

Abandoned Mine Land Program

**Construction Start:**

September 27, 2002

**Construction Completion:**

August 22, 2003

**Construction Cost:**

\$154,913

**Geotechnical Consultant:**

AK GeoConsult,  
Albuquerque, NM

**Bat Consultant:**

Dr. J. Scott Altenbach,  
University of New Mexico

**Archaeological Consultant:**

Southwest Archaeological  
Consultants, Inc.,  
Santa Fe, NM

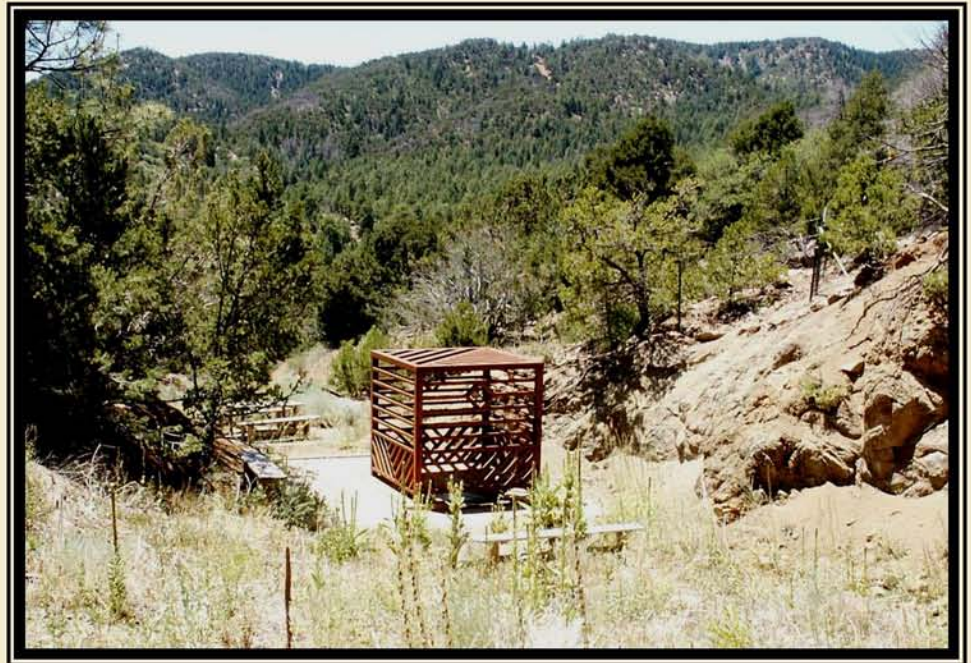
**Construction Contractor:**

St. Cloud Mining Company,  
Truth or Consequences, NM

**MARCH  
2007**

**REAL DE DOLORES MINE SAFEGUARD PROJECT**

Cerrillos, New Mexico  
New Mexico AML Program

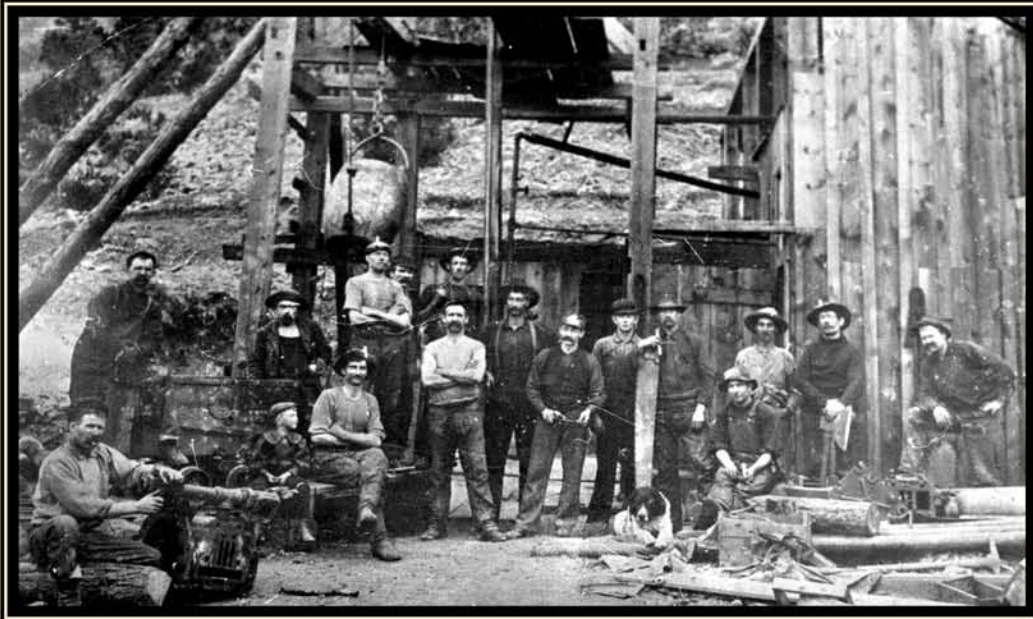


Weathering steel bat cupola at the Tunia shaft,  
Ortiz Mountains Educational Preserve  
(Note the wooden benches used for bat watching)

**SUBMITTED BY**

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Mining and Minerals Division  
Energy, Minerals and Natural Resource Department  
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Lumber  
and mine  
workers at the  
Ortiz  
(Santa Rosalia)  
shaft, 1880

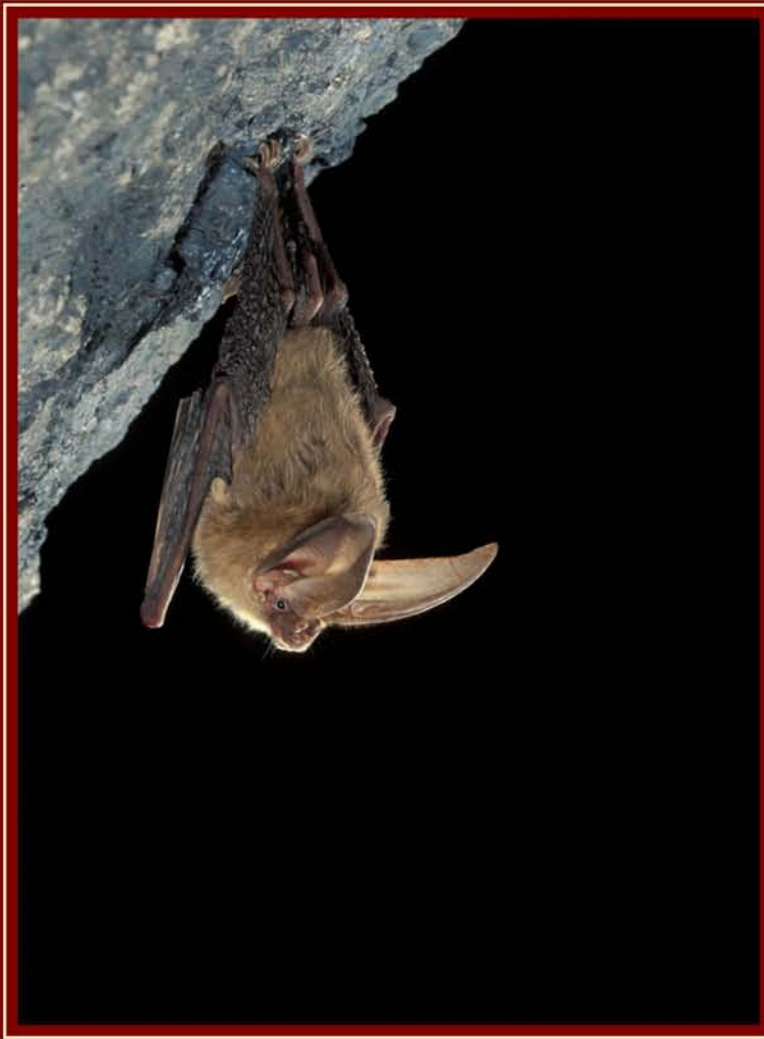
### SITE HISTORY AND BACKGROUND

In 1821, the Mexican government opened the borders of its New Mexico province to traders from the United States. The developing market for the goods brought over the Santa Fe Trail from Missouri into New Mexico gave impetus for gold mining in the Ortiz Mountains, 25 miles south of Santa Fe. By 1822, the mining camp of Real de Dolores was in place and several thousand people were washing the gravels of these mountains for placer gold.

By at least 1831, the Santo Niño mine, the oldest lode gold mine in what is now the western United States, was being developed in these mountains. The shaft of the Santa Rosalia, situated 325 feet southwest of the Santo Niño shaft, was sunk in 1833, 15 years before gold was found in California. These mines were eventually joined together in the Old Ortiz mine, where gold continued to be mined after the Mexican War in 1846, when New Mexico became a territory of the United States. See the photo above, indicating continued production in 1880.

The Ortiz gold mines went on to set other historic records, including the first rail line in New Mexico, which, prior to the Civil War, carried ore over a mile from the Old Ortiz mine to a stamp mill in the valley below. Due to the lack of water in the Ortiz Mountains, Thomas Edison was asked to design a dry gold separator for the mining operations in the early 1900s. Unfortunately his separator proved to be unsuccessful. Historic mining in the Ortiz Mountains continued into the 1940s. The State Historic Preservation Division has designated the site as historically significant and eligible for inclusion in the National and State historic registers.

In the 1980s, Gold Fields Ltd. opened and operated a modern, open pit gold mine at Cunningham Hill, a half-mile from the Old Ortiz vein. They also removed and reprocessed the much of the mine waste from the Old Ortiz mine site. In 2001, LAC Minerals, which later managed the site, donated 1,350 acres of land, including the Ortiz vein, to the Santa Fe Botanical Garden as part of the settlement of a groundwater pollution lawsuit. The Botanical Garden agreed to conserve and maintain the site and offers education programming to the public at the Ortiz Mountains Educational Preserve. Recently the Botanical Garden entered into a management agreement with Santa Fe County, transferring ownership of the Preserve to the County as part of their open-space program. (Information on the Ortiz Mountains Educational Preserve, including more details on the local history and on bat use of the abandoned mines, can be found at [http://www.santafebotanicalgarden.org/mainpages/6\\_ortiz.html](http://www.santafebotanicalgarden.org/mainpages/6_ortiz.html).)



Townsend's big-eared bat  
(photo courtesy of Dr. J. Scott Altenbach)

## DESIGN APPROACH/RECLAMATION TECHNIQUES

Knowing the historic importance of mining in the Ortiz Mountains and wishing to preserve what remained of that history, the NM Abandoned Mine Land Program began to survey the Ortiz Mountains in the early 1990s. The Program located eight shafts, two adits, two pits and two open stopes dangerous to the public. In addition, the Program's archaeological consultants recorded remnants of the old rail line, the Edison mill, and the Real de Delores mining town, as well as a standing timber headframe and several arrastras, circular stone ore grinders used by small miners.

Although most of the shafts and the decline that had accessed the Old Ortiz mine workings had either collapsed or been filled, the Tunia shaft and adjacent decline stope were open. Some of the openings could be (and were) backfilled, with access routes and borrow sites carefully mapped out to avoid historic artifacts. Given their historic importance, the collapsed shaft of the Santo Niño and the collapsed decline developed in 1856 at the Old Ortiz mine were fenced. Two of the openings, however, had occupants who had moved in after mining.

Townsend's big-eared bats (*Corynorhinus townsendii*) were using the underground workings at the Tunia shaft and at the English Mine shaft, a quarter mile to the north. The bats were using these mine workings for both summer maternity and winter hibernation sites.

By the time the project was entering the design phase in the mid-1990s, the land exchange to the Santa Fe Botanical Garden was in process. The land exchange promised to greatly increase the level of public accessibility to the site, so public safety, became an even more important design consideration. The NM AML Program met with the Botanical Garden to find solutions that met their needs for public safety and educational opportunities. As well as responsibly safeguarding the mine openings in and near the Ortiz Mountains Educational Preserve and preserving historic structure and artifacts, the Program funded two interpretive signs on mining history and bat habitat preservation at the Preserve.

The project involved the construction of bat cupolas at two shafts with corrugated steel riser pipes in polyurethane foam (PUF) plugs; construction of a large PUF plug in one stope decline; construction of a PUF plug with scoria fill at one shaft; installation of woven wire fences with barbed wire at one collapsed decline trench and one collapsed shaft; backfilling of one shaft with the installation of cable netting and a rock erosion barrier; and backfilling of three shafts, two pits, one open stope and one adit.

## DESIGN CHALLENGES AND RESPONSES

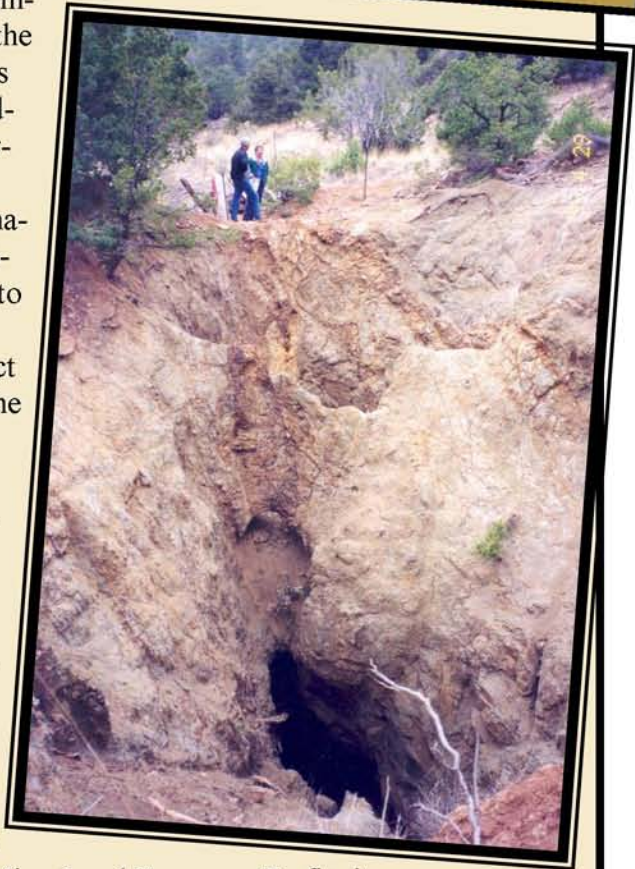
In addition to access difficulties for construction equipment in the steep terrain, the mine features needed to be safeguarded in a manner that honored the mining history of the site and the coming together of two cultures at a critical point in the history of the American Southwest. Avoidance areas, allowable access routes and borrow areas all had to be determined and designated in advance of construction. In addition LAC Minerals stipulated certain restrictions on construction access and timing and the bat compatible structures had to be built between the winter hibernation and summer maternity seasons. Above all, the closures, especially on the Ortiz Mountains Educational Preserve, needed to be safe for public visitation. The Santa Fe Botanical Garden planned to lead educational tours of the Preserve and to conduct public bat counts at the Tunia cupola on selected evenings in the spring through fall.

Several of the shafts also presented unique engineering design challenges. The near-surface rock at both shafts requiring bat cupolas was weathered and required stabilization to support a structure. In addition, the large intersecting stope decline immediately adjacent to the Tunia shaft had to be sealed for public safety without blocking the shaft. The final design for the stope opening incorporated a polyurethane foam (PUF) plug 16-feet deep, covered with twelve feet of lightweight scoria fill (to minimize loads on the plug), filter cloth and one foot of soil topdressing. Requiring 100 cubic yards of foam, this is the largest PUF plug designed to date by the NM Abandoned Mine Land Program. To fit site conditions, the Tunia shaft required a 15½-foot deep PUF plug with four feet of scoria fill.



Polyurethane foam placement for the plug at the Tunia shaft; the scoria fill in the foreground has been placed over the polyurethane foam plug at the Tunia stope opening (See the cover photo for the completed installation)

The Tunia stope decline prior to closure (the Tunia shaft is just beyond the rock bridge in the center of the photo)



With regular public visitation planned at the site, aesthetic, artistic and safety considerations all went into the design of the Tunia cupola. As you can see in the cover photo, the diagonal bars at the base and the top that meet at 90 degrees symbolize the meeting and, sometimes, clashing of the two cultures that met at the Old Ortiz mine – the Hispanic settlers for over 200 years of a remote corner of the Spanish Empire and the traders and miners from the young, brash country called the United States. The overall cubic form of the cupola (6'-6" on each side) reflects the cubic crystalline structure of gold. The lower bars are spaced at four inches clear for the safety of children and the upper horizontal bars at 5¾-inches clear for bat passage.



Rock cover over cable net at the McPhee shaft,  
Ortiz Mountains Educational Preserve

One of the shafts at the Old Ortiz mine, the McPhee shaft, had been filled, probably in the 1980s when Gold Fields removed the mine waste material for processing. The fill had subsided about 15 feet, raising concerns about the continuity and soundness of the backfill within the shaft. Since the visitors' kiosk for the Ortiz Mountains Educational Preserve was slated to be within 100 yards of this shaft, the subsidence was filled to the surface, a cable net anchored to bedrock around the opening (as a

secondary safety measure, in case the shaft fill subsides again), and the net covered with rock both to mark the shaft's location and for erosion control.

The English Mine was active from the 1880s to the early 1900s. Its shaft opening was smaller than the Tunia shaft, requiring only an eight-foot deep PUF plug. The cupola for this shaft was designed with two sides sloped at 60 degrees. This helped to minimize the weight of the fabricated steel structure, which had to be ferried to the site up a steep, narrow abandoned mining road. Both cupolas were constructed using weathering steel structural tubing. AMLP chose this material for its strength, vandal resistance, aesthetics and permanent corrosion protection of the steel.



The bat cupola at the English Mine shaft on LAC Mineral property (the open pit mine at Cunningham Hill, undergoing reclamation, is in the background)

## PROJECT STATISTICS

Tunia cupola:  
3,300 pounds of  
weathering steel

English cupola:  
1,300 pounds of  
weathering steel

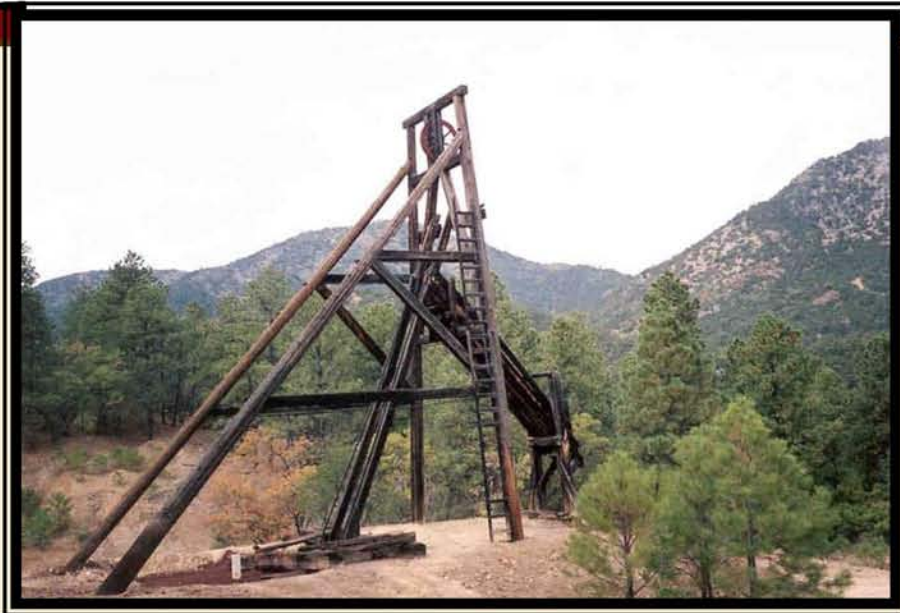
157 cubic yards of  
polyurethane foam

430 cubic yards of  
lightweight scoria fill

600 square feet of  
cable netting

400 linear feet of  
woven wire fence  
with barbed wire

1,100 cubic yards of  
unclassified fill in  
shafts, pits and adit



The preserved timber headframe and collar at the Benton Mine on LAC Mineral Property (note that some of the lower ladder rungs were removed to discourage climbing on the structure)

At the Benton Mine, active between the 1880s and the 1930s, the timber lining for the shaft had partially collapsed, creating an unstable debris plug 35 feet below the surface. To ensure a permanent shaft closure, a nine-foot thick PUF plug was placed in bedrock and covered with five-feet of lightweight scoria fill. This preserved the mining district's only remaining headframe structure and the near surface remnants of the timber collar for the shaft. Since Gold Fields had removed the mine waste on three sides of the headframe, fill was borrowed nearby and placed around the structure's base for long-term stabilization.

The contractor disturbed only a little over an acre to safeguard 14 dangerous mine openings. The disturbed area was graded to conform to the natural environment and seeded with native grass, forb and shrub species. More than 500 native shrub and tree seedlings were also planted for revegetation.

## SUMMARY

Rising to the challenges of working on historic mine openings, this project demonstrates the effective use of large polyurethane foam plugs, including two with six-foot diameter riser pipes, to preserve not only bat habitat in underground workings but also mine workings and structures that were built up to 175 years ago. It also demonstrates the use of lightweight fill over PUF plugs to minimize loads on the plugs and consequently the required thickness of the plugs. Since this project, the NM AML Program has gone on to design numerous other polyurethane foam plugs with steel riser pipes for other bat compatible closures at shafts, stope openings and declines throughout New Mexico. Cooperating with the State Historic Preservation Division, Santa Fe Botanical Garden, and mining companies, the New Mexico Abandoned Mine Land Program has helped to provide the public a place to become informed on bat habitat preservation in abandoned mines, on the long and varied mining history of New Mexico, and on the work of the NM AML Program and the Office of Surface Mining.