

TECHNICAL SPECIFICATIONS

EMNRD-MMD-2025-06 La Ventana Mine Maintenance Project

DIVISION 1 – GENERAL REQUIREMENTS

01010 – SUMMARY OF WORK

The New Mexico Abandoned Mine Land Program (NM AMLP) requests an itemized cost estimate reflecting the costs necessary to safeguard 5 coal mine features in Sandoval County, near Cuba, New Mexico. Safeguarding techniques will include but are not limited to Polyurethane foam plugs (PUF), metal fabrication of steel bat gates, culvert bat gates, and mechanized or hand backfills. Work will be conducted in a remote setting with a variety of extreme terrain and weather conditions. The project engineering plan set, and specifications are attached.

01012 – AVOIDANCE AREAS FOR PRESERVATION OF CULTURAL AND BIOLOGICAL RESOURCES

The Contractor shall avoid all designated cultural and biological resources including those discovered during construction. The contractor shall avoid these areas with all equipment, vehicles, foot traffic, and any other ground surface disturbing activities. Avoidance areas will be flagged by the AML Program or by a representative of the AML Program and will extend up to 50 feet (15 meters) from the designated cultural and biological resources, unless otherwise indicated by the Project Manager. Where it is infeasible to complete construction activities without disturbing the designated avoidance areas, avoidance area distances and access to work areas may be adjusted, in coordination with the Project Manager, to accommodate construction activities and ensure that no resources are impacted. The Contractor shall also coordinate with the Project Manager for any overland access routes around designated avoidance areas to access construction work sites. Construction disturbance adjacent to designated avoidance areas shall be minimized. The Project Manager or Project Engineer may designate additional avoidance areas as deemed necessary. No construction disturbance including excavation, fill, stockpiling of construction materials, staging, etc. shall take place within designated avoidance areas. When the Contractor is working near designated avoidance areas and where construction access routes pass adjacent to these locations, the Contractor shall place four-foot high, temporary, highvisibility barrier fencing (Hi-Vis, ADPI, or equivalent) around the features. Barrier fencing shall be removed upon completion of work. The Contractor shall bear all direct, indirect, and consequential costs of mitigation or repairs due to unauthorized damage caused by the Contractor's operations to cultural or biological resources within designated avoidance areas. These costs shall include but are not limited to fees and charges of engineers, attorneys, and other professionals, made necessary thereby. The Contractor shall cooperate fully to preserve archaeological and historic artifacts, and any threatened or endangered species found within the project area. Moving, removal or collecting of archaeological or historic materials or biological specimens from the project area or

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vicinity is prohibited. If the Contractor encounters a previously unidentified archaeological site, historic site, artifacts, unmarked human burials, or species suspected to be listed as or proposed to be listed as threatened or endangered, the Contractor shall terminate all operations in that immediate area (100-foot radius, 30 meters) until the archaeological or biological preservation agencies have been notified and assessed the discovery site. This termination shall not preclude continuation of work in other areas nor shall it entitle the Contractor to additional payment in any form, other than an extension of time, unless the Contractor is substantially precluded from working on the entire project.

01135 - HAZARDOUS AND CONFINED AREA PROCEDURES

This project requires construction work around and over hazardous and unprotected mine shafts, stopes, adits, and other openings which may be open to the surface or hidden from view by vegetation, trash, debris, or thin and unstable layers of surface materials or rock. The Contractor shall be responsible for thoroughly investigating the site conditions and scheduling equipment, equipment operations, personnel, and safety procedures to prevent accidents and injuries in accordance with the Project HASP. The Contractor shall follow appropriate procedures in accordance with applicable OSHA construction industry regulations, including 29 CFR Part 1926 – Safety and Health Regulations for Construction (latest revision). The Contractor shall designate a site safety officer for each work shift. The site safety officer shall be present on-site at all times while any work is being performed. The site safety officer shall be CPR/First Aid trained and certified by an accredited institution e.g. American Red Cross and shall conduct daily safety tailgate meetings at the start of each shift. In accordance with the Project HASP, any accidents or safety incidents shall be reported immediately to the Project Manager or as soon as practicable. The Contractor is fully responsible for construction safety and shall keep the Project Manager informed of any hazardous areas, conditions or safety procedures that may be necessary or are applicable to specific work areas. The following provides an outline of some commonly encountered abandoned mine hazards and appropriate procedures to be followed:

- I. Bad Air
 - a. Miners use the term "bad air" to describe an atmosphere that will not support life. The poor air circulation in some mine openings can allow carbon dioxide (CO₂), carbon monoxide (CO), methane, hydrogen sulfide (H₂S), or radon gas to accumulate. These gases are treacherous inside mine openings and even experienced miners have been killed or harmed by entering areas containing them. Carbon monoxide is odorless, cannot be readily detected and is lethal in very small amounts. The Contractor shall not allow entry of personnel into any mine opening.
- II. Adit Cave-ins
 - a. Cave-ins are a danger in any abandoned mine. Disturbances such as vibrations caused by walking, speaking, blasting, hammering, percussion drilling, or construction equipment may cause a cave-in inside an inactive mine. The Contractor shall follow appropriate adit cave-in protection procedures, including scaling and barring of loose rock before beginning work in an area, shoring of decayed or weak timber framing, and shoring, jacking, or rock bolting of materials in the back (roof) and sides (ribs) of the adits.

III. Collar Cave-ins

- a. The collar or top of a shaft, stope, or subsidence often contains decomposed rock, decayed timbers, and other conditions that allow for rapid disintegration at the opening. With the additional weight and vibration of construction machinery, workers, and backfilling operations near the mine opening, the area around the collar can slide into the opening, along with nearby machinery and laborers. Backfilling operations can tear loose cribbing or lining in a shaft leading to collapse at the collar. The Contractor shall follow appropriate collar cave-in protection procedures.

IV. Falling

- a. Because a shaft or stope has little light, the feeling of height and normal reaction to "pull back" is not evident to most persons. Many abandoned mine shafts, stopes, and winzes are deep enough to cause injury or death to persons entering these features. Rescue operations of a fallen person can also be extremely hazardous. Work above the highwall also presents fall hazards including unstable edges, poor footing, and/or trip hazards. The Contractor shall follow appropriate hazardous fall protection procedures. This includes but is not limited to use of proper lighting, barricades, fences, personal fall arrest systems, guardrails, covers, safety net systems, safety monitoring systems, and other protection as suitable for the conditions. Fall protection shall be in accordance with OSHA regulations regarding construction fall protection (OSHA 29 CFR Subpart M). These regulations establish a six-foot threshold for the height at which fall protection is required, require employers to provide training for each employee who might be exposed to a fall hazard, and prohibit the use of body belts for fall protection and the use of non-locking snap hooks. The Contractor is responsible for ensuring adequate fall protection and tie-off points are maintained at remote mine features that are not accessible by heavy equipment. Details specifying fall protection measures shall be included in the Contractor's HASP.

V. Loose Rock

- a. Highwalls are a dominant mine feature at the work site and typically consist of vertical to nearvertical faces of weathered Paleozoic sedimentary rocks (limestone, dolomite). On average, the height of the highwall features at the site varies, and the size of rock that could fall ranges from small to many cubic feet in size. Any falling rock has the potential to injure or kill, and there is no way to predict when a rock fall will occur. Certain construction activities may promote rock fall including those that require vibration, shock, or removing material that may be supporting loose rocks. In accordance with the Project HASP, the Contractor shall require workers to use appropriate PPE and implement measures to protect workers from loose, falling materials (e.g. shields, scaling loose rocks, etc.) A mineshaft or open stope will weather in much the same way as a cliff. Loose rocks are always found on timbers or on the walls. A small rock that falls a sufficient distance can penetrate a person's skull. The Contractor shall incorporate within the Project HASP, requirements for appropriate hazardous loose rock protection procedures, including but not limited to scaling of loose rock, construction of shields or other barriers, and wearing appropriate head, eye, foot and hand protection.

01330 – HEALTH AND SAFETY PLAN (HASP)

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The Contractor shall prepare a HASP detailing site-specific hazards and safety precautions associated with site work and the Project in general. The HASP shall comply with OSHA standards (29 CFR Part 1926 – Safety and Health Regulations for Construction, latest revision) and shall include but not be limited to a list of emergency contact information for responsible on and off-site personnel, hazard identification, hazard controls and safe practices, emergency and accident response, employee training requirements, required personal protective equipment (PPE), SDS, and communication information and procedures.

The HASP shall include the Contractor's Infections Disease Preparedness and Response Plan, which shall include but not be limited to:

- Non-occupational risk factors at home and in community settings.
- Workers' individual risk factors (e.g., older age; presence of chronic medical conditions, including immunocompromising conditions; pregnancy).
- Controls necessary to address these risks.
- Basic infection prevention measures.
- Policies and procedures for prompt identification and isolation of sick people.
- Workplace controls for reducing the risk of communicable diseases spread in the workplace.

The Contractor shall submit a draft of the HASP to the Project Engineer for review and comment prior to mobilization to the site. The Contractor shall finalize the HASP and submit a final copy to the Project Engineer prior to beginning work on the project site.

01500 – CONSTRUCTION FACILITIES AND TEMPORARY CONTROLS

01516 - TEMPORARY SANITARY FACILITIES

The Contractor shall provide temporary sanitation facilities during the contract work, and made available to AML personnel. The facility shall be installed on the project site prior to the start of work in a designated staging area approved by the Project Manager and Project Engineer. Sanitation facilities (portable toilet units) shall include a handwash station or hand sanitizer. Sanitation unit(s) shall be staked down or otherwise secured to prevent tipping from wildlife, livestock or high winds. The facility shall be locked to prevent unauthorized access during times when work is not being conducted. The Contractor shall remove the facility upon completion of the contract work and restore any damage evident to the area, or areas, in which the facilities have been installed and used.

01533 - TREE, PLANT AND WILDLIFE PROTECTION

To comply with wildlife restrictions, construction is limited to certain periods of the year. Should construction activities take place during the migratory bird nesting season (March 1 – July 1), a pre-construction nesting bird survey will be completed by the AML Program or representative of the AML Program to locate any active nest that would need to be avoided. This survey should be conducted no more than 10 days prior to the start of construction. If occupied nests are found, they must be avoided until after

the AML Program or representative of the AML Program has verified the young have fledged to comply with the requirements of the Migratory Bird Treaty Act (MBTA).

I. Tree and Plant Protection

- a. Environmental disturbance throughout the Project Area shall be kept to a practical minimum. In steep areas and around vegetation, the Contractor shall, before beginning work, discuss the planned extent and nature of disturbance with the Project Manager. Existing plants and trees shall be protected from damage or injury resulting from the Contractor's operations. Damaged trees and shrubs shall be trimmed to remove broken limbs where minor damage has occurred. Where any limbs must be removed the Contractor shall cut branches away from the bole to avoid damage to the branch collar.

II. Wildlife Protection

- a. All area wildlife, including bats and owls, that may use the mine features are protected, and this safeguard project shall not adversely affect them. Shooting at, chasing or otherwise harassing wildlife in the Project Area is prohibited.
- b. During or before the preconstruction conference, the Contractor shall submit a construction schedule, which includes anticipated construction dates. Based on this schedule the AML Project Manager may give written or verbal authorization to proceed on closure of any specific mine features that require netting or trapping or other means necessary to allow escape and to exclude animals prior to closure. It is solely the Contractor's responsibility to obtain this authorization. Typically, within a minimum of one week, written notice including the proposed dates of closure is required for submittal from the Contractor to the AML Project Manager. After approval of the schedule, any need for changes shall be coordinated with the Project Manager a minimum of 48 hours before closure of the features. The Contractor's failure to follow this procedure may result in stoppage of the construction activity at the Contractor's expense until the biological staff can schedule any required exclusion measures such as netting and tarping of the specified features.
- c. The Contractor shall aid AML staff to expel remaining bats or other wildlife before backfilling or closing any mine features, by covering the following closure. The Contractor shall provide sufficient quantities and sizes of netting, tarps, polyethylene sheets or other suitable wildlife exclusion measures for this purpose.
- d. All mine openings, except those whose workings can be fully visually checked by the Project Manager and those which are safeguarded by the construction of bat closures, airflow closures or high-strength steel mesh, shall be tarped or netted (one-inch mesh material, e.g., chicken wire, polypropylene or similar material) 72 hours before closure and require agreement on the dates and timeframes for maintaining them in place.
- e. During construction of bat-compatible closures, the Contractor shall schedule activities so the bats can readily pass through the partially completed closures from one hour before sunset until sunrise. In addition, during construction of bat closures at shafts, the Contractor shall take measures to reduce any loose rock and other material that may drop into those mine features.

- f. Internal combustion engines, including those used for generators and on air compressors, shall be situated in such a way that any exhaust emissions from the engine are not drawn into the mine openings.

01560 – TEMPORARY CONTROLS

The Contractor shall take all reasonable steps to reduce or avoid any inconvenience and disruption to the public as a result of this project. The Contractor shall implement the following temporary controls for the duration of the contract work:

01561 - CONSTRUCTION CLEANING

The Contractor shall keep the contract work area, equipment, and adjacent areas free from spillages of construction and maintenance materials used during the contract work. The Contractor shall also provide for the containment of any solid waste and debris created by unpackaging construction materials and waste from meals and water consumed at the contract work site. The Contractor shall ensure that the cleanup and removal of all spillages, solid waste and debris is removed from the work site and taken to an approved disposal site at the end of each contract workday.

01562 - DUST CONTROL

The Contractor shall take all necessary measures to control dust emanations from vehicles and construction equipment on access roads and at work sites. The Contractor shall ensure that any equipment used in the contract work is fitted with standard dust control devices. To maintain the health and safety of project personnel, dust control measures at the site shall comply with all local, state, and federal health and safety regulations. The Contractor shall be prepared to initiate dust control measures at any time at the request of the Project Manager. Water for use during dust control measures shall be distributed in sufficient quantity and at proper intervals by water truck(s) equipped with spray bars, cannons, and hoses (of sufficient lengths) and approved by the Project Manager. The quantity of water required and the frequency of watering intervals shall be entrances of designated mine features with netting, tarps or other barricades after the animals have exited and to also aid in removing any barricades determined by the Project Manager and are dependent upon the weather and the site's surface conditions and may vary throughout the project duration. There is no source of water on site for dust suppression. The contractor shall be responsible for identifying a reliable and consistent source for obtaining water in sufficient quantities and for providing water for dust suppression measures at no additional cost to the project.

01564 - NOISE CONTROL

The Contractor shall ensure that all equipment used in the contract work is fitted with standard noise suppression devices.

01565 - FIRE PREVENTION AND SAFETY AWARENESS

The Contractor shall develop an emergency plan outlining precautionary fire prevention measures and that also identifies initial attack resources and procedures for fire suppression in the event of a fire incident occurring in the Project Area as a result of project related activities. This plan will be submitted to the Project Manager for review at the Pre-Construction meeting and the Project Manager will provide any feedback or suggestions about the plan and approve it for use during the contract period. The Contractor shall provide a copy of the fire emergency plan to all individuals working on this project during daily pre-work safety meetings.

Examples of precautionary measures may include but are not limited to:

1. Daily inspection of all motorized and mechanized equipment to insure mufflers and spark arresters are installed and operating properly.
2. Ensure that all personnel working on site are properly trained in the safe use of welding torches, arc welders, generators, power saws and grinders, chainsaws, and other tools and are also familiar with the potential of this equipment to create hot sparks and ignite fires.
3. Avoid welding or cutting in areas adjacent to or above flammable materials or during windy conditions. This precaution pertains to welding or cutting materials inside of the mine as well as outside the mine opening. Welding shall not take place within 25 feet of any exposed PUF either during or after its application. Following application, welding shall not take place above any PUF installation without first covering the PUF surface with 6" minimum of fill material or soil cover.
4. Hot work (welding, cutting, grinding, etc.) may be suspended by the Project Manager on days with a Red Flag Warning as issued by the National Weather Service. These warnings indicate an increased risk of wildfires.

Examples of fire suppression resources and procedures may include but are not limited to:

1. Maintain an adequate number of fire extinguishers that are fully charged and in good working order, water tanks, sprayers, buckets, shovels, welding blankets and other equipment at the work site that would enable personnel to immediately extinguish any accidental ignition.
2. Have lookout personnel observe the work area and require welders to utilize protective welding blankets, where applicable and while welders are operating (welders cannot see where the sparks are falling when the welder is under the welding hood).
3. Assign an individual or other lookout personnel to be responsible for inspecting the work area and to verify that it is "safe" (no hot sparks or spot fires, iron is cold) before leaving the work site.
4. Create a list of local, nearby emergency fire departments or other agencies in the area to contact and will quickly respond during any emergency. Develop an emergency notification procedure that the Contractor and AML staff are aware of for contacting nearby local or regional fire suppression support in the event that the fire incident is out of control, threatening people or equipment or appears to be reaching an out-of-control status.

The Contractor shall obey all fire restrictions declared by the landowner(s) and/or adjoining land and property management agencies (i.e. University of New Mexico, U.S. Forest Service, and/or Bureau of Land Management).

01566 – PUBLIC SAFETY

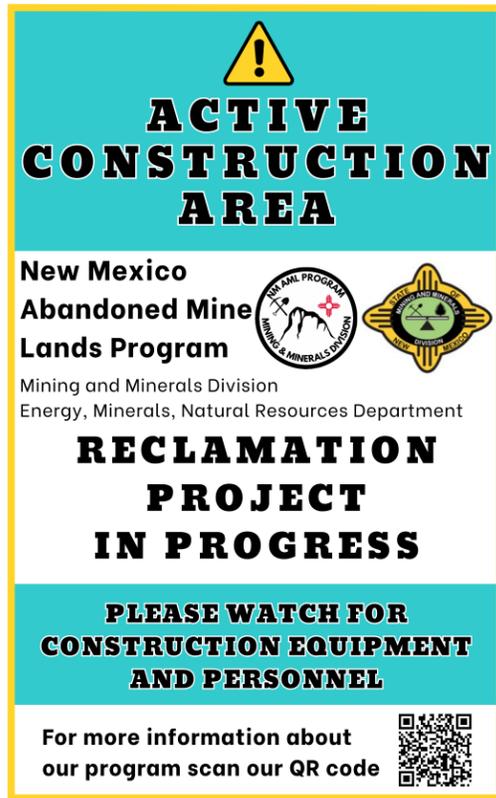
Efforts to protect visitors from injury due to execution of the work shall be taken wherever practical. Examples of procedures that shall be followed may include but are not limited to:

1. Use of caution flagging tape or signage.
2. Maintaining cleared unimpeded access to staging area or vehicle parking areas.
3. Maintaining at least one cleared pedestrian access route to primary mine features at all times.
4. Securing of unused or staged materials and temporarily parked equipment.
5. Cordon off active work areas using flagging (12-inch by 9-inch orange triangles, minimum) and/or construction barriers and temporary fencing to restrict access.

01580 – PROJECT IDENTIFICATION AND SIGNS

Portable A-frame folding construction-warning signs shall be provided by the Project Manager and erected on vehicular access routes and hiking trails to the project site. The Contractor shall provide sandbags for ballast to stabilize the signs against high winds. Folding signs shall be returned to the Project Manager upon completion of the project.

Sample of portable folding signs:



01700 – CONTRACT CLOSEOUT

01702 - FINAL INSPECTION

Upon written notice from the Contractor that the entire Work or an agreed portion thereof is complete, the Project Manager will make a final inspection with input from the Project Engineer and Contractor and following inspection, will notify the Contractor in writing, within 10 days of any particulars in which this inspection reveals that the Work is either incomplete and/or defective. The Contractor shall immediately undertake any such measures as are required to remedy any identified deficiencies within 10 days of being notified.

01710 - Final Cleaning

After completion of all work, the Contractor shall demobilize and remove all equipment, any temporary buildings or shed, materials, spills, supplies, and trash from the project site and shall reclaim all areas disturbed by the Contractor's activities. Unless otherwise specified, developed, maintained roads that existed prior to commencement of the Contractor's activities need not be reclaimed, but must be left in a condition equal to or better than what existed prior to the Contractor's activities began. Fences, gates, plants, stockpiled soil or rock and other surface materials disrupted by these operations shall be removed, replaced or restored to original or better conditions immediately upon completion of work at the site. Other damage to private or public property shall be immediately repaired within 10 days of discovery. All such cleanup, repair,

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removal or replacement work shall be done at the Contractor's expense and to the satisfaction of the Project Manager pending approval of the appropriate public officials, property owners or land management agencies.

END OF DIVISION 1

DIVISION 2 – SITEWORK

02100 – SITE PREPARATION

02110 - SITE CLEARING

This work shall consist of trimming, removing, and disposing of vegetation and debris in accordance with these specifications, except those items designated to remain. This work shall also include implementation of protective measures to ensure the preservation from damage or defacement of vegetation and other natural resources that are designated to remain intact. Within construction limits and constraints on borrowing backfill material from onsite sources, all surface debris, roots, stumps, trees, and other objectionable protruding obstructions shall be cleared or removed with the Project Manager's concurrence.

02200 – EARTHWORK

The following sections describe the earthwork to be performed under this contract.

02212 - DECOMPACTION

Before construction demobilization and following the need for any construction access to each mine feature, the Contractor shall decompact areas compacted by construction activity, including temporary work areas and access trails, and staging, storage and parking areas. Areas where more than four feet of overburden material has been removed shall also be decompact. Decompaction shall be performed to the satisfaction of the Project Manager. Where bedrock is exposed at the surface, such decompaction will not be required. Decompaction methods shall be effective at reducing soil density to a minimum depth of twelve inches (except where bedrock is closer to the surface) and shall be accomplished without inverting the soil layers. Where practicable, ripping shall be done along the contour. Alternatives to ripping or auguring for decompaction shall be acceptable to the Project Engineer.

02218 – LANDSCAPE GRADING

Following feature closure, backfilling, and rough grading, disturbed sites shall be graded to blend them with the surrounding landscape to reduce excessively steep areas and to reduce channelized surface water as directed by the Project Manager. Except in areas to be drill seeded, the soil surface shall be finished as rough as possible, by ripping, using the teeth of an excavator bucket, or similar methods to slow the velocity of erosive overland flows and to create small pockets and furrows to trap seed and water to create favorable microclimates to enhance seed germination for optimal plant growth. Where done by hand, this roughening can be done by shovel or mattock, creating many, closely spaced depressions and pits two to six inches deep. Wherever possible chiseling, ripping, and similar operations shall be done along the contour. The actual final topography shall be determined by consulting with and obtaining the approval of the Project Manager.

02220 - EXCAVATING, BACKFILLING, AND COMPACTING

The following sections describe the excavating, backfilling and compacting to be performed under this contract.

02223 – BACKFILLING OF MINE OPENINGS

This work shall consist of backfilling mine opening with onsite or imported fill materials as designated in the specifications or as directed by the Project Manager.

I. General

Before backfilling mine openings, the Contractor shall remove cribbing, garbage, wood and other materials as specified and as directed by the Project Manager. All trash debris shall be hauled to a permitted landfill or transfer station. Backfill material shall be free of snow, ice, frozen lumps, logs, timbers, significant amounts of woody or vegetative debris, other deleterious materials of such size and shape that they may bridge or create voids within the opening being filled. Hand backfilling is an option if the site is difficult for equipment access or too steep to operate equipment safely.

II. Shaft, Pit, and Open Stope Backfilling Shafts, pits, stopes, declines, and trenches shall be backfilled completely from the bottom of the feature to the specified minimum distance above or below the surface. In shafts and stopes with intact or partially intact cribbing or lining to remain, the maximum size of backfill material shall have no dimension exceeding twelve inches. Care shall be taken during backfilling to reduce damage to the cribbing or lining to prevent bridging of fill materials on collapsed timbers and to minimize potential for voids or collapse of the collar. Where judged to be feasible by the Project Manager, the Contractor may break collapsed timbers deeper than can practicably be removed by using other methods, including dropping heavy rock, boulders, or broken concrete during the initial stages of backfill. Wherever practicable, at least 80 percent by weight of fill material shall be larger than $\frac{3}{4}$ inch. In shafts, stopes and declines, the coarsest available backfill material shall be used from the bottom of each drift level to a minimum height of five times the diameter or diagonal dimension of the shaft above the drift floor level.

III. Materials Contractor shall provide a submittal providing material specifications of all imported fill materials before delivery to the site. The Project Manager may request a sample of the material in addition to product specification data.

- i. Imported Granular Fill: naturally occurring granular material free from wood vegetation, or other deleterious matter. Fill shall contain sufficient sand or filler to permit compaction. Materials including well-sorted sands and gravels, very fine sand, shale, clayey soil, contaminated soil, or soil that will not support plant growth shall not be used.
- ii. Imported Rocky Fill: Angular rock or stone and of such characteristics that will not disintegrate when subject to the action of flowing water. At

least 80 percent by weight of fill material shall be larger than ¾ inch. The maximum particle size shall be 36 inches.

- IV. Final Layer of Fill Wherever practicable, the final eight- to twelve-inch layer of the fill at mine openings shall be soil of comparable composition and quality to that of the undisturbed native soil surrounding the backfilled feature.

02224 - BORROW

Except where otherwise specified or indicated herein, fill material shall come from the areas immediately at and/or surrounding the mine features or from nearby mine waste piles as directed by the Project Manager. Preferentially, mine waste material from onsite source(s) shall be used; however, borrow material may also be excavated and taken from other approved areas as required and as directed by the Project Manager.

As indicated for specified mine openings and as required, fill material shall be taken only from designated borrow source areas as indicated in the maps or drawings. Any other non-designated borrow sources shall be approved by the Project Manager prior to use and in consultation with AML cultural resources staff. Any topsoil present at onsite borrow areas shall be stripped and stockpiled for later use as topdressing prior to commencing borrow material excavation and removal operations. Haul routes for borrow material shall be approved by the Project Manager prior to commencement of removal or hauling from its source.

Except as otherwise noted or approved by the Project Manager, the Contractor shall not use any mine waste material from within designated avoidance areas, shall avoid undermining the cultural features within avoidance areas during borrow material excavation and removal operations, and shall not leave disturbed slopes in the mine waste steeper than two horizontal to one vertical (2h:1v) outside of avoidance areas.

02229 - COMPACTION

Material used for fill shall be compacted whenever possible using multiple passes with available heavy equipment. The fill shall obtain a compaction density not less than what the equipment can reasonably obtain to the satisfaction of the Project Manager. Fill material shall be moisture conditioned prior to compaction at the discretion of the Project Engineer.

Where vibratory compaction equipment is used, it shall be the Contractor's responsibility to insure that vibrations do not damage nearby cultural resources, structures or underground mine voids.

02890 – SURVEY MARKERS

The survey marker designating the name and tracking number of each mine feature shall be installed in a location provided by the Project Manager. A new six-foot long nominal 4-inch diameter galvanized steel pipe (4.0" O.D., minimum 9.11lbs./ft.) shall be installed in front of backfilled and safeguarded mine features as indicated in the plan set. The lower two feet of pipe shall be set in concrete a minimum of one foot in diameter and the upper twelve inches of pipe shall extend above grade. The Contractor shall grout a survey marker, provided by the Project Manager, into the pipe using a non-shrink grout, such as Quikrete Non-Shrink General Purpose Grout, or approved equivalent. Alternately, where the Project Manager

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concurr, the Contractor may drill and grout a survey marker into undisturbed, competent bedrock or concrete immediately adjacent to each specified feature.

02900 - LANDSCAPING

The following sections describe revegetation to be performed under this contract. Revegetation shall be required at areas disturbed during construction and as specified by the AML Project Manager.

02920 – SOIL PREPARATION / SURFACE ROUGHENING

Prior to seedbed preparation, the Contractor shall grade all disturbed areas as described, decompact those areas specified above, and roughen the surface as specified below. Disturbed areas may include but are not limited to the mine backfill borrow areas, depressions and mounds at safeguarded shafts, filled areas at adits, temporary overland access and haul routes, areas stripped of native vegetation and any other surface disturbance areas, except as otherwise specified.

On slopes up to 1.5h:1v, the soil surface in areas to be seeded shall be prepared to be continuously rough and hummocky. This shall be accomplished by using an excavator bucket, or other acceptable methods that produce similar results, to create small pockets and furrows to trap water and create favorable microclimates promoting seed germination and plant growth.

After roughening, seed shall be broadcast by hand. In areas with extremely dry and loose soil, the Project Manager may require the Contractor to wait until the soil has settled before seeding.

Large and small boulders may be left exposed on site prior to seeding, either singularly or amongst groupings that blend with the natural surroundings, as directed by the Project Manager. The Project Manager may require that additional boulders be placed on site to permanently block site access, enhance visual variation and provide diversity in wildlife habitat.

Unless the soil is severely compacted or as otherwise noted and approved by the Project Manager, soil preparation will not be required for discontinuous, isolated areas of disturbance less than 0.05 acres (approximately 2,500 square feet or 50 feet by 50 feet), such as areas around mine portal closures.

The extent of seedbed preparation disturbance shall not exceed the total size of an area upon which the entire seeding operation can be applied. Seed shall be applied before soil surface crusting occurs. Loss of seed and mulch materials due to stormwater or wind erosion shall be prevented from occurring and installation of silt fencing, straw wattling or other stormwater and erosion control BMP's may be required by the Project Manager. If crusting or erosion occurs, the entire area affected shall be reworked beginning with seedbed preparation.

02921 - TOPDRESSING

As specified, on construction sites, mined areas, and other critical areas where the existing surface material is either chemically or physically unsuited to support adequate vegetation, the best available soil material as determined by the Project Manager shall be evenly spread on the surface in sufficient depths to maintain plant growth. Available topdressing excavated from areas to be disturbed shall be accomplished without inverting the soil layers, set aside and protected from erosion prior to deeper soil disturbance for

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excavation, mine feature backfilling and access road blading. Topdressing shall be applied without inverting the soil layers and generally along the contour, but if hazardous conditions arise, the application may be in another direction. In all cases, placement shall be such that erosion is kept to a minimum. All top-dressed slopes shall be prepared by surface roughening before planting to reduce erosion.

02930 - GRASSES

The following section describes the seeding to be conducted under this contract.

02933 - SEEDING

Following completion of seedbed preparation, the Contractor shall seed areas according to the Specifications and as follows:

1. **Seed Species and Mixtures** To ensure that the seed purchased exhibits the required characteristics associated with the given variety, and that the seed is certified to be genetically pure, the Contractor shall provide AML with proof of certification for any seed varieties, or their alternate species, to be used in the seed mix as prescribed for the Project and shall be approved by the Project Manager prior to purchase. All varieties of seed prescribed in the approved seed mix shall be obtained by the Contractor from a source in New Mexico that is adapted to the local climate and soil in which it is being sown; that is, a similar land resource area which is not more than approximately three hundred miles south or about two hundred miles east, north or west of the Project. The percentage of each species comprising seed mixtures for application is outlined below. The mixture is to be used for revegetation of areas defined above in Section 02920. Seed species and varieties, which are well adapted to the soil, climate, and topography of the disturbed areas, shall be used in revegetation and are discussed below.

2. **Seeding Methods**

- a. Hand-Broadcasting

The seed shall be hand-broadcast. When hand-broadcast seeding, passes shall be made over the site to be seeded such that an even distribution of seed is obtained. Hand-broadcast seeding shall take place immediately following the completion of final soil preparation. Hand-broadcast seeding shall not be conducted when wind velocities would prohibit an even seed distribution as determined by the Project Manager. Hand-broadcast seeding shall be followed by hand raking, manual use of a drag chain, or sweeping with sturdy tree or shrub branches to cover seed. This shall be done over the entire seeded area but shall not be so extreme as to reduce the extent of soil relief.

Broadcast seeding of small areas of disturbance, less than 0.05 acres (approximately 2500 square feet or 50 feet by 50 feet) may be done by hand scattering. Ranking of small areas is not necessary if there is sufficient surface roughness to ensure that seed will fall in crevices and other micro-topographic depressions such that weather and gravity will cause them to be covered and stay in place.

Following hand-broadcast seeding and seed covering, organic debris such as logs, tree stumps and grubbed vegetation shall be randomly redistributed across the sites. This shall be done at the Project Manager's direction for the purpose of creating visual variation, ground shading, protection from seed predation and production of wildlife habitat. Care shall be taken to avoid leveling the soil surface.

b. Completion

If the Contractor is scheduled to close the project outside the specified seeding timeframe when seeding is the only incomplete item, the Contractor shall complete only seed bed preparation and 75 percent of the lump sum bid price for seeding will be retained. Then the job shall be held open for seeding during the next seeding season with the remainder of the bid price being paid upon completion and acceptance of seeding.

If all the work required by the contract, except seeding, is completed before seeding is accomplished because of seasonal limitations, partial acceptance of the work will be made with final acceptance delayed until seeding has been accomplished in accordance with these specifications. Liquidated damages will not be assessed against the Contractor during the interim period between the dates of partial acceptance and final acceptance if such delay is the result of seasonal limitations.

c. Seed Mix/ Seeding Rates

Seed mix shall be Homesteader's Choice – Native Grass Mixture by Curtis and Curtis Seed (<https://curtisseed.com/homesteaders-choice-native-grass-mixture/>). Seeding rates shall be as specified by the seed manufacturer.

02940 – MULCHING

The Contractor shall apply mulch to all seeded areas. Mulching is not permitted when wind velocity exceeds fifteen miles per hour. The mulch type shall be WoodStraw ®ECM made by Forest Concepts, or approved equivalent. Materials shall be wind resistant and shall be an engineered all-wood, long-strand soil erosion control mulch that is a blend of geometrically regular wood elements that have a straw-like form and function. The materials shall be inherently free of noxious weed seed and other additives detrimental to plant life.

The mulch shall be spread uniformly over the prepared area either by hand or with a mechanical mulch spreader. Mulch shall be applied by the Contractor to all seeded areas immediately after seeds are planted to provide suitable surface litter for improvement of soil moisture conditions and to reduce the potential for damaging erosion or soil blowing which might occur before or during plant establishment.

02955 – SALVAGE OF NATIVE PLANTS

Before any area is disturbed for access, borrow, fill or other construction activities, the Contractor shall thoroughly scout the area with the Project Manager for presence of native plant species. Any significant plants shall be avoided wherever practicable. Of those that need to be disturbed, the Contractor shall

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salvage those that can be replanted, as the Project Manager directs and as specified below. Species that shall be salvaged may include but are not limited to prickly pears (*Opuntia* spp.), barrel cactus (*Ferocactus* spp.) and other species of cacti, including pincushion types (*Mammillaria* spp.).

Plants to be salvaged shall be dug from the soil before commencing earthmoving operations, preserving as many roots and as much of the soil around the roots as practicable. The south side of the plant and the soil line shall be marked with paint or marking crayons. When transplanted the plant shall be placed in the same orientation it was exposed to before harvesting.

The top half of prickly pear pads shall be cut from the mother plant. Before replanting cactus roots on the mother plant and the cut prickly pear pads shall be allowed to dry in a shaded, ventilated location for at least two weeks but no more than six weeks. Any Cacti of other species as well as any other salvaged plants shall be planted as soon as practicable but no later than one week after harvest.

Salvaged plants shall be placed into well-drained soil, preferably in areas that have been disturbed by construction activities and along closed access roads. The soil in planting areas shall be tested before planting by filling a planting hole with water. If the water drains within four hours, the site is suitable.

Cacti shall be placed into the planting hole at their original orientation and planting height to avoid sunburn and stem decay. The bottom one-third of the cut prickly pear pads shall be covered with soil, with the pads oriented so that their broad sides face east and west. The planting holes shall be backfilled with native, unamended soil and the air in the soil worked out by gently moving the soil with a rod or pole. The plants shall be watered in at the time of planting; no further watering is required. Larger specimens shall be staked as necessary as determined by the Project Manager.

DIVISION 3 – CONCRETE, GROUT AND MORTAR

This work shall consist of foundation supports for metal grate shaft, adit, and stope closures; foundations for metal barrier fences; waste rock and mortar surrounds for egress closures; and concrete and grouted anchor supports for horizontal and vertical metal grate closure, as indicated on the drawings. Unless otherwise specified all grouting shall be done with non-shrink grout. This work includes any excavation for base of bulkheads and furnishing and installation of forms and reinforcing steel.

Use of brand names is for the purpose of describing the standard of quality, performance and characteristics desired and is not intended to limit or restrict competition.

03001 – GENERAL REQUIREMENTS

All cast-in-place grout shall be accurately and properly placed and finished as indicated on the drawings and as specified in this section.

At least forty-eight (48) hours in advance, the Contractor shall inform the Project Manager and Project Engineer of the times and places at which the Contractor intends to place concrete and grout. No grout shall be placed without prior examination of the bedrock, anchor conditions, formwork, and reinforcing steel by the Project Manager or Project Engineer.

All grout work shall conform to appropriate requirements of ACI 301, Specifications for Structural Concrete for Buildings, except as modified by the requirements below.

03010 - CONCRETE MATERIALS

I. Materials

A. Cement

All cement used in concrete shall be Portland cement conforming to all requirements of ASTM C150, Type II, low alkali. High-early-strength Type III Portland cement may be used in concrete at the Contractor's option. When Portland cement is delivered in packages, the name and brand of the manufacturer and the type shall be plainly identified thereon. When cement is delivered in bulk, the same information shall be contained in the shipping invoices accompanying the shipment. A bag shall contain 94 pounds net weight and will be considered equal to one cubic foot. A barrel shall consist of 376 pounds net weight and will be considered equal to four cubic feet. The Contractor shall obtain from the manufacturer and furnish a certificate of compliance stating that the cement delivered to the work complies with the requirements herein provided. To prevent deterioration after delivery, cement and aggregates shall be protected from weather and properly stored or covered as to prevent intrusion of water or foreign matter. Any material that has deteriorated or has been contaminated shall not be used for concrete.

B. Admixtures

Admixtures shall conform to ASTM C494. Sugar, calcium chloride, or admixtures containing chloride from other than impurities from admixture ingredients will not be permitted. Air entraining admixtures shall be required and shall conform to ASTM C260. Water reducing admixtures may be used and shall conform to ASTM C494 or ASTM C1017.

C. Curing Compounds

Liquid membrane-forming compounds for curing concrete shall conform to the requirements of ASTM C309.

D. Water

Water for concrete shall be clean and free from harmful amounts of acids, alkalis, oils, organic materials, salts, sand, sewage, or other deleterious substances and shall be furnished by the Contractor. Water shall be potable and shall have a pH value of not less than 4.5 nor more than 8.5 as determined by AASHTO T26 before its use. The sulfate content as SO₄ shall not exceed one thousand parts per million (1,000 ppm).

E. Fine Aggregate

1. General Characteristics. Fine aggregate shall consist of natural sand, manufactured sand, or a combination thereof, or other accepted inert materials as approved by the Project Engineer and composed of clean, durable, hard, uncoated, well-rounded grains.
2. Grading. Fine aggregate shall be well graded and, when tested by standard laboratory sieves, shall conform to the following:

Sieve (ASTM E11)	Percent Passing by Weight
3/8-in.	100
No. 4	95 to 100

The fine aggregate shall have not more than 45 percent passing any sieve and retained on the next consecutive sieve of those shown above, and its fineness modulus shall be not less than 2.3 nor more than 3.1.

3. Deleterious Substances. The maximum percentage of deleterious substances shall not exceed the following limits:

Clay lumps	3.0% by weight
Material finer than No. 200 sieve	3.0% by weight
Coal and lignite	1.0% by weight
Other deleterious substances	1.0% by weight

All fine aggregate shall be free from harmful amounts of alkali and organic impurities.

4. Soundness. Fine aggregate shall conform to the requirements of magnesium sulfate soundness of ASTM C33. The maximum loss in five (5) cycles shall not exceed 12 percent by weight.

F. Coarse Aggregate

1. General Characteristics. Coarse aggregate shall consist of natural gravel, crushed gravel, crushed stone, or crushed hydraulic-cement concrete, or a combination thereof, or other accepted inert materials having clean durable, hard, strong pieces; free from adherent coatings; and conforming to the requirements of these Specifications. Fifty percent by weight of the minus $\frac{3}{4}$ inch sieve size particles shall have a minimum of two fractured faces.
2. Grading. Coarse aggregate shall be well graded between the limits specified and shall conform to the following requirements:

Sieve	Percent Passing by Weight
1-in.	100
¾-in.	95 to 100

3. Deleterious Substances. The maximum allowable percentage of deleterious substances and physical properties shall not exceed the following limits:

Soft fragments	2.0% by weight
Clay lumps	0.25% by weight
Material finer than No. 200 sieve	1.0% by weight
Coal and lignite	0.25% by weight

4. Sampling and Testing. Methods of sampling and testing the coarse and fine aggregate shall be in accordance with ASTM C33.

G. Bagged Concrete Mixes

1. General Characteristics. Bagged, premixed concrete products such as Sackrete or Quikrete shall consist of a uniformly blended mixture of stone/gravel, sand, and Portland cement packaged in multi-walled 2/3 cubic feet (80lbs) paper bags. The concrete mix shall meet or exceed the minimum physical requirements of ASTM C387.

H. Mortar (Mason's Mix)

1. General Characteristics. Water Resistant Type S Mortar Mix Bags shall consist of a uniformly blended mixture of stone/gravel, sand, and Portland cement packaged in multi-walled 2/3 cubic foot feet (80lbs) paper bags. The mortar mix shall meet or exceed the minimum physical requirements of ASTM C387. The minimum compressive strength shall be 1,800 psi at 28 days.

03600 – GROUTS AND MORTARS

This section specifies grouting as indicated on the drawings.

03610 – GROUT AND MORTAR MATERIALS

Non-shrink grout QUIKRETE® “Non-Shrink General Purpose Grout”, L&M Construction Chemicals “Crystex” or “Premier” or “DuragROUT”, Master Builders "Masterflow 713 Plus" or “Masterflow 928” or “Set Grout”, Euclid “Hi-Flow Grout” or “N-S Grout”, "Five Star Grout", or approved equivalent², meeting the requirements of ASTM C1107, Grade C

Mortar QUIKRETE® Mortar Mix (No. 1102) Type N, S, M

Water Clean and free from deleterious substances

03620 – NON-SHRINK GROUT AND MORTAR

Non-shrink grout and mortar shall be furnished factory premixed so only water is added at the job site. Grout and mortar shall be mixed in a mechanical mixer. No more water shall be used than is necessary to produce a flowable mix. Grout shall meet strength requirements of $f'c = 5,000$ psi at 28 days. Mortar shall be type S and shall meet strength requirements of $f'c = 1,800$ psi at 28 days.

Concrete foundations to receive non-shrink grout and/or mortar shall be saturated with water for 24 hours prior to grouting.

Grout and mortar shall be placed in strict accordance with the manufacturer’s directions, so all spaces and cavities are filled without voids. Forms shall be provided where structural components will not confine the grout/mortar. The grout/mortar shall be finished smooth in all locations where the edge of the grout/mortar will be exposed to view after it has reached its initial set.

Non-shrink grout and mortar shall be protected against rapid loss of moisture by covering with wet rags or polyethylene sheets. After edge finishing is completed, the grout/mortar shall be wet cured for at least seven days. Alternatives to 7 days of wet curing shall be submitted to the Project Engineer for review.

03990 - SUBMITTALS

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Submittals shall include the following information:

1. Slump on which design is based;
2. Total gallons of water per cubic yard;
3. Brand, type, composition and quantity of cement;
4. Specific gravity, source and gradation of each aggregate;
5. Ratio of fine to total aggregate;
6. Surface dry weight of each aggregate per cubic yard;
7. Brand, type, ASTM designation, active chemical ingredients, and quantity of each admixture;
8. Compressive strength based on 7-day and 28-day compression tests; and
9. Other submittals shall be made as required by ACI 301.

The Contractor shall submit the following information for both concrete, grout, and mortar:

1. Manufacturer's data or catalog information, including placing and finishing recommendations, wet-curing method, and weather protection method for the cementitious materials and any curing compounds.
2. A proposed wet-curing method for review by the Project Engineer.
3. A cold weather and/or hot weather concreting plan, as applicable, for review by the Project Engineer.

Submittals shall be made in accordance with the procedure set forth in Section 01340.

END OF DIVISION 3

DIVISION 5 – METALS

The following section specifies all items fabricated from metal shapes, plates, sheets, rods, bars, or castings, and all wrought or cast metal items. Fabricated metal items that are detailed in the contract documents but not mentioned specifically herein shall be fabricated in accordance with the applicable requirements of this section.

Use of brand names is for the purpose of describing the standard of quality, performance and characteristics desired and is not intended to limit or restrict competition.

05010 – METAL MATERIALS

All materials shall be new and undamaged and shall conform to pertinent ASTM or other industry standard specifications including the following

Steel

Shapes, Plates, and Bars (including Concrete imbedded items other than reinforcing steel) ASTM A588 or ASTM A242 (weathering)

Structural Tubing ASTM A847 or ASTM A606, Type 4 (weathering)

Flat Washers ANSI B27.2, of the same material as bolts and nuts

Bat gate closures shall be fabricated from high strength ($F_y=50,000$ psi), self-weathering, low alloy, atmospheric corrosion resistant steel as specified above.

05030 – Metal Finishes

Specified hereunder are shop-applied coatings. It is the intent of these specifications to use atmospheric corrosion resistance structural steel (weathering steel), grating and appurtenances to the fullest extent practicable. This section specifies the required shop coatings for metal services where it is not practicable to use a corrosion resistant material.

05031 – Shop Coating

I. Materials

Unless otherwise authorized, shop applied prime coatings shall be: Zinc-rich Urethane Primer Tnemec "90-97 Tnemec-Zinc" or DuPont "Imron 62 ZF", or approved equivalent³.

For repair of hot-dip galvanized surfaces and to rustproof welds, field applied coatings shall be: Cold Galvanizing Compound Z.R.C. Cold Galvanizing Compound, or approved equivalent⁴.

II. Cleaning

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Surfaces shall be dry and of a proper temperature when coated, and free of grease, oil, dirt, dust, grit, rust, loose mill scale, weld flux, slag, weld spatter, or other objectionable substances. Articles to be galvanized shall be pickled before galvanizing. All other ferrous metal surfaces shall be cleaned by high power wire brushing or by sandblasting. Welds shall be scraped, chipped, and brushed as necessary to remove all weld spatter.

III. Galvanizing

All galvanizing shall be done after fabrication by the hot-dip process in conformity with requirements of ASTM A123, A153 and A385.

IV. Steel

Unless otherwise specified and if such an occasion shall occur, all ungalvanized structural and miscellaneous steel shall be given an anticorrosion prime coat in the shop after fabrication. Steel surfaces shall be prime coated as soon as practicable after cleaning. All painting shall be done in a heated structure if the outside air temperature is below 50 degrees Fahrenheit. Steel shall not be moved or handled until the shop coat is dry and hard.

Plates shapes, and bars of weathering steel shall not be shop or field primed or painted, except as noted.

END OF DIVISION 5

DIVISION 13 – SPECIAL CONSTRUCTION

The following sections describe the special construction to be performed under this con

13050 - POLYURETHANE FOAM CLOSURES

The following section describes the PUF closures to be installed in the specified mine features. The work consists of installing a bottom form (as needed), installing PUF to specifications, backfilling over the PUF to the specified level, and, where required, installing corrugated steel riser pipes with steel grates.

The Contractor shall inform the Project Engineer and Project Manager of the times and places at which PUF is to be placed at least (3) three working days in advance.

Use of brand names is for the purpose of describing the standard of quality, performance and characteristics desired and is not intended to limit or restrict competition.

13051 - MATERIALS AND EQUIPMENT

Unless otherwise specified, PUF shall have a minimum installed density of 1.85 pounds per cubic foot (pcf). Machine-applied or poured-in-place PUF shall be equivalent to SWD Urethane Co. "SWD 425," North Carolina Foam Inc. "NCFI-811," Foam Concepts LLC, "EFS Equipment-less Foam Sealant", Mine Seal, LLC, "PUF-Seal" or Urethane Contractors Supply and Consulting "SES III 2.0 Pour." Bagged PUF shall be equivalent to Foam Concepts Inc. "EFS Equipment-less Foam Sealant" or Mine Seal, LLC "PUF-Seal," or approved equal.

PUF characteristics shall conform to the following standards:

PUF CHARACTERISTIC	STANDARD	SPECIFICATION
Density	As specified	ASTM D1622
Closed Cell Content	>85%	ASTM D6226
Compressive Strength	25 psi minimum	ASTM D1621
Water Absorption	0.2 lbs./sq. ft. maximum	ASTM D2842
Exothermic Reaction Rate	Low	-
Fire Resistance	High	-

PUF used in mine closures shall not contain chlorinated fluorocarbons (CFC's) or hydrochlorofluorocarbons (HCFC's).

The proportioning unit shall be capable of attaining a minimum temperature of 125°F and shall be a Gusmer Model H-11 or equivalent. For remote project locations, or with the approval of the Project Manager, smaller capacity proportioners will be acceptable. In this event the proportioner shall be the Gusmer FF or equivalent.

Minimum heated hose length from proportioner to gun shall be 80 feet. The hose shall maintain or increase component temperature from the proportioner. Longer heated hose lengths may be required depending upon the distance from the proportioning unit to the reclamation site. Approval of the Project Manager is required for the use of any length of unheated hose on a PUF closure.

If the Contractor specifies the use of an application gun, it shall be capable of mixing plural components in the proper ratio at the minimum acceptable output of (4) four pounds per minute. The gun shall be a Gusmer AR mechanically self-cleaning design or equivalent. Application guns constructed by individuals or manufacturers not typically used in the PUF industry may be used if warranted by the PUF supplier or manufacturer.

For poured foam, separate component measuring and mixing containers shall be used. Each component shall be assigned a specific measuring container, each marked with a predetermined volume level corresponding to the required mix ratio. The components shall always be measured in the same quantities, the components added in a separate container, and thoroughly mixed using an appropriate mixing device. In all cases, measuring and mixing of poured PUF shall be done in strict accordance with manufacturer's recommendations, including maintenance of recommended temperatures of the components for mixing and placement. The Contractor shall supply a proper thermometer and use it to check each mixed batch.

The manufacturer shall package bagged foam with pre-measured amounts of each component. Foam shall be used prior to the end of the manufacturer's designated shelf life.

13052 - MATERIAL SAFETY, HANDLING AND TRANSPORT

Materials shall be stored in accordance with the manufacturer's recommendations. All safety precautions outlined by the Polyurethane Division of the Society of Plastics Industries, NFPA, OSHA, EPA, and the manufacturer's SDS shall be observed. SDS and technical data sheets shall be on-site and available at all times.

There shall be no welding, smoking, or open flames within 25 feet of PUF application. A minimum 15-pound, class ABC, fire extinguisher shall be on site during foam application.

Workers wearing organic respirator masks and safety glasses or goggles shall apply PUF. State or federal regulations requiring additional safety equipment shall supersede these requirements. Workers wearing respirator masks shall follow the training, fit testing, medical surveillance, and other relevant requirements specified in 29 CFR 1910.134.

The Contractor shall follow all applicable state and local regulations for the transport and use of PUF and chemicals required for cleanup. The Contractor shall obtain any required permits for transportation. In the event of a component leak or spill, the Contractor shall notify the appropriate agencies and jurisdictions.

An oxygen meter shall be used to test air before and during installation of the bottom forms or any other work more than 10 feet inside a mine opening. The oxygen meter shall be a National Mine Service (NMS) OX231 oxygen meter or equivalent. The oxygen meter shall continuously monitor oxygen levels and have an audible warning. If the oxygen level falls below 19 percent, all personnel shall withdraw from the working area in the mine until the oxygen content increases to safe levels.

Any remedy for increasing oxygen content of the working area or providing ventilation from the surface shall be determined in consultation with the Project Manager.

13055 - EXECUTION

Debris, soil, and loose rock in each of the subsidence features shall be cleared wherever PUF will be installed. A reasonable effort shall be made to excavate any soils down to bedrock or based upon the limitation of the equipment used and safe equipment travel.

Formwork

The bottom form and cross members may consist of any commonly available building materials capable of sustaining an initial lift of two to four feet of PUF. Acceptable cross member materials include, but are not limited to, reinforcing steel, 2x4's, dowels, cardboard tubes, and fabric air-inflated plugs. Acceptable bottom form materials include, but are not limited to, foam that has been poured and allowed to cure, wire sheeting (e.g., poultry netting, hog wire) affixed to a flat material, plywood, cardboard, paneling, and carpeting. Any combination of the above materials will be acceptable. Alternate bottom forms shall be reviewed with the Project Engineer prior to use.

The formwork shall be installed at that level specified in the closure drawings or as directed by the Project Engineer following uncovering by the Contractor of the existing conditions within the mine opening. Unless otherwise indicated, cross members may be placed at an angle no greater than 20 degrees from the horizontal as long as both ends are seated in competent rock. The bottom form shall be set over the cross members.

All bottom forms shall be completed prior to the application of any polyurethane foam. The Contractor shall provide the Project Manager with a list of installed depth to bottom forms for polyurethane foam closures. Any breach in the bottom form caused by rock fall or other reason shall be repaired prior to the arrival of PUF applicators at that site. The Contractor shall be responsible for the integrity of the bottom form and the loss of any polyurethane should it fail.

Ventilation/Drainage Pipe and Corrugated Steel Pipe

The ventilation/drainage pipe shall consist of a six-inch diameter Schedule 40 PVC or similar gauge HDPE pipe. The ventilation/drainage pipe shall be cut with a hacksaw across the circumference to create slits no longer than three inches and no less than ¼-inch wide at six-inch increments. Only the portions of the pipe exposed to common fill, granular fill, and lightweight aggregate fill shall be slit.

Four to twelve inches of the ventilation/drainage pipe shall extend above the finish grade, except where otherwise indicated. The six-inch PVC or HDPE pipe shall be encased in an eight-inch steel sleeve in the portion exposed above grade and for two feet below grade, except where otherwise indicated. The annular area shall be filled with concrete or grout.

The ventilation/drainage pipe and corrugated steel pipe for access shall be placed over a portion of the bottom form unobstructed by cross members. In shafts with more than one compartment, the access pipe shall be placed in one of the outside compartments, or as directed by the Project Manager. Both pipes shall be open to the underlying mine void after installation of the

foam and shall be supported by a tripod or other load-bearing device such that the load is not placed on the bottom form. Any welding that takes place above the PUF closure shall take place prior to placement of PUF in the mine opening or after installation of the backfill. Under no circumstances shall welding take place over exposed PUF.

The slits made for drainage in the ventilation/drainage pipe shall be covered with visqueen or polyethylene tape during foam application. After application of PUF the visqueen or tape shall be removed exposing the slits. Any foam covering the slits shall be removed to allow an unobstructed flow of water into the pipe.

The corrugated steel pipe shall have PUF covering the outside of the pipe at least two inches thick in the common fill section of the PUF plug. Polyurethane foam may be draped or splashed against the culvert during foam installation to achieve this coverage.

Steel strap with a width greater than two inches shall be welded to the steel sleeve across the opening of the ventilation/drainage pipe in such a manner as to prevent rocks with a dimension greater than two inches from being dropped down the pipe. As an alternative, steel grating as specified in Division 5 may be cut to fit the opening across the ventilation/drainage pipe and welded in place.

Polyurethane Foam (PUF)

The depth of polyurethane foam installed to plug a feature opening shall be as specified or indicated in the project drawings.

In large pours, PUF can get hot enough to actually melt and even burn. This may leave a hollowed out plug or “eggshell” that has very little strength. The remaining foam will be cracked and discolored, very similar to severe UV damage.

PUF shall be installed in lifts with a maximum rise of 18 inches. The lifts shall be installed no sooner than 20 minutes apart (and no sooner than 30 minutes apart for ambient air temperatures above 84°F) and have a maximum lift height of three vertical feet per hour. Installed PUF lifts shall pass through the tack free stage before applying the next lift. At no time shall sprayed or poured PUF cut into the rising foam. The PUF shall be applied in such a manner that the entire void is filled, that shadow zones or voids are not created during PUF application, and that temperatures are not raised to unsafe levels.

The Project Manager may use an infrared non-contact thermometer to monitor exothermic generation. If the ambient air temperature is below 60°F, extra time will be required to allow the PUF to fully expand and may prevent each lift from reaching a full height of 18 inches. Every degree of ambient air temperature over 65°F adds at least two degrees to the temperature of the rising foam. Ambient air temperatures above 90°F can cause problems with PUF formation. PUF application shall cease if heating or off-ratio foam is observed. The Contractor shall remedy off-ratio foam and demonstrate proper quality PUF to the Project Manager before application resumes. The surface temperature should reach a plateau and start to drop before resuming foam installation. If using bulk foam, reduce the quantity per bucket as the day heats up.

Bagged or poured-in-place PUF shall be placed in strict accordance with the manufacturer's recommendations, including the need for thorough mixing of components. If required by the Project

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Engineer, the manufacturer of bagged or poured-in-place polyurethane foam shall provide a certified representative experienced in the placement of their product for a minimum of one eight-hour day. This representative will direct field operations and instruct the Contractor in the proper mixing, placement, and safety procedures for bagged or poured-in-place PUF.

The surfaces of the void to be filled shall be as free as possible of grease and standing water. PUF shall not be applied to surfaces with running water. Remedial action for such situations shall be reviewed with the Project Manager. PUF shall not be applied directly to a debris plug, but shall be applied to a bottom form of known physical and chemical properties. PUF shall not be applied during rain unless the foam is fully protected from interaction with water by a physical barrier.

If off-ratio PUF is observed, the applicator must stop, correct the imbalance, and continue application with the proper ratio PUF. Correction and determination of the foam ratio shall be done on a plastic sheet away from the work area. Any lift of off-ratio PUF comprising over two percent of the intended PUF column heights shall be removed. An amount of off-ratio PUF less than two percent of the specified volume may remain if allowed to cool and if the outer perimeter of off-ratio PUF is removed. If off-ratio foam comprises more than 10% of the specified PUF volume, five percent of the price bid for the site will be deducted as a penalty.

The Contractor shall be responsible for lost or damaged equipment. Damages or claims arising from PUF overspray shall be the responsibility of the Contractor. Under no circumstances shall foreign material be placed in the PUF material unless specifically specified or authorized by the Project Manager. Non-PUF materials shall be non-toxic and non-hazardous and shall not compromise the strength or water saturation characteristics of the PUF.

Upon reaching the specified grade level for application of PUF, the Contractor shall undertake cleanup of PUF operations.

Field Quality Control

The Project Manager will make periodic checks of the quality of PUF applied. The principal check on quality will be visual. Acceptable PUF shall be tan-white to buff in color with no vesicles and a smooth to coarse orange peel surface. Any one of the following conditions shall cause PUF application to cease and efforts to correct the off-ratio condition begun.

<u>Condition</u>	<u>Possible Cause</u>
Dark PUF color Smooth and Glassy Friable or Brittle PUF Improper Density	Excess A Component
Light in Color to White Bad Cell Structure Mottled Appearance Blowholes or Pinholes	Excess B Component
Slow Rise	Bad Material

<u>Condition</u>	<u>Possible Cause</u>
Poor Cell Structure	
Frequent Equipment Clogging	
Slow Curing	
Poor Physical Properties	
Air Bubbles on Surface	Pouring Too Fast Between Lifts
Tension Cracks on Surface	
Excessive Air Bubbles	

At any time during PUF application the Project Manager may call for a density test. The Contractor shall provide and fill a container for this purpose and the sample will be tested for density. The density of the sample shall be within the range of 1.85 to 3.00 pounds per cubic foot. Density tests indicating that PUF installed is not within the minimum specified range shall cause corrective action resulting in PUF within the acceptable nominal range, less deviation due to barometric pressure changes from Standard Temperature and Pressure.

The Contractor shall conduct density tests of PUF at no additional expense to AML. At the discretion of the Project Manager, density tests showing PUF in the acceptable range will be taken in the center of the cavity to which PUF is being applied. A sampling box constructed of sheet aluminum and lined with polyethylene shall be lowered into the cavity to take a representative sample of PUF just above the level of installed polyurethane.

At the option of the Project Manager, up to three one-cubic-foot samples of PUF may be taken from the job site for density analysis at the Contractor's expense. In addition, at the option of the Project Manager, up to three samples of up to 100 cubic inches in volume may be taken for on-site tensile strength testing at the Contractor's expense. PUF shall be provided for the samples at no additional cost to AML.

Backfilling

To protect the PUF from vandalism if the site is to be left unattended, two to six inches of fill shall be uniformly shoveled over the foam as soon as possible after the last layer of PUF has solidified. No sooner than 24 hours after PUF application, the remaining void above the PUF plug shall be backfilled. The first two-foot lift of fill shall be placed by hand, bucket, or chute to lower the velocity of impact against the PUF. With approval of the Project Manager, this fill may be placed by streaming from heavy equipment such as a loader bucket. The depths and types of fill over the PUF shall be as indicated or specified in the contract documents or as directed by the Project Manager. Unless otherwise indicated, the minimum cover shall be 36 inches of common fill.

Unless otherwise specified or directed by the Project Manager, common fill above polyurethane foam closures shall be nearby cohesionless material with no pieces larger than six inches in diameter, free of debris or trash, and containing no materials classified as toxic or hazardous. The unit weight of the fill material shall be less than 130 lb/cu. Ft.

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Fill above the polyurethane foam closures shall be placed in a manner that will prevent damage to the polyurethane foam plug and riser pipes and will allow these structures to assume the load from the fill gradually and uniformly.

The use of riding vibratory compaction equipment shall be prohibited above polyurethane foam closures and vibrations due to other construction equipment operations shall be kept to a minimum in these areas. With care and for the minimum acceptable period of time, small walk-behind compaction equipment, such as rammer tampers, may be used in these areas.

Survey Markers

As described in Division 2, a steel pipe with grouted survey cap shall be installed near the ventilation/drainage pipe. Where the PUF/interface is less than five feet below finish grade, the pipe shall be set in a concrete footing, which shall be at least one foot in diameter and extend from the PUF/fill interface to a height of two feet. The upper six inches to one foot of pipe shall extend above grade. Where the PUF/fill interface is more than five feet below the finish grade, a six-foot long pipe shall be used. The lower two feet of pipe shall be set in concrete a minimum of one foot in diameter and the upper six inches to one foot of pipe shall extend above grade.

Alternately, the Contractor may drill and grout the cap in undisturbed, competent rock or concrete at or immediately adjacent to the feature.

Cleanup

The Contractor shall clean the site of all PUF fragments and overspray. PUF overspray greater than 1/8-inch thick on timbers or historic materials shall be scraped or ablated to 1/8 inch minus to permit ultraviolet degradation of over sprayed polyurethane. Tools and equipment shall be cleaned in such a manner as to avoid injury to vegetation or wildlife. Handling of chemicals used in cleanup, and their disposal, shall comply with all applicable local, State and Federal regulations.

13990 - SUBMITTALS

Complete data covering polyurethane foam and accessories along with ventilation/drainage pipe shall be submitted in accordance with the procedure set forth in Section 01340.

END OF DIVISION 13