# Grassy Mountain Project

# Final Portal Design and Construction Plan

**Submitted to**

## Calico Resources USA Corp.

**Report prepared by**

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# Grassy Mountain Project

# Final Portal Design and Construction Plan

# Rev2

**Geotechnical Mine Solutions**
Mardoqueo Fernández 128, of 503.
Providencia - Santiago
Chile

e-mail: contacto@gms-engineering.cl
Website: www.gms-engineering.cl

Phone :(+56-2) 2297 5377

## Authors

Rodrigo Flores, Sebastián Vera, Leonardo Palma, Andrés Torres.

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# 1. INTRODUCTION

Calico Resources USA Corp (Calico) has requested Geotechnical Mine Solutions (GMS) carried out the mine portal final design and the construction plan for the Grassy Mountain Gold Project (Grassy Mountain), Malheur County, Oregon. The initial design was made during the Pre-feasibility study (PFS) for permits purposes.

To carried out the final design and the construction plan, GMS has been evaluated the excavation methodology for each bench of the slopes at the portal, from the geotechnical information updated including the drill core logging (GM19-38). The results allow to define properly equipment, excavation sequence and the final support for the portal and initial 33 ft. of the decline ramp.

# 2. SCOPE

The scope is to assess and define the final portal design from new geotechnical information, study the excavation methodology and define the properly equipment for construction, including the plan of the portal construction and the operating costs associated.

In particular, the objective of the geotechnical review is to validate the geotechnical characteristics of the rock mass where the portal will be placed and excavated, propose the excavation sequence including timing, necessary equipment and support elements to apply.

The operating cost associated to the construction process will be performed according to the excavation, final support, equipment to use and labor quantities.

Construction plan schedule will be provided to complete the study and support the bid process (or construction by owner).

Was excluded the estimation of equipment acquisition cost and indirect personnel.

Was excluded in the operating cost estimation the mining services required, such as, water pump and water storage, power transmission, radiant cable communications, concrete facilities, shotcrete facilities and others.

# 3. OVERALL TERMS

The geological and geotechnical characteristics in the portal area were estimated from a geological cross section of the decline ramp provided by Calico´s geologists during the Pre-feasibility study (PFS), and including the information from cores of the drill hole GM19-38, carried out for this purpose during the Feasibility study (FS). The geotechnical characteristics were evaluated according to the Rock Quality Designation, RQD (Deere et al. 1967).

The excavation methodology was evaluated according to the geotechnical characteristics of the materials in the portal location. The results allow to define properly equipment for excavation, the sequence, the final support element and the capital costs associated.

## 4. AVAILABLE INFORMATION

The available background information used in this study:

- NI 43-101 - Preliminary Feasibility Study and Technical Report for the Grassy Mountain Gold and Silver Project, Malheur County, Oregon, USA. July 9, 2018 (Mine Development Associated, 2018).
- Grassy Mountain Project, Consolidated Permits, Geotechnical Design. May 23, 2019 (Geotechnical Mine Solutions, 2019).
- Grassy Mountain Project, Main Access Portal, Excavation Design and Support Plan, General Plan and Sections GM022019-01. April 11, 2019 (Geotechnical Mine Solutions, 2019).
- Site Layout Map, Calico Resource USA Corp. Grassy Mountain Project. August 2, 2019.
- Geological cross section of the decline ramp axis in the portal area. May 15, 2019 (Calico Resources USA Corp, 2019).
- Topography “Updated Grassy Site Plan” (contour 10 ft). March 13, 2019.

## 5. GENERAL OVERVIEW

The portal is designed to allow access to the underground mine facilities while providing adequate space for equipment and vehicles. Is located uphill and approximately 750 feet south of the primary crusher at an approximate elevation of 3749 fasl. The portal pad has been designed with a 1% inclination towards outside, to allow the stormwater flow away from the portal and towards the stormwater drainage ditches. The portal pad will have sufficient area for installation of the required ventilator infrastructure to be used during the excavation of the decline ramp, the installation of construction facilities and to allow the safe transit of the development equipment. In this way, the pad area was increased to permit major space for facilities from the initial area designed during Permit process. To that, the general cut design was updated, therefore the total area of the portal and the volume for excavation increased.

The portal will have a waste rock excavation volume of 1,347,895 $ft^3$. This, will be transported and disposed in the temporary waste rock dump storage facility designed for the mine operations.

Figure 5-1 shows a plan view of the general layout related to the portal location and Figure 5-2 shows a detailed view of the portal pad area.

UTM coordinates and the dimensions of the portal are indicated in Table 5-1.

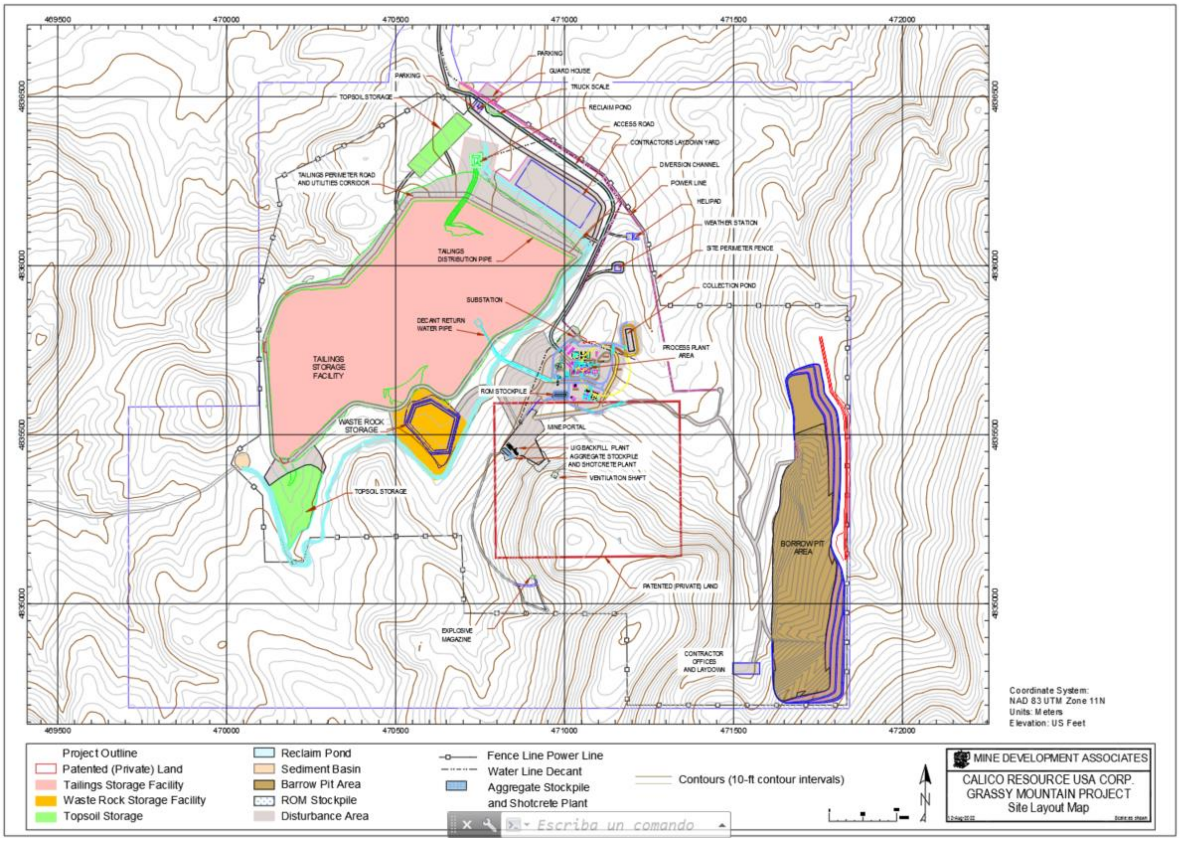



**Figure 5-1** General site layout – related to portal location.

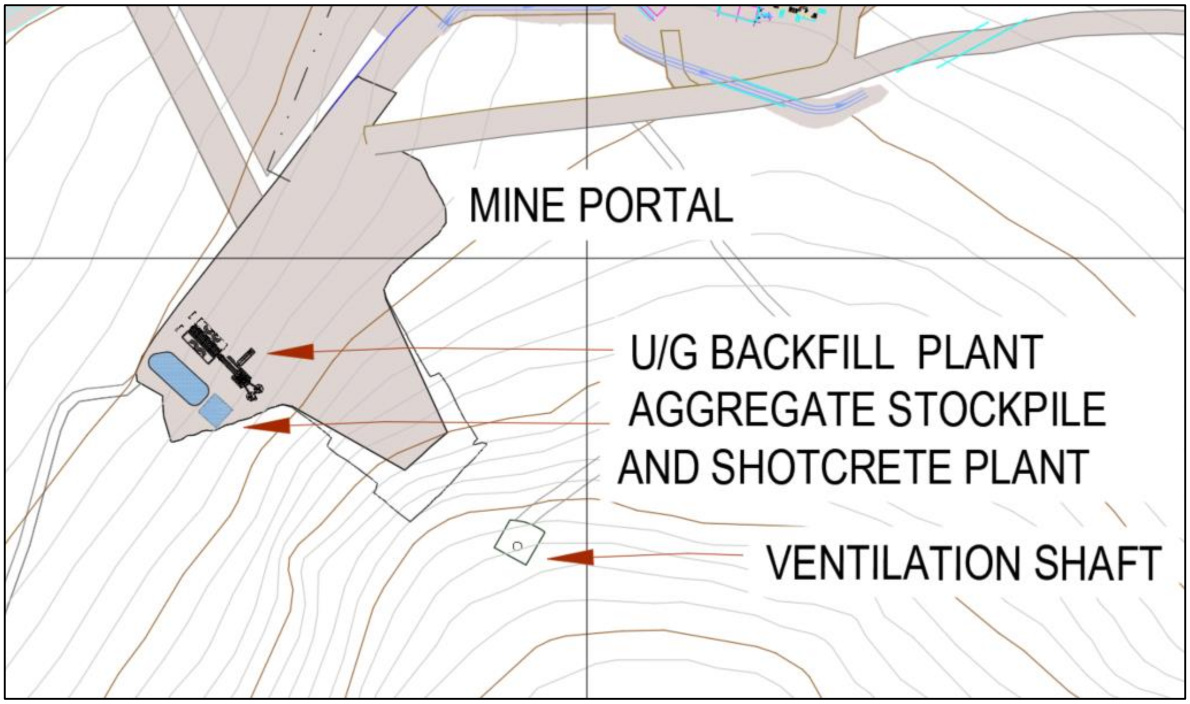



**Figure 5-2** Portal pad area.

**Table 5-1** Portal location (UTM NAD83, Zone 11).

| Portal | Coordinates | | Elevation [fasl] | Pad Area [ft$^2$] |
|---|---|---|---|---|
| | North | East | | |
| Entry | 15864312 | 1544950 | 3750 | 3.322,293 |

# 6. GEOTECHNICAL ANALYSIS

## 6.1. General Constructability Approach

The constructability approach proposed in this report establishes the premise of:

- Temporary waste rock storage facility from the portal construction is located at a reasonable distance from the portal.

Near the portal, an estimated area of 10,764 ft² is considered to be the industrial facilities for the contractor and the owner, this area must be made by the contractor, either including available fill material or from the portal excavation.

## 6.2. Geotechnical Investigations - Portal Drill Hole

As part of the preliminary activities for the study and design of the portal, a drill hole was carried out near the portal location to study the geology and geotechnical conditions presents.

The drill hole, GM19-38 has 100 feet long and was conducted in HQ3 diameter. Table 6-1 shows the location of the drill hole.

**Table 6-1** Location of drill hole coordinates.

| Hole ID | Location X | Location Y | Location Z | Length (ft.) |
|---|---|---|---|---|
| GM19–38 | 1544958.00 | 15864211.00 | 3791.00 | 100.00 |

## 6.3. Rock Mass Characterization

Previous information related to the geology present in the portal area was estimated by Calico´s geologists. The information used was based on the correlations between drill holes near the portal area and the surface excavation carried out in the portal area.

The geology of the site was estimated using a cross section in the decline ramp location (Figure 6-1). The results of these estimations provided the lithologies present in the portal area, according to:

- Colluvium (Non-consolidated material presents on surface);
- Sandstone/Arkose;
- Siltstone;

- Clay and;
- Sinter

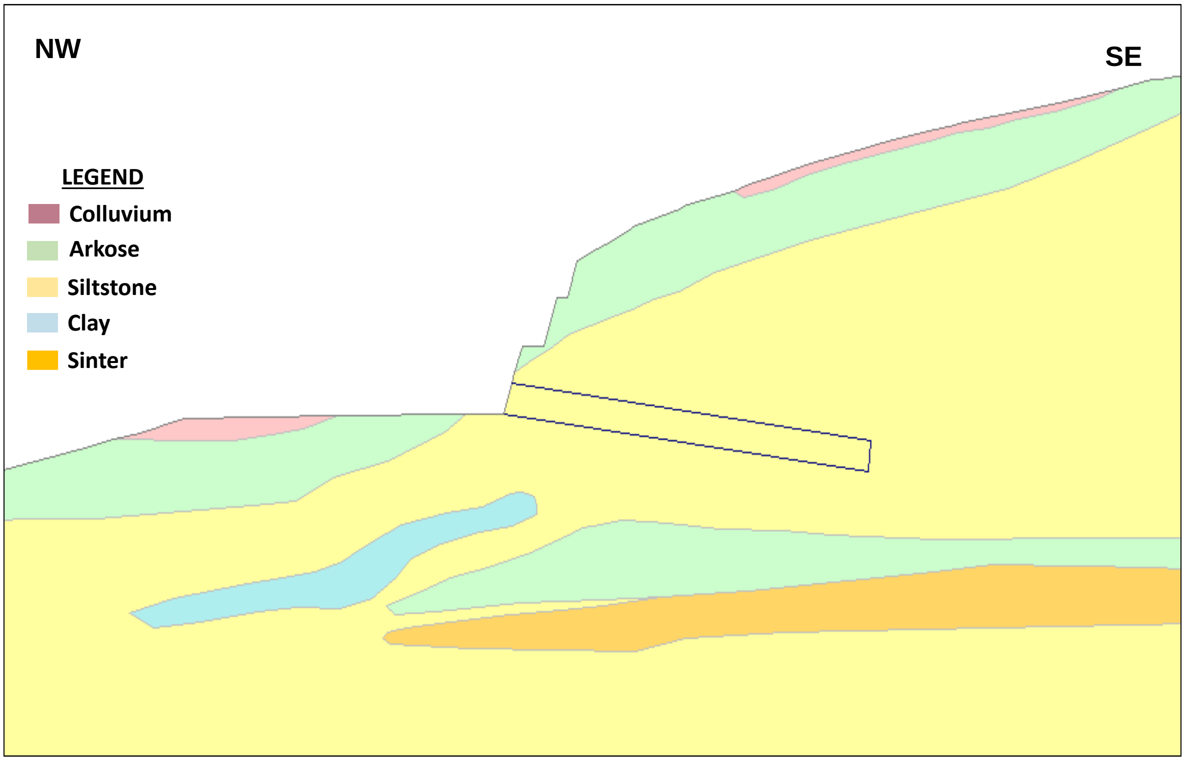



**Figure 6-1** Geological cross section, decline ramp at portal.

Currently, a drill hole was carried out at the portal location specially for geotechnical purposes (GM19-38). The drill hole cores were logged by Calico´s geologists and then re-logged by GMS´s geotechnical personnel as a quicklog of geotechnical parameters.

The re-logging methodology consisted of recording the fracture spacing and frequency through the RQD. They were used for the subsequent geotechnical characterization of the rock mass in the portal area.

Table 6-2 presents the distribution of the logged RQD from the drill hole.

**Table 6-2** Rock mass quality distribution.

| From (ft.) | To (ft.) | Interval length (ft.) | RQD (%) | Lithology |
|---|---|---|---|---|
| 0 | 7 | 2.1 | 63 | Conglomerate |
| 7 | 11 | 1.2 | 0 | Conglomerate |
| 11 | 15 | 1.2 | 46 | Sandstone |
| 15 | 20 | 1.5 | 9 | Tuff |
| 20 | 29.4 | 2.9 | 88 | Sandstone |
| 29.4 | 31 | 0.5 | 0 | Sandstone |
| 31 | 34.3 | 1.0 | 0 | Sandstone |
| 34.3 | 40 | 1.7 | 85 | Tuff |
| 40 | 44.8 | 1.5 | 0 | Tuff |
| 44.8 | 54 | 2.8 | 65 | Sinter |
| 54 | 64.5 | 3.2 | 19 | Tuff |
| 64.5 | 71 | 2.0 | 71 | Tuff |
| 71 | 88.5 | 5.3 | 9 | Tuff |
| 88.5 | 100 | 3.5 | 0 | Tuff |

Rock quality was estimated using the RQD logged, for the portal area and for the initial 33 feet of decline ramp development. Figure 6-2 shows the GM19-38 drill core trays.

| From (ft.) | To (ft.) | RQD (%) |
|---|---|---|
| 0.0 | 7.0 | 63 |

| From (ft.) | To (ft.) | RQD (%) |
|---|---|---|
| 7.0 | 11.0 | 0 |

| From (ft.) | To (ft.) | RQD (%) |
|---|---|---|
| 11.0 | 15.0 | 46 |

| From (ft.) | To (ft.) | RQD (%) |
|---|---|---|
| 15.0 | 20.0 | 9 |

| From (ft.) | To (ft.) | RQD (%) |
|---|---|---|
| 29.0 | 29.4 | 88 |

| From (ft.) | To (ft.) | RQD (%) |
|---|---|---|
| 29.4 | 34.3 | 0 |

| From (ft.) | To (ft.) | RQD (%) |
|---|---|---|
| 34.3 | 40.0 | 85 |

| From (ft.) | To (ft.) | RQD (%) |
|---|---|---|
| 40.0 | 44.8 | 0 |

| From (ft.) | To (ft.) | RQD (%) |
|---|---|---|
| 44.8 | 54.0 | 65 |

| From (ft.) | To (ft.) | RQD (%) |
|---|---|---|
| 54.0 | 64.5 | 19 |

| From (ft.) | To (ft.) | RQD (%) |
|---|---|---|
| 64.5 | 71 | 71 |

| From (ft.) | To (ft.) | RQD (%) |
|---|---|---|
| 71 | 88.5 | 9 |

| From (ft.) | To (ft.) | RQD (%) |
|---|---|---|
| 88.5 | 100 | 0 |

| From (ft.) | To (ft.) | RQD (%) |
|---|---|---|
| 88.5 | 100 | 0 |

**Figure 6-2** Rock core qualities RQD – GM19-38.

In addition, the execution times for the portal construction were estimated according to the rock mass quality estimated to be found.

## 6.4. Estimation of Rock Mass Properties

The strength properties were estimated on the basis of geotechnical characteristics, the results of the rock mechanics laboratory tests carried out as part of the Feasibility study (Golder, 2020) and the experience of the authors in materials with similar characteristics.

Table 6-3 indicates the estimated strength properties of the rock mass in the portal location. for the study of the portal stability.

**Table 6-3** Strength properties estimated for the rock mass.

| Lithology | Friction Angle[°] | Cohesion [kPa] | Unit Weight [ton/m3] |
|---|---|---|---|
| Sandstone/Arkose | 48 | 798 | 2.47 |
| Siltstone | 38 | 525 | 2.49 |
| Tuff | 47 | 717 | 2.44 |
| Sinter | 51 | 875 | 2.45 |
| Conglomerate | 48 | 706 | 2.47 |
| Coluvium | 37 | 50 | 2.00 |

## 6.5. Rippability Estimation

The rippability analysis was made using the Franklin's methodology for excavations in engineering works (Franklin, 1974). The methodology relates the RQD index and the Point Load resistance ($MN/m^2$), the Uniaxial Compressive Strength (MPa) and the Schmidt number.

As part of the geotechnical logging carried out, the Point Load Testing (PLT) was conducted. The results of the PLT tested is the index available in this case for the Franklin's analysis, since the RQD index was logged from the core trays.

Table 6-4 show the PLT results, tested from the GM19-38 drill hole.

Table 6-4 PLT test results.

| PLT Results | |
|---|---|
| Depth (ft.) | Is50 (Mpa) |
| 4.5 | 3.6 |
| 6.1 | 5.0 |
| 12 | 5.0 |
| 20.5 | 9.6 |
| 23.8 | 10.9 |
| 27.4 | 12.4 |
| 34.5 | 11.0 |
| 47.1 | 11.7 |
| 51.8 | 8.4 |
| 57.2 | 10.9 |
| 65.9 | 11.3 |
| 69.1 | 11.7 |
| 71.7 | 6.8 |
| 80.5 | 11.6 |
| 84.3 | 1.2 |
| 93.2 | 5.1 |
| 98 | 9.6 |

Figure 6-3 shows the rippability chart according to the RQD index and the results of the PLT tests for the estimation of the portal excavation.

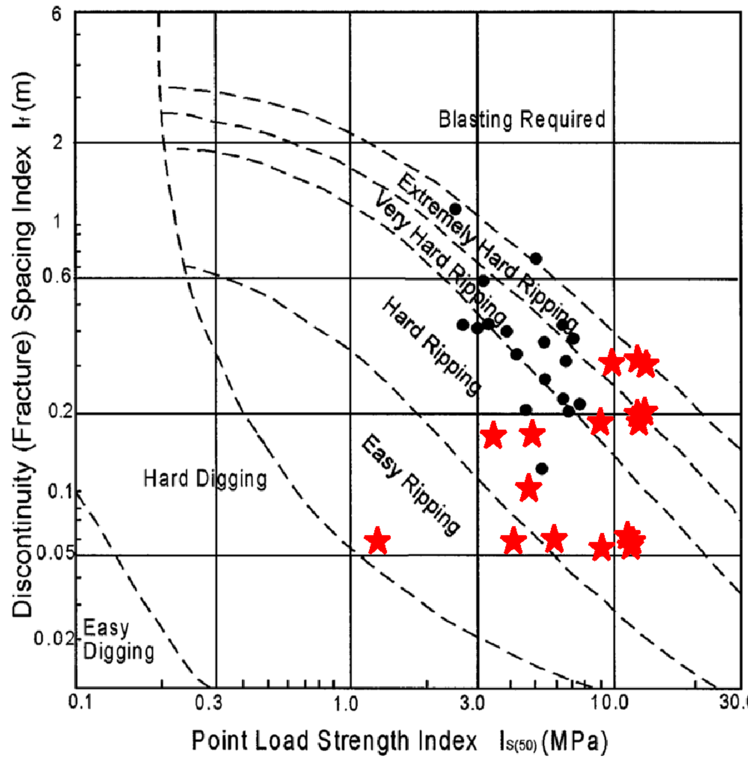



**Figure 6-3** Rippability chart.

The results show that the materials at the portal location could be excavated through ripping from easy ripping to extremely hard ripping. This should be considered for the equipment selected to excavate.

In addition, should be considered the possible case of hard materials found that are likely to require blasting operations to excavate. This assumption should be taken in account in an eventual bid process.

# 7. PORTAL WORKS

The work of the portal mainly considers the extraction and support activities. The assumptions to develop these activities consider 9 effective hours per shift, 2 shift per day and 4x3 shift system. This strategy will permit the use of 2 crews per shift while lowering overheads.

Table 7-1 show the details of the slope design by benches and the Figure 7-1 show a cross section.

**Table 7-1** Slope design for the Portal excavation.

| Bench n° | Height (ft.) | Berm width (ft.) |
|---|---|---|
| Bench 1 (upper) | 12.00 | - |
| Bench 2 | 22.97 | 6.56 |
| Bench 3 | 22.97 | 6.56 |
| Bench 4 (decline opening) | 32.81 | 13.12 |

Bench 1 is located at the top of the slope design and will be first bench to be excavated. The height of the bench is the result of the design according to the surface topography.

Each bench has 72º of face angle design or H/V = 1:3 of horizontal-vertical ratio for excavation purposes, and a slope overall angle of 59º.

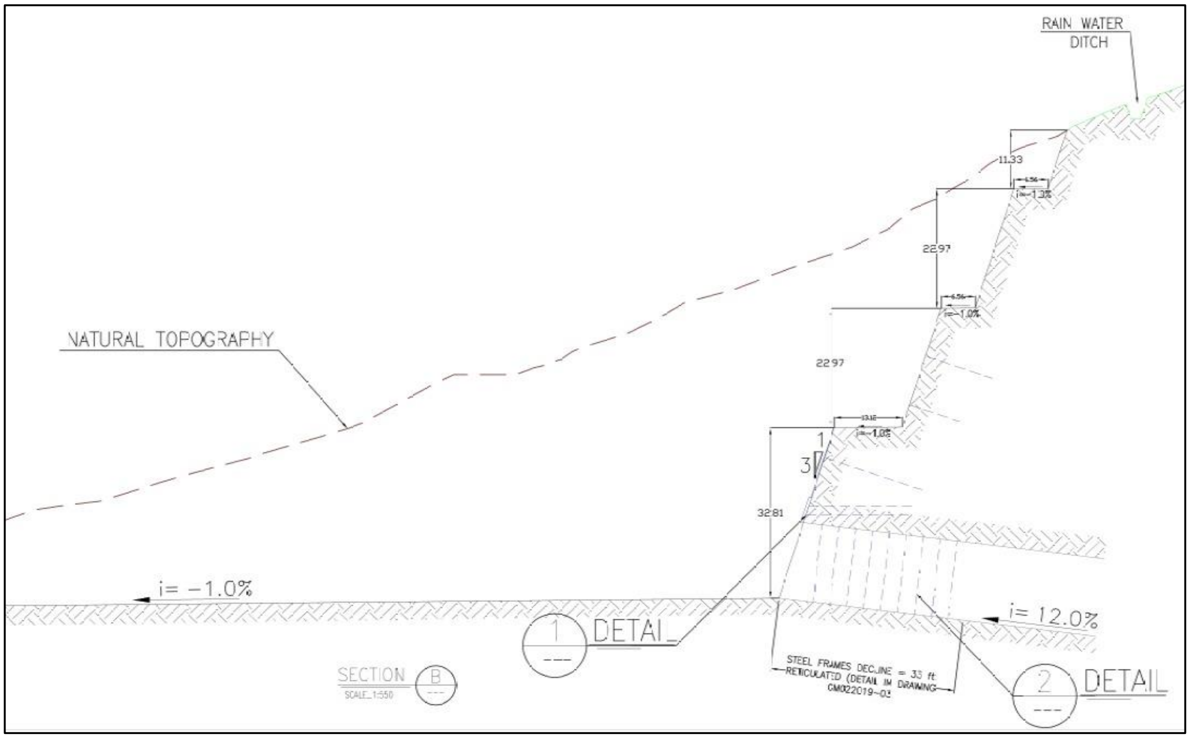



**Figure 7-1** Cross Section.

## 7.1. Access Roads

For the construction, vegetation in the area must be removed to provide from adjacent road, an access track to the top of the slope.

The details of the roads are shown in Table 7-2. The estimate of the volume of topsoil material to be moved was considered a typical cross section that considerers a width of 1.5 times the width of the truck, approximately 12 feet and 3 feet high.

**Table 7-2** Detail of Roads Excavations.

| Roads | Length (ft.) | Volume (ft3.) |
|---|---|---|
| Road 1 | 530 | 19,562 |
| Road 2 | 151 | 5,573 |
| Road 3 | 276 | 10,187 |

Figure 7-2 shows the adjacent roads that will be built to access the portal benches.

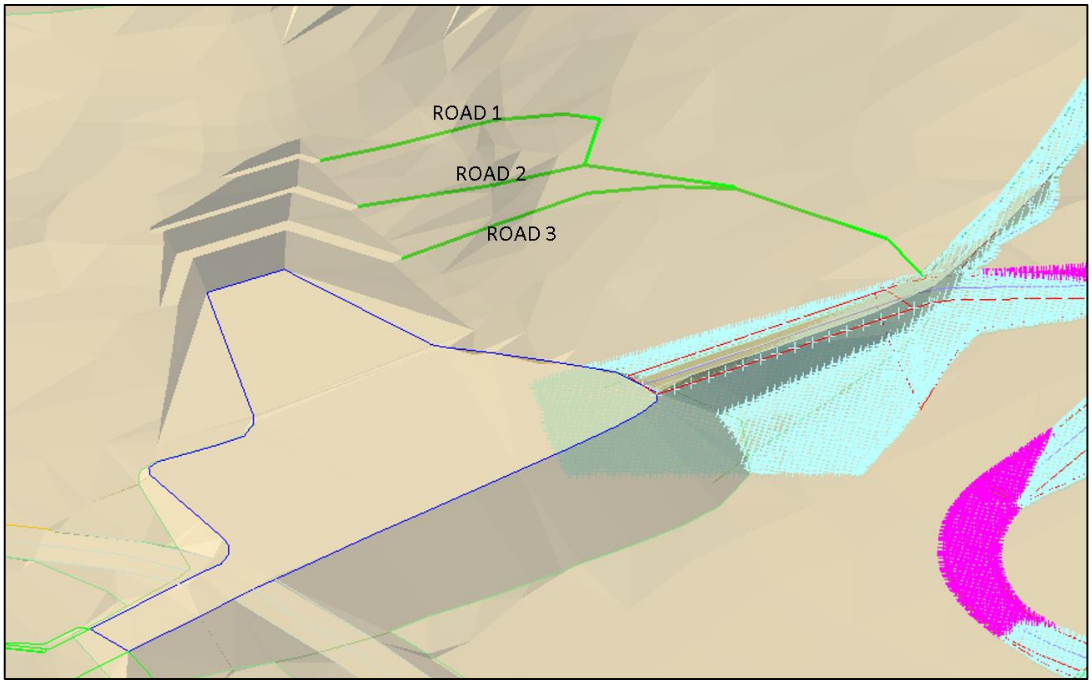



**Figure 7-2** Pad and adjacent roads.

These roads will be constructed using heavy machinery, like bulldozer D6T. The performance for topsoil material was estimated in 1,766 ft3/hr.

# 8. SLOPE DEVELOPMENT

## 8.1. Design

Cutting excavation of the slope will be the initial construction activity using heavy machinery based on bulldozers and hydraulic excavators. The bulldozer will access the top of the Bench 1 area, previously stacked out by the topography, opening an access track from the adjacent road. The characteristics of the material to be removed will permit the excavation only using a bulldozer (to rip the material) and an excavator for truck loading.

Excavation sequence will be bench by bench from the top of the slope, excavating and profiling the slope design before to the reinforcement and support process.

Benches 2, 3 and 4, the extraction will be developed in two stages considering a high safety operation.

Table 8-1 shows the volume to be excavated for each slope. Figure 8-1 show the benches to be excavated.

**Table 8-1** Volume to excavate in portal design.

| Bench | Area (ft$^2$.) | Volume (ft$^3$.) |
|---|---|---|
| 1 | 1,637 | 22,998 |
| 2 | 3,386 | 107,934 |
| 3 | 4,696 | 304,358 |
| 4 | 9,170 | 912,605 |

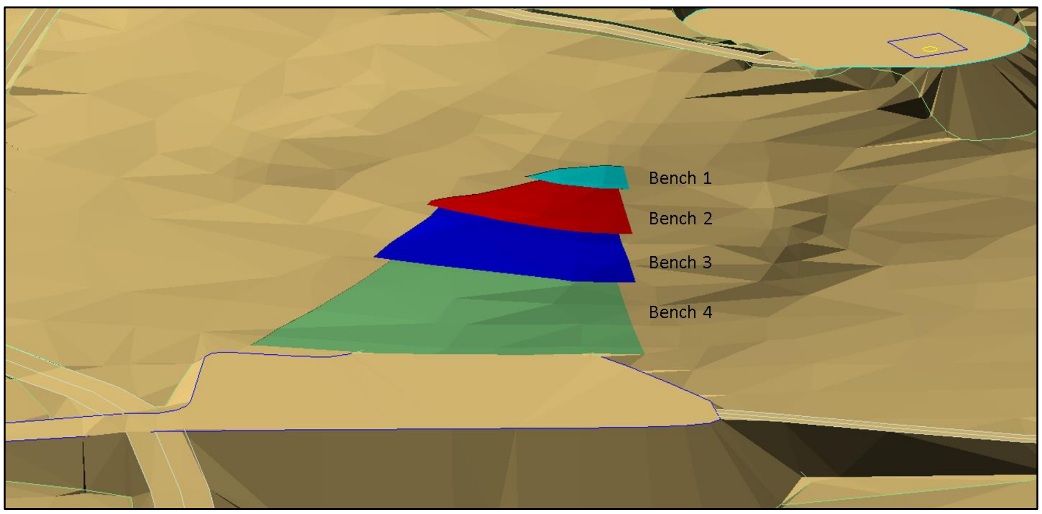



**Figure 8-1** Slope design to excavate.

## 8.2. Excavation Methodology

Excavation system will allow the sequence with the descending platforms to generate a parking lot for the trucks (temporary berms) so that they can be safely loaded. These platforms should be built in stages from 9.8 to 16.4 feet high, depending on the reach of the excavator arm and the extension of the track drill arm to carry out the support required by the design.

According to the above, benches 2, 3 and 4 will be excavated in two stages depending on the operating height.

Excavation will be made with the hydraulic excavator, which will load the trucks to transport the material to the temporary waste rock storage facility.

Equipment and personnel were considered to obtain a reasonable schedule of excavation.

The distances from excavation points to the temporary waste rock storage facility are as follows:

- From the connection with adjacent road (benches access): 1,817 ft.
- From the portal access (decline ramp access): 1,300 ft.

Figure 8-2 shows the temporary waste rock storage facility roads.

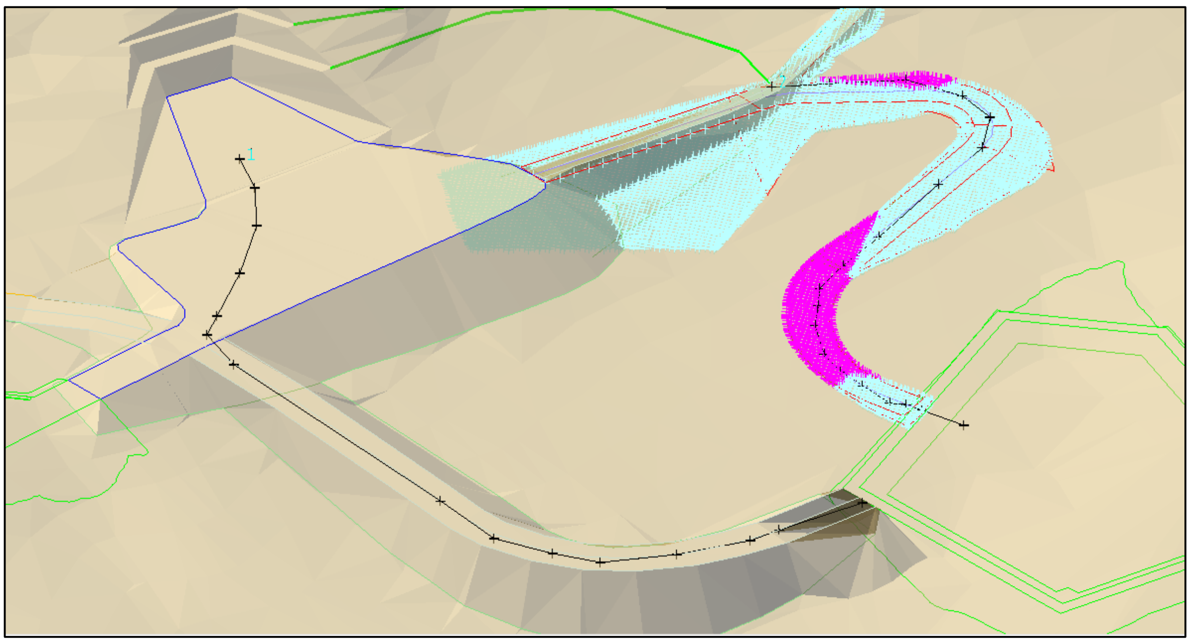


**Figure 8-2** Roads to the temporary waste rock storage facility.

## 8.3. Equipment

The mainly equipment considered for excavation is the following:

**Table 8-2** Direct Equipment.

| Equipment Description | Quantity |
|---|---|
| Excavator 2.2 $yd^3$ | 1 |
| Conventional dump truck 19.62 yd3 | 2 |
| Shotcrete sprayer | 1 |
| Bulldozer D6T | 1 |
| Bolter drilling | 1 |
| Telehandler | 1 |

The performance indicators considered for the estimation fleet and capacities is the following:

- Operational Factor: 80%
- Availability: 90%
- Utilization: 80%

## 8.4. Rock Reinforcement and Support

The reinforcement and support will be carried out in downward direction, starting from the top of the slope and descending according to the reach of the drilling arm to install the bolts required to support the excavations.

Table 8-3 show the elements support for the portal slope.

**Table 8-3** Reinforcement and support elements for the portal slope.

| Bench | Support Element | Design |
|---|---|---|
| 1, 2 and 3 | Self-drilling bolt | ○ Length: 9.8 ft. (series 1); 13.12 ft. (series 2). (series: from bottom to top of bench) |

| Bench | Support Element | Design |
|---|---|---|
| | | ○ Drill bit: ∅51 mm |
| | | ○ Pattern: @9.8 x 9.8 ft. |
| | Wire linked mesh | ○ Ø 5.6 mm |
| | | ○ 12” overlap |
| | | ○ Overlap stirrup: ∅8 mm c/1m; 9” length |
| | Shotcrete | ○ 2” thickness (f´c = 35 MPa) |
| | Dewatering Pipes | ○ Length: 4.9 ft. (for costs purposes) |
| | | ○ Pattern: @9.8 x 9.8 ft. |
| 4 | Self-drilling bolt | ○ Length: 9.8 ft. (series 1); 13.12 ft. (series 2); 19.89 ft. (series 3). (series: from bottom to top of bench) |
| | | ○ Drill bit: ∅51 mm |
| | | ○ Pattern: @9.8 x 9.8 ft. |
| | Wire linked mesh | ○ Ø 5.6 mm |
| | | ○ 12” overlap |
| | | ○ Overlap stirrup: ∅8 mm c/1m; 9” length |
| | Shotcrete | ○ 2” thickness (f´c = 35 MPa) |
| | Dewatering Pipes | ○ Length: 4.9 ft. (for costs purposes) |
| | | ○ Pattern: @9.8 x 9.8 ft. |

Figure 8-3 is a reference frontal view of the portal slopes reinforcement and support (lateral slopes are presented at real scale).

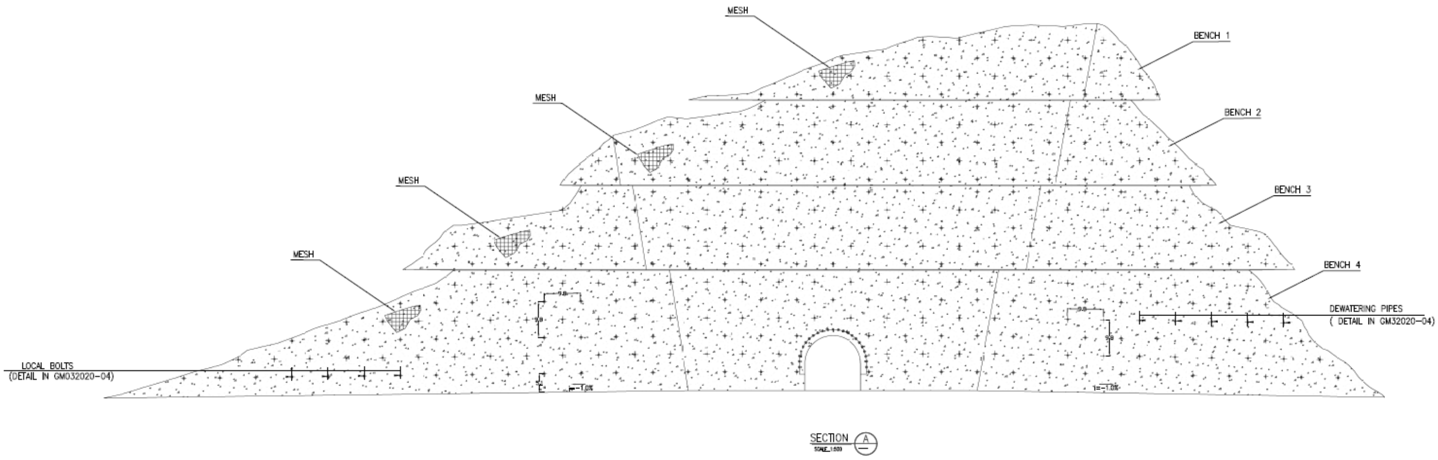



**Figure 8-3** Reinforcement and support design of the portal.

# 9. DECLINE OPENING

## 9.1. Design

As part of the portal works, the opening of the first 33 feet of the decline ramp was included.

This installation considers a cross section as the type of horseshoe ½ point inverted. The dimension is 15 feet x 15 feet, the cross section has an area of 201 $ft^2$ and a perimeter of 53.6 ft.

The opening of the decline ramp requires a complete support system considering: fore pole pipes (umbrella support), self-drilling bolts, mesh, shotcrete and reticulated steel arches.

Figure 9-1 show the design of decline ramp opening for Grassy Mountain Project.

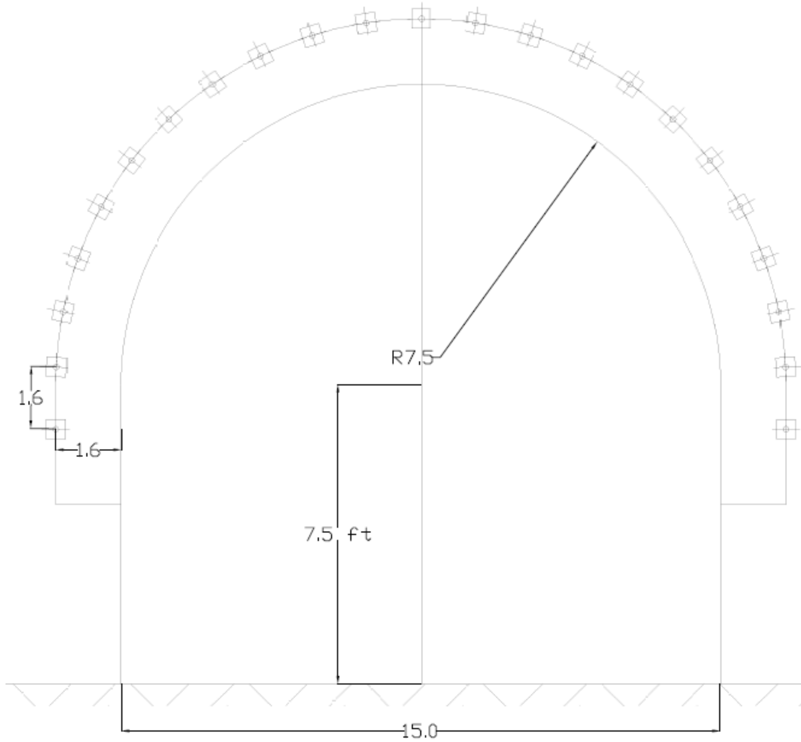



**Figure 9-1** Design of Decline Ramp opening.

## 9.2. Opening Methodology

### 9.2.1. Drilling and Blasting

The decline ramp will be excavated using standard drilling and blasting methods.

The decline ramp will be excavated using a jumbo drill. The nominal diameters of the holes shall be 45 mm and the relief holes shall be of the same diameter.

An ANFO loader for explosive agents will be used to charge the holes and non-electric detonators will be used.

The transport of explosives and handling of powder magazines are not part of the scope of this report.

Figure 9-2 shows a referential round for the decline ramp, which should be checked during the excavation stage and the quality of the rock found.

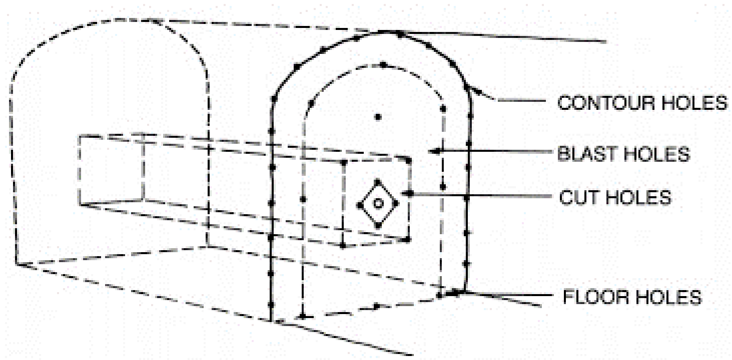



**Figure 9-2** Referential round for decline ramp

Once blasting is complete, the gases should be expected to dissipate naturally before mucking begins.

### 9.2.2. Scaling

The scaling must be done immediately after blasting and then repeat the operation once the forehead has been cleaned. Care must be taken to ensure that all loose block of rock is removed from the perimeter of the blast and that the rock is tested to demonstrate stability.

This activity may be carried out manually or with hydraulic equipment.

Figure 9-3 show a referential scaling activity.

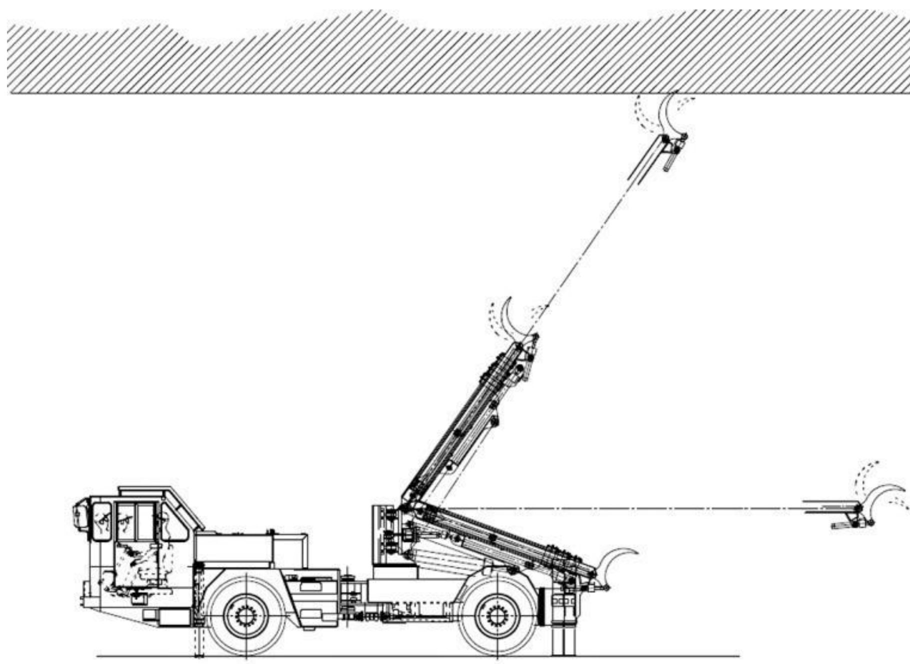


**Figure 9-3** Referential scaling activity.

### 9.2.3. Mucking

After each blasting round, the materials from the underground excavation will be evacuated and deposited in the temporary waste rock storage facility. A 19.62 yd3 dump truck will be used to transport the materials.

Figure 9-4 shows a mucking activity as example.

**Figure 9-4** Referential mucking activity.

## 9.3. Rock Support

The drilling of the rock bolts and their placement will be carried out by the bolter drill equipment. Self-drilling bolts are the selected rock bolts for the support inside the opening decline in order to provide a fast support operation and then to improve on performance and cost efficiency.

Figure 9-5 shows a self-drilling bolt as example.

**Figure 9-5** Self-drilling bolt.

The shotcrete will be fiber reinforced and 2” thick as first layer after blasting and scaling. The second layer of shotcrete will be placed after the mesh, bolts and arches, completing 4” of thickness.

Reticulated steel frames will be used to stabilize the decline ramp opening, consist of a special structure of steel bars, which are welded by controlled processes.

They are characterized by being light structures, with a high capacity to adapt to the excavated geometries, providing immediate support and adequately absorbing the deformations experienced by the ground to be stabilized.

Together with shotcrete, they form a structural support system with good performance and load capacity.

Figure 9-6 shows a reticulated steel frame as example.

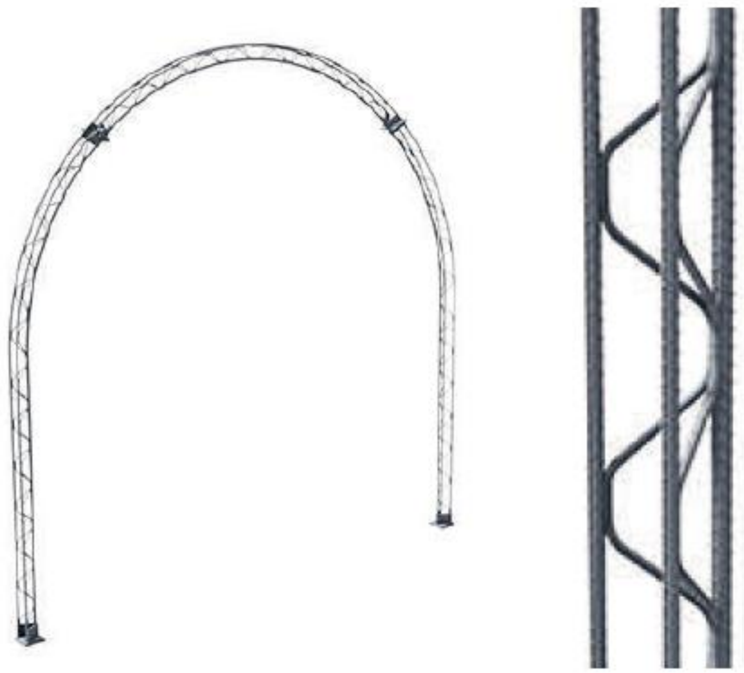


**Figure 9-6** Reticulated steel frame.

The summary of the support elements for the opening of the decline ramp is presented in Table 9-1.

**Table 9-1** Reinforcement and support elements for the decline ramp opening.

| Support Element | Design |
|---|---|
| Forepole Pipe | ○ Ø: 100/88.9 mm |
| | ○ Length: 19.7 ft. (or 29.5 ft. according to suppliers' availability) |
| | ○ Overlap: 9.8 ft. (forepoling every 9.8 ft. face run) |
| | ○ Pattern: @1.6 x 1.6 ft. |
| | ○ Fill cement, w/c proportion: 1:2 (preliminary) |
| Self-drilling bolt | ○ Length: 9.8 ft. |

| Support Element | Design |
|---|---|
| | ○ Drill bit: ∅51 mm |
| | ○ Pattern: @3.3 x 3.3 ft. |
| Welded wire mesh | ○ 150 mm x 150 mm x 9 mm |
| | ○ 12” overlap |
| | ○ Overlap stirrup: ∅8 mm c/1m; 9” length |
| Shotcrete | ○ 4” thickness (f´c = 35 MPa) in 2 layers |
| Dewatering Pipe | ○ Length: 3.3 ft. (for costs purposes) |
| | ○ Pattern: @3.3 x 3.3 ft. |
| Steel Arch | ○ Welded bar: ASTM A615 steel quality |
| | ○ Steel Bar Ø: 32 mm |
| | ○ Base Plates and Connecting Plates: ASTM A-36 steel quality |
| | ○ Pattern: @3.0 ft. |

The installation of forepole pipes will be made using the jumbo or bolter equipment with the necessary accessories for this propose.

Figure 9-7 show a referential image of the final installation of this forepole pipes, for umbrella support system.

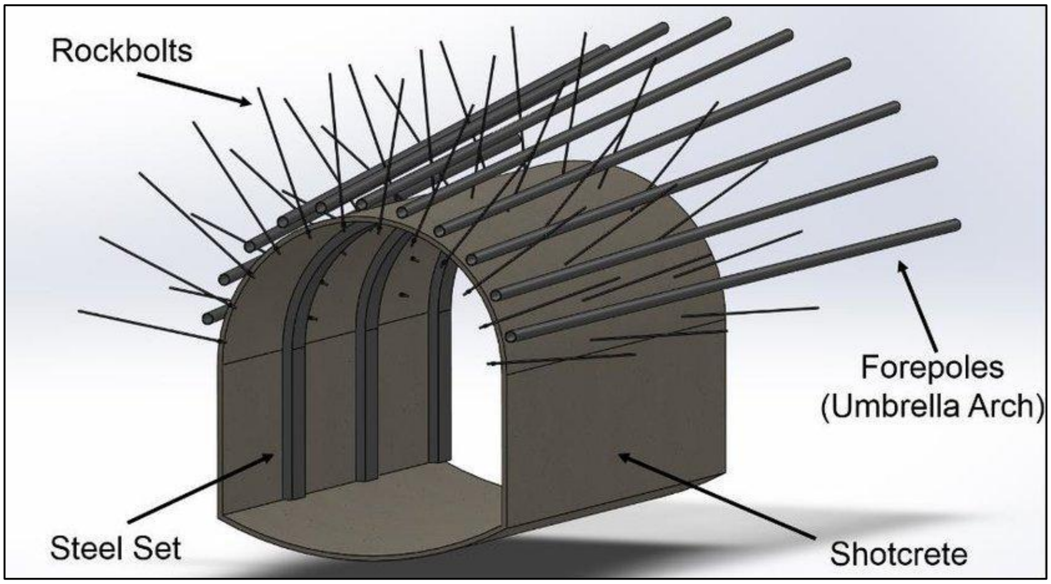



**Figure 9-7** Referential Fore Pole Pipe for Umbrella System Support.

## 9.4. Equipment

The opening of the decline ramp considers the equipment used in development of typical underground excavations. For this infrastructure was considered the principal equipment as shown in Table 9-2.

**Table 9-2** Direct Equipment.

| Equipment Description | Quantity |
|---|---|
| Jumbo w/2 arms | 1 |
| Conventional dump truck 19.62 $yd^3$ | 2 |
| Shotcrete mixer | 1 |
| Shotcrete sprayer | 1 |
| LHD | 1 |
| Bolter drilling | 1 |
| Telehandler | 1 |

# 10. RAIN WATER DITCH

A drainage ditch will be excavated and constructed to control of water inflow to the face of the portal and then control the wall support element conditions. The ditch will be placed around the contour of the portal constructed.

The dimensions are:

- Upper Base:3.75 ft.
- Down Base: 1.7 ft.
- Depth: 2.08 ft.

A mini-loader (like Doosan bobcat) with excavator arm will be used for the ditch excavation. To control the stability of the ditch, a shotcrete layer should be projected. Figure 10-1 shows the standard design.

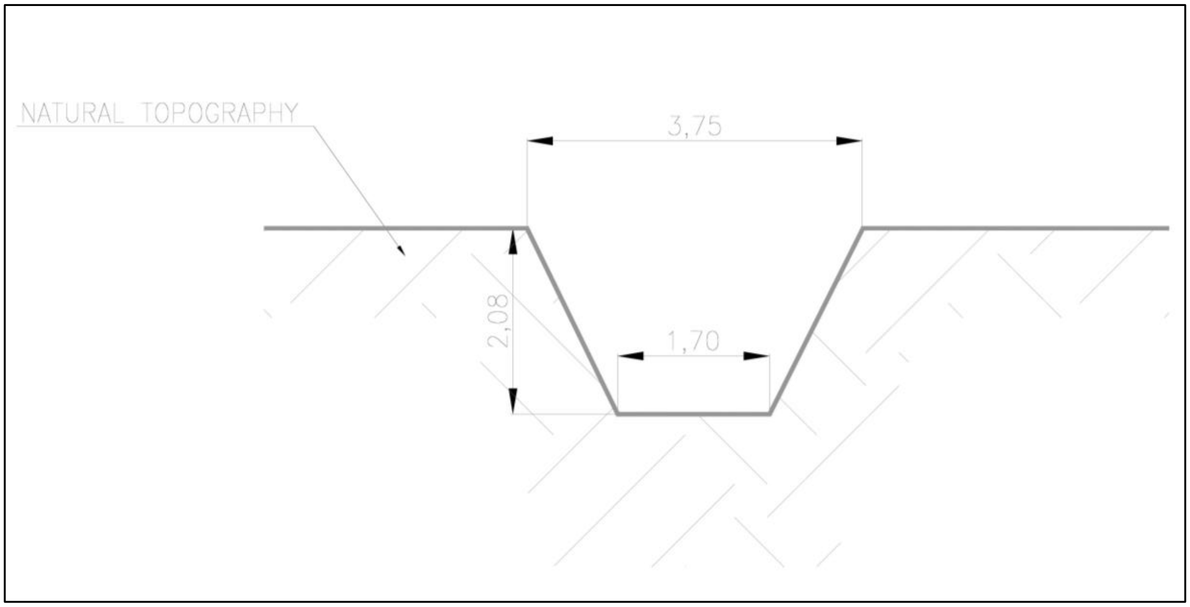



**Figure 10-1** Drainage ditch standard design.

The estimated length to develop the ditch is 753 feet. This infrastructure requires to move 4,307 ft3 of material and a shotcrete cover of 4,789 ft2.

# 11. OVERHEAD

## 11.1. Direct Personnel

Two crews of work will be used on the portal excavation, where the main activities will be related to command the excavation equipment.

For the purposes of this estimation, the crews were considered working in continuous days of 9 to 10 effective hours per shift, in a schedule of 4 days of work and 3 days resting (4 x 3 shift). Table 11-1, shows the estimated labor for the portal construction.

**Table 11-1** Direct labor.

| Direct | Quantity Per Shift | Shift | Schedule (days on/off) | Number of Employees Total |
|---|---|---|---|---|
| UG Miner (Heavy Equipment) | 4 | 2 | 4x3 | 8 |
| UG Miner (Support Equipment) | 5 | 2 | 4x3 | 10 |

The total personnel required in direct labor are 18.

## 11.2. Indirect Personnel

This report not consider indirect personnel for the portal excavation.

However, the portal construction must include supervision and support (operational and technical). These costs should be included under Mine Management.

# 12. SERVICES

The services required for the development of the portal excavation and the opening of the decline ramp was not considered for the estimating cost as defined in the scope.

However, must be considered the follow infrastructure.

## 12.1. Compressed Air and Water

Compressed air and water will be provided at the front of the decline ramp. It is suggested to use a 6” line for compressed air and a 4” line for industrial water. The material for these pipes can be steel or aluminum with Victaulic connections, it can also be proposed to use other types of pipes such as PVC or HDPE, with prior certification and respective authorization.

## 12.2. Dewatering System

The water that appears during the excavation and that used for the drilling process will be drained to the outside by pumping.

Drainage is carried out in surface ponds where it is processed and reused both for the construction of the decline ramp or for watering the facilities.

## 12.3. Electricity Services

It will be necessary to supply power to the front of the decline ramp. The electricity service will be provided via generators located outside the portal, far enough away so that the gases emanating from the generator do not enter the decline ramp.

## 12.4. Surface Work Areas

The minimum infrastructure considered in these facilities incorporates the use of containers for offices, bathrooms, showers and dining rooms, mechanical workshop, electrical workshop, warehouse, storeroom, equipment yard, electric generators and parking areas.

The installation of chemical toilets near the work fronts should also be considered according to the progress of the works.

## 12.5. Environmental Aspects

Care for the environment should be considered in the project areas. This includes protection from fuel or lubricant spills, garbage deposits and treatment of the decline ramp discharge water.

There are supposed to be areas where the garbage can be properly deposited.

Management plans must be submitted for the containment of fuel and lubricant spills inside the decline ramp and outside of the portal areas, as well as for the treatment of wastewater, the management of toilets, dumps, others., prior to the start of the works.

## 12.6. Safety in Work Areas

Safe working instructions and procedures must be generated for the project, focusing on all the activities to be carried out and possible emergency contingencies.

Some procedures should include, at least, the following:

- Training plans for the personnel to be employed in the project.
- Security systems in the workplace.
- Plans and schedule for periodic safety meetings.
- Risk analysis procedures.
- Work risk analysis

## 13. EQUIPMENT

The total equipment required for all projected work is shown in the Table 13-1.

**Table 13-1** Equipment required.

| Equipment | Quantity |
|---|---|
| Jumbo (Development & Support Drilling) | 1 |
| LHD | 1 |
| Excavator | 1 |
| Conventional Truck | 2 |
| Explosive & Emulsion Loader | 1 |
| Shotcrete Sprayer | 1 |
| Telescopic Telehandler | 1 |
| Bulldozer | 1 |

# 14. OPERATING COST

## 14.1. Direct Operating Cost

Operating costs were compiled to develop the main portal access, proposing a baseline for the construction stage.

Table 14-1 summarizes the operating cost of the portal construction.

**Table 14-1** Operating Cost Summary (KUS$).

| Item | KUS$ |
| --- | --- |
| Roads | 1.6 |
| Bench 1 | 17.5 |
| Bench 2 | 32.7 |
| Bench 3 | 79.5 |
| Bench 4 | 201.7 |
| Decline Ramp Opening | 38.97 |
| Rain Water Ditch | 5.9 |

Total operating cost for the development of this project is **377,7 KUS$** considering owner build. The total direct personnel cost is **170,1 KUS$** and is equivalent to 45% of the total operating cost.

The budget is distributed as shown if Figure 14-1.

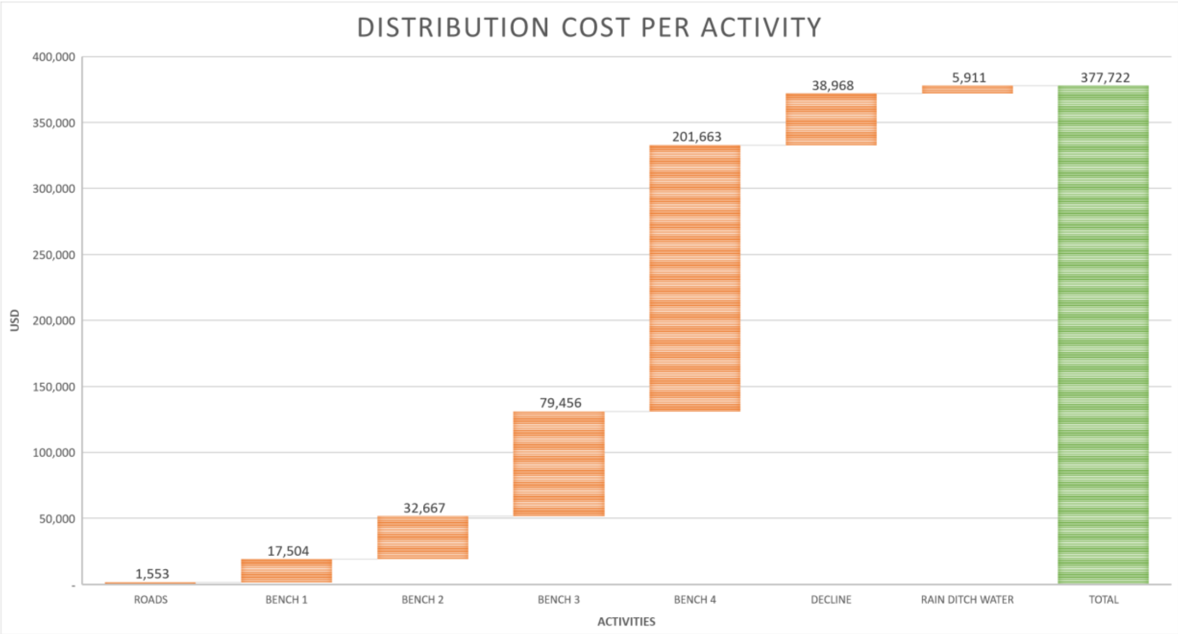



**Figure 14-1** Operational Cost Distribution.

### 14.1.1. Portal Slope Construction - Operating Cost

Table 14-2 summarizes the operating cost of the benches' construction.

**Table 14-2** Summary of Benching Operating Cost (US$).

| Item | US$ |
|---|---|
| **Bench 1** | **13,019** |
| Movement | 613 |
| Reinforcement and Support | 12,406 |
| **Bench 2** | **20,296** |
| Movement | 6,561 |
| Reinforcement and Support | 13,735 |
| **Bench 3** | **44,200** |

| Item | US$ |
|---|---|
| Movement | 22,237 |
| Reinforcement and Support | 21,963 |
| **Bench 4** | **104,093** |
| Movement | 70,108 |
| Reinforcement and Support | 33,985 |

Total operating cost to develop the construction of the portal slope, without overhead are **181.6 KU$**.

### 14.1.2. Rain Water Ditch - Operating Cost

Table 14-3 summarizes the operating cost for the rain water ditch construction.

**Table 14-3** Summary of Rain Water Ditch Operating Cost (USD).

| Item | Quantity | Unit |
|---|---|---|
| Volume to Remove | 4,307 | $ft^3$ |
| Volume of Shotcrete | 798 | $ft^3$ |
| Ratio Excavator | 816.9 | $ft^3/hr$ |
| Ratio Shotcrete Sprayer | 2.5 | $ft^3/min$ |
| Excavator Requirement | 5.3 | hr op |
| Shotcrete Sprayer requirement | 5 | hr op |
| Unit Cost Excavator | 31.89 | US$/hr op |
| Unit Cost Shotcrete Sprayer | 71 | US$/hr op |
| Unit cost shotcrete | 5 | US$/$ft^3$ |

Total operating cost to develop the rain water ditch construction, without overhead are **4,597 US$**.

### 14.1.3. Decline Ramp Opening - Operating Cost

Table 14-4 summarizes the operating cost for the decline ramp construction.

**Table 14-4** Summary of Decline Ramp Opening Operating Cost (KUSD).

| Equipment | US$/hr | Ratio hr/ Round | US$ Round | Material US$/Round | Material US$/Round |
|---|---|---|---|---|---|
| Jumbo (Development & Support Drilling | 71.47 | 8.85 | 632.4 | 3544.5 | 1000.42 |
| Explosives Loader | 16.57 | 1.00 | 16.6 | 1,048.8 | 296.02 |
| Extraction LHD | 63.21 | 1.13 | 71.19 | 0.00 | 20.09 |
| Truck | 16.57 | 3.93 | 65.18 | 0.00 | 18.40 |
| Shotcrete Sprayer | 71.47 | 0.64 | 45.57 | 0.00 | 12.86 |
| Telehandler | 13.57 | 0.68 | 9.27 | 0.00 | 2.62 |
| Umbrella Support System | | | | | 536.37 |

Total operating cost to develop the opening of the decline ramp construction, without overhead are **20,634 US$**.

### 14.1.4. Direct Personnel

Table 14-5 summarizes the personnel direct cost.

**Table 14-5** Personnel direct cost (US$).

| Position | #/shift | # of Employees | Cost per Month US$ |
|---|---|---|---|
| **Heavy Equipment Operators** | | | |
| Jumbo (Development & Support Drilling) | 1 | 2 | 13,900 |
| LHD | 1 | 2 | 13,900 |
| Excavator | 1 | 2 | 13,900 |
| Bulldozer | 1 | 2 | 13,900 |
| **Support Equipment Operators** | | | |
| Conventional Truck | 2 | 4 | 19,516 |
| Explosive & Emulsion Loader | 1 | 2 | 9,758 |
| Shotcrete Sprayer | 1 | 2 | 9,758 |
| Telescopic Telehandler | 1 | 2 | 9,758 |

The estimation of the unit cost of the personnel was considered in the PFS.

The total personnel calculated are 18 employees for the development of all activities scheduled.

The total operating cost considering for direct personnel are **170.1 KUS$**. This is the most important item of the project, considering **3.38 months of work**.

**¡Error! No se encuentra el origen de la referencia.** show the details of the cost calculations made.

To ensure the success of the construction, it is important to control the quality and costs. Therefore, technical support for the development of detailed engineering will be necessary.

## 15. WORK SCHEDULE

This project considers loss of time, mainly in the lunch and change shift. This is not an operational time, so 12 hours per shift is considered only 10.5 hours.

The shift was considered 4 days in and 3 days off (4x3) day and night. The construction from the roads until the decline ramp opening consider 62 workable days as the critical route in Gantt Chart.

Considering the ratio performances in the development of preparing roads, benching, rain water ditch and the decline ramp opening is shown in Figure 15-1.

The preparation of the roads to reach bench 1, 2 and 3 will be done in one day, using only a bulldozer.

The excavation of the total benches (including the support), will be done in 55 days. This activity is the most important one in time of the project.

The opening of the decline ramp considers 5 days for construction including all support.

For the rain water ditch, it is estimated that the work would be done in 1 day (2 shifts).

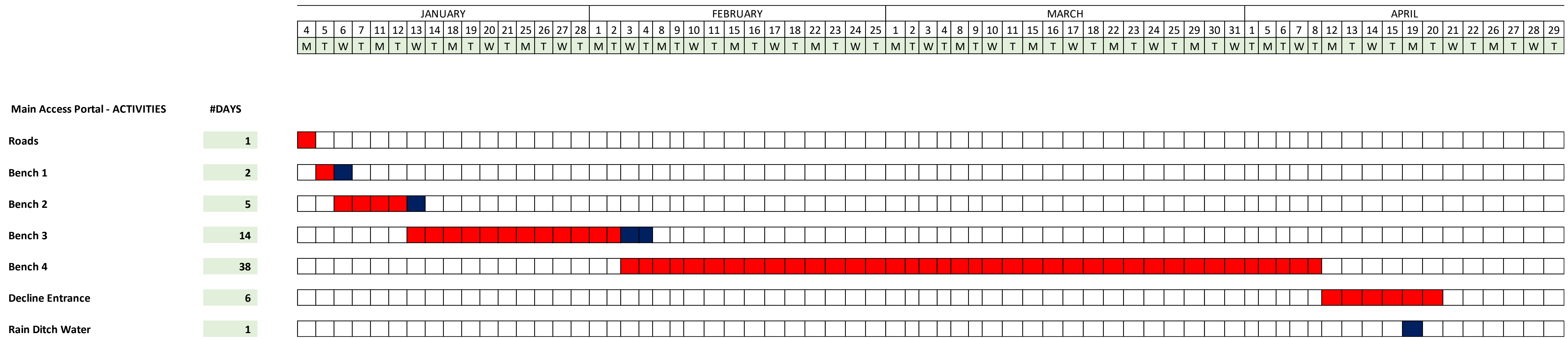



**Figure 15-1** Gantt Schedule – Portal Construction.

## 16. CONCLUSIONS

Based on the results, the most relevant conclusions are:

- The rippability results show that the materials at the portal location could be excavated through ripping from easy ripping to extremely hard ripping.
- In the case of hard materials possible to found, should be taken in account that are likely to require blasting operations to excavate.
- For the portal slope construction is required to develop 3 external road. These roads will connect the principal road to the portal.
- The portal slope excavation considers a hydraulic excavator equipment and a scaling hammer to profile the slope design.
- The timeline scheduled for the develop all portal activities need 62 days in shift 4 days in and 3 days off, with two shifts per day.
- The number of employees considered to develop the portal construction are 18, as direct personnel.
- The budget calculated to develop this project is **377,7 KUSD**, considering owner building.
- The budget estimation not consider the investment of required equipment.
- The budget estimation not consider indirect personnel cost (Supervision and Support).
- The present document not consider the estimation capacity of facilities and investments for follow activities:

    - Camp
    - Truck shop
    - Casino
    - Warehouse
    - Powder Magazine
    - Mining Services (power, water, air, pumps, etc)

GEOTECHNICAL MINE SOLUTIONS

# 17. RECOMMENDATIONS

According to the results of the present work, the following is recommended:

- Is necessary to develop a stability analysis to validate the current reinforcement and support design in the decline ramp opening, or to define an appropriate definition according to the stability results.
- During the excavation process of the portal slope, detailed geotechnical mapping should be carried out to validate the rock reinforcement and support, and then to assess modes of failure as wedges, planes and toppling. The design should be then reviewed to ensure stability and safely long operation.
- The portal has a slope angle of H: V / 1: 3 (excavation ratio), a bench height of 32.81 feet and berm width of 13.12 feet for the bench 4 (decline ramp opening) and a bench height of 22.97 feet and berm widths of 6.56 feet for the benches 2 and 3. The equivalent global slope angle is 59°. Based on the geotechnical conditions, it is recommended that the geometric configuration does not exceed these specifications.
- The reinforcement and support application must be carried out for safety reasons in the excavation process, the sequence must be from top to bottom as the excavation advance. At the same time, the berms and benches must be cleaned before applying the reinforcement and support elements.
- The portal area was designed for the life of mine, it will require constant evaluation and if is necessary, review to ensure stability and safety.
- Nowadays, it is really important optimize as much as possible, so it is recommended that the profile of operators include extra skills, such as maintenance-operator. If the company considers this alternative, minor failures in the main equipment maximize utilization and minimize transfers to maintenance facilities.
- The costs underlying this document should be updated with local suppliers.
- The construction of the portal is the first activity to be developed by the project, therefore, it is important to know the equipment requirements for the purchase program.
- To ensure the success of the construction, it is important to control the quality and costs. Therefore, technical support for the development of detailed engineering will be necessary.

# 18. REFERENCES


Mine Development Associates, 2019, *Preliminary Feasibility Study and Technical Report for the Grassy Mountain Gold and Silver Project, Malheur County, Oregon, USA*, July 9, 2019.

Barton, N.; Lien, R. & Lunde, J., 1974, *Engineering classification of rock masses for the design of tunnel support*, Rock Mechanics: Vol. 6, N° 4.

Barton, N., 2002, *Some new Q-value correlations to assist in site characterization and tunnel design*: Int. J Rock Mech and Min Sci, (39), p. 185-21.

Bieniawski, Z.T. 1976. *Rock mass classification in rock engineering*. In Exploration for rock engineering, proc. of the symp., (ed. Z.T. Bieniawski) 1, 97-106. Cape Town: Balkema.

Bieniawski, Z.T. 1989. *Engineering rock mass classifications*. New York: Wiley.

Brady, B.H. & Brown, E.T. (2004): *ROCK MECHANICS FOR UNDERGROUND MINING*, 3rd Ed. Kluwer Academic Publishers, Netherlands.

Deere D.U. 1968. Chapter 1: *Geological considerations*. In Rock Mechanics in Engineering Practice (eds. Stagg K.G. and Zienkiewicz, O.C.), 1-20. London: John Wiley and Sons.

Gonzalez de Vallejo (2004), *Ingeniería Geológica*: Pearson Educación, Madrid.

Hoek, E. 1983. *Strength of jointed rock masses*, 23rd. Rankine Lecture. Géotechnique 33(3), 187-223.

Hoek, E. 1994. *Strength of rock and rock masses*, ISRM News J, 2(2), 4-16.

Hoek, E. and Brown, E.T. 1980a. *Underground excavations in rock*. London: Instn Min. Metall.

Hoek, E. and Brown, E.T. 1980b. *Empirical strength criterion for rock masses*. J. Geotech. Engng Div., ASCE 106(GT9), 1013-1035.

Hoek, E. and Brown, E.T. 1988. *The Hoek-Brown failure criterion - a 1988 update*. In Rock engineering for underground excavations, proc. 15th Canadian rock mech. symp., (ed. J.C. Curran), 31-38. Toronto: Dept. Civ. Engineering, University of Toronto.

Hoek, E., Marinos, P. and Benissi, M. 1998. *Applicability of the Geological Strength Index (GSI) classification for very weak and sheared rock masses*. The case of the Athens Schist Formation. Bull. Engng. Geol. Env. 57(2), 151-160.

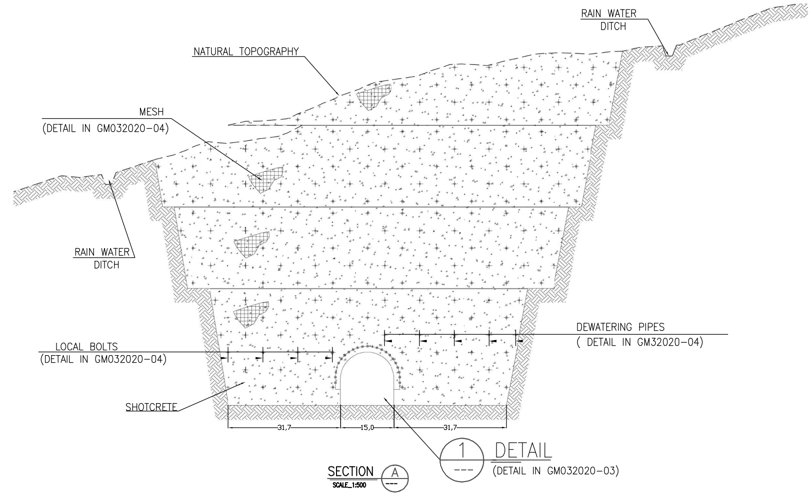
Hoek, E. and Brown, E.T. 1997. *Practical estimates or rock mass strength*. Int. J. Rock Mech. Min.g Sci. & Geomech. Abstr. 34(8), 1165-1186.

Hoek, E. and Bray, J. (1981) *Rock Slope Engineering*, 3rd edn, IMM, London.

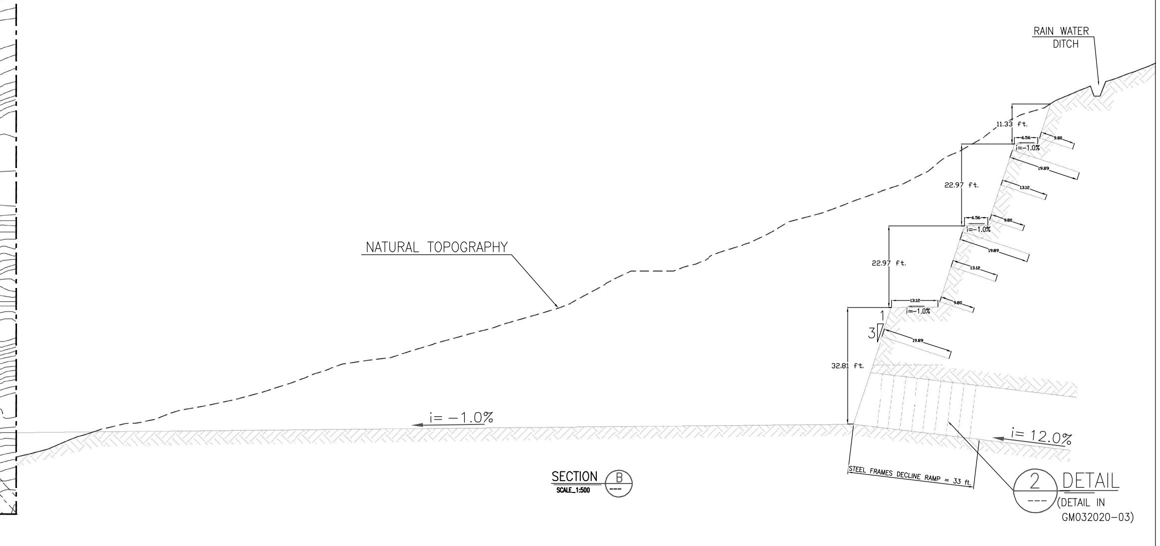
# APPENDIX 1

# Portal Drawings


PORTAL LOCATION PLAN VIEW
SCALE 1:1250




SECTION A
SCALE 1:500




SECTION B
SCALE 1:500

LEGEND

- NATURAL TERRAIN CURVE EVERY 6.56ft
- NATURAL TERRAIN CURVE EVERY 16.40ft
- SHOTCRETE
- PLATFORM SOLID (VOLUME TOTAL 2,958,245.5 ft3)
- NATURAL TOPOGRAPHY
- PORTAL ACCESS
- RAIN WATER DITCH
- NATURAL TERRAIN
- MESH

NOTES:

1.- DIMENSIONS IN ft (S.I.C.), ELEVATIONS ARE IN m.
2.- THE EXCAVATION SEQUENCE WILL BE FROM THE TOP OF THE SLOPE IN BENCH 1 TO BENCH 4, FOLLOWING THE BENCH – BERM DESIGN AND REINFORCEMENT AND SUPPORT DESIGN, AND SEQUENCE PROVIDED IN REPORT "RT_GM032020_GMS_REV0".
3.- THE INCLINED LENGTHS OF THE BOLTS ARE THEORETICAL TO THE SURFACE OF EXCAVATION; HOWEVER, THE LENGTHS WILL BE LARGER AS REQUIRED TO ALLOW THE INSTALLATION AND ADJUSTMENT OF THE PLATE AND NUT OF THE BOLT.
4.- THE INCREASE OF THE LENGTH OF BOLTS WILL BE THE RESPONSIBILITY OF THE GEOTECHNICAL ENGINEER ON SITE, DEPENDING ON THE GEOTECHNICAL CONDITION OF THE ROCK MASS.
5.- THE DEWATERING PIPES WILL BE SLOTTED. DRAINAGE DRILLS WILL BE SYSTEMATIC AND WILL RESPOND TO THE REQUIREMENTS OF THE DESIGN.
6.- SHOTCRETE COATING WILL BE APPLIED AT ALL BENCHES.
7.- ALL REINFORCEMENT AND SUPPORT ELEMENTS MUST BE GALVANIZED.
8.- SPACING BETWEEN RETICULATED FRAMES, ACCORDING TO QUALITY OF THE ROCK MASS (MAXIMUM 3.28 ft).

| REF | DRAWING No. | REFERENCES | No | BY | DATE | REVIEW | CHK | ING | APPR |
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| DRAWN | R. NUÑEZ | 05-11-2020 |
| DESIGN | S. VERA | 05-11-2020 |
| REVIEW | R. FLORES | 06-01-2020 |
| DES. APPR | A. TORRES | 06-08-2020 |
| PROJ. APPR | G. VAN TREEK | 06-30-2020 |

GEOTECHNICAL MINE SOLUTIONS

CLIENT: CALICO RESOURCES

TITLE: GRASSY MOUNTAIN FINAL PORTAL DESIGN EXCAVATION , REINFORCEMENT AND SUPPORT DESIGN

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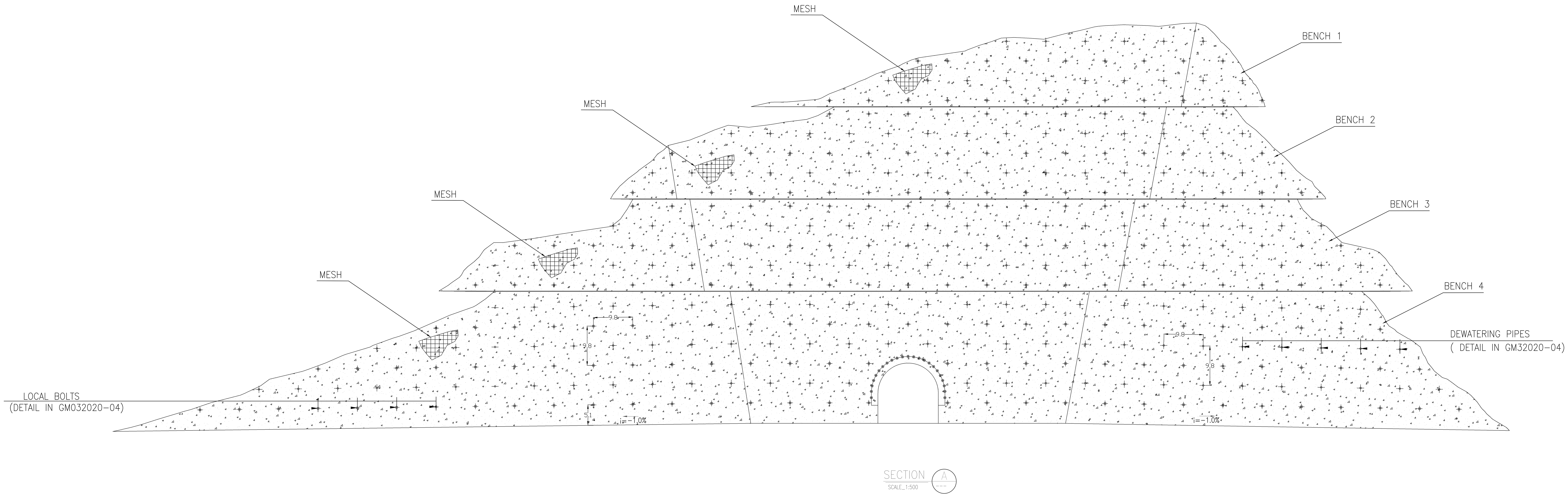


**BENCH 1:**

1. AREA: 1637 Square feet.
2. VOLUME: 22998 Cubic feet.
3. AREA MESH: 1637 Square feet.
4. SHOTCRETE: 546 Cubic feet.
5. BOLTS: 20 Units.
6. DEWATERING PIPES: 16 Units.

**BENCH 2:**

1. AREA: 3386 Square feet.
2. VOLUME: 107934 Cubic feet.
3. AREA MESH: 3386 Square feet.
4. SHOTCRETE: 1129 Cubic feet.
5. BOLTS: 45 Units.
6. DEWATERING PIPES: 31 Units.

**BENCH 3:**

1. AREA: 4696 Square feet.
2. VOLUME: 304358 Cubic feet.
3. AREA MESH: 4696 Square feet.
4. SHOTCRETE: 1565 Cubic feet.
5. BOLTS: 63 Units.
6. DEWATERING PIPES: 42 Units.

**BENCH 4:**

1. AREA: 9170 Square feet.
2. VOLUME: 912605 Cubic feet.
3. AREA MESH: 9170 Square feet.
4. SHOTCRETE: 3057 Cubic feet.
5. BOLTS: 85 Units.
6. DEWATERING PIPES: 79 Units.

## LEGEND

SHOTCRETE
LOCAL BOLTS
MESH
NATURAL TERRAIN
PORTAL ACCESS
DEWATERING PIPES
RAIN WATER DITCH

NOTES:

1.– DIMENSIONS IN ft (S.I.C.), ELEVATIONS ARE IN m.
2.– THE EXCAVATION SEQUENCE WILL BE FROM THE TOP OF THE SLOPE IN BENCH 1 TO BENCH 4, FOLLOWING THE BENCH – BERM DESIGN AND REINFORCEMENT AND SUPPORT DESIGN, AND SEQUENCE PROVIDED IN REPORT "RT_GM032020_GMS_REV0".
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4.– THE INCREASE OF THE LENGTH OF BOLTS WILL BE THE RESPONSIBILITY OF THE GEOTECHNICAL ENGINEER ON SITE, DEPENDING ON THE GEOTECHNICAL CONDITION OF THE ROCK MASS.
5.– THE DEWATERING PIPES WILL BE SLOTTED. DRAINAGE DRILLS WILL BE SYSTEMATIC AND WILL RESPOND TO THE REQUIREMENTS OF THE DESIGN.
6.– SHOTCRETE COATING WILL BE APPLIED AT ALL BENCHES.
7.– ALL REINFORCEMENT AND SUPPORT ELEMENTS MUST BE GALVANIZED.
8.– SPACING BETWEEN RETICULATED FRAMES, ACCORDING TO QUALITY OF THE ROCK MASS (MAXIMUM 3.28 ft).

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| PROJ. APPR | G. VAN TREEK | 06-30-2020 |

GEOTECHNICAL MINE SOLUTIONS

CLIENT: CALICO RESOURCES

TITLE: GRASSY MOUNTAIN
FINAL PORTAL DESIGN
EXCAVATION , REINFORCEMENT
AND SUPPORT QUANTITIES

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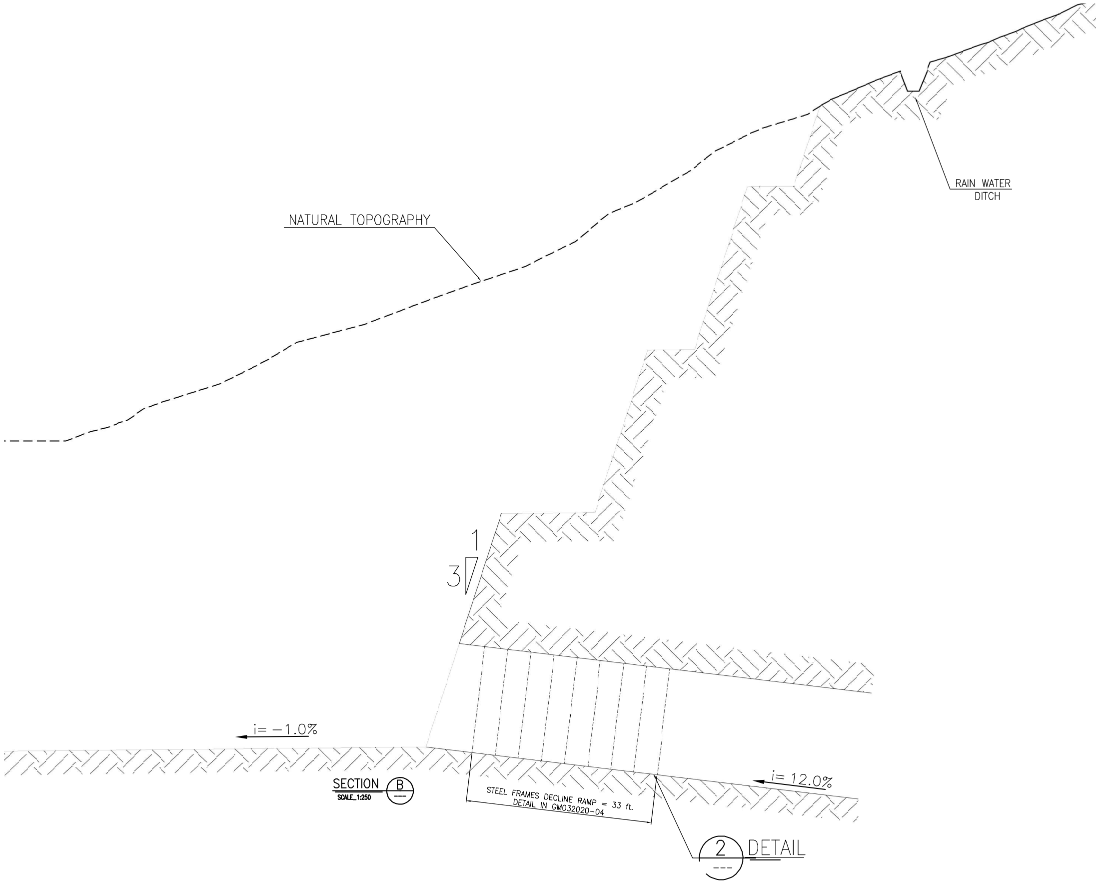


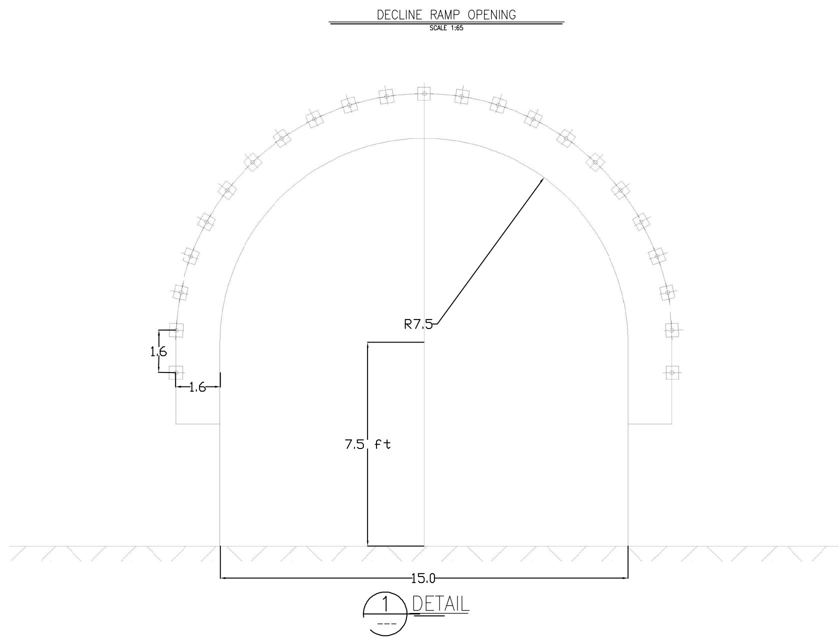


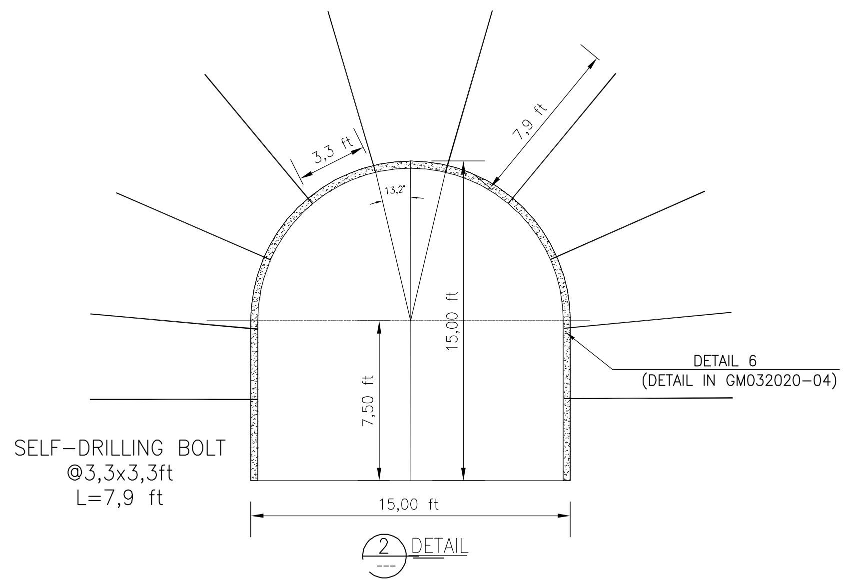


LEGEND

- SHOTCRETE
- PORTAL ACCESS
- LOCAL BOLTS
- DEWATERING PIPES
- MESH
- RAIN WATER DITCH
- NATURAL TERRAIN

NOTES:

1.– DIMENSIONS IN ft (S.I.C.), ELEVATIONS ARE IN m.
2.– THE EXCAVATION SEQUENCE WILL BE FROM THE TOP OF THE SLOPE IN BENCH 1 TO BENCH 4, FOLLOWING THE BENCH – BERM DESIGN AND REINFORCEMENT AND SUPPORT DESIGN, AND SEQUENCE PROVIDED IN REPORT "RT_GM032020_GMS_REV0".
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4.– THE INCREASE OF THE LENGTH OF BOLTS WILL BE THE RESPONSIBILITY OF THE GEOTECHNICAL ENGINEER ON SITE, DEPENDING ON THE GEOTECHNICAL CONDITION OF THE ROCK MASS.
5.– THE DEWATERING PIPES WILL BE SLOTTED. DRAINAGE DRILLS WILL BE SYSTEMATIC AND WILL RESPOND TO THE REQUIREMENTS OF THE DESIGN.
6.– SHOTCRETE COATING WILL BE APPLIED AT ALL BENCHES.
7.– ALL REINFORCEMENT AND SUPPORT ELEMENTS MUST BE GALVANIZED.
8.– SPACING BETWEEN RETICULATED FRAMES, ACCORDING TO QUALITY OF THE ROCK MASS (MAXIMUM 3.28 ft).

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| DES. APPR | A. TORRES | 06-15-2020 |
| PROJ. APPR | G. VAN TREEK | 06-30-2020 |

GEOTECHNICAL MINE SOLUTIONS

CLIENT: CALICO RESOURCES

TITLE: GRASSY MOUNTAIN
FINAL PORTAL DESIGN
DECLINE RAMP OPENING
REINFORCEMENT AND SUPPORT DESIGN

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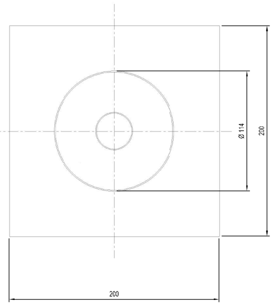
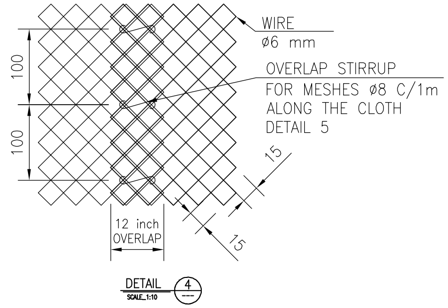
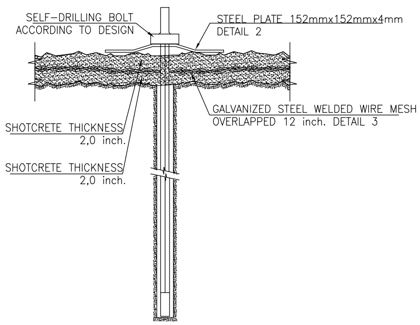
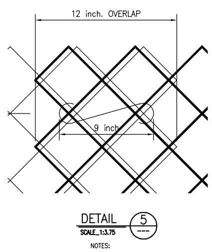
|---|---|
| GM032020-03 | B |



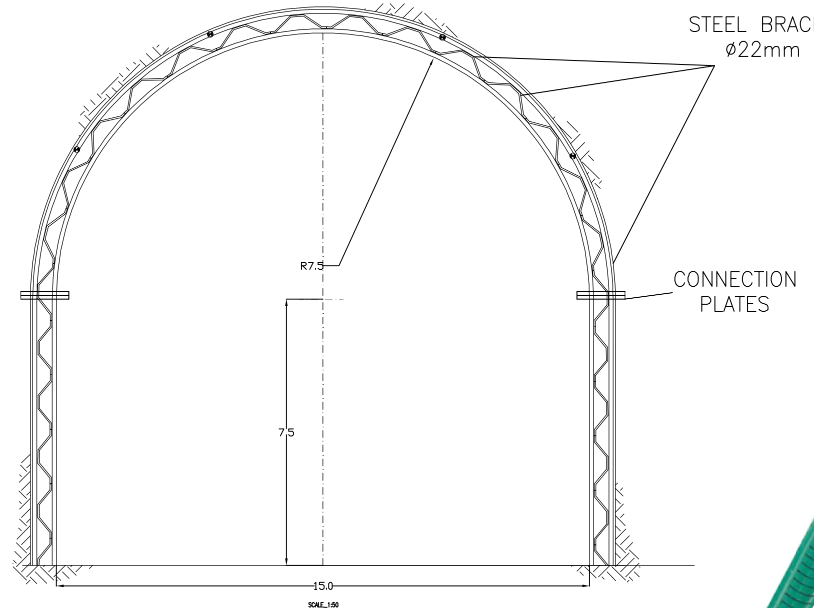

DETAIL 2
STEEL PLATE
ESC.1:1

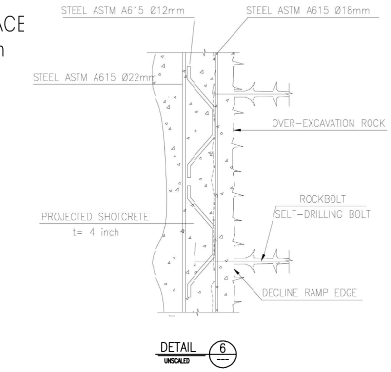



DETAIL 3
GALVANIZED STEEL WELDED WIRE MESH
INSTALLATION DETAIL
ESC.1:20




DEWATERING PIPES SPECIFICATIONS

| | |
|---|---|
| Material: | PVC |
| External diameter (mm): | 44 |
| Thickness (mm): | 3.5 |
| Bar weight (Kg/m): | 1.6 |
| Lengths (ft): | 9.8 |

DETAIL 1
SELF-DRILLING BOLT
ESC.1:30

Bar Technical Specifications

| | |
|---|---|
| External diameter (mm): | 25 |
| Internal diameter (mm): | 12 |
| Yield load (kN): | 150 |
| Ultimate load (kN): | 200 |
| Bar weight (Kg/m): | 2,3 |

Nut Technical Specifications

| | |
|---|---|
| Distances between faces(mm): | 41 |
| Length (mm): | 35 |
| Weight (Kg): | 0.25 |

Steel Anchor Plate Technical Specifications

| | |
|---|---|
| Dimensions (mm): | 200x200 |
| Thickness (mm): | 6 |
| Drilling diameter (mm): | 34 |
| Weight (Kg): | 2 |

Coupler Technical Specifications

| | |
|---|---|
| External diameter (mm): | 36 |
| Length (mm): | 150 |
| Weight (Kg): | 0.66 |

Drill Bit Technical Specifications

| | |
|---|---|
| Drilling diameter (mm): | 42–51 |

Forepole Pipes Specifications

TUBE:

| | |
|---|---|
| External diameter (mm): | 88.9 |
| Thickness (mm): | 6.45 |
| Yield load (kN): | 150 |
| Ultimate load (kN): | 200 |
| Bar weight (Kg/m): | 14.2 – 15.3 |

CROWN:

| | |
|---|---|
| External diameter (mm): | 95 |
| Internal diameter (mm): | 51 |

BIT:

| | |
|---|---|
| Diameter (mm): | 50 |
| Thread: | T38 |

NOTES:

1.- DIMENSIONS IN ft (S.I.C.), ELEVATIONS ARE IN m.
2.- THE EXCAVATION SEQUENCE WILL BE FROM THE TOP OF THE SLOPE IN BENCH 1 TO BENCH 4, FOLLOWING THE BENCH – BERM DESIGN AND REINFORCEMENT AND SUPPORT DESIGN, AND SEQUENCE PROVIDED IN REPORT "RT_GM032020_GMS_REV0".
3.- THE INCLINED LENGTHS OF THE BOLTS ARE THEORETICAL TO THE SURFACE OF EXCAVATION; HOWEVER, THE LENGTHS WILL BE LARGER AS REQUIRED TO ALLOW THE INSTALLATION AND ADJUSTMENT OF THE PLATE AND NUT OF THE BOLT.
4.- THE INCREASE OF THE LENGTH OF BOLTS WILL BE THE RESPONSIBILITY OF THE GEOTECHNICAL ENGINEER ON SITE, DEPENDING ON THE GEOTECHNICAL CONDITION OF THE ROCK MASS.
5.- THE DEWATERING PIPES WILL BE SLOTTED. DRAINAGE DRILLS WILL BE SYSTEMATIC AND WILL RESPOND TO THE REQUIREMENTS OF THE DESIGN.
6.- SHOTCRETE COATING WILL BE APPLIED AT ALL BENCHES.
7.- ALL REINFORCEMENT AND SUPPORT ELEMENTS MUST BE GALVANIZED.
8.- SPACING BETWEEN RETICULATED FRAMES, ACCORDING TO QUALITY OF THE ROCK MASS (MAXIMUM 3.28 ft).

| REF | DRAWING No. | REFERENCES | No | BY | DATE | REVIEW | CHK | ING | APPR |
|---|---|---|---|---|---|---|---|---|---|

| | | |
|---|---|---|
| DRAWN | R. NUÑEZ | 06-01-2020 |
| DESIGN | S. VERA | 06-01-2020 |
| REVIEW | R. FLORES | 06-22-2020 |
| DES. APPR | A. TORRES | 06-29-2020 |
| PROJ. APPR | G. VAN TREEK | 06-30-2020 |

GEOTECHNICAL MINE SOLUTIONS

CLIENT: CALICO RESOURCES

TITLE: GRASSY MOUNTAIN
FINAL PORTAL DESIGN
DECLINE RAMP OPENING
REINFORCEMENT AND SUPPORT ELEMENTS DETAIL

| PROJECT No | SCALE | FORMAT |
|---|---|---|
| GM032020 | IND. | A0 |

| DRAWING No | REV |
|---|---|
| GM032020-04 | B |

# APPENDIX 2

# Operating Costs Summary

| ACTIVITIES | MACHINERY | | | | MACHINERY TOTAL COST (US$) | SUPPLIES | | | | TOTAL COST SUPPORT SUPPLIES (US$) | PERSONNEL | | | | | | | PERSONNEL TOTAL COST (US$) | TOTAL COST (US$) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | TYPE | UNITS | HRS | UNT COST (USD/HR) | | SUPPORT | REQUIREMENT | UNITS | UNIT COST | | OPERATOR LABOR | QTY per Shift | Shift | Schedule (days on/off) | # of Employees | Days Required | UNIT COST (USD/DAY) | | |
| **ROADS** | BULLDOZER | 1 | 20.0 | 39 | 781 | | | | | | BULLDOZER | 1 | 2 | 4x3 | 2 | 1 | 386 | 772 | 1,553 |
| **BENCH 1** | BULLDOZER | 1 | 4.5 | 39 | 176 | SELFDRILLING 1 | 9 | un | 70.0 | 630 | BULLDOZER | 1 | 2 | 4X3 | 2 | 1 | 386 | 772 | 17,504 |
| | EXCAVATOR | 1 | 6.7 | 32 | 214 | SELFDRILLING 2 | 15 | un | 60.0 | 900 | EXCAVATOR | 1 | 2 | 4X3 | 2 | 1 | 386 | 772 | |
| | TRUCKS | 2 | 6.7 | 17 | 223 | SELFDRILLING 3 | 21 | un | 50.0 | 1,050 | TRUCKS | 2 | 2 | 4X3 | 4 | 1 | 271 | 1,084 | |
| | BOLTER | 1 | 3.0 | 74 | 226 | EYEBOLT | 7 | un | 5.0 | 35 | BOLTER | 1 | 2 | 4X3 | 2 | 1 | 386 | 772 | |
| | SHOTRETE SPRAYER | 1 | 1.5 | 71 | 109 | PLATE | 45 | un | 1.6 | 72 | SHOTRETE SPRAYER | 1 | 2 | 4X3 | 2 | 1 | 271 | 542 | |
| | TELEHANDLER | 1 | 0.1 | 14 | 1 | NUTS | 45 | un | 1.4 | 62 | TELEHANDLER | 1 | 2 | 4X3 | 2 | 1 | 271 | 542 | |
| | | | | | | MESH | 7,015 | ft2 | 0.5 | 3,584 | | | | | | | | | |
| | | | | | | BARBICAN | 7 | un | 12.0 | 84 | | | | | | | | | |
| | | | | | | CONCRETE | 0 | m3 | 30.0 | 1 | | | | | | | | | |
| | | | | | | SHOTCRETE | 6,685 | ft2 | 0.8 | 5,652 | | | | | | | | | |
| **BENCH 2** | BULLDOZER | 1 | 49.0 | 39 | 1,914 | SELFDRILLING 1 | 9 | un | 70.0 | 630 | BULLDOZER | 1 | 2 | 4X3 | 2 | 4 | 386 | 3,089 | 32,667 |
| | EXCAVATOR | 1 | 71.5 | 32 | 2,279 | SELFDRILLING 2 | 15 | un | 60.0 | 900 | EXCAVATOR | 1 | 2 | 4X3 | 2 | 4 | 386 | 3,089 | |
| | TRUCKS | 2 | 71.5 | 17 | 2,369 | SELFDRILLING 3 | 21 | un | 50.0 | 1,050 | TRUCKS | 2 | 2 | 4X3 | 4 | 4 | 271 | 4,337 | |
| | BOLTER | 1 | 11.1 | 74 | 824 | EYEBOLT | 15 | un | 5.0 | 75 | BOLTER | 1 | 2 | 4X3 | 2 | 1 | 386 | 772 | |
| | SHOTRETE SPRAYER | 1 | 7.3 | 71 | 522 | PLATE | 45 | un | 1.6 | 72 | SHOTRETE SPRAYER | 1 | 2 | 4X3 | 2 | 1 | 271 | 542 | |
| | TELEHANDLER | 1 | 0.3 | 14 | 3 | NUTS | 45 | un | 1.4 | 62 | TELEHANDLER | 1 | 2 | 4X3 | 2 | 1 | 271 | 542 | |
| | | | | | | MESH | 7,015 | ft2 | 0.5 | 3,584 | | | | | | | | | |
| | | | | | | BARBICAN | 30 | un | 12.0 | 360 | | | | | | | | | |
| | | | | | | CONCRETE | 0 | m3 | 30.0 | 1 | | | | | | | | | |
| | | | | | | SHOTCRETE | 6,685 | ft2 | 0.8 | 5,652 | | | | | | | | | |
| **BENCH 3** | BULLDOZER | 1 | 165.0 | 39 | 6,437 | SELFDRILLING 1 | 20 | un | 70.0 | 1,400 | BULLDOZER | 1 | 2 | 4X3 | 2 | 12 | 386 | 9,266 | 79,456 |
| | EXCAVATOR | 1 | 243.0 | 32 | 7,747 | SELFDRILLING 2 | 26 | un | 60.0 | 1,560 | EXCAVATOR | 1 | 2 | 4X3 | 2 | 12 | 386 | 9,266 | |
| | TRUCKS | 2 | 243.0 | 17 | 8,052 | SELFDRILLING 3 | 32 | un | 50.0 | 1,600 | TRUCKS | 2 | 2 | 4X3 | 4 | 12 | 271 | 13,010 | |
| | BOLTER | 1 | 19.4 | 74 | 1,441 | EYEBOLT | 26 | un | 5.0 | 130 | BOLTER | 1 | 2 | 4X3 | 2 | 2 | 386 | 1,544 | |
| | SHOTRETE SPRAYER | 1 | 11.2 | 71 | 802 | PLATE | 78 | un | 1.6 | 124 | SHOTRETE SPRAYER | 1 | 2 | 4X3 | 2 | 2 | 271 | 1,084 | |
| | TELEHANDLER | 1 | 0.4 | 14 | 6 | NUTS | 78 | un | 1.4 | 107 | TELEHANDLER | 1 | 2 | 4X3 | 2 | 2 | 271 | 1,084 | |
| | | | | | | MESH | 10,772 | ft2 | 0.5 | 5,504 | | | | | | | | | |
| | | | | | | BARBICAN | 51 | un | 12.0 | 612 | | | | | | | | | |
| | | | | | | CONCRETE | 0 | m3 | 30.0 | 1 | | | | | | | | | |
| | | | | | | SHOTCRETE | 10,262 | ft2 | 0.8 | 8,676 | | | | | | | | | |
| **BENCH 4** | BULLDOZER | 1 | 574.6 | 39 | 22,419 | SELFDRILLING 1 | 34 | un | 70.0 | 2,380 | BULLDOZER | 1 | 2 | 4X3 | 2 | 35 | 386 | 27,027 | 201,663 |
| | EXCAVATOR | 1 | 733.4 | 32 | 23,384 | SELFDRILLING 2 | 41 | un | 60.0 | 2,460 | EXCAVATOR | 1 | 2 | 4X3 | 2 | 35 | 386 | 27,027 | |
| | TRUCKS | 2 | 733.4 | 17 | 24,305 | SELFDRILLING 3 | 48 | un | 50.0 | 2,400 | TRUCKS | 2 | 2 | 4X3 | 4 | 35 | 271 | 37,947 | |
| | BOLTER | 1 | 33.3 | 74 | 2,468 | EYEBOLT | 41 | un | 5.0 | 205 | BOLTER | 1 | 2 | 4X3 | 2 | 3 | 386 | 2,317 | |
| | SHOTRETE SPRAYER | 1 | 16.7 | 71 | 1,191 | PLATE | 123 | un | 1.6 | 196 | SHOTRETE SPRAYER | 1 | 2 | 4X3 | 2 | 3 | 271 | 1,626 | |
| | TELEHANDLER | 1 | 0.5 | 14 | 7 | NUTS | 123 | un | 1.4 | 169 | TELEHANDLER | 1 | 2 | 4X3 | 2 | 3 | 271 | 1,626 | |
| | | | | | | MESH | 16,172 | ft2 | 0.5 | 8,263 | | | | | | | | | |
| | | | | | | BARBICAN | 113 | un | 12.0 | 1,356 | | | | | | | | | |
| | | | | | | CONCRETE | 0 | m3 | 30.0 | 2 | | | | | | | | | |
| | | | | | | SHOTCRETE | 15,244 | ft2 | 0.8 | 12,888 | | | | | | | | | |
| **DECLINE** | JUMBO | 1 | 8.8 | 71 | 1,952 | **EXPLOSIVES** | | | | | JUMBO | 1 | 2 | 4X3 | 2 | 6 | 386 | 4,633 | 38,968 |
| | EXPLOSIVES LOADER | 1 | 1.0 | 17 | 51 | Emulsion | 229 | Kg/Drill | 1.3 | 891 | EXPLOSIVES LOADER | 1 | 2 | 4X3 | 2 | 3 | 271 | 1,626 | |
| | LHD | 1 | 1.1 | 63 | 220 | Pentofex 80 gr | 82 | un/Drill | 2.0 | 506 | LHD | 1 | 2 | 4X3 | 2 | 3 | 386 | 2,317 | |
| | TRUCKS | 2 | 2.0 | 17 | 201 | Nonel | 82 | un/Drill | 6.8 | 1,708 | TRUCKS | 2 | 2 | 4X3 | 4 | 3 | 271 | 3,253 | |
| | SHOTCHRETE SPRAYER | 1 | 0.6 | 71 | 141 | 3 gr detonant cord | 20 | m/round | 0.9 | 57 | SHOTCHRETE SPRAYER | 1 | 2 | 4X3 | 2 | 6 | 271 | 3,253 | |
| | TELEHANDLER | 1 | 0.7 | 14 | 29 | Slow cord | 10 | m/round | 0.2 | 6 | TELEHANDLER | 1 | 2 | 4X3 | 2 | 6 | 271 | 3,253 | |
| | | | | | | Fulminant 8 | 2 | un/round | 2.8 | 17 | | | | | | | | | |
| | | | | | | **DRILLING STEELS** | | | | | | | | | | | | | |
| | | | | | | Bit | 0.8 | US$/un. | 65.0 | 163 | | | | | | | | | |
| | | | | | | Escareador | 0.0 | US$/un. | 80.0 | 4 | | | | | | | | | |
| | | | | | | Barr | 0.4 | US$/un. | 210.0 | 229 | | | | | | | | | |
| | | | | | | Adapter | 0.1 | US$/un. | 56.0 | 19 | | | | | | | | | |
| | | | | | | Couple | 0.1 | US$/un. | 56.0 | 25 | | | | | | | | | |
| | | | | | | **SUPPORT** | | | | | | | | | | | | | |
| | | | | | | Plate | 6 | un/yd adv | 1.6 | 104 | | | | | | | | | |
| | | | | | | Nut | 6 | un/yd adv | 1.4 | 90 | | | | | | | | | |
| | | | | | | Self drilling Dia 32 mm L = 9.8 ft | - | un/yd adv | 50.0 | - | | | | | | | | | |
| | | | | | | Self drilling Dia 32 mm L = 13.12 ft | 6 | un/yd adv | 60.0 | 3,937 | | | | | | | | | |
| | | | | | | Drilling Steels | 20 | yd/yd adv | 0.8 | 167 | | | | | | | | | |
| | | | | | | Mesh | 58 | ft2/yd adv | 0.5 | 322 | | | | | | | | | |
| | | | | | | Shotcrete e = 2" | 159 | ft2/yd adv | 0.8 | 1,474 | | | | | | | | | |
| | | | | | | Steel Arches | 1 | un/yd adv | 265.0 | 2,454 | | | | | | | | | |
| | | | | | | Grouting (self drilling) | - | m3/yd adv | 30.0 | - | | | | | | | | | |
| | **UMBRELLA SUPPORT SYSTEM** | | | | | **UMBRELLA SUPPORT SYSTEM** | | | | | | | | | | | | | |
| | Pole Pipe Drilling | 1 | 52.1 | 79 | 4,093 | | | | | | | | | | | | | | |
| | SHOTCHRETE SPRAYER | 1 | 0.9 | 71 | 64 | Pole Pipe AT-89 | 15 | un | 110.0 | 1,650 | | | | | | | | | |
| | TELEHANDLER | 1 | 2.5 | 14 | 34 | Grouting Reqirement | 1 | m3 | 30.0 | 25 | | | | | | | | | |
| **RAIN DITCH WATER** | EXCAVATOR | 1 | 5.3 | 32 | 168 | SHOTCRETE | 798 | ft3 | 5.1 | 4,049 | EXCAVATOR | 1 | 2 | 4X3 | 2 | 1 | 386 | 772 | 5,911 |
| | SHOTCHRETE SPRAYER | 1 | 5.3 | 71 | 380 | | | | | | SHOTCHRETE SPRAYER | 1 | 2 | 4X3 | 2 | 1 | 271 | 542 | |