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## **ANNEX 6**

# **ENVIRONMENTAL MANAGEMENT PLAN FOR THE MUCK DISPOSAL SITES**

### **1. INTRODUCTION**

This document sets forth the Environmental Management Plan for the disposal of muck generated by the PHAM. The Plan was developed on the basis of the specifications and recommendations provided in the Manual for Developing Environmental Management Plans for Works under Concession, published by the Ministry of Public Works (2004). In particular, it establishes the environmental considerations for operating the muck disposal sites to be implemented during the tunnel and road construction phase of the PHAM.

### **2. OBJECTIVE**

The objective of the Environmental Management Plan is to provide background data on the location of the muck disposal sites, the related activities of the construction and operation phases, the identification and assessment of associated impacts, the control, mitigation and restoration measures, and the monitoring plan.

### **3. GENERAL BACKGROUND**

A total of 14 disposal areas will be sited throughout the PHAM area for the muck generated by tunneling operations, and a smaller amount of surplus inert material coming from the rehabilitation of roads and the construction of underground ducts. The total amount of material that is expected to be disposed of in these sites is estimated to be of the order of 2.75 Mm<sup>3</sup>.

The selection of locations, the design and the management practices relating to the muck disposal sites were all based on technical, environmental and safety criteria.

#### **3.1 LOCATION**

The locations of the muck disposal sites are shown in Table 3.2.1 of Section 3.2 of this report.

Table 3.1.1 below shows the reference coordinates for the different disposal sites.

**Table 3.1.1  
Muck Disposal Site Locations**

<b>Nº</b>	<b>Name</b>	<b>Sector</b>	<b>E Coord.</b>	<b>N Coord.</b>
1	Muck Disposal Site Nº 1 - Volcán V1	El Volcán	405385	6260845
2	Muck Disposal Site Nº 2 - Volcán V6	El Yeso	399012	6272810
3	Muck Disposal Site Nº 3 - Lo Encañado	Lo Encañado	396713	6272603
4	Muck Disposal Site Nº 4 - Alfalfal II VA4 Tunnel	Estero Manzanito	395345	6272311
5	Muck Disposal Site Nº 5 - Aucayes Alto	Aucayes Alto	384974	6285983
6	Muck Disposal Site Nº 6 - Aucayes Alto Road	Aucayes Alto	385566	6286691
7	Muck Disposal Site Nº 7 - Alfalfal VL7	Caballo Muerto	386045	6290828
8	Muck Disposal Site Nº 8 – Alfalfal VL8	El Trescientos	387447	6291425
9	Muck Disposal Site Nº 9 - Laguna Los Maitenes	Aucayes Bajo	383323	6288903
10	Muck Disposal Site Nº 10 – Ventana VL5	Km 10.5 Route G-345	380352	6287495
11	Muck Disposal Site Nº 11 – Km 10, Route G-345	Km 10 Route G-345	379982	6287413
12	Muck Disposal Site Nº 12 – Maipo River Discharge	Las Lajas	368240	6284051
13	Muck Disposal Site Nº 13 – El Sauce	El Sauce	379273	6287238
14	Muck Disposal Site Nº 14 – Km. 8, Route G-345	Km. 8, Route G-345	378307	6286479

To meet the technical and safety criteria, muck disposal sites will be located as close as possible to tunnel entries and other above-ground work fronts, generally in areas where there are no risks of avalanches or landslides.

The environmental criteria for locating muck disposal sites are as follows:

— Locations to be avoided:

- Areas where there are evident traces of water or other types of erosion;
- Areas located less than 1,000 m upstream from underground water intakes;
- Sectors with phreatic levels near the surface;
- Areas where threatened flora and fauna are present (otherwise, appropriate measures will be taken);
- Areas within a 500-meter radius of sites of archaeological or historical interest. (According to the surface prospecting studies, the possibility of archaeological findings or sites within the locations proposed for the muck disposal areas has been excluded);
- Agricultural land with land-use I, II and III capacity;
- Areas interrupting streams or ravines;
- Areas interrupting surface runoff;
- Flood-prone areas with recurrence intervals of less than 20 years, such as ravines, flat lowland plains, marshes, etc.

— Preferred locations:

- Environmentally degraded areas, e.g. abandoned borrow pits or zones with large depressions (as in Aucayes and Colorado);
- Areas with low soil productivity (land-use V, VI and VII), where the alteration of the original terrain morphology, and the disruption of surface water streams have been avoided (a criteria that Project disposal areas generally meet);
- Zones of low visual impact, i.e., located far from potential observation points on public roads or elevated areas (the case of Aucayes, El Yeso and Lo Encañado).

— In the high part of the Project area, the filling sites have been located adjacent to natural elevations, so that the fill terraces provide continuity to the area's general morphology.

— Natural risk prevention:

Muck disposal sites will be located in areas that are not exposed to flooding or other geomorphologic risks. Ravines, steep slope areas and locations near waterways exposed to high water will be avoided.

The disposal sites on the banks of the Colorado River will be set up in terraces, at an elevation well above the level attainable by a potential rise of river waters (see the plans enclosed as Appendix 2 of this Annex). More specifically, these sites are located between 3 and 15 meters above the 100-year high water mark, as shown in Table 3.1.2 below:

**Table 3.1.2**  
**Location of Muck Disposal Sites relative to the Maximum Flood Level of the Colorado River**

<b>Nº</b>	<b>Name</b>	<b>100-Year High Water Mark</b>	<b>Lowest Level of the Disposal Site</b>
7	Muck Disposal Site Nº 7 - Alfalfal VL7	1,237	1,240
8	Muck Disposal Site Nº 8 – Alfalfal VL8	1,272	1,275
10	Muck Disposal Site Nº 10 – Ventana VL5	1,067	1,074
11	Muck Disposal Site Nº 11	1,061	1,066
13	Muck Disposal Site Nº 13 – El Sauce	1,045	1,058
14	Muck Disposal Site Nº 14 – Km. 8, Route G-345	1,005	1,020

### 3.2 DESCRIPTION OF THE MUCK DISPOSAL SITES

A brief description of each of the 14 muck disposal sites, including a reference to their location plans, is provided below.

**Table 3.2.1  
Description of the Muck Disposal Sites**

<b>Site</b>	<b>Plan</b>	<b>Description</b>
Muck Disposal Site N° 1 - Volcán V1	Plan 020-TU-PLA-100 Rev.C	Adjacent to the Volcán Tunnel Access Portal, this disposal area is located downwards from the road leading to the El Morado water intake.
Muck Disposal Site N° 2 - Volcán V6	Plan 020-TU-PLA-100 Rev.C	Located near the Volcán Tunnel Exit Portal, 200 meters from Route G-455 to the El Yeso reservoir, resting on the hillside. Intended for stocking excavated material from the Volcán Tunnel.
Muck Disposal Site N° 3 - Lo Encañado	Plan 020-TU-PLA-101 Rev.C	Located near the El Yeso Tunnel Exit Portal, west of the Aguas Andina service road, resting on the hillside. Intended for stocking excavated material from the tunneling operations and surplus material from the construction of the access road.
Muck Disposal Site N° 4 - Alfalfal II VA4 Tunnel	Plan 020-TU-PLA-101 Rev.C	Adjacent to the Alfalfal II Tunnel Access Portal, in a terrain dip. Intended for stocking excavated material from the Alfalfal II Tunnel and surplus material from the construction of the access road.
Muck Disposal Site N° 5 - Aucayes Alto	Plan 020-TU-PLA-102 Rev.E	Located near the Ventana Access Portal VA2, on a platform located downwards from the road leading to this portal. The tunneling operations and surplus material from the construction of the access road.
Muck Disposal Site N° 6 - Aucayes Alto Road	Plan 020-TU-PLA-102 Rev.E	Located on both sides of the road leading from the Alfalfal II Powerhouse Access Road to Ventana VA2. Intended for stocking surplus material from the construction of the access road.
Muck Disposal Site N° 7 - Alfalfal VL7	Plan 020-TU-PLA-103 Rev. D	Located near the Ventana Portal VL7 of the Las Lajas Tunnel, on a terrace situated between Caballo Muerto and the Colorado River. Intended for stocking excavated material from Ventana VL7 and the Las Lajas Tunnel.
Muck Disposal Site N° 8 - Alfalfal VL8	Plan 020-TU-PLA-104 Rev.E	Located near the Las Lajas Tunnel Access Portal, on a terrace situated between Bellavista and the Colorado River. Intended for stocking excavated material from the Las Lajas Tunnel.

<b>Site</b>	<b>Plan</b>	<b>Description</b>
Muck Disposal Site N° 9 - Laguna Los Maitenes	Plan 020-TU-PLA-104 Rev.E	Adjacent to the reservoir of the auxiliary plant of the Maitenes Power Plant, on a branch of the road leading to the Alfalfal II Power Plant Access Portal. Intended for stocking excavated material from Ventana VA2, the cavern and the Alfalfal II Tunnel, and surplus material from the construction of the access road.
Muck Disposal Site N° 10 – Ventana VL5	Plan 020-TU-PLA-105 Rev.D	Adjacent to the Ventana VL5 Portal of the Las Lajas Tunnel, on a terrace between Route G-345 and the Colorado River. Intended for stocking excavated material from Ventana VL5 and the Las Lajas Tunnel.
Muck Disposal Site N° 11 – Sub-station	Plan 020-TU-PLA-105 Rev.D	Located near the 10km mark of Route G-345, on a terrace between Route G-345 and the Colorado River. Intended for stocking excavated material from the Las Lajas Tunnel.
Muck Disposal Site N° 12 - Maipo River Discharge	Plan 630-CI-PLA-049 Rev. A	Adjacent to the Exit Portal of the Discharge Tunnel of the Las Lajas Power Plant, between Route G-25 and the Maipo River. Intended for stocking excavated material from the Las Lajas Discharge Tunnel.
Muck Disposal Site N° 13 – El Sauce	Plan 020-TU-PLA-106 Rev.D	Located on a terrace between Route G-345 and the Colorado River. Intended for stocking excavated material from Ventana VL4.
Muck Disposal Site N° 14 – Km. 8, Route G-345	Plan 020-TU-PLA-106 Rev.D	Located on the 8km mark of Route G-345, on a terrace between Route G-345 and the Colorado River. Intended for stocking excavated material from Ventana VL4, VL2, the cavern, the headrace shaft, and the Las Lajas Discharge Tunnel.

### 3.3 TOTAL DISPOSAL VOLUMES

The materials to be deposited in the muck disposal sites include waste rock from tunnel construction, and, to a lesser degree, surplus material from the rehabilitation of roads and the construction of underground ducts. It is estimated that 1.7 Mm<sup>3</sup> of rock will be extracted. Table 3.3.1 shows the surface and approximate quantities of materials to be dumped in each muck disposal site. It should be noted that the increase in muck quantity resulting from bulking (up to a maximum of 2.7 Mm<sup>3</sup>) has been considered in the calculations.

**Table 3.3.1  
Surface and Capacity of the Muck Disposal Sites**

Nº	Name	Surface (ha)	Total Volume (m <sup>3</sup> )	Monthly Volume (m <sup>3</sup> )	Maximum Capacity (m <sup>3</sup> )
1	Muck Disposal Site Nº 1 - Volcán V1	1.84	198,954	4,325.09	230,000
2	Muck Disposal Site Nº 2 - Volcán V6	3	119,113	3,403.23	240,000
3	Muck Disposal Site Nº 3 - Lo Encañado	0.83	24,000	1,200.00	70,000
4	Muck Disposal Site Nº 4 - Alfalfal II VA4 Tunnel	2.32	202,677	7,795.27	275,000
5	Muck Disposal Site Nº 5 - Aucayes Alto	3.43	464,791	14,524.72	620,000
6	Muck Disposal Site Nº 6 - Aucayes Alto Road	2.24	176,000	29,333.33	176,000
7	Muck Disposal Site Nº 7 - Alfalfal VL7	2.12	121,400	3,372.22	200,000
8	Muck Disposal Site Nº 8 - Alfalfal VL8	3.09	52,000	4,333.33	212,000
9	Muck Disposal Site Nº 9 - Laguna Los Maitenes	5.61	605,860	15,534.87	710,000
10	Muck Disposal Site Nº 10 – Ventana VL5	1.18	68,000	9,714.29	68,000
11	Muck Disposal Site Nº 11 – Km 10, Route G-345	1.63	71,000	3,944.44	71,000
12	Muck Disposal Site Nº 12 – Maipo River Discharge	2.36	210,000	4,468.09	210,000
13	Muck Disposal Site Nº 13 – El Sauce	1.12	91,000	3,033.33	91,000
14	Muck Disposal Site Nº 14 - Km. 8, Route G-345	2.97	345,000	8,414.63	345,000
<b>TOTAL (m<sup>3</sup>)</b>			<b>2,749,795</b>		<b>2,898,000</b>

See Appendix 1 of this Annex for details on the Project's muck-generating activities.

### 3.4 TRANSVERSE AND LONGITUDINAL PROFILES

The transverse and longitudinal profiles for each of the muck disposal sites are presented in Appendix 2 of this Annex.

#### **4. DESCRIPTION OF ACTIVITIES AND GENERAL ENVIRONMENTAL CRITERIA**

The activities and environmental criteria associated with the setup, management and abandonment of the muck disposal sites are discussed below, based on the Manual for Developing Environmental Management Plans for Works under Concession<sup>1</sup>.

All the activities and locations of the muck disposal sites are described in Section 2.3, Chapter 2 of the Environmental Impact Assessment document.

The measures adopted during the setup, operation and abandonment phases of the muck disposal sites will be implemented by the works contractor. AES Gener will develop an environmental monitoring plan for site management and use, which will include field inspections, and regular control of entries to the sites, among other actions.

##### **4.1 MUCK DISPOSAL SITE SETUP**

The activities involved in setting up the muck disposal sites include:

- i) Identifying the work areas

The location of the 14 muck disposal sites followed the environmental criteria mentioned in Section 3.1 above.

- ii) Topographic layout

The filling sites have been located adjacent to natural elevations, so that the filling terraces will provide continuity to the area's general morphology.

When setting up the disposal sites, care will be taken to ensure that the height of the dumps and their final form at closure adapt to the topographical features of the area where they are located.

- iii) Land clearing and storing

This activity involves the removal or cutting down of shrubs, brushwood, and trees to clear the land for the construction works.

The use of heavy equipment for this activity will be kept to the minimum necessary, in order to reduce the impact on vegetation.

Prior to the filling, 20 cm of topsoil will be removed and stored on-site to be used later, when closing the disposal sites.

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<sup>1</sup> MOP, 2004. Manual de Planes de Manejo Ambiental para Obras Concesionadas. Versión 5.0. Ministerio de Obras Públicas. 117 pp.

iv) Temporary or final closing

Disposal site closings, where needed, will be done with wood posts and wire. The use of green fences made up of plant species existing locally will be evaluated, particularly in the case of disposal sites located on the banks of the Maipo and Colorado Rivers.

v) Rehabilitating access roads for muck disposal operation

As long as the muck disposal sites are operational, access to the deposit areas will be controlled.

The public roads to be used to access the muck disposal sites will be rehabilitated with the traffic solutions and signaling proposed by the study of the road capacity of the PHAM area (see Section 5.6.1.3 of the EIA and Annex 14).

vi) Installing safety signs

Safety signs will be installed for the protection of workers and visitors.

Throughout the construction phase of the muck disposal sites, the mitigation measures associated with the preparation of the working area, mentioned in Table 5.1 of this Annex, will be implemented.

## 4.2 MUCK DISPOSAL SITE OPERATION

### A. Deposition Method

The dumping of muck will be done in the form of terraces. A first 1.5 to 2 meter-high layer of excavated material from the tunnels will be deposited on the previously prepared land. This material will then be compacted using heavy equipment. The same method will apply to the following layers of muck, forming even, stable platforms, with the natural slopes created by the material itself. This will ensure stability and enable proper drainage. Finally, the muck will be covered with 20 cm of organic soil, thus enabling the definitive closure of the waste heap.

The quantity of muck disposed of at the different sites will not exceed the predetermined maximum capacity.

The PHAM will meet all the requirements established by the local highway administration authority (*Dirección Regional de Vialidad de la Región Metropolitana*) relating to the location of waste disposal sites with respect to public roads. Particularly relevant to the Project are the following requirements: i) disposal sites should not affect the stability of the filling supporting the road or pose a risk of landslides or falling material that could affect the functionality or safety of the road; and, ii) disposal sites located in proximity to public roads should not reduce or block the lateral or panoramic views from the roadway or the shoulder, i.e., the waste heap should not constitute a visual obstruction for users of the road. Accordingly, in the case of muck disposal sites to be set up near public roads, the final altitude of the waste heap will not exceed the altitude of the road.

During the operation phase of the muck disposal sites, the following measures will be adopted to protect the environment:

- People who are not involved in the works and animals will not be allowed in the muck disposal sites. For this purpose, fences with gates and controlled access points will be installed.
- The areas surrounding the muck disposal sites, as well as the access roads, will be kept clean of excavated material, dampened and perfectly passable.
- All roadways used by project-related equipment and vehicles will have an adequate signaling system.
- Equipment and vehicle traffic will be restricted to the access points and roads designated for Project works. The contractor will be responsible for clearly delimiting the roadways and parking areas to be used for carrying out activities, and ensuring that unauthorized areas are not used.
- Dumping of organic waste, scrap, wood, paper, mud, petroleum derivatives and hazardous waste will be prohibited.
- Burning of waste material will be prohibited.
- The muck disposal sites will not accept construction debris. The latter will be transported to an authorized dump site.

## **B. Inputs for Operating the Muck Disposal Sites**

As mentioned in Section 2.4, Chapter 2 of the EIA, the inputs needed to operate the muck disposal sites include:

### **I) Electricity**

Electricity will be supplied through provisional 23KVA splices to existing energy-generation sources owned by Gener. El Volcán, El Yeso and Lo Encañado will be supplied with electricity from the Queltehues hydropower facility. Electricity for the works at the El Colorado sector will come, via a connection, from the Alfafal and Maitenes power plants. Electricity posts along the roads will be used for power distribution.

### **II) Fuel**

Diesel oil and gasoline will be used to operate motor vehicles and equipment. Fuel will be supplied by distributors based in the Metropolitan Region and transported to the work sites and camps in tank trucks. Fuel transportation will be undertaken in compliance with the relevant provisions set forth in Supreme Decree N° 298, Road Transportation of Hazardous Substances.

### III) Water Supply and Sanitary Installations

Drinking water will be distributed from the camps to *ad hoc* storage tanks.

Chemical bathroom cabinets will be set up and managed by a qualified, duly-authorized company, and the waste disposed of according to existing regulations. The bathrooms will comply with the provisions of Supreme Decree N° 594/99, issued by the Ministry of Health, particularly regarding the quantity and other specifications. The contractor will be responsible for the proper functioning and maintenance of the bathrooms.

### IV) Equipment

The operation of the muck disposal sites requires the following equipment:

- Shuttle cars hauled by locomotives, operating on tracks, will transport waste from the tunnels to the disposal sites. Each locomotive will haul approximately 6 cars with a capacity of 5 m<sup>3</sup>.
- Agitating trucks with a capacity of 12 to 15 m<sup>3</sup> will be used for tunnel construction works.
- Conveyor belt for tunnels that will be excavated using tunnel boring machines.

## 4.3 MUCK DISPOSAL SITE ABANDONMENT

Site abandonment activities include:

- As already mentioned, the final shape of each deposit will fit into the local topography. The terraces will be leveled to form a flat surface, and the slopes resulting from the piling and compacting of the waste material will be graded. The finished slopes will not exceed 30% to prevent landslides and water erosion.
- All temporary structures or facilities set up by the contractor will be removed, together with the signaling system.
- Sterile material will be covered with scarified soil from the slopes of the dump itself, the roads and other above-ground works. The thickness of the cover will be of at least 20 cm.
- A vegetation restoration plan will be implemented for the muck disposal sites. The aim of the plan is to stabilize the terraces and slopes created by the works and restore, to the extent possible, the pre-existing vegetation. This will help control erosion, mitigate visual impacts and restore animal habitats (Annex 29).

#### 4.4 PERIOD OF USE

The period of use will vary across muck disposal sites, depending on the rate of progress of the work front, and the site's storage capacity and shape.

In general, muck disposal sites will operate parallel to the daily activities at the work fronts.

To the extent possible, disposal site activities involving the use of equipment will be carried out during the day.

Appendix 1 of this Annex shows the inflow of muck to the disposal sites, by activity. Annex 28 shows the muck transportation means, by sector, and the excavation methods.

### 5. RAINWATER MANAGEMENT

Although tunneling operations will produce inert material<sup>2</sup>, the residual water that could eventually result from the contact of the muck with rainwater or snow will be controlled as follows:

- The ground surfaces of the muck disposal sites will be graded so that rainwater runoff is directed outward.
- Trenches dug along the perimeter of contact between the sites and the ground surface will stop runoff from adjacent terrains (see detailed plans in Appendix 2 of this Annex).
- Parallel to the above, exploration drilling will be carried out to survey the rock ahead of the face during tunneling, and to determine if waterproofing will be necessary. If required, ABA and TCLP tests will be performed and the results presented to the competent authority.
- If the ABA and TCLP results reveal the existence of acid or base water (using the pH values established by Chilean water quality standard 1333 as reference), the Project Owner undertakes to implement, as a contingency measure, a system of soil waterproofing, drainage recovery and water neutralization following discharge. This and other contingency measures will be agreed upon with the Environmental Authority, and all the necessary permits and authorizations will be obtained.

Ultimately, the muck disposal areas will be covered with soil and vegetation, as indicated in the Vegetation Restoration Plan of Annex 29 (Table 3).

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<sup>2</sup> Data from the construction of the Alfafal power plant tunnels, where 35 km of tunnel were excavated and no evidence of material with acid or base drainage potential was found.

## **6. ENVIRONMENTAL MONITORING PROGRAM**

An Environmental Monitoring Program will be put in place to ensure the effectiveness and compliance with the environmental management measures proposed in the EIA.

The main actions contemplated in this program are:

- Verifying the delimitation of the work areas and the degree of modification of the landforms;
- Verifying that delimitation of the work areas and cutting of vegetation is limited to what is necessary;
- Checking natural risk protection systems;
- Conducting tests to assess the potential for acid drainage;
- Assessing the effectiveness of revegetation efforts;
- Controlling the proper closing and cleanup of the disposal sites, and the removal of provisional facilities;
- Measuring the waste heap to ensure capacity and area limits are not exceeded;
- Checking river banks and beds for possible spills, and taking appropriate measures (cleanup, containment) when needed.

## APPENDIX 1 PRELIMINARY EARTHMOVING AND MUCKSHIFTING BALANCE

**Table 1  
Earthmoving and Muck shifting – Aucayes System**

Surplus Source	Earthmoving (m <sup>3</sup> ) – Roads				Roads Surplus	Tunnel Muck	Muck Disposal Site No. 9 – Los Maitenes Lagoon		Muck Disposal Site No. 5 - Aucayes Alto		Soil Stockpile Site No. 6 - Aucayes Alto Road	
	Rock	Soil	Fills	Granular Surface	(m <sup>3</sup> )	(m <sup>3</sup> )	Volume	DMT (km)	Volume	DMT (km)	Volume	DMT (km)
<b>AUCAYES SYSTEM</b>												
Access Road from VA1 to Muck Disposal	15,000	35,000	0	-1,814	48,186		48,186	1.2				
Access Road – Alfalfal II (VA1) Power Plant	106,000	155,000	-12,000	-13,500	235,500		141,119	2			94,381.00	3
Access Road to VA2 (Aucayes Alto)	20,000	145,000	-5,000	-7,100	152,900				71,281.00	1.5	81,619.00	1.5
Road to Alfalfal II Loading Chamber	25,000	69,691	-20,000	-14,000	60,691				60,691.00			
Excavation of Alfalfal II Loading Chamber						59360			59,360.00			
Road Tunnel L=500 m						14,160	14,160			1.8		1.8
Portal and Tunnels – Alfalfal II VA1 Power Plant						226,752	226,752	3				
Las Lajas Tunnel						175,643	175,643	1.5				
Construction Window Portal – VA2						273,459			273,459.00	0		
Deposit Capacity (m <sup>3</sup> )	-	-	-				710,000.00		620,000.00		176,000.00	
Volume Deposited (m <sup>3</sup> )							605,860		464,791.00		176,000.00	

**Table 2**  
**Earthmoving and Muck shifting – Las Lajas System**

Surplus Source	Earthmoving (m <sup>3</sup> ) – Roads				Roads Surplus (m <sup>3</sup> )	Tunnel Muck (m <sup>3</sup> )	Muck Disposal Site No. 8 – Alfalfal VL8		Muck Disposal Site No. 7 – Alfalfal VL7		Muck Disposal Site No. 10 – Window VL5		Muck Disposal Site No. 11		Muck Disposal Site No. 13 – Las Lajas Power Plant		Muck Disposal Site No. 14 – km 8, Route G-345		Muck Disposal Site No. 12 – Tailrace into Maipo River	
	Rock	Soil	Fills	Granular Surface			Volume	DMT (km)	Volume	DMT (km)	Volume	DMT (km)	Volume	DMT (km)	Volume	DMT (km)	Volume	DMT (km)	Volume	DMT (km)
<b>LAS LAJAS SYSTEM</b>																				
Access Road to Las Lajas Power Plant	0	12,000	-3,000	-800	8,200	-	-	-	-	-	-	-	-	8,200	0.3	-	-	-	-	
Access Road to VL5	140	13,050	-1,000	-490	11,700	-	-	-	-	-	0.1	11,700	-	-	-	-	-	-	-	
Las Lajas Tunnel Construction Window Portal – VL9						52,000	52,000	0.1	-	-	-	-	-	-	-	-	-	-	-	
Las Lajas Tunnel Construction Window Portal – VL7						121,400	-	-	121,400	0.3	-	-	-	-	-	-	-	-	-	
Las Lajas Tunnel Construction Window Portal – VL5						96,500	-	-	-	68,000	0	28,500	0,3	-	-	-	-	-	-	
Las Lajas Power Plant Access Tunnel Portal – VL4						307,000	-	-	-	-	-	30,800	1	91,000	0	185,200	2	-	-	
Las Lajas Tunnel Construction Window Portal – VL2						159,800	-	-	-	-	-	-	-	-	-	159,800	-	-	-	
Tailrace Tunnel into the Maipo River						210,000	-	-	-	-	-	-	-	-	-	-	14	210,000	0	
Maximum Deposit Capacity (m <sup>3</sup> )							212,000		200,000		68,000		71,000		91,000		345,000		210,000	
Volume Deposited							52,000		121,400		68,000		71,000		91,000		345,000		210,000	

**Table 3**  
**Earthmoving and Muck shifting – Yeso System**

Surplus Source	Earthmoving (m <sup>3</sup> ) – Roads				Roads Surplus (m <sup>3</sup> )	Tunnel Muck (m <sup>3</sup> )	Muck Disposal Site No. 4 – Alfalfal II Tunnel VA4		Muck Disposal Site No. 2 – Volcán V6		Soil Stockpile Site No. 3 – Lo Encañado Sector	
	Rock	Soil	Fills	Granular Surface			Volume	DMT (km)	Volume	DMT (km)	Volume	DMT (km)
<b>YESO SYSTEM</b>												
Access Road to VA4 (Alfalfal II Tunnel Entrance)	10,000	90,000	-40,000	-7,900	52,100	-	52,100	1.2	-	-	-	
Construction Window Portal – VA4						150,577	150,577	0	-	-	-	
Volcán Tunnel Portal V6						119,113	-	-	119,113	0	-	
Floor Tunnel Portal (Yeso Siphon)						24,000	-	-	-	-	24,000 0.2	
Maximum Deposit Capacity (m <sup>3</sup> )							275,000		240000		70000	
Volume Deposited							202,677		119,113		24,000	

**Table 4**  
**Earthmoving and Muck shifting – Volcán System**

Surplus Source	Earthmoving (m <sup>3</sup> ) – Roads				Roads Surplus	Tunnel Muck	Muck Disposal Site No. 1 – Volcán V1	
	Rock	Soil	Fills	Granular Surface	(m <sup>3</sup> )	(m <sup>3</sup> )	Volume	DMT (km)
<b>VOLCÁN SYSTEM</b>								
Road to Volcán Tunnel Sector Works	14,000	120,000	-32,000	-10,811	91,189	-	91,189	1.2
Volcán Tunnel Portal V1						107,765	107,765	0.0
Maximum Deposit Capacity (m <sup>3</sup> )								230,000
Volume Deposited							198,954	















