LIMITED GEOTECHNICAL EVALUATION
SHELDON MINE
BRADSHAW RANGER DISTRICT OF THE
PRESCOTT NATIONAL FOREST
YAVAPAI COUNTY, ARIZONA

Geotechnical
and
Environmental
Sciences
Consultants

Ninyo & Moore
LIMITED GEOTECHNICAL EVALUATION
SHELDON MINE
BRADSHAW RANGER DISTRICT OF THE
PRESCOTT NATIONAL FOREST
YAVAPAI COUNTY, ARIZONA

PREPARED FOR:
Ecology and Environment, Inc.
11 Golden Shore Drive, Suite 340
Long Beach, California 90802

PREPARED BY:
Ninyo & Moore
Geotechnical and Environmental Sciences Consultants
3001 South 35th Street, Suite 6
Phoenix, Arizona 85034

August 31, 2005
Project No. 206366001
Task Order 2005-003-A
Mr. Ernie Hernandez  
Ecology and Environment, Inc.  
11 Golden Shore Drive, Suite 340  
Long Beach, California 90802  

Subject: Limited Geotechnical Evaluation  
Sheldon Mine  
Bradshaw Ranger District of the Prescott National Forest  
Yavapai County, Arizona

Dear Mr. Hernandez:

In accordance with our proposal dated July 1, 2005 and your authorization of Task Order 2005-003-A, Ninyo & Moore has performed a limited geotechnical evaluation of the Sheldon Mine site located near Sheldon Road in the Bradshaw Ranger District of the Prescott National Forest, Yavapai County, Arizona. The attached report presents our methodology, findings, conclusions, and recommendations regarding the geotechnical conditions at the project site.

We appreciate the opportunity to be of service to you during this phase of the project. If you have any questions or comments regarding this report, please call at your convenience.

Sincerely,

NINYO & MOORE

Michael D. McDowell, P.E.  
Project Engineer

Robert W. McMichael, P.E.  
Principal Engineer

KLP/MDM/RM/hnm

Distribution: (3) Addressee

August 31, 2005  
Project No. 206366001  
Task Order 2005-003-A
# TABLE OF CONTENTS

<table>
<thead>
<tr>
<th>Section</th>
<th>Pages</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. INTRODUCTION</td>
<td>1</td>
</tr>
<tr>
<td>2. SCOPE OF SERVICES</td>
<td>1</td>
</tr>
<tr>
<td>3. SITE DESCRIPTION AND BACKGROUND</td>
<td>2</td>
</tr>
<tr>
<td>3.1. Sheldon Waste Rock</td>
<td>3</td>
</tr>
<tr>
<td>3.2. Sheldon Tailings Pile</td>
<td>4</td>
</tr>
<tr>
<td>4. GEOLOGY AND SUBSURFACE CONDITIONS</td>
<td>5</td>
</tr>
<tr>
<td>4.1. Geologic Setting</td>
<td>5</td>
</tr>
<tr>
<td>4.2. Subsurface Conditions</td>
<td>5</td>
</tr>
<tr>
<td>4.2.1. Sheldon Waste Rock</td>
<td>6</td>
</tr>
<tr>
<td>4.2.2. Sheldon Tailings Pile</td>
<td>6</td>
</tr>
<tr>
<td>4.3. Surface Water and Groundwater</td>
<td>6</td>
</tr>
<tr>
<td>5. GEOLOGIC HAZARDS</td>
<td>7</td>
</tr>
<tr>
<td>5.1. Faulting and Seismicity</td>
<td>7</td>
</tr>
<tr>
<td>5.2. Liquefaction Potential</td>
<td>8</td>
</tr>
<tr>
<td>5.3. Landslides</td>
<td>8</td>
</tr>
<tr>
<td>6. FIELD EXPLORATION</td>
<td>9</td>
</tr>
<tr>
<td>7. GEOPHYSICAL TESTING</td>
<td>10</td>
</tr>
<tr>
<td>8. LABORATORY TESTING</td>
<td>10</td>
</tr>
<tr>
<td>9. SLOPE STABILITY ANALYSIS</td>
<td>11</td>
</tr>
<tr>
<td>10. DISCUSSION AND DESIGN CONSIDERATIONS</td>
<td>13</td>
</tr>
<tr>
<td>10.1. Sheldon Waste Rock</td>
<td>13</td>
</tr>
<tr>
<td>10.1.1. Alternative 1 - Re-grading and Re-vegetation to Control Surface Erosion</td>
<td>13</td>
</tr>
<tr>
<td>10.1.2. Alternative 2 - Improve Drainage to Route Water Away from the Site</td>
<td>14</td>
</tr>
<tr>
<td>10.1.3. Alternative 3 - Gabion Wall Stabilization</td>
<td>14</td>
</tr>
<tr>
<td>10.1.4. Alternative 4 - Cut-off Wall or Barrier</td>
<td>15</td>
</tr>
<tr>
<td>10.1.5. Alternative 5 - Passive Treatment of Acid Mine Drainage</td>
<td>15</td>
</tr>
<tr>
<td>10.1.6. Alternative 6 - Do Nothing</td>
<td>15</td>
</tr>
<tr>
<td>10.2. Sheldon Tailings Pile</td>
<td>16</td>
</tr>
<tr>
<td>10.2.1. Alternative 1 - Re-grading and Re-vegetation to Control Surface Erosion</td>
<td>16</td>
</tr>
<tr>
<td>10.2.2. Alternative 2 - Improve Drainage</td>
<td>16</td>
</tr>
<tr>
<td>10.2.3. Alternative 3 - Sub-drainage System</td>
<td>17</td>
</tr>
<tr>
<td>10.2.4. Alternative 4 - Do Nothing</td>
<td>17</td>
</tr>
<tr>
<td>11. RECOMMENDATIONS</td>
<td>17</td>
</tr>
<tr>
<td>11.1. Sheldon Waste Rock</td>
<td>18</td>
</tr>
<tr>
<td>11.2. Sheldon Tailings Pile</td>
<td>18</td>
</tr>
</tbody>
</table>
Limited Geotechnical Evaluation
Sheldon Mine, Yavapai County, Arizona
August 31, 2005
Project No. 206366001

12. ADDITIONAL INFORMATION ......................................................... 19
13. LIMITATIONS ........................................................................... 19
14. SELECTED REFERENCES .............................................................. 21

Tables
Table 1 – Seismic Design Parameters ................................................. 8
Table 2 – Chemical Analysis ................................................................. 10
Table 3 – Summary of Analysis Parameters ......................................... 11
Table 4 – Summary of Stability Analyses ............................................. 12

Figures
Figure 1 – Site Map
Figure 2 – Site Location Map
Figure 3 – Sheldon Waste Rock Exploration Location Map
Figure 4 – Sheldon Tailings Pile Exploration Location Map

Appendices
Appendix A – Test Pit Logs
Appendix B – Laboratory Testing
Appendix C – Geophysical Survey
Appendix D – Site Photographs
1. INTRODUCTION

In accordance with our proposal dated July 1, 2005 and your authorization of Task Order 2005-003-A, we have performed a limited geotechnical evaluation of the Sheldon Mine site located near Sheldon Road in the Bradshaw Ranger District of the Prescott National Forest, Yavapai County, Arizona (Figure 1). Our purpose was to evaluate the stability of the existing tailing and waste rock piles on site, evaluate the potential source(s) of acid mine drainage (AMD), and to provide geotechnical data for slope stabilization, re-vegetation, and future reclamation design. This report presents the results of our limited evaluation and our geotechnical conclusions and recommendations, as well as a discussion of the various remedial design alternatives.

It is our understanding that the United States Environmental Protection Agency (USEPA) intends to improve the overall condition of the site by implementing cost-effective remediation that requires little or no maintenance. Based on this understanding, Ninyo & Moore performed research, conducted field exploration including a geophysical survey, and performed laboratory testing to aid with the preparation of preliminary recommendations for slope stabilization, re-vegetation, and alternatives for future reclamation. Our preliminary recommendations outline practical alternatives that will improve the site by addressing slope stability and/or stabilization, surface erosion, and AMD.

2. SCOPE OF SERVICES

The scope of our services for the project generally included the following:

- Researching and reviewing readily available background data including geologic maps, topographic maps, aerial photographs, project reports, or other background information pertinent to the mining operations.

- Conducting a site reconnaissance to observe existing site features and topography.

- Preparing and implementation of a site-specific Health and Safety Plan (HSP) describing the proposed scope of work and addressing the health and safety concerns with respect to proposed activities. The HSP defined appropriate personal protection equipment, safe working practices, site control procedures, and contingency plans for emergency situations.

- Executing of a field exploration work plan comprised of eight test pits at select locations around the site. The test pit logs are presented in Appendix A.
• Performing laboratory tests on selected samples obtained from the test pits to evaluate in-situ moisture content and dry density, grain size analysis, Atterberg limits, moisture-density relationship, shear strength, and corrosivity tests. The results of the laboratory testing are presented on the logs in Appendix A and/or the laboratory sheets present in Appendix B.

• Performing of a geophysical survey at the subject site using seismic refraction techniques to evaluate the approximate depth to bedrock below existing ground surface. The seismic profile results and a brief narrative summary of the geophysical results are presented in Appendix C.

• Preparing this report that presents our findings, conclusions, and preliminary recommendations for slope stabilization, re-vegetation, and alternatives for future reclamation.

3. SITE DESCRIPTION AND BACKGROUND

The project site is located within an unincorporated area of the Bradshaw Ranger District of the Prescott National Forest, approximately five miles southeast of the City of Prescott, Yavapai County, Arizona. The project site is located in Township 12 1/2 N, Range 1 W, Sections 19 and 30 of the Groom Creek, AZ (7.5-minute) topographic quadrangle.

Based on our review of available background data, the Sheldon Mine site experienced substantial mining activity between 1860 and 1950. The mining operations were for copper, gold, silver, and lead occurring using underhand stopping technology and hoisting through an inclined shaft. In approximately 1975 or 1976, limited surface restoration efforts were attempted to cover and stabilize the exposed mine tailings. In July 1994, the Sheldon Mine was listed as a CERCLIS hazardous waste site by the United States Environmental Protection Agency (USEPA).

The site consists of three areas of concern: the Sheldon Waste Rock (SWR), the Sheldon Tailings Pile (STP), and the Sheldon Tributary Bank (STB), as shown on Figure 2. The approximate 3.5-acre SWR site is located between Sheldon Road and a tributary to Lynx Creek and reportedly contains approximately 40,000 to 80,000 cubic yards (cy) of waste rock. There is a gabion wall (constructed in approximately 1975 or 1976) at the toe of the SWR slope adjacent to the tributary. The STB is located between the gabion wall and the SWR, with pockets of tailings visible in both. AMD from the site has been observed in the vicinity of the STB (Photo 1, Appendix D).
limited Geotechnical evaluation
Sheldon Mine, Yavapai County, Arizona
August 31, 2005
Project No. 206366001

The approximately 3.2-acre STP site is located southeast of the SWR near the convergence of Sheldon Road, Eagle Road, and Walker Road and approximately 200-feet upgradient of Lynx Creek. The STP site reportedly contains approximately 10,000 cy of tailings.

The following sections provide a summary of our pertinent observations during our site reconnaissance and geotechnical evaluation.

3.1. Sheldon Waste Rock
The SWR site is a moderate to steeply sloping area bounded by Sheldon Road to the south and east, a private access road (Mary May Lane) to the west, and a tributary to Lynx Creek to the north. The slope face has sparse vegetation, consisting of scattered grasses and small pine trees concentrated at the top and edges of the slope. There are a number of dead trees, some of which had been chopped down, at the site. It is not known why the trees died.

There are considerable surface erosion-related features located across the face of the SWR. The slope face shows numerous erosion channels which vary in depth, estimated from a few inches to several feet. In some areas the tailings are exposed and susceptible to erosion. There is one pronounced drainage channel eroded into the SWR. The location of this channel is on the east side of the SWR adjacent to Sheldon Road (Photos 2 and 3, Appendix D).

Perimeter drainage, specifically along Sheldon Road, is achieved through shallow roadside ditches that convey surface flows. Flows may be significant after rain events, specifically near the base and side of the SWR slope (Photo 3, Appendix D). Washout could potentially occur in portions of the ditch and roadway. Near the base of the slope and adjacent to Sheldon Road, the perimeter drainage is routed along the side of the SWR slope and toward the creek at a relatively steep slope. There has been significant erosion and damage to this area, including portions of the gabion wall.

The gabion wall at the base of the SWR (Photo 4, Appendix D) visually appeared to be in good condition with the exception of one area close to Sheldon Road that has been damaged by erosion and other areas of wire mesh corrosion. Waste rock and/or tailings are exposed in
portions of the incised drainage channel at this location. Water, presumed to be AMD, was observed to be seeping below the base of the gabion wall, particularly at the northern edge of the SWR. There have been erosion-induced failures of the STB at the toe of the SWR pile and above the creek that we noted.

We noted that the water in the tributary to Lynx Creek was orange in coloration. Surface materials (i.e. gravels, cobbles, etc.) and the exposed bedrock surface in the creek bottom also had an orange coloration. At the time of our initial site visit, Lynx Creek had a very low flow, estimated at less than 5 gallons per minute. However, during our field exploration, shortly after a brief monsoon season rainstorm season, Lynx Creek had a significantly higher flow rate.

3.2. Sheldon Tailings Pile
The STP site is comprised of a moderate slope, approximately 40 feet in height, and oriented in a north-south direction (Photo 5, Appendix D). There is a narrow bench partially up the slope. Beyond the slope crest, the slope is a relatively flat area with sparse vegetation, consisting of scattered grasses and small pine trees. The grasses and trees are concentrated at the top and edges of the slope, and extend to the limits of the site.

A notable observable feature at the STP is the light-colored precipitates on the ground surface, extending from the lower one-third of the slope to near the toe, and the lack of vegetation at this area. The lack of vegetation and the precipitated material present are related to seepage at the slope face. Other erosion features were observed on the east side of the STP, adjacent to the existing concrete channel (Photo 6, Appendix D).

Perimeter drainage at the site, specifically along the north and east side of the tailings pile, is primarily achieved in a shallow concrete drainage ditch (Photo 7, Appendix D). The ditch collects surface water from uphill, offsite sources and conveys the flows east and southward around the site. Portions of the perimeter drainage ditch seem to serve their intended purpose; however, other portions are filled with sediment or the concrete is severely damaged.
The mid-slope bench does not route drainage to the sides; rather, it instead provides a channel through the center of the slope resulting in minor erosion and potentially more AMD.

Tailings were observed near the ground surface at some locations. It should be noted that at the time of our exploration, a rain event caused erosion, mobilization, and migration of some of the exposed tailings, thus demonstrating the high mobility the tailings possess in the presence of flowing water.

4. GEOLOGY AND SUBSURFACE CONDITIONS
The geology and subsurface conditions at the site are described in the following sections.

4.1. Geologic Setting
The project area is located in what is known as the Transition Zone province. The Transition Zone tectonic province is typified by the absence of younger units that have been removed by erosion, including many Mesozoic and Paleozoic sedimentary rock units that typically overlie older sedimentary, granitic, and metamorphic units. The older Proterozoic age basement granites, phyllites, gneisses, and other metamorphic rocks are sometimes exposed in restricted erosional windows, but more often are widely exposed within the main trend of the northwest trending Transition Zone. The bedrock in this area (such as the outcrops in Lynx Creek) has been mapped as older Precambrian granite (Arizona Bureau of Mines, 1958).

4.2. Subsurface Conditions
Our knowledge of the subsurface conditions at the project site is based on our field exploration, laboratory testing, and our understanding of the general geology of the area. The following sections provide generalized descriptions of the materials encountered. More detailed descriptions are presented on the test pit logs in Appendix A.
4.2.1. **Sheldon Waste Rock**

Fill soils derived from mine operations were encountered in test pits conducted at the site. At the SWR site, a thin veneer of fill soil less than 1-foot in thickness, presumably placed during surface restoration efforts in approximately 1975 and 1976, overlies the mine waste materials. The mine waste materials are comprised of yellowish-brown silty sand and gravel and clayey sand with gravel and cobbles and/or boulders which overlie the native reddish brown silty sand (weathered bedrock).

The thickness of mine waste materials over bedrock ranged from approximately 2 to 20 feet based on our test pit logs and the results of our geophysical survey, as shown in Appendix A and C. However, there may be areas where the thickness of mine waste materials exceeds 20 feet that were not encountered during our limited exploration.

4.2.2. **Sheldon Tailings Pile**

At the STP site, a thin veneer of fill soil less than 1-foot in thickness, presumably placed during surface restoration efforts in approximately 1975 and 1976, overlies the mine tailings. Scattered decaying organics, primarily consisting of pine needles, were also observed overlying the mine tailings. Mine tailings are comprised of yellow to gray sandy silt and clay with occasional thin lenses of silty sand. The tailings are underlain by native material at depth, presumably consisting of weathered bedrock.

The thickness of tailings over relatively dense native soil ranged from approximately 3 to 22 feet based upon test pit logs and the results of our geophysical survey, as shown in Appendix A and C. However, there may be areas where the thickness of mine tailings exceeds 22 feet that were not encountered during our limited exploration.

4.3. **Surface Water and Groundwater**

Surface water was observed seeping from beneath the gabion wall at the SWR and STB locations along a geologic contact. Based on its orange coloration, it is anticipated this water is AMD. The source(s) of the AMD could not be located using the investigative techniques.
utilized, as described above. However, it is our opinion that some of the observed AMD flow may be the result of percolation of surface water through the existing mine waste materials down to a geologic contact (i.e., bedrock), which then transmits the flow laterally. Additional sources of water could also be contributing (e.g., mine shafts or adits that are hidden beneath the SWR or remote from the SWR), but could not be confirmed.

Shallow groundwater was encountered in test pit TP-6 located near the toe of the STP slope. However, groundwater levels can fluctuate due to seasonal variations, the presence of perched water, rainfall, and other factors.

5. GEOLOGIC HAZARDS
The following sections describe potential geologic hazards at the site, including faulting and seismicity and liquefaction.

5.1. Faulting and Seismicity
The site lies within the Arizona Mountain zone, which is an active area of slow-rate block faulting (Euge et al., 1992). This zone is distinguished from the rest of the state by its higher level of seismicity and abundant northwest trending Quaternary faults. Based on our field observations, review of pertinent geologic data, and analysis of aerial photographs, faults are not located on or adjacent to the property. The closest fault to the site is the Prescott Valley Grabens, located approximately 15 miles to the northwest of the site (Pearthree, 1998). Approximately 4 meters of displacement has occurred along this fault within the upper Pleistocene deposits.

Based on a Probabilistic Seismic Hazard Assessment for the Western United States, issued by the USGS (1999), the site is located in a zone where the peak ground accelerations that have a 10 percent, 5 percent, and 2 percent probability of being exceeded in 50 years are 0.09g, 0.13g and 0.21g, respectively. These ground motion values are calculated for "firm rock" sites, which correspond to a shear-wave velocity of approximately 2,500 feet per second in approximately the top 100 feet bgs. Different soils or site conditions may amplify or
attenuate these values. Seismic design parameters according to 2003 International Building Code (IBC) are presented in Table 1.

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Value</th>
<th>2003 IBC Reference</th>
</tr>
</thead>
<tbody>
<tr>
<td>Site Class Definition</td>
<td>C</td>
<td>Table 1615.1.1</td>
</tr>
<tr>
<td>Site Coefficient (F_a)</td>
<td>1.2</td>
<td>Table 1615.1.2(1)</td>
</tr>
<tr>
<td>Site Coefficient (F_v)</td>
<td>1.6</td>
<td>Table 1615.1.2(2)</td>
</tr>
</tbody>
</table>

### 5.2. Liquefaction Potential

The tailings materials located at the STP site consist of fine sand and silt with little cohesion; however, based on the relatively low ground motion hazard (relatively low ground accelerations), the likelihood or potential for liquefaction at the project site is negligible and is not a design consideration.

### 5.3. Landslides

Neither our limited review of pre-development aerial photographs nor our limited visual evaluation of the nearby natural slopes in Tertiary Sediment suggested that landsliding of natural slopes represents a significant geologic hazard. Therefore, it is our opinion that the landslide hazard at the project site exists primarily in fill slopes and, perhaps in natural slopes that have been loaded beyond their natural condition. Our analysis and recommendations concerning slope stability at the project site are presented in the following sections.

### 6. FIELD EXPLORATION

On July 25 through 27, 2005, Ninyo & Moore conducted subsurface explorations at the SWR and STP sites in order to evaluate the existing subsurface conditions and to collect soil samples for laboratory testing. Specifically, our exploration consisted of a geophysical survey and the excavation, logging, and sampling of eight test pits, at the approximate locations shown on Figures 3 and 4.
The geophysical survey consisted of the performance of five seismic lines using seismic refraction geophysical techniques as discussed in Section 7.

The test pits were excavated using a CAT 314 track-mounted excavator equipped with a 2-foot wide bucket. Of these test pits, five were excavated at the SWR site (denoted as TP-1 through TP-5) and three were excavated at the STP site (denoted as TP-6 through TP-8). Bulk and relatively undisturbed drive samples were collected at selected depths. Descriptions of the soils encountered are presented on the logs in Appendix A. A few selected photographs of the test pits are included in Appendix D (Photos 8 - 15).

7. GEOPHYSICAL TESTING

Ninyo & Moore personnel conducted seismic refraction surveys at the site on July 25 and 26, 2005, to evaluate the depth to bedrock, rippability characteristics of the subsurface materials, develop a preliminary compression-wave velocity model of the site, and attempt to locate potential preferential groundwater flow paths. The seismic refraction data were collected with a Geometrics SmartSeis™ S12, high performance exploration seismograph and 12 vertical component geophones. A 10-pound hammer and plate were used as the seismic wave source. A total of three seismic traverses were performed at the SWR site and two traverses were performed at the STP site. The approximate locations of the seismic refraction survey lines are shown on Figures 3 and 4. A description of the methodology and results of the survey are discussed in Appendix C.

In general, seismic shear wave velocities can be correlated to material density and/or rock hardness. Seismic shear velocities for the upper layer of material at the SWR site ranged from 1,500 feet per second (fps) to 2,000 fps. Seismic shear velocities for the lower layer of material at the SWR site ranged from 6,200 fps to 7,800 fps. This lower layer of material correlates to bedrock based on the relatively high velocities obtained and the granite observed in test pits TP-2 and TP-3. Based on the geophysical results at the SWR site, the thickness of soil over bedrock ranged from approximately 2 to 18 feet.
Seismic shear wave velocities for the upper layer of material at the STP site ranged from 1,200 fps to 1,700 fps. Seismic shear velocities for the lower layer of material at the STR site ranged from 2,700 fps to 2,800 fps. Based on the geophysical results at the STP site, the thickness of soil over relatively dense native material (presumably bedrock) ranged from approximately 4 to 30 feet.

8. LABORATORY TESTING

The soil samples collected from our field activities were transported to the Ninyo & Moore laboratory in Phoenix, Arizona for geotechnical laboratory analysis. The analysis included in-situ moisture content and dry density, grain size analysis, Atterberg limits, moisture-density relationship, shear strength, and corrosivity tests. The results of the laboratory testing are presented on the test pit logs in Appendix A and/or the laboratory sheets presented in Appendix B.

Three samples were submitted for chemical analysis for corrosivity. Relatively low pH levels and concentrations of sulfate and chloride, expressed in parts per million (ppm), are summarized in Table 2.

<table>
<thead>
<tr>
<th>Test Pit Sample (Foot)</th>
<th>Material/Location</th>
<th>pH</th>
<th>Sulfate (ppm)</th>
<th>Chloride (ppm)</th>
</tr>
</thead>
<tbody>
<tr>
<td>TP-3 (2.5' - 3.5')</td>
<td>Mine waste materials/ SWR</td>
<td>4.1</td>
<td>2189</td>
<td>6.7</td>
</tr>
<tr>
<td>TP-6 (1' - 2')</td>
<td>Mine tailings/STR</td>
<td>3.5</td>
<td>1932</td>
<td>7.0</td>
</tr>
<tr>
<td>TP-8 (2.8' - 3.8')</td>
<td>Mine tailings/STR</td>
<td>3.2</td>
<td>1837</td>
<td>7.1</td>
</tr>
</tbody>
</table>

Based on the results of the chemical analyses, these soils may not support indigenous vegetation. Detailed soil fertility analysis was not part of the proposed scope of work. An agronomist or landscape architect should be consulted prior to the re-vegetation process.

9. SLOPE STABILITY ANALYSIS

Slope stability analyses were performed on the slope at the STP site. Stability analyses were performed using the computer program GSTABL7, a static and pseudostatic stability program.
Bishop's Modified Method was used for analysis because it provides conservative solutions when compared with other limit equilibrium methods. Due to the lack of precise topographic and groundwater information, basic assumptions regarding slope geometry and groundwater conditions were made based on site observations, measurements, and engineering judgment.

Table 3 provides various criteria used for the slope stability analyses. The laboratory tests we performed were, in part, used to estimate strength parameters for the stability analyses. The following table provides the parameters used in our analyses.

<table>
<thead>
<tr>
<th>Material Description</th>
<th>Dry Unit Weight(^1) (pcf)</th>
<th>Estimated Shear Strength Parameters(^1)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mine tailings</td>
<td>90</td>
<td>(\phi = 25) (\text{degrees}) (C = 50) psf</td>
</tr>
<tr>
<td>Bedrock</td>
<td>140</td>
<td>(\phi = 40) (\text{degrees}) (C = 5000) psf</td>
</tr>
</tbody>
</table>

\(^1\) Mine tailing parameters are based on laboratory testing. Bedrock parameters are estimated.

The stability analysis performed resulted in the calculation of a factor of safety for the specific slope condition analyzed. The factor of safety is the ratio of forces resisting movement to forces driving movement. A factor of safety less than 1.0 indicates the driving forces exceed the resisting forces and that movement, and failure, may occur. A target factor of safety of about 1.5 is typically used for design purposes under normal conditions. A lower factor of safety is acceptable for other conditions, such as seismic events, but is rarely less than 1.1.

Table 4 provides the results of our stability analyses on the assumed slope geometries at the site.
Table 4 – Summary of Stability Analyses

<table>
<thead>
<tr>
<th>Case</th>
<th>Loading Conditions</th>
<th>Estimated Calculated Safety Factor</th>
<th>Minimum Criteria</th>
</tr>
</thead>
<tbody>
<tr>
<td>I</td>
<td>Static, low groundwater</td>
<td>1.98</td>
<td>1.5</td>
</tr>
<tr>
<td>II</td>
<td>Static, high groundwater</td>
<td>1.07</td>
<td>1.2</td>
</tr>
<tr>
<td>III</td>
<td>Seismic, low groundwater</td>
<td>1.35</td>
<td>1.1</td>
</tr>
<tr>
<td>IV</td>
<td>Seismic, high groundwater</td>
<td>0.73</td>
<td>1.0</td>
</tr>
</tbody>
</table>

Psuedostatic analyses assumed horizontal ground acceleration of 0.13g (2/3 of peak).

Our limited analyses indicate that the stability of the slope should be considered sensitive to changes in soil shear strength. For example, for Case I analysis, reducing the cohesion to a value of 0 results in the factor of safety reducing from 1.98 to 1.52. However, a detailed sensitivity analysis was not performed as part of our slope stability evaluation. Given the broad assumptions used to develop slope geometry without the benefit of topographic information, our analysis should be considered preliminary.

Based on the results of our limited and preliminary evaluation, the slope is considered to be stable under reasonably foreseeable scenarios. The results of our stability analysis demonstrate the importance of maintaining positive drainage and limiting the amount of groundwater in the tailings. Although our analysis for Case IV results in a factor of safety less than 1.0, the likelihood that a seismic event will occur at a time when groundwater level is high is unquantifiable, but thought to be low. The consequences of a slope failure are not considered severe because the risk to human safety is considered low.

Due to the absence of topographic data at the SWR site, slope stability analyses were not performed. However, based on our observations of the site and the materials encountered in our explorations, it is our opinion the slope is stable (i.e. the factor of safety currently exceeds 1.0). The slope in its current condition is likely at, or shallower than its angle of repose, which is estimated to be approximately 45 degrees. The material encountered in the test pits generally consisted of a mixture of angular rock particles (gravel, cobbles, boulders) in a sandy clay ma...
A shear test strength performed on this material resulted in a very high angle of internal friction (approximately 58 degrees).

Based on our judgment that the slope is resting at or below its angle of repose, and because soil shear strength generally increases with depth, a deep-seated slope failure is not anticipated at this site. However, it is possible that surface sloughing or raveling of the slope could occur. A significant slough could affect surface drainage of the site and call for regrading. As noted above, maintenance and control of surface water will reduce the likelihood of slope instability. The few minor failures observed at the site are attributed to erosion and not considered to be slope stability issue.

10. DISCUSSION AND DESIGN CONSIDERATIONS

The following discussion summarizes our observations and potential design considerations based on our site reconnaissance and geotechnical evaluation at the SWR and STP sites:

10.1. Sheldon Waste Rock

Based on our analysis and review of the available data, Ninyo & Moore believes that two issues should be addressed: control of surface drainage and treatment of AMD. Slope stability and/or slope stabilization are not considered significant issues for the SWR. Based on this opinion, Ninyo & Moore offers the following recommendations and considerations:

10.1.1. Alternative 1 – Re-grading and Re-vegetation to Control Surface Erosion

The existing SWR slope face and adjacent areas could be suitably prepared prior to the placement of new fill. Re-grading could be performed to fill in existing erosion channels. A brow ditch may be placed to help re-route drainage. Although re-grading of the SWR is not needed for stability, if the top of the slope were loaded instability of the slope could occur. Cross berms, or other erosion control products and/or methods, may also be used to route water to the sides of the SWR and slow the velocity of the water down the slope face. Native grasses and trees could be used to stabilize surface soils. Based on the results of the chemical analyses, these soils may not support indigenous vegetation. Erosion control blankets or other stabilization techniques may be needed.
The re-use of onsite materials is acceptable if the materials are moisture conditioned and compacted. All tailings encountered during the re-grading process should be maintained within the SWR limits and stabilized. It should be noted that import soil with additional biosolids may be needed to support vegetative growth.

10.1.2. Alternative 2 – Improve Drainage to Route Water Away from the Site

Although the source of the AMD is unknown, it can likely be reduced in volume by controlling surface and subsurface water. Slope surfaces could be improved to route drainage away from the site. The roadside ditches and existing drainage channels near Sheldon Road could be improved by lining the existing channel with concrete, rip-rap, or other relatively impervious liner (e.g. HDPE); or conveying drainage flows within piping. Care should be exercised so that tailings are not left exposed to the effects of erosion. Ditches with anchor trenches could be installed to help channelize surface runoff. Concrete improvements should use sulfate resistant cement.

Care should be taken to divert the channelized surface runoff away from the mine waste materials and gabion wall. Design improvements should consider increased flow rates and impacts to downstream areas. Ninyo & Moore does not believe that a cap is needed to reduce water infiltration because we believe that the effects of rain falling on the slope face are minor. It is our opinion that it is better to re-route surface water run-on by installing a brow ditch.

10.1.3. Alternative 3 – Gabion Wall Stabilization

The gabion wall visually appeared in good condition, with the exception of one area closest to Sheldon Road that has been damaged by erosion. A rip-rap buttress, possibly constructed with limestone, could be installed to help reduce future damage. An additional gabion wall may also be constructed in areas that have experienced damage.
10.1.4. Alternative 4 – Cut-off Wall or Barrier
A cut-off wall or barrier could be used to help re-route the seepage of AMD. However, this redirection of AMD may result in piezometric issues in areas around the cut-off wall and possibly lead to unexpected slope stability problems. Further, a barrier could route AMD to an uncontrolled and/or undesirable locations and create additional problems.

10.1.5. Alternative 5 – Passive Treatment of Acid Mine Drainage
Two passive treatment methods are thought to be viable alternatives for this site; engineered wetlands and sacrificial limestone. Passive treatment of the AMD is a viable option; however, additional hydrologic information is needed.

An engineered wetland may be considered to treat the AMD and to remove inorganic contaminants from the AMD in the tributary of Lynx Creek. It may be difficult to establish/maintain a wetland considering the presence of shallow bedrock and variable stream flows. A stilling basin or cistern may be used to reduce silting downstream and capture water for passive treatment. If a stilling basin were constructed, rock excavation or blasting may be needed (see Appendix C for rippability characteristics). The location of the stilling basin or cistern should be evaluated based on site access for maintenance equipment.

Sacrificial limestone may also be used as passive treatment of the AMD. Sacrificial limestone used to treat the AMD would eventually be coated with a scale that would need periodic engineered turbulent flow to remove/reduce the scale buildup, and that alternative may not be supported at this location because of hydrologic constraints. Periodic replacement of the limestone will be needed.

10.1.6. Alternative 6 – Do Nothing
Doing nothing to stabilize the slope of the SWR may be feasible; however, Ninyo & Moore believes that doing nothing to surface drainage and treatment of the AMD would not meet the objectives for this site. By not making improvements, erosion would con-
tinue and slope stability issues would increase in both number and severity resulting in slope failures and additional seepage of AMD.

10.2. Sheldon Tailings Pile

Based on our analysis and review of the available data, Ninyo & Moore believes that two issues should be addressed: slope stability/stabilization and control of surface drainage. AMD treatment is not considered a significant issue for the STP. Based on this opinion, Ninyo & Moore offers the following recommendations and considerations:

10.2.1. Alternative 1 – Re-grading and Re-vegetation to Control Surface Erosion

The existing STP slope face and adjacent areas could be suitably prepared prior to the placement of new fill to control surface drainage and reduce water infiltration. Re-grading should be performed to create positive drainage away from the site. Native grasses, trees, erosion control blankets or other stabilization techniques may be needed as discussed above.

The re-use of onsite materials is acceptable if the materials are moisture conditioned and compacted. All tailings encountered during the re-grading process should be maintained in the STP and stabilized. It should be noted that the tailings pile may need import soil with additional biosolids to support vegetative growth.

10.2.2. Alternative 2 – Improve Drainage

The existing perimeter drainage channels of the STP could be improved by re-establishing the existing channel and lining it with concrete, rip-rap, or other relatively impervious liner.

Surface water from off-site sources should be collected and/or redirected away from the tailings. Ditches with anchor trenches could be installed to help channelize surface run-off, especially on the east side of the STP where erosion on the sides of the channel has previously been noted. Any improvements or repairs made to the existing concrete
channel should be constructed with sulfate resistant concrete, rip-rap, and/or other relatively impervious material.

10.2.3. **Alternative 3 – Sub-drainage System**

A sub-drainage system, or french drain, could be constructed along the north limits of the STP to lower the piezometric surface within the tailings. A french drain could lower the water table such that water no longer seeps from the slope face. The results of our seismic survey indicates groundwater could be migrating below the existing concrete channel from off-site sources. The installation of a french drain along the north perimeter of the site could intercept this water. The design depth of a french drain would depend on actual groundwater elevations and the desired piezometric surface within the tailings.

Ninyo & Moore does not recommend placing a french drain at the toe of the slope. Although a french drain at this location may be useful in collecting water, the water quality may be effected and may need treatment before discharging to a nearby drainage channel. Pumping may be needed if there is not adequate topographic relief between the french drain at the toe of the slope and the desirable discharge location.

10.2.4. **Alternative 4 – Do Nothing**

Doing nothing to stabilize the slope of the STP may be feasible; however, Ninyo & Moore believes that doing nothing to address the surface drainage would not meet the objectives for this site. By not making improvements to the surface drainage or existing concrete drainage channel, erosion and seepage at the slope face would continue and may increase in severity.

11. **RECOMMENDATIONS**

The following sections present our preliminary recommendations for design and construction of the system modifications discussed in Section 10. Ninyo & Moore should be allowed to recon-
consider these recommendations after any accompanying comments or additional information is received.

11.1. Sheldon Waste Rock

Considering the foregoing, Ninyo & Moore recommends a two-phased approach that involves a combination of Alternatives 1, 2, 3, and 5, namely, re-grading and re-vegetation, drainage improvements, gabion wall stabilization, and passive treatment of AMD. Although the source of the AMD may not be affected, the volume of the AMD may be reduced by controlling surface and subsurface water. By implementing Alternatives 1 and 2 (re-grading/re-vegetation and drainage improvements) in the first phase, the water source of the AMD will likely be reduced, resulting in less AMD that would need treatment. Alternative 3 (gabion wall) would also be applied in the first phase and includes buttressing the existing gabion wall, buttressing the STB, and replacing failed portions of the existing gabion wall. New gabion wall wire mesh should be galvanized or PVC-coated given the corrosive potential of the on-site materials.

The second phase would involve the application of Alternative 5. Existing and potential AMD may be treated with either sacrificial limestone or an engineered wetland. Computer modeling and cost-analysis may be performed to help select an appropriate passive treatment option (e.g. sacrificial limestone versus engineered wetlands).

11.2. Sheldon Tailings Pile

Ninyo & Moore recommends a combination of Alternatives 1 and 2, namely, re-grading and re-vegetation and drainage improvements. By implementing Alternatives 1 and 2, the stability of the site would be improved and the water source of the AMD may be reduced, resulting in less AMD that would need treatment. Alternative 3 may also be applied to the STP, to help reduce the seepage that was observed at the toe of the STP.
12. ADDITIONAL INFORMATION

It is our opinion that additional information is needed to proceed with design improvements at the site. Additional information that would be beneficial to potential designs includes:

- Topographic information for slope stability and for design of drainage improvements;
- Hydrologic data to calculate design flows and analyses for design of drainage improvements;
- Groundwater elevations and flow direction for slope stability and AMD management; and
- Soil fertility analyses to evaluate suitability of onsite or import soils for re-vegetation improvements.

13. LIMITATIONS

The field evaluation, laboratory testing, and geotechnical analyses presented in this geotechnical report have been conducted in general accordance with current practice and the standard of care exercised by geotechnical consultants performing similar tasks in the project area. No warranty, expressed or implied, is made regarding the conclusions, recommendations, and opinions presented in this report. There is no evaluation detailed enough to reveal every subsurface condition. Variations may exist and conditions not observed or described in this report may be encountered during construction. Uncertainties relative to subsurface conditions can be reduced through additional subsurface exploration. Additional subsurface evaluation will be performed upon request.

Please also note that our evaluation was limited to assessment of the geotechnical aspects of the project, and did not include evaluation of structural issues, environmental concerns, or the presence of hazardous materials.

This document is intended to be used only in its entirety. No portion of the document, by itself, is designed to completely represent any aspect of the project described herein. Ninyo & Moore should be contacted if the reader requires additional information or has questions regarding the content, interpretations presented, or completeness of this document.

Our conclusions, recommendations, and opinions are based on an analysis of the observed site conditions. If geotechnical conditions different from those described in this report are encountered,
our office should be notified and additional recommendations, if warranted, will be provided upon request. It should be understood that the conditions of a site could change with time as a result of natural processes or the activities of man at the subject site or nearby sites. In addition, changes to the applicable laws, regulations, codes, and standards of practice may occur due to government action or the broadening of knowledge. The findings of this report may, therefore, be invalidated over time, in part or in whole, by changes over which Ninyo & Moore has no control.

This report is intended exclusively for use of our client. Any use or reuse of the findings, conclusions, and/or recommendations of this report by parties other than the client is undertaken at said parties’ sole risk.
14. SELECTED REFERENCES


Ninyo & Moore, In-house proprietary information.


Source: Yahoo Maps.
LEGEND

TP-5 ✗ Approximate Test Pit Location
SL-3 — Approximate Seismic Refraction Location

Source: Yavapai County Assessor’s Department, 2000.
APPENDIX A

TEST PIT LOGS

Field Procedure for the Collection of Disturbed Samples
Disturbed soil samples were obtained in the field using the following methods.

Bulk Samples
Bulk samples of representative earth materials were obtained from the exploratory borings. The samples were bagged and transported to the laboratory for testing.

Field Procedure for the Collection of Relatively Undisturbed Samples
Relatively undisturbed soil samples were obtained in the field using the following method.

The Split-Barrel Knocker Bar Sampler
The sampler, with an external diameter of 3.0 inches, was lined with 1-inch long, thin brass rings with inside diameters of approximately 2.4 inches. The sampler was manually driven into the ground with a hammer weighing approximately 35 pounds. The samples were removed from the sample barrel in the brass rings, sealed, and transported to the laboratory for testing.
U.S.C.S. METHOD OF SOIL CLASSIFICATION

MAJOR DIVISIONS | SYMBOL | TYPICAL NAMES
--- | --- | ---
COARSE-GRAINED SOILS (More than 1/2 of coarse fraction > No. 4 sieve size) | GW | Well graded gravels or gravel-sand mixtures, little or no fines
| GP | Poorly graded gravels or gravel-sand mixtures, little or no fines
| GM | Silty gravels, gravel-sand-silt mixtures
| GC | Clayey gravels, gravel-sand-clay mixtures
| SW | Well graded sands or gravelly sands, little or no fines
| SP | Poorly graded sands or gravelly sands, little or no fines
| SM | Silty sands, sand-silt mixtures
| SC | Clayey sands, sand-clay mixtures

SANDS (More than 1/2 of coarse fraction < No. 4 sieve size) | Inorganic silts and very fine sands, rock flour, silty or clayey fine sands or clayey silts with slight plasticity
| CL | Inorganic clays of low to medium plasticity, gravelly clays, sandy clays, silty clays, lean clays
| OL | Organic silts and organic silty clays of low plasticity
| MH | Inorganic silts, micaceous or diatomaceous fine sandy or silty soils, elastic silts
| CH | Inorganic clays of high plasticity, fat clays
| OH | Organic clays of medium to high plasticity, organic silty clays, organic silts

FINE-GRAINED SOILS (More than 1/2 of soil < No. 200 sieve size) | ML | Liquid Limit <50
| CL | Liquid Limit >50

SILTS & CLAYS | Pt | Peat and other highly organic soils

HIGHLY ORGANIC SOILS

GRAIN SIZE CHART

CLASSIFICATION | RANGE OF GRAIN SIZE | GRAIN SIZE IN MILLIMETERS
--- | --- | ---
BOULDERS | Above 12" | Above 305
COBBLES | 12" to 3" | 305 to 76.2
GRAVEL Coarse | 3" to No. 4 | 76.2 to 4.76
Coarse | 3" to 3/4" | 76.2 to 19.1
Fine | 3/4" to No. 4 | 19.1 to 4.76
SAND Coarse | No. 4 to No. 200 | 4.76 to 0.075
Medium | No. 4 to No. 10 | 4.76 to 0.075
Fine | No. 10 to No. 40 | 4.00 to 0.420
| No. 40 to No. 200 | 0.420 to 0.075
SILT & CLAY | Below No. 200 | Below 0.075

PLASTICITY CHART
# EXCAVATION LOG EXPLANATION SHEET

<table>
<thead>
<tr>
<th>Depth (Feet)</th>
<th>Samples</th>
<th>Moisture (%)</th>
<th>Classification U.S.C.S.</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>SM</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>ML</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Explanation:**
- **SM**: Bulk sample.
- **ML**: Dashed line denotes material change.

**Drive Sample:**
- Sand cone performed.
- Seepage
- Groundwater encountered during excavation.
- No recovery with drive sampler.

**Groundwater:**
- Sample retained by others.
- Shelby tube sample. Distance pushed in inches/length of sample recovered in inches
- No recovery with Shelby tube sampler.

**ALLUVIUM:**
- Solid line denotes unit change.
- Attitude: Strike/Dip
- b: Bedding
- c: Contact
- j: Joint
- f: Fracture
- F: Fault
- cs: Clay Seam
- s: Shear
- bss: Basal Slide Surface
- sf: Shear Fracture
- sz: Shear Zone
- sbs: Sheared Bedding Surface

The total depth line is a solid line that is drawn at the bottom of the excavation log.
**TEST PIT LOG**

**DATE EXCAVATED:** 07/26/05  **TEST PIT NO.:** TP-1

**GROUND ELEVATION LOGGED BY:** ESZ

**METHOD OF EXCAVATION:** Cat 314 Excavator

**LOCATION:** See Figure 3

**DESCRIPTION**

<table>
<thead>
<tr>
<th>DEPTH (FEET)</th>
<th>BULK SAMPLES</th>
<th>CLASSIFICATION</th>
<th>CLASSIFICATION U.S.C.S.</th>
<th>DRY DENSITY (pcf)</th>
<th>MOISTURE (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>3</td>
<td></td>
<td></td>
<td></td>
<td>10.7</td>
<td>104.7</td>
</tr>
<tr>
<td>6</td>
<td></td>
<td></td>
<td>GM</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Dark brown, moist, loose, sandy SILT; high organic content.</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Reddish to yellow brown, damp, medium dense, silty fine to coarse GRAVEL; little sand; cobbles of broken rock.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>12</td>
<td></td>
<td></td>
<td>SC</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Organic zone approximately 2&quot; thick.</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Yellowish brown, moist, dense, clayey fine to coarse SAND; some fine to coarse gravel; weathered rock.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>15</td>
<td></td>
<td></td>
<td>SM</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Reddish brown, damp, dense, silty fine to coarse SAND; little fine to coarse gravel.</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Total depth ≈ 12.5 feet.</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Groundwater not encountered.</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Backfilled on 07/26/05.</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**SCALE:** 1 in./3 ft.
<table>
<thead>
<tr>
<th>DEPTH (FEET)</th>
<th>SAMPLES</th>
<th>MOISTURE (%)</th>
<th>DRY DENSITY (pcf)</th>
<th>CLASSIFICATION</th>
<th>U.S.C.S.</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>Bulk</td>
<td></td>
<td></td>
<td>SM</td>
<td>FILL:</td>
</tr>
<tr>
<td></td>
<td>Driven</td>
<td></td>
<td></td>
<td></td>
<td>Dark reddish brown, moist to wet, loose, silty SAND; scattered caliche filaments; high organic content.</td>
</tr>
<tr>
<td></td>
<td>Sand</td>
<td></td>
<td></td>
<td></td>
<td>Yellowish brown, moist, medium dense, clayey fine to coarse SAND; some cobbles of broken rock.</td>
</tr>
<tr>
<td>3</td>
<td>SC</td>
<td>13.7</td>
<td>1096</td>
<td>SM</td>
<td>Reddish to yellow brown, moist, medium dense, silty fine to coarse SAND; some fine to coarse gravel; cobbles of broken rock.</td>
</tr>
<tr>
<td>6</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Reddish brown; mostly broken rock material.</td>
</tr>
<tr>
<td>9</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>12</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>BEDROCK:</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Reddish brown, moist, moderately hard GRANITE; intensely weathered/decomposed.</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Total depth = 11.0 feet. (Backhoe refusal on rock)</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Groundwater not encountered.</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Backfilled on 07/26/05.</td>
</tr>
</tbody>
</table>
# Test Pit Log

**Sheldon Mine**  
Prescott National Forest  
Yavapai County, Arizona

**Project No.:** 206366001  
**Date:** 08/05

<table>
<thead>
<tr>
<th>Depth (Feet)</th>
<th>Bulk Density</th>
<th>Dry Density (pcf)</th>
<th>Classification U.S.C.S.</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>13.0</td>
<td>106.7</td>
<td>SC</td>
<td>Fill: Dark brown, moist, loose, clayey fine to coarse gravel; some sand; cobbles of broken rock. Yellowish brown, moist, medium dense, silty fine to coarse sand; some gravel of broken rock. Dense.</td>
</tr>
<tr>
<td>6</td>
<td></td>
<td></td>
<td>SM</td>
<td></td>
</tr>
<tr>
<td>9</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>12</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>15</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>18</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Date Excavated:** 07/26/05  
**Test Pit No.:** TP-3  
**Ground Elevation:** Logged by ESZ  
**Method of Excavation:** Cat 314 Excavator  
**Location:** See Figure 3

**Description:**  
- **Bedrock:** Reddish brown, damp, hard, granite; weathered. Total depth = 10.0 feet. (Refusal on bedrock)  
  Groundwater not encountered.  
  Backfilled on 07/26/05.
TEST PIT LOG

SHELDON MINE
PRESCOTT NATIONAL FOREST
YAVAPAI COUNTY, ARIZONA

PROJECT NO. 206366001
DATE 08/05

DATE EXCAVATED 07/26/05 TEST PIT NO. TP-4
GROUND ELEVATION LOGGED BY ESZ
METHOD OF EXCAVATION Cat 314 Excavator
LOCATION See Figure 3

DESCRIPTION

FILL:
SM
GM
Brown, moist, loose, silty fine to coarse SAND; some gravel; cobbles of
broken rock; high organic content.
Reddish to yellow brown, damp, medium dense, silty GRAVEL; cobbles of
broken rock up to 9" in diameter.

Sidewall caving; cobbles of broken rock up to 10" in diameter.

Total depth = 14.0 feet. (Refusal due to caving)
Groundwater not encountered.
Backfilled on 07/26/05.
## TEST PIT LOG

**SHELDON MINE**  
**PRESCOTT NATIONAL FOREST**  
**YAVAPAI COUNTY, ARIZONA**

<table>
<thead>
<tr>
<th>PROJECT NO.</th>
<th>DATE</th>
<th>DEPTH (FEET)</th>
<th>BULK</th>
<th>DRIVEN</th>
<th>SAND CORE</th>
<th>SAMPLES</th>
<th>MOISTURE (%)</th>
<th>DRY DENSITY (PCF)</th>
<th>CLASSIFICATION</th>
<th>U.S.C.S.</th>
</tr>
</thead>
<tbody>
<tr>
<td>206366001</td>
<td>08/05</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**DATE EXCAVATED** 07/26/05  
**TEST PIT NO.** TP-5  
**GROUND ELEVATION** LOGGED BY ESZ  
**METHOD OF EXCAVATION** Cat 314 Excavator  
**LOCATION** See Figure 3

### DESCRIPTION

- **FILL:**
  - GM: Dark brown, moist, loose, silty GRAVEL; little cobbles of broken rock.
  - GC: Yellowish brown, moist, loose, clayey GRAVEL; cobbles.
    - Gray, damp, loose, cobbles to boulders of blast rock; scattered timbers.

Total depth = 6.0 feet. (Refusal due to caving)  
Groundwater not encountered.  
Backfilled on 07/26/05.
DATE EXCAVATED: 07/27/05  
TEST PIT NO.: TP-6

GROUND ELEVATION LOGGED BY: ESZ

METHOD OF EXCAVATION: Cat 314 Excavator

LOCATION: SHELDON MINE
PRESCOTT NATIONAL FOREST
YAVAPAI COUNTY, ARIZONA

PROJECT NO.: 206366001  
DATE: 08/05

DESCRIPTION:

SM FILL:
- Dark brown, moist, loose, silty fine to medium SAND; scattered organics.
- Yellowish brown, damp, dense, silty fine to coarse SAND.

SM BEDROCK:
- Brown, damp, very hard, GRANITE; slightly weathered.

- Total depth = 3.0 feet. (Refusal on bedrock)
- Groundwater encountered at 3.0 feet.
- Backfilled on 07/27/05.

SCALE = 1 in./3 ft.
DATE EXCAVATED          07/27/05     TEST PIT NO.        TP-7
GROUND ELEVATION        LOGGED BY        ESZ
METHOD OF EXCAVATION    Cat 314 Excavator
LOCATION                See Figure 3

DESCRIPTION

SM          FILL:
SM Dark reddish brown, moist, loose, silty fine to medium SAND; little gravel.
Gray to brown, moist, medium dense, silty fine SAND.

Scattered roots and pine needles.

Total depth = 15.5 feet.
Groundwater not encountered.
Backfilled on 07/27/05.
**Testing Pit Log**

**Sheldon Mine**

**Prescott National Forest**

**Yavapai County, Arizona**

**Project No.** 20636001  
**Date** 08/05

**Test Pit No.** TP-8  
**Date Excavated** 07/27/05

**Ground Elevationlogged By** ESZ

**Method of Excavation** Cat 314 Excavator

**Location** See Figure 3

**Description**

- **SC** Fill: Dark reddish brown, moist, loose, clayey fine to coarse SAND; scattered organics.
- **SM** Yellow, moist, loose to medium dense, silty fine SAND.
- **ML** Gray, moist, firm, clayey SILT; little fine sand; interlayers of yellow silty SAND.
- **ML** Gray, moist, medium dense, fine sandy SILT.
- **CL** Gray, moist, firm, silty CLAY.

Total depth = 16.0 feet.

Groundwater not encountered.

Backfilled on 07/27/05.
APPENDIX B

LABORATORY TESTING

Classification
Soils were visually and texturally classified in accordance with the Unified Soil Classification System (USCS) in general accordance with ASTM D 2488-93. Soil classifications are indicated on the logs of the exploratory excavations in Appendix A.

Moisture Content
The moisture content of samples obtained from the exploratory borings was evaluated in accordance with ASTM D 2216-92. The test results are presented on the logs of the exploratory borings in Appendix A.

In-Place Moisture and Density Tests
The moisture content and dry density of relatively undisturbed samples obtained from the exploratory excavations were evaluated in general accordance with ASTM D 2937-94. The test results are presented on the logs of the exploratory borings in Appendix A.

Gradation Analysis
Gradation analysis tests were performed on selected representative soil samples in general accordance with ASTM D 422-63. The grain-size distribution curves are shown on Figures B-1 through B-5. These test results were utilized in evaluating the soil classifications in accordance with the USCS.

Atterberg Limits
Tests were performed on selected representative fine-grained soil samples to evaluate the liquid limit, plastic limit, and plasticity index in general accordance with ASTM D 4318-00. These test results were utilized to evaluate the soil classification in accordance with the USCS System. The test results and classifications are shown on Figure B-6.

Soil Corrosivity Tests
Soil pH, and resistivity tests were performed on representative samples in general accordance with ADOT Test Method ARIZ 236b. The chloride content of selected samples was evaluated in general accordance with ADOT Test Method ARIZ 736. The sulfate content of selected samples was evaluated in general accordance with ADOT Test Method ARIZ 733. The test results are presented on Figure B-7.
Direct Shear Tests
Direct shear tests were performed on undisturbed samples in general accordance with ASTM D 3080-98 to evaluate the shear strength characteristics of selected materials. The samples were inundated during shearing to represent adverse field conditions. The results are shown on Figures B-8 through B-10.

Maximum Dry Density and Optimum Moisture Content Tests
The maximum dry density and optimum moisture content of selected representative soil samples were evaluated in general accordance with ASTM D 698-00. The results of these tests are summarized on Figures B-11 and B-12.
### Gradation Test Results

**Sheldon Mine**  
**Prescott National Forest**  
**Yavapai County, Arizona**

**Project No.:** 20636001  
**Date:** 08/05  
**Figure:** B-1

#### U.S. Standard Sieve Numbers

<table>
<thead>
<tr>
<th>Depth (ft)</th>
<th>Liquid Limit</th>
<th>Plastic Limit</th>
<th>Plasticity Index</th>
<th>D_10</th>
<th>D_30</th>
<th>D_60</th>
<th>C_u</th>
<th>C_c</th>
<th>Passing No. 200 (%)</th>
<th>U.S.C.S</th>
</tr>
</thead>
<tbody>
<tr>
<td>5-7</td>
<td>--</td>
<td>--</td>
<td>--</td>
<td>--</td>
<td>--</td>
<td>--</td>
<td>--</td>
<td>--</td>
<td>24</td>
<td>SC</td>
</tr>
</tbody>
</table>

**Performing in General Accordance with ASTM D 422-02**
<table>
<thead>
<tr>
<th>GRAVEL</th>
<th>SAND</th>
<th>FINES</th>
</tr>
</thead>
<tbody>
<tr>
<td>Coarse</td>
<td>Fine</td>
<td>Coarse</td>
</tr>
</tbody>
</table>

**U.S. STANDARD SIEVE NUMBERS**

<table>
<thead>
<tr>
<th>Depth Liquid Plastic Plasticity Passing Index</th>
</tr>
</thead>
<tbody>
<tr>
<td>Symbol Hole No.</td>
</tr>
<tr>
<td>----------------</td>
</tr>
<tr>
<td>TP-2</td>
</tr>
</tbody>
</table>

**PERFORMED IN GENERAL ACCORDANCE WITH ASTM D 422-02**

**NINYO & MOORE**

**GRADATION TEST RESULTS**

SHELTON MINE
PRESCOTT NATIONAL FOREST
YAVAPAI COUNTY, ARIZONA

<table>
<thead>
<tr>
<th>PROJECT NO.</th>
<th>DATE</th>
<th>FIGURE</th>
</tr>
</thead>
<tbody>
<tr>
<td>206366001</td>
<td>08/05</td>
<td>B-2</td>
</tr>
</tbody>
</table>
PERFORMED IN GENERAL ACCORDANCE WITH ASTM D 422-02

**GRAVITY TEST RESULTS**

**SHELDON MINE**
**PRESCOTT NATIONAL FOREST**
**YAVAPAI COUNTY, ARIZONA**

**PROJECT NO.** 206366001  **DATE** 08/05  **FIGURE** B-3
PERFORMED IN GENERAL ACCORDANCE WITH ASTM D 422-02

NP-INDICATES NON-PLASTIC
<table>
<thead>
<tr>
<th>GRAVEL</th>
<th>SAND</th>
<th>FINES</th>
</tr>
</thead>
<tbody>
<tr>
<td>Coarse</td>
<td>Fine</td>
<td>Coarse</td>
</tr>
</tbody>
</table>

**U.S. STANDARD SIEVE NUMBERS**

Percent Finer by Weight

**HYDROMETER**

Grain Size in Millimeters

<table>
<thead>
<tr>
<th>Symbol</th>
<th>Hole No.</th>
<th>Depth (ft)</th>
<th>Liquid Limit</th>
<th>Plastic Limit</th>
<th>Plasticity Index</th>
<th>D&lt;sub&gt;10&lt;/sub&gt;</th>
<th>D&lt;sub&gt;30&lt;/sub&gt;</th>
<th>D&lt;sub&gt;50&lt;/sub&gt;</th>
<th>C&lt;sub&gt;u&lt;/sub&gt;</th>
<th>C&lt;sub&gt;c&lt;/sub&gt;</th>
<th>Passing No. 200 (%)</th>
<th>U.S.C.S</th>
</tr>
</thead>
<tbody>
<tr>
<td>●</td>
<td>TP-8</td>
<td>2.8-3.8</td>
<td>33</td>
<td>27</td>
<td>6</td>
<td>--</td>
<td>--</td>
<td>--</td>
<td>--</td>
<td>--</td>
<td>84</td>
<td>ML</td>
</tr>
</tbody>
</table>

Performed in general accordance with ASTM D 422-02

**GRADATION TEST RESULTS**

Sheldon Mine
Prescott National Forest
Yavapai County, Arizona

Project No. 206366001 Date 08/05 Figure B-5
<table>
<thead>
<tr>
<th>SYMBOL</th>
<th>LOCATION</th>
<th>DEPTH (FT)</th>
<th>LL (%)</th>
<th>PL (%)</th>
<th>PI (%)</th>
<th>U.S.C.S. CLASSIFICATION (Minus No. 40 Sieve Fraction)</th>
<th>U.S.C.S. (Entire Sample)</th>
</tr>
</thead>
<tbody>
<tr>
<td>•</td>
<td>TP-3</td>
<td>2.5-3.5</td>
<td>39</td>
<td>28</td>
<td>11</td>
<td>ML</td>
<td>SM</td>
</tr>
<tr>
<td>•</td>
<td>TP-7</td>
<td>2-3</td>
<td>--</td>
<td>--</td>
<td>NP</td>
<td>NP</td>
<td>SM</td>
</tr>
<tr>
<td>•</td>
<td>TP-8</td>
<td>2.8-3.8</td>
<td>33</td>
<td>27</td>
<td>6</td>
<td>ML</td>
<td>ML</td>
</tr>
</tbody>
</table>

NP - INDICATES NON-PLASTIC

PERFORMED IN GENERAL ACCORDANCE WITH ASTM D 4318-00

ATTERBERG LIMITS TEST RESULTS
SHELDON MINE
PRESCOTT NATIONAL FOREST
YAVAPAI COUNTY, ARIZONA

PROJECT NO. 206366001 DATE 08/05 FIGURE B-6

NP - INDICATES NON-PLASTIC

ATTERBERG LIMITS TEST RESULTS
SHELDON MINE
PRESCOTT NATIONAL FOREST
YAVAPAI COUNTY, ARIZONA

PROJECT NO. 206366001 DATE 08/05 FIGURE B-6
**CORROSIVITY TEST RESULTS**

<table>
<thead>
<tr>
<th>SAMPLE ID</th>
<th>DEPTH (FT)</th>
<th>pH*</th>
<th>RESISTIVITY* (ohm-cm)</th>
<th>WATER-SOLUBLE SULFATE CONTENT IN SOIL** (ppm)</th>
<th>CHLORIDE CONTENT*** (ppm)</th>
</tr>
</thead>
<tbody>
<tr>
<td>TP-3</td>
<td>2.5-3.5</td>
<td>4.1</td>
<td>684</td>
<td>2189</td>
<td>6.7</td>
</tr>
<tr>
<td>TP-6</td>
<td>1-2</td>
<td>3.5</td>
<td>684</td>
<td>1932</td>
<td>7.0</td>
</tr>
<tr>
<td>TP-8</td>
<td>2.8-3.8</td>
<td>3.2</td>
<td>752</td>
<td>1837</td>
<td>7.1</td>
</tr>
</tbody>
</table>

* PERFORMED IN GENERAL ACCORDANCE WITH ADOT TEST METHOD ARIZ 236b
** PERFORMED IN GENERAL ACCORDANCE WITH ADOT TEST METHOD ARIZ 733
*** PERFORMED IN GENERAL ACCORDANCE WITH ADOT TEST METHOD ARIZ 736

PPM- PARTS PER MILLION
### DIRECT SHEAR TEST RESULTS

**SHELTON MINE**  
**PRESCOTT NATIONAL FOREST**  
**YAVAPAI COUNTY, ARIZONA**  

<table>
<thead>
<tr>
<th>Description</th>
<th>Symbol</th>
<th>Sample Location</th>
<th>Depth (ft)</th>
<th>Shear Strength</th>
<th>Cohesion, c (psf)</th>
<th>Friction Angle, $\phi$ (degrees)</th>
<th>Soil Type</th>
</tr>
</thead>
<tbody>
<tr>
<td>UNDISTURBED</td>
<td>TP-1</td>
<td>6-7</td>
<td>Peak</td>
<td>1.5</td>
<td>58</td>
<td>58</td>
<td>SC</td>
</tr>
<tr>
<td>UNDISTURBED</td>
<td>TP-1</td>
<td>6-7</td>
<td>Ultimate</td>
<td>60</td>
<td>54</td>
<td>54</td>
<td>SC</td>
</tr>
</tbody>
</table>

PERFORMED IN GENERAL ACCORDANCE WITH ASTM D 3080-03
UNDISTURBED

TP-7

2-3

Peak

138

28

SM

UNDISTURBED

TP-7

2-3

Ultimate

66

29

SM

DIRECT SHEAR TEST RESULTS

SHELDON MINE

PRESCOTT NATIONAL FOREST

YAVAPAI COUNTY, ARIZONA

PERFORMED IN GENERAL ACCORDANCE WITH ASTM D 3080-03

Ninio & Moore
### Direct Shear Test Results

**Sheldon Mine**  
**Prescott National Forest**  
**Yavapai County, Arizona**

**Project No.:** 206366001  
**Date:** 08/05  
**Figure:** B-10

---

**Diagram:**

A graph showing the relationship between shear stress (PSF) and normal stress (PSF).

---

**Table: Shear Strength Properties**

<table>
<thead>
<tr>
<th>Description</th>
<th>Symbol</th>
<th>Sample Location</th>
<th>Depth (ft)</th>
<th>Shear Strength</th>
<th>Cohesion, c (psf)</th>
<th>Friction Angle, ( \phi ) (degrees)</th>
<th>Soil Type</th>
</tr>
</thead>
<tbody>
<tr>
<td>Undisturbed</td>
<td>- - -</td>
<td>TP-8</td>
<td>2.8-3.8</td>
<td>Peak</td>
<td>84</td>
<td>28</td>
<td>ML</td>
</tr>
<tr>
<td>Undisturbed</td>
<td>- - x</td>
<td>TP-8</td>
<td>2.8-3.8</td>
<td>Ultimate</td>
<td>48</td>
<td>27</td>
<td>ML</td>
</tr>
</tbody>
</table>

**Performed in General Accordance with ASTM D 3080-93**
### Proctor Density Test Results

**Sheldon Mine**  
Prescott National Forest  
Yavapai County, Arizona

**Table:**

<table>
<thead>
<tr>
<th>Sample Location</th>
<th>Depth (ft)</th>
<th>Soil Description</th>
<th>Maximum Dry Density (pcf)</th>
<th>Optimum Moisture Content (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>TP-1</td>
<td>5-7</td>
<td>Clayey Fine to Coarse SAND</td>
<td>117.3*</td>
<td>14.8*</td>
</tr>
</tbody>
</table>

*19% ROCK ON 3/8" SCREEN WAS FOUND IN THE LABORATORY SAMPLE PERFORMED IN GENERAL ACCORDANCE WITH [ASTM D 1557-02](#) [ASTM D 698-00a](#) METHOD "B"*

**Figure B-11**
Zero Air Void Line
(Specific Gravity = 2.70)

<table>
<thead>
<tr>
<th>Sample Location</th>
<th>Depth (ft)</th>
<th>Soil Description</th>
<th>Maximum Dry Density (pcf)</th>
<th>Optimum Moisture Content (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>TP-7</td>
<td>7-12.5</td>
<td>Silty Fine SAND</td>
<td>108.7</td>
<td>17.0</td>
</tr>
</tbody>
</table>

PERFORMED IN GENERAL ACCORDANCE WITH □ ASTM D 1557-02 □ ASTM D 698-00a METHOD "A"
The seismic refraction method uses first-arrival times of refracted seismic waves to determine the thicknesses and seismic velocities of subsurface layers. Seismic waves generated at the surface are refracted at boundaries separating materials of contrasting velocities. These refracted seismic waves are then detected by a series of surface geophones and recorded with a seismograph. The travel times of the seismic waves are used in conjunction with the shot-to-geophone distances to obtain thickness and velocity information on the subsurface materials.

The refraction method requires that subsurface velocities (and therefore material density) increase with depth. A layer having a velocity lower than that of the layer above will not be detectable by the seismic refraction method and, therefore, could lead to errors in the depth calculations of subsequent layers. In addition, lateral variations in velocity can also result in the misinterpretation of the subsurface conditions.

In general, seismic wave velocities can be correlated to material density and/or rock hardness. The relationship between rippability and seismic velocity is empirical and assumes a homogeneous mass. Localized areas of differing composition, texture, or structure may affect both the measured data and the actual rippability of the mass. The rippability of a mass is also dependent on the excavation equipment used and the skill and experience of the equipment operator.

The following rippability chart (Table C-1) is based on our experience with similar materials. It assumes that a Caterpillar D-9 dozer ripping with a single shank is used. We emphasize that the cutoffs in this classification scheme are approximate and that soil characteristics can play a significant role in determining excavation rates and rippability. In addition, where excavations encounter or penetrate weathered or fresh bedrock, rock characteristics, such as depth of and degree of weathering, and fracture spacing and orientation play a significant role in determining rock rippability. These soil and rock characteristics may also vary with location and depth.
Table C-1 – Qualitative Rippability Classification

<table>
<thead>
<tr>
<th>Velocity Range</th>
<th>Rippability</th>
</tr>
</thead>
<tbody>
<tr>
<td>0 to 2000 ft/s</td>
<td>Easy Ripping</td>
</tr>
<tr>
<td>2000 to 4000 ft/s</td>
<td>Moderate Ripping</td>
</tr>
<tr>
<td>4000 to 5500 ft/s</td>
<td>Difficult Ripping, Possible Blasting</td>
</tr>
<tr>
<td>5500 to 7000 ft/s</td>
<td>Very Difficult Ripping, Probable Blasting</td>
</tr>
<tr>
<td>Greater than 7000 ft/s</td>
<td>Blasting Generally Required</td>
</tr>
</tbody>
</table>

For trenching operations, the rippability figures should be scaled downward. For example, velocities as low as 3,500 feet per second may indicate difficult ripping during trenching operations. In addition, the presence of cobbles and boulders, which can be troublesome in a narrow trench, should be anticipated. The above classification scheme should be used with discretion, and contractors should not be relieved of making their own independent evaluation of the rippability of the on-site materials prior to submitting their bids.

Table C-2 lists the average velocities and depths calculated from the seismic refraction traverses conducted during this evaluation. Layer profiles are presented in Figures C-1 through C-5, which are attached to this appendix.

It should also be noted that, as a general rule of thumb, the effective depth of evaluation for a seismic refraction traverse is approximately one-third to one-fifth the length of the refraction line. The lengths of the seismic refraction lines are listed, with their interpretations, in Table C-2.

Table C-2 – Seismic Refraction Results

<table>
<thead>
<tr>
<th>Traverse No. And Length</th>
<th>Velocity V1 = 2,000 Feet/Second</th>
<th>Velocity V2 = 6,200 Feet/Second</th>
<th>Approximate Depth to Bottom of Layer (feet)</th>
<th>Rippability</th>
</tr>
</thead>
<tbody>
<tr>
<td>SL-1 240 feet</td>
<td>V1 = 2,000</td>
<td>V2 = 6,200</td>
<td>8-18</td>
<td>Easy to Moderate Very Difficult, Probable Blasting</td>
</tr>
<tr>
<td>SL-2 160 feet</td>
<td>V1 = 1,500</td>
<td>V2 = 7,300</td>
<td>2-12</td>
<td>Easy Blasting Generally Required</td>
</tr>
<tr>
<td>SL-3 160 feet</td>
<td>V1 = 1,900</td>
<td>V2 = 7,800</td>
<td>8-12</td>
<td>Easy Blasting Generally Required</td>
</tr>
<tr>
<td>SL-4 160 feet</td>
<td>V1 = 1,700</td>
<td>V2 = 2,800</td>
<td>16-30</td>
<td>Easy Moderate</td>
</tr>
<tr>
<td>SL-5 110 feet</td>
<td>V1 = 1,200</td>
<td>V2 = 2,700</td>
<td>4-19</td>
<td>Easy Moderate</td>
</tr>
</tbody>
</table>
FIGURE C-2: SHELDON MINE, SEISMIC REFRACTION SURVEY, SL-2

APPROXIMATE GROUND SURFACE

SEISMIC PROFILE LINE 2

SHELDON MINE
PRESCOTT NATIONAL FOREST
YAVAPAI COUNTY, ARIZONA

PROJECT NO.: 206366001
DATE: 08/05
FIGURE C-4: SHELDON MINE, SEISMIC REFRACTION SURVEY, SL-4

SEISMIC PROFILE
LINE 4

SHELDON MINE
PREScott NATIONAL FOREST
YAVAPAI COUNTY, ARIZONA

PROJECT NO.: 206366001
DATE: 08/05

APPROXIMATE GROUND SURFACE

1652 ft/s

2793 ft/s

DISTANCE IN FEET

DEPTH IN FEET

S

N

D

E

C

B

A

Spread A
APPENDIX D

SITE PHOTOGRAPHS
Photograph No. 1: AMD in tributary to Lynx Creek near gabion wall.

Photograph No. 2: SWR erosion feature adjacent to Sheldon Road.
Photograph No. 3: SWR erosion feature adjacent to Sheldon Road after a rain event.
Photograph No. 4: SWR gabion wall and Lynx Creek tributary; view to the west.
Limited Geotechnical Evaluation
Sheldon Mine, Yavapai County, Arizona

August 31, 2005
Project No. 206366001

Photograph No. 5: STP; view to the northwest.

Photograph No. 6: Erosion at concrete-lined drainage ditch/structure on the east side of the STP.
Photograph No. 7: Drainage ditch at the north side of the STP site filled with debris.

Photograph No. 8: View of test pit TP-1.
Limited Geotechnical Evaluation
Sheldon Mine, Yavapai County, Arizona

Photograph No. 9: View of test pit TP-2.

Photograph No. 10: View of test pit TP-3.
Photograph No. 11: View of test pit TP-4.

Photograph No. 12: View of test pit TP-5.
Limited Geotechnical Evaluation
Sheldon Mine, Yavapai County, Arizona

Photograph No. 13: View of test pit TP-6.

Photograph No. 14: View of test pit TP-7.
Photograph No. 15: View of test pit TP-8.