full analysis of the total cost of operation. It is not expected that savings will be significant in regard to the total electrical cost, since the pumping consumes the greatest amount of electricity.

As pumping operations move from seasonal to year round there will be an increased requirement for pipeline heating. Operations in the winter months will also trigger increased demand charges by the utility since the demand charge is not reset on a monthly basis during the winter months.

There will also be load growth associated with the conversion from diesel pumping to electric, by the use of the new water well, the use of the shop and by increases expected in pumping demands site wide.

4.2 Energy Cost

The current energy charge is $0.1207 per kWhr. This will increase to $0.1274 per kWhr January 1st 2010.

The current demand charge is $11.56 per kW demand. This will increase to $12.20 per kW January 1st 2010.

5.0 S2 Substation Tie Breaker

It has been suggested that the feeder from one of the two 138/5 kV utility transformers be opened and that the S2 substation tie breaker be closed to supply the complex from one utility transformer. The second transformer could be de-energized thus saving core losses.

Since the mine site metering is downstream from the utility transformers this would not result in savings to the Care and Maintenance Project.

Indications are that the Utility prefers to leave both transformers energized in order to reduce maintenance costs.

6.0 Mine Site Distribution System

6.1 Grum 69 kV Substation

An overhead line operating at 69 kV delivers power to the Grum and Vangorda pits. This line is supplied from the 5 kV volt system at the faro mill with voltage transitions step up and step down at the respective ends of the line.

The capacity of the step up and step down transformers is 10 MVA. 10 MVA is well above what is required for the treatment and pumping operations at Grum and Vangorda pits. Suggestions have been made to replace the transformers with transformers of smaller size or to reduce the operating voltage of the line.

Since final pumping requirements for the long term have not been determined it is premature to consider this option.

Currently, by agreement, the power utility maintains the cost of powering the 69 kV line during the winter months. It is advantageous to maintain this agreement since the transformers are better served if they remain warm year round.

A concern has been raised regarding the stability of the Grum pit wall. There is a possibility of failure of the wall and the possibility that the failure could envelope the 69 kV Grum substation. It is understood that the risk associated with pit wall movement is being assessed by geotechnical engineers and this issue will be further addressed in the annual risk assessment.

Relocating the substation will be costly and somewhat time consuming. It is estimated that to rebuild/relocate the substation in a more desirable location within 500 meters of the present site could cost approximately $300,000. This cost estimate is based on a construction time frame of one summer

season. A reduced construction time is possible but would come with higher cost.

Further engineering is required to determine a more accurate cost.

6.2 Mill Medium Voltage Switches

The existing mill and site electrical infrastructure was installed in the early '70s (MCC Room #3) with a major expansion in 1980 (MCC Room #3E). Indications are that the equipment has had little maintenance in the past 15 to 20 years. Equipment of this type requires regular maintenance, calibration and safety labels as per code requirements

All the medium voltage switchgear in use should be cleaned and the protective relays should be re-calibrated (or replaced).

Current codes (Canadian Electrical Code C22.1) require that all distribution equipment be labelled for the Hazard/Risk Category present due to the possibility of Arc flash.

Work plan as follows:

- Engineering
- Clean all 4160 and 69 kV equipment in use.
- Calibrate or replace all protective relays
- Perform thermal scan of equipment
- Test equipment and provide reports
- Label equipment as per the requirements of CEC 22.1.
- Label decommissioned equipment and operating equipment

Until an inventory is completed it is difficult to estimate the cost of this work, however it is expected that this work would require a crew of 2 to 4 technicians on site for up to a month. Preliminary estimate at this time: $200,000.00

6.3 Faro Pit Transformer

The three pumps located in the Faro pit are supplied from a single oil filled transformer. Concern has been raised regarding the age of the transformer in regard to its reliability, the cost of operating the transformer since it is oversized, the safety of the road crossing and the safety of the skid mount unit in regard to its lack of compliance to current codes.

There are two options for correcting the installation:

- Option one consists of replacing the transformer with a new overhead structure and new transformers. Work includes:
    - Engineering
    - Remove cables and connections to existing transformer. Utilize the transformer as an emergency spare.
    - Install new 450 kVA transformer bank on existing pole
    - Install 600 volt secondary connections to the pumphouse

- Option two involves upgrading the existing installation to meet current codes. Work includes:
    - Engineering
    - Install fencing around transformer to the requirements of the Canadian Electrical Code C22.2.
    - Install touch and step grounding to the requirements of the Canadian Electrical Code C22.2.
    - Perform ground resistance and infrared scan tests on the transformer.
    - Perform oil test on the transformer.
    - Install new 5kV drop from the existing pole (Teck cable drop - cut and cover by others).

Both options carry a similar cost in the $25,000 to $35,000 range.

It is recommended that detailed cost benefit analysis be undertaken to determine the best course of action to address the issues identified.

6.4 General Maintenance

As indicated in previous sections it is recommended that specific maintenance projects be put in place. In addition to these projects the following are recommended:

- Clean all MCC rooms
- Re-lamp all MCC rooms/replace ballasts
- Replace covers on exposed wiring
- Perform thermal scan of transformer connections and windings
- Perform Oil Sample Tests
- Provide Maintenance Reports for above work.

7.0 Single Line Diagram

Only minimal electrical distribution single line drawing records are available for the 4160 volt, 347/600 volt and 120/208 volt distribution systems. During the engineer's site visit the mill drawing store room was searched and all relevant electrical drawings were taken for reproduction in Whitehorse. The important drawings have been copied (paper photo copy) and all of the respective originals have been returned to site.

Digital (.pdf) drawings are recommended for some of the most important records. Since scans can be made at any time from the paper nothing has been digitized to date.

An AutoCAD single line drawing has being developed using the paper drawings and information gathered on site. The single line drawing documents the 138 kV utility supply, the 4160 volt switchgear connections, the 600 volt MCC's in use and an outline of the 5 and 69 kV site distribution.

The single line diagram is being developed in sufficient detail to provide bidding contractors the information they require to prepare well informed bids for switchgear cleaning and maintenance.

The single line drawing is presented in Appendix C.

8.0 Electrical Safety

There are several safety concerns which were identified on site. Most critical is the Mill distribution system however similar concerns exist throughout the entire site.

In relative order they are as follows:

8.1 Arc Flash Safety: The medium voltage distribution system site wide (5 and 69 kV) has had little maintenance over the past 20 years. Some equipment would not meet present minimum standards. The work recommended in Section 6.2 should be undertaken.

8.2 General Maintenance: In any working plant there is a need for constant clean up. As housekeeping deteriorates safety hazards are, over time, accepted as the norm. There is a large amount of electrical equipment in various states of functionality in the Mill. There are many instances where covers are off, equipment is exposed and where it is uncertain if voltages are present. Efforts should be taken to isolate and tag all live equipment and remove or decommission redundant equipment.

8.3 Lighting: Lighting in the Mill does not meet the minimum standard for safety. The lack of lighting is a contributing factor to the poor housekeeping that has been observed. The physical environment should reflect the importance placed on safety in the workplace.

8.4 Office Supply Indoor Substation: The office complex is supplied from an electrical room located adjacent to the building. The electrical room contains a home built 4160/600 V substation. There is no enclosure on the equipment. All wiring is open. The installation is a fire and safety hazard. It is recommended that this equipment be immediately replaced with a modular switch gear package, or a set of standard overhead cans with overhead drops to the building. Further engineering is required to develop a cost effective solution.

8.5 Faro to Grum Line 5 kV Feeder: The existing 5 kV teck cables on the secondary of the feeder's isolation transformer have collapsed and are pulling apart at the pot heads on the overhead structure. These cables should be replaced as soon as possible to prevent a failure and possible fire and downtime.

8.6 Faro Pit 4160/600 V Transformer : The Faro pit transformer is supplied from an overhead structure by a rubber cable crossing the roadway. The cable is only protected by some rubber matting, over which the vehicles travel. Concern has been raised regarding the age of the transformer in regard to its reliability, the cost of operating the transformer since it is oversized, the safety of the road crossing and the safety in regard to its lack of compliance to current codes. It is recommended that this installation be corrected.

8.7 Faro to Grum 69 kV Pole Line: A number the poles on the Grum 69 kV line are leaning. It is recommended that these poles be straightened.

9.0 Summary of All Recommendations:

9.1 5 kV Line Extensions (5 total) (Reference Sections 2.1 – 2.5): All planned extensions should be bundled into one work package for completion by one contractor crew. The work will be more cost effective if tendered as a package as the bulk work will be more attractive at the remote site. Consideration should be given to line extension work to be undertaken in conjunction with recommendations 2, 3, 4 and 5.

9.2 MCC Room Consolidation (Reference Section 3.0): In order to enhance safety and improve energy efficiency a work plan should be put in place to consolidate the Mill distribution system.

9.3 Equipment Cleaning, Calibration and Labelling (Reference Section 6.2): In order to improve safety a work plan should be put into place to have all medium voltage equipment cleaned, calibrated, tested and labelled.

9.4 Faro Pit 5 kV Transformer (Reference Section 6.3): Correct safety issues.

9.5 General Maintenance (Reference Section 6.4): Perform maintenance tasks identified

9.6 Improve Mill Lighting: **(Reference Section 8.3):** In order to improve worksite safety a work plan should be put into place to improve mill lighting**.**

9.7 Office Sub Station Replacement (Reference Section 8.4): Replace substation to correct safety issue.

9.8 Faro to Grum Line 5 kV Feeder Repair (Reference Section 8.5): Repair Teck cable feeder behind main substation. Maintenance issue.

9.9 Faro to Grum 69 kV Pole Repairs (Reference Section 8.7): Repair leaning poles. Maintenance issue.

10.0 Cost Summary Table

The following table summarises the recommendations and costs outlined in this report:

Item	Action	Cost	Immediate Work
1	Electrical Service to Intermediate Pond	$180,000	$130,000
2	Electrical Service to S-Well Pump Station	$65,000	$40,000
3	Electrical Service to ETA	$40,000	$40,000
4	Electrical Service to Grum V-15	$70,000	$60,000
5	Electrical Service to Shop	$35,000	$30,000
6	Consolidate MCC Rooms	$150,000	
7	Medium Voltage Switchgear Maintenance and Arc Flash Labeling	$200,000	
8	Faro Pit 5 kV transformer	$35,000	
9	General Maintenance	$25,000	$25,000
10	Improve Mill Lighting	$30,000	
11	Office Substation Replacement	$35,000	
12	Faro to Grum 5 kV Line - feeder repair	$15,000	
13	Faro to Grum 69 kV Line Pole Repair	$10,000	
		$890,000	**$325,000**

----------end----------

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Prepared By: V. Wraich/M.Slama
Authorized By: R. Dorward
Date: December, 2009
Revision No. 3

FARO MINE

ANNUAL COST WORKSHEET

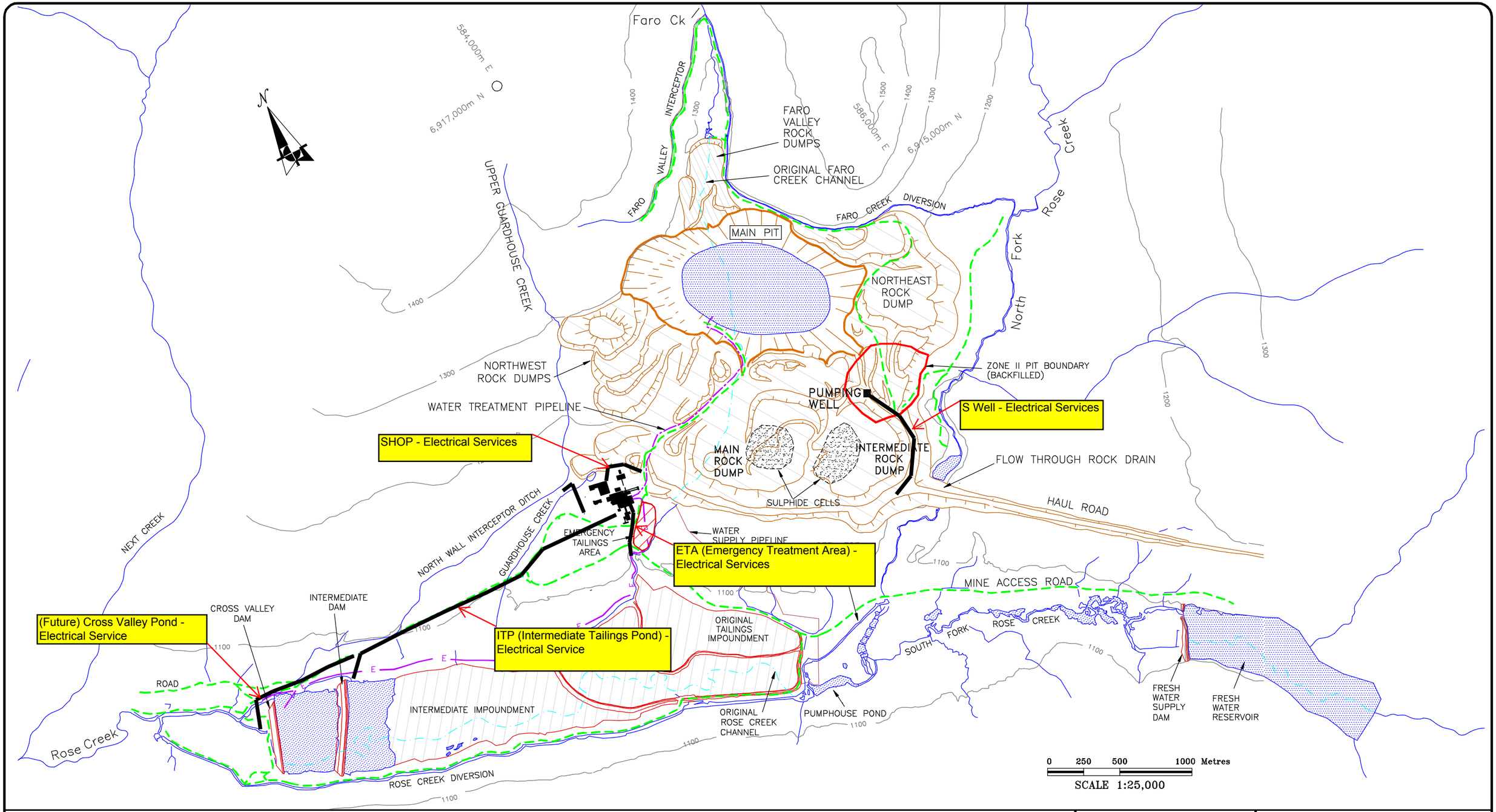
AREA	EQUIP No.	MCC/ SUPPLY RM	FRAME	EQUIPMENT NAME	HP	% LOAD DEMAND	DRAW (kW)	HOURS/ DAY	DAYS/ YR	KWH/ YR	COST/ YR
Faro Mill Treatment Plant											
Floation	4225	64M6	445	K Bank Zinc Scav	100						
	4226	64M5	445	K Bank Zinc Scav	100						
	4227	64M4	445	K Bank Zinc Scav	100						
	4228	64M3	445	K Bank Zinc Rougher	100						
	4229	64M2	445	K Bank Zinc Rougher	100						
	4230	64M1	445	K Bank Zinc Rougher	100						
	4231	65M6	445	L Bank Zinc Scav	100						
	4232	65M5	445	L Bank Zinc Scav	100						
	4233	65M4	445	L Bank Zinc Scav	100						
	4234	65M3	445	L Bank Zinc Rougher	100						
	4235	65M2	445	L Bank Zinc Rougher	100						
	4236	65M1	445	L Bank Zinc Rougher	100						
Lime Bay	1307	41M33	365	Lime Vaccum Pump	75						
	4401	70M4	56C	Outside Lime Bin Hoist Motor	2						
	4402	33M11	256	Lime Screw Feeder Northland	20						
	3527	70M18	182T	Lime Screw Feeder	3						
	4403	41M61	286	Lime Mixing Agitator	15						
	3902	41M30	NO PLT	Lime Storage Tank Feed Pump	NO PLT						
	3903	33M1	256T	Lime Dist. Feed Pump (West)	20						
	3904	33M14	256T	Lime Dist. Feed Pump (East)	20						
	4306	33M3	184	Lime Storage Tank Agitator (West)	5						
	4307	33M4	184	Lime Storage Tank Agitator (East)	5						
	6079	34M7		East Flyght Agitator							
75'	1174	33M19	184T	Rake Drive	5						
Thickner	1176	33M23	213	Rake Lift	1.5						
#1 Tank	3501	70F45 VFD	286T	Underflow Pump	30						
	3516	37M3	184T	U/F Tunnel Sump Pump	5						
90'	1189	33M18	254	Rake Drive	5						
Clarifier	1191	33M22	213	Rake Lift	1.5						
#2 Tank	3526	70M17	286T	Underflow Pump	30						
36'	1139	33M16	182	Rake Drive	3						
Thickner	1141	33M20	213	Rake Lift	1.5						
#3 Tank	3524	37M7	286T	Underflow Pump	30						
	3518	37M1	256	Sludge Clarifier Sump Pump	20						
Floculation	4601	2001M1	184T	Floc Transfer Pump	5						
System	4602	2001M2	184T	Floc Mixing Pump	5						
	4603	2001M3	M56C	Floc Agitator	0.75						
	4604	2001M4	143T	Floc Dist Pump #1	1						
	4605	2001M5	FM56C	Floc Dist Pump #2	0.5						
Misc.	4501	41M62	184T	Air Compressor	5						
	3528	70M19	256T	Gland Water Pump #1	20						
	3126	33M26	256T	Gland Water Pump #2	20						
		31M38	FLYGHT	Sludge Decanting Pump	5						
	3123	17M26	254T	Sludge Clarifier Overflow Sump	15						
		74M01	455T0592	Intermediate Agitator #1	150						
		74M02	455T0592	Intermediate Agitator #2	150						

ANNUAL COST WORKSHEET

AREA	EQUIP No.	MCC/ SUPPLY RM	FRAME	EQUIPMENT NAME	HP	% LOAD DEMAND	DRAW (kW)	HOURS/ DAY	DAYS/ YR	KWH/ YR	COST/ YR
Mill Building Lighting Load											
	33-F25	Heating plant		Lighting Panel							
	33-F26	Heating plant		Lighting Panel							
	MCC 70	Heating plant		Lighting Panel							
	37-F16	Heating plant		Lighting Panel							
	MCC 41	Heating plant		Lighting Panel							
	MCC 41	Heating plant		Lighting Panel							
	MCC 41	Heating plant		Lighting Panel							
	37-F16	Heating plant		Lighting Panel							
	37-F17	Heating plant		Lighting Panel							
	37-F31	Heating plant		Lighting Panel							
	MCC 14	MCC Room 3		Lighting Panel							
	MCC 14	MCC Room 3		Lighting Panel							
	MCC 14	MCC Room 3		Lighting Panel							
	MCC 14	MCC Room 3		Lighting Panel							
	17-3029	MCC Room 3		Lighting Panel							
	32-1829	MCC Room 3		Lighting Panel							
	MCC 32	MCC Room 3		Lighting Panel							
	74-F15	MCC Room 3		Lighting Panel							
	31-F22	MCC Room 3		Lighting Panel							
	31-F25	MCC Room 3		Lighting Panel							
	68-F50	MCC Rom 3E		Lighting Panel							
	68-F51	MCC Rom 3E		Lighting Panel							
	68-F52	MCC Rom 3E		Lighting Panel							
	68-F53	MCC Rom 3E		Lighting Panel							
	68-F55	MCC Rom 3E		Lighting Panel							
	68-F54	MCC Rom 3E		Lighting Panel							
Vangorda Treatment Plant											
		Plant Building		Floculant Prep Unit (Allied Controls)	1						
		Plant Building		Lime Water Circulation Pump	5						
		Plant Building		Fresh Water Circulation Pump	5						
		Plant Building		Primary Reactor Agitator	10						
		Plant Building		Secondary Reactor Agitator	25						
		Plant Building		Flocculant Reactor Agitator	1.5						
		Plant Building		Plant Sump Pump	3						
		Plant Building		Lime Slurry Circulation Pump 1	5						
		Plant Building		Lime Slurry Circulation Pump 2	5						
		Plant Building		Plant Air Compressor	3						
		Plant Building		Rotary Air Lock Feeder	0.33						
		Plant Building		Blower	20						
		Plant Building		Bin Activator	1.5						
		Plant Building		Vollumetric Screw Feeder	0.75						
		Plant Building		Lime Slacker	0.25						
		Plant Building		Lime Slacker	0.5						
		Plant Building		Lime Slurry Storage Tank Agitator	3						
		Plant Building		Dosing Pump	1						
Vangorda Pit											
				Pit Pump	650						
				Pit Pump	650						
S Well Pumps											
				Boost Pump	30						
				Hp Well Pump	1.5						
				Hp Well Pump	1.5						
				Heat Trace Cable							
Faro Pit											
				Pit Pump	250						
				Propane Shack							

ANNUAL COST WORKSHEET

AREA	EQUIP No.	MCC/ SUPPLY RM	FRAME	EQUIPMENT NAME	HP	% LOAD DEMAND	DRAW (kW)	HOURS/ DAY	DAYS/ YR	KWH/ YR	COST/ YR
Emergency Treatment Area (ETA)				Pump	30						
				Pump	5						
Administration Building				Panel							
Site Lighting			-	-							
Future Loads (Assumptions Only)				Water Well	3						
				Itermediate Pond	400						
				V15 pump	50						
				Total kWH/Year							
				Total Cost/Year							



SOURCE OF FIGURE:

DRAWING NO. 4.1 "OVERVIEW OF FARO MINESITE"
DIAND WASTE MANAGEMENT PROGRAM BY GARTNER LEE LIMITED
03/16/01 ADAPTED FROM ROBERTSON GEOCONSULTANTS INC.

Notes:

Base Map supplied by the Orthoshop, January 1991
North American Datum 1927
Contour Interval 100 m
Universal Transverse Mercator Projection
Map is a composite of 9 basemaps,
it was redigitized to simplify planimetric features.

LEGEND:

- ROADS
- EXISTING DRAINAGE
- ORIGINAL DRAINAGE
- E — EFFLUENT PIPELINE
- PIPELINE

DRAWING INFORMATION:	
REVIEWED BY:	ED
DRAWN BY:	CPW
DATE ISSUED:	APRIL, 2002
PROJECT NUMBER:	22-943
FILE NAME:	22943-D1-20r1.DWG
REVISION:	1

APPENDIX A: FIGURE 1.0

POWER LINE ROUTING

Gartner Lee Limited

Deloitte & Touche

Figure No. 1.0

Demolish Buildings – Dispose non-hazardous material at Grum Dump

WATER TREATMENT PLANT

SLUDGE POND

Cover Sludge Pond

Diversion to Dixon Creek Headworks Embankment

Breach Settling Pond

Headworks Embankment

GRUM SETTLING POND

BLASTER'S SHACK

Proposed Creek Alignment in to Grum Pit

Cover Source:
1.7 million cu.m. for Grum/Vangorda
? 2.0 million cu.m. for Faro mine site
? 2.0 million cu.m. for Tailings Area

Vangorda Creek Diversion Option A: North of Pit. (include Upgrade Dixon Creek Diversion)

Vangorda Creek Diversion Option B: To Dixon Creek

Safety Berm

Pit Water Pumped to Treatment Facility

Regrade and Revegetate Waste Rock Piles

0.5m Till Cover

Cover Sludge Disposal Cell

OVERBURDEN DUMP (8 MILLION M³)

ORE TRANSFER PAD

Biological Treatment in Pit Lake

GRUM PIT

VANGORDA PIT

Rock Drain

Widen Road for 777 Traffic

Regrade (3:1) and Revegetate Overburden Dump

Existing Electrical Line To Vangorda Pit.

Regrade and Revegetate Transfer Pad

Breach Dam

Treatment Effluent Discharged into Vangorda Creek

Relocate Acidic Material to Sulphide Cell

Drop Structures

Proposed HDS Treatment Facility

Plunge Pool

Proposed Creek Alignment Out of Grum Pit

Proposed Seepage Collection Sump

WASTE ROCK PILES

Low Infiltration Cover

VANGORDA WASTE DUMP

LUBE STATION

Slope NOT Regraded

Proposed Seepage Transfer Pipeline

Seepage Pumped to Grum Pit

Building Disposal Area

FUEL TANKS

MAINTENANCE STORAGE AREA

Proposed Bioremediation Cell for Hydrocarbon Soils

Low Infiltration Cover

Proposed Holding Pond

Regrade and Revegetate Vangorda Waste Dump

SHOP

Demolish Buildings – Dispose non-hazardous material at Grum Dump

V - 15 - Electrical Service

Proposed Sediment Basin

Proposed Sediment Collection Ditches

Sediment Collection Ditch

GRUM WASTE DUMP

Regrade (3:1), cover with 0.5m Till Cover and Revegetate Grum Dump

Approx. Outline of Sulphide Cell

Proposed Seepage Collection Sumps

Proposed Seepage Transfer Pipeline

Seepage Pumped to Pit

Proposed Seepage French Drain

Contingency Groundwater Collection Wells pumped into the seepage transfer pipeline

Proposed Seepage Collection Sump

Grum V -15

Toe of Dump

ROAD

Dixon Creek

LEGEND

- Low Infiltration Soil Cover (0.5m Compacted Till, 1m Loose Till)
- Vegetative Soil Cover (0.5m Loose Till)
- Waste Rock Slope Not Regraded
- Collection Sump
- Sediment Collection Basin
- Groundwater Collection Well
- Water Treatment Plant
- Proposed Creek Alignment
- Sediment Collection Ditch
- Groundwater / Seepage Pipeline
- Seepage French Drain
- Safety Berm around Faro Pit

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

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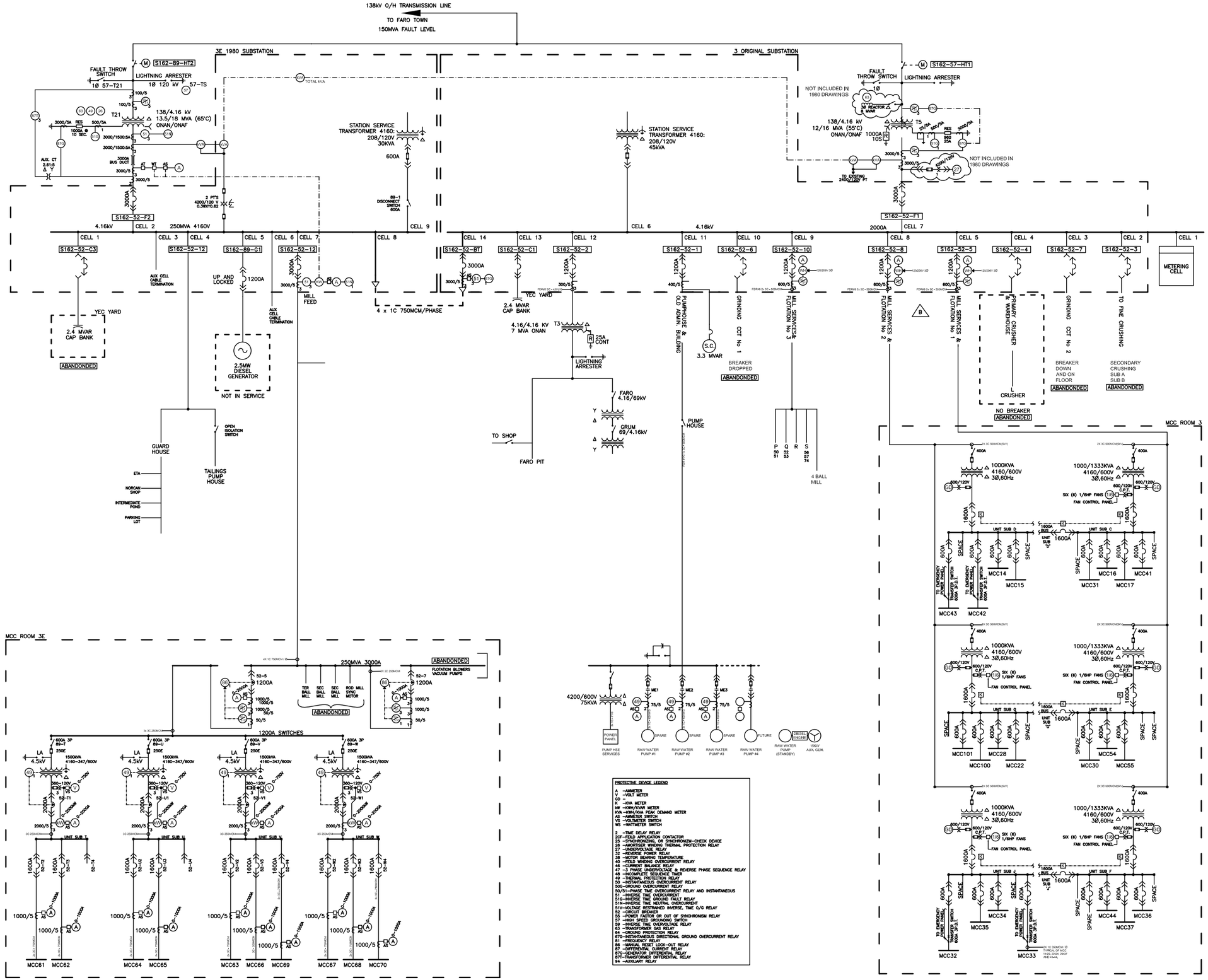
SRK Consulting
Engineers and Scientists

Deloitte & Touche

APPENDIX A: FIGURE 2.0

POWER LINE ROUTING

PROJECT NO.	DATE	APPROVED	FIG.
1CD003.65	FEB. 2005		2.0



NOTES:

1.

LEGEND

- EQUIPMENT DESCRIPTION
- EP2 — MECHANICAL EQUIPMENT REFERENCE
- UNIT NUMBER
- DETAIL NUMBER
- E2 — DETAIL REFERENCE
- DRAWING NUMBER
- DETAIL NUMBER
- SCHEDULE — DETAIL DESCRIPTION
- E1 — DRAWING NUMBER

REVISIONS:

NO.	DATE	BY	DESCRIPTION
01	22/12/09	RD	REVIEW

PERMIT TO PRACTICE:

DORWARD ENGINEERING SERVICES LTD.
CONSULTING ELECTRICAL ENGINEERS
3147 3rd AVENUE
WHITEHORSE, Y1A 1E9
PHONE: (867) 668-6888
FAX: (867) 633-4561
E-MAIL: dorward@ees.org

PROJECT:

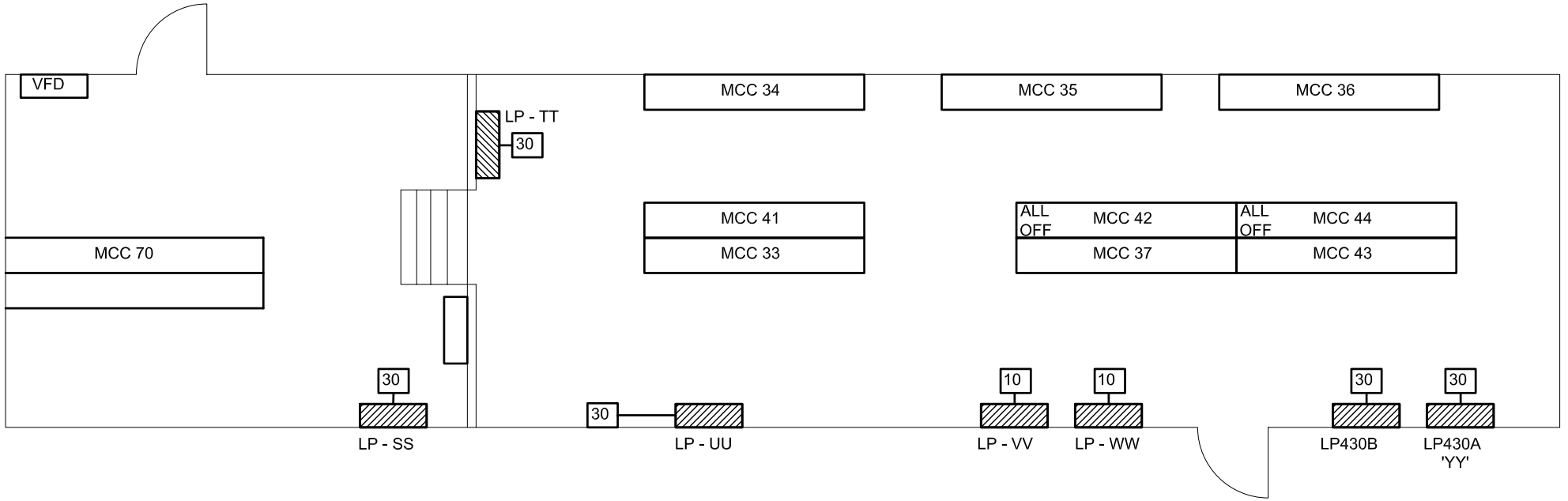
FARO MINES 4kV DISTRIBUTION UP-GRADE

DRAWING TITLE:

APPENDIX C: 138/4.16KV MAIN DISTRIBUTION SLD

SCALE:	N.T.S.
DATE:	JULY 6, 2009
DESIGN:	RD
DRAWN:	VW
CHECKED:	RD
NOT APPROVED FOR CONSTRUCTION:	

D.E.S. PROJECT NUMBER:	SHEET:
9025	E1 of 1



NOTES:

1. AS-BUILT FROM SITE DATA COLLECTED SEPTEMBER 11, 2001

REVISIONS:

NO.	DATE M/D/Y	BY	ISSUED FOR
1	09/09/09	RD	AS-BUILT
2	07/05/09	RD	REVISED

SCALE: NTS
DATE: SEPTEMBER 2009
DESIGN: RD
DRAWN: JAZZ
CHECKED: RD

DORWARD ENGINEERING SERVICES LTD.
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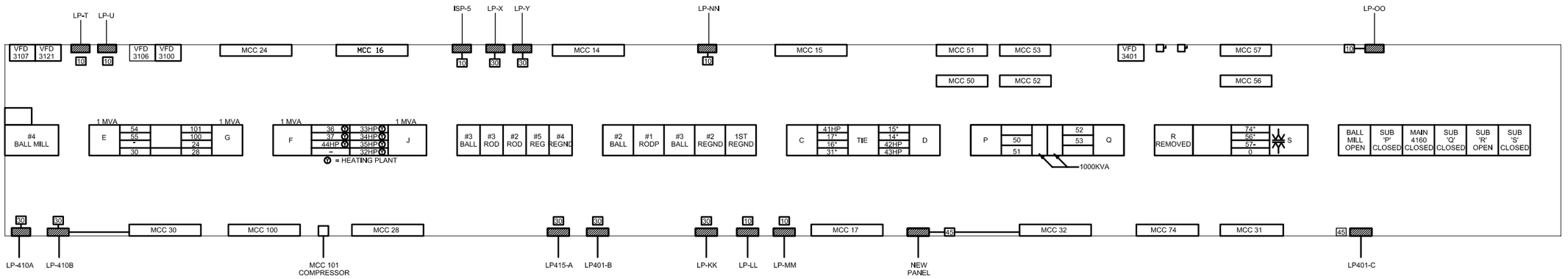
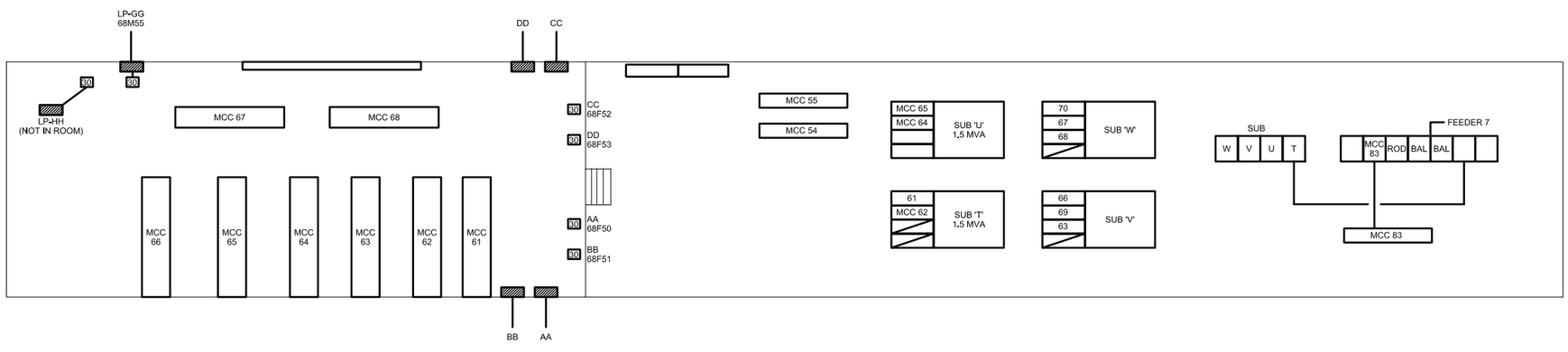
PROJECT:
FARO MINE CARE AND MAINTENANCE PROJECT

DRAWING TITLE:
APPENDIX D:
HEATING PLANT MCC ROOM

PROJECT NUMBER:	SHEET:
9069	E2 OF 2



1/E1 MCC ROOM #3



2/E1 MCC ROOM #3E

NOTES:

REVISIONS:

NO.	DATE M/D/Y	BY	ISSUED FOR
1	09/09/09	RD	AS-BUILT
2	07/05/09	RD	REVISED

DORWARD ENGINEERING SERVICES LTD.
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E-MAIL: dorward@ieee.org

PROJECT:
FARO MINE CARE AND MAINTENANCE PROJECT

DRAWING TITLE:
APPENDIX D:
MCC ROOM 3 AND 3E

SCALE:	NTS
DATE:	SEPTEMBER 2009
DESIGN:	RD
DRAWN:	JAZZ
CHECKED:	RD
APPROVED FOR CONSTRUCTION:	

PROJECT NUMBER:	SHEET:
9069	E1 OF 2