LISBON VALLEY MINING CO

Centennial Pit Partial Backfilling
Revision 3 March 11, 2015

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Moab Field Office

Operator/Claimant Information

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BLM File UTU-72499
Federal Tax ID Number 84-1422662
State Tax ID 12296563002

Primary Commodity: Copper
Claim Type: Lode

Legal Description: T30S R25E sections 25, 26, 35, and 36
County: San Juan County, Utah

Description of Operations (Proposed Action)

LVMC operates an open-pit copper mine and wishes to partially reclaim (backfill) one of the open pits (Centennial Pit) as part of final reclamation. The Centennial Pit spans BLM Section 25 and SITLA Section 36 T30S, R25E (SITLA Lease ML 49306). BLM Claims are listed below.

BLM Serial Number of Unpatented Mining Claim(s)

Claim	Book/Page	Township Range Section	BLM Serial
CW No. 1	510 62	30S/25E/25,26,35,36	129811
Amended	821 91/92		
CW No. 2	510 63	30S/25E/25,36	129812
Amended	821 93/94		
CW No. 3	510 64	30S/25E/25,26	129813
Amended	821 95/96		
CW No. 4	510 65	30S/25E/25,36	129814
Amended	821 97/98		
CW No. 5	510 66	30S/25E/25	129815
Amended	821 99/100		
CW No. 6	510 67	30S/25E/25,26	129816
Amended	821 101/102		
CW No. 7	510 68	30S/25E/25,36	129817
Amended	821 103/104		
CW No. 8	510 69	30S/25E/25,36	129818
Amended	821 105/106		
CW No. 9	510 70	30S/25E/25	129819
Amended	821 905/906		

Mining Operation

LVMC mines sandstone-hosted copper using conventional open pit mining methods. The ore is drilled and then blasted to an acceptable fragmentation from 20ft benches. The ore is loaded and transported to the heap leach pads using conventional front end loaders and haul trucks. Waste rock is hauled to waste dumps using the same methods and equipment.

Drilling and Blasting

LVMC contracts its drilling and blasting. The drilling contractors utilize a fleet of conventional 10" rotary drills. The blast contractor utilizes an ammonium nitrate/fuel oil (AN/FO) explosive. Blast hole depth is 20 feet and spaced 15-20 feet depending on rock hardness. The blast schedule is every other day during daylight hours.

Waste and Ore Haul

Waste rock is hauled using a conventional open-pit mining fleet from three pits to three above-ground waste dumps. Ore is hauled to the heap leach pad. The leach pad is shown on Figures 1-2.

The mine fleet is detailed below.

HAUL TRUCK FLEET

MAKE	MODEL	QTY
CATERPILLAR	777G	2
CATERPILLAR	773F	3
CATERPILLAR	740B	6

LOADER FLEET

MAKE	MODEL	QTY
CATERPILLAR	992K	1
KAWASAKI	115Z-2	2
KAWASAKI	115Z-IV	1

DOZER FLEET

MAKE	MODEL	QTY
CATERPILLAR	D10N	1
CATERPILLAR	D9H	1
CATERPILLAR	D9T	1
CATERPILLAR	D6H	1

MOTORGRADER FLEET

MAKE	MODEL	QTY
CATERPILLAR	14M	1

WATER TRUCK FLEET

MAKE	MODEL	QTY
INTERNATIONAL	4300	1
STERLING	4200	1

Maps of Project Area

A map of the project area is shown below and attached in D-size as Figures 3 and 4. The attached maps show land ownership, the current Centennial Pit, surface water diversion and retention, and proposed monitoring wells.

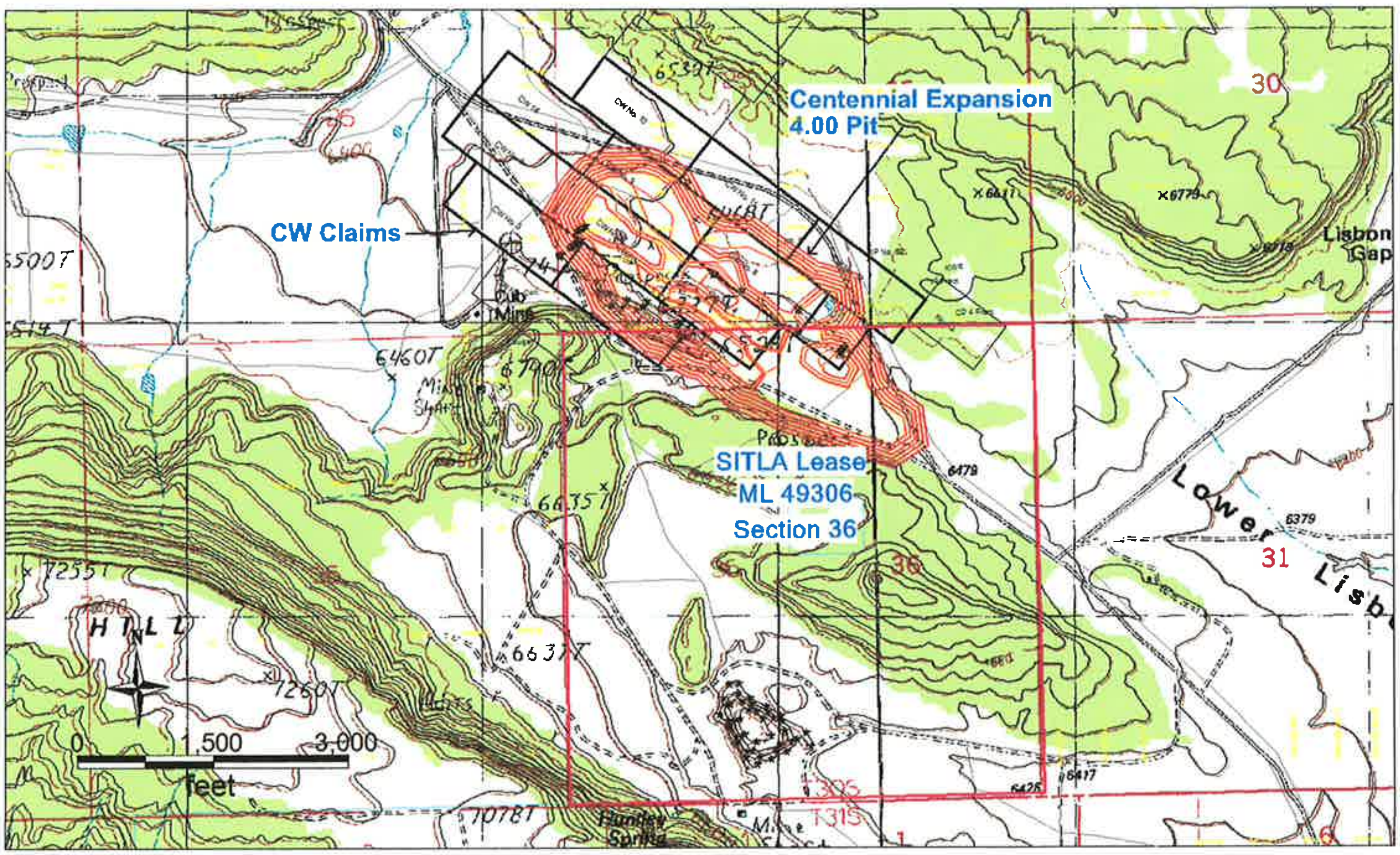
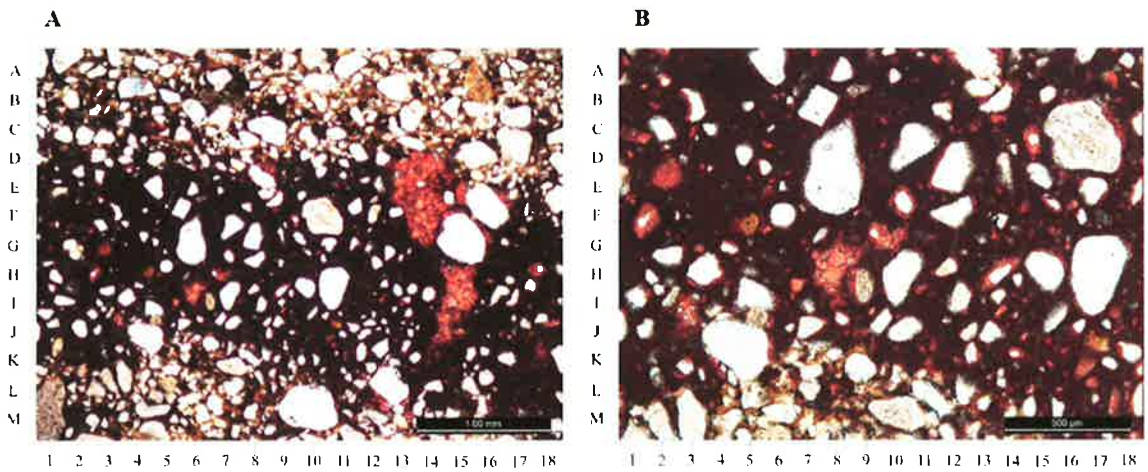


Figure 1

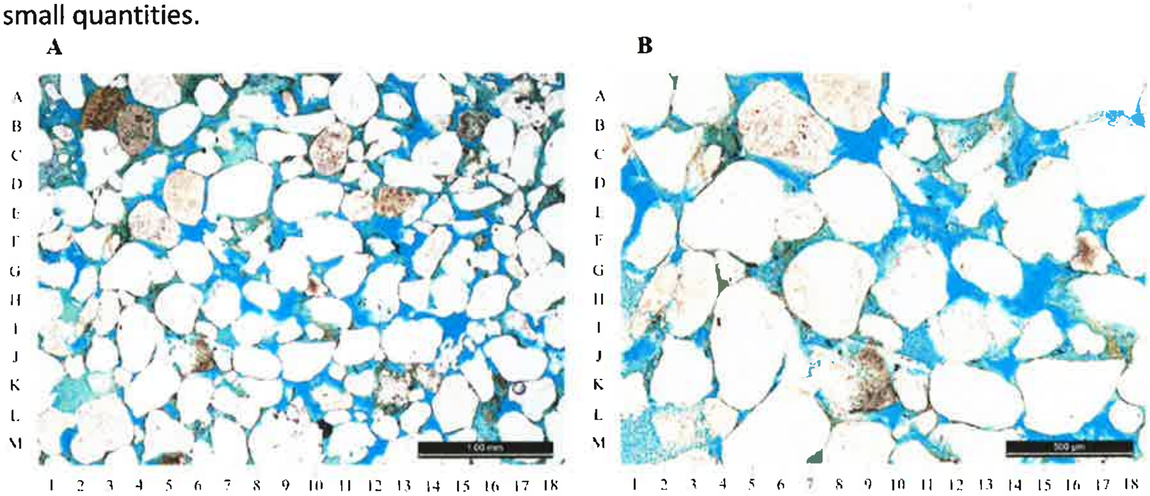
Backfilling Composition, Sequence, and Tonnage

LVMC mines copper from the mineralized portions of the Cretaceous Dakota and Burro Canyon Formation. 16 individual beds can be distinguished in this sequence. Only Beds 14 and 15 are proposed for backfilling. These beds are comprised of clayey limestone and fine grained sandstone respectively. Detailed thin section descriptions are provided below.



Thin Section Photomicrograph of the Bed 14 in the Centennial Pit

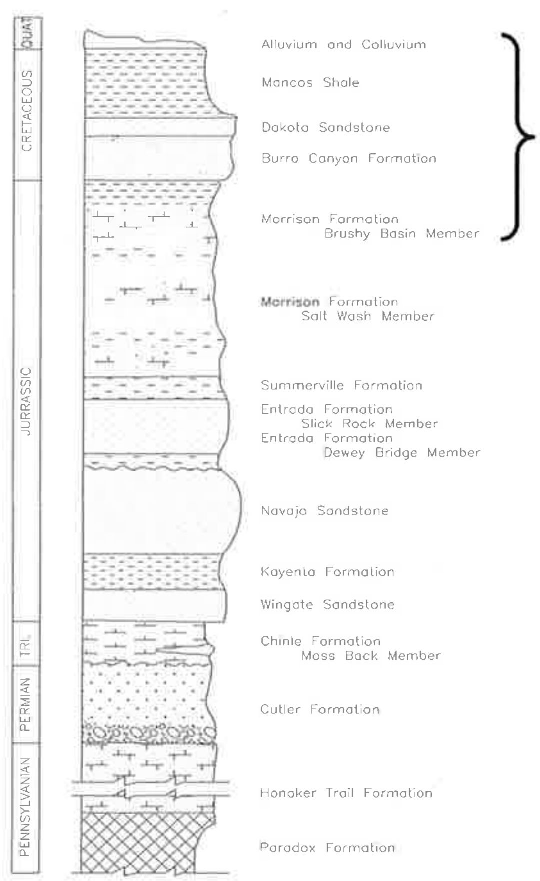
Photomicrographs display a sandy, argillaceous limestone. Layers of sandy calcareous shale (brown) alternate with sandy lime mudstone (Photo A center). The rock is very poorly sorted. Sand grains are supported by a matrix of detrital shale (brown) and lime mud (pink). Detrital grains consist predominantly of quartz with very small amounts of potassium feldspar. Apatite grains occur in very small quantities.



Thin Section Photomicrograph of the Bed 15 in the Centennial Pit

Photomicrographs display a fine grained, moderately well sorted sandstone. Framework sand grains have tangential to long contacts indicative of moderate burial compaction and grain packing adjustment. Grains are rounded to subrounded in shape. Quartz is the dominant grain constituent. Potassium and plagioclase feldspar as well as feldspathoids are present in very small quantities. Grains are coated by films of clay cement (apparently illite and illite-smectite from XRD analysis). The interiors of some pores are also filled by masses of kaolinite clay cement (blue-white area in lower left of Photo B). The grain rimming clay may be illuviated rather than authigenic. Some kaolinite appears to occur in the form of pedoliths. Intergranular porosity (blue) is well developed.

The figure below identifies all beds in correlation with the greater stratigraphy of Lisbon Valley.



Lithology	**Bed Number**
Quaternary Alluvium	1
Mancos Formation	2
Upper Dakota Sandstone	3, 4, 5
Dakota Sandstone, coaly beds	6, 7, 8
Dakota Sandstone, shaley beds	9, 10
Lower Dakota Sandstone	11, 12, 13
Burro Canyon Formation	14
Burro Canyon Formation	15
Morrison Formation	17

The backfilling sequence will mirror the sequence of mining phases of the Centennial Pit, except only Bed 14 and 15 waste rock (Burro Canyon FM) will be used to backfill. The reminder of the waste will be deposited in above-ground dumps. All waste is dumped in 20' lifts, whether on the dumps or when backfilling the pit. The lifts are compacted as a function of the haul truck (100-ton) traffic.

The Centennial Pit is mined in phases which allow the backfilling process to occur within the larger (planned) pit boundaries. The backfilling process will begin by incrementally identifying areas within the Centennial Pit that have been mined to planned limits (generally final pit walls) or geologic/mineralization boundaries (pit floors). Because backfilling has the potential to permanently condemn future economic mining in the area of the pit it is conducted in, a careful assessment will be made beforehand to provide a reasonable degree of certainty that future economic loss of the ore body will be minimized. Once that assessment is completed, backfilling will proceed.

Based on current understanding, the initial target area for backfilling will be in the Penny Phase area of the Centennial pit. Following Penny, portions of the Keystone Phase immediately north of the Penny would likely become additional backfill targets. These phases are shown on Figure 3-4. Beyond these two phases the envisioned sequence becomes less clear as future mining sequences could change depending on then-economic and operational conditions. As a general rule, backfill progression will follow pit development along successive pushbacks of the pit walls to final mining limits.

Physically, this will be accomplished by establishing an access to the target area in the form of either an in-pit haul route or a haul-back route along the pit perimeter. In the case of an in-pit haul, ramps will be constructed within the pit to allow haul traffic to access different elevations. In the haul-back scenario, the trucks would exit the pit, travel around the rim on the surface and then dump over the rim into the target area. Backfilling would then proceed in the target area to predefined limits which would be established from the aforementioned assessment. When backfilling operations are completed in a target area, the process would repeat itself until all backfilling opportunities are exhausted, resulting in the final configuration.

Estimated Annual Acreage/Tonnage of Backfill

Since backfilling will occur within previously mined pits, the waste tonnage will not be added to waste dumps located outside the pit. Therefore, the planned waste dumps will be reduced accordingly. Based on the current mine schedule and fleet capacity, approximately 7 million tons per year will be backfilled. The backfill will be a mixture of Beds 14 and 15. The mixture will be a minimum 75% Bed 14.

Final Backfill Configuration

LVMC wishes to emphasize the opportunistic nature of backfilling. A specific volume of backfill is difficult to plan or predict. However, for the purposes of project authorization, LVMC requests approval to backfill a range of 7-75M tons, with a commitment to backfill any final pit to an elevation 10 feet above the pre-mine groundwater elevation [6,200 feet above mean sea level (amsl), using a minimum 75/25% mix of Beds 14/15. A 25MM ton backfill simulation is shown on Figure 2 with the backfilled surface in green.

Figure 2

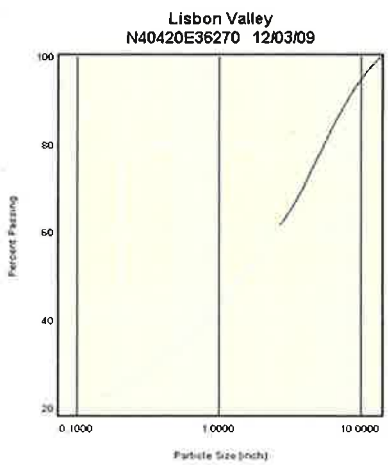
Water Management Plans

LVMC manages surface water through diversions and berms. Surface runoff is diverted from the pit in accordance with an approved Storm Water Pollution Prevention Plan SWPPP.[1] A 3' minimum height berm is planned for post mine closure around the pit. This berm is shown in Figures 3-4 along with the current storm water diversion channels

[1] UPDES Multi-Sector Storm Water Permit for Industrial Activity, Permit UTR000737.

Rock Characterization and Handling Plans

The Centennial Pit with be backfilled in accordance with the approved waste rock management plan. [2] Waste rock is blasted into a maximum 36" minus gradation. An example of blasted material is shown below along with a typical gradation analysis.



size (in)	%
75.00	100.00
50.00	100.00
25.00	100.00
15.00	100.00
10.00	94.52
8.000	89.80
6.000	82.06
4.000	70.45
2.000	55.07
1.500	49.55
1.000	42.69
0.750	38.43
0.500	33.13
0.375	29.08
0.250	25.84
0.187	23.35
0.0787	17.84

P20 Size (in) 0.118
P50 Size (in) 1.538
P80 Size (in) 5.593
Top size (in) 13.75

SPLIT ENGINEERING

Reclamation Plan

The reclamation plan is comprised of backfilling the Centennial Pit. Backfilling will partially reclaim the pit and reduce the reclamation of the above-ground dumps. Backfilling the Centennial Pit will reduce the pit, high walls, slopes, and ponding as these features are partially inundated with waste rock. The backfilled area is capable of revegetation and will be re-seeded from the air with a BLM-approved seed mix.

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[2] LVMC 2005 Waste Rock Sampling Plan. Lisbon Valley Mining Company LLC. 20 December 2005

Monitoring Plan

LVMC will monitor the backfilling project in accordance with Groundwater Discharge Permit (UDEQ, 2012)[3] and Waste Rock Monitoring Plan (LVMC 2005). The groundwater monitoring will extend to a period of at least 5 years following mine closure (BLM, 1997). Groundwater monitoring wells are shown on Figures 3-4. An additional monitoring well is planned to supplement the existing monitoring wells in the Burro Canyon (BC) aquifer. This well (MW15-16) is included in Figures 3-4.

Groundwater Monitoring Program

The groundwater monitoring program for the Lisbon Valley Mine includes routine monitoring of water level elevations and water quality. The sampling frequency, sampling methods, and analytical suite are listed in the following sections, and are subject to annual review.

Water levels will be measured quarterly during operations in 12 monitoring wells and piezometers listed in Table 1 and these measurements will be presented in the quarterly sampling reports submitted to UDEQ and BLM. Water levels in active pumping wells and observation piezometers located near the pits are measured approximately monthly for operational purposes, and the data are presented in the Annual Hydrogeologic Update Report submitted to BLM and UDEQ. Water levels will be measured in accordance with the standard operating procedures. Time-contiguous water level data will be collected, to the extent possible.

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[3] UDEQ, 2012. Ground Water Quality Discharge Permit No. UGW37005, modified and re-issued to Lisbon Valley Mining Co., LLC.

Table 1. Water Level Measurement Locations and Frequency

I. Water Levels Measured for Discharge Permit UGW37005	
Well / Piezometer ID	**Water Level Measurement Frequency**
SLV-2	Quarterly
SLV-3	Quarterly (dry[1])
94MW2	Quarterly (dry[2])
94MW4	Quarterly[3]
MW96-7A	Quarterly
MW96-7B	Quarterly
MW97-8	Quarterly (dry[4])
MW97-9	Quarterly
MW97-11	Quarterly
MW97-13	Quarterly
MW05-14	Quarterly (dry[4])
MW06-15	Quarterly

II. Water Levels Measured for Mine Operations	
Well / Piezometer ID	**Water Level Measurement Frequency**
PW-2	Monthly
PW-3	Monthly
PW-5	Monthly
PW-6	Monthly
PW-7	Monthly
98R4	Monthly
98R8	Monthly
4R44	Monthly
PW-8	Quarterly[6]
PW-9	Annually[5]
PW-10	Annually[5]
PW-11	Monthly
PW-12	Monthly

NOTES:

(1) Well SLV-3 went dry in April 2006, as a result of planned dewatering of the Centennial Pit

(2) Well 94MW2 went dry between October 2005 and March 2006 as a result of pumping from wells PW-5 and PW-6 for water supply

(3) Well 94MW4 typically contains insufficient water for sampling

(4) Wells MW97-8 and MW05-14 have been dry since drilled

(5) Pumping wells PW-9 and PW-10 will be monitored at least annually while no mine pumping is occurring in the area

(6) Access to PW-8 is limited by sounder tube diameter and depth; Water level monitoring may not be possible in some quarters

Water Quality Sampling Frequency

Water quality will be sampled routinely in monitoring wells and water supply wells at the Lisbon Valley Mine. The list of wells to be sampled for water quality will be reviewed on an annual basis, as described in in the Sampling and Analysis Plan (SAP) (LVMC, 2012). In general, the sampling approach can be divided into a three periods: pre-mining, operation period, and post-mining. The sampling frequency for each of these periods is discussed below:

Pre-mining Period

Monitoring wells were sampled quarterly, semi-annually, and annually from 1994 to 2004 to establish pre-mining baseline conditions.

Operational Period

During operations, wells will be monitored according to the frequency given in Table 2. Shallow wells (typically <600 ft. deep) will be sampled quarterly during operations and deep wells (N-aquifer wells typically 1,000 – 1,440 ft. deep) will typically be sampled annually. The well sampling list will be reviewed annually, to determine which wells are should be included or excluded from the sampling program, in accordance with the SAP.

A post-mine monitoring well will be drilled to provide additional monitoring of the Burro Canyon Aquifer near the Centennial Pit during and after backfilling. The proposed well location is shown in Figures 3-4. Quarterly monitoring is proposed.

Post-mining Period

The list of wells and the frequency of groundwater sampling during the post-mining period will be developed prior to the end of mining operations, and will be based on data collected during operations. At that time, additional wells may be available for sampling, and additional information about the hydrogeologic system can be factored in to the post-operation sampling plan. Monitoring will likely take place annually after mining for a period of time to be determined by LVMC and UDEQ. If no degradation of water quality is evident during the monitoring period, the monitoring frequency should be decreased and wells should be sampled for a limited suite of analytes only, until a finding of "no impact" is established.

Table 2. Water Quality Sampling Locations and Frequency During LVMC Mine Operations

Well ID	Sampling Frequency
SLV-2	Quarterly
SLV-3 → PW-3 (1)	Quarterly
94MW2 → PW-6 (2)	Quarterly
94MW4	Quarterly(3)
MW96-7A	Quarterly
MW96-7B	Annually
MW97-9	Annually
MW97-11	Annually
MW97-13	Annually
MW06-15	Quarterly
MW15-16 (Planned)	Quarterly

NOTES: (1) Well SLV-3 went dry as a result of pumping for water supply. Well PW-3 substituted as of May 2006.
(2) Well 94MW2 went dry as a result of pumping for water supply. Well PW-6 substituted as of May 2006.
(3) 94MW4 typically contains insufficient water for sampling
Annual water quality monitoring of active water supply wells will also be conducted, in accordance with the ROD

Analytical Suite

The list of parameters to be analyzed in groundwater was developed in 1994 – 1996 and revised in 2006 based on over ten years of monitoring results. Phosphorus was added to the analytical suite in May, 2012. The Comprehensive Analytical Suite for groundwater monitoring at the Lisbon Valley Mine is provided in Table 3. In summary, the Comprehensive Suite includes the following parameters:

Major ions: Ca, Mg, Na, K, HCO_3^-, SO_4^{-2}, PO_3^{-2} as P, Cl^-, F^-

Dissolved Metals: Al, Sb, As, Ba, Be, Cd, Cr, Cu, Fe, Pb, Mn, Hg, Mo, Ni, Se, Si, Ag, Tl, V, Zn

Total Metals: U

Radionuclides: gross alpha, gross beta

Other Parameters: temperature, pH, conductivity, TDS, TSS, total alkalinity, hardness, nitrate, nitrite, ammonia

Analytes that are consistently below detection limits will be evaluated and possibly omitted from quarterly or annual sampling. A limited analytical suite may be developed on a well-specific basis. Elements such as uranium, copper, and nickel which occur in the orebody will not be eliminated from sampling.

Table 3. Groundwater Analytical Suite

Parameter	Units	Method	Utah Groundwater Quality Standards	Utah Primary Drinking Standards	Secondary Drinking Water Standards
Dissolved Aluminum	mg/L	EPA 200.7			0.5-0.2
Dissolved Antimony	mg/L	EPA 200.8	0.006	0.006	
Dissolved Arsenic	mg/L	EPA 200.8	0.05	0.010	
Dissolved Barium	mg/L	EPA 200.7	2.0	2.0	
Dissolved Beryllium	mg/L	EPA 200.8	0.004	0.004	
Dissolved Cadmium	mg/L	EPA 200.8	0.005	0.005	
Dissolved Calcium	mg/L	EPA 200.7			
Dissolved Chromium	mg/L	EPA 200.8	0.1	0.1	
Dissolved Copper	mg/L	EPA 200.7	1.3	1.3	1.0
Dissolved Iron	mg/L	EPA 200.7			0.3
Dissolved Lead	mg/L	EPA 200.8	0.015	0.015	
Dissolved Magnesium	mg/L	EPA 200.7			
Dissolved Manganese	mg/L	EPA 200.7			0.05
Dissolved Mercury	mg/L	EPA 245.1	0.002	0.002	
Dissolved Molybdenum	mg/L	EPA 200.7			
Dissolved Nickel	mg/L	EPA 200.7			
Dissolved Potassium	mg/L	EPA 200.7			
Dissolved Selenium	mg/L	SM 3114B	0.05	0.05	
Dissolved Silica	mg/L	EPA 200.7			
Dissolved Silver	mg/L	EPA 200.8	0.1		0.1
Dissolved Sodium	mg/L	EPA 200.7			
Dissolved Thallium	mg/L	EPA 200.8	0.002	0.002	
Dissolved Vanadium	mg/L	EPA 200.7			
Dissolved Zinc	mg/L	EPA 200.7	5.0		5.0
Ammonia as NH_3-N	mg/L	EPA 350.1			
Nitrate as NO_3-N	mg/L	EPA 353.2	10	10	
Nitrite as NO_2-N	mg/L	EPA 354.1	1.0	1.0	
NO_3-N + NO_2-N	mg/L	EPA 353.2	10.0	10.0	
Chloride	mg/L	SM 4500 Cl-E			250
Fluoride	mg/L	SM 4500 F-C	4.0	4.0	2.0
Sulfate	mg/L	SM 4500 SO4-D		1,000	250
Phosphorus	mg/L	EPA 365.1			
pH	units	SM 4500 H+B			6.50-8.5
Conductivity	µmhos/cm	SM 2510B			
Hardness as $CaCO_3$	mg/L	SM 2340B			
TSS	mg/L	SM 2540D			
TDS	mg/L	SM 2540C		2,000	500
Alkalinity as $CaCO_3$, total	mg/L	SM 2320B			
Uranium (total)	mg/L	EPA 200.8	0.03	0.03	
Gross Alpha	pCi/L	EPA 9310	15 pCi/L [1]	15 pCi/L [1]	
Gross Beta	pCi/L	EPA 9310	8 pCi/L [2]	8 pCi/L [2]	

Notes: Water quality results will be compared to the well-specific background levels and protection levels identified in the Ground Water Discharge Permit.

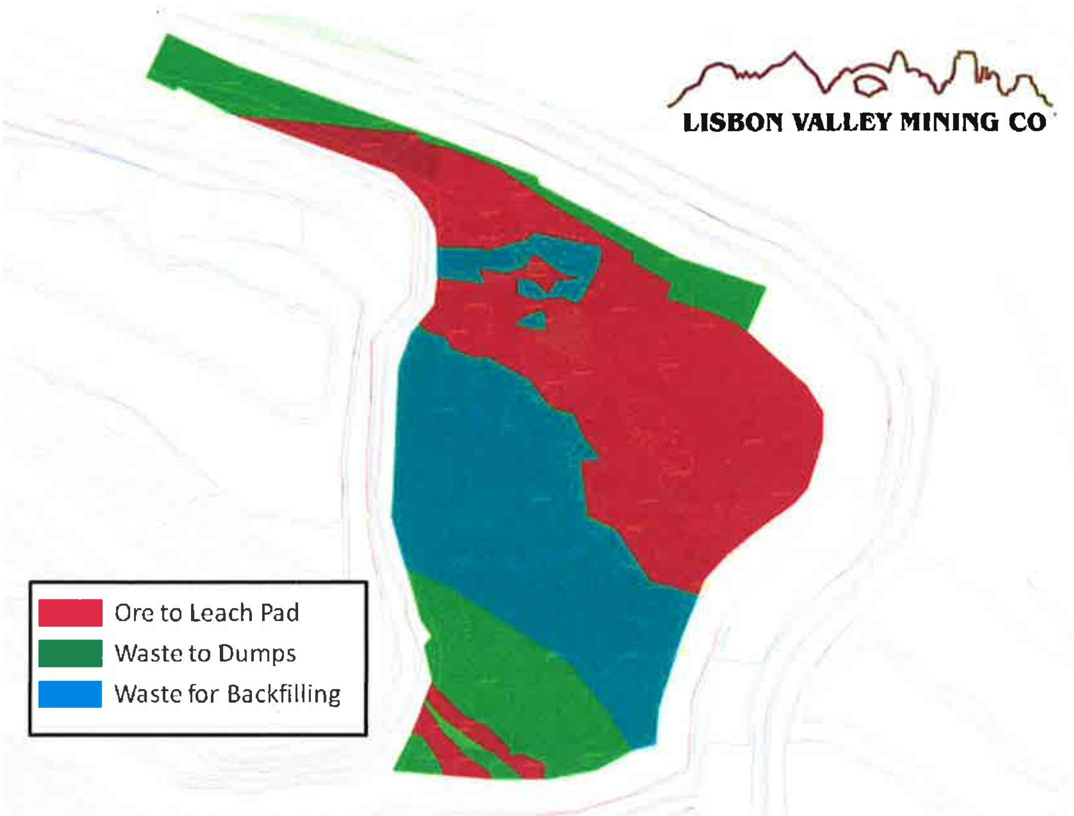
(1) Excludes activity due to uranium

(2) Standard of 4 mrem/yr converted to 8 pCi/L assuming all activity due to Sr^{90} and 90 kg man consuming 2 liters of untreated groundwater per day. EPA Action Level is 50 pCi/L.

Waste Management Plan

Waste management starts at the blast holes. Samples are taken from the drill cuttings and sent to the LMVC laboratory for assaying. The assay results will allow the Mine Geologist to determine ore and waste mining boundaries based upon known blast hole locations. Waste rock beds for backfilling will be identified on a mining bench using the 3D Geology model and verified in blast holes and blasted material by the Mine Geologist. The blast holes will then be loaded with explosives, filled with drill cuttings or crushed gravel and then detonated in a sequence that allows for optimum rock breakage. After blasting, the blasted material will be marked using survey grade GPS equipment to delineate ore and waste. Maps representing the ore, waste for backfill and waste for surface dumps will be illustrated on ore control maps and provided to operations personnel responsible for mining the material. An example waste management map is shown below.

Next, the material will be loaded into haul trucks and delivered to the appropriate location. Ore will be delivered to the leach pad or oversize stockpile and waste to either a surface waste dump area or an in-pit backfill area as described in the Proposed Location and Process Sequence section below. Shot material will generally consist of fragments less than 24 inches in diameter with occasional pieces exceeding that size. Waste rock that has acid-generating potential will be segregated by trained personnel and placed in appropriate, designated areas in accordance with LVMC Waste Rock Management Plan.



Example Waste Management Map

Interim Management Plan

Temporary and seasonal closures are not planned. Unnecessary or undue degradation inside the pit is not possible, since the backfill material is not toxic, nor deleterious. Interim management outside the pit area is provided by surface water diversion in accordance with LVMC's SWPPP.

Quality Assurance Plans

LVMC analyzes all of the blast holes, surveys and demarks ore/waste boundaries, and creates detailed geologic maps of the all pits as part of its grade control process.[4] This process provides the quality assurance (QA) necessary to identify waste to dumps and waste for backfill in accordance with the waste rock management plan (LVMC 2005).

Backfill Characteristics

Geochemical characterization was conducted to assess short-term and long-term water quality associated with the backfill material. The characterization program was conducted in several phases: 1) in support of the EIS, 2) for permit compliance and operational waste rock handling, and 3) to address deficiencies identified by the BLM regarding the use of static methods to predict long-term post-mining groundwater quality in saturated backfill.

Testing Overview

Bed 14 and Bed 15 material from the Centennial Pit area has been subject to extensive testing.

- Acid-base accounting (ABA)
- Static water leach testing using single and multiple extraction modified meteoric water mobility procedure (MWMP) and Synthetic Precipitation Leaching Procedure (SPLP) testing.
- Kinetic column testing following the procedures specified in the Final Work Plan for Additional Geochemical Testing of Lisbon Valley Mine Waste Rock.[5]
- Solid phase elemental analysis by inductively coupled plasma atomic emission spectroscopy and mass spectrometry (ICP-AES and ICP-MS);
- Mineralogy by transmitted light thin-section microscopy and Rietveld x-ray diffraction (XRD); and, In addition, six wall rock samples from the Sentinel West Pit were collected and composited into one Bed 14 and one Bed 15 sample and characterized. The Sentinel

Acid-base Accounting

The ABA methods used to characterize Bed 14 and Bed 15 waste rock include sulfur analysis and neutralization potential determination. Standard Sobek neutralization potential (Sobek et al. 1978; EPA M600/2-78-054) is the primary ABA method used over the life of the Project (1997 to present). This method involves heating a sample in excess acid until the reaction is complete and titrating the remaining unreacted acid with sodium hydroxide to a pH 7.0 endpoint. Results are reported in tons of calcium carbonate per kiloton of material (t $CaCO_3$/kt). Modified Sobek neutralization potential

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[4] LVMC 2008 Ore Grade Control Quality Assurance Plan. Aug 2008

[5] Whetstone 2014. Workplan for Additional Geochemical Testing of Waste Rock Jan 2014

(Lawrence et al. 1989) was used to characterize the samples subjected to column testing. The Modified Sobek method largely follows the standard Sobek methodology except the sample is treated with excess acid at ambient temperature for a 24 hour (hr) period and titrated to a pH 8.3 endpoint.

ABA Results

ABA conducted for the 1997 FEIS, operational characterization (2005 through 2013), and for the column testing program (2014), demonstrates that the Bed 14 and Bed 15 backfill material is unlikely to generate acid due to high excess acid neutralization potential (ANP) compared to acid generation potential (AGP), as detailed below. ABA is used to estimate the capacity of material to produce and neutralize acid. ABA methods compare the acid AGP with the ANP for a given material using either the total sulfur or sulfide sulfur content. ABA results were used to determine the neutralization potential ratio (NPR = ANP/AGP) and net neutralization potential (NNP), where NNP is the difference between the ANP and AGP (i.e., NNP = ANP - AGP). These criteria are commonly used to categorize material into potentially acid-generating (PAG) or nonacid- generating (non-PAG). Many interpretation schemes have been developed to assess the potential for acid generation using either ANP/AGP or NNP. The BLM uses criteria that categorize samples with ANP/AGP of three or greater and NNP greater than +20 t CaCO3/kt as non-PAG. In contrast, materials with NNP less than -20 t CaCO3/kt and ANP/AGP less than one are considered PAG. Values between these designations are considered to have uncertain acid-generating characteristics The bulk of the waste rock at LVM is low sulfur and considered highly acid neutralizing, as illustrated by plotting the NNP as a function of sulfide sulfur. The Bed 14 and Bed 15 waste rock samples had an average NNP of 187.2 t CaCO3/kt. Of the 135 samples subjected to ABA, one sample was characterized as PAG using an NNP criteria for PAG rock of -20 t CaCO3/kt. Six samples were characterized as PAG using an NPR less than one. Three of these samples were collected within the perimeter of the GTO and Sentinel pits, and three were collected from within the Centennial Pit. The Bed 14 and Bed 15 samples collected from the Centennial Pit for the column testing program were fairly low sulfur (0.03 to 0.06 wt. % sulfide sulfur) with high excess ANP in the Bed 14 limestone sample (and replicate) compared to the Bed 15 sandstone sample as discussed in the mineralogy section below. The Bed 14 and Bed 15 waste rock samples collected from the Sentinel West Pit for the column testing program were also non-PAG, with total sulfur below the reporting limit (< 0.01 wt. %) and high excess ANP in the Bed 14 limestone sample compared to the Bed 15 sandstone sample, consistent with samples collected from Centennial Pit . Overall, the ABA results demonstrate the non-acid generating character of the backfill, which is supported by the mineralogy as discussed below.

Static Water Leach Testing

Standard MWMP testing, multiple extraction MWMP testing, and SPLP were conducted on representative samples of waste rock from Centennial Pit, as described below. MWMP testing was used to characterize the potential chemistry of meteoric water infiltrating through unsaturated waste rock. MWMP testing was conducted on samples of waste rock from Bed 14 and Bed 15. Standard MWMP testing consists of a single extraction column leach over a 24-hour period using Type II reagent grade deionized water (total dissolved solids [TDS] = 0 mg/L) and a 1:1 waste rock to extraction fluid ratio. LVM conducts single extraction MWMP testing on a quarterly basis on composite waste rock samples as part of the operational characterization program. Prior to 2011, MWMP testing was conducted using extraction solutions ranging from pH 5.7 to 9.0. In 2011, Whetstone demonstrated that a pH 7 extraction solution was appropriate given that the median pH of the Burro Canyon aquifer is 7.1 (Whetstone 2011). Quarterly MWMP leachate samples are typically analyzed for eight metals including antimony, arsenic, cadmium, copper, molybdenum, selenium, uranium, and zinc. In 2012 (3rd quarter), MWMP testing was expanded to include a larger analytical suite (i.e., major ions and dissolved metals) and lower method detection limits. Multiple extraction MWMP testing was also conducted on representative waste rock samples from the Centennial Pit (one Bed 14 sample and one Bed 15 sample) to provide an indication of leachable concentrations over time. Multiple extraction MWMP testing follows the same procedures as described above for the standard MWMP with the addition of repeat extractions over a 24-hour period for each extraction step. In this case, each column was leached four times using new pH 7 extraction fluid. Leachates from standard and multiple MWMP tests were filtered prior to analysis. SPLP testing was conducted on waste rock samples as part of the FEIS (BLM 1997a). Four composite samples were analyzed: 1) Beds 6, 7, 8 of Dakota Sandstone; 2) Beds 9 and 10 of Dakota Sandstone; 3) Bed 14 Burro Canyon Mudstone; and 4) Bed 14 Burro Canyon Limestone. SPLP uses a water-to-rock ratio of 20:1 and an acidic extraction solution (pH 5). For this study, MWMP results more adequately represent post-closure backfill leachate quality than SPLP due to the lower water to rock ratio and the use of a neutral to alkaline extraction solution, which is characteristic of Burro Canyon aquifer groundwater that would be in contact with the backfill.

Single Extraction Leach Results

MWMP test results demonstrate that water in contact with the backfill will have a neutral to alkaline pH and will not leach high concentrations of metals. In addition, the leachate results demonstrate that highly alkaline leachate will not be generated by backfilling the Centennial Pit. The non-potentially acid generating (non-PAG) nature of the backfill is supported by the range of effluent pH values observed for the MWMP test samples (pH 6.3 to 8.5) and pH 8.1 to 8.2 water pooled in the Penny Phase (southwestern portion of the Centennial Pit) for short periods following rainfall events provide a statistical comparison of the different datasets. Each box and whisker plot displays the upper and lower quartiles of the data by the top and bottom of a rectangle and the median is represented by a horizontal line segment. The spread of the bulk of the data (central 50%) is seen as the length of the box. The tails of the distribution are provided by a line extending from the top and bottom of the box. The data points displayed outside of the "whiskers" may be considered outliers or values that may be implausibly large or small, although they may not necessarily be outliers in a true statistical sense. Average MWMP leachate concentrations for eight metals routinely analyzed were generally below the associated Standards. Of the 52 samples tested, the following exceedances were observed: Seven MWMP leachate samples resulted in selenium concentrations that exceeded the Utah groundwater quality standard, with a maximum concentration of 0.08 mg/L, compared to the standard of 0.05 mg/L. Three of the seven samples were samples subjected to column testing.

Multiple Extraction MWMP Testing Results

The multiple extraction MWMP leachate pH values ranged from pH 6.6 to 7.5 for Bed 15 waste rock and from 7.1 to 8.4 from Bed 14 waste rock, which contains limestone. For the multiple extraction MWMP tests on Bed 14 and Bed 15 waste rock samples leachate concentrations were below Standards (UAC R317-6-2.1 Table 1) for the parameters tested. Multiple extraction MWMP tests demonstrate that in general leachate concentrations will decrease and pH will increase with each subsequent extraction. However, there are a few exceptions to this trend on the fourth extraction. For example, aluminum, which does not have an associated Groundwater Quality Standard, increased from approximately 0.03 mg/L to 0.25 mg/L on the fourth extraction. Concentrations of iron, silica, and sodium also increase on the fourth extraction for both the Bed 14 and Bed 15 sample. Due to the low concentrations leached after three extractions through the column and the low ionic strength of the extraction solution (Type II reagent grade deionized water), results from the fourth extraction through the column may not be representative of leaching under natural conditions at the mine. The low ionic strength of the leached solution after the initial extraction demonstrates that the backfill material is relatively non-reactive.

Leachate concentrations of several analytes decreased over time, including selenium and uranium. Selenium was detected at a maximum concentration of 0.0033 mg/L on the first extraction from the Bed 15 MWMP column and decreased to 0.0001 mg/L and <0.0001 mg/L after the fourth extraction from Beds 14 and 15 waste rock, respectively. Uranium was present at a maximum concentration of 0.0053 mg/L on the first extraction through Bed 14 column and decreased to 0.0005 mg/L for the subsequent extraction from both Bed 14 and Bed 15 waste rock samples. These results suggest that a "first flush" from the backfill will occur. However, first flush concentrations were low and concentrations will decrease over time. Multiple extraction MWMP test leachates for Bed 14 and Bed 15 waste rock samples were below Standards. Leached concentrations were also lower than average concentrations reported for the Burro Canyon aquifer in the vicinity of the Centennial Pit, except for one or more detections of aluminum, silica, vanadium, and fluoride. These parameters are not expected to be problematic, as described in the bullet list below.

- The aluminum concentration generated from the fourth extraction through the Bed 15 waste rock MWMP column was 0.25 mg/L, which was above the Burro Canyon aquifer average concentration of 0.062 mg/L. Leach concentrations from the first three extractions remained below 0.06 mg/L. As described above, the fourth extraction through the column may not be representative of natural leaching conditions due to the low ionic strength of the extraction solution and removal of readily leachable salts from the previous three extractions.
- MWMP silica concentrations range from 8.0 to 11.4 mg/L, which was above the average concentration for the Burro Canyon aquifer (7.1 mg/L). However, the silica concentrations from the MWMP tests were within range of reported values for the Burro Canyon aquifer, which had a maximum silica concentration of 14.9 mg/L for wells in the vicinity of the Centennial Pit.
- Several vanadium concentrations from MWMP leachate (maximum of 0.009 mg/L) were higher than the average Burro Canyon concentration of 0.006 mg/L. However, the vanadium detections from the MWMP test were estimated concentrations (between the practical quantitation limit and method detection limit) and are below the maximum concentration reported for the Burro Canyon aquifer (0.050 mg/L). Vanadium does not have an associated Standard.
- Fluoride concentrations for the Bed 14 MWMP column sample ranged from 1.8 mg/L for the initial extraction to 0.3 mg/L after the fourth extraction. Concentrations from first, second, and third extraction were greater than the average Burro Canyon aquifer concentration of 0.4 mg/L. Fluoride concentrations for the Bed 15

MWMP column results were lower, ranging from 0.2 mg/L for the first extraction to less than 0.1 mg/L for subsequent leaching steps. Leached fluoride concentrations were below the Utah groundwater quality standard of 4 mg/L. For the eight metals routinely analyzed, average concentrations of antimony, arsenic, cadmium, copper, molybdenum, uranium, and zinc for Bed 14 were lower than average concentrations for the Burro Canyon aquifer, as represented by wells in the vicinity of the pit (wells SLV-1A, SLV-3, MW-2A, and MW96-7A). This is illustrated with box-and-whisker plots of the selenium and uranium concentrations in the Burro Canyon aquifer and the single extraction MWMP leachate concentrations for Bed 14 waste rock. On average, uranium in the Burro Canyon aquifer was significantly higher than concentrations obtained during single extraction water leaching of Bed 14 and Bed 15 waste rock. As discussed above, the maximum uranium concentrations obtained by multiple extraction MWMP testing on Bed 14 and Bed 15 waste rock samples (0.0053 and 0.0036 mg/L, respectively) occurred during the first extraction, which is well below the average uranium concentration of 0.092 mg/L in the Burro Canyon aquifer. The maximum selenium concentration for the multiple extraction MWMP tests was 0.0004 mg/L for Bed 14 waste rock and 0.0033 mg/L for Bed 15 waste rock, compared to an average Burro Canyon aquifer concentration of 0.003 mg/L.

The characterization program demonstrated that the Bed 14 and Bed 15 backfill material is not acid-generating and is not likely to generate highly alkaline leachates. Single and multiple extract MWMP testing showed that leached concentrations of constituents are generally lower than the average concentrations for the shallow aquifer at the site (Burro Canyon aquifer) and largely below the Utah groundwater quality standards (Utah Administrative Code [UAC] R317-6-2.1). Similarly, the Centennial Pit Bed 14 and Bed 15 column leachates met the standards for all constituents except uranium and selenium. Multiple extraction MWMP test and column leachate concentrations decreased over time after an initial "first flush". MWMP test and column leachates were well buffered solutions with calcium-sulfate compositions. The major ion composition of the leachates was consistent throughout the leaching cycles, although the total dissolved ions generally decreased with subsequent leaching cycles. Characterization of Bed 14 and Bed 15 samples from the Sentinel West Pit demonstrated the similarity between each bed collected from different pits.

Saturated Column Testing

Monolithic columns were prepared to provide quantitative estimates of the leaching characteristics of waste rock proposed for backfilling in the Centennial and Sentinel West pits under saturated conditions. The column testing was designed to simulate Burro Canyon aquifer groundwater coming in contact with the pit backfill after mining when the pumps are shut off.
The monolithic columns provided individual drainage chemistry information associated with Bed 14 and Bed 15 waste rock, which are visually distinct rock types that may be selectively handled. Four composite samples and one replicate sample (20-kg each) were subjected to saturated column testing, including

- two composite samples from Centennial Pit Bed 14 (primary and replicate) and one composite sample from Centennial Pit Bed 15; and,
- one composite sample each from Sentinel West Pit Bed 14 and Bed 15.

Each test was performed in a clear polyvinyl chloride (PVC) column, with an inside diameter of 6-inches, and approximately 36 inches in length. The columns were configured in parallel to permit simultaneous sample collection. The columns were operated under upward flow conditions by applying the head solution to the bottom of the column and collecting the effluent from the top. No evidence of preferential flow, bacterial activity (biofilms), or mineral precipitates was observed with the exception of an orange precipitate in the Centennial Pit Bed 15 column discharge tube, which was observed three days before the third pore volume (PV3) was collected and the columns were shut down.

The test procedure involved repeated leaching cycles using Burro Canyon aquifer groundwater (PW-3) followed by a reaction period. Specifically, initial saturation of each column took approximately one day at a rate of 200 ml/hr (±1%), followed by a 3-day reaction period, and a 10-day solution application period at a rate of 15 ml/hr (±3%) to generate effluent for chemical analysis. Each leaching cycle was designed to produce 3,600 ml (± 5%), or approximately one pore volume. Column tests were performed for three leaching cycles (approximately 40 days). The first cycle included collection of column effluent in two aliquots representing the first (PV0.5) and second (PV1) half pore volumes of solution released from each column. Each leaching cycle after the first cycle required 10 days to complete and included a reaction period (3 days) to allow solution to react with the solid sample and a solution application period (10 days)at an application rate of 15 ml/hr (±3%). The analyte list for the column leachates included bulk parameters (effluent volume, temperature, pH, dissolved oxygen [DO], oxidation-reduction potential [ORP], and electrical conductivity [EC]) and analysis of major ions, dissolved metals, and other solution parameters needed to evaluate compliance with water quality standards contained in UAC R317-6-2 and to assess long-term water quality.

Elemental Analysis

Solid phase element analysis provides the near-total elemental composition and gives an indication of the potential load of constituents to the environment. Elemental analysis of samples subjected to column testing was performed by acid digestion using EPA method 3050B followed by ICP-AES (EPA 6010) or ICP-MS (EPA 6020) analysis. EPA method 3050B is not a total digestion (e.g., four acid digestion) since some elements bound in silicate structures may not be dissolved by the procedure. Acid digestion of the MWMP samples was conducted using EPA method 3052, which is a microwave assisted four acid digestion that results in total sample decomposition.

The elemental compositions of Bed 14 and Bed 15 waste rock samples, including the metals/metalloids historically monitored as part of the operational MWMP testing (antimony, arsenic, cadmium, copper, molybdenum, selenium, uranium, and zinc), are presented includes results for additional elements analyzed as part of the column study program. The results were compared to the average crustal abundance for sedimentary rocks, specifically carbonate rocks and sandstone (Turekian and Wedepohl 1961). The elemental composition of several Bed 14 samples from the Adrian Brown Consultants (1997) study were elevated in cadmium, copper, and molybdenum compared to a screening criteria of 10 times the crustal abundance. The Bed 14 and 15 samples subjected to column testing were also elevated in cadmium and copper but not molybdenum. The detection limits for antimony made comparisons difficult; however, the recent results suggest antimony was not enriched. It is important to note that enrichment in the solid phase is not necessarily indicative of mobility in water. The uranium and selenium content of samples subjected to column testing was at or near the average crustal abundance.

Mineralogy

The thin-section analysis was used to provide information about the texture, mineralogy (non-opaque), weathering, cementation, and porosity of the samples. Samples for the analysis were oriented with respect to bedding, impregnated with epoxy resin, mounted on glass slides, and ground to a thickness of 30 μm. The thin sections were examined using a Zeiss Axioskop 40 petrographic microscope equipped with an electromechanical stage and Leica digital camera. XRD analysis provided a quantitative assessment of the different mineral phases and distinguished and quantified clay minerals. The waste rock samples were reduced to the optimum grain size range for quantitative X-ray analysis (<10 · m) by grinding in a McCrone Micronizing mill. The bulk and clay fractions of each sample were analyzed using a PANalytical X'Pert Pro x-ray diffractometer equipped with a PIXcel detector. Samples were scanned from 2 to 60°2· . Phase identification was performed using PANalytical HighScore Plus software and the digital International Centre for Diffraction Data (ICDD) database. Quantitative mineralogy was performed using full powder pattern Rietveld analysis.

One sample each from Centennial Pit Beds 14 and 15 were subjected to transmitted light thin-section microscopy (thin-section analysis) and quantitative XRD analysis. One sample each from Sentinel Pit Beds 14 and 15 were also subjected to mineralogical analyses as discussed in additional detail in the.

The thin section and XRD analyses indicate both Centennial Pit samples have low pyrite (0 - 1%) content, which was the only sulfide mineral identified. Apatite grains were visible in small quantities in thin section and shown by XRD to be calciumfluorapatite (CFA) in trace amounts (< 1 weight %). The Centennial Pit Bed 14 sample was a sandy, argillaceous limestone with minor detrital quartz and no identifiable allochems. XRD analysis indicated that the Bed 14 sample was primarily composed of calcite (48%) and quartz (37%) with minor pyrite (1%). The sample contained 14% total clays, which were dominated by illite. The Centennial Pit Bed 15 sample was a massive, moderately well-sorted, clean, finegrained sandstone with well-developed intergranular macroporosity. Weathering was apparent in the sample grains, which were coated by films of clay cement with the interiors of some pores filled by masses of kaolinite clay cement. The grain rimming clay was identified as possibly illuviated rather than authigenic, further indication of weathering. In contrast to the Bed 14 sample, the Bed 15 sample was dominantly quartz (91%) with trace carbonate minerals and pyrite. Kaolinite (6%), with subordinate illite (1%) were the primary clay minerals. Lazurite, a sulfate-sulfur-chloride0 tectosilicate, which is a non-acid generating sulfur-containing mineral, comprised 2% of the sample.

The Sentinel West Pit and Centennial Pit samples had similar mineralogy demonstrating the low variability in the geochemistry of each bed across different deposits at the LVM. The mineralogical analysis is consistent with the ABA results presented above, with excess ANP associated with the limestone samples, and low overall sulfide sulfur.

Particle Size Distribution

Particle size analysis using modified ASTM 702-98 (ASTM 1998) was conducted on waste rock samples subjected to saturated column testing. The as-received samples were air-dried to stable weight (21 ± 3 degrees Celsius [°C]) and screened to pass a 0.75-inch wire mesh screen. Oversized material was reduced by hand breaking or jaw crushing to meet the size specification. Furthermore, the MWMP testing included a determination of the portion of particles greater than 5 cm (2 inches) size, which provides some indication of the particle size distribution.

Reclamation Plan

Erosion Control

There is no requirement to control erosion or runoff (meteoric run on) in the open pit. However, the same is reduced as a function of backfilling which reduces the surface area pf the pit. Outside the pit, surface runoff is diverted around the pit in accordance with an approved Storm Water Pollution Prevention Plan SWPPP.[6] A 3' minimum height berm is planned for post mine closure around the pit. This berm is shown in Figures 1-2 along with the current storm water diversion channels. LVMC is currently permitted to leave the pit open. Backfilling the pit serves to buttress the walls and will provide additional stability relative to the final height. Stability is increased by additional backfill.

[6] UPDES Multi-Sector Storm Water Permit for Industrial Activity, Permit UTR000737.

Economic, Environmental, and Safety Factors

Economic Factors	Environmental	Safety
Backfilling the pit reduces haul costs \$0.3/ton relative to mean distance hauls to LVMC permitted above-ground dumps.	LVMC abides by a fugitive dust control plan for control of all dust sources associated with the Lisbon Valley open pit copper mine. This plan contains sufficient controls to prevent an increase in PM IO emissions. Dust emissions increase as a function of haul distance. The haul distance is reduced by backfilling relative to all pits. Fuel use, and related emissions are reduced. The groundwater used for dust control is reduced accordingly.	Safety is increased as a function of reduced haul distance and partially backfilled pit. The backfilled pit will not contain a pit pool.

Wildlife and Fisheries Habitat Rehabilitation

The backfilled pit has vegetation potential unlike the open pit that will contain a pit pool.[7] Loss of wildlife habitat will be reduced by a function of backfilled area.

Isolation, Removal, and/or Control of Acid-forming, Toxic, or Deleterious Materials

Acid-forming waste is encapsulated in the dumps in accordance with the waste rock management plan.[8] None of the waste is considered toxic or deleterious.[9]

Post-closure Management

LVMC will manage the pit after closure with fencing, berms, and re-seeding signage in accordance with the Mitigation & Monitoring Plan.[10] This will include surface water management in accordance with the SWPPP and long term groundwater monitoring in accordance with the reclamation bond.
The boundaries of the area of the operation; The Centennial Pit comprises the operation boundaries. All activities will occur inside the pit.

Sedimentation of Surface Water

There are no natural surface water bodies or streams within ½ mile of the Centennial Pit. Further excess sedimentation cannot occur cannot from inside the pit. Sedimentation outside the pit is managed by surface water diversion and retention. This is shown on Figures 3-4.

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[7] WP Resource Consulting Inc 2012. Lisbon Valley Mining Company Reclamation Guidelines September 2012.

[8] Lisbon Valley Mining Co LLC 2013. Waste Rock Sampling Plan Rev 2. 3 April 2013

[9] Lisbon Valley Mining Co LLC 2005-2013. Annual Waste Rock Monitoring Reports

[10] USBLM 1997. Mitigation & Monitoring Plan Final Environmental Impact Statement February 1997

Acreage Disturbance

An estimate of the number of acres affected by each type of disturbance. The permitted Centennial Pit boundary is 176 acres. This disturbance will be reduced and partially reclaimed by backfilling. The area of backfill is dependent on volume.

Backfill Volume (MM tons)	Backfill Area (acres)	% Reclamation
7	50	28%
25	106	60%
50	128	73%
75	152	86%

Proposed Productive Post-mining Use of the Land

The backfilled waste is suitable for revegetation. It will be aerially re-seeded prior to closure.

Proposed Reclamation Schedule

The reclamation schedule is dependent on mine life. The present mine life is 5-10 years.

Proposed Post-mining Topography

Post-mining topography is shown in Figures 3-4. The proposed backfill surface is flat to enhance evaporation.

Slope Stability

No backfilled slopes are proposed, only ramps into and out of the pit. These ramps are <10%.

Concurrent Reclamation

Concurrent reclamation is achieved as a function of the backfill sequence. As one phase of the pit is completed, it is backfilled by the next phase, and so on. Concurrent reclamation is intrinsic to the backfilling sequences.

Statement of Reclamation Constraints

Backfilling (reclamation) is constrained only by the phases of the mining, which provide the backfilling opportunity. More phases increase opportunity and volume. Less phases constrain the same.

Description of any necessary monitoring and maintenance of fences, signs and other structures which will be performed by the operator on the reclaimed land

Post-closure cattle fencing and berms will be constructed in accordance with Mitigation and Monitoring Plan (BLM 1997).

Effect on Future Mining

The reclamation will not affect future mining in the area. Additional deposits below the pit are too deep to mine by open-pit methods.

Effect on Public Safety

Public safety will be improved as a function of the reduced depth of the backfilled pit, and elimination of any potential groundwater pit pool. The flat backfilled surface will reduce the chances of meteoric ponds.

Operator Statement

L VMC agrees to backfill the Centennial Pit above the pre-mine water level (6200 ft amsl) with a mixture of Bed 14/15 waste. The Bed 14 component will be at least 75%. The process will be managed daily, reported annually, and at closure to document the final backfill elevation and mixture.

Acknowledgements

This reclamation plan is consistent with the plan of operations.

- It is understood that approval of this plan does not relieve LVMC of responsibility to comply with any other applicable State or Federal laws, rules or regulations.

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