

## **Parkdale Quarry Expansion**

### **Exhibit D - MINING PLAN**

#### **1. Introduction**

The original mining application, the 2008 amendment, and this amendment, all propose surface mining of sand and gravel and quarried granite aggregate at the Parkdale Quarry. Martin Marietta Materials has requested a Mineral Materials Competitive Sale, COC-078119, in order to expand operations at its privately-owned Parkdale Quarry onto adjacent Bureau of Land Management (BLM)-administered lands. The Parkdale Quarry is located in Fremont County, Colorado, approximately 12 road miles west of the Town of Canon City, Colorado. Martin Marietta proposes to expand operations generally north onto BLM property in portions of Sections 1, 2, 11, and 12, Township 18 South, Range 72 West, Sixth Prime Meridian (the Mineral Materials Sale Area). The location of the Parkdale Quarry and the onsite areas are shown on the Index Map in Exhibit B.

The currently mined approximate 112-acre gravel extraction area is located between the Arkansas River and Tallahassee Creek. The current approximate 72-acre granite quarry is located on the opposite side (north) of Tallahassee Creek from the gravel extraction area. As part of the amendment process, the mining southern mining limit of the granite quarry on the private land will be moved north away from the Arkansas River. The amendment also removes the approximate 3-acre sandstone mining area from the area of permitted mining lands. As amended, mining is expected to disturb approximately 170 acres on the privately-owned portions of the quarry and approximately 700 acres in the BLM Mineral Materials Sale Area over the life of the mine. The Mineral Materials Sale Area is surrounded by an approximate 730-acre buffer that will be included in the mining permit boundaries, but will be left undisturbed. The purpose of the buffer is to provide a separation between the area where mining will occur and adjacent private lands and areas open to the public. Activities that create a ground disturbance will be restricted to the Mineral Materials Sale Area. Final mineral processing, loadout, offsite transportation, and associated activities will continue to be performed on Martin Marietta Materials' owned property south of the Mineral Materials Sale Area. Activities that will be conducted on the Mineral Materials Sale Area include:

- Construction and operation of access/haul roads and possible construction of a material handling and conveyor system from the Mineral Materials Sale Area to the processing area on the private land;
- Excavation of mineral materials using explosives and/or heavy-duty excavation equipment;
- Loading of mineral materials onto haul trucks and/or a material handling and overland conveyor system for transport to the processing facilities on the adjacent private land;
- Reclamation of disturbed areas in accordance with our reclamation plan, to be approved by BLM and the Colorado Department of Reclamation, Mining, and Safety.

Final reclamation of the Mineral Materials Sale Area, as envisioned, will create a landscape that substantially mimics the landscape currently present in Webster Park, south of and bordering the Mineral Materials Sale Area. Final reclamation of the alluvial mining area and the granite quarry on the private land will remain water storage, as per the currently approved reclamation plan.

## **2. Mine Phasing**

Mining of the Mineral Materials Sale Area will be performed in five phases progressing generally from west and northwest to southeast. The sixth phase of mining will extend the mining from the BLM land onto the current granite quarry area. The areas expected to be disturbed by the six mining phases are shown on the Parkdale Expansion Mine Plan Maps in Exhibit D. The road used to access the mining area and transport mined materials will be constructed prior to the commencement of Phase 1 mining. A conveyor system may be constructed during the first phase of mining to replace haul trucks for transporting material from the Phase 1, 2, and 3 mining areas. The mine plan and mining phases are designed to minimize the area of disturbed unreclaimed ground, and to minimize the length of time that a piece of ground remains disturbed and unreclaimed. The mine plan and phasing is also designed to minimize viewshed impacts along the Arkansas River/U.S. Highway 50 corridor from the mining operation in the Mineral Materials Sales Area. Viewshed impacts will be minimized by using a technique called “mine from behind” wherein the existing topography acts as a view screen, and where mining of visible elevated areas is conducted from the side away from the viewpoint. Additionally, the sandstone outcroppings along the southern edge of the Mineral Materials Sales Area will remain undisturbed to further screen mining from being visible along the Arkansas River/U.S. Highway 50 corridor.

We anticipate that Phase 1 of the mining process will disturb approximately 81 acres over a period of 15 to 20 years in the area designated as the West Pit. Phase 2 mining will disturb approximately 166 acres over an estimated period of 20 to 40 years in the area designated as the West Central Pit. We estimate that Phase 3 will disturb approximately 228 acres over a period of 25 to 50 years in the area designated as the Central Pit. The Phase 4 will disturb approximately 110 acres over an estimated 15 to 30-year period in the area designated as the East Central Pit. Phase 5 mining will disturb approximately 113 acres in the area designated as the East Pit, and will take an estimated 15 to 25 years. Phase 6 mining will disturb approximately 57 acres of private land and will take an estimated 10 to 20 years to complete. The generalized post-mining topography is shown on the Reclamation Plan Map in Exhibit F. Reclamation activities will begin in a particular part of a pit area when mining is complete in that part of the pit area, and there is no longer a need to access it. Thus, reclamation will be occurring concurrently with mining, in order to minimize the total disturbed acreage.

## **3. Haul Road Construction**

The haul road running along the southern and southwestern boundary of the Mineral Materials Sale Area, shown on the Pre-mining Map in Exhibit C, will be constructed prior to the commencement of mining as the initial haul/access road serving the area. The haul road will lead from the material processing facilities on the Martin Marietta owned portion of the quarry. The haul road will remain in place throughout the life of the mine. Semi-permanent and temporary haul roads will be constructed to bring material from the pit areas to the main haul road. Haul roads

will have an approximate six-inch thick fine gravel-surfaced wearing course over approximately nine inches of coarse crushed rock, which will in turn sit on approximately 18 inches of compacted aggregate base over the native subgrade. Haul roads will generally be at least 60 feet in width to provide ample room for vehicles to safely pass each other. Maximum grades on the haul roads will generally be 10-percent or less, and roads will be designed with a 2-percent cross fall to facilitate drainage. Horizontal curves will generally be designed with a radius of at least 150 feet and will be designed with approximately 10-percent superelevation to safely accommodate anticipated travel speeds. Vertical curves will be flat enough to allow for safe braking distances by loaded haul trucks to avoid obstruction in the travel way. A drainage ditch will run along the downhill side of the haul road, and haul roads will be bordered by berms, the height of which will be at least as high as the axle on the largest piece of equipment expected to use the road. Haul roads will be watered as needed to control dust, and will also be treated with a chemical dust suppressant such as calcium or magnesium chloride. A typical haul road cross section is shown on Figure 1. A conveyor may be installed to transport material from the Mineral Materials Sale Area to the processing area on Martin Marietta-owned property. The proposed conveyor route will generally run north-south and will follow the natural topography outside of the mining area. Conveyor supports will not be placed within designated waterways.

#### **4. Bench Design**

Two types of mining benches will be created during the mining process, production benches and reclamation benches. The production benches are those created during the active mining process, the face of which is the source of the mined materials. Reclamation benches are those which remain when mining is completed, and are generally located at the mining disturbance boundary. Production benches will not exceed 60 feet in height, have a face angle anticipated to be approximately 80 degrees, and a width of not less than 40 feet. Temporary safety berms will be constructed parallel to and at the top edge, and ten feet from the base of production benches that are not actively being mined. Reclamation benches will typically be approximately 35 feet high, have a bench width of approximately 30 feet, and a face angle of approximately 80 degrees, resulting in an overall approximate 1:1 (horizontal to vertical) reclamation slope. However, some reclamation benches may be left taller to enhance wildlife habitat. The actual bench geometry selected will be that which provides a minimum static factor of safety of 1.3, based on rock slope stability analysis. Cross-sections of typical production and reclamation benches are shown in Figure 2.

#### **5. Material Handling – Alluvial Quarry**

The alluvial deposit on the site is mostly mined out, with only residual material available. However, limited mining of the residual alluvial material may continue. Mining of the alluvial materials will be conducted using the excavation techniques approved in the original mine permit and the 2008 mine plan amendment.

#### **6. Materials Handling – Granite Quarry**

Overburden and topsoil will be stripped from areas to be mined by the use of conventional heavy earthmoving equipment. Overburden and topsoil will be placed in stockpiles for reuse during the

reclamation process. Overburden and topsoil stockpiles that will not be used within six months of excavation will be seeded to establish a vegetative cover from stabilization and protection from erosion. Typical stripping depths for topsoil and overburden in the mining area are one-half and six feet respectively.

Aggregate materials will be excavated by using explosives to free the rock from the matrix. All explosive work on the site will be performed by a licensed third party. The explosives needed for each blast will be transported to the site immediately before blast holes are loaded and excess explosives will be removed from the site after the blast holes are loaded. No explosives will be stored on site.

Once the aggregate material is blasted free of the rock matrix, a loader or excavator will be used to handle and load it into off-road dump trucks and/or onto the conveyor feed for transport to the material processing area on the adjacent Martin Marietta-owned property. Blocks of rock that are too large to process (oversize material) or that will not be used as riprap will be temporarily set aside adjacent to the excavation site for mechanical size reduction or use in reclamation. An excavator equipped with a mechanical breaker or other mechanical means will be used as-needed to reduce oversized material to an appropriate size for transport and processing.

## **7. Water Supply**

The current quarry operation uses about 1,500 gallons of water per minute (gpm), most of which is recycled water that is used at the wash plant. Some water is applied to roads for dust control. Water usage is not anticipated to increase as mining progresses onto BLM lands. Water for the quarry is obtained from tributary groundwater that collects in the alluvial pit and is augmented as needed by water from Tallahassee Creek or the Arkansas River under a state reviewed and approved withdrawal permit. Water shares are leased from the Board of Water Works of Pueblo, the Twin Lakes Reservoir and Canal Company, and the Cañon City Water Department to allow the use of groundwater and surface water by the mine.

## **8. Need for Active Dewatering of the Granite Quarry**

The need for active dewatering of the pits to facilitate mining in the granite area was evaluated based on observations on groundwater inflow to the current quarry operation and scoping-level calculations of inflow performed by ERM (2019) and Whetstone (2020) for the project Environmental; Impact Statement (EIS). Copies of the Whetstone and ERM reports can be found in the EIS, and are excerpted in Exhibit G of the 112(c) permit application package. The analysis by ERM used two types of analytical calculations: one for southwest linear flow towards the quarry highwall and one for radial flow to a semicircle representing the northeast portion of the quarry. Both calculations assumed the following conditions:

- The hydraulic conductivity of the granitic rocks is equal to the average of the testing data (i.e., 0.0039 ft./day).
- Specific yield of the granitic rocks is equal to 0.01.
- The quarry is instantaneously excavated to full depth at time zero.

- Groundwater drawdown at the quarry wall would be 300 feet.
- The thickness of the permeable fractured bedrock is 500 feet.
- Groundwater flow is horizontal.
- The potentially affected area has homogeneous characteristics, is unbounded, and has infinite aerial extent.

The analysis by Whetstone used the groundwater modeling software MODFLOW-SURFACT V.4.0- (Hydrogeologic 2011) and a similar set of assumptions with the following exceptions:

- The potentially affected area is bound (no flow) to the south by the Arkansas River. The river elevation is below the planned elevation of the pit floor and therefore the cone of depression caused by groundwater drawdown cannot expand past this boundary.
- The potentially affected area is also bound (no flow) by Currant and Tallahassee Creeks where the elevations of the drainages are below the minimum level of the planned pit floor.

The analyses by ERM and Whetstone generally provide similar estimates of groundwater inflow to the quarry. ERM estimated that inflows during mining were likely to range from 15 to 25 gpm (ERM 2019). These values are consistent with observed flows from the existing quarry face, which is about 270 feet high and typically has little or no seepage except after precipitation events and during spring snowmelt. Whetstone estimated an inflow rate of 27 gpm to the quarry at its full extent after 100 years of mining (Whetstone 2020a). This estimate is considered to be conservatively high because groundwater systems in fractured granite bodies with low hydraulic conductivity tend to be poorly connected over broad areas and the Parkdale an unnamed are likely to act as boundaries to the north and east (Whetstone 2020a). Under any circumstance, the predicted inflows are low enough to not be of operational consequence, and advanced dewatering of the quarry by pumping from groundwater wells would not be required to facilitate mining. Free flowing groundwater that enters the quarry during mining would be routed to settling ponds for re-infiltration to groundwater or discharge to Currant or Tallahassee Creek.