

# PLAN OF OPERATIONS

*for Dolomite Mining  
Deming, New Mexico*

July 2017

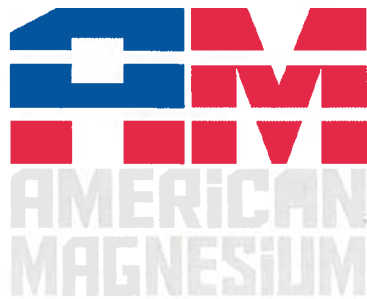
Prepared for:



**U.S. DEPARTMENT OF THE INTERIOR  
BUREAU OF LAND MANAGEMENT – Las Cruces  
Field Office**

Submitted by:

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Prepared by:



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## EXECUTIVE SUMMARY

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This Plan of Operations (PoO) is submitted to the Bureau of Land Management, Las Cruces Office (BLM), and the New Mexico Energy, Minerals and Natural Resources Department (EMNRD) Mining and Minerals Division (MMD) by Amec Foster Wheeler, Environment & Infrastructure, Inc. (Amec Foster Wheeler) for the American Magnesium Mining Project (Project) located near Deming, New Mexico. The Project is administered by American Magnesium, LLC (AmMg), a New Mexico limited liability company. As outlined in Section 1.1 of this Plan, AmMg will be the operator. This PoO is submitted in accordance with BLM Surface Management Regulations 43 Code of Federal Regulations (CFR) 3809, as amended, and New Mexico Mining Act Reclamation Program regulations at New Mexico Administrative Code (NMAC) 19.10.3. This PoO is intended both to satisfy the BLM's requirements for a plan of operations and to supplement and support AmMg's corresponding application to MMD for a Subpart 3 minimal impact new mining operations permit for mining development and reclamation. This application is for mining operations, which include mine planning, mining, and reclamation.

The Project is located on public lands administered by the BLM in part or all of Sections 26 & 27, Township 25 South, Range 8 West, NMPM, in the Little Florida Mountains Mining District, Luna County, New Mexico (Project Area). The Project Area includes approximately 44 acres. Project disturbance and bonding will occur in phases. There are approximately 8.6 miles of existing road that will be utilized for Project access. Figure 1 shows the Project Area. Figure 2 shows the proposed Phase I Project access roads within the Project Area.

AmMg proposes to create, over the life of the project, a total of 44 acres of surface disturbance under this PoO. At any given time during the project, however, there will be no more than 40 un-reclaimed acres of disturbance at one time. All 44 acres of anticipated total new disturbance will be analyzed as required under the National Environmental Policy Act. The mine planning activities covered under this Plan consist of the following: drilling reverse circulation and core holes for mine planning, blasting operations (using the mine planning drill holes), geologic and geophysical mapping, construction of resource verification roads, drill sites, sumps, and maintenance of the existing roads within the Project Area and the Project access roads and reclamation of Project-related surface disturbance.

Table 1 outlines the total acreage of authorized and proposed surface disturbance, by type of disturbance. The proposed disturbance under Phase I will create a total of approximately 15 acres of new surface disturbance. The remaining surface disturbance acreage (29 acres) will be utilized through resource verification under subsequent phases over approximately five years. These phased activities will consist of the same type of activities as in the PoO, but the locations will be submitted as work plans to the BLM. The locations will be based on the success of previously completed resource verification activities. The work plans will

include maps that show the location of the proposed surface disturbance to ensure that all listed and eligible and unevaluated cultural resources or any other sensitive resources are avoided.

**Table 1: Acreage of Approved and Proposed Project Disturbance**

Surface Disturbing Activity	Disturbance		
	Proposed Phase I (acres)	Subsequent Phases (acres)	Total (acres)
Constructed Roads	0.5	0.5	1.0
Overland Travel	1.0	2.0	3.0
Drill Sites (Pads)	13.0	26.0	39.0
Existing Access Road Needing Rehabilitation	0.5	0.5	1.0
<b>TOTAL*</b>	15.0	29.0	44.0

\*No more than 40 acres of disturbance will occur at one time. The mining development project will be phased to reduce the amount of surface disturbance and incorporate rolling reclamation into the project.

**Table 2: Bonding for Existing and Proposed Disturbance under Phase I**

Proposed Phase I Acres	Total Bonded Disturbance Acres
15.0	44.0

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## ACRONYMS AND ABBREVIATIONS

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BGS	Below Ground Surface
BLM	Bureau of Land Management
BLS	Bureau of Labor Statistics
BMP	Best Management Practice
IO	Isolated Occurrence
MSHA	Mining Safety and Health Administration
MSL	Mean Sea Level
NIAS	NMCRIS Investigation Abstract Form
NMCRIS	New Mexico Cultural Resource Information System
NMDOT	New Mexico Department of Transportation
NMED	New Mexico Environment Department
NMOSE	New Mexico Office of the State Engineer
NRCS	Natural Resources Conservation Service (formerly the SCS)
PFYC	Potential Fossil Yield Classification
PoO	Plan of Operations
RC	Reverse Circulation
ROI	Region of Influence
SCS	Soil Conservation Service
SWPPP	Storm Water Pollution Prevention Plan
USDA	United States Department of Agriculture

## 1.0 APPLICANT INFORMATION [3809.401(b)(1)]

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### 1.1 Operator Information

Operator Name: American Magnesium LLC  
Mailing Address: 104 Rinconada  
PO Box 684  
Elephant Butte, NM 87935-0684  
Phone Number: (575) 741-1527  
Tax Payer Identification Number: EIN #46-2831543  
Point of Contact: David Q. Tognoni, PE  
104 Rinconada  
PO Box 684  
Elephant Butte, NM 87935-0684  
Office: (575) 741-1527  
Emergency Contact Information: David Q. Tognoni, PE  
104 Rinconada  
PO Box 684  
Elephant Butte, NM 87935-0684  
Office: (575) 741-1527

### 1.2 Claims Information

Owner(s): David Q. Tognoni  
Address: PO Box 684  
Elephant Butte, NM 87935-0684  
Primary Commodity: Magnesium  
Claim Name(s): MAG 21 Lode Claim  
MAG 22 Lode Claim  
Claim Type(s): Lode

#### Description:

MAG 21 Lode Claim				
1/4	Section	Township	Range	Meridian
SE	27	25 South	8 West	NMB&M
NE	34	25 South	8 West	NMB&M

MAG 22 Lode Claim				
1/4	Section	Township	Range	Meridian
SE	27	25 South	8 West	NMB&M
NE	34	25 South	8 West	NMB&M

### 1.3 Individual Completing Application

This application is prepared by Amec Foster Wheeler, with input from the Modrall Sperling law firm, on behalf of American Magnesium LLC. All the information contained in the application has been reviewed and verified by American Magnesium LLC.

### 1.4 Business Information

American Magnesium LLC is a New Mexico limited liability company that was formed on April 30, 2013, for the business of owning mining interests and developing, mining, processing and selling magnesium and other minerals and related substances. Its duration is perpetual.

In May 2013, American Magnesium LLC (AmMg) and American Magnesium LLP were formed in order to facilitate the management of the initial phases of the research and development of the Magnesium Metal Complex. In June 2015, American Magnesium LLP was terminated. In January 2016, American Minerals Management LLC (Manager) was formed to act as manager for AmMg and to continue the research and development of the Magnesium Metal Complex. Manager will provide technical expertise, project management, community and government relations, and financial reporting and accountability to this project. Manager will also facilitate the recruitment of investors for this project.

### 1.5 Corporation Information

The principal executive offices of American Magnesium LLC are located at 104 Rinconada, Box 684, Elephant Butte, New Mexico 87935. The primary business telephone number is 575-741-1527. Email correspondence should be directed to [dqtognoni@gmail.com](mailto:dqtognoni@gmail.com).

### 1.6 Partnership Information

American Minerals Management LLC (Manager) was organized in 2016 as a New Mexico limited liability company for the purpose of managing mining development, including additional mineral resource verification, mine planning and other development projects. Its members and principals have experience in minerals resource verification, development, operation and disposition. They are, as of January 31, 2016, as follows:

David Q. Tognoni P.E. – Mr. Tognoni graduated from Arizona State University (ASU) with a Bachelor of Science degree in Geological Engineering and a minor in Industrial Engineering. He completed post-graduate studies in business, finance, and mining engineering at the University of Arizona (Tucson) and ASU. Mr. Tognoni has been a Professional Engineer in good standing for over 35 years. He has worked primarily on special assignment consulting projects for major and junior resource companies in oil, gas, and minerals. Mr. Tognoni was raised around resource/land law, resource verification and resource development. In 2005, Mr. Tognoni founded BE Resources, Inc., an international publicly traded resource company, and served as its and Chief Executive Officer from 2005 to 2012.

Robert Lufkin - Mr. Lufkin attended Arizona State University, College of Construction Engineering, and received certification as a Construction Contract Administrator by the Construction Specifications Institute. This experience has provided him with a full understanding of construction projects from inception to completion. Mr. Lufkin has 40 years of experience in the construction industry. This experience includes project management and field supervision for commercial general contractors and construction contract administration for an international architecture firm. In cooperation with David Tognoni, he has also participated in numerous mineral resource verification projects across the western U.S., recently serving as a board member of BE Resources, Inc., an international beryllium resource verification company. He is also a United States Marine Corps veteran.

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## **2.0 DESCRIPTION OF OPERATIONS – PROPOSED ACTION [3809.401(b)(2)]**

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### **2.1 Legal Description [3809.401(b)(2)(i)]**

The Project is located on public lands administered by the BLM, and comprises the southeast quarter of the southeast quarter of section 27, Township 25 South, Range 8 West in Luna County, NM. The project location is depicted in Figure 1.

### **2.2 Project Access**

The Project Area is located within the Tres Hermanas Mining District of Luna County, NM in the western foothills of the Little Florida Mountains, centered on a relatively small hill just west of Mahoney Park. The Project is accessed by traveling on State Road 11 south from Deming for a distance of 12 miles, then turning left on County Road 1286 for a distance of four miles until one encounters a road fork. At the fork one turns right, traveling another 2.4 miles to Mahoney Park (a level area of the valley). Turning right at this point, a four-wheel track continues approximately one mile southwesterly to a location near the base of the dolomite hill. The access routes are shown in Figure 2. Access around the base of the hill is best done using ATV lightweight vehicles.

### **2.3 Site Ownership (Acres) and Land Status within the Proposed Project Area**

The Project Area contains approximately 44 acres of public land administered by the BLM. The target dolomite deposit is encompassed within the boundaries of unpatented mining claims (named Mag 21 & 22 lode mining claims) perfected and maintained under the General Mining Law of 1872, and since AmMg owns those claims, subject only to the paramount title of the United States and surface management requirements of the BLM, it has a real property interest sufficient to conduct development and mining activities thereon, including resource verification, mine development, and mining-related work. The administration authority for the land is shown in Figure 3 and the claim locations are shown in Figure 4.

### **2.4 Description of Proposed Action and Site Conceptual Design [3809.401(b)(2)(ii)]**

The anticipated surface disturbance includes the utilization of overland travel as well as the construction of drill sites, the excavation and removal of dolomite resources, and necessary road improvements. AmMg plans a total of 44 acres of disturbance for mine development, including resource verification, mining, operation, and reclamation activities. The surface disturbance would occur in phases and the final mine plan would be based on the results of the additional resource verification. Activities which are planned to be conducted as the

initial phase of mining development. Drilling is proposed to verify the resource and confirm the mine plan of operations. The proposed verification drill holes shown in Figure 5 will be used as blast holes during active mining. Surface disturbance that AmMg plans to conduct under Phase I would occur in the Project Area and is also identified on Figure 5. The subsequent phases shown on Figure 5 depict the entire area to be quarried. A block cultural survey has been conducted in the Project Area, including all areas planned for mine development, including resource verification drilling, blasting, road construction, drill pad construction, mining, reclamation, and the maintenance and improvement of existing roads.

For the initial phase of mine development, limited resource verification will be conducted using a dual-tube, reverse-circulation (RC) air rotary rigs and diamond-bit core rigs at the Project in phases. The purpose of the verification is to assist in mine planning. Each type of drill has its advantages and disadvantages depending upon the nature of the material being drilled, the depth of the target, and the information sought. In most drilling programs, more than one drill rig and often more than one type of drill is used. For some holes, both methods may be used sequentially to complete the resource verification boring. Following are characteristics of each type of drilling method.

- The RC air rig is the standard resource verification drill, used for the drilling range of 100 to 2,000 feet below ground surface, usually to depths of approximately 900 feet below ground surface. At shallow depths, dry air is the working fluid, with water injected optionally for dust suppression. Typical RC drills are truck mounted with optional auxiliary booster compressors to enable deeper penetration.
- Core drilling rigs are used where conditions prevent the use of other rigs and/or where solid samples of rock core are needed for geological, geotechnical, or metallurgical studies. Core rigs may be truck-mounted or skid-mounted and moved on site with a bulldozer.

Existing, primitive roads will require improvement. No new roads are proposed at this time; however, some of the existing roads will be improved with a bulldozer using cut-fill balance methods. The cut-fill balance method results in level surfaces that are essential for movement of the relatively top-heavy, truck-mounted drilling equipment. In areas of relatively low traffic levels with reasonably level terrain, construction of bladed roads would be avoided and drilling equipment would be driven overland to the drill locations. Berms will also be constructed, where necessary, as safety precautions.

Resource verification activities will generally be conducted in two phases. The first phase of drilling is generalized drilling to confirm geologic materials observed at the surface and conceptual geologic models. The first phase of drilling will include approximately 15 acres of disturbance. The second phase of resource verification is to expand on the drilling that produced results. This second phase will include stepping out from the first phase of drilling on spacing between 500 and 1,000 feet, which will result in approximately 29 acres of disturbance. As explained below, the Project includes rolling reclamation such

that no more than 40 acres of disturbance will exist at one time. The results of resource verification will be used to phase the mine development. At this time, AmMg plans to mine the resource from the highest elevation to the valley floor, in increments of varying sizes that will avoid more than 40 acres of un-reclaimed disturbance at any one time.

Given the consistent outcropping of dolomite in the Project area, it is possible that the mineralization has little overburden and this will be confirmed during the early planning stages of mining during the verification planning stage. AmMg's proposed resource verification activities will also verify the amount of overburden present at the site. The proposed method of operation is mining of the ore from the top of the deposit. The AmMg Project will be mined from the top of the dolomite hill down, and the excavated ore will undergo primary crushing, if needed, on site. The mining approach that will be implemented is similar to quarrying, which is conducted in close proximity to the site. The Project will be managed to meet the State of New Mexico's requirements for Minimal Impact New Mining Operations (Subpart 3). Reclamation of disturbed areas will be conducted contemporaneously with mining, to the extent feasible, to ensure no more than 40 acres of total un-reclaimed disturbance. During resource verification, each disturbed area will be reclaimed before advancing to the next area. Since verification efforts will result in a minimum of disturbance, the area surrounding the verification drill hole will be regraded and revegetated, using a native seed mix. A Reclamation Plan will be prepared in accordance with the guidance provided by New Mexico State University Cooperative Extension Service, Circular 525, *Seeding New Mexico Rangeland*. This plan will be submitted approximately 30 days after the submittal of this PoO.

## **2.5 Proposed Equipment [38.09.401(b)(2)ii]**

One reverse circulation rig and one core drilling rig will be used in the Project Area for mine development and planning. A Wesco track-mounted rig is currently proposed. Each rig will include the following support vehicles:

- One pipe truck;
- One booster truck;
- One 3,000-gallon water truck;
- One all-terrain support vehicle; and
- One auxiliary air compressor.

The Project work force during resource verification activities will include one three-man crew per shift for each reverse circulation rig, and one two-man crew per shift for the core rig. One to two geologists will supervise drilling operations. One D7 dozer will be required for rehabilitation of an existing access road and for resource verification road construction. One tracked excavator hoe will be required to aid in existing road rehab, for new road construction, and for drill pad construction. Each field vehicle shall be equipped with hand tools, first aid kit, and a fire extinguisher. Water trucks at the Project Area will be used in



the event of a fire. All portable equipment, including drill rigs, support vehicles, and drilling supplies, will be removed from the Project Area during extended periods of non-operation.

During mine operations a comparably-sized work force will be employed to operate the following anticipated equipment, or suitable alternatives, for quarrying the dolomite rock and crushing it for transport off-site:

- Up to 10 haul trucks;
- One 3,000 gallon water truck;
- Two all-terrain support vehicles;
- Storage igloo for blasting storage;
- Excavator;
- Primary crusher, if needed;
- Grader;
- Backhoe; and
- Broadcast seeder for reclamation activities.

The equipment used will be based on availability and production rates. AmMg plans to conduct blasting, under an approved blasting plan. This plan will be submitted independently by a licensed and permitted blasting contractor. Once the material is blasted, it will be loaded into over the road haul trucks for transportation off-site. Primary crushing may occur onsite if it is deemed necessary prior to loading the haul trucks. The blast and haul operation that is currently planned is similar in nature to a quarry operation, in that the material will be blasted and excavated from the top of the dolomite hill formation, moving toward the valley floor. At this stage of development, it is assumed that the blasting operation will achieve the required size of material to direct loading to the haul vehicles. No additional on-site crushing is proposed at this time, but that will be evaluated as operations proceed. Based on the production rate, it is possible for quarried material to be temporarily stored on-site prior to transport. The area required for any storage of quarried material will be counted as disturbance for purposes of calculations to ensure the Project does not exceed the 40 acre disturbance footprint already discussed.

## **2.6 Operating Practices [3809.401(b)(2)ii]**

AmMg will follow standard drilling procedures and will require a company representative to be on-site or on-call during all drilling activities. The company representative will monitor and coordinate the layout and construction of each drill site, the setup of the drill rig, drilling progress, demobilization, and cleanup of the drill site. Due to the type of equipment used for drilling operations, a drill pad will not be constructed. A company geologist will also coordinate drilling activities, log each hole according to the geologic

features encountered, determine the maximum depth of each hole, and advise the drill operator as needed. The company representative and geologist will travel to and from the drill site in separate four-wheel drive pickup trucks.

Standard drill rig crews will consist of a drill operator and one or two helpers. The helpers will remove and box the recovered core samples, bag the cuttings from reverse circulation rigs, mix drilling fluids in the portable mud tank, operate the water truck, assist with drilling operations, and conduct maintenance as necessary. The crew will be transported to and from the drill site in four-wheel drive vehicles.

The mine will operate similar to a quarry operation. However, no crushing, screens or conveyers are currently planned for use. The dolomite will be blasted, in accordance with an approved blasting plan (to be submitted at a later date) and loaded into haul trucks for off-site transportation. Blasting and hauling operations are planned to be conducted during daylight hours. The proposed mining activities are currently planned to operate during daylight hours. No nighttime operations or 24-hour operations are planned at this time.

## **2.7 Mining Operations and Ancillary Facilities**

No construction of permanent structures for mining operations or ancillary facilities will be required. Even if primary crushing onsite is needed, the crushing facility will be demobilized and removed at the end of the mining operations. The mining operation does not require support structures to be constructed. AmMg will have a mobile office trailer and portable out-house and sanitation facilities for workers on the site, all of which will be removed following mining. These structures are temporary and mobile. A laydown area for mining equipment will be developed within the footprint of the mining operations. The laydown and equipment staging area will be included within AmMg's disturbance calculations. Storage for explosives in temporary storage building (two buildings approximately 8 X 8) and one explosive silo are also planned for the storage of explosives expected to be used during mining operations to blast the rock for excavation and transport. There will be no processing or other ancillary facilities required for resource verification activities or mining operations.

## **2.8 Site Access and Proposed Constructed Roads**

The Project consists of expanding and maintaining certain existing dirt roadways in order to access the proposed mining site and to transport extracted ore to a manufacturing facility that is currently planned to be located the Peru Industrial Park in Deming, NM. The site of the manufacturing facility has not been confirmed. Currently, AmMg is in the early stages of negotiating a location, which is planned to be in the Peru Industrial Park. A map of the potential manufacturing location is provided (Figure C-6) and preliminary proposed trucking route, from the mining site to the Peru Industrial Park is provided. The manufacturing process is detailed in the Conceptual Feasibility Study, dated April 25,

2013. This report contains confidential market analysis information and is provided under separate cover. Two routes to the mine site are being considered, referred to as the North Route and the South Route. The North Route is 5.0 miles long, 4.1 miles of which is on BLM land. The South Route is 4.6 miles long, 3.0 miles of which is on BLM land. A route will be selected, and a drainage plan developed, approximately 30 days from the submittal of this document. Based on available information regarding the resource, the estimated duration of mining operations is 30 years. The roads would be used year-round. The road improvements would occur during daylight hours, and would be completed as quickly as possible.

Existing roads on the property are planned to be improved by blading or otherwise resurfacing existing road surfaces and, in some limited areas, by widening the existing roads. The total estimated disturbance beyond existing road widths from widening is 1 acre for all roads that will be improved. The existing roads will be improved to allow for movement of heavy equipment and the average running width of 14 to 16 feet for roads within the property boundary proposed. Road improvements will occur in areas with varying topography, and as a result, roads will have an average disturbance width of 25 feet. Planned disturbance associated with road improvement is shown in Table 1. Resource verification roads that require earth-moving will be constructed using typical construction practices to minimize surface disturbance, erosion, and visual contrast, as well as to facilitate reclamation. A modest amount of overland travel is planned to access certain drill pad locations and to conduct blasting operations. Overland travel will be limited and will only be conducted when needed, and areas affected thereby will be counted as part of the disturbance footprint.

Road improvements will be implemented using a Caterpillar dozer, backhoe, or equivalent equipment. Road grades will be no steeper than ten percent, except for short drill spurs, in order to be consistent with the BLM roads manual. When drainages must be crossed by a road, Best Management Practices (BMPs) established by MMD and the Luna County Soil Conservation District will be followed in order to minimize the surface disturbance and erosion potential. Culverts may be required in various areas along the proposed access road. These areas will be reviewed with BLM, and culverts will be installed as required by BLM. It is not anticipated that blasting will be necessary to construct roadbeds. If drilling and blasting of roads should become necessary, prior to blasting the operator will submit a blasting plan to the MMD.

Routine road maintenance may be required and will consist of smoothing ruts, filling holes with fill material, grading, and re-establishing waterbars when necessary. In addition, AmMg may need to blade and emplace gravel surfacing on the roads to minimize excess disturbance. The gravel will be obtained from outside the Project Area from a commercial gravel source.

Balanced cut and fill construction will be used to the extent practicable to minimize the exposed cut slopes and the volume of fill material. Since the depth of the cut will be kept

to a minimum, growth media removed during construction will be stockpiled as the fill slope to be used during reclamation. Road construction within drainages will be avoided where possible. When drainages must be crossed by a road, BMPs established by MMD and the Luna County Soil Conservation District will be followed to minimize the surface disturbance and erosion potential.

Approximately 5,000 feet of the existing access road will require rehabilitation to safely accommodate resource verification and future ore hauling traffic. These areas requiring rehabilitation are shown on Figure 2. Considering an average disturbance width of ten feet outside of the existing road prism in the proposed rehabilitation areas, it is estimated that 1.0 acre of disturbance will be required to improve these areas of the existing access road.

## **2.9 Use and Occupancy**

Under 43 CFR 3715.01, occupancy means full or part-time residence on the public lands. It also means activities that involve residence; the construction, presence, or maintenance of temporary or permanent structures that may be used for such purposes; or the use of a watchman or caretaker for the purpose of monitoring activities. Residence structures include, but are not limited to, barriers to access, fences, tents, motor homes, trailers, cabins, houses, buildings, and storage of equipment or supplies.

No structures, except for the possibility of a temporary crushing facility as listed above, are proposed in this Plan to be located on public lands; however, AmMg may utilize a trailer in the Project Area for logging core and cuttings. A temporary, 5,000-gallon water tank will also be located in the Project Area for resource verification and mining operations to aide in dust suppression activities during periods of mining and for general road maintenance. Additionally, porta-potties are planned to be utilized in the Project Area.

### **2.9.1 Proposed Temporary and Permanent Structures**

Intermodal containers may be used to store project equipment and supplies at the site. A temporary job trailer is also proposed for employees to gather for health and safety briefings, store personnel belongings during working hours, shelter during inclement weather and serve a meeting and break facility during resource verification and mining.

### **2.9.2 Access Restrictions to Mining Site**

If necessary, AmMg would construct BLM-approved barbed wire fencing to prevent livestock from entering disturbed areas. In areas where a higher level of security or safety is needed, for example in the mobile trailer area and laydown yard, chain-link fences would be erected. Gates or cattle guards would be installed along roadways within the proposed mine area, as appropriate.

AmMg shall monitor any constructed fences on a regular basis and repairs would be made as needed. In the event that livestock manage to enter the proposed area of disturbance via a gate or opening in a fence, the grazing permittee would be contacted immediately. AmMg would assist as requested in moving these animals out of the proposed mine area.

The use of avian exclusion devices to prevent deleterious exposure of birds will not be required, as no toxic or hazardous chemical are planned to be used. In addition, no ponds will be constructed. The only water needed would be for dust suppression, and a water truck and on-site storage tank (enclosed) will be used to apply water to the surface to prevent dust.

### **2.9.3 Estimated Duration for Use of On-site Structures**

Temporary structures may be used throughout the duration of resource verification, mine development and mining activities.

### **2.10 Hazardous Materials (Hazmat)**

Hazardous materials utilized at the Project Area will include diesel fuel, gasoline, and lubricating grease. Approximately 500 gallons of diesel fuel will be stored in fuel delivery systems on vehicles and drill rigs. Approximately 100 gallons of gasoline will be stored in fuel delivery systems for light vehicles. Approximately 100 pounds of lubricating grease will be stored on the drill rigs or transported by drill trucks. All containers of hazardous substances will be labeled and handled in accordance with requirements of the New Mexico Department of Transportation (NMDOT) and Mining Safety and Health Administration (MSHA). In the event that a reportable quantity of hazardous or regulated materials, such as diesel fuel, is spilled, immediate measures will be taken to control and address the spill, and the New Mexico Environment Department (NMED), and the Emergency Response Hotline will be notified, as may be required. If any oil, hazardous material, or chemicals are spilled during operations, they will be cleaned up in a timely manner. After clean up, the oil, toxic fluids, or chemicals and any contaminated material will be removed from the site and disposed of at an approved disposal facility.

Blasting components, including ammonium nitrate and diesel fuel, would be stored on-site in bins and tanks during mining operations. AmMg currently anticipates utilizing two explosives magazines (one for boosters and one for blasting caps), each no larger than 8 feet by 8 feet, with 1,000-pound capacities. In addition, AmMg would utilize one 15-ton capacity silo for storage of ammonium nitrate. All explosive materials would be stored in compliance with MSHA, New Mexico SMIO's regulations, and U.S. Department of Homeland Security requirements. Management of hazardous materials would comply with all applicable Federal, State, and local requirements, including the inventory and reporting requirements of Title III of CERCLA, also known as the Emergency Planning and

Community Right to Know Act. All petroleum products, kerosene, and reagents used would be stored in aboveground tanks within a secondary containment area capable of holding 110 percent of the volume of the largest vessel in the area.

### **2.11 Spill Prevention Plan [3809.401(b)(2)(vi)]**

Over the life of the proposed Project, small or limited spills of oils and lubricants may occur during fueling or from equipment. These releases could occur during operations, for example, as a result of a bad connection on an oil supply line, from equipment failure, or from mishandling during transfer operations. Equipment will be inspected and properly maintained to limit adverse impacts from any unintentional release. Impacts of such minor spills could include contamination of surface soils. Spills of this nature would most likely be small, localized, and contained. Formal safety data sheets for hazardous materials would be posted and readily available, in accordance with MSHA's Hazard Communication for the Mining Industry (30 CFR Part 47).

The potential for spills of both hazardous and non-hazardous materials would be further mitigated with the implementation of a spill prevention plan. The Spill Prevention Plan for the Project describes the reporting requirements and response actions that would take place in the event of a spill, release, or other unexpected condition, as well as procedures for cleanup and disposal. The plan will be posted and distributed to key site personnel and will be used as a guide in the training of employees. The plan addresses mitigation of potential spills associated with project facilities as well as activities of on-site contractors. The plan will be reviewed and updated at a minimum of every 3 years, and whenever major changes are made in the management of the materials addressed in the plan. Inspection and maintenance schedules and procedures for equipment at the site will be set forth in sections of the plan addressing hazardous materials and petroleum products. In addition, the implementation of a health and safety manual and hazard communication program will provide employees with education and awareness of hazardous materials management, thereby further minimizing the potential for spills at the mine area. A Spill Prevention Plan for the Project will be included as Appendix A. This plan will be submitted at a later date.

### **2.12 Project-specific Quality Assurance Plan [3809.401(b)(2)(v)]**

A quality assurance plan is not applicable as this is a mine development and quarry project. However, quality assurance for reclamation will be addressed under the Reclamation Plan (Section 3).

### **2.13 Water Use and Management [3809.401(b)(2)(iii)]**

Minimal or no water will be required for the mining process. Water for sanitation and dust suppression purposes will be brought to the site using a 5,000 gallon water truck, portable water tank, or similar vessel. If water is needed to resource verification activities, a water

truck, portable water tank, or similar vessel will also be used. Resource verification holes are limited in depth and minimal water will be used. Water will be used for dust suppression and site reclamation activities.

## **2.14 Environmental Protection Measures**

AmMg commits to compliance with all applicable environmental protection measures, including but not limited to the following, to prevent unnecessary or undue degradation during construction, operation, and reclamation of the Project. The measures are derived from the general requirements established in the BLM's Surface Management Regulations at 43 CFR 3809 and water, air quality, and other environmental protection regulations, including the reclamation requirements applicable to minimal impact new mining operations under the Mining Act Reclamation Program rules administered by MMD.

### **2.14.1 Water Quality**

- Drill holes will be surveyed and plugged as an operational procedure immediately after completion of drilling in accordance with 19.10.4 NMAC. The drill holes will be plugged by placing drill cuttings or cement grout, concrete grout, or neat cement plug into the total depth of the hole, or if ground water is encountered, plugged as a well pursuant to 19.27.4 NMAC. There is a limited chance that groundwater will be encountered during drilling, given the proposed depth of the drill holes.
- Storm water BMPs will be used at construction sites to minimize erosion from storm water.
- Drill cuttings will be contained on-site and the fluids will be managed utilizing appropriate control measures. Sediment traps will be used as necessary and filled at the end of the drill program.
- The Spill Prevention Plan, Appendix A, will be followed.
- Only nontoxic fluids will be used in the drilling process.

### **2.14.2 Air Quality**

- Emissions of fugitive dust from disturbed surfaces will be minimized by the application of water from a water truck as a method of dust control.
- In addition, gravel may be emplaced on some existing roads to minimize excess disturbance and control dust. A Storm Water Pollution Prevention Plan (SWPPP) will be required because the proposed surface disturbance exceeds one acre. A Sediment Control Plan will be included in the SWPPP, which will be provided at a later date.

## 2.15 Site Geology

The proposed site for the Project, sometimes referred to as the Foothills Dolomite Quarry, encompasses a foothill that rises 200-300 feet above the western alluvial fans of the Florida Mountains, west of Mahoney Park. Rock formations that entirely make up the site are the Fusselman and the Montoya Formations. These strata are Ordovician and early Silurian in age, and are part of a regionally extensive carbonate platform that stretches into Texas and Oklahoma. The platform was part of a shallow sea that once formed the southwest continental margin of Laurentia. Broad exposures of these rocks occur wherever there is significant mountain block faulting of Paleozoic rocks in southern New Mexico and West Texas, including the San Andres, Sacramento and Franklin mountain ranges. On the western flank of the Florida Mountains, these rocks are highly faulted and brecciated by high angle Laramide thrust faulting and tilted to the east and southeast, complicating their stratigraphy.

The Fusselman and Montoya formations contain primarily dolomitized limestones and dolomitic sandstones. Fossils in these formations are primarily shallow marine invertebrates such as corals and crinoids. Dolomitization has destroyed much of the internal structure of the fossils that are not replaced by silica, due to recrystallization. Results of the literature based paleontological resource survey are summarized in Section 2.15.4 of this Plan of Operations.

### 2.15.1 Hydrology

The proposed Foothills Dolomite Quarry lies in the south-central portion of the Mimbres basin, a closed basin bounded by mountain ranges on all sides, extending from the Continental Divide to the Black Range and Silver City to the north and south, into the Chihuahua province of Mexico. The primary aquifer in the region is made up of basin fill. Mountain-front recharge and the Mimbres River provide the majority of recharge to the aquifer. Modeled potentiometric surfaces near the western flank of the Florida Mountains are approximately 4500 feet above mean sea level (MSL) or about 300 feet below ground surface (BGS) at the base of the quarry site foothill.

Surface water in the immediate area of the proposed quarry flows via ephemeral stream channels westward, down the slope of the Florida Mountains alluvial fan to a relatively flat intermontane basin with no large bodies of surface water.

The only perennial stream or large body of surface water in the Mimbres Basin is the Mimbres River, which flows south from the Black Range and then turns east just north of Deming, NM. The river terminates in a closed basin a few miles east of Deming, NM with no large bodies of surface water.



## 2.15.2 Soils

The rocky prominence that is the primary interest at the site is entirely composed of bedrock, virtually devoid of soil exposures, and is mapped by the US Department of Agriculture National Resource Conservation Service as *Rough and Broken Rock Land*. The alluvial fan from which it rises is mapped as the *Eba Very Gravelly Clay Loam*. This latter soil unit appears on alluvial fans and fan remnants with slopes of zero- to ten percent. Runoff potential is moderately high when wet, due in part to its clayey matrix. The typical soil profile of this unit is as follows:

- 0-2 inches: Very gravelly clay loam
- 2-60 inches: Very gravelly clay

A custom soils report detailing the properties of the Eba Very Gravelly Clay Loam, generated by the U.S. Department of Agriculture Natural (USDA) Natural Resources Conservation Service (NRCS) from information originally presented in the Soil Survey of Luna County, NM, is presented in Appendix B.

## 2.15.3 Vegetation

The plant community in the project area and vicinity is a matrix of Chihuahuan Desert Broadleaf Evergreen Scrub and Chihuahuan Desert Broadleaf Deciduous Desert Scrub (BISON-M 2016). Shrubby species dominate the vegetation of the Project area and include honey mesquite (*Prosopis glandulosa*), broom snakeweed (*Gutierrezia sarothrae*), ocotillo (*Fouquieria splendens*), sotol (*Dasyliion wheeleri*), redberry juniper (*Juniperus arizonica*), and yellow trumpetbush (*Tecoma stans*). Cactus species and other succulents such as candy barrelcactus (*Ferocactus wislizeni*), cholla (*Cylindropuntia sp.*), prickly pear cactus (*Opuntia sp.*), Graham's nipple cactus (*Mammillaria grahamii*), and Palmer's century plant (*Agave palmeri*) are also common. Grasses and forbs are less common in the rocky, shrubby terrain, including threeawn (*Aristida sp.*), matted grama (*Bouteloua simplex*), and silverleaf nightshade (*Solanum elaeagnifolium*). Table 1 contains a list of all plant species identified in the project area during the biological field survey on July 28, 2016.

**Table 3. Complete List of Plant Species Observed in the Project Area.**

Common Name	Scientific Name
Trees	
redberry juniper	<i>Juniperus arizonica</i>
singleneedle pinyon	<i>Pinus monophylla</i>
honey mesquite	<i>Prosopis glandulosa</i>
Shrubs/Sub-shrubs	
saltbush	<i>Atriplex sp.</i>

Common Name	Scientific Name
broom snakeweed	<i>Gutierrezia sarothrae</i>
yellow trumpetbush	<i>Tecoma stans</i>
Forbs	
Cochise scaly cloakfern	<i>Astrolepis cochisensis</i>
silverleaf nightshade	<i>Solanum elaeagnifolium</i>
Cacti, Agave, & Succulents	
Palmer's century plant	<i>Agave palmeri</i>
cholla	<i>Cylindropuntia sp.</i>
sotol	<i>Dasylirion wheeleri</i>
candy barrelcactus	<i>Ferocactus wislizeni</i>
ocotillo	<i>Fouquieria splendens</i>
Graham's nipple cactus	<i>Mammillaria grahamii</i>
prickly pear cactus	<i>Opuntia sp.</i>
soaptree yucca	<i>Yucca elata</i>
Grasses	
threeawn	<i>Aristida sp.</i>
matted grama	<i>Bouteloua simplex</i>

### 2.15.3.1 Noxious Weeds

Noxious weeds will be controlled through implementation of the following BMPs: concurrent reclamation efforts to the extent feasible; operator control; removal of invasive, nonnative, and noxious weeds on reclaimed areas; washing heavy equipment prior to entering the Project Area; and avoiding areas of known invasive, nonnative, and noxious weeds during periods when the weeds could be spread by vehicles.

### 2.15.4 Cultural and Paleontological Resources

Dos Rios Consultants, Inc. performed a Class III preliminary archaeological survey of the proposed quarry site from August 5 through August 8, 2016 (Report will be provided upon request). Seventeen isolated occurrences (IOs) were found within the survey area. An isolated occurrence (IO) is a single or scatter of artifacts or a feature (or features) that are not extensive enough to meet the criteria of being an archaeological site. The IOs within the survey area ranged from isolated mine shafts to fragments of ceramics, metal cans and fragments of rock from the working of stone tools. No archaeological sites were discovered during the survey. A copy of the New Mexico Cultural Resource Information System (NMCRIS) Information Abstract Form (NIAF), a summary of the archaeological survey finds, is available upon request. Information related to the isolated occurrences identified during the preliminary survey can also be provided to the Agencies upon request.

Amec Foster Wheeler has extensively reviewed geologic literature pertaining to fossil fauna in the locality and stratigraphic intervals present at the proposed quarry site, and proposes that the site should be given a classification of Class 2, i.e., *Low*, under the BLM Potential Fossil Yield Classification (PFYC) System.

A PFYC rating of Class 2 means that the gross potential fossil yield for the rock units present is low, and refers to sedimentary geologic units that are not likely to contain vertebrate fossils or scientifically significant non-vertebrate fossils. Scientifically significant fossils are generally defined as: *all vertebrate fossils and their tracks or traces, and some invertebrate or plant fossils identified as rare or important by the scientific community*. Typical geological and paleontological conditions for a Class 2 classification include:

- Vertebrate or significant invertebrate or plant fossils not present or very rare.
- Units that are generally younger than 10,000 years before present.
- Recent aeolian deposits.
- Sediments that exhibit significant physical and chemical changes (i.e., diagenetic alteration).

The fossils found in the Fusselman and Montoya Formations are primarily shallow marine invertebrates, e.g., horn corals, echinoderms, brachiopods and gastropods. Both formations have undergone significant chemical diagenesis from dolomitization, which destroys structural detail in carbonate fossils through recrystallization. Some of the corals in the Fusselman are preserved by silica replacement. However, the carbonate platform in which the formations present at the site formed is very extensive; and both the Fusselman and Montoya Formations have many outcrops across the southern portion of the State of New Mexico and Texas.

- Pursuant to 43 CFR 10.4(g), AmMg will notify the BLM authorized officer, by telephone, and with written confirmation, immediately upon the discovery of human remains, funerary objects, sacred objects, or objects of cultural patrimony (as defined in 43 CFR 10.2). Further, pursuant to 43 CFR 10.4 (c) and (d), the operator will immediately stop all activities in the vicinity of the discovery and not commence again for 30 days or when notified to proceed by the BLM authorized officer.
- In the event that previously undiscovered paleontological resources are discovered in the performance of any surface disturbing activities, the item(s) or condition(s) will be left intact and immediately brought to the attention of the authorized officer of the BLM. If significant paleontological resources are found, avoidance, recordation, and data recovery will be required.
- Any cultural resource discovered by the permit holder, or by any person working on their behalf, during the course of activities on federal land will be immediately

reported to the authorized officer by telephone, with written confirmation. The permit holder will suspend all operations in the immediate area of such discovery and protect it until an evaluation of the discovery can be made by the authorized officer. This evaluation will determine the significance of the discovery and what mitigation measures are necessary to allow activities to proceed. The holder is responsible for the cost of evaluation and mitigation. Operations may resume only upon written authorization to proceed from the authorized officer.

### 2.15.5 Wildlife

The project area provides habitat for a variety of mammals, reptiles, and birds. Wildlife species encountered during the preliminary biological survey included a whiptail lizard (*Aspidoscelis* sp.) and various species of birds, including cactus wren (*Campylorhynchus brunneicapillus*), Gambel’s quail (*Callipepla gambelii*), northern mockingbird (*Mimus polyglottos*), black-chinned sparrow (*Spizella atrogularis*), bushtit (*Psaltriparus minimus*), thrasher (*Toxostoma* sp.), and greater roadrunner (*Geococcyx californianus*). See Table 4 for a list of all wildlife species identified during the preliminary biological field survey.

**Table 4. Complete List of Wildlife Species Observed in the Project Area.**

Common Name	Scientific Name
<b>Birds</b>	
black-chinned sparrow	<i>Spizella atrogularis</i>
bushtit	<i>Psaltriparus minimus</i>
cactus wren	<i>Campylorhynchus brunneicapillus</i>
Gambel's quail	<i>Callipepla gambelii</i>
greater roadrunner	<i>Geococcyx californianus</i>
northern mockingbird	<i>Mimus polyglottos</i>
thrasher	<i>Toxostoma sp.</i>
<b>Reptiles</b>	
whiptail lizard	<i>Aspidoscelis sp.</i>

### 2.15.6 Migratory Birds

To avoid potential impacts to and unintentional takes of migratory bird species, it is recommended that significant quarrying activities be initiated outside of the breeding season (March 1 to August 31). If activities were to occur during this time period, a survey for nesting birds would be completed to ensure there are none on-site. It is expected that the ongoing disturbance caused by these activities will then deter migratory birds from nesting in the project area in the future.

### **2.15.7 Public Safety and Site Access**

- Public safety will be maintained throughout the duration of the Project. All equipment and other facilities will be maintained in a safe and orderly manner.
- Any survey monuments, witness corners, or reference monuments will be protected to the extent economically and technically feasible.
- All solid wastes will be disposed of in a state, federal, or local designated site.
- Pursuant to 43 CFR 8365.1-1(b)(3), no sewage, petroleum products, or refuse will be dumped from any trailer or vehicle.
- All applicable state and federal fire laws and regulations will be observed and all reasonable measures will be taken to prevent and suppress fires in the Project Area.

### **2.15.8 Socioeconomic Conditions in and Around the Proposed Project Area**

The analysis of socioeconomic resources identifies aspects of the social and economic environment that are sensitive to changes and that may be affected by the proposal to conduct resource verification activities, mining development, and mining operations. The analysis specifically considers how the proposed actions might affect the individuals, communities, and the larger social and economic systems of Luna County, the surrounding region; and the State of New Mexico.

Appendix D of Social Science Considerations in Land Use Planning Decisions of BLM's Land Use Planning Handbook H-1601-1 provides guidance on how social and economic issues and concerns may be incorporated into the planning process. This section evaluates socioeconomic characteristics, including population, employment, housing, community services, and economic systems. Social impacts would be felt most by individuals, communities, residents, and workers in Luna County. Businesses, community services, and economic systems in Luna County would likely change the most in response to the implementation of the Proposed Action. Since potential impacts with the greatest magnitude, duration, extent, and likelihood would occur in Luna County, it is therefore defined as the Region of Influence (ROI) for the analysis of socioeconomic impacts. Impacts that extend outside of the ROI are discussed where applicable throughout the section.

The data supporting this analysis are collected from standard sources, including the U.S. Census Bureau (Census), Bureau of Labor Statistics (BLS), other Federal, State, and local agencies, or other research institutes. Demographic and economic data is presented for Luna County and compared to demographic and economic data for the State of New Mexico. Demographic data from the Census is also presented for the City of Deming as applicable. The inclusion of demographic data for the City of Deming does not change the ROI, since these are located within Luna County.

### 2.15.8.1 Population

The 2010 estimated population of Deming is 14,855, a net increase of 739 or 5 percent from the 2000 estimated population. The State population grew by 13.2 percent from 2000-2010. Luna County grew negatively by 0.1 percent and 11.2, respectively.

**Table 5. Population Change, 2000-2010**

Location	2000	2010	Numeric Change 2000-2010	Percent Change 2000-2010
Deming	14,116	14,855	739	5
Luna County	25,016	25,095	79	>0.01
New Mexico	1,819,046	2,059,179	240,133	13.2

Source: U.S. Census Bureau 2000, 2010.

In general, the population of Luna County is older than that of the state as a whole. The percentage of children in Luna County (the ROI), including those under 5 years and between 5 and 18 years, is lower than percentages for those same age groups in the State of New Mexico. Population estimates and the percent of children by age group in the City of Deming, Sierra County, and New Mexico are shown below.

**Table 6. Population Under 18 Years of Age, 2010**

Location	Total population	Children Under 5 Years	Children 5 to 18 Years	All Children Under 18 Years
Deming	14,855	8%	19.6%	27.6%
Luna County	25,095	7.3%	19.2%	26.5%
New Mexico	2,059,179	7%	18.1%	25.1%

Source: U.S. Census Bureau 2010

The distribution of population by age in Luna County, including the City of Deming, and New Mexico is summarized below. The percent of the population between the ages of 20 and 44 is lower in Luna County than in the State as a whole. The percent of persons 65 and older in Luna County is about double the percent in the State overall.

**Table 7. Distribution of Population by Age, 2010**

Location	Percent Under 18 Years	Percent 20-44 Years	Percent 45-64 Years	Percent 65 and Older
Deming	27.6	28.9	21.8	21.7
Luna County	26.5	26.8	24.4	22.3
New Mexico	25.1	64.8	26.5	13.2

Source: U.S. Census Bureau 2010

## **2.15.8.2 Housing**

A housing unit refers to a house, an apartment, a mobile home or trailer, a group of rooms, or a single room occupied as separate living quarters, or if vacant, intended for occupancy as separate living quarters. An owner-occupied housing unit indicates that the owner or co-owner lives in the unit even if mortgaged or not fully paid for. The median value(s) of housing units reflects housing units with and without a mortgage. A household includes all the people who occupy a housing unit as their usual place of residence.

Luna County has 10,999 total housing units. About 67.4 percent of homeowners in Luna County occupy their housing unit. The median value of housing in New Mexico is 48 percent higher than in Luna County.

## **2.16 Proposed Preliminary Schedule of Operations (Concept to Closure)**

The verification of the resource is expected to take approximately 1 year. During this time, the workforce would average about 5 to 10 persons per day. The estimated operational life required to recover the minerals 30 years, although this estimate likely will be refined using the results of the resource verification. The mining activities, which will be similar to quarrying, will be conducted and are anticipated to take up to 30 years and employ up to 10 on-site personnel. The reclamation workforce would consist of up to 10 employees. Reclamation will occur contemporaneously during operations, to the extent feasible, and will be conducted in the form of “rolling” reclamation to support phased approach within a maximum 40 acre disturbance footprint, and after all mining/quarrying activities are completed.

Southwestern New Mexico and Luna County have a history of mining and agriculture, and AmMg would provide employment opportunities to individuals living in the immediate area of the project. It is likely that personnel from outside the local area would be required in order to meet the full needs of the Project; however, the southwestern United States is capable of providing a large base of experienced personnel.

## **2.17 Other Plans and Requirements**

The following Plans and Requirements are anticipated for this project:

- SWPPP (to be provided)
- Blasting Plan (to be provided)
- MMD Minimal Impact New Mining Permitting (submitted to MMD)

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### **3.0 RECLAMATION PLAN [3809.41(b)(3)]**

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Disturbed areas that are not needed for, or within the planned footprint of, ongoing operations shall be reclaimed. These areas include the office area and laydown yard. They also include the final surface once the deposit is quarried to the valley floor. Areas will be restored to a safe and stable condition that blends with the surrounding undisturbed area, and that meets MMD's requirement to achieve a self-sustaining ecosystem appropriate for the surrounding area that is consistent with approved post-mining land uses. The impacted surface area shall substantially be restored to the condition that existed prior to operations by placement of a soil cover, re-contoured so that the remaining ground surface approximates the surrounding topography and will be re-vegetated. Disturbed areas shall be maintained to control dust and minimize erosion to the extent practicable.

Topsoils and subsoils shall be replaced more or less to their original relative positions and contoured so as to achieve erosion control, long-term stability and preservation of surface water flow patterns. The disturbed area then shall be reseeded in the first favorable growing season following closure of the Project.

If it is determined that the areas disturbed are reasonably needed for future production operations, but will not be utilized reasonably promptly, the disturbed areas will be compacted, covered, or otherwise stabilized and maintained in such a way as to minimize dust and erosion to the extent practicable but in anticipation of use in future operations.

If the areas will no longer be used for mining operations, reclamation will begin as soon as reasonably practicable. Reclamation of all disturbed areas no longer in use shall be considered complete when all ground surface disturbing activities at the site have been completed, and a uniform vegetative cover has been established that reflects a life-form ratio of plus or minus fifty percent (50%) of pre-disturbance levels and a total percent plant cover of at least seventy percent (70%) of pre-disturbance levels, excluding noxious weeds. Seeding will be conducted as outlined in New Mexico State University Cooperative Extension Service Circular 525. Notification shall be provided when reclamation and re-vegetation are complete.

#### **3.1 Mine Reclamation [3809.401(b)(3)(ii)]**

Reclamation will be completed to the standards described in 43 CFR 3809.420(3) and New Mexico Mining and Minerals Part 3 requirements. Reclamation will meet the reclamation objectives as outlined in the U.S. Department of Interior Solid Minerals Reclamation Handbook #H-3042-1 (BLM 1992), Surface Management of Mining Operations Handbook H-3809-1 (BLM 1989), and revegetation success standards per BLM/NDEP "Revised Guidelines for Successful Mining and Resource verification Revegetation" (BLM 1999).

Reclamation will be designed to achieve land uses consistent with the BLM- and New Mexico Mining and Minerals-approved Post Mine Land Uses (PMLUs) and any applicable

land use management plans for the area. Reclamation is intended to return disturbed land to a level of productivity comparable to pre-resource verification levels. Land use includes wildlife habitat, livestock grazing, hunting, and dispersed recreation. The post-mining land uses are not expected to differ from pre-project land use.

During Project activities, reclamation will involve management of drilling to contain cuttings and manage drilling fluids, monitoring road conditions, and keeping sites clean and safe. During seasonal closure of the Project and periods of inactivity between drilling phases, reclamation will involve cleaning sites, and maintaining the overall safety of the Project Area. The BLM and MMD will be notified prior to any periods of inactivity greater than 120 days.

After Project activities are completed, reclamation will involve regrading disturbed areas related to this Project to their approximate adjacent contours. The Project will then be seeded using the approved reclamation seed mixture and application rates furnished by the BLM. Yearly visits to the site will be conducted to monitor the success of the revegetation for a period of up to three years or until revegetation success has been achieved.

### **3.2 Regrading and Reshaping of 40-Acre Disturbed Area [3809.401(b)(3)(ii)]**

Upon closure of the operations, disturbance locations will be reclaimed according to the reclamation plan. Prior to final closure, AmMg will confer with the State of New Mexico and the BLM will determine which roads used or improved during operations should be left intact around the site in order to conduct post-closure monitoring or provide adjacent landowner access. All other mine-related roads that were not in existence at the commencement of operations contemplated by this PoO would be reclaimed.

### **3.3 Revegetation [3809.401(b)(3)(vii)]**

Where salvageable soil exists in areas that are to be newly disturbed, AmMg will salvage as much material as can be safely and practically recovered. The lack of reclamation cover material available from disturbed areas and the poor development of topsoil (top dressing) at the site may require the evaluation of alternative sources and types of materials for use as reclamation cover and suitable growing media.

Where possible, the near-surface alluvial materials from within the limits of ground-disturbing operations will be salvaged to cover the identified soil deficit to meet reclamation cover requirements. Diversion ditches will be constructed and maintained around the reclamation material stockpiles to prevent run-on erosion. Salvage material stockpiles will be seeded with an interim, weed-free seed mix. Seeding is typically done once, right before the monsoon season. Prior to and during soil salvage, woody plants and vegetation will be removed. Except to the extent any plants may be recovered and salvaged or transplanted by AmMg or others who may be permitted to do so, the vegetation will be

combined with the growth media to increase the organic matter content of the growth media.

### **3.4 Wildlife Rehabilitation [3809.401(b)(3)(v)]**

Reclamation of the Project area will be conducted to achieve a stable configuration and a self-sustaining ecosystem appropriate for the life zones of the surrounding area, and access to the site will be restricted for protection of the public and animals. The Project will result in the reclamation of land disturbed by quarrying activities.

### **3.5 Removal of Building and Associated Structures [3809.401(b)(3)(ix)]**

All temporary structures required for the Project will be demobilized or demolished and removed from the site for appropriate disposition when activities are completed.

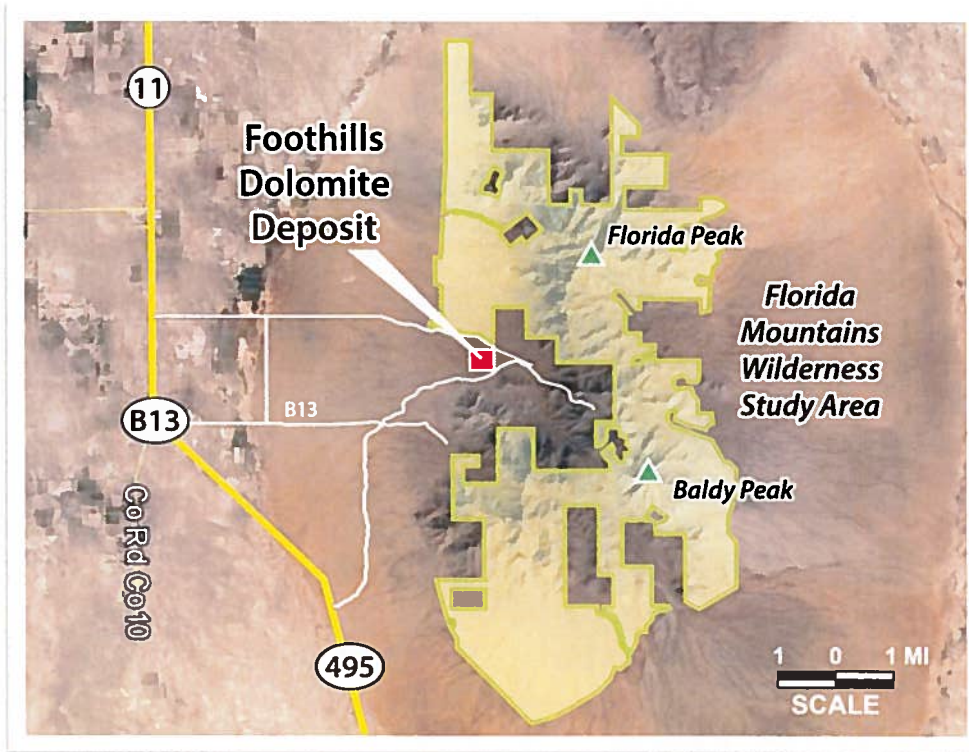
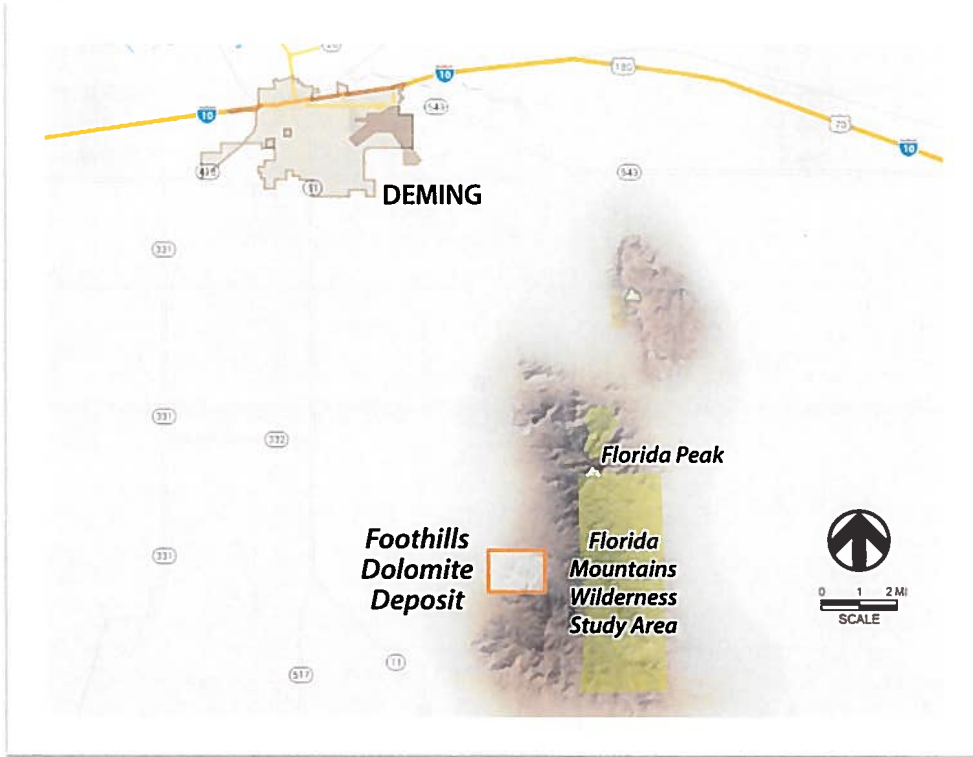
### **3.6 Post-Closure Management [3809.401(b)(3)(x)]**

Following the completion of reclamation and closure activities, revegetation will be monitored for at least two growing seasons and will meet Part 3 requirements under the New Mexico Mining Act. In accordance with Paragraph (2) of Subsection S of 19.10.1 NMAC, a “self-sustaining ecosystem” will be established for all reclaimed areas impacted by mine development. The reclaimed land will be self-renewing without augmented seeding, amendments, or other assistance which is capable of supporting communities of living organisms and their environment. By MMD definition, a “self-sustaining ecosystem” includes hydrologic and nutrient cycles functioning at level of productivity sufficient to support biological diversity. No discharges that will impact groundwater are anticipated from the proposed activities; only water for dust suppression is planned.

### **3.7 Project Maps**

The project location, access routes, surface land administration, and claim locations are presented below.

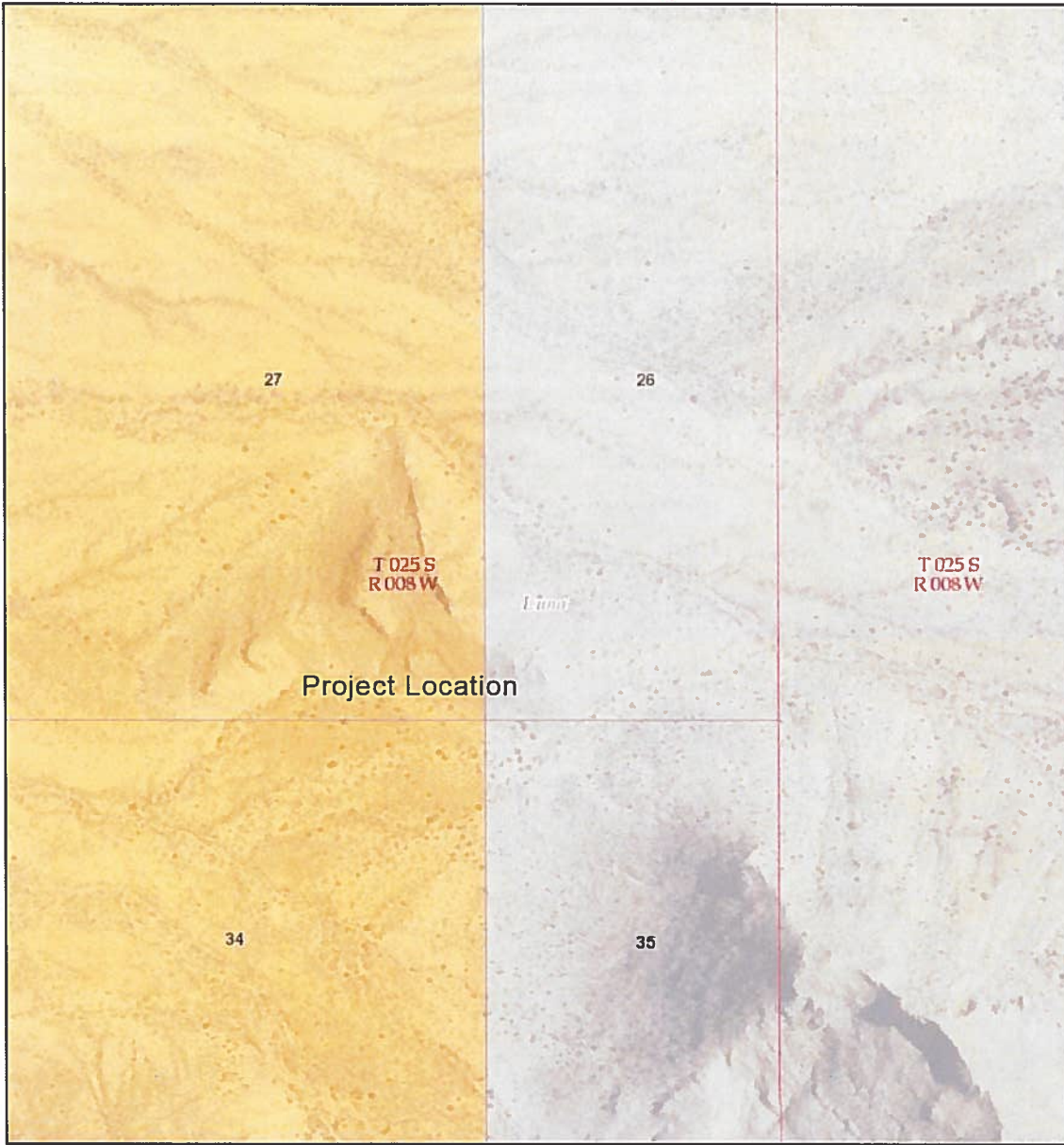
**Figure 1. Project Location**







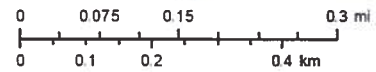
**Figure 3. Land Management Agency**



February 6, 2017

1:9,028

- |                                  |                         |                   |
|----------------------------------|-------------------------|-------------------|
| Administrative Unit Boundary     | Dept. of Agriculture    | Private           |
| Counties                         | Dept. of Defense        | State             |
| Townships                        | Dept. of Energy         | State Game & Fish |
| Sections                         | Fish & Wildlife Service | State Park        |
| <b>Surface Management Agency</b> | Forest Service          | Tribal            |
| Bureau of Land Management        | National Park Service   |                   |
| Bureau of Reclamation            | Other Federal Agency    |                   |



Bureau of Land Management - New Mexico State Office  
 Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus  
 DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community

US Bureau of Land Management

**Figure 4. Proposed Alternate Route and MAG 21 and MAG 22 Claim Boundaries**

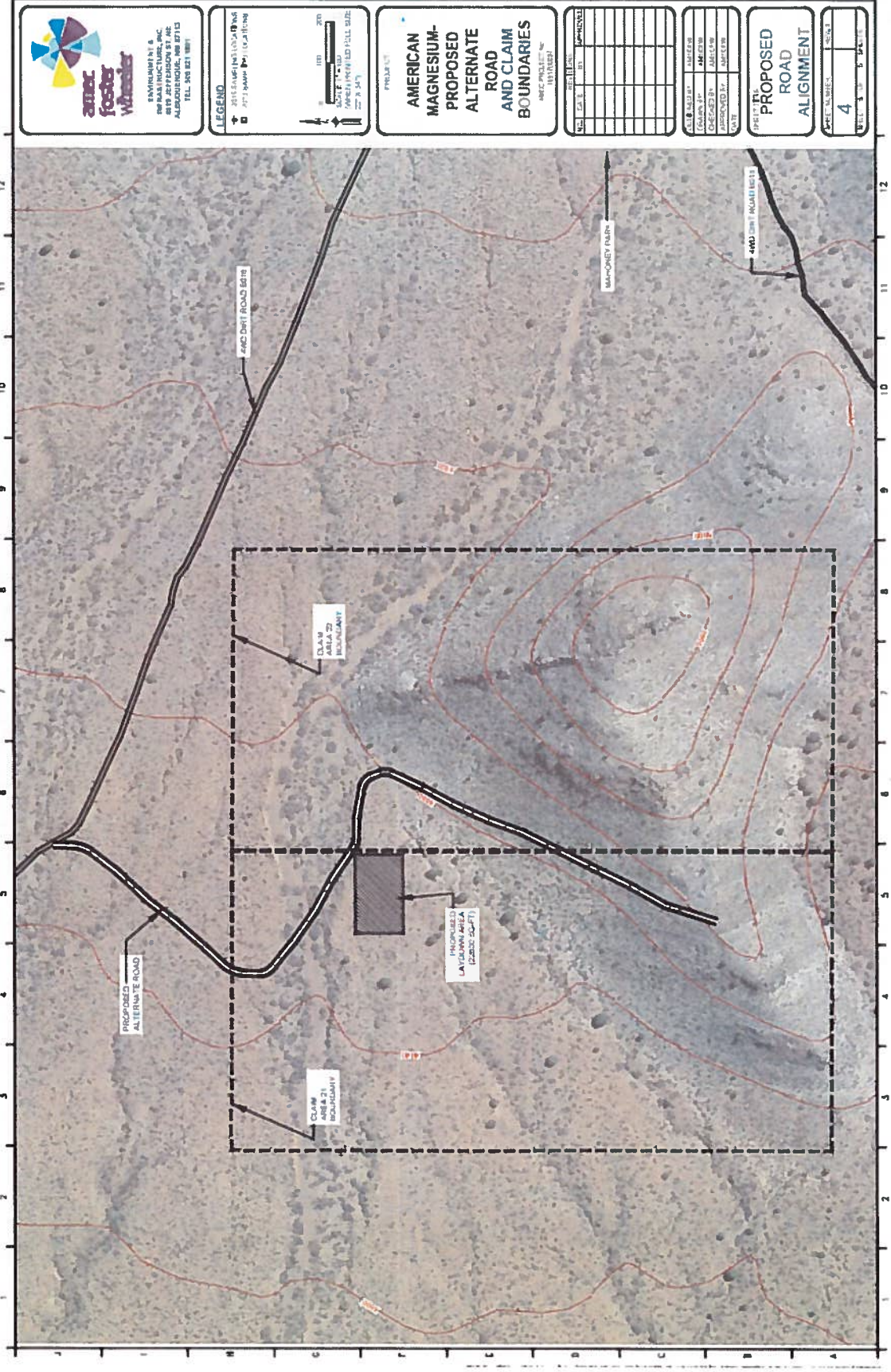
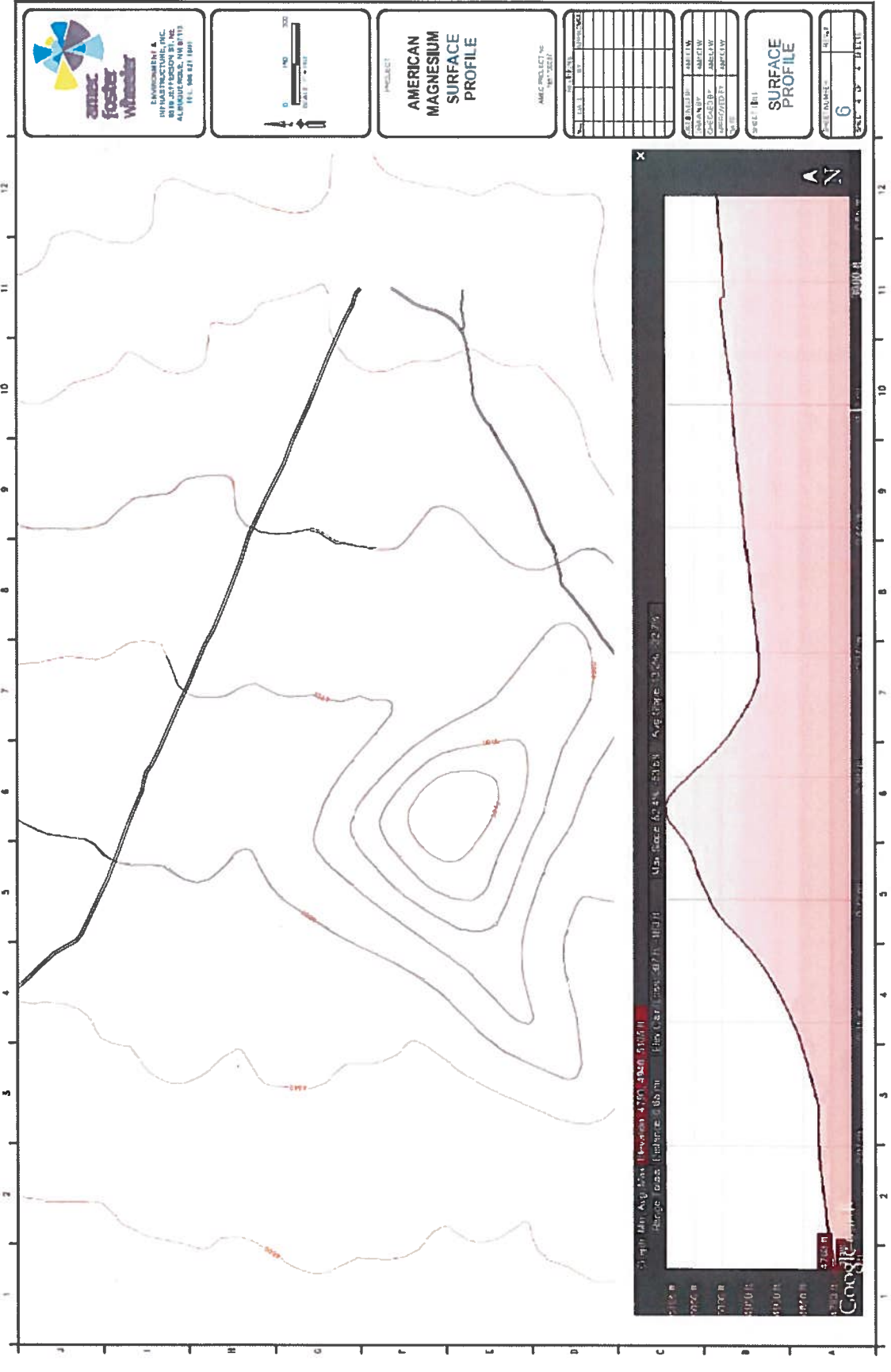








Figure 6. Surface Profile



PROJECT

**AMERICAN MAGNESIUM SURFACE PROFILE**

AMEC PROJECT NO. 100-20211

DATE	NOV 13 2013
TIME	10:52 AM
USER	AMERICAN
OPERATOR	AMERICAN
PROJECT	AMERICAN
FILE	100-20211

SHEET 1811

**SURFACE PROFILE**

SHEET NUMBER: 6

### **3.8 Proposed Productive Post-Mining Land Use**

Major land uses occurring in the vicinity of the mine area are mining, grazing, wildlife habitat, watershed, and recreation. Following closure, the mine area would continue to support mineral development, grazing, wildlife habitat, watershed, and recreation. Land use in the project area will not change from pre-mining approved purposes and the project area will continue to support these approved uses. Reclamation and closure of the disturbed area will result in post-mining land uses that will be sustainable and will be consistent with uses currently approved. Mining, grazing, recreation and wildlife habitat are the designations consistent with the surrounding land uses of the site, and will be appropriate for the site upon reclamation. The Reclamation and Closure Plan is designed to re-establish grazing in the area and allow for long-term use of the reclaimed areas by wildlife known to historically use the area without affecting the potential for other uses such as mining and recreation.

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## **4.0 MONITORING PLAN [3809.401(b)(4)]**

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The operation is designed to produce zero discharge. As such, sediment control is an important design feature at the site. The only sedimentation that may be produced will be from surface water runoff from several on-site sources including the mining areas and any rock stockpiles.

A SWPPP will be developed for construction and maintained during operation. Sediment control will be achieved by the use of BMPs including regrading, seeding and mulching, silt fences, straw bale dams, diversion ditches with energy dissipaters, and rock check dams at appropriate locations during construction and operation. Diversion structures, including existing structures, will divert run-on away from disturbed areas. All sediment control structures will be monitored and maintained on a regular basis. During operations, all runoff from the plant site will be directed into impacted storm water impoundments and other ponds, as discussed below. During reclamation, all areas where water ponds will be re-contoured and graded, surfaces covered with top dressing, and vegetated.

### **4.1 Monitoring Devices**

BMPs will be used to limit erosion and reduce sediment in runoff from the project disturbed areas during construction, operations, and reclamation. Structural and operational BMPs will be used to minimize erosion and control sediment. Disturbance will be limited to preserve existing vegetation to the maximum extent possible. Following construction activities, areas such as cut and fill embankments will be seeded as soon as practicable and safe. Revegetation of disturbed areas will reduce the potential for wind and water erosion. Concurrent reclamation will be utilized to the extent practicable to accelerate revegetation of disturbed areas. All sediment and erosion control measures will be inspected periodically and repairs performed as needed. Additional details regarding BMPs will be included in the SWPPP permit required for mine construction and operation.

### **4.2 Sampling Parameters and Frequency**

There are no non-point discharges anticipated that will require monitoring. However, non-point sources will be managed to the extent they may occur during resource verification, mining development, mining or reclamation with the use of BMPs including such things as seeding and mulching of disturbed areas, silt fences, straw bale check dams, diversion ditches with energy dissipaters, and rock check dams, as necessary.

### **4.3 Analytical Methods**

No analysis is required.

#### **4.4 Reporting Procedures**

Reports shall be completed in accordance with project plans and requirements.

## **5.0 INTERIM MANAGEMENT PLAN [3809.401(b)(5)]**

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### **5.1 Schedule of Anticipated Periods of Temporary Closure [3809.401(b)(5)(vi)]**

No temporary closures are anticipated during the execution of this project. If a temporary closure is required due to mechanical, operational, or weather requirements, the following measures will be taken:

- Excavations and workings will be stabilized;
- Toxic or deleterious materials will be removed from the site;
- Equipment, supplies and structures will be stored or removed;
- Project area will be monitored to maintain a safe and clean condition; and,
- Site conditions will be inspected every 14 days or following periods of rainfall exceeding 0.25 inches in a 24-hour period.

### **5.2 Plans for Monitoring Site Conditions during Periods of Non-Operation [3809.401(b)(5)(v)]**

Site conditions will be inspected every 14 days or following periods of rainfall exceeding 0.25 inches in a 24-hour period.

#### **5.2.1 Measures to Stabilize Excavations and Workings [3809.401(b)(5)(i)]**

When possible, final and interim reclamation would be performed concurrently with resource verification activities. When re-contoured, the disturbed areas will be graded to promote non-erosive runoff, and would be vegetated. To the extent feasible, any remaining disturbed areas will be shaped to blend with the surrounding topography and seeded.

Reclamation will consist of re-contouring and seeding. Regrading will consist of redistributing fill slopes back onto the cut portion of roads to return the area to near pre-disturbance topography. Culverts are not anticipated on resource verification roads, and therefore, it is not anticipated that the removal any culverts during re-contouring of the roads will be necessary. However, if installation of culverts along a primary access road is necessary for resource verification or ore hauling during mining, they will be left in place if permitted by BLM as they are likely to have long-term benefits for site access. Regrading would, to the extent practical, re-establish pre-disturbance topography and drainage, and provide slopes that would, in conjunction with revegetation, control erosion. The re-contoured surface will be seeded with 13 pounds pure live seed per acre.

#### **5.2.2 Measures to Isolate or Control Toxic or Deleterious Materials [3809.401(b)(5)(ii)]**

All refuse generated by the Project will be disposed of at an authorized landfill facility off-site, consistent with applicable regulations. No refuse will be disposed of on-site. Water

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and/or nontoxic drill hole abandonment materials, including abantonite, Alcomer 120L, bentonite, EZ-mud, polyplus, and super plug, will be utilized as necessary during drilling and will be stored at the Project Area.

Hazardous and regulated materials utilized at the Project Area will include diesel fuel, gasoline, and lubricating grease. All containers of hazardous substances will be labeled and handled in accordance with the NMDOT and MSHA. In the event hazardous or regulated materials, such as diesel fuel, are spilled, measures will be taken to control the spill, and they will be cleaned up in a timely manner. After clean up, the oil, toxic fluids, or chemicals and any contaminated material will be removed from the site and disposed of at an approved disposal facility. Self-contained, portable, chemical toilets will be used for human waste. The human waste and toilet chemicals will not be buried on site.

### **5.2.3 Provisions for the Storage or Removal of Equipment, Supplies, and Structures [3809.401(b)(5)(iii)]**

Not applicable.

### **5.2.4 Measures to Maintain the Project Area in a Safe and Clean Condition [3809.401(b)(5)(iv)]**

The Project Area will remain trash free and will be left in a safe condition. Routine road maintenance may be required and will consist of smoothing ruts, filling holes with fill material, grading, and re-establishing waterbars when necessary.

Periods of non-operation greater than 120 days are not anticipated; however, if temporary closures are required, the drill rig will vacate the Project Area and sumps will be adequately fenced. Once the sumps have dried out, they will be backfilled.

The BLM and MMD will be notified in writing within 90 days after work is suspended at the operation for more than 120 days. The Notice will state the nature and the reason for the suspension of work, the anticipated duration of the suspension, and any event that will reasonably be expected to result in either the resumption of activities or the abandonment of the operation.

All trash will be hauled off site and there will be no resource verification or mining materials left on site at the conclusion of operations. All drill sites will be patrolled with hand rake and shovel after Project completion to scatter and cover any cuttings piles, fill ruts, and to perform general clean up. No core samples will be left on-site after the completion of Project activities.

## 6.0 RECLAMATION COST ESTIMATE [3809.401(d)]

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A preliminary reclamation cost estimate is included here, and a final reclamation cost estimate will be submitted in the future as Appendix D. As required by 43 CFR 3809.552, a complete reclamation cost estimate will be prepared for the entire mine project during evaluation or upon completion of the requirements of the National Environmental Policy Act (NEPA). The planned cost estimating effort will utilize industry acceptable software to facilitate accuracy, completeness, and consistency in the calculation of costs for mine site reclamation.

The total reclamation cost estimate for the 15 acres of authorized disturbance within the Project Area associated with proposed Phase I surface disturbance will be calculated and submitted initially, and AmMg anticipates that the total reclamation cost estimate will be submitted in coordination with BLM and MMD in connection with determining the appropriate financial assurance to be submitted for the Project. The financial assurance will be posted in the approved amount in order to cover this Plan upon receiving concurrence from the BLM and MMD that the amount is satisfactory.

### 6.1 Proposed Reclamation Activities

The primary closure and reclamation activities to be undertaken for this Project include:

- Re-contouring disturbed areas;
- Drill hole plugging and abandonment; and
- Seeding disturbed areas to establish vegetation.

Reclamation costs will be estimated for the activities described in the Reclamation Plan. The estimated costs will be based on Davis-Bacon Act labor wage rates and local equipment rental rates and 40 hours (1 equipment operator and 2 laborers) for the estimated time to complete the tasks and the anticipated costs of materials that would be required for hydro seeding. Per BLM guidelines, these separate cost categories (manpower, equipment, and materials) will be provided as separate line items for each reclamation disturbance category. The costs will be based on reclamation of 15 acres and a 40 hour work week to complete.

**Table 8. Preliminary Reclamation Cost Estimate**

Project Component	Manpower	Equipment	Material	Total
Mine Planning, including Resource verification Roads and Drill Pads	\$1,783	\$3,800	\$65,340	\$70,923.00



## 7.0 REFERENCES

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**Appendix A  
Spill Prevention Plan  
(future submittal)**

**Appendix B**  
**Soil Survey of Luna County, NM**



United States  
Department of  
Agriculture

**NRCS**

Natural  
Resources  
Conservation  
Service

A product of the National  
Cooperative Soil Survey,  
a joint effort of the United  
States Department of  
Agriculture and other  
Federal agencies, State  
agencies including the  
Agricultural Experiment  
Stations, and local  
participants

# Custom Soil Resource Report for Luna County, New Mexico



October 25, 2016

# Preface

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Soil surveys contain information that affects land use planning in survey areas. They highlight soil limitations that affect various land uses and provide information about the properties of the soils in the survey areas. Soil surveys are designed for many different users, including farmers, ranchers, foresters, agronomists, urban planners, community officials, engineers, developers, builders, and home buyers. Also, conservationists, teachers, students, and specialists in recreation, waste disposal, and pollution control can use the surveys to help them understand, protect, or enhance the environment.

Various land use regulations of Federal, State, and local governments may impose special restrictions on land use or land treatment. Soil surveys identify soil properties that are used in making various land use or land treatment decisions. The information is intended to help the land users identify and reduce the effects of soil limitations on various land uses. The landowner or user is responsible for identifying and complying with existing laws and regulations.

Although soil survey information can be used for general farm, local, and wider area planning, onsite investigation is needed to supplement this information in some cases. Examples include soil quality assessments (<http://www.nrcs.usda.gov/wps/portal/nrcs/main/soils/health/>) and certain conservation and engineering applications. For more detailed information, contact your local USDA Service Center (<http://offices.sc.egov.usda.gov/locator/app?agency=nrcs>) or your NRCS State Soil Scientist ([http://www.nrcs.usda.gov/wps/portal/nrcs/detail/soils/contactus/?cid=nrcs142p2\\_053951](http://www.nrcs.usda.gov/wps/portal/nrcs/detail/soils/contactus/?cid=nrcs142p2_053951)).

Great differences in soil properties can occur within short distances. Some soils are seasonally wet or subject to flooding. Some are too unstable to be used as a foundation for buildings or roads. Clayey or wet soils are poorly suited to use as septic tank absorption fields. A high water table makes a soil poorly suited to basements or underground installations.

The National Cooperative Soil Survey is a joint effort of the United States Department of Agriculture and other Federal agencies, State agencies including the Agricultural Experiment Stations, and local agencies. The Natural Resources Conservation Service (NRCS) has leadership for the Federal part of the National Cooperative Soil Survey.

Information about soils is updated periodically. Updated information is available through the NRCS Web Soil Survey, the site for official soil survey information.

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EG—Eba very gravelly clay loam, 0 to 10 percent slopes.....	12
RU—Rough broken and Rock land.....	13
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# How Soil Surveys Are Made

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Soil surveys are made to provide information about the soils and miscellaneous areas in a specific area. They include a description of the soils and miscellaneous areas and their location on the landscape and tables that show soil properties and limitations affecting various uses. Soil scientists observed the steepness, length, and shape of the slopes; the general pattern of drainage; the kinds of crops and native plants; and the kinds of bedrock. They observed and described many soil profiles. A soil profile is the sequence of natural layers, or horizons, in a soil. The profile extends from the surface down into the unconsolidated material in which the soil formed or from the surface down to bedrock. The unconsolidated material is devoid of roots and other living organisms and has not been changed by other biological activity.

Currently, soils are mapped according to the boundaries of major land resource areas (MLRAs). MLRAs are geographically associated land resource units that share common characteristics related to physiography, geology, climate, water resources, soils, biological resources, and land uses (USDA, 2006). Soil survey areas typically consist of parts of one or more MLRA.

The soils and miscellaneous areas in a survey area occur in an orderly pattern that is related to the geology, landforms, relief, climate, and natural vegetation of the area. Each kind of soil and miscellaneous area is associated with a particular kind of landform or with a segment of the landform. By observing the soils and miscellaneous areas in the survey area and relating their position to specific segments of the landform, a soil scientist develops a concept, or model, of how they were formed. Thus, during mapping, this model enables the soil scientist to predict with a considerable degree of accuracy the kind of soil or miscellaneous area at a specific location on the landscape.

Commonly, individual soils on the landscape merge into one another as their characteristics gradually change. To construct an accurate soil map, however, soil scientists must determine the boundaries between the soils. They can observe only a limited number of soil profiles. Nevertheless, these observations, supplemented by an understanding of the soil-vegetation-landscape relationship, are sufficient to verify predictions of the kinds of soil in an area and to determine the boundaries.

Soil scientists recorded the characteristics of the soil profiles that they studied. They noted soil color, texture, size and shape of soil aggregates, kind and amount of rock fragments, distribution of plant roots, reaction, and other features that enable them to identify soils. After describing the soils in the survey area and determining their properties, the soil scientists assigned the soils to taxonomic classes (units). Taxonomic classes are concepts. Each taxonomic class has a set of soil characteristics with precisely defined limits. The classes are used as a basis for comparison to classify soils systematically. Soil taxonomy, the system of taxonomic classification used in the United States, is based mainly on the kind and character of soil properties and the arrangement of horizons within the profile. After the soil scientists classified and named the soils in the survey area, they compared the



## Custom Soil Resource Report

individual soils with similar soils in the same taxonomic class in other areas so that they could confirm data and assemble additional data based on experience and research.

The objective of soil mapping is not to delineate pure map unit components; the objective is to separate the landscape into landforms or landform segments that have similar use and management requirements. Each map unit is defined by a unique combination of soil components and/or miscellaneous areas in predictable proportions. Some components may be highly contrasting to the other components of the map unit. The presence of minor components in a map unit in no way diminishes the usefulness or accuracy of the data. The delineation of such landforms and landform segments on the map provides sufficient information for the development of resource plans. If intensive use of small areas is planned, onsite investigation is needed to define and locate the soils and miscellaneous areas.

Soil scientists make many field observations in the process of producing a soil map. The frequency of observation is dependent upon several factors, including scale of mapping, intensity of mapping, design of map units, complexity of the landscape, and experience of the soil scientist. Observations are made to test and refine the soil-landscape model and predictions and to verify the classification of the soils at specific locations. Once the soil-landscape model is refined, a significantly smaller number of measurements of individual soil properties are made and recorded. These measurements may include field measurements, such as those for color, depth to bedrock, and texture, and laboratory measurements, such as those for content of sand, silt, clay, salt, and other components. Properties of each soil typically vary from one point to another across the landscape.

Observations for map unit components are aggregated to develop ranges of characteristics for the components. The aggregated values are presented. Direct measurements do not exist for every property presented for every map unit component. Values for some properties are estimated from combinations of other properties.

While a soil survey is in progress, samples of some of the soils in the area generally are collected for laboratory analyses and for engineering tests. Soil scientists interpret the data from these analyses and tests as well as the field-observed characteristics and the soil properties to determine the expected behavior of the soils under different uses. Interpretations for all of the soils are field tested through observation of the soils in different uses and under different levels of management. Some interpretations are modified to fit local conditions, and some new interpretations are developed to meet local needs. Data are assembled from other sources, such as research information, production records, and field experience of specialists. For example, data on crop yields under defined levels of management are assembled from farm records and from field or plot experiments on the same kinds of soil.

Predictions about soil behavior are based not only on soil properties but also on such variables as climate and biological activity. Soil conditions are predictable over long periods of time, but they are not predictable from year to year. For example, soil scientists can predict with a fairly high degree of accuracy that a given soil will have a high water table within certain depths in most years, but they cannot predict that a high water table will always be at a specific level in the soil on a specific date.

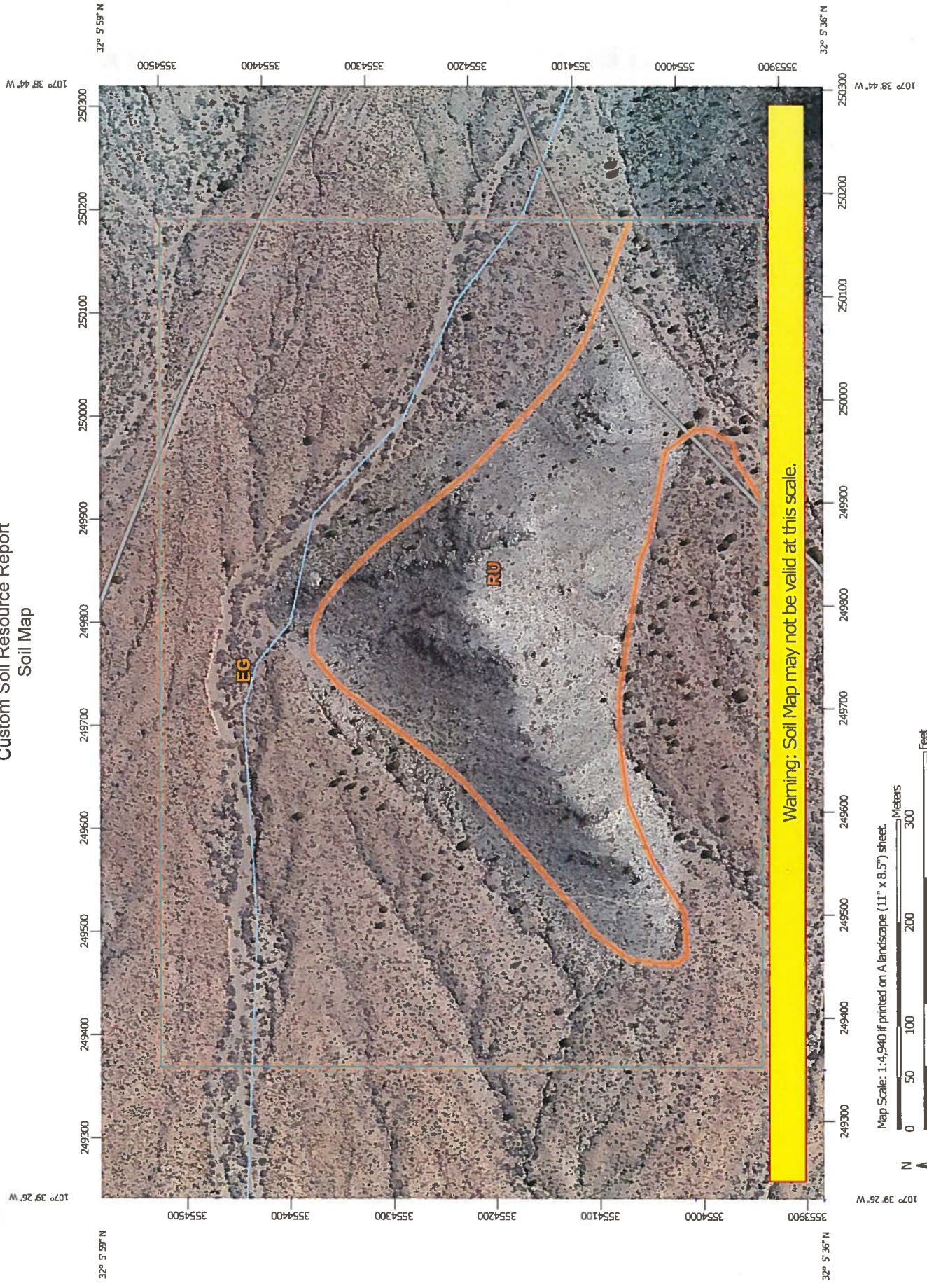
After soil scientists located and identified the significant natural bodies of soil in the survey area, they drew the boundaries of these bodies on aerial photographs and identified each as a specific map unit. Aerial photographs show trees, buildings, fields, roads, and rivers, all of which help in locating boundaries accurately.

# Soil Map

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The soil map section includes the soil map for the defined area of interest, a list of soil map units on the map and extent of each map unit, and cartographic symbols displayed on the map. Also presented are various metadata about data used to produce the map, and a description of each soil map unit.

# Custom Soil Resource Report Soil Map



Map Scale: 1:4,940 if printed on A landscape (11" x 8.5") sheet.



Map projection: Web Mercator Corner coordinates: WGS84 Edge tics: UTM Zone 13N WGS84



### MAP LEGEND

- Area of Interest (AOI)
- Area of Interest (AOI)
- Soils**
- Soil Map Unit Polygons
- Soil Map Unit Lines
- Soil Map Unit Points
- Special Point Features**
- Blowout
- Borrow Pit
- Clay Spot
- Closed Depression
- Gravel Pit
- Gravelly Spot
- Landfill
- Lava Flow
- Marsh or swamp
- Mine or Quarry
- Miscellaneous Water
- Perennial Water
- Rock Outcrop
- Saline Spot
- Sandy Spot
- Severely Eroded Spot
- Sinkhole
- Slide or Slip
- Sodic Spot
- Spoil Area
- Stony Spot
- Very Stony Spot
- Wet Spot
- Other
- Special Line Features
- Water Features**
- Streams and Canals
- Transportation**
- Rails
- Interstate Highways
- US Routes
- Major Roads
- Local Roads
- Background**
- Aerial Photography

### MAP INFORMATION

The soil surveys that comprise your AOI were mapped at 1:24,000.

Warning: Soil Map may not be valid at this scale.

Enlargement of maps beyond the scale of mapping can cause misunderstanding of the detail of mapping and accuracy of soil line placement. The maps do not show the small areas of contrasting soils that could have been shown at a more detailed scale.

Please rely on the bar scale on each map sheet for map measurements.

Source of Map: Natural Resources Conservation Service  
 Web Soil Survey URL: <http://websoilsurvey.nrcs.usda.gov>  
 Coordinate System: Web Mercator (EPSG:3857)

Maps from the Web Soil Survey are based on the Web Mercator projection, which preserves direction and shape but distorts distance and area. A projection that preserves area, such as the Albers equal-area conic projection, should be used if more accurate calculations of distance or area are required.

This product is generated from the USDA-NRCS certified data as of the version date(s) listed below.

Soil Survey Area: Luna County, New Mexico  
 Survey Area Data: Version 12, Sep 26, 2014

Soil map units are labeled (as space allows) for map scales 1:50,000 or larger.

Date(s) aerial images were photographed: Jan 15, 2011—Feb 23, 2011

The orthophoto or other base map on which the soil lines were compiled and digitized probably differs from the background imagery displayed on these maps. As a result, some minor shifting of map unit boundaries may be evident.

## Map Unit Legend

Luna County, New Mexico (NM029)			
Map Unit Symbol	Map Unit Name	Acres in AOI	Percent of AOI
EG	Eba very gravelly clay loam, 0 to 10 percent slopes	84.2	71.1%
RU	Rough broken and Rock land	34.3	28.9%
<b>Totals for Area of Interest</b>		<b>118.5</b>	<b>100.0%</b>

## Map Unit Descriptions

The map units delineated on the detailed soil maps in a soil survey represent the soils or miscellaneous areas in the survey area. The map unit descriptions, along with the maps, can be used to determine the composition and properties of a unit.

A map unit delineation on a soil map represents an area dominated by one or more major kinds of soil or miscellaneous areas. A map unit is identified and named according to the taxonomic classification of the dominant soils. Within a taxonomic class there are precisely defined limits for the properties of the soils. On the landscape, however, the soils are natural phenomena, and they have the characteristic variability of all natural phenomena. Thus, the range of some observed properties may extend beyond the limits defined for a taxonomic class. Areas of soils of a single taxonomic class rarely, if ever, can be mapped without including areas of other taxonomic classes. Consequently, every map unit is made up of the soils or miscellaneous areas for which it is named and some minor components that belong to taxonomic classes other than those of the major soils.

Most minor soils have properties similar to those of the dominant soil or soils in the map unit, and thus they do not affect use and management. These are called noncontrasting, or similar, components. They may or may not be mentioned in a particular map unit description. Other minor components, however, have properties and behavioral characteristics divergent enough to affect use or to require different management. These are called contrasting, or dissimilar, components. They generally are in small areas and could not be mapped separately because of the scale used. Some small areas of strongly contrasting soils or miscellaneous areas are identified by a special symbol on the maps. If included in the database for a given area, the contrasting minor components are identified in the map unit descriptions along with some characteristics of each. A few areas of minor components may not have been observed, and consequently they are not mentioned in the descriptions, especially where the pattern was so complex that it was impractical to make enough observations to identify all the soils and miscellaneous areas on the landscape.

The presence of minor components in a map unit in no way diminishes the usefulness or accuracy of the data. The objective of mapping is not to delineate pure taxonomic classes but rather to separate the landscape into landforms or landform segments that have similar use and management requirements. The delineation of such segments on the map provides sufficient information for the development of resource plans. If intensive use of small areas is planned, however, onsite investigation is needed to define and locate the soils and miscellaneous areas.

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An identifying symbol precedes the map unit name in the map unit descriptions. Each description includes general facts about the unit and gives important soil properties and qualities.

Soils that have profiles that are almost alike make up a *soil series*. Except for differences in texture of the surface layer, all the soils of a series have major horizons that are similar in composition, thickness, and arrangement.

Soils of one series can differ in texture of the surface layer, slope, stoniness, salinity, degree of erosion, and other characteristics that affect their use. On the basis of such differences, a soil series is divided into *soil phases*. Most of the areas shown on the detailed soil maps are phases of soil series. The name of a soil phase commonly indicates a feature that affects use or management. For example, Alpha silt loam, 0 to 2 percent slopes, is a phase of the Alpha series.

Some map units are made up of two or more major soils or miscellaneous areas. These map units are complexes, associations, or undifferentiated groups.

A *complex* consists of two or more soils or miscellaneous areas in such an intricate pattern or in such small areas that they cannot be shown separately on the maps. The pattern and proportion of the soils or miscellaneous areas are somewhat similar in all areas. Alpha-Beta complex, 0 to 6 percent slopes, is an example.

An *association* is made up of two or more geographically associated soils or miscellaneous areas that are shown as one unit on the maps. Because of present or anticipated uses of the map units in the survey area, it was not considered practical or necessary to map the soils or miscellaneous areas separately. The pattern and relative proportion of the soils or miscellaneous areas are somewhat similar. Alpha-Beta association, 0 to 2 percent slopes, is an example.

An *undifferentiated group* is made up of two or more soils or miscellaneous areas that could be mapped individually but are mapped as one unit because similar interpretations can be made for use and management. The pattern and proportion of the soils or miscellaneous areas in a mapped area are not uniform. An area can be made up of only one of the major soils or miscellaneous areas, or it can be made up of all of them. Alpha and Beta soils, 0 to 2 percent slopes, is an example.

Some surveys include *miscellaneous areas*. Such areas have little or no soil material and support little or no vegetation. Rock outcrop is an example.

## Luna County, New Mexico

### EG—Eba very gravelly clay loam, 0 to 10 percent slopes

#### Map Unit Setting

*National map unit symbol:* 1w94  
*Elevation:* 4,000 to 5,500 feet  
*Mean annual precipitation:* 8 to 11 inches  
*Mean annual air temperature:* 57 to 60 degrees F  
*Frost-free period:* 170 to 210 days  
*Farmland classification:* Not prime farmland

#### Map Unit Composition

*Eba and similar soils:* 100 percent  
*Estimates are based on observations, descriptions, and transects of the mapunit.*

#### Description of Eba

##### Setting

*Landform:* Alluvial fans, fan remnants  
*Landform position (three-dimensional):* Riser, rise  
*Down-slope shape:* Linear  
*Across-slope shape:* Linear  
*Parent material:* Mixed alluvium

##### Typical profile

*H1 - 0 to 2 inches:* very gravelly clay loam  
*H2 - 2 to 60 inches:* very gravelly clay

##### Properties and qualities

*Slope:* 0 to 10 percent  
*Depth to restrictive feature:* More than 80 inches  
*Natural drainage class:* Well drained  
*Runoff class:* Very high  
*Capacity of the most limiting layer to transmit water (Ksat):* Moderately low to moderately high (0.06 to 0.20 in/hr)  
*Depth to water table:* More than 80 inches  
*Frequency of flooding:* None  
*Frequency of ponding:* None  
*Calcium carbonate, maximum in profile:* 40 percent  
*Salinity, maximum in profile:* Nonsaline to slightly saline (0.0 to 4.0 mmhos/cm)  
*Sodium adsorption ratio, maximum in profile:* 1.0  
*Available water storage in profile:* Low (about 4.8 inches)

##### Interpretive groups

*Land capability classification (irrigated):* 4e  
*Land capability classification (nonirrigated):* 7s  
*Hydrologic Soil Group:* C  
*Ecological site:* Gravelly Loam (R042XB035NM)  
*Hydric soil rating:* No

## RU—Rough broken and Rock land

### Map Unit Setting

*National map unit symbol:* 1wbg  
*Elevation:* 4,000 to 8,400 feet  
*Mean annual precipitation:* 8 to 14 inches  
*Mean annual air temperature:* 50 to 62 degrees F  
*Frost-free period:* 150 to 210 days  
*Farmland classification:* Not prime farmland

### Map Unit Composition

*Rough broken:* 50 percent  
*Lozier and similar soils:* 35 percent  
*Estimates are based on observations, descriptions, and transects of the mapunit.*

### Description of Rough Broken

#### Typical profile

*H1 - 0 to 60 inches:* bedrock

#### Properties and qualities

*Slope:* 25 to 75 percent  
*Depth to restrictive feature:* 0 inches to lithic bedrock  
*Runoff class:* Very high  
*Capacity of the most limiting layer to transmit water (Ksat):* Very low to moderately low (0.00 to 0.06 in/hr)

#### Interpretive groups

*Land capability classification (irrigated):* None specified  
*Land capability classification (nonirrigated):* 8s  
*Hydric soil rating:* No

### Description of Lozier

#### Setting

*Landform:* Hillslopes  
*Landform position (two-dimensional):* Shoulder, backslope, footslope  
*Landform position (three-dimensional):* Side slope  
*Down-slope shape:* Linear  
*Across-slope shape:* Linear  
*Parent material:* Residuum weathered from limestone

#### Typical profile

*H1 - 0 to 8 inches:* very stony loam  
*H2 - 8 to 60 inches:* bedrock

#### Properties and qualities

*Slope:* 25 to 60 percent  
*Depth to restrictive feature:* 4 to 16 inches to lithic bedrock  
*Natural drainage class:* Well drained  
*Runoff class:* Very high



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*Capacity of the most limiting layer to transmit water (Ksat):* Moderately low to high  
(0.06 to 2.00 in/hr)

*Depth to water table:* More than 80 inches

*Frequency of flooding:* None

*Frequency of ponding:* None

*Calcium carbonate, maximum in profile:* 70 percent

*Salinity, maximum in profile:* Nonsaline to slightly saline (0.0 to 4.0 mmhos/cm)

*Sodium adsorption ratio, maximum in profile:* 1.0

*Available water storage in profile:* Very low (about 0.6 inches)

### **Interpretive groups**

*Land capability classification (irrigated):* None specified

*Land capability classification (nonirrigated):* 7s

*Hydrologic Soil Group:* D

*Ecological site:* Hills (R042XB027NM)

*Hydric soil rating:* No

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**Appendix C**  
**Archaeological Survey Summary (to be provided upon request)**  
**Preliminary Biological Survey**

**Appendix D**  
**Reclamation Cost**  
(to be completed following NEPA)

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