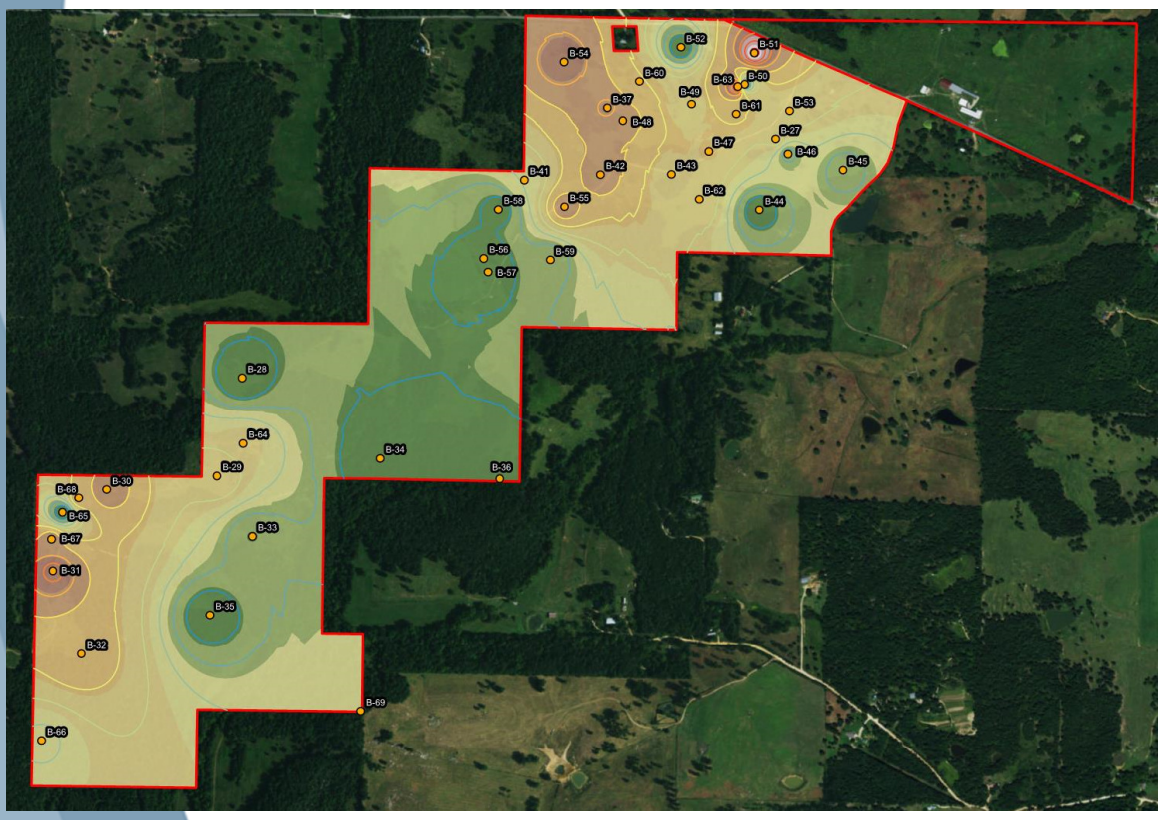
SELECT SANDS CORPORATION
STANDARDS OF DISCLOSURE FOR MINERAL PROJECTS WITHIN CANADA
NI 43-101 TECHNICAL REPORT
SELECT SANDS CORPORATION BELL PROPERTY, SHARP COUNTY, AR

Project No. 20173931.001A | JAX17R57119



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A Report Prepared for:

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APRIL 20, 2017

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1 EXECUTIVE SUMMARY

This Technical Report summarizes exploration drilling programs conducted on the Select Sands Corporation Property (Property) in southwest Sharp County, northeast Arkansas (AR) and presents a resource estimate based upon the wire-line core drilling programs conducted in 2011, 2012 and 2014 and associated drilling information, sampling, mapping and laboratory analyses.

1.1 Property Description

The center of the Property is located at about 35°57'12'' N, 91°37'33'' W, approximately five (5) miles west of Cave City, AR and the northern portion of the Property can be accessed via West Center Street from Cave City. Ash Flat is the county seat of Sharp County, AR and Cave City is located approximately 20 miles south of Ash Flat via US Highway 167 (**Figure 1 – Property Location Map**). The Property is a single tract comprised of 457 acres.

1.2 Land Tenure

The Property is owned by American Select Corp (a Delaware-based US company), which is a subsidiary of Select Sands Corporation. The Property is located in Sections 10, 11, 15 and 16, Township 15 North, Range 6 West. The total area of the Property is 457 acres (**Figure 2 – Property Boundary on Topographic Map and Figure 3 – Property Boundary on Aerial Photograph**). The Quit Claim Deed for the purchase of the Property by American Select Corp. is included in **Appendix 1.**

1.3 Geology and Mineralization

The Property lies within the Salem Plateau of the Ozark Plateaus of the Interior Highlands Region of AR. Rocks in the Salem Plateau are primarily Ordovician-aged dolostones, sandstones and limestones. The Property is underlain primarily the Joachim Dolomite, St. Peter Sandstone and Everton Formation, which are Champlainian Series, Chazyan Stage, Ordovician Period-aged sandstone and dolomite/limestone.

“The Joachim Dolomite Formation is a middle Ordovician-aged, chiefly fine-grained dolostone or dolomitic limestone with thin beds of shale. Some thin sandstones occur near its base and some of the carbonates are sandy in places. Supratidal deposits are frequent and display mud cracks, Calcite pseudomorphic after halite hopper crystals and laminated horizons. A few bivalves have been collected from the lower part of the formation. The Joachim Dolomite rests conformably on the St. Peter Sandstone and appears to occur in areas of highest elevation on the Property.”

“The middle Ordovician-aged St Peter Sandstone is generally a massive bedded, medium- to fine-grained, well- rounded, friable, white sandstone. A few minor beds of shale, limestone, and/or dolostones have been noted in places. The cement is commonly calcite often with single crystals incorporating hundreds to thousands of sand grains. The unit is a frequent bluff-former. Crossbedding and ripple marks are rare. No fossils are known from the formation in Arkansas, but a few trace fossils have been reported. The base of the St. Peter Sandstone is unconformable, often with several feet of relief. The formation ranges from a feather edge to as

much as 175 feet in thickness."

"The Everton Formation shows considerable differences in lithologic character from one place to another. It is composed of various mixtures of dolostone, sandstone and limestone. The formation also has trace of conglomerate, shale and chert in limited areas. The limestones are light-grey to brownish-grey and are generally more or less dolomitic and sandy. The Everton has thick members of friable, sandstone dominating local sections in the different regions. These sands tend to be made of white, well rounded, frosted, medium-sized grains and are almost indistinguishable from the overlying St Peter Sandstone when observed out of context. It is not unusual for one lithology to grade into another along the bedding. Bedding throughout this unit is thin to massive. Fossils are not common in the Everton. The lower contact is unconformable and other disconformities occur within this formation. The thickness of the Everton ranges from about 300 feet to as much 650 feet." (**McFarland 1998 and Figure 4**).

Based on the descriptions of the St. Peter Sandstone and Everton Formation above, this report will not attempt to differentiate between the two lithologies. The sandstone, where present in drill holes, ranges from 1 foot to a maximum thickness of 108 feet on the Property.

The Ozark Plateau Region is characterized by slightly southward-dipping Pennsylvanian and Ordovician-aged sandstone, limestone and dolostone.

1.4 Exploration

This Technical Report presents the results of all exploration drilling and mapping conducted on the Property to date. Forty (40) NQ diameter core holes have been drilled on the Property in three (3) separate drilling programs (October 2011, November 2012 and March/April 2014). The 2011 and 2012 drilling programs were conducted by representatives of what now is American Silica, LLC (Tommy Bronson – **Table 1 - Drill Hole Data Summary, American Silica, LLC**) and in 2014 by National Silica, LLC (**Table 2 - Drill Hole Data, National Silica, LLC**). Creative Environmental Solutions, Inc. (Jesse DelaMater – Geologist) logged the cores holes for all drilling campaigns. Six (6) of the cores did not intersect the St Peter Sandstone and the remaining 34 cores identified sandstone thicknesses between 1 foot and 103 feet (**Figure 5 – Drill Hole Locations on Topographic Map and Figure 6 - Drill Hole Locations on Aerial Photograph**). Drill logs from cores B-63 to B-69 are not available, but summary data of these cores were recorded in a previous mapping exercise.

1.5 Sand Quality

The limited core samples collected in 2011, 2012 and 2014 confirm the presence of St. Peter Sandstone on the Property. Stim-Lab, Inc. issued six separate reports for sieve analysis of core intervals and screened products and product quality parameters. The reports are titled "Measurement of Properties for Proppants Used in Hydraulic Fracturing and Gravel Packing Operations", with specific samples and dates and are identified as follows:

- “Measurement of Properties for Proppants Used In Hydraulic Fracturing and Gravel-Packing Operations” Evaluations on Sample Labeled FSR B-29 0’-10’ For Creative Environmental Solutions, Inc. Submitted December 8, 2011
- “Measurement of Properties for Proppants Used In Hydraulic Fracturing and Gravel-Packing Operations” Evaluations on Sample Labeled FSR B-30 26’-36’ For Creative Environmental Solutions, Inc. Submitted December 8, 2011
- “Measurement of Properties for Proppants Used In Hydraulic Fracturing and Gravel-Packing Operations” Evaluations on Sample Labeled FSR B-31 26’-36’ For Creative Environmental Solutions, Inc. Submitted December 8, 2011
- “Measurement of Properties for Proppants Used In Hydraulic Fracturing and Gravel-Packing Operations” Evaluations on Six Composite Sand Samples For Creative Environmental Solutions, Submitted February 6, 2012
- “Measurement of Properties for Proppants Used In Hydraulic Fracturing and Gravel-Packing Operations” Evaluations on Four Composite Samples For Creative Environmental Solutions, Submitted March 1, 2013
- "Measurement of Properties for Proppants Used In Hydraulic Fracturing and Gravel-Packing Operations" Evaluations on Three Samples Labeled NS 30/50, NS 40/70 and NS 100 Mesh For National Silica, LLC - Submitted May 2, 2014

Samples were tested for the following ISO 13503-2/API RP19C Standards:

- Samples Tested in accordance with ISO 13503-2/API RP19C Standards
- ISO 13503-2:2006/API RP19C:2008, Section 6, “Sieve Analysis”
- ISO 13503-2:2006/API RP19C:2008, Section 7, "Proppant Sphericity and Roundness"
- ISO 13503-2:2006/API RP19C:2008, Section 8, "Acid Solubility"
- ISO 13503-2:2006/API RP19C:2008, Section 9, "Turbidity Test"
- ISO 13503-2:2006/API RP19C:2008, Section 10, "Procedure for Determining Proppant Bulk Density"
- ISO 13503-2:2006/API RP19C:2008, Section 11, "Proppant Crush-Resistance Test"

The individual reports are included in **Appendix 2**.

Summaries of Core Intervals and Product Sieve Analyses are included in **Table 3** and **Table 4**, respectively. **Table 5** includes Composite Sample Product Quality Test Result Summary, while **Table 6** is comprised of Core Samples Interval Product Quality Test Result Summary.

The Stim-Lab Reports indicate that samples met or exceeded ISO 13503-2:22006/API RP19C:2008 standards for sphericity and roundness (Krumbein Shape Factor), acid solubility and turbidity.

1.6 Mineral Resource Estimates

The in-situ, Inferred Mineral Resource for the Select Sands Corporation Property are summarized in **Table 6** below. These areas are outlined in the sandstone thickness (Isopach) map in **Figure 7**. Assumptions and methodology for the mineral resource estimate are provided in Section 14.

TABLE 6

Inferred Mineral Resource Estimate – Select Sands Corporation, Sharp County, AR Property

Domain	Acres	Average Thickness (ft)	Specific Gravity	Inferred Mineral Resource Tons
A (NE)	145	52.8	2.24	27,667,763
B (SW)	135	45.0	2.24	21,954,240
Total Inferred Mineral Resource Tons				**49,622,003**

1.7 Conclusions and Recommendations

The Inferred Mineral Resources occur in two (2) domains on the Property that are severed by Sullivan Creek: Domain A, northeast of Sullivan Creek; and Domain B, southwest of the creek. These domains occur in ridges or areas of highest elevation on the Property (**Figure 7**). The Inferred Mineral Resource for Domain A is 27.67 million tons and for Domain B is 21.95 million for a total Inferred Mineral Resource of 49.62 million tons. The sandstone deposit does not appear to occur at lower elevations where the creek has eroded through the sandstone.

It is apparent, based on limited sample analysis, that the sandstone can produce proppant quality sand products based on ISO 13503-2:22006API RP19C:2008 standards.

In order to increase the confidence in the sandstone resources/deposit(s) on the property it is recommended to conduct additional exploration drilling to define the extent of the sandstone in the domains and ascertain why adjacent core holes show presence/absence of sandstone.

Additional quality testing of sandstone samples is recommended.

If the results from the additional exploration drilling are successful, it is recommended to conduct a close-spaced developmental drilling program on the Property.

2 INTRODUCTION

Kleinfelder, Inc. (Kleinfelder) has been retained by Select Sands Corporation to prepare a Technical Report on the Bell Property, Sharp County, AR (Property), located near Cave City, AR, US (**Figure 1**). The report was commissioned by Select Sands Corporation to comply with regulatory disclosure and reporting requirements outlined in Canadian National Instrument 43-101, Standards for Disclosure of Mineral Projects ("NI 43-101"), companion policy NI 43-101CP, and Form 43-101F ("Technical Reports").

Elliott A Mallard, P.G. is the Qualified Person responsible for preparing this Technical Report on the Property.

The purpose of this report is to review exploration on the Property carried out in 2011, 2012, and 2014 and present a mineral resource estimate based upon drilling completed to date. Information,

conclusions, and recommendations contained in this report are based on field observations and drilling data, as well as published and unpublished data (see Section 27: References). Mr. Mallard visited the Property on April 13, 2017

3 RELIANCE ON OTHER EXPRERTS

This report has been prepared by Elliott A Mallard, P.G., Mining Program Manager for Kleinfelder, Inc., for Select Sands Corporation. The information, conclusions, opinions, and estimates contained herein are based on:

Information available to the author at the time of report preparation, assumptions, conditions, and qualifications as set forth in this report.

Data, reports, and other information supplied by Creative Environmental Solutions, Inc., representatives of American Silica, LLC and National Silica, LLC or available in the public domain.

The author has relied upon the professional quality of the historical work reported in previous drilling programs and subsequent studies. The author has no reason to believe the information used in the preparation of this report is false or purposefully misleading and has relied on the accuracy and integrity of the data referenced in Section 27 of this report.

4 PROPERTY DESCRIPTION AND LOCATION

4.1 Location

The center of the Property is located at about 35°57'12'' N, 91°37'33'' W, approximately five (5) miles west of Cave City, AR and the northern portion of the Property can be accessed via West Center Street from Cave City. Ash Flat is the county seat of Sharp County, AR and Cave City is located approximately 20 miles south of Ash Flat via Highway 58 (**Figure 1**). The Property is a single tract comprised of 457 acres.

4.2 Environmental Liabilities

The authors are not aware of any environmental liabilities associated with the Property; however; recommend a Phase 1 Environmental Site Assessment.

4.3 Required Permits

An “Exploration Permit” is not required for drilling in AR. Sand Mining is regulated by the AR Department of Environmental Quality (AR DEQ), Surface Mining and Reclamation Division. The category of mining permit for open pit sand mining in AR is Non-Coal Mining (Open-Cut Mining). **Appendix 3** is AR Pollution Control and Ecology Commission, Regulation No. 15, AR Open-Cut Mining and Land Reclamation. Other permits required for mining in AR are Air (based on Particulate Matter (PM), CO, NOx, VOC or SO2) and Water (NPDES and Stormwater). Based on mining plans and equipment utilized, additional state or federal permits may be required. The current or future operations of Select Sands Corporation, including development and

commencement of production activities on this property may require other permits governed by laws and regulations pertaining to development, mining, production, taxes, labor standards, occupational health, waste disposal, toxic substances, land use, environmental protection, mine safety and other matters, may be required as the Project progresses.

4.4 Other Significant Factors and Risks

There are no other significant factors and risks known at this time.

5 ACCESSIBILITY, CLIMATE, LOCAL, RESOURCES, INFRASTRUCTURE AND PHYSIOGRAPHY

5.1 Topography, Elevation, and Vegetation

The Property is situated within the Salem Plateau of the Ozark Plateaus of the Interior Highlands Region of AR. Generally, the terrain can be characterized as hilly, with two hills in the northeast and southwest portions of the Property, rising about 160 feet above the floodplain of Sullivan Creek (**Figure 2**). The hills or ridges in the northeast and southwest areas of the Property have outcrops (exposures at surface) of St Peter Sandstone. Sullivan Creek bisects the Property and flows north to south through the Property. Topography on the Property ranges from approximately 495 feet to slightly above 660 feet. Land Use on the Property is a mix between woodlands, improved pasture and agricultural fields (**Figure 3**). Vegetation on the Property is dominated by grass in improved pastures and oak, maples, hickory and pine in woodlands.

5.2 Infrastructure and Local Resources

The Property is located approximately 5 miles west of Cave City, AR, about 20 miles south of Ash Flat, AR, which is the county seat of Sharp County, AR. The Property can be accessed by driving west/northwest on West Center Street from Cave City and by driving south on US Highway 167 (20 miles) from Ash Flat and north from Batesville, AR approximately 13 miles on US Highway 167. The northern boundary of the Property is West Center Street, which a two lane, paved road. Transport to and from the Property is by can be by light vehicle, but access within the site is on unpaved roads and trails and a four wheel drive (4WD) vehicle is recommended. Three-phase power is accessible in the northern portion of Property.

The Property is located about 45 miles west of the Burlington Northern Santa Fe Railway line.

Cave City, the closest community, with a population of 1,904 (2010 census) is located about 5 miles east of the Property. It hosts a select few accommodations, food, fuel and other necessary services. Major employers are the local school district, WalMart, the healthcare industry, banks and restaurants. Other communities near to the Property include Ash Flat (population 1,082 (2010 census)), about 20 miles to the north along US Highway 167, and Batesville (population. 10,248 (2010 census)), about 13 miles to the south.

There are four (4) operating proppant sand mines operating in the local area: 1) Select Sands Corporation's Sandtown Mine located two miles southeast of the Property; 2) Bluebird Sand, LLC,

which is located near Melbourne, AR in adjacent Izard County about nine (9) miles west/northwest of the Property; 3) American Silica, LLC East Cave City Quarry, located approximately seven (7) east/southeast of Cave City; and 4) the Unimin Guion, AR operation located approximately 20 miles west of the Property. The Select Sand Corporation Sandtown Quarry has operated since 2016. The Bluebird sand mine has been in operation since 2010, while American Silica commenced in 2016. Historically, sand has been mined near Guion, AR for approximately 100 years.

There is no existing mine infrastructure on the Property.

5.3 Climate

The climate of the region is classified as humid subtropical, characterized by cold winters and hot summers. Daily temperatures range from a mean maximum of 93.6ºF (August) to a mean minimum of 26.4ºF (January), with a mean daily temperature of 59.5ºF. Extreme temperatures range from a maximum of 80.5ºF in August to a minimum of minus 38ºF in January. The average annual rainfall is 49.8 inches, with average peak rainfall in April of 6.22 inches and annual low rainfall of 1.58 inches in June. The area receives snow in January, February, March and December for a total annual average of 18 inches.

6 HISTORY

The Property was originally explored by representatives of American Silica, LLC in 2011 and 2012. The Property was acquired by National Silica, LLC, a Delaware LLC, in 2014.

6.1 Prior Ownership

National Silica, LLC acquired the Property in 2014 for the purposes of producing a proppant-grade sand products.

6.2 Previous Exploration and Development

Forty (40) NQ diameter core holes have been drilled on the Property in three (3) separate drilling programs: 1) October 2011; 2) November 2012; and 3) March/April 2014. The 2011 and 2012 drilling programs were conducted by representatives of what now is American Silica, LLC (Tommy Bronson) and consisted of 15 cores (**Table 1**). The 2014 drilling by National Silica, LLC entailed 25 cores drilled on the Property (**Table 2**). Creative Environmental Solutions (Jesse DelaMater – Geologist) logged the core holes for all drilling campaigns. Drill logs of cores on the Property are included in **Appendix 4**.

6.3 Production

To the knowledge of the author, no production has taken place on the Select Sand Corporation's Property.

7 GEOLOGICAL SETTING AND MINERALIZATION

7.1 Regional Geology

The Property lies within the Salem Plateau of the Ozark Plateaus of the Interior Highlands Region of AR. Rocks in the Salem Plateau are primarily Ordovician-aged dolostones, sandstones and limestones. The Property is underlain primarily the St. Peter Sandstone and Everton Formation, which are Champlainian Series, Chazyan Stage, Ordovician Period-aged sandstone and dolomite. **Figure 4** shows the stratigraphy of AR complied in Information Circular 36, Stratigraphic Summary of AR, by the AR Geological Commission. The St Peter Sandstone and Everton Formations are highlighted in **Figure 4**.

7.2 Property Geology

The sandstone deposits on the Property lie with the St Peter Sandstone, which is middle Ordovician-aged. Sullivan Creek appears to have eroded through the sandstone in the middle portion of the Property. The hills/ridges located in the northeast and southwest areas of the Property contain outcrops of St Peter Sandstone. The St Peter Sandstone is absent in the lower elevation areas. The Everton Formation is exposed at surface in lower elevations, especially along Sullivan Creek.

7.3 Stratigraphy

The Property is underlain primarily the St. Peter Sandstone and Everton Formation, which are Champlainian Series, Chazyan Stage, Ordovician Period-aged sandstone and dolomite (**Figure 4**).

The middle Ordovician-aged St Peter Sandstone is generally a massive bedded, medium- to fine-grained, well- rounded, friable, white sandstone. A few minor beds of shale, limestone, and/or dolostones have been noted in places. The cement is commonly calcite often with single crystals incorporating hundreds to thousands of sand grains. The unit is a frequent bluff-former. Crossbedding and ripple marks are rare. No fossils are known from the formation in Arkansas, but a few trace fossils have been reported. The base of the St. Peter Sandstone is unconformable, often with several feet of relief. The formation ranges from a feather edge to as much as 175 feet in thickness.

The Everton Formation shows considerable differences in lithologic character from one place to another. It is composed of various mixtures of dolostone, sandstone and limestone. The formation also has trace of conglomerate, shale and chert in limited areas. The limestones are light-grey to brownish-grey and are generally more or less dolomitic and sandy. The Everton has thick members of friable, sandstone dominating local sections in the different regions. These sands tend to be made of white, well rounded, frosted, medium-sized grains and are almost indistinguishable from the overlying St Peter Sandstone when observed out of context. It is not unusual for one lithology to grade into another along the bedding. Bedding throughout this unit is thin to massive. Fossils are not common in the Everton. The lower contact is unconformable and

other disconformities occur within this formation. The thickness of the Everton ranges from about 300 feet to as much 650 feet.

The St Peter is exposed at surface in higher elevations on the Property, while the Everton Formation outcrops at lower elevation and along Sullivan Creek. The St Peter Sandstone, where present in drill holes, ranges from 1 foot to a maximum thickness of 108 feet on the Property.

7.4 Structural Geology

The Salem Plateau of the Ozark Plateaus of the Interior Highlands Region of AR is characterized by slightly southward-dipping Pennsylvanian and Ordovician-aged sandstone, limestone and dolostone.

7.5 Mineralized Zones

The St. Peter Sandstone occurs in two domains: 1) Domain A, northeast of Sullivan Creek; and 2) Domain B, southwest of the creek (**Figure 7**). These domains occur in ridges or areas of highest elevation on the Property and are considered to be the "Mineralized Zone" on the Property. The sandstone ranges, where present, from 1 foot to 108 feet in thickness on the Property.

8 DEPOSIT TYPE

The deposit type is a thin to massive-bedded sandstone deposit, where it exists, within the Ordovician-aged St Peter Sandstone, where the sand is comprised of proppant-grade material/products.

9 EXPLORATION

This technical report presents results of exploration conducted by representatives of what now is American Silica, LLC (Tommy Bronson) in 2011 and 2012 and by National Silica, LLC in 2014. Forty (40) NQ diameter core holes have been drilled on the Property in three (3) separate drilling programs: 1) October 2011; 2) November 2012; and 3) March/April 2014. The 2011 and 2012 drilling programs consisted of 15 cores (**Table 1**). The 2014 entailed 25 cores drilled on the Property (**Table 2**). Creative Environmental Solutions (Jesse DelaMater – Geologist) logged the core holes for all drilling campaigns. Locations of drill holes are shown in **Figure 5 – Drill Hole Locations on Topographic Map and Figure 6 – Drill Hole Locations on Aerial Photograph**. Core drill/lithologic logs are included in **Appendix 4**.

The site visit by the author is described in Section 12. Details of the historic exploration programs on the Property are presented in Sections 6.

9.1 Mapping

Drill hole data summarizing overburden and sandstone thickness from the 2011, 2012 and 2014 drilling programs are presented in **Table 1 and 2.** These datasets were utilized to generate isopach maps of sandstone (**Figure 7**) and overburden (**Figure 8**). Inferred Mineral Resource Domains A

and B are identified in **Figure 7**. **Figure 9** details the Geologic Cross-Section Plan View, while **Figure 10** shows the Geologic Cross-Section of the Property.

10 DRILLING

Forty (40) NQ diameter core holes have been drilled on the Property in three (3) separate drilling programs (October 2011, November 2012 and March/April 2014). The 2011 and 2012 drilling programs were conducted by representatives of what now is American Silica, LLC (Tommy Bronson) and in 2014 by National Silica, LLC. Creative Environmental Solutions (Jesse DelaMater – Geologist) logged the cores holes for all drilling campaigns. Six (6) of the cores did not intersect the St Peter Sandstone and the remaining 34 cores identified sandstone thicknesses between 1 foot and 108 feet (**Table 1**).

11 SAMPLE PREPARATION, ANALYSES, AND SECURITY

11.1 Conventional Drill Sampling

The author is not aware of any conventional drilling conducted on the Property.

11.2 Core Sampling

Cores were removed from the core barrel in nominal 5 feet lengths for logging by the site geologist, Jesse DelaMater of Creative Environmental Solutions, Inc. Core intervals were logged and placed into plastic core boxes bags with drill hole identification and sample intervals marked. The site geologist transported core boxes from the Property for subsequent laboratory testing.

11.3 Petrograhic Samples

The author is not aware of any petrographic analysis of samples from the Property.

11.4 Laboratory Sample Preparation and Analysis

Stim-Lab, Inc. issued a report titled “Measurement of Properties for Proppants Used in Hydraulic Fracturing and Gravel packing Operations” Evaluations on Three Samples Labeled NS 30/50, NS 40/70 and NS 100 Mesh for National Silica, LLC – Submitted May 2, 2014” (Appendix 1). Samples were evaluated utilizing ISO 13503-2:22006API RP19C:2008 on three sieved samples: 1) NS 30/50; 2) NS 40/70; and 3) NS 100. Sieve analysis, sphericity and roundness (Krumbein Shape Factor), acid solubility, turbidity, bulk density, apparent density and crush tests (6,000, 7,000 and 8,000 psi) were performed on the three (3) samples. The Stim-Lab Report indicate that samples met or exceeded ISO 13503-2:22006API RP19C:2008 standards for sphericity and roundness (Krumbein Shape Factor), acid solubility and turbidity.

11.5 Quality Control and Quality Assurance

As detailed in a previous section, original logs and analytical data were not always available.

12 DATA VERIFICATION

Author Elliott A Mallard, P.G. visited the Property on April 13, 2017 and he reviewed geology and stratigraphy.

Historical data including drill hole/lithologic logs, mapping, location data and sandstone intervals were reviewed and verified for consistency in 2014, and re-evaluated in 2017. As mentioned in a previous section, certain drill hole/lithologic logs and analytical data were not available. The author has relied on the professional quality of the historic work. The author has concluded that work completed by Creative Environmental Solutions, Inc., representatives of American Silica, LLC (Tommy Bronson) and National Silica, LLC were completed in a professional manner that was consistent with the data collection and reporting standards of the time, and can be incorporated in interpretation for modeling purposes. The author acknowledges some uncertainty, especially relating to formation identification. Reliance on sandstone identification and thickness was based on the assumption of employment of best practices on the part of geological professionals representing the companies.

13 MINERAL PROCESSING AND METALLURGICAL TESTING

There has been no mineral processing or metallurgical testing performed on sandstone from the Property at this stage of exploration.

14 MINERAL RESOURCE ESTIMATES

Mineral resource estimates for the Select Sands Corporation Property in this report are based on historical drilling data from the 2011, 2012 and 2014 programs. The mineral resources for the Property are classified per the Canadian Institute of Mining, Metallurgy and Petroleum (CIM), CIM Definition Standards – For Mineral Resources and Mineral Reserves (**Appendix 5**). The CIM Definition Standards provides the following for a Mineral Resource: “A Mineral Resource is a concentration or occurrence of solid material of economic interest in or on the earth’s crust in such form, grade or quantity and quantity that there are reasonable prospects for eventual economic extraction. The location, quantity, grade or quality, continuity and other geological characteristics of a Mineral Resource are known, estimated or interpreted from specific geological evidence and knowledge, including sampling.” Furthermore the CIM Definition Standards states: “An Inferred Mineral Resource is that part of a Mineral Resource for which quantity and grade or quality are estimated on the basis of limited geological evidence and sampling. Geological evidence is sufficient to imply but not verify geological and grade or quality continuity. An Inferred Mineral Resource has a lower level of confidence than that applying to an Indicated Mineral Resource and must not be converted to a Mineral Reserve. It is reasonable expected that the majority of Inferred Mineral Resources could be upgraded to Indicated Mineral Resources with continued exploration.”

14.1 Mineral Resource Estimate Assumptions

Drill holes with less than 10 feet of sandstone were removed from the mineral resource estimate calculations.

Based on the sandstone isopach map (**Figure 7**), acreages were determined for Domains A and B.

Drill holes contained in Domains A and B were used to calculate an average thickness of sandstone for Domains A and B.

A conservative specific gravity of 2.24 (bulk density of 140 lbs per cubic foot) was utilized for mineral resources calculations.

14.2 Inferred Mineral Resource Estimate

Utilizing the assumptions listed in section 14.1 above and the CIM Definition Standards – For Mineral Resources and Mineral Reserves the mineral resources on the Property are classified as "Inferred Mineral Resources". The Inferred Mineral Resource Estimate for Domain A is 27.67 million short tons and Domain B is 21.95 million short tons for a Total Inferred Mineral Resource Estimate of 49.62 million tons (**Table 3**).

15 MINERAL RESERVE ESTIMATES

There are no mineral reserves, as defined by NI 43-101 criteria, on the Property at this time.

16 MINING METHODS

Given the stage of exploration on the Property, mining methods have not yet been considered.

17 RECOVERY METHODS

Given the stage of exploration on the Property, recovery methods have not yet been considered.

18 PROJECT INFRASTRUCTURE

Given the stage of exploration on the Property, project infrastructure requirements have not yet been considered.

19 MARKETING STUDIES AND CONTRACTS

Given the stage of exploration on the Property, marketing studies and contracts have not been considered.

20 ENVIRONMENTAL STUDIES, PERMITTING AND SOCIAL OR COMMUNITY IMPACT

Given the stage of exploration on the property, environmental studies, permitting and social or community impact have not yet been evaluated or considered.

21 CAPITAL AND OPERATING COST

Given the stage of exploration on the Property, capital and operating cost have not been

evaluated or considered.

22 ECONOMIC ANALYSIS

Given the stage of exploration on the Property, an economic analysis has not been conducted.

23 ADJACENT PROPERTIES

There are four (4) operating proppant sand mines operating in the local area: 1) Select Sands Corporation Sandtown Quarry located about two (2) miles southeast of the Property; 2) Bluebird Sand, LLC, which is located near Melbourne, AR in adjacent Izard County about nine (9) miles west/northwest of the Property; 3) American Silica, LLC East Cave City Quarry, located approximately seven (7) east/southeast of Cave City; and 4) Unimin Guion operation is located about 18 miles west of the Property. Select Sands Corporation Sandtown Quarry has been operating since 2016. The Bluebird Sand Mine has been in operation since 2010, while American Silica commenced in 2016. Historically, sand has been mined near Guion, AR for approximately 100 years.

24 OTHER RELEVANT DATA AND INFORMATION

The authors are unaware of any other relevant information.

25 INTERPRETATION AND CONCLUSIONS

The Inferred Mineral Resources occur in two (2) domains on the Property that are severed by Sullivan Creek: Domain A, northeast of Sullivan Creek; and Domain B, southwest of the creek. These domains occur in ridges or areas of highest elevation on the Property (**Figure 7**). The Inferred Mineral Resource for Domain A is 27.67 million tons and for Domain B is 21.95 million for a total Inferred Mineral Resource of 49.62 million tons. The sandstone deposit does not appear to occur at lower elevations where the creek has eroded through the sandstone (**Figure 10**).

It is apparent, based on limited sample analysis, that the sandstone can produce proppant quality sand products based on ISO 13503-2:22006API RP19C:2008 standards.

26 RECOMMENDATIONS

Additional drilling is recommended to define the sandstone deposits in the NE and SW portions of the Property, especially in the SW portion of the Property. The additional drilling will assist in clarifying why certain drill holes show the presence of thick deposits of sandstone and have adjacent drill holes with no sandstone. Additional exploration drilling will increase the confidence of the presence of sandstone in the mineral resources of Domains A and B and the lack of sandstone in the vicinity of Sullivan Creek.

Additional quality testing of sandstone samples is recommended.

If the results from the additional exploration drilling are successful, it is recommended to conduct a close-spaced developmental drilling program on the Property.

27 REFERENCES

Arkansas Pollution Control and Ecology Commission # 014.00-015, 2014, Regulation No. 15, Arkansas Open-Cut Mining and Land Reclamation

Canadian Institute of Mining, Metallurgy and Petroleum (CIM), 2014, CIM Definition Standards – For Mineral Resources and Mineral Reserves

McFarland, J.D., 1998, Revised 2004, Stratigraphic Summary of Arkansas, Information Circular 26, Arkansas Geological Commission, p. 2, 5

Owen, D.D., 1847, Preliminary Report of the Geological Survey of Wisconsin and Iowa: US General Land Office Report 1847 (US 30th Congress, 1st Session. S. Ex. Doc.2), p. 169,170

Purdue, A.H., 1907, Geologic Society Bulletin, v. 18, p. 251-256

Winslow, A., 1894, Missouri Geological Survey, V. 6, p. 331, 352

28 DATE AND SIGNATURE PAGE

This report entitled "STANDARDS OF DISCLOSURE FOR MINERAL PROJECTS WITHIN CANADA, NI 43-101 TECHNICAL REPORT, BELL PROPERTY, SHARP COUNTY, AR" with an effective date of April 20, 2017, was prepared on behalf of Kleinfelder, Inc. and is signed by the author Elliott A Mallard, P.G.

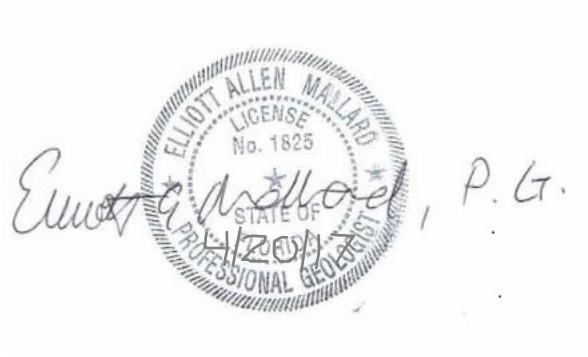
Elliott A Mallard, P.G.
Mining Program Manager – ESR
Kleinfelder, Inc.
8933 Western Way, Suite 12
Jacksonville, FL 32256

Dated: April 20, 2017

29 CERTIFICATE OF QUALIFIED PERSONS

I, Elliott A Mallard, of 8933 Western Way, Suite 12, Jacksonville, FL 32256, do hereby certify that:

- I, Elliott A Mallard, P.G., am Mining Program Manager – ESR of Kleinfelder, Inc.
- This certificate applies to the Technical Report titled "STANDARDS OF DISCLOSURE FOR MINERAL PROJECTS WITHIN CANADA, NI 43-101 TECHNICAL REPORT, SELECT SANDS CORPORATION PROPERTY, SHARP COUNTY, AR" with an effective date of March 31, 2017 (the "Technical Report").
- I graduated with a Bachelor of Science in Geology from Western Kentucky University in 1983.
- I graduated with a Master of Science in Geology from the University of Florida in 1988.
- I am a member of the Society for Mining, Metallurgy and Exploration (Member # 04122651)
- I am a Professional Geologist, Licensed by the State of Florida, Department of Business and Professional Regulation, Board of Professional Geologists, License # 1825.
- I have worked as a geologist in the mining industry or as a mining consultant for a total of 32 years. My past experience includes exploration, development, operations, reclamation and closure work for the industrial minerals industry (titanium minerals and zircon, sand, aggregate (limestone and granite) and absorbent clay in the US. I have experience working on industrial minerals projects in Australia, New Zealand and Mexico.
- I have read the definition of "qualified person" set out in NI 43-101 and certify that by reason of my education, affiliation with a professional association and relevant work experience, I fulfill the requirements to be a "qualified person". I am independent of Select Sands Corporation and American Select Corp. in accordance with section 1.5 of NI 43-101.
- I inspected the Property on April 13, 2017.
- I work as a geological consultant to the mining industry.
- I have read NI 43-101 and Form 43-101F1 and the Technical Report has been prepared in compliance with that instrument and form.
- As of the effective date of' this report, to the best of my knowledge, information and belief, the Technical Report contains all scientific and technical information that in required to be disclosed to make the Technical Report not misleading.



Elliott A Mallard, P.G.

FIGURES

Figure 1
Project Location Map

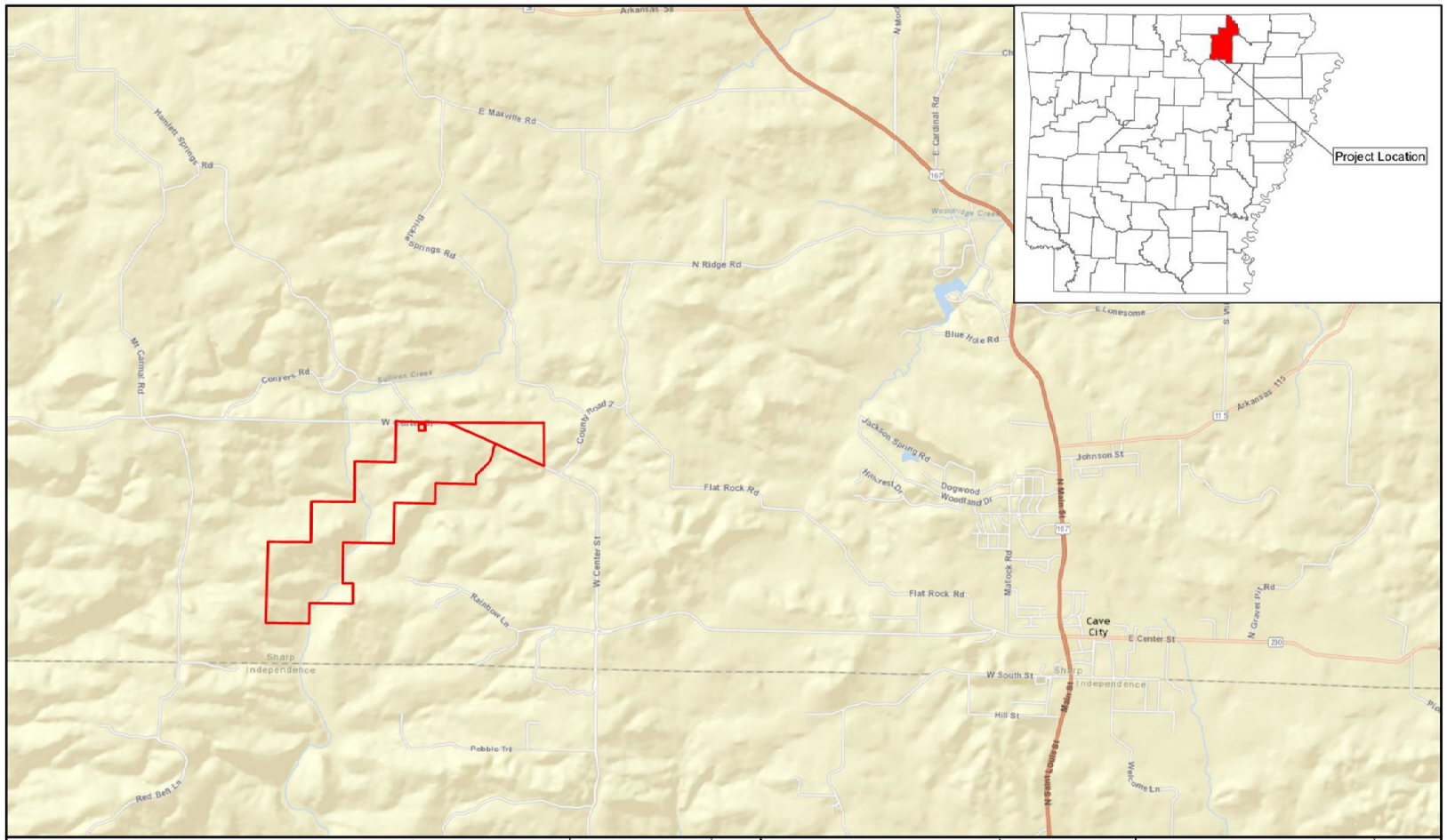


Image Source: ESRI Street Basemap

0 1,500 3,000 Feet

N

Legend

Project Boundary

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Project Location Map

Select Sands Corporation
Sharp County, Arkansas

FIGURE
1

Figure 2
Project Boundary on Topographic Map

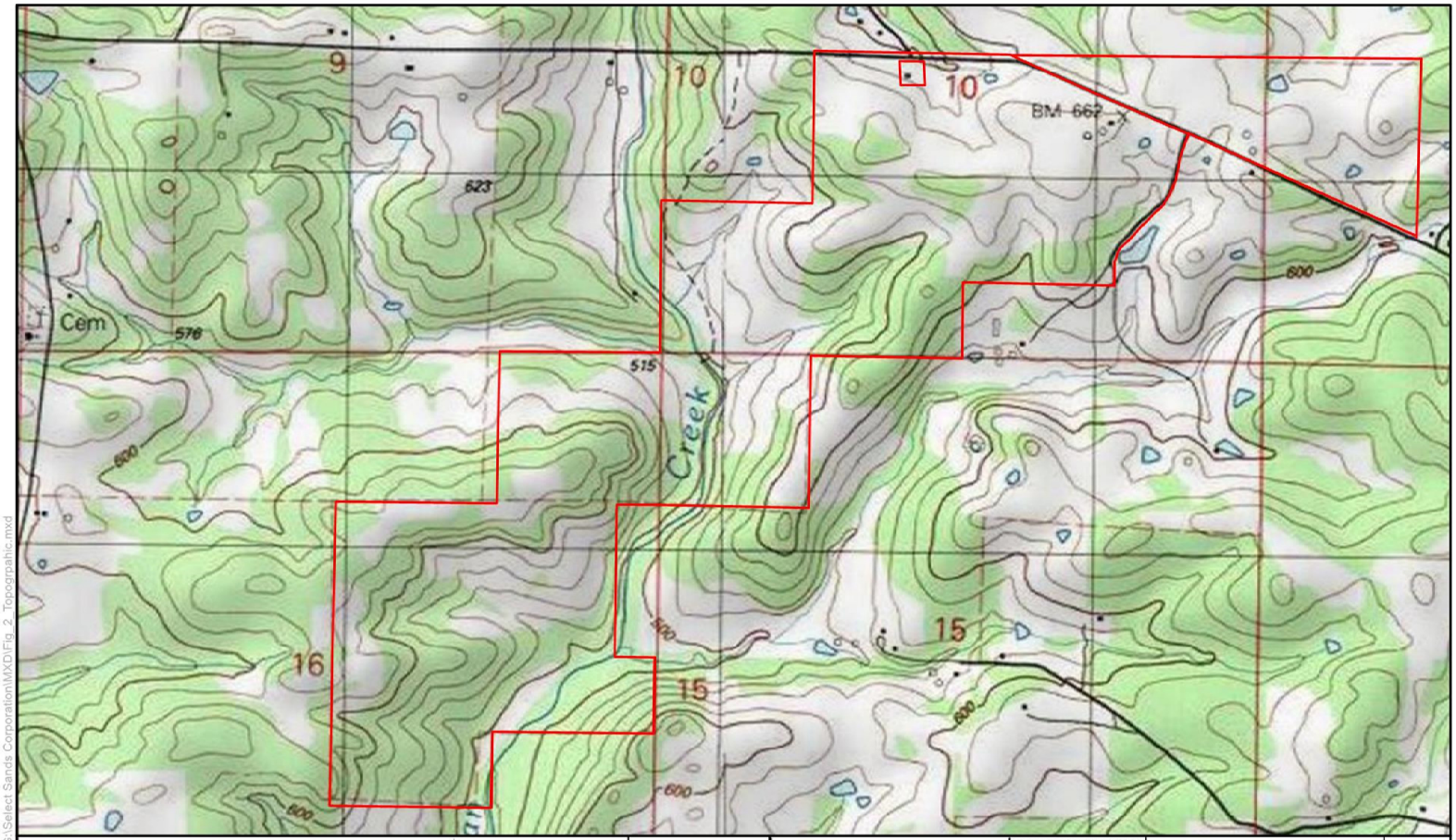

Image Source: USGS Topographic Map. Sandtown and Cave City Quadrangles

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0 400 800 Feet

N

Legend

Project Boundary

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Topographic Map

Select Sands Corporation
Sharp County, Arkansas

FIGURE
2

Document Path: G:\Select Sands Corporation\MXD\Fig_2_Topographic.mxd

Figure 3
Project Boundary on Aerial Photograph

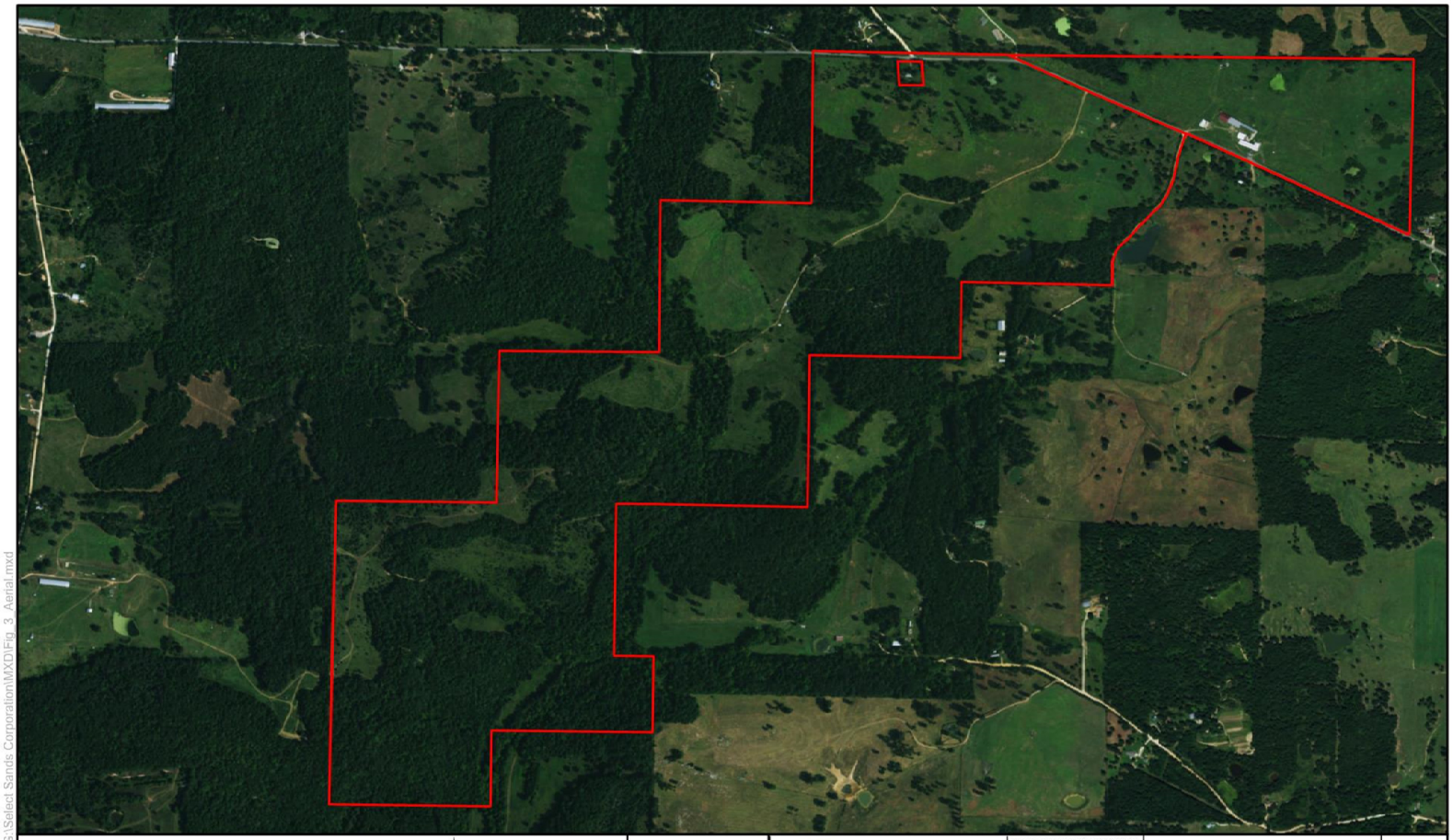

Image Source: USDA-FSA National Agriculture Inventory Program (NAIP) Date: 2015

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Legend

Project Boundary

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Aerial Map

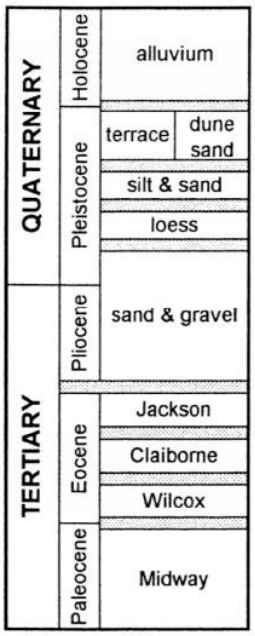
Select Sands Corporation
Sharp County, Arkansas

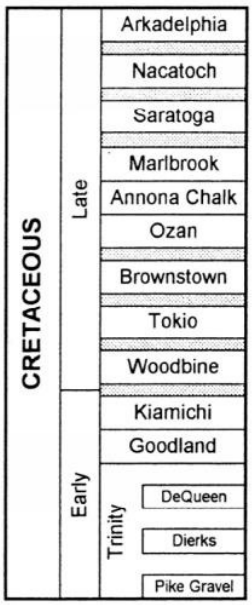
FIGURE
3

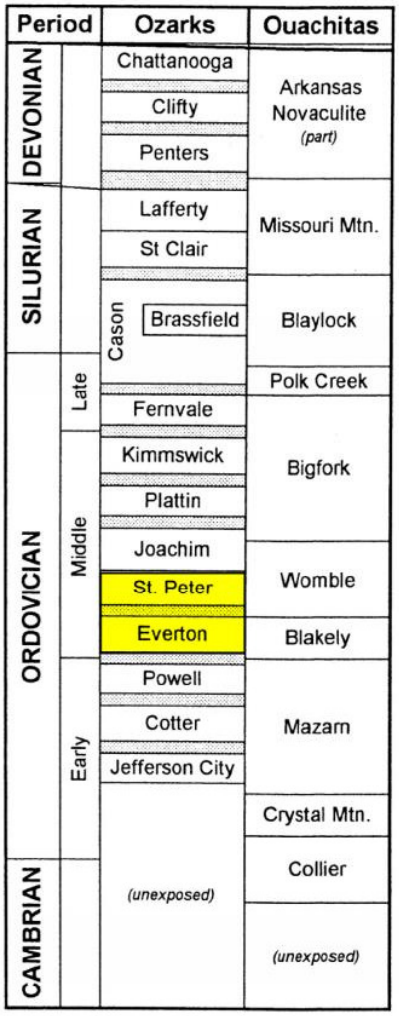
Document Path: G:\Select Sands Corporation\MXD\Fig_3_Aerial.mxd

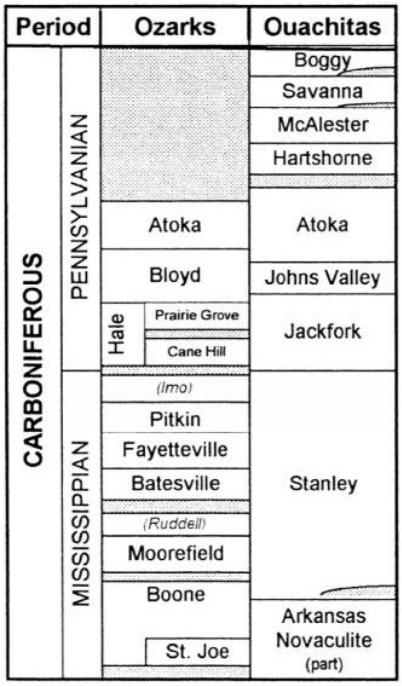
Figure 4
Summary of AR Stratigraphy

Stratigraphic Summary of AR, Information Circular 36, AR Geological Commission









Correlation charts of Arkansas formations.
Recognized unconformities separating formations are indicated by a stipple pattern. No relative thickness or significance is implied by these charts.

Figure 5
Drill Hole Locations on Topographic Map

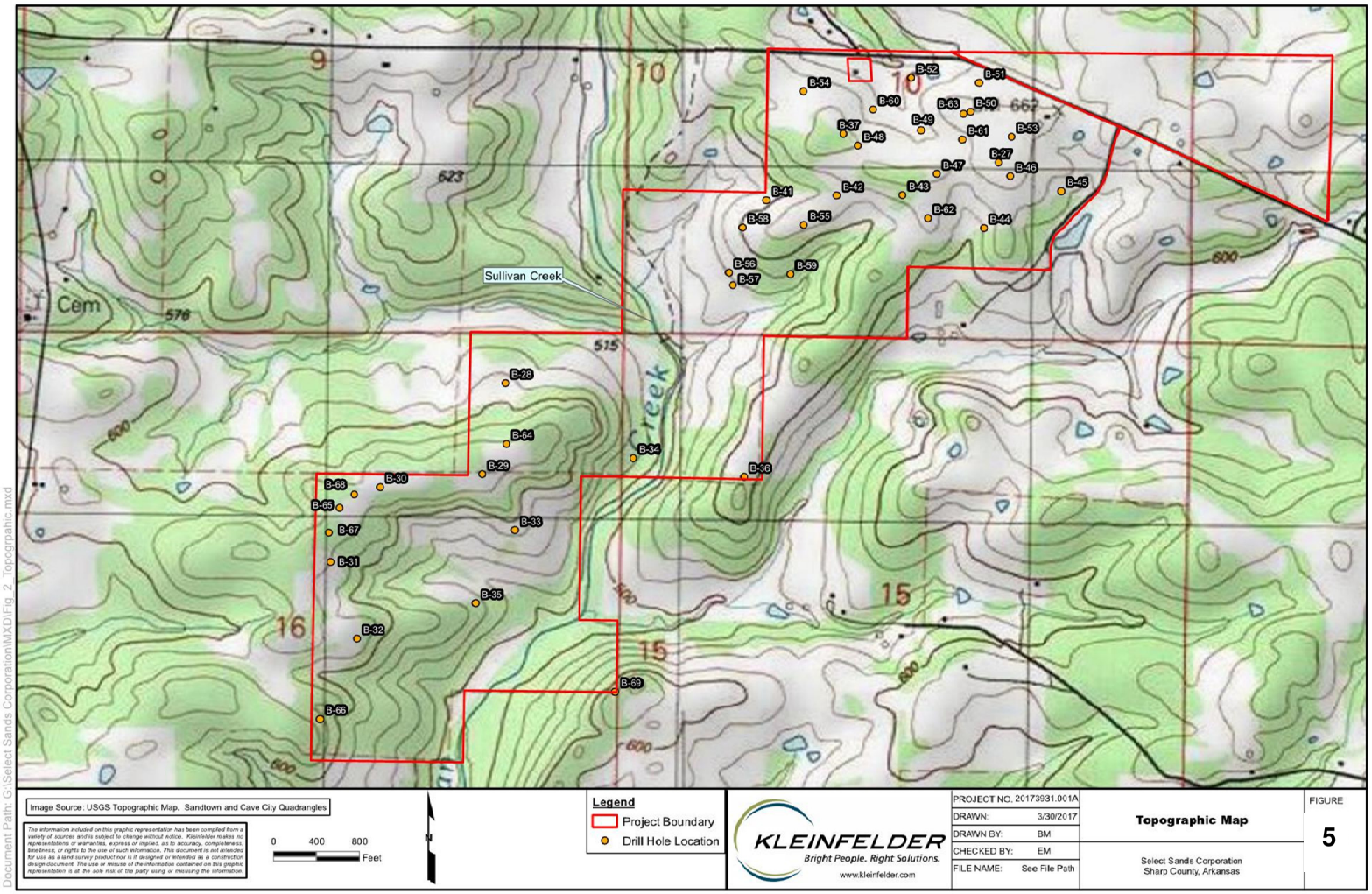


Image Source: USGS Topographic Map, Sandtown and Cave City Quadrangles

0 400 800 Feet

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Legend

- Project Boundary
- Drill Hole Location

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Topographic Map

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Sharp County, Arkansas

FIGURE
5

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Figure 6
Drill Hole Locations on Aerial Photograph

Drill Hole ID	Surface Elevation (FT)	Overburden Thickness (FT)	Sandstone Thickness (FT)	Elevation of Sandstone Bottom (FT)
B-27	671.75	0.00	43.00	628.75
B-28	590.88	N/A	N/A	N/A
B-29	652.54	0.50	47.50	604.54
B-30	652.58	15.50	70.50	566.98
B-31	643.86	6.50	84.50	552.86
B-32	626.30	7.00	58.00	561.30
B-33	597.38	6.00	11.50	579.88
B-34	524.11	N/A	N/A	N/A
B-35	550.01	N/A	N/A	N/A
B-36	621.28	7.00	2.50	611.78
B-37	663.21	3.00	73.00	587.21
B-41	583.98	8.00	30.00	545.98
B-42	631.67	7.00	67.00	557.67
B-43	647.20	7.00	42.00	598.20
B-44	618.56	N/A	N/A	N/A
B-45	629.47	1.50	13.50	614.47
B-46	674.89	0.00	16.00	658.89
B-47	660.47	0.00	49.00	611.44
B-48	663.27	0.00	64.00	599.27
B-49	630.72	8.50	42.50	579.72
B-50	674.89	N/A	N/A	N/A
B-51	646.63	0.50	103.00	535.63
B-52	617.38	N/A	N/A	N/A
B-53	670.72	10.00	47.00	606.72
B-54	654.29	4.50	80.00	569.79
B-55	631.62	8.00	68.00	537.62
B-56	562.35	4.00	1.50	556.85
B-57	558.00	2.00	1.00	555.00
B-58	602.00	7.00	3.00	592.00
B-59	586.00	3.00	12.00	554.00
B-60	638.00	2.00	50.00	586.00
B-61	652.00	3.50	50.50	598.00
B-62	637.00	5.00	45.00	587.00
B-63	672.00	19.00	108.00	545.00
B-64	646.00	6.00	39.00	601.00
B-65	652.00	70.00	0.00	652.00
B-66	633.00	2.00	28.00	603.00
B-67	647.00	39.00	66.00	542.00
B-68	648.00	22.00	60.00	566.00
B-69	636.00	1.50	29.50	605.00

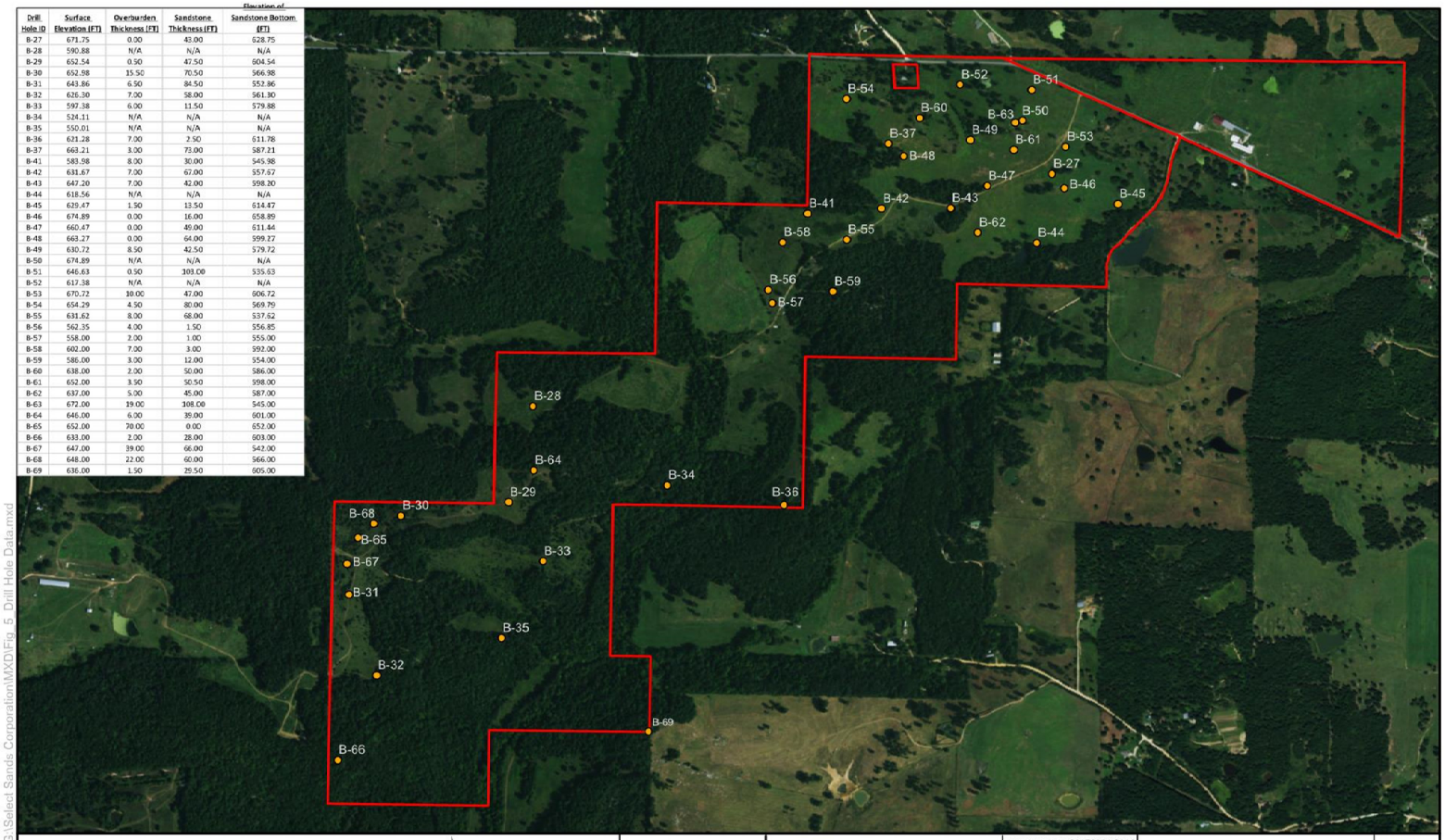

Image Source: USDA-FSA National Agriculture Inventory Program (NAIP) Date: 2015

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Legend

- Project Boundary
- Drill Hole Location

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Drill Hole Data Map

Select Sands Corporation
Sharp County, Arkansas

FIGURE
6

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Figure 7
Isopach Map of Sandstone Thickness

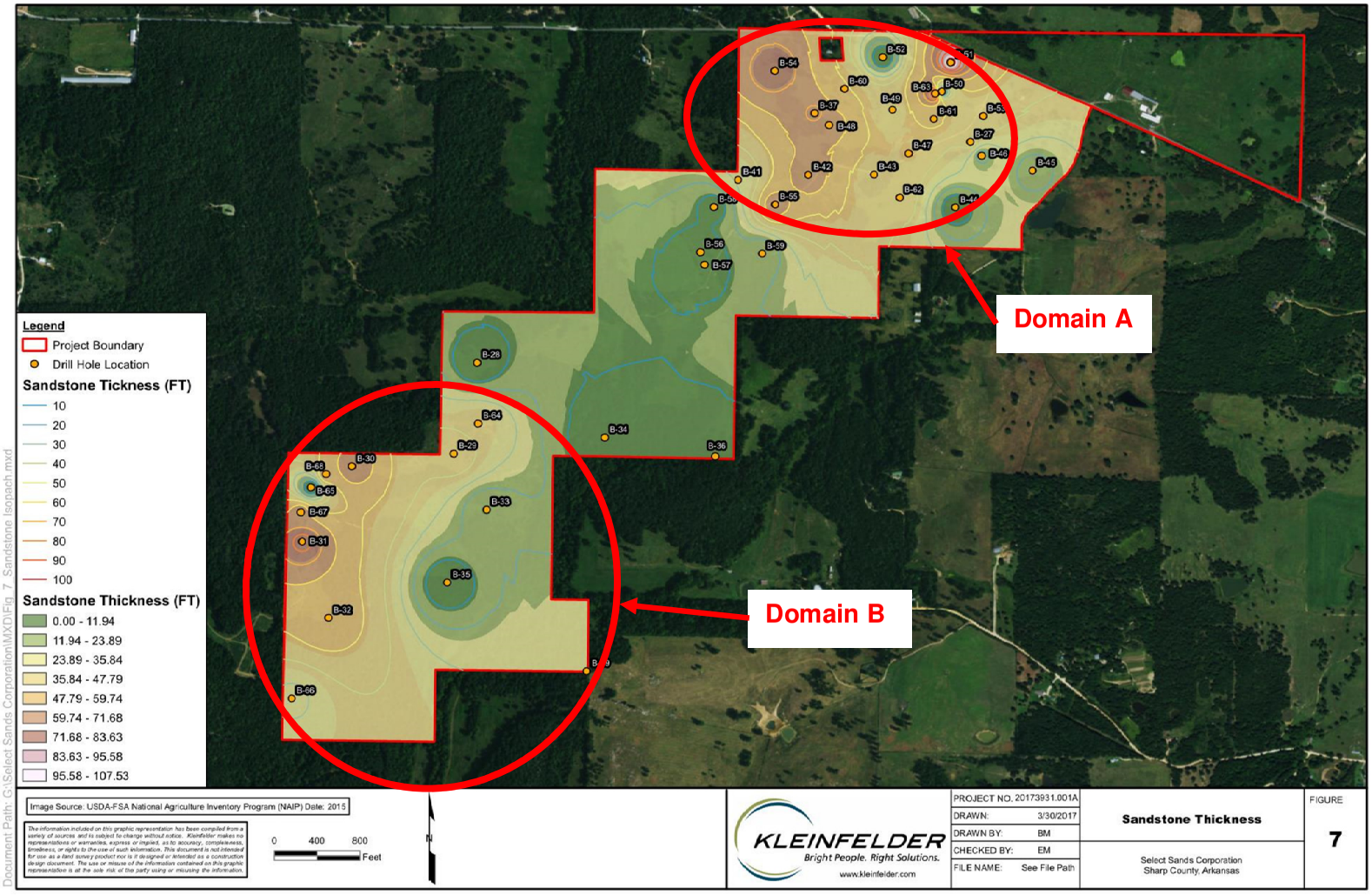

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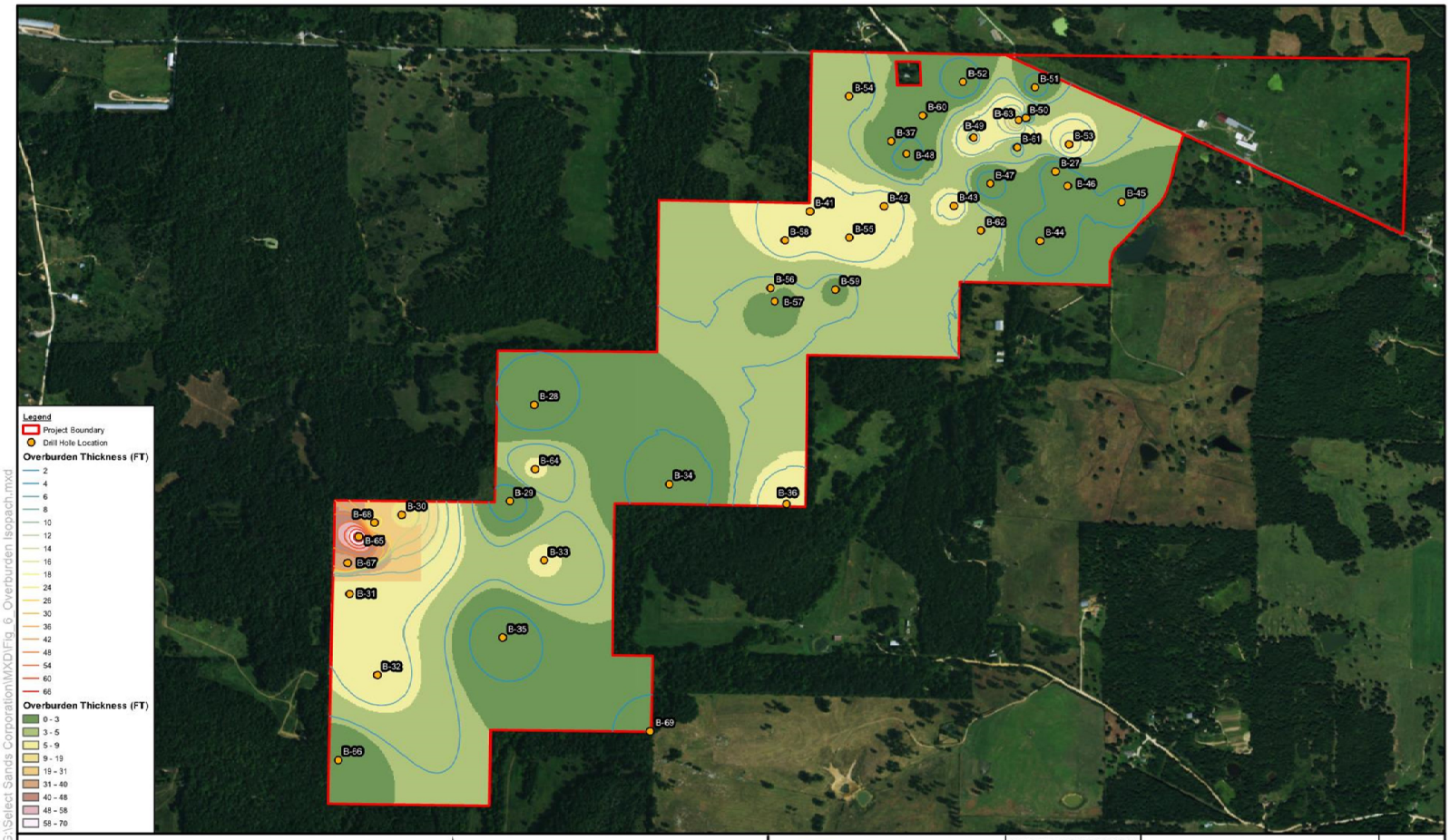
Figure 8
Isopach Map of Overburden Thickness



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Overburden Thickness

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Sharp County, Arkansas

FIGURE
8

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Figure 9

Geologic Cross-Section Plan View Map

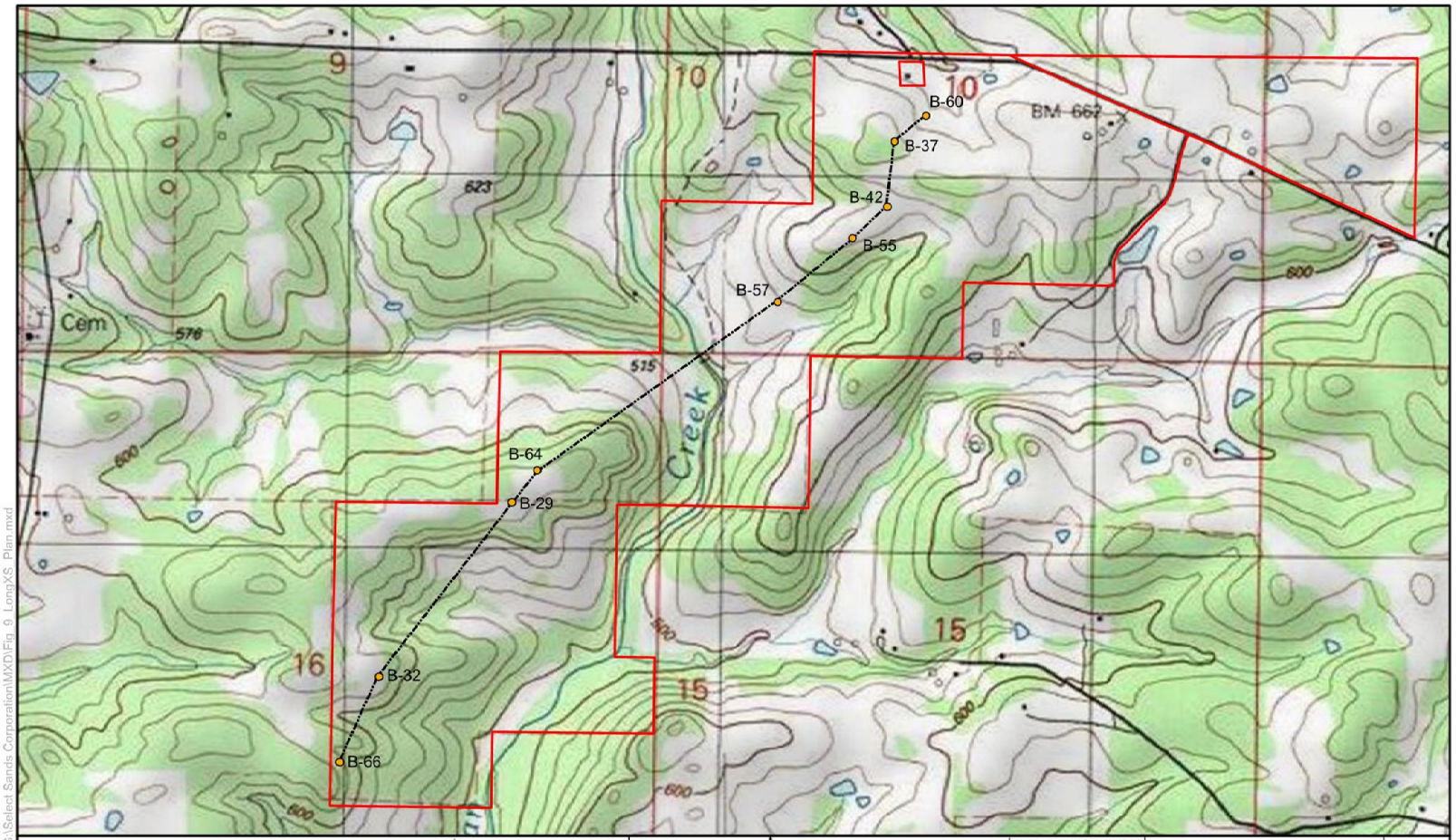

Image Source: USGS Topographic Map. Sandtown and Cave City Quadrangles

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N

Legend
- Drill Holes
- Cross Section
- Project Boundary

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Cross Section Plan View

Select Sands Corporation
Sharp County, Arkansas

FIGURE
9

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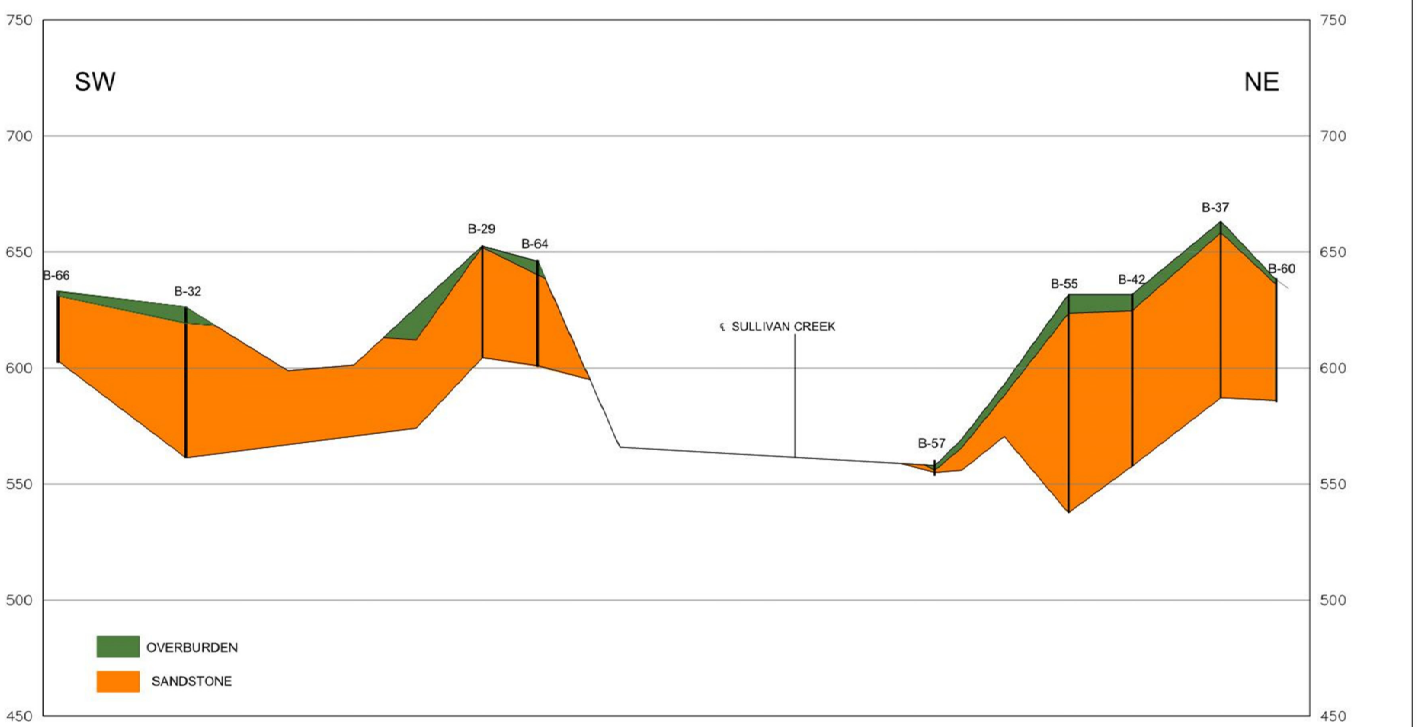
Figure 10
Geologic Cross-Section (NE – SW)



HORIZONTAL SCALE: 1" = 600'

600 300 0 600 1200

40 20 0 40 80

VERTICAL SCALE: 1"=40'

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CROSS-SECTION

SELECT SANDS CORPORATION

SHARP COUNTY, ARKANSAS

FIGURE

10

PAGE: XX of XX

TABLES

Table 1

Drill Hole Data Summary – American Silica, LLC

Drill Hole ID	Surface Elevation (FT)	Overburden Thickness (FT)	Sandstone Thickness (FT)	Sandstone Bottom Elevation (FT)	# of Drill Holes
B-27	671.75	0.00	43.00	628.75	1
B-28	590.88	N/A	N/A	N/A	2
B-29	652.54	0.50	47.50	604.54	3
B-30	652.98	15.50	70.50	566.98	4
B-31	643.86	6.50	84.50	552.86	5
B-32	626.30	7.00	58.00	561.30	6
B-33	597.38	6.00	11.50	579.88	7
B-34	524.11	N/A	N/A	N/A	8
B-35	550.01	N/A	N/A	N/A	9
B-36	621.28	7.00	2.50	611.78	10
B-37	663.21	3.00	73.00	587.21	11
B-41	583.98	8.00	30.00	545.98	12
B-42	631.67	7.00	67.00	557.67	13
B-43	647.20	7.00	42.00	598.20	14
B-44	618.56	N/A	N/A	N/A	15

Table 2

Drill Hole Data Summary – American Silica, LLC

Drill Hole ID	Surface Elevation (FT)	Overburden Thickness (FT)	Sandstone Thickness (FT)	Sandstone Bottom Elevation (FT)	# of Drill Holes
B-45	629.47	1.50	13.50	614.47	16
B-46	674.89	0.00	16.00	658.89	17
B-47	660.47	0.00	49.00	611.44	18
B-48	663.27	0.00	64.00	599.27	19
B-49	630.72	8.50	42.50	579.72	20
B-50	674.89	N/A	N/A	N/A	21
B-51	646.63	0.50	103.00	535.63	22
B-52	617.38	N/A	N/A	N/A	23
B-53	670.72	10.00	47.00	606.72	24
B-54	654.29	4.50	80.00	569.79	25
B-55	631.62	8.00	68.00	537.62	26
B-56	562.35	4.00	1.50	556.85	27
B-57	558.00	2.00	1.00	555.00	28
B-58	602.00	7.00	3.00	592.00	29
B-59	586.00	3.00	12.00	554.00	30
B-60	638.00	2.00	50.00	586.00	31
B-61	652.00	3.50	50.50	598.00	32
B-62	637.00	5.00	45.00	587.00	33
B-63	672.00	19.00	108.00	545.00	34
B-64	646.00	6.00	39.00	601.00	35
B-65	652.00	70.00	0.00	652.00	36
B-66	633.00	2.00	28.00	603.00	37
B-67	647.00	39.00	66.00	542.00	38

Table 3

Stim-Lab, Inc., Core Sample Interval Sieve Analysis Summary

Drill Hole	B-21	B-23	B-27	B-29	B-29	B-30	B-30	B-31	B-31	B-32	B-32	B-37	B-40	Average
Sample Interval (ft)	14-24	4-14	24-34	0-10	20-30	26-36	36-46	16-26	26-36	18-28	28-38	16-26	28-38	
% Loss (-200 mesh)	2.6	7.02	3.47	NA	5.04	NA	5.06	5.72	NA	4.31	9.02	4.66	5.51	**5.2**
25 mesh	0.2	0.2	0.3	0	0	0	0	0	0	0.4	0	0.1	0.1	**0.1**
30 mesh	0.6	1	0.5	0.9	0.2	0.1	0.4	0.2	1.3	0.5	0.2	0.3	0.2	**0.5**
35 mesh	1.5	2.3	1.2	2.3	0.9	0.6	1.2	0.8	1.6	1.3	0.7	1	0.8	**1.2**
40 mesh	3.5	6.1	2.9	5.2	2.5	2.4	3	1.7	3.5	2.7	1.7	2.6	1.6	**3.0**
45 mesh	7.2	13.3	7.8	11.4	6.6	8.5	6.9	4	8.9	6.1	4.7	6.3	4.1	**7.4**
50 mesh	9.5	15.1	13.6	17	10	15.3	12	9.4	14.5	9.9	8.8	13.2	6.3	**11.9**
60 mesh	10.6	12	14.9	17.1	10.9	18.8	16.7	18	16.1	11.1	11.6	21.5	9.2	**14.5**
70 mesh	14.8	13.4	15.5	14.2	9.5	16.8	13.4	16.9	14.7	12.6	10.7	19.5	12.9	**14.2**
80 mesh	17.7	13.5	13.3	12.1	14.6	13.9	13.8	17.9	13.2	16.4	14.3	15.2	16.4	**14.8**
100 mesh	17.2	10.7	11.3	7.4	18.7	8.1	13.8	15	8.4	16.2	17.9	10.2	17.9	**13.3**
120 mesh	9.7	5.9	8	5.5	11.9	5.8	7.9	7.8	6.6	10.7	11.6	5.6	15.5	**8.7**
140 mesh	4.6	3.6	5.6	3.6	7	4	4.8	3.9	4.8	7.4	7.3	3	10.4	**5.4**
170 mesh	1.4	1.5	2.7	1.6	3.9	2	3.2	2.2	2.5	3	4.8	0.9	3.2	**2.5**
200 mesh	0.7	0.7	1.2	1	1.9	1.9	2	1.2	1.9	1.2	2.8	0.3	0.8	**1.4**
230 mesh	0.3	0.3	0.5	0.5	0.6	1	0.5	0.4	1	0.3	1.2	0.1	0.3	**0.5**
Pan	0.4	0.4	0.6	0.3	0.7	0.9	0.2	0.4	1	0.2	1.5	0.1	0.3	**0.5**
Total	**100**	**100**	**100**	**100**	**100**	**100**	**100**	**100**	**100**	**100**	**100**	**100**	**100**	**100**

ISO 13503-2/API RP19C, Section 6, "Sieve Analysis" Standards used for sieve analysis

Table 4

Stim-Lab, Inc., Product Sieve Analysis Summary

Drill Hole	B-21	B-23	B-27	B-29	B-29	B-30	B-30	B-31	B-31	B-32	B-32	B-37	B-40	Average
Sample Interval (ft)	14-24	4-14	24-34	0-10	20-30	26-36	36-46	16-26	26-36	18-28	28-38	16-26	28-38	
16/30 mesh	0.8	1.2	0.8	0.9	0.2	0.1	0.4	0.2	1.3	0.9	0.2	0.4	0.3	**0.6**
20/40 mesh	5.8	9.6	4.9	8.4	3.6	3.1	4.6	2.7	6.4	4.9	2.6	4	2.7	**4.9**
30/50 mesh	21.7	36.8	25.5	35.9	20	26.8	23.1	15.9	28.5	20	15.9	23.1	12.8	**23.5**
40/70 mesh	42.1	53.8	51.8	59.7	37	59.4	49	48.3	54.2	39.7	35.8	60.5	32.5	**48.0**
70/140 mesh	49.2	33.7	38.2	28.6	52.2	31.8	40.3	44.6	33	50.7	51.1	34	60.2	**42.1**
ISO 13503-2/API RP19C, Section 6, "Sieve Analysis" Standards used for sieve analysis														

Table 5

Stim-Lab, Inc., Composite Samples Product Quality Test Result Summary

Composite Samples	NS 30/50	NS 40/70	NS 70/140
Sphericity	0.7	0.7	0.7
Roundness	0.7	0.7	0.6
Clusters	None Observed	None Observed	None Observed
Acid Solubility (%)	1.0	1.1	1.5
Turbidity (NTU)	8.0	8.0	8.0
Bulk Density (g/cm^3)	1.42	1.41	1.34
Bulk Density (lbs/ft^3)	88.6	88.0	83.6
Apparent Density (g/cm^3)	2.62	2.63	2.63
Crush Test Resistance % Fines (6,000 psi)	4.5	NA	NA
Crush Test Resistance % Fines (7,000 psi)	7.1	NA	NA
Crush Test Resistance % Fines (8,000 psi)	NA	7.2	6.6

Samples Tested in accordance with ISO 13503-2/API RP19C Standards

ISO 13503-2:2006/API RP19C:2008, Section 7, "Proppant Sphericity and Roundness"

ISO 13503-2:2006/API RP19C:2008, Section 8, "Acid Solubility"

ISO 13503-2:2006/API RP19C:2008, Section 9, "Turbidity Test"

ISO 13503-2:2006/API RP19C:2008, Section 10, "Procedure for Determining Proppant Bulk Density"

ISO 13503-2:2006/API RP19C:2008, Section 11, "Proppant Crush-Resistance Test"

Recommended Sphericity/Roundness for Proppants is 0.6 or greater (ISO/DIS 13503-2/Amendment 1/API RP19C)

Recommended Sphericity/Roundness for High Strength Proppants is 0.7 or greater (ISO/DIS 13503-2/Amendment 1/API RP19C)

Recommended Maximum Acid Solubility for Proppants 6/12 through 30/50 = 2.0%

Maximum Proppant Turbidity = less than or equal to 250 NTU (ISO/DIS13503-2/Amendment 1:2009

K value = The highest stress level which proppant generates no more than 10% crushed material, rounded down to the nearest 1,000 psi

Table 6

Stim-Lab, Inc., Core Sample Interval Product Quality Test Result Summary

Drill Hole	B-29	B-29	B-30	B-30	B-31	B-31	B-32
Sample Interval (ft)	**0-10**	**20-30**	**26-36**	**36-46**	**16-26**	**26-36**	**28-38**
Product Tested	**70/140**	**30/50**	**70/140**	**30/50**	**30/50**	**40/70**	**30/50**
Sphericity	0.7	0.7	0.8	0.7	0.7	0.8	0.7
Roundness	0.6	0.6	0.7	0.7	0.7	0.7	0.7
Clusters	None Observed	1:200	None Observed	1:200	1:200	None Observed	1:200
Acid Solubility (%)	NA	0.6	NA	0.8	0.7	NA	0.8
Bulk Density (g/cm^3)	NA	1.44	NA	1.47	1.51	NA	1.47
Bulk Density (lbs/ft^3)	NA	89.9	NA	91.7	94.2	NA	91.7
Crush Test Resistance % Fines (4,000 psi)	NA	2.9	NA	2.5	1.7	NA	2.8
Crush Test Resistance % Fines (5,000 psi)	4.2	NA	2.1	NA	NA	3.7	NA
Crush Test Resistance % Fines (6,000 psi)	NA	8.5	NA	8.4	6.5	NA	7.0
Crush Test Resistance % Fines (7,000 psi)	NA	14.1	NA	11.9	12.8	8.4	11.2
Crush Test Resistance % Fines (8,000 psi)	7.5	NA	NA	NA	NA	12.9	NA
Crush Test Resistance % Fines (9,000 psi)	10.8	NA	NA	NA	NA	NA	NA
Crush Test Resistance % Fines (10,000 psi)	NA	NA	7.7	NA	NA	NA	NA
Crush Test Resistance % Fines (11,000 psi)	NA	NA	10.9	NA	NA	NA	NA
K Value	8,000	6,000	10,000	6,000	6,000	7,000	6,000

Samples Tested in accordance with ISO 13503-2/API RP19C Standards

ISO 13503-2:2006/API RP19C:2008, Section 7, "Proppant Sphericity and Roundness"

ISO 13503-2:2006/API RP19C:2008, Section 8, "Acid Solubility"

ISO 13503-2:2006/API RP19C:2008, Section 10, "Procedure for Determining Proppant Bulk Density"

ISO 13503-2:2006/API RP19C:2008, Section 11, "Proppant Crush-Resistance Test"

Recommended Sphericity/Roundness for Proppants is 0.6 or greater (ISO/DIS 13503-2/Amendment 1/API RP19C)

Recommended Sphericity/Roundness for High Strength Proppants is 0.7 or greater (ISO/DIS 13503-2/Amendment 1/API RP19C)

Recommended Maximum Acid Solubility for Proppants 6/12 through 30/50 = 2.0%

K value = The highest stress level which proppant generates no more than 10% crushed material, rounded down to the nearest 1,000 psi

Table 7

Inferred Mineral Resource Estimate

Domain	Acres	Average Thickness (ft)	Specific Gravity	Inferred Mineral Resource Tons
A (NE)	145	52.8	2.24	27,667,763
B (SW)	135	45.0	2.24	21,954,240
Total Inferred Mineral Resource Tons				**49,622,003**

APPENDICES

Appendix 1

Quit Claim Deed for Purchase of Sharp County, AR Property by American Select Corp.

This instrument was prepared by:
J.T. Skinner, Attorney at Law
555 East Main Street, Suite 200
Batesville, AR 72501

QUITCLAIM DEED

KNOW ALL MEN BY THESE PRESENTS:

THAT We, **Stephen Stauffer and Paula Stauffer, husband and wife, GRANTORS**, for and in consideration of the sum of TEN DOLLARS ($10.00) AND OTHER VALUABLE CONSIDERATIONS, to me in hand paid by **American Select Corp., A Delaware Corporation, GRANTEE**, the receipt of which is hereby acknowledged, do(es) hereby grant, sell, convey and Quitclaim unto **American Select Corp., A Delaware Corporation, GRANTEE** and unto its successors and assigns forever, the following lands lying in the County of **Sharp** and State of Arkansas, to-wit:

The Northeast Quarter of the Northeast Quarter (NE1/4-NE1/4); The Southwest Quarter of the Northeast Quarter (SW1/4-NE1/4); Part of the Southeast Quarter of the Northeast Quarter (SE1/4-NE1/4); The Northwest Quarter of the Southeast Quarter (NW1/4-SE1/4); The North Half of the Northeast Quarter of the Southeast Quarter (N1/2-NE1/4-SE1/4), lying in Section 16; ALSO, The Northwest Quarter of the Northwest Quarter (NW1/4-NW1/4) lying in Section 15; ALSO, The Southwest Quarter of the Southwest Quarter (SW1/4-SW1/4); The Southeast Quarter of the Southwest Quarter (SE1/4-SW1/4); Part of the Northeast Quarter of the Southwest Quarter (NE1/4-SW1/4); Part of the Northwest Quarter of the Southeast Quarter (NW1/4-SE1/4); The North Half of the Southwest Quarter of the Southeast Quarter (N1/2-SW1/4-SE1/4); Part of the Southeast Quarter of the Southeast Quarter (SE1/4-SE1/4); Part of the Northeast Quarter of the Southeast Quarter (NE1/4-SE1/4), lying in Section 10, all located in Township 15 North, Range 6 West of the 5th P. M., Sharp County, Arkansas, being more particularly described as follows: Beginning at the NE corner of the NE1/4-NE1/4 of Section 16, Township 15 North, Range 6 West; thence North 00 degrees 34 minutes 18 seconds East 1335.11 feet to the NW corner of the SW1/4-SW1/4 of Section 10, Township 15 North, Range 6 West; thence South 88 degrees 51 minutes 51 seconds East 1325.96 feet to the NE corner of the SW1/4-SW1/4 of Section 10, aforesaid; thence North 00 degrees 45 minutes 30 seconds East 1333.68 feet to the NW corner of the NE1/4-SW1/4 of Section 10, aforesaid; thence South 88 degrees 51 minutes 34 seconds East 1708.72 feet; thence South 65 degrees 41 minutes 26 seconds East 289.18 feet to a point in the centerline of West Center Street; thence along said centerline as follows: South 65 degrees 50 minutes 01 second East 104.26 feet; South 65 degrees 43 minutes 42 seconds East 376.72 feet; South 66 degrees 33 minutes 00 seconds East 483.82 feet; South 65 degrees 18 minutes 15 seconds East 146.33 feet; South 66 degrees 46 minutes 02 seconds East 111.51 feet; South 67 degrees 25 minutes 07 seconds East 201.11 feet; thence along the centerline of a gravel road as follows: South 19 degrees 50 minutes 17 seconds West 217.72 feet; South 11 degrees 23 minutes 03 seconds West 197.56 feet; South 20 degrees 53 minutes 56 seconds West 147.37 feet; South 34 degrees 04 minutes 12 seconds West 106.43 feet; South 45 degrees 15 minutes 00 seconds West 66.78 feet; South 45 degrees 06 minutes 49 seconds West 194.38 feet; South 42 degrees 22 minutes 19 seconds West 141.55 feet; South 45 degrees 44 minutes 09 seconds West 52.07 feet; South 47 degrees 55 minutes 08 seconds West 66.11 feet; South 36 degrees 01 minute 44 seconds West 41.33 feet; South 19 degrees 15 minutes 55 seconds West 98.34 feet to a point on the East line of the SW1/4-SE1/4 of Section 10, aforesaid; thence South 00 degrees 25 minutes 49 seconds West 209.93 feet to the SE corner of the N1/2-SW1/4-SE1/4 of Section 10 aforesaid; thence North 88 degrees 45 minutes 54 seconds West 1324.17 feet to the SW corner of the N1/2-SW1/4-SE1/4 of Section 10 aforesaid; thence South 00 degrees 34 minutes 03 seconds West 666.81 feet to the SE corner of the SE1/4-SW1/4 of Section 10 aforesaid; thence North 88 degrees 53 minutes 47 seconds West 1330.40 feet to the NE corner of the NW1/4-NW1/4 of Section 15, Township 15 North, Range 6 West; thence South 00 degrees 45 minutes 47 seconds West 1333.31 feet to the SE corner of the NW1/4-NW1/4 of Section 15 aforesaid; thence North 88 degrees 54 minutes 33 seconds West 1330.31 feet to the SW corner of the NW1/4-NW1/4 of Section 15 aforesaid; thence North 89 degrees 22 minutes 17 seconds West 351.04 feet; thence South 00 degrees 50 minutes 57 seconds West 1333.67 feet; thence South 89 degrees 10 minutes 13 seconds East 353.13 feet to the NE corner of the N1/2-NE1/4-SE1/4 of Section 16 aforesaid; thence South 00 degrees 45 minutes 51 seconds West 667.78 feet to the SE corner of the N1/2-NE1/4-SE1/4 of Section 16 aforesaid; thence North 89 degrees 17 minutes 38 seconds West 1414.67 feet to the SW corner of the N1/2-NE1/4-SE1/4 of Section 16 aforesaid; thence South 00 degrees 56 minutes 54 seconds West 667.10 feet to the SE corner of the NW1/4-SE1/4 of Section 16 aforesaid; thence North 89 degrees 15 minutes 58 seconds West 1416.81 feet to the SW corner of the NW1/4-SE1/4 of Section 16 aforesaid; thence North 01 degree 07 minutes 56 seconds East 1340.32 feet to the NW corner of the NW1/4-SE1/4 of Section 16 aforesaid; thence North 01 degree 17 minutes 32 seconds East 1325.08 feet to the NW corner of the SW1/4-NE1/4 of Section 16 aforesaid; thence South 89 degrees 22 minutes 17 seconds East 1408.55 feet to the NE corner of the SW1/4-NE1/4 of Section 16 aforesaid; thence North 01 degree 07 minutes 11 seconds East 1329.31 feet to the NW corner of the NE1/4-NE1/4 of Section 16 aforesaid; thence South 89 degrees 32 minutes 44 seconds East 1404.60 feet, back to the point of beginning. ALSO, Part of the Northwest Quarter of the Southeast Quarter (NW1/4-SE1/4); Part of the Northeast Quarter of the Southeast Quarter (NE1/4-SE1/4) in Section 10; Part of the Northwest Quarter of the Southwest Quarter (NW1/4-SW1/4); Part of the Southwest Quarter of the Southwest Quarter (SW1/4-SW1/4) in Section 11, all in Township 15 North, Range 6 West of the 5th P. M., Sharp County, Arkansas, being more particularly described as follows: Beginning at the NW corner of the NW1/4-SW1/4 of Section 11, Township 15 North, Range 6 West; thence South 89 degrees 06 minutes 07 seconds East 1325.75 feet to the NE corner of the NW1/4-SE1/4 of Section 11 aforesaid; thence South 00 degrees 09 minutes 33 seconds East 1570.02 feet to the centerline of West Center Street; thence along said centerline as follows: North 64 degrees 27 minutes 10 seconds West 1252.40 feet; North 64 degrees 51 minutes 45 seconds West 228.26 feet; North 65 degrees 44 minutes 05 seconds West 747.66 feet; North 67 degrees 27 minutes 16 seconds West 201.17 feet; North 66 degrees 46 minutes 02 seconds West 111.51 feet; North 65

degrees 18 minutes 15 seconds West 146.33 feet; North 66 degrees 33 minutes 00 seconds West 483.82 feet; North 65 degrees 43 minutes 42 seconds West 376.72 feet; North 65 degrees 50 minutes 01 second West 104.26 feet; thence North 65 degrees 41 minutes 26 seconds West departing said centerline 289.18 feet to a point on the North line of the NW1/4-SE1/4 of Section 10, aforesaid; thence South 88 degrees 51 minutes 34 seconds East along said North line 934.32 feet to the NE corner of the NW1/4-SE1/4 of Section 10 aforesaid; thence South 88 degrees 51 minutes 34 seconds East 1321.52 feet, back to the point of beginning. Being subject to all rights of way and easements of record.
LESS AND EXCEPT: Part of the Northeast Quarter of the Southwest Quarter (NE1/4-SW1/4) of Section 10, Township 15 North, Range 6 West of the 5th P.M., Sharp County, Arkansas, being more particularly described as follows: Commencing at the NW corner of the NE1/4-SW1/4 of Section 10 aforesaid; thence South 88 degrees 51 minutes 34 seconds East 737.03 feet; thence South 03 degrees 51 minutes 54 seconds East 75.58 feet to the point of beginning; thence continue South 03 degrees 51 minutes 54 seconds East 210.0 feet; thence South 89 degrees 39 minutes 47 seconds East 210.0 feet; thence North 03 degrees 51 minutes 54 seconds West 210.0 feet; thence North 89 degrees 39 minutes 47 seconds West 210.0 feet, back to the point of beginning.

ALSO LESS AND EXCEPT: All that part of the Southeast Quarter of the Southeast Quarter (SE1/4-SE1/4) of Section 10, Township 15 North, Range 6 West of the 5th P.M., Sharp County, Arkansas lying North and West of the road as now located.

I certify under penalty of false swearing that documentary stamps or a documentary symbol in the legally correct amount has been placed on this instrument.

Grantee's Address:

_____

_____

_____
(Grantee of Grantee's Agent

TO HAVE AND TO HOLD the same unto the said GRANTEES and unto their heirs and assigns forever, with all appurtenances thereto belonging.

WITNESS our hand and seal on this 24th day of January, 2017.

_____
Stephen Stauffer

_____
Paula Stauffer

ACKNOWLEDGMENT

STATE OF ARKANSAS)
)**ss.**
COUNTY OF INDEPENDENCE)

BE IT REMEMBERED that on this day came before me, the undersigned, a Notary Public, within and for the county and state aforesaid, duly commissioned and acting, **Stephen Stauffer and Paula Stauffer, husband and wife**, to me well known as the Grantors in the foregoing deed, and stated that they had executed the same for the consideration and purpose mentioned and set forth.

WITNESS my hand and seal as such Notary Public on this 24th day of January 2017.

My Commission Expires: 6/17/2023

_____
Notary Public

KIMBERLY ANN DALE
NOTARY PUBLIC-STATE OF ARKANSAS
IZARD COUNTY
My Commission Expires 06-17-2023
Commission # 12394196

Appendix 2

Stim-Lab, Inc. Sieve Analysis and Product Quality Reports

"Measurement of Properties for Proppants Used In Hydraulic Fracturing and Gravel-Packing Operations"
Evaluations on Sample Labeled FSR B-29 0'-10'
For Creative Environmental Solutions, Inc.
Submitted December 8, 2011

Prepared For:
Mr. George Foster
Creative Environmental Solutions, Inc
700 DeSoto Avenue
Brooksville, FL 34601
(352) 796-3374
(352) 796-2449 Fax

Prepared By:
Stim-Lab, Inc.
7406 North Hwy 81
Duncan, OK 73533-1644
(580) 252-4309

Lisa O'Connell

Lisa O'Connell, Laboratory Supervisor

P.O. Number: Per G. Foster

File Number: SL9749

January 2012

Stim-Lab
A CORE LABORATORIES COMPANY

STIM-LAB, Inc.
7406 North HWY 81
Duncan, Oklahoma 73533
Phone: 580-252-4309
Fax: 580-252-6979
www.stimlab.com

January 18, 2012

Mr. George Foster
Creative Environmental Solutions, Inc
700 DeSoto Avenue
Brooksville, FL 34601

Dear Mr. Foster:

STIM-LAB, Inc. has completed the ISO 13503-2/API RP19C evaluations requested on the submitted sand sample labeled FSR B-29 0'-10'. The sample was received at Stim-Lab Inc. on December 8, 2011.

Upon arrival the sample was disassociated, and washed and dried. A composite sieve analysis was then done on the sample. The sample was then screened into the requested size. The composite sieve analysis results for the sample are provided in Table 1. The results for the sphericity and roundness (Krumbein Shape Factor), bulk density and crush resistance for the sample are provided in Table 2. A picture of the sample is provided at the end of the report for your review. The procedures followed are as stated in ISO 13503-2/API RP19C.

Thank you for having STIM-LAB, Inc. perform these analyses. We hope you will consider us for your future testing needs. If you have any questions regarding the testing or results, please do not hesitate to give me a call.

Sincerely,

Lisa O'Connell

Lisa O'Connell
Laboratory Supervisor
Conductivity Laboratory

SL 9749

Table 1

Sieve Analysis of Submitted Proppant Samples
Submitted By: Creative Environmental Solutions
ISO 13503-2/API RP19C, Section 6, "Sieve Analysis"

Sample I.D.	Proppant Sample Labeled: FSR B-29 0'-10'	
US Standard	Weight %	
Sieve No.	Retained	Cumulative
6	0.0	0.0
8	0.0	0.0
10	0.0	0.0
12	0.0	0.0
14	0.0	0.0
16	0.0	0.0
18	0.0	0.0
20	0.0	0.0
25	0.0	0.0
30	0.9	0.9
35	2.3	3.2
40	5.2	8.4
45	11.4	19.8
50	17.0	36.8
60	17.1	53.9
70	14.2	68.1
80	12.1	80.2
100	7.4	87.6
120	5.5	93.0
140	3.6	96.7
170	1.6	98.2
200	1.0	99.2
230	0.5	99.7
pan	0.3	100.0
total	100.0	
in-size	0.0	= as 6/12
in-size	0.0	= as 8/16
in-size	0.0	= as 12/20
in-size	0.9	= as 16/30
in-size	8.4	= as 20/40
in-size	35.9	= as 30/50
in-size	59.7	= as 40/70
in-size	28.6	= as 70/140
ISO Mean Dia. (mm)	0.273	
Median Dia. (mm)	0.249	

January 2012

Stim-Lab
A CORE LABORATORIES COMPANY

SL 9749

Table 2

Proppant Sample Labeled: FSR B-29 0'-10' 70/140
Submitted By: Creative Environmental Solutions
Arrived 12/8/2011

Measurement of Properties of Proppants
Used In Hydraulic Fracturing and Gravel-Packing Operations

ISO 13503-2/API RP19C, Section 7, "Proppant Sphericity and Roundness"

* mean of a 20 count

Sphericity =	**0.7**
Roundness =	**0.6**
Clusters =	**None Observed in Field of Count**

Recommended Sphericity and Roundness for proppants = 0.6 or greater (ISO/DIS 13503-2/Amd.1/API RP19C)
Recommended Sphericity and Roundness for high strength proppants = 0.7 or greater (ISO/DIS 13503-2/Amd.1/API RP19C)

ISO 13503-2/API RP 19C, Section 10, "Procedures for Determining Proppant Bulk Density"

Bulk Density =	**1.37**	**g/cm^3**
Bulk Density =	**85.5**	**lb/ft^3**

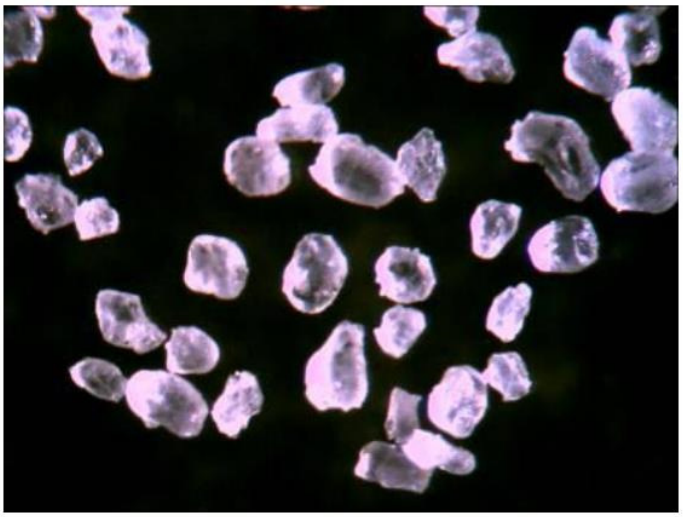
ISO 13503-2/API RP19C, Section 11, "Proppant Crush-Resistance Test"

Stresses Tested (psi)	*% Fines -70+140 crush prep*
5000	**4.2**
8000	**7.5**
9000	**10.8**
K-Value =	**8K**

The highest stress level which proppant generates no more than 10% crushed material, rounded down to the nearest 1000psi = K-Value

January 2012

Stim-Lab
A CORE LABORATORIES COMPANY



FSR B-29 0'-10' 70/140

Stim-Lab
A CORE LABORATORIES COMPANY

"Measurement of Properties for Proppants Used In Hydraulic Fracturing and Gravel-Packing Operations"
Evaluations on Sample Labeled FSR B-30 26'-36'
For Creative Environmental Solutions, Inc.
Submitted December 8, 2011

Prepared For:
Mr. George Foster
Creative Environmental Solutions, Inc
700 DeSoto Avenue
Brooksville, FL 34601
(352) 796-3374
(352) 796-2449 Fax

Prepared By:
Stim-Lab, Inc.
7406 North Hwy 81
Duncan, OK 73533-1644
(580) 252-4309

Lisa O'Connell

Lisa O'Connell, Laboratory Supervisor

P.O. Number: Per G. Foster

File Number: SL9749

January 2012

Stim-Lab
A CORE LABORATORIES COMPANY

STIM-LAB, Inc.
7406 North HWY 81
Duncan, Oklahoma 73533
Phone: 580-252-4309
Fax: 580-252-6979
www.stimlab.com

January 18, 2012

Mr. George Foster
Creative Environmental Solutions, Inc
700 DeSoto Avenue
Brooksville, FL 34601

Dear Mr. Foster:

STIM-LAB, Inc. has completed the ISO 13503-2/API RP19C evaluations requested on the submitted sand sample labeled FSR B-30 26'-36'. The sample was received at Stim-Lab Inc. on December 8, 2011.

Upon arrival the sample was disassociated, and washed and dried. A composite sieve analysis was then done on the sample. The sample was then screened into the requested size. The composite sieve analysis results for the sample are provided in Table 1. The results for the sphericity and roundness (Krumbein Shape Factor), bulk density and crush resistance for the sample are provided in Table 2. A picture of the sample is provided at the end of the report for your review. The procedures followed are as stated in ISO 13503-2/API RP19C.

Thank you for having STIM-LAB, Inc. perform these analyses. We hope you will consider us for your future testing needs. If you have any questions regarding the testing or results, please do not hesitate to give me a call.

Sincerely,

Lisa O'Connell

Lisa O'Connell
Laboratory Supervisor
Conductivity Laboratory

SL 9749

Table 1

Sieve Analysis of Submitted Proppant Samples
Submitted By: Creative Environmental Solutions
ISO 13503-2/API RP19C, Section 6, "Sieve Analysis"

Sample I.D.	Proppant Sample Labeled: FSR B-30 26'-36'	
US Standard	Weight %	
Sieve No.	Retained	Cumulative
6	0.0	0.0
8	0.0	0.0
10	0.0	0.0
12	0.0	0.0
14	0.0	0.0
16	0.0	0.0
18	0.0	0.0
20	0.0	0.0
25	0.0	0.0
30	0.1	0.1
35	0.6	0.7
40	2.4	3.0
45	8.5	11.6
50	15.3	26.9
60	18.8	45.7
70	16.8	62.5
80	13.9	76.4
100	8.1	84.5
120	5.8	90.3
140	4.0	94.3
170	2.0	96.3
200	1.9	98.1
230	1.0	99.1
pan	0.9	100.0
total	100.0	
in-size	0.0	= as 6/12
in-size	0.0	= as 8/16
in-size	0.0	= as 12/20
in-size	0.1	= as 16/30
in-size	3.0	= as 20/40
in-size	26.8	= as 30/50
in-size	59.5	= as 40/70
in-size	31.8	= as 70/140
ISO Mean Dia. (mm)	0.246	
Median Dia. (mm)	0.225	

January 2012

Stim-Lab
A CORE LABORATORIES COMPANY

SL 9749

Table 2

Proppant Sample Labeled: FSR B-30 26'-36' 70/140
Submitted By: Creative Environmental Solutions
Arrived 12/8/2011

Measurement of Properties of Proppants
Used In Hydraulic Fracturing and Gravel-Packing Operations

ISO 13503-2/API RP19C, Section 7, "Proppant Sphericity and Roundness"

* mean of a 20 count

Sphericity =	**0.8**
Roundness =	**0.7**
Clusters =	**None Observed in Field of Count**

Recommended Sphericity and Roundness for proppants = 0.6 or greater (ISO/DIS 13503-2/Amd.1/API RP19C)
Recommended Sphericity and Roundness for high strength proppants = 0.7 or greater (ISO/DIS 13503-2/Amd.1/API RP19C)

ISO 13503-2/API RP 19C, Section 10, "Procedures for Determining Proppant Bulk Density"

Bulk Density =	**1.43**	**g/cm^3**
Bulk Density =	**89.2**	**lb/ft^3**

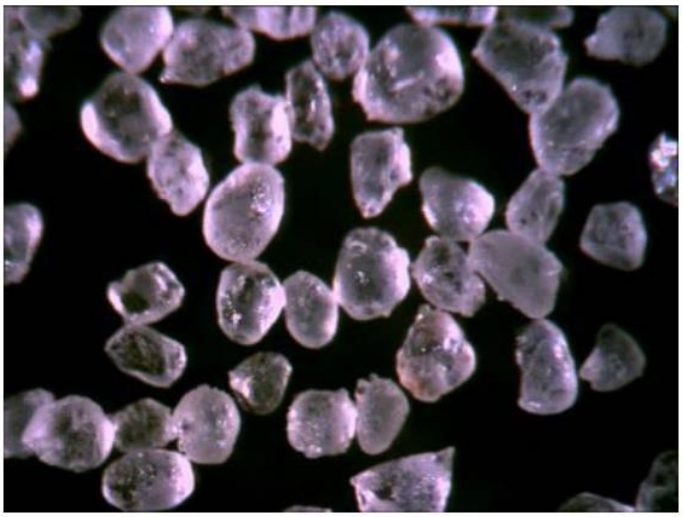
ISO 13503-2/API RP19C, Section 11, "Proppant Crush-Resistance Test"

Stresses Tested (psi)	*% Fines -70+140 crush prep*
5000	2.1
10000	7.7
11000	10.9
K-Value =	10K

The highest stress level which proppant generates no more than 10% crushed material, rounded down to the nearest 1000psi = K-Value

January 2012

Stim-Lab
A CORE LABORATORIES COMPANY



FSR B-30 26'-36' 70/140

Stim-Lab
A CORE LABORATORIES COMPANY

"Measurement of Properties for Proppants Used In Hydraulic Fracturing and Gravel-Packing Operations"
Evaluations on Sample Labeled FSR B-31 26'-36'
For Creative Environmental Solutions, Inc.
Submitted December 8, 2011

Prepared For:
Mr. George Foster
Creative Environmental Solutions, Inc
700 DeSoto Avenue
Brooksville, FL 34601
(352) 796-3374
(352) 796-2449 Fax

Prepared By:
Stim-Lab, Inc.
7406 North Hwy 81
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Lisa O'Connell

Lisa O'Connell, Laboratory Supervisor

P.O. Number: Per G. Foster

File Number: SL9749

January 2012

Stim-Lab
A CORE LABORATORIES COMPANY

STIM-LAB, Inc.
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Duncan, Oklahoma 73533
Phone: 580-252-4309
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January 18, 2012

Mr. George Foster
Creative Environmental Solutions, Inc
700 DeSoto Avenue
Brooksville, FL 34601

Dear Mr. Foster:

STIM-LAB, Inc. has completed the ISO 13503-2/API RP19C evaluations requested on the submitted sand sample labeled FSR B-31 26'-36'. The sample was received at Stim-Lab Inc. on December 8, 2011.

Upon arrival the sample was disassociated, and washed and dried. A composite sieve analysis was then done on the sample. The sample was then screened into the requested size. The composite sieve analysis results for the sample are provided in Table 1. The results for the sphericity and roundness (Krumbein Shape Factor), bulk density and crush resistance for the sample are provided in Table 2. A picture of the sample is provided at the end of the report for your review. The procedures followed are as stated in ISO 13503-2/API RP19C.

Thank you for having STIM-LAB, Inc. perform these analyses. We hope you will consider us for your future testing needs. If you have any questions regarding the testing or results, please do not hesitate to give me a call.

Sincerely,

Lisa O'Connell

Lisa O'Connell
Laboratory Supervisor
Conductivity Laboratory

SL 9749

Table 1

Sieve Analysis of Submitted Proppant Samples
Submitted By: Creative Environmental Solutions
ISO 13503-2/API RP19C, Section 6, "Sieve Analysis"

Sample I.D.	Proppant Sample Labeled: FSR B-31 26'-36'	
US Standard	Weight %	
Sieve No.	Retained	Cumulative
6	0.0	0.0
8	0.0	0.0
10	0.0	0.0
12	0.0	0.0
14	0.0	0.0
16	0.0	0.0
18	0.0	0.0
20	0.0	0.0
25	0.0	0.0
30	1.3	1.3
35	1.6	2.9
40	3.5	6.4
45	8.9	15.2
50	14.5	29.7
60	16.1	45.8
70	14.7	60.5
80	13.2	73.7
100	8.4	82.1
120	6.6	88.8
140	4.8	93.5
170	2.5	96.0
200	1.9	97.9
230	1.0	98.9
pan	1.1	100.0
total	100.0	
in-size	0.0	= as 6/12
in-size	0.0	= as 8/16
in-size	0.0	= as 12/20
in-size	1.3	= as 16/30
in-size	6.4	= as 20/40
in-size	28.4	= as 30/50
in-size	54.2	= as 40/70
in-size	33.0	= as 70/140
ISO Mean Dia. (mm)	0.253	
Median Dia. (mm)	0.226	

January 2012

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Table 2

Proppant Sample Labeled: FSR B-31 26'-36' 40/70
Submitted By: Creative Environmental Solutions
Arrived 12/8/2011

Measurement of Properties of Proppants
Used In Hydraulic Fracturing and Gravel-Packing Operations

ISO 13503-2/API RP19C, Section 7, "Proppant Sphericity and Roundness"

* mean of a 20 count

Sphericity =	**0.8**
Roundness =	**0.7**
Clusters =	**None Observed in Field of Count**

Recommended Sphericity and Roundness for proppants = 0.6 or greater (ISO/DIS 13503-2/Amd.1/API RP19C)
Recommended Sphericity and Roundness for high strength proppants = 0.7 or greater (ISO/DIS 13503-2/Amd.1/API RP19C)

ISO 13503-2/API RP 19C, Section 10, "Procedures for Determining Proppant Bulk Density"

Bulk Density =	**1.42**	**g/cm^3**
Bulk Density =	**88.6**	**lb/ft^3**

ISO 13503-2/API RP19C, Section 11, "Proppant Crush-Resistance Test"

Stresses Tested (psi)	*% Fines -40+70 crush prep*
5000	**3.7**
7000	**8.4**
8000	**12.9**
K-Value =	**7K**

The highest stress level which proppant generates no more than 10% crushed material, rounded down to the nearest 1000psi = K-Value

January 2012

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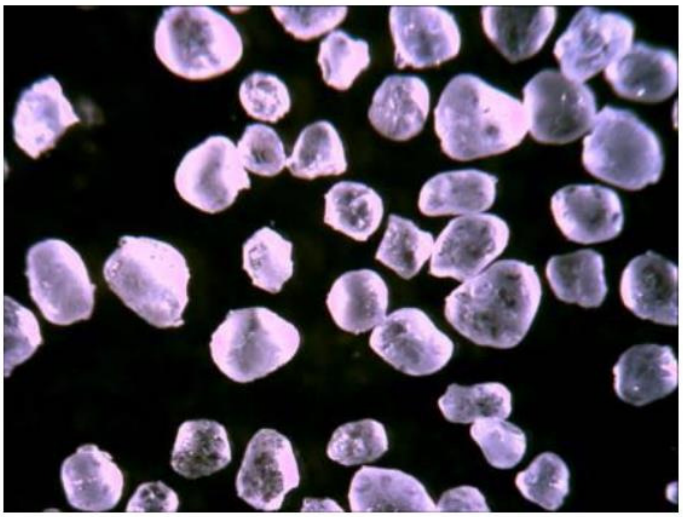

FSR B-31 26'-36' 40/70

Stim-Lab
A CORE LABORATORIES COMPANY

"Measurement of Properties for Proppants Used In Hydraulic Fracturing and Gravel-Packing Operations"
Evaluations on Six Composite Sand Samples
For Creative Environmental Solutions
Submitted February 6, 2012

Prepared For:
Mr. George Foster
Creative Environmental Solutions
700 DeSoto Ave
Brooksville, FL 34601
(352) 279-7368
(352) 796-2449 Fax

Prepared By:
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Lisa O'Connell

Lisa O'Connell, Laboratory Supervisor

P.O. Number: Per G. Foster

File Number: SL 9862

March 2012

Stim-Lab
A CORE LABORATORIES COMPANY

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www.stimlab.com

March 14, 2012

Mr. George Foster
Creative Environmental Solutions
700 DeSoto Ave
Brooksville, FL 34601

Dear Mr. Foster:

STIM-LAB, Inc. has completed the ISO 13503-2/API RP19C evaluations requested on the submitted samples labeled B-21 14'-24', B-23 4'-14', B-27 24'-34', B-32 18'-28', B-37 16'-26' and B-40 28'-38'. The samples were received at Stim-Lab Inc. on February 6, 2012. Following arrival the samples were weighed, disassociated and washed through a 200 mesh sieve. The sample retained on the sieve was then dried and reweighed. The percent loss was calculated from the material that washed through the sieve.

The "Pre" and "Post" wash weights as well as the calculated loss for each sample are provided in Table 1. The composite sieve analysis results for the samples are provided in Tables 2 and 3. The procedures followed are as stated in ISO 13503-2/API RP19C.

Thank you for having STIM-LAB, Inc. to perform these analyses. We hope you will consider us for your future testing needs. If you have any questions regarding the testing or results, please do not hesitate to give me a call.

Sincerely,

Lisa O'Connell

Lisa O'Connell
Laboratory Supervisor
Conductivity Laboratory

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A CORE LABORATORIES COMPANY

SL 9862

Table 1				
Loss From Washing				
Sample ID	Dry Prewash Wt (g)	Dry Postwash Wt(g)	Grams Lost	% Loss
B-21 14'-24'	3598.39	3504.73	93.66	2.60
B-23 4'-14'	4553.26	4233.42	319.84	7.02
B-27 24'-34'	3261.20	3148.08	113.12	3.47
B-32 18'-28'	2515.40	2407.05	108.35	4.31
B-37 16'-26'	3192.15	3043.45	148.70	4.66
B-40 28'-38'	2369.14	2238.64	130.50	5.51

March 2012

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Table 2

Sieve Analysis of Submitted Proppant Samples
Creative Environmental Solutions

ISO 13503-2/API RP19C, Section 6, "Sieve Analysis"

Sample I.D.	B-21 14'-24'		B-23 4'-14'		B-27 24'-34'	
US Standard Sieve No.	Weight %		Weight %		Weight %	
	Retained	Cumulative	Retained	Cumulative	Retained	Cumulative
6	0.0	0.0	0.0	0.0	0.0	0.0
8	0.0	0.0	0.0	0.0	0.0	0.0
10	0.0	0.0	0.0	0.0	0.0	0.0
12	0.0	0.0	0.0	0.0	0.0	0.0
14	0.0	0.0	0.0	0.0	0.0	0.0
16	0.0	0.0	0.0	0.0	0.0	0.0
18	0.0	0.0	0.0	0.0	0.0	0.0
20	0.0	0.0	0.0	0.0	0.1	0.1
25	0.2	0.2	0.2	0.3	0.2	0.3
30	0.6	0.8	1.0	1.2	0.5	0.8
35	1.5	2.4	2.3	3.5	1.2	2.0
40	3.5	5.9	6.1	9.6	2.9	4.9
45	7.2	13.1	13.3	22.9	7.8	12.7
50	9.5	22.6	15.1	38.0	13.6	26.3
60	10.6	33.2	12.0	50.0	14.9	41.2
70	14.8	47.9	13.4	63.4	15.5	56.7
80	17.7	65.6	13.5	76.9	13.3	70.0
100	17.2	82.8	10.7	87.6	11.3	81.3
120	9.7	92.5	5.9	93.5	8.0	89.3
140	4.6	97.1	3.6	97.1	5.6	94.9
170	1.4	98.5	1.5	98.7	2.7	97.6
200	0.7	99.3	0.7	99.3	1.2	98.9
230	0.3	99.6	0.3	99.6	0.5	99.4
pan	0.4	100.0	0.4	100.0	0.6	100.0
total	100.0		100.0		100.0	
in-size	0.0	= as 6/12	0.0	= as 6/12	0.0	= as 6/12
in-size	0.0	= as 8/16	0.0	= as 8/16	0.0	= as 8/16
in-size	0.0	= as 12/20	0.0	= as 12/20	0.1	= as 12/20
in-size	0.8	= as 16/30	1.2	= as 16/30	0.8	= as 16/30
in-size	5.9	= as 20/40	9.5	= as 20/40	4.8	= as 20/40
in-size	21.7	= as 30/50	36.8	= as 30/50	25.5	= as 30/50
in-size	42.0	= as 40/70	53.9	= as 40/70	51.8	= as 40/70
in-size	49.2	= as 70/140	33.7	= as 70/140	38.3	= as 70/140
ISO Mean Dia. (mm)	0.237		0.273		0.244	
Median Dia. (mm)	0.216		0.248		0.247	

March 2012

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Table 3

Sieve Analysis of Submitted Proppant Samples
Creative Environmental Solutions

ISO 13503-2/API RP19C, Section 6, "Sieve Analysis"

Sample I.D.	B-37 16'-26'		B-40 28'-38'		B-32 18'-28'	
US Standard Sieve No.	Weight %		Weight %		Weight %	
	Retained	Cumulative	Retained	Cumulative	Retained	Cumulative
6	0.0	0.0	0.0	0.0	0.0	0.0
8	0.0	0.0	0.0	0.0	0.0	0.0
10	0.0	0.0	0.0	0.0	0.0	0.0
12	0.0	0.0	0.0	0.0	0.1	0.1
14	0.0	0.0	0.0	0.0	0.0	0.1
16	0.0	0.0	0.0	0.0	0.0	0.2
18	0.0	0.0	0.0	0.0	0.0	0.2
20	0.0	0.0	0.0	0.0	0.1	0.3
25	0.1	0.1	0.1	0.1	0.2	0.5
30	0.3	0.4	0.2	0.3	0.5	0.9
35	1.0	1.4	0.8	1.0	1.3	2.2
40	2.6	4.0	1.6	2.7	2.7	4.9
45	6.3	10.3	4.1	6.8	6.1	11.0
50	13.2	23.5	6.3	13.1	9.9	20.9
60	21.5	45.0	9.2	22.3	11.1	31.9
70	19.5	64.5	12.9	35.2	12.6	44.5
80	15.2	79.7	16.4	51.6	16.4	61.0
100	10.2	89.9	17.9	69.6	16.2	77.2
120	5.6	95.5	15.5	85.1	10.7	87.9
140	3.0	98.5	10.4	95.4	7.4	95.3
170	0.9	99.4	3.2	98.6	3.0	98.3
200	0.3	99.7	0.8	99.4	1.2	99.5
230	0.1	99.7	0.3	99.7	0.3	99.8
pan	0.1	99.8	0.3	100.0	0.2	100.0
total	99.8		100.0		100.0	
in-size	0.0 = as 6/12		0.0 = as 6/12		0.1 = as 6/12	
in-size	0.0 = as 8/16		0.0 = as 8/16		0.1 = as 8/16	
in-size	0.0 = as 12/20		0.0 = as 12/20		0.2 = as 12/20	
in-size	0.4 = as 16/30		0.3 = as 16/30		0.7 = as 16/30	
in-size	4.0 = as 20/40		2.7 = as 20/40		4.6 = as 20/40	
in-size	23.2 = as 30/50		12.8 = as 30/50		20.0 = as 30/50	
in-size	60.5 = as 40/70		32.5 = as 40/70		39.6 = as 40/70	
in-size	34.0 = as 70/140		60.3 = as 70/140		50.8 = as 70/140	
ISO Mean Dia. (mm)	0.252		0.205		0.230	
Median Dia. (mm)	0.236		0.188		0.188	

March 2012

Stim-Lab
A CORE LABORATORIES COMPANY

"Measurement of Properties for Proppants Used In Hydraulic Fracturing and Gravel-Packing Operations"
Evaluations on Four Composite Samples
For Creative Environmental Solutions
Submitted March 1, 2013

Prepared For:
Mr. George Foster
Creative Environmental Solutions
700 DeSoto Ave
Brooksville, FL 34601
(352) 279-7368
(352) 796-2449 Fax

Prepared By:
Stim-Lab, Inc.
7406 North Hwy 81
Duncan, OK 73533-1644
(580) 252-4309

Lisa O'Connell, Laboratory Supervisor

P.O. Number: Per G. Foster

File Number: SL 10577

March 2013

Stim-Lab
A CORE LABORATORIES COMPANY

STIM-LAB, Inc.
7406 North HWY 81
Duncan, Oklahoma 73533
Phone: 580-252-4309
Fax: 580-252-6979
www.stimlab.com

March 29, 2013

Mr. George Foster
Creative Environmental Solutions
700 DeSoto Ave
Brooksville, FL 34601

Dear Mr. Foster:

STIM-LAB, Inc. has completed the ISO 13503-2/API RP19C evaluations requested on the submitted sandstone samples labeled FSR B-29 20'-30', FSR B-30 36'-46', FSR B-31 16'-26' and FSR B-32 28'-38'. The samples were received at Stim-Lab Inc. on March 1, 2013 as partially cemented sandstone.

Following arrival, the samples were weighed, disassociated and washed through a 200 mesh sieve. The sample retained on the sieve was then dried, reweighed and re-disassociated prior to testing. The percent loss was calculated from the material that washed through the sieve. The "Pre" and "Post" wash weights as well as the calculated loss for each sample are provided in Table 1. The composite sieve analysis results for the samples are provided in Table 2.

Per instructions, the 30/50 portion of the samples was isolated for testing. The sphericity and roundness (Krumbein Shape Factor), acid solubility, bulk density and crush for K-Value results for the samples are provided in Tables 3 through 6. Pictures of the samples are provided at the end of the report for your review. The procedures followed are as stated in ISO 13503-2/API RP19C.

Thank you for having STIM-LAB, Inc. perform these analyses. We hope you will consider us for your future testing needs. If you have any questions regarding the testing or results, please do not hesitate to give me a call.

Sincerely,

Lisa O'Connell

Lisa O'Connell
Laboratory Supervisor
Conductivity Laboratory

SL 10577

Table 1				
Creative Environmental Solutions March 1, 2013				
Loss From Washing				
Sample ID	Dry Prewash Wt (g)	Dry Postwash Wt(g)	Grams Lost	% Loss
FSR B-29 20'-30'	13479.39	12800.18	679.21	5.04
FRS B-30 36'-46'	10123.05	9610.63	512.42	5.06
FSR B-31 16'-26'	8274.50	7800.96	473.54	5.72
FSR B-32 28'-38'	11791.22	10727.66	1063.56	9.02

March 2013

SL 10577

Table 2

Sieve Analysis of Submitted Proppant Samples
Creative Environmental Solutions

ISO 13503-2:2006/API RP19C:2008, Section 6, "Sieve Analysis"

Sample I.D.	FSR B-29 20'-30'		FSR B-30 36'-46'		FSR B-31 16'-26'		FRS B-32 28'-38'	
US Standard	Weight %		Weight %		Weight %		Weight %	
Sieve No.	Retained	Cumulative	Retained	Cumulative	Retained	Cumulative	Retained	Cumulative
6	-	0.0	-	0.0	-	0.0	-	0.0
8	-	0.0	-	0.0	-	0.0	-	0.0
10	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
12	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
14	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
16	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
18	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
20	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
25	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
30	0.2	0.2	0.4	0.4	0.2	0.2	0.2	0.2
35	0.9	1.2	1.2	1.7	0.8	1.0	0.7	0.9
40	2.5	3.7	3.0	4.7	1.7	2.7	1.7	2.6
45	6.6	10.3	6.9	11.6	4.0	6.7	4.7	7.3
50	10.0	20.3	12.0	23.7	9.4	16.1	8.8	16.1
60	10.9	31.2	16.7	40.3	18.0	34.1	11.6	27.7
70	9.5	40.7	13.4	53.7	16.9	51.0	10.7	38.5
80	14.6	55.3	13.8	67.6	17.9	68.9	14.3	52.8
100	18.7	74.0	13.8	81.4	15.0	83.9	17.9	70.6
120	11.9	85.9	7.9	89.3	7.8	91.7	11.6	82.3
140	7.0	92.9	4.8	94.0	3.9	95.7	7.3	89.6
170	3.9	96.8	3.2	97.2	2.2	97.9	4.8	94.4
200	1.9	98.7	2.0	99.2	1.2	99.1	2.8	97.2
230	0.6	99.3	0.5	99.7	0.4	99.5	1.2	98.5
pan	0.7	100.0	0.2	100.0	0.4	100.0	1.5	100.0
total	100.0		100.0		100.0		100.0	
in-size	0.0	= as 6/12	0.0	= as 6/12	0.0	= as 6/12	0.0	= as 6/12
in-size	0.0	= as 8/16	0.0	= as 8/16	0.0	= as 8/16	0.0	= as 8/16
in-size	0.0	= as 12/20	0.0	= as 12/20	0.0	= as 12/20	0.0	= as 12/20
in-size	0.2	= as 16/30	0.4	= as 16/30	0.2	= as 16/30	0.2	= as 16/30
in-size	3.7	= as 20/40	4.7	= as 20/40	2.7	= as 20/40	2.6	= as 20/40
in-size	20.1	= as 30/50	23.2	= as 30/50	15.8	= as 30/50	15.9	= as 30/50
in-size	37.0	= as 40/70	49.0	= as 40/70	48.3	= as 40/70	35.9	= as 40/70
in-size	52.2	= as 70/140	40.3	= as 70/140	44.7	= as 70/140	51.1	= as 70/140
ISO Mean Dia. (mm)	0.219		0.238		0.227		0.207	
Median Dia. (mm)	0.197		0.217		0.211		0.185	

March 2013

SL 10577

Table 3

Sample ID: FSR B-29 20'-30' 30/50
Creative Environmental Solutions
March 1, 2013

Measurement of Properties of Proppants Used In Hydraulic Fracturing and Gravel-Packing Operations

ISO 13503-2:2006/API RP19C:2008, Section 7, "Proppant Sphericity and Roundness"

Sphericity =	**0.7**
Roundness =	**0.6**
Clusters =	**Approx. 1 of Every 200 Grains Contained Clusters**

Recommended Sphericity and Roundness for proppants = 0.6 or greater (ISO/DIS 13503-2/Amd.1:2009)
Recommended Sphericity and Roundness for high strength proppants = 0.7 or greater (ISO/DIS 13503-2/Amd.1:2009)

ISO 13503-2:2006/API RP19C:2008, Section 8, "Acid Solubility"

* mean of 3 analyses

Acid Sol. Percent =	**0.6**	**%**

Recommended Maximum Acid Solubility for proppants 6/12 thru 30/50 = 2.0%

Tested as per ISO 13503-2/API RP19C, 100ml of 12:3 HCl:HF* with 5 grams of sand or proppant at 150ºF for 30 minutes, *Other acids may be specified, depending on desired application

ISO 13503-2:2006/API RP19C:2008, Section 10, "Procedures for Determining Proppant Bulk Density"

Bulk Density =	**1.44**	**g/cm^3**
Bulk Density =	**89.9**	**lb/ft^3**

ISO 13503-2:2006/API RP19C:2008, Section 11, "Proppant Crush-Resistance Test"

Stresses Tested (psi)	*% Fines -30+50 crush prep*
4000	2.9%
6000	8.5%
7000	14.1%
K-Value =	6K

The highest stress level which proppant generates no more than 10% crushed material, rounded down to the nearest 1000psi = K-Value

March 2013

Stim-Lab
A CORE LABORATORIES COMPANY

SL 10577

Table 4

Sample ID: FSR B-30 36'-46' 30/50
Creative Environmental Solutions
March 1, 2013

Measurement of Properties of Proppants Used In Hydraulic Fracturing and Gravel-Packing Operations

ISO 13503-2:2006/API RP19C:2008, Section 7, "Proppant Sphericity and Roundness"

Sphericity =	**0.7**
Roundness =	**0.7**
Clusters =	**Approx. 1 of Every 200 Grains Contained Clusters**

Recommended Sphericity and Roundness for proppants = 0.6 or greater (ISO/DIS 13503-2/Amd.1:2009)
Recommended Sphericity and Roundness for high strength proppants = 0.7 or greater (ISO/DIS 13503-2/Amd.1:2009)

ISO 13503-2:2006/API RP19C:2008, Section 8, "Acid Solubility"

* mean of 3 analyses

Acid Sol. Percent =	**0.8**	**%**

Recommended Maximum Acid Solubility for proppants 6/12 thru 30/50 = 2.0%

Tested as per ISO 13503-2/API RP19C, 100ml of 12:3 HCl:HF* with 5 grams of sand or proppant at 150ºF for 30 minutes, *Other acids may be specified, depending on desired application

ISO 13503-2:2006/API RP19C:2008, Section 10, "Procedures for Determining Proppant Bulk Density"

Bulk Density =	**1.47**	**g/cm^3**
Bulk Density =	**91.7**	**lb/ft^3**

ISO 13503-2:2006/API RP19C:2008, Section 11, "Proppant Crush-Resistance Test"

Stresses Tested (psi)	*% Fines -30+50 crush prep*
4000	2.5%
6000	8.4%
7000	11.9%
K-Value =	6K

The highest stress level which proppant generates no more than 10% crushed material, rounded down to the nearest 1000psi = K-Value

March 2013

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SL 10577

Table 5

Sample ID: FSR B-31 16'-26' 30/50
Creative Environmental Solutions
March 1, 2013

Measurement of Properties of Proppants Used In Hydraulic Fracturing and Gravel-Packing Operations

ISO 13503-2:2006/API RP19C:2008, Section 7, "Proppant Sphericity and Roundness"

Sphericity =	**0.7**
Roundness =	**0.7**
Clusters =	**Approx. 1 of Every 200 Grains Contained Clusters**

Recommended Sphericity and Roundness for proppants = 0.6 or greater (ISO/DIS 13503-2/Amd.1:2009)

Recommended Sphericity and Roundness for high strength proppants = 0.7 or greater (ISO/DIS 13503-2/Amd.1:2009)

ISO 13503-2:2006/API RP19C:2008, Section 8, "Acid Solubility"

* mean of 3 analyses

Acid Sol. Percent =	**0.7**	**%**

Recommended Maximum Acid Solubility for proppants 6/12 thru 30/50 = 2.0%

Tested as per ISO 13503-2/API RP19C, 100ml of 12:3 HCl:HF* with 5 grams of sand or proppant at 150ºF for 30 minutes, *Other acids may be specified, depending on desired application

ISO 13503-2:2006/API RP19C:2008, Section 10, "Procedures for Determining Proppant Bulk Density"

Bulk Density =	**1.51**	**g/cm^3**
Bulk Density =	**94.2**	**lb/ft^3**

ISO 13503-2:2006/API RP19C:2008, Section 11, "Proppant Crush-Resistance Test"

Stresses Tested (psi)	*% Fines -30+50 crush prep*
4000	1.7%
6000	6.5%
7000	12.8%
K-Value =	6K

The highest stress level which proppant generates no more than 10% crushed material, rounded down to the nearest 1000psi = K-Value

March 2013

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Table 6

Sample ID: FRS B-32 28'-38' 30/50
Creative Environmental Solutions
March 1, 2013

Measurement of Properties of Proppants Used In Hydraulic Fracturing and Gravel-Packing Operations

ISO 13503-2:2006/API RP19C:2008, Section 7, "Proppant Sphericity and Roundness"

Sphericity =	**0.7**
Roundness =	**0.7**
Clusters =	**Approx. 1 of Every 200 Grains Contained Clusters**

Recommended Sphericity and Roundness for proppants = 0.6 or greater (ISO/DIS 13503-2/Amd.1:2009)

Recommended Sphericity and Roundness for high strength proppants = 0.7 or greater (ISO/DIS 13503-2/Amd.1:2009)

ISO 13503-2:2006/API RP19C:2008, Section 8, "Acid Solubility"

* mean of 3 analyses

Acid Sol. Percent =	**0.8**	**%**

Recommended Maximum Acid Solubility for proppants 6/12 thru 30/50 = 2.0%

Tested as per ISO 13503-2/API RP19C, 100ml of 12:3 HCl:HF* with 5 grams of sand or proppant at 150ºF for 30 minutes, *Other acids may be specified, depending on desired application

ISO 13503-2:2006/API RP19C:2008, Section 10, "Procedures for Determining Proppant Bulk Density"

Bulk Density =	**1.47**	**g/cm^3**
Bulk Density =	**91.7**	**lb/ft^3**

ISO 13503-2:2006/API RP19C:2008, Section 11, "Proppant Crush-Resistance Test"

Stresses Tested (psi)	*% Fines -30+50 crush prep*
4000	2.8%
6000	7.0%
7000	11.2%
K-Value =	6K

The highest stress level which proppant generates no more than 10% crushed material, rounded down to the nearest 1000psi = K-Value

March 2013

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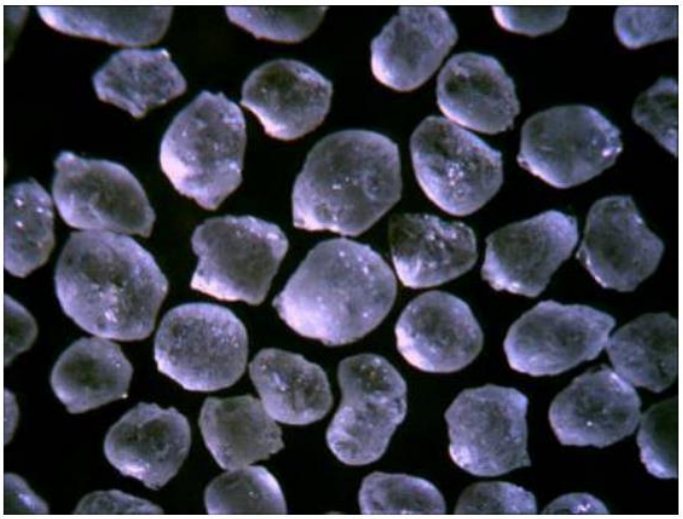
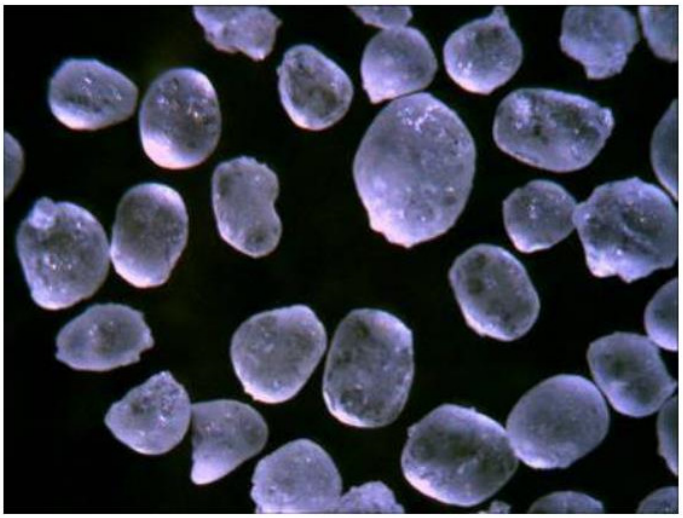
FSR B-29 20'-30' 30/50



FSR B-30 36'-46' 30/50



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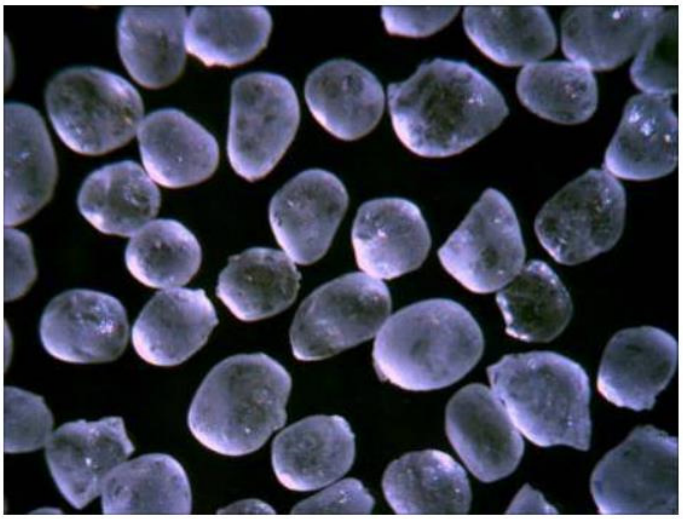
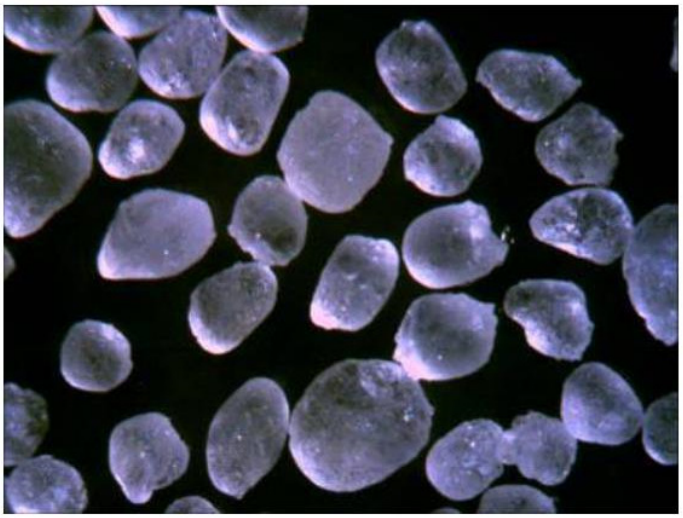
FSR B-31 16'26' 30/50



FSR B-32 28'-38' 30/50



Stim-Lab
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"Measurement of Properties for Proppants Used In Hydraulic Fracturing and Gravel-Packing Operations" Evaluations on Three Samples Labeled NS 30/50, NS 40/70 and NS 100 Mesh For National Silica, LLC - Submitted May 2, 2014

Prepared For:
Shawn Arthur and Carey Carlson
National Silica, LLC
4054 Sawyer Road
Sarasota, FL 34233
(817) 733-7382
Sarthur@nationalsilica.com
Ccarlson@nationalsilica.com

Prepared By:
Stim-Lab, Inc.
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Lisa O'Connell, Laboratory Supervisor

P.O. Number: Work Request No. API2014-0502019

File Number: SL 11192

May 2014

Stim-Lab
A CORE LABORATORIES COMPANY

STIM-LAB, Inc.
7406 North HWY 81
Duncan, Oklahoma 73533
Phone: 580-252-4309
Fax: 580-252-6979
www.stimlab.com

May 30, 2014

Shawn Arthur and Carey Carlson
National Silica, LLC
4054 Sawyer Road
Sarasota, FL 34233

Dear Sirs:

STIM-LAB, Inc. has completed the ISO 13503-2:2006/API RP19C:2008 evaluations requested on the submitted Sioux Creek samples labeled NS 30/50, NS 40/70 and NS 100 Mesh. The samples were received at Stim-Lab Inc. on May 2, 2014.

The sieve analysis results for the samples are provided in Table 1. The sphericity and roundness (Krumbein Shape Factor), acid solubility, turbidity, bulk density, apparent density and crush results for the samples are provided in Tables 2 through 4.

As instructed, the 100 Mesh sample was sized as a 70/140 for testing. The 30/50 sample was crushed at 6,000psi and 7,000psi; the 40/70 and 100 Mesh samples were crushed at 8,000psi. Pictures of the samples are provided following Table 4 for you to review. The procedures followed are as stated in ISO 13503-2:2006/API RP19C:2008.

Thank you for choosing STIM-LAB, Inc. to perform these analyses. We hope you will consider us for your future testing needs. If you have any questions regarding the testing or results, please do not hesitate to give me a call.

Sincerely,

Lisa O'Connell

Lisa O'Connell
Laboratory Supervisor
Conductivity Laboratory

SL 11192

Table 1

Sieve Analysis of Submitted Proppant Samples
National Silica, LLC

ISO 13503-2:2006/API RP19C:2008, Section 6, "Sieve Analysis"

Sample I.D.	NS 30/50		NS 40/70		NS 100 Mesh	
US Standard	Weight %		Weight %		Weight %	
Sieve No.	Retained	Cumulative	Retained	Cumulative	Retained	Cumulative
6	-	0.0	-	0.0	-	0.0
8	-	0.0	-	0.0	-	0.0
10	-	0.0	-	0.0	-	0.0
12	-	0.0	-	0.0	-	0.0
14	-	0.0	-	0.0	-	0.0
16	-	0.0	-	0.0	-	0.0
18	-	0.0	-	0.0	-	0.0
20	0.0	0.0	-	0.0	-	0.0
25	0.0	0.0	-	0.0	-	0.0
30	0.1	0.1	0.0	0.0	-	0.0
35	6.1	6.2	0.0	0.0	-	0.0
40	14.6	20.8	0.1	0.1	-	0.0
45	32.5	53.3	14.4	14.4	-	0.0
50	46.0	99.3	26.7	41.2	0.0	0.0
60	0.5	99.8	37.1	78.3	0.0	0.0
70	0.1	99.9	21.6	99.8	0.2	0.2
80	-	99.9	0.1	99.9	25.7	25.9
100	-	99.9	0.0	100.0	30.5	56.4
120	-	99.9	-	100.0	29.6	86.0
140	-	99.9	-	100.0	14.0	99.9
170	-	99.9	-	100.0	0.1	100.0
200	-	99.9	-	100.0	0.0	100.0
230	-	99.9	-	100.0	-	100.0
pan	0.0	100.0	0.0	100.0	0.0	100.0
total	100.0		100.0		100.0	
in-size	99.3	= as 30/50	99.8	= as 40/70	99.7	= as 70/140
ISO Mean Dia. (mm)	0.381		0.296		0.158	
Median Dia. (mm)	0.374		0.290		0.155	

May 2014

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SL 11192

Table 2

Sample ID: NS 30/50
National Silica, LLC
May 2, 2014

Measurement of Properties of Proppants Used In Hydraulic Fracturing and Gravel-Packing Operations

ISO 13503-2:2006/API RP19C:2008, Section 7, "Proppant Sphericity and Roundness"

* mean of a 20 count

Sphericity =	0.7
Roundness =	0.7
Clusters =	None Observed in Field of Count

Recommended Sphericity and Roundness for proppants = 0.6 or greater (ISO/DIS 13503-2/Amd.1:2009)

ISO 13503-2:2006/API RP19C:2008, Section 8, "Acid Solubility"

* mean of 3 analyses

Acid Sol. Percent =	1.0%

Recommended Maximum Acid Solubility for proppants 6/12 thru 30/50 = 2.0% (ISO/DIS 13503-2/Amd.1:2009)

Tested as per ISO 13503-2:2006/API RP19C:2008, 100ml of 12:3 HCl:HF* with 5 grams of sand or proppant at 150°F for 30 minutes, *Other acids may be specified, depending on desired application

ISO 13503-2:2006/API RP19C:2008, Section 9, "Turbidity Test"

Turbidity =	8	NTU

Method 1: Turbidity, suggested maximum proppant turbidity = equal or less than 250 NTU (ISO/DIS 13503-2/Amd.1:2009)

ISO 13503-2:2006/API RP19C:2008, Section 10, "Procedures for Determining Proppant Bulk Density, Apparent Density"

Bulk Density =	1.42	g/cm^3
Bulk Density =	88.6	lb/ft^3
Apparent Density = (Oil)	2.62	g/cm^3

ISO 13503-2:2006/API RP19C:2008, Section 11, "Proppant Crush-Resistance Test"

Stresses Tested (psi)	*% Fines -30+50 crush prep*
6000	4.5%
7000	7.1%

May 2014

Stim-Lab
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Table 3

Sample ID: NS 40/70
National Silica, LLC
May 2, 2014

Measurement of Properties of Proppants Used In Hydraulic Fracturing and Gravel-Packing Operations

ISO 13503-2:2006/API RP19C:2008, Section 7, "Proppant Sphericity and Roundness"

* mean of a 20 count

Sphericity =	0.7
Roundness =	0.7
Clusters =	None Observed in Field of Count

Recommended Sphericity and Roundness for proppants = 0.6 or greater (ISO/DIS 13503-2/Amd.1:2009)

ISO 13503-2:2006/API RP19C:2008, Section 8, "Acid Solubility"

* mean of 3 analyses

Acid Sol. Percent =	1.1%

Recommended Maximum Acid Solubility for proppants 40/70 to 70/140 = 3.0% (ISO/DIS 13503-2/Amd.1:2009)

Tested as per ISO 13503-2:2006/API RP19C:2008, 100ml of 12:3 HCl:HF* with 5 grams of sand or proppant at 150°F for 30 minutes,
*Other acids may be specified, depending on desired application

ISO 13503-2:2006/API RP19C:2008, Section 9, "Turbidity Test"

Turbidity =	8	NTU

Method 1: Turbidity, suggested maximum proppant turbidity = equal or less than 250 NTU (ISO/DIS 13503-2/Amd.1:2009)

ISO 13503-2:2006/API RP19C:2008, Section 10, "Procedures for Determining Proppant Bulk Density, Apparent Density"

Bulk Density =	1.41	g/cm^3
Bulk Density =	88.0	lb/ft^3
Apparent Density = (Oil)	2.63	g/cm^3

ISO 13503-2:2006/API RP19C:2008, Section 11, "Proppant Crush-Resistance Test"

Stresses Tested (psi)	*% Fines -40+70 crush prep*
8000	7.2%

May 2014

Stim-Lab
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SL 11192

Table 4

Sample ID: NS 100 Mesh (70/140)
National Silica, LLC
May 2, 2014

Measurement of Properties of Proppants Used In Hydraulic Fracturing and Gravel-Packing Operations

ISO 13503-2:2006/API RP19C:2008, Section 7, "Proppant Sphericity and Roundness"

* mean of a 20 count

Sphericity =	0.7
Roundness =	0.6
Clusters =	None Observed in Field of Count

Recommended Sphericity and Roundness for proppants = 0.6 or greater (ISO/DIS 13503-2/Amd.1:2009)

ISO 13503-2:2006/API RP19C:2008, Section 8, "Acid Solubility"

* mean of 3 analyses

Acid Sol. Percent =	1.5%

Recommended Maximum Acid Solubility for proppants 40/70 to 70/140 = 3.0% (ISO/DIS 13503-2/Amd.1:2009)

Tested as per ISO 13503-2:2006/API RP19C:2008, 100ml of 12:3 HCl:HF* with 5 grams of sand or proppant at 150°F for 30 minutes, *Other acids may be specified, depending on desired application

ISO 13503-2:2006/API RP19C:2008, Section 9, "Turbidity Test"

Turbidity =	8	NTU

Method 1: Turbidity, suggested maximum proppant turbidity = equal or less than 250 NTU (ISO/DIS 13503-2/Amd.1:2009)

ISO 13503-2:2006/API RP19C:2008, Section 10, "Procedures for Determining Proppant Bulk Density, Apparent Density"

Bulk Density =	1.34	g/cm^3
Bulk Density =	83.6	lb/ft^3
Apparent Density = (Oil)	2.63	g/cm^3

ISO 13503-2:2006/API RP19C:2008, Section 11, "Proppant Crush-Resistance Test"

Stresses Tested (psi)	*% Fines -70+140 crush prep*
8000	6.6%

May 2014

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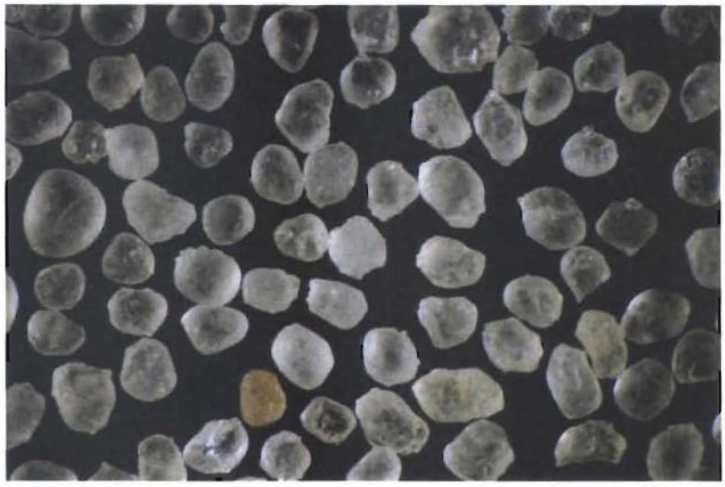
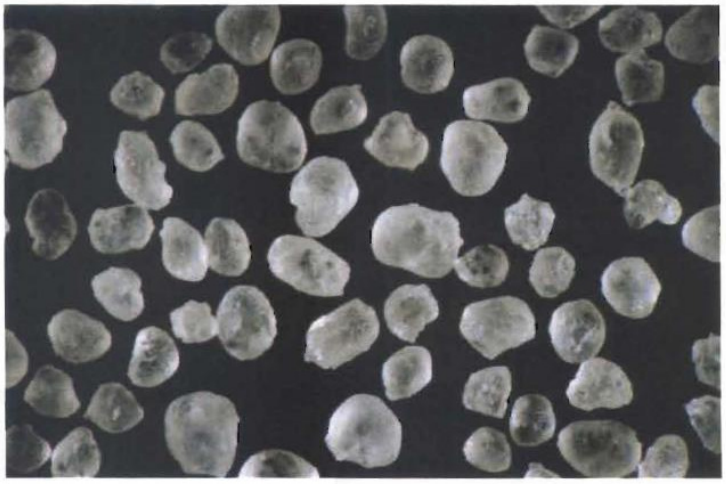
NS 30/50



NS 40/70



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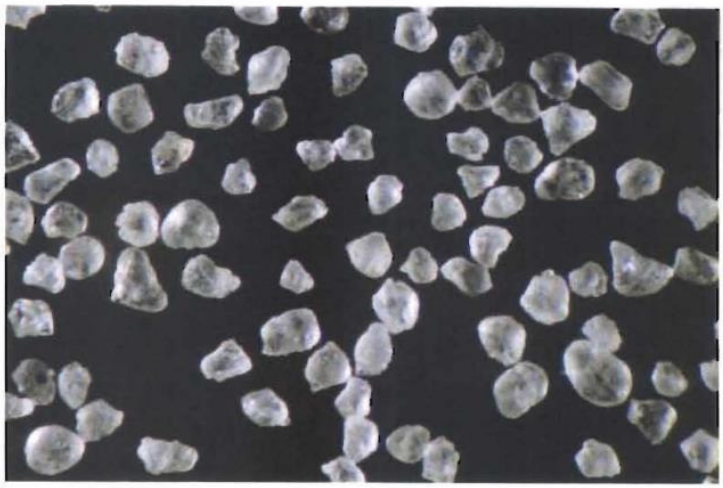
NS 100 Mesh (70/140)



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Appendix 3

AR PCEC, Regulation No. 15, AR Open-Cut Mining and Land Reclamation

Pollution Control and Ecology Commission # 014.00-015

ARKANSAS POLLUTION CONTROL AND ECOLOGY COMMISSION

REGULATION NO. 15

ARKANSAS OPEN-CUT MINING AND LAND RECLAMATION

Approved By Pollution Control and Ecology Commission
JANUARY 24, 2014

TABLE OF CONTENTS

CHAPTER ONE: TITLE AND PURPOSE

Reg.15.101 Title and Authority

The following rules and regulations of the Arkansas Pollution Control and Ecology Commission are promulgated pursuant to the authority of the Arkansas Open-Cut Land Reclamation Act (Act 827 of 1991, as amended) and the Arkansas Water and Air Pollution Control Act (Act 472 of 1949, as amended). This Regulation shall be known as Arkansas Pollution Control and Ecology Commission Regulation Number 15: Arkansas Open-Cut Mining and Land Reclamation" and may be referred to herein as "Regulation".

Reg.15.102 Purpose

It is the purpose of this Regulation to protect the public health, safety, and the environment during and after completion of open-cut or stream bed mining operations.

CHAPTER TWO: DEFINITIONS

Reg.15.201 Definitions

Definitions as used in this Regulation unless the context otherwise requires:

"Act" means the Arkansas Open-Cut Land Reclamation Act;

"Affected land" means the area of land where open-cut mining has been or is taking place or upon which spoil has been deposited, or any other surface disturbance including haul roads, processing and loading facilities, or appurtenances related to the mining operations on or after July 1, 1977, until the land is reclaimed;

"Commercial purposes" means the sale of material from an open-cut mine as either a cash transaction, part of a contractual agreement involving payment for materials provided, or use in another process to create a product with value;

"Commission" means the Arkansas Pollution Control and Ecology Commission (APC&EC), or such commission or other entity as may lawfully succeed to the powers and duties of the Commission;

"Contemporaneous Reclamation" means a mining method for a sand and gravel operation where the mining and reclamation of the mine site has been planned such that the reclamation of the mined areas takes place at intervals or stages as prescribed by the Department and defined in the permit. This mining method reduces the amount of land affected by mining at any given point in time and reduces reclamation costs through efficient management of resources;

"Department" means the Arkansas Department of Environmental Quality or such department or other entity which may lawfully succeed to the powers and duties of the Department;

"Director" means the executive head and active administrator of the Department;

"Final cut" means the last pit created in an open-cut mined area;

"Highwall" means that side of the pit adjacent to unmined land;

"Material" means any commodity or natural deposit mined or treated as spoil during open-cut mining operations;

"Open-cut mining" means the surface extraction of clay, bauxite, sand, gravel, soil, shale or other materials for commercial purposes;

"Operator" means any person engaged in or controlling an open-cut mining or stream channel mining operation;

"Ordinary high water mark" means that line delimiting the bed from the bank and is found by

ascertaining where the presence and actions of water are so usual and long, continuing in ordinary years, as to mark upon the soil of the bed a character distinct from that of the banks, with respect to vegetation and the nature of the soil;

"Peak" means a projecting point of spoil created in the open-cut mining process;

"Permit term" means the period of time beginning with the date upon which a permit is granted for open-cut mining of lands under the provisions of this act and ending on the date requested by the operator and specified by the Department, though not to exceed five (5) years;

"Person" means any individual, partnership, firm, company, public or private corporation, cooperative, association, joint-stock company, trust, estate, political subdivision or any agency, board, department or bureau of the state or any other legal entity whatever which is recognized by law as the subject of rights and duties;

"Pit" means a tract of land where open-cut mining is taking place;

"Reclamation for productive use" means conditioning areas affected by open-cut mining to make them suitable for any uses or purposes consistent with those enumerated in the declaration of policy;

"Ridge" means a lengthened elevation of spoil created in the open-cut mining process;

"Right-of-way" means the portion of land over or under which certain facilities, including, but not limited to roadways, pipelines or power lines, are built;

"Soil" means the unconsolidated mineral or organic material on the immediate surface of the earth that serves as a natural medium for the growth of plants, generally free of boulders, cobbles or other floating rock;

"Spoil" means all waste material and debris connected with open-cut mining and with the mechanical removal, cleaning and preparation of materials at the mine site;

"Streambed" or "stream channel" means that area that lies between the lines delimiting the bed from the bank on each side of a creek, branch, or river. Due to the naturally high turbidity and flow rate of certain rivers, the provisions of this Regulation do not apply to the following rivers: Arkansas, Mississippi, Ouachita (Louisiana State line to Remmel Dam), Red, Little River (not including Lake Millwood), White, North Fork of White (Norfork Dam to White), Black and St. Francis (mouth to 36° parallel); and

"Waterway" means the natural channel of any perennial or intermittent river, creek or stream.

CHAPTER THREE: PERMITTING

Reg.15.301 Permit Required

(A) It shall be unlawful for any operator to engage in open-cut mining without first obtaining all appropriate permits from the Department.

(B) An operator shall be deemed to be engaged in open-cut mining from the time he or she affects any land, until all affected land has been reclaimed and released by the Department.

(C) Operators desiring to remove gravel or other materials from stream beds must obtain a permit to do so from the Department.

(1) The Department will not develop a general permit for the removal of gravel and other materials from stream beds.

(2) There shall be no mining in streams designated as "extraordinary resource waters" of the State as established in water quality standards duly promulgated by the Commission for all surface waters of the State of Arkansas (APC&EC Regulation No. 2). Refer to APC&EC Regulation 2 to determine what streams and waterbodies are considered to be "extraordinary resource waters."

(3) All stream gravel mining operations on streams designated as "extraordinary resource waters" after January 1, 1995 may continue to operate under a permit issued by the Department for a period of two (2) years from the date of such designation. At the end of said two-year period, all mining activities must be terminated and the affected area reclaimed in accordance with the operator's approved reclamation plan.

(D) Previously mined and un-reclaimed land which is to become affected land during new open-cut mining operations must be permitted.

(E) The Arkansas State Highway Department or its contractor shall not be required to obtain a permit for an open-cut mine where the material is used exclusively in the construction, reconstruction, improvement or maintenance of roadways. Reclamation of the area shall conform to the provisions of the standard specifications for highway construction upon discontinuation of use of the pit for the above listed purposes. This exemption does not alleviate any obligations to obtain appropriate permits from the Department, including but not limited to short-term authorizations or water quality permits.

(1) The occasional sale of material to the Highway Department by an operator does not exempt the operator from complying with the requirements of his or her permit, the Act or this Regulation.

(2) In the event the reclamation requirements of the operator interfere with a

contractual agreement with the Highway Department, the operator will be allowed to revise his or her reclamation plan and schedule of completion accordingly. However, any revision must be in compliance with the declaration of policy in the Act.

(F) The following subdivisions apply to governmental units:

(1) County and municipal governments shall not be required to obtain a permit for open-cut mining operations on lands outside of the channel of a waterway for which said government entity has established rights when the material is used for construction, reconstruction, improvement or maintenance of streets, roads, highways or other public projects.

(a) The county or municipal government shall remove topsoil and spoil and store it on site.

(b) Upon completion of mining, the site shall be graded such that no slope will be steeper than one foot (1') vertical to three feet (3') horizontal and the topsoil shall be respread and the site revegetated in a manner to prevent pollution of the waters of Arkansas.

(2) An agent or employee of a county government or municipal government acting in his or her official capacity may remove gravel or other materials from any stream in order to protect the integrity of bridges or low water crossings of any public roadway without obtaining a permit.

(3) A governmental unit may remove gravel or other material from any stream in order to protect the integrity of a governmental owned or controlled structure without obtaining a permit.

(4) The above exemptions do not preclude the governmental unit from obtaining any necessary U.S. Army Corps of Engineers permits or any necessary permits from the Department, including but not limited to short-term authorizations or water quality permits.

(5) Flood control projects authorized by the U.S. Army Corps of Engineers shall be exempt from the mining permit requirement, provided, however, that certification under Section 401 of the Federal Clean Water Act is obtained for said project as well as any appropriate permits from the Department, including but not limited to short-term authorizations or water quality permits.

(a) In the event that authorization pursuant to Section 404 of the Federal Clean Water Act is determined by the U.S. Corps of Engineers not to be required for a specific flood control or bank stabilization project, the Department will review the proposed plan using the Section 401 water quality certification criteria.

(b) The Department shall issue the necessary authorizations and permits as deemed needed for the project once it has been established that the activity will not adversely affect water quality through the Section 401 water quality certification criteria review.

(6) Governmental units not specifically excluded pursuant to the above sections~~,~~ shall obtain a permit from the Department as required by this Regulation.

(G) The following subdivisions apply to landowners:

(1) The requirements of the Act, as amended, and this Regulation shall not apply to the noncommercial removal of clay, bauxite, sand, gravel, soil, shale or other materials from lands by the owner of said lands or by a contractor hired by the owner for the exclusive use by the land owner for construction, improvement or maintenance of roads or other projects on land owned by said owner, or any environmental improvements to previously disturbed lands, or the concurrent or short term, ninety (90) days or less, excavation of materials during the construction of buildings either for residential, commercial or industrial purposes. This exemption does not alleviate any obligation to obtain appropriate permits from the Department, including but not limited to short-term authorizations or water quality permits.

(2) Landowners may sell or barter gravel or other material from stream beds as a part of an approved flood control or bank stabilization project designed or approved by the U.S. Army Corp of Engineers, the Natural Resources Conservation Service, or the Arkansas Game and Fish Stream Team program without a mining permit from the Department. A landowner may remove sufficient stream bed material from one's own land for road maintenance, construction or other uses on said land without obtaining a mining permit. Except as provided above, material shall not be removed for the purpose of commercial sale without first obtaining a mining permit from the Department. This exemption does not alleviate any obligation to obtain appropriate permits from the Department, including but not limited to short-term authorizations or water quality permits.

(H) The following subdivisions are exceptions to this section:

(1) Land affected by open-cut mining operations prior to July 1, 1971 are exempt from the Act and this Regulation unless subsequently affected after July 1, 1971.

(2) Nothing in this Regulation shall be construed to require any operator to reclaim or revegetate any previously exempted excavation sites such as soil and shale pits that were affected and abandoned prior to January 1, 1999.

(3) Nothing in this Regulation shall be construed to apply to the removal of soil, shale, or stone at a quarry operation that is regulated under Ark. Code Ann. §§ 15-

57-401 through 15-57-414.

(4) Nothing in this Regulation shall be construed to apply to any excavation activity associated with the improvement or maintenance of any agricultural lands or associated irrigation systems.

(5) The requirements of the Act, as amended, and the Regulation shall not apply to any area being excavated for soil or shale that is less than three (3) acres where an undisturbed buffer zone of not less than fifty feet (50') exists between the highwalls of the excavation site and any adjacent property line or to any size area being excavated if the area being excavated is at least one-fourth (1/4) of a mile from any adjacent property line.

(6) The above-listed exemptions do not alleviate any obligation to obtain the appropriate permits from the Department, including but not limited to short-term authorizations or water quality permits.

Reg.15.302 Permits: In General

(A) Individual Permit

(1) Any person desiring to engage in an open-cut mining operation that is not covered by a general permit authorized by the Department or stream bed mining shall make written application for an individual permit to the Department.

(2) The application must include, but may not be limited to the following documents:

(a) Two (2) permit application forms;

(b) Permit application fee;

(c) Proof of right to mine the land;

(d) Maps as described in this Regulation;

(e) A mining plan;

(f) A plan of reclamation;

(g) Detailed bond determination;

(h) An acceptable bond instrument; and

(i) A disclosure form as provided by the Department.

(B) General Permit

(1) Any person desiring coverage under a general permit from the Department shall make written notification to the Department. The notification must include the following documents:

(a) Notice of Intent form as provided by the Department;

(b) Notice of Intent fee of two hundred dollars ($200);

(c) Proof of right to mine as described in Reg.15.305;

(d) A 7.5 minute topographic quadrangle map with the outline of the permit boundary clearly marked;

(e) A disclosure form as provided by the Department; and

(f) Reclamation Bond Instrument.

(2) The Department will not approve more than one (1) general permit on a single property. Mining operations that could exceed the acreage limitations of an approved general permit should apply for an individual permit.

(C) A decision on issuance of a permit will be made by the Department upon submittal of a complete application or Notice of Intent. A complete application or Notice of Intent consists of all materials listed in this section for an individual permit or a general permit, and any additional written information or materials the Department determines to be necessary to comply with the Act and this Regulation.

Reg.15.303 Permit Application Requirements

(A) The permit application must be made on a form(s) furnished by the Department.

(B) The application form shall be prepared as two (2) originals with an original notarized signature of an owner, corporate officer, or duly authorized agent on each.

(C) An agent must provide proof of his or her authority by a power of attorney or other such document signed by the principal.

(D) The permit term shall not exceed five (5) years. At the Director's discretion and based on information contained in the operator's right to mine and other environmental concerns, including but not limited to, the proximity of the proposed mining operation to any water bodies, the permit term that is approved may be less than the maximum of five (5) years.

(E) Minor revisions do not require public notice. An applicant for a new permit or major modification of an existing permit shall comply with the public notice requirements

delineated in the Commission's regulations on administrative procedures.

(F) Written comments on a new permit application or major modification of an existing permit with respect to the effects of the proposed mining operations on the environment may be submitted to the Department by any person within thirty (30) days after the last publication of the newspaper notice required by the Commission's regulations on administrative procedures.

(G) The Department shall, immediately upon receipt of any written comments:

(1) Transmit a copy of the letter to the applicant;

(2) File a copy for public inspection with the permit application at the Department's North Little Rock office;

(3) Review the comments and prepare a written response to the comments prior to permit issuance; and

(4) Provide notice of date of permit issuance to all persons who submitted timely written comments.

(H) An applicant for a new or major modification of an existing stream bed mining permit shall make a reasonable effort to notify all adjacent land owners that a complete application for a stream bed mining permit is on file with the Department. This notice shall also contain the permittee's name, mailing address, type of mine, commodity to be mined, and the location of the mine. The adjacent land owners shall be notified at the same time that the permit application is submitted to the Department. The applicant must provide a copy of the letter sent to each adjacent land owner with the application.

(I) A permit issued under the provisions of the Act and this Regulation does not convey to the operator the right of access to the property proposed to be mined. Access must be granted under the Proof of Right to Mine as required in Reg.15.305.

Reg.15.304 Permit Application Fee

(A) The application for a permit shall be accompanied by a fee of ten dollars ($10.00) per acre with a two hundred dollar ($200) minimum.

(B) This fee must be paid by check or money order and made payable to the Arkansas Department of Environmental Quality.

Reg.15.305 Proof of Right to Mine

(A) The applicant must provide the Department with proof that it has the right to mine the land for which a permit is requested.

(B) Acceptable documentation to prove this right is as follows:

(1) A copy of the lease agreement with the landowner. The agreement must contain a legal description of the land to be permitted and be signed by the applicant and landowner;

(2) A copy of the deed containing a legal description of the land in the event the applicant owns the land;

(3) A copy of a letter from the land owner expressly giving the applicant permission to conduct mining. The letter must contain a legal description of the land and be signed and notarized by the land owner;

(4) In the event mineral rights have been severed from the surface rights, an agreement signed by the mineral rights holder, the surface rights holder, and the applicant must be provided to the Department. The agreement shall contain legal descriptions of the mineral rights and surface rights, identify the conditions of the agreement, and give the applicant permission to conduct mining. The agreement must be provided to the Department along with proof of the surface rights holder's and mineral rights holder's respective ownership; or

(5) If the mining operation involves the removal of gravel or other material from within a stream channel where the property boundaries are defined by the centerline of the stream channel, then the site map should clearly identify the boundary of the mining area and the property line.

Reg.15.306 Maps

(A) The applicant must provide the Department with a minimum of one (1) vicinity map, one (1) site map and one (1) reclamation map.

(B) Additional maps may be submitted as needed. All maps must be to scale.

(1) The vicinity map must be a 7.5 minute topographic quadrangle map as prepared by the U.S. Geological Survey, and contain the following:

(a) A clearly-marked permit area;

(b) The legal description of the area to be permitted; and

(c) A clearly-identifiable site entrance.

(2) The site map must be to scale (i.e. 1" = 200') and depict the following features:

(a) The permit area must be outlined and labeled on a site map showing dimensions and elevations.

(i) Boundaries of the mine site and elevations must be tied to temporary reference points established outside the mine site.

(ii) If the mine site is greater than forty (40) acres, an engineer or land surveyor who is registered in Arkansas must prepare the survey.

(iii) The Department may require sites smaller than forty (40) acres to submit a survey, if the site map calls for the construction of engineered structures such as dams, impoundments, shows complex ownership, or for other reasons;

(b) The location and identification of all affected and unaffected areas.

(i) All areas that will not be affected should be marked and labeled.

(ii) Areas to be affected such as haul roads, offices, maintenance shelter(s), loading and process facilities, ponds, scales, refuse storage, spoil storage area, top soil storage area, and excavation area must be clearly marked;

(c) Flow patterns in the event decant ponds or canals are used;

(d) The precautions taken to avoid affecting any nearby water body;

(e) Identification of any diversion ditches used to channel water from sensitive areas, including the flow patterns; and

(f) The mining plan.

(3) The reclamation map should be of similar scale as the site map, and contain the following:

(a) The permit area must be outlined and labeled;

(b) Identification of any roads to remain after reclamation;

(c) Identification of any water impoundments to remain after reclamation, including approximate size and location;

(d) Areas to be revegetated must be marked;

(e) Areas to remain unaffected must be marked; and

(f) Appurtenances for which the Department has given prior approval to remain must be identified and labeled.

Reg.15.307 Mining Plan

(A) In order to adequately assess the environmental soundness of the proposed operation and assess the proposed bond amount and its relationship to the proposed reclamation plan a detailed mining plan must be submitted by the applicant.

(B) The mining plan must include all provisions of this section.

(C) The Department, in its discretion, may require the applicant to address other issues in the mining plan which may impact environmental preservation and the amount of reclamation bond to be posted.

(D) Where applicable, the mining plan must include:

(1) Provisions to prevent unpermitted releases of water from the site, which provisions are to be identified on the site map and described in the mine plan narrative;

(2) A description of the functions of any ponds used as part of the process (i.e., decant ponds) and depiction on the site map;

(3) Methods used to restrict access to and warn the public of the dangers inherent in a mining operation such as fencing, natural or man-made barriers and warning signs;

(4) A description of plan to preserve topsoil for redistribution during reclamation, unless the Director approves otherwise;

(5) A detailed description of any incremental mining map(s) depicting the plan;

(6) Information on the thickness of the topsoil, overburden, and the resource material to be mined; and

(7) A description of plans for contemporaneous reclamation as required by the Department. For sand and gravel open-cut mining operations, a detailed description of the proposed incremental mining that will be conducted which incorporates contemporaneous reclamation.

Reg.15.308 Reclamation Plan

(A) A reclamation plan to return all affected land at the proposed mine site to a useful purpose must be submitted by the applicant.

(B) Stream channel operators must comply with the reclamation requirements of

Reg.15.401(B) and the applicable requirements of this section.

(C) The applicant shall state the intended post mining use of all affected land.

(D) The reclamation plan shall include:

(1) A detailed description of the plans for contemporaneous reclamation as part of the incremental mining plan set forth under the conditions of Reg.15.307(D)(7);

(2) A minimum of two (2) cross-sections of the permit area before mining and two (2) cross-sections of the same area as anticipated upon completion of the proposed reclamation. Cross-sections shall be tied to established elevations in the applicant's survey submitted along with the applicant's site map;

(3) A reclamation map which shows the planned reclamation goal on all of the permit area;

(4) A plan for the final contour of all reclaimed land. The following criteria apply to such plan:

(a) If the original slope of the affected land was less steep than one (1) vertical to three (3) horizontal (1:3), then no final slope shall be steeper than 1:3. If a pond is to be left, the banks must be graded at 1:3 to a point below the water surface at the annual low water level that will allow safe ingress and egress. Beyond this point the normal angle of repose for the material being used may be acceptable, provided it will provide adequate lateral support for the 1:3 slope preceding it;

(b) If the original slope of the affected land was steeper than one (1) vertical to three (3) horizontal (1:3), the Department may approve a final slope steeper than 1:3;

(c) If the material in which excavation is occurring is unconsolidated, in that it is lacking sufficient hardness or ability to resist weathering and inhibit erosion or sloughing, the Department may approve a final slope of approximate original contour, provided the operator can assure the integrity of this slope;

(d) If the material in which excavation is occurring is consolidated, in that it is of sufficient hardness or ability to resist weathering and inhibit erosion or sloughing, the Department may approve a slope deviation involving terracing, provided the reclamation plan meets the criteria as follows:

(i) Final slope of a reclaimed highwall must be approved by the Department as part of the written reclamation plan;

(ii) The top of excavation is to be fenced;

(iii) The uppermost terrace to be no more than ten feet (10') below top of excavation;

(iv) The remainder of a highwall must be terraced with no terrace face greater than twenty feet (20') in height;

(v) The terrace widths are no less than ten feet (10'); and

(vi) Each terrace is to be revegetated with trees or other approved vegetative cover.

(5) Methods used to assure the proper pH of any water impoundments to be left as part of the reclamation. The impoundments must have a pH no less than six (6) or no greater than nine (9).

(6) The methods used to assure the proper pH range shall include:

(a) The procedure for any water treatment;

(b) The design and maintenance of any diversion berms needed to channel water, which are depicted on the site map;

(c) In the event other naturally occurring water bodies in the area of the permit possess pH levels outside the six (6) to nine (9) pH range, and which levels are not caused by human influence, then a similar pH level may be accepted by the Department; and

(d) The Department may accept a deviation from the six (6) to nine (9) pH range due to water runoff from outside the affected area if the influent cannot be avoided through prior planning or sound engineering practice.

(7) A plan to cover all acid-forming materials that become exposed with earth or spoil materials to a depth of not less than three feet (3'), or an alternative approved by the Department;

(8) The location of any proposed fire lanes must be shown on the reclamation map, in the event reforestation is to be used as part of the reclamation. Fire lanes of not less than ten feet (10') in width must be constructed unless otherwise approved by the Department;

(9) A list of the varieties and applicable seeding rate that will be used must be included with the reclamation plan. The applicant shall obtain recommendations on plant varieties and seeding rates based on the intended use of the land from state and federal agricultural or forestry agencies;

(10) Plans for reuse of salvaged topsoil, including the locations where and depth at which topsoil is to be spread; and

(11) A schedule for completion of the reclamation. If the operator fails to meet the completion date, the permit may, in the discretion of the Department, be extended in one -year increments from the termination of the permit.

(12) In the event that the applicant does not comply with its schedule of reclamation after no more than three (3) extensions have been granted, the bond or substituted security posted for such unsatisfactorily reclaimed land shall be forfeited.

(E) Reclamation using only trees must be in accordance with the planting guidelines of the State Forestry Department and include provisions for erosion control.

(F) Successful revegetation will be measured as follows:

(1) Land reclaimed with grasses, etc. must attain a seventy percent (70%) coverage, such that any randomly selected twenty-four inch (24") diameter circle of vegetation must have no less than seventy percent (70%) coverage; or

(2) Land reclaimed with trees must have no less than fifty percent (50%) survival rate after two (2) growing seasons.

(G) All equipment on site must be removed. Permanent structures may remain provided they serve a useful purpose and upon approval by the Department.

(H) The results of the soil analysis made when the site slope is in condition for vegetating. A soil analysis shall be made as a basis for soil amendments, such as lime, fertilizer, or secondary micronutrients needed to support the growth of the vegetation species to be planted. Laboratory analysis shall be obtained from the University of Arkansas Cooperative Extension Service Office or any other public or private organization or person approved by the Department.

Reg.15.309 Reclamation Bond

(A) The application for a mining permit shall be accompanied by a bond or substituted security for the affected or the proposed affected area in favor of the State of Arkansas through the Department.

(B) The bond or substituted security must be effective prior to the date of issuance of the permit by the Department and continue in effect until released by the Department.

(C) The bond amount must be sufficient to assure performance of the reclamation according to the approved reclamation plan for the permitted area in the event the reclamation must

be done by the Department through an independent contractor.

(D) In the event the Department determines the proposed bond amount to be inadequate, the Applicant/Operator and any surety or indemnifier on the bond will be notified that the value of the required bond or substituted security must be increased as provided in the Act.

(E) The operator may submit any of the following three (3) types of bonds:

(1) A surety bond;

(2) A collateral bond with supporting collateral consisting of irrevocable letters of credit or certificates of deposit in favor of the Department; or

(3) A self bond with unencumbered right to certain property to be held by the Department.

(F) Recommended bond forms shall be provided by the Department. A variation of the language in all but the self bond form may be acceptable provided the requirements of the Act and this Regulation are incorporated and the Department approves the language.

(G) In the event self bonding is used, the following conditions apply:

(1) The Applicant/Operator must use the self bond form provided by the Department;

(2) The Applicant/Operator shall pay to have the collateral to be offered appraised by a licensed appraiser approved by the Applicant/Operator and the Department;

(3) The Applicant/Operator must have unencumbered ownership of the collateral, and provide proof of such ownership to the Department;

(4) The value of the collateral as bond will be no more than eighty percent (80%) of the fair market value of the collateral as established by the appraiser;

(5) Any collateral that decreases in value due to usage (i.e., rolling stock) will not be acceptable;

(6) In the event the collateral consists of real property, an environmental audit of the area must be provided to the Department; and

(7) Where applicable, a lien will be filed against the collateral until the affected area is reclaimed and released by the Department.

(H) In the event incremental mining and bonding is to be used, the bond amount for each increment must be determined by the operator and approved by the Department. The accepted amount for the first increment must then be posted with the Department prior to issuance of the permit. The approved bond amount for each succeeding increment must be posted before the land can be affected.

(I) No bond or substituted security shall be canceled by the Surety or Indemnifier for any reason unless it has given no less than ninety (90) days' written notice of the cancellation to the Department's Legal Chief.

(J) In no event shall a bond be canceled on a permitted area that at the time of cancellation has become affected land under the provisions of the Act and this Regulation.

(K) If the license to do business of any corporate surety upon a bond filed with the Department pursuant to the Act and this Regulation shall be suspended or revoked, the operator, within thirty (30) days after receiving notice of such suspension or revocation, shall substitute for the surety a licensed corporate surety. In the event the operator fails to substitute the bond or substituted security upon cancellation or loss of value of its existing bond, the Department shall suspend the permit of the operator until the substitution is made.

(L) No operator shall be eligible to receive a new, renewed, or modified permit who has had a permit revoked, bond forfeited, or who has outstanding substantial unmitigated violations of the Act or this Regulation, unless the Department finds, upon review, a demonstrable change of circumstances justifying an exception to these prohibitions.

Reg.15.310 Temporary Variances and Interim Authority

The issuance of temporary variances and interim authority shall comply with the requirements found in Ark. Code Ann. § 8-4-230.

Reg.15.311 Permit Renewal and Modification

(A) In the event any area for which a permit applies is not mined or where mining operations have not been completed during the permit term, the permit as to such area may be extended by the Department upon application by the permittee. The permittee must mark the application form as "For an extension of time" and submit a review fee of one hundred dollars ($100).

(B) Prior to application for renewal or modification, the permittee should review the current mining plan, reclamation plan, and bond amount. In the event the permittee desires to renew or modify the mining or reclamation plan, the permittee must make application to do so and update the documentation. The permittee must review the bond amount taking into account inflation and any changes to the mining and reclamation plan.

(C) The permittee must mark any application for modification that does not include adding additional new acreage with "To amend" and submit a review fee of one hundred dollars ($100).

(D) In the event the permittee seeks to add additional acreage to the permit area, he or she must submit the following documents for modification:

(1) The permit application filed in duplicate and marked "To amend" on the designated blank;

(2) A permit application fee for the new acreage based on the fee schedule listed in Reg.15.304 in addition to the permit modification review fee of one hundred dollars ($100);

(3) Proof of right to mine the new area as set out in Reg.15.305;

(4) A new site map with the new area clearly delineated from the current permit area;

(5) A mining plan for the new area as set out in Reg.15.307;

(6) A reclamation plan for the new area that is compatible with that of the current reclamation plan as set out in Reg.15.308;

(7) A detailed bond determination for the new area; and

(8) An acceptable bond instrument for the new area as set out in Reg.15.309.

(E) General Permits.

(1) General permits may be renewed or modified by the Department after notice and opportunity for a public hearing.

(2) Under no circumstances will a modification of an existing general permit be approved without notice and opportunity for a public hearing.

(F) General Permit Reissuance.

(1) An operator wishing to continue coverage under a general permit once that permit is reissued must submit written notification to the Department as found in Reg.15.302(B)(1) within thirty (30) days after the date of reissuance.

(2) The fee for continued coverage under a general permit will be one hundred dollars ($100).

Reg.15.312 Permit Revocation

(A) The Department may revoke, modify, or suspend, in whole or in part, for cause any permit issued under the Act and this Regulation, including without limitation:

(1) Violation of any condition of the permit or the bond; or

(2) Obtaining a permit by misrepresentation or failure to disclose fully all relevant facts.

(B) No operator shall be eligible to receive a new, renewed, transferred, or modified permit who has had a permit revoked, bond forfeited, or who has outstanding substantial unmitigated violations of the Act or the Regulation, unless the Department finds, upon review, a demonstrable change of circumstances justifying an exception to these prohibitions.

Reg.15.313 General Permit

(A) After notice and opportunity for a public hearing, the Department may issue general permits for categories of open-cut mining operations that:

(1) Are similar in nature;

(2) Will cause only minimal temporary adverse environmental effects if performed separately; and

(3) Will have only minimal cumulative adverse effects on the environment.

(B) A general permit may be revoked or modified by the Department if after opportunity for a public hearing, the Department determines that the activities authorized by the general permit:

(1) May have an adverse impact on the environment; or

(2) Are more appropriately authorized by individual permits.

(C) The Director, at his or her discretion, may require an applicant to seek coverage under an individual permit.

CHAPTER FOUR: PERFORMANCE STANDARDS

Reg.15.401 Performance Standards — General

(A) Every operator to whom a permit is issued pursuant to the provisions of the Act and this Regulation may engage in open-cut mining during the permit term on the area described in the permit upon the performance of and subject to the listed requirements in Reg.15.402 with respect to the permitted area.

(B) In-Stream Mining

(1) Removal of alluvial materials below the ordinary high water mark of a stream or other waterway shall be permitted only if an operator demonstrates to the satisfaction of the Department that activities associated with the removal, processing, or transport of said materials will not cause a violation of the State's water quality standards and will provide for preservation of bank stability and stream channel integrity, and maintain localized in-stream fish cover.

(2) In addition to compliance with the applicable requirements of the Act and other provisions of this Regulation, compliance with the performance standards listed in Reg.15.403 is required for in-stream mining operations.

(C) Throughout the performance of any permitted mining activities, the operator must implement measures approved in the operator's mining and reclamation plan(s) to ensure that the affected area does not contribute sediment to the stream and restrict access to the site to enhance stream recovery.

(D) Any permitted operator must notify the Department in the case of insolvency, bankruptcy, or receivership.

Reg.15.402 Open-Cut Mining Standards

(A) The perimeter of the permit area must be clearly marked on the ground at all times using metal posts or stakes projecting thirty-six inches (36") above ground and painted Hunter Orange or like color. These markers must remain in place until the operator has reclaimed the site and obtained release from reclamation liability from the Department.

(B) The operator shall protect the public from the dangers inherent in an open-cut mining operation by restricting access to the mine site and posting adequate warning signs.

(C) The operator shall preserve any topsoil for redistribution during reclamation unless otherwise approved by the Director.

(D) All affected land shall be graded to a rolling or terraced topography. No final slope shall

be steeper than one (1) vertical to three (3) horizontal unless otherwise approved by the Department.

(E) The operator may construct earth dams, where lakes or other impoundments may be formed, provided they are constructed and maintained in accordance with sound engineering practices and the provisions of this Regulation.

(F) If a lake is to be left as a part of the reclamation plan, provisions must be made by the operator to assure that a pH factor of six (6) to nine (9) is maintained unless otherwise authorized by the Department.

(G) If the permit area is near or includes a waterway, an undisturbed buffer zone must be maintained between the permit boundary and the ordinary high water mark.

(1) The ordinary high water mark elevation at the upstream and downstream limits of the permit area shall be determined numerically by the Department and included as a permit condition.

(2) If the applicant proposes a buffer zone of less than one hundred feet (100'), reasonable scientific and technical data based on the site specific conditions such as the geology, soil type, slope, or waterway use designation that shows the proposed buffer zone will protect stream channel integrity must be presented to and approved by the Director.

(3) If after review of the data submitted by the applicant, the Director determines that the proposed buffer zone is not adequate, then the buffer zone shall be established by the Department and not to exceed one hundred feet (100') measured horizontally from the ordinary high water mark.

(H) Unless waived by the Department, all affected land that is reforested shall have reasonable fire lanes or access roads of at least ten feet (10') in width constructed through the land.

(I) When the site slope is in condition for vegetation, a soil analysis shall be made as a basis for soil amendments.

(J) The operator shall furnish copies of the soil sample report and recommendations to the Department.

(K) In the event the permit area adjoins another land owner's property line or a right-of-way, open-cut mining operations must maintain an undisturbed buffer zone of fifty feet (50') from any adjacent property line or right-of-way until reclamation begins. For the department to approve a variance on the fifty-foot buffer zone:

(1) There must be an agreement between the affected property owner or right-of-way holder and the operator.

(2) The agreement must identify the land to be affected, describe what is to be done, how close the excavation will encroach on the property line or right-of-way, the plan and schedule of reclamation and be signed by all parties.

(3) This agreement must be submitted with the permit application.

(4) The operator may begin creating the final slope during reclamation at ten feet (10') from the adjacent property line or right-of-way.

(L) Whenever the exposed face of mined seams that contain acid-forming materials is not covered by water or by permanent water impoundment, the operator shall cover the exposed face of the seams with earth or spoil material to a depth of not less than three feet (3') upon approval of the Department.

(M) No later than June 1st of each year of the permit term, the operator shall submit to the Department, an annual report, in the form described in Chapter Six of this Regulation.

(N) All mine spoil generated by the operator shall be disposed of in a manner approved by the Department.

(O) For sand and gravel operations, the operator shall perform contemporaneous reclamation of the mine site in accordance with the operator's incremental mining plan approved by the Department.

(P) Upon approval from the Department, stockpiles of processed materials may be left without being reclaimed if there is a likelihood that there will be a market for the material in the future and that there will be no form of pollution from the stockpiles remaining on or leaving the property.

(Q) Mine and permit identification signs shall:

(1) Be displayed at each point of access to the permit area from public roads;

(2) Show the current permit number and the name, business address, and telephone number of the operator; and

(3) Be retained and maintained until after the final release of the bond for the permit area.

Reg.15.403 Stream Bed Mining Standards

(A) Material removal below the ordinary high water mark must not create a violation of any of the State's water quality standards established by the Commission.

(B) At no time shall equipment such as trucks, loaders or dozers be allowed to operate in the water except as otherwise provided by the Act and this Regulation.

(C) Material removal must not be conducted below an elevation of one foot (1') above the elevation of the surface of the water at the time of removal. If the stream is dry, material removal may proceed to a depth equivalent to one foot (1') above the lowest point of a cross section of the stream at that location.

(D) At no time shall any material removal create a condition(s) that will cause the stream to change course or alter the location of the deepest part of the stream channel or cause bank or channel instability.

(E) Any removal of material below the ordinary high water mark must be conducted in a manner that leaves an undisturbed slope next to the bank to prevent erosion.

(F) An undisturbed buffer zone must be maintained from the ordinary high water mark landward for the length of the material removal site.

(1) If the applicant proposes a buffer zone of less than one hundred feet (100'), reasonable scientific and technical data based on the site specific conditions such as geology, soil type, slope, or waterway use designation that shows the proposed buffer zone will protect the water quality of the waterway must be presented to and approved by the Director.

(2) If, after review of the data submitted by the applicant, the director determines that the proposed buffer zone is not adequate, then the buffer zone shall be established by the Department not to exceed one hundred feet (100') measured horizontally from the ordinary high water mark.

(3) Disturbance in this buffer zone shall be limited to well-maintained access roads for ingress and egress only and when no other reasonable access is available.

(4) Upon temporary or permanent cessation of material removal at a site, steps shall be taken to minimize the amount of surface water and sediment that may enter the stream via an unvegetated access road.

(G) If available, large oversized material shall be salvaged and placed back on the excavated area upon cessation of material removal to provide stability to the area. A description of such material must be included in the mining plan and replacement detailed in the reclamation plan.

(H) Mechanical material processing or storage:

(1) Mechanical material processing or storage shall not occur below the ordinary high water mark;

(2) Mechanical material processing or storage shall occur at a higher elevation than the ordinary high water mark and be outside the buffer zone; and

(3) An incidental pile of material used to facilitate loading below the ordinary high water mark will not be deemed as material storage providing that the pile is of a reasonable size that could practicably be removed that day.

(I) Where conditions exist at specific sites that pose unique environmental threats to a stream, the Department may require additional steps to be taken to protect water quality and aquatic habitat.

(J) If no other access to the material to be mined is available other than to cross a stream, thereby creating turbidity, the Department may approve a temporary crossing structure, provided the structure:

(1) Is designed to reduce or eliminate turbidity;

(2) Is placed perpendicular to the stream;

(3) Does not block or dam the stream; and

(4) Is removed immediately upon cessation of mining.

(K) The mining plan must include, but is not limited to:

(1) A map or maps that depict the permit area, access to the site (from a state, county or municipal road);

(2) Identification of all land to be affected (i.e., process facility, product storage, location of material to be mined with respect to the stream, etc.);

(3) Provisions for storm water and process water containment;

(4) A cross section of the stream channel to be mined; and

(5) Any other site specific information the Department determines to be necessary to provide adequate information to determine if the goals of the Act and this Regulation will be achieved.

(L) There will be no reclamation requirements within the stream channel other than what is necessary to provide bank stability and prevent erosion as listed in paragraphs (E) and (G) above and all affected area outside the stream channel must be reclaimed in accordance with the grading and revegetation requirements of the open-cut provisions of the Act and this Regulation.

(M) No material removal shall be conducted in streams designated as extraordinary resource waters except as provided in Reg.15.301(F) and (G).

(N) Where a stream that is not designated as an extraordinary resource water converges with a stream that is designated as an extraordinary resource water, no mining shall be permitted in the non- extraordinary resource water from the point of confluence upstream for a distance equal to two times the stream channel width of the extraordinary resource water at the confluence or some other distance as agreed to by the Department and the applicant.

(O) A permit obtained under the Act and this Regulation does not exempt the operator from the necessity of obtaining other state or federal permits or licenses nor does it authorize site activities to begin that require other permits or licenses.

(P) Storage of such fluids as fuel, oil or hydraulic fluid and the respective wastes thereof must be such that they cannot enter the stream channel. However, should extraordinary events occur that result in waste water or one or more of these fluids entering the stream, the Department must be notified immediately.

(Q) Landowners may sell or barter gravel or other material from stream beds as a part of an approved flood control project without obtaining a mining permit from the Department. A landowner may remove sufficient stream material from his or her own land for road maintenance, construction or other uses on said land without obtaining a mining permit. Except as provided above, material shall not be removed for the purpose of commercial sale without first obtaining a mining permit from the Department.

(R) The Department may allow deviations from the provisions of paragraphs (B), (D), (E) and (H) above where in the Department's opinion proposed alternatives will achieve the same level of stream protection or rehabilitation.

(S) No later than June 1st of each year of the permit term, the operator shall submit to the Department an annual report in the form described in Chapter Six of this Regulation.

CHAPTER FIVE: ENFORCEMENT

Reg.15.501 Inspections

(A) The Department or its designated representative may enter upon the lands affected by open-cut mining at all reasonable times for the purpose of determining compliance with the provisions of the Act or this Regulation.

(B) The Department shall file all reports concerning any site visits in accordance with Department and division guidance documents.

Reg.15.502 Enforcement

(A) The Department shall seek compliance with the Act and this Regulation through the cooperation of all regulated parties and will afford suspected violators a reasonable opportunity to resolve violations through informal procedures prior to the initiation of administrative enforcement proceedings unless circumstances warrant otherwise.

(B) It shall be unlawful for any person to:

(1) Violate any provision of the Act, this Regulation or order of the Commission or the Department issued pursuant to the Act or this Regulation;

(2) Engage in open-cut or stream bed mining without a permit issued pursuant to the Act or this Regulation;

(3) Violate any conditions of a permit or reclamation plan issued pursuant to the Act or this Regulation;

(4) Knowingly make any false statement, representation or certification or knowingly fail to make a statement, representation or certification in any application, plan, record, report or other document filed or required to be maintained under the Act or this Regulation; or

(5) Willfully resist, prevent, impede or interfere with the Director or any of his or her authorized representatives in the performance of duties pursuant to the Act or this Regulation.

(C) Any person who engages in open-cut or stream bed mining without first securing a permit as required by the Act and this Regulation or who fails to reclaim affected lands in accordance with the Act or this Regulation or who violates any provision of the Act or this Regulation or any order, regulations, rule, permit or reclamation plan issued pursuant thereto, may be issued a Notice of Violation and assessed an administrative civil penalty by the Department not to exceed:

(1) One thousand dollars ($1,000) for the first violation;

(2) Two thousand five hundred ($2,500) for a second separate violation of the same offense within two (2) years; and

(3) Five thousand dollars ($5,000) for a third separate or subsequent violation of the same offense within two (2) years.

(D) No administrative civil penalty may be assessed until the person charged with the violation has been given the opportunity for a hearing and has exhausted all administrative appellate remedies.

(E) The amount of the administrative civil penalty assessed by the Department shall be determined pursuant to the Commission's administrative regulations and procedures.

(F) The Department is authorized to institute a civil action in any court of competent jurisdiction to accomplish any or all of the following:

(1) Restrain any violation of, or compel compliance with, the Act, this Regulation, the permit, the reclamation plan, or any order, rule, or regulation issued pursuant thereto;

(2) Accomplish remedial measures as may be necessary or appropriate to implement or effectuate the purpose and intent of the Act and this Regulation, including the reclamation of affected land;

(3) Recover all costs, expenses and damages to the Department or any other agency of the State in enforcing the provisions of the Act and this Regulation and reclaiming affected land;

(4) Assess civil penalties for violations of the Act or of any order, rule, regulation, permit, or reclamation plan issued pursuant thereto, in an amount not to exceed:

(a) One thousand dollars ($1,000) for the first violation;

(b) Two thousand five hundred dollars ($2,500) for a second separate violation of the same offense within two (2) years; and

(c) Five thousand dollars ($5,000) for a third separate or subsequent violation of the same offense within two (2) years;

(5) Recover civil penalties assessed by the Department; or

(6) Forfeit reclamation bond.

(G) For the purposes of fines only, each day or part of a day during which the violation is continued or repeated shall constitute a separate offense.

(H) As an alternative to the limits on civil or administrative penalties under Reg.15.502(C) or Reg.15.502(F), if a person who is found liable in an action brought under Reg.15.502(C) or Reg.15.502(F) has derived pecuniary gain from the commission of mining without a permit or mining outside of the area authorized in the permit, then the person may be ordered to pay a civil penalty equal to the amount of the pecuniary gain.

(I) All hearings and appeals arising under the Act and this Regulation shall be conducted in accordance with the procedures described in Ark. Code Ann. § 8-4-218, *et seq.* and in accordance with regulations adopted by the Commission, including, but not limited to, the Commission's regulations on administrative procedures.

(J) The Department may institute proceedings to have the bond or substituted security of the operator forfeited for any of the following reasons including but not limited to:

(1) Failure to abate any violation of the Act or this Regulation;

(2) Failure to comply with the terms and conditions of the open-cut mining permit or the bond;

(3) Failure to comply with any order of the Department;

(4) Failure to reclaim the affected land in accordance with the approved reclamation plan, the Act or this Regulation; or

(5) Insolvency, bankruptcy or receivership of the permittee.

(K) The Department shall notify the operator in writing of the bond forfeiture and the operator shall be given an opportunity for a hearing as provided in this Regulation.

CHAPTER SIX: ADMINISTRATIVE REQUIREMENTS

Reg.15.601 Annual Report and Fees

(A) No later than June 1st of each year of the permit term, the operator shall submit to the Department an annual report that contains the following information:

(1) A site map showing the current status of the permit area with the following features clearly marked:

(a) Permit boundary;

(b) Equipment installation;

(c) All roadways including entrance road;

(d) Water impoundments and water circulation system if applicable;

(e) Areas mined but unreclaimed;

(f) Areas currently being mined;

(g) Areas being reclaimed;

(h) Area not yet affected; and

(i) The section, range, township and county.

(2) A narrative providing the following:

(a) The total number of affected acres that have not yet been released by the Department; and

(b) The amount of material mined during the period from May 1st of the previous year through April 30th of the current year.

(B) As authorized in Ark. Code Ann. § 15-57-319(c), the Commission prescribes the following annual permit fee on affected land:

First 100 acres.....$10.00 per acre
101 to 200 acres..... $7.50 per acre
201 and up..... $5.00 per acre

CHAPTER SEVEN: RELEASES

Reg.15.701 Land and Bond Releases

(A) Release from reclamation liability and a proportionate amount of bond may be obtained for permitted land not yet affected and for affected land upon approved reclamation.

(B) To obtain release from reclamation liability on reclaimed or unaffected land and, if desired, a proportionate bond release for land on which bond has been posted:

(1) The operator must make a formal written request to the Department for the release;

(2) The Department will make a preliminary review of the release area to assure compliance with the Act, this Regulation, the permit or any conditions thereto, and the approved reclamation plan;

(3) In the event the preliminary inspection finds the site a viable candidate for release, a Mined Land Review Committee comprised of representatives of various state agencies having experience in foresting and reclaiming open-cut mined lands with forest or agronomic or horticultural species, will tour the site;

(4) The Director will determine release based on the advice and technical assistance provided by the Mined Land Review Committee and the recommendation of Department staff; and

(5) The amount of bond released will be based solely on the cost of reclamation of the release area. In no event shall the amount of bond remaining be less than the cost of reclaiming the remainder of the affected land in accordance with the Act, this Regulation, the permit and the conditions thereto, and the approved reclamation plan.

CHAPTER EIGHT: ABANDONED MINE LAND

Reg.15.801 Inactive or Abandoned Mine Lands

(A) The Department shall locate and document inactive or abandoned mine lands.

(B) The Department shall conduct investigations to ascertain whether any sites were mined post-1971 and make every reasonable effort to locate and notify the operator of the site to comply with the Act and this Regulation.

CHAPTER NINE: SEVERABILITY AND EFFECTIVE DATE

Reg.15.901 Severability

If any provision of this Regulation or the application thereof to any person or circumstance is held invalid, such invalidity shall not affect other provisions or applications of this Regulation which can be given effect without the invalid provision or application, and, to this end, provisions of this Regulation are declared to be severable.

Reg.15.902 Effective Date

This Regulation is effective thirty (30) days after filing with the Secretary of State, the State Library, and the Bureau of Legislative Research.

ARKANSAS REGISTER

Transmittal Sheet

* Use only for **FINAL** and **EMERGENCY RULES**

Secretary of State
Mark Martin
State Capitol, Suite 026
Little Rock, Arkansas 72201-1094
(501) 682-3527
www.sos.arkansas.gov

For Office Use Only:

Effective Date _____ Code Number _____

Name of Agency Arkansas Pollution Control & Ecology Commission

Department Arkansas Department of Environmental Quality

Contact Jim Stephens E-mail stephens@adeq.state.ar.us Phone (501) 682-0809

Statutory Authority for Promulgating Rules A.C.A. §§15-57-301, et seq

Rule Title: Regulation No. 15, Arkansas Open-Cut Mining & Land Reclamation; Docket No. 13-008-R; Minute Order No. 14-05

Intended Effective Date (Check One)

- ☐ Emergency (ACA 25-15-204)
- ☐ 30 Days After Filing (ACA 25-15-204)
- ☐ Other 10 days after filing (Must be more than 30 days after filing date.)

Date	
Legal Notice Published	08/28/13
Final Date for Public Comment	10/21/13
Reviewed by Legislatice Council	12/18/13
Adopted by State Agency	01/24/14

Electronic Copy of Rule submitted under ACA 25-15-218 by:

Jim Stephens (Contact Person) stephens@adeq.state.ar.us (E-mail Address) BY 02/03/14 (Date)

CERTIFICATION OF AUTHORIZED OFFICER

I Hereby Certify That The Attached Rules Were Adopted
In Compliance with Act 434 of 1967 the Arkansas Administrative Procedures Act. (ACA 25-15-201 et. seq.)

Signature

(501) 682-7890 moulton@adeq.state.ar.us
Phone Number E-mail Address

Administrative Law Judge
Title

February 3, 2014
Date

FILED
14 JAN 31 PM 3:03
SECRETARY OF STATE
STATE OF ARKANSAS
REGISTER DIV.

Revised 8/2011 to reflect new legislation passed in 2011.

ARKANSAS POLLUTION CONTROL & ECOLOGY COMMISSION
101 EAST CAPITOL
SUITE 205
LITTLE ROCK, ARKANSAS 72201
PHONE: (501) 682-7890
FAX: (501) 682-7891

February 3, 2014

Ms. Donna Davis
Administrative Rules and Regulations Committee
Room 433, State Capitol Building
Little Rock, Arkansas 72201

RE: Regulation No 15, Arkansas Open-Cut Mining and Land Reclamation - **FINAL FILING**.

Dear Ms. Davis:

I am enclosing the following for filing with your office:

1. One (1) hard copies of the amendment to Regulation No 15, Arkansas Open-Cut Mining and Land Reclamation.
2. One (1) copies of Commission Minute Order No. 14-05
3. One (1) copy of the Financial Impact Statement.

Please provide written confirmation of your receipt of these materials by file-marking the enclosed copy of this letter and returning it to me.

Thank you for your assistance in this matter.

Respectfully,

Charles Moulton
Administrative Law Judge

Enclosures

ARKANSAS STATE LIBRARY

Agency Certification Form
For Depositing Final Rules and Regulations At the Arkansas State Library

Documents Services • Arkansas State Library
One Capitol Mall • Little Rock, AR 72201-1094
501-682-2326 Phone; 501-682-1532 FAX

For Office Use Only

Effective Date: **Classification Number:**

Name of Agency: Arkansas Department of Environmental Quality

Contact Person: Jim Stephens **Telephone:** (501) 682-0809

Statutory Authority for Promulgating Rules: A.C.A. §§15-57-301, et seq.

Title of Rule: Regulation No 15, Arkansas Open-Cut Mining and Land Reclamation; Docket No. 13-008-R; Minute Order 14-05.

Rule Status	Effective Date Status	Effective Date
☐ New Rule/Regulation	☐ Emergency	
☒ Amended Rule/Regulation	☒ 10 Days after filing	February 13, 2014
☐ Repealed Rule/Regulation	☐ Other	
☐ Order	☐ Repealed	
☐ Emergency Rule/Regulation	Adopted by State Agency	

☐ Rule above is proposed and will be replaced by final version

☒ Financial and/or Fiscal Impact Statement Attached

Certification of Authorized Officer

I hereby certify that the attached rules were adopted in compliance with Act 434 of 1967 as amended.

Signature: _____ Date: February 3, 2014

Title: Administrative Law Judge

1/14/99

ARKANSAS POLLUTION CONTROL AND ECOLOGY COMMISSION

LOCATION-SUBJECT
Adoption of Revisions to Regulation No. 15, Arkansas Open-Cut Mining and Land Reclamation Regulation

Docket No. 13-008-R

MINUTE ORDER NO. 14-05

PAGE 1 OF 1

Pursuant to public notice and hearing, and in consideration of comments received, the Arkansas Pollution Control and Ecology Commission hereby adopts changes to Regulation No. 15, Arkansas Open-Cut Mining and Land Reclamation.

PROMULGATED THIS 24th DAY OF JANUARY, 2014, BY ORDER OF THE ARKANSAS POLLUTION CONTROL AND ECOLOGY COMMISSION.

BY: _____
L. Sickel, Chairman

ATTEST: _____
Teresa Marks, ADEQ Director

COMMISSIONERS

M. Armstrong	**S. Jorgenson**
J. Bates	**L. Sickel**
L. Bengal	**J. Simpson**
J. Chamberlin	**W. Thompson**
J. Fox	**B. White**
D. Hendrix	**R. Young**
A. Henry	

_____ **SUBMITTED BY: James F. Stephens PASSED: 01/24/14**
L. Sickel, Chairman

Appendix 4

Drill Logs

Job No. 11-025
Client Bronson
Project FSR

Location of Boring	N 35° 57' 30.4"
Water Level	W 094° 36' 54.3"
Time	
Date	

Boring No. B-27 Date 10/17/11 Sheet 1 of 3
Type of Boring Core Rig D-50
Casing used ____ Size 2" Drilling mud used Poly-plus
Boring begun 1615 Boring completed 1745
Ground Elevation ____ referred to ____ Datum
Field Party CCS/Amdrill

Depth of Casing, ft.	Time Sample No.	Sample depth from-to (in feet)	Total Time per Sample	ID of Sampler (inches)	Tot. length of recov. sample	Length of Lab. sample	DEPTH IN FEET	SOIL GRAPH	DESCRIPTION: Soil type, color, texture, consistency, sampler driving notes, blows per foot on casing, depths wash water lost, observed fluctuation in water level, notes on drilling ease, etc.
	1:15	0-4	3:00		0.1		0	SS-SP	Loose sand w/ sandstone fragments. Orange color. Fine to med. grain.
	2:00	4-9	4:50		0.8		5	SS-SP	Same as above.
	2:50	9-14	12:15		4		10	SS-SP	Same as above.
	7:20	14-19	11:20		5		15	SS	White sandstone. Medium hard. Fine to medium grained. Well rounded. Has thin clay seems.
	6:00	19-24	9:00		0.4		20	SS	Same as above.
							23		

Geologist

Job No. 11-025
Client Bronson
Project FSR

Location of Boring
Water Level
Time
Date

Boring No. B-27 Date 10/17/11 Sheet 2 of 3
Type of Boring Core Rig D-50
Casing used ____ Size 2" Drilling mud used Poly-plus
Boring begun ____ Boring completed ____
Ground Elevation ____ referred to ____ Datum
Field Party CLS/Amdrill

Depth of Casing, ft.	Sample No.	Sample depth from-to (in feet)	Blows/foot on Sampler	ID of Sampler (inches)	Tot. length of recov. sample	Length of Lab. sample	DEPTH IN FEET	SOIL GRAPH	DESCRIPTION Soil type, color, texture, consistency, sampler driving notes, blows per foot on casing, depths wash water lost, observed fluctuation in water level, notes on drilling ease, etc.
	6:10	24-29	4.05		5		25	SS	White sandstone - Med. hard to soft. Has clay lenses in fractures.
	3:05	29-34	6:40		4.5		30	SS	Same as above. Soft.
	4:45	34-39	11.00		4		35	SS	Same as above.
	2:05	39-44	5:55		2		40	SS	
	1:00	44-49	3:45		0		45	CH	Green clay w/ orange & black staining Plastic.
							50		

Geologist

Job No. 11-025
Client Bronson
Project FSR

Location of Boring
Water Level
Time
Date

Boring No. B-27 Date 10/17/11 Sheet 3 of 3
Type of Boring Core Rig D-50
Casing used ____ Size 2" Drilling mud used Poly-plus
Boring begun ____ Boring completed ____
Ground Elevation ____ referred to ____ Datum
Field Party CSS / Amidrill

Depth of Casing, ft.	Sample No.	Sample depth from-to (in feet)	Blows/foot on Sampler	ID of Sampler (inches)	Tot. length of recov. sample	Length of Lab. sample	DEPTH IN FEET	SOIL GRAPH	DESCRIPTION Soil type, color, texture, consistency, sampler driving notes, blows per foot on casing, depths wash water lost, observed fluctuation in water level, notes on drilling ease, etc.
	1:10	49-54	6:00		1.5		50	CH	Green clay.
								SS	weathered sandstone.
								CH	Green clay w/ brown staining. Plastic
	2:25	54-59			2				
							55		
								Dol	Dolomite, Hard. Dark gray.
									EOB @ 59'
							60		

Geologist

Job No. 11-025
Client Bronson
Project FSR

Location of Boring	N 35° 57' 10.3"
Water Level	W 091° 37' 50.4"
Time	
Date	

Boring No. B-28 Date 10/19/11 Sheet 1 of 1
Type of Boring Core Rig D-50
Casing used ____ Size 2" Drilling mud used Poly-plus
Boring begun 0750 Boring completed 0815
Ground Elevation ____ referred to ____ Datum
Field Party CES/Amdrill

Depth of Casing, ft.	Time	Sample depth from-to (in feet)	Total Time	ID of Sampler (inches)	Tot. length of recov. sample	Length of Lab. sample	DEPTH IN FEET	SOIL GRAPH	DESCRIPTION Soil type, color, texture, consistency, sampler driving notes, blows per foot on casing, depths wash water lost, observed fluctuation in water level, notes on drilling ease, etc.
	2:00	0-4	6:10		2'		0	CL	Red, sandy clay.
	2:10	4-9	5:35		4'		5	CL	Same as above
	1:35	9-14	5:45		5'		10	CL	Same as above. Contains sandstone fragments. Also has pockets of green clay.
	1:35	14-19			3.5'		15	CL	Same as above.
		19-24					20		EOB @ 19'
							25		

Geologist [signature]

Job No. 11-025
Client Bronson
Project FSR

Location of Boring	N 35° 57' 02.0"
Water Level	W 094° 37' 53.1"
Time	
Date	

Boring No. B-29 Date 10/19/11 Sheet 1 of 3
Type of Boring Core Rig D-50
Casing used ____ Size 2" Drilling mud used Poly-plus
Boring begun 0850 Boring completed 1100
Ground Elevation ____ referred to ____ Datum
Field Party CES/Amdrill

Depth of Casing, ft.	Time Sampling	Sample depth from-to (in feet)	Total Depth of Sampler	ID of Sampler	Tot. length of recov. sample	Length of Lab. sample	DEPTH IN FEET	SOIL GRAPH	DESCRIPTION
	3:10	0-4	6:10		3.6		0	CL	Sandy clay - Brown.
								SS	White sandstone - Soft - Fine to medium grained - Well rounded.
	4:25	4-9	7:25		5		5	SS	Same as above.
	4:50	9-14	8:30		5		10	SS	Same as above.
	5:00	14-19	8:00		5		15	SS	Same as above.
	6:30	19-24	10:05		5		20	SS	Same as above. Medium hardness.
							25		

Geologist

Job No. 11-025
Client Brunson
Project FSR

Location of Boring
Water Level
Time
Date

Boring No. B-29 Date 10/19/11 Sheet 2 of 3
Type of Boring Core Rig D-50
Casing used ____ Size 2" Drilling mud used Poly-Plus
Boring begun ____ Boring completed ____
Ground Elevation ____ referred to ____ Datum
Field Party CES / Amador

Depth of Casing, ft.	Sample No.	Sample depth from-to (in feet)	Blows/foot on Sampler	ID of Sampler (inches)	Tot. length of recov. sample	Length of Lab. sample	DEPTH IN FEET	SOIL GRAPH	DESCRIPTION Soil type, color, texture, consistency, sampler driving notes, blows per foot on casing, depths wash water lost, observed fluctuation in water level, notes on drilling ease, etc.
	6:30	24-29	11:30		5		25	SS	White sandstone - Medium hard. Has moderate orange oxidation staining.
	7:00	29-34	11:30		5		30	SS	Same as above. White.
	6:50	34-39	11:30		5		35	SS	Same as above. Soft to medium hard.
	4:35	39-44	8:45		5		40	SS	Same as above. Soft.
	4:15	44-49	8:00		4.5		45		Sandstone is green.
								CL	Sandy clay. Orange color.
							50		

Geologist

Job No. 11-025
Client Bronson
Project FSR

Location of Boring
Water Level
Time
Date

Boring No. B-24 Date 10/19/11 Sheet 3 of 3
Type of Boring Core Rig D-50
Casing used ____ Size 2" Drilling mud used Poly-plus
Boring begun ____ Boring completed ____
Ground Elevation ____ referred to ____ Datum
Field Party CEJ/Anderson

Depth of Casing, ft.	Sample No.	Sample depth from-to (in feet)	Blows/foot on Sampler	ID of Sampler (inches)	Tot. length of recov. sample	Length of Lab. sample	DEPTH IN FEET	SOIL GRAPH	DESCRIPTION Soil type, color, texture, consistency, sampler driving notes, blows per foot on casing, depths wash water lost, observed fluctuation in water level, notes on drilling ease, etc.
	1:00	49-54	6.5		2.2'		50	CL	Sandy clay. Brown color. Has some green staining.
	4:55	54-59			4		55		Same as above. w/ lenses of sandstone
								Dol	Dolomite. Dark gray. Hard
							60		EOB @ 54'

Geologist

Job No. 11-025
Client Bronson
Project FSR

Location of Boring	N 35° 57' 00.8"
Water Level	W 091° 38' 04.7"
Time	
Date	

Boring No. B-30 Date 10/19/11 Sheet 1 of 4
Type of Boring Core Rig D-50
Casing used ____ Size 2" Drilling mud used Poly-plug
Boring begun 1315 Boring completed 1645
Ground Elevation ____ referred to ____ Datum
Field Party CLS / Mudrill

Depth of Casing, ft.	Time	Sample depth from-to (in feet)	Total Recovery of Sample	ID of Sampler (inches)	Tot. length of recov. sample	Length of Lab. sample	DEPTH IN FEET	SOIL GRAPH	DESCRIPTION Soil type, color, texture, consistency, sampler driving notes, blows per foot on casing, depths wash water lost, observed fluctuation in water level, notes on drilling ease, etc.
	1:05	0-4	8:20		2.5'		0	CL	Sandy clay. Red-orange.
	1:55	4-9	7:00		1.6		5	CL	Same as above w/ sandstone fragments.
	2:35	9-14	5:00		0.5		10		Only recovered 6 inches of sandstone fragments.
	4:30	14-19	6:55		3.2		15	SS	White sandstone. Very soft
	2:00	19-24	8:30		2		20	SS-SC	Mix of clayey sand & sandstone fragments. Orange
							25		

Geologist

Job No. 11-025
Client Branson
Project FIR

Location of Boring
Water Level
Time
Date

Boring No. B-30 Date 10/14/11 Sheet 2 of 4
Type of Boring Core Rig D-50
Casing used ____ Size 2" Drilling mud used Poly-plus
Boring begun ____ Boring completed ____
Ground Elevation ____ referred to ____ Datum
Field Party CES / Aardvark

Depth of Casing, ft.	Sample No.	Sample depth from-to (in feet)	Blows/foot on Sampler	ID of Sampler (inches)	Tot. length of recov. sample	Length of Lab. sample	DEPTH IN FEET	SOIL GRAPH	DESCRIPTION
	1.45	24-24	5.50		1.2		25	SS	White sandstone. Silt.
	3.25	29-34	8.30		4		30	SS	Same as above
	3.65	34-39	7.00		4.1		35	SS	Same as above. Contains clay lense.
	5.20	39-44	9.55		3.8		40	SS	Same as above.
	3.15	44-49	9.15		4.1		45	SS	Same as above.
							50		

Geologist

Job No. 11-025
Client Bronson
Project FSR

Location of Boring
Water Level
Time
Date

Boring No. B-30 Date 10/19/11 Sheet 3 of 4
Type of Boring Core Rig D-50
Casing used ____ Size 2" Drilling mud used Poly-Plug
Boring begun ____ Boring completed ____
Ground Elevation ____ referred to ____ Datum
Field Party CES/Andrew

Depth of Casing, ft.	Sample No.	Sample depth from-to (in feet)	Blows/foot on Sampler	ID of Sampler (inches)	Tot. length of recov. sample	Length of Lab. sample	DEPTH IN FEET	SOIL GRAPH	DESCRIPTION
	6.40	49-54	11.00		5		50	SS	White sandstone, Medium hard. Fine to medium grained. Well rounded.
	4.45	54-54	10.20		4		55	SS	Same as above.
	7.50	54-64	12.25		4.2		60	SS	Same as above. w/ clay lense.
	6.50	64-69	9.35		2		65	CL	Drilled soft no recovery
	10.10	69-74	15.10		4		70	SS	Sandstone White w/ orange clay lenses. Med. hard.
							75		

Geologist

Job No. 11-025
Client Bronson
Project FSR

Location of Boring
Water Level
Time
Date

Boring No. B-30 Date 10/19/11 Sheet 4 of 4
Type of Boring Core Rig D-50
Casing used ____ Size 2" Drilling mud used Poly-Plus
Boring begun ____ Boring completed ____
Ground Elevation ____ referred to ____ Datum
Field Party CES / Andrill

Depth of Casing, ft.	Sample No.	Sample depth from-to (in feet)	Blows/foot on Sampler	ID of Sampler (inches)	Tot. length of recov. sample	Length of Lab. sample	DEPTH IN FEET	SOIL GRAPH	DESCRIPTION Soil type, color, texture, consistency, sampler driving notes, blows per foot on casing, depths wash water lost, observed fluctuation in water level, notes on drilling ease, etc.
	6:25	74-79	21.60		5'		75	SS	
								CH	Plastic clay.
								SS	Sandstone - Green color. Soft to medium hard.
	5:60	79-84	11.45		3.8		80		
								SS	Same as above.
									Sandstone has black spots.
	2:55	84-89	11.35		5.7		85		
								CL	Sandy clay - Brown.
	1:40	89-94	7.45		2		90		Same as above w/ sandstone fragments.
	1:25	94-99			3		95		Same as above.
							100		EOB @ 99'

Geologist

Job No. 11-025
Client Bronson
Project FSR

Location of Boring	N 35° 56' 53.9"
Water Level	W 094° 38' 10.3"
Time	
Date	

Boring No B-31 Date 10/19/11 Sheet 1 of 4
Type of Boring Core Rig D-55
Casing used ____ Size 2" Drilling mud used Poly-plus
Boring begun 1730 Boring completed 1545
Ground Elevation ____ referred to ____ Datum
Field Party CES / Arnold

Depth of Casing, ft.	Time Sample No.	Sample depth from-to (in feet)	Total Depth of Sample	ID of Sampler (inches)	Tot. length of recov. sample	Length of Lab. sample	DEPTH IN FEET	SOIL GRAPH	DESCRIPTION Soil type, color, texture, consistency, sampler driving notes, blows per foot on casing, depths wash water lost, observed fluctuation in water level, notes on drilling ease, etc.
	1:00	0-4	4.00		0		0		No recovery, very soft.
	2:20	4-4			2.3		5	SS	Sandstone. White w/ black & green staining. Soft.
	2:15	9-14	4.45		1		10		White sandstone w/ loose sand. Fine to medium grained. Well rounded.
	5:25	14-19	9.45		5		15	SS	White sandstone. Soft to very soft.
	3:55	19-24	9.40		5		20	SS	Same as above.
							25		

Geologist

Job No. 11-025
Client Bronson
Project FSR

Location of Boring
Water Level
Time
Date

Boring No. B-31 Date 10/20/11 Sheet 2 of 4
Type of Boring Core Rig D-50
Casing used ____ Size 2" Drilling mud used Poly-plus
Boring begun ____ Boring completed ____
Ground Elevation ____ referred to ____ Datum
Field Party CES / Andrill

Depth of Casing, ft.	Sample No.	Sample depth from-to (in feet)	Blows/foot on Sampler	ID of Sampler (inches)	Tot. length of recov. sample	Length of Lab. sample	DEPTH IN FEET	SOIL GRAPH	DESCRIPTION Soil type, color, texture, consistency, sampler driving notes, blows per foot on casing, depths wash water lost, observed fluctuation in water level, notes on drilling ease, etc.
	3:15	24-29	9.00		5		25	SS	White sandstone. Soft. Fine to medium grained. Well rounded.
	3:10	29-34	9.00		5		30	SS	Same as above.
	4:25	34-39	8.00		4.2		35	SS	
								CL	Sandy clay. Orange-brown.
	5:35	39-44	17.00		3.9		40	SS	White sandstone. Med. soft.
	5:10	44-49	10.00		3.6		45	SS	Same as above. Medium hard.
							50		

Geologist

Job No. 11-025
Client Brown
Project FSR

Location of Boring
Water Level
Time
Date

Boring No. B-31 Date 10/26/11 Sheet 3 of 4
Type of Boring Core Rig D-50
Casing used ____ Size 2" Drilling mud used Poly-plus
Boring begun ____ Boring completed ____
Ground Elevation ____ referred to ____ Datum
Field Party CES/Amdrill

Depth of Casing, ft.	Sample No.	Sample depth from-to (in feet)	Blows/foot on Sampler	ID of Sampler (inches)	Tot. length of recov. sample	Length of Lab. sample	DEPTH IN FEET	SOIL GRAPH	DESCRIPTION
	4.30	49-54	11.30		2.5		50	SS	White sandstone. Hard. Minor orange oxidation staining.
	19.20	54-59	28.00		5		55	SS	Same as above. Contains clay lense.
	9.30	59-64	13.00		4		60	SS	Same as above.
	5.20	64-69	10.00		4.1		65	SS	Same as above w/ intermittent sand layers.
	4.40	69-74	9.05		0		70		No recovery
							75		

Geologist

Job No. 11-025
Client Bronson
Project FSR

Location of Boring	
Water Level	
Time	
Date	

Boring No. B-31 Date 10/20/11 Sheet 4 of 4
Type of Boring Core Rig D-50
Casing used ____ Size 2" Drilling mud used Poly-plus
Boring begun ____ Boring completed ____
Ground Elevation ____ referred to ____ Datum
Field Party CLS/Andrill

Depth of Casing, ft.	Sample No.	Sample depth from-to (in feet)	Blows/foot on Sampler	ID of Sampler (inches)	Tot. length of recov. sample	Length of Lab. sample	DEPTH IN FEET	SOIL GRAPH	DESCRIPTION Soil type, color, texture, consistency, sampler driving notes, blows per foot on casing, depths wash water lost, observed fluctuation in water level, notes on drilling ease, etc.
	2:25	74-79	B:30		1		75	SP-SS	Loose sand w/ sandstone fragments - Brown.
	2:46	79-84	8:20		0		80		No recovery, very soft.
	0:35	84-89	9:20		0		85		No recovery, very soft.
	2:40	89-94			2		90	CH	Green clay w/ orange oxidation staining, Plastic
								SS	Green, weathered sandstone.
								CH	Green clay. Plastic
							95		EOB @ 94'
							100		

Geologist

Job No. 11-025
Client Bronson
Project FSR

Location of Boring	N 35° 56' 46.9"
Water Level	W 091° 38' 07.5"
Time	
Date	

Boring No. B-32 Date 10/20/11 Sheet 1 of 3
Type of Boring Core Rig D-50
Casing used ____ Size 2" Drilling mud used Poly-plus
Boring begun 1635 Boring completed 1900
Ground Elevation ____ referred to ____ Datum
Field Party CES/Andrill

Depth of Casing, ft.	Time Sampling Began	Sample depth from-to (in feet)	Total Depth of Sampler	Time ID of Sampler (inches)	Tot. length of recov. sample	Length of Lab. sample	DEPTH IN FEET	SOIL GRAPH	DESCRIPTION
	0:30	0-4	3.00		1		0	SM	Silty sand. Brown.
	2:10	4-9	4.45		0.8		5	SS	White sandstone w/ orange oxidation staining. Soft.
	2:50	9-14	5.35		3		10	SS	Same as above.
	3:20	14-19	6.50		4.1		15	SS	White sandstone. Fine to medium grained. Well rounded. Soft. Friable.
	4:20	19-24	7.35		5		20	SS	Same as above. W/ orange oxidation staining. Med. hard.
							25		

Geologist

Job No. 11-025
Client Bronson
Project FSR

Location of Boring
Water Level
Time
Date

Boring No. B-32 Date 10/20/11 Sheet 2 of 3
Type of Boring Core Rig D-50
Casing used ____ Size 2" Drilling mud used Poly-plus
Boring begun ____ Boring completed ____
Ground Elevation ____ referred to ____ Datum
Field Party CES/Ambrill

Depth of Casing, ft.	Sample No.	Sample depth from-to (in feet)	Blows/foot on Sampler	ID of Sampler (inches)	Tot. length of recov. sample	Length of Lab. sample	DEPTH IN FEET	SOIL GRAPH	DESCRIPTION Soil type, color, texture, consistency, sampler driving notes, blows per foot on casing, depths wash water lost, observed fluctuation in water level, notes on drilling ease, etc.
	5:30	24-29	9:15		4		25	SS	White sandstone w/ orange oxidation staining. Hard.
	6:45	29-34	27:45		5		30	SS	Same as above.
	7:10	34-39			4.1		35	SS	Same as above.
	5:20	39-44	12:40		1		40	SS	Same as above.
	6:00	44-49	17:30		1.2		45	SS	Same as above.
							50		

Geologist [signature]

Job No. 11-025
Client Bronson
Project FSR

Location of Boring
Water Level
Time
Date

Boring No. B-32 Date 10/21/11 Sheet 3 of 3
Type of Boring Core Rig D-50
Casing used ____ Size 2" Drilling mud used Poly-plus
Boring begun ____ Boring completed ____
Ground Elevation ____ referred to ____ Datum
Field Party CCS/Amdrill

Depth of Casing, ft.	Sample No.	Sample depth from-to (in feet)	Blows/foot on Sampler	ID of Sampler (inches)	Tot. length of recov. sample	Length of Lab. sample	DEPTH IN FEET	SOIL GRAPH	DESCRIPTION Soil type, color, texture, consistency, sampler driving notes, blows per foot on casing, depths wash water lost, observed fluctuation in water level, notes on drilling ease, etc.
	2:55	49-54	8:20		2'		50	SS	White sandstone. Very soft. Fine to medium grained. Well rounded.
	0:30	54-54	6:40		0		55		No recovery, very soft.
	1:58	59-64	7:25		0.5		60	SS-SP	Loose sand w/ lenses of sandstone. White w/ orange oxidation staining.
	1:01	64-68			1		65	CH	Green clay. Plastic.
									EOB @ 66'
		69-74					70		
							75		

Geologist

Job No. 11-025
Client Bronson
Project FSR

Location of Boring	N 35° 56' 56.8"
Water Level	W 97° 37' 44.4"
Time	
Date	

Boring No. B-33 Date 10/21/11 Sheet 1 of 1
Type of Boring Core Rig D-50
Casing used ____ Size 2" Drilling mud used Poly-plus
Boring begun 1415 Boring completed 1500
Ground Elevation ____ referred to ____ Datum
Field Party CES/Amdrill

Depth of Casing, ft.	Time	Sample depth from-to (in feet)	Total Time	ID of Sampler (inches)	Tot. length of recov. sample	Length of Lab. sample	DEPTH IN FEET	SOIL GRAPH	DESCRIPTION Soil type, color, texture, consistency, sampler driving notes, blows per foot on casing, depths wash water lost, observed fluctuation in water level, notes on drilling ease, etc.
		0-4			1		0	SM	Silty sand. Brown.
	2:20	4-9	4:35		2		5	SS	White sandstone. Soft. Fine to medium grained. Well rounded.
	0:50	9-14	2:30		0		10		Very soft, no recovery.
	1:00	14-19	3:50		1		15	CH	Green clay. Plastic.
	2:15	19-24			2.5		20	SS	Green sandstone
								CH	Green clay Plastic
							25		EOB @ 24'

Geologist [signature]

Job No. 11-025
Client Brown
Project FSR

Location of Boring	N 35° 57' 03.4"
Water Level	W 094° 37' 35.9"
Time	
Date	

Boring No. B-34 Date 10/22/11 Sheet 1 of 1
Type of Boring CPT Rig D-50
Casing used ____ Size 2" Drilling mud used Poly-plus
Boring begun 0855 Boring completed 0900
Ground Elevation ____ referred to ____ Datum
Field Party CES / Arndt

Depth of Casing, ft.	Time / Sample No.	Sample depth from-to (in feet)	Blows on Sampler (Type)	ID of Sampler (inches)	Tot. length of recov. sample	Length of Lab. sample	DEPTH IN FEET	SOIL GRAPH	DESCRIPTION
	2:55	0-4			2		0	CH	Green clay - Plastic.
								DJ	Dolomite - Hard. Dark gray
									EOB @ 4'
		4-9					5		
		9-14					10		
		14-19					15		
		19-24					20		
							25		

Geologist

Job No. 11-025
Client Bronson
Project FSR

Location of Boring	N 35° 56' 50.1"
Water Level	W 091° 37' 53.7"
Time	
Date	

Boring No. B-35 Date 10/22/11 Sheet 1 of 1
Type of Boring Core Rig D-50
Casing used ____ Size 2" Drilling mud used Poly-plug
Boring begun 1015 Boring completed 1025
Ground Elevation ____ referred to ____ Datum
Field Party CES / Amdrill

Depth of Casing, ft.	Time	Sample depth from-to (in feet)	Total Time	ID of Sampler (inches)	Tot. length of recov. sample	Length of Lab. sample	DEPTH IN FEET	SOIL GRAPH	DESCRIPTION Soil type, color, texture, consistency, sampler driving notes, blows per foot on casing, depths wash water lost, observed fluctuation in water level, notes on drilling ease, etc.
	1:30	0-4	6:30		1.5		0	CL	Sandy clay.
								CH	Green clay, sandy, plastic. Has orange oxidation staining
	2:30	4-9			2.1		5	CH	Same as above.
									EOB @ 9'
		9-14					10		
		14-19					15		
		19-24					20		
							25		

Geologist [signature]

Job No. 11-025
Client Bronson
Project FJR

Location of Boring	N 35° 57' 01.7"
Water Level	W 041° 37' 23.5"
Time	
Date	

Boring No. B-36 Date 10/22/11 Sheet 1 of 1
Type of Boring Core Rig D-50
Casing used ___ Size 2" Drilling mud used Poly-plus
Boring begun 1140 Boring completed 1205
Ground Elevation ___ referred to ___ Datum
Field Party CSS/Ambrik

Depth of Casing, ft.	Time Sampling	Sample depth from-to (in feet)	Total Time Boring	ID of Sampler (inches)	Tot. length of recov. sample	Length of Lab. sample	DEPTH IN FEET	SOIL GRAPH	DESCRIPTION Soil type, color, texture, consistency, sampler driving notes, blows per foot on casing, depths wash water lost, observed fluctuation in water level, notes on drilling ease, etc.
	0:30	0-4	2:05		0		0		No recovery. Very soft. Most likely loose sand.
	1:50	4-9	5:00		2		5	SS	White sandstone w/ orange oxidation staining. Soft. Fine to medium grained. Well rounded.
	1:35	9-14	4:10		1.5		10	SS-CH	Intermittent layers of sandstone & plastic clay. Orange.
	1:35	14-19	5:00		1.5		15	SS. CH	Same as above
	2:50	19-24					20		@ 23' loss circulation
								DOL	Dolomite
							25		EOB @ 24' Geologist

Job No. 11-025
Client Bronson
Project FSR

Location of Boring	N 35° 57' 33.1"
Water Level	W 094° 37' 12.7"
Time	
Date	

Boring No. B-37 Date 10/22/11 Sheet 1 of 4
Type of Boring Core Rig D-50
Casing used ____ Size 2" Drilling mud used Poly-plus
Boring begun 1405 Boring completed 1720
Ground Elevation ____ referred to ____ Datum
Field Party CES / Amdrill

Depth of Casing, ft.	Time	Sample depth from-to (in feet)	Total Time	ID of Sampler (inches)	Tot. length of recov. sample	Length of Lab. sample	DEPTH IN FEET	SOIL GRAPH	DESCRIPTION Soil type, color, texture, consistency, sampler driving notes, blows per foot on casing, depths wash water lost, observed fluctuation in water level, notes on drilling ease, etc.
	1:35	0-4	5:10		2		0	SC	Clayey sand - Brown
								SS	White sandstone w/ orange oxidation staining. Soft. Fine to medium grain. Well rounded
	2:20	4-9	4:40		1		5		
								SS-SP	Same as above.
	3:30	9-14	8:45		4.5		10	SS	White sandstone. Soft.
	3:40	14-19	6:20		5		15	SS	Same as above. Has orange oxidation staining.
	3:15	19-24	7:20		5		20	SS	Same as above.
							25		

Geologist [signature]

Job No. 11-075
Client Bronson
Project FSR

Location of Boring
Water Level
Time
Date

Boring No. B-37 Date 10/22/11 Sheet 2 of 4
Type of Boring Core Rig D-50
Casing used ____ Size 2" Drilling mud used Poly-plus
Boring begun ____ Boring completed ____
Ground Elevation ____ referred to ____ Datum
Field Party CES / Amdrill

Depth of Casing, ft.	Sample No.	Sample depth from-to (in feet)	Blows/foot on Sampler	ID of Sampler (inches)	Tot. length of recov. sample	Length of Lab. sample	DEPTH IN FEET	SOIL GRAPH	DESCRIPTION Soil type, color, texture, consistency, sampler driving notes, blows per foot on casing, depths wash water lost, observed fluctuation in water level, notes on drilling ease, etc.
	3:10	24-29	6:50		5		25	SS	White sandstone. Soft. Fine to medium grained. Well rounded.
	3:25	29-34	7:30		5		30	SS	Same as above. Medium hardness.
	5:30	34-39	24:30		5		35	SS	Same as above.
	4:30	39-44	8:15		5		40	SS	Same as above. Medium hard.
	6:35	44-49	9:50		5		45	SS	Same as above. Hard
							50		

Geologist

Job No. 11-025
Client Bronson
Project FSR

Location of Boring	
Water Level	
Time	
Date	

Boring No. B-37 Date 10/22/11 Sheet 3 of 7
Type of Boring Core Rig D-50
Casing used ____ Size 2" Drilling mud used Poly-plus
Boring begun ____ Boring completed ____
Ground Elevation ____ referred to ____ Datum
Field Party CES / Arndt

Depth of Casing, ft.	Sample No.	Sample depth from-to (in feet)	Blows/foot on Sampler	ID of Sampler (inches)	Tot. length of recov. sample	Length of Lab. sample	DEPTH IN FEET	SOIL GRAPH	DESCRIPTION Soil type, color, texture, consistency, sampler driving notes, blows per foot on casing, depths wash water lost, observed fluctuation in water level, notes on drilling ease, etc.
	9:35	49-54	13:35		5		50	SS	White sandstone Hard. Fine to medium grained Well rounded.
	15:25	54-59	19:05		5		55	SS	Same as above.
	17:30	59-64	21:50		5		60	SS	Same as above. Minor orange oxidation staining.
	3:30	64-69	8:10		5		65	CL	Sandy clay
								SS	Green sandstone. Soft.
	3:35	69-74	8:00		4.2		70	SS	Same as above.
							75		

Geologist

Job No. 11-025
Client Bronson
Project FJR

Location of Boring
Water Level
Time
Date

Boring No. B-37 Date 10/22/11 Sheet 4 of 4
Type of Boring Core Rig D-50
Casing used ____ Size 2" Drilling mud used Poly-plus
Boring begun ____ Boring completed ____
Ground Elevation ____ referred to ____ Datum
Field Party CLS / Ambrill

Depth of Casing, ft.	Sample No.	Sample depth from-to (in feet)	Blows/foot on Sampler	ID of Sampler (inches)	Tot. length of recov. sample	Length of Lab. sample	DEPTH IN FEET	SOIL GRAPH	DESCRIPTION Soil type, color, texture, consistency, sampler driving notes, blows per foot on casing, depths wash water lost, observed fluctuation in water level, notes on drilling ease, etc.
	1:05	74-79	4.50		1.2		75	SS	Green sandstone w/ orange oxidation staining. Soft.
									Soft, no recovery.
	2:20	79-84	7.10		2.2		80	CL	Sandy clay. Orange-green
								SS	White sandstone w/ black specs. Med. hard.
	16:30	84-89			5		85	DOL	Dolomite - Hard Gray
							90		EOB @ 89'
							95		
							100		

Geologist

Job No. 11-025
Client Brannon
Project FJR

Location of Boring	N 35° 57' 35.1''
Water Level	W 094° 36' 14.1''
Time	
Date	

Boring No. B-38 Date 10/25/11 Sheet 1 of 1
Type of Boring Core Rig D-50
Casing used ____ Size 2" Drilling mud used Poly-plg
Boring begun 0846 Boring completed 0845
Ground Elevation ____ referred to ____ Datum
Field Party CCS/Arndt/ill

Depth of Casing, ft.	Sample No.	Sample depth from-to (in feet)	Tot. Time Blows per 6" or RQD	ID of Sampler (inches)	Tot. length of recov. sample	Length of Lab. sample	DEPTH IN FEET	SOIL GRAPH	DESCRIPTION Soil type, color, texture, consistency, sampler driving notes, blows per foot on casing, depths wash water lost, observed fluctuation in water level, notes on drilling ease, etc.
	2.35	0-4	6.05		2.1'		0	CH	Sandy clay. Plastic. Orange.
								SS	Orange sandstone. Medium hard.
								CH	Plastic clay. Orange.
	1.00	4-9	3.50		0.1		5		
								CH	Same as above w/ gray mottling.
	0.45	9-14			0.1		10	CH	Green clay w/ orange oxidation staining. Contains weathered sandstone fragments.
		14-14					15		EOB @ 14'
		14-24					20		
							25		

Geologist

Job No. 12-095
Client Bronson
Project FSL

Location of Boring	See boring log for AB-1
Water Level	
Time	
Date	

Boring No. B-41 Date 11/1/12 Sheet 1 of 4
Type of Boring Core Rig D-50
Casing used ___ Size NQ Drilling mud used ___
Boring begun 1705 Boring completed 0920
Ground Elevation ___ referred to ___ Datum
Field Party CGS / Andrill

Depth of Casing, ft.	Sample No.	Sample depth from-to (in feet)	Blows per foot on casing or sampler	ID of Sampler (inches)	Tot. length of recov. sample	Length of Lab. sample	DEPTH IN FEET	SOIL GRAPH	DESCRIPTION Soil type, color, texture, consistency, sampler driving notes, blows per foot on casing, depths wash water lost, observed fluctuation in water level, notes on drilling ease, etc.
		0-4	4:30		0		0		No recovery.
		4-9	6:00		1		5		
		9-14	6:00		1.8		10	SS	Weathered sandstone. Orange to white. Fine grained. Well rounded
		14-19	7:45		2.2		15	SS	Same as above. White w/ moderate orange oxidation staining.
		19-24	10:00		0		20		Soft. No recovery. Drill cuttings indicate sand.
							25		

Geologist RSM

Job No. 12-095
Client Braxton
Project FSE

Location of Boring
Water Level
Time
Date

Boring No. B-41 Date 11/1/12 Sheet 2 of 4
Type of Boring Core Rig D-50
Casing used ____ Size NQ Drilling mud used ____
Boring begun ____ Boring completed ____
Ground Elevation ____ referred to ____ Datum
Field Party CLS / Purdy: 11

Depth of Casing, ft.	Sample No.	Sample depth from-to (in feet)	Blows/foot on Sampler	ID of Sampler (inches)	Tot. length of recov. sample	Length of Lab. sample	DEPTH IN FEET	SOIL GRAPH	DESCRIPTION Soil type, color, texture, consistency, sampler driving notes, blows per foot on casing, depths wash water lost, observed fluctuation in water level, notes on drilling ease, etc.
		24-29	5:10		0		25		No recovery. Soft sand.
		29-34	9:48		0		30		Same as above.
		34-39	8:23		0.5		35		
		39-44	6:29		1		40	CH	Sandy, plastic clay. Green w/ orange oxidation staining. Contains white sandstone gravel.
		44-49	8:45		2		45	CH	Green clay. Very plastic w/ orange oxidation staining
							50		

Geologist Q. PSMt

Job No. 12-095
Client Branson
Project FSS

Location of Boring
Water Level
Time
Date

Boring No. B-41 Date 11/1/12 Sheet 3 of 4
Type of Boring Core Rig D-50
Casing used ____ Size NQ Drilling mud used ____
Boring begun ____ Boring completed ____
Ground Elevation ____ referred to ____ Datum
Field Party CSS / Amdrill

Depth of Casing, ft.	Sample No.	Sample depth from-to (in feet)	Blows per foot on sampler	ID of Sampler (inches)	Tot. length of recov. sample	Length of Lab. sample	DEPTH IN FEET	SOIL GRAPH	DESCRIPTION Soil type, color, texture, consistency, sampler driving notes, blows per foot on casing, depths wash water lost, observed fluctuation in water level, notes on drilling ease, etc.
		49-54	7.00		0.5		50	CH SS	Plastic clay - Orange - Contains white sandstone gravel
		54-59	10.00		0.1		55	CH	Sandy clay. Plastic - Green
		59-64	9.33		1		60	CH	" "
								SS	Sandstone Boulder.
		64-69	14.21		2.3		65	CH	Plastic clay. Sandy - Green w/ orange oxidation staining.
		69-74	12.00		4		70	CH	Plastic clay. Orange. Slightly Sandy. Contains minor amount of sandstone fragments.
							75		

Geologist

Job No. 12-095
Client Brunson
Project ESC

Location of Boring
Water Level
Time
Date

Boring No. B41 Date 11/2/12 Sheet 4 of 4
Type of Boring Core Rig D-50
Casing used ____ Size NQ Drilling mud used ____
Boring begun ____ Boring completed ____
Ground Elevation ____ referred to ____ Datum
Field Party CES / Andrill

Depth of Casing, ft.	Sample No.	Sample depth from-to (in feet)	Blows per foot on casing	ID of Sampler (inches)	Tot. length of recov. sample	Length of Lab. sample	DEPTH IN FEET	SOIL GRAPH	DESCRIPTION Soil type, color, texture, consistency, sampler driving notes, blows per foot on casing, depths wash water lost, observed fluctuation in water level, notes on drilling ease, etc.
		74-79	13.36	2	3		75	CH	Plastic clay. Orange. Sandy.
		79-84					80	DOL	Dolomite. Dark Gray. COB @ 79'
		84-89					85		
		89-94					90		
		94-99					95		
							100		

Geologist D. Pho

Job No. 12-095
Client Branson
Project FSL

Location of Boring	N 35° 57' 27.4"
Water Level	W 011° 37' 12.4"
Time	
Date	

Boring No. B-42 Date 11/2/12 Sheet 1 of 5
Type of Boring Core Rig D-50
Casing used ____ Size NQ Drilling mud used Poly-Plus
Boring begun 1055 Boring completed 1550
Ground Elevation ____ referred to ____ Datum
Field Party CES/Andrill

Depth of Casing, ft.	Sample No.	Sample depth from-to (in feet)	Time Blows/foot on Sampler	ID of Sampler (inches)	Tot. length of recov. sample	Length of Lab. sample	DEPTH IN FEET	SOIL GRAPH	DESCRIPTION Soil type, color, texture, consistency, sampler driving notes, blows per foot on casing, depths wash water lost, observed fluctuation in water level, notes on drilling ease, etc.
		0-4	3:55	2	0.8		0	SM	Silty sand. Dark brown.
		4-9	25:38		0.6		5	SS	Sandstone. Orange. Soft. Fine grained. well rounded. poorly sorted.
		9-14	3:24		1		10	SS	" "
		14-19	13:24		1.2		15	CL-SS	Orange clay intermixed w/ sandstone. Soft
		19-24	7:15		1.5		20	SS	White Sandstone stained orange. Very soft. well rounded. Fine grained. Poorly sorted
							25		

Geologist

Job No. 12-095
Client Evasion
Project FSC

Location of Boring
Water Level
Time
Date

Boring No. B-42 Date 11/7/12 Sheet 2 of 5
Type of Boring Core Rig D-50
Casing used ____ Size NQ Drilling mud used ____
Boring begun ____ Boring completed ____
Ground Elevation ____ referred to ____ Datum
Field Party CES/Andr:11

Depth of Casing, ft.	Sample No.	Sample depth from-to (in feet)	Blows/foot on Sampler	ID of Sampler (inches)	Tot. length of recov. sample	Length of Lab. sample	DEPTH IN FEET	SOIL GRAPH	DESCRIPTION Soil type, color, texture, consistency, sampler driving notes, blows per foot on casing, depths wash water lost, observed fluctuation in water level, notes on drilling ease, etc.
		24-24	13.15		3		25	SS	Sandstone. White. Fine grained. well rounded Has orange oxidation staining.
		29-34	6.55		4		30	SS	" "
		34-39	7.30		5		35	SS	" Med. hard " . Contains clay seams.
		39-44	7.20		4.2		40	SS	" "
		44-49	8.25		5		45	SS	" "
							50		

Geologist [signature]

Job No. 12-095
Client Branson
Project FSE

Location of Boring
Water Level
Time
Date

Boring No B-42 Date 11/2/12 Sheet 3 of 5
Type of Boring Core Rig D-50
Casing used ____ Size NQ Drilling mud used ____
Boring begun ____ Boring completed ____
Ground Elevation ____ referred to ____ Datum
Field Party CGS/Andr. H

Depth of Casing, ft.	Sample No.	Sample depth from-to (in feet)	Time Blows/foot on Sampler	ID of Sampler (inches)	Tot. length of recov. sample	Length of Lab. sample	DEPTH IN FEET	SOIL GRAPH	DESCRIPTION Soil type, color, texture, consistency, sampler driving notes, blows per foot on casing, depths wash water lost, observed fluctuation in water level, notes on drilling ease, etc.
		49-54	7.15	2"	2.2		50	SS	Sandstone, White w/ orange oxidation staining. Med. Hard. Fine grained - Well rounded
									No recovery. Soft.
		54-59	9.50		2.1		55		
								SS	Sandstone. Soft to medium hard. Orange. Fine grained. Well rounded.
		54-64	13.40		4.5		60		" "
								SS	
		64-69	15.68		2.7		65		" "
								SS	
		69-74	7.30		1		70	SS	" "
							75		

Geologist [signature]

Job No. 12-095
Client Bronson
Project FSL

Location of Boring
Water Level
Time
Date

Boring No B-42 Date 11/2/12 Sheet 4 of 5
Type of Boring Core Rig D-50
Casing used ____ Size NQ Drilling mud used ____
Boring begun ____ Boring completed ____
Ground Elevation ____ referred to ____ Datum
Field Party CSS/Amdrill

Depth of Casing, ft.	Sample No.	Sample depth from-to (in feet)	Blows (Type) or Sampler	ID of Sampler (inches)	Tot. length of recov. sample	Length of Lab. sample	DEPTH IN FEET	SOIL GRAPH	DESCRIPTION Soil type, color, texture, consistency, sampler driving notes, blows per foot on casing, depths wash water lost, observed fluctuation in water level, notes on drilling ease, etc.
		74-79	11.20		1		75	SS	Mix of sandstone & clay. Orange.
								CL	
		79-84	12.18		2.5		80		
								CH	Green clay Plastic.
		84-89	15.35		1.8			SS	White sandstone.
							85		
								CH	Green clay w/ orange Oxidation Staining. Plastic
								SS	Sandstone.
		89-94	12.40		2.0		90		
								CH	Green clay. Plastic
								DOL	Dolomite
		94-99	13.00		3.0			CH	Green clay. Plastic.
							95		
								SS	Sandstone. Weathered.
							100		

Geologist DSMK

Job No. 12-095
Client Branson
Project FSE

Location of Boring
Water Level
Time
Date

Boring No. B-42 Date 11/2/12 Sheet 5 of 5
Type of Boring Core Rig D-50
Casing used ____ Size NA Drilling mud used ____
Boring begun ____ Boring completed ____
Ground Elevation ____ referred to ____ Datum
Field Party CER/Ambrill

Depth of Casing, ft.	Sample No.	Sample depth from-to (in feet)	Blows/foot on Sampler	ID of Sampler (inches)	Tot. length of recov. sample	Length of Lab. sample	DEPTH IN FEET	SOIL GRAPH	DESCRIPTION Soil type, color, texture, consistency, sampler driving notes, blows per foot on casing, depths wash water lost, observed fluctuation in water level, notes on drilling ease, etc.
		99-104	1235		1		100	CH	Green & orange clay. Plastic.
								DJ	Dolomite
		104-109							
							105		EOB @ 104
							110		
							115		
							120		
							125		

Geologist [signature]

Job No. 12-095
Client Branson
Project FSE

Location of Boring	N 35° 57' 27.5"
Water Level	W 091° 37' 05.4"
Time	
Date	

Boring No. B-43 Date 11/2/12 Sheet 1 of 4
Type of Boring Core Rig D-50
Casing used ___ Size NQ Drilling mud used Poly-plus
Boring begun 1650 Boring completed 1045
Ground Elevation ___ referred to ___ Datum
Field Party CGS/Amdrill

Depth of Casing, ft.	Sample No.	Sample depth from-to (in feet)	Time Blows/foot on Sampler	ID of Sampler (inches)	Tot. length of recov. sample	Length of Lab. sample	DEPTH IN FEET	SOIL GRAPH	DESCRIPTION Soil type, color, texture, consistency, sampler driving notes, blows per foot on casing, depths wash water lost, observed fluctuation in water level, notes on drilling ease, etc.
		0-4	2:07		1.5		0	CL	Sandy clay. Red.
		4-9	5:15		2		5	SS	Sandstone. White w/ orange oxidation staining. Soft to medium hardness. Fine grained. Well rounded. Poorly sorted.
		9-14	1430		5		10	SS	Sandstone. White. Hard. Fine grained. Well rounded. Poorly sorted.
		14-19	10:45		5		15	SS	Same as above. Contains thin lenses of red clay.
		19-24	12:20		5		20	SS	" "
							25		

Geologist [signature]

Job No. 12-095
Client Branson
Project FSL

Location of Boring
Water Level
Time
Date

Boring No B-43 Date 11/2/12 Sheet 2 of 4
Type of Boring Core Rig D-50
Casing used ____ Size NQ Drilling mud used ____
Boring begun ____ Boring completed ____
Ground Elevation ____ referred to ____ Datum
Field Party CSS/Ambrill

Depth of Casing, ft.	Sample No.	Sample depth from-to (in feet)	Blows/foot on Sampler	ID of Sampler (inches)	Tot. length of recov. sample	Length of Lab. sample	DEPTH IN FEET	SOIL GRAPH	DESCRIPTION Soil type, color, texture, consistency, sampler driving notes, blows per foot on casing, depths wash water lost, observed fluctuation in water level, notes on drilling ease, etc.
		24-29	15:13		5		25	SS	Sandstone. White. Hard.
								CL	Orange-red clay.
								SS	Sandstone. Orange. Hard.
		29-34	22:30		4.5		30	SS	Same as above. Contains thin clay fossil.
		34-39	16:08		5			CH	Orange clay. Plastic.
							35	SS	Sandstone. White. Soft. Fine to med. hardness. Well rounded.
		39-44	8:45		4.2		40	SS	Same as above. Contains clay seams in fractures.
		44-49	17:41		2.9		45	SS	Same as above.
							50		

Geologist DSN

Job No. 12-095
Client Branson
Project FSC

Location of Boring
Water Level
Time
Date

Boring No. B-43 Date 11/3/12 Sheet 3 of 4
Type of Boring Core Rig D-50
Casing used ____ Size NQ Drilling mud used ____
Boring begun ____ Boring completed ____
Ground Elevation ____ referred to ____ Datum
Field Party CES/Antrill

Depth of Casing, ft.	Sample No.	Sample depth from-to (in feet)	Blows per foot on Sampler	ID of Sampler (inches)	Tot. length of recov. sample	Length of Lab. sample	DEPTH IN FEET	SOIL GRAPH	DESCRIPTION: Soil type, color, texture, consistency, sampler driving notes, blows per foot on casing, depths wash water lost, observed fluctuation in water level, notes on drilling ease, etc.
		49-54	6:50		0.8		50	CL	Clay, Sandy, Contains sandstone fragments Orange
		54-59	6:20		1		55	CL	" "
		59-64	10:47		2		60	CL	" "
								SS	Weathered Sandstone.
		64-69	8:33		2.2		65	CH	Plastic clay. Orange & green.
		69-74	6:00		0		70		Soft. No recovery.
							75		

Geologist [signature]

Job No. 12-095
Client Branson
Project FSC

Location of Boring
Water Level
Time
Date

Boring No. B-43 Date 11/3/12 Sheet 4 of 4
Type of Boring Core Rig D-50
Casing used ____ Size NQ Drilling mud used ____
Boring begun ____ Boring completed ____
Ground Elevation ____ referred to ____ Datum
Field Party CSS/Amdrill

Depth of Casing, ft.	Sample No.	Sample depth from-to (in feet)	Time Required per sample	ID of Sampler (inches)	Tot. length of recov. sample	Length of Lab. sample	DEPTH IN FEET	SOIL GRAPH	DESCRIPTION Soil type, color, texture, consistency, sampler driving notes, blows per foot on casing, depths wash water lost, observed fluctuation in water level, notes on drilling ease, etc.
		74-79	13:20	2	1.5		75	CH	Plastic clay. Orange & greenish. Contains sandstone fragments.
		79-84	6:15		2		80	CH	" "
		84-89	7:38		1		85	CH	" "
		89-94	7:35		2		90		
		94-99	9:00		2.5		95	SC	Clayey sand. Brown-orange. Contains sandstone fragments.
							100		Dolomite EOB @ 99'

Geologist

Job No. 12-095

Client Bronson

Project FSL

Location of Boring N 35° 57' 24.4"

Water Level

Time W 091° 36' 56.2"

Date

Boring No. B-44 Date 11/3/12 Sheet 1 of 1

Type of Boring Core Rig D-60

Casing used ____ Size NQ Drilling mud used Poly-plus

Boring begun 1335 Boring completed 1420

Ground Elevation ____ referred to ____ Datum

Field Party CCS/Andrill

Depth of Casing, ft.	Sample No.	Sample depth from-to (in feet)	Blows/foot on Sampler	ID of Sampler (inches)	Tot. length of recov. sample	Length of Lab. sample	DEPTH IN FEET	SOIL GRAPH	DESCRIPTION Soil type, color, texture, consistency, sampler driving notes, blows per foot on casing, depths wash water lost, observed fluctuation in water level, notes on drilling ease, etc.
		0-4		2	0		0		Soft - No recovery
		4-9	8:00	[illegible]	3.5		5	CH	Plastic clay - Orange. Contains dolomite cobbles. Contain weathered sandstone pebbles
		9-14	15:20		3		10	CH	" "
		14-19			2		15	CH	" "
		19-24					20		EOB @ 19'
							25		

Geologist [signature]

Job No. _____

Client National Silica

Project Bell Property Prospecting

Location of Boring	N 35° 57' 28.1"
Water Level	W 091° 36' 47.0"
Time	
Date	

Boring No B-45 Date 3-24-14 Sheet 1 of 1

Type of Boring Wireline Rig CME-55

Casing used ____ Size na Drilling mud used ____

Boring begun 09:40 Boring completed 12:00

Ground Elevation ____ referred to ____ Datum

Field Party CES / Andvill

Depth of Casing, ft.	Sample No.	Sample depth from-to (in feet)	Blows/foot on Sampler	ID of Sampler (inches)	Tot. length of recov. sample	Length of Lab. sample	DEPTH IN FEET	SOIL GRAPH	DESCRIPTION Soil type, color, texture, consistency, sampler driving notes, blows per foot on casing, depths wash water lost, observed fluctuation in water level, notes on drilling ease, etc.
		0-~~8.5~~ 4			0.5		0	CH	No recovery. Clay drill cuttings. Orange.
								SS	Sandstone. Medium grained. Friable. White w/ orange oxidation staining.
		~~8.5-13.5~~			~~0.8~~			CH	~~Sandy clay. Plastic. Green w/ red-orange oxidation staining.~~
		4-9			3		5	SS	Sandstone. White. Medium to fine grained. Soft. Friable. Moderate to well rounded.
		~~8.5-13.5~~							
		9-14			1.5		10	SS	Sandstone. Very soft. White to orange. Fine to medium grained. Moderate to well rounded. Friable.
		~~13.5-18.5~~							
		14-19			1.8		15	CH	Sandy clay. Plastic. Green w/ Orange oxidation staining
		~~18.5-23.5~~						SS	Sandstone. Weathered. White w/ black staining. Soft. Containing small pockets of green clay. Friable. Fine to medium grained.
		19-24			2.6		20	CH	Sandy clay. Plastic. Orange brown.
		~~23.5-28~~							Clay becomes green. Less sand.
							25		

Geologist [signature]

Job No. _____

Client National Silica

Project Bell property Prospecting

Location of Boring	N 35° 57' 29.2"
Water Level	W 091° 36' 53.2"
Time	
Date	

Boring No. B-46 Date 3-24-14 Sheet 1 of 2

Type of Boring Wireline Core Rig CME 55

Casing used _____ Size NQ Drilling mud used _____

Boring begun 12:26 Boring completed 14:00

Ground Elevation _____ referred to _____ Datum

Field Party CB/Amdrill

Depth of Casing, ft.	Sample No.	Sample depth from-to (in feet)	Blows/foot on Sampler	ID of Sampler (inches)	Tot. length of recov. sample	Length of Lab. sample	DEPTH IN FEET	SOIL GRAPH	DESCRIPTION Soil type, color, texture, consistency, sampler driving notes, blows per foot on casing, depths wash water lost, observed fluctuation in water level, notes on drilling ease, etc.
		0-4			0.1		0	SS	Sandstone. White w/ orange oxidation staining. Medium soft. Fine grained. Moderate to well rounded.
		4-9			2.1		5	SS	Sandstone. White w/ orange oxidation staining. Medium to medium hard. Moderately rounded. Fine to medium grained.
		9-14			1.5		10	SS	" "
								CH	Sandy clay. Orange-brown.
		14-19			2.1		15	SS	Sandstone. Soft to medium soft. Green color. Well rounded. Fine to medium grained.
								CH	Sandy clay. Orange
		19-24			1.8		20	SS	White sandstone. Medium hard.
								CH	Orange clay.
								SS	Sandstone
		24-25					25	CH	

Geologist _____

Job No. _____

Client National Silica

Project Bell Property Prospecting

Location of Boring
Water Level
Time
Date

Boring No. B-46 Date 3-24-14 Sheet 1 of 2

Type of Boring Direct Push Rig CME-55

Casing used _____ Size NQ Drilling mud used _____

Boring begun 1226 Boring completed 14:05

Ground Elevation _____ referred to _____ Datum

Field Party CSS/Amdrill

Depth of Casing, ft.	Sample No.	Sample depth from-to (in feet)	Blows/foot on Sampler	ID of Sampler (inches)	Tot. length of recov. sample	Length of Lab. sample	DEPTH IN FEET	SOIL GRAPH	DESCRIPTION Soil type, color, texture, consistency, sampler driving notes, blows per foot on casing, depths wash water lost, observed fluctuation in water level, notes on drilling ease, etc.
		25-29			1.1		25	CH	Sandy clay, green w/ orange oxidation staining. Plastic.
							30		EOB @ 29'

Geologist _____

Job No. _____

Client National Silica

Project Bell Property Prospecting

Location of Boring	N 35° 57' 29.3"
Water Level	
Time	W 091° 37' 01.4"
Date	

Boring No. B-47 Date 3-24-14 Sheet 1 of 3

Type of Boring Wireline Core Rig CME-55

Casing used ____ Size NQ Drilling mud used ____

Boring begun 1500 Boring completed 08:45

Ground Elevation ____ referred to ____ Datum

Field Party CCS/Amdrill

Depth of Casing, ft.	Sample No.	Sample depth from-to (in feet)	Blows/foot on Sampler	ID of Sampler (inches)	Tot. length of recov. sample	Length of Lab. sample	DEPTH IN FEET	SOIL GRAPH	DESCRIPTION Soil type, color, texture, consistency, sampler driving notes, blows per foot on casing, depths wash water lost, observed fluctuation in water level, notes on drilling ease, etc.
		0-4			1.8		0	SS	Sandstone. White. Moderately rounded. Fine grained.
		4-9			3		5	SS	Sandstone. White w/ mild orange oxidation staining. Medium hardness. Fine to medium grained. Moderate to well rounded.
		9-14			5		10	SS	" "
		14-19			5		15	SS	Sandstone. White. Medium hard to hard. Fine grained. Moderate to well rounded.
		19-24			5		20	SS	" "
		24-25					25		

Geologist [signature]

Job No.

Client National Silica

Project Bell Property Prospecting

Location of Boring

Water Level

Time

Date

Boring No. B-47 Date 3-24-14 Sheet 2 of 3

Type of Boring Wireline Core Rig CME-55

Casing used ______ Size NQ Drilling mud used ______

Boring begun ______ Boring completed ______

Ground Elevation ______ referred to ______ Datum

Field Party CES/Amdrill

Depth of Casing, ft.	Sample No.	Sample depth from-to (in feet)	Blows/foot on Sampler	ID of Sampler (inches)	Tot. length of recov. sample	Length of Lab. sample	DEPTH IN FEET	SOIL GRAPH	DESCRIPTION Soil type, color, texture, consistency, sampler driving notes, blows per foot on casing, depths wash water lost, observed fluctuation in water level, notes on drilling ease, etc.
		25-29			4.8		25	SS	Sandstone. White w/ orange oxidation staining. Medium hard to hard. Fine to medium grained. Moderate to well rounded.
		29-34			4.9		30	SS	" " Contains fractures that have thin coating of orange clay.
		34-39			4.8		35	SS	Sandstone. White-gray w/ orange oxidation staining. Medium hard to hard. Fine to medium grained. Moderate to well rounded.
		39-44			5		40	SS	Sandstone. Blue-gray w/ orange oxidation staining. Medium hard to hard. Fine to medium grained.
		44-49			4		45	SS	Sandstone. Green to blue-gray. Has orange mottling. Contains small fractures w/ orange clay lining. Medium to medium hard. Fine to medium grained. Moderate to well rounded.
		49-50			1		50	CH / SS	Green clay w/ orange staining (plastic)

Geologist [signature]

Job No.
Client National Silica
Project Bell Property Prospecting

Location of Boring

Water Level

Time

Date

Boring No. B-47 Date 3-19-14 Sheet 3 of 3
Type of Boring Wireline Core Rig CME-55
Casing used ____ Size NQ Drilling mud used ____
Boring begun ____ Boring completed ____
Ground Elevation ____ referred to ____ Datum
Field Party CCS / Ambill

Depth of Casing, ft.	Sample No.	Sample depth from-to (in feet)	Blows/foot on Sampler	ID of Sampler (inches)	Tot. length of recov. sample	Length of Lab. sample	DEPTH IN FEET	SOIL GRAPH	DESCRIPTION Soil type, color, texture, consistency, sampler driving notes, blows per foot on casing, depths wash water lost, observed fluctuation in water level, notes on drilling ease, etc.
		50-54			0		50	?	Drilled very soft. Most likely clay.
		54-59			1.8		55	CL	Sandy Clay, Brown-orange. Contained lenses of weathered sandstone.
		59-64			2		60		
								SS	Sandstone. White w/ orange oxidation staining. Medium hard.
								Dol	Dolomite.
							65		COB@ 64'
							70		
							75		

Geologist [signature]

Job No. _____

Client Natural Silica

Project Bell Property Prospecting

Location of Boring	N 35° 57' 31.4"
Water Level	
Time	W 094° 37' 10.4"
Date	

Boring No B-4P Date 3-25-14 Sheet 1 of 3

Type of Boring Wireline Core Rig Core-55

Casing used _____ Size NQ Drilling mud used _____

Boring begun 0940 Boring completed 1425

Ground Elevation _____ referred to _____ Datum

Field Party CS / Arnold

Depth of Casing, ft.	Sample No.	Sample depth from-to (in feet)	Blows/foot on Sampler	ID of Sampler (inches)	Tot. length of recov. sample	Length of Lab. sample	DEPTH IN FEET	SOIL GRAPH	DESCRIPTION Soil type, color, texture, consistency, sampler driving notes, blows per foot on casing, depths wash water lost, observed fluctuation in water level, notes on drilling ease, etc.
		0-4			1.7		0	SS	Sandstone. White w/ minor orange mottling soft to medium hardness. Fine to medium grained. Moderately rounded. Friable.
		4-9			5		5	SS	Sandstone, White. Medium to medium hard. Friable. Fine to medium grained. Moderate to well rounded.
		9-14			4.9		10	SS	" "
		14-19			5		15	SS	Sandstone, White w/ orange banding. Soft to medium hardness. Fine to medium grained. Moderate to well rounded. Friable.
		19-24			5		20	SS	" "
		24-25			1		25	SS	" "

Geologist _____

Job No. _____

Client National Silica

Project Bell Property Prospecting

Location of Boring
Water Level
Time
Date

Boring No. B-48 Date 3-25-14 Sheet 1 of 3

Type of Boring Wireline Core Rig CME-55

Casing used _____ Size NQ Drilling mud used _____

Boring begun _____ Boring completed _____

Ground Elevation _____ referred to _____ Datum

Field Party CES / Amdrill

Depth of Casing, ft.	Sample No.	Sample depth from-to (in feet)	Blows/foot on Sampler	ID of Sampler (inches)	Tot. length of recov. sample	Length of Lab. sample	DEPTH IN FEET	SOIL GRAPH	DESCRIPTION Soil type, color, texture, consistency, sampler driving notes, blows per foot on casing, depths wash water lost, observed fluctuation in water level, notes on drilling ease, etc.
		25-29			4		25	SS	Sandstone. White. Medium to medium hard. Fine to medium grained. Moderate to well rounded. Friable.
		29-34			5		30	SS	" "
		34-39			5		35	SS	" "
		39-44			5		40	SS	Sandstone. White w/ orange staining. Contains fracturing. Medium hard to hard. Fine grained. Moderate to well rounded.
		44-49			4.2		45	SS	Sandstone. White ~~or~~ Contains fractures w/ orange clay. Medium hard to hard. Fine grained. Moderate to well rounded.
								SS	Sandstone. White. Fractured w/ clay lining. Hard
		49-50			1		50		

Geologist DSM

Job No.

Client National Silica

Project Bell Property Prospecting

Boring No. B-48 Date 3-25-14 Sheet 3 of 3

Type of Boring Wireline Core Rig CME-55

Casing used ______ Size NQ Drilling mud used ______

Boring begun ______ Boring completed ______

Ground Elevation ______ referred to ______ Datum

Field Party CES / Amdrill

Location of Boring
Water Level
Time
Date

Depth of Casing, ft.	Sample No.	Sample depth from-to (in feet)	Blows/foot on Sampler	ID of Sampler (inches)	Tot. length of recov. sample	Length of Lab. sample	DEPTH IN FEET	SOIL GRAPH	DESCRIPTION Soil type, color, texture, consistency, sampler driving notes, blows per foot on casing, depths wash water lost, observed fluctuation in water level, notes on drilling ease, etc.
		50-54			4		50	SS	Sandstone. White. Fractured w/ orange clay lining fractures. Med. hard to hard. Fine to medium grained. Moderate to well sorted.
		54-59			5		55	SS	Sandstone. White - pale green. Medium hard. Contains clay seam (~2 cm). Fine to medium grained. Moderate to well sorted.
		59-64			2		60	SS	
								?	Very soft. No recovery
								SS	Sandstone
		64-69			0.5		65	?	Very soft. Poor recovery. Contained weathered sandstone w/ clay residue.
		69-74			0		70	?	No recovery. Drill hole drained of drill mud during core removal. 100% LOC
									Sandstone.
									No recovery.
		74-75			1		75	SS	EOB @ 74'

Geologist [signature]

Job No. _____

Client National Silica

Project Bell Property Prospecting

Location of Boring	N 35° 57' 33.4"
Water Level	W 091° 37' 03.4"
Time	
Date	

Boring No. B-49 Date 3-25-14 Sheet 1 of 3

Type of Boring Wireline Core Rig CME-55

Casing used _____ Size NQ Drilling mud used _____

Boring begun 1515 Boring completed 0955

Ground Elevation _____ referred to _____ Datum

Field Party CCS / Amdrill

Depth of Casing, ft.	Sample No.	Sample depth from-to (in feet)	Blows/foot on Sampler	ID of Sampler (inches)	Tot. length of recov. sample	Length of Lab. sample	DEPTH IN FEET	SOIL GRAPH	DESCRIPTION Soil type, color, texture, consistency, sampler driving notes, blows per foot on casing, depths wash water lost, observed fluctuation in water level, notes on drilling ease, etc.
		0-5			0		0		Very soft. No recovery.
								?	
		5-10			1.5		5		
									Sandstone. Orange. Medium soft. Fine to medium grained. Moderate to well sorted. Friable.
		10-15			4.2		10	SS	
								SS	No recovery, very soft. Drill cuttings indicate loose sand.
									Core slid out of barrel and was retrieved on next run.
		15-20			4		15	SS	Sandstone. White w/ orange banding. Hard. Fine grained. Moderate to well rounded.
									" "
		20-25			5		20	SS	
							25		

Geologist [signature]

Job No. _____

Client National Silica

Project Bell Property Prospecting

Location of Boring
Water Level
Time
Date

Boring No B-44 Date 3-25-14 Sheet 2 of 3

Type of Boring Wireline Core Rig CME-55

Casing used _____ Size NQ Drilling mud used _____

Boring begun _____ Boring completed _____

Ground Elevation _____ referred to _____ Datum

Field Party CCS / Ambrill

Depth of Casing, ft.	Sample No.	Sample depth from-to (in feet)	Blows/foot on Sampler	ID of Sampler (inches)	Tot. length of recov. sample	Length of Lab. sample	DEPTH IN FEET	SOIL GRAPH.	DESCRIPTION Soil type, color, texture, consistency, sampler driving notes, blows per foot on casing, depths wash water lost, observed fluctuation in water level, notes on drilling ease, etc.
		25-30			5		25	SS	Sandstone, White w/ minor orange oxidation staining. Hard to very hard. Fine grained. Moderate to well rounded.
									" "
		30-35			5		30	SS	
		35-40			4.2		35	SS	Sandstone - White - orange. Medium soft to medium hardness. Fine to medium grained. Moderate to well rounded. Friable.
		40-45			4.8		40	SS	" "
		45-50			4		45	SS	Sandstone - Pale green w/ orange banding. Medium to medium hard. Fine to medium grained. Moderate to well rounded.
							50		

Geologist _____

Job No. _____

Client National Silica

Project Bell Property Prospecting

Location of Boring
Water Level
Time
Date

Boring No. B-44 Date 3-26-14 Sheet 3 of 3

Type of Boring Wireline Core Rig CME-55

Casing used _____ Size NQ Drilling mud used _____

Boring begun _____ Boring completed _____

Ground Elevation _____ referred to _____ Datum

Field Party CES/Andrill

Depth of Casing, ft.	Sample No.	Sample depth from-to (in feet)	Blows/foot on Sampler	ID of Sampler (inches)	Tot. length of recov. sample	Length of Lab. sample	DEPTH IN FEET	SOIL GRAPH	DESCRIPTION Soil type, color, texture, consistency, sampler driving notes, blows per foot on casing, depths wash water lost, observed fluctuation in water level, notes on drilling ease, etc.
		50-55			1		50	SS	Sandstone, white w/ orange oxidation staining, medium hard, fine to medium grained
								?	Very soft. No recovery
		55-60			0.5		55	CL	Drill cuttings appear to be orange clay. Drilled very soft
								DOL	Dolomite
		60-65					60		EOBH 60'
		65-70					65		
		70-75					70		
							75		

Geologist [signature]

Job No. _____

Client National Silica

Project Bell Property Prospecting

Location of Boring	N 35° 57' 35.2"
Water Level	W 094° 36' 57.6"
Time	
Date	

Boring No. B-50 Date 3-26-14 Sheet 1 of 2

Type of Boring Wireline core Rig CME-55

Casing used _____ Size NQ Drilling mud used _____

Boring begun 11:00 Boring completed 17:15

Ground Elevation _____ referred to _____ Datum

Field Party CES/Amarillo

Depth of Casing, ft.	Sample No.	Sample depth from-to (in feet)	Blows/foot on Sampler	ID of Sampler (inches)	Tot. length of recov. sample	Length of Lab. sample	DEPTH IN FEET	SOIL GRAPH	DESCRIPTION Soil type, color, texture, consistency, sampler driving notes, blows per foot on casing, depths wash water lost, observed fluctuation in water level, notes on drilling ease, etc.
		0-4			0.1		0	CL	Red clay.
								SS	Sandstone. Very hard.
		4-9			4		5	CH	Green clay w/ orange oxidation staining. Very plastic. Sticky.
		9-14			1.7		10	CH	" "
		14-19			1		15	SS	Silicified sandstone-Crystalline. Very hard. Pale brown.
		19-24			2		20	CH	Plastic clay. Brown-orange.
								SS	silicified sandstone.
		24-25					25		

Geologist [signature] DSMA

Job No. _____

Client National Silica

Project Bell Property Prospecting

Location of Boring
Water Level
Time
Date

Boring No. B-55 Date 3-26-14 Sheet 2 of 2

Type of Boring Wireline Core Rig CME-55

Casing used _____ Size NQ Drilling mud used _____

Boring begun _____ Boring completed _____

Ground Elevation _____ referred to _____ Datum

Field Party CES / Ambrill

Depth of Casing, ft.	Sample No.	Sample depth from-to (in feet)	Blows/foot on Sampler	ID of Sampler (inches)	Tot. length of recov. sample	Length of Lab. sample	DEPTH IN FEET	SOIL GRAPH	DESCRIPTION Soil type, color, texture, consistency, sampler driving notes, blows per foot on casing, depths wash water lost, observed fluctuation in water level, notes on drilling ease, etc.
		25-29			1.8		25	CH SS	Mix of plastic clay & silicified sandstone boulders.
		29-34			4		30	CH SS	" "
		34-39			2		35	CH SS	" "
		39-44			1		40	CH SS	" "
		44-49			0.6		45		
								DOL	Dolomite.
							50		EOB @ 49'

Geologist _____

Job No. _____

Client National Silica

Project Ball Property Prospecting

Location of Boring	N 35° 57' 37.7"
Water Level	
Time	W 091° 36' 56.7"
Date	

Boring No. B-5 Date 3-27-14 Sheet 1 of 5

Type of Boring Wireline Core Rig CME-55

Casing used ____ Size NQ Drilling mud used ____

Boring begun 0900 Boring completed 1455

Ground Elevation ____ referred to ____ Datum

Field Party CCS/Amdrill

Depth of Casing, ft.	Sample No.	Sample depth from-to (in feet)	Blows/foot on Sampler	ID of Sampler (inches)	Tot. length of recov. sample	Length of Lab. sample	DEPTH IN FEET	SOIL GRAPH	DESCRIPTION Soil type, color, texture, consistency, sampler driving notes, blows per foot on casing, depths wash water lost, observed fluctuation in water level, notes on drilling ease, etc.
		0-4			1		0	SP	Mix of sand & weathered sandstone fragments.
								SS	
								SS	Sandstone. Orange transitions to white. Soft to medium. Friable. Fine to medium grained. Moderate to well rounded.
		4-9			4.1		5		
		9-14			5		10	SS	Sandstone. White w/ orange banding. Soft to medium hardness. Friable. Fine to medium grained. Moderate to well rounded.
		14-19			5		15	SS	Sandstone. White w/ orange oxidation staining. Contains fractures lined w/ clay seams. Soft to medium hard. Fine to med. grained. Moderate to well rounded.
		19-24			5		20	SS	" "
								SS	" "
		24-25			1		25		

Geologist [signature]

Job No. _____

Client National Silica

Project Bell Property Prospecting.

Location of Boring
Water Level
Time
Date

Boring No. B-51 Date 3-27-14 Sheet 1 of 5

Type of Boring Wireline Core Rig CME-55

Casing used _____ Size NQ Drilling mud used _____

Boring begun _____ Boring completed _____

Ground Elevation _____ referred to _____ Datum

Field Party CES / Andrill

Depth of Casing, ft.	Sample No.	Sample depth from-to (in feet)	Blows/foot on Sampler	ID of Sampler (inches)	Tot. length of recov. sample	Length of Lab. sample	DEPTH IN FEET	SOIL GRAPH	DESCRIPTION Soil type, color, texture, consistency, sampler driving notes, blows per foot on casing, depths wash water lost, observed fluctuation in water level, notes on drilling ease, etc.
		25-29			4		25	SS	Sandstone. White w/ minor orange oxidation staining. Medium hardness. Fine to medium grained. Well rounded. Friable.
		29-34			5		30	SS	Sandstone. White. Medium to medium hard. Fine to medium grained. Moderate to well rounded. Friable.
		34-39			5		35	SS	Sandstone. White. Soft. Fine to medium grained. Well rounded. Friable.
		39-44			5		40	SS	Sandstone. White w/ thin orange banding. Medium soft to medium. Fine to medium grained. Moderate to well rounded. Friable
		44-49			5		45	SS	Sandstone. White contains two fractures @ 46.5'. Soft to medium soft. Fine to medium grained. Moderate to well rounded. Friable
		49-50			1		50		

Geologist _____

Job No. _____

Client National Silica

Project Bell Property Prospecting

Location of Boring
Water Level
Time
Date

Boring No. B-51 Date 3-27-14 Sheet 3 of 5

Type of Boring Wireline Core Rig CME-55

Casing used _____ Size NQ Drilling mud used _____

Boring begun _____ Boring completed _____

Ground Elevation _____ referred to _____ Datum

Field Party CSS/Am drill

Depth of Casing, ft.	Sample No.	Sample depth from-to (in feet)	Blows/foot on Sampler	ID of Sampler (inches)	Tot. length of recov. sample	Length of Lab. sample	DEPTH IN FEET	SOIL GRAPH	DESCRIPTION Soil type, color, texture, consistency, sampler driving notes, blows per foot on casing, depths wash water lost, observed fluctuation in water level, notes on drilling ease, etc.
		50-54			3.7		50	SS	Sandstone. White - pale green w/ orange banding. Soft to medium soft. Fine to medium grained. Moderate to well sorted. Friable.
		54-59			5		55	SS	Sandstone. White - pale green w/ orange oxidation staining. Medium soft to medium hardness. Fine to medium grained. Moderate to well rounded.
									Minor amount of red-orange clay
		59-64			5		60	SS	Sandstone. White. Medium to medium hard. Fine to medium grained. Moderate to well rounded. Friable
									" "
		64-69			5		65	SS	
		69-74			5		70	SS	Sandstone. White. Medium hard to hard. Fine to medium grained. Moderate to well rounded
									" "
		74-75			1		75		

Geologist _____

Job No. _____

Client National Silica

Project Bell Property Prospecting

Location of Boring	
Water Level	
Time	
Date	

Boring No. B-51 Date 3-27-14 Sheet 4 of 5

Type of Boring Wireline Core Rig CME-55

Casing used _____ Size NQ Drilling mud used _____

Boring begun _____ Boring completed _____

Ground Elevation _____ referred to _____ Datum

Field Party CSS/Anderson

Depth of Casing, ft.	Sample No.	Sample depth from-to (in feet)	Blows/foot on Sampler	ID of Sampler (inches)	Tot. length of recov. sample	Length of Lab. sample	DEPTH IN FEET	SOIL GRAPH	DESCRIPTION Soil type, color, texture, consistency, sampler driving notes, blows per foot on casing, depths wash water lost, observed fluctuation in water level, notes on drilling ease, etc.
		75-79			4		75	SS	Sandstone - White - Hard - Fine grained, well rounded.
									Has black alteration spots and minor amount of orange clay coating.
		79-84			5		80	SS	" "
		84-89			5		85	SS	" "
		89-94			2.1		90	CL	Orange clay.
								SS	Sandstone White w/ black alteration spots Hard. Fine grained. Moderate to well rounded
		94-99			2.1		95	CL	Red-orange clay. Soft. No recovery
		99-103			0		100		

Geologist _____

Job No. _____

Client National Silica

Project Bell Property Prospecting

Location of Boring
Water Level
Time
Date

Boring No. B-51 Date 3-27-14 Sheet 5 of 5

Type of Boring Wireline Rig CME-55

Casing used _____ Size NQ Drilling mud used _____

Boring begun _____ Boring completed _____

Ground Elevation _____ referred to _____ Datum

Field Party CSS / Andrill

Depth of Casing, ft.	Sample No.	Sample depth from-to (in feet)	Blows/foot on Sampler	ID of Sampler (inches)	Tot. length of recov. sample	Length of Lab. sample	DEPTH IN FEET	SOIL GRAPH	DESCRIPTION Soil type, color, texture, consistency, sampler driving notes, blows per foot on casing, depths wash water lost, observed fluctuation in water level, notes on drilling ease, etc.
		100-104			3		100	CL	Red-orange clay. No recovery.
								SS	Sandstone. White w/ black alteration spots. Medium hardness. Friable. Fine to medium grained. Moderate to well sorted.
		104-109			33		105		
								CL	Orange clay. Soft.
								SS	Sandstone. Same as above.
		109-114			3		110		
								CL	Orange clay. Soft. No recovery.
		114-119			0		115	CL	No recovery. Very soft. Drill cuttings consist of orange clay.
		119-124			0		120		
								CL	EOB @ 124'
							125		

Geologist _____

Job No. _____

Client National Silica

Project Bell Property Prospecting

Location of Boring	N 35° 57' 38.4"
Water Level	W094° 37' 04.3"
Time	
Date	

Boring No B-52 Date 3-27-14 Sheet 1 of 1

Type of Boring Wireline Core Rig CME-55

Casing used _____ Size NQ Drilling mud used _____

Boring begun 1535 Boring completed 1645

Ground Elevation _____ referred to _____ Datum

Field Party CCS/Andrill

Depth of Casing, ft.	Sample No.	Sample depth from-to (in feet)	Blows/foot on Sampler	ID of Sampler (inches)	Tot. length of recov. sample	Length of Lab. sample	DEPTH IN FEET	SOIL GRAPH	DESCRIPTION Soil type, color, texture, consistency, sampler driving notes, blows per foot on casing, depths wash water lost, observed fluctuation in water level, notes on drilling ease, etc.
		0-4			0		0		No recovery
		4-9			2		5	Dol	Dolomite.
		9-14			1		10		
							11	cl	Brown-orange clay.
							12		
		14-19			0.5		15	cl	" "
		19-24			2		20	Dol	Dolomite
								cl	clay.
							25		EOB @ 24'

Geologist [signature]

Job No. _____

Client Natural Silica

Project Bell Property Prospecting

Location of Boring	N 35° 57' 32.8"
Water Level	W 091° 36' 53.0"
Time	
Date	

Boring No. B-53 Date 3-30-14 Sheet 1 of 4

Type of Boring Wireline Core Rig CME-55

Casing used ____ Size NQ Drilling mud used ____

Boring begun 1035 Boring completed 08:15

Ground Elevation ____ referred to ____ Datum

Field Party CES/Amdin

Depth of Casing, ft.	Sample No.	Sample depth from-to (in feet)	Blows/foot on Sampler	ID of Sampler (inches)	Tot. length of recov. sample	Length of Lab. sample	DEPTH IN FEET	SOIL GRAPH	DESCRIPTION Soil type, color, texture, consistency, sampler driving notes, blows per foot on casing, depths wash water lost, observed fluctuation in water level, notes on drilling ease, etc.
		0-5			1		0	CL-CH	Mix of clay & weathered sandstone fragments
		5-10			1.5		5	CH-SS	Mix of sandstone & gray, plastic clay.
		10-15			1		10	* ? SS	Possibly soft sand. No recovery Sandstone. Very soft. White w/ orange oxidation staining. Fine to medium grained. Moderate to well rounded. Friable.
		15-20			4		15		
		20-25			4.1		20	SS	Sandstone. White w/ orange staining. Soft. Friable. Fine to medium grained. Moderate to well rounded.
							25		

Geologist _____

Job No. _____

Client National Silica

Project Bell Property Prospecting

Location of Boring
Water Level
Time
Date

Boring No. B-53 Date 3-20-14 Sheet 2 of 4

Type of Boring Wireline Core Rig CME-55

Casing used _____ Size NQ Drilling mud used _____

Boring begun _____ Boring completed _____

Ground Elevation _____ referred to _____ Datum

Field Party CCS/Amarillo

Depth of Casing, ft.	Sample No.	Sample depth from-to (in feet)	Blows/foot on Sampler	ID of Sampler (inches)	Tot. length of recov. sample	Length of Lab. sample	DEPTH IN FEET	SOIL GRAPH	DESCRIPTION Soil type, color, texture, consistency, sampler driving notes, blows per foot on casing, depths wash water lost, observed fluctuation in water level, notes on drilling ease, etc.
		25-30			5		25	SS	Sandstone. Soft. Friable. White - pale orange. Fine to medium grained. More medium grains than normal. Moderate to well rounded.
		30-35			5		30	SS	〃 〃
		35-40			5		35	SS	〃 〃
		40-45			4.8		40	SS	Sandstone. White. Medium to Med. hard. Friable. Fine to medium grained. Moderate to well rounded.
								CL	Sandy clay. Orange-red.
								SS	Sandstone. Medium soft. White. Fine to medium grained. Moderate to well rounded.
		45-50			4		45		
								CL	Red-orange clay.
								SS	Sandstone. White. Medium to medium hard.
							50		

Geologist _____

Job No. _____

Client National Silica

Project Bell Property Prospecting

Location of Boring
Water Level
Time
Date

Boring No. B-53 Date 2-20-14 Sheet 3 of 4

Type of Boring Washing Rig CME-55

Casing used _____ Size NQ Drilling mud used _____

Boring begun _____ Boring completed _____

Ground Elevation _____ referred to _____ Datum

Field Party CSS/Amdrill

Depth of Casing, ft.	Sample No.	Sample depth from-to (in feet)	Blows/foot on Sampler	ID of Sampler (inches)	Tot. length of recov. sample	Length of Lab. sample	DEPTH IN FEET	SOIL GRAPH	DESCRIPTION Soil type, color, texture, consistency, sampler driving notes, blows per foot on casing, depths wash water lost, observed fluctuation in water level, notes on drilling ease, etc.
		50-55			4.5		50	SS	Sandstone. White w/ minor orange oxidation staining. Medium to medium hard. Fine to medium grained. Moderate to well rounded.
							55		
		55-60			4			CL	~~Orange~~ clay.
								SS	Sandstone. Same as above.
								CL	~~Orange~~ clay
								SS	Sandstone. Same as above.
		60-65			1.2		60		
								CL	Clay. No recovery.
							65	SS	Sandstone
		65-70			1			?	Drill through intermittent layers of soft & hard.
							70		
		70-75			1.8			SS-?	Sandstone w/ intermittent soft layers of unknown material
							75		

Geologist _____

Job No. _____

Client National Siting

Project Bell Property Prospecting

Location of Boring
Water Level
Time
Date

Boring No. B-53 Date 4-1-14 Sheet 4 of 4

Type of Boring Wireline Core Rig CME-55

Casing used _____ Size NQ Drilling mud used _____

Boring begun _____ Boring completed _____

Ground Elevation _____ referred to _____ Datum

Field Party CSS / Amdrill

Depth of Casing, ft.	Sample No.	Sample depth from-to (in feet)	Blows/foot on Sampler	ID of Sampler (inches)	Tot. length of recov. sample	Length of Lab. sample	DEPTH IN FEET	SOIL GRAPH	DESCRIPTION Soil type, color, texture, consistency, sampler driving notes, blows per foot on casing, depths wash water lost, observed fluctuation in water level, notes on drilling ease, etc.
		75-80			1.2		75	55	Sandstone. Orange. Hard. Fine grained. Moderate to well banded.
								9	No recovery.
		80-85			0		80	7	No recovery. Very soft.
							85		EOB @ 85'
							90		
							95		
							100		

Geologist _____

Job No. _____

Client National Slim

Project Bell Property Prospecting

Location of Boring	N 35° 57' 37.0"
Water Level	
Time	W 094° 37' 16.4"
Date	

Boring No. B-54 Date 3-28-14 Sheet 1 of 4

Type of Boring Wireline Core Rig CME-55

Casing used _____ Size NQ Drilling mud used _____

Boring begun 15:20 Boring completed 09:25

Ground Elevation _____ referred to _____ Datum

Field Party CES/Amdrill

Depth of Casing, ft.	Sample No.	Sample depth from-to (in feet)	Blows/foot on Sampler	ID of Sampler (inches)	Tot. length of recov. sample	Length of Lab. sample	DEPTH IN FEET	SOIL GRAPH	DESCRIPTION Soil type, color, texture, consistency, sampler driving notes, blows per foot on casing, depths wash water lost, observed fluctuation in water level, notes on drilling ease, etc.
		0-5			0.5		0		No Recovery.
								?	
									Sandstone. White w/ orange oxidation staining. Medium hardness. Fine to medium grained. Moderate to well rounded. Friable.
		5-10			5		5	SS	
									" "
		10-15			5		10	SS	
									" "
		15-20			5		15	SS	
									Sandstone. White. Medium hardness. Fine to medium grained. Moderate to well rounded. Friable
		20-25			5		20	SS	
							25		

Geologist _____

Job No. _____

Client National Silica

Project Bell Property Prospecting

Location of Boring
Water Level
Time
Date

Boring No B-54 Date 3-28-14 Sheet 2 of 4

Type of Boring Wireline Core Rig Cme-55

Casing used _____ Size NQ Drilling mud used _____

Boring begun _____ Boring completed _____

Ground Elevation _____ referred to _____ Datum

Field Party CG/Armbrill

Depth of Casing, ft.	Sample No.	Sample depth from-to (in feet)	Blows/foot on Sampler	ID of Sampler (inches)	Tot. length of recov. sample	Length of Lab. sample	DEPTH IN FEET	SOIL GRAPH	DESCRIPTION Soil type, color, texture, consistency, sampler driving notes, blows per foot on casing, depths wash water lost, observed fluctuation in water level, notes on drilling ease, etc.
		25-30			5		25	SS	Sandstone. White w/ orange oxidation staining. Medium soft to medium hardness. Fine to medium grained. Moderate to well rounded. Fe. Nodule
									" "
		30-35			5		30	SS	
		35-40			5		35	SS	Sandstone. White w/ orange, banding. Medium to medium hard. Fine to medium grained. well rounded.
									" "
		40 45			5		40	SS	
		45-50			5		45	SS	Sandstone. White w/ orange staining & black alteration spots. Medium hardness Fine to medium grained. Moderate to well rounded.
							50		

Geologist _____

Job No. _____

Client National Silica

Project Bell Property Prospecting

Location of Boring	
Water Level	
Time	
Date	

Boring No. B-54 Date 3-30-14 Sheet 3 of 4

Type of Boring Wireline WC Rig CME-55

Casing used _____ Size NQ Drilling mud used _____

Boring begun _____ Boring completed _____

Ground Elevation _____ referred to _____ Datum

Field Party CCS/Amdrill

Depth of Casing, ft.	Sample No.	Sample depth from-to (in feet)	Blows/foot on Sampler	ID of Sampler (inches)	Tot. length of recov. sample	Length of Lab. sample	DEPTH IN FEET	SOIL GRAPH	DESCRIPTION Soil type, color, texture, consistency, sampler driving notes, blows per foot on casing, depths wash water lost, observed fluctuation in water level, notes on drilling ease, etc.
		50-55			5		50	SS	Sandstone - White w/ orange oxidation staining. Medium to medium hard. Fine to medium grained. Moderate to well rounded.
		55-60			5		55	SS	" "
		60-65			5		60	SS	Sandstone - White w/ orange oxidation staining and black banding. Medium to medium hard. Fine to medium grained. Moderate to well rounded.
		65-70			5		65	SS	Sandstone - White w/ minor orange oxidation staining. Medium hard. Fine to medium grained. Moderate to well rounded
		70-75			5		70	SS	" "
							75		

Geologist _____

Job No. _____

Client National Silica

Project Bell Property Prospecting

Location of Boring
Water Level
Time
Date

Boring No. B-54 Date 3-30-14 Sheet 4 of 4

Type of Boring Wireline Core Rig CME-55

Casing used _____ Size NA Drilling mud used _____

Boring begun _____ Boring completed _____

Ground Elevation _____ referred to _____ Datum

Field Party CES/Andrill

Depth of Casing, ft.	Sample No.	Sample depth from-to (in feet)	Blows/foot on Sampler	ID of Sampler (inches)	Tot. length of recov. sample	Length of Lab. sample	DEPTH IN FEET	SOIL GRAPH	DESCRIPTION Soil type, color, texture, consistency, sampler driving notes, blows per foot on casing, depths wash water lost, observed fluctuation in water level, notes on drilling ease, etc.
		75-80			5		75	SS	Sandstone. White to pale green. Medium to medium coarse. Friable. Fine to medium grained. Moderate to well rounded.
		80-85			4.2		80	SS	Sandstone. Green. Medium, silty. Friable. Fine to medium grained. Moderate to well rounded.
		85-90			0		85	CL	Orange clay. Very soft. No recovery.
		90-95			2		90	CL CH	" "
		95-100					95	Di	Dolomite. EOB @ 95'
							100		

Geologist _____

Job No. _____

Client National Silica

Project Bell Property Prospecting

Location of Boring	N 35° 57' 24.9"
Water Level	
Time	W 091° 37' 16.6"
Date	

Boring No. B-55 Date 3-27-14 Sheet 1 of 5

Type of Boring Wireline Core Rig CME-55

Casing used _____ Size NQ Drilling mud used _____

Boring begun 13:00 Boring completed 14:10

Ground Elevation _____ referred to _____ Datum

Field Party CES/Amdrill

Depth of Casing, ft.	Sample No.	Sample depth from-to (in feet)	Blows/foot on Sampler	ID of Sampler (inches)	Tot. length of recov. sample	Length of Lab. sample	DEPTH IN FEET	SOIL GRAPH	DESCRIPTION Soil type, color, texture, consistency, sampler driving notes, blows per foot on casing, depths wash water lost, observed fluctuation in water level, notes on drilling ease, etc.
		0-4			0		0	CL	clay.
		4-9			1		5	SS	Sandstone. Orange. Medium to medium hard. Fine to medium grained. Moderate to well rounded.
					4.5			SS/CL	mix of sandstone & clay.
		9-14			1		10	SS/CL	Sandstone. White w/ orange oxidation staining. Medium to medium hard. Fine grained. Moderate to well rounded.
		14-19			2.5		15	CL	clay. Green & orange.
								SS	Sandstone. White. Medium to medium hard. Fine to medium grained. Moderate to well rounded
		19-24			3		20	CH	Green clay w/ orange staining. Plastic
		24-25			1		25		

Geologist _____

Job No. _____

Client National Silica

Project Bell Property Prospecting

Location of Boring
Water Level
Time
Date

Boring No. B-55 Date 3-28-14 Sheet 2 of 5

Type of Boring Wireline Core Rig CME-55

Casing used _____ Size NQ Drilling mud used _____

Boring begun _____ Boring completed _____

Ground Elevation _____ referred to _____ Datum

Field Party CCS/Andrill

Depth of Casing, ft.	Sample No.	Sample depth from-to (in feet)	Blows/foot on Sampler	ID of Sampler (inches)	Tot. length of recov. sample	Length of Lab. sample	DEPTH IN FEET	SOIL GRAPH	DESCRIPTION Soil type, color, texture, consistency, sampler driving notes, blows per foot on casing, depths wash water lost, observed fluctuation in water level, notes on drilling ease, etc.
		25-29			3		25	CH	Plastic clay. Red.
								SS	Sandstone. White. medium hardness. Fine to medium grained. Moderate to well rounded.
		29-34			5				
							30	SS	" "
		34-39			5				
							35	SS	" "
		39-44			5				
							40	SS	" "
		44-49			5				
							45	SS	Sandstone. White. Medium hard. Has a few black stringers staining. Fine to medium grained. Moderate to well rounded.
									Has small clay lined fracture @ 47.5'
		49-50			1		50	SS	

Geologist _____

Job No. _____

Client National Silica

Project Bell Property Prospecting

Location of Boring
Water Level
Time
Date

Boring No. B-55 Date 2-28-14 Sheet 3 of 5

Type of Boring Wireline Core Rig CME-55

Casing used _____ Size NQ Drilling mud used _____

Boring begun _____ Boring completed _____

Ground Elevation _____ referred to _____ Datum

Field Party CSI/Andrill

Depth of Casing, ft.	Sample No.	Sample depth from-to (in feet)	Blows/foot on Sampler	ID of Sampler (inches)	Tot. length of recov. sample	Length of Lab. sample	DEPTH IN FEET	SOIL GRAPH	DESCRIPTION Soil type, color, texture, consistency, sampler driving notes, blows per foot on casing, depths wash water lost, observed fluctuation in water level, notes on drilling ease, etc.
		50-54			4		50	SS	Sandstone. White w/ minor orange staining. Medium to medium hard. Fine to medium grained. Moderate to well rounded.
									" "
		54-59			4		55	SS	
		59-64			1		60	U	Orange clay
								SS	Sandstone. Very hard. White.
								U	Orange clay.
		64-69			5		65	SS	Sandstone. White. Very hard. Fine grained. Well rounded.
		69-74			5		70	SS	Sandstone. White. Medium hard to hard. Fine to medium grained. Moderate to well rounded.
									" "
		74-75			1		75	SS	

Geologist _____

Job No. _____

Client National Silica

Project Bell Property Prospecting

Location of Boring
Water Level
Time
Date

Boring No. B-55 Date 3-28-14 Sheet 4 of 5

Type of Boring Wireline Core Rig CME-55

Casing used _____ Size NQ Drilling mud used _____

Boring begun _____ Boring completed _____

Ground Elevation _____ referred to _____ Datum

Field Party CES/Amdrill

Depth of Casing, ft.	Sample No.	Sample depth from-to (in feet)	Blows/foot on Sampler	ID of Sampler (inches)	Tot. length of recov. sample	Length of Lab. sample	DEPTH IN FEET	SOIL GRAPH	DESCRIPTION Soil type, color, texture, consistency, sampler driving notes, blows per foot on casing, depths wash water lost, observed fluctuation in water level, notes on drilling ease, etc.
		75-79			2.6		75	SS	Sandstone. White w/ moderate orange staining. Medium hard. Fine to medium grained. Moderate to well rounded.
								CH	Green clay. Plastic.
		79-84			4		80	SS	Sandstone. Pale green. Medium hard. Fine to medium grained. Moderate to well rounded.
								CL	Clay.
		84-89			5		85	SS	Sandstone. Pale orange. Medium hard. Fine grained. Moderate to well rounded.
		89-94			5		90	SS	" "
		94-99			0		95	?	No recovery. Drilled soft
		99-(100)			1		100	CH	Plastic, orange clay

Geologist _____

Job No. _____

Client National Silica

Project Bell Property Prospecting

Location of Boring
Water Level
Time
Date

Boring No. B-55 Date 3-28-14 Sheet 5 of 5

Type of Boring Wireline Core Rig CME-55

Casing used _____ Size NQ Drilling mud used _____

Boring begun _____ Boring completed _____

Ground Elevation _____ referred to _____ Datum

Field Party CSS / Andrill

Depth of Casing, ft.	Sample No.	Sample depth from-to (in feet)	Blows/foot on Sampler	ID of Sampler (inches)	Tot. length of recov. sample	Length of Lab. sample	DEPTH IN FEET	SOIL GRAPH	DESCRIPTION Soil type, color, texture, consistency, sampler driving notes, blows per foot on casing, depths wash water lost, observed fluctuation in water level, notes on drilling ease, etc.
		100-104			4		100	CH	Plastic orange clay. Stiff.
		104-109			5		105	CH	Plastic clay. Stiff. Orange
									Transition to blue @ 107'.
							110		EOB @ 109'

Geologist _____

Job No.

Client National Silica

Project Bell Property Prospecting

Location of Boring	N 35° 57' 20.2"
Water Level	
Time	W 091° 37' 25.0"
Date	

Boring No. B-5 Date 4-1-14 Sheet 1 of 1

Type of Boring Wireline core Rig CME-55

Casing used ____ Size NQ Drilling mud used ____

Boring begun 09:30 Boring completed 09:40

Ground Elevation ____ referred to ____ Datum

Field Party CES/Ambrill

Depth of Casing, ft.	Sample No.	Sample depth from-to (in feet)	Blows/foot on Sampler	ID of Sampler (inches)	Tot. length of recov. sample	Length of Lab. sample	DEPTH IN FEET	SOIL GRAPH	DESCRIPTION Soil type, color, texture, consistency, sampler driving notes, blows per foot on casing, depths wash water lost, observed fluctuation in water level, notes on drilling ease, etc.
		0-4			0.1		0	CL	Red clay.
		4-9			1.1		5	SS SP DJ	Dolomite. EOB @ 5.5'
		9-14					10		
		14-19					15		
		19-24					20		
							25		

Geologist J. Rima

Job No. _____

Client National S.T.A.

Project Bell Property Prospecting

Location of Boring	N 35° 57' 19.2"
Water Level	W 091° 37' 24.6"
Time	
Date	

Boring No. B-57 Date 4-1-14 Sheet 1 of 1

Type of Boring Wireline, roto Rig CME-55

Casing used _____ Size NQ Drilling mud used _____

Boring begun _____ Boring completed _____

Ground Elevation _____ referred to _____ Datum

Field Party CES/Arndt

Depth of Casing, ft.	Sample No.	Sample depth from-to (in feet)	Blows/foot on Sampler	ID of Sampler (inches)	Tot. length of recov. sample	Length of Lab. sample	DEPTH IN FEET	SOIL GRAPH	DESCRIPTION Soil type, color, texture, consistency, sampler driving notes, blows per foot on casing, depths wash water lost, observed fluctuation in water level, notes on drilling ease, etc.
		0-4			3		0	CL	clay.
								SS	Sandstone.
								Di	Dolomite.
									EOB @ 4'
							5		
							10		
							15		
							20		
							25		

Geologist _____

Job No. _____

Client National Silica

Project Bell Property Prospecting

Location of Boring	
Water Level	
Time	
Date	

Boring No. B-58 Date 4-1-14 Sheet 1 of 1

Type of Boring Wireline Core Rig CME-55

Casing used _____ Size NQ Drilling mud used _____

Boring begun 1040 Boring completed 1125

Ground Elevation _____ referred to _____ Datum

Field Party CSJ/Arndt

Depth of Casing, ft.	Sample No.	Sample depth from-to (in feet)	Blows/foot on Sampler	ID of Sampler (inches)	Tot. length of recov. sample	Length of Lab. sample	DEPTH IN FEET	SOIL GRAPH	DESCRIPTION Soil type, color, texture, consistency, sampler driving notes, blows per foot on casing, depths wash water lost, observed fluctuation in water level, notes on drilling ease, etc.
		0-5			1		0		
								CH	Green clay w/ orange mottling. Plastic
		5-10			2.5		5		
								SS	Sandstone. Green. Hard to very hard. Fine grained. Moderate to well rounded.
		10-15			1		10	CH	Plastic clay. Green-orange
		15-20			2		15	CH	" "
		20-25					20		TOB @ 20
							25		

Geologist _____

Job No. _____

Client National Silica

Project Bell Property Prospecting

Location of Boring	N 35° 57' 20.2"
Water Level	W 011° 37' 18.1"
Time	
Date	

Boring No. B-51 Date 4-1-14 Sheet 1 of 2

Type of Boring Wireline Core Rig CME-55

Casing used ____ Size NQ Drilling mud used ____

Boring begun 12:15 Boring completed 13:00

Ground Elevation ____ referred to ____ Datum

Field Party CCS/Amadri 11

Depth of Casing, ft.	Sample No.	Sample depth from-to (in feet)	Blows/foot on Sampler	ID of Sampler (inches)	Tot. length of recov. sample	Length of Lab. sample	DEPTH IN FEET	SOIL GRAPH	DESCRIPTION Soil type, color, texture, consistency, sampler driving notes, blows per foot on casing, depths wash water lost, observed fluctuation in water level, notes on drilling ease, etc.
		0-4			1		0		
								SS	Sandstone- Soft- White w/ orange staining. Fine to medium grained. Moderate to well rounded. Friable.
		4-9			2		5		
								CL	Orange- Clay-
								SS	Same as above
		9-14			3		10	CL	Orange clay
								SS	Sandstone- White- Soft. Fine to medium grained- Moderate to well rounded. Friable
		14-19			1		15	CL	Orange clay
								SS	Sandstone- Pale green
		19-24			1		20	CL	Clay. Soft. No recovery.
							25		

Geologist _____

Job No. _____

Client National Silica

Project Bell Property Prospecting

Location of Boring
Water Level
Time
Date

Boring No B-59 Date 4-1-14 Sheet 2 of 2

Type of Boring Wireline Rig Core-55

Casing used _____ Size HQ Drilling mud used _____

Boring begun _____ Boring completed _____

Ground Elevation _____ referred to _____ Datum

Field Party CES/Hendrix

Depth of Casing, ft.	Sample No.	Sample depth from-to (in feet)	Blows/foot on Sampler	ID of Sampler (inches)	Tot. length of recov. sample	Length of Lab. sample	DEPTH IN FEET	SOIL GRAPH	DESCRIPTION Soil type, color, texture, consistency, sampler driving notes, blows per foot on casing, depths wash water lost, observed fluctuation in water level, notes on drilling ease, etc.
		25-29			0		25	?	No recovery. Possibly clays
		29-34			2		30	CH	Green clay. Plastic.
								SS	White. Sandstone. Med. hard.
								CH	Plastic clay. (green, orange. containing weathered sandstone fragments
									EoB @ 34
							35		
							40		
							45		
							50		

Geologist _____

Job No. National Silica

Client

Project Bell Property Prospecting

Location of Boring	N 35° 57' 35.3"
Water Level	W 091° 37' 08.7"
Time	
Date	

Boring No. B-60 Date 4-1-14 Sheet 1 of 3

Type of Boring Wireline Core Rig CME-55

Casing used ____ Size HQ Drilling mud used ____

Boring begun 1345 Boring completed 1540

Ground Elevation ____ referred to ____ Datum

Field Party CSI/Ardvill

Depth of Casing, ft.	Sample No.	Sample depth from-to (in feet)	Blows/foot on Sampler	ID of Sampler (inches)	Tot. length of recov. sample	Length of Lab. sample	DEPTH IN FEET	SOIL GRAPH	DESCRIPTION Soil type, color, texture, consistency, sampler driving notes, blows per foot on casing, depths wash water lost, observed fluctuation in water level, notes on drilling ease, etc.
		0-4			2		0		
								SS	Sandstone. White w/ orange staining. Medium hardness. Fine grained. Moderate to well rounded.
		4-9			5		5	SS	Sandstone. White w/ orange staining. Soft to medium hardness. Fine to medium grained. Moderate to well rounded.
		9-14			5		10	SS	" "
		14-19			5		15	SS	" "
		19-24			5		20	SS	" "
		24-25			1		25	SS	

Geologist

Job No. _____

Client National Silica

Project Bell Property Prospecting

Location of Boring	
Water Level	
Time	
Date	

Boring No. B-60 Date 4-1-14 Sheet 2 of 3

Type of Boring Wireline Core Rig CME-55

Casing used _____ Size NQ Drilling mud used _____

Boring begun _____ Boring completed _____

Ground Elevation _____ referred to _____ Datum

Field Party Cos / Brad / Ill

Depth of Casing, ft.	Sample No.	Sample depth from-to (in feet)	Blows/foot on Sampler	ID of Sampler (inches)	Tot. length of recov. sample	Length of Lab. sample	DEPTH IN FEET	SOIL GRAPH	DESCRIPTION Soil type, color, texture, consistency, sampler driving notes, blows per foot on casing, depths wash water lost, observed fluctuation in water level, notes on drilling ease, etc.
		25-29			4		25	SS	Sandstone. Medium Soft to medium. White. w/ orange staining. Fine to medium grained- Moderate to well rounded- Friable.
		29-34			5		30	SS	" "
		34-39			5		35	SS	Sandstone. White. Medium to medium hard. Fine to medium grained. Moderate to well rounded-
		39-44			5		40	SS	" "
		4449			5		45	SS	Sandstone. White. Hard. Fine grained. Moderate to well rounded.
							50		

Geologist _____

Job No. _____

Client National Silica

Project Bell Property Prospecting

Location of Boring
Water Level
Time
Date

Boring No B-60 Date 4-1-14 Sheet 3 of 3

Type of Boring Wireline Core Rig Cme-55

Casing used _____ Size NQ Drilling mud used _____

Boring begun _____ Boring completed _____

Ground Elevation _____ referred to _____ Datum

Field Party CES/Arndt II

Depth of Casing, ft.	Sample No.	Sample depth from-to (in feet)	Blows/foot on Sampler	ID of Sampler (inches)	Tot. length of recov. sample	Length of Lab. sample	DEPTH IN FEET	SOIL GRAPH	DESCRIPTION Soil type, color, texture, consistency, sampler driving notes, blows per foot on casing, depths wash water lost, observed fluctuation in water level, notes on drilling ease, etc.
		50-54			2		50	SS	Sandstone. White. Hard to very hard. Fine grained. Moderate to well rounded.
									EOB @ 52'
		54-59					55		
		59-64					60		
		64-64					65		
		69-74					70		
							75		

Geologist D. D. Mt

Job No. _____

Client National Silica

Project Bell Property Prospecting

Location of Boring	N 35° 57' 32.5"
Water Level	
Time	W 091° 36' 58.6"
Date	

Boring No. B-61 Date 4-2-14 Sheet 1 of 3

Type of Boring Wireline Core Rig CME-55

Casing used _____ Size NA Drilling mud used _____

Boring begun 07:20 Boring completed 08:50

Ground Elevation _____ referred to _____ Datum

Field Party CGS/Amdrill

Depth of Casing, ft.	Sample No.	Sample depth from-to (in feet)	Blows/foot on Sampler	ID of Sampler (inches)	Tot. length of recov. sample	Length of Lab. sample	DEPTH IN FEET	SOIL GRAPH	DESCRIPTION Soil type, color, texture, consistency, sampler driving notes, blows per foot on casing, depths wash water lost, observed fluctuation in water level, notes on drilling ease, etc.
		0-4			0.5		0	U	
								SS	Sandstone. White, w/ orange staining. Medium soft to soft. Fine to medium grained. Moderate to well rounded. Friable.
		4-9			5		5		
		9-14			5		10	SS	" "
		14-19			5		15	SS	" "
		19-24			5		20	SS	Sandstone. White. Medium hard to hard. Fine grained. Moderate to well rounded. Contains minor amounts of clay.
								SS	" "
		24-25			1		25		

Geologist _____

Job No. _____

Client National Silica

Project Bell Property Prospecting

Location of Boring
Water Level
Time
Date

Boring No B-61 Date 4-2-14 Sheet 2 of 3

Type of Boring Wireline Core Rig CME-55

Casing used _____ Size NQ Drilling mud used _____

Boring begun _____ Boring completed _____

Ground Elevation _____ referred to _____ Datum

Field Party CES / Ambrish

Depth of Casing, ft.	Sample No.	Sample depth from-to (in feet)	Blows/foot on Sampler	ID of Sampler (inches)	Tot. length of recov. sample	Length of Lab. sample	DEPTH IN FEET	SOIL GRAPH	DESCRIPTION Soil type, color, texture, consistency, sampler driving notes, blows per foot on casing, depths wash water lost, observed fluctuation in water level, notes on drilling ease, etc.
		25-29			4		25	SS	Sandstone. White w/ minor orange staining. Hard. Fine grained. Moderate to well rounded.
		29-34			5		30	SS	Sandstone. White - pale green. Medium hard. Fine to medium grained. Moderate to well rounded. Friable.
		34-39			4.2		35	SS	Sandstone. White w/ orange staining. Soft to medium hardness. Fine to medium grained. Moderate to well Rounded.
		39-44			3		40	SS	Sandstone. Medium Soft. Green-orange. Fine to medium grained. Moderate to well rounded. Friable.
		44-49			1		45	SS SS	Sandstone & poorly graded sand. Orange. Fine to medium grained. Moderate to well Rounded. Very soft. Friable.
		49-50			0		50		

Geologist _____

Job No. _____

Client National Silica

Project Bell Property Prospecting

Location of Boring
Water Level
Time
Date

Boring No. B-61 Date 4-2-14 Sheet 3 of 3

Type of Boring Wireline Core Rig CME-55

Casing used _____ Size No. Drilling mud used _____

Boring begun _____ Boring completed _____

Ground Elevation _____ referred to _____ Datum

Field Party CCS / Amdrill

Depth of Casing, ft.	Sample No.	Sample depth from-to (in feet)	Blows/foot on Sampler	ID of Sampler (inches)	Tot. length of recov. sample	Length of Lab. sample	DEPTH IN FEET	SOIL GRAPH	DESCRIPTION Soil type, color, texture, consistency, sampler driving notes, blows per foot on casing, depths wash water lost, observed fluctuation in water level, notes on drilling ease, etc.
		50-54			0		50		Very soft. No recovery. Drill mud but sand. No clay.
		54-59					55	Qd	Dolomite
									COB @ 56'
							60		

Geologist _____

Job No. _____

Client National Silica

Project Bell Property Prospecting.

Location of Boring	N 35° 57' 25.3"
Water Level	W 091° 37' 02.5"
Time	
Date	

Boring No. B-6 Date 4-2-14 Sheet 1 of 3

Type of Boring Wireline Rig CME-55

Casing used _____ Size NQ Drilling mud used _____

Boring begun 0920 Boring completed 1030

Ground Elevation _____ referred to _____ Datum

Field Party CCS / Arnold

Depth of Casing, ft.	Sample No.	Sample depth from-to (in feet)	Blows/foot on Sampler	ID of Sampler (inches)	Tot. length of recov. sample	Length of Lab. sample	DEPTH IN FEET	SOIL GRAPH	DESCRIPTION Soil type, color, texture, consistency, sampler driving notes, blows per foot on casing, depths wash water lost, observed fluctuation in water level, notes on drilling ease, etc.
		0-4			6		0		
		4-9			4		5	SS	Sandstone. Orange-Soft to medium soft. fine to medium grained - Moderate to well rounded- friable.
		9-14			3.7		10	SS	" "
		14-19			2		15	SS	" "
									Very soft. No recovery.
		19-24			2		20		
		24-25			0		25	SS	Sandstone. Medium soft to medium. White w/ brown & orange staining. Fine to medium grained. Moderately rounded.

Geologist _____

Job No. _____

Client National Silica

Project Bell Property Prospecting

Location of Boring	
Water Level	
Time	
Date	

Boring No. B-62 Date 4-2-14 Sheet 2 of 3

Type of Boring Wireline Core Rig CME-55

Casing used _____ Size NQ Drilling mud used _____

Boring begun _____ Boring completed _____

Ground Elevation _____ referred to _____ Datum

Field Party CES / Andrill

Depth of Casing, ft.	Sample No.	Sample depth from-to (in feet)	Blows/foot on Sampler	ID of Sampler (inches)	Tot. length of recov. sample	Length of Lab. sample	DEPTH IN FEET	SOIL GRAPH	DESCRIPTION Soil type, color, texture, consistency, sampler driving notes, blows per foot on casing, depths wash water lost, observed fluctuation in water level, notes on drilling ease, etc.
		25-29			4		25	SS	Sandstone. Brown & gray banded. Medium hardness. Fine to medium grained. Moderate to well rounded. Friable.
		29-34			3		30	SS	" "
		34-39			4		35	SS	Sandstone. Transitions from orange to white back to orange. Medium hardness. Friable. Fine to medium grained. Moderate to well rounded
		39-44			5		40	SS	Sandstone. White w/ orange staining & black alteration spots. Medium hardness. Friable. Fine to medium grained. Moderate to well rounded.
		44-49			3		45	SS	" " Becomes dark orange. Fractures have clay lining.
		49-50			0		50		Drilled very soft. No recovery

Geologist [signature]

Job No. _____

Client National Silica

Project Bell Property Prospecting

Location of Boring	
Water Level	
Time	
Date	

Boring No. B-62 Date 4-2-14 Sheet 3 of 3

Type of Boring Wireline Core Rig CME-55

Casing used _____ Size HQ Drilling mud used _____

Boring begun _____ Boring completed _____

Ground Elevation _____ referred to _____ Datum

Field Party CSS/Arnold

Depth of Casing, ft.	Sample No.	Sample depth from-to (in feet)	Blows/foot on Sampler	ID of Sampler (inches)	Tot. length of recov. sample	Length of Lab. sample	DEPTH IN FEET	SOIL GRAPH	DESCRIPTION Soil type, color, texture, consistency, sampler driving notes, blows per foot on casing, depths wash water lost, observed fluctuation in water level, notes on drilling ease, etc.
		50-54			0.1		50		Very soft. No recovery
		54-59			0.5		55	SS	Stratified sandstone. Very hard. Orange.
							60		EOB @ 59'
							65		
							70		
							75		

Geologist [signature]

Appendix 5

Canadian Institute of Mining, Metallurgy and Petroleum (CIM), CIM Definition Standards – For Mineral Resources and Mineral Reserves

CIM DEFINITION STANDARDS - For Mineral Resources and Mineral Reserves

Prepared by the *CIM Standing Committee on Reserve Definitions*
Adopted by CIM Council on May 10, 2014

FOREWORD

The CIM Definition Standards on Mineral Resources and Reserves (CIM Definition Standards) establish definitions and guidance on the definitions for mineral resources, mineral reserves, and mining studies used in Canada. The Mineral Resource, Mineral Reserve, and Mining Study definitions are incorporated, by reference, into National Instrument 43-101 – *Standards of Disclosure for Mineral Projects* (NI 43-101). The CIM Definition Standards can be viewed on the CIM website at www.cim.org.

Readers should be aware that reports written by persons issuing technical reports that disclose information about exploration or other mining properties to the public in Canada are governed by a number of securities regulations.

CIM DEFINITION STANDARDS

The CIM Definition Standards presented herein provide definitions and guidance on those definitions for Mineral Resource and Mineral Reserve and their confidence categories. The category to which a mineral resource or mineral reserve estimate is assigned depends on the level of confidence in the geological information available on the mineral deposit; the quality and quantity of data available on the deposit; the level of detail of the technical and economic information which has been generated about the deposit, and the interpretation of the data and information. In the document the definitions are in bold type and the guidance is in italics. Defined terms referenced to other CIM Definitions are underlined and defined terms referenced to NI 43-101 are double underlined.

Throughout the CIM Definition Standards, where appropriate, "quality" may be substituted for "grade" and "volume" may be substituted for "tonnage". Technical Reports dealing with estimates of Mineral Resources and Mineral Reserves, or summarizing the results of Mining Studies (Preliminary Feasibility or Feasibility Studies), must use only the terms and definitions contained herein.

DEFINITIONS

Qualified Person

Mineral Resource and Mineral Reserve estimates and any supporting Technical Reports must be prepared by or under the direction of a Qualified Person, as that term is defined in NI 43-101.

The Qualified Person(s) should be clearly satisfied that they could face their peers and demonstrate competence and relevant experience in the commodity, type of deposit and situation under consideration. If doubt

exists, the person must either seek or obtain opinions from other colleagues or demonstrate that he or she has obtained assistance from experts in areas where he or she lacked the necessary expertise.

Determination of what constitutes relevant experience can be a difficult area and common sense has to be exercised. For example, in estimating Mineral Resources for vein gold mineralization, experience in a high-nugget, vein-type mineralization such as tin, uranium etc. should be relevant whereas experience in massive base metal deposits may not be. As a second example, for a person to qualify as a Qualified Person in the estimation of Mineral Reserves for alluvial gold deposits, he or she would need to have relevant experience in the evaluation and extraction of such deposits. Experience with placer deposits containing minerals other than gold, may not necessarily provide appropriate relevant experience for gold.

In addition to experience in the style of mineralization, a Qualified Person preparing or taking responsibility for Mineral Resource estimates must have sufficient experience in the sampling, assaying, or other property testing techniques that are relevant to the deposit under consideration in order to be aware of problems that could affect the reliability of the data. Some appreciation of extraction and processing techniques applicable to that deposit type might also be important.

Estimation of Mineral Resources is often a team effort, for example, involving one person or team collecting the data and another person or team preparing the Mineral Resource estimate. Within this team, geologists usually occupy the pivotal role. Estimation of Mineral Reserves is almost always a team effort involving a number of technical disciplines, and within this team mining engineers have an important role. Documentation for a Mineral Resource and Mineral Reserve estimate must be compiled by, or under the supervision of, a Qualified Person(s), whether a geologist, mining engineer or member of another discipline. It is recommended that, where there is a clear division of responsibilities within a team, each Qualified Person should accept responsibility for his or her particular contribution. For example, one Qualified Person could accept responsibility for the collection of Mineral Resource data, another for the Mineral Reserve estimation process, another for the mining study, and the project leader could accept responsibility for the overall document. It is important that the Qualified Person accepting overall responsibility for a Mineral Resource and/or Mineral Reserve estimate and supporting documentation, which has been prepared in whole or in part by others, is satisfied that the other contributors are Qualified Persons with respect to the work for which they are taking responsibility and that such persons are provided adequate documentation.

Pre-Feasibility Study (Preliminary Feasibility Study)

The CIM Definition Standards requires the completion of a Pre-Feasibility Study as the minimum prerequisite for the conversion of Mineral Resources to Mineral Reserves.

A Pre-Feasibility Study is a comprehensive study of a range of options for the technical and economic viability of a mineral project that has advanced to a stage where a preferred mining method, in the case of underground mining, or the pit configuration, in the case of an open pit, is established and an effective method of mineral processing is determined. It includes a financial analysis based on reasonable assumptions on the Modifying Factors and the evaluation of any other relevant factors which are sufficient for a Qualified Person, acting reasonably, to determine if all or part of the Mineral Resource may be converted to a Mineral Reserve at the time of reporting. A Pre-Feasibility Study is at a lower confidence level than a Feasibility Study.

Feasibility Study

A Feasibility Study is a comprehensive technical and economic study of the selected development option for a mineral project that includes appropriately detailed assessments of applicable Modifying Factors together with any other relevant operational factors and detailed financial analysis that are necessary to demonstrate, at the time of reporting, that extraction is reasonably justified (economically mineable). The results of the study may reasonably serve as the basis for a final decision by a proponent or financial institution to proceed with, or finance, the development of the project. The confidence level of the study will be higher than that of a Pre-Feasibility Study.

The term proponent captures issuers who may finance a project without using traditional financial institutions. In these cases, the technical and economic confidence of the Feasibility Study is equivalent to that required by a financial institution.

Mineral Resource

Mineral Resources are sub-divided, in order of increasing geological confidence, into Inferred, Indicated and Measured categories. An Inferred Mineral Resource has a lower level of confidence than that applied to an Indicated Mineral Resource. An Indicated Mineral Resource has a higher level of confidence than an Inferred Mineral Resource but has a lower level of confidence than a Measured Mineral Resource.

A Mineral Resource is a concentration or occurrence of solid material of economic interest in or on the Earth's crust in such form, grade or quality and quantity that there are reasonable prospects for eventual economic extraction.

The location, quantity, grade or quality, continuity and other geological characteristics of a Mineral Resource are known, estimated or interpreted from specific geological evidence and knowledge, including sampling.

Material of economic interest refers to diamonds, natural solid inorganic material, or natural solid fossilized organic material including base and precious metals, coal, and industrial minerals.

The term Mineral Resource covers mineralization and natural material of intrinsic economic interest which has been identified and estimated through exploration and sampling and within which Mineral Reserves may subsequently be defined by the consideration and application of Modifying Factors. The phrase 'reasonable prospects for eventual economic extraction' implies a judgment by the Qualified Person in respect of the technical and economic factors likely to influence the prospect of economic extraction. The Qualified Person should consider and clearly state the basis for determining that the material has reasonable prospects for eventual economic extraction. Assumptions should include estimates of cutoff grade and geological continuity at the selected cut-off, metallurgical recovery, smelter payments, commodity price or product value, mining and processing method and mining, processing and general and administrative costs. The Qualified Person should state if the assessment is based on any direct evidence and testing.

Interpretation of the word 'eventual' in this context may vary depending on the commodity or mineral involved. For example, for some coal, iron, potash deposits and other bulk minerals or commodities, it may be reasonable to envisage 'eventual economic extraction' as covering time periods in excess of 50 years. However, for many gold deposits, application of the concept would normally be restricted to perhaps 10 to 15 years, and frequently to much shorter periods of time.

Inferred Mineral Resource

An Inferred Mineral Resource is that part of a Mineral Resource for which quantity and grade or quality are estimated on the basis of limited geological evidence and sampling. Geological evidence is sufficient to imply but not verify geological and grade or quality continuity.

An Inferred Mineral Resource has a lower level of confidence than that applying to an Indicated Mineral Resource and must not be converted to a Mineral Reserve. It is reasonably expected that the majority of Inferred Mineral Resources could be upgraded to Indicated Mineral Resources with continued exploration.

An Inferred Mineral Resource is based on limited information and sampling gathered through appropriate sampling techniques from locations such as outcrops, trenches, pits, workings and drill holes. Inferred Mineral Resources must not be included in the economic analysis, production schedules, or estimated mine life in publicly disclosed Pre-Feasibility or Feasibility Studies, or in the Life of Mine plans and cash flow models of developed mines. Inferred Mineral Resources can only be used in economic studies as provided under NI 43-101.

There may be circumstances, where appropriate sampling, testing, and other measurements are sufficient to demonstrate data integrity, geological and grade/quality continuity of a Measured or Indicated Mineral Resource, however, quality assurance and quality control, or other information may not meet all industry norms for the disclosure of an Indicated or Measured Mineral Resource. Under these circumstances, it may be reasonable for the Qualified Person to report an Inferred Mineral Resource if the Qualified Person has taken steps to verify the information meets the requirements of an Inferred Mineral Resource.

Indicated Mineral Resource

An Indicated Mineral Resource is that part of a Mineral Resource for which quantity, grade or quality, densities, shape and physical characteristics are estimated with sufficient confidence to allow the application of Modifying Factors in sufficient detail to support mine planning and evaluation of the economic viability of the deposit.

Geological evidence is derived from adequately detailed and reliable exploration, sampling and testing and is sufficient to assume geological and grade or quality continuity between points of observation.

An Indicated Mineral Resource has a lower level of confidence than that applying to a Measured Mineral Resource and may only be converted to a Probable Mineral Reserve.

Mineralization may be classified as an Indicated Mineral Resource by the Qualified Person when the nature, quality, quantity and distribution of data are such as to allow confident interpretation of the geological framework and to reasonably assume the continuity of mineralization. The Qualified Person must recognize the importance of the Indicated Mineral Resource category to the advancement of the feasibility of the project. An Indicated Mineral Resource estimate is of sufficient quality to support a Pre-Feasibility Study which can serve as the basis for major development decisions.

Measured Mineral Resource

A Measured Mineral Resource is that part of a Mineral Resource for which quantity, grade or quality, densities, shape, and physical characteristics are estimated with confidence sufficient to allow the application of Modifying Factors to support detailed mine planning and final evaluation of the economic viability of the deposit.

Geological evidence is derived from detailed and reliable exploration, sampling and testing and is sufficient to confirm geological and grade or quality continuity between points of observation.

A Measured Mineral Resource has a higher level of confidence than that applying to either an Indicated Mineral Resource or an Inferred Mineral Resource. It may be converted to a Proven Mineral Reserve or to a Probable Mineral Reserve.

Mineralization or other natural material of economic interest may be classified as a Measured Mineral Resource by the Qualified Person when the nature, quality, quantity and distribution of data are such that the tonnage and grade or quality of the mineralization can be estimated to within close limits and that variation from the estimate would not significantly affect potential economic viability of the deposit. This category requires a high level of confidence in, and understanding of, the geology and controls of the mineral deposit.

Modifying Factors

Modifying Factors are considerations used to convert Mineral Resources to Mineral Reserves. These include, but are not restricted to, mining, processing, metallurgical, infrastructure, economic, marketing, legal, environmental, social and governmental factors.

Mineral Reserve

Mineral Reserves are sub-divided in order of increasing confidence into Probable Mineral Reserves and Proven Mineral Reserves. A Probable Mineral Reserve has a lower level of confidence than a Proven Mineral Reserve.

A Mineral Reserve is the economically mineable part of a Measured and/or Indicated Mineral Resource. It includes diluting materials and allowances for losses, which may occur when the material is mined or extracted and is defined by studies at Pre-Feasibility or Feasibility level as appropriate that include application of Modifying Factors. Such studies demonstrate that, at the time of reporting, extraction could reasonably be justified.

The reference point at which Mineral Reserves are defined, usually the point where the ore is delivered to the processing plant, must be stated. It is important that, in all situations where the reference point is different, such as for a saleable product, a clarifying statement is included to ensure that the reader is fully informed as to what is being reported.

The public disclosure of a Mineral Reserve must be demonstrated by a Pre-Feasibility Study or Feasibility Study.

Mineral Reserves are those parts of Mineral Resources which, after the application of all mining factors, result in an estimated tonnage and grade which, in the opinion of the Qualified Person(s) making the estimates, is the basis of an economically viable project after taking account of all relevant Modifying Factors. Mineral Reserves are inclusive of diluting material that will be mined in conjunction with the Mineral Reserves and delivered to the treatment plant or equivalent facility. The term 'Mineral Reserve' need not necessarily signify that extraction facilities are in place or operative or that all governmental approvals have been received. It does signify that there are reasonable expectations of such approvals.

'Reference point' refers to the mining or process point at which the Qualified Person prepares a Mineral Reserve. For example, most metal deposits disclose mineral reserves with a "mill feed" reference point. In these cases, reserves are reported as mined ore delivered to the plant and do not include reductions attributed to anticipated plant losses. In contrast, coal reserves have traditionally been reported as tonnes of "clean coal". In this coal example, reserves are reported as a "saleable product" reference point and include reductions for plant yield (recovery). The Qualified Person must clearly state the 'reference point' used in the Mineral Reserve estimate.

Probable Mineral Reserve

A Probable Mineral Reserve is the economically mineable part of an Indicated, and in some circumstances, a Measured Mineral Resource. The confidence in the Modifying Factors applying to a Probable Mineral Reserve is lower than that applying to a Proven Mineral Reserve.

The Qualified Person(s) may elect, to convert Measured Mineral Resources to Probable Mineral Reserves if the confidence in the Modifying Factors is lower than that applied to a Proven Mineral Reserve. Probable Mineral Reserve estimates must be demonstrated to be economic, at the time of reporting, by at least a Pre-Feasibility Study.

Proven Mineral Reserve (Proved Mineral Reserve)

A Proven Mineral Reserve is the economically mineable part of a Measured Mineral Resource. A Proven Mineral Reserve implies a high degree of confidence in the Modifying Factors.

Application of the Proven Mineral Reserve category implies that the Qualified Person has the highest degree of confidence in the estimate with the consequent expectation in the minds of the readers of the report. The term should be restricted to that part of the deposit where production planning is taking place and for which any variation in the estimate would not significantly affect the potential economic viability of the deposit. Proven Mineral Reserve estimates must be demonstrated to be economic, at the time of reporting, by at least a Pre-Feasibility Study. Within the CIM Definition standards the term Proved Mineral Reserve is an equivalent term to a Proven Mineral Reserve.

MINERAL RESOURCE AND MINERAL RESERVE CLASSIFICATION

The CIM Definition Standards provide for a direct relationship between Indicated Mineral Resources and Probable Mineral Reserves and between Measured Mineral Resources and Proven Mineral Reserves. In other words, the level of geoscientific confidence for Probable Mineral Reserves is the same as that required for the in situ determination of Indicated Mineral Resources and for Proven Mineral Reserves is the same as that required for the in situ determination of Measured Mineral Resources. Figure 1, displays the relationship between the Mineral Resource and Mineral Reserve categories.

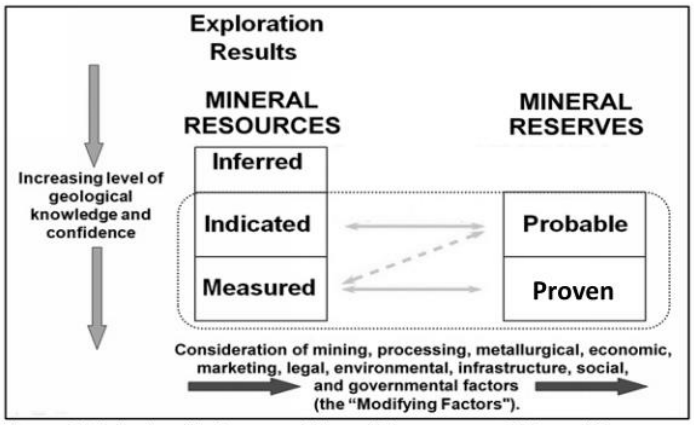

Figure 1, Relationship between Mineral Reserves and Mineral Resources

Figure 1 sets out the framework for classifying tonnage and grade/quality estimates so as to reflect different levels of geological confidence and different degrees of technical and economic evaluation. Mineral Resources can be estimated by a Qualified Person, with input from persons in other disciplines, as necessary, on the basis of geoscientific information and reasonable assumptions of technical and economic factors likely to influence the eventual prospect of economic extraction. Mineral Reserves, which are a modified sub-set of the Indicated and Measured Mineral Resources (shown within the dashed outline in Figure 1), require consideration of modifying factors affecting profitable extraction, including mining, processing, metallurgical, economic, marketing, legal, environmental, infrastructure, social and governmental factors, and should be estimated with input from a range of disciplines. Additional test work, e.g. metallurgy, mining, environmental is required to reclassify a resource as a reserve.

In certain situations, Measured Mineral Resources could convert to Probable Mineral Reserves because of uncertainties associated with the modifying factors that are taken into account in the conversion from Mineral Resources to Mineral Reserves. This relationship is shown by the dashed arrow in Figure 1 (although the trend of the dashed arrow includes a vertical component, it does not, in this instance, imply a reduction in the level of geological knowledge or confidence). In such a situation these modifying factors should be fully explained. Under no circumstances can Indicated Resources convert directly to Proven Reserves.

In certain situations previously reported Mineral Reserves could revert to Mineral Resources. It is not intended that re-classification from Mineral Reserves to Mineral Resources should be applied as a result of changes expected to be of a short term or temporary nature, or where company management has made a deliberate decision to operate in the short term on a non-economic basis. Examples of such situations might be a commodity price drop expected to be of short duration, mine emergency of a non-permanent nature, transport strike etc.

GUIDANCE FOR REPORTING MINERAL RESOURCE AND MINERAL RESERVE INFORMATION

Qualified Persons preparing public Mineral Resource and Mineral Reserve reports in Canada must follow the requirements in Form 43-101F1 of National Instrument 43-101, available on the following websites: www.osc.gov.ca; www.bcsc.bc.ca; www.albertasecurities.com and www.cvmq.com.

The following discussion is included for additional guidance when preparing a Technical Report.

Qualified Persons are encouraged to provide information that is as comprehensive as possible in their Technical Reports on Exploration Information, Mineral Resources and Mineral Reserves. The Mineral Exploration Best Practices Guidelines, the Estimation of Mineral Resource and Mineral Reserve Best Practice Guidelines provide, in a summary form, a list of the main criteria which should be considered when reporting Mineral Resources and Mineral Reserve estimates. These guidelines are available on the CIM website, www.cim.org.

These Guidelines are not prescriptive and it may not be necessary to comment on each item in the guidelines, however, the need for comment on each item should be considered. It is essential to discuss any matters that might materially affect the reader's understanding of the estimates being reported. Problems encountered in the collection of data or with the sufficiency of data must be clearly disclosed at all times, particularly when they affect directly the reliability of, or confidence in, an estimate of Mineral Resources and Mineral Reserves; for example, poor sample recovery, poor reproducibility of assay or laboratory results, limited information on tonnage factors, etc.
Mineral Resources and Mineral Reserves must be reported on a site by site basis.

When reporting both Mineral Resources and Mineral Reserves, a clarifying statement must be included that clearly indicates whether Mineral Reserves are part of the Mineral Resource or that they have been removed from the Mineral Resource. A single form of reporting should be used in a report. Appropriate forms of clarifying statements may be:

- *"The Measured and Indicated Mineral Resources are inclusive of those Mineral Resources modified to produce the Mineral Reserves", or*
- *"The Measured and Indicated Mineral Resources are additional to the Mineral Reserves".*

Inferred Mineral Resources are, by definition, always additional to Mineral Reserves.

REPORTING OF COAL RESERVES

For consistency in public reporting of Mineral Resources and Mineral Reserves for coal, it is recommended that all issuers use the Mineral Resource and Mineral Reserve categories set out in the CIM Definition Standards. Qualified Person(s) should be guided by the Estimation of Mineral Resources and Mineral Reserve Best Practices Guidelines for Coal and by GSC Paper 88-21: A Standardized coal Resource/Reserve Reporting System for Canada. It is acceptable to use the GSC Paper 88-21 as a framework for the development and categorization of coal estimates, but the GSC 88-21 categories should be converted to the equivalent CIM Definition Standard categories for public reporting.

REPORTING OF INDUSTRIAL MINERALS

*When reporting Mineral Resource and Mineral Reserve estimates relating to an industrial mineral site, the Qualified Person(s) should be guided by the Estimation of Mineral Resources and Mineral Reserves Best Practice Guidelines for Industrial Mineral*s.

REPORTING OF DIAMONDS AND GEMSTONES

When reporting diamond Exploration Information and Mineral Resources and Mineral Reserves the Qualified Person is expected to comply with the CIM Guidelines for the Reporting of Diamond Exploration Results and the Estimation of Mineral Resources and Mineral Reserves Best Practice Guidelines for Rock Hosted Diamonds.