

SITE C CLEAN ENERGY PROJECT

PORTAGE MOUNTAIN QUARRY - MINING AND RECLAMATION PLAN

Project No.: 97289, Release 03

DCC Document No.: PMQ MRP Rev01

BCH Document No.: 1016.N.04.001.DUZ04.CMO.00030.PLAN

Revision: 1

Revision Date: May 04, 2019



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Appendix A – Figure 1 Portage Mountain General Arrangement

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1. BACKGROUND

Portage Mountain Quarry is an undeveloped area that has been identified as a potential riprap source for construction of the Highway 29 realignment sections and the Hudson's Hope Berm, as well as for reservoir protection during filling. Portage Mountain Quarry is located approximately 14 km from Hudson's Hope and is accessed via Canyon Drive and south on FSR R14210 "D" & "H".

Permits for quarrying activities have been provided by BC Hydro with any amendments to follow, as required, during the term of the Contract

2. PURPOSE AND SCOPE

The plan has been developed in accordance with Schedule B of Contract #97289, Release #3. This plan will ensure Duz Cho Construction L.P. compliance with all applicable contractual requirements, and any applicable provincial and federal regulations.

The 'Portage Mountain Quarry Mine Development Plan', which was produced following a trial blast in 2018, details the anticipated yield volume, haul road design is included in Appendix B.

This Mining and Reclamation Plan provides a reference on how the site will be utilized in safe and environmentally sound manner throughout the lifetime of the quarry. It will describe the following:

- Borrow pit site development;
- Mining activities and processes;
- The equipment and methodology for screening and sorting material;
- The equipment and methodology for stockpiling material at the quarry;
- The equipment and methodology for hauling material; and
- The anticipated production rates.

3. SITE DEVELOPMENT

3.1. Volume

The yearly required riprap production (m3) is listed in table 3.1 below.

Table 3.1: Yearly Material Volumes

Year	Yearly RIPRAP production (m3)
2019	25,000
2020	45,000
2021	55,000
2022	20.000



3.2. Overall Development

In order to produce the amount of riprap material that will be required, areas for storage of surplus rock and overburden will need to be created within the quarry site. Figure 1, Appendix A, illustrates the overall area of Portage Quarry and the boundaries of the property. As the site is developed, overburden will be cleared from areas of rock extraction and stockpiled for eventual quarry site reclamation. There will be the Waste Stockpile Area, and the Rip Rap Stockpile Area.

It is estimated that Portage Mountain Quarry will have a 25% yield.

Prior to the start of any phase of operation, DCCLP will verify that all relevant permits and documentations are in place. Appropriate personnel and contractors are briefed and familiar with the work to be performed.

4. PROPOSED METHODOLOGY

4.1. Stripping

The plan is to remove the existing vegetation, strip the organic soils and excavate and stockpile the overburden so that the surplus rock stockpile is stored in the designated stockpile area.

The stripping of the organic-rich topsoil will be undertaken either through bulldozing the topsoil into heaps and then loading out, or directly loading the material out with a tracked excavator, depending on the terrain being prepared. All stockpiles would be at a maximum 2H:1V slope.

The topsoil stockpile will be a live stockpile such that topsoil could be placed on any areas (such as overburden stockpile at capacity, quarry benches or floor area) where active mining is complete and access is not required. The stockpile will be protected against water ingress. This will facilitate future operations of the quarry, once the surplus rock stockpile is depleted.

Where overburden is to be placed on sloping ground, the area on which the overburden is to be placed will be cleared and grubbed, with the organic-rich topsoil layer stripped. The sloping ground will be benched to create a ridged base layer and interface on which the stripped overburden is placed.

4.2. Mining

Once competent bedrock is accessible, benches will be constructed through drilling and blasting of either 5 m benches using a double benching technique or 10 m benches using a single benching technique. The blast rock acquired from the construction of the benches will be mined and process in order to acquire the necessary RIPRAP material. Bulldozer work and secondary drilling and blasting may be required to enable



access to steep areas by tracked blast holes. Blasting will be done in a controlled fashion to ensure to the best of the abilities a level working surface for loading equipment and continue the benching mining process.

Following the drilling and blasting operations, material will be loaded by either hydraulic excavator or wheel loaders into designated dump trucks that will then transport the RIPRAP material to designated stockpiles for sorting or shipment as deemed necessary. Large RIPRAP material will be sorted at the active face for stockpiling onsite. Further details on equipment to be used can found in Section 8 of this plan.

Bulldozer work and ancillary drilling and blasting may be required to enable access to steep areas by tracked blast hole drills. Blasting will be undertaken and planned in such a manner to create level working surfaces for loading equipment.

Drilling and blasting will be required for excavation of the sandstone rock in the quarry. Duz Cho Construction L.P. and our blast engineer will determine the blasting parameters to achieve the required riprap and rock embankment products. Blasting operations will only be conducted between May 15 and September 15. Weather permitting, ancillary work may take place prior to or after these dates.

4.3. Explosives

The design, installation, maintenance and safe work practices associated with the handling and firing of explosives is a specific requirement of the DCCLP subcontractor. Blasting times will be set so as to protect persons from exposure to dust, fumes, smoke and debris. Prior to blasting, the blaster shall be responsible for clearing the blast danger zone of all persons and non-essential equipment and will ensure that all entrances to the blast danger zone are guarded to prevent access. Immediately prior to detonation an effective and audible warning will sound.

All additional details for safe work practices will be included in the site-specific blasting plan that will be authorized just prior to the planned activity.

4.4. Hauling, Sorting, Storage and Stockpile

Loading will be done by either hydraulic excavators or wheeler loader. Quarry haulage will be by rock truck from the Quarry to the Stockpile area, as shown in Appendix B - Figure 1. Some quarry run may need to be fed through a mobile screen at the stockpile area, with the surplus rock and rock fines. Riprap and riprap bedding material and rock fill material will also be stored in stockpile area for haulage offsite.



In accordance with Contract requirements, a temporary mag site will be established and licenced under the B.C. mines act. The blasting operation will conform to the applicable laws and/or regulation (e.g. timing of blasts during the day, etc.).

Blasted rock will be loaded by a tracked excavator. To maximize the use of the mined rock from the quarry, it may be subject to screening to recover the riprap material classes required. This will be undertaken by tipping the mined material, directly from the mine trucks over a mobile screen. The oversize material will then be stockpiled for transport off site for use in construction and the undersize portion may be further screened for reducing the fines or stockpiled on site.

Off site haulage will be done by highway legal trucks. On site haulage will be done using rock trucks up to 40 tonne capacity.

Roads will be maintained into the quarry stockpile area for highway legal trucks such that loading and scaling operations can be carried out. Quarry Haul road maintenance will also be carried out through the life of the Contract. Appropriately sized Safety Berms will be constructed per design requirements on both the access road to the stockpile area as well as the Quarry Haul road.

5. QUARRY OPERATIONS

5.1. Management

The DCCLP Project Manager will:

- Ensure all applicable execution plans, requirements and reports are communicated, complied and delivered for use with this execution plan;
- A survey has been performed and reference stakes have been laid out and approved by the BCH representative;
- Clearing grubbing and stripping has been performed within the area to be mined;
- Coordinate as required with all stakeholders: BC Hydro, other contractors, Mine Managers, environmental, etc.;
- Monitor and report all daily activities.

The DCCLP Mine Manager will:

- Coordinate as required with area foremen, environmental management, safety management, and other contractors;
- Ensure road maintenance as required;
- Ensure all sediment and erosion controls as directed by environmental monitors area adhered to;
- Plan, execute and report daily activities required;



• Ensure that a copy of the Health, Safety and Reclamation Code for Mines in BC is available for all employee at the site office.

5.2. Operations Guidelines

The quarry is an undeveloped area and will be operated in a consistent manner in compliance with the Health, Safety and Reclamation Code for Mines in British Columbia. The Province's Aggregate Management Principles have been established to ensure that aggregate activities are undertaken in compliance with health and safety standards and environmental protection requirements. Quarrying activities will be conducted in accordance with these requirements. The reference documents are:

- Health, Safety and Reclamation Code for Mines in British Columbia;
- Health and Safety: A Practical Guide for Aggregate Operations (2007);
- Ministry of Energy, Mines and Petroleum Resources, Mining and Minerals Division (2007);
- Aggregate Operators Best Management Practices Handbook for British Columbia, Vol1 & 2 (2002);
- Aggregate Management Principles (2009);
- Tennant and Regensburg "Guidelines for Mine Haul Road Design" (2001);
- Ministry of Energy, Mines and Natural Gas Mines and Mineral Resources "Mine Emergency Response Plan Guidelines for the Mining Industry" (February 2013, V1.3);
- BC Ministry of Transportation and Highways "Reclamation and Environmental Protection handbook for Sand, Gravel and Quarry Operations in British Columbia" (1995).

5.3. Operations Considerations

The following is a summary of quarry operation considerations:

- Excavation, haul road, Waste Stockpile Area, and the Rip Rap Stockpile Area will follow the design report in Appendix B;
- The maximum volumes proposed for extraction will be based on the suitability and quality of the
 materials as per the Trial Blast report and as they are processed. The materials unsuitable for
 Contract fulfillment will remain within the site and will be stockpiled for future use by others.
- The site will contain a trailer office, maintenance and storage area, and environmental equipment C-can or trailer;
- Potable water for the office and service area and water for dust control will be brought to the site from an offsite location;
- Extraction requires drilling, blasting and processing, such as screening, prior to riprap being removed from the site. More than one area will be active with room to maintain equipment maneuverability and production rates;



- Blasting materials will be commercially available. No explosives will be stored on site. Blasting
 activities will be in accordance with WorksafeBC, the Mines Act (BC) the Explosives Act (Canada),
 the Transportation of Dangerous Goods Regulations (Canada), the Motor Vehicle Act (BC) and
 Contract requirements;
- Produced material will be delivered to applicable work sites by others using highway-legal haul trucks. Haul trucks will be restricted to movement on the Access road and designated areas of the stockpile area;
- Anticipated working hours would be 7 days a week, 12 hrs a day, using rotating crews.

5.4. Operations Equipment:

The following is a summary of quarry operation equipment:

- The equipment required for operations will be as follows with the number of equipment pieces to be determined as work progresses/changes:
 - Excavators (to loosen and remove material and process material at the quarry and stock pile area);
 - Wheel loader (to load out material);
 - Bulldozers (to push material for stripping, dressing berms and maintenance);
 - Rock drills;
 - Highway legal haul trucks (to transport the material off site);
 - Water Trucks (to control dust as required);
 - Personnel Site Pick-ups (for onsite mobility);
 - Service vehicles (mechanic, fuel trucks, blasting materials).
- The facilities which could be located on site, or as may be directed by the Mines Act, include:
 - Mobile office with lunch room, wash rooms and safety room;
 - Potable water storage;
 - Mining vehicle laydown area;
 - Mobile screen;
 - Gated access;
 - Wash car;
 - o Mobile scale; Staff parking area; and
 - Wash bay with dirty water retention pond.

5.5. Access

Access will be gated and closed to the public. Truck haul will be limited to the Access Road and FSR R14210 "D" & "H" from Canyon Drive.



5.6. Safety and Environmental Management

Duz Cho Construction L.P. will adhere to the environment and safety requirements described in the site specific Environmental Protection Plan (EPP) and Safety Management Plan.

Management measures to be implemented during quarry operation will include:

- Gated access with security to control access;
- Berms will be constructed at the top edges of excavations to control movement within the quarry, stockpile area and on Access Road;
- Portable toilet facilities may be used within the quarry area and near the project site offices. These
 facilities will be maintained as required. If wash car stations are used onsite, the grey water created
 will be disposed of into a suitable tank and then pumped out and trucked to the municipal
 treatment location;
- Provide for environmental management in accordance with the EPP for erosion, sediment control, oil/water separation, control of noxious weeds, control of air emissions, drainage and future reclamation;
- The planning and installation of a lighting system, if required, for the safe operation of the site will
 follow guidelines in the Aggregate Operators Best Management Practices Handbook. The goal will
 be to facilitate safe and secure operations for the extraction, processing and stockpiling locations
 while minimizing offsite visual nuisance. The lighting of road junctions and site entrances will be
 kept to the minimum required for safety purposes.

5.7. Reclamation and Future Use

Following use by Duz Cho Construction L.P./BC Hydro, Portage Mountain Quarry will transfer operation to the jurisdiction of the MOTI. Slopes will be placed in a stabilized manner and drainage features will be established to control drainage. Seeding to control noxious weeds will be done on soil slopes and overburden stockpiles.

Usable materials will be available for future mining of the quarry after the Contract is completed. All temporary slopes not required for continued operations will be profiled for long term stability. Overburden materials could be used to construct embankment against excavated slopes to profile and cover up the exposed depleted rock faces and then covered with topsoil previously retained on site. Slopes may be hydro seeded. Control of noxious weeds will be undertaken by others until affected areas are ecologically stable.



APPENDIX A

Figure 1 – Portage Mountain General Arrangement



APPENDIX B





PORTAGE MOUNTAIN QUARRY MINE DEVELOPMENT PLAN

Mine Development Plan with Stockpiles

Please find the following attached to this letter:

- 3D Visualization PortageMountain_Elevation1000_PIT_Dump_3D2
 This is a 3D drawing of the Haul Road and the Pit developed to the 1000m elevation.
- PortageMountain_Elevation1020_Pit_Dump_Haul
 This drawing shows the Haul Road developed to the start of the Pit at the 1020m elevation. Also shown on this drawing are the Waste Rock Dump and the Rip Rap Stockpile locations.
- 3. PortageMountain_Elevation1010_Pit_Dump_Haul
 This drawing illustrates the Pit development to the 1010m elevation.
- 4. PortageMountain_Elevation1000_Pit_Dump_Haul
 This drawing shows the pit development to the 1000m elevation.

DESIGN PARAMETERS

The design parameters are listed in Table 1

Portage Mountain Quarry - Haul Road and Quarry Design Parameters											
	Rip Rap	Rip Rap Yield Total Volume Waste Rock Stockpile									
	Contract Vol	to Blast		Volume	Rip Rap Swell	Waste Rock Swell	Rip Rap Vol	Waste Rock Vol	Total Blasted		
	(BCM)		(BCM)	(BCM)	Factor	Factor	(LCM)	(LCM)	(LCM)		
							•				
2019	25000	25%	100000	75000	1.5	1.3	37500	97500	135000		
2020	45000	25%	180000	135000	1.5	1.3	67500	175500	243000		
2021	55000	25%	220000	165000	1.5	1.3	82500	214500	297000		
2022	20000	25%	80000	60000	1.5	1.3	30000	78000	108000		
TOTAL	145000		580000	435000			217500	565500	783000		

Table 1. Design Parameters

It was assumed that the Rip Rap Yield would be 25%. To determine the stockpile areas for the waste rock and rip rap, swell factors of 1.3 and 1.5 respectively, were used.







MINE DEVELOPMENT PLAN

The Mine Development Plan includes the Haul Road Development; Access to the 1020 Elevation; Development and Mining to the 1010 Elevation; Development and Mining to the 1000 Elevation; Development of the Waste Stockpile Area; and Development of the Rip Rap Stockpile Area.

Table 2. Summary - MINE DEVELOPMENT PLAN

MINE DEVELOPMENT PLAN									
Haul Road Cut to 1020 elevaton	102,689	BCM							
Bench 1010 (Available)	390,339	BCM							
Bench 1000 (Available)	247,550	BCM							
Total In-pit Volume Available	637,889	BCM							
Waste Rock Dump Capacity (defined)	608,051	LCM							
Rip Rap Stockpile Area	17,000	SqM							

HAUL ROAD

The Haul road is design to comply with Mines Act regulations for Volvo A40D rock trucks. The criteria for the design is noted below under Section 6.9.1 of the BC Ministry of Energy and Mines - Health, Safety and Reclamation Code for Mines in British Columbia. <u>Although not shown on the drawings, run-away-lanes/retardation barriers will be constructed at all switchbacks.</u>

Mine Haul Road Design Haulage Road Width

- 6.9.1 The manager shall prepare a plan pursuant to section 10 (1) of the Mines Act which
 - (1) Shows the type and method of construction for haulage roads that are to be constructed at the mine site.
 - (2) Except for roads constructed prior to 1990, the manager shall ensure that haulage roads are designed, constructed and maintained to provide:
 - (a) a travel width where dual lane traffic exists, of not less than 3 times, or where single lane traffic exists, of not less than 2 times the width of the widest haulage vehicle used on the road, and
 - (b) a shoulder barrier
 - (i) at least 3/4 of the height of the largest tire on any vehicle hauling on the road,





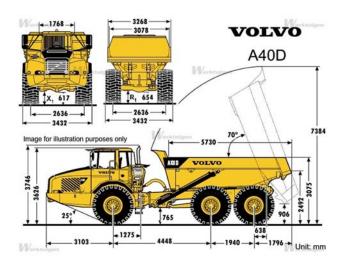


- (ii) of a construction or a specification that is in general conformance to accepted engineering practice,
- (iii) located and maintained along the edge of the haulage road wherever a drop-off greater than 3 m exists, and
- (iv) incorporating breaks that do not exceed the width of the blade of the equipment constructing and maintaining the breaks to allow for drainage and snow clearance.
- (3) For the purpose of subsection (2) (a), the width of the barrier referred to in subsection (2)
- (b) shall be excluded from the travel width.

Vehicle Runaway Protection

6.9.2 On roadways where the grade exceeds 5% the manager shall have installed and maintained runaway lanes or retardation barriers where conditions/risk warrant.

Technical Specifications – VOLVO A40D



The Volvo A40D has a width of 3.432m and 1/2tire height of 0.906m. To accommodate this vehicle, the Haul road is designed at 2 times the truck width, plus 1.5m width for a safety berm on the outside of the road. The haul road is designed as a single lane 8.4m wide road and a 0.25m deep ditch on the inside of the road. Pull out lanes, with additional 3.4m widths, have been added for passing zones. In these zones, the overall width of the Haul Road is 11.8m. The pull-out lanes are evident on the drawings. Loaded trucks will have the right-of-way and all traffic will be radio controlled.

The road grades and material volumes (cuts) for various stations along the Haul road are listed in Table 3. Haul Road Profile.







As shown, it is estimated that 102,689 bank cubic meters (bcm) of material will be moved to build the road. The overall grade of the road is 9.74% although some sections are at 10%. The overall length of the haul road 2,523m.

See Table 3: Haul Road Profile

L-Stn	SG Cut V.	Rd. Wd.	Gnd Elev	Grade	L-Stn	SG Cut V.	Rd. Wd.	Gnd Elev	Grade	L-Stn	SG Cut V.	Rd. Wd.	Gnd Elev	Grade
m.	Cu. m.	m.	m.	%	m.	Cu. m.	m.	m.	%	m.	Cu. m.	m.	m.	%
134.8	418.1	8.4	820	8	1074.1	1064.8	8.4	906.1	10	1851.1	2798.6	8.4	979.1	10
178.9	526.6	8.4	824.7	10	1103.1	1268.5	8.4	909.4	10	1881.1	1999.9	8.4	973.6	10
224.2	363.4	8.4	829.4	10	1136.1	2870	11.8	912.6	10	1909.8	2217.8	11.8	976.6	10
246.9	260.4	8.4	831.9	10	1181.8	1583.4	8.4	917.6		1942.7	356.4	8.4	978.6	10
260.3	1240.9	8.4	833.4	10	1211.6	396.3	8.4	919.9		1960.5	923.2	8.4	979	
314	34.9	8.4	837.6	10	1217.9	369.3	8.4	920.3		1980.8	1757.2	8.4	982.6	
317.3	216.5	8.4	837.7	10	1223.6	1314.7	8.4	922		2010.3	956.5	8.4	985.3	
349.2	105.4	8.4	840.7	10	1238.1	3602.7	8.4	928.9		2025.2	1722.2	8.4	987.1	
393.9	250.9	8.4	844.7	10	1274.2	1517	8.4	926.9	10	2049.6	772.4	8.4	985.3	
428.2	902.5	8.4	848.4	10	1300.3	1639	8.4	924.1	10	2071.9	916.9	8.4	984.1	10
468.9	1113.8	8.4	853.6	10	1337.3	1292.4	11.8	927.5	10	2099	3692.6	11.8	990.3	10
523.3	527.5	8.4	857.8	10	1367	886.2	8.4	930.2	10	2152.8	595.3	8.4	993.3	
573.6	3054.3	8.4	862.8	10	1389.5	1400.9	8.4	933.2		2193	229.3	8.4	993.2	
644.7	1249.1	11.8	870.9	10	1421.9	913.4	8.4	934		2207.9	1186.8	8.4	997.6	
691.2	477.8	8.4	874.4		1437	2328.7	8.4	943.2		2236.4	1206.4	8.4	999.8	9
716.1	361	8.4	874.8		1456.4	4761.3	8.4	945.2		2266.9	1141.7	11.8	1001.7	9
740.4	221.1	8.4	877.9		1512	2809.4	8.4	942.3	10	2289.8	550.8	11.8	1003.1	9
749	675.8	8.4	878.3		1565.8	741.7	11.2	946.1	10	2307.1	525.8	8.4	1004.1	9
764.3	805.7	8.4	880.7		1586.5	476.8	8.4	947.9	10	2329.5	348	8.4	1005.7	9
789.9	366.7	8.4	880.7	9	1603.9	927.4	8.4	951.6	10	2347.8	366.2	8.4	1007.4	
808.7	363.1	8.4	882.7	9	1621.7	170.7	8.4	953.2	10	2362.7	791.1	8.4	1010.2	
852.1	276.7	8.4	885.2	9	1624.9	1301.2	8.4	953.4	10	2387.8	662.5	8.4	1010.5	
881.7	1018.6	11.8	888.3	9	1640.1	738	8.4	960.1	10	2402.5	942	8.4	1016.7	
916	577.2	8.4	893.3	9	1647.6	1076.4	8.4	960.2	10	2414.1	1783.5	8.4	1017.9	
940.4	347.2	8.4	896.8	9	1667	666.9	8.4	954.9	10	2445.5	983.5	8.4	1015.5	10
954.4	314.3	8.4	896.3	9	1683.9	3135.1	11	960.6	10	2471.1	1007.7	8.4	1019.5	10
967.4	509.4	8.4	898		1719.3	2407.8	8.8	963.8	10	2498.2	292.9	8.4	1018.2	10
992.8	663.5	8.4	898.1		1761.4	1365.9	8.4	967		2511.2	193.5	8.4	1021.1	
1007.8	944.4	8.4	906		1779.9	1980.8	8.4	970.7		2522.9		8.4	1020.7	
1019.8	1690.6	8.4	906.1		1805	1611.2	8.4	973						
1046.9	1034.7	8.4	904.5	10	1820.2	4238.6	8.4	977.4		Total/Ave	102689.3			9.74

Table 3. Haul Road Profile







QUARRY BENCH DEVELOPMENT

The Haul Road has been designed to access the 1020m elevation to establish drilling for the first bench. Figure 1 shows the Haul Road development to the 1020 Elevation.

It has been determined that 2 benches from the 1020 elevation will be required to fulfill the quantity requirements. Please note that there is design flexibility available with the pit geometry that allows pit design changes if the pit volume decreases as a result of increased rip rap yield.





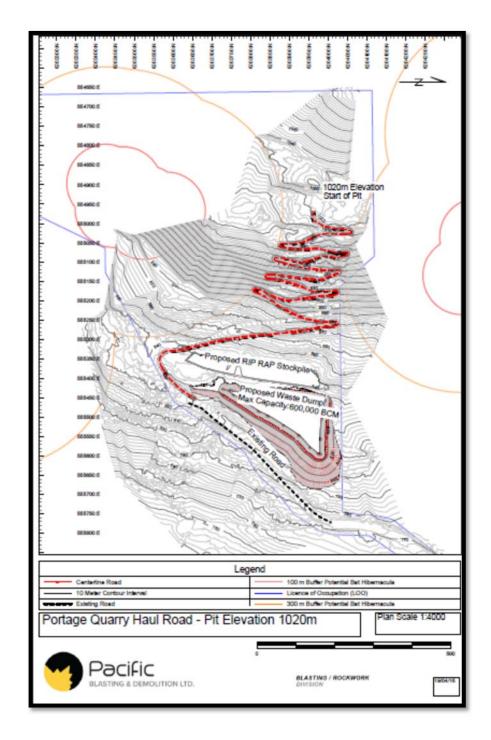


Figure 1: Haul Road development to 1020 Elevation





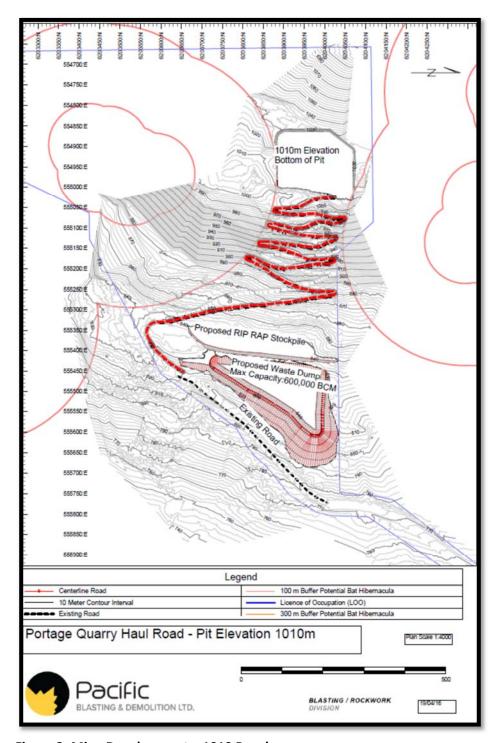


Figure 2: Mine Development - 1010 Bench





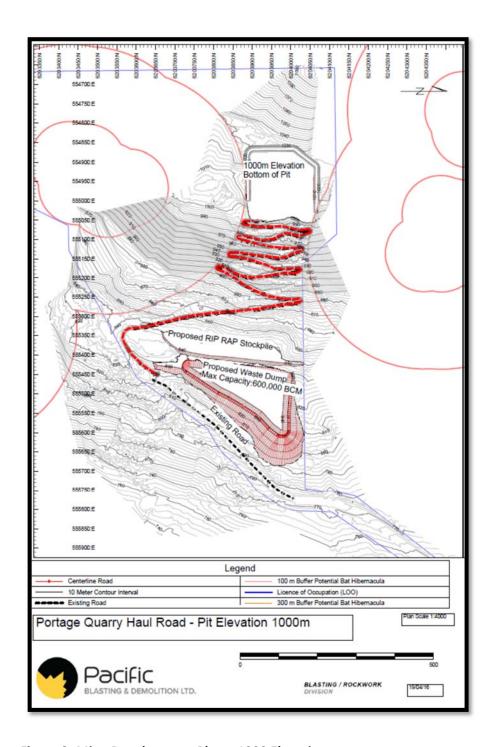


Figure 3: Mine Development Plan - 1000 Elevation





The first bench (1010m) of the quarry, as designed, contains 390,3391 BCM. Unsuitable material (waste) will be hauled to develop the Waste Dump.

Figure 3. shows the development of the 1000 bench and the retreating Haul Road. This bench contains 247,550 BCM and the total pit volume is 637,889 BCM.

Figure 4 presents a 3-d view of the Haul Road and final bench of the Quarry:

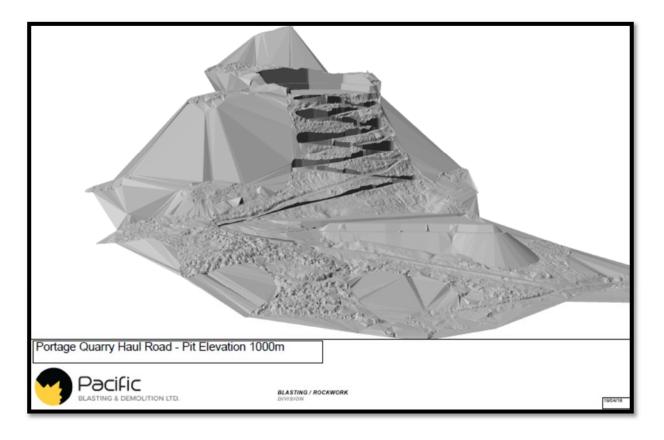


Figure 4: Overall quarry operation - 3D View





STOCKPILES

The Waste Rock Dump location was chosen at a convenient location at the bottom of the ramp. An access from the Haul Road will be configured to enable trucks to easily enter the dump area.

The Waste Dump stockpile is designed with 2 lifts, can accommodate 600,000 cubic meters of waste rock

The Rip Rap Stockpile location was chosen for its ease of access and proximity to the Haul Road and the Existing Road.

We trust this meets your satisfaction and if you have any questions, please call.



April 18,2019