# CEDAR LAKE MINING, INC.
# BULL GAP MINE, P-3960

ALABAMA SURFACE MINING COMMISSION
SURFACE COAL MINING PERMIT APPLICATION

# ATTACHMENT IV-C-2
# TOPSOIL VARIANCE APPLICATION

Prepared by;

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## INTRODUCTION

As per Section 880-X-10C.08(5) of the Administrative Code of the Alabama Surface Mining Commission, selected overburden materials may be substituted for or used as a supplement to topsoil materials if it can be demonstrated to the State Regulatory Authority by the person and/or entity who conducts surface mining activities that the resulting soil medium is equal to or more suitable for sustaining revegetation than existing topsoil and the substitute material is the best available within the permit area to support revegetation. The following study will endeavor to prove that the previously stated criteria is met for Cedar Lake Mining, Inc. at the proposed Bull Gap Mine - ASMC Permit P-3960 and to request a Topsoil Variance on the entire permit area. The total acreage of the Bull Gap mine area is approximately 550.0 acres. This proposed topsoil waiver will address 116.0 acres of Increment No. 1, 90.0 acres of Increment No. 2, 151.0 acres of Increment No. 3, 101.0 acres of Increment No. 4, and 17.0 acres of Increment No. 7. Increments No. 5 and No. 6 (49.0 and 26.0 acres respectively) have been designated as non-bonded abandoned mine areas for off-site placement of spoils as stipulated by Section 880-X-8J-.03, Rules of Alabama Surface Mining Commission. The surface area of both increments consists of open-pits developed and abandoned by pre-law contour surface mine operations, are barren of any topsoil deposits, and are not considered as part of this topsoil waiver request.

## MINE SITE INFORMATION

Bull Gap Mine occupies 550.0 acres of which 458.0 acres are mining acres, 75.0 acres are designated as non-bonded off-site spoil placement areas and 17.0 acres are set aside for the mine office, road, ponds and other incidentals. The mine site is located in Sections 8, 9, 16, 17, 18, 19 and 20, Township 12 South, Range 3 East and in Section 24, Township 12 South, Range 2 East, Blount County, Alabama as found on the Hyatt Gap, Altoona and Oneonta U.S.G.S. Quadrangle maps. See the attached Soil Map showing the mine site location, soil types within the permit area, drill hole locations, topsoil and overburden collection sites. The coal seams to mined at this site are the Upper Bynum, Lower Bynum and the Underwood coal seams.

The proposed mine site is located in northeastern Blount County northeast of the town of Oneonta, Alabama within the Locust Fork drainage basin of the Cumberland Plateau physiographic section. The Cumberland Plateau section is the southernmost section of the Appalachian Plateau's province of the Appalachian Highland Region. The Cumberland Plateau borders the Highland Rim section to the north, the Valley and Ridge province to the southeast and the Coastal Plane section to the southwest and consists of flat-topped high-elevation plateaus separated by deep, steep-sided valleys. Tops of the plateaus slope gently from the northeast to the southwest. The landforms are the result of differential erosion of the underlying strata with the more resistant rock of the great conglomerate of the Lower Coal Measures of the Appalachian Coal Field forming the ridges and the steep-sided valleys from erosional actions acting upon the softer strata below. Bull Gap Mine lies within the Blount Mountain district of the Cumberland Plateau physiographic section. This district is a "submaturely dissected synclinal sandstone and shale plateau of moderate relief" (Sapp and Emplaincourt 1975). Topographically, the proposed mine area has elevations ranging from approximately 1000 to 1240 feet AMSL.

## SOILS PRESENT BEFORE MINING

The National Cooperative Soil Survey for Blount County (NCSS 2007) classifies two (2) soil types with the survey:

Soils present within the permit area are as follows:

| | | |
|---|---|---|
| Montevallo-Townley Complex | MtF, | 15 - 45% Slopes |
| Palmerdale Very Channery Silt Loam | Pr, | 2 - 60% Slopes |

## LANDUSE

The pre-mining land use of the proposed permitted area consists of undeveloped/no current use with trees. The proposed post mining land use of the proposed permit areas will be undeveloped/no current use with grasses as the primary vegetative cover. All proposed sediment basins will be temporary water impoundments.

## SOIL DESCRIPTIONS

The National Cooperative Soil Survey for Blount County (NCSS) indicates that two (2) soil types and complexes occur within the proposed permit area. The descriptions of these soils and complexes are as follows:

***Montevallo-Townley Complex, 15 to 45 percent slopes, (MtF)*** - The soils in this complex are on rough hilly uplands that have narrow winding ridgetops and steep side slopes that are dissected by drainageways and intermittent streams. Because of steep slopes and a very high hazard of erosion, this complex is not suited to cultivated crops; it is better suited to woodlands. Most of the acreage is second-growth pine and mixed hardwoods.

***Palmerdale Series, 2 to 60 percent slopes, (Pr)*** - The Palmerdale series consists of deep, somewhat excessively drained, very shaly soils. These soils formed in spoil material derived from strip mining of coal. They are gently rolling to very steep. Most of the acreage is idle, but a few areas have been planted to pine, and a few small areas have been smoothed and are in pasture. This soil is suited to pine trees.

## GEOLOGIC DESCRIPTION

The proposed Bull Gap Mine is located on the Raccoon Mountain section of Blount Mountain and is underlain by the Pottsville Formation of Pennsylvanian age of the Plateau coal field. The sandstone cap rock of the great conglomerate has preserved the Pottsville formation from geologic forces and erosional actions and hence the coal deposits of the Plateau coal field. The strata of the Pottsville Formation are comprised of shales, siltstones, and sandstones with lesser amounts of coal, underclay and conglomerate as described on page 8 of "Hydrology of Area 22, Eastern Coal Province, Alabama". The seams to be mined are the Upper Bynum, Lower Bynum and the Underwood coal beds.

Geology of the immediate area is complex in which the strata are folded and faulted to form northeast/southwest trending anticlines and synclines whose axes are generally parallel to the Appalachian Range and are dipping to the southwest. Anticlinal uplift, which are up-arch folds, has impaired the structural integrity of the overlying conglomerate cap rock thus exposing the softer shales, limestones and dolomites of the older underlying Paleozoic strata and the corresponding erosional weathering has resulted in the formation of the topographic lows of Sequatchie and Murphree valleys. Great forces have acted on the immediate and surrounding areas of Bull Gap mine causing geologic folding generally parallel to the axes of the Appalachian Mountain Range. These folds have resulted in both up-arch folding and down-arch folding. These forces caused the uplift of the Sequatchie Valley Anticline and the Murphree Valley Anticline while the corresponding troughs (depressions) of down-arch folds have resulted in the formation of the synclinal structures of Sand Mountain and Blount Mountain that has left the erosion-resistant sandstone cap rock of the Cumberland Plateau in place protecting the coal measures of the Pottsville Formation.

The Blount Mountain Syncline is located on the downthrown side of an unnamed thrust fault that resulted during the formation (uplift) of the Murphree Valley Anticline and has resulted in a much greater thickness of the Blount Mountain coal measures as compared to other coal measures of the Plateau Field. Due to these greater thicknesses, four (4) defined conglomerates are present within the strata layers of the Blount Mountain Syncline while all other coal measures of the Plateau field define only two (2) conglomerates. The fourth (4th) and

geologically the youngest conglomerate occurs at the higher elevations of Blount Mountain and the Bynum (Upper and Lower) coal bed occurs just above the fourth conglomerate while the Underwood (Altoona) coal bed lies below this conglomerate. The Woodward coal bed appears periodically within the overlying strata above the Underwood coal seam, just below the Fourth Conglomerate and below the Bynum seams. Below the Underwood coal bed, there are the third, second and first conglomerates and intervening strata with various named and un-named coal beds but due to the depth below existing surface contours and streambeds are not economically minable.

The main geologic structural feature impacting surface coal mining operations at the Bull Gap Mine is the Blount Mountain Syncline. This structure is basically a canoe shaped trough three (3) to six (6) miles in width between the southwest to northeast trending escarpments of Blount Mountain. The greatest depth of overlying measures trend to this northwestern side of the syncline. The axis of Blount Mountain Syncline runs typically parallel to the axis of the Murphree Valley Anticline but has formed more closely along the northwestern side of the structure due to past geologic interactions with Straight Mountain. The northwestern limb of the syncline runs but a short distance from the axis to be exposed by the erosional actions of Hale Creek. Minable outcrops have been exposed and have been historically mined at the site. The Southeastern limb of the syncline gains elevation up to its outcrop along the southeastern escarpment of Blount Mountain and dips approximately 4° near the center of the mountain and increases to approximately 10° to 12° near the escarpment. Dips on the northwest limb are low due to the weathering and subsequent exposure of the strata of the syncline. Because of the tremendous geologic forces generated by the formation of the Murphree Valley Anticline, both Raccoon Mountain and Altoona Mountain strata, while part of the Blount Mountain Syncline, have both been upthrust and tilted and are higher in elevation than the general surface elevation trends along Blount Mountain.

The synclinal structure of Raccoon Mountain follows the same trends of Blount Mountain Syncline with its southeastern side elevated approximately two hundred (200) feet above its northwestern side and dips to the northwest along its limb and southwest along its axis up to a local down-trending hinge fault approximately perpendicular to its axis and commencing at 33°59'40.20"N, 86°21'40.31"W approximately 365 feet due west of Basin 001P. (See Hydro-

Geo Map for location of the fault line near Basin 001P that defines the low-point and axis of the described hinge fault.) Due to the tilt and dip of the structure, the lowest point of coal outcroppings have occurred here at the axis of the hinge fault. The Underwood Coal Seam, which is the lowest stratigraphical minable seam on the property, increases in elevation both to the northeast and to the southwest from this point along the axis of the syncline with all overlying strata and coal seams following the corresponding trend.

In addition to this fault, several normal displacement faults have resulted in minimum displacements, typically twenty (20) feet or less along the axis of the syncline. These faults typically occur along the southeastern limb of Blount (Raccoon) Mountain Syncline in conjunction with the higher dips of the strata along the southeastern escarpment of Blount Mountain. With the increasing elevation of the coal seams to the southwest as a result of the perpendicular fold previously discussed, the corresponding decrease in overburden depth results in much lower cover above the coal seams of the Pottsville Formation.

The lithology description was developed as a composite of the four (4) overburden sample drill holes drilled by MS&R Equipment Company Inc. using a Simco 7000 rotary air drill, utilizing a 4-3/4 inch drill bit and by fourteen (14) exploratory rotary drill holes drilled by and under the supervision of Cedar Lake Mining, Inc utilizing the same equipment. (See drawings entitled Overburden Columns for geologic columns of these four (4) overburden samples and Drillhole Columns for geologic columns of the fourteen (14) exploratory drill holes.) For the locations of drillholes, overburden sample sites and ground-water monitoring wells, see the attached Hydro-Geo Map.

Incorporating these exploration drillhole data, overburden sample drillhole data and surface contour data, a digital model of the entire proposed mine site has been developed using Carlson Mining 2012 with AutoCad 2012 computer software. The methodology of this software constructs a geologic model of the mine site by constructing a surface grid file on 20' X 20' spacing to determine the top limits of the said geologic model. Strata grid files are then developed to correspond to the same 20' X 20' grid spacing for the bottom elevation of each strata layer from the top limit elevation surface grid to the bottom elevation grid of the Underwood Coal seam. (Note that all drillhole and/or overburden column drawings are shown in

the drawings with the legend and descriptions of the corresponding strata grid files.) These surface and strata grid files are correlated from the top (ground surface) to the bottom (bottom of Underwood coal) and are defined by a Pre-Calculated Grid file which constitutes the geologic model for the site. All grid files other that the surface (top) grid are based on the drillhole data developed from exploration drilling at the site.

Once the geologic model has been constructed, geologic fence diagrams, cross-sections and volumetric calculations can be constructed as required. (See OB-01/MW-01, OB-02/MW-02, OB-03/MW-03 and OB-04/MW-04 for detailed drawings showing the overburden sequences/lithology of the overburden sample holes as well as specific data on the wellhead appliances installed in each overburden sample/monitoring well hole.) Overburden lithology remains constant across the extent of the proposed mine site. See enclosed drawings of these exploratory drill columns for geologic details of the overburden and exploratory drill holes shown by Overburden Columns and Drillhole Columns. (See Drill Logs for drilling data.) The following table lists the historical drillhole data and personnel in charge of drilling operations corresponding to the graphical exploration drill columns depicted below in Exhibit 2.1.

According to the "Hydrologic Assessment, Eastern Coal Province Area 22, Alabama", the regional dip of the Pottsville formation is to the southwest but due to the complex geological structures that have been subjected to folding and faulting, the local strike is approximately North 50 degrees West and the strata dips to the southwest at about 2.5 degrees.

| **EXHIBIT 2.1** | | |
|---|---|---|
| Drill Hole ID | Drilling Supervisor | Drill Date |
| MW-01(OB-01) | MS&R Personnel | 10/20/2008 |
| MW-02(OB-02) | MS&R Personnel | 10/23/2008 |
| MW-03(OB-03) | Jerry W. Williams | 03/11/2009 |
| MW-04(OB-04) | MS&R Personnel | 10/24/2008 |
| | | |
| BG-002 | MS&R Personnel | 10/20/2008 |
| BG-003 | MS&R Personnel | 10/22/2008 |
| BG-004 | MS&R Personnel | 10/24/2008 |
| BG-005 | MS&R Personnel | 10/24/2008 |
| BG-006 | MS&R Personnel | 11/17/2008 |
| BG-007 | MS&R Personnel | 11/17/2008 |
| BG-008 | MS&R Personnel | 11/18/2008 |
| BG-009 | MS&R Personnel | 11/18/2008 |
| BG-010 | MS&R Personnel | 11/24/2009 |
| BG-011 | MS&R Personnel | 03/27/2009 |
| BG-012 | MS&R Personnel | 04/01/2009 |
| BG-013 | MS&R Personnel | 04/07/2009 |
| BG-014 | MS&R Personnel | 04/07/2009 |
| BG-015 | MS&R Personnel | 04/08/2009 |

Four (4) overburden drill holes have been drilled at the proposed mine site to document the chemical properties of the overburden materials and for acid base accounting purposes. These drill holes were drilled with a Simco 7000 rotary air drill and the overburden cuttings generated by the process were collected in five (5) foot intervals, logged, labeled and prepared for laboratory analysis. The cuttings were sampled in minimum five (5) foot increments and at each change of the lithology of the overburden materials. In some instances due to drilling constraints and to maintain continuity the five (5) foot interval may not be maintained but these instances are rare and generally the required sample intervals have been maintained. The geologic properties of the overburden strata are noted in the geologic logs listed in Exhibit 2.2 and a graphical representation of the lithology at each overburden testing site is depicted by the drawing entitled Overburden Columns.

Samples collected in the field were then packed in chronological order, packed and shipped for analysis to Standard Laboratories, Inc. located in Whitesburg, Kentucky. Chemical analysis was performed on each lithologic unit by a laboratory test for the total sulfur of that unit. Using industry standard methodology the total sulfur is converted to potential acidity by multiplying total sulfur percent by 31.25. The results of these analyses determine potential acidity and are reported in tons of calcium carbonate equivalent per 1000 tons of material. Any overburden with a potential acidity less than zero (0) tons calcium carbonate equivalent per 1000 tons of overburden material is considered acid or toxic-forming. The final laboratory reports from Standard Laboratories, Inc reported Acid Base Accounts of each strata interval. This Acid Base Account reported Potential Acidity, Paste pH, Total Sulfur (Dry Basis), Neutralization Potential and Net Potential Surplus/Deficiency (+/-). Neutralization potential is the ability of strata units to neutralize acid material and is reported in tons of calcium carbonate equivalent per 1000 tons of material. Acid-Base account is the mathematical determination developed by calculating the neutralization potential minus potential acidity. This parameter is the results of these calculations reported as a deficiency (-) or excess (+) for each geologic column interval. Results of all chemical analysis for each strata sampled are listed by drill hole in Exhibit 2.3.

From the chemical data determined by Standard Laboratories, Inc. the composite results of all overburden intervals have been tabulated using the industry standard spreadsheet program designed by the Pennsylvania Department of Environmental Resources, Bureau of Mining and Reclamation.

According to the results of the overburden analysis spreadsheets each overburden hole and corresponding area of influence shows an excess of native alkaline materials to neutralize any acid forming strata. The overall average Acid-Base Accounts of the overburden sampled from the overburden holes show a small portion of the overburden that could be considered mildly acid forming. As sampled from OB-1, the strata from 0' to 5', the shale layer immediately above the coal seam indicated acid forming material. The coal seam more than likely indicates substantial acid forming material but was not available for acidity analysis. As sampled from OB-2, the strata from 0' to 5', 5' to 10' and the coal seam indicate mildly acid forming material. As sampled from OB-3, the strata from 50' to 55', indicate mildly acidic material and immediately above the Upper Bynum coal seam and the coal seam indicate moderately acid forming material. The Lower Bynum coal seam indicates moderately acid forming material as well. The samples from OB-4, indicate the strata from 50' to 55' and the strata from 60' to 70' to be mildly acid forming material. The strata immediately above and below the Lower Bynum coal seam are mildly acidic. The coal seam is strongly acidic. The strata from 130' to 135' indicate mildly acidic material and the strata from 150' to 155' indicate moderately material. The negative ABA in the strata surrounding the coal seams is due to contamination from the coal seam. The coal seam within each overburden hole contains a high amount of acid forming material but only a small portion of the coal seam material will be spoiled in the coal removal operations. This material will be specifically handled according to the Alabama Surface Mining Commission (ASMC) approved mining plan. See Exhibit 2.4 for spreadsheet outputs for each overburden hole.

The weighted averages indicate that there is sufficient alkaline material contained in the overburden materials at this proposed mine to neutralize the intervals of acid forming materials within the overburden column.

Acid forming material should not pose a problem at this mine site according to the overall Acid Base Account of the drill holes.

The following chart shows the thickness-weighted averages for each overburden hole.

**TABLE 1**

| Drill Hole ID | Percent Sulfur | Neutralization Potential | Acid-Base Account | Tons/Acre Excess CaCO3 |
|---|---|---|---|---|
| MW-1/OB-1 | 0.0352 | 13.5166 | 12.4180 | 1964 |
| MW-2/OB-2 | 0.0483 | 9.2730 | 7.7644 | 1282 |
| MW-3/OB-3 | 0.0941 | 6.4563 | 3.5170 | 139 |
| MW-4/OB-4 | 0.0868 | 5.5594 | 2.8457 | 124 |

## SAMPLING TECHNIQUES

As depicted on the attached Soils Map, soil and overburden samples were taken at locations throughout the proposed permit area. This map also shows the proposed mine site (permit boundary), soil types present within the permit area, topsoil and overburden collection sites.

Topsoil Samples were taken by digging a cylindrical to slightly conical shaped hole with a spade ten (10") inches to twelve (12") inches in depth after removing the top unconsolidated surface mulch where present. All material removed from the excavated section is included in the sample. Topsoil samples were logged, located by GPS and stored in new, one-gallon, clean plastic pails. Samples collected were conveyed to Bhate Geosciences Corporation located in Birmingham, Alabama where sieve analyses were conducted on oven-dried composite samples to determine coarse fragment and soil percentages. Results of these analyses and graphical representations of screening results are listed in Table 2.

Overburden samples were taken by collecting the cuttings from rotary drilled holes. These cuttings were sampled at each strata change, or at a minimum of five (5') foot intervals. At each interval limit, the drill down-pressure was disengaged to allow all cuttings generated from the drilling operation to be blown from the drillhole before proceeding with the next interval and prevent contamination of the sampled interval. Cuttings were collected, logged and stored in gallon size zip-lock bags. Samples collected in the field were then sorted in chronological order, packed and shipped for analysis to Standard Laboratories, Inc. located in Whitesburg, Kentucky.

The minus 2 mm (soil) fraction of all samples are collected and sent to Auburn University Soil Testing Laboratory for the following analyses: soil fertility; pH; recommendation for post-mining revegetation; percent (%) sand; percent (%) silt; percent (%) clay; CEC; available water capacity*; neutralization potential; maximum potential acidity; percent (%) organic matter and parts per million (ppm) of nitrate nitrogen in the soil. Results of these analyses are shown in Table 3.

*****NOTE: Available water capacity conducted by Auburn University Testing Laboratory is determined on only the soil (-2mm) fraction of the sample. To obtain a "total" available water capacity, the AWC should be multiplied by the fraction of the soil sample obtained in the field. See Table 4 for an Estimation of the Total Available Water Capacity.

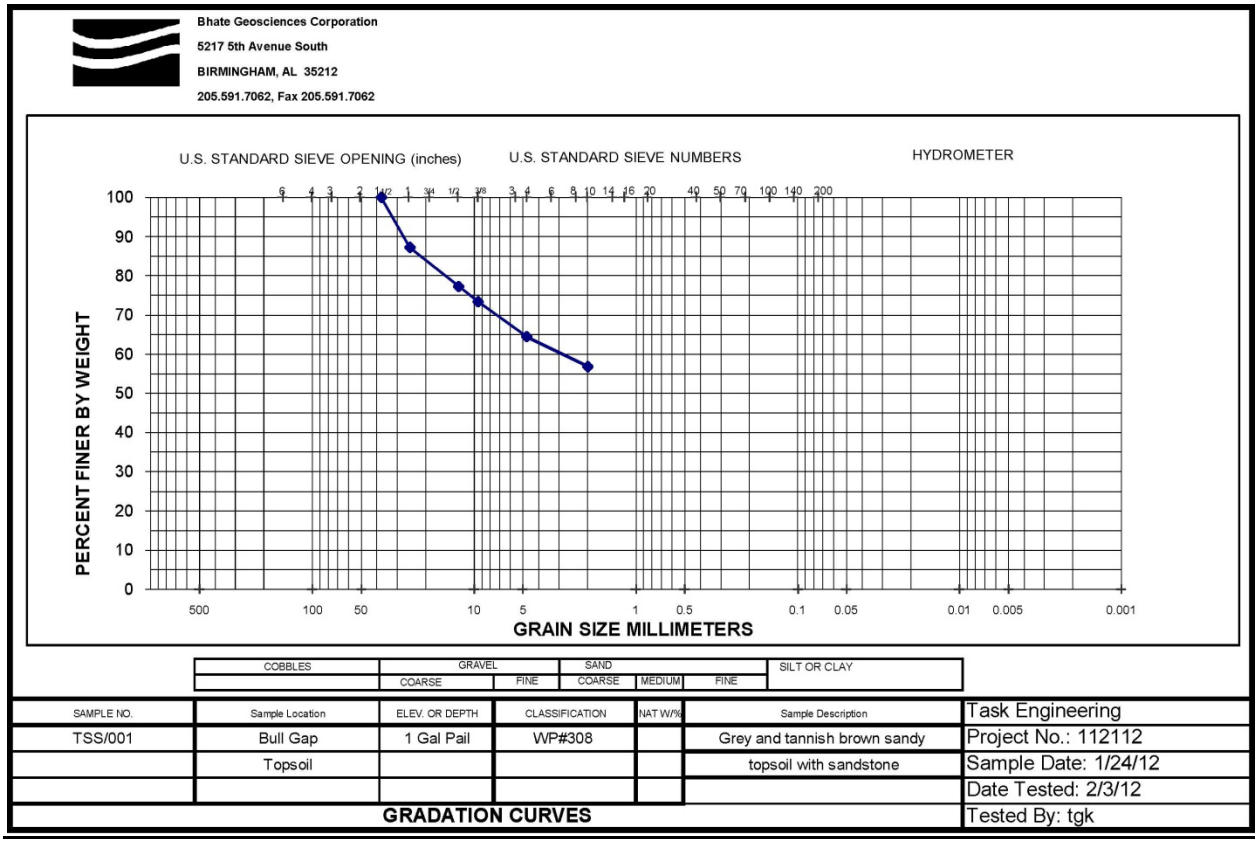
# TABLE 2 - SIEVE ANALYSIS

Company Name: **Cedar Lake Mining, Inc.**
Mine Name: **Bull Gap Mine, P-3960**
Sample I.D.: **TSS#001**
Soil Designation at Sample Point: **Previously Mined Spoils**
Sampled: **12/13/2011**
Analyzed: **2/03/2012**
Analyzed By: **Bhate Geosciences Corporation**
Sample Weight: **946.3 gm**

| Sieve No. | Sieve Opening (mm) | Weight Retained on each Sieve (gm) | Percent of Weight Retained on each Sieve | Cumulative Percent Retained | Percent Passing |
|---|---|---|---|---|---|
| 1½" | 37.50 | 0.0 | 0.0 | 0.0 | 100.0 |
| 1" | 25.00 | 120.8 | 12.8 | 12.8 | 87.2 |
| ½" | 12.50 | 94.2 | 10.0 | 22.8 | 77.2 |
| ¼" | 9.50 | 36.7 | 3.9 | 26.7 | 73.3 |
| 4 | 4.75 | 84.3 | 8.9 | 35.6 | 91.9 |
| 10 | 2.00 | 57.5 | 6.1 | 41.7 | 58.3 |
| Pan | --- | 552.8 | 58.3 | 100.0 | 0.0 |

Percentage (%) of sample that is: coarse fragments: **41.7%** soil: **58.3%**

Average size left in 1" Sieve: **1"**

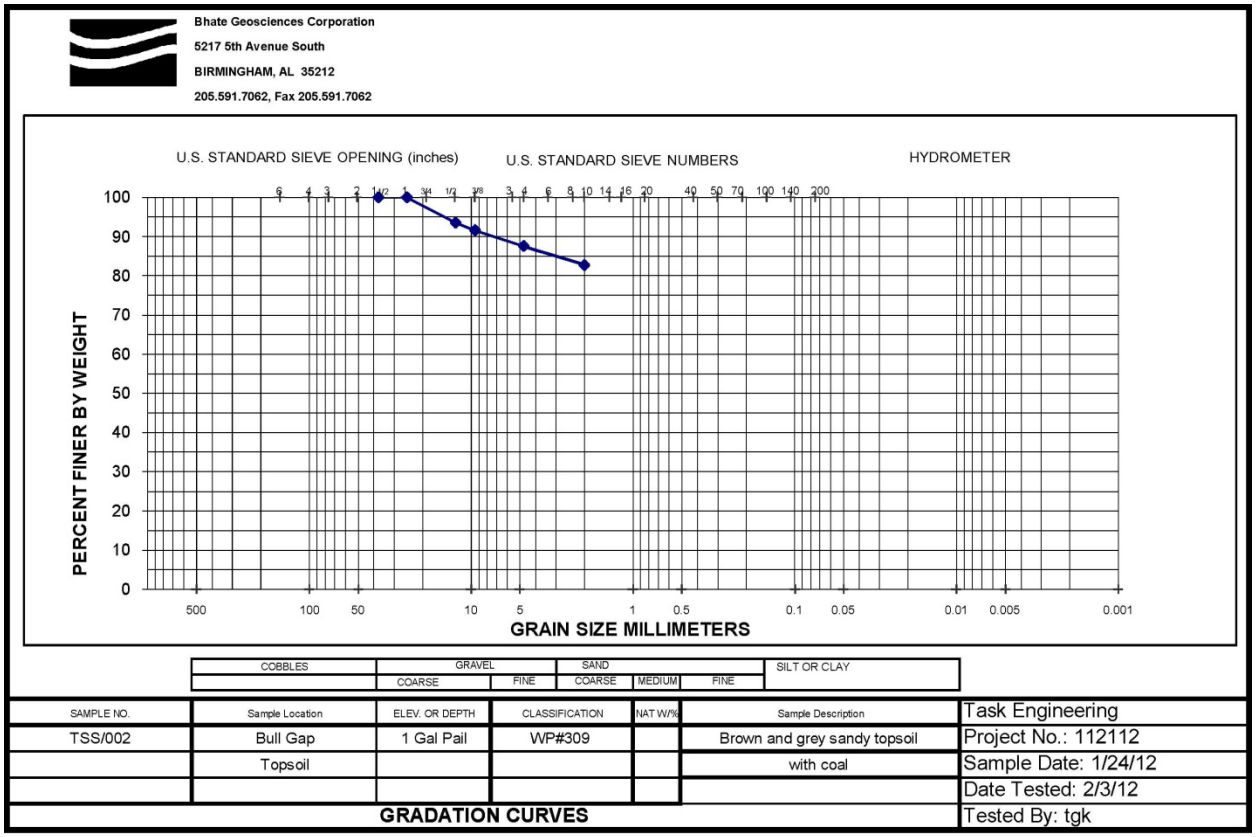


# TABLE 2 - SIEVE ANALYSIS

Company Name: **Cedar Lake Mining, Inc.**
Mine Name: **Bull Gap Mine, P-3960**
Sample I.D.: **TSS#002**
Soil Designation at Sample Point: **Montevallo-Townley Complex (MtF), 15-45% Slopes**
Sampled: **12/13/2011**
Analyzed: **2/03/2012**
Analyzed By: **Bhate Geosciences Corporation**
Sample Weight: **719.4 gm**

| Sieve No. | Sieve Opening (mm) | Weight Retained on each Sieve (gm) | Percent of Weight Retained on each Sieve | Cumulative Percent Retained | Percent Passing |
|---|---|---|---|---|---|
| 1½" | 37.50 | 0.0 | 0.0 | 0.0 | 100.0 |
| 1" | 25.00 | 0.0 | 0.0 | 0.0 | 100.0 |
| ½" | 12.50 | 46.5 | 6.5 | 6.5 | 93.5 |
| ¼" | 9.50 | 13.9 | 1.9 | 8.4 | 91.6 |
| 4 | 4.75 | 28.9 | 4.0 | 12.4 | 87.6 |
| 10 | 2.00 | 27.5 | 3.8 | 16.2 | 83.8 |
| Pan | --- | 602.6 | 83.8 | 100.0 | 0.0 |

Percentage (%) of sample that is: coarse fragments: **16.2%** soil: **83.8%**
Average size left in 1" Sieve: **0"**



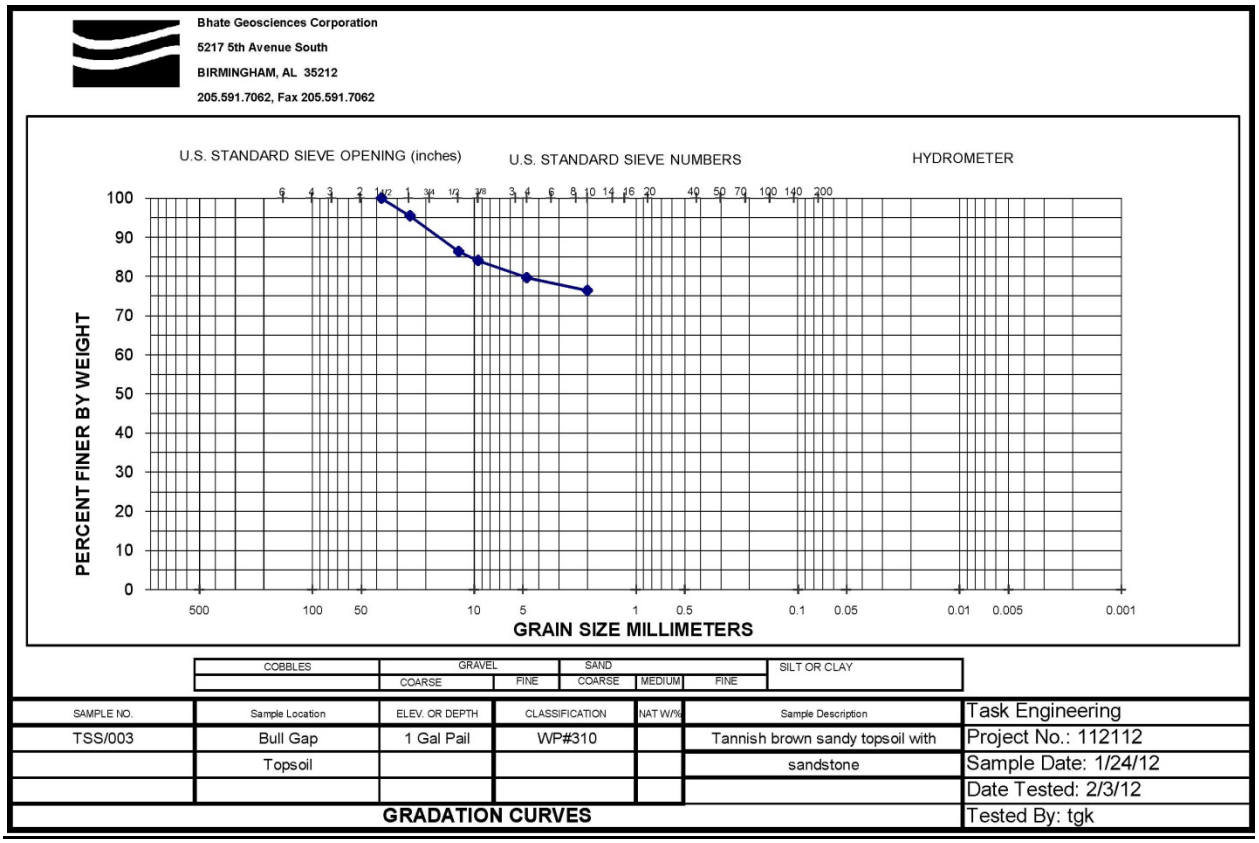
# TABLE 2 - SIEVE ANALYSIS

Company Name: **Cedar Lake Mining, Inc.**
Mine Name: **Bull Gap Mine, P-3960**
Sample I.D.: **TSS#003**
Soil Designation at Sample Point: **Montevallo-Townley Complex (MtF), 15-45% Slopes**
Sampled: **12/13/2011**
Analyzed: **2/03/2012**
Analyzed By: **Bhate Geosciences Corporation**
Sample Weight: **1030.5 gm**

| Sieve No. | Sieve Opening (mm) | Weight Retained on each Sieve (gm) | Percent of Weight Retained on each Sieve | Cumulative Percent Retained | Percent Passing |
|---|---|---|---|---|---|
| 1½" | 37.50 | 0.0 | 0.0 | 0.0 | 100.0 |
| 1" | 25.00 | 46.6 | 4.5 | 4.5 | 95.5 |
| ½" | 12.50 | 94.2 | 9.1 | 13.6 | 86.4 |
| ¼" | 9.50 | 23.3 | 2.3 | 15.9 | 84.1 |
| 4 | 4.75 | 44.8 | 4.4 | 20.3 | 79.7 |
| 10 | 2.00 | 27.8 | 2.7 | 23.0 | 77.0 |
| Pan | --- | 793.8 | 77.0 | 100.0 | 0.0 |

Percentage (%) of sample that is: coarse fragments: **23.0%** soil: **77.0%**

Average size left in 1" Sieve: **1"**



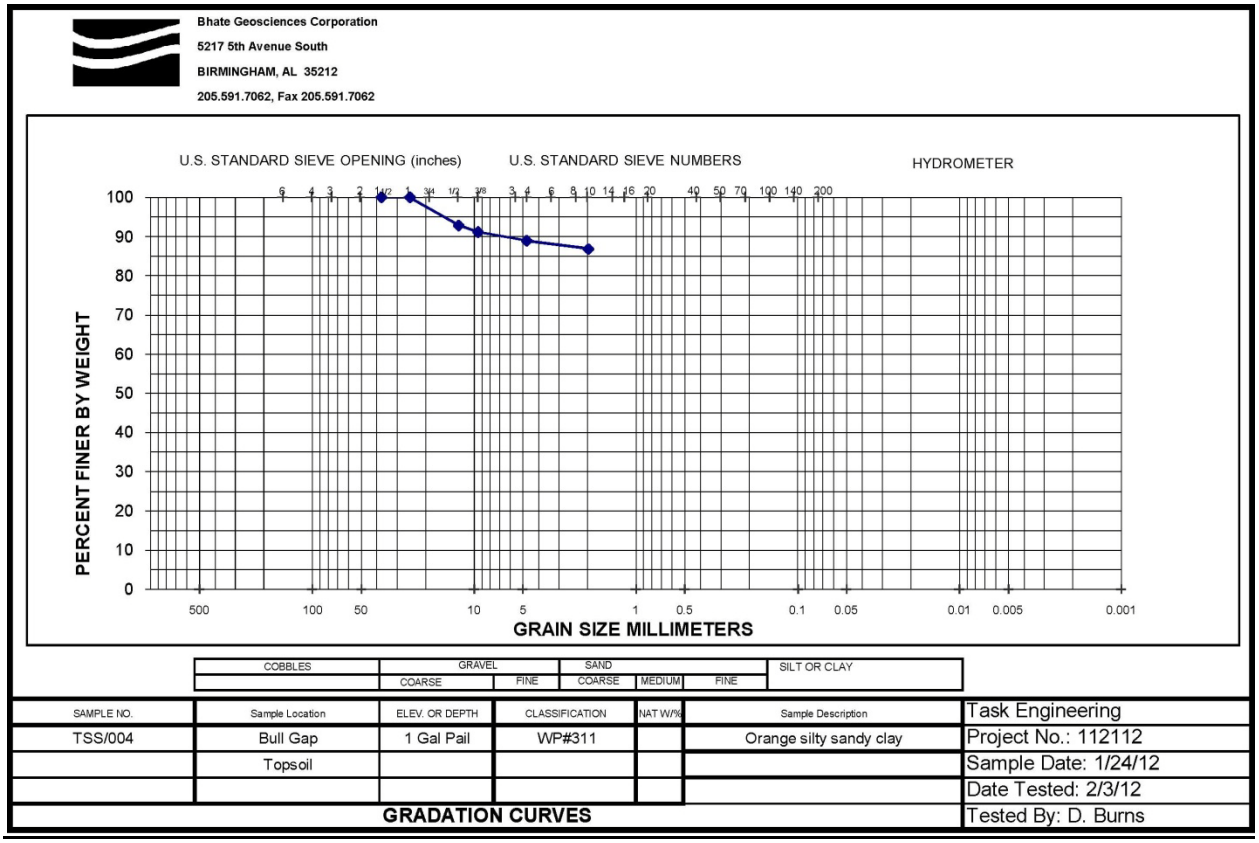
# TABLE 2 - SIEVE ANALYSIS

Company Name: **Cedar Lake Mining, Inc.**
Mine Name: **Bull Gap Mine, P-3968**
Sample I.D.: **TSS#004**
Soil Designation at Sample Point: **Montevallo-Townley Complex (MtF), 15-45% Slopes**
Sampled: **12/13/2012**
Analyzed: **2/03/2012**
Analyzed By: **Bhate Geosciences Corporation**
Sample Weight: **845.8 gm**

| Sieve No. | Sieve Opening (mm) | Weight Retained on each Sieve (gm) | Percent of Weight Retained on each Sieve | Cumulative Percent Retained | Percent Finer |
|---|---|---|---|---|---|
| 1½" | 37.50 | 0.0 | 0.0 | 0.0 | 100.0 |
| 1" | 25.00 | 0.0 | 0.0 | 0.0 | 100.0 |
| ½" | 12.50 | 60.3 | 7.1 | 7.1 | 92.9 |
| ¼" | 9.50 | 14.4 | 1.7 | 8.8 | 91.2 |
| 4 | 4.75 | 18.6 | 2.2 | 11.0 | 89.0 |
| 10 | 2.36 | 13.1 | 1.6 | 12.6 | 87.4 |
| Pan | --- | 739.4 | 87.4 | 100.0 | 0.0 |

Percentage (%) of sample that is: coarse fragments: **12.6%** soil: **87.4%**

Average size left in 1" Sieve: **0"**



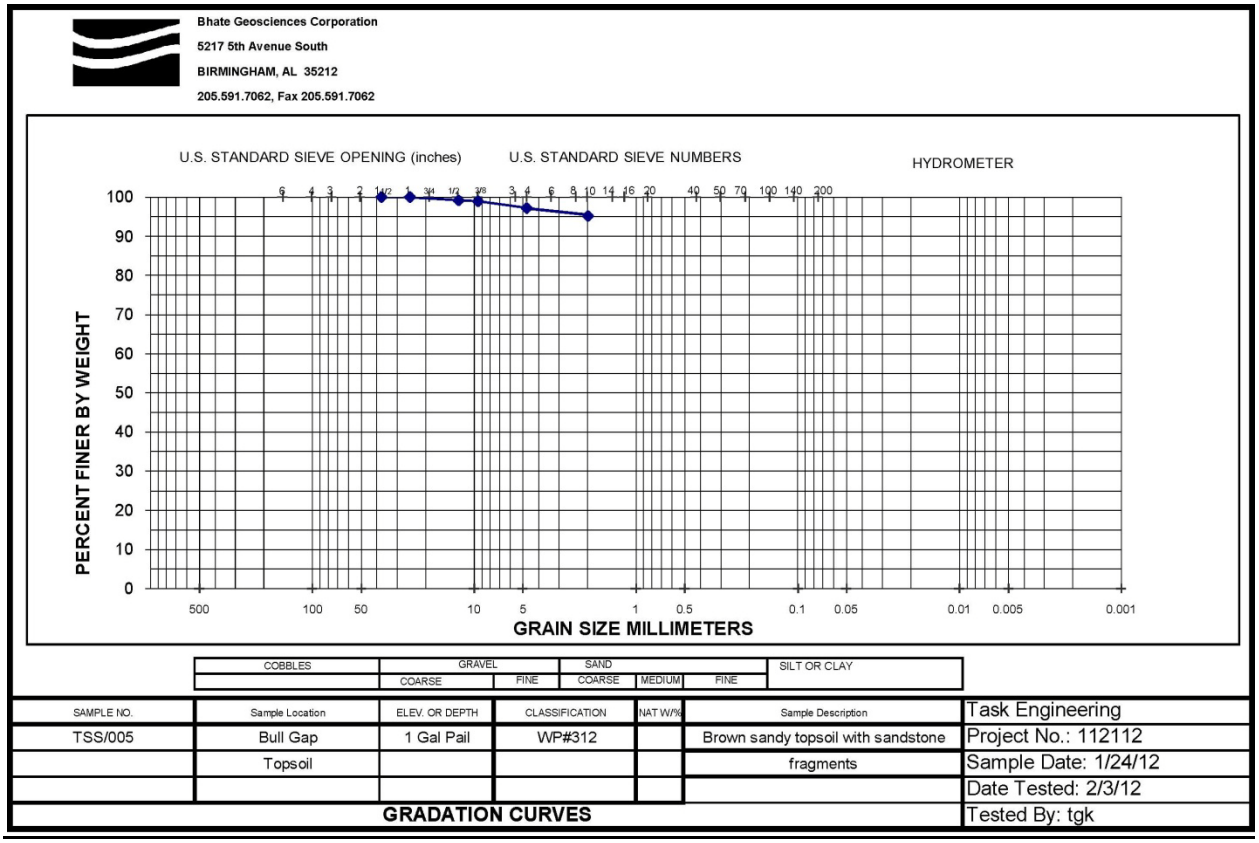
# TABLE 2 - SIEVE ANALYSIS

Company Name: **Cedar Lake Mining, Inc.**
Mine Name: **Bull Gap Mine, P-3960**
Sample I.D.: **TSS#005**
Soil Designation at Sample Point: **Montevallo-Townley Complex (MtF), 15-45% Slopes**
Sampled: **12/13/2011**
Analyzed: **2/03/2012**
Analyzed By: **Bhate Geosciences Corporation**
Sample Weight: **867.7 gm**

| Sieve No. | Sieve Opening (mm) | Weight Retained on each Sieve (gm) | Percent of Weight Retained on each Sieve | Cumulative Percent Retained | Percent Passing |
|---|---|---|---|---|---|
| 1½" | 37.50 | 0.0 | 0.0 | 0.0 | 100.0 |
| 1" | 25.00 | 0.0 | 0.0 | 0.0 | 100.0 |
| ½" | 12.50 | 6.7 | 0.8 | 0.8 | 99.2 |
| ¼" | 9.50 | 2.5 | 0.3 | 1.1 | 98.9 |
| 4 | 4.75 | 14.4 | 1.7 | 2.8 | 97.2 |
| 10 | 2.00 | 11.1 | 1.3 | 4.1 | 95.9 |
| Pan | --- | 833.0 | 95.9 | 100.0 | 0.0 |

Percentage (%) of sample that is: coarse fragments: **4.1%** soil: **95.9%**

Average size left in 1" Sieve: **0"**



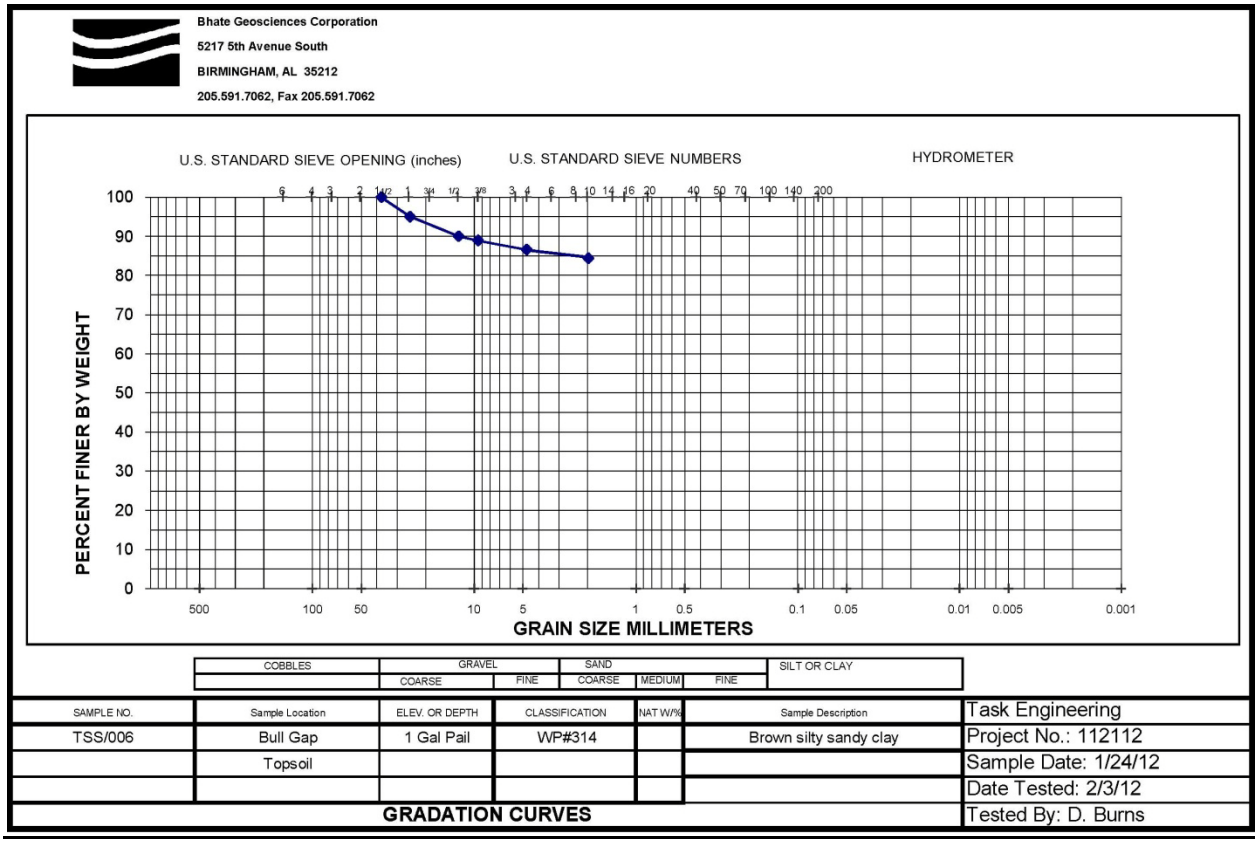
# TABLE 2 - SIEVE ANALYSIS

Company Name: **Cedar Lake Mining, Inc.**
Mine Name: **Bull Gap Mine, P-3960**
Sample I.D.: **TSS#006**
Soil Designation at Sample Point: **Montevallo-Townley Complex (MtF), 15-45% Slopes**
Sampled: **12/13/2011**
Analyzed: **2/03/2012**
Analyzed By: **Bhate Geosciences Corporation**
Sample Weight: **892.9 gm**

| Sieve No. | Sieve Opening (mm) | Weight Retained on each Sieve (gm) | Percent of Weight Retained on each Sieve | Cumulative Percent Retained | Percent Passing |
|---|---|---|---|---|---|
| 1½" | 37.50 | 0.0 | 0.0 | 0.0 | 100.0 |
| 1" | 25.00 | 44.2 | 5.0 | 5.0 | 95.0 |
| ½" | 12.50 | 45.2 | 5.1 | 10.1 | 89.9 |
| ¼" | 9.50 | 9.6 | 1.1 | 11.2 | 88.8 |
| 4 | 4.75 | 20.5 | 2.3 | 13.5 | 86.5 |
| 10 | 2.00 | 13.6 | 1.5 | 15.0 | 85.0 |
| Pan | --- | 759.8 | 85.0 | 100.0 | 0.0 |

Percentage (%) of sample that is: coarse fragments: **15.0%** soil: **85.0%**

Average size left in 1" Sieve: **1"**

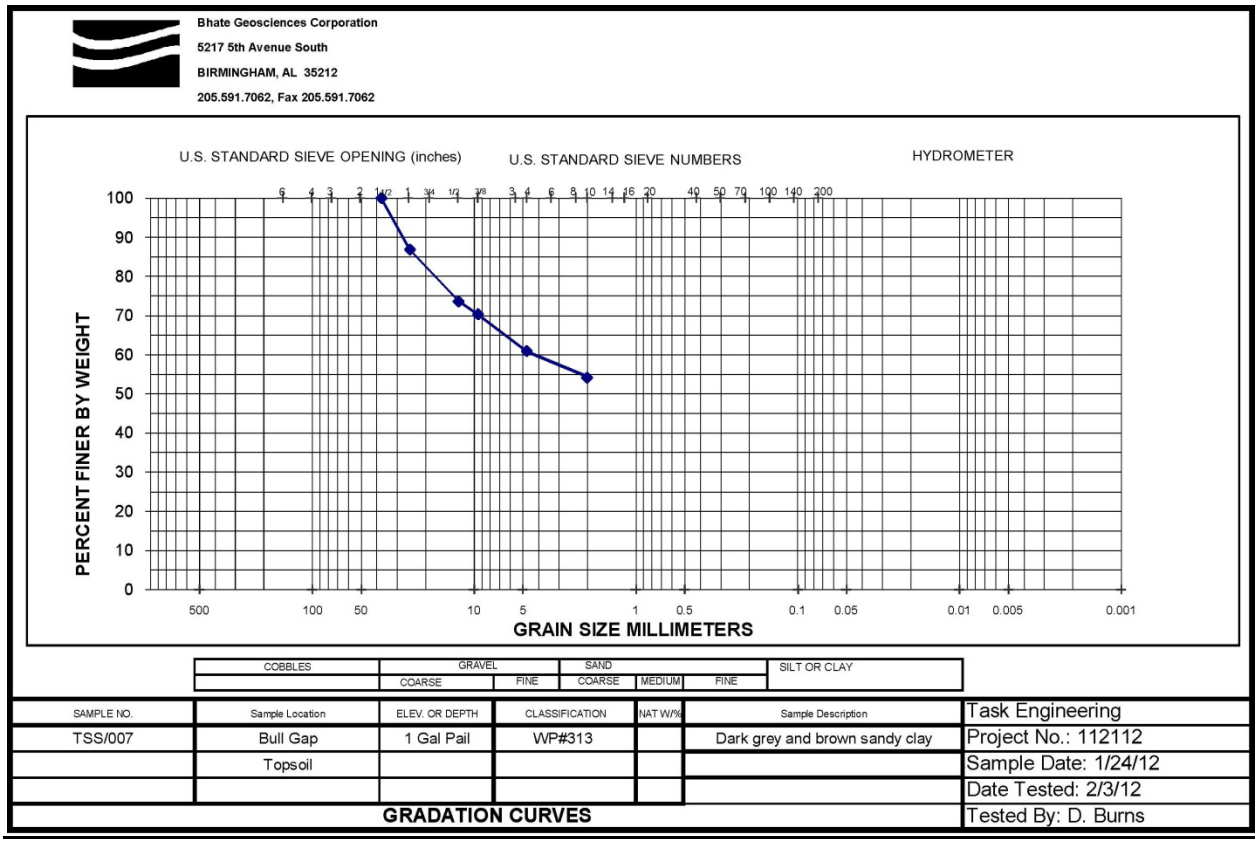


# TABLE 2 - SIEVE ANALYSIS

Company Name: **Cedar Lake Mining, Inc.**
Mine Name: **Bull Gap Mine, P-3960**
Sample I.D.: **TSS#007**
Soil Designation at Sample Point: **Previously Mined Spoils**
Sampled: **12/13/2011**
Analyzed: **2/03/2012**
Analyzed By: **Bhate Geosciences Corporation**
Sample Weight: **921.8 gm**

| Sieve No. | Sieve Opening (mm) | Weight Retained on each Sieve (gm) | Percent of Weight Retained on each Sieve | Cumulative Percent Retained | Percent Passing |
|---|---|---|---|---|---|
| 1½" | 37.50 | 0.0 | 0.0 | 0.0 | 100.0 |
| 1" | 25.00 | 121.1 | 13.1 | 13.1 | 86.9 |
| ½" | 12.50 | 121.7 | 13.2 | 26.3 | 73.7 |
| ¼" | 9.50 | 31.1 | 3.4 | 29.7 | 70.3 |
| 4 | 4.75 | 86.3 | 9.4 | 39.1 | 60.9 |
| 10 | 2.00 | 48.7 | 5.3 | 44.4 | 55.6 |
| Pan | --- | 512.9 | 55.6 | 100.0 | 0.0 |

Percentage (%) of sample that is: coarse fragments: **44.4%** soil: **55.6%**
Average size left in 1" Sieve: **1"**



## CHEMICAL ANALYSIS COMPARISONS

Examination of the physical and chemical comparison between the average of the topsoils within the permit area and the average of the overburden samples collected reveals that selected overburden at the Bull Gap Mine is more suitable as a plant growth medium than the natural topsoils present at the site. The pH of the topsoils ranged between 5.20 and 6.60 and the pH of the selected overburden samples (drill holes OB-1, OB-2, OB-3, and OB-4) ranged between 4.10 and 8.04*. The post mine land use is proposed to be Undeveloped/No Current Use.

Soil testing provided by Auburn University resulted in the following recommendations for an average addition of amendments per acre to naturally occurring topsoils:

- Limestone (LS): Zero point four three (0.43) tons/acre
- Nitrogen (N): Sixty (60) pounds/acre
- Phosphate ($P_2O_5$): 0.0 pounds/acre
- Potassium/Potash ($K_20$): Fifty-seven point one four (57.14) pounds/acre

The acid-base accounts for the natural soils are slightly negative according to the Neutralizing Potential and Maximum Potential Acidity as reported by Auburn soil testing results while the selected overburden materials as reported from overburden analysis holes (drill holes) was substantially more positive with significantly higher neutralization potential than the natural soils.

*The interval from 30' to 35' of OB-2 indicated a pH value of 12.25 but appears to be a local anomaly and/or contamination and should not be considered in this analysis

## TEXTURAL ANALYSIS COMPARISONS

Textural analyses of the topsoil samples classified all seven (7) topsoil samples as Sand by Auburn University Testing Lab. Relative percentages indicated an excess of ninety (90%) percent sand with low silt values on all samples and zero clay content on all samples. Exploratory drilling at the site indicated layers of massive sandstone immediately above the Underwood Coal seam which indicate the presence of the strata within the fourth conglomerate as discussed in the Geology section of this report and loosely cemented, coarse grained sandstones across the extent of the proposed mine site. In the areas drilled above the intact (previously non-mined) strata of the Upper Bynum and the Lower Bynum, weathered clays and sandstone occur immediately above alternating layers of shales and sandstones above the Upper Bynum seam marker. All massive sandstones and sandstone layers have random layers of shale within their intervals. Topsoil samples on both disturbed and undisturbed areas indicated pH values at 5.2 or above and is considered acidic to mildly acidic, it should also be noted that other than strata adjacent (immediately above or below) to the coal seam or the coal seam itself, low pH values were recorded in the top intervals of overburden sampling holes OB#1, OB#3, and OB#4. As shown by the thickness-weighted averages for each overburden hole (TABLE 1), the overburden at this site would produce a substantial excess of alkaline materials than the native soils and would be superior as reclamation materials.

The available water capacity for the Montevallo-Townley Complex, 15-45% slopes is 0.0400 $cm^3/cm^3$ and the available water capacity for the Palmerdale Channery Silt Loam, 4-60% slopes is 0.0500 $cm^3/cm^3$. Lower AWC values reflect the sandy clay topsoils and the weathered sandstone subsoils of the Montevallo-Townley Complex and loosely cemented coarse grained sandstone layers associated with the Pottsville formation of the upper strata layers at this site.

Topsoil, where present, at the site is thin and in several areas has basically been removed by logging and mechanical equipment operation associated with logging and past surface mining operations. Basic clearing operations in the mining process would remove most available topsoils and associated subsoils to expose the acid subsoils as denoted by overburden sampling.

As shown by the average of +877.25 tons/acre Excess $CaCO_3$ from TABLE 1, the overburden produced in mining at this site is superior to native soils for surface mine revegetation and therefore satisfies the criteria set forth in section 880-X-10C.08(5).

**TABLE 3**

**TOPSOIL VS. OVERBURDEN COMPARISON**

| | Montevallo-Townley Complex 15-45% (range) | Palmerdale Series (weathered spoils) 2-60% (range) | SELECTED OVERBURDEN OB-1, OB-2, OB-3, and OB-4 (range) |
|---|---|---|---|
| pH (low) | 5.2 | 5.7 | 4.10 |
| pH (high) | 6.6 | 6.4 | 8.04 |

**EXTRACTABLE NUTRIENTS FOR P, K, & Mg (lbs/acre)**

| | Montevallo-Townley Complex 15-45% (average) | Palmerdale Series (weathered spoils) 2-60% (average) | SELECTED OVERBURDEN OB-1, OB-2, OB-3, and OB-4 (average) |
|---|---|---|---|
| PHOSPHOROUS | 79.00 | 266.25 | N/A |
| POTASSIUM | 19.33 | 49.25 | N/A |
| MAGNESIUM | 27.00 | 73.75 | N/A |
| CALCIUM | 172.33 | 353.25 | N/A |

**RECOMMENDATIONS - LIMESTONE, N, $P_2O_5$, $K_2O$:**

| | Montevallo-Townley Complex 15-45% (average) | Palmerdale Series (weathered spoils) 2-60% (average) | SELECTED OVERBURDEN OB-1, OB-2, OB-3, and OB-4 (average) |
|---|---|---|---|
| LIMESTONE (tons/acre) | 0.67 | 0.25 | N/A |
| NITROGEN (tons/acre) | 60.0 | 60.0 | N/A |
| $P_2O_5$ (lbs/acre) | 0.0 | 0.0 | N/A |
| $K_2O$ (lbs/acre) | 73.33 | 45.0 | N/A |
| $NO_3$ - N (ppm) | 2.97 | 5.05 | N/A |

**TABLE 3**

**TOPSOIL VS. OVERBURDEN COMPARISON**
(continued)

| | Montevallo-Townley Complex 15-45% | Palmerdale Series (weathered spoils) 2-60% | SELECTED OVERBURDEN OB-1, OB-2, OB-3, and OB-4 (average) |
|---|---|---|---|
| NEUTRALIZAION POTENTIAL | 0.0 | 1.50 | +8.7013 |
| MAXIMUM POTENTIAL ACIDITY | +0.8233 | +3.2075 | +2.6133 |
| SULFUR (%) | 0.0267 | 0.1410 | 0.0661 |
| ACID-BASE ACCOUNT | -0.8233 | -1.7075 | +6.0880 |
| SAND (%) | 95.83 | 91.88 | N/A |
| SILT (%) | 4.17 | 8.13 | N/A |
| CLAY (%) | 0.0 | 0.0 | N/A |
| AVAILABLE WATER CAPACITY ($cm^3/cm^3$) | 0.0400 | 0.0500 | N/A |
| COARSE FRAGMENTS (%) | 16.9 | 26.6 | N/A |
| SOIL (%) | 83.1 | 73.4 | N/A |
| TOTAL AVAILABLE WATER CAPACITY ($cm^3/cm^3$) | 0.0435 | 0.0466 | N/A |
| SOIL ERODIBILITY FACTOR "K" | 0.30 | 0.24 | N/A |

**TABLE 4**

**TOTAL AVAILABLE WATER CAPACITY**

**Montevallo-Townley Complex (MtF) 15-45%**

**PERCENT OF SAMPLE RETAINED**

| SAMPLE I.D. | 1" | ½ " | ¼ " | >2 mm |
|---|---|---|---|---|
| TSS#003 | 4.5 | 9.1 | 2.3 | 7.1 |
| TSS#004 | 0.0 | 7.1 | 1.7 | 3.8 |
| TSS#006 | 5.0 | 5.1 | 1.1 | 3.8 |
| **AVERAGE** | **3.2** | **7.1** | **1.7** | **4.9** |

| SIEVE OPENING | PERCENT RETAINED | AWC FACTOR | AWC $cm^3/cm^3$ |
|---|---|---|---|
| 1" | 3.2 | 0.0389 | 0.0012 |
| ½" | 7.1 | 0.0492 | 0.0035 |
| ¼" | 1.7 | 0.0603 | 0.0010 |
| >2 mm | 4.9 | 0.1149 | 0.0056 |
| **TOTAL** | | | **0.0113** |

< 2 mm average from Table 1: 83.13%
> 2 mm average from Table 1: 16.87%

Average available water capacity of < 2 mm from Auburn Data = 0.0500 $cm^3/cm^3$

83.13% X 0.0500 $cm^3/cm^3$ = 0.0416 $cm^3/cm^3$
16.87% X 0.0113 $cm^3/cm^3$ = 0.0019 $cm^3/cm^3$

TOTAL = 0.0435 $cm^3/cm^3$

Average Total Available Water Capacity for the Native Soils = 0.0435 $cm^3/cm^3$

*Available water capacity values were obtained from "A Method of Comparing Soil Materials for Plant Available Water" supplied by the Alabama Surface Mining Commission.

**TABLE 4**

**TOTAL AVAILABLE WATER CAPACITY**

**Palmerdale Series (Pr) 2-60%**

**PERCENT OF SAMPLE RETAINED**

| SAMPLE I.D. | 1" | ½ " | ¼ " | >2 mm |
|---|---|---|---|---|
| TSS#001 | 12.8 | 10.0 | 3.9 | 15.0 |
| TSS#002 | 0.0 | 6.5 | 1.9 | 7.8 |
| TSS#005 | 0.0 | 0.8 | 0.3 | 3.0 |
| TSS#007 | 13.1 | 13.2 | 3.4 | 14.7 |
| **AVERAGE** | **6.5** | **7.7** | **2.4** | **13.5** |

| SIEVE OPENING | PERCENT RETAINED | AWC FACTOR | AWC $cm^3/cm^3$ |
|---|---|---|---|
| 1" | 6.5 | 0.0389 | 0.0025 |
| ½" | 7.7 | 0.0492 | 0.0038 |
| ¼" | 2.4 | 0.0603 | 0.0014 |
| >2 mm | 13.5 | 0.1149 | 0.0155 |
| **TOTAL** | | | **0.0232** |

< 2 mm average from Table 1: 73.40%
> 2 mm average from Table 1: 26.60%

Average available water capacity of < 2 mm from Auburn Data = 0.0550 $cm^3/cm^3$

73.40% X 0.0550 $cm^3/cm^3$ = 0.0404 $cm^3/cm^3$
26.60% X 0.0232 $cm^3/cm^3$ = 0.0062 $cm^3/cm^3$

TOTAL = 0.0466 $cm^3/cm^3$

Average Total Available Water Capacity for the Native Soils = 0.0466 $cm^3/cm^3$

*Available water capacity values were obtained from "A Method of Comparing Soil Materials for Plant Available Water" supplied by the Alabama Surface Mining Commission.

## CONCLUSION

The pH of the native topsoil is relatively equal to the overburden materials as shown by the overburden sample holes with the exception of the top five (5') feet of the geologic column. The average acid-base account of the selected overburden (drill holes OB#1, OB#2, OB#3, and OB#4) was +6.0880 while the native topsoils, Montevall0-Townley Complex has an average acid-base account of -0.8233 and Palmerdale Series has an average acid-base account of -1.7075. Low pH values occur within the top five (5') feet of the existing soils, which could cause acidic conditions which would be detrimental to successful reclamation operations if not blended with other overburden materials at the site.

As shown in this study the overburden material at the Bull Gap Mine site is more suitable for sustaining revegetation and is the best to support reclamation operations and therefore satisfies the criteria set forth in section 880-X-10C.08-(5).

## OVERBURDEN RESTABILIZATION PLAN

All overburden shall be backfilled, compacted, and graded so that the post mining slope shall approximate the pre-mining slope (See Attachment IV-B-3) and in a timely manner (See Part IV-B-2). Overburden will be rough graded with Caterpillar type dozers. Once rough grading has been completed, a farm-type tractor will be used to disc the overburden to its final contour, decrease compaction, and increase the mechanical breakage of the surface layer. If any rocks +24 inches in diameter remain on the surface, they will be collected and buried. All slopes too steep to operate farm equipment on will use the following criteria to evaluate the textural quality of the graded overburden:

A) Rocks of size larger than ten (10") inches shall not exceed 10% by weight of the substitute material, and no rocks larger than twenty four (24) inches can be included in the substitute material.

B) Rock between three (3") inches and ten (10") inches in size shall not exceed 15% by weight of the topsoil substitute material.

C) The substitute material shall not contain more than 50% by weight of materials between three (3") inches and three quarters (¾") inches in size.

D) The substitute material shall contain at least 30% by weight of material less than two (2mm) millimeters in size.

Sampling frequency shall be one (1) sample per twenty (20) acres. Overburden sampling will follow the guidelines as described in the "SAMPLING TECHNIQUES" section of this report.

Based on the sieve analysis shown in Table 2 the overburden material meets the grading requirements for a Topsoil Variance. The final texture samples will be sent to the Auburn University Soil Laboratory where the following tests will be conducted: percent (%) sand, silt, and clay; textural classification; pH, percent (%) sulfur; fertility ratings for phosphorus, potassium, and magnesium; and amendment recommendations for limestone, nitrogen, phosphorus, and potassium. An acid-base account will be calculated from the sulfur and neutralization potential readings. Results of these analyses will be used to determine the amount of soil amendments, if any, to be applied to the plant medium. All results of analyses will be submitted to the Regulatory Authority for review. Any acid-forming materials encountered will be covered with four (4) feet of non-toxic, non-acid forming material.

**AUBURN SOIL TESTING LAB**

**SOIL TEST - MINE ANALYSIS REPORT**

**LABORATORY TEST RESULTS**