APPENDIX H
INVESTIGATION OF ROCK RUBBLE MATERIAL, ROXANA SITE

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Results of Investigation of Materials to be Excavated at the Proposed United States Penitentiary and Federal Prison Camp, Roxana Site Letcher County, Kentucky

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Table of Contents

1 Introduction 1
1.1 Scope and Limitations 1
2 Site Location and Description 2
2.1 Location 2
2.2 Topography 2
2.3 General Geology 2
2.4 Previous Mining 2
2.4.1 Surface Mining 2
2.4.2 Underground Mining 2
3 Reconnaissance of Existing Water Quality 3
3.1 Field Reconnaissance and Water Sampling 3
3.2 Water Analyses 3
3.3 Water Chemistry 4
3.4 Historical Site Water Quality 4
Table 1: Summary of November 11, 2015 Water Quality Sampling 5
4 Investigation of Mine Overburden Material to be Handled 6
4.1 Overburden Distribution 6
4.2 Acid-Base Accounting Analyses 6
4.3 Overburden Material Characterization 7
5 Summary and Conclusions 7
6 References 8

Map

1 ..... Site Index Map

Biography of Writer

Appendices

A ..... Permit No. 867-0298 Documentation
B ..... November 11, 2015 Sampling Results
C ..... Stiff and Piper Diagrams
D ..... Water Quality Reports from 1993-1995 Period
E ..... Geologist's Logs of Drilling Results
F ..... Acid-Base Accounting Results

1 Introduction

The **Federal Bureau of Prisons (*Bureau)*** proposes to construct a new United States Penitentiary (*USP*), Federal Prison Camp (*FPC*), and associated ancillary facilities on a property generally known as the "Meade Farm," near Roxana, Letcher County, Kentucky. **Cardno, Inc.** is contracted by the Bureau to undertake and/or oversee research and investigations of the subject property to, among other things, develop and support an Environmental Impact Statement as to the proposed development.

The subject development is to be located on a former coal surface mine site that has been reclaimed. The existing ground surface at the planned construction site is immediately underlain by up to approximately 17 meters (56 feet) of broken, rubblized rock material residual to the mining operation. That unconsolidated material will generally need to be removed (to allow for the planned site construction) and re-placed in head-of-hollow fills at certain points around the construction site perimeter. **Cardno's Engineering and Environmental Services** division (**Cardno**), mining advisory services group, has investigated the geochemical character of the rock rubble; and evaluated whether its further disturbance, removal, and re-placement is likely to induce material environmental impacts on the site and/or to streams receiving drainage from the site that could have significant bearing on human health due to the geochemical nature of the material.

1.1 Scope and Limitations

The focus of this component of the site investigation is to determine whether there is a likelihood of acid mine drainage (to include dissolution of metals of possible health concern) being generated by the handling and re-placement of rubblized rock material that is necessary for the planned site development. The investigation was conceived as a phased investigation, with the results of each stage dictating the need for or level of effort to be applied in a following stage. The scope of the commissioned investigation is an initial phase. However, as is discussed herein, the results are consistent and suggest that the investigation performed to date is adequate to serve the intent and purpose of the study. The investigation has involved: 1) sampling and analyses of existing water discharges from the site, most of which reflect water that has drained through the rubble material; and 2) collection, sampling, and analyses of the rubble material itself from multiple subsurface horizons at several locations within the area where construction and development are proposed. Additionally, site water quality information as documented in historical discharge monitoring reports associated with the surface mining permit, provided by the Bureau, has been compared to the recent data generated in this investigation.

In performing this investigation, Cardno has relied on information provided by others, including: historical water quality information from mine permit files, provided by the Bureau; a map of the boundary of underground mining provided in a report by Summit Engineering; and mine permit status information set forth in the Kentucky regulatory agency online-searchable database. Cardno has not attempted to verify the accuracy or completeness of such information, and makes no warranty as to such for information not generated by Cardno in this investigation.

The scope of investigation completed is consistent with that authorized by the client, and the approach and tasks performed are in accordance with accepted industry standards for the intended purpose. The consistency of results throughout indicate that a more intensive subsurface investigation is unlikely to produce significantly different results. However, no warranty or guarantee can be made as to whether a condition remains undetected by the extent of investigation conducted to date.

2 Site Location and Description

2.1 Location

The Meade Farm site, reportedly consisting of approximately 700 acres, lies on the south side of the North Fork of the Kentucky River near the small community of Roxana, Letcher County, Kentucky. The subject proposed development area is situated on the surface mined and reclaimed ridgecrest surrounded by the drainages of Tolson Branch to the west, North Fork Kentucky River to the north, and Kings Creek to the east. To the south, the subject site is bordered by the continuation of the ridgeline (*see Map 1, in pocket following page 8*).

2.2 Topography

The reclaimed surface mine site lies as a flattened ridgetop plateau at an elevation of approximately 460 meters (*m*) (1500 feet [*ft.*]) above mean sea level (*msl*). To the east, north, and west of the plateau, the mountain slopes drop steeply to the streams situated at elevations of approximately 310 m to 330 m (1000 to 1100 ft.) msl, for a total local topographic relief of 130 m to 150 m (400 to 500 ft.). It is expected that the rubblized rock material that currently mantles the bedrock surface will be excavated to allow the building foundations to be placed on firm bedrock material. The excavated material, as shown on *Map 1*, is to be placed in head-of-hollow fills situated adjacent to the northwest and southwest of the proposed USP location. (The northwest head-of-hollow contains an existing fill that was constructed during the previous surface mining, but may have additional remaining storage capacity.)

2.3 General Geology

Surficial bedrock strata at the proposed building site are of the Breathitt Formation of Pennsylvanian age. These strata consist of clastic sedimentary rocks including, in general, sandstone, siltstone, shale and/or clay shale, and coal beds. Structural dip of the strata is very gently to the northwest at a magnitude of approximately 1.0 percent.

2.4 Previous Mining

2.4.1 Surface Mining

The subject site was surface mined by mountaintop mining methods in the late 1980s – early 1990s (Kentucky Department for Surface Mining Reclamation and Enforcement Permanent Program Permit No. 867-0298, issued December 31, 1987, effective date of license of April 29, 1988 – *see Appendix A*). The site has been fully reclaimed and requires no further monitoring or reporting, based on research of Kentucky Department of Natural Resources, Division of Mine Permits, Surface Mining Information System databases. The permit is identified as having been released in the Division of Mines' Mine History Report for Cumulative Impact Area assessment (*see Appendix A*).

The surface mining involved the removal of up to about 60 m (200 ft.) of rock overburden to allow recovery of the Fireclay Rider (also known as Hazard No. 4 Rider) coal seam. Rubblized overburden material was re-placed onto the nearly horizontal coal seam pavement after the coal was extracted, and in three head-of-hollow fills located to the northwest, east, and southeast of the proposed facility (*see Map 1*). The depth of backstacked rubble on the reclaimed mine site ranges from nil to approximately 17 m (56 ft.), based on available exploratory drilling results.

2.4.2 Underground Mining

No underground mining is known to have occurred beneath the proposed locations of the USP, FPC, or the associated ancillary facilities. There is one small, long-inactive underground mine, in the Fireclay Rider coal bed, located to the south of the area of previous surface mining and planned subject development (Big Oak Coal Company, Kentucky Permit No. 867-5062). As can be seen on *Map 1*, the mine horizon is situated at an elevation of approximately 465 m (1525 ft.) above msl, and about 45 m (150 ft.) vertically upslope of the

proposed fill crest. The portal location was visited by Cardno, with the observation that there was no flowing water discharge on the day of the field visit, and no indication of any significant drainage at other times.

3 Reconnaissance of Existing Water Quality

The rubblized overburden generated in surface mining of the site in the late 1980s – early 1990s was placed back on top of the extracted coal seam horizon, and into three head-of-hollow fills around the mine perimeter. Infiltrating precipitation percolates through the rubble and concentrates in the bases of the hollow fills, then migrates downslope in the subsurface to discharge at the toes of those fills. That water is in contact with the rock rubble, and its quality upon discharge is an excellent indicator of the geochemical nature of the fill material and of the quality of water that is expected to issue from the material after it has been excavated from the backstack area (the plateau) and re-placed into new or expanded perimeter head-of-hollow fills. Further, the acidity/alkalinity ratio and pH of the water is a principal control upon its ability to dissolve and mobilize “heavy” metals that could be of possible human health concern. As is discussed below in section 3.3, low-pH, acidic water is much more likely to mobilize most metals, while net alkaline, moderate-pH water is not likely to promote such mobilization.

As an initial planning step, topographic maps, aerial photographs, and mine maps were reviewed to determine likely or potential locations where flowing water may be sampled as an indicator of site geochemical conditions. Features of note in that review include the three head-of-hollow fills, a fill toe pond at the base of the easterly fill, small stream segments downstream of the planned construction site, and the surface drift entry of the abandoned underground mine.

3.1 Field Reconnaissance and Water Sampling

Site hydrogeologic reconnaissance was conducted by a Cardno geologist on November 11, 2015. Water samples were collected from the toe discharges of each of the three hollow fills, the mouths of the two small streams flowing westerly from the site (one of which is below a hollow fill, and one of which does not have an upstream fill), and the eastern fill discharge after it has passed through the toe pond (*see Map 1*). The old underground mine portal was visited and confirmed to exhibit no surface discharge.

At each of the six sampling points, field measurements were recorded as to water temperature, pH, and conductivity. Samples were collected in four containers for each sample, placed on ice, and transported to the laboratory on November 13, 2015.

3.2 Water Analyses

The collected samples were transported to the main laboratory of Research Environmental & Industrial Consultants, Inc. (*REIC*), at Beaver, West Virginia, for analyses of general chemistry and metals. Specifically, the analytes and laboratory methods used were:

Analysis	Analytes	Method
Anions by Ion Chromatography	chlorides, sulfate	EPA 300.0, Rev. 2.1
Dissolved Metals by ICP	antimony, arsenic, barium, beryllium, cadmium, calcium, chromium, copper, iron, lead, magnesium, manganese, potassium, selenium, sodium, thallium	EPA 200.7, Rev. 4.4
Total Metals by ICP	chromium, iron, manganese	EPA 200.7, Rev. 4.4
Dissolved Mercury	mercury	EPA 245.1, Rev. 3.0
Total Dissolved Solids	TDS	SM2540 C-1997
Total Suspended Solids	TSS	SM2540 D-1997
Acidity	total acidity	SM2310 B-1997
Alkalinity	total alkalinity (as $CaCO_3$)	SM2320 B-1997
pH	pH	SM4500-H^+-B-2000

Results of analyses are incorporated in A*ppendix B* and discussed below.

3.3 Water Chemistry

Excavation and rubblization of rock strata has the potential to expose relatively fresh, unweathered rock to air (oxygen) and water, accelerating the weathering process by which rock minerals are dissolved and leached from the rock. Breaking of the rock also increases the surface area potentially exposed to air and water. Water infiltrating and passing through the rubblized rock transports dissolved mineral constituents, so that chemical analysis of that water is an indicator of the mineral composition of the broken rock strata.

Oxidation of sulfidic minerals produces acidic, sulfate-enriched (SO_4) drainage. In the absence of acid-neutralization (alkalinity), the drainage tends to exhibit a low pH value[1], and most metals are more soluble at lower, as opposed to higher, pH values. Where minerals containing substantial acid-neutralizing constituents are present (principally calcium [Ca] and magnesium [Mg] carbonate minerals, in the subject strata), the acidic drainage may be fully neutralized, resulting in pH values in the desirable 6 to 9 range. At that pH range, most metals exhibit a markedly lower solubility than they do at pH values below that range.

All of the waters flowing from the site are of a Mg-Ca-SO_4 ionic facies, with elevated concentrations of magnesium, calcium, and sulfate, and with substantial net alkalinity (*see Stiff and Piper diagrams, Appendix C*). All show influence of weathering of both sulfide and alkaline-rich minerals, such that any acid production has been completely neutralized by calcareous or carbonate minerals. These characteristics and the associated total dissolved solids (TDS) levels are likely representative of virtually all hollow fill discharges in the region as a whole.

The analyses results indicate there to be no concentrations of metals at levels of human health concern in water that has migrated through the rubblized rock material. While the water exhibits elevated sulfate and total dissolved solids concentrations (and consequent elevated conductivity) reflective of oxidation and dissolution of sulfidic minerals in the rock, it also contains net alkalinity with dissolved calcium and magnesium that, again, reflect dissolution of acid-neutralizing minerals. Acidity generated by oxidation of sulfidic minerals has been, in all cases, fully neutralized. The resulting water quality exhibits net alkalinity, pH values in the range of 6.73 to 8.11, and extremely low to non-detectable concentrations of metals of potential human health concern in occupancy of the site. Parameters that are often indicators of impacts from gas or oil well drilling (that is, reflective of deep saline waters) such as sodium, chloride, and barium are of quite low concentrations in the site discharges, indicating no impact in that regard from the existing gas wells that occur within the site (*see Table 1 on page 5*).

As is discussed further below, re-handling of the site overburden materials is likely to result in no significant change in the chemistry of water draining from the site.

3.4 Historical Site Water Quality

Mining permit-related historical water quality reports from the 1993-1995 period show results consistent with those of the recent sampling; that is, the waters exhibit net alkalinity, moderate pH values (6.34 – 8.17), and low iron and manganese, indicating likely low dissolved metals concentrations in general. (The data are enclosed in *Appendix D*, but specific sampling locations are undetermined.)

[1] The pH value reflects the hydrogen ion activity level in a solution. It is expressed as the negative logarithm of that activity, such that the lower the pH value, the higher the hydrogen ion activity level.

The pH scale typically ranges from 0 to 14, and 7 is neutral (the point where hydrogen ion (H^+) activity and hydroxyl ion (OH^-) activity are in balance). Water quality standards typically reference a desired pH range of 6 to 9 (a common natural range) although normal rainwater is generally in the range of approximately 5 to 5.5 pH.

Summary of Water Quality
November 11, 2015 Sampling
Table 1

Parameter	Units	Southwest Stream Mouth	Northwest Toe Of Hollow Fill	Northwest Stream Mouth	Southeast Hollow Fill Toe	East Hollow Fill Toe	East Hollow Fill Below Pond
Field Temp	ºF	50.8	54.1	54.5	54.9	55.4	55.9
Field Conductivity	µmhos/cm	711	1,831	1,505	1,211	1,900	1,675
Field pH	su	6.73	7.05	8.11	7.75	7.90	7.97
Lab pH	su	7.22	7.41	8.31	7.89	8.09	8.23
Chromium	mg/L	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
Iron	mg/L	0.0503	0.0854	<0.0100	<0.0100	<0.0100	<0.0100
Manganese	mg/L	0.0162	0.0740	<0.0010	<0.0010	0.0061	0.0350
Chloride	mg/L	<0.20	3.95	2.34	1.93	3.02	2.26
Sulfate	mg/L	316	1,210	794	763	1,310	1,030
Total Dissolved Solids	mg/L	521	2,230	1,450	1,300	2,260	1,820
Total Suspended Solids	mg/L	<1	2	1	3	1	1
Total Acidity	mg/L	10.9	32.9	<1.0	11	<1.0	<1.0
Total Alkalinity	mg/L as CaCO3	51.1	377	215	191	308	270
Dissolved Antimony	mg/L	<0.0080	<0.0080	<0.0080	<0.0080	<0.0080	<0.0080
Dissolved Arsenic	mg/L	<0.0070	<0.0070	<0.0070	<0.0070	<0.0070	<0.0070
Dissolved Barium	mg/L	0.0618	0.0335	0.0581	0.0373	0.0217	0.0277
Dissolved Beryllium	mg/L	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002
Dissolved Cadmium	mg/L	<0.0003	<0.0003	<0.0003	<0.0003	<0.0003	<0.0003
Dissolved Calcium	mg/L	63.5	259	181	155	250	207
Dissolved Chromium	mg/L	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
Dissolved Copper	mg/L	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020
Dissolved Iron	mg/L	<0.0100	<0.0100	<0.0100	<0.0100	<0.0100	<0.0100
Dissolved Lead	mg/L	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030
Dissolved Magnesium	mg/L	54.7	234	178	153	238	216
Dissolved Manganese	mg/L	0.0161	0.0502	<0.0010	<0.0010	0.0064	0.0293
Dissolved Potassium	mg/L	3.42	13.2	9.14	8.87	16.4	14.3
Dissolved Selenium	mg/L	<0.0100	<0.0100	<0.0100	<0.0100	<0.0100	<0.0100
Dissolved Sodium	mg/L	8.73	24.1	20.3	17.3	32.5	25.7
Dissolved Thallium	mg/L	<0.0090	<0.0090	<0.0090	<0.0090	<0.0090	<0.0090
Dissolved Mercury	mg/L	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001

4 Investigation of Mine Overburden Material to be Handled

Six exploratory borehole drilling locations were specified by the Bureau (*see Map 1*). Drilling was conducted by Central Star Drilling, Inc., of Peebles, Ohio, using hollow-stem auger (*HSA*) and continuous split-spoon (*SPT*) sample collection techniques, under the supervision of a Cardno geologist. The geologist's logs of drilling results are enclosed in *Appendix E*.

The rubblized overburden is a mixture of clay shale, siltstone, and sandstone. In each of the six boreholes, auger refusal was encountered a few meters beneath the apparent base of the rubblized backstack material, in weathered sandstone that appears to be representative of the uppermost bedrock surface. A total of 45 samples were collected from the six borings. Sample selections were made by the geologist with the intent of achieving fair representation of the rubblized material and weathered bedrock that would or may be excavated and re-placed into a fill.

4.1 Overburden Distribution

As is shown on *Map 1*, two borehole locations (Nos. 3 and 4) are within the central part of the site where the USP would be built. They encountered approximately 12 and 16 m (39 and 52 ft.) of rubble material, and extended into apparent weathered bedrock for another 2 to 5 m (6 to 16 ft.). Two boreholes (Nos. 5 and 6) located at the southern end of the site (general vicinity of the proposed central utility plant and outside warehouse) encountered about 13 to 17 m (43 to 56 ft.) of rubble and another 2 to 6 m (6 to 20 ft.) of apparent weathered bedrock. The two boreholes (Nos. 1 and 2) located on the northern point of the ridgeline (proposed FPC area) revealed no significant distribution of backstacked rubble there, and auger refusal was reached in weathered sandstone at depths of 3 and 4 m (10 and 13 ft.) below the ground surface.

4.2 Acid-Base Accounting Analyses

The 45 selected samples were delivered to Appalachian Laboratories, Inc., of Beckley, West Virginia, for acid-base accounting (*ABA*) analyses. ABA (EPA 600/2-78-054) is essentially a screening test designed to determine the relative proclivity for a material to produce either acidic or alkaline drainage, based on the potentially acid-generating and acid-neutralizing minerals present in the materials.

Acid generation in rocks of the subject area is due to oxidation of sulfidic minerals (most commonly pyrite) that releases acidity (hydronium ion, H^+) and sulfate. Sulfur in the rock may occur as sulfate or as organic sulfur, but these forms do not produce acidity. It is common practice to perform a "total sulfur" analysis as the basis for an initial estimate (calculation) of the potential acid-generating capability of the material, and conduct further analysis of sulfur forms only where substantial acidity generation is suggested. This utilization of total sulfur as the basis for estimation overstates the actual acid-generating potential, and is thus conservative from the standpoint of identifying material that may produce more acidity than will be offset by its own neutralization potential.

The other principal component of ABA is the determination of acid-neutralizing potential. The majority of neutralizing potential (*NP*) is provided by calcium and/or magnesium carbonate minerals present in the rocks, although aluminosilicate minerals may also contribute to a typically small degree.

Material that contains a greater acid-generating than neutralizing potential is considered to be likely to produce acid drainage upon weathering, and low pH values resulting from the acidity favors the dissolution and mobility of many "heavy" metals during the weathering process. Conversely, material with more neutralizing than acid-generating potential is likely to produce neutral or somewhat alkaline drainage, which is not conducive to mobilization of those metals.

In addition to the determination of acid-producing versus acid-neutralizing potential, the ABA test procedures normally include quantification of the material color (a potential indicator of oxidation-reduction geochemical

conditions affecting the mineralogy of the material), a fizz (effervescence) rating (indicative of the degree and type of carbonate minerals present), and paste pH (indicative of the immediate tendency for acid or alkaline conditions to be formed).

Results of the ABA testing are enclosed in *Appendix F* and are discussed below.

4.3 Overburden Material Characterization

Results of the ABA testing show all of the sampled material to be quite low in sulfur content with very low potential to generate acidic drainage. Most of the material also exhibits only a mild neutralization potential (*NP*), and appears to be generally well-weathered material with relatively little remaining reactivity. There are a few scattered zones with greater than 2% total NP (as $CaCO_3$), but none exceed 3% NP. Most exhibit total NP in the range of 0.6 to 1.5%, with net NP (NP less acid-generating potential) of 0.3 to 1.0%.

It is concluded that the material that may be excavated and re-placed is weathered, low-reactivity material with a consistent excess net neutralization potential in all samples. It would be expected to produce net alkaline drainage of circumneutral pH, similar to that currently discharging from the site. Based on both the water analyses and the ABA test results, there are no zones that require special handling, and there is very low potential for mobilization of metals of any concern to either human health or aquatic environments.

5 Summary and Conclusions

The proposed construction activities will entail excavation of rubblized rock overburden associated with previous surface mining, and placement of that material into new or expanded existing head-of-hollow fills. Some small amounts of weathered bedrock material may also be included in such handling. Investigation of the material shows it to be of low reactivity geochemically, exhibiting more acid-neutralizing potential than acid-generating potential (which is extremely low), and posing no significant risk of producing acidic drainage or drainage with significant levels of dissolved metals of concern as to human health in occupancy of the site.

The existing water chemistry in discharges from the fill structures is consistent with the findings of the subsurface materials investigation. The total dissolved solids contents of that drainage are elevated, reflecting the high degree of weathering that has occurred since mining and the continued flushing out of weathering-produced dissolved components, but the drainage is essentially devoid of heavy metal or trace metal components. The character of current drainage is similar to that which existed upon completion of mining, and that condition is not likely to be significantly changed by the excavation and the proposed site development to take place.

Although it was beyond the stated scope of investigation, it is noted that the current water chemistry indicates that there is no significant or detectable impact from deep saline waters that may have been encountered in installation of the gas wells that are present at the subject site. (Natural water present at depths commonly associated with gas well installations in the subject area is saline, with very high [relative to surficial or shallow groundwater] concentrations of sodium, chloride, and often barium. Those elements are not enriched in the current water discharges from the site.)

6 References

> Draft Environmental Impact Statement for Proposed United States Penitentiary and Federal Prison Camp, Letcher County, Kentucky, Federal Bureau of Prisons, February 2015.

> Preliminary Engineering Report, Addendum #1: Report Update, prepared by Summit Engineering, Inc., for Letcher County Planning Commission.

> Geotechnical drilling logs, drilling performed in August-September 2011, prepared by Marshall Miller & Associates.

> Kentucky Department of Natural Resources, Division of Mine Permits, Surface Mining Information System.

> Kentucky Division of Mine Permits (2011, July 14); Kings Creek – North Fork Kentucky River, Cumulative Hydrologic Impact Assessment (HUC12:051002010105).
Retrieved from: http://eec.ky.gov/SearchCenter/Results.aspx?k=867-0298.

> Geologic Map of the Roxana Quadrangle, Edward K. Maughan, US Geological Survey, 1976.

Roxana Prison Site,
Letcher County, Kentucky

Map

Cardno®
Shaping the Future

Roxana Prison Site,
Letcher County, Kentucky

Biography of Writer

Cardno®
Shaping the Future

Ronald H. Mullennex

Current Position

CPG, CGWP, Senior Principal, Practice Leader – Geology and Hydrogeology

Profession

Professional Geologist, Certified Ground Water Professional

Years' Experience

40

Joined Cardno

1977

Education

MS – Geology, West Virginia University, Morgantown, WV
BS – Geology, West Virginia University, Morgantown, WV

Professional Registrations

CPG

CGWP

PG – VA, SC, TN, PA, KY, NC, GA

LRS – WV

WVDEP Approved Person for preparing, signing and certifying surface mine permit applications

Competent Person for coal resource determination under JORC Code

Summary of Experience

Mr. Mullennex is a Certified Professional Geologist and Certified Ground Water Professional with over 40 years' professional experience in resource and mining geology, hydrogeology, environmental issues, and engineering applications. At Cardno, he directs geological and hydrogeological investigations, prepares and presents reports, and is frequently called upon in expert witness capacities in litigation concerning geological or hydrologic matters. He has authored a wide range of technical articles on coal resources, mining and mine drainage issues, groundwater and hydrogeology, environmental remediation, and geochemistry issues. He has also authored over 1,400 professional reports to clients in his consulting career.

A principal focus of his work in recent years has involved mineral resource evaluations and groundwater investigations in association with mineral extraction activities. Such groundwater studies include assessments of probable hydrologic consequences of mining; determination of existing and baseline hydrogeologic conditions; evaluation of hydrogeologic, geochemical, and geotechnical conditions and their potential impact on mining activities; and investigations of water quality and/or quantity impacts resulting from past mining or gas well drilling/operation. In mineral resource studies, his work has focused on resource distribution and classification, geologic factors affecting mineability and accessibility, and coal and tailings quality.

Mr. Mullennex earned Bachelor of Science and Master of Science degrees in Geology from West Virginia University in 1971 and 1975, respectively. He serves on the Visiting Committee for the Department of Geology and Geography at West Virginia University, and on the external advisory board for WVU's Advanced Energy Initiative. He holds certification, licensing, and/or registration as a professional geologist in seven states, and is a Licensed Remediation Specialist under West Virginia's Voluntary Remediation Program. He is a Competent Person in coal resource determination under the Australasian Code for Reporting of Exploration Results, Mineral Resources and Ore Resources (JORC Code).

Affiliations

American Institute of Professional Geologists
Geological Society of America, Coal Geology and Hydrogeology Divisions
Society of Mining Engineers of Association of Mining, Metallurgical, and Petroleum Engineers
Sigma Gamma Epsilon (Earth Sciences Honorary Fraternity)
Association of Ground Water Scientists and Engineers, Division of National Ground Water Association
Association of Engineering Geologists
American Society of Mining and Reclamation
International Mine Water Association

Significant Projects

> Explore and evaluate geologic, hydrogeologic, and geochemical issues pertaining to large coal exploration, mine planning, and Definitive Feasibility Study (DFS) in virgin area of Western Australia, including water supply, mine inflow, water quality, and materials handling investigations, and delineation and assessment of resources and classification under JORC.

> Joint coordinator and principal investigator in compilation of environmental audit for World Bank affiliate, for large mining project in the People's Republic of China.

> Expert Witness in litigation and regulatory administrative proceedings. Qualified as expert in hydrogeology, geology, hydrology, water quality, and geomorphology.

> Evaluate sources, extent, and nature of impact of selenium leaching from mine disturbances into receiving streams and develop mitigation through water management and enhanced passive reduction-adsorption processes.

> Site characterization, monitoring, and implementation of enhanced bioattenuation remediation program in fractured bedrock aquifer.

> Hydrogeologic investigations of potential hydrologic consequences (PHC) by mining operations (numerous studies, some involving large areas).

> Hydrogeologic and geotechnical evaluations of conditions to be encountered, potential hydrologic impacts, and design of preventive measures for advancement of underground mines beneath stream valleys (numerous studies).

> Investigated and served as expert in litigations concerning natural flow, transference, and water chemistry of brackish and saline waters from deep underground mine.

> Water chemistry and contaminants investigations of alleged impacts to groundwater by gas well drilling and/or operations.

> Investigations and assessments of causative and contributory factors regarding landslides, subsidence, and flooding events, including geomorphological analysis of features.

> Hydrogeologic investigation and development of during-construction monitoring and preventive action to prevent adverse grout migration through the aquifer during mine shaft pre-grouting and construction project.

> Assessment of potential impact of high-extraction underground mining upon stream conditions, and worked with mine design engineering personnel to devise alternative mine plan to avoid impact to stream.

> Investigation of acid-producing rock materials and acid drainage for large highway construction program, and work with design engineers to develop materials handling plans, drainage structures and treatment plans.

> Hydrogeologic and geotechnical investigation of large pre–Subtitle D landfill located in karstic terrain to evaluate impact on environment and develop plans for closure.

> Remedial Investigation and Feasibility Study of a state superfund office site, involving ground water impact by dissolved trichloroethane and related compounds in fractured bedrock aquifer. Coordinated and critiqued baseline risk assessment.

> Served on Tazewell County, Virginia, Comprehensive Plan Committee, assessing karst impacts and ground water concerns for land use planning.

> Developed numerous Subtitle D landfill groundwater monitoring programs for solid waste and CDD facilities, and managed the implemented programs; to include sampling, analyses, data evaluation, and reporting.

> Development of landfill gas migration mitigation measures at sites complicated by karstic conditions and by underground mine workings.

Significant Projects (Continued)

> Utilized ground water modeling to design extraction/injection system for aquifer remediation.

> Hydrogeologic assessment, aquifer testing, groundwater modeling, and expert witness testimony concerning DNAPL–related contaminants in bedrock aquifer.

> Hydrogeologic investigation of impact of abandoned underground coal mine on adjacent stream and residential water supplies; developed successful remedial plan, and monitored results.

> Investigation of impacts to hydrologic regime resulting from underground mining in areas beneath stream valleys.

> Investigation and delineation of impacts and design inadequacies of several solid waste landfills for closure design. Led design team of geologists, hydrogeologists, and engineers in completing closure designs, and acted as Principal Investigator in the investigation and design phases.

> Served as Principal–in–Charge of Construction Quality Assurance/Quality Control and field inspection for landfill closure construction projects.

> Hydrogeologic investigation and litigation support in alleged salt impact to shallow groundwater.

> Supervision and peer review of numerous investigative reports involving leaking underground storage tanks and similar contaminant releases to ground water.

> Detailed investigation of geologic factors controlling or influencing coal resource distribution and development potential, with analysis of potential hazards to be encountered in longwall mining.

> Detailed depositional analysis and interpretation of coal resource distribution and factors impacting future development.

> Regional investigation and exploration of deep coals.

> Stratigraphic analysis and interpretation of depositional patterns responsible for producing extreme hazardous conditions encountered in mining.

> Exploration and delineation of coal resources; prediction of mine roof hazard areas.

> Exploration and delineation of stone resources and stone geochemical characteristics.

> Detailed investigation and interpretation of small–scale depositional features impacting coal reserve development.

> Study and interpretation of paleogeographic and depositional conditions controlling resource distribution in several different coal seams.

> Geologic investigation and expert witness for properties and mining ventures involved in prosecution in Federal court.

> Management of active oil and gas leaseholds.

> Evaluations of oil and gas estates involved in condemnation.

> Reserve and economic development feasibility evaluation of several thousand acres in widely scattered tracts. Served as expert witness in civil proceedings in Federal Tax Court, with beneficial results to client.

> Mapping, investigation, and evaluation of geologic, hydrogeologic, and geomorphic features relevant to new highway construction.

Significant Projects (Continued)

> Investigation of ground water contamination susceptibility of a regional area involving largely karstic limestone and dolomite bedrock, incorporating assessment of multiple geologic and cultural components to delineate relative hazard potential at any point within the area. Study involved evaluation of stratigraphy and lithologic factors, structural geology, soil types, remote sensing analysis of fracture systems, water table levels, ground water flow directions, recharge and discharge areas and points, and investigation of ground water communication between wells. Results used for determining relative need for sewerage construction at different points within study area.

> Investigation of karst sinkhole subsidence and triggering mechanisms, pertaining to damage to existing structures.

> Utilization of geologic evaluation and remote sensing analysis to locate high–yield water wells for municipalities and industries.

> Consultation to an engineering firm regarding dye–tracing applications to define ground water flow characteristics.

> Determination of karstic controls on ground water in evaluation of suitability of construction site.

> Conducting geologic evaluations and remote sensing analyses, and integrating these studies to define potential ground water flow characteristics that may impact underground mining.

> Supervision and analysis of packer testing techniques to determine permeability of formations in boreholes.

> Utilization of geophysical logs to identify ground water flow characteristics encountered in boreholes and select optimum horizons for piezometer installation.

> Utilization of geophysical logs and analytical data to define geochemical characteristics of rock and coal strata.

> Site evaluation of a planned large commercial landfill facility encompassing in excess of 500 acres. Acted as project manager for field activities including planning and executing of 58–borehole geologic and hydrogeologic exploration program; access road construction in very rugged terrain, with associated sediment and erosion control; and installation of single and nested piezometers and monitoring well construction. Performed analysis of geologic, geophysical, and hydrogeologic data to evaluate suitability of site, and determined post–construction monitoring requirements in relatively complex hydrogeologic setting. Acted as primary coordinator for report and permit application preparation, incorporating investigative reports from other consultants into a comprehensive permit application package.

Professional History

2014 - Present

Senior Principal, Practice Leader – Geology and Hydrogeology

Cardno, Inc. – Bluefield, Virginia (USA)

Responsible for office management and administration; project management, coordination, and supervision; and project reporting and presentation. Is Cardno's corporate officer member of the Radiation Safety Committee and provides management oversight of the company's geophysical logging division.

1979 - 2014

Senior Vice President

Cardno, Inc. (formerly Marshall Miller & Associates, Inc.) – Bluefield, Virginia (USA)

Responsible for office management and administration; project management, coordination, and supervision; and project reporting and presentation. Provided management oversight of drilling services division for several years. Projects involve all phases of geologic application to coal exploration, evaluation, and development in the United States and abroad; quarry stone resources and stone quality; construction and environmental site characterization; ground water and surface water investigations; investigation of mining and hydrogeologic considerations in the United States and abroad; underground injection permitting and impact assessment; and writing of technical reports. Specific experience includes coal and geologic mapping; mineral property evaluation; management and supervision of exploration programs; study of geologic factors in resource minability (geologic hazards, depositional analyses); initiation and utilization of stratigraphic and depositional environmental studies as applied to exploration and development; ground water availability, contamination, and monitoring studies; investigation of karst impacts on environmental considerations; utilization of remote sensing techniques, including lineament and fracture analyses; development of ground water monitoring strategies and systems for solid waste landfill facilities; assessment of monitoring data to determine impacts; coordination of full site investigation and remedial design teams for landfill closures and sites impacted by volatile organic compound contaminants in ground water; investigations of hydrologic impacts resulting from mining; risk assessment and development of remediation designs for ground water contamination; development of mitigative measures for landfill gas migration; geomorphic evaluations of flooding and earth movement issues, and serving as expert witness in cases concerning mineral properties, ground water, and flood analysis.

1977 - 1979

Project Geologist

Geological Consulting Services, Inc. – Bluefield, Virginia (USA)

Responsible for field and in–office project management, coordination, and supervision. Projects involved primarily coal property exploration and evaluation.

1974 - 1977

Coal Geologist, West Virginia Geological and Economic Survey

West Virginia Geological Survey – Morgantown, West Virginia (USA)

Responsible for mapping, data collection, and correlation of coals in regional study of coal resources and development potential.

Publications & Presentations

> "Selenium – Sources and Considerations for Treatment or Prevention" Wastewater Treatment and Water Quality for Indiana Coal Mines Workshop, 26th Annual Surface Mined Land Reclamation Technology Transfer Seminar, Jasper, Indiana, December 9, 2013.

> "A Cost-Effective Approach to In Situ Bioremediation in Fractured Bedrock," The Ninth International In Situ and On-Site Bioremediation Symposium, Baltimore, Maryland, May 7-10, 2007.

> “Stratigraphic Distribution of Selenium in Upper Kanawha-Lower Allegheny Formation Strata at a Location in Southwestern West Virginia,” 22nd Annual International Pittsburgh Coal Conference, Pittsburgh, Pennsylvania, September 14, 2005.

> “The Floods of July 8, 2001: A Review of Characteristics, Distribution and Contributing Factors,” Virginia Center for Coal and Energy Research and the Central Appalachian Section of SME, Abingdon, Virginia, April 2002.

> "Subsidence Impacts on Ground Water," Virginia Center for Coal and Energy Research and the Central Appalachian Section of SME, Abingdon, Virginia, June 2000.

> “Recognition of Paleosols From Wireline Logs,” Predictive Stratigraphic Analysis Workshop, U.S. Geological Survey, Reston, Virginia, April 1996.

> “Mitigation of Environmental Impacts Resulting From Mine Pool Build–up,” Mine Drainage Task Force Symposium, Morgantown, West Virginia, April 1996.

> “Integration of Hydrogeologic and Geophysical Techniques for Identification of AMD Seepage and Remedial Design,” R.H. Mullennex, C.P.G., C.G.W.P., V.P. Wiram, C.P.G., H.E. Naumann, P.E., Mine Drainage Task Force Symposium, Morgantown, West Virginia, April 1995.

> “Remedial Measures,” Business and the Environment Seminar, Bluefield, West Virginia, July 1993.

> “Hydrogeology of the Appalachian Plateau,” Ground Water Hydrology, Contamination and Management: Wellhead Protection in the Appalachian Plateau, USEPA and Cook College of Continuing Education, National Mine Safety and Health Academy, Beckley, West Virginia, June 1993.

> “Remedial Measures: Planning and Managing Closure and Post Closure Activities at your Sanitary Landfill,” Business and the Environment Seminar, Bluefield, Virginia, 1993.

> “Downhole Camera Brings Visible Benefits to Ground Water Monitoring,” *World Wastes*, Vol. 35, No. 12, December 1992.

> “Ground Water Monitoring at Sanitary Landfills – Sampling and Analysis Considerations Under Subtitle D,” *World Wastes*, Vol. 35, No. 6, June 1992.

> “Ground Water Monitoring at Sanitary Landfills – System Design Considerations Under Subtitle D,” *World Wastes*, Vol. 35, No. 2, February 1992.

> “Water–Bearing Fracture Identification Through High–Resolution Density Logging Techniques,” presented at National Water Well Association Exposition Forum on Ground Water Technologies for the 1990's, October 23, 1991, Washington, D.C. “Ground Water Issues,” Business and the Environment Seminar, Bluefield, Virginia, 1991.

> “Geological and Environmental Impact on Development and Construction in Our Area,” Business and the Environment Seminar, Bluefield, Virginia, 1991.

> “Preparing for an Environmentally Safe Landfill,” Business and the Environment Seminar, Bluefield, Virginia, 1991.

> “Lithologic Indicators of Geochemical Conditions of Sedimentation in Pennsylvanian Age Rocks of the Appalachian Basin,” C. Blaine Cecil, U.S.G.S.; Ronald W. Stanton, U.S.G.S.; and Ronald H. Mullennex, Geological Consulting Services, Inc.; American Association of Petroleum Geologists Symposium, Charleston, West Virginia, September 1988.

> “Geological Modeling Techniques for Evaluation of Productivity–Related Longwall Mining Roof Conditions: A Case Study,” Longwall U.S.A. Conference, Pittsburgh, Pennsylvania, co–author, September 1988.

> "Prediction of Coal Continuity, Quality, and Mining Conditions as Afforded by Depositional Analysis," Society of Mining Engineers of AIME, Fall Meeting, St. Louis Missouri, 1986.

> "Use of Depositional Models and Stratigraphic Mapping Techniques to Determine New Coal Reserve Potentials in the Appalachian Region," AIME Annual Meeting, Chicago, Illinois, published in *Transactions*, the permanent technical literature of the Society of Mining Engineers of AIME February 1981.

> "No. 3 Pocahontas Coal in Southern West Virginia – Resources and Depositional Trends,"
West Virginia Geological Survey Bulletin B–38, co–author 1981.

> "Case Histories and Depositional Modeling for Classifying Reserves in the Appalachian Region," Miller, M. S., and Mullennex, R. H., American Association of Petroleum Geologists Meeting, Morgantown, West Virginia, October 1980.

> "Major Cross–Strike Structures of the Central Sedimentary Appalachians," *Proceedings of the West Virginia Academy of Science*, Vol. 46, No. 2. , 1974.

Continuing Education

> Passive Treatments for Sulfate and Metals in Mine Water, American Society of Mining and Reclamation Conference, June 8, 2015, Lexington, Kentucky.

> West Virginia Surface Mine Drainage Task Force Symposium, Morgantown, West Virginia (Annually).

> Environmental Considerations in Energy Production, Society of Mining Engineers/Virginia Center for Coal & Energy Research, Virginia Tech, April 14-18, 2013.

> Landfill Leachate and Gases, Midwest Geosciences Group, February 5, 2013.

> Calculation and Use of Time of Concentration, American Society of Civil Engineers, December 20, 2012.

> Wastewater Treatment and Water Quality for Indiana Coal Mines Workshop, 26th Annual Surface Mined Land Reclamation Technology Transfer Workshop, Jasper, Indiana, December 9, 2013.

> Applications of Groundwater Geochemistry, National Ground Water Association, Nashville, Tennessee, October 17-18, 2011.

> Ground Water Geochemistry and Isotopes, National Ground Water Association Web Seminar, November 17, 2009.

> Pump/Yield Testing Design and Transducer Data Collection, National Ground Water Association Web Seminar, April 7, 2009.

> Geologic Sequestration Research Activities and EPA Requirements, Air & Waste Management Association Web Seminar, February 18, 2009.

> Environmental Geochemistry of Metals: Investigation and Remediation, National Ground Water Association, Las Vegas, Nevada, March 13 – 15, 2007.

> Basics of Natural Stream Design on Mined Lands, American Society for Mining and Reclamation/West Virginia Surface Mine Drainage Task Force, April 18-22, 2004.

> Regional Coalfield Water Resource Symposium, Virginia Water Resource Research Center and Virginia Tech, Wise, Virginia, September 4, 2002.

> Environmental Remediation in Coal Mining, Virginia Center for Coal and Energy Research and the Central Appalachian Section of SME, Abingdon, Virginia, June 8, 2000.

> Low–Cost Remediation Strategies for Contaminated Soil and Ground Water, National Ground Water Association, Baltimore, Maryland, June 1–2, 1998.

- Defining Coalbed Methane Exploration Fairways and Resources, 1997 International Coalbed Methane Symposium, Tuscaloosa, Alabama, May 1997.
- Advanced Applications of Borehole Geophysics to Hydrogeological Investigations, National Ground Water Association, Natick, MA, October 3, 1995.
- Capture Zone Analysis Techniques Applied to Ground Water Protection and Remediation, Environmental Education Enterprises, Columbus, Ohio, June 1993.
- Analysis and Design of Aquifer Tests, National Ground Water Association, Columbus, Ohio, March 1992.
- Selection and Analysis of Shallow Aquifer Tests, Association of Engineering Geologists, Chicago, Illinois, September 30, 1991.
- Remote Sensing Applications to Hydrogeology, National Water Well Association, 1988.
- Borehole Geophysics: Applications to Hydrogeology, National Water Well Association, 1988.
- Modeling Ground water Flow in an Aquifer, University of Kentucky, Institute of Mining and Minerals Research, 1988.
- Expert Witness Short Course, National Water Well Association, 1987.
- Ground Water Monitoring in Karst Terrains, National Water Well Association, 1987.
- Ground Water Monitoring Principles and Sampling Techniques, University of Kentucky, Institute of Mining and Minerals Research, 1986.
- Applied Hydrology and Sedimentology for Disturbed Areas, University of Kentucky, Institute of Mining and Minerals Research, 1985.
- Economic Evaluation and Investment Decision Methods, Colorado School of Mines, 1984.
- Roof Control and Pillar Design, University of Kentucky, Institute of Mining and Minerals Research, 1983.
- Technical Communications, Colorado School of Mines, 1981.
- Handling, Preparation, and Use of Coal, American Coal Testing Institute, 1980.

Roxana Prison Site,
Letcher County, Kentucky

Appendix

A

PERMIT NO. 867-0298 DOCUMENTATION

Cardno®
Shaping the Future

MARY HELEN MILLER
SECRETARY

Wallace G. Wilkinson
GOVERNOR

COMMONWEALTH OF KENTUCKY
NATURAL RESOURCES AND ENVIRONMENTAL PROTECTION CABINET
DEPARTMENT FOR ENVIRONMENTAL PROTECTION
FRANKFORT OFFICE PARK
18 REILLY ROAD
FRANKFORT, KENTUCKY 40601

KPDES COAL GENERAL PERMIT NOTIFICATION OF COVERAGE

Dear Permittee: Date: December 31, 1987

Those discharges that are or will be covered by the Kentucky Department for Surface Mining Reclamation and Enforcement Permanent Program Permit No. 867-0298 have (been [redacted]) approved for coverage under the Kentucky Division of Water's "General Permit for Coal Mining Activities in the Commonwealth of Kentucky". The coverage becomes effective on the date the permanent program permit is issued or the above date, which ever is later.

Coverage under the general permit requires compliance with the (____ existing source, ____ new discharger, ✓ new source) conditions set forth in the permit and the submission of self-monitoring reports to the appropriate DSMRE Regional Office. The general permit expires on February 28, 1989, at which time the conditions of the general permit may be altered.

Individual Kentucky Pollutant Discharge Elimination System (KPDES) Permits shall be required for the following types of facilities:

1. Mining activities which have been denied coverage under the general permit.
2. Coal preparation (washing) plants.
3. Operations not permitted under the Permanent Program.
4. Two acre operations.
5. Sanitary wastewater discharges.

If you disagree with this general permit coverage determination then contact the Industrial and Synfuel Section of the Division of Water by certified mail within thirty (30) days of the date of this notification.

Any questions concerning the coverage of the general permit, requests for permit applications or copies of the general permit should be addressed to: Larry Sowder of my staff at (502) 564-3410.

Sincerely,

Donald F. Harker, Jr.

Donald F. Harker, Jr., Director
Division of Water

DFH:LS:tre

COMMONWEALTH OF KENTUCKY
DEPARTMENT OF MINES AND MINERALS
P.O. BOX 680 LEXINGTON, KENTUCKY

LICENSE NUMBER
1560-16316

LICENSE TO OPERATE A MINE

EXPIRES: 12/31/88

FIRM OR COMPANY:
MEADE & SHEPHERD COAL CO

PRINCIPAL EXECUTIVE:
LAWRENCE SHEPHERD
ADDRESS:
721 MARYLAND DR
WHITESBURG, KY 41858

DATE OF ISSUE: 05/09/88
EFFECTIVE DATE: 04/29/88

THIS LICENSE IS NOT TRANSFERABLE

14 MINE NAME OR NO.
13284.13 FILE NUMBER
ROXANA LOCATION
LETCHER COUNTY
STC TYPE MINE

Willard Stanley
WILLARD STANLEY COMMISSIONER

COMMONWEALTH OF KENTUCKY
DEPARTMENT OF MINES AND MINERALS
P.O. BOX 680 LEXINGTON, KENTUCKY

LICENSE NUMBER
1561-16316

LICENSE TO OPERATE A MINE

EXPIRES: 12/31/88

FIRM OR COMPANY:
MEADE & SHEPHERD COAL CO

PRINCIPAL EXECUTIVE:
LAWRENCE SHEPHERD
ADDRESS:
721 MARYLAND DR
WHITESBURG, KY 41858

DATE OF ISSUE: 05/09/88
EFFECTIVE DATE: 04/29/88

THIS LICENSE IS NOT TRANSFERABLE

15 MINE NAME OR NO.
13284.14 FILE NUMBER
ROXANA LOCATION
LETCHER COUNTY
STC TYPE MINE

Willard Stanley
WILLARD STANLEY COMMISSIONER

COMMONWEALTH OF KENTUCKY
DEPARTMENT OF MINES AND MINERALS
P.O. BOX 680 LEXINGTON, KENTUCKY

LICENSE NUMBER
1559-16316

LICENSE TO OPERATE A MINE

EXPIRES: 12/31/88

FIRM OR COMPANY:
MEADE & SHEPHERD COAL CO

PRINCIPAL EXECUTIVE:
LAWRENCE SHEPHERD
ADDRESS:
721 MARYLAND DR
WHITESBURG, KY 41858

DATE OF ISSUE: 05/09/88
EFFECTIVE DATE: 04/29/88

THIS LICENSE IS NOT TRANSFERABLE

16 MINE NAME OR NO.
13284.15 FILE NUMBER
ROZANA LOCATION
LETCHER COUNTY
STC TYPE MINE

Willard Stanley
WILLARD STANLEY COMMISSIONER

COMMONWEALTH OF KENTUCKY
DEPARTMENT OF MINES AND MINERALS
P.O. BOX 680 LEXINGTON, KENTUCKY

LICENSE NUMBER 0044-16361

LICENSE TO OPERATE A MINE

EXPIRES: 12/31/90

FIRM OR COMPANY:
MEADE & SHEPHERD COAL CO

PRINCIPAL EXECUTIVE:
LAWRENCE SHEPHERD
ADDRESS:
HC 84 BOX 1404
WHITESBURG, KY 41858

DATE OF ISSUE: 01/15/90
EFFECTIVE DATE: 01/09/90

THIS LICENSE IS NOT TRANSFERABLE

14 MINE NAME OR NO.
13284.13 FILE NUMBER
ROXANA LOCATION
LETCHER COUNTY
STC TYPE MINE

Willard Stanley
WILLARD STANLEY COMMISSIONER

COMMONWEALTH OF KENTUCKY
DEPARTMENT OF MINES AND MINERALS
P.O. BOX 680 LEXINGTON, KENTUCKY

LICENSE NUMBER 0045-16361

LICENSE TO OPERATE A MINE

EXPIRES: 12/31/90

FIRM OR COMPANY:
MEADE & SHEPHERD COAL CO

PRINCIPAL EXECUTIVE:
LAWRENCE SHEPHERD
ADDRESS:
HC 84 BOX 1404
WHITESBURG, KY 41858

DATE OF ISSUE: 01/15/90
EFFECTIVE DATE: 01/09/90

THIS LICENSE IS NOT TRANSFERABLE

16 MINE NAME OR NO.
13284.15 FILE NUMBER
ROXANA LOCATION
LETCHER COUNTY
STC TYPE MINE

Willard Stanley
WILLARD STANLEY COMMISSIONER

COMMONWEALTH OF KENTUCKY
DEPARTMENT OF MINES AND MINERALS
P.O. BOX 680 LEXINGTON, KENTUCKY

LICENSE NUMBER 2164-00000

LICENSE TO OPERATE A MINE

EXPIRES: 12/31/85

FIRM OR COMPANY:
MEADE & SHEPHERD COAL CO

PRINCIPAL EXECUTIVE:
LUTHER MEADE
ADDRESS:
721 MARYLAND DR
WHITESBURG, KY 41858

DATE OF ISSUE: 06/18/85
EFFECTIVE DATE: 05/29/85

THIS LICENSE IS NOT TRANSFERABLE

13 MINE NAME OR NO.
13284.12 FILE NUMBER
ROXANA LOCATION
LETCHER COUNTY
STC TYPE MINE

Willard Stanley
WILLARD STANLEY COMMISSIONER

NOTICE OF BOND RELEASE

In accordance with provisions of KRS 350, notice is hereby given that Meade and Shepherd Coal Co., Inc., HC 84 Box 1404, Whitesburg, KY. 41858 has filed for Phase III bond release on permit no. 867-0298, which was issued on 4/25/96. The property is located approximately 0.36 miles Southeast of Roxana, Kentucky in Letcher County. The total area within the permit boundary is 151.69 acres.

The proposed bond release is approximately 0.36 miles Southeast from KY. 160's junction KY. 588 and located 0.13 miles East of Tolson Branch. The latitude 37°06'11". The longitude is 82°57'20". $119,200, respectively of which is approximately 40% is to be included in this application for release. This represents Increments I, III, IV.

Reclamation work thus far performed includes backfilling, grading and post mine land use achieved on or about Feb. 1992.

Surface owners notified are Douglas Gentry, Irvin Ison and Rondall Meade.

Public hearing date is 8-12-96. Written comments, objections or request for a permit conference must be received within thirty (30) days of 8-12-96. Contact Dept. of Reclamation and Enforcement, 109 Mays Branch Road, Pikeville, KY. 41501.

This is the final advertisement of this application; all comments, objections, or requests for a permit conference must be received within thirty (30) days of July 10, 1996.

Cumulative Hydrologic Impact Assessement

Mine History Report for Cumulative Impact Area

Kings Creek-North Fork Kentucky River

CIA Acreage: 18,612.00

HUC12: 051002010105

Date of Report: 7/14/2011

Status

Active

Permit #	Company Name	Status	Mine Types	Seams	Acreages Permitted	Acreages Disturbed
8670393	NALLY & HAMILTON ENTERPRISES INC	A2	SM SC SG	HAZARD 5A, HAZARD 4A, HAZARD 4 RIDER, HADDIX	657.03	575
8670444	ENTERPRISE MINING COMPANY LLC	A2	SC SG UG	HAZARD NO 4 RIDER, HAZARD NO 4	601.25	45
8670445	ENTERPRISE MINING COMPANY LLC	A2	SC SG UG	HAZARD 4 RIDER	1295.83	50
8670461	FLEENOR, INC	AP	SR SC UG SG	FIRECLAY HAZARD 4, FIRECLAY RIDGER HAZARD 4 RIDER, WHITESBURG, U AMBURGY 2, L AMBURGY 1	476.6	50
8670503	BSD1 LLC	ND	SC SG SR	HAZARD 4, HAZARD 4R	34.4	0
8675268	ENTERPRISE MINING COMPANY LLC	AP	UG SR SA SG	HAZARD NO4 RIDER, HAZARD NO4	957.8	52
8675270	ENTERPRISE MINING COMPANY LLC	A1	UG SG SA SC SR	FIRECLAY	303.69	84
8675312	SAPPHIRE COAL COMPANY	AP	UG SR	ELKHORN 3,	7575.85	0
8677024	ENTERPRISE MINING COMPANY LLC	A1	HR	XXXX	29.86	20
8678051	ENTERPRISE MINING COMPANY LLC	A1	PP RD SC SG SS	FIRE CLAY, FIRE CLAY RIDER	230.98	150
8678052	ENTERPRISE MINING COMPANY LLC	A1	PP	XXXX	26	25

Released

Permit #	Company Name	Status	Mine Types	Seams	Acreages Permitted	Acreages Disturbed
0260090	ROCK GAP COAL CO	FF	CM	MANCHESTER	8	8
0670020	GOLDEN OAK MINING CO INC	RC	CM	HAZARD NUMBER 4	112.43	46
0670105	RICHARD ISON	RC	SG	#4 RIDER ELEV 1480, #4 RIDER ELEV 1480, HAZARD #4 ELEV 1440, HAZARD #4 ELEV 1440	70	70
0675048	LAKE COAL CO INC	RC	UG	HAZARD #4	5.4	6
0675099	LAKE COAL CO INC	RC	UG	AMBURGEY	1	5
0675106	LAKE COAL CO INC	RC	UG	HAZARD NO 4	8	0
2670340	LAKE COAL CO INC	RC	UG	HZ NO 4	17.22	20
2675021	SOUTH-EAST COAL COMPANY	RC	UG	ELKHORN # 3	10	10
2678017	LAKE COAL CO INC	RC	PP	XXXXX	1.44	21
438175X	KY CAROLINA COAL CO	RC	CM	HAZARD NO 4	0	3
4670144	ASHERS QUALITY COAL CORPORATION	RC	SG	FIRECLAY	26	18.65

Status
Released

Permit #	Company Name	Status	Mine Types	Seams	Acreages Permitted	Acreages Disturbed
4675074	BISMARCK COAL INC	RC	UG	FIRECLAY	369.32	18
4677003	GOLDEN OAK MINING CO INC	RC	HR	XXXXX	4.1	5
547476X	B & A COAL CO	RC	SP	HAZARD NO 4	0	10
585376X	B & A COAL CO	RC	CM	HAZARD NO 4, WHITESBURG	0	10
6675066	LUCKY BRANCH COAL CO INC	FF	UG	FIRECLAY	256.11	7.56
673377X	L & J COAL CO	RC	CM	HAZARD NO 4	12	8
8670078	MEADE & SHEPHERD COAL COMPANY INC	RC	SC	FIRECLAY, FIRECLAY RIDER	23.18	14
8670117	TOLSON CREEK COAL COMPANY	RC	SC	HAMLIN	2	0
8670118	PEE WEE COAL COMPANY	RC	SC	HAMLIN	1.9	3.88
8670119	BUDDY COLLINS CONSTRUCTION	RC	SC	HAMLIN	2	0
8670145	RONNIE RATLIFF	FF	SC	AMBURGEY	2	1.6
8670171	CLIFFORD PITTMAN	RC	SC	HAZARD #4	1.96	20
8670183	JERALD PITTMAN	FF	SC	WHITESBURG	1.99	2
8670298	MEADE & SHEPHERD COAL COMPANY INC	RC	SC	FIRECLAY, FIRECLAY RIDER, HAMLIN, #4 RIDER	151.69	120
8670335	MANNING COAL CORPORATION	RC	SA SC SG SM UG	AMBURGEY, WHITESBURG, HAZARD #4, HAZARD #4R	269.6	50.79
8670346	MANNING COAL CORPORATION	RC	SA SC SG SM UG	5-A, HAMLIN, HAZARD NO 4 RIDER, HAZARD NO 4	932.34	189.46
8670363	KATCO MINING COMPANY INC	RC	SC SG	HAZARD 4, HAZARD 4 RIDER	47.06	39.64
8670364	KATCO MINING COMPANY INC	RC	SC	HAZARD 4, 4 RIDER	37.62	37.62
8670437	ENTERPRISE MINING COMPANY LLC	RC	SA SG	FIRE CLAY, FIRE CLAY RIDER	165.15	0
8674008	C & C COAL CO	FF	SC	HAMLIN	1.9	2
8675023	LAKE COAL CO INC	RC	UG	AMBURGY	264.2	1
8675032	COAL MOLE INC	RC	UG	FIRECLAY #4	406.19	4
8675062	BIG OAK COAL COMPANY	FF	UG	HAZARD #4	104.31	11
8675088	COAL MOLE INC	RC	UG	HAZARD NO 4, FIRECLAY	183.96	7.3
8675101	ENTERPRISE COAL COMPANY	RC	UG	HAZARD #4	321.78	43.92
8675113	W & P COAL COMPANY INC	RC	UG	FIRECLAY, W BURG	242.99	5
8675164	DLX INC	RC	UG	ELKHORN #3	111.92	3.64
8675165	DLX INC	RC	UG	ELKHORN #3	1018.89	9.29
8675169	PHOENIX MINING INC	RC	UG	HAZARD NO 7, HAZARD NO 4	1024.46	29.8
8675170	PHOENIX MINING INC	RC	UG	HAZARD NO 7	51.34	20.8
8675244	COASTAL COAL COMPANY LLC	RC	UG	FIRECLAY, UNNAMED, UNNAMED #2	453.96	9.96
8677022	COASTAL COAL COMPANY LLC	RC	HR	XXXX	4.6	4.6
8679015	ENTERPRISE MINING COMPANY LLC	RC	PP	XXXX	37	17

Status

Total Active Surface Acreage:	3,351.95	**Acreage Grand Totals:**	Permitted:	18,956.30
Total Active Underground Acreage:	8,837.34		Disturbed:	1965.51
Total Released Surface Acreage:	2,128.23		Reclaimed:	1514.76
Total Released Underground Acreage:	4,851.05			
Total Proposed Surface Acreage:	241.03			
Total Proposed Underground Acreage:	1.00			

Roxana Prison Site,
Letcher County, Kentucky

Appendix

B

NOVEMBER 11, 2015 SAMPLING RESULTS

Cardno®
Shaping the Future

REI Consultants, Inc.
PO Box 286
Beaver, WV 25813
TEL: (304) 255-2500
Website: www.reiclabs.com

Improving the environment, one client at a time...

3029-C Peters Creek Road
Roanoke, VA 24019
TEL: 540.777.1276

101 17th Street
Ashland, KY 41101
TEL: 606.393.5027

1557 Commerce Road, Suite 201
Verona, VA 24482
TEL: 540.248.0183

16 Commerce Drive
Westover, WV 26501
TEL: 304.241.5861

Friday, November 20, 2015

Mr. Steve Stansfield
CARDNO MM&A
534 INDUSTRIAL PARK RD
BLUEFIELD, VA 24605-9364

TEL: (276) 322-5467
FAX: (276) 322-1510

RE: ROXANA PRISON SITE

Work Order #: 1511G81

Dear Mr. Steve Stansfield:

REI Consultants, Inc. received 6 sample(s) on 11/13/2015 for the analyses presented in the following report.

Sincerely,

Beth Johnson

Beth Johnson

Project Manager

REI Consultants, Inc. - Case Narrative

WO#: 1511G81

Date Reported: 11/20/2015

Client: CARDNO MM&A

Project: ROXANA PRISON SITE

The analytical results presented in this report were produced using documented laboratory SOPs that incorporate appropriate quality control procedures as described in the applicable methods. Verification of required sample preservation (as required) is recorded on associated laboratory logs. Any deviation from compliance or method modification is identified within the body of this report by a qualifier footnote which is defined at the bottom of this page.

All sample results for solid samples are reported on an "as-received" wet weight basis unless otherwise noted.

Results reported for sums of individual parameters, such as TTHM and HAA5, may vary slightly from the sum of the individual parameter results, due to rounding of individual results, as required by EPA.

The test results in this report meet all NELAP and/or VELAP requirements for parameters clearly designated as PA, VA, PA/VA, or VELAP in the column labeled NELAP.

Please note if the sample collection time is not provided on the Chain of Custody, the default recording will be 0:00:00. This may cause some tests to be apparently analyzed out of hold.

All tests performed by REIC Service Centers are designated by an annotation on the test code. All other tests were performed by REIC's Main Laboratory in Beaver, WV.

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DEFINITIONS:
MCL: Maximum Contaminant Level
MDL: Method Detection Limit; The lowest concentration of analyte that can be detected by the method in the applicable matrix.
Mg/Kg or mg/L: Units of part per million (PPM) - milligram per Kilogram (weight/weight) or milligram per Liter (weight/volume).
NA: Not Applicable
ND: Not Detected at the PQL or MDL
PQL: Practical Quantitation Limit; The lowest verified limit to which data is quantified without qualifications. Analyte concentrations below PQL are reported either as ND or as a number with a "J" qualifier.
Qual: Qualifier that applies to the analyte reported.
TIC: Tentatively Identified Compound, Estimated Concentration denoted by "J" qualifier.
Ug/Kg or ug/L: Units of part per billion (PPB) - microgram per kilogram (weight/weight) or microgram per liter (weight/volume).

QUALIFIERS:
X: Reported value exceeds required MCL
B: Analyte detected in the associated Method Blank at a concentration > 1/2 the PQL
E: The sample result is within the method accepted Linear Dynamic Range determined by the lab for this analysis. However, it may be considered estimated when applying the TNI (The NELAC Institute) standard.
H: Holding time for preparation or analysis has been exceeded.
J: Analyte concentration is reported, and is less than the PQL and greater than or equal to the MDL. The result reported is an estimate.
S: % REC (% recovery) exceeds control limits

CERTIFICATIONS:
Beaver, WV: WVDHHR 00412CM, WVDEP 060, VADCLS 00281, KYDEP 90039, TNDEQ TN02926, NCDWQ 466, PADEP 68-00839, VADCLS (VELAP) 460148
Bioassay (Beaver, WV): WVDEP 060, VADCLS(VELAP) 460148, PADEP 68-00839
Roanoke, VA: VADCLS(VELAP) 460150
Verona, VA: VADCLS(VELAP) 460151
Ashland, KY: KYDEP 00094, WVDEP 389
Morgantown, WV: WVDHHR 003112M, WVDEP 387

REI Consultants, Inc. - Analytical Report

WO#: 1511G81

Date Reported: 11/20/2015

Client:	CARDNO MM&A	**Collection Date:**	11/11/2015 10:10:00 AM
Project:	ROXANA PRISON SITE	**Date Received:**	11/13/2015
Lab ID:	1511G81-01A	**Matrix:**	Liquid
Client Sample ID:	SOUTHWEST STREAM MOUTH	**Site ID:**	

Analysis	Result	MDL	PQL	MCL	Qual	Units	Date Analyzed	NELAP
Field/Miscellaneous Parameters			**Method: FLD/MISC**				**Analyst:**	
Field Sampler	SS	NA		NA				
Field Conductivity	711	NA		NA		µmhos/cm		
Field pH	6.73	NA		NA		SU		
Field Temp	50.8	NA		NA		DEG F		
METALS BY ICP			**Method: EPA 200.7 Rev. 4.4 (1994)**				**Analyst: LF**	
Chromium	ND	0.0010	0.0050	NA		mg/L	11/17/15	PA/VA
Iron	0.0503	0.0100	0.0500	NA		mg/L	11/17/15	PA/VA
Manganese	0.0162	0.0010	0.0050	NA		mg/L	11/17/15	PA/VA
ANIONS by ION CHROMATOGRAPHY			**Method: EPA 300.0, Rev.2.1 (1993)**				**Analyst: CF**	
Chloride	ND	0.20	1.00	NA		mg/L	11/13/15	PA/VA
Sulfate	316	10.0	50.0	NA		mg/L	11/16/15	PA/VA
TOTAL DISSOLVED SOLIDS			**Method: SM2540 C-1997**				**Analyst: KY**	
Total Dissolved Solids	521	5	10	NA		mg/L	11/17/15	PA/VA
TOTAL SUSPENDED SOLIDS			**Method: SM2540 D-1997**				**Analyst: KY**	
Total Suspended Solids	ND	NA	1	NA		mg/L	11/16/15	PA/VA
ACIDITY			**Method: SM2310 B-1997**				**Analyst: VS**	
Acidity, Total	10.9	1.0	10	NA		mg/L	11/16/15	PA/VA
ALKALINITY			**Method: SM2320 B-1997**				**Analyst: VS**	
Alkalinity, Total (As CaCO3)	51.1	1.0	20.0	NA		mg/L	11/16/15	PA/VA
pH - LAB TEST, HOLD TIME EXPIRED:			**Method: SM4500-H+-B-2000**				**Analyst: VS**	
pH	7.22	NA	NA	NA		SU	11/16/15 10:41AM	

REI Consultants, Inc. - Analytical Report

WO#: 1511G81

Date Reported: 11/20/2015

Client:	CARDNO MM&A	**Collection Date:**	11/11/2015 10:10:00 AM
Project:	ROXANA PRISON SITE	**Date Received:**	11/13/2015
Lab ID:	1511G81-01B	**Matrix:**	Liquid
Client Sample ID:	SOUTHWEST STREAM MOUTH	**Site ID:**	

Analysis	Result	MDL	PQL	MCL	Qual	Units	Date Analyzed	NELAP
Field/Miscellaneous Parameters			**Method: FLD/MISC**				**Analyst:**	
Field Sampler	SS	NA		NA				
DISSOLVED METALS BY ICP			**Method: EPA 200.7 Rev. 4.4 (1994)**				**Analyst: LF**	
Antimony	ND	0.0080	0.0200	NA		mg/L	11/17/15	PA/VA
Arsenic	ND	0.0070	0.0200	NA		mg/L	11/17/15	PA/VA
Barium	0.0618	0.0020	0.0050	NA		mg/L	11/17/15	PA/VA
Beryllium	ND	0.0002	0.0010	NA		mg/L	11/17/15	PA/VA
Cadmium	ND	0.0003	0.0010	NA		mg/L	11/17/15	PA/VA
Calcium	63.5	0.0500	0.500	NA	E	mg/L	11/17/15	PA/VA
Chromium	ND	0.0010	0.0050	NA		mg/L	11/17/15	PA/VA
Copper	ND	0.0020	0.0050	NA		mg/L	11/17/15	PA/VA
Iron	ND	0.0100	0.0500	NA		mg/L	11/17/15	PA/VA
Lead	ND	0.0030	0.0100	NA		mg/L	11/17/15	PA/VA
Magnesium	54.7	0.0500	0.500	NA	E	mg/L	11/17/15	PA/VA
Manganese	0.0161	0.0010	0.0050	NA		mg/L	11/17/15	PA/VA
Potassium	3.42	0.0400	0.100	NA		mg/L	11/17/15	PA/VA
Selenium	ND	0.0100	0.0200	NA		mg/L	11/17/15	PA/VA
Sodium	8.73	0.0300	0.100	NA		mg/L	11/17/15	PA/VA
Thallium	ND	0.0090	0.0100	NA		mg/L	11/17/15	PA/VA

Notes:

Calculation of the percent recovery on the matrix spike for Magnesium was not applicable since the spike added was <30% of the parent sample's background concentration.

MERCURY, Dissolved			**Method: EPA 245.1, Rev. 3.0 (1994)**				**Analyst: EP**
Mercury	ND	0.0001	0.0010	NA		mg/L	11/20/15

REI Consultants, Inc. - Analytical Report

WO#: 1511G81

Date Reported: 11/20/2015

Client:	CARDNO MM&A	**Collection Date:**	11/11/2015 11:50:00 AM
Project:	ROXANA PRISON SITE	**Date Received:**	11/13/2015
Lab ID:	1511G81-02A	**Matrix:**	Liquid
Client Sample ID:	NORTHWEST TOE OF HOLLOW FILL	**Site ID:**	

Analysis	Result	MDL	PQL	MCL	Qual	Units	Date Analyzed	NELAP
Field/Miscellaneous Parameters			**Method: FLD/MISC**				**Analyst:**	
Field Sampler	SS	NA		NA				
Field Conductivity	1831	NA		NA		umhos/cm		
Field pH	7.05	NA		NA		SU		
Field Temp	54.1	NA		NA		DEG F		
METALS BY ICP			**Method: EPA 200.7 Rev. 4.4 (1994)**				**Analyst: LF**	
Chromium	ND	0.0010	0.0050	NA		mg/L	11/17/15	PA/VA
Iron	0.0854	0.0100	0.0500	NA		mg/L	11/17/15	PA/VA
Manganese	0.0740	0.0010	0.0050	NA		mg/L	11/17/15	PA/VA
ANIONS by ION CHROMATOGRAPHY			**Method: EPA 300.0, Rev.2.1 (1993)**				**Analyst: CF**	
Chloride	3.95	0.20	1.00	NA		mg/L	11/13/15	PA/VA
Sulfate	1,210	25.0	125	NA		mg/L	11/16/15	PA/VA
TOTAL DISSOLVED SOLIDS			**Method: SM2540 C-1997**				**Analyst: KY**	
Total Dissolved Solids	2,230	5	10	NA		mg/L	11/17/15	PA/VA
TOTAL SUSPENDED SOLIDS			**Method: SM2540 D-1997**				**Analyst: KY**	
Total Suspended Solids	2	NA	1	NA		mg/L	11/16/15	PA/VA
ACIDITY			**Method: SM2310 B-1997**				**Analyst: VS**	
Acidity, Total	32.9	1.0	10	NA		mg/L	11/16/15	PA/VA
ALKALINITY			**Method: SM2320 B-1997**				**Analyst: VS**	
Alkalinity, Total (As CaCO3)	377	1.0	20.0	NA		mg/L	11/16/15	PA/VA
pH - LAB TEST, HOLD TIME EXPIRED:			**Method: SM4500-H+-B-2000**				**Analyst: VS**	
pH	7.41	NA	NA	NA		SU	11/16/15 10:41AM	

REI Consultants, Inc. - Analytical Report

WO#: 1511G81

Date Reported: 11/20/2015

Client:	CARDNO MM&A	**Collection Date:**	11/11/2015 11:50:00 AM
Project:	ROXANA PRISON SITE	**Date Received:**	11/13/2015
Lab ID:	1511G81-02B	**Matrix:**	Liquid
Client Sample ID:	NORTHWEST TOE OF HOLLOW FILL	**Site ID:**	

Analysis	Result	MDL	PQL	MCL	Qual	Units	Date Analyzed	NELAP
Field/Miscellaneous Parameters			**Method: FLD/MISC**				**Analyst:**	
Field Sampler	SS	NA		NA				
DISSOLVED METALS BY ICP			**Method: EPA 200.7 Rev. 4.4 (1994)**				**Analyst: LF**	
Antimony	ND	0.0080	0.0200	NA		mg/L	11/17/15	PA/VA
Arsenic	ND	0.0070	0.0200	NA		mg/L	11/17/15	PA/VA
Barium	0.0335	0.0020	0.0050	NA		mg/L	11/17/15	PA/VA
Beryllium	ND	0.0002	0.0010	NA		mg/L	11/17/15	PA/VA
Cadmium	ND	0.0003	0.0010	NA		mg/L	11/17/15	PA/VA
Calcium	259	0.500	5.00	NA		mg/L	11/18/15	PA/VA
Chromium	ND	0.0010	0.0050	NA		mg/L	11/17/15	PA/VA
Copper	ND	0.0020	0.0050	NA		mg/L	11/17/15	PA/VA
Iron	ND	0.0100	0.0500	NA		mg/L	11/17/15	PA/VA
Lead	ND	0.0030	0.0100	NA		mg/L	11/17/15	PA/VA
Magnesium	234	0.500	5.00	NA		mg/L	11/18/15	PA/VA
Manganese	0.0502	0.0010	0.0050	NA		mg/L	11/17/15	PA/VA
Potassium	13.2	0.0400	0.100	NA	E	mg/L	11/17/15	PA/VA
Selenium	ND	0.0100	0.0200	NA		mg/L	11/17/15	PA/VA
Sodium	24.1	0.0300	0.100	NA	E	mg/L	11/17/15	PA/VA
Thallium	ND	0.0090	0.0100	NA		mg/L	11/17/15	PA/VA
MERCURY, Dissolved			**Method: EPA 245.1, Rev. 3.0 (1994)**				**Analyst: EP**	
Mercury	ND	0.0001	0.0010	NA		mg/L	11/20/15	

REI Consultants, Inc. - Analytical Report

WO#: 1511G81

Date Reported: 11/20/2015

Client:	CARDNO MM&A	**Collection Date:**	11/11/2015 12:25:00 PM
Project:	ROXANA PRISON SITE	**Date Received:**	11/13/2015
Lab ID:	1511G81-03A	**Matrix:**	Liquid
Client Sample ID:	NORTHWEST STREAM MOUTH	**Site ID:**	

Analysis	Result	MDL	PQL	MCL	Qual	Units	Date Analyzed	NELAP
Field/Miscellaneous Parameters			**Method: FLD/MISC**				**Analyst:**	
Field Conductivity	1505	NA		NA		umhos/cm		
Field pH	8.11	NA		NA		SU		
Field Sampler	SS	NA		NA				
Field Temp	54.5	NA		NA		DEG F		
METALS BY ICP			**Method: EPA 200.7 Rev. 4.4 (1994)**				**Analyst: LF**	
Chromium	ND	0.0010	0.0050	NA		mg/L	11/17/15	PA/VA
Iron	ND	0.0100	0.0500	NA		mg/L	11/17/15	PA/VA
Manganese	ND	0.0010	0.0050	NA		mg/L	11/17/15	PA/VA
ANIONS by ION CHROMATOGRAPHY			**Method: EPA 300.0, Rev.2.1 (1993)**				**Analyst: CF**	
Chloride	2.34	0.20	1.00	NA		mg/L	11/13/15	PA/VA
Sulfate	794	25.0	125	NA		mg/L	11/16/15	PA/VA
TOTAL DISSOLVED SOLIDS			**Method: SM2540 C-1997**				**Analyst: KY**	
Total Dissolved Solids	1,450	5	10	NA		mg/L	11/17/15	PA/VA
TOTAL SUSPENDED SOLIDS			**Method: SM2540 D-1997**				**Analyst: KY**	
Total Suspended Solids	1	NA	1	NA		mg/L	11/16/15	PA/VA
ACIDITY			**Method: SM2310 B-1997**				**Analyst: VS**	
Acidity, Total	ND	1.0	10	NA		mg/L	11/16/15	PA/VA
ALKALINITY			**Method: SM2320 B-1997**				**Analyst: VS**	
Alkalinity, Total (As CaCO3)	215	1.0	20.0	NA		mg/L	11/16/15	PA/VA
pH - LAB TEST, HOLD TIME EXPIRED:			**Method: SM4500-H+-B-2000**				**Analyst: VS**	
pH	8.31	NA	NA	NA		SU	11/16/15 10:41AM	

REI Consultants, Inc. - Analytical Report

WO#: 1511G81

Date Reported: 11/20/2015

Client:	CARDNO MM&A	**Collection Date:**	11/11/2015 12:25:00 PM
Project:	ROXANA PRISON SITE	**Date Received:**	11/13/2015
Lab ID:	1511G81-03B	**Matrix:**	Liquid
Client Sample ID:	NORTHWEST STREAM MOUTH	**Site ID:**	

Analysis	Result	MDL	PQL	MCL	Qual	Units	Date Analyzed	NELAP
Field/Miscellaneous Parameters			**Method: FLD/MISC**				**Analyst:**	
Field Sampler	SS	NA		NA				
DISSOLVED METALS BY ICP			**Method: EPA 200.7 Rev. 4.4 (1994)**				**Analyst: LF**	
Antimony	ND	0.0080	0.0200	NA		mg/L	11/17/15	PA/VA
Arsenic	ND	0.0070	0.0200	NA		mg/L	11/17/15	PA/VA
Barium	0.0581	0.0020	0.0050	NA		mg/L	11/17/15	PA/VA
Beryllium	ND	0.0002	0.0010	NA		mg/L	11/17/15	PA/VA
Cadmium	ND	0.0003	0.0010	NA		mg/L	11/17/15	PA/VA
Calcium	181	0.0500	0.500	NA	E	mg/L	11/17/15	PA/VA
Chromium	ND	0.0010	0.0050	NA		mg/L	11/17/15	PA/VA
Copper	ND	0.0020	0.0050	NA		mg/L	11/17/15	PA/VA
Iron	ND	0.0100	0.0500	NA		mg/L	11/17/15	PA/VA
Lead	ND	0.0030	0.0100	NA		mg/L	11/17/15	PA/VA
Magnesium	178	0.0500	0.500	NA	E	mg/L	11/17/15	PA/VA
Manganese	ND	0.0010	0.0050	NA		mg/L	11/17/15	PA/VA
Potassium	9.14	0.0400	0.100	NA		mg/L	11/17/15	PA/VA
Selenium	ND	0.0100	0.0200	NA		mg/L	11/17/15	PA/VA
Sodium	20.3	0.0300	0.100	NA	E	mg/L	11/17/15	PA/VA
Thallium	ND	0.0090	0.0100	NA		mg/L	11/17/15	PA/VA
MERCURY, Dissolved			**Method: EPA 245.1, Rev. 3.0 (1994)**				**Analyst: EP**	
Mercury	ND	0.0001	0.0010	NA		mg/L	11/20/15	

REI Consultants, Inc. - Analytical Report

WO#: 1511G81

Date Reported: 11/20/2015

Client:	CARDNO MM&A	**Collection Date:**	11/11/2015 1:30:00 PM
Project:	ROXANA PRISON SITE	**Date Received:**	11/13/2015
Lab ID:	1511G81-04A	**Matrix:**	Liquid
Client Sample ID:	SOUTHEAST HOLLOW FILL TOE	**Site ID:**	

Analysis	Result	MDL	PQL	MCL	Qual	Units	Date Analyzed	NELAP
Field/Miscellaneous Parameters			**Method: FLD/MISC**				**Analyst:**	
Field Sampler	SS	NA		NA				
Field Conductivity	1211	NA		NA		umhos/cm		
Field pH	7.75	NA		NA		SU		
Field Temp	54.9	NA		NA		DEG F		
METALS BY ICP			**Method: EPA 200.7 Rev. 4.4 (1994)**				**Analyst: LF**	
Chromium	ND	0.0010	0.0050	NA		mg/L	11/17/15	PA/VA
Iron	ND	0.0100	0.0500	NA		mg/L	11/17/15	PA/VA
Manganese	ND	0.0010	0.0050	NA		mg/L	11/17/15	PA/VA
ANIONS by ION CHROMATOGRAPHY			**Method: EPA 300.0, Rev.2.1 (1993)**				**Analyst: CF**	
Chloride	1.93	0.20	1.00	NA		mg/L	11/13/15	PA/VA
Sulfate	763	25.0	125	NA		mg/L	11/16/15	PA/VA
TOTAL DISSOLVED SOLIDS			**Method: SM2540 C-1997**				**Analyst: KY**	
Total Dissolved Solids	1,300	5	10	NA		mg/L	11/17/15	PA/VA
TOTAL SUSPENDED SOLIDS			**Method: SM2540 D-1997**				**Analyst: KY**	
Total Suspended Solids	3	NA	1	NA		mg/L	11/16/15	PA/VA
ACIDITY			**Method: SM2310 B-1997**				**Analyst: VS**	
Acidity, Total	11.0	1.0	10	NA		mg/L	11/16/15	PA/VA
ALKALINITY			**Method: SM2320 B-1997**				**Analyst: VS**	
Alkalinity, Total (As CaCO3)	191	1.0	20.0	NA		mg/L	11/16/15	PA/VA
pH - LAB TEST, HOLD TIME EXPIRED:			**Method: SM4500-H+-B-2000**				**Analyst: VS**	
pH	7.89	NA	NA	NA		SU	11/16/15 10:41AM	

REI Consultants, Inc. - Analytical Report

WO#: 1511G81

Date Reported: 11/20/2015

Client:	CARDNO MM&A	**Collection Date:**	11/11/2015 1:30:00 PM
Project:	ROXANA PRISON SITE	**Date Received:**	11/13/2015
Lab ID:	1511G81-04B	**Matrix:**	Liquid
Client Sample ID:	SOUTHEAST HOLLOW FILL TOE	**Site ID:**	

Analysis	Result	MDL	PQL	MCL	Qual	Units	Date Analyzed	NELAP
Field/Miscellaneous Parameters			**Method: FLD/MISC**				**Analyst:**	
Field Sampler	SS	NA		NA				
DISSOLVED METALS BY ICP			**Method: EPA 200.7 Rev. 4.4 (1994)**				**Analyst: LF**	
Antimony	ND	0.0080	0.0200	NA		mg/L	11/17/15	PA/VA
Arsenic	ND	0.0070	0.0200	NA		mg/L	11/17/15	PA/VA
Barium	0.0373	0.0020	0.0050	NA		mg/L	11/17/15	PA/VA
Beryllium	ND	0.0002	0.0010	NA		mg/L	11/17/15	PA/VA
Cadmium	ND	0.0003	0.0010	NA		mg/L	11/17/15	PA/VA
Calcium	155	0.0500	0.500	NA	E	mg/L	11/17/15	PA/VA
Chromium	ND	0.0010	0.0050	NA		mg/L	11/17/15	PA/VA
Copper	ND	0.0020	0.0050	NA		mg/L	11/17/15	PA/VA
Iron	ND	0.0100	0.0500	NA		mg/L	11/17/15	PA/VA
Lead	ND	0.0030	0.0100	NA		mg/L	11/17/15	PA/VA
Magnesium	153	0.0500	0.500	NA	E	mg/L	11/17/15	PA/VA
Manganese	ND	0.0010	0.0050	NA		mg/L	11/17/15	PA/VA
Potassium	8.87	0.0400	0.100	NA		mg/L	11/17/15	PA/VA
Selenium	ND	0.0100	0.0200	NA		mg/L	11/17/15	PA/VA
Sodium	17.3	0.0300	0.100	NA	E	mg/L	11/17/15	PA/VA
Thallium	ND	0.0090	0.0100	NA		mg/L	11/17/15	PA/VA
MERCURY, Dissolved			**Method: EPA 245.1, Rev. 3.0 (1994)**				**Analyst: EP**	
Mercury	ND	0.0001	0.0010	NA		mg/L	11/20/15	

REI Consultants, Inc. - Analytical Report

WO#: 1511G81

Date Reported: 11/20/2015

Client:	CARDNO MM&A	**Collection Date:**	11/11/2015 3:35:00 PM
Project:	ROXANA PRISON SITE	**Date Received:**	11/13/2015
Lab ID:	1511G81-05A	**Matrix:**	Liquid
Client Sample ID:	EAST HOLLOW FILL TOE	**Site ID:**	

Analysis	Result	MDL	PQL	MCL	Qual	Units	Date Analyzed	NELAP
Field/Miscellaneous Parameters			**Method: FLD/MISC**				**Analyst:**	
Field Sampler	SS	NA		NA				
Field Conductivity	1900	NA		NA		umhos/cm		
Field pH	7.90	NA		NA		SU		
Field Temp	55.4	NA		NA		DEG F		
METALS BY ICP			**Method: EPA 200.7 Rev. 4.4 (1994)**				**Analyst: LF**	
Chromium	ND	0.0010	0.0050	NA		mg/L	11/17/15	PA/VA
Iron	ND	0.0100	0.0500	NA		mg/L	11/17/15	PA/VA
Manganese	0.0061	0.0010	0.0050	NA		mg/L	11/17/15	PA/VA
ANIONS by ION CHROMATOGRAPHY			**Method: EPA 300.0, Rev.2.1 (1993)**				**Analyst: CF**	
Chloride	3.02	0.20	1.00	NA		mg/L	11/13/15	PA/VA
Sulfate	1,310	25.0	125	NA		mg/L	11/16/15	PA/VA
TOTAL DISSOLVED SOLIDS			**Method: SM2540 C-1997**				**Analyst: KY**	
Total Dissolved Solids	2,260	5	10	NA		mg/L	11/17/15	PA/VA
TOTAL SUSPENDED SOLIDS			**Method: SM2540 D-1997**				**Analyst: KY**	
Total Suspended Solids	1	NA	1	NA		mg/L	11/16/15	PA/VA
ACIDITY			**Method: SM2310 B-1997**				**Analyst: VS**	
Acidity, Total	ND	1.0	10	NA		mg/L	11/16/15	PA/VA
ALKALINITY			**Method: SM2320 B-1997**				**Analyst: VS**	
Alkalinity, Total (As CaCO3)	308	1.0	20.0	NA		mg/L	11/16/15	PA/VA
pH - LAB TEST, HOLD TIME EXPIRED:			**Method: SM4500-H+-B-2000**				**Analyst: VS**	
pH	8.09	NA	NA	NA		SU	11/16/15 10:41AM	

REI Consultants, Inc. - Analytical Report

WO#: 1511G81

Date Reported: 11/20/2015

Client:	CARDNO MM&A	**Collection Date:**	11/11/2015 3:35:00 PM
Project:	ROXANA PRISON SITE	**Date Received:**	11/13/2015
Lab ID:	1511G81-05B	**Matrix:**	Liquid
Client Sample ID:	EAST HOLLOW FILL TOE	**Site ID:**	

Analysis	Result	MDL	PQL	MCL	Qual	Units	Date Analyzed	NELAP
Field/Miscellaneous Parameters			**Method: FLD/MISC**				**Analyst:**	
Field Sampler	SS	NA		NA				
DISSOLVED METALS BY ICP			**Method: EPA 200.7 Rev. 4.4 (1994)**				**Analyst: LF**	
Antimony	ND	0.0080	0.0200	NA		mg/L	11/17/15	PA/VA
Arsenic	ND	0.0070	0.0200	NA		mg/L	11/17/15	PA/VA
Barium	0.0217	0.0020	0.0050	NA		mg/L	11/17/15	PA/VA
Beryllium	ND	0.0002	0.0010	NA		mg/L	11/17/15	PA/VA
Cadmium	ND	0.0003	0.0010	NA		mg/L	11/17/15	PA/VA
Calcium	250	0.500	5.00	NA		mg/L	11/18/15	PA/VA
Chromium	ND	0.0010	0.0050	NA		mg/L	11/17/15	PA/VA
Copper	ND	0.0020	0.0050	NA		mg/L	11/17/15	PA/VA
Iron	ND	0.0100	0.0500	NA		mg/L	11/17/15	PA/VA
Lead	ND	0.0030	0.0100	NA		mg/L	11/17/15	PA/VA
Magnesium	238	0.500	5.00	NA		mg/L	11/18/15	PA/VA
Manganese	0.0064	0.0010	0.0050	NA		mg/L	11/17/15	PA/VA
Potassium	16.4	0.0400	0.100	NA	E	mg/L	11/17/15	PA/VA
Selenium	ND	0.0100	0.0200	NA		mg/L	11/17/15	PA/VA
Sodium	32.5	0.0300	0.100	NA	E	mg/L	11/17/15	PA/VA
Thallium	ND	0.0090	0.0100	NA		mg/L	11/17/15	PA/VA
MERCURY, Dissolved			**Method: EPA 245.1, Rev. 3.0 (1994)**				**Analyst: EP**	
Mercury	ND	0.0001	0.0010	NA		mg/L	11/20/15	

REI Consultants, Inc. - Analytical Report

WO#: 1511G81

Date Reported: 11/20/2015

Client:	CARDNO MM&A	**Collection Date:**	11/11/2015 4:50:00 PM
Project:	ROXANA PRISON SITE	**Date Received:**	11/13/2015
Lab ID:	1511G81-06A	**Matrix:**	Liquid
Client Sample ID:	EAST HOLLOW FILL BELOW POND	**Site ID:**	

Analysis	Result	MDL	PQL	MCL	Qual	Units	Date Analyzed	NELAP
Field/Miscellaneous Parameters			**Method: FLD/MISC**				**Analyst:**	
Field Sampler	SS	NA		NA				
Field Conductivity	1675	NA		NA		umhos/cm		
Field pH	7.97	NA		NA		SU		
Field Temp	55.9	NA		NA		DEG F		
METALS BY ICP			**Method: EPA 200.7 Rev. 4.4 (1994)**				**Analyst: LF**	
Chromium	ND	0.0010	0.0050	NA		mg/L	11/17/15	PA/VA
Iron	ND	0.0100	0.0500	NA		mg/L	11/17/15	PA/VA
Manganese	0.0350	0.0010	0.0050	NA		mg/L	11/17/15	PA/VA
ANIONS by ION CHROMATOGRAPHY			**Method: EPA 300.0, Rev.2.1 (1993)**				**Analyst: CF**	
Chloride	2.26	0.20	1.00	NA		mg/L	11/13/15	PA/VA
Sulfate	1,030	25.0	125	NA		mg/L	11/16/15	PA/VA
TOTAL DISSOLVED SOLIDS			**Method: SM2540 C-1997**				**Analyst: KY**	
Total Dissolved Solids	1,820	5	10	NA		mg/L	11/17/15	PA/VA
TOTAL SUSPENDED SOLIDS			**Method: SM2540 D-1997**				**Analyst: KY**	
Total Suspended Solids	1	NA	1	NA		mg/L	11/16/15	PA/VA
ACIDITY			**Method: SM2310 B-1997**				**Analyst: VS**	
Acidity, Total	ND	1.0	10	NA		mg/L	11/16/15	PA/VA
ALKALINITY			**Method: SM2320 B-1997**				**Analyst: VS**	
Alkalinity, Total (As CaCO3)	270	1.0	20.0	NA		mg/L	11/16/15	PA/VA
pH - LAB TEST, HOLD TIME EXPIRED:			**Method: SM4500-H+-B-2000**				**Analyst: VS**	
pH	8.23	NA	NA	NA		SU	11/16/15 10:41AM	

REI Consultants, Inc. - Analytical Report

WO#: 1511G81

Date Reported: 11/20/2015

Client:	CARDNO MM&A	**Collection Date:**	11/11/2015 4:50:00 PM
Project:	ROXANA PRISON SITE	**Date Received:**	11/13/2015
Lab ID:	1511G81-06B	**Matrix:**	Liquid
Client Sample ID:	EAST HOLLOW FILL BELOW POND	**Site ID:**	

Analysis	Result	MDL	PQL	MCL	Qual	Units	Date Analyzed	NELAP
Field/Miscellaneous Parameters			**Method: FLD/MISC**				**Analyst:**	
Field Sampler	SS	NA		NA				
DISSOLVED METALS BY ICP			**Method: EPA 200.7 Rev. 4.4 (1994)**				**Analyst: LF**	
Antimony	ND	0.0080	0.0200	NA		mg/L	11/17/15	PA/VA
Arsenic	ND	0.0070	0.0200	NA		mg/L	11/17/15	PA/VA
Barium	0.0277	0.0020	0.0050	NA		mg/L	11/17/15	PA/VA
Beryllium	ND	0.0002	0.0010	NA		mg/L	11/17/15	PA/VA
Cadmium	ND	0.0003	0.0010	NA		mg/L	11/17/15	PA/VA
Calcium	207	0.0500	0.500	NA	E	mg/L	11/17/15	PA/VA
Chromium	ND	0.0010	0.0050	NA		mg/L	11/17/15	PA/VA
Copper	ND	0.0020	0.0050	NA		mg/L	11/17/15	PA/VA
Iron	ND	0.0100	0.0500	NA		mg/L	11/17/15	PA/VA
Lead	ND	0.0030	0.0100	NA		mg/L	11/17/15	PA/VA
Magnesium	216	0.0500	0.500	NA	E	mg/L	11/17/15	PA/VA
Manganese	0.0293	0.0010	0.0050	NA		mg/L	11/17/15	PA/VA
Potassium	14.3	0.0400	0.100	NA	E	mg/L	11/17/15	PA/VA
Selenium	ND	0.0100	0.0200	NA		mg/L	11/17/15	PA/VA
Sodium	25.7	0.0300	0.100	NA	E	mg/L	11/17/15	PA/VA
Thallium	ND	0.0090	0.0100	NA		mg/L	11/17/15	PA/VA
MERCURY, Dissolved			**Method: EPA 245.1, Rev. 3.0 (1994)**				**Analyst: EP**	
Mercury	ND	0.0001	0.0010	NA		mg/L	11/20/15	

REI Consultants, Inc.
PO Box 286
Beaver, WV 25813
TEL: (304)255-2500
Website: www.reiclabs.com

Improving the environment, one client at a time...

Sample Receipt Checklist

Client Name:	**CAR044**			Work Order Number:	**1511G81**
RCPNo:	**1**	Date and Time Received:	**11/13/2015 2:19:00 PM**	Received by:	**Traves Meadows**
Completed By:	**Amanda Wilkins**		Reviewed By:	**Beth Johnson**	
Completed Date:	**11/13/2015 2:38:37 PM**		Reviewed Date:	**11/13/2015 3:57 PM**	

Carrier Name: REIC

1.	Chain of custody present?	Yes [x]	No [ ]	
2.	Chain of custody signed when relinquished and received?	Yes [x]	No [ ]	
3.	Are matrices correctly identified on Chain of custody?	Yes [x]	No [ ]	
4.	Is it clear what analyses were requested?	Yes [x]	No [ ]	
5.	Custody seals intact?	Yes [ ]	No [ ]	Not Present [x]
6.	Samples in proper container type and preservative?	Yes [x]	No [ ]	
7.	Were correct preservatives noted on COC?	Yes [x]	No [ ]	NA [ ]
8.	Sample containers intact?	Yes [x]	No [ ]	
9.	Sufficient sample volume for indicated test?	Yes [x]	No [ ]	
10.	Were container labels complete?	Yes [x]	No [ ]	
11.	All samples received within holding time?	Yes [x]	No [ ]	
12.	Was an attempt made to cool the samples?	Yes [x]	No [ ]	NA [ ]
13.	Sample Temp. taken and recorded upon receipt?	Yes [x]	No [ ]	To 1.2 ºC
14.	Water - Were bubbles absent in VOC vials?	Yes [ ]	No [ ]	No Vials [x]
15.	Are Samples considered acceptable?	Yes [x]	No [ ]	
16.	COC filled out properly?	Yes [x]	No [ ]	

Client Notification/Response

Client Name: **CAR044** Work Order Number: **1511G81**

Comment:

Client Contacted: Yes [ ] No [ ] NA [x] Person Contacted:

Contact Mode: Phone [ ] Fax: [ ] Email: [ ] In Person: [ ]

Date Contacted: Contacted By:

Regarding:

Client Instructions:

Corrective Action:

DBPix Evaluation

471178

CHAIN OF CUSTODY RECORD

REIC

Research Environmental & Industrial Consultants, Inc.

MAIN LABORATORY & CORPORATE HEADQUARTERS:
P.O. Box 286 • 225 Industrial Park Rd, Beaver, WV 25813
800-999-0105 • 304-255-2500 • 304-255-2572/fax • www.reiclabs.com

Client: Cardno, Inc. PO #
Contact Person: Steve Stansfield Phone: 276-322-5467
QUOTE #: Fax: Email: steve.stansfield@cardno.com
Address: 534 Industrial Park Rd. City: Bluefield State: VA Zip: 24605
Billing Address (if different): Same as Above
City: State: Zip:
Site ID & State: Project ID: Roxana Prison Site Sampler: Steve Stansfield (Cardno)

MID-OHIO VALLEY Service Center
101 17th Street
Ashland, KY 41101
606-393-5027

SHENANDOAH Service Center
1557 Commerce Rd., Ste 201
Verona, VA 24482
540-248-0183

ROANOKE Service Center
3029-C Peters Creek Rd
Roanoke, VA 24019
540-777-1276

MORGANTOWN Service Center
16 Commerce Drive
Westover, WV 26501
304-241-5861

SAMPLE LOG & ANALYSIS REQUEST

TURNAROUND TIME
[✓] NORMAL
RUSH TURNAROUND*: [ ] 5 DAY [ ] 3 DAY [ ] 2 DAY [ ] 1 DAY
*Rush work needs prior laboratory approval and will incur additional charges

Send Results Via:
[✓] Email
[ ] Fax

All analytical requests are subject to REIC's Standard Terms and Conditions.

ANALYSIS & METHOD REQUESTED: Mg, Mn, Hg, K, Se, Na, Thallium (Field-Filtered); Dissolved Sb, As, Ba, Be, Cd, Ca, Cr, Cu, Fe, Pb; Total Cr, Fe, Mn; pH, acidity, alkalinity, chloride, sulfate, TDS, TSS

SAMPLE ID	No. & Type of Containers	Sampling Date/Time	Matrix	Sample Comp/Grab	2	2	0							
Southwest Stream Mouth	4 Plastic	11/11/15 1010	Water	Grab	✓	✓	✓							
Northwest Toe of Hollow Fill	4 Plastic	11/11/15 1150	Water	Grab	✓	✓	✓							
Northwest Stream Mouth	4 Plastic	11/11/15 1225	Water	Grab	✓	✓	✓							
Southeast Hollow Fill Toe	4 Plastic	11/11/15 1330	Water	Grab	✓	✓	✓							
East Hollow Fill Toe	4 Plastic	11/11/15 1535	Water	Grab	✓	✓	✓							
East Hollow Fill Below Pond	4 Plastic	11/11/15 1650	Water	Grab	✓	✓	✓							
	~~4 Plastic~~ (SS)		~~Water~~	~~Grab~~										
	~~4 Plastic~~ (SS)		~~Water~~	~~Grab~~										

ENTER PRESERVATIVE CODE

Preservative Codes:
0 None
1 Hydrochloric Acid
2 Nitric Acid
3 Sulfuric Acid
4 Sodium Thiosulfate
5 Sodium Hydroxide/ Sodium Arsenite
6 Sodium Hydroxide
7 Ascorbic Acid
8 Sodium Bisulfate/Methanol
9 Ammonium Chloride
10 CH6 Buffer
11 Sodium Sulfite/ Hydrochloric Acid
12 _____*
*(Use blank for a preservative not listed.)

COMMENTS:
- All "dissolved" analyses field-filtered
- Include field parameters on lab sheet
- Analyze mercury by 245.1
- Analyze all other metals by 200.7 low MDL

Temperature at arrival: 1.2°C ICED? Y [X] N [ ] Containers provided by: [✓] REIC [ ] Client Delivered by: [ ] Client [X] REIC [ ] UPS [ ] FedEx [ ] USPS Other

1	Relinquished by (signature)	11/11/15 1021	2	Relinquished by (signature)	11-13-15	3	Relinquished by (signature)	Date/Time
	Received by (signature) 11-13-15	Date/Time 10:21		Received by (signature)	Date/Time		Received by (signature)	Date/Time
4	Relinquished by (signature)	Date/Time	5	Relinquished by (signature)	Date/Time	6	Relinquished by (signature)	Date/Time
	Received by (signature)	Date/Time		Received by (signature)	Date/Time		Received by (signature)	Date/Time

COC-NCR-070113

CHAPMAN PRINTING CO. CHARLESTON, WV 25327

www.ammara.com

Roxana Prison Site
(Collected by Cardno, Inc.)
Field Parameters

Sample ID	Collection Date	Field pH (s.u.)	Field Conductivity (µmhos/cm)	Field Temp (°F)
Southwest Stream Mouth	11/11/15	6.73	711	50.8
Northwest Toe Of Hollow Fill	11/11/15	7.05	1831	54.1
Northwest Stream Mouth	11/11/15	8.11	1505	54.5
Southeast Hollow Fill Toe	11/11/15	7.75	1211	54.9
East Hollow Fill Toe	11/11/15	7.90	1900	55.4
East Hollow Fill Below Pond	11/11/15	7.97	1675	55.9

Roxana Prison Site,
Letcher County, Kentucky

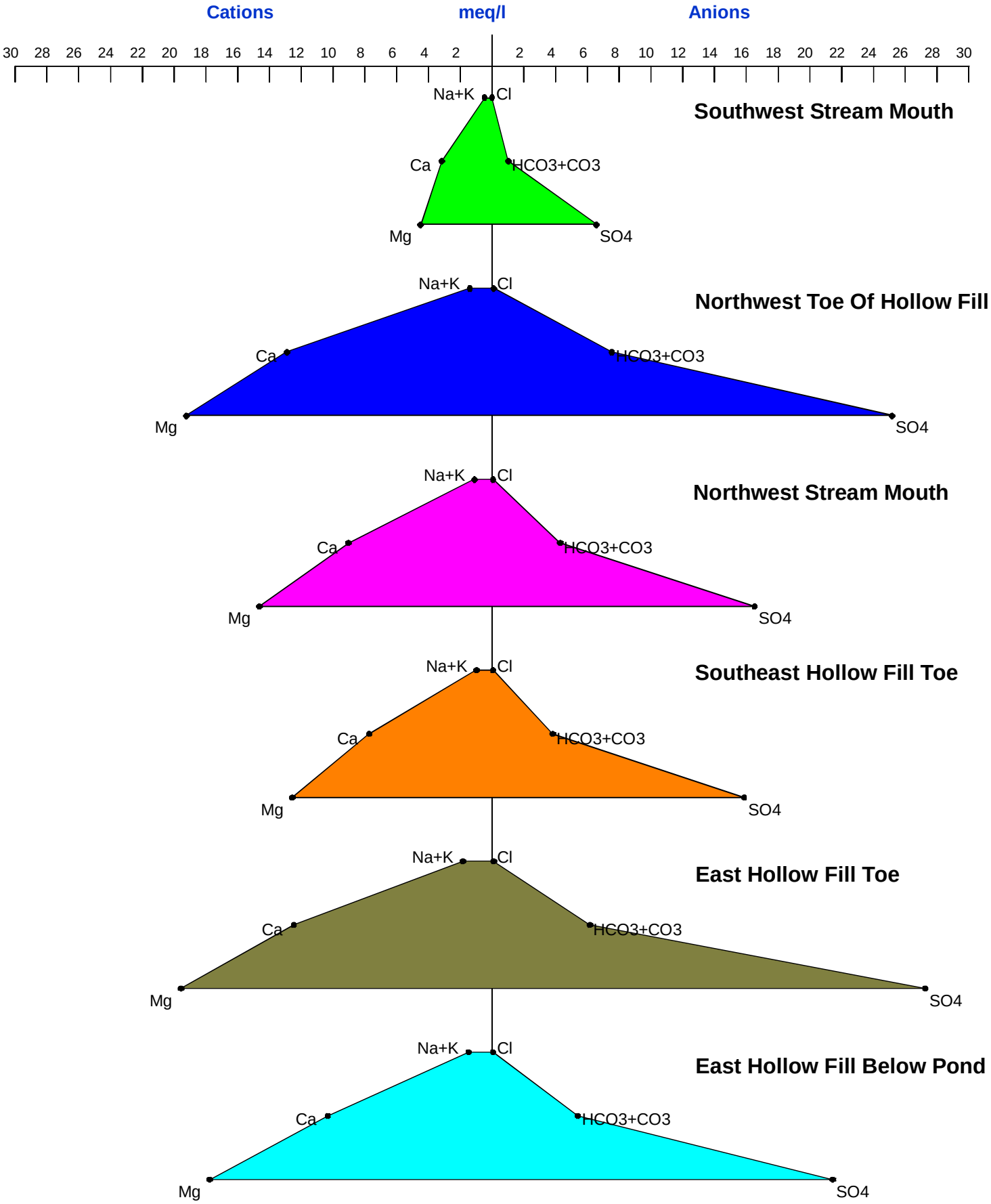
Appendix

C

STIFF AND PIPER DIAGRAMS

Cardno®
Shaping the Future

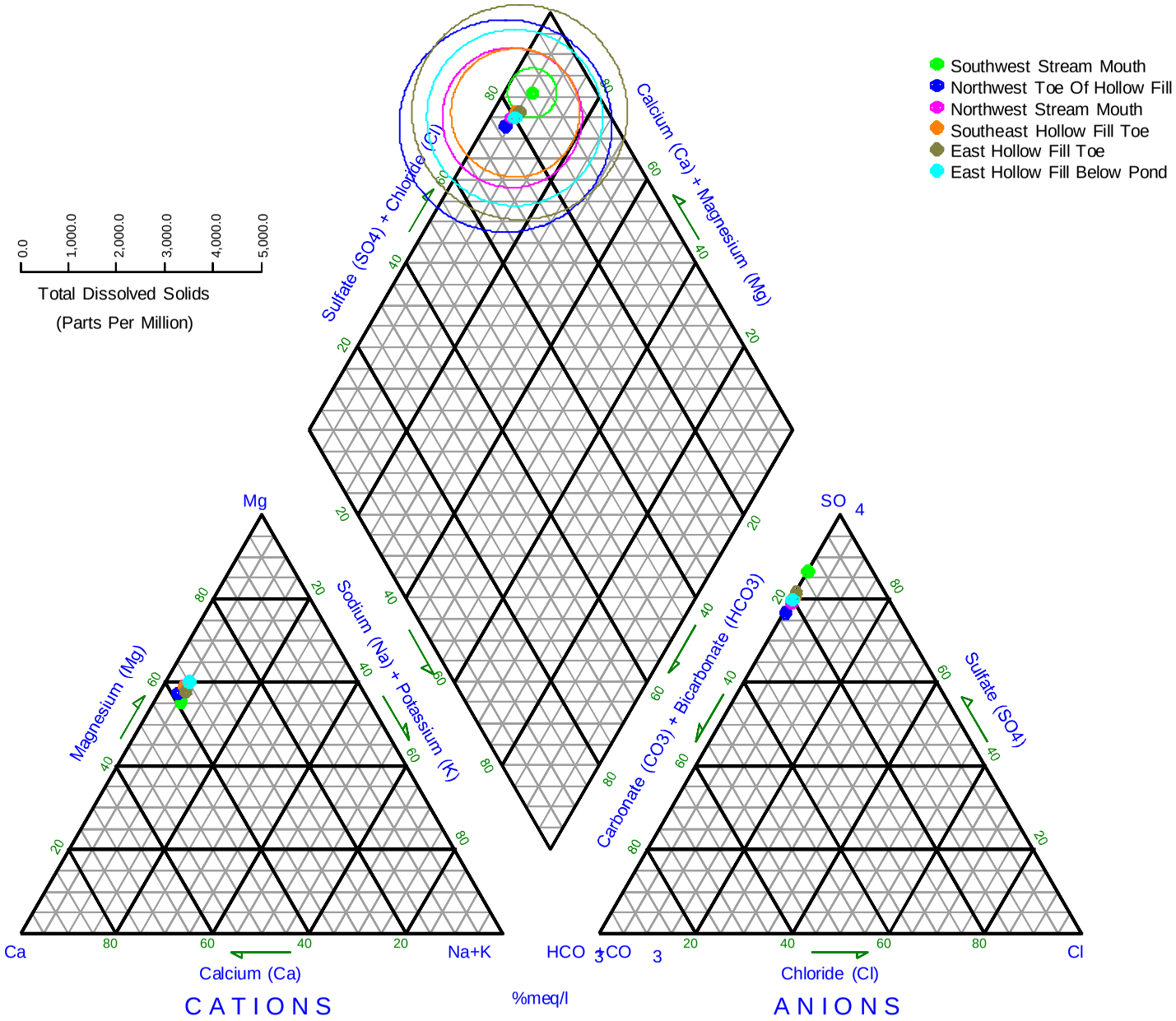
Roxana Prison Site
November 11, 2015 Sampling



CARD138 11/15 drd

Roxana Prison Site

November 11, 2015 Sampling



Roxana Prison Site,
Letcher County, Kentucky

Appendix

D

WATER QUALITY REPORTS FROM 1993-1995

Cardno®
Shaping the Future

Lab. No. 96674

Date Rec'd. 10/27/93

Date Sampled 10/27/93

Sampled By YOURSELVES

STANDARD LABORATORIES, INC.
PO BOX 606
WHITESBURG, KY 41858

MEADE & SHEPHERD COAL COMPANY
HC 84, BOX 1404
WHITESBURG
KENTUCKY 41858

SAMPLE ID:
P.N. 867-0298
SS-1
ROXANNA

WATER REPORT

pH	7.89	
TOTAL ALKALINITY,(AS CACO3 EQUIVALENT	233.10	MG/L
TOTAL ACIDITY, (AS CACO3 EQUIVALENT)	0.00	MG/L
TOTAL SUSPENDED SOLIDS	14	MG/L
TOTAL IRON	0.26	MG/L
TOTAL MANGANESE	<0.01	MG/L

FOR YOUR PROTECTION THIS DOCUMENT HAS BEEN PRINTED ON CONTROLLED PAPER STOCK. NOT VALID IF ALTERED.

Respectfully Submitted, Terry York

Lab. No. 96675

Date Rec'd 10/27/93

Date Sampled 10/27/93

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STANDARD LABORATORIES, INC.
PO BOX 606
WHITESBURG, KY 41858

SAMPLE ID:

MEADE & SHEPHERD COAL COMPANY
HC 84, BOX 1404
WHITESBURG
KENTUCKY 41858

P.N. 867-0298
SS-2
ROXANNA

WATER REPORT

pH	8.17
TOTAL ALKALINITY,(AS CACO3 EQUIVALENT	208.00 MG/L
TOTAL ACIDITY, (AS CACO3 EQUIVALENT)	0.00 MG/L
TOTAL SUSPENDED SOLIDS	20 MG/L
TOTAL IRON	0.42 MG/L
TOTAL MANGANESE	<0.01 MG/L

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Respectfully Submitted, Gary York

Lab. No. 96676

Date Rec'd. 10/27/93

Date Sampled 10/27/93

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PO BOX 606
WHITESBURG, KY 41858

SAMPLE ID:

MEADE & SHEPHERD COAL COMPANY
HC 84, BOX 1404
WHITESBURG
KENTUCKY 41858

P.N. 867-0298
G.W.
ROXANNA

WATER REPORT

pH	8.05
TOTAL ALKALINITY,(AS CACO3 EQUIVALENT	126.00 MG/L
TOTAL ACIDITY, (AS CACO3 EQUIVALENT)	0.00 MG/L
TOTAL DISSOLVED SOLIDS	136 MG/L
TOTAL SULFATE	53.27 MG/L
DISSOLVED IRON	0.14 MG/L
DISSOLVED MANGANESE	0.03 MG/L

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Respectfully Submitted, Terry York

Lab. No. 96714

Date Rec'd 07/15/93

Date Sampled 07/15/93

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PO BOX 606
WHITESBURG, KY 41858

MEADE & SHEPHERD COAL COMPANY
HC 84, BOX 1404
WHITESBURG
KENTUCKY 41858

SAMPLE ID:

P.N. 867-0298
POND #1
ROXANNA

WATER REPORT

pH	7.11
TOTAL ALKALINITY,(AS CACO3 EQUIVALENT	216.00 MG/L
TOTAL ACIDITY, (AS CACO3 EQUIVALENT)	0.00 MG/L
TOTAL SUSPENDED SOLIDS	16 MG/L
TOTAL IRON	0.29 MG/L
TOTAL MANGANESE	<0.01 MG/L

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Respectfully Submitted, Terry York

Lab. No. 96715

Date Rec'd. 07/29/93

Date Sampled 07/29/93

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WHITESBURG, KY 41858

SAMPLE ID:

MEADE & SHEPHERD COAL COMPANY
HC 84, BOX 1404
WHITESBURG
KENTUCKY 41858

P.N. 867-0298
POND #1
ROXANNA

WATER REPORT

pH	7.39	
TOTAL ALKALINITY,(AS CACO3 EQUIVALENT	280.00	MG/L
TOTAL ACIDITY, (AS CACO3 EQUIVALENT)	0.00	MG/L
TOTAL SUSPENDED SOLIDS	31	MG/L
TOTAL IRON	0.74	MG/L
TOTAL MANGANESE	<0.01	MG/L

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Respectfully Submitted, Terry York

Lab. No. 96716

Date Rec'd. 08/12/93

Date Sampled 08/12/93

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STANDARD LABORATORIES, INC.
PO BOX 606
WHITESBURG, KY 41858

SAMPLE ID:

MEADE & SHEPHERD COAL COMPANY
HC 84, BOX 1404
WHITESBURG
KENTUCKY 41858

P.N. 867-0298
POND #1
ROXANNA

WATER REPORT

pH	7.50	
TOTAL ALKALINITY,(AS CACO3 EQUIVALENT	264.00	MG/L
TOTAL ACIDITY, (AS CACO3 EQUIVALENT)	0.00	MG/L
TOTAL SUSPENDED SOLIDS	17	MG/L
TOTAL IRON	0.26	MG/L
TOTAL MANGANESE	0.03	MG/L

FOR YOUR PROTECTION THIS DOCUMENT HAS BEEN PRINTED ON CONTROLLED PAPER STOCK. NOT VALID IF ALTERED.

Respectfully Submitted, Terry York

Lab. No. 96717

Date Rec'd. 08/27/93

Date Sampled 08/27/93

Sampled By YOURSELVES

STANDARD LABORATORIES, INC.
PO BOX 606
WHITESBURG, KY 41858

SAMPLE ID:

MEADE & SHEPHERD COAL COMPANY
HC 84, BOX 1404
WHITESBURG
KENTUCKY 41858

P.N. 867-0298
POND #1
ROXANNA

WATER REPORT

pH	7.60	
TOTAL ALKALINITY,(AS CACO3 EQUIVALENT	234.00	MG/L
TOTAL ACIDITY, (AS CACO3 EQUIVALENT)	0.00	MG/L
TOTAL SUSPENDED SOLIDS	33	MG/L
TOTAL IRON	0.31	MG/L
TOTAL MANGANESE	<0.01	MG/L

FOR YOUR PROTECTION THIS DOCUMENT HAS BEEN PRINTED ON CONTROLLED PAPER STOCK. NOT VALID IF ALTERED.

Respectfully Submitted, Terry York

Lab. No. 96718

Date Rec'd. 09/09/93

Date Sampled 09/09/93

Sampled By YOURSELVES

STANDARD LABORATORIES, INC.
PO BOX 606
WHITESBURG, KY 41858

SAMPLE ID:

MEADE & SHEPHERD COAL COMPANY
HC 84, BOX 1404
WHITESBURG
KENTUCKY 41858

P.N. 867-0298
POND #1
ROXANNA

WATER REPORT

pH	7.20	
TOTAL ALKALINITY,(AS CACO3 EQUIVALENT	250.00	MG/L
TOTAL ACIDITY, (AS CACO3 EQUIVALENT)	0.00	MG/L
TOTAL SUSPENDED SOLIDS	11	MG/L
TOTAL IRON	0.32	MG/L
TOTAL MANGANESE	<0.01	MG/L

FOR YOUR PROTECTION THIS DOCUMENT HAS BEEN PRINTED ON CONTROLLED PAPER STOCK. NOT VALID IF ALTERED.

Respectfully Submitted, Terry York

Lab. No. 96719

Date Rec'd. 09/23/93

Date Sampled 09/23/93

Sampled By YOURSELVES

STANDARD LABORATORIES, INC.
PO BOX 606
WHITESBURG, KY 41858

MEADE & SHEPHERD COAL COMPANY
HC 84, BOX 1404
WHITESBURG
KENTUCKY 41858

SAMPLE ID:

P.N. 867-0298
POND #1
ROXANNA

WATER REPORT

pH	7.55
TOTAL ALKALINITY,(AS CACO3 EQUIVALENT	270.00 MG/L
TOTAL ACIDITY, (AS CACO3 EQUIVALENT)	0.00 MG/L
TOTAL SUSPENDED SOLIDS	33 MG/L
TOTAL IRON	0.92 MG/L
TOTAL MANGANESE	<0.01 MG/L

FOR YOUR PROTECTION THIS DOCUMENT HAS BEEN PRINTED ON CONTROLLED PAPER STOCK. NOT VALID IF ALTERED.

Respectfully Submitted, Terry York

Lab. No. 96720

Date Rec'd. 10/28/93

Date Sampled 10/28/93

Sampled By YOURSELVES

STANDARD LABORATORIES, INC.
PO BOX 606
WHITESBURG, KY 41858

SAMPLE ID:

MEADE & SHEPHERD COAL COMPANY
HC 84, BOX 1404
WHITESBURG
KENTUCKY 41858

P.N. 867-0298
POND #1
ROXANNA

WATER REPORT

pH	7.93
TOTAL ALKALINITY,(AS CACO3 EQUIVALENT	274.00 MG/L
TOTAL ACIDITY, (AS CACO3 EQUIVALENT)	0.00 MG/L
TOTAL SUSPENDED SOLIDS	25 MG/L
TOTAL IRON	0.21 MG/L
TOTAL MANGANESE	<0.01 MG/L

FOR YOUR PROTECTION THIS DOCUMENT HAS BEEN PRINTED ON CONTROLLED PAPER STOCK. NOT VALID IF ALTERED.

Respectfully Submitted, Gary York

Lab. No. 96721

Date Rec'd. 07/15/93

Date Sampled 07/15/93

Sampled By YOURSELVES

STANDARD LABORATORIES, INC.
PO BOX 606
WHITESBURG, KY 41858

SAMPLE ID:

MEADE & SHEPHERD COAL COMPANY
HC 84, BOX 1404
WHITESBURG
KENTUCKY 41858

P.N. 867-0298
POND #2
ROXANNA

WATER REPORT

pH	7.87
TOTAL ALKALINITY,(AS CACO3 EQUIVALENT	302.00 MG/L
TOTAL ACIDITY, (AS CACO3 EQUIVALENT)	0.00 MG/L
TOTAL SUSPENDED SOLIDS	9 MG/L
TOTAL IRON	0.18 MG/L
TOTAL MANGANESE	<0.01 MG/L

FOR YOUR PROTECTION THIS DOCUMENT HAS BEEN PRINTED ON CONTROLLED PAPER STOCK. NOT VALID IF ALTERED.

Respectfully Submitted, Terry York

Lab. No. 96722

Date Rec'd. 07/29/93

Date Sampled 07/29/93

Sampled By YOURSELVES

STANDARD LABORATORIES, INC.
PO BOX 606
WHITESBURG, KY 41858

SAMPLE ID:

MEADE & SHEPHERD COAL COMPANY
HC 84, BOX 1404
WHITESBURG
KENTUCKY 41858

P.N. 867-0298
POND #2
ROXANNA

WATER REPORT

pH	7.57
TOTAL ALKALINITY,(AS CACO3 EQUIVALENT	198.00 MG/L
TOTAL ACIDITY, (AS CACO3 EQUIVALENT)	0.00 MG/L
TOTAL SUSPENDED SOLIDS	17 MG/L
TOTAL IRON	0.22 MG/L
TOTAL MANGANESE	<0.01 MG/L

FOR YOUR PROTECTION THIS DOCUMENT HAS BEEN PRINTED ON CONTROLLED PAPER STOCK. NOT VALID IF ALTERED.

Respectfully Submitted, Terry York

Lab. No. 96723

Date Rec'd 08/12/93

Date Sampled 08/12/93

Sampled By YOURSELVES

STANDARD LABORATORIES, INC.
PO BOX 606
WHITESBURG, KY 41858

SAMPLE ID:

MEADE & SHEPHERD COAL COMPANY
HC 84, BOX 1404
WHITESBURG
KENTUCKY 41858

P.N. 867-0298
POND #2
ROXANNA

WATER REPORT

pH	7.77
TOTAL ALKALINITY,(AS CACO3 EQUIVALENT	242.00 MG/L
TOTAL ACIDITY, (AS CACO3 EQUIVALENT)	0.00 MG/L
TOTAL SUSPENDED SOLIDS	17 MG/L
TOTAL IRON	0.25 MG/L
TOTAL MANGANESE	<0.01 MG/L

FOR YOUR PROTECTION THIS DOCUMENT HAS BEEN PRINTED ON CONTROLLED PAPER STOCK. NOT VALID IF ALTERED.

Respectfully Submitted, Terry York

Lab. No. 96724

Date Rec'd. 08/27/93

Date Sampled 08/27/93

Sampled By YOURSELVES

STANDARD LABORATORIES, INC.
PO BOX 606
WHITESBURG, KY 41858

SAMPLE ID:

MEADE & SHEPHERD COAL COMPANY
HC 84, BOX 1404
WHITESBURG
KENTUCKY 41858

P.N. 867-0298
POND #2
ROXANNA

WATER REPORT

pH	7.88	
TOTAL ALKALINITY,(AS CACO3 EQUIVALENT	282.00	MG/L
TOTAL ACIDITY, (AS CACO3 EQUIVALENT)	0.00	MG/L
TOTAL SUSPENDED SOLIDS	11	MG/L
TOTAL IRON	0.22	MG/L
TOTAL MANGANESE	<0.01	MG/L

FOR YOUR PROTECTION THIS DOCUMENT HAS BEEN PRINTED ON CONTROLLED PAPER STOCK. NOT VALID IF ALTERED.

Respectfully Submitted, Terry York

Lab. No. 96725

Date Rec'd. 09/09/93

Date Sampled 09/09/93

Sampled By YOURSELVES

STANDARD LABORATORIES, INC.
PO BOX 606
WHITESBURG, KY 41858

SAMPLE ID:

MEADE & SHEPHERD COAL COMPANY
HC 84, BOX 1404
WHITESBURG
KENTUCKY 41858

P.N. 867-0298
POND #2
ROXANNA

WATER REPORT

pH	7.83	
TOTAL ALKALINITY,(AS CACO3 EQUIVALENT	260.00	MG/L
TOTAL ACIDITY, (AS CACO3 EQUIVALENT)	0.00	MG/L
TOTAL SUSPENDED SOLIDS	12	MG/L
TOTAL IRON	0.33	MG/L
TOTAL MANGANESE	<0.01	MG/L

FOR YOUR PROTECTION THIS DOCUMENT HAS BEEN PRINTED ON CONTROLLED PAPER STOCK. NOT VALID IF ALTERED.

Respectfully Submitted, Terry York

Lab. No. 96726

Date Rec'd. 09/23/93

Date Sampled 09/23/93

Sampled By YOURSELVES

STANDARD LABORATORIES, INC.
PO BOX 606
WHITESBURG, KY 41858

SAMPLE ID:

MEADE & SHEPHERD COAL COMPANY
HC 84, BOX 1404
WHITESBURG
KENTUCKY 41858

P.N. 867-0298
POND #2
ROXANNA

WATER REPORT

pH	7.81
TOTAL ALKALINITY,(AS CACO3 EQUIVALENT	250.00 MG/L
TOTAL ACIDITY, (AS CACO3 EQUIVALENT)	0.00 MG/L
TOTAL SUSPENDED SOLIDS	13 MG/L
TOTAL IRON	0.11 MG/L
TOTAL MANGANESE	<0.01 MG/L

FOR YOUR PROTECTION THIS DOCUMENT HAS BEEN PRINTED ON CONTROLLED PAPER STOCK. NOT VALID IF ALTERED.

Respectfully Submitted, Terry York

Lab. No. 96727

Date Rec'd. 10/28/93

Date Sampled 10/28/93

Sampled By YOURSELVES

STANDARD LABORATORIES, INC.
PO BOX 606
WHITESBURG, KY 41858

SAMPLE ID:

MEADE & SHEPHERD COAL COMPANY
HC 84, BOX 1404
WHITESBURG
KENTUCKY 41858

P.N. 867-0298
POND #2
ROXANNA

WATER REPORT

pH	7.99	
TOTAL ALKALINITY,(AS CACO3 EQUIVALENT	320.00	MG/L
TOTAL ACIDITY, (AS CACO3 EQUIVALENT)	0.00	MG/L
TOTAL SUSPENDED SOLIDS	14	MG/L
TOTAL IRON	0.22	MG/L
TOTAL MANGANESE	<0.01	MG/L

FOR YOUR PROTECTION THIS DOCUMENT HAS BEEN PRINTED ON CONTROLLED PAPER STOCK. NOT VALID IF ALTERED.

Respectfully Submitted, Terry York

Lab. No. 96728

Date Rec'd. 10/28/93

Date Sampled 10/28/93

Sampled By YOURSELVES

STANDARD LABORATORIES, INC.
PO BOX 606
WHITESBURG, KY 41858

SAMPLE ID:

MEADE & SHEPHERD COAL COMPANY
HC 84, BOX 1404
WHITESBURG
KENTUCKY 41858

P.N. 867-0298
G.W.

WATER REPORT

pH	7.98
TOTAL ALKALINITY,(AS CACO3 EQUIVALENT	264.00 MG/L
TOTAL ACIDITY, (AS CACO3 EQUIVALENT)	0.00 MG/L
TOTAL DISSOLVED SOLIDS	144 MG/L
TOTAL SULFATE	56.39 MG/L
DISSOLVED IRON	0.12 MG/L
DISSOLVED MANGANESE	0.02 MG/L

FOR YOUR PROTECTION THIS DOCUMENT HAS BEEN PRINTED ON CONTROLLED PAPER STOCK. NOT VALID IF ALTERED.

Respectfully Submitted, Terry York

WATER QUALITY DATA ENTRY FORMS: Part 1

Type of Report:
[ ] Premining
[ ] During Mining/Reclamation
[ ] Other

STATION INFORMATION

PERMIT #: 867-0298 STATION #: GW SOAP PERMITTEE #: _____

*COUNTY #: _____ *BASIN #: _____ QUAD NAME: _____

STATION TYPE (check): [01] Spring [04] Well
[02] Stream [05] Sediment Pond/Influent
[03] Lake [06] Sediment Pond/Discharge

FOR WELLS ONLY

DEPTH (ft): _____ CASING DIAMETER (in): _____ AQUIFER DESCRIPTION: _____
TOP OF AQUIFER (MSL): _____ AQUIFER THICKNESS (ft): _____ TOP OF WELL ELEVATION (MSL): _____

WATERSHED DESCRIPTION: _____ DRAINAGE AREA (acres): _____

LATITUDE (DMS): _____ LONGITUDE (DMS): _____

UTM ZONE: _____ 16 West of 84° Longitude 17 East of 84° Longitude UTM EASTING: _____ UTM NORTHING: _____

LOCAL STREAM NAME: _____

COAL COMPANY NAME: Meade & Shepherd Coal Co.

COLLECTING FIRM NAME: Meade & Shepherd Coal Co.

ANALYZING FIRM NAME: Standard Labs Inc.

COMMENTS: _____

* Refer to Coding Instructions for list of codes.

4014.pdf

SAMPLE DATA

PERMIT # 867-0298 STATION # GW

Sample No. [ ]

PARAMETER	DATE MM/DD/YY	TEMP(F)	DISCHARGE (cfs)	CONDUCTIVITY (umhos)	pH, (Std. Units)	ACIDITY mg/l	ALKALINITY mg/l	TSS mg/l	TDS mg/l	SETT. SOLIDS ml/l
VALUE	9-16-94				6.87	0	110		132	

PARAMETER	SO_4 DISS. mg/l	O_2 DISS. mg/l	Fe, Diss. mg/l	Fe, Total mg/l	Mn, Diss. mg/l	Mn, Total mg/l	Depth to Water/ft.			
VALUE	9.88		0.05		0.18					

COMMENT:

Sample No. [ ]

PARAMETER	DATE MM/DD/YY	TEMP(F)	DISCHARGE (cfs)	CONDUCTIVITY (umhos)	pH, (Std. Units)	ACIDITY mg/l	ALKALINITY mg/l	TSS mg/l	TDS mg/l	SETT. SOLIDS ml/l
VALUE										

PARAMETER	SO_4 DISS. mg/l	O_2 DISS. mg/l	Fe, Diss. mg/l	Fe, Total mg/l	Mn, Diss. mg/l	Mn, Total mg/l	Depth to Water/ft.			
VALUE										

COMMENT:

Sample No. [ ]

PARAMETER	DATE MM/DD/YY	TEMP(F)	DISCHARGE (cfs)	CONDUCTIVITY (umhos)	pH, (Std. Units)	ACIDITY mg/l	ALKALINITY mg/l	TSS mg/l	TDS mg/l	SETT. SOLIDS ml/l
VALUE										

PARAMETER	SO_4 DISS. mg/l	O_2 DISS. mg/l	Fe, Diss. mg/l	Fe, Total mg/l	Mn, Diss. mg/l	Mn, Total mg/l	Depth to Water/ft.			
VALUE										

Lab. No. 4014

Date Rec'd 09/16/94

Date Sampled 09/16/94

Sampled By YOURSELVES

STANDARD LABORATORIES, INC.
BOX 606
WHITESBURG, KY 41858

SAMPLE ID:

MEADE & SHEPHERD COAL COMPANY
HC 84, BOX 1104
WHITESBURG, KY 41858

ROXANA
PN 867-0298
GW

WATER REPORT

pH	6.87
TOTAL ALKALINITY, (AS CACO3 EQUIVALENT	110 MG/L
TOTAL ACIDITY, (AS CACO3 EQUIVALENT)	0 MG/L
TOTAL DISSOLVED SOLIDS	132 MG/L
TOTAL SULFATE	9.88 MG/L
DISSOLVED IRON	0.05 MG/L
DISSOLVED MANGANESE	0.18 MG/L

FOR YOUR PROTECTION THIS DOCUMENT HAS BEEN PRINTED ON CONTROLLED PAPER STOCK. NOT VALID IF ALTERED.

Respectfully Submitted,

DeLane Thomas

WATER QUALITY DATA ENTRY FORMS: Part 1

Type of Report:
[ ] Premining
[ ] During Mining/Reclamation
[ ] Other

STATION INFORMATION

PERMIT #: 867-0298 STATION #: GW SOAP PERMITTEE #: _____

*COUNTY #: _____ *BASIN #: _____ QUAD NAME: _____

STATION TYPE (check): [01] Spring [04] Well
[02] Stream [05] Sediment Pond/Influent
[03] Lake [06] Sediment Pond/Discharge

FOR WELLS ONLY

DEPTH (ft): _____ CASING DIAMETER (in): _____ AQUIFER DESCRIPTION: _____
TOP OF AQUIFER (MSL): _____ AQUIFER THICKNESS (ft): _____ TOP OF WELL ELEVATION (MSL): _____

WATERSHED DESCRIPTION: _____ DRAINAGE AREA (acres): _____

LATITUDE (DMS): _____ LONGITUDE (DMS): _____

UTM ZONE: _____ 16 West of 84° Longitude 17 East of 84° Longitude UTM EASTING: _____ UTM NORTHING: _____

LOCAL STREAM NAME: _____

COAL COMPANY NAME: Meade & Shepherd Coal Co.

COLLECTING FIRM NAME: Meade & Shepherd Coal Co.

ANALYZING FIRM NAME: Standard Labs Inc.

COMMENTS: _____

* Refer to Coding Instructions for list of codes.

4015.pdf

SAMPLE DATA

PERMIT # 867-0298 STATION # GW

Sample No. [ ]

PARAMETER	DATE MM/DD/YY	TEMP(F)	DISCHARGE (cfs)	CONDUCTIVITY (umhos)	pH, (Std. Units)	ACIDITY mg/l	ALKALINITY mg/l	TSS mg/l	TDS mg/l	SETT. SOLIDS ml/l
VALUE	9-16-94				6.75	0	114		116	

PARAMETER	SO_4 DISS. mg/l	O_2 DISS. mg/l	Fe, Diss. mg/l	Fe, Total mg/l	Mn, Diss. mg/l	Mn, Total mg/l	Depth to Water/ft.			
VALUE	139.53		0.11		0.13					

COMMENT:

Sample No. [ ]

PARAMETER	DATE MM/DD/YY	TEMP(F)	DISCHARGE (cfs)	CONDUCTIVITY (umhos)	pH, (Std. Units)	ACIDITY mg/l	ALKALINITY mg/l	TSS mg/l	TDS mg/l	SETT. SOLIDS ml/l
VALUE										

PARAMETER	SO_4 DISS. mg/l	O_2 DISS. mg/l	Fe, Diss. mg/l	Fe, Total mg/l	Mn, Diss. mg/l	Mn, Total mg/l	Depth to Water/ft.			
VALUE										

COMMENT:

Sample No. [ ]

PARAMETER	DATE MM/DD/YY	TEMP(F)	DISCHARGE (cfs)	CONDUCTIVITY (umhos)	pH, (Std. Units)	ACIDITY mg/l	ALKALINITY mg/l	TSS mg/l	TDS mg/l	SETT. SOLIDS ml/l
VALUE										

PARAMETER	SO_4 DISS. mg/l	O_2 DISS. mg/l	Fe, Diss. mg/l	Fe, Total mg/l	Mn, Diss. mg/l	Mn, Total mg/l	Depth to Water/ft.			
VALUE										

Lab. No. 4015

Date Rec'd 09/16/94

Date Sampled 09/16/94

Sampled By YOURSELVES

STANDARD LABORATORIES, INC.
BOX 606
WHITESBURG, KY 41858

SAMPLE ID:

MEADE & SHEPHERD COAL COMPANY
HC 84, BOX 1404
WHITESBURG, KY 41858

ROXANA
PN 867-0298
GW

WATER REPORT

pH	6.75
TOTAL ALKALINITY, (AS CACO3 EQUIVALENT	114 MG/L
TOTAL ACIDITY, (AS CACO3 EQUIVALENT)	0 MG/L
TOTAL DISSOLVED SOLIDS	116 MG/L
TOTAL SULFATE	139.53 MG/L
DISSOLVED IRON	0.11 MG/L
DISSOLVED MANGANESE	0.13 MG/L

FOR YOUR PROTECTION THIS DOCUMENT HAS BEEN PRINTED ON CONTROLLED PAPER STOCK. NOT VALID IF ALTERED.

Respectfully Submitted,

Delano Hogg, V.P.

ATER QUALITY DATA ENTRY FORMS: Part 1

Type of Report:
[ ] Premining
[ ] During Mining/Reclamation
[ ] Other

STATION INFORMATION

ERMIT #: 867-0298 STATION #: GW SOAP PERMITTEE #: _____

COUNTY #: _____ *BASIN #: _____ QUAD NAME: _____

TATION TYPE (check): [01] Spring [04] Well
[02] Stream [05] Sediment Pond/Influent
[03] Lake [06] Sediment Pond/Discharge

OR WELLS ONLY

EPTH (ft): _____ CASING DIAMETER (in): _____ AQUIFER DESCRIPTION: _____
OP OF AQUIFER (MSL): _____ AQUIFER THICKNESS (ft): _____ TOP OF WELL ELEVATION (MSL): _____

ATERSHED DESCRIPTION: _____ DRAINAGE AREA (acres): _____

ATITUDE (DMS): _____ LONGITUDE (DMS): _____

TM ZONE: _____ 16 West of 84° Longitude UTM EASTING: _____ UTM NORTHING: _____
17 East of 84° Longitude

LOCAL STREAM NAME: _____

COAL COMPANY NAME: Meade & Shepherd Coal Co.

COLLECTING FIRM NAME: Meade & Shepherd Coal Co.

ANALYZING FIRM NAME: Standard Labs Inc.

COMMENTS: _____

* Refer to Coding Instructions for list of codes.

4017.pdf

SAMPLE DATA

PERMIT # 867-0298 STATION # GW

Sample No. [ ]

PARAMETER	DATE MM/DD/YY	TEMP(F)	DISCHARGE (cfs)	CONDUCTIVITY (umhos)	pH, (Std. Units)	ACIDITY mg/l	ALKALINITY mg/l	TSS mg/l	TDS mg/l	SETT. SOLIDS ml/l
VALUE	9-16-94				6.95	0	126		128	

PARAMETER	SO_4 DISS. mg/l	O_2 DISS. mg/l	Fe, Diss. mg/l	Fe, Total mg/l	Mn, Diss. mg/l	Mn, Total mg/l	Depth to Water/ft.			
VALUE	156.00		0.05		0.12					

COMMENT:

Sample No. [ ]

PARAMETER	DATE MM/DD/YY	TEMP(F)	DISCHARGE (cfs)	CONDUCTIVITY (umhos)	pH, (Std. Units)	ACIDITY mg/l	ALKALINITY mg/l	TSS mg/l	TDS mg/l	SETT. SOLIDS ml/l
VALUE										

PARAMETER	SO_4 DISS. mg/l	O_2 DISS. mg/l	Fe, Diss. mg/l	Fe, Total mg/l	Mn, Diss. mg/l	Mn, Total mg/l	Depth to Water/ft.			
VALUE										

COMMENT:

Sample No. [ ]

PARAMETER	DATE MM/DD/YY	TEMP(F)	DISCHARGE (cfs)	CONDUCTIVITY (umhos)	pH, (Std. Units)	ACIDITY mg/l	ALKALINITY mg/l	TSS mg/l	TDS mg/l	SETT. SOLIDS ml/l
VALUE										

PARAMETER	SO_4 DISS. mg/l	O_2 DISS. mg/l	Fe, Diss. mg/l	Fe, Total mg/l	Mn, Diss. mg/l	Mn, Total mg/l	Depth to Water/ft.			
VALUE										

Lab. No. 4017

Date Rec'd 09/16/94

Date Sampled 09/16/94

Sampled By YOURSELVES

STANDARD LABORATORIES, INC.
BOX 606
WHITESBURG, KY 41858

SAMPLE ID:

MEADE & SHEPHERD COAL COMPANY
HC 84, BOX 1104
WHITESBURG, KY 41858

ROXANA
PN 867-0298
GW

WATER REPORT

pH	6.95
TOTAL ALKALINITY, (AS CACO3 EQUIVALENT	120 MG/L
TOTAL ACIDITY, (AS CACO3 EQUIVALENT)	0 MG/L
TOTAL DISSOLVED SOLIDS	128 MG/L
TOTAL SULFATE	156.00 MG/L
DISSOLVED IRON	0.05 MG/L
DISSOLVED MANGANESE	0.12 MG/L

FOR YOUR PROTECTION THIS DOCUMENT HAS BEEN PRINTED ON CONTROLLED PAPER STOCK. NOT VALID IF ALTERED.

Respectfully Submitted,

WATER QUALITY DATA ENTRY FORMS: Part 1

Type of Report:
[ ] Premining
[ ] During Mining/Reclamation
[ ] Other

STATION INFORMATION

PERMIT #: 867-0298 STATION #: Stream SOAP PERMITTEE #: _____

*COUNTY #: _____ *BASIN #: _____ QUAD NAME: _____

STATION TYPE (check): [01] Spring [04] Well
[02] Stream [05] Sediment Pond/Influent
[03] Lake [06] Sediment Pond/Discharge

FOR WELLS ONLY

DEPTH (ft): _____ CASING DIAMETER (in): _____ AQUIFER DESCRIPTION: _____
TOP OF AQUIFER (MSL): _____ AQUIFER THICKNESS (ft): _____ TOP OF WELL ELEVATION (MSL): _____

WATERSHED DESCRIPTION: _____ DRAINAGE AREA (acres): _____

LATITUDE (DMS): _____ LONGITUDE (DMS): _____

UTM ZONE: _____ 16 West of 84° Longitude 17 East of 84° Longitude UTM EASTING: _____ UTM NORTHING: _____

LOCAL STREAM NAME: _____

COAL COMPANY NAME: Meade & Shepherd Coal Co.

COLLECTING FIRM NAME: Meade & Shepherd Coal Co.

ANALYZING FIRM NAME: Standard Labs Inc.

COMMENTS: _____

* Refer to Coding Instructions for list of codes.

4020.pdf

SAMPLE DATA

PERMIT # 867-0298 STATION # Stream

Sample No. [ ]

PARAMETER	DATE MM/DD/YY	TEMP(F)	DISCHARGE (cfs)	CONDUCTIVITY (umhos)	pH, (Std. Units)	ACIDITY mg/l	ALKALINITY mg/l	TSS mg/l	TDS mg/l	SETT. SOLIDS ml/l
VALUE	9-16-94			0.160	6.81	0	114	30	92	

PARAMETER	SO_4 DISS. mg/l	O_2 DISS. mg/l	Fe, Diss. mg/l	Fe, Total mg/l	Mn, Diss. mg/l	Mn, Total mg/l	Depth to Water/ft.			
VALUE	88.49			0.69		0.09				

COMMENT:

Sample No. [ ]

PARAMETER	DATE MM/DD/YY	TEMP(F)	DISCHARGE (cfs)	CONDUCTIVITY (umhos)	pH, (Std. Units)	ACIDITY mg/l	ALKALINITY mg/l	TSS mg/l	TDS mg/l	SETT. SOLIDS ml/l
VALUE										

PARAMETER	SO_4 DISS. mg/l	O_2 DISS. mg/l	Fe, Diss. mg/l	Fe, Total mg/l	Mn, Diss. mg/l	Mn, Total mg/l	Depth to Water/ft.			
VALUE										

COMMENT:

Sample No. [ ]

PARAMETER	DATE MM/DD/YY	TEMP(F)	DISCHARGE (cfs)	CONDUCTIVITY (umhos)	pH, (Std. Units)	ACIDITY mg/l	ALKALINITY mg/l	TSS mg/l	TDS mg/l	SETT. SOLIDS ml/l
VALUE										

PARAMETER	SO_4 DISS. mg/l	O_2 DISS. mg/l	Fe, Diss. mg/l	Fe, Total mg/l	Mn, Diss. mg/l	Mn, Total mg/l	Depth to Water/ft.			
VALUE										

Lab. No. 4020

Date Rec'd 09/16/94

Date Sampled 09/16/94

Sampled By YOURSELVES

STANDARD LABORATORIES, INC.
PO BOX 606
WHITESBURG, KY 41858

SAMPLE ID:

HEADE & SHEPHERD COAL COMPANY
HC 84, BOX 1404
WHITESBURG, KY 41858

ROXANA
PN 867-0298
STREAM

WATER REPORT

pH	6.81	
TOTAL ALKALINITY,(AS CACO3 EQUIVALENT	114	MG/L
TOTAL ACIDITY, (AS CACO3 EQUIVALENT)	0	MG/L
TOTAL SUSPENDED SOLIDS	30	MG/L
TOTAL IRON	0.69	MG/L
TOTAL MANGANESE	0.09	MG/L
TOTAL DISSOLVED SOLIDS	92	MG/L
TOTAL SULFATE	88.49	MG/L
SPECIFIC CONDUCTANCE	0.160	MICROMHOS/CM

FOR YOUR PROTECTION THIS DOCUMENT HAS BEEN PRINTED ON CONTROLLED PAPER STOCK. NOT VALID IF ALTERED.

Respectfully Submitted,

WATER QUALITY DATA ENTRY FORMS: Part 1

Type of Report:
[ ] Premining
[ ] During Mining/Reclamation
[ ] Other

STATION INFORMATION

PERMIT #: 867-0298 STATION #: Stream SOAP PERMITTEE #: _____

*COUNTY #: _____ *BASIN #: _____ QUAD NAME: _____

STATION TYPE (check): [01] Spring [04] Well
[02] Stream [05] Sediment Pond/Influent
[03] Lake [06] Sediment Pond/Discharge

FOR WELLS ONLY

DEPTH (ft): _____ CASING DIAMETER (in): _____ AQUIFER DESCRIPTION: _____
TOP OF AQUIFER (MSL): _____ AQUIFER THICKNESS (ft): _____ TOP OF WELL ELEVATION (MSL): _____

WATERSHED DESCRIPTION: _____ DRAINAGE AREA (acres): _____

LATITUDE (DMS): _____ LONGITUDE (DMS): _____

UTM ZONE: _____ 16 West of 84° Longitude 17 East of 84° Longitude UTM EASTING: _____ UTM NORTHING: _____

LOCAL STREAM NAME: _____

COAL COMPANY NAME: Meade & Shepherd Coal Co.

COLLECTING FIRM NAME: Meade & Shepherd Coal Co.

ANALYZING FIRM NAME: Standard Labs Inc.

COMMENTS: _____

* Refer to Coding Instructions for list of codes.

4023.pdf

SAMPLE DATA

PERMIT # 867-0298 STATION # Stream

Sample No. [ ]

PARAMETER	DATE MM/DD/YY	TEMP(F)	DISCHARGE (cfs)	CONDUCTIVITY (umhos)	pH, (Std. Units)	ACIDITY mg/l	ALKALINITY mg/l	TSS mg/l	TDS mg/l	SETT. SOLIDS ml/l
VALUE	9-16-94			0.128	7.00	0	106	50	250	

PARAMETER	SO_4 DISS. mg/l	O_2 DISS. mg/l	Fe, Diss. mg/l	Fe, Total mg/l	Mn, Diss. mg/l	Mn, Total mg/l	Depth to Water/ft.			
VALUE	108.25			0.64		0.10				

COMMENT:

Sample No. [ ]

PARAMETER	DATE MM/DD/YY	TEMP(F)	DISCHARGE (cfs)	CONDUCTIVITY (umhos)	pH, (Std. Units)	ACIDITY mg/l	ALKALINITY mg/l	TSS mg/l	TDS mg/l	SETT. SOLIDS ml/l
VALUE										

PARAMETER	SO_4 DISS. mg/l	O_2 DISS. mg/l	Fe, Diss. mg/l	Fe, Total mg/l	Mn, Diss. mg/l	Mn, Total mg/l	Depth to Water/ft.			
VALUE										

COMMENT:

Sample No. [ ]

PARAMETER	DATE MM/DD/YY	TEMP(F)	DISCHARGE (cfs)	CONDUCTIVITY (umhos)	pH, (Std. Units)	ACIDITY mg/l	ALKALINITY mg/l	TSS mg/l	TDS mg/l	SETT. SOLIDS ml/l
VALUE										

PARAMETER	SO_4 DISS. mg/l	O_2 DISS. mg/l	Fe, Diss. mg/l	Fe, Total mg/l	Mn, Diss. mg/l	Mn, Total mg/l	Depth to Water/ft.			
VALUE										

Lab. No. 4023

Date Rec'd 09/16/94

Date Sampled 09/16/94

Sampled By YOURSELVES

STANDARD LABORATORIES, INC.
PO BOX 606
WHITESBURG, KY 41858

SAMPLE ID:

MEADE & SHEPHERD COAL COMPANY
HC 84, BOX 1404
WHITESBURG, KY 41858

ROXANA
PN 867-0298
STREAM

WATER REPORT

pH	7.00	
TOTAL ALKALINITY,(AS CACO3 EQUIVALENT	106	MG/L
TOTAL ACIDITY, (AS CACO3 EQUIVALENT)	0	MG/L
TOTAL SUSPENDED SOLIDS	50	MG/L
TOTAL IRON	0.64	MG/L
TOTAL MANGANESE	0.10	MG/L
TOTAL DISSOLVED SOLIDS	250	MG/L
TOTAL SULFATE	108.25	MG/L
SPECIFIC CONDUCTANCE	.128	MICROMHOS/CM

FOR YOUR PROTECTION THIS DOCUMENT HAS BEEN PRINTED ON CONTROLLED PAPER STOCK. NOT VALID IF ALTERED.

Respectfully Submitted,

ATER QUALITY DATA ENTRY FORMS: Part 1

Type of Report:
[ ] Premining
[ ] During Mining/Reclamation
[ ] Other

STATION INFORMATION

ERMIT #: 867-0298 STATION #: Stream SOAP PERMITTEE #: _____

COUNTY #: _____ *BASIN #: _____ QUAD NAME: _____

STATION TYPE (check): [01] Spring [04] Well
[02] Stream [05] Sediment Pond/Influent
[03] Lake [06] Sediment Pond/Discharge

FOR WELLS ONLY

DEPTH (ft): _____ CASING DIAMETER (in): _____ AQUIFER DESCRIPTION: _____
TOP OF AQUIFER (MSL): _____ AQUIFER THICKNESS (ft): _____ TOP OF WELL ELEVATION (MSL): _____

WATERSHED DESCRIPTION: _____ DRAINAGE AREA (acres): _____

LATITUDE (DMS): _____ LONGITUDE (DMS): _____

UTM ZONE: _____ 16 West of 84° Longitude 17 East of 84° Longitude UTM EASTING: _____ UTM NORTHING: _____

LOCAL STREAM NAME: _____

COAL COMPANY NAME: Meade & Shepherd Coal Co.

COLLECTING FIRM NAME: Meade & Shepherd Coal Co.

ANALYZING FIRM NAME: Standard Labs Inc.

COMMENTS: _____

* Refer to Coding Instructions for list of codes.

4024.pdf

SAMPLE DATA

PERMIT # 867-0298 STATION # Stream

Sample No. [ ]

PARAMETER	DATE MM/DD/YY	TEMP(F)	DISCHARGE (cfs)	CONDUCTIVITY (umhos)	pH, (Std. Units)	ACIDITY mg/l	ALKALINITY mg/l	TSS mg/l	TDS mg/l	SETT. SOLIDS ml/l
VALUE	9-16-94			0.154	6.70	0	116	70	80	

PARAMETER	SO_4 DISS. mg/l	O_2 DISS. mg/l	Fe, Diss. mg/l	Fe, Total mg/l	Mn, Diss. mg/l	Mn, Total mg/l	Depth to Water/ft.			
VALUE	122.66			0.57		0.07				

COMMENT:

Sample No. [ ]

PARAMETER	DATE MM/DD/YY	TEMP(F)	DISCHARGE (cfs)	CONDUCTIVITY (umhos)	pH, (Std. Units)	ACIDITY mg/l	ALKALINITY mg/l	TSS mg/l	TDS mg/l	SETT. SOLIDS ml/l
VALUE										

PARAMETER	SO_4 DISS. mg/l	O_2 DISS. mg/l	Fe, Diss. mg/l	Fe, Total mg/l	Mn, Diss. mg/l	Mn, Total mg/l	Depth to Water/ft.			
VALUE										

COMMENT:

Sample No. [ ]

PARAMETER	DATE MM/DD/YY	TEMP(F)	DISCHARGE (cfs)	CONDUCTIVITY (umhos)	pH, (Std. Units)	ACIDITY mg/l	ALKALINITY mg/l	TSS mg/l	TDS mg/l	SETT. SOLIDS ml/l
VALUE										

PARAMETER	SO_4 DISS. mg/l	O_2 DISS. mg/l	Fe, Diss. mg/l	Fe, Total mg/l	Mn, Diss. mg/l	Mn, Total mg/l	Depth to Water/ft.			
VALUE										

Lab. No. 4024

Date Rec'd 09/16/94

Date Sampled 09/16/94

Sampled By YOURSELVES

STANDARD LABORATORIES, INC.
PO BOX 606
WHITESBURG, KY 41858

SAMPLE ID:

MEADE & SHEPHERD COAL COMPANY
HC 84, BOX 1404
WHITESBURG, KY 41858

ROXANA
PN 867-0298
STREAM

WATER REPORT

pH	6.70
TOTAL ALKALINITY,(AS CACO3 EQUIVALENT	116 MG/L
TOTAL ACIDITY, (AS CACO3 EQUIVALENT)	0 MG/L
TOTAL SUSPENDED SOLIDS	70 MG/L
TOTAL IRON	0.57 MG/L
TOTAL MANGANESE	0.07 MG/L
TOTAL DISSOLVED SOLIDS	80 MG/L
TOTAL SULFATE	122.66 MG/L
SPECIFIC CONDUCTANCE	0.154 MICROMHOS/CM

FOR YOUR PROTECTION THIS DOCUMENT HAS BEEN PRINTED ON CONTROLLED PAPER STOCK. NOT VALID IF ALTERED.

Respectfully Submitted,

Lab. No. 4203

Date Rec'd 09/28/94

Date Sampled

Sampled By YOURSELVES

STANDARD LABORATORIES, INC.
PO BOX 606
WHITESBURG, KY 41858

SAMPLE ID:

MEADE & SHEPHERD COAL COMPANY
HC 84, BOX 1404
WHITESBURG, KY 41858

ROXANA - STREAM
PN #867-0298

WATER REPORT

pH	6.43	
TOTAL ALKALINITY,(AS CACO3 EQUIVALENT	116	MG/L
TOTAL ACIDITY, (AS CACO3 EQUIVALENT)	0	MG/L
TOTAL SUSPENDED SOLIDS	12	MG/L
TOTAL IRON	0.57	MG/L
TOTAL MANGANESE	0.08	MG/L
TOTAL DISSOLVED SOLIDS	158	MG/L
TOTAL SULFATE	4.94	MG/L
SPECIFIC CONDUCTANCE	0.686	MICROMHOS/CM

FOR YOUR PROTECTION THIS DOCUMENT HAS BEEN PRINTED ON CONTROLLED PAPER STOCK. NOT VALID IF ALTERED.

Respectfully Submitted,

Delano Thomas, VP

WATER QUALITY DATA ENTRY FORMS: Part 1

Type of Report:
[ ] Premining
[ ] During Mining/Reclamation
[ ] Other

STATION INFORMATION

PERMIT #: 867-0298 STATION #: Stream SOAP PERMITTEE #: _____

*COUNTY #: _____ *BASIN #: _____ QUAD NAME: _____

STATION TYPE (check): [01] Spring [02] Stream [03] Lake [04] Well [05] Sediment Pond/Influent [06] Sediment Pond/Discharge

FOR WELLS ONLY

DEPTH (ft): _____ CASING DIAMETER (in): _____ AQUIFER DESCRIPTION: _____

TOP OF AQUIFER (MSL): _____ AQUIFER THICKNESS (ft): _____ TOP OF WELL ELEVATION (MSL): _____

WATERSHED DESCRIPTION: _____ DRAINAGE AREA (acres): _____

LATITUDE (DMS): _____ LONGITUDE (DMS): _____

UTM ZONE: _____ 16 West of 84° Longitude 17 East of 84° Longitude UTM EASTING: _____ UTM NORTHING: _____

LOCAL STREAM NAME: _____

COAL COMPANY NAME: Meade + Shepherd Coal Co.

COLLECTING FIRM NAME: Meade + Shepherd Coal Co.

ANALYZING FIRM NAME: Standard Labs. Inc.

COMMENTS: _____

* Refer to Coding Instructions for list of codes.

4204.pdf

SAMPLE DATA

PERMIT # 867-0298 STATION # Stream

Sample No. [ ]

PARAMETER	DATE MM/DD/YY	TEMP(F)	DISCHARGE (cfs)	CONDUCTIVITY (umhos)	pH, (Std. Units)	ACIDITY mg/l	ALKALINITY mg/l	TSS mg/l	TDS mg/l	SETT. SOLIDS ml/l
VALUE	9-28-94			0.697	6.34	0	124	20	160	

PARAMETER	SO_4 DISS. mg/l	O_2 DISS. mg/l	Fe, Diss. mg/l	Fe, Total mg/l	Mn, Diss. mg/l	Mn, Total mg/l	Depth to Water/ft.			
VALUE	4.94			0.77		0.34				

COMMENT:

Sample No. [ ]

PARAMETER	DATE MM/DD/YY	TEMP(F)	DISCHARGE (cfs)	CONDUCTIVITY (umhos)	pH, (Std. Units)	ACIDITY mg/l	ALKALINITY mg/l	TSS mg/l	TDS mg/l	SETT. SOLIDS ml/l
VALUE										

PARAMETER	SO_4 DISS. mg/l	O_2 DISS. mg/l	Fe, Diss. mg/l	Fe, Total mg/l	Mn, Diss. mg/l	Mn, Total mg/l	Depth to Water/ft.			
VALUE										

COMMENT:

Sample No. [ ]

PARAMETER	DATE MM/DD/YY	TEMP(F)	DISCHARGE (cfs)	CONDUCTIVITY (umhos)	pH, (Std. Units)	ACIDITY mg/l	ALKALINITY mg/l	TSS mg/l	TDS mg/l	SETT. SOLIDS ml/l
VALUE										

PARAMETER	SO_4 DISS. mg/l	O_2 DISS. mg/l	Fe, Diss. mg/l	Fe, Total mg/l	Mn, Diss. mg/l	Mn, Total mg/l	Depth to Water/ft.			
VALUE										

Lab. No. 4204

Date Rec'd 09/28/94

Date Sampled

Sampled By YOURSELVES

STANDARD LABORATORIES, INC.

PO BOX 606
WHITESBURG, KY 41858

SAMPLE ID:

HEADE & SHEPHERD COAL COMPANY
HC 84, BOX 1404
WHITESBURG, KY 41858

ROXANA - STREAM
PN #867-0298

WATER REPORT

pH	6.34
TOTAL ALKALINITY, (AS CACO3 EQUIVALENT	124 MG/L
TOTAL ACIDITY, (AS CACO3 EQUIVALENT)	0 MG/L
TOTAL SUSPENDED SOLIDS	20 MG/L
TOTAL IRON	0.77 MG/L
TOTAL MANGANESE	0.34 MG/L
TOTAL DISSOLVED SOLIDS	160 MG/L
TOTAL SULFATE	4.94 MG/L
SPECIFIC CONDUCTANCE	0.697 MICROMHOS/CM

FOR YOUR PROTECTION THIS DOCUMENT HAS BEEN PRINTED ON CONTROLLED PAPER STOCK. NOT VALID IF ALTERED.

Respectfully Submitted,

DeLano Thomas

WATER QUALITY DATA ENTRY FORMS: Part 1

Type of Report:
[ ] Premining
[ ] During Mining/Reclamation
[ ] Other

STATION INFORMATION

PERMIT #: 867-0298 STATION #: Stream SOAP PERMITTEE #: _____

*COUNTY #: _____ *BASIN #: _____ QUAD NAME: _____

STATION TYPE (check): [01] Spring [04] Well
[02] Stream [05] Sediment Pond/Influent
[03] Lake [06] Sediment Pond/Discharge

FOR WELLS ONLY

DEPTH (ft): _____ CASING DIAMETER (in): _____ AQUIFER DESCRIPTION: _____
TOP OF AQUIFER (MSL): _____ AQUIFER THICKNESS (ft): _____ TOP OF WELL ELEVATION (MSL): _____

WATERSHED DESCRIPTION: _____ DRAINAGE AREA (acres): _____

LATITUDE (DMS): _____ LONGITUDE (DMS): _____

UTM ZONE: _____ 16 West of 84° Longitude 17 East of 84° Longitude UTM EASTING: _____ UTM NORTHING: _____

LOCAL STREAM NAME: _____

COAL COMPANY NAME: Meade & Shepherd Coal Co.

COLLECTING FIRM NAME: Meade & Shepherd Coal Co.

ANALYZING FIRM NAME: Standard Labs Inc.

COMMENTS: _____

* Refer to Coding Instructions for list of codes.

4205.pdf

SAMPLE DATA

PERMIT # 867-0298 STATION # Stream

Sample No. [ ]

PARAMETER	DATE MM/DD/YY	TEMP(F)	DISCHARGE (cfs)	CONDUCTIVITY (umhos)	pH, (Std. Units)	ACIDITY mg/l	ALKALINITY mg/l	TSS mg/l	TDS mg/l	SETT. SOLIDS ml/l
VALUE	9-28-94			0.678	6.42	0	103	8	162	

PARAMETER	SO_4 DISS. mg/l	O_2 DISS. mg/l	Fe, Diss. mg/l	Fe, Total mg/l	Mn, Diss. mg/l	Mn, Total mg/l	Depth to Water/ft.			
VALUE	3.29			0.60		0.17				

COMMENT:

Sample No. [ ]

PARAMETER	DATE MM/DD/YY	TEMP(F)	DISCHARGE (cfs)	CONDUCTIVITY (umhos)	pH, (Std. Units)	ACIDITY mg/l	ALKALINITY mg/l	TSS mg/l	TDS mg/l	SETT. SOLIDS ml/l
VALUE										

PARAMETER	SO_4 DISS. mg/l	O_2 DISS. mg/l	Fe, Diss. mg/l	Fe, Total mg/l	Mn, Diss. mg/l	Mn, Total mg/l	Depth to Water/ft.			
VALUE										

COMMENT:

Sample No. [ ]

PARAMETER	DATE MM/DD/YY	TEMP(F)	DISCHARGE (cfs)	CONDUCTIVITY (umhos)	pH, (Std. Units)	ACIDITY mg/l	ALKALINITY mg/l	TSS mg/l	TDS mg/l	SETT. SOLIDS ml/l
VALUE										

PARAMETER	SO_4 DISS. mg/l	O_2 DISS. mg/l	Fe, Diss. mg/l	Fe, Total mg/l	Mn, Diss. mg/l	Mn, Total mg/l	Depth to Water/ft.			
VALUE										

Lab. No. 4205

Date Rec'd 09/28/94

Date Sampled

Sampled By YOURSELVES

STANDARD LABORATORIES, INC.

PO BOX 606
WHITESBURG, KY 41858

SAMPLE ID:

MEADE & SHEPHERD COAL COMPANY
HC 84, BOX 1404
WHITESBURG, KY 41858

ROXANA - STREAM
PN #867-0298

WATER REPORT

pH	6.42
TOTAL ALKALINITY,(AS CACO3 EQUIVALENT	103 MG/L
TOTAL ACIDITY, (AS CACO3 EQUIVALENT)	0 MG/L
TOTAL SUSPENDED SOLIDS	8 MG/L
TOTAL IRON	0.60 MG/L
TOTAL MANGANESE	0.17 MG/L
TOTAL DISSOLVED SOLIDS	162 MG/L
TOTAL SULFATE	3.29 MG/L
SPECIFIC CONDUCTANCE	0.678 MICROMHOS/CM

FOR YOUR PROTECTION THIS DOCUMENT HAS BEEN PRINTED ON CONTROLLED PAPER STOCK. NOT VALID IF ALTERED.

Respectfully Submitted,

Delano Thomas

WATER QUALITY DATA ENTRY FORMS: Part 1

Type of Report:
[ ] Premining
[ ] During Mining/Reclamation
[ ] Other

STATION INFORMATION

PERMIT #: 867-0298 STATION #: GW SOAP PERMITTEE #: _____

*COUNTY #: _____ *BASIN #: _____ QUAD NAME: _____

STATION TYPE (check): [01] Spring [04] Well
[02] Stream [05] Sediment Pond/Influent
[03] Lake [06] Sediment Pond/Discharge

FOR WELLS ONLY

DEPTH (ft): _____ CASING DIAMETER (in): _____ AQUIFER DESCRIPTION: _____
TOP OF AQUIFER (MSL): _____ AQUIFER THICKNESS (ft): _____ TOP OF WELL ELEVATION (MSL): _____

WATERSHED DESCRIPTION: _____ DRAINAGE AREA (acres): _____

LATITUDE (DMS): _____ LONGITUDE (DMS): _____

UTM ZONE: _____ 16 West of 84° Longitude 17 East of 84° Longitude UTM EASTING: _____ UTM NORTHING: _____

LOCAL STREAM NAME: _____

COAL COMPANY NAME: Meade & Shepherd Coal Co.

COLLECTING FIRM NAME: Meade & Shepherd Coal Co.

ANALYZING FIRM NAME: Standard Lab Inc.

COMMENTS: _____

* Refer to Coding Instructions for list of codes.

4209.pdf

SAMPLE DATA

PERMIT # 867-0298 STATION # GW

Sample No. [ ]

PARAMETER	DATE MM/DD/YY	TEMP(F)	DISCHARGE (cfs)	CONDUCTIVITY (umhos)	pH, (Std. Units)	ACIDITY mg/l	ALKALINITY mg/l	TSS mg/l	TDS mg/l	SETT. SOLIDS ml/l
VALUE	9-28-94				6.75	0	118		124	

PARAMETER	SO_4 DISS. mg/l	O_2 DISS. mg/l	Fe, Diss. mg/l	Fe, Total mg/l	Mn, Diss. mg/l	Mn, Total mg/l	Depth to Water/ft.			
VALUE	5.76		0.16		0.20					

COMMENT:

Sample No. [ ]

PARAMETER	DATE MM/DD/YY	TEMP(F)	DISCHARGE (cfs)	CONDUCTIVITY (umhos)	pH, (Std. Units)	ACIDITY mg/l	ALKALINITY mg/l	TSS mg/l	TDS mg/l	SETT. SOLIDS ml/l
VALUE										

PARAMETER	SO_4 DISS. mg/l	O_2 DISS. mg/l	Fe, Diss. mg/l	Fe, Total mg/l	Mn, Diss. mg/l	Mn, Total mg/l	Depth to Water/ft.			
VALUE										

COMMENT:

Sample No. [ ]

PARAMETER	DATE MM/DD/YY	TEMP(F)	DISCHARGE (cfs)	CONDUCTIVITY (umhos)	pH, (Std. Units)	ACIDITY mg/l	ALKALINITY mg/l	TSS mg/l	TDS mg/l	SETT. SOLIDS ml/l
VALUE										

PARAMETER	SO_4 DISS. mg/l	O_2 DISS. mg/l	Fe, Diss. mg/l	Fe, Total mg/l	Mn, Diss. mg/l	Mn, Total mg/l	Depth to Water/ft.			
VALUE										

Lab. No. 4209

Date Rec'd 09/28/94

Date Sampled

Sampled By YOURSELVES

STANDARD LABORATORIES, INC.
PO BOX 606
WHITESBURG, KY 41858

SAMPLE ID:

MEADE & SHEPHERD COAL COMPANY
HC 84, BOX 1404
WHITESBURG, KY 41858

ROXANA - GROUND WATER
PN #867-0298

WATER REPORT

pH	6.75
TOTAL ALKALINITY, (AS CACO3 EQUIVALENT	118 MG/L
TOTAL ACIDITY, (AS CACO3 EQUIVALENT)	0 MG/L
TOTAL DISSOLVED SOLIDS	124 MG/L
TOTAL SULFATE	5.76 MG/L
DISSOLVED IRON	0.16 MG/L
DISSOLVED MANGANESE	0.20 MG/L

FOR YOUR PROTECTION THIS DOCUMENT HAS BEEN PRINTED ON CONTROLLED PAPER STOCK. NOT VALID IF ALTERED.

Respectfully Submitted,

Orlando Thomas

ATER QUALITY DATA ENTRY FORMS: Part 1

Type of Report:
[ ] Premining
[ ] During Mining/Reclamation
[ ] Other

STATION INFORMATION

ERMIT #: 867-0298 STATION #: GW SOAP PERMITTEE #: _____

COUNTY #: _____ *BASIN #: _____ QUAD NAME: _____

TATION TYPE (check): [01] Spring [04] Well
[02] Stream [05] Sediment Pond/Influent
[03] Lake [06] Sediment Pond/Discharge

OR WELLS ONLY

EPTH (ft): _____ CASING DIAMETER (in): _____ AQUIFER DESCRIPTION: _____

OP OF AQUIFER (MSL): _____ AQUIFER THICKNESS (ft): _____ TOP OF WELL ELEVATION (MSL): _____

WATERSHED DESCRIPTION: _____ DRAINAGE AREA (acres): _____

LATITUDE (DMS): _____ LONGITUDE (DMS): _____

UTM ZONE: _____ 16 West of 84° Longitude 17 East of 84° Longitude UTM EASTING: _____ UTM NORTHING: _____

LOCAL STREAM NAME: _____

COAL COMPANY NAME: Meade & Shepherd Coal Co.

COLLECTING FIRM NAME: Meade & Shepherd Coal Co.

ANALYZING FIRM NAME: Standard Labs Inc.

COMMENTS: _____

* Refer to Coding Instructions for list of codes.

4210.pdf

SAMPLE DATA

PERMIT # 867-0298 STATION # GW

Sample No. [ ]

PARAMETER	DATE MM/DD/YY	TEMP(F)	DISCHARGE (cfs)	CONDUCTIVITY (umhos)	pH, (Std. Units)	ACIDITY mg/l	ALKALINITY mg/l	TSS mg/l	TDS mg/l	SETT. SOLIDS ml/l
VALUE	9-28-94				6.52	0	104		148	

PARAMETER	SO_4 DISS. mg/l	O_2 DISS. mg/l	Fe, Diss. mg/l	Fe, Total mg/l	Mn, Diss. mg/l	Mn, Total mg/l	Depth to Water/ft.			
VALUE	32.93		0.25		0.14					

COMMENT:

Sample No. [ ]

PARAMETER	DATE MM/DD/YY	TEMP(F)	DISCHARGE (cfs)	CONDUCTIVITY (umhos)	pH, (Std. Units)	ACIDITY mg/l	ALKALINITY mg/l	TSS mg/l	TDS mg/l	SETT. SOLIDS ml/l
VALUE										

PARAMETER	SO_4 DISS. mg/l	O_2 DISS. mg/l	Fe, Diss. mg/l	Fe, Total mg/l	Mn, Diss. mg/l	Mn, Total mg/l	Depth to Water/ft.			
VALUE										

COMMENT:

Sample No. [ ]

PARAMETER	DATE MM/DD/YY	TEMP(F)	DISCHARGE (cfs)	CONDUCTIVITY (umhos)	pH, (Std. Units)	ACIDITY mg/l	ALKALINITY mg/l	TSS mg/l	TDS mg/l	SETT. SOLIDS ml/l
VALUE										

PARAMETER	SO_4 DISS. mg/l	O_2 DISS. mg/l	Fe, Diss. mg/l	Fe, Total mg/l	Mn, Diss. mg/l	Mn, Total mg/l	Depth to Water/ft.			
VALUE										

Lab. No. 4210

Date Rec'd 09/28/94

Date Sampled

Sampled By YOURSELVES

STANDARD LABORATORIES, INC.
PO BOX 606
WHITESBURG, KY 41858

SAMPLE ID:

MEADE & SHEPHERD COAL COMPANY
HC 84, BOX 1404
WHITESBURG, KY 41858

ROXANA - GROUND WATER
PN #867-0298

WATER REPORT

pH	6.52
TOTAL ALKALINITY,(AS CACO3 EQUIVALENT	104 MG/L
TOTAL ACIDITY, (AS CACO3 EQUIVALENT)	0. MG/L
TOTAL DISSOLVED SOLIDS	148 MG/L
TOTAL SULFATE	32.93 MG/L
DISSOLVED IRON	0.25 MG/L
DISSOLVED MANGANESE	0.14 MG/L

FOR YOUR PROTECTION THIS DOCUMENT HAS BEEN PRINTED ON CONTROLLED PAPER STOCK. NOT VALID IF ALTERED.

Respectfully Submitted, Delano Thomas

Delano Thomas, VP

WATER QUALITY DATA ENTRY FORMS: Part 1

Type of Report:
[ ] Premining
[ ] During Mining/Reclamation
[ ] Other

STATION INFORMATION

PERMIT #: 867-0298 STATION #: 6W SOAP PERMITTEE #: _____

*COUNTY #: _____ *BASIN #: _____ QUAD NAME: _____

STATION TYPE (check): [01] Spring [04] Well
[02] Stream [05] Sediment Pond/Influent
[03] Lake [06] Sediment Pond/Discharge

FOR WELLS ONLY

DEPTH (ft): _____ CASING DIAMETER (in): _____ AQUIFER DESCRIPTION: _____
TOP OF AQUIFER (MSL): _____ AQUIFER THICKNESS (ft): _____ TOP OF WELL ELEVATION (MSL): _____

WATERSHED DESCRIPTION: _____ DRAINAGE AREA (acres): _____

LATITUDE (DMS): _____ LONGITUDE (DMS): _____

UTM ZONE: _____ 16 West of 84° Longitude 17 East of 84° Longitude UTM EASTING: _____ UTM NORTHING: _____

LOCAL STREAM NAME: _____

COAL COMPANY NAME: Meade & Shepherd Coal Co.

COLLECTING FIRM NAME: Meade & Shepherd Coal Co.

ANALYZING FIRM NAME: Standard Labs Inc.

COMMENTS: _____

* Refer to Coding Instructions for list of codes.

4211.pdf

SAMPLE DATA

PERMIT # 867-0298 STATION # GW

Sample No. [ ]

PARAMETER	DATE MM/DD/YY	TEMP(F)	DISCHARGE (cfs)	CONDUCTIVITY (umhos)	pH, (Std. Units)	ACIDITY mg/l	ALKALINITY mg/l	TSS mg/l	TDS mg/l	SETT. SOLIDS ml/l
VALUE	9-28-94				6.56	0	118		68	

PARAMETER	SO_4 DISS. mg/l	O_2 DISS. mg/l	Fe, Diss. mg/l	Fe, Total mg/l	Mn, Diss. mg/l	Mn, Total mg/l	Depth to Water/ft.			
VALUE	17.29		0.43		0.25					

COMMENT:

Sample No. [ ]

PARAMETER	DATE MM/DD/YY	TEMP(F)	DISCHARGE (cfs)	CONDUCTIVITY (umhos)	pH, (Std. Units)	ACIDITY mg/l	ALKALINITY mg/l	TSS mg/l	TDS mg/l	SETT. SOLIDS ml/l
VALUE										

PARAMETER	SO_4 DISS. mg/l	O_2 DISS. mg/l	Fe, Diss. mg/l	Fe, Total mg/l	Mn, Diss. mg/l	Mn, Total mg/l	Depth to Water/ft.			
VALUE										

COMMENT:

Sample No. [ ]

PARAMETER	DATE MM/DD/YY	TEMP(F)	DISCHARGE (cfs)	CONDUCTIVITY (umhos)	pH, (Std. Units)	ACIDITY mg/l	ALKALINITY mg/l	TSS mg/l	TDS mg/l	SETT. SOLIDS ml/l
VALUE										

PARAMETER	SO_4 DISS. mg/l	O_2 DISS. mg/l	Fe, Diss. mg/l	Fe, Total mg/l	Mn, Diss. mg/l	Mn, Total mg/l	Depth to Water/ft.			
VALUE										

Lab. No. 4211

Date Rec'd 09/28/94

Date Sampled

Sampled By YOURSELVES

STANDARD LABORATORIES, INC.
PO BOX 606
WHITESBURG, KY 41858

SAMPLE ID:

MEADE & SHEPHERD COAL COMPANY
HC 84, BOX 1404
WHITESBURG, KY 41858

ROXANA - GROUND WATER
PN #867-0298

WATER REPORT

pH	6.56
TOTAL ALKALINITY,(AS CACO3 EQUIVALENT	118 MG/L
TOTAL ACIDITY, (AS CACO3 EQUIVALENT)	0 MG/L
TOTAL DISSOLVED SOLIDS	68 MG/L
TOTAL SULFATE	17.29 MG/L
DISSOLVED IRON	0.43 MG/L
DISSOLVED MANGANESE	0.25 MG/L

FOR YOUR PROTECTION THIS DOCUMENT HAS BEEN PRINTED ON CONTROLLED PAPER STOCK. NOT VALID IF ALTERED.

Respectfully Submitted,

Delano Thomas, VP

Lab. No. 5753

Date Rec'd. 1/10/95

Date Sampled 12/31/94

Sampled By YOURSELVES

STANDARD LABORATORIES, INC.
PO BOX 606
WHITESBURG, KY 41858

SAMPLE ID:

MEADE & SHEPHERD COAL COMPANY
HC 84, BOX 1404
WHITESBURG, KY 41858

LETCHER
P.N. #867-0298

WATER REPORT

pH	7.86	
TOTAL ALKALINITY,(AS CACO3 EQUIVALENT)	220.00	MG/L
TOTAL ACIDITY, (AS CACO3 EQUIVALENT)	0.00	MG/L
TOTAL SUSPENDED SOLIDS	8	MG/L
TOTAL IRON	0.65	MG/L
TOTAL MANGANESE	0.05	MG/L
TOTAL DISSOLVED SOLIDS	1321	MG/L
TOTAL SULFATE	811.65	MG/L
SPECIFIC CONDUCTANCE	1.559	MICROMHOS/CM

FOR YOUR PROTECTION THIS DOCUMENT HAS BEEN PRINTED ON CONTROLLED PAPER STOCK. NOT VALID IF ALTERED.

Respectfully Submitted,

Delano Thomas, VP

Lab. No. 5754

Date Rec'd 01/10/95

Date Sampled 12/31/94

Sampled By YOURSELVES

STANDARD LABORATORIES, INC.
PO BOX 606
WHITESBURG, KY 41858

MEADE & SHEPHERD COAL COMPANY
HC 84, BOX 1404
WHITESBURG, KY 41858

SAMPLE ID:
LETCHER
P.N. #867-0298

WATER REPORT

pH	7.85
TOTAL ALKALINITY,(AS CACO3 EQUIVALENT)	200.00 MG/L
TOTAL ACIDITY, (AS CACO3 EQUIVALENT)	0.00 MG/L
TOTAL SUSPENDED SOLIDS	7 MG/L
TOTAL IRON	0.54 MG/L
TOTAL MANGANESE	0.01 MG/L
TOTAL DISSOLVED SOLIDS	1221 MG/L
TOTAL SULFATE	812.50 MG/L
SPECIFIC CONDUCTANCE	1.581 MICROMHOS/CM

FOR YOUR PROTECTION THIS DOCUMENT HAS BEEN PRINTED ON CONTROLLED PAPER STOCK. NOT VALID IF ALTERED.

Respectfully Submitted,

Delano Thomas, VP

Lab. No. 5755

Date Rec'd. 1/10/95

Date Sampled 12/31/94

Sampled By YOURSELVES

STANDARD LABORATORIES, INC.
PO BOX 606
WHITESBURG, KY 41858

SAMPLE ID:

MEADE & SHEPHERD COAL COMPANY
HC 84, BOX 1404
WHITESBURG, KY 41858

LETCHER
P.N. #867-0298

WATER REPORT

pH	7.89	
TOTAL ALKALINITY,(AS CACO3 EQUIVALENT)	226.00	MG/L
TOTAL ACIDITY, (AS CACO3 EQUIVALENT)	0.00	MG/L
TOTAL SUSPENDED SOLIDS	11	MG/L
TOTAL IRON	0.70	MG/L
TOTAL MANGANESE	0.02	MG/L
TOTAL DISSOLVED SOLIDS	1310	MG/L
TOTAL SULFATE	829.37	MG/L
SPECIFIC CONDUCTANCE	1.544	MICROMHOS/CM

FOR YOUR PROTECTION THIS DOCUMENT HAS BEEN PRINTED ON CONTROLLED PAPER STOCK. NOT VALID IF ALTERED.

Respectfully Submitted,

Delano Thomas, VP

STANDARD LABORATORIES, INC.

PO BOX 606
WHITESBURG, KY 41858

Lab. No. 5759

Date Rec'd. 1/10/95

Date Sampled 12/31/94

Sampled By YOURSELVES

SAMPLE ID:

MEADE & SHEPHERD COAL COMPANY
HC 84, BOX 1404
WHITESBURG, KY 41858

LETCHER
P.N. #867-0298

WATER REPORT

pH	6.80
TOTAL ALKALINITY,(AS CACO3 EQUIVALENT)	66.00 MG/L
TOTAL ACIDITY, (AS CACO3 EQUIVALENT)	0.00 MG/L
TOTAL DISSOLVED SOLIDS	75 MG/L
DISSOLVED IRON	1.46 MG/L
DISSOLVED MANGANESE	0.04 MG/L
TOTAL SULFATE	51.45 MG/L

FOR YOUR PROTECTION THIS DOCUMENT HAS BEEN PRINTED ON CONTROLLED PAPER STOCK. NOT VALID IF ALTERED.

Respectfully Submitted,

Delano Thomas, VP

Lab. No. 5760

Date Rec'd. 1/10/95

Date Sampled 12/31/94

Sampled By YOURSELVES

STANDARD LABORATORIES, INC.
PO BOX 606
WHITESBURG, KY 41858

SAMPLE ID:

MEADE & SHEPHERD COAL COMPANY
HC 84, BOX 1404
WHITESBURG, KY 41858

LETCHER
P.N. #867-0298

WATER REPORT

pH	6.68
TOTAL ALKALINITY,(AS CACO3 EQUIVALENT)	94.00 MG/L
TOTAL ACIDITY, (AS CACO3 EQUIVALENT)	0.00 MG/L
TOTAL DISSOLVED SOLIDS	108 MG/L
DISSOLVED IRON	0.24 MG/L
DISSOLVED MANGANESE	0.02 MG/L
TOTAL SULFATE	34.16 MG/L

FOR YOUR PROTECTION THIS DOCUMENT HAS BEEN PRINTED ON CONTROLLED PAPER STOCK. NOT VALID IF ALTERED.

Respectfully Submitted,

Delano Thomas, VP

Lab. No. 5761

Date Rec'd. 1/10/95

Date Sampled 12/31/94

Sampled By YOURSELVES

STANDARD LABORATORIES, INC.

PO BOX 606
WHITESBURG, KY 41858

SAMPLE ID:

MEADE & SHEPHERD COAL COMPANY
HC 84, BOX 1404
WHITESBURG, KY 41858

LETCHER
P.N. #867-0298

WATER REPORT

pH	6.72
TOTAL ALKALINITY,(AS CACO3 EQUIVALENT)	84.00 MG/L
TOTAL ACIDITY, (AS CACO3 EQUIVALENT)	0.00 MG/L
TOTAL DISSOLVED SOLIDS	102 MG/L
DISSOLVED IRON	0.70 MG/L
DISSOLVED MANGANESE	<0.01 MG/L
TOTAL SULFATE	36.22 MG/L

FOR YOUR PROTECTION THIS DOCUMENT HAS BEEN PRINTED ON CONTROLLED PAPER STOCK. NOT VALID IF ALTERED.

Respectfully Submitted,

Delano Thomas, VP

QUALITY DATA ENTRY FORMS: Part 1

Type of Report:
[ ] Premining
[ ] During Mining/Reclamation
[ ] Other

STATION INFORMATION

IT #: January 867-0298 STATION #: Stream SOAP PERMITTEE #:

NTY #: *BASIN #: QUAD NAME:

TION TYPE (check): [01] Spring [02] Stream [03] Lake [04] Well [05] Sediment Pond/Influent [06] Sediment Pond/Discharge

WELLS ONLY

TH (ft): CASING DIAMETER (in): AQUIFER DESCRIPTION: TOP OF WELL ELEVATION (MSL):

OF AQUIFER (MSL): AQUIFER THICKNESS (ft):

DRAINAGE AREA (acres):

ERSHED DESCRIPTION:

LONGITUDE (DMS):

TITUDE (DMS): UTM EASTING: UTM NORTHING:

H ZONE: 16 West of 84° Longitude 17 East of 84° Longitude

CAL STREAM NAME:

AL COMPANY NAME: Meade + Shepherd

OLLECTING FIRM NAME: Meade + Shepherd

ALYZING FIRM NAME: Standard Labs, Inc.

OMMENTS:

STREAM ANALYSIS

COMPANY	PERMIT #	STATION #	SAMPLE #	DATE
Meade/Shepherd	867-0298	SW	7707	6/25/95
pH	ALKALINITY mg/l	ACIDITY mg/l	TSS mg/l	IRON mg/l
7.57	224	0	11	0.46
MN mg/l	TDS mg/l	SO4 mg/l	SP. COND (umhos)	FIELD pH
0.04	996	526.85	0.556	
TEMP (c)	FLOW gal. per day			

STANDARD LABORATORIES, INC.

Lab No. 7707

Date Rec'd. 05/24/95

Date Sampled 03/31/95

Sampled By YOURSELVES

PO BOX 606
WHITESBURG, KY 41858

SAMPLE ID:

MEADE & SHEPHERD COAL COMPANY
HC 84, BOX 1404
WHITESBURG, KY 41858

ROXANA
867-0298
JANUARY

WATER REPORT

pH	7.57
TOTAL ALKALINITY,(AS CACO3 EQUIVALENT)	224.00 MG/L
TOTAL ACIDITY, (AS CACO3 EQUIVALENT)	0.00 MG/L
TOTAL SUSPENDED SOLIDS	11 MG/L
TOTAL IRON	0.46 MG/L
TOTAL MANGANESE	0.04 MG/L
TOTAL DISSOLVED SOLIDS	996 MG/L
TOTAL SULFATE	526.85 MG/L
SPECIFIC CONDUCTANCE	0.556 MICROMHOS/CM

FOR YOUR PROTECTION THIS DOCUMENT HAS BEEN PRINTED ON CONTROLLED PAPER STOCK. NOT VALID IF ALTERED.

Respectfully Submitted,

DELANO THOMAS, VP

QUALITY DATA ENTRY FORMS: Part 1

Type of Report:
[ ] Premining
[ ] During Mining/Reclamation
[ ] Other

STATION INFORMATION

LT #: February 867-0298

STATION #: Stream

SOAP PERMITTEE #:

NTY #:

*BASIN #:

QUAD NAME:

ION TYPE (check): [01] Spring [02] Stream [03] Lake [04] Well [05] Sediment Pond/Influent [06] Sediment Pond/Discharge

WELLS ONLY

PTH (ft):

CASING DIAMETER (in):

AQUIFER DESCRIPTION:

TOP OF WELL ELEVATION (MSL):

OF AQUIFER (MSL):

AQUIFER THICKNESS (ft):

DRAINAGE AREA (acres):

ERSHED DESCRIPTION:

LONGITUDE (DMS):

ITUDE (DMS):

UTM NORTHING:

UTM EASTING:

N ZONE:

16 West of 84° Longitude
17 East of 84° Longitude

CAL STREAM NAME:

AL COMPANY NAME: Meade + Shepherd

OLLECTING FIRM NAME: Meade + Shepherd

NALYZING FIRM NAME: Standard Labs, Inc.

OMMENTS:

STREAM ANALYSIS

COMPANY	PERMIT #	STATION #	SAMPLE #	DATE
Meade/Shepherd	867-0298	SW	7708	3/31/95
pH	ALKALINITY mg/l	ACIDITY mg/l	TSS mg/l	IRON mg/l
7.5	234	0	9	0.35
MN mg/l	TDS mg/l	SO4 mg/l	SP. COND (umhos)	FIELD pH
0.06	1058	622.75	0.427	
TEMP (c)	FLOW gal. per day			

WATER QUALITY DATA FORMS: PART 2

STANDARD LABORATORIES, INC.

Lab No. 7708

Date Rec'd. 05/24/95

Date Sampled 03/31/95

Sampled By YOURSELVES

PO BOX 606
WHITESBURG, KY 41858

SAMPLE ID:

MEADE & SHEPHERD COAL COMPANY
HC 84, BOX 1404
WHITESBURG, KY 41858

ROXANA
867-0298
FEBRUARY

WATER REPORT

pH	7.50	
TOTAL ALKALINITY,(AS CACO3 EQUIVALENT)	234.00	MG/L
TOTAL ACIDITY, (AS CACO3 EQUIVALENT)	0.00	MG/L
TOTAL SUSPENDED SOLIDS	9	MG/L
TOTAL IRON	0.35	MG/L
TOTAL MANGANESE	0.06	MG/L
TOTAL DISSOLVED SOLIDS	1058	MG/L
TOTAL SULFATE	622.75	MG/L
SPECIFIC CONDUCTANCE	0.427	MICROMHOS/CM

FOR YOUR PROTECTION THIS DOCUMENT HAS BEEN PRINTED ON CONTROLLED PAPER STOCK. NOT VALID IF ALTERED.

Respectfully Submitted,

DELANO THOMAS, VP

QUALITY DATA ENTRY FORMS: Part 1

Type of Report:
[ ] Premining
[ ] During Mining/Reclamation
[ ] Other

STATION INFORMATION

IT #: March 867-0298 STATION #: Stream SOAP PERMITTEE #:

NTY #: *BASIN #: QUAD NAME:

ION TYPE (check): [01] Spring [02] Stream [03] Lake [04] Well [05] Sediment Pond/Influent [06] Sediment Pond/Discharge

WELLS ONLY

TH (ft): CASING DIAMETER (in): AQUIFER DESCRIPTION: TOP OF WELL ELEVATION (MSL):

OF AQUIFER (MSL): AQUIFER THICKNESS (ft):

ERSHED DESCRIPTION: DRAINAGE AREA (acres):

ITUDE (DMS): LONGITUDE (DMS):

UTM EASTING: UTM NORTHING:

ZONE: 16 West of 84° Longitude 17 East of 84° Longitude

CAL STREAM NAME:

AL COMPANY NAME: Meade + Shepherd

OLLECTING FIRM NAME: Meade + Shepherd

NALYZING FIRM NAME: Standard Kalis, Inc.

OMMENTS:

STREAM ANALYSIS

COMPANY	PERMIT #	STATION #	SAMPLE #	DATE
Meade/Shepherd	867-0298	SW	7709	3/31/95
pH	ALKALINITY mg/l	ACIDITY mg/l	TSS mg/l	IRON mg/l
7.52	226	0	7	0.35
MN mg/l	TDS mg/l	SO4 mg/l	SP. COND (umhos)	FIELD pH
0.06	988	603.41	0.397	
TEMP (c)	FLOW gal. per day			

WATER QUALITY DATA FORMS: PART 2

STANDARD LABORATORIES, INC.

Lab No. 7709

Date Rec'd. 05/24/95

Date Sampled 03/31/95

Sampled By YOURSELVES

PO BOX 606
WHITESBURG, KY 41858

SAMPLE ID:

MEADE & SHEPHERD COAL COMPANY
HC 84, BOX 1404
WHITESBURG, KY 41858

ROXANA
867-0298
MARCH

WATER REPORT

pH	7.52
TOTAL ALKALINITY,(AS CACO3 EQUIVALENT)	226.00 MG/L
TOTAL ACIDITY, (AS CACO3 EQUIVALENT)	0.00 MG/L
TOTAL SUSPENDED SOLIDS	7 MG/L
TOTAL IRON	0.35 MG/L
TOTAL MANGANESE	0.06 MG/L
TOTAL DISSOLVED SOLIDS	988 MG/L
TOTAL SULFATE	603.41 MG/L
SPECIFIC CONDUCTANCE	0.397 MICROMHOS/CM

FOR YOUR PROTECTION THIS DOCUMENT HAS BEEN PRINTED ON CONTROLLED PAPER STOCK. NOT VALID IF ALTERED.

Respectfully Submitted,

DELANO THOMAS, VP

QUALITY DATA ENTRY FORMS: Part 1

Type of Report:
[ ] Premining
[ ] During Mining/Reclamation
[ ] Other

STATION INFORMATION

IT #: April 867-0298 STATION #: Stream SOAP PERMITTEE #:

NTY #: *BASIN #: QUAD NAME:

ION TYPE (check): [01] Spring [02] Stream [03] Lake [04] Well [05] Sediment Pond/Influent [06] Sediment Pond/Discharge

WELLS ONLY

PTH (ft): CASING DIAMETER (in): AQUIFER DESCRIPTION: TOP OF WELL ELEVATION (MSL):

OF AQUIFER (MSL): AQUIFER THICKNESS (ft):

ERSHED DESCRIPTION: DRAINAGE AREA (acres):

ITUDE (DMS): LONGITUDE (DMS):

I ZONE: 16 West of 84° Longitude 17 East of 84° Longitude UTM EASTING: UTM NORTHING:

CAL STREAM NAME:

AL COMPANY NAME: Meade + Shepherd

OLLECTING FIRM NAME: Meade + Shepherd

NALYZING FIRM NAME: Standard Labs, Inc.

OMMENTS:

STREAM ANALYSIS

COMPANY	PERMIT #	STATION #	SAMPLE #	DATE
Meade/Shepherd	867-0298	SW	7710	6/25/95
pH	ALKALINITY mg/l	ACIDITY mg/l	TSS mg/l	IRON mg/l
7.95	222	0	7	0.27
MN mg/l	TDS mg/l	SO4 mg/l	SP. COND (umhos)	FIELD pH
0.05	954	629.34	0.397	
TEMP (c)	FLOW gal. per day			

WATER QUALITY DATA FORMS: PART 2

STANDARD LABORATORIES, INC.

Lab No. 7710

Date Rec'd. 05/24/95

Date Sampled 05/24/95

Sampled By YOURSELVES

PO BOX 606
WHITESBURG, KY 41858

SAMPLE ID:

MEADE & SHEPHERD COAL COMPANY
HC 84, BOX 1404
WHITESBURG, KY 41858

ROXANNE
867-0298
APRIL

WATER REPORT

pH	7.95	
TOTAL ALKALINITY,(AS CACO3 EQUIVALENT)	222.00	MG/L
TOTAL ACIDITY, (AS CACO3 EQUIVALENT)	0.00	MG/L
TOTAL SUSPENDED SOLIDS	7	MG/L
TOTAL IRON	0.27	MG/L
TOTAL MANGANESE	0.05	MG/L
TOTAL DISSOLVED SOLIDS	954	MG/L
TOTAL SULFATE	629.34	MG/L
SPECIFIC CONDUCTANCE	0.397	MICROMHOS/CM

FOR YOUR PROTECTION THIS DOCUMENT HAS BEEN PRINTED ON CONTROLLED PAPER STOCK. NOT VALID IF ALTERED.

Respectfully Submitted,

DELANO THOMAS, VP

QUALITY DATA ENTRY FORMS: Part 1

Type of Report:
[ ] Premining
[ ] During Mining/Reclamation
[ ] Other

STATION INFORMATION

IT #: May 867-0298 STATION #: Stream SOAP PERMITTEE #:

NTY #: *BASIN #: QUAD NAME:

ION TYPE (check): [01] Spring [02] Stream [03] Lake [04] Well [05] Sediment Pond/Influent [06] Sediment Pond/Discharge

WELLS ONLY

PTH (ft): CASING DIAMETER (in): AQUIFER DESCRIPTION: TOP OF WELL ELEVATION (MSL):

OF AQUIFER (MSL): AQUIFER THICKNESS (ft):

ERSHED DESCRIPTION: DRAINAGE AREA (acres):

ITUDE (DMS): LONGITUDE (DMS):

N ZONE: 16 West of 84° Longitude 17 East of 84° Longitude UTM EASTING: UTM NORTHING:

CAL STREAM NAME:

AL COMPANY NAME: Meade + Shepherd

OLLECTING FIRM NAME: Meade + Shepherd

NALYZING FIRM NAME: Standard Labs, Inc.

OMMENTS:

STREAM ANALYSIS

COMPANY	PERMIT #	STATION #	SAMPLE #	DATE
Meade/Shepherd	867-0298	SW	7711	6/25/95
pH	ALKALINITY mg/l	ACIDITY mg/l	TSS mg/l	IRON mg/l
7.44	226	0	12	0.34
MN mg/l	TDS mg/l	SO4 mg/l	SP. COND (umhos)	FIELD pH
0.05	1086	631.39	0.406	
TEMP (c)	FLOW gal. per day			

WATER QUALITY DATA FORMS: PART 2

STANDARD LABORATORIES, INC.

Lab No. 7711

Date Rec'd. 05/24/95

Date Sampled 05/24/95

Sampled By YOURSELVES

PO BOX 606
WHITESBURG, KY 41858

MEADE & SHEPHERD COAL COMPANY
HC 84, BOX 1404
WHITESBURG, KY 41858

SAMPLE ID:

ROXANNE
867-0298
MAY

WATER REPORT

pH	7.44
TOTAL ALKALINITY,(AS CACO3 EQUIVALENT)	226.00 MG/L
TOTAL ACIDITY, (AS CACO3 EQUIVALENT)	0.00 MG/L
TOTAL SUSPENDED SOLIDS	12 MG/L
TOTAL IRON	0.34 MG/L
TOTAL MANGANESE	0.05 MG/L
TOTAL DISSOLVED SOLIDS	1086 MG/L
TOTAL SULFATE	631.39 MG/L
SPECIFIC CONDUCTANCE	0.406 MICROMHOS/CM

FOR YOUR PROTECTION THIS DOCUMENT HAS BEEN PRINTED ON CONTROLLED PAPER STOCK. NOT VALID IF ALTERED.

Respectfully Submitted,

DELANO THOMAS, VP

QUALITY DATA ENTRY FORMS: Part 1

Type of Report:
[ ] Premining
[ ] During Mining/Reclamati
[ ] Other

STATION INFORMATION

IT #: June 867-0298 STATION #: Stream SOAP PERMITTEE #:

INTY #: *BASIN #: QUAD NAME:

TION TYPE (check): [01] Spring [02] Stream [03] Lake [04] Well [05] Sediment Pond/Influent [06] Sediment Pond/Discharge

WELLS ONLY

TH (ft): CASING DIAMETER (in): AQUIFER DESCRIPTION: TOP OF WELL ELEVATION (MSL):

OF AQUIFER (MSL): AQUIFER THICKNESS (ft):

DRAINAGE AREA (acres):

ERSHED DESCRIPTION:

LONGITUDE (DMS):

TITUDE (DMS):

UTM NORTHING:

H ZONE: 16 West of 84° Longitude 17 East of 84° Longitude UTM EASTING:

CAL STREAM NAME:

AL COMPANY NAME: Meade + Shepherd

OLLECTING FIRM NAME: Meade + Shepherd

NALYZING FIRM NAME: Standard Labs, Inc.

OMMENTS:

STREAM ANALYSIS

COMPANY	PERMIT #	STATION #	SAMPLE #	DATE
Meade/Shepherd	867-0298	SW	7712	6/25/95
pH	ALKALINITY mg/l	ACIDITY mg/l	TSS mg/l	IRON mg/l
7.55	224	0	10	0.23
MN mg/l	TDS mg/l	SO4 mg/l	SP. COND (umhos)	FIELD pH
0.08	1028	630.57	0.388	
TEMP (c)	FLOW gal. per day			

WATER QUALITY DATA FORMS: PART 2

STANDARD LABORATORIES, INC.

Lab No. 7712

Date Rec'd. 05/24/95

Date Sampled 05/24/95

Sampled By YOURSELVES

PO BOX 606
WHITESBURG, KY 41858

SAMPLE ID:

MEADE & SHEPHERD COAL COMPANY
HC 84, BOX 1404
WHITESBURG, KY 41858

ROXANNE
867-0298
JUNE

WATER REPORT

pH	7.55
TOTAL ALKALINITY,(AS CACO3 EQUIVALENT)	224.00 MG/L
TOTAL ACIDITY, (AS CACO3 EQUIVALENT)	0.00 MG/L
TOTAL SUSPENDED SOLIDS	10 MG/L
TOTAL IRON	0.23 MG/L
TOTAL MANGANESE	0.08 MG/L
TOTAL DISSOLVED SOLIDS	1028 MG/L
TOTAL SULFATE	630.57 MG/L
SPECIFIC CONDUCTANCE	0.388 MICROMHOS/CM

FOR YOUR PROTECTION THIS DOCUMENT HAS BEEN PRINTED ON CONTROLLED PAPER STOCK. NOT VALID IF ALTERED.

Respectfully Submitted,

DELANO THOMAS, VP

QUALITY DATA ENTRY FORMS: Part 1

Type of Report:
[ ] Premining
[ ] During Mining/Reclamation
[ ] Other

STATION INFORMATION

T #: January 867-0298 STATION #: Ground Water SOAP PERMITTEE #:

TY #: *BASIN #: QUAD NAME:

ION TYPE (check): [01] Spring [02] Stream [03] Lake [04] Well [05] Sediment Pond/Influent [06] Sediment Pond/Discharge

WELLS ONLY

H (ft): CASING DIAMETER (in): AQUIFER DESCRIPTION: TOP OF WELL ELEVATION (MSL):

OF AQUIFER (MSL): AQUIFER THICKNESS (ft):

DRAINAGE AREA (acres):

RSHED DESCRIPTION:

LONGITUDE (DMS):

TUDE (DMS): UTM EASTING: UTM NORTHING:

ZONE: 16 West of 84° Longitude 17 East of 84° Longitude

AL STREAM NAME:

L COMPANY NAME: Meade + Shepherd

LECTING FIRM NAME: Meade + Shepherd

ALYZING FIRM NAME: Standard Labs, Inc.

MENTS:

GROUNDWATER ANALYSIS

COMPANY	PERMIT #	STATION #	SAMPLE #	DATE
Meade/Shepherd	867-0298	GW	7719	3/31/95
pH	ALKALINITY mg/l	ACIDITY mg/l	TDS mg/l	SO4 mg/l
6.85	86	0	123	30.05
DISS. IRON mg/l	DISS MANG. mg/l	FIELD pH	TEMP (c)	Water depth (ft)
0.26	0.04			
Depth to water (ft)	Well depth (ft)			

STANDARD LABORATORIES, INC.

Lab No. 7719

Date Rec'd. 05/24/95

Date Sampled 03/31/95

Sampled By YOURSELVES

PO BOX 606
WHITESBURG, KY 41858

SAMPLE ID:

MEADE & SHEPHERD COAL COMPANY
HC 84, BOX 1404
WHITESBURG, KY 41858

ROXANNE
867-0298
JANUARY

WATER REPORT

pH	6.85
TOTAL ALKALINITY, (AS CACO3 EQUIVALENT)	86.00 MG/L
TOTAL ACIDITY, (AS CACO3 EQUIVALENT)	0.00 MG/L
TOTAL DISSOLVED SOLIDS	123 MG/L
DISSOLVED IRON	0.26 MG/L
DISSOLVED MANGANESE	0.04 MG/L
TOTAL SULFATE	30.05 MG/L

FOR YOUR PROTECTION THIS DOCUMENT HAS BEEN PRINTED ON CONTROLLED PAPER STOCK. NOT VALID IF ALTERED.

Respectfully Submitted,

DELANO THOMAS, VP

QUALITY DATA ENTRY FORMS: Part 1

Type of Report:
[ ] Premining
[ ] During Mining/Reclamation
[ ] Other

STATION INFORMATION

T #: February 867-0298 STATION #: Ground Water SOAP PERMITTEE #:

ITY #: *BASIN #: QUAD NAME:

ION TYPE (check): [01] Spring [04] Well
[02] Stream [05] Sediment Pond/Influent
[03] Lake [06] Sediment Pond/Discharge

WELLS ONLY

H (ft): CASING DIAMETER (in): AQUIFER DESCRIPTION: TOP OF WELL ELEVATION (MSL):

OF AQUIFER (MSL): AQUIFER THICKNESS (ft):

DRAINAGE AREA (acres):

ERSHED DESCRIPTION:

LONGITUDE (DMS):

ITUDE (DMS): UTM NORTHING:

UTM EASTING:

ZONE: 16 West of 84° Longitude
17 East of 84° Longitude

CAL STREAM NAME:

AL COMPANY NAME: Meade + Shepherd

LLECTING FIRM NAME: Meade + Shepherd

ALYZING FIRM NAME: Standard Labs, Inc.

MMENTS:

GROUNDWATER ANALYSIS

COMPANY	PERMIT #	STATION #	SAMPLE #	DATE
Meade/Shepherd	867-0298	GW	7720	3/31/95
pH	ALKALINITY mg/l	ACIDITY mg/l	TDS mg/l	SO4 mg/l
6.91	104	0	123	23.46
DISS. IRON mg/l	DISS MANG. mg/l	FIELD pH	TEMP (c)	Water depth (ft)
0.44	<0.01			
Depth to water (ft)	Well depth (ft)			

WATER QUALITY DATA FORMS: PART 2

STANDARD LABORATORIES, INC.

Lab No. 7720

Date Rec'd. 05/24/95

Date Sampled 03/31/95

Sampled By YOURSELVES

PO BOX 606
WHITESBURG, KY 41858

SAMPLE ID:

MEADE & SHEPHERD COAL COMPANY
HC 84, BOX 1404
WHITESBURG, KY 41858

ROXANNE
867-0298
FEBRUARY

WATER REPORT

pH	6.91
TOTAL ALKALINITY,(AS CACO3 EQUIVALENT)	104.00 MG/L
TOTAL ACIDITY, (AS CACO3 EQUIVALENT)	0.00 MG/L
TOTAL DISSOLVED SOLIDS	123 MG/L
DISSOLVED IRON	0.44 MG/L
DISSOLVED MANGANESE	<0.01 MG/L
TOTAL SULFATE	23.46 MG/L

FOR YOUR PROTECTION THIS DOCUMENT HAS BEEN PRINTED ON CONTROLLED PAPER STOCK. NOT VALID IF ALTERED.

Respectfully Submitted,

DELANO THOMAS, VP

QUALITY DATA ENTRY FORMS: Part 1

Type of Report:
[ ] Premining
[ ] During Mining/Reclamation
[ ] Other

STATION INFORMATION

.T #: March 867-0298 STATION #: Ground Water SOAP PERMITTEE #:

ITY #: *BASIN #: QUAD NAME:

ION TYPE (check): [01] Spring [02] Stream [03] Lake [04] Well [05] Sediment Pond/Influent [06] Sediment Pond/Discharge

WELLS ONLY

:H (ft): CASING DIAMETER (in): AQUIFER DESCRIPTION: TOP OF WELL ELEVATION (MSL):

OF AQUIFER (MSL): AQUIFER THICKNESS (ft):

ERSHED DESCRIPTION: DRAINAGE AREA (acres):

ITUDE (DMS): LONGITUDE (DMS):

ZONE: 16 West of 84° Longitude 17 East of 84° Longitude UTM EASTING: UTM NORTHING:

:AL STREAM NAME:

AL COMPANY NAME: Meade + Shepherd

LLECTING FIRM NAME: Meade + Shepherd

ALYZING FIRM NAME: Standard Labs, Inc.

MMENTS:

GROUNDWATER ANALYSIS

COMPANY	PERMIT #	STATION #	SAMPLE #	DATE
Meade/Shepherd	867-0298	GW	7721	3/31/95
pH	ALKALINITY mg/l	ACIDITY mg/l	TDS mg/l	SO4 mg/l
6.72	94	0	126	23.46
DISS. IRON mg/l	DISS MANG. mg/l	FIELD pH	TEMP (c)	Water depth (ft)
0.27	<0.01			
Depth to water (ft)	Well depth (ft)			

WATER QUALITY DATA FORMS: PART 2

STANDARD LABORATORIES, INC.

Lab No. 7721

Date Rec'd. 05/24/95

Date Sampled 03/31/95

Sampled By YOURSELVES

PO BOX 606
WHITESBURG, KY 41858

SAMPLE ID:

MEADE & SHEPHERD COAL COMPANY
HC 84, BOX 1404
WHITESBURG, KY 41858

ROXANNE
867-0298
MARCH

WATER REPORT

pH	6.72
TOTAL ALKALINITY,(AS CACO3 EQUIVALENT)	94.00 MG/L
TOTAL ACIDITY, (AS CACO3 EQUIVALENT)	0.00 MG/L
TOTAL DISSOLVED SOLIDS	126 MG/L
DISSOLVED IRON	0.27 MG/L
DISSOLVED MANGANESE	<0.01 MG/L
TOTAL SULFATE	23.46 MG/L

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Respectfully Submitted,

DELANO THOMAS, VP

QUALITY DATA ENTRY FORMS: Part 1

Type of Report:
[ ] Premining
[ ] During Mining/Reclamation
[ ] Other

STATION INFORMATION

IT #: April 867-0298 STATION #: Ground Water SOAP PERMITTEE #:

NTY #: *BASIN #: QUAD NAME:

ION TYPE (check): |01| Spring |02| Stream |03| Lake |04| Well |05| Sediment Pond/Influent |06| Sediment Pond/Discharge

WELLS ONLY

TH (ft): CASING DIAMETER (in): AQUIFER DESCRIPTION: TOP OF WELL ELEVATION (MSL):

OF AQUIFER (MSL): AQUIFER THICKNESS (ft):

DRAINAGE AREA (acres):

ERSHED DESCRIPTION:

LONGITUDE (DMS):

ITUDE (DMS): UTM NORTHING:

UTM EASTING:

H ZONE: 16 West of 84° Longitude
17 East of 84° Longitude

CAL STREAM NAME:

AL COMPANY NAME: Meade + Shepherd

OLLECTING FIRM NAME: Meade + Shepherd

NALYZING FIRM NAME: Standard Labs, Inc.

OMMENTS:

GROUNDWATER ANALYSIS

COMPANY	PERMIT #	STATION #	SAMPLE #	DATE
Meade/Shepherd	867-0298	GW	7722	6/25/95
pH	ALKALINITY mg/l	ACIDITY mg/l	TDS mg/l	SO4 mg/l
6.87	92	0	126	57.62
DISS. IRON mg/l	DISS MANG. mg/l	FIELD pH	TEMP (c)	Water depth (ft)
0.06	0.02			
Depth to water (ft)	Well depth (ft)			

STANDARD LABORATORIES, INC.

Lab No. 7722

Date Rec'd. 05/24/95

Date Sampled 05/24/95

Sampled By YOURSELVES

PO BOX 606
WHITESBURG, KY 41858

SAMPLE ID:

MEADE & SHEPHERD COAL COMPANY
HC 84, BOX 1404
WHITESBURG, KY 41858

ROXANNE
867-0298
APRIL

WATER REPORT

pH	6.87
TOTAL ALKALINITY, (AS CACO3 EQUIVALENT)	92.00 MG/L
TOTAL ACIDITY, (AS CACO3 EQUIVALENT)	0.00 MG/L
TOTAL DISSOLVED SOLIDS	126 MG/L
DISSOLVED IRON	0.06 MG/L
DISSOLVED MANGANESE	0.02 MG/L
TOTAL SULFATE	57.62 MG/L

FOR YOUR PROTECTION THIS DOCUMENT HAS BEEN PRINTED ON CONTROLLED PAPER STOCK. NOT VALID IF ALTERED.

Respectfully Submitted,

DELANO THOMAS, VP

QUALITY DATA ENTRY FORMS: Part 1

Type of Report:
[ ] Premining
[ ] During Mining/Reclamation
[ ] Other

STATION INFORMATION

:T #: May 867-0298 STATION #: Ground Water SOAP PERMITTEE #:

NTY #: *BASIN #: QUAD NAME:

ION TYPE (check): [01] Spring [04] Well
[02] Stream [05] Sediment Pond/Influent
[03] Lake [06] Sediment Pond/Discharge

WELLS ONLY

:H (ft): CASING DIAMETER (in): AQUIFER DESCRIPTION: TOP OF WELL ELEVATION (MSL):

OF AQUIFER (MSL): AQUIFER THICKNESS (ft):

ERSHED DESCRIPTION: DRAINAGE AREA (acres):

ITUDE (DMS): LONGITUDE (DMS): UTM NORTHING:

UTM EASTING:

ZONE: 16 West of 84° Longitude
17 East of 84° Longitude

CAL STREAM NAME:

AL COMPANY NAME: Meade + Shepherd

LLECTING FIRM NAME: Meade + Shepherd

ALYZING FIRM NAME: Standard Labs, Inc.

MMENTS:

GROUNDWATER ANALYSIS

COMPANY	PERMIT #	STATION #	SAMPLE #	DATE
Meade/Shepherd	867-0298	GW	7723	6/25/95
pH	ALKALINITY mg/l	ACIDITY mg/l	TDS mg/l	SO4 mg/l
6.8	86	0	157	40.75
DISS. IRON mg/l	DISS MANG. mg/l	FIELD pH	TEMP (c)	Water depth (ft)
0.3	<0.01			
Depth to water (ft)	Well depth (ft)			

STANDARD LABORATORIES, INC.

Lab No. 772

Date Rec'd. 05/24/95

Date Sampled 05/24/95

Sampled By YOURSELVES

PO BOX 606
WHITESBURG, KY 41858

SAMPLE ID:

HEADE & SHEPHERD COAL COMPANY
HC 84, BOX 1404
WHITESBURG, KY 41858

ROXANNE
867-0298
MAY

WATER REPORT

pH	6.80
TOTAL ALKALINITY, (AS CACO3 EQUIVALENT)	86.00 MG/L
TOTAL ACIDITY, (AS CACO3 EQUIVALENT)	0.00 MG/L
TOTAL DISSOLVED SOLIDS	157 MG/L
DISSOLVED IRON	0.30 MG/L
DISSOLVED MANGANESE	<0.01 MG/L
TOTAL SULFATE	40.75 MG/L

FOR YOUR PROTECTION THIS DOCUMENT HAS BEEN PRINTED ON CONTROLLED PAPER STOCK. NOT VALID IF ALTERED.

Respectfully Submitted,

DELANO THOMAS, VP

7724.pdf

QUALITY DATA ENTRY FORMS: Part 1

Type of Report:
[ ] Premining
[ ] During Mining/Reclamation
[ ] Other

STATION INFORMATION

LT #: June 867-0298 STATION #: Ground Water SOAP PERMITTEE #:

NTY #: *BASIN #: QUAD NAME:

ION TYPE (check): [01] Spring [04] Well
[02] Stream [05] Sediment Pond/Influent
[03] Lake [06] Sediment Pond/Discharge

WELLS ONLY

PTH (ft): CASING DIAMETER (in): AQUIFER DESCRIPTION: TOP OF WELL ELEVATION (MSL):
OF AQUIFER (MSL): AQUIFER THICKNESS (ft):

ERSHED DESCRIPTION: DRAINAGE AREA (acres):

ITUDE (DMS): LONGITUDE (DMS):

N ZONE: 16 West of 84° Longitude UTM EASTING: UTM NORTHING:
17 East of 84° Longitude

CAL STREAM NAME:

AL COMPANY NAME: Meade + Shepherd

OLLECTING FIRM NAME: Meade + Shepherd

NALYZING FIRM NAME: Standard Labs, Inc.

OMMENTS:

GROUNDWATER ANALYSIS

COMPANY	PERMIT #	STATION #	SAMPLE #	DATE
Meade/Shepherd	867-0298	GW	7724	6/25/95
pH	ALKALINITY mg/l	ACIDITY mg/l	TDS mg/l	SO4 mg/l
6.89	86	0	146	39.1
DISS. IRON mg/l	DISS MANG. mg/l	FIELD pH	TEMP (c)	Water depth (ft)
0.23	<0.01			
Depth to water (ft)	Well depth (ft)			

WATER QUALITY DATA FORMS: PART 2

STANDARD LABORATORIES, INC.

Lab No. 7724

Date Rec'd. 05/24/95

Date Sampled 05/24/95

Sampled By YOURSELVES

PO BOX 606
WHITESBURG, KY 41858

SAMPLE ID:

MEADE & SHEPHERD COAL COMPANY
HC 84, BOX 1404
WHITESBURG, KY 41858

ROXANNE
867-0298
JUNE

WATER REPORT

pH	6.89
TOTAL ALKALINITY,(AS CACO3 EQUIVALENT)	86.00 MG/L
TOTAL ACIDITY, (AS CACO3 EQUIVALENT)	0.00 MG/L
TOTAL DISSOLVED SOLIDS	146 MG/L
DISSOLVED IRON	0.23 MG/L
DISSOLVED MANGANESE	<0.01 MG/L
TOTAL SULFATE	39.10 MG/L

FOR YOUR PROTECTION THIS DOCUMENT HAS BEEN PRINTED ON CONTROLLED PAPER STOCK. NOT VALID IF ALTERED.

Respectfully Submitted,

DELANO THOMAS, VP

Roxana Prison Site,
Letcher County, Kentucky

Appendix

E

GEOLOGIST'S LOGS OF DRILLING RESULTS

Cardno®
Shaping the Future

TEST BORING FIELD LOG

Cardno Shaping the Future

Test Boring No.: BH-1-15
Location: Roxana Prison

Project Name: BoP, Letcher County EIS, Roxana Prison Site **Project No.:** CARD138 **Date:** 11/20/15

Logged By: Steve Stansfield **Drilling Company:** Central Star **Drill Crew:** Andrew Risner/Richard Knisley

Rig: CME850 **Drill Method:** HSA / Split Spoon **Page:** 1 of 1

Depth (m) From	Depth (m) To	Soil Visual Classification / Descriptions and Remarks Surface Condition:	Sample No.	1st 0.152 m	2nd 0.152 m	3rd 0.152 m	4th 0.152 m	5th 0.152 m	Rec. (%)
0.00	0.61	Top 0.08 m: Brown organic soil with roots, moist From 0.08 m - 0.61 m: Silty clay becoming more sandy downward, tan to brown, moist, weathered, coal lense near base (Sample SS-1 from 0.08 m - 0.61 m)	SS-1	3	8	11	8		73
0.61	1.22	Top 0.46 m is sandy clay, highly weathered, tan to brown, moist, slight plasticity Bottom 0.15 m: grey sandstone, micaceous, dry, mostly unweathered.	-	4	5	20	14		80
1.22	1.83	Sandy shale, highly weathered, soft, brown at top becoming grey and crumbly downward.	-	4	4	5	3		42
1.83	2.44	Very weathered sandstone, soft, brown, coal laminations throughout, micaceous, moist (Sample SS-2)	SS-2	6	7	5	10		45
2.44	3.05	From 2.44 m - 2.82 m: Predominantly sandstone, weathered grey to tan, micaceous, dry From 2.82 m - 3.05 m: Sandstone, light grey, unweathered, dry	SS-3	7	7	7	50/0.15		70
3.05	3.35	Sandstone, grey, unweathered, hard, dry, micaceous Auger Refusal at 3.35 m	-	50/.05	-	-	-		25
		Note: BH-1-15 did not encounter any rock fill material.							

Total Boring Depth: _____

Comments: [Drill Method, Boring Diameter, UD Shelby Tubes, Well Construction (draw sketch on back), etc]

Water Levels:
_____ @ First Noted in Samples / Cuttings
_____ @ Completion
_____ @ _____ After _____Hrs
_____ @ Backfilling _____ (date/ time)

Hammer Type: Donut Hammer / Safety Hammer / Automatic Hammer
SPT Hammer: (Weight / Drop / Spoon Dia.) _____
Auger Dia.: ID / OD (meters): _____

Drilling Times:
Moving: _____
Drilling: _____
Standby: _____
Hauling Water: _____
Abandon/Grout Boring: _____
Fluid Losses: _____ @ Depth _____

HSA - Hollow Stem Augers
MD - Rotary Mud Drilling
REF - Refusal (Spoon or Auger)
RC - Rock Core
SS - SPT Split Spoon Sample
DC - Driven Casing (Hammer Type and Record Blows/ft vs. Depth)

ST - Shelby Tube Sample
WOR - SPT Weight of Rods
WOH - SPT Weight of Hammer
REC - Recovery (Meters)
RQD - Rock Quality Designation

TEST BORING FIELD LOG

Test Boring No.: BH-2-15
Location: Roxana Prison

Project Name: BoP, Letcher County EIS, Roxana Prison Site **Project No.:** CARD138 **Date:** 11/20/15

Logged By: Steve Stansfield **Drilling Company:** Central Star **Drill Crew:** Andrew Risner/Richard Knisley

Rig: CME850 **Drill Method:** HSA / Split Spoon **Page:** 1 of 1

Depth (m) From	Depth (m) To	Soil Visual Classification / Descriptions and Remarks Surface Condition:	Sample No.	1st 0.152 m	2nd 0.152 m	3rd 0.152 m	4th 0.152 m	5th 0.152 m	Rec. (%)
0.00	0.61	Top 0.05 m: Brown organic soil, moist Bottom 0.56 m: Silty clay, grey with occasional brown sandy zones, numerous shale fragments, becoming sandy downward, very slightly moist (Sample SS-1 from 0.05 m - 0.61 m).	SS-1	5	7	9	8		66
0.61	1.22	Top 0.18 m: Sandy clay, dark grey, very slightly moist, slight plasticity, slightly micaceous, becoming more sandy downward Bottom 0.43m: Predominantly sandstone, grey, occasional coal spars, micaceous, weathered	-	10	12	8	9		72
1.22	1.83	Sandy shale, weathered, grey with occasional brown sandstone fragments, dry, slightly micaceous	-	6	6	4	5		65
1.83	2.44	Predominantly sandstone, grey, weathered, dry, micaceous, some tan weathered zones, poor recovery	-	7	5	6	5		27
2.44	3.05	Sandstone, top 0.06 m weathered brown, remainder light grey, micaceous, dry	-	14	9	9	4		57
3.05	3.66	Sandstone, very weathered and soft, light grey to mostly brown, occasional orange stains and coal spars, slightly moist (Sample SS-2)	SS-2	3	8	12	11		66
3.66	4.21	Spoon only advanced to 4.02 m: Top 0.18 m is weathered grey sandstone, soft. From 3.84 m - 3.93 m there is coal and shale with orange staining. From 3.93 m - 4.02 m: Sandstone, light grey with tan zones, rare coal spars. Auger Refusal at 4.21 m (Sample SS-3)	SS-3	17	20	50/0.05	-		95

Total Boring Depth: _____

Comments: [Drill Method, Boring Diameter, UD Shelby Tubes, Well Construction (draw sketch on back), etc]

Water Levels: _____ @ First Noted in Samples / Cuttings
_____ @ Completion
_____ @ _____ After _____Hrs
_____ @ Backfilling _____ (date/ time)

Hammer Type: Donut Hammer / Safety Hammer / Automatic Hammer
SPT Hammer: (Weight / Drop / Spoon Dia.) _____
Auger Dia.: ID / OD (meters): _____

Drilling Times:
Moving: _____
Drilling: _____
Standby: _____
Hauling Water: _____
Abandon/Grout Boring: _____
Fluid Losses: _____ @ Depth _____

HSA - Hollow Stem Augers
MD - Rotary Mud Drilling
REF - Refusal (Spoon or Auger)
RC - Rock Core
SS - SPT Split Spoon Sample
DC - Driven Casing (Hammer Type and Record Blows/ft vs. Depth)
ST - Shelby Tube Sample
WOR - SPT Weight of Rods
WOH - SPT Weight of Hammer
REC - Recovery (Meters)
RQD - Rock Quality Designation

TEST BORING FIELD LOG

Test Boring No.: BH-3-15
Location: Roxana Prison

Project Name: BoP, Letcher County EIS, Roxana Prison Site **Project No.:** CARD138 **Date:** 11/19/15

Logged By: Steve Stansfield **Drilling Company:** Central Star **Drill Crew:** Andrew Risner/Richard Knisley

Rig: CME850 **Drill Method:** HSA / Split Spoon **Page:** 1 of 3

Depth (m) From	Depth (m) To	Soil Visual Classification / Descriptions and Remarks Surface Condition:	Sample No.	1st 0.152 m	2nd 0.152 m	3rd 0.152 m	4th 0.152 m	5th 0.152 m	Rec. (%)
0.00	0.61	Top 0.15 m: Organic clay, brown, wet, root material Bottom 0.46 m: Silty clay, moist, weathered , light grey, occasional coal fragments, numerous shale fragments	-	4	7	10	11		62
0.61	1.22	Silty clay, light grey, weathered, numerous shale fragments, moist, becoming less plastic downward	-	8	7	6	6		87
1.22	1.83	Silty clay, light grey, occasional coal fragments, numerous shale fragments, slightly moist, low plasticity (Sample SS-1)	SS-1	5	6	7	5		61
1.83	2.44	Silty clay, becoming sandy downward, light grey, rare coal fragments, slightly moist, low plasticity, sandy zone is tan/brown	-	3	3	6	22		60
2.44	3.05	Sandy clay becoming silty clay downward, occasional sandstone fragments, sandy zones weathered brown, light grey shale fragments downward, moist	-	14	5	4	5		62
3.05	3.66	Clayey sand, brown to grey with some orange staining, occasional coal spars, light grey shale inclusions, friable, micaceous (Sample SS-2)	SS-2	6	15	17	14		92
3.66	4.27	Silty clay, immediate top is brown weathered sandy zone, light grey, dry, non-plastic	-	16	5	5	5		70
4.27	4.88	Silty clay, grey, moist, somewhat plastic, occasional sandstone inclusions with orange staining, numerous grey shale fragments	-	5	3	3	5		90
4.88	5.49	Silty clay, grey, moist, somewhat plastic, sandstone inclusions throughout that are orange, occasional coal fragments (Sample SS-3)	SS-3	3	4	4	5		52
5.49	6.10	Silty clay, grey, moist, somewhat plastic, sandstone inclusions throughout that are orange, occasional coal fragments	-	3	5	7	4		70
6.10	6.71	Silty clay, grey, not as moist or plastic as above, rare sandstone inclusions, numerous light grey shale fragments	-	8	4	5	9		75
6.71	7.32	Silty clay, moist, somewhat plastic, grey with dark grey zones, some orange stained sandstone throughout, rare coal fragments (Sample SS-4)	SS-4	3	3	4	3		75
7.32	7.92	Silty clay, only slightly moist and plastic, sandstone lense near top, rare sandstone fragment inclusions and occasional shale inclusions	-	5	3	3	6		67
7.92	8.53	Silty clay, grey, slightly moist with slight plasticity, numerous shale inclusions, very rare sandstone fragments	-	6	7	6	6		95
8.53	9.14	Silty clay, grey, slightly moist with slight plasticity, increasing orange stained sandstone fragments, occasional coal fragments (Sample SS-5)	SS-5	8	8	18	11		74

Total Boring Depth: _____

Comments: [Drill Method, Boring Diameter, UD Shelby Tubes, Well Construction (draw sketch on back), etc]

Water Levels:
_____ @ First Noted in Samples / Cuttings
_____ @ Completion
_____ @ _____ After _____Hrs
_____ @ Backfilling _____ (date/ time)

Hammer Type: Donut Hammer / Safety Hammer / Automatic Hammer
SPT Hammer: (Weight / Drop / Spoon Dia.) _____
Auger Dia.: ID / OD (meters): _____

Drilling Times:
Moving: _____
Drilling: _____
Standby: _____
Hauling Water: _____
Abandon/Grout Boring: _____
Fluid Losses: _____ @ Depth _____

HSA - Hollow Stem Augers
MD - Rotary Mud Drilling
REF - Refusal (Spoon or Auger)
RC - Rock Core
SS - SPT Split Spoon Sample
DC - Driven Casing (Hammer Type and Record Blows/ft vs. Depth)

ST - Shelby Tube Sample
WOR - SPT Weight of Rods
WOH - SPT Weight of Hammer
REC - Recovery (Meters)
RQD - Rock Quality Designation

TEST BORING FIELD LOG

Cardno Shaping the Future

Test Boring No.: BH-3-15
Location: Roxana Prison

Project Name: BoP, Letcher County EIS, Roxana Prison Site **Project No.:** CARD138 **Date:** 11/19/15

Logged By: Steve Stansfield **Drilling Company:** Central Star **Drill Crew:** Andrew Risner/Richard Knisley

Rig: CME850 **Drill Method:** HSA / Split Spoon **Page:** 2 of 3

Depth (m) From	Depth (m) To	Soil Visual Classification / Descriptions and Remarks Surface Condition:	Sample No.	1st 0.152 m	2nd 0.152 m	3rd 0.152 m	4th 0.152 m	5th 0.152 m	Rec. (%)
9.14	9.75	Silty clay, grey, very slightly moist with increasing sand content, mostly non-plastic, very rare brown sandstone fragments and coal fragments	-	5	5	6	7		78
9.75	10.36	Silty sand, light grey to grey, mostly dry, non-plastic, slightly micaceous	-	6	6	8	11		74
10.36	10.97	Silty sand becoming more sandy downward, occasional orange stained sandstone fragments, scattered coal fragments, shale and sandy shale fragments throughout, grey, dry (Sample SS-6)	SS-6	6	10	40	50/0.08		87
10.97	11.58	Very difficult auger drilling Hard rock Only spoon returns consisted of hard, fine grained sandstone, grey	-	50/0.05	-	-	-		
11.58	12.19	Silty clay, grey, rare brown/orange lenses, shale inclusions throughout, dry	-	10	10	13	9		86
12.19	12.80	Silty clay, grey, dry, non-plastic, scattered shale inclusions some of which are silty, very rare and small sandstone fragments (broken)	-	7	7	10	8		71
12.80	13.41	Silty clay, grey to dark grey, slightly moist and slight plasticity, occasional orange sandstone inclusions and coal fragments, slightly sandy downward (Sample SS-7)	SS-7	5	8	9	14		90
13.41	14.02	Silty clay, grey to dark grey, mostly dry and non-plastic, silty shale inclusions throughout	-	7	11	9	8		60
14.02	14.63	Silty clay, grey to dark grey, mostly dry and non-plastic, silty shale inclusions throughout, very rare brown sandstone fragments	-	5	10	6	7		74
14.63	15.24	Silty clay, grey to dark grey, carbonaceous zones, scattered coal fragments throughout, sandy at immediate top, brown to orange sandstone lense in center (Sample SS-8)	SS-8	6	7	8	8		72
15.24	15.85	Top 0.15 m: Wet clayey sand, dark Bottom 0.46 m: Brown to grey sandstone, micaceous, coal fragments at base (Sample SS-9)	SS-9	4	12	12	12		91
15.85	16.46	Predominantly sandstone, alternating grey and brown, dry, micaceous, driller reports drilling conditions becoming more difficult	-	10	18	21	19		62
16.46	17.07	Predominantly sandstone, alternating grey and brown, dry, micaceous, few coal fragments at base	-	12	19	11	8		60
17.07	17.68	Claystone with sandstone lenses, dark grey, occasional orange sandstone lenses, coal fragments throughout, moist, somewhat plastic (Sample SS-10)	SS-10	6	9	10	9		82
17.68	18.29	Top 0.30 m: Claystone with sandstone lenses, dark grey, occasional orange sandstone lenses, coal fragments throughout, moist, somewhat plastic Bottom 0.30 m: Predominantly sandstone, alternating grey and brown, micaceous, dry, scattered coal fragments at base	-	12	17	21	13		95

Total Boring Depth: _____

Comments: [Drill Method, Boring Diameter, UD Shelby Tubes, Well Construction (draw sketch on back), etc]

Water Levels:
_____ @ First Noted in Samples / Cuttings
_____ @ Completion
_____ @ _____ After _____Hrs
_____ @ Backfilling _____ (date/ time)

Hammer Type: Donut Hammer / Safety Hammer / Automatic Hammer
SPT Hammer: (Weight / Drop / Spoon Dia.) _____
Auger Dia.: ID / OD (meters): _____

Drilling Times:
Moving: _____
Drilling: _____
Standby: _____
Hauling Water: _____
Abandon/Grout Boring: _____
Fluid Losses: _____ @ Depth _____

HSA - Hollow Stem Augers
MD - Rotary Mud Drilling
REF - Refusal (Spoon or Auger)
RC - Rock Core
SS - SPT Split Spoon Sample
DC - Driven Casing (Hammer Type and Record Blows/ft vs. Depth)

ST - Shelby Tube Sample
WOR - SPT Weight of Rods
WOH - SPT Weight of Hammer
REC - Recovery (Meters)
RQD - Rock Quality Designation

TEST BORING FIELD LOG

Test Boring No.: BH-3-15
Location: Roxana Prison

Project Name: BoP, Letcher County EIS, Roxana Prison Site **Project No.:** CARD138 **Date:** 11/19/15

Logged By: Steve Stansfield **Drilling Company:** Central Star **Drill Crew:** Andrew Risner/Richard Knisley

Rig: CME850 **Drill Method:** HSA / Split Spoon **Page:** 3 of 3

Depth (m) From	Depth (m) To	Soil Visual Classification / Descriptions and Remarks Surface Condition:	Sample No.	1st 0.152 m	2nd 0.152 m	3rd 0.152 m	4th 0.152 m	5th 0.152 m	Rec. (%)
18.29	18.90	Sandstone, grey with alternating tan layers, dry, micaceous, crumbly	-	N/A	N/A	N/A	12		61
18.90	19.51	Sandstone, grey with alternating tan layers, micaceous, crumbly, scattered coal fragments near base, dry, friable	-	10	9	9	12		85
19.51	20.12	Sandstone, grey with alternating tan layers, micaceous, crumbly, very scattered coal fragments, friable	-	7	12	14	21		45
20.12	20.73	Sandstone, grey with alternating tan layers, micaceous, crumbly, very scattered coal fragments, friable, Total Depth	-	23	14	26	28		53

Total Boring Depth: _____

Comments: [Drill Method, Boring Diameter, UD Shelby Tubes, Well Construction (draw sketch on back), etc]

Water Levels:
_____ @ First Noted in Samples / Cuttings
_____ @ Completion
_____ @ _____ After _____Hrs
_____ @ Backfilling _____ (date/ time)

Hammer Type: Donut Hammer / Safety Hammer / Automatic Hammer

SPT Hammer: (Weight / Drop / Spoon Dia.) _____

Auger Dia.: ID / OD (meters): _____

Drilling Times:
Moving: _____
Drilling: _____
Standby: _____
Hauling Water: _____
Abandon/Grout Boring: _____
Fluid Losses: _____ @ Depth _____

HSA - Hollow Stem Augers
MD - Rotary Mud Drilling
REF - Refusal (Spoon or Auger)
RC - Rock Core
SS - SPT Split Spoon Sample
DC - Driven Casing (Hammer Type and Record Blows/ft vs. Depth)
ST - Shelby Tube Sample
WOR - SPT Weight of Rods
WOH - SPT Weight of Hammer
REC - Recovery (Meters)
RQD - Rock Quality Designation

TEST BORING FIELD LOG

Test Boring No.: BH-4-15
Location: Roxana Prison

Project Name: BoP, Letcher County EIS, Roxana Prison Site **Project No.:** CARD138 **Date:** 11/16-17/15

Logged By: Steve Stansfield **Drilling Company:** Central Star **Drill Crew:** Andrew Risner/Richard Knisley

Rig: CME850 **Drill Method:** HSA / Split Spoon **Page:** 1 of 2

Depth (m) From	Depth (m) To	Soil Visual Classification / Descriptions and Remarks Surface Condition:	Sample No.	1st 0.152 m	2nd 0.152 m	3rd 0.152 m	4th 0.152 m	5th 0.152 m	Rec. (%)
0.00	0.61	Organic material, very slightly moist, some shale fragments and rare weathered sandstone fragments, non-plastic	-	20	50/0.15				40
0.61	1.22	Silty clay, slightly moist, non-plastic, occasional weathered light grey shale fragments	-	32	33	18	22		65
1.22	1.83	Silty clay, slightly moist, dark grey, low plastic, very rare fine grained sandstone (Sample SS-1)	SS-1	6	50/0.05				30
1.83	2.44	Silty clay and shale, light grey, mostly dry, non-plastic, occasional sandstone boulder	-	23	19	7	5		38
2.44	3.05	Silty clay, dark grey, moist with some iron staining in matrix, slightly plastic (Sample SS-2)	SS-2	5	7	8	5		65
3.05	3.66	Silty clay, medium grey with tan sandstone boulders, mostly dry and non-plastic	-	34	50/0.03				30
3.66	4.27	Silty clay, medium grey, numerous shale fragments, mostly dry but slightly damp at immediate base, very minimal sandstone (Sample SS-3)	SS-3	20	15	12	11		80
4.27	4.88	Silty clay, moist, dark grey, shale fragments within matrix, very slightly plastic (Sample SS-4)	SS-4	5	11	5	5		70
4.88	5.49	Silty clay, moist, dark grey, shale fragments within matrix, very slightly plastic	-	6	6	9	11		70
5.49	6.10	Silty clay, slightly moist, dark grey, numerous shale fragments, rare coal spars, very slightly plastic (Sample SS-5)	SS-5	8	7	6	6		54
6.10	6.71	Silty clay, slightly moist, dark grey, numerous shale fragments, rare coal spars, very slightly plastic	-	10	4	5	4		65
6.71	7.32	Silty clay, slightly moist, slightly plastic, very rare sandstone fragments (some weathered), abundant dark shale fragments (Sample SS-6)	SS-6	4	5	5	6		55
7.32	7.92	Sandy clay, light grey, predominantly sandstone with some weathering, mostly dry, non-plastic	-	9	8	11	7		75
7.92	8.53	Sandy clay, predominantly light grey sandstone with abundant coal laminations, some highly weathered zones, dry, non-plastic (Sample SS-7)	SS-7	9	23	4	13		66
8.53	9.14	Top half predominantly silty clay, bottom predominantly sandstone fragments, grey to light grey, slightly moist, top slightly plastic	-	11	15	9	50/0.13		80

Total Boring Depth: _____

Comments: [Drill Method, Boring Diameter, UD Shelby Tubes, Well Construction (draw sketch on back), etc]

Water Levels:
_____ @ First Noted in Samples / Cuttings
_____ @ Completion
_____ @ _____ After _____Hrs
_____ @ Backfilling _____ (date/ time)

Hammer Type: Donut Hammer / Safety Hammer / Automatic Hammer
SPT Hammer: (Weight / Drop / Spoon Dia.) _____
Auger Dia.: ID / OD (meters): _____

Drilling Times:
Moving: _____
Drilling: _____
Standby: _____
Hauling Water: _____
Abandon/Grout Boring: _____
Fluid Losses: _____ @ Depth _____

HSA - Hollow Stem Augers
MD - Rotary Mud Drilling
REF - Refusal (Spoon or Auger)
RC - Rock Core
SS - SPT Split Spoon Sample
DC - Driven Casing (Hammer Type and Record Blows/ft vs. Depth)

ST - Shelby Tube Sample
WOR - SPT Weight of Rods
WOH - SPT Weight of Hammer
REC - Recovery (Meters)
RQD - Rock Quality Designation

TEST BORING FIELD LOG

Test Boring No.: BH-4-15
Location: Roxana Prison

Project Name: BoP, Letcher County EIS, Roxana Prison Site **Project No.:** CARD138 **Date:** 11/16-17/15

Logged By: Steve Stansfield **Drilling Company:** Central Star **Drill Crew:** Andrew Risner/Richard Knisley

Rig: CME850 **Drill Method:** HSA / Split Spoon **Page:** 2 of 2

Depth (m) From	Depth (m) To	Soil Visual Classification / Descriptions and Remarks Surface Condition:	Sample No.	1st 0.152 m	2nd 0.152 m	3rd 0.152 m	4th 0.152 m	5th 0.152 m	Rec. (%)
9.14	9.75	Predominantly sandstone and siltstone fragments, micaceous, slightly weathered, mostly dry, non-plastic	-	12	14	19	9		82
9.75	10.36	Silty clay, occasional highly weathered tan shale zones and coal lenses, moist, somewhat plastic (Sample SS-8)	SS-8	15	9	7	10		85
10.36	10.97	Silty clay, dark grey, slightly moist, shale fragments, rare tan weathered zones, slightly plastic	-	7	8	4	4		67
10.97	11.58	Silty clay, medium to dark grey, slightly moist zones, occasional carbonaceous lenses, shale fragments and rare weathered zones, mostly non-plastic, sandy at base	-	8	8	8	9		75
11.58	12.19	Predominantly highly weathered sandstone and siltstone, grey to tan, micaceous, non-plastic, moist	-	11	19	11	16		47
12.19	12.80	Predominantly highly weathered sandstone and siltstone, tan with some orange zones, micaceous, rare shale fragments, moist, non-plastic (Sample SS-9)	SS-9	15	22	24	13		52
12.80	13.41	Predominantly highly weathered sandstone and siltstone, tan with some orange zones, micaceous, rare shale fragments, moist, non-plastic	-	31	25	50/0.10			65
13.41	13.56	Predominantly highly weathered sandstone and siltstone, tan with some orange zones, micaceous, rare shale fragments, moist, non-plastic, Auger refusal.	-	50/0.05					55

Total Boring Depth: _____

Comments: [Drill Method, Boring Diameter, UD Shelby Tubes, Well Construction (draw sketch on back), etc]

Water Levels: _____ @ First Noted in Samples / Cuttings
_____ @ Completion
_____ @ _____ After _____Hrs
_____ @ Backfilling _____ (date/ time)

Hammer Type: Donut Hammer / Safety Hammer / Automatic Hammer
SPT Hammer: (Weight / Drop / Spoon Dia.) _____
Auger Dia.: ID / OD (meters): _____

Drilling Times:
Moving: _____
Drilling: _____
Standby: _____
Hauling Water: _____
Abandon/Grout Boring: _____
Fluid Losses: _____ @ Depth _____

HSA - Hollow Stem Augers
MD - Rotary Mud Drilling
REF - Refusal (Spoon or Auger)
RC - Rock Core
SS - SPT Split Spoon Sample
DC - Driven Casing (Hammer Type and Record Blows/ft vs. Depth)

ST - Shelby Tube Sample
WOR - SPT Weight of Rods
WOH - SPT Weight of Hammer
REC - Recovery (Meters)
RQD - Rock Quality Designation

TEST BORING FIELD LOG

Cardno Shaping the Future

Test Boring No.: BH-5-15
Location: Roxana Prison

Project Name: BoP, Letcher County EIS, Roxana Prison Site **Project No.:** CARD138 **Date:** 11/18/15

Logged By: Steve Stansfield **Drilling Company:** Central Star **Drill Crew:** Andrew Risner/Richard Knisley

Rig: CME850 **Drill Method:** HSA / Split Spoon **Page:** 1 of 3

Depth (m) From	Depth (m) To	Soil Visual Classification / Descriptions and Remarks Surface Condition:	Sample No.	1st 0.152 m	2nd 0.152 m	3rd 0.152 m	4th 0.152 m	5th 0.152 m	Rec. (%)
0.00	0.61	Top 0.30 m: Dark organic soil with roots, coal chip and occasional sandstone fragments Bottom 0.30 m: Sandy soil, numerous sandstone fragments, micaceous, dry, non-plastic, weathered tan	-	3	3	12	18		83
0.61	1.22	Sandy clay, predominantly soft weathered sandstone fragments, very slightly moist, tan, no noticeable staining, non-plastic	-	20	20	20	18		100
1.22	1.83	Predominantly silty shale fragments, light grey, mostly dry, non-plastic rare coal fragments and weathered tan sandstone inclusions (Sample SS-1)	SS-1	26	10	9	10		80
1.83	2.44	Silty clay, numerous shale fragments, mainly dry and non-plastic, very rare weathered (tan) sandstone fragments	-	8	32	20	33		70
2.44	3.05	Predominantly crumbled sandstone fragments, mostly dry, micaceous, non-plastic, very little weathering, light grey	-	11	10	10	5		52
3.05	3.66	Predominantly weathered shaley sandstone, more weathered and tan than above, some minor orange staining, dry, non-plastic (Sample SS-2)	SS-2	8	8	19	17		55
3.66	4.27	Predominantly shaley sandstone, hard, dry, micaceous, not as weathered as above, non-plastic, grey (no recovery from 3.81 m - 4.27 m)	-	5	50/0.13				90
4.27	4.88	Shaley sandstone, hard, grey, dry (no recovery from 4.36 m - 4.88 m) (Note: Driller added ~5 gallons of water, very difficult auger drilling)	-	50/0.05					-
4.88	5.49	Intermixed shaley sandstone and weathered shale, moist at top and dry at base, coal lense near middle, some orange staining (Sample SS-3)	SS-3	21	26	48	50		80
5.49	6.10	Silty clay at top and becoming more sandy downward, moist, slightly plastic, some orange staining throughout and red at base (Sample SS-4)	SS-4	12	8	7	7		77
6.10	6.71	Silty clay, weathered, grey, becoming sandy downward, little to no orange staining noted, moist	-	6	6	3	3		50
6.71	7.32	Silty clay, numerous coal fragments, rare orange sandstone fragments, moist, slightly plastic, sandstone fragments near base (Sample SS-5)	SS-5	3	1	2	1		47
7.32	7.92	Silty clay, numerous orange stains throughout, moist, moderate plasticity, occasional shale and coal fragments (Sample SS-6)	SS-6	1	1	4	9		57
7.92	8.53	Predominantly clay soil, moist, brown, occasional sandstone and shale fragments, moderate plasticity	-	8	4	4	6		35
8.53	9.14	Sandy clay, numerous sandstone fragments and boulders, tan to brown, very rare shale inclusions, moist	-	3	6	6	9		56

Total Boring Depth: _____

Comments: [Drill Method, Boring Diameter, UD Shelby Tubes, Well Construction (draw sketch on back), etc]

Water Levels: _____ @ First Noted in Samples / Cuttings
_____ @ Completion
_____ @ _____ After _____Hrs
_____ @ Backfilling _____ (date/ time)

Hammer Type: Donut Hammer / Safety Hammer / Automatic Hammer
SPT Hammer: (Weight / Drop / Spoon Dia.) _____
Auger Dia.: ID / OD (meters): _____

Drilling Times:
Moving: _____
Drilling: _____
Standby: _____
Hauling Water: _____
Abandon/Grout Boring: _____
Fluid Losses: _____ @ Depth _____

HSA - Hollow Stem Augers
MD - Rotary Mud Drilling
REF - Refusal (Spoon or Auger)
RC - Rock Core
SS - SPT Split Spoon Sample
DC - Driven Casing (Hammer Type and Record Blows/ft vs. Depth)

ST - Shelby Tube Sample
WOR - SPT Weight of Rods
WOH - SPT Weight of Hammer
REC - Recovery (Meters)
RQD - Rock Quality Designation

TEST BORING FIELD LOG

Test Boring No.: BH-5-15
Location: Roxana Prison

Project Name: BoP, Letcher County EIS, Roxana Prison Site **Project No.:** CARD138 **Date:** 11/18/15
Logged By: Steve Stansfield **Drilling Company:** Central Star **Drill Crew:** Andrew Risner/Richard Knisley
Rig: CME850 **Drill Method:** HSA / Split Spoon **Page:** 2 of 3

Depth (m) From	Depth (m) To	Soil Visual Classification / Descriptions and Remarks Surface Condition:	Sample No.	1st 0.152 m	2nd 0.152 m	3rd 0.152 m	4th 0.152 m	5th 0.152 m	Rec. (%)
9.14	9.75	Sandy clay, moist to wetter downward, tan to brown, scattered shale and coal inclusions throughout, dense, some orange/red staining	-	3	3	4	4		100
9.75	10.36	Silty clay, dark grey, moist, large coal fragments, some sandstone inclusions (tan to brown), scattered shale fragments, moderate plasticity (Sample SS-7)	SS-7	3	6	5	4		57
10.36	10.97	Silty clay at top with predominantly sandstone downward, scattered shale and sandstone inclusions in top (Moist, moderate plasticity); sandstone is light grey, micaceous, dry with rare coal spars	-	6	5	24	4		90
10.97	11.58	Predominantly sandstone, crumbly, light grey to tan/orange, micaceous, dry	-	8	5	22	11		30
11.58	12.19	Sandy clay, numerous sandstone inclusions, grey to tan, crumbly, coal spars throughout, rare orange staining (Sample SS-8)	SS-8	6	7	7	6		67
12.19	12.80	Predominantly weathered sandstone, light grey and tan, occasional orange staining, micaceous, crumbly, dry	-	9	26	28	18		47
12.80	13.41	Friable sandstone, tan to orange, grey shale inclusions, moderate soft, very slightly damp, occasional large coal fragments (Sample SS 9). Note: A piece of wiring was in spoon sample from 12.80 m - 13.41 m, indicating boring is not in natural rock at this depth.	SS-9	8	7	9	14		90
13.41	14.02	Friable sandstone, brown to tan, rare grey shale and coal inclusions, mostly dry	-	10	14	10	14		52
14.02	14.63	Clayey sand, brown to tan, rare grey shale and small coal inclusions, somewhat moist, some larger sandstone boulders	-	6	4	8	8		56
14.63	15.24	Clayey sand, brown to tan, rare grey shale and small coal inclusions, somewhat moist, some larger sandstone boulders (Sample SS-10)	SS-10	5	5	10	7		57
15.24	15.85	Top half: Clayey sand, brown to tan, rare grey shale and small coal inclusions, somewhat moist, some larger sandstone boulders (Driller added water, difficult augering) Bottom half: Predominantly sandstone, tan, micaceous, dry	-	6	12	8	8		61
15.85	16.46	Clayey sand, brown, micaceous, several large shale fragments, micaceous (sample wet due to driller adding water to hole)	-	5	8	8	6		39
16.46	17.07	Intermixed clayey sand and shale, numerous coal fragments, sand is tan to orange color, sample wet due to driller adding water (Sample S-11)	SS-11	4	6	6	11		95
17.07	17.68	Predominantly sandstone, some shale inclusions, tan/brown, friable, micaceous (sample wet due to driller adding water)	-	8	11	11	9		57

Total Boring Depth: _____

Comments: [Drill Method, Boring Diameter, UD Shelby Tubes, Well Construction (draw sketch on back), etc]

Water Levels:
_____ @ First Noted in Samples / Cuttings
_____ @ Completion
_____ @ _____ After _____Hrs
_____ @ Backfilling _____ (date/ time)

Hammer Type: Donut Hammer / Safety Hammer / Automatic Hammer
SPT Hammer: (Weight / Drop / Spoon Dia.) _____
Auger Dia.: ID / OD (meters): _____

Drilling Times:
Moving: _____
Drilling: _____
Standby: _____
Hauling Water: _____
Abandon/Grout Boring: _____
Fluid Losses: _____ @ Depth _____

HSA - Hollow Stem Augers
MD - Rotary Mud Drilling
REF - Refusal (Spoon or Auger)
RC - Rock Core
SS - SPT Split Spoon Sample
DC - Driven Casing (Hammer Type and Record Blows/ft vs. Depth)

ST - Shelby Tube Sample
WOR - SPT Weight of Rods
WOH - SPT Weight of Hammer
REC - Recovery (Meters)
RQD - Rock Quality Designation

TEST BORING FIELD LOG

Cardno Shaping the Future

Test Boring No.: BH-5-15
Location: Roxana Prison

Project Name: BoP, Letcher County EIS, Roxana Prison Site **Project No.:** CARD138 **Date:** 11/18/15

Logged By: Steve Stansfield **Drilling Company:** Central Star **Drill Crew:** Andrew Risner/Richard Knisley

Rig: CME850 **Drill Method:** HSA / Split Spoon **Page:** 3 of 3

Depth (m) From	Depth (m) To	Soil Visual Classification / Descriptions and Remarks Surface Condition:	Sample No.	1st 0.152 m	2nd 0.152 m	3rd 0.152 m	4th 0.152 m	5th 0.152 m	Rec. (%)
17.68	18.29	Predominently sandstone, tan to brown, weathered, occasional coal streaks, micaceous, Auger refusal		4	6	27	50/0.08		

Total Boring Depth: _____

Comments: [Drill Method, Boring Diameter, UD Shelby Tubes, Well Construction (draw sketch on back), etc]

Water Levels: _____ @ First Noted in Samples / Cuttings
_____ @ Completion
_____ @ _____ After _____Hrs
_____ @ Backfilling _____ (date/ time)

Hammer Type: Donut Hammer / Safety Hammer / Automatic Hammer
SPT Hammer: (Weight / Drop / Spoon Dia.) _____
Auger Dia.: ID / OD (meters): _____

Drilling Times:
Moving: _____
Drilling: _____
Standby: _____
Hauling Water: _____
Abandon/Grout Boring: _____
Fluid Losses: _____ @ Depth _____

HSA - Hollow Stem Augers
MD - Rotary Mud Drilling
REF - Refusal (Spoon or Auger)
RC - Rock Core
SS - SPT Split Spoon Sample
DC - Driven Casing (Hammer Type and Record Blows/ft vs. Depth)
ST - Shelby Tube Sample
WOR - SPT Weight of Rods
WOH - SPT Weight of Hammer
REC - Recovery (Meters)
RQD - Rock Quality Designation

TEST BORING FIELD LOG

Cardno Shaping the Future

Test Boring No.: BH-6-15
Location: Roxana Prison

Project Name: BoP, Letcher County EIS, Roxana Prison Site **Project No.:** CARD138 **Date:** 11/17/15

Logged By: Steve Stansfield **Drilling Company:** Central Star **Drill Crew:** Andrew Risner/Richard Knisley

Rig: CME850 **Drill Method:** HSA / Split Spoon **Page:** 1 of 2

Depth (m) From	Depth (m) To	Soil Visual Classification / Descriptions and Remarks Surface Condition:	Sample No.	1st 0.152 m	2nd 0.152 m	3rd 0.152 m	4th 0.152 m	5th 0.152 m	Rec. (%)
0.00	0.61	Brown organic material grading to silty clay, moist, shale fragments with plant impressions, moderate plasticity, moist, slightly weathered tan to grey	-	3	6	5	9		81
0.61	1.22	Silty clay with coal laminations, tan to dark grey, top weathered, slightly moist, slightly organic at top (top 0.335 m sampled) (Sample SS-1)	SS-1	6	14	11	8		95
1.22	1.83	Silty clay, moist, dark grey, scattered coal pieces, moderately weathered, shale fragments, slightly plastic	-	8	8	11	9		63
1.83	2.44	Silty clay with coal and carbonaceous shale layers, dark grey, moist, moderate plasticity, scattered sandstone fragments (Sample SS-2)	SS-2	2	5	6	9		66
2.44	3.05	Silty clay with coal and carbonaceous shale layers, dark grey, moist, moderate plasticity, scattered sandstone fragments	-	4	3	6	5		47
3.05	3.66	Intermixed silty clay and sandstone, slightly moist, coal fragments throughout, mostly non-plastic, light grey (sandstone) to dark grey (Sample SS-3)	SS-3	8	8	5	23		52
3.66	4.27	Silty clay and sand, slightly moist, dark grey, very slight plasticity, shale and occasional sandstone fragments	-	12	11	12	7		55
4.27	4.88	Silty sand, very slightly moist, predominantly light gray sandstone with occasional dark grey shale fragments, non-plastic, thin orange zone at immediate base	-	34	15	11	19		77
4.88	5.49	Silty clay with some sandy zones, fairly moist, some tan to orange coloring but mostly dark grey, shale and occasional sandstone fragments (Sample SS-4)	SS-4	11	4	12	8		65
5.49	6.10	Silty clay with some siltstone/shale fragments throughout, rare sandstone fragments, dark grey, moist, medium plasticity in silty zones, moderate orange staining downward, large wood fragments at base	SS-5	7	4	6	8		69
6.10	6.71	Predominantly wood stump with thin silty clay at base	-	25	4	6	5		52
6.71	7.32	No recovery (possible wood stump?)	-	3	4	4	5		0
7.32	7.92	Clay with sandstone boulder, moist, brown to tan, sandstone is weathered with red-orange coloration, clay is plastic	-	5	5	4	5		40
7.92	8.53	Brown clay matrix with occasional sandstone and coal fragments, sandstone is weathered and occasional red, plastic (Sample SS-6)	SS-6	3	3	2	4		58
8.53	9.14	From 8.53 m - 8.84 m: Brown clay matrix with occasional sandstone and coal fragments, sandstone is weathered and occasional red, plastic From 8.84 m - 9.14 m: Silty clay, dark grey, very slightly moist, non-plastic, occasional shale and red sandstone fragments	-	3	33	3	14		55

Total Boring Depth: _____

Comments: [Drill Method, Boring Diameter, UD Shelby Tubes, Well Construction (draw sketch on back), etc]

Water Levels:
_____ @ First Noted in Samples / Cuttings
_____ @ Completion
_____ @ _____ After _____Hrs
_____ @ Backfilling _____ (date/ time)

Hammer Type: Donut Hammer / Safety Hammer / Automatic Hammer
SPT Hammer: (Weight / Drop / Spoon Dia.) _____
Auger Dia.: ID / OD (meters): _____

Drilling Times:
Moving: _____
Drilling: _____
Standby: _____
Hauling Water: _____
Abandon/Grout Boring: _____
Fluid Losses: _____ @ Depth _____

HSA - Hollow Stem Augers
MD - Rotary Mud Drilling
REF - Refusal (Spoon or Auger)
RC - Rock Core
SS - SPT Split Spoon Sample
DC - Driven Casing (Hammer Type and Record Blows/ft vs. Depth)

ST - Shelby Tube Sample
WOR - SPT Weight of Rods
WOH - SPT Weight of Hammer
REC - Recovery (Meters)
RQD - Rock Quality Designation

TEST BORING FIELD LOG

Cardno Shaping the Future

Test Boring No.: BH-6-15
Location: Roxana Prison

Project Name: BoP, Letcher County EIS, Roxana Prison Site **Project No.:** CARD138 **Date:** 11/17/15

Logged By: Steve Stansfield **Drilling Company:** Central Star **Drill Crew:** Andrew Risner/Richard Knisley

Rig: CME850 **Drill Method:** HSA / Split Spoon **Page:** 2 of 2

Depth (m) From	Depth (m) To	Soil Visual Classification / Descriptions and Remarks Surface Condition:	Sample No.	1st 0.152 m	2nd 0.152 m	3rd 0.152 m	4th 0.152 m	5th 0.152 m	Rec. (%)
9.14	9.75	Silty clay, dark grey, numerous shale fragments, mostly dry and non-plastic, coal fragments near base (Sample SS-7)	SS-7	26	19	7	5		35
9.75	10.36	Dark grey, silty clay at immediate top, light grey sandstone in bottom three-quarters, micaceous, dry, non-plastic	-	7	17	12	10		45
10.36	10.97	Intermixed silty clay and sandstone, coal zone, numerous shale and sandstone fragments, slightly moist, non-plastic (Sample SS-8)	SS-8	8	11	22	14		65
10.97	11.58	Top 0.30 m: Intermixed silty clay and sandstone, coal zone, numerous shale and sandstone fragments, slightly moist, non-plastic Bottom 0.30 m: Clayey silt with shale fragments, some very faint orange stains, moist, plastic	-	12	29	8	7		87
11.58	12.19	Silty clay, moist, tan to dark grey, numerous small diameter red-orange inclusions, occasional coal fragments, moderate plasticity (Sample SS-9)	SS-9	6	5	6	5		92
12.19	12.80	Silty clay, moist, tan to dark grey, numerous small diameter red-orange inclusions, occasional coal fragments, moderate plasticity	-	4	7	8	6		90
12.80	13.41	Predominantly sandstone, weathered tan to light grey with rare red-orange zones, mostly dry and non-plastic	-	7	6	14	7		67
13.41	14.02	Highly weathered sandstone with clay zones, micaceous, some green sandstone at base, moist	-	6	13	10	9		90
14.02	14.63	Claystone, dark gray, moist, plastic, occasional coal incluions	-	4	9	15	50/0.08		70
14.63	14.69	Siltstone, grey, unweathered, Auger Refusal	-	50/0.08	-	-	-		

Total Boring Depth: _____

Comments: [Drill Method, Boring Diameter, UD Shelby Tubes, Well Construction (draw sketch on back), etc]

Water Levels:
_____ @ First Noted in Samples / Cuttings
_____ @ Completion
_____ @ _____ After _____Hrs
_____ @ Backfilling _____ (date/ time)

Hammer Type: Donut Hammer / Safety Hammer / Automatic Hammer
SPT Hammer: (Weight / Drop / Spoon Dia.) _____
Auger Dia.: ID / OD (meters): _____

Drilling Times:
Moving: _____
Drilling: _____
Standby: _____
Hauling Water: _____
Abandon/Grout Boring: _____
Fluid Losses: _____ @ Depth _____

HSA - Hollow Stem Augers
MD - Rotary Mud Drilling
REF - Refusal (Spoon or Auger)
RC - Rock Core
SS - SPT Split Spoon Sample
DC - Driven Casing (Hammer Type and Record Blows/ft vs. Depth)
ST - Shelby Tube Sample
WOR - SPT Weight of Rods
WOH - SPT Weight of Hammer
REC - Recovery (Meters)
RQD - Rock Quality Designation

Roxana Prison Site,
Letcher County, Kentucky

Appendix

F

ACID-BASE ACCOUNTING RESULTS

Cardno®
Shaping the Future

Appalachian Laboratories, Inc.

P.O. BOX 392
BECKLEY, WEST VIRGINIA 25802

PHONE 304-253-8677
FAX 304-253-4157
E-mail: applabs@charter.net

Client: Cardno

Date Sampled: 11/20/2015
Date Received: 11/24/2015
Date Analyzed: 11/30/2015

Roxana Prison
BH-1-15
ACID BASE ACCOUNTABILITY
CAC03 Equiv. (Tons/1000 Tons of Material)

Lab No.	SAMPLE ID	Color	Fizz	% Sulfur	Max. From %	Amount Present	Max. Needed pH 7	Excess	Paste pH
15631	SS-1	10yr/6/2	none	0.0510	1.5938	7.5000	-0-	5.9062	7.16
15632	SS-2	10yr/5/1	none	0.0404	1.2625	7.2500	-0-	5.9875	7.20
15633	SS-3	10yr/5/2	none	0.0554	1.7313	10.0000	-0-	8.2687	7.49

*Calculated from the Pyritic Sulfur Content
See Attachment

cardno roxana prison bh-1-15 acid base,11-30-15

Respectively Submitted: Donald M. Fox

Appalachian Laboratories, Inc.

P.O. BOX 392
BECKLEY, WEST VIRGINIA 25802

PHONE 304-253-8677
FAX 304-253-4157
E-mail: applabs@charter.net

Client: Cardno

Date Sampled: 11/20/2015
Date Received: 11/24/2015
Date Analyzed: 11/30/2015

Roxana Prison
BH-2-15
ACID BASE ACCOUNTABILITY
CAC03 Equiv. (Tons/1000 Tons of Material)

Lab No.	SAMPLE ID	Color	Fizz	% Sulfur	Max. From %	Amount Present	Max. Needed pH 7	Excess	Paste pH
15634	SS-1	10yr/6/2	none	0.0585	1.8281	6.7500	-0-	4.9219	7.49
15635	SS-2	10yr/5/2	none	0.0897	2.8031	12.2500	-0-	9.4469	6.94
15633	SS-3	10yr/6/1	slight	0.1088	3.4000	24.2500	-0-	20.8500	7.84

*Calculated from the Pyritic Sulfur Content
See Attachment

cardno roxana prison bh-2-15 acid base,11-30-15

Respectively Submitted: Kenneth M. Fox

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Client: Cardno

Date Sampled: 11/19/2015
Date Received: 11/24/2015
Date Analyzed: 11/30/2015

Roxana Prison
BH-3-15
ACID BASE ACCOUNTABILITY
CAC03 Equiv. (Tons/1000 Tons of Material)

Lab No.	SAMPLE ID	Color	Fizz	% Sulfur	Max. From %	Amount Present	Max. Needed pH 7	Excess	Paste pH
15637	SS-1	10yr/6/1	none	0.0895	2.7969	13.7500	-0-	10.9531	7.76
15638	SS-2	10yr/6/2	none	0.0462	1.4438	15.0000	-0-	13.5562	7.70
15639	SS-3	10yr/6/2	none	0.1228	3.8375	7.7500	-0-	3.9125	7.32
15640	SS-4	10yr/7/2	none	0.1133	3.5406	7.0000	-0-	3.4594	6.95
15641	SS-5	10yr/7/1	none	0.1662	5.1938	12.5000	-0-	7.3062	7.25
15642	SS-6	10yr/7/1	none	0.1340	4.1875	6.5000	-0-	2.3125	7.36
15643	SS-7	10yr/6/1	none	0.1178	3.6813	11.0000	-0-	7.3187	7.43
15644	SS-8	10yr/5/1	none	0.1010	3.1563	10.5000	-0-	7.3437	7.31
15645	SS-9	10yr/5/1	none	0.0972	3.3075	6.5000	-0-	3.4625	7.15
15646	SS-10	10yr/6/2	none	0.0801	2.5031	6.7500	-0-	4.2469	7.11

*Calculated from the Pyritic Sulfur Content
See Attachment

cardno roxana prison bh-3-15 acid base,11-30-15

Respectively Submitted: _____

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Date Sampled: 11/16/2015
Date Received: 11/24/2015
Date Analyzed: 11/30/2015

Roxana Prison
BH-4-15
ACID BASE ACCOUNTABILITY
CAC03 Equiv. (Tons/1000 Tons of Material)

Lab No.	SAMPLE ID	Color	Fizz	% Sulfur	Max. From %	Amount Present	Max. Needed pH 7	Excess	Paste pH
15647	SS-1	10yr/6/2	none	0.0376	1.1750	9.0000	-0-	7.8250	7.57
15648	SS-2	10yr/6/1	none	0.0594	1.8563	6.0000	-0-	4.1437	6.82
15649	SS-3	10yr/5/2	none	0.1186	3.7063	8.5000	-0-	4.7937	6.56
15650	SS-4	10yr/6/1	slight	0.0972	3.0375	21.0000	-0-	17.9625	7.85

*Calculated from the Pyritic Sulfur Content
See Attachment

cardno roxana prison bh-4-15 acid base,11-30-15

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Date Sampled: 11/17/2015
Date Received: 11/24/2015
Date Analyzed: 11/30/2015

Roxana Prison
BH-4-15

ACID BASE ACCOUNTABILITY
CAC03 Equiv. (Tons/1000 Tons of Material)

Lab No.	SAMPLE ID	Color	Fizz	% Sulfur	Max. From %	Amount Present	Max. Needed pH 7	Excess	Paste pH
15651	SS-5	10yr/6/1	none	0.1437	4.4906	12.7500	-0-	8.2594	7.42
15652	SS-6	10yr/6/1	slight	0.1408	4.4000	23.2500	-0-	18.8500	7.57
15653	SS-7	10yr/6/1	none	0.1807	5.6469	13.2500	-0-	7.6031	7.55
15654	SS-8	10yr/6/2	none	0.0990	3.0938	9.5000	-0-	6.4062	7.33
15655	SS-9	10yr/7/3	moderate	0.0008	0.0250	26.2500	-0-	26.2250	8.07

*Calculated from the Pyritic Sulfur Content
See Attachment

cardno roxana prison bh-4-15 (5-9) acid base,11-30-15

Respectively Submitted: Kenneth M. Lee

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Date Sampled: 11/18/2015
Date Received: 11/24/2015
Date Analyzed: 11/30/2015

Roxana Prison
BH-5-15
ACID BASE ACCOUNTABILITY
CAC03 Equiv. (Tons/1000 Tons of Material)

Lab No.	SAMPLE ID	Color	Fizz	% Sulfur	Max. From %	Amount Present	Max. Needed pH 7	Excess	Paste pH
15656	SS-1	10yr/7/1	none	0.0446	1.3938	5.0000	-0-	3.6062	7.84
15657	SS-2	10yr/6/1	none	0.1109	3.4656	20.5000	-0-	17.0344	7.77
15658	SS-3	10yr/6/1	slight	0.4033	12.6031	26.7500	-0-	14.1469	7.33
15659	SS-4	10yr/6/2	none	0.2140	6.6875	15.5000	-0-	8.8125	7.32
15660	SS-5	10yr/6/1	none	0.1688*	5.2750	6.5000	-0-	1.2250	6.89
15661	SS-6	10yr/7/3	slight	0.1121	3.5031	23.2500	-0-	19.7469	7.27
15662	SS-7	10yr/7/3	none	0.0760	2.3750	7.5000	-0-	5.1250	7.12
15663	SS-8	10yr/7/3	none	0.0231	0.7219	7.2500	-0-	6.5281	7.41
15664	SS-9	10yr/7/4	none	0.0497	1.5531	7.2500	-0-	5.6969	7.07
15665	SS-10	10yr/7/4	none	0.0452	1.4125	3.5000	-0-	2.0875	5.49
15666	SS-11	10yr/7/4	none	0.0406	1.2688	2.5000	-0-	1.2312	5.37

*Calculated from the Pyritic Sulfur Content
See Attachment

cardno roxana prison bh-5-15 acid base,11-30-15

Respectively Submitted: _____

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Date Sampled: 11/18/2015
Date Received: 11/24/2015
Date Analyzed: 11/30/2015

Roxana Prison
BH-5-15
%
SULFUR FORMS

Lab No.	I.D. No.	% Pyritic Sulfur	% Organic Sulfur	% Sulfate Sulfur	% Total Sulfur
15660	SS-5	0.1688	0.2521	<0.0001	0.4209

Respectively Submitted: _____

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Date Sampled: 11/17/2015
Date Received: 11/24/2015
Date Analyzed: 11/30/2015

Roxana Prison
BH-6-15
ACID BASE ACCOUNTABILITY
CAC03 Equiv. (Tons/1000 Tons of Material)

Lab No.	SAMPLE ID	Color	Fizz	% Sulfur	Max. From %	Amount Present	Max. Needed pH 7	Excess	Paste pH
15667	SS-1	10yr/5/1	none	0.1460	4.5625	6.7500	-0-	2.1875	7.51
15668	SS-2	10yr/4/1	none	0.2132	6.6625	10.0000	-0-	3.3375	7.69
15669	SS-3	10yr/6/1	none	0.0928	2.9000	9.2500	-0-	6.3500	7.93
15670	SS-4	10yr/6/2	slight	0.0870	2.7188	29.2500	-0-	26.5312	7.77
15671	SS-5	10yr/6/2	none	0.0632	1.9750	12.7500	-0-	10.7750	7.56
15672	SS-6	10yr/6/4	none	0.0351	1.0969	3.5000	-0-	2.4031	6.51
15673	SS-7	10yr/6/1	none	0.0440	1.3750	6.7500	-0-	5.3750	7.54
15674	SS-8	10yr/4/1	none	0.0976	3.0500	5.0000	-0-	1.9500	6.54
15675	SS-9	10yr/6/2	none	0.0943	2.9469	4.5000	-0-	1.5531	6.14

*Calculated from the Pyritic Sulfur Content
See Attachment

cardno roxana prison bh-6-15 acid base,11-30-15

Respectively Submitted: _____