

ATTACHMENT A: TECHNICAL SPECIFICATIONS

**Pennsylvania Department of Conservation and Natural Resources
Bureau of Topographic and Geologic Survey
2016 Exploratory Drilling Program
State Game Lands 070
Starrucca 7.5-Minute Quadrangle, Wayne County, Pennsylvania**

1. PRIMARY WORK-SITE MOBILIZATION AND DEMOBILIZATION

1.1 CONTRACTOR RESPONSIBILITY

The work covered by this section consists of the delivery to the first work site by the Contractor of all equipment, material, and supplies; acquisition of any permits; removal from the site of all equipment, material, and supplies after the completion of work; cleanup of the site, including cementing of the borehole unless waived or postponed by the Department Representative; delivery of records; and final inspection by the Department Representative.

1.2 PROCEDURE

Mobilization by the Contractor shall consist of the delivery to the first work site of all equipment, material, and supplies to be furnished by the Contractor; the complete assembly in satisfactory working order of all such equipment on the job; and, the satisfactory storage at the site of all such material and supplies.

Demobilization by the Contractor shall consist of the removal of all equipment, material, and supplies from the Project site; the cleanup of the site; the restoration of any damaged areas (e.g., deep ruts, holes, sedimentation pits, etc.) and any specific conditions that may be outlined in the State Game Lands Special Use Permit agreement, to as good or better condition than that which existed prior to the commencement of work.

All equipment and methods to be used by the Contractor shall be subject to prior approval by the Department Representative. However, approval of the equipment shall not be construed as approval of the performance thereof. The Contractor shall furnish any additional or "special" equipment necessary for him to obtain the desired results.

The Contractor, at his expense, shall obtain all permits, of whatever nature, necessary for the completion of the work, and the Contractor shall comply with all existing laws, ordinances, rules, and regulations relating to his operations. Easements from property owners will be obtained by the Department or its designated representative.

Every effort shall be made by the Contractor to minimize damage incidental to site access and to the drilling operations. Maximum use shall be made of existing roads and lanes for access. Where it is necessary to deviate from roads and lanes, such deviation shall be by one track, at a location causing the least damage.

The Contractor shall be liable to the property owners for any damage to vegetation, crops, and/or property, irrespective of whether the damage was caused by his negligence or was an unavoidable consequence of drilling operations. The Contractor shall be liable for any and all damage, including damages for necessary access. The Contractor shall be required to consult with the Department Representative as to when he intends to move equipment to the drilling location.

1.3 DELIVERY OF RECORDS

The Contractor shall be responsible for furnishing the following records for the work site within the following time constraints:

1. One pencil copy of the boring description (log), not later than 48 hours after the completion of the borehole.
2. Two typed copies of the borehole description (log), in either hard-copy (paper) or electronic format as specified by the Department Representative, not later than seven (7) days after completion of all drilling of the borehole. Each log shall provide pertinent information such as, but not limited to (**see Item 3.4 for more details**):
 1. Borehole number.
 2. Borehole completion date.
 3. Elevation of surface.
 4. Beginning and end of each core run.
 5. Rock types.
 6. Rock colors.
 7. Water elevations.
3. Copies of any other records kept by the Contractor that, in the opinion of the Department Representative, will aid in the interpretation of the core borings may be requested at any time during the course of the enforcement of the Contract.

No additional payment will be made for the delivery of records, as delivery is included in Contract Item No. 1.1, "Primary Work-Site Mobilization and Demobilization, Contractor Responsibility."

1.4 MEASUREMENT AND PAYMENT

Measurement, when accepted and approved, will be made on the basis of a complete unit Work Site, but only to the extent directed by the Department Representative.

Payment will be made at the Contract Unit Price bid per Work Site for Contract Item, "Primary Work-Site Mobilization and Demobilization," for which price and payment shall constitute full compensation for furnishing all labor, material, equipment, supplies, and other necessary incidentals required to satisfactorily complete these items of work. Payment, including mobilization, will be paid upon completion of the hole.

2. OVERBURDEN DRILLING

2.1 CONTRACTOR RESPONSIBILITY

The work covered by this section consists of furnishing all labor, material, equipment, supplies, and other necessary incidentals required to drill borings through the overburden.

2.2 BOREHOLE LOCATION

The site of the work to be performed shall be at the location within the boundaries of the map area in Attachment B. The borehole location for the work site indicated on the map in Attachment B is approximate. The borehole site will be exactly located in the field by the Department Representative, and the Department Representative will furnish the Contractor with the surface elevation of the borehole. If applicable, it is the Contractor's responsibility to ascertain exact locations of utilities from the appropriate utility companies and to verify all measurements in the field in order to ensure that the boring is made at a location that will not interfere with or harm existing surface or subsurface utilities. The Contractor shall notify the Department Representative when a conflict occurs. The Contractor shall bear sole responsibility for any damage to existing utilities resulting from his operations. The boring proposed for the work site will be noted in the Department's instructions to the Contractor and outlined on the drawing(s) accompanying the site-work order.

2.3 PROCEDURE

The Contractor shall make one boring into earth and material other than rock for the purpose of penetrating to the top of solid rock or for ascertaining the depth and thickness of the overburden material. Specific sampling of overburden material will not be necessary. The Contractor may decide what method of boring to use in approaching bedrock and the type of surface (overburden) casing to set once the top of solid rock is reached. However, the surface casing at the work site must be of a strong and durable nature and of a kind such that a locking cap or lid can and will be fastened to the top of the casing. (This shall be done to prevent vandalism of the well and so that no material can fall into the hole from the surface, which could potentially bridge it, after drilling is completed but prior to backfilling and cementing. During this interim period, the hole is to remain open to total depth so that the Department or its representatives can conduct tests or measurements in the borehole, such as geophysical logging, water sampling, and geochemical testing. The size of the overburden hole and casing are to be approximately 6 inches in diameter for drilling on the borehole. If the Contractor penetrates weathered bedrock to any depth, the depth and thickness of said weathered bedrock shall be carefully documented. Samples of this weathered bedrock, if

recovered, shall be saved and placed in separate containers, unless designated otherwise by the Department Representative. It is estimated that the depth of the overburden at the work site is 1-10 feet, but the actual depth (footage) may vary from this figure.

2.4 MEASUREMENT AND PAYMENT

Measurement, when accepted and approved, will be made on the basis of the linear feet of borehole actually drilled in overburden, but only to the extent directed by the Department Representative. No separate payment will be made for coring or other methods of advancing overburden drilling through boulders or other obstructions unless said obstructions are cored and greater than five (5) feet in thickness, in which case payment shall be made as Core Drilling.

Payment will be made at the Contract Unit Price bid per Linear Foot for Contract Item, "Overburden Drilling," for actual quantities used, which price and payment shall constitute full compensation for furnishing all labor, material, equipment, supplies, and other necessary incidentals required to satisfactorily complete this item of work.

3. NQ CORE DRILLING

3.1 CONTRACTOR RESPONSIBILITY

The work covered by this section consists of furnishing all labor, materials, equipment, supplies, and other necessary incidentals required to drill core borings through rock.

3.2 EQUIPMENT AND SUPPLIES

Equipment for core drilling shall include hydraulic-feed core-drilling machinery of a type or types approved by the Department Representative, complete with pressure gauge for measuring down-hole pressure, water-pressure gauge, and relief-valve assembly, together with all other necessary accessories for taking complete and continuous rock cores of at least 2 inches (NQ size) in diameter. In no event will a core size of less than 2 inches (NQ size) be acceptable, unless pre-approved by the Department Representative.

Unless otherwise directed by the Department Representative, the Contractor shall use either an exploratory diamond core drilling rig or a sonic rig.

Supplies for core drilling shall include all casing and casing caps, drill rods, core barrels, diamond coring bits, reaming shells, piping, pumps, water, tools, and power, and all other items not included herein but required for satisfactory performance of required work. Bits shall be set with the proper size stones for the kind of rock being cored. Note, however, that core boxes (bottoms, dividers, and lids) will be supplied by the Department.

If the Contractor believes that the core size will have to be reduced during the drilling of the core hole, then the Contractor shall initiate the drilling with a larger size core. In no event will a core size less than 2 inches (NQ size) in diameter be acceptable, unless specifically approved in advance by the Department Representative.

All equipment and methods to be used by the Contractor shall be subject to prior approval by the Department Representative. However, approval of the equipment shall not be construed as approval of the performance thereof. The Contractor shall furnish any additional or "special" equipment necessary to obtain the desired end results.

The Contractor shall provide a secure, firm, and level work platform at each borehole location. Borings shall not be offset from locations shown on the boring layout plan without prior approval of the Department Representative. Water for the drilling will be the responsibility of the Contractor. No separate payment will be made for obtaining water. Transporting water to the work sites by tanker will be required at the drill site location (See Attachment B).

3.3 PROCEDURE

The Contractor shall be responsible for drilling one vertical borehole. From the surface to the depth (elevation) where the borehole encounters rock (i.e., the bottom of the overburden), casing shall be installed to prevent possible collapse of the hole, and the casing shall be seated tightly in the rock to a depth of at least one (1) foot, provided that the rock is stable. If the rock is unstable, the casing shall be seated tightly in the rock to a depth of at least two (2) feet. In either case, the casing shall be thoroughly cleaned out preparatory to commencement of rock coring. All drill-rod sections shall be tightly sealed to each other by means of commercial seals made for the purpose or by the application of wicking to the joints. In coring rock (including coal, shale, and indurated clays), the Contractor shall operate the drills at such speeds, feeds, and water pressures as will ensure maximum core recovery. The individual drill runs in the coring operation shall, in no case, be in excess of fifteen (15) feet, unless otherwise approved in advance by the Department Representative. Bottom discharge bits shall be used to increase recovery in soft and broken rock. The Contractor shall frequently check the condition of the core lifter, reaming shell, and rotation of the inner barrel to avoid any grinding of the core. Whenever blockage of the core barrel occurs, the "run" shall be terminated immediately and the rods and barrel pulled. The core barrel shall then be removed from the borehole. The core barrel shall be dismantled horizontally and the core pushed out into a trough when, in the opinion of the Department Representative, such steps are necessary for the protection of the core during its removal from the barrel (i.e., to keep the core from disintegrating or falling apart). Prior to placing the core into core boxes, the Contractor shall lay the core out in proper order on a bench or other suitable flat surface, protected by plastic tarps or similar material underneath the core, for inspection by the Department Representative. Thereafter, the recovered core shall be placed in the core box in proper order. However, before core of specific geochemical interest, determined by the Department

Representative, are placed in core boxes with the rest of the rock core, they will be wrapped and sealed in plastic film.

The Contractor shall ensure a minimum core recovery of ninety percent (90%) for each run, unless unusual subsurface conditions exist, since high recovery is considered necessary for any proper interpretation of the subsurface conditions. When a "run" is made that results in complete core loss, the tools shall be checked for damage or malfunction and a second attempt made to recover the material by coring an additional few inches.

Failure to comply with the foregoing procedure shall constitute justification for the Department to require re-drilling, at the Contractor's expense, if over ten percent (10%) of the total core length is lost without any unusual circumstances being present.

When the borehole is completed to the final total depth as determined by the Department Representative, the Contractor will remove the last of the core from the hole. Unless directed otherwise by the Department Representative the Contractor will then proceed with borehole development by cleaning (flushing) out the hole with fresh water for two (2) hours. It is imperative that the borehole walls and water coming into the well be as clear and clean as possible and free of suspended cuttings and other material so that the Department Representative or his proxy can obtain the most complete and accurate information possible during subsequent tests and measurements within the hole. After flushing is completed, the Contractor will remove the hollow drill-stem rods and all other equipment from the borehole. In removing these items, the Contractor shall take every reasonable precaution to prevent any rocks or other materials from falling back into the open borehole so that the hole will remain open to total depth for subsequent tests and measurements that the Department or its representatives may make.

3.4 LOGS

The Contractor shall keep accurate logs and records of all core borings, which shall include the following information:

1. Project name and contract number, borehole number, location of borehole, ground (surface) elevation, total depth of borehole, time and date of starting, time and date of completion, driller's name, and logger's name.
2. Size and depth of surface casing and size and type of drilling tools used to advance the borehole.
3. Depth of top and bottom of each run, and core recovery of each run.
4. Color changes in drill-water returned.
5. Depths at which sudden losses or gains of drill-water return occur and

estimated quantities involved.

6. Visual classification of rock, including color, grain size, and inclination of beds or layers as measured from the horizontal.
7. Depth of top of firm or fresh rock and all other contacts between dissimilar materials.
8. Depth of static water level at completion of the borehole and, where possible, after 24 hours.
9. Notes, remarks, and other information on pertinent incidents occurring during drilling operations.

3.5 CONTAINERS

During the course of the drilling at the work site, the Contractor shall take adequate precautions to protect the core from mechanical damage. Once recovered and cleaned, the core shall be laid on protective sheeting in a sequence consistent with that in which they were drilled (arranged in descending order). A variety of wood or cardboard spacers shall be inserted at the beginning and end of each run to indicate the measured depths of that run, or the depths can be recorded by clearly writing them on the core stem with a highly visible marker. If voids are encountered, a spacer block shall be inserted, on which is clearly noted that a void occurred and the depth to the top and bottom of the void. All core will then be packaged by the Department Representative, in sequential order, in partitioned boxes provided by the Department (i.e., the Contractor is not required to provide core boxes or package the core into these boxes).

The Department's Representatives, not the Contractor, shall be responsible for transportation and delivery of the core/core boxes to the Department's (BTGS's) core library at 3240 Schoolhouse Road, Middletown, Pennsylvania, 17057.

3.6 ABANDONED BORINGS

Except with the permission of the Department Representative, the Contractor shall not abandon or complete any boring, or remove any casing or drilling equipment, without first affording the Department Representative the opportunity to obtain the position and the depth of the boring to abandonment or completion, to secure samples of material already penetrated, and to make any other tests and measurements, or collect any other information, which the Department Representative may require.

No payment will be made for any boring, which has been abandoned by the Contractor before reaching the depth, elevation, or condition specified, unless the Department Representative approves and accepts the boring as being completed. Any boring abandoned by the Contractor without the Department Representative's approval shall be sealed at the Contractor's expense. The Department Representative may, at his

option, accept a boring that fails to reach the required depth due to an unusual obstruction, which, in his opinion, could not reasonably have been anticipated.

3.7 MEASUREMENT AND PAYMENT

Measurement, when accepted and approved, will be made on the basis of the linear feet of borehole actually drilled into rock, but only to the extent directed by the Department Representative.

Payment will be made at the Contract Unit Price bid per Linear Foot for Contract Item, "NQ Core Drilling," for actual quantities used, which price and payment shall constitute full compensation for furnishing all labor, material, equipment, supplies, water for flushing and other necessary incidentals required to satisfactorily complete all the items of work included in this section.

4. SEALING (CEMENTING) BOREHOLE

4.1 CONTRACTOR RESPONSIBILITY

The work covered by this section consists of furnishing all labor, material, equipment, supplies, and other necessary incidentals required to cement the borehole from bottom to top.

4.2 PROCEDURE

At the direction of the Department Representative, the Contractor shall be required to seal the borehole in the following manner:

1. Upon completion of the borehole and acceptance by the Department Representative (after the Department or its representatives have completed any planned tests or measurements made in the open borehole and/or in the borehole still containing the hollow drill-stem rods), the Contractor will fill the hole with a cement approved by the Department's representative, from the bottom of the hole to within two (2) feet of the surface, unless directed otherwise by the Department Representative.
2. The casing shall be withdrawn.
3. In the event the casing cannot be recovered, it shall be cut off one (1) foot below the ground surface, unless directed otherwise by the Department Representative, and the borehole shall be sealed as indicated in item 1 above of this list.
4. The top two (2) feet of the borehole shall be filled with topsoil.
5. The surface shall be restored to as good as or better than original condition.

4.3 MEASUREMENT AND PAYMENT

Measurement, when accepted and approved, will be made on the basis of the linear feet of borehole actually sealed (cemented) before final demobilization of the Project is complete, but only to the extent directed by the Department Representative.

Payment will be made at the Contract Unit Price bid per Linear Foot for Contract Item, "Sealing (Cementing) Borehole," for actual quantities used, which price and payment shall constitute full compensation for furnishing all labor, material, equipment, supplies, and other necessary incidentals required to satisfactorily complete this item of work.

5. RESTORATION OF BOREHOLE

5.1 CONTRACTOR RESPONSIBILITY

The work covered under this section consists of providing all labor, material, equipment, and other incidentals necessary to restore the area surrounding the borehole and the access route to the borehole to a condition equal to or better than that which existed prior to the start of work. The work included in this section is considered discretionary and must be directed, approved, and accepted by the Department Representative, since clean-up and restoration are considered incidental to and included in Contract Items that include "Site Mobilization and Demobilization."

5.2 PROCEDURE

In the case of a borehole located on public lands, restoration includes but is not limited to restoring surface to as good or better than original condition to the extent directed, approved, and accepted by the Department Representative, and any specific conditions that may be outlined in the State Game Lands Special Use Permit agreement.

5.3 MEASUREMENT AND PAYMENT

Measurement, when accepted and approved, for restoration of the borehole at the specified location, will be made on the basis of the borehole restored, but only to the extent directed, approved, and accepted by the Department Representative.

Payment will be made at the Contract Unit Price bid per Borehole for Contract Item, "Restoration of Borehole," for actual quantities used, which price and payment shall constitute full compensation for furnishing all labor, material, equipment, supplies, and other necessary incidentals required to satisfactorily complete this item of work. No payment will be made for restoration of the borehole that have not been directed, approved, and accepted by the Department Representative, since clean up and restoration is considered incidental to and included in Contract Items that include "Site Mobilization and Demobilization."

6. STAND-BY TIME

6.1 CONTRACTOR RESPONSIBILITY

The work item covered by this section is intended to address any delays in drilling in which a drill rig and crew are ordered by the Department Representative to stand idle.

6.2 PROCEDURE

When the Contractor is ordered by the Department Representative to delay the drilling of the boring or other activities occurring at the work site, the Contractor will be reimbursed for any such delays, provided that the delays are the sole responsibility of the Department Representative and the delays are in excess of one-half hour in duration.

Stand-by time shall not be used for payment to the Contractor of delays caused by equipment breakdown and malfunctions or for delays caused by non-availability of necessary equipment and supplies. Such delays shall be considered the sole responsibility of the Contractor and shall be incidental to other items of work, and no additional compensation will be allowed. No payment for stand-by time will be made for items of equipment other than a complete drill rig and crew in full operating condition. A crew shall consist of a driller and helper and if any delay does occur, the Department Representative will record it on a daily basis with dates and times directed to be idle.

6.3 MEASUREMENT AND PAYMENT

Measurement, when accepted and approved, will be made on the basis of hours a drill rig and crew are ordered to stand idle, but only to the extent directed by the Department Representative.

Payment will be made at the Contract Unit Price bid per Hour for Contract Item, "Stand-by Time," for actual quantities used, and will be divided no finer than by one-half hour increments, which price and payment shall constitute full compensation for the delay of a drill rig and crew.

7. INSPECTIONS

Ample opportunity shall be furnished at all times to the Department Representative for inspecting the work. If any imperfect work is performed at any time, the defects therein shall be remedied by the Contractor, at his expense, to the full satisfaction of the Department Representative. No drilling or field testing shall be done except in the presence of the Department Inspector or Department Representative, unless specific permission has been granted to the contrary by the Department Representative. The presence of a Department Inspector, or the keeping of separate drilling records by the

Department Representative, shall not relieve the Contractor of the responsibility for work specified in the Contract.

8. DESCRIPTIONS OF CONDITIONS TO BE ENCOUNTERED

The following description of the borehole, referenced in more detail in Attachment B, is approximate, and the Department assumes no liability for the accuracy thereof:

Hole No. WAY127_0426

Estimated Total Depth 1000 lineal feet

For the purposes of this Contract, the footage for the hole listed above shall be used in making bid calculations. Depending upon the actual distance (depth) to target horizons as determined by the Department Representative, the total depth of the holes may deviate from the estimates listed above. Therefore, the Department Representative reserves the right to shorten the total depth of the drill holes by any amount, if required, or to lengthen (deepen) the cumulative total depth of the drill holes by up to 100 feet deeper than each listed above, keeping to the same unit price for core drilling as used in making bid calculations.