



REPORT OF PRELIMINARY
ON-SITE WASTEWATER FEASIBILITY EVALUATION

CREBILLY FARM

Westtown Township, Chester County, Pennsylvania

March 2017

Prepared For:

TOLL BROTHERS, INC.
516 North Newtown Street Road
Newtown Square, PA 19073

Attn: Mr. Gary Chase

Prepared By:

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A Practicing Geoprofessional Business Association Member Firm



March 27, 2017

Toll Brothers, Inc.
516 North Newtown Street Road
Newtown Square, PA 19073

Attn: Mr. Gary Chase

Re: Report of Preliminary On-site Wastewater Feasibility Evaluation
Crebilly Farm
Westtown Township, Chester County, Pennsylvania

Dear Gary:

In accordance with our Agreement dated June 6, 2016, Geo-Technology Associates, Inc. (GTA) has performed a preliminary on-site wastewater suitability evaluation for the proposed residential subdivision, located on the Crebilly Farm property in Westtown Township, Chester County, Pennsylvania. In accordance with direction from Toll Brothers, Inc., this evaluation is based on a 250 gallon per day design wastewater flow rate for each proposed residential unit, including for the purposes of groundwater mounding analysis, preliminary area requirements for drip irrigation, etc. The results of field testing and analysis associated with the preliminary evaluation are summarized in the attached report.

We appreciate the opportunity to have been of assistance to you on this project. Should you have questions, please contact the undersigned at (410) 515-9446.

Sincerely,
GEO-TECHNOLOGY ASSOCIATES, INC.

Paul S. Scott, P.G.
Vice President

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Staff Scientist

PSS/GM/mlw
31161348

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REPORT OF PRELIMINARY ON-SITE WASTEWATER FEASIBILITY EVALUATION

CREBILLY FARM WESTTOWN TOWNSHIP, CHESTER COUNTY, PENNSYLVANIA MARCH 2017

1.0 INTRODUCTION

This Report presents the results of our preliminary on-site wastewater evaluation performed on the Crebilly Farm property (site) located immediately northwest of the intersection of West Street Road and Wilmington Pike in Westtown Township, Chester County, Pennsylvania. Geo-Technology Associates, Inc. (GTA) understands that Toll Brothers is considering the purchase of the subject site for construction of a residential community, and is also considering potential service via an on-site community wastewater disposal system.

The gross site area is approximately 322.4 +/- acres. GTA was provided with two concept plans designated Plan B and the Overall Open Space Plan (Site Plan), prepared by Eastern States Engineering (ESE). The concept plans indicate the two alternate layouts of the subdivision and stormwater management areas. The proposed subdivision will be a mix of estate/executive lots, executive/courtyard lots, and carriage homes. According to the concept plans, the house totals may range from 317 (Site Plan) to 397 (Plan B) units. The plans included boundary information, potential lot and roadway configuration, and the locations of the proposed stormwater management facilities. Proposed and existing grades and utility locations were not provided for our review at the time this Report was prepared.

In conjunction with the proposed development, GTA was retained to perform a preliminary on-site wastewater evaluation at the northwestern portion of the project site (evaluated area). The preliminary evaluation included test pit exploration, soil profile evaluation, infiltrometer testing, soil borings, preliminary hydraulic testing of soil borings, water quality evaluation and mounding analysis. Preliminary conclusions and recommendations provided herein regarding the suitability of soil and groundwater conditions for on-site wastewater disposal were derived from analysis of field and laboratory data, and review of the previously referenced concept plans. In conjunction with the area-specific wastewater evaluation

at the northwestern portion of the site, GTA also reviewed published information and the results of GTA's previous geotechnical evaluation, for preliminary evaluation of general feasibility at the site.

2.0 SITE AND EVALUATED AREA DESCRIPTION AND INFORMATION REGARDING POTENTIAL ON-SITE WASTEWATER DISPOSAL

2.1 Site Description

The subject site is located northwest of the intersection of Wilmington-West Chester Pike (Route 202) and West Street Road (Route 926), in Westtown Township, Chester County, Pennsylvania, as shown on the *Site Location Map, Figure 1*, included in *Appendix A*. Specifically, the subject site is comprised of eleven lots, identified as Tax Parcels 67-4-029, 67-4-029.1 through 67-4-029.4, 67-4-030 through 67-4-033, 67-4-033.1, and 67-4-134, totaling approximately 322.4 +/- acres. At the time the field exploration was performed, the subject site was primarily an undeveloped property containing a few single-story and two-story residential structures, barns, stables, and horse training facilities in the central and western portions of the site. The site also contained asphalt paved and gravel driveways and various utilities associated with the existing structures. GTA understands that there were residential structures on the eastern portion of the site that were demolished. Remnant slabs and demolition debris were present on this portion of the site at the time our field exploration was performed.

The site topography is generally gently to steeply sloping, with surface drainage generally directed toward Radley Run and the unnamed tributaries to the south and west. Ground surface elevations range from approximately elevation (EL) 380 in the southeast corner of the site, near the residential structure located adjacent to the intersection of West Street Road and Wilmington-West Chester Pike, to approximately EL 250 in the southwest portion of the site, near Radley Run. Ground surface elevations were based on Google Earth Imagery from 2011 and limited survey data and should be considered approximate. A stream, identified as Radley Run, is located in the southwest portion of the site near the farm entrance. Additionally, unnamed tributaries to Radley Run are situated at the southern-central and northwestern portions of the site.

2.2 Description of Proposed Wastewater Disposal Areas

GTA was directed by Toll Brothers to evaluate an approximate 32-acre area located at the northwestern corner of the site (evaluated area). The evaluated area is indicated on the *Test Pit and Observation Hole Location Plan*, attached to this Report in *Appendix A*. The Overall Open Space Plan (Site Plan; attached in *Appendix A*), prepared by ESE and dated October 7, 2016 depicts the overall site area and the 317 residential unit layout. Proposed wastewater disposal areas are indicated on the Site Plan, and total approximately 25.5 acres in area; two relatively large disposal areas are indicated at the northwestern and southeastern portions of the site, with two smaller areas shown at the east-central portion. At the time of the preliminary evaluation the evaluated area was under soybean crop cover and GTA was instructed to perform all exploration and testing outside of the soybean crop area. Thus, the test pits and soil borings used to evaluate the potential disposal area were generally outside of, or on the margins of the area. Based on topographic information provided by ESE, the evaluated area is situated over a ridgeline/topographic divide, with about half to two thirds of the area sloping to the southeast and toward the immediately adjacent unnamed tributary to Radley Run, and the other portion sloping to the northwest and toward another unnamed tributary (off-site) to Radley Run.

2.3 Proposed Wastewater Flows and Potential System Types

Based on discussions with Mr. Andrew Semon of Toll Brothers, this evaluation was performed assuming wastewater flows for the proposed 317 residential units and two community centers, as well as a scenario including 397 residential units with the aforementioned community centers. In accordance with direction from Toll Brothers, Inc., this evaluation is based on a 250 gallon per day (gpd) design wastewater flow rate for each proposed equivalent dwelling unit (EDU), including for the purposes of groundwater mounding analysis, preliminary area requirements for drip irrigation, etc. Also, based on information provided to GTA by Toll Brothers, the flows associated with each community center is 750 gpd, or 3 EDUs. Thus, the potential wastewater flows assumed in this Report for the 317 (Site Plan) and 397 (Plan B) residential unit scenarios are 80,750 and 100,750 gpd, respectively. GTA understands that each of the development concept plans, i.e., the *Site Plan* and *Plan B*, are proposed to be served by an on-site community drip irrigation wastewater treatment and disposal system.

Options for wastewater disposal systems at the site may include spray irrigation, drip irrigation and deeper bed-type systems, depending upon wastewater flows and suitability of site conditions. Spray or drip irrigation systems may be used to apply up to a maximum 2-inches per week of wastewater per acre of suitable area. Storage is required for winter months when wastewater cannot be applied via spray irrigation. For the maximum application rate of 2-inches per week, 30 or more acres may be necessary for an initial spray irrigation system, not including storage area. Depending upon site conditions and based on information provided in the Treatment and Dispersal Packages Design Manual prepared by the American Manufacturing Company and dated March 1999, initial system area requirements for a drip irrigation system may be 20 acres or more, not including storage area or infrastructure. Bed type systems generally require less area but due to the greater concentration of wastewater, groundwater mounding is effectively enhanced and can be more challenging to large system implementation, depending upon site conditions.

It is noted that there are many PADEP design and system siting requirements for each of the aforementioned systems which may influence the size and practicable implementation of the systems. Refer to the PADEP Manual for Land Application (October 15, 1997) and PADEP Code Chapter 73 for additional information. Some of the requirements include setbacks that may be 100 feet (e.g., from property lines); avoidance of slopes greater than 25 percent, etc. For existing potable water supply wells the required horizontal isolation distance is indicated as 100 feet.

Based on discussions with PADEP personnel, the PADEP does not require a replacement area for a large system. However, through the planning process the local municipality or controlling authority as applicable may require a replacement area to be held in reserve.

3.0 SOILS AND HYDROGEOLOGY

3.1 Soils

According to the U.S. Department of Agriculture (USDA) web soil survey, the soils underlying the site are mapped as the Glenville silt loam (GIB, GIC), Glenelg silt loam (GgB, GgC), Chester silt loam (CdB), Baile silt loam (Ba), Codorus silt loam (Co), Gaila silt loam

(GaD) and Hatboro silt loam (Ha) series soils. The Glenelg, Chester and Gaila series soils are described as being well-drained, with depths to the water of more than 6 feet and a depth to bedrock generally ranging from 60 to 120 inches. The evaluated area of the site for potential on-site wastewater disposal appears to be underlain primarily by the Glenelg and Chester soils. A map indicating soil types at the site based on USDA information is attached to this Report in *Appendix B*.

The Glenville and Codorus series soils are described as being moderately well-drained, with depths to the water of approximately 6 to 36 inches and a depth to bedrock generally ranging from 15 to 99 inches. The Baile and Hatboro series soils are described as being poorly-drained, with depths to the water of approximately 0 to 6 inches and a depth to bedrock generally ranging from 60 to 99 inches. These soils were typically mapped in the low lying areas. Refer to the publications for additional information.

3.2 Hydrogeology

According to *The Preliminary Bedrock Geologic Map of a Portion of The Wilmington 30-by 60- Minute Quadrangle, Southeastern Pennsylvania*, published by Pennsylvania Department of Conservation and Natural Resources (2005), the subject site is primarily situated within the Glenarm Wissahickon formation of the Piedmont Physiographic Province. Specifically, the map indicates that the majority if the site is underlain by the Doe Run schist which is identified as garnet-staurolite-kyanite pelitic schist with abundant biotite and muscovite. The residual soils resulting from the weathering of the parent bedrock of the Doe Run schist can result in low plasticity silts and clays transitioning to non-plastic sands with lesser percentages of silt and clay. These materials generally become increasingly stiff or dense with depth; although, differential weathering can often result in softer zones within otherwise very dense weathered rock material.

The above-referenced bedrock geology map also indicates that a small portion of the site along the western property boundary may be underlain by Ultramafic rock, which is described as primarily serpentinite containing magnesium-rich rocks derived from pyroxenite and peridotite. The residual soils resulting from the weathering of the parent bedrock of the Ultramafic rock can result in high plasticity soils with low unit weights. The Ultramafic rock does not appear to be

mapped within the evaluated area for potential on-site wastewater disposal.

The *Geohydrology of Southeastern Pennsylvania*, published by the USGS in 2002, indicates median hydraulic conductivity (K) values of 0.25, 0.55 and 1.0 for three schist members of the Wissahickon Formation. In GTA's experience with hydraulic testing of residual soils of the Wissahickon, K-values have generally ranged from about 0.5 to 2 ft/day, although in some instances values have been lower or higher.

4.0 SUBSURFACE EXPLORATION AND INFILTRMETER TESTING

Subsurface exploration and infiltrometer testing was performed on July 27, 2016, to preliminarily evaluate the soil conditions for accommodation of a large community wastewater disposal system. The exploration/testing included excavation of 10 test pits by R. Keating and Sons, Inc., using a rubber-tire backhoe at the approximate locations depicted on the *Test Pit and Observation Hole Location Plan* (Plan), attached to this Report in *Appendix A*. As previously noted, at the time of the preliminary evaluation the evaluated area was under soybean crop cover and GTA was instructed to perform all exploration and testing outside of the soybean crop area. Thus, the test pits used to evaluate the potential disposal area were generally outside of, or on the margins of the proposed disposal area. Thus, these results are preliminary and it will be necessary to perform additional soil evaluation within the proposed disposal area. GTA subcontracted the services of DelMarva Environmental, Inc. (DEI) for assistance with preliminary detailed soil profile evaluation and infiltrometer testing performed by a Certified Professional Soil Scientist/Soil Classifier. Please see the report prepared by DEI for the site, attached to this Report in *Appendix B*, for additional details regarding the results of the preliminary detailed soil profile evaluation and infiltrometer testing.

The test pits were excavated to depths ranging from approximately 7 to 14 feet below the existing ground surface (ft bgs). Groundwater was encountered in Test Pit TP-438 at a depth of approximately 12 ft bgs. Mottling, which may be an indicator of seasonally saturated (possibly perched water) soil conditions, was observed within test pits TP-437, TP-438, and TP-440 at about 2.5 ft bgs. It is noted that these three test pits are situated at relatively low topographic settings in the evaluated area, and within about 100 feet of the stream.

Single ring infiltrometer tests were conducted within Test Pits TP-435, TP-441, and TP-443 on July 28, 2016. Two tests were conducted in each test pit within horizons that potentially represent the most hydraulically restrictive soil material. Infiltration rates ranged from 8.6 minutes per inch (mpi) at a depth of 20 inches below the ground surface (in bgs) in TP-441, to 240 mpi at a depth of 18 in bgs in TP-435. Percolation tests were also performed in TP-435 and TP-441 at respective depths of 43 and 48 in bgs. Percolation rates for TP-435 and TP-441 were estimated at 10.7 and 18.7, respectively. For more information regarding infiltration and percolation test rates and this preliminary soil evaluation, see the DEI report attached in *Appendix B* of this Report.

5.0 SOIL BORING DRILLING AND HYDRAULIC TESTING

Four soil borings, identified as OH-1 through OH-4, were drilled by GTA on August 9, 2016. The borings were drilled by making use of a truck-mounted hollow-stem auger rig. The borings were drilled at the locations indicated on the Plan, attached in Appendix A. Boring OH-1 was drilled to a depth of about 44.3 ft bgs, and had a static water level of approximately 16.12 ft bgs. Boring OH-2 was drilled to a depth of about 33.4 ft bgs, and had a static water level of approximately 4.31 ft bgs. Boring OH-3 was drilled to a depth of about 35.2 ft bgs, and had a static water level of approximately 11.03 ft bgs. Boring OH-4 was drilled to a depth of about 38.1 ft bgs, and had a static water level of approximately 12.4 ft bgs. Temporary PVC casing and perforated piping was installed within the borings to facilitate water level measurement and preliminary hydraulic testing.

Preliminary hydraulic testing was performed to facilitate preliminary estimation of hydraulic properties of subsurface materials encountered by borings OH-1 through OH-4. Slug tests were performed within OH-1 through OH-4 by rapidly lowering and removing cylindrical slugs composed of stainless steel into and out of each boring, causing water level displacement. Changing groundwater levels were measured using a Solinst Levellogger pressure transducer, supplemented with manual hand measurements via a Solinst Model 101 water level meter. A barologger was used to measure barometric pressure changes during the testing period.

Test data obtained were barometrically compensated and reduced for input to analytical models for hydraulic conductivity (K) estimation. The Aqtesolv program was used to analyze hydraulic test data, resulting in K-value estimates ranging from approximately 0.5 to 1.2 ft/day for borings OH-1, OH-2, and OH-3. It is noted that the water level response at OH-4 was anomalously slow (essentially no measureable water level change); this location was excluded from our analysis. Hydraulic test results are attached to this Report in *Appendix C*.

6.0 GROUNDWATER SAMPLING

GTA performed groundwater quality sampling and analysis within observation holes OH-1 through OH-4 on August 10, 2016. Samples were collected and analyzed for nitrate, nitrite, and TKN. Submersible pumps were deployed within each sampled observation hole, and utilized to purge groundwater prior sampling. Field measurements of pH, temperature and conductivity were collected during purging. The samples were collected after approximately 3 well volumes of groundwater were evacuated from the wells and the groundwater temperature, electrical conductance, and pH appeared to have stabilized, or, in the case of OH-4, after the boring was pumped to effective dryness and allowed to recover. The laboratory results of the groundwater quality monitoring within observation holes OH-1 through OH-4 are attached to this report in *Appendix D*.

The samples were decanted directly into laboratory-cleaned sampling containers, and each sample container was placed on ice immediately after filling, and remained so until delivery to the laboratory. The groundwater samples were transported to SGS Accutest for analysis, with completed Chain of Custody documentation.

TKN and nitrite concentrations were either not detected or were detected at concentrations of about 0.5 mg/L or less. Nitrate concentrations ranged from about 5.4 mg/L to 6.4 mg/L at locations OH-1, OH-2 and OH-3, and at OH-4, a relatively low concentration of 0.5 mg/L was detected. Nitrate concentrations for all locations were below the USEPA Maximum Contaminant Level (MCL) of 10 mg/L. Concentrations of nitrate below the MCL may allow for some flexibility in treatment requirements.

7.0 INFORMATION FROM GTA'S PRELIMINARY GEOTECHNICAL EXPLORATION

GTA performed a preliminary geotechnical exploration of the site, the results of which are summarized in GTA's *Report of Preliminary Geotechnical Exploration*, dated August 2016 (GTA, 2016). The exploration included the drilling of 40 soil borings, the excavation of 22 test pits and the performance of 13 infiltrometer tests. In agreement with the published geology, the test borings and test pits typically encountered surficial topsoil underlain by residual soils consistent with the Wissahickon Formation throughout the maximum depths explored. Below the topsoil and/or existing fill, the preliminary borings and test pits encountered fine-grained residual soils visually classified as silts and clays with lesser percentages of sand and rock fragments to depths of approximately 2 to 9½ feet below existing grades. Underlying the fine-grained soils, the borings and test pits typically encountered granular residual soils visually classified as silty sand with varying amounts of rock fragments, generally transitioning into highly weathered rock. At several locations the drill rig was able to auger through the weathered rock. Auger refusal was not encountered to the explored depths. Highly weathered rock was also identified at some test pit locations at depths of approximately 7 to 10½ feet below ground surface.

Uncorrected SPT N-values for the encountered surficial fine-grained soils ranged from 2 to 14 blows per foot (bpf), averaging 6 bpf, indicating these soils are generally medium stiff. The uncorrected N-Values for the granular materials ranged from 4 to 50, averaging 16, which indicates the soils were generally medium dense. The silty sands generally transformed into highly weathered rock materials with uncorrected N-values of 50 or more blows per increment. Hard augering and excavation difficulties were also experienced in the highly weathered rock at depths ranging from about 5 to 13 feet below existing grades and as indicated on the logs in GTA (2016).

Groundwater was observed at 11 of the exploration locations at depths ranging from about 4.4 to 12.9 feet below the ground surface, corresponding to elevations ranging from approximately EL 302 to 337. The remaining test locations were dry to their cave-in or termination depths.

Groundwater levels were recorded during the exploration and again prior to backfilling the exploration holes. Most of the test borings were left open to collect 24-hour groundwater measurements; however, test borings conducted within the horse pastures and the test pits were backfilled upon completion for safety considerations. The observed water levels in the higher areas of the site are likely perched water trapped in sandy lenses over dense weathered rock. Water levels encountered in the exploration locations in the low lying areas are considered to be the seasonal water table. It should be noted that fluctuations of ground water levels of several feet typically occur seasonally with variations in precipitation and runoff. During the wet season of the year (late winter/early spring) groundwater or “perched” water conditions can develop locally within existing granular soils above the less permeable layers such as the very dense weathered rock and/or bedrock surface. Refer to the GTA (2016) for additional information.

Thirteen proposed stormwater management (SWM) facility locations were evaluated for infiltration potential of the underlying soils. Single-ring infiltrometer tests were performed within holes offset from Test Pits TP-1 through TP-13. The test depths were established to maintain a minimum of 3 feet of separation between the test elevations and hydraulically limiting zones.

The testing consisted of seating an open-bottom 12-inch diameter casing approximately 4 inches into the hand-trimmed subgrade soils. The holes were then pre-soaked, and water level measurements were taken with time until a steady state condition was observed. The tests were conducted for approximately 2 hours, and the unfactored steady-state values recorded over the last 1-hour time period were about 1 to 2 inches per hour (in/hr) for 8 of the locations, 4 in/hr for one location, 0.5 in/hr for 2 locations and no discernable movement of water level for 2 locations. It should be noted that infiltration rates can vary widely with variations in soil texture and gradation. See GTA (2016) for more information including test locations.

8.0 GROUNDWATER MOUNDING ANALYSIS

A groundwater mounding analysis (GMA) for the proposed wastewater flows at the site was performed by simulating groundwater flow and the potential mounding effects due to introduction of the proposed flows to the water table. As previously mentioned, the proposed

wastewater flows for the site are estimated at approximately 80,750 gpd (317 residential units) for the proposed development, up to 100,750 gpd (if 397 units were proposed). The model construction details and results of the GMA are summarized herein.

8.1 Groundwater Flow Model

The mounding analysis was performed by utilizing the MODFLOW program, developed by M. McDonald and A. Harbaugh, and incorporated into Visual MODFLOW, Version 4.1 by Waterloo Hydrogeologic, Inc. A MODFLOW model of the site, with grid dimensions of 6,000 by 4,000 feet, and 50- to 100-foot grid spacing, was constructed. Two layers were incorporated into the model to represent the unconsolidated overburden and upper portion of the underlying crystalline rock. A saturated thickness of approximately 40 feet was assumed in the model for the overburden (Layer 1) and the upper approximate 150 feet of the underlying rock was simulated as Layer 2. Model parameters included K-values of approximately 0.75 ft/day and 0.55 ft/day input for Layer 1 and 2, respectively.

No-flow boundaries were assigned to the north to represent an apparent groundwater flow divide associated with a topographic divide, and the drain package was used to simulate Radley Run to the west and its tributaries that flank the evaluated area to the north and south. River segments were assigned elevations based on the USGS Westchester Topographic Quadrangle (USGS, 2016). An initial recharge value of 0.0019 ft/day (USGS WRI 93-4055) was specified for the entirety of the model, based on approximately 20 percent of precipitation (40 inches per year) recharging the groundwater table.

The largest two of the four proposed disposal areas indicated on the Site Plan are separated by streams (hydraulic barriers) and over 3,400 feet of distance; no hydraulic communication between these two disposal areas when is anticipated. In like manner, the remaining two smaller disposal areas indicated on the Site Plan are also isolated. In order to provide a conservative evaluation of mounding potential in any one of these four disposal areas, the largest area with the highest potential inflows was selected for simulation, i.e., the evaluated area at the northwest portion of the site, where based on area proportionality about 50% of the total flows associated with the 317 and 397 unit scenarios may be directed. Thus, about 40,000

and 50,000 gpd of the respective total 80,750 (317 unit) and 100,750 (397 unit) gpd flows were input to the simulated, evaluated area at the northwestern portion of the site. Groundwater mounding in the other three proposed disposal areas is expected to be lower due to lower flows; therefore inflows to these other areas were not simulated.

8.2 Model Runs and GMA Results

A steady state simulation was performed without the simulated wastewater influx in order to obtain a set of initial heads for the transient simulation. Transient simulations were then performed, incorporating the flows associated with 317 and 397 unit scenarios (see Section 8.1) over a 10-year stress period. The simulated wastewater flows were evenly distributed over the disposal area and added to the applicable natural recharge rate for each area. The transient mound-height estimation maps are attached to this Report in *Appendix E*.

Based on the GMA results, the simulated 10-year, maximum groundwater mound heights beneath the proposed disposal area are approximately 10 and 12 feet for the respective 317 and 397 unit scenarios, tapering to less than two feet toward the unnamed stream tributaries. Generally, GTA understands that an approximate 2 to 4 foot treatment zone is required to be maintained below the wastewater disposal system, depending upon design limitations and regulatory evaluation. Observed groundwater levels in the evaluated area ranged from about 4 ft bgs at OH-2 within about 100 feet of the stream to about 16 ft bgs about 400 feet upslope of the stream at OH-1 (see the Test Pit and Observation Hole Location Plan in *Appendix A* for surface elevations). Location OH-1, with the observed groundwater depth of about 16 ft bgs is the nearest Observation Hole to the disposal area proposed at the northwestern portion of the site. It appears based on the results of this evaluation, including this mounding analysis, that the required treatment zone beneath the system can be maintained for areas of relatively high topographic elevation with groundwater level depths such as observed at Location OH-1. Considering the potential for seasonal groundwater levels to rise several feet from the levels observed, a groundwater mound of similar height and extent to that simulated for this preliminary evaluation may impinge on a required 4-foot treatment zone for a drip irrigation system in a relatively low-lying area, e.g., relatively near to the stream adjacent to the evaluated area.

9.0 CONCLUSIONS AND RECOMMENDATIONS

Based upon the results of this preliminary evaluation, it is our opinion that on-site wastewater disposal of the proposed flows is feasible for implementation at the site; additional soil and hydrogeologic evaluation will be necessary to evaluate the required size and configuration of the initial system, and the required area for initial system accommodation. Based on the results of our preliminary evaluation (see additional conclusion information in the following paragraphs), it appears that an area with suitable subsurface conditions totaling approximately 25.5 acres –the combined acreage which is shown on the proposed Site Plan - would be sufficient to accommodate the proposed flows via a drip irrigation system. It is again noted that with the exception of one location in a drainage swale at the central portion of the approximate 32-acre evaluated area, the preliminary wastewater exploration/testing locations were either on the margins or outside of the proposed evaluated area due to instructions to avoid crop damage.

It is noted that there are many PADEP design and system siting requirements for drip irrigation systems which may influence the size and practicable implementation of the systems. Based on discussions with PADEP personnel, the PADEP does not require a replacement area for a large system. However PADEP personnel indicated that through the planning process a local municipality or controlling authority, as applicable, may require additional area for system replacement/repair to be established at a site.

Based on the test pits excavated for this evaluation, the observed depths to limiting conditions such as groundwater or rock and the drainage characteristics (soils appeared generally to be well drained) appeared to be generally favorable for wastewater disposal. Infiltration/percolation rates were variable, with generally suitable rates observed at two locations at multiple depths, and relatively very slow rates observed at a third tested location. For GTA's (2016) preliminary geotechnical evaluation, 9 of 13 infiltration test rates resulted in infiltration rates that appear generally favorable for wastewater disposal, while four of the results appear marginal to unsuitable.

The residual soils appear to be relatively deep at the locations of the soil borings, with borings ranging in depth from about 33 to 44 ft bgs; groundwater depths at the borings ranged from about 4 to 16 ft bgs. It is noted that topographically higher portions of the evaluated area, such as the topographic knob at the central portion, may be associated with relatively shallow rock. Groundwater levels may rise by several feet seasonally relative to depths observed for this preliminary evaluation.

The residual soils/highly weathered rock at the site appears to be relatively dense and potentially relatively low in permeability, based on field observations for the four borings at/near the evaluated area, and the soil borings performed for the preliminary geotechnical evaluation at the site (GTA, 2016). Hydraulic testing results for the preliminary wastewater evaluation within three of the four tested soil borings resulted in relatively low K-values, but generally within the range of residual soil K-values in GTA's experience for the Wissahicken. One of the tested locations was associated with anomalously slow water level response to testing, and potentially a relatively low K-value. It is possible that this location from a hydraulics testing standpoint, was adversely influenced by borehole smearing/skin effects during the drilling process, or that the materials at that location are relatively dense and of low permeability. Hydraulic test results were variable.

The preliminary groundwater mounding analysis for this evaluation indicated potential groundwater mound heights, after 10 years of continuous operation at the proposed flow rates, of up to 10 (317 units) to 12 (397 units) feet at the central portion of the simulated system, tapering toward the margins. Depending on the configuration of the groundwater table in the vicinity of a proposed disposal area a groundwater mound of similar height and extent to that simulated for this preliminary evaluation may impinge on the required treatment zone beneath a shallow system such as a drip irrigation system. This potentially would result in the necessity of a reduction of flows, or reconfiguration/splitting of system flows. The splitting of flows such that they are directed to hydraulically discrete portions of the site, separated by relatively great distances, as is indicated on the Site Plan should substantially reduce groundwater mounding potential relative to a system where all wastewater flows for the site are concentrated into one area. Systems installed such that

they straddle topographic/groundwater divides in applicable areas can also reduce the potential for groundwater mounding.

Depending upon the type of system that is selected for implementation for the site, e.g., drip irrigation, spray irrigation or subsurface bed type systems, the testing requirements, area requirements, storage requirements etc., will vary. For example, a spray irrigation system may require more land than other types of systems for both the application area and for storage during times of the year associated with low temperatures. However, mounding analysis requirements may be relaxed for spray systems due to PADEP's recognition that a large fraction of applied waste water evapo-transpires, and never reaches the water table.

The following recommendations are included with respect to pursuit of a large on-site wastewater disposal system for the site:

- Confirm/refine anticipated water usage/wastewater flows.
- Perform additional soils and hydrogeologic evaluation of area(s) proposed for wastewater disposal.
- Considering land availability, practical site constraints and soil/hydrogeologic conditions, select a system type for proposed implementation at the site.
- Engage the PADEP and other applicable agencies/governmental entities to review the proposal and provide feedback on system configuration, proposed flows, potential requirements such as replacement area, etc.
- The system should be configured such that it occupies topographically relatively high areas that are suitable, and straddles topographic divides where applicable. The system should be configured to avoid relatively low permeability and/or shallow rock/groundwater areas as applicable.

10.0 LIMITATIONS

This report, including all supporting test boring, test pit logs, field data, field notes, laboratory test data, calculations, estimates, and other documents prepared by GTA in connection with this project, has been prepared for the exclusive use of Toll Brothers pursuant to the agreement between GTA and Toll Brothers, Inc., and in accordance with generally accepted soil evaluation practice. No warranty, express or implied, is given herein. Use and reproduction of this report by any other person without the expressed written permission of GTA and Toll Brothers, Inc. is unauthorized and such use is at the sole risk of the user.

The analysis and recommendations contained in this report are based on assumed design wastewater flows of 250 gpd per EDU/residential unit, and the data obtained from limited observation and testing of the encountered materials, from locations that were generally outside of the evaluated disposal areas. Thus the results, conclusions and recommendations provided herein must be considered preliminary until additional exploration and testing is performed within the proposed disposal area(s). Test borings and test pits indicate soil conditions only at specific locations and times and only to the depths penetrated. They do not necessarily reflect strata variations that may exist between the test pit locations. Consequently, the analysis and recommendations must be considered preliminary until the subsurface conditions can be verified by direct observation at the time of construction. If variations in subsurface conditions from those described are noted during construction, recommendations in this report may need to be re-evaluated.

In the event that any changes in the nature, design, or location of the facilities or lots are planned, the conclusions and recommendations contained in this report should not be considered valid unless the changes are reviewed and conclusions of this report are verified in writing. GTA is not responsible for any claims, damages, or liability associated with interpretation of subsurface data or re-use of the subsurface data or engineering analysis without the expressed written authorization of GTA.

The scope of our services for this preliminary evaluation did not include any environmental assessment or investigation for the presence or absence of wetlands, or hazardous or toxic materials in the soil, surface water, groundwater or air, on or below or around this site. Any statements in this report or on the logs regarding odors or unusual or suspicious items or conditions observed are strictly for the information of our Client.

This Report and the attachments are instruments of service. The subject matter of this report is limited to the facts and matters stated herein. Absence of a reference to any other conditions or subject matter shall not be construed by the reader to imply approval by the writer.

31161348

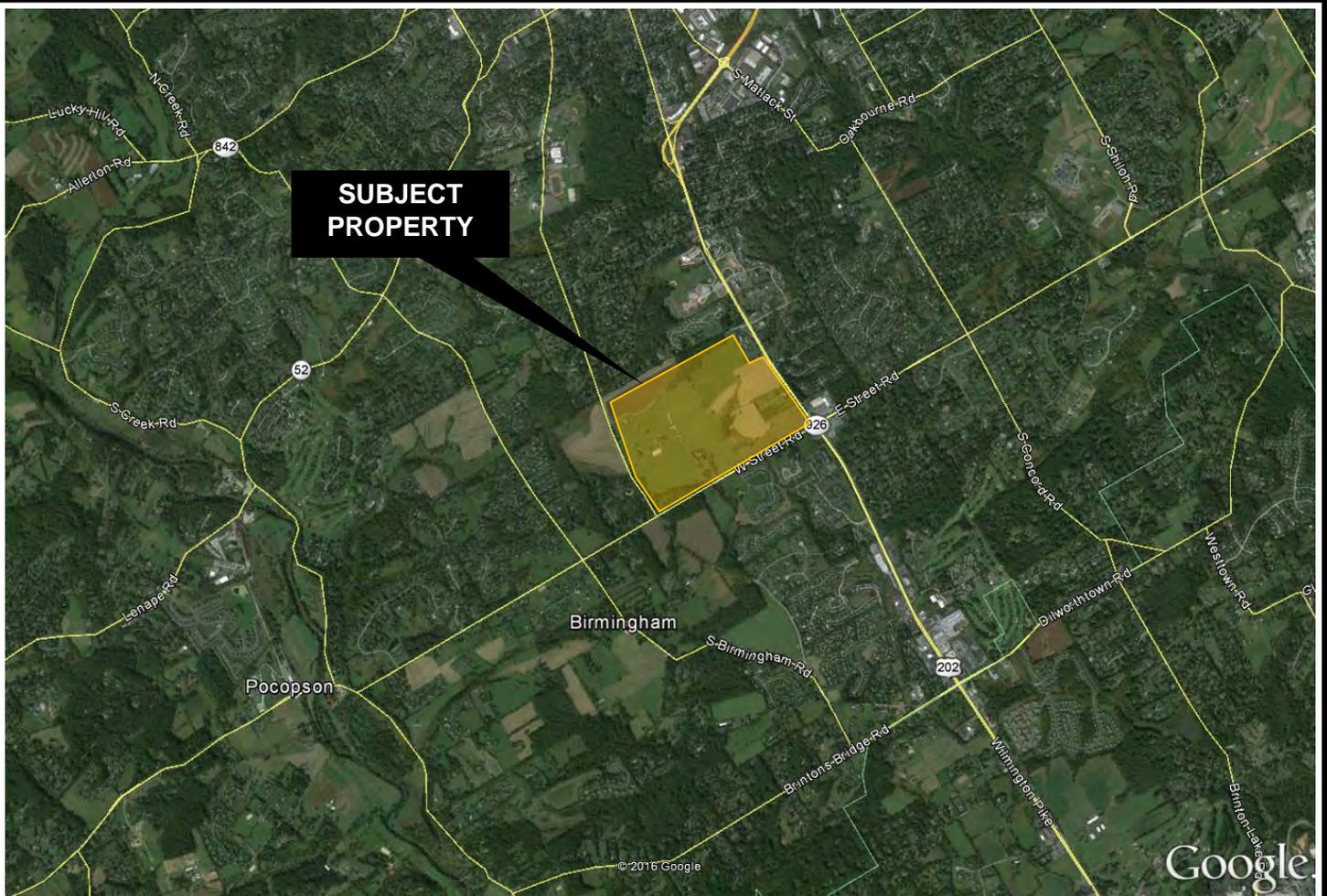
GEO-TECHNOLOGY ASSOCIATES, INC.

APPENDIX A

SITE LOCATION MAP

TEST PIT AND OBSERVATION HOLE LOCATION PLAN

SITE PLAN – OVERALL OPEN SPACE PLAN



Notes: (1) Layout was obtained from a Google Earth Imagery, dated October 7, 2011.



GEO-TECHNOLOGY ASSOCIATES, INC.
Geotechnical and Environmental Consultants
 18 Boulden Circle, Suite 36
 New Castle, Delaware 19720
 (302) 326-2100
 Fax (302) 326-2399

SITE LOCATION MAP

CREBILLY FARM

WESTTOWN TOWNSHIP
 CHESTER COUNTY, PENNSYLVANIA

SCALE
 NTS

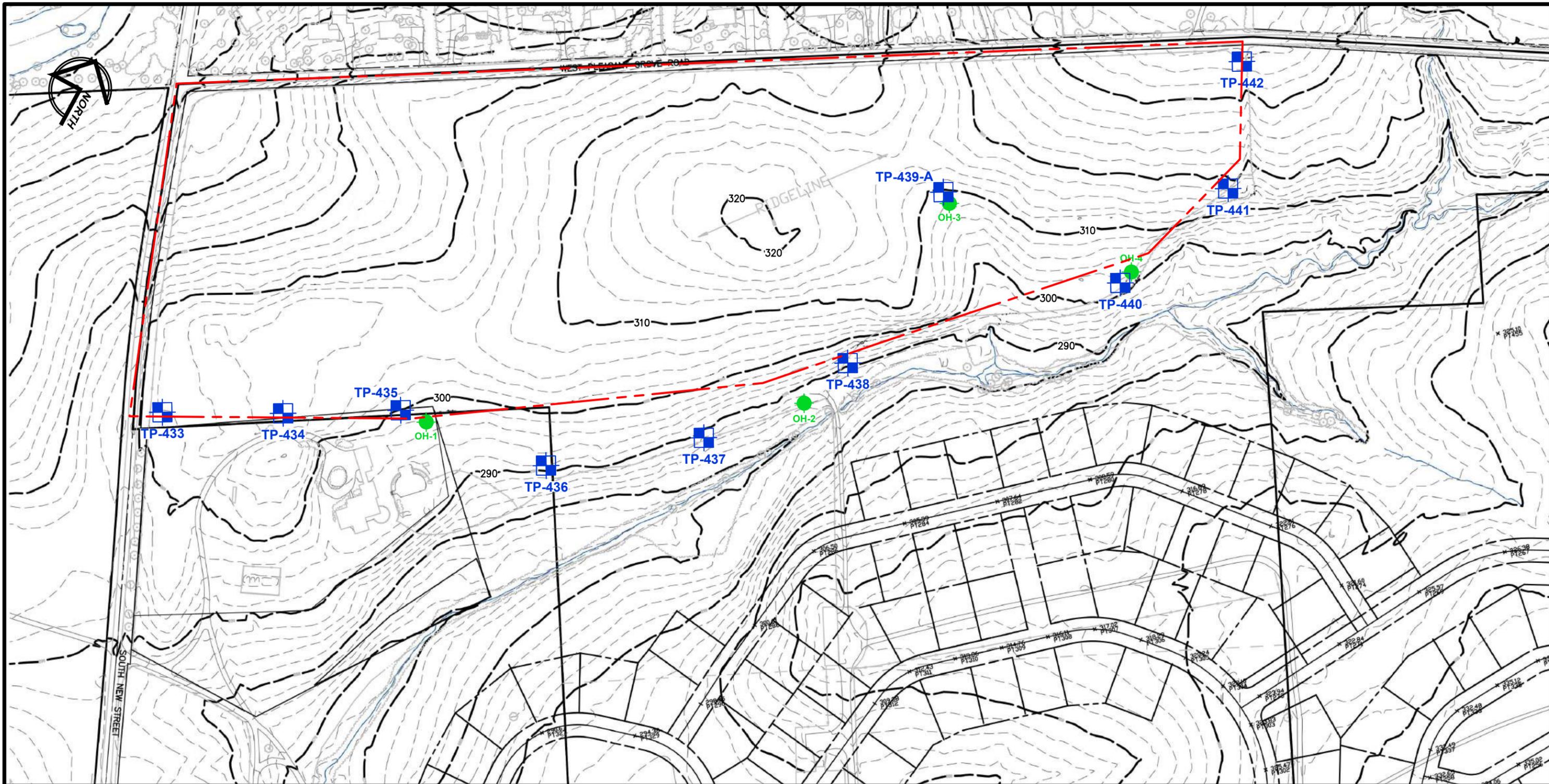
DATE
 AUG 2016

DRAWN BY
 GOOGLE

REVIEW BY
 CMR

JOB NO.
 161348

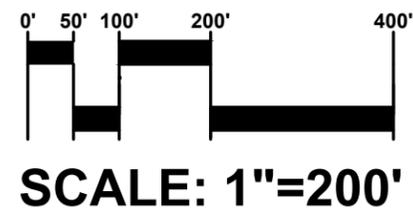
FIGURE:
 1



SOURCE: PLAN IS ADAPTED FROM A PLAN PRODUCED BY ESE CONSULTANTS, INC. AND EMAILED TO GTA ON AUGUST 9, 2016

LEGEND

-  EVALUATED AREA
-  APPROXIMATE TEST PIT LOCATION
-  APPROXIMATE OBSERVATION HOLE LOCATION



GEO-TECHNOLOGY ASSOCIATES, INC.
 GEOTECHNICAL AND ENVIRONMENTAL CONSULTANTS
 3445-A BOX HILL CORPORATE CENTER DRIVE
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**TEST PIT AND OBSERVATION HOLE
 LOCATION PLAN
 CREBILLY FARM**

Chester County, Pennsylvania

JOB NO.	31161348	SCALE:	1"=200'	DATE:	SEPTEMBER 2016	DRAWN BY:	GMM	REVIEW BY:	PSS	FIGURE:
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ESE-CTB
 N:\PROJECTS\PENNSYLVANIA\4050-CREBILLY FARM\PROJECT\DRAWINGS\4050-S-OPENSACE.DWG-entire-10/17/2016 1:30 PM



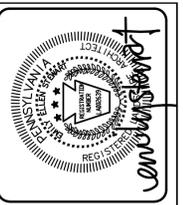
OPEN SPACE DATA:
 CURRENT ZONING: A/C AGRICULTURAL CLUSTER
 RESIDENTIAL DISTRICT & R-1
 PROPOSED: FLEXIBLE DEVELOPMENT OPTION

SITE AREA: 322.36 ACRES
 ADJUSTED TRACT ACREAGE: 290.20 ACRES

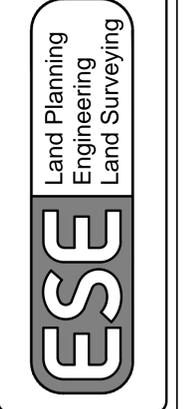
REQUIRED OPEN SPACE: 60% (193.41 AC)

-  PROPOSED OPEN SPACE:
61% (197.15 AC)
-  PROPOSED NATURAL AREAS
93 ACRES
-  INFILTRATION AREAS
8 ACRES
-  PROPOSED EFFLUENT DISPOSAL AREA
25.5 ACRES

ALL OTHER AREAS SHALL BE CLASSIFIED AS LAWN



ESE Consultants, Inc.
 250 Gibraltar Road,
 Suite 2E
 Honesdale, PA 19044
 Tel: 215-914-2050
 Fax: 215-293-5488



REV.	DATE	DESCRIPTION	DRAWN

OVERALL OPEN SPACE PLAN

CREBILLY FARM

WESTTOWN TOWNSHIP, CHESTER COUNTY, PENNSYLVANIA

DATE: 10-7-16 SCALE: 1" = 200'
 DESIGN: EES DRAWN: EES
 JOB NO.: 4050 FILE NAME: 4050-S-OPENSACE
 REF. NO.: **SD04.02**
 SHEET NO.: **4** OF **45**

APPENDIX B

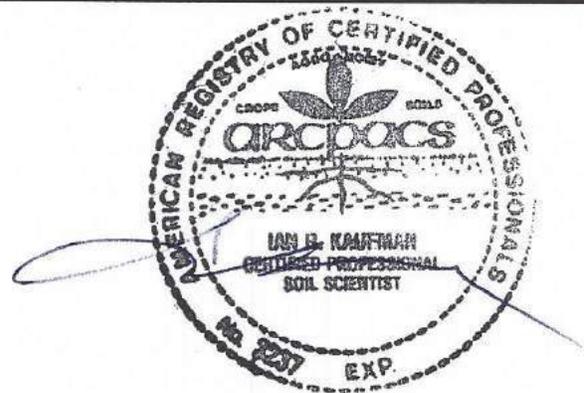
WEB SOIL SURVEY – SOILS MAP DELMARVA ENVIRONMENTAL— PRELIMINARY SOIL INVESTIGATION REPORT

PRELIMINARY SOIL INVESTIGATION
For
CREBILLY FARM
CHESTER COUNTY, PENNSYLVANIA

JULY 2016



For:
Geo-Technology Associates, Inc. (GTA)
Paul Scott, P.G.
3445-A Box Hill Corporate Center Drive
Abingdon, MD 21009



Certified Professional Soil Scientist/Soil Classifier

PO Box 117
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Ian R. Kaufman
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PRELIMINARY SOIL INVESTIGATION REPORT
for
CREBILLY FARM
Chester County, Pennsylvania
JULY 2016

INTRODUCTION:

Delmarva Environmental, Inc. has performed a Preliminary Soil Investigation for the above referenced property located on the north side of East Street Road (Route 926) between South New Road and Old Wilmington Pike (Route 202) in Chester County, Pennsylvania. A limited area was evaluated for a proposed community on-site wastewater treatment and disposal system to serve a proposed development project for residential use. A Concept Plan of the project "Crebilly Farm; Concept Plan B" indicated a proposed 347 homes on approximately 322 acres. Approximately 30 acres in the northwest corner of the site was evaluated. The evaluation was hindered by that area being actively farmed with full season soybeans and only the margin of that area was available for observations.

Under Pennsylvania Department of Environmental (PADEP) Regulations and Policies there are three basic methods of community wastewater disposal. They are Spray Irrigation, Drip Irrigation, and Incised Beds or Trenches. For Spray Irrigation and Drip Irrigation a limiting zone such as depth to a seasonal high water table or rock must be at least 40 inches below the existing ground surface. This can be reduced to 20 inches, with design limitations, for Spray Irrigation and Drip Irrigation. For Incised Beds the limiting zone must be 72 to 84 inches below ground surface or deeper. Limiting zones can be a seasonal high groundwater level, a seasonal perched groundwater level, depth to bedrock, depth to rock with greater than 50 percent coarse fragments, slowly permeable material, and possibly other encumbrances for wastewater disposal. This limitations for soils do not include other potential limitations associated with buffer requirements and results of hydrological testing such as mounding analysis.

The Web Soil Survey ((NRCS) Natural Resource Conservation Service: United State Department of Agriculture) of the evaluated area indicates that the evaluated area is potentially underlain by well drained Glenelg silt loam, 8 to 15 percent slopes (GgC) and well drained Chester silt loam, 3 to 8 percent slopes (CdB) with poorly drained Hatboro silt loam (Ha) at the lowest elevations associated with a stream just outside of the evaluated area. GgC soils are described as having a water table deeper than 80 inches and a paralithic contact at 72 to 120 inches. CdB soils are described as having a water table and paralithic contact deeper than 80 inches. The capacity of the most limiting layer to transmit water (Ksat) in these soils is indicated to be 0.57 to 2.00 inches per hour.

The property as a whole is dominated by GgC and CdB soils. Moderately well drained Glenville silt loam, 3 to 18 percent slopes (GIB) with a slowly permeable Fragipan is a significant mapped soil unit in the general area. Glenelg silt loam, 3 to 8 percent slopes (GgB) is also a significant soil mapping unit in the general area. Other soils mapped on the property are minor inclusions and include poorly drained Baile silt loam (Ba); moderately well drained Codorus silt loam (Co); moderately well drained Glenville silt loam, 8 to 15 percent slopes (GIC); well drained Chrome silt loam, 3 to 8 percent slopes (ChB) and 15 to 25 percent slopes (ChD); and well drained Gaila silt loam 15 to 25 percent slopes (GaD).

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PROCEDURES:

Ten locations around the soybean field were located for conducting test pits to a depth of approximately 84 inches below ground surface. An extendadahoe backhoe was utilized to excavate the test pits. Test pits were described by an ARCPACS Certified Professional Soil Scientist/Soil Classifier utilizing the general guidance of the Field Book for Describing and Sampling Soils Version 3.0 (NRCS, 2012). Several test pits were excavated to the maximum depth of the backhoe to observe depth to rock or groundwater if encountered. Three sets of preliminary infiltration testing was conducted in the upper and lower portion of the soil profile at those locations to estimate potential limiting infiltration rates for wastewater disposal.

FINDINGS:

TABLE 1: Summary of Selected Observations from Test Pit Descriptions

Test Pit	Depth to Estimated Seasonal High Water Table (inches below ground surface (bgs))	Depth to Lithic or Paralithic Contact (inches bgs)	Depth to Observed Groundwater (inches bgs)	Soil Classification
433	>84	~57	>84	Typic Hapludult
434	>84	~128	>128	Typic Hapludult
435	>84	~65	>84	Typic Hapludult
436	>84	~36	>84	Typic Dystrudept
437	~34	~62	>84	Oxyaquic Hapludult
438	~40	>84	~144	Typic Hapludult
439-A	>84	~20	>84	Typic Hapludult
440	~40	>84	>84	Typic Hapludult
441	>84	>84	>164	Typic Hapludult
442	>84	~54	>84	Typic Hapludult

Table 1 above is a summary of the observations from the test pits. Groundwater does not appear to be a major limitation to siting a large wastewater disposal facility. Drainage appears to follow the contour with the most moderately well drained observations being at the lowest relative elevations. Depth to lithic or paralithic contact may be a more limiting factor. There is a great deal of variability observed in the degree of weathering at the lowest strata observed. Test Pit 436 was the most unweathered saprolitic material at approximately 36 inches below ground surface with more than 50 percent coarse fragments that were saprolitic but somewhat intact. Much of the paralithic material observed was completely weathered and no remnant of the rock material was left. In Test Pit 439-A, which is located in a broad draw between two knobs was observed to have large cobbles of weathered quartzite material not observed in other pits.

In general soil conditions were very similar with an abrupt Ap (plowzone) Horizon, immediately underlain by a distinct argillic Bt (increased clay) Horizon, underlain by a zone of transition of weathered saprolitic material and is consistent with the soil mapping by the Web Soil Survey.

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The main limiting factor for a large community wastewater facility is likely to be related to infiltration rates. Preliminary infiltration rates were conducted at two depths at three locations. Test depths were selected to represent the Bt Horizon and the Saprolitic subsoils as potentially representative of the most hydraulically restrictive soil material. Tests were not necessarily carried to equilibrium especially at Test Pit 433 and additional percolation testing was preliminarily conducted at Test Pits 435 and 441 to evaluate the variability of the saprolitic material deep in the soils. Findings are summarized in Table 2 below.

The numbers below should be utilized to estimate loading rates and are just one factor that goes into the design considerations. Loading rates for Spray Disposal uses one set of criteria and the subsurface distribution utilizes another set of criteria. The criteria is set forth in the PADEP Manual for Land Treatment of Wastewater.

Table 2: Preliminary Infiltration Test Results

Test Pit & Type of Test	Depth of Test Inches Below Ground Surface	Minutes Per Inch	Inches Per Hour
443 Single Ring	20	43.6	1.4
443 Single Ring	48	40.0	1.5
435 Single Ring	18	240	0.25
435 Single Ring	43	160	0.38
435 Percolation Test	43	10.7	5.6
441 Single Ring	20	8.6	7.0
441 Single Ring	48	53	1.1
441 Percolation Test	48	18.7	3.2

Based on 347 proposed homes and the above referenced manual the design flows would be 400 gallons per day per dwelling or 138,800 gallons per day not including additional wastewater needs such as a community center or banquet hall. Based on the acreage available and the uniformity of the soil mapping units it is Delmarva Environmental's opinion that this site has the potential to support a large community wastewater disposal system. Additional testing will need to be conducted to determine the variability and limitations of the site. Hydrogeological testing such as mounding analysis is also required and could be potentially more limiting than the loading rates based on soil limitations alone. Consultation with the PADEP including a Planning Meeting is required as part of the process to further evaluate if the area will meet the requirements and the information provided in this Report should be helpful in planning further investigations.

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LIMITATIONS:

This Report represents the technical opinion of Delmarva Environmental, Inc. based on the information presented in this Report. This is not a permit for any regulated activities. Conditions between observation points and below the depth of observation are unknown and additional testing, observations, and evaluations could significantly alter the conclusions presented in this Report.

ATTACHMENTS:

1. Web Soil Survey Soil Mapping and Soil Mapping Unit Descriptions (9 pages)
2. Soil Profile Descriptions (10 pages)
3. Infiltration Testing Data Sheets (3 pages)

Certified Professional Soil Scientist/Soil Classifier

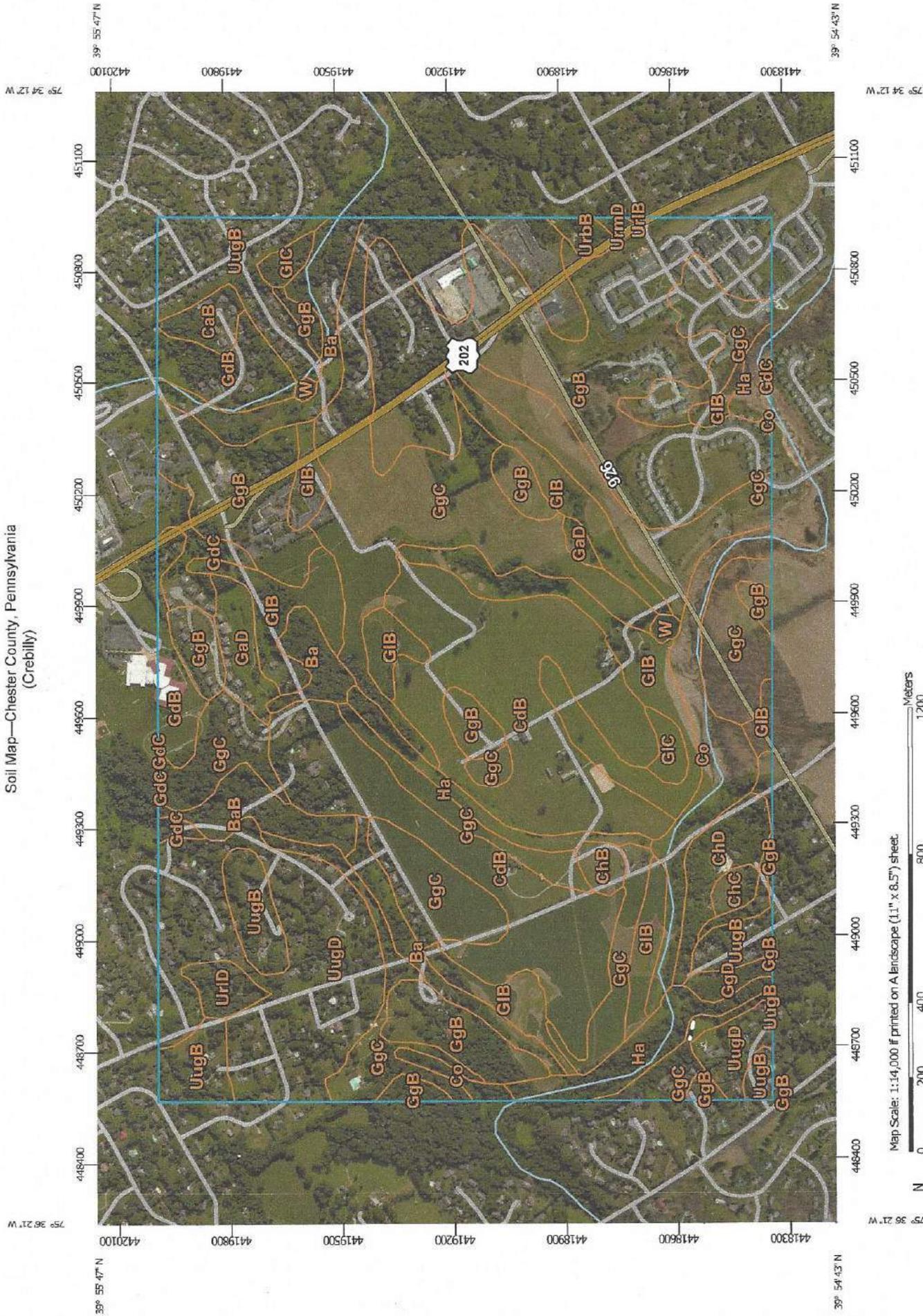
Ian R. Kaufman

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Soil Map—Chester County, Pennsylvania
(Crebilly)



Map Scale: 1:14,000 if printed on A landscape (11" x 8.5") sheet.



Map projection: Web Mercator Corner coordinates: WGS84 Edge tics: UTM Zone 18N WGS84



MAP LEGEND

 Area of Interest (AOI)	 Spoil Area
 Soils	 Stony Spot
 Soil Map Unit Polygons	 Very Stony Spot
 Soil Map Unit Lines	 Wet Spot
 Soil Map Unit Points	 Other
Special Point Features	 Special Line Features
 Blowout	Water Features
 Borrow Pit	 Streams and Canals
 Clay Spot	Transportation
 Closed Depression	 Rails
 Gravel Pit	 Interstate Highways
 Gravelly Spot	 US Routes
 Landfill	 Major Roads
 Lava Flow	 Local Roads
 Marsh or swamp	Background
 Mine or Quarry	 Aerial Photography
 Miscellaneous Water	
 Perennial Water	
 Rock Outcrop	
 Saline Spot	
 Sandy Spot	
 Severely Eroded Spot	
 Sinkhole	
 Slide or Slip	
 Sodic Spot	

MAP INFORMATION

The soil surveys that comprise your AOI were mapped at 1:24,000. Please rely on the bar scale on each map sheet for map measurements.

Source of Map: Natural Resources Conservation Service
Web Soil Survey URL: <http://websoilsurvey.nrcs.usda.gov>
Coordinate System: Web Mercator (EPSG:3857)

Maps from the Web Soil Survey are based on the Web Mercator projection, which preserves direction and shape but distorts distance and area. A projection that preserves area, such as the Albers equal-area conic projection, should be used if more accurate calculations of distance or area are required.

This product is generated from the USDA-NRCS certified data as of the version date(s) listed below.

Soil Survey Area: Chester County, Pennsylvania
Survey Area Data: Version 7, Nov 16, 2015

Soil map units are labeled (as space allows) for map scales 1:50,000 or larger.

Date(s) aerial images were photographed: Mar 19, 2011—Sep 22, 2014

The orthophoto or other base map on which the soil lines were compiled and digitized probably differs from the background imagery displayed on these maps. As a result, some minor shifting of map unit boundaries may be evident.

Drainage Class

Drainage Class— Summary by Map Unit — Chester County, Pennsylvania (PA029)				
Map unit symbol	Map unit name	Rating	Acres in AOI	Percent of AOI
Ba	Baile silt loam	Poorly drained	6.9	2.2%
CdB	Chester silt loam, 3 to 8 percent slopes	Well drained	94.3	30.5%
ChB	Chrome silt loam, 3 to 8 percent slopes	Well drained	2.3	0.8%
ChD	Chrome silt loam, 15 to 25 percent slopes	Well drained	0.3	0.1%
Co	Codorus silt loam	Moderately well drained	16.2	5.2%
GaD	Gaila silt loam, 15 to 25 percent slopes	Well drained	1.8	0.6%
GgB	Glenelg silt loam, 3 to 8 percent slopes	Well drained	24.0	7.8%
GgC	Glenelg silt loam, 8 to 15 percent slopes	Well drained	91.8	29.6%
GIB	Glenville silt loam, 3 to 8 percent slopes	Moderately well drained	58.2	18.8%
GIC	Glenville silt loam, 8 to 15 percent slopes	Moderately well drained	3.7	1.2%
Ha	Hatboro silt loam	Poorly drained	8.9	2.9%
W	Water		1.2	0.4%
Totals for Area of Interest			309.6	100.0%

Description

"Drainage class (natural)" refers to the frequency and duration of wet periods under conditions similar to those under which the soil formed. Alterations of the water regime by human activities, either through drainage or irrigation, are not a consideration unless they have significantly changed the morphology of the soil. Seven classes of natural soil drainage are recognized—excessively drained, somewhat excessively drained, well drained, moderately well drained, somewhat poorly drained, poorly drained, and very poorly drained. These classes are defined in the "Soil Survey Manual."

Rating Options

Aggregation Method: Dominant Condition

Component Percent Cutoff: None Specified

Tie-break Rule: Higher

Chester County, Pennsylvania

GgC—Glenelg silt loam, 8 to 15 percent slopes

Map Unit Setting

National map unit symbol: pjbk

Elevation: 200 to 2,000 feet

Mean annual precipitation: 40 to 55 inches

Mean annual air temperature: 45 to 61 degrees F

Frost-free period: 110 to 235 days

Farmland classification: Farmland of statewide importance

Map Unit Composition

Glenelg and similar soils: 90 percent

Minor components: 10 percent

Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Glenelg

Setting

Landform: Hillslopes

Landform position (two-dimensional): Shoulder, backslope

Landform position (three-dimensional): Side slope, nose slope

Down-slope shape: Linear, convex

Across-slope shape: Convex, linear

Parent material: Residuum weathered from mica schist

Typical profile

Ap - 0 to 8 inches: silt loam

Bt - 8 to 22 inches: silt loam

C - 22 to 60 inches: fine sandy loam

Properties and qualities

Slope: 8 to 15 percent

Depth to restrictive feature: 72 to 120 inches to paralithic bedrock

Natural drainage class: Well drained

Runoff class: Medium

Capacity of the most limiting layer to transmit water (Ksat):

Moderately high to high (0.60 to 2.00 in/hr)

Depth to water table: More than 80 inches

Frequency of flooding: None

Frequency of ponding: None

Available water storage in profile: High (about 9.3 inches)

Interpretive groups

Land capability classification (irrigated): None specified

Land capability classification (nonirrigated): 3e

Hydrologic Soil Group: B

Minor Components

Glenville

Percent of map unit: 10 percent

Landform: Hillslopes

Landform position (two-dimensional): Footslope, backslope

Landform position (three-dimensional): Side slope, head slope

Down-slope shape: Linear, concave

Across-slope shape: Concave, linear

Data Source Information

Soil Survey Area: Chester County, Pennsylvania

Survey Area Data: Version 7, Nov 16, 2015

Chester County, Pennsylvania

CdB—Chester silt loam, 3 to 8 percent slopes

Map Unit Setting

National map unit symbol: 2tt7y

Elevation: 10 to 1,170 feet

Mean annual precipitation: 40 to 55 inches

Mean annual air temperature: 48 to 57 degrees F

Frost-free period: 150 to 192 days

Farmland classification: All areas are prime farmland

Map Unit Composition

Chester and similar soils: 80 percent

Minor components: 20 percent

Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Chester

Setting

Landform: Hillslopes

Landform position (two-dimensional): Summit

Landform position (three-dimensional): Interfluve

Down-slope shape: Linear, convex

Across-slope shape: Linear, convex

Parent material: Residuum weathered from mica schist

Typical profile

Ap - 0 to 10 inches: silt loam

BE - 10 to 17 inches: silt loam

Bt1 - 17 to 22 inches: clay loam

Bt2 - 22 to 30 inches: clay loam

Bt3 - 30 to 38 inches: clay loam

Bt4 - 38 to 56 inches: loam

C - 56 to 92 inches: fine sandy loam

Properties and qualities

Slope: 3 to 8 percent

Depth to restrictive feature: More than 80 inches

Natural drainage class: Well drained

Capacity of the most limiting layer to transmit water (Ksat):

Moderately high to high (0.57 to 1.98 in/hr)

Depth to water table: More than 80 inches

Frequency of flooding: None

Frequency of ponding: None

Available water storage in profile: High (about 9.9 inches)

Interpretive groups

Land capability classification (irrigated): None specified

Land capability classification (nonirrigated): 2e

Hydrologic Soil Group: B

Minor Components

Glenville

Percent of map unit: 10 percent

Landform: Hillslopes

Landform position (two-dimensional): Footslope, toeslope

Landform position (three-dimensional): Head slope

Down-slope shape: Linear

Across-slope shape: Concave

Gladstone

Percent of map unit: 5 percent

Landform: Hillslopes

Landform position (two-dimensional): Summit, shoulder, backslope

Landform position (three-dimensional): Interfluve

Down-slope shape: Linear, convex

Across-slope shape: Convex, linear

Mt. airy

Percent of map unit: 5 percent

Landform: Hillslopes

Landform position (two-dimensional): Summit, shoulder

Landform position (three-dimensional): Nose slope, crest, side slope

Down-slope shape: Convex

Across-slope shape: Convex

Data Source Information

Soil Survey Area: Chester County, Pennsylvania

Survey Area Data: Version 7, Nov 16, 2015

Chester County, Pennsylvania

Ha—Hatboro silt loam

Map Unit Setting

National map unit symbol: 1lwqq
Elevation: 200 to 800 feet
Mean annual precipitation: 36 to 50 inches
Mean annual air temperature: 48 to 57 degrees F
Frost-free period: 140 to 200 days
Farmland classification: Not prime farmland

Map Unit Composition

Hatboro and similar soils: 95 percent
Minor components: 5 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Hatboro

Setting

Landform: Flood plains
Landform position (two-dimensional): Toeslope
Landform position (three-dimensional): Tread
Down-slope shape: Concave, linear
Across-slope shape: Concave, linear
Parent material: Alluvium derived from metamorphic and sedimentary rock

Typical profile

Ap - 0 to 9 inches: silt loam
Bg - 9 to 44 inches: silt loam
Cg - 44 to 56 inches: sandy clay loam
C - 56 to 70 inches: stratified gravelly sand to clay

Properties and qualities

Slope: 0 to 3 percent
Depth to restrictive feature: 60 to 99 inches to lithic bedrock
Natural drainage class: Poorly drained
Runoff class: Very high
Capacity of the most limiting layer to transmit water (Ksat):
Moderately high to high (0.60 to 2.00 in/hr)
Depth to water table: About 0 to 6 inches
Frequency of flooding: Frequent
Frequency of ponding: None
Available water storage in profile: High (about 9.7 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 4w
Hydrologic Soil Group: B/D

Minor Components

Glenville

Percent of map unit: 5 percent

Landform: Hillslopes

Landform position (two-dimensional): Foothlope, backslope

Landform position (three-dimensional): Side slope, head slope

Down-slope shape: Linear, concave

Across-slope shape: Concave, linear

Data Source Information

Soil Survey Area: Chester County, Pennsylvania

Survey Area Data: Version 7, Nov 16, 2015

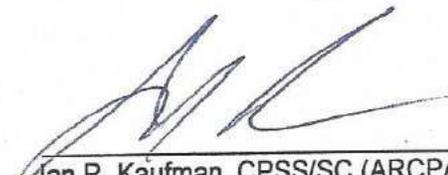
SOIL PROFILE NOTES

Profile #: TEST PIT 433 Job Number: 16086
 Date of Observation: 7/27/2016
 Tax ID Number: _____
 Project Name: CREEBILLY FARM
 Location: _____
 Slope: 2-5%
 Relief: SHOULDER
 Depth to Redoximorphic Features or other potential limiting factor: > 84"
 Estimated Permeability based on field estimates of soil textures: _____
 Free water at time of observation: > 84"
 Soil Classification: TYPIC HAPLUDULT
 GPS Coordinates: N 39.92000 ° W 75.59606 °

Horizon	Depth (inches)		Moist Munsell Colors		RMF or Non-RMF Colors; Quantity/Size/Contrast	Field Estimated Soil Texture	Structure Grade/Size/Type	Consistence (moist)
			Matrix	Redoximorphic Features (RMF)				
Ap	0	10	10YR4/4			L	2MGR	FR
Bt	10	26	10YR5/6	gradual	10YR5/4 (worm channels)	C 3 F	2MSBK	FR
Bc	26	32	10YR5/6	gradual	HIGHLY VERIGATED 2.5Y5/4	C 3 F	1MSBK	FR
C	32	57	HIGHLY VERIGATED (STRATIFIED)			15-30% SL	COARSE FRAGMENTS O MA	FR
Cr	57	84	HIGHLY VERIGATED (GRAVEL)			30% GRSL	COARSE FRAGMENTS O MA	FR

Nomenclature and abbreviations are adapted from the *Field Book for Describing and Sampling Soils*; Version 3.0 (NRCS, 2012)

Comments: * C HORIZON IS HIGHLY VERIGATED WEATHERED RESIDUAL MATERIAL


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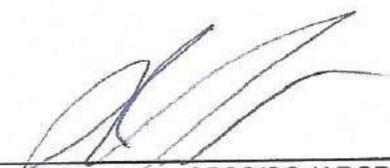
SOIL PROFILE NOTES

Profile #: TEST PIT 435 Job Number: 16086
 Date of Observation: 7/27/2016
 Tax ID Number: -
 Project Name: CRIBILLY
 Location: -
 Slope: -
 Relief: BACKSLOPE
 Depth to Redoximorphic Features or other potential limiting factor: >84"
 Estimated Permeability based on field estimates of soil textures: -
 Free water at time of observation: >84"
 Soil Classification: TYPIC HAPLUDULT
 GPS Coordinates: N 39.92048 °, W 75.59447 °

Horizon	Depth (inches)		Moist Munsell Colors			RMF or Non-RMF Colors; Quantity/Size/Contrast	Field Estimated Soil Texture	Structure Grade/Size/Type	Consistence (moist)
			Matrix	Redoximorphic Features (RMF)	Non-RMF & Mottles				
A	0	10	10YR4/4	-	-	-	SL	2MGR	1FR
B _b	10	20	10YR5/6	-	WORM CHANNELS		SL	2MSBK	FR
B _c	20	35	10YR5/4	-	WORM CHANNELS & WEATHERED ROCKS		SL	1MSBK	FR
C	35	65	10YR5/3 2.5Y5/1	LITHO-CHROMIC	10YR5/4	C 3 D	SL	0MA	FR
C _{SAP}	65	84	2.5Y5/1	LITHO-CHROMIC	10YR8/1	HIGHLY MICACEOUS M 1 P	SL/LS	0MA	VFR/FR

Nomenclature and abbreviations are adapted from the *Field Book for Describing and Sampling Soils; Version 3.0* (NRCS, 2012)

Comments:


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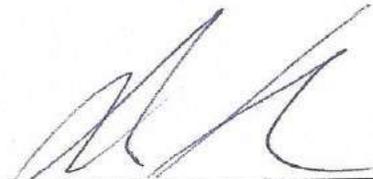
SOIL PROFILE NOTES

Profile #: TEST PIT 437 Job Number: 16086
 Date of Observation: 7/27/2016
 Tax ID Number: _____
 Project Name: CREEBILLY
 Location: _____
 Slope: 5-15%
 Relief: BATHSLOPE
 Depth to Redoximorphic Features or other potential limiting factor: 234"
 Estimated Permeability based on field estimates of soil textures: _____
 Free water at time of observation: 289"
 Soil Classification: Oxyaquic Hapludult
 GPS Coordinates: N39.92114 °, W75.57239 °

Horizon	Depth (inches)		Moist Munsell Colors			RMF or Non-RMF Colors; Quantity/Size/Contrast	Field Estimated Soil Texture	Structure Grade/Size/Type	Consistence (moist)
			Matrix	Redoximorphic Features (RMF)	Non-RMF & Mottles				
A	0	18	10YR4/4	—	—	—	10% Coarse frags L	2MCR	FR
Bt	18	34	10YR4/6	—	—	—	15% Coarse frags L	2MSBK	FR
C1	34	46	10YR5/6	7.5YR6/8	—	C 3 D	SL	0 MA	FR
C2	46	62	10YR5/6	10YR7/11 10YR5/8	—	C 2 P C 2 F	FSL/SIL	0 MA	FR
C _{SAP}	62	89	N9/	LITHO- CHROMIC	—	HIGHLY WEATHERED NATIVE ROCK HIGHLY MICACEOUS			

Nomenclature and abbreviations are adapted from the *Field Book for Describing and Sampling Soils*; Version 3.0 (NRCS, 2012)

Comments: CLOSE TO WETLANDS


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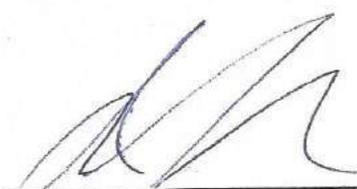
SOIL PROFILE NOTES

Profile #: TEST PIT 438 Job Number: 16086
 Date of Observation: 7/27/2016
 Tax ID Number: _____
 Project Name: CREEKLEY
 Location: _____
 Slope: 2-5%
 Relief: BACKSLOPE
 Depth to Redoximorphic Features or other potential limiting factor: 240"
 Estimated Permeability based on field estimates of soil textures: _____
 Free water at time of observation: 2/49"
 Soil Classification: TYPIC HAPLUDULT
 GPS Coordinates: N 39.52188 ° , W 75.59171 °

Horizon	Depth (inches)		Moist Munsell Colors			RMF or Non-RMF Colors; Quantity/Size/Contrast	Field Estimated Soil Texture	Structure Grade/Size/Type	Consistence (moist)
			Matrix	Redoximorphic Features (RMF)	Non-RMF & Mottles				
Ap	0	13	10YR4/4	—	—	—	SL	2MGR	FA
Bt	13	30	10YR4/6	—	—	—	SCL	2MSBK	FR
Bc	30	40	10YR5/6	—	—	—	SL	1MSBK	FR
C	40	84	10YR5/6	10YR7/1 10YR6/8	—	C 2 D C 2 D	SL	0 MA	FR

Nomenclature and abbreviations are adapted from the *Field Book for Describing and Sampling Soils*, Version 3.0 (NRCS, 2012)

Comments: - NEAR WETLANDS
 - FEW COARSE FRAGMENTS MOSTLY ABOVE 30"
 - DUG TO 144" AFTER DESCRIBING


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SOIL PROFILE NOTES

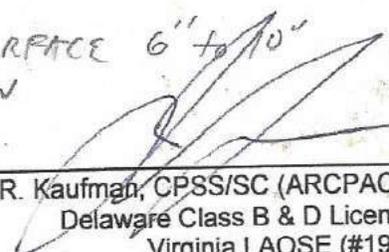
Profile #: TEST PIT 439-A Job Number: 16086
 Date of Observation: 7/27/2016
 Tax ID Number: _____
 Project Name: CRAIBILLY
 Location: _____
 Slope: 5-15%
 Relief: BACKSLOPE
 Depth to Redoximorphic Features or other potential limiting factor: >84" to SHWT (220")
 Estimated Permeability based on field estimates of soil textures: >84"
 Free water at time of observation: _____
 Soil Classification: Typic Hapludalf
 GPS Coordinates: N39.92301 ° , W75.59164 °

Horizon	Depth (inches)		Moist Munsell Colors			RMF or Non-RMF Colors: Quantity/Size/Contrast	Field Estimated Soil Texture	Structure Grade/Size/Type	Consistence (moist)
			Matrix	Redoximorphic Features (RMF)	Non-RMF & Mottles				
Ap	0	9	10YR4/4				L	2M CR	FR
Bt	9	20	10YR5/6			MICACEOUS	SL	2M SBM	FR
C1	20	48	Brownish yellow UNORGANIZED TO GRAY HIGHLY MICACEOUS			WITH COBBLES >50% coarse frags	SL	0 MA	FR
C2	48	84	GRAY WITH STRATIFIED YELLOWISH BROWN BANDS			HIGHLY WEATHERED	SMALL SL	COARSE FRAG. 20% 0 MA	FR

Nomenclature and abbreviations are adapted from the *Field Book for Describing and Sampling Soils*; Version 3.0 (NRCS, 2012)

Comments: * SIGNIFICANTLY UP-SLOPE FROM STAKE 439
 * MIDDLE OF SOXBERT'S
 * LARGE QUARTZITE COBBLES NEAR SURFACE 6" to 10" ANGULAR BLOCKS IN C1 HORIZON

7/28/16 Adjacent pit with less coarse fragments (Better)


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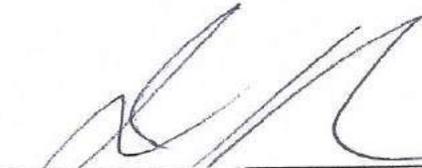
SOIL PROFILE NOTES

Profile #: TEST PIT 440 Job Number: 16086
 Date of Observation: 7/27/2016
 Tax ID Number: _____
 Project Name: CREBILLY
 Location: _____
 Slope: 2.5%
 Relief: TORSELOPS
 Depth to Redoximorphic Features or other potential limiting factor: ~40"
 Estimated Permeability based on field estimates of soil textures: _____
 Free water at time of observation: 289"
 Soil Classification: Type Hapludult
 GPS Coordinates: N 39.92305 ° W 75.59017 °

Horizon	Depth (inches)		Moist Munsell Colors			RMF or Non-RMF Colors; Quantity/Size/Contrast	Field Estimated Soil Texture	Structure Grade/Size/Type	Consistence (moist)
			Matrix	Redoximorphic Features (RMF)	Non-RMF & Mottles				
A1p	0	11	10YR4/4	—	—	—	L	2MGR	FR
A2	11	30	10YR4/4	—	—	—	L	2MGR	FR
Bt	30	40	10YR5/6	—	—	—	SL/L	2MSBK	FR
C1	40	60	10YR6/6	10YR6/2 7.5YR5/8	HIGHLY VERIGATED	C 2 D C 2 F	SL/L	0 MA	FR
C2	60	84	10YR5/4	10YR6/2 7.5YR6/8	HIGHLY VERIGATED	C 2 D C 2 D	SL	0 MA	FR

Nomenclature and abbreviations are adapted from the *Field Book for Describing and Sampling Soils; Version 3.0* (NRCS, 2012)

Comments: FEW RANDOM COARSE FRAGMENT THROUGHOUT
3" to 6" in size


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SOIL PROFILE NOTES

Profile #: TEST PIT 442 Job Number: 16056

Date of Observation: 7/27/16

Tax ID Number: _____

Project Name: CREEBILLY

Location: _____

Slope: 2-5%

Relief: UPPER BACKSLOPE

Depth to Redoximorphic Features or other potential limiting factor: > 84"

Estimated Permeability based on field estimates of soil textures: > 84"

Free water at time of observation: _____

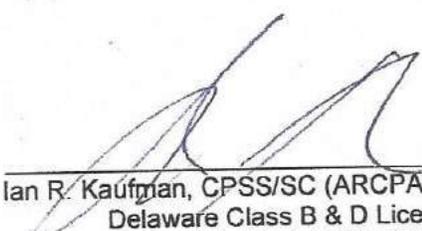
Soil Classification: Typic Hapludult

GPS Coordinates: N 39.92444 °, N 75.59010 °

Horizon	Depth (inches)		Moist Munsell Colors		RMF or Non-RMF Colors; Quantity/Size/Contrast	Field Estimated Soil Texture	Structure Grade/Size/Type	Consistence (moist)
			Matrix	Redoximorphic Features (RMF)				
Ap	0	7	10YR5/4	—	—	L	2MGR	FR
Bt	7	27	10YR5/6	—	—	10% LF, SLT/SC	2MSBR	FA
C1	27	32	10YR4/6 10YR4/4	—	—	SL	0 MA	FA
C2	32	42	10YR4/6	VARIATED DARK YELLOWISH BROWN	—	CO SL	0 MA	VFR/FR
C3	42	54	2.5Y7/3 10YR7/6	—	C 2 D C 2 H	FSL	0 MA	FR
C5AP	54	84	LITHO-CHROMIC	GRAY + WHITE	HIGHLY MICACEOUS	FSL/SIL	0 MA	FR

Nomenclature and abbreviations are adapted from the *Field Book for Describing and Sampling Soils*; Version 3.0 (NRCS, 2012)

Comments:
• A FEW COARSE FRAGMENTS (C.F.) 3"-5"
• SLOW ESTIMATED PERMEABILITY BELOW 54"


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Infiltration Testing Data Sheet

Project Name: CRESBILLY
Tax Map Number: 16086
Job Number: 16086

Double Rings

Percolation Test

Single Rings

Test Number: 435 SINGLE
 Test Depth: 13" RINGS
 Date of Test: 7/28/16

Time	Interval (minutes)	Depth of Water	Drop in Inches
0	-	0	-
30	30	-	9/16
0	-	0	-
30	30	-	1/4
0	-	0	-
30	30	-	1/4
0	-	0	-
30	30	-	1/8
0	-	0	-
30	30	-	1/8

Rate in Minutes Per Inch (MPI) = 240
 Rate in Inches Per Hour = 0.25

Test Run By: _____

Test Number: 435 SINGLE
 Test Depth: 43" RINGS
 Date of Test: 7/28/16

Time	Interval	Depth of Water	Drop in Inches
0	-	0	-
30	30	-	9/16
0	-	0	-
30	30	-	3/16
0	-	0	-
30	30	-	3/16
0	-	0	-
30	30	-	3/16
0	-	0	-
30	30	-	3/16

Rate in Minutes Per Inch (MPI) = 160
 Rate in Inches Per Hour = 0.91

Test Run By: _____

Test Number: 435 PERC
 Test Depth: 43" TEST
 Date of Test: 7/28/16

Time	Interval	Depth of Water	Drop in Inches
0	-	-	0
4:16	4:16	-	1
4:50	4:10.44	-	2
TEST			
ABANDONED			
DUE TO			
THUNDERSTORM			

Rate in Minutes Per Inch (MPI) = 10.7
 Rate in Inches Per Hour = 0.526

Test Run By: _____

Supervised by Ian R. Kaufman, CPSS/SC
Delaware Licensced Class-D Soil Scientist
Certified Professional Soil Scientist/Soil Classifier

APPENDIX C
HYDRAULIC TESTING RESULTS

APPENDIX D
LABORATORY RESULTS

Technical Report for

Geo-Technology Associates

Crebilly Farms, 501 West Street Road, West Chester, PA

31161348

SGS Accutest Job Number: JC25567

Sampling Date: 08/10/16

Report to:

Geo-Technology Associates
3445-A Box Hill Corporate Center Drive
Abingdon, MD 21009
gmckee@gtaeng.com; pscott@gtaeng.com

ATTN: Greg McKee

Total number of pages in report: 12



Test results contained within this data package meet the requirements of the National Environmental Laboratory Accreditation Program and/or state specific certification programs as applicable.

Nancy Cole
Laboratory Director

Client Service contact: Tammy McCloskey 732-329-0200

Certifications: NJ(12129), NY(10983), CA, CT, DE, FL, IL, IN, KS, KY, LA, MA, MD, MI, MT, NC, OH VAP (CL0056), AK (UST-103), AZ (AZ0786), PA, RI, SC, TN, TX, VA, WV, DoD ELAP (L-A-B L2248)

This report shall not be reproduced, except in its entirety, without the written approval of SGS Accutest.
Test results relate only to samples analyzed.

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3.3: JC25567-3: OH-3	8
3.4: JC25567-4: OH-4	9
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Sample Summary

Geo-Technology Associates

Job No: JC25567

Crebilly Farms, 501 West Street Road, West Chester, PA
 Project No: 31161348

Sample Number	Collected		Received	Matrix		Client Sample ID
	Date	Time By		Code	Type	
JC25567-1	08/10/16	10:15 GM	08/10/16	AQ	Ground Water	OH-1
JC25567-2	08/10/16	11:40 GM	08/10/16	AQ	Ground Water	OH-2
JC25567-3	08/10/16	12:30 GM	08/10/16	AQ	Ground Water	OH-3
JC25567-4	08/10/16	13:10 GM	08/10/16	AQ	Ground Water	OH-4

Summary of Hits

Job Number: JC25567
Account: Geo-Technology Associates
Project: Crebilly Farms, 501 West Street Road, West Chester, PA
Collected: 08/10/16

Lab Sample ID	Client Sample ID	Result/ Qual	RL	MDL	Units	Method
JC25567-1		OH-1				
		Nitrogen, Nitrate ^a	6.4	0.31	mg/l	EPA353.2/SM4500NO2B
		Nitrogen, Nitrate + Nitrite	6.5	0.30	mg/l	EPA 353.2/LACHAT
		Nitrogen, Nitrite	0.074	0.010	mg/l	SM4500NO2 B-11
		Nitrogen, Total Kjeldahl	0.54	0.20	mg/l	EPA 351.2/LACHAT
JC25567-2		OH-2				
		Nitrogen, Nitrate ^a	6.4	0.31	mg/l	EPA353.2/SM4500NO2B
		Nitrogen, Nitrate + Nitrite	6.4	0.30	mg/l	EPA 353.2/LACHAT
		Nitrogen, Total Kjeldahl	0.21	0.20	mg/l	EPA 351.2/LACHAT
JC25567-3		OH-3				
		Nitrogen, Nitrate ^a	5.4	0.31	mg/l	EPA353.2/SM4500NO2B
		Nitrogen, Nitrate + Nitrite	5.4	0.30	mg/l	EPA 353.2/LACHAT
		Nitrogen, Total Kjeldahl	0.21	0.20	mg/l	EPA 351.2/LACHAT
JC25567-4		OH-4				
		Nitrogen, Nitrate ^a	0.50	0.11	mg/l	EPA353.2/SM4500NO2B
		Nitrogen, Nitrate + Nitrite	0.50	0.10	mg/l	EPA 353.2/LACHAT
		Nitrogen, Total Kjeldahl	0.31	0.20	mg/l	EPA 351.2/LACHAT

(a) Calculated as: (Nitrogen, Nitrate + Nitrite) - (Nitrogen, Nitrite)

Sample Results

Report of Analysis

Report of Analysis

Client Sample ID: OH-1		Date Sampled: 08/10/16
Lab Sample ID: JC25567-1		Date Received: 08/10/16
Matrix: AQ - Ground Water		Percent Solids: n/a
Project: Crebilly Farms, 501 West Street Road, West Chester, PA		

General Chemistry

Analyte	Result	RL	Units	DF	Analyzed	By	Method
Nitrogen, Nitrate ^a	6.4	0.31	mg/l	1	08/12/16 13:56	YZ	EPA353.2/SM4500NO2B
Nitrogen, Nitrate + Nitrite	6.5	0.30	mg/l	3	08/12/16 13:56	YZ	EPA 353.2/LACHAT
Nitrogen, Nitrite	0.074	0.010	mg/l	1	08/10/16 21:54	IO	SM4500NO2 B-11
Nitrogen, Total Kjeldahl	0.54	0.20	mg/l	1	08/16/16 12:05	BM	EPA 351.2/LACHAT

(a) Calculated as: (Nitrogen, Nitrate + Nitrite) - (Nitrogen, Nitrite)

RL = Reporting Limit

Report of Analysis

Client Sample ID: OH-2		Date Sampled: 08/10/16
Lab Sample ID: JC25567-2		Date Received: 08/10/16
Matrix: AQ - Ground Water		Percent Solids: n/a
Project: Crebilly Farms, 501 West Street Road, West Chester, PA		

General Chemistry

Analyte	Result	RL	Units	DF	Analyzed	By	Method
Nitrogen, Nitrate ^a	6.4	0.31	mg/l	1	08/12/16 13:59	YZ	EPA353.2/SM4500NO2B
Nitrogen, Nitrate + Nitrite	6.4	0.30	mg/l	3	08/12/16 13:59	YZ	EPA 353.2/LACHAT
Nitrogen, Nitrite	< 0.010	0.010	mg/l	1	08/10/16 21:54	IO	SM4500NO2 B-11
Nitrogen, Total Kjeldahl	0.21	0.20	mg/l	1	08/16/16 12:06	BM	EPA 351.2/LACHAT

(a) Calculated as: (Nitrogen, Nitrate + Nitrite) - (Nitrogen, Nitrite)

RL = Reporting Limit

Report of Analysis

Client Sample ID: OH-3		Date Sampled: 08/10/16
Lab Sample ID: JC25567-3		Date Received: 08/10/16
Matrix: AQ - Ground Water		Percent Solids: n/a
Project: Crebilly Farms, 501 West Street Road, West Chester, PA		

General Chemistry

Analyte	Result	RL	Units	DF	Analyzed	By	Method
Nitrogen, Nitrate ^a	5.4	0.31	mg/l	1	08/12/16 14:00	YZ	EPA353.2/SM4500NO2B
Nitrogen, Nitrate + Nitrite	5.4	0.30	mg/l	3	08/12/16 14:00	YZ	EPA 353.2/LACHAT
Nitrogen, Nitrite	< 0.010	0.010	mg/l	1	08/10/16 21:54	IO	SM4500NO2 B-11
Nitrogen, Total Kjeldahl	0.21	0.20	mg/l	1	08/16/16 12:06	BM	EPA 351.2/LACHAT

(a) Calculated as: (Nitrogen, Nitrate + Nitrite) - (Nitrogen, Nitrite)

RL = Reporting Limit

Report of Analysis

Client Sample ID: OH-4		Date Sampled: 08/10/16
Lab Sample ID: JC25567-4		Date Received: 08/10/16
Matrix: AQ - Ground Water		Percent Solids: n/a
Project: Crebilly Farms, 501 West Street Road, West Chester, PA		

General Chemistry

Analyte	Result	RL	Units	DF	Analyzed	By	Method
Nitrogen, Nitrate ^a	0.50	0.11	mg/l	1	08/12/16 13:23	YZ	EPA353.2/SM4500NO2B
Nitrogen, Nitrate + Nitrite	0.50	0.10	mg/l	1	08/12/16 13:23	YZ	EPA 353.2/LACHAT
Nitrogen, Nitrite	< 0.010	0.010	mg/l	1	08/10/16 21:54	IO	SM4500NO2 B-11
Nitrogen, Total Kjeldahl	0.31	0.20	mg/l	1	08/16/16 12:07	BM	EPA 351.2/LACHAT

(a) Calculated as: (Nitrogen, Nitrate + Nitrite) - (Nitrogen, Nitrite)

RL = Reporting Limit

Misc. Forms

Custody Documents and Other Forms

Includes the following where applicable:

- Chain of Custody



ACCUTEST

GW

CHAIN OF CUSTODY

E

SGS Accutest - Dayton
2235 Route 130, Dayton, NJ 08810
TEL: 732-329-0200 FAX: 732-329-3499/3480
www.accutest.com

FED-EX Tracking #
SGS Accutest Quote #
SGS Accutest Job # JC25567

Client / Reporting Information
Project Information
Requested Analysis (see TEST CODE sheet)
Matrix Codes
LAB USE ONLY

Turnaround Time (Business days)
Data Deliverable Information
Comments / Special Instructions
Matrix was AQ on delivery request form

Relinquished by Sampler:
Date/Time: 8/10/2016 1410
Received By:
Date/Time: 8/10/16
Relinquished by:
Date/Time: 8/10/16 1900
Received By:
Date/Time:
Custody Seal # 922
Preserved (when applicable)
On Ice
Cooler Temp: 0.400 1-9

JC25567: Chain of Custody

Page 1 of 2

SGS Accutest Sample Receipt Summary

Job Number: JC25567

Client: _____

Project: _____

Date / Time Received: 8/10/2016 6:00:00 PM

Delivery Method: _____

Airbill #s: _____

Cooler Temps (Raw Measured) °C: Cooler 1: (0.4);

Cooler Temps (Corrected) °C: Cooler 1: (1.3);

Cooler Security

Y or N

Y or N

- | | | | | | |
|---------------------------|-------------------------------------|--------------------------|-----------------------|-------------------------------------|--------------------------|
| 1. Custody Seals Present: | <input checked="" type="checkbox"/> | <input type="checkbox"/> | 3. COC Present: | <input checked="" type="checkbox"/> | <input type="checkbox"/> |
| 2. Custody Seals Intact: | <input checked="" type="checkbox"/> | <input type="checkbox"/> | 4. Smpl Dates/Time OK | <input checked="" type="checkbox"/> | <input type="checkbox"/> |

Cooler Temperature

Y or N

- | | | |
|------------------------------|-------------------------------------|--------------------------|
| 1. Temp criteria achieved: | <input checked="" type="checkbox"/> | <input type="checkbox"/> |
| 2. Cooler temp verification: | IR Gun | |
| 3. Cooler media: | Ice (Bag) | |
| 4. No. Coolers: | 1 | |

Quality Control Preservation

Y or N

N/A

- | | | | |
|---------------------------------|-------------------------------------|-------------------------------------|-------------------------------------|
| 1. Trip Blank present / cooler: | <input type="checkbox"/> | <input checked="" type="checkbox"/> | <input type="checkbox"/> |
| 2. Trip Blank listed on COC: | <input type="checkbox"/> | <input checked="" type="checkbox"/> | <input type="checkbox"/> |
| 3. Samples preserved properly: | <input checked="" type="checkbox"/> | <input type="checkbox"/> | |
| 4. VOCs headspace free: | <input type="checkbox"/> | <input type="checkbox"/> | <input checked="" type="checkbox"/> |

Sample Integrity - Documentation

Y or N

- | | | |
|--|-------------------------------------|--------------------------|
| 1. Sample labels present on bottles: | <input checked="" type="checkbox"/> | <input type="checkbox"/> |
| 2. Container labeling complete: | <input checked="" type="checkbox"/> | <input type="checkbox"/> |
| 3. Sample container label / COC agree: | <input checked="" type="checkbox"/> | <input type="checkbox"/> |

Sample Integrity - Condition

Y or N

- | | | |
|----------------------------------|-------------------------------------|--------------------------|
| 1. Sample recvd within HT: | <input checked="" type="checkbox"/> | <input type="checkbox"/> |
| 2. All containers accounted for: | <input checked="" type="checkbox"/> | <input type="checkbox"/> |
| 3. Condition of sample: | Intact | |

Sample Integrity - Instructions

Y or N

N/A

- | | | | |
|---|-------------------------------------|-------------------------------------|-------------------------------------|
| 1. Analysis requested is clear: | <input checked="" type="checkbox"/> | <input type="checkbox"/> | |
| 2. Bottles received for unspecified tests | <input type="checkbox"/> | <input checked="" type="checkbox"/> | |
| 3. Sufficient volume recvd for analysis: | <input checked="" type="checkbox"/> | <input type="checkbox"/> | |
| 4. Compositing instructions clear: | <input type="checkbox"/> | <input type="checkbox"/> | <input checked="" type="checkbox"/> |
| 5. Filtering instructions clear: | <input type="checkbox"/> | <input type="checkbox"/> | <input checked="" type="checkbox"/> |

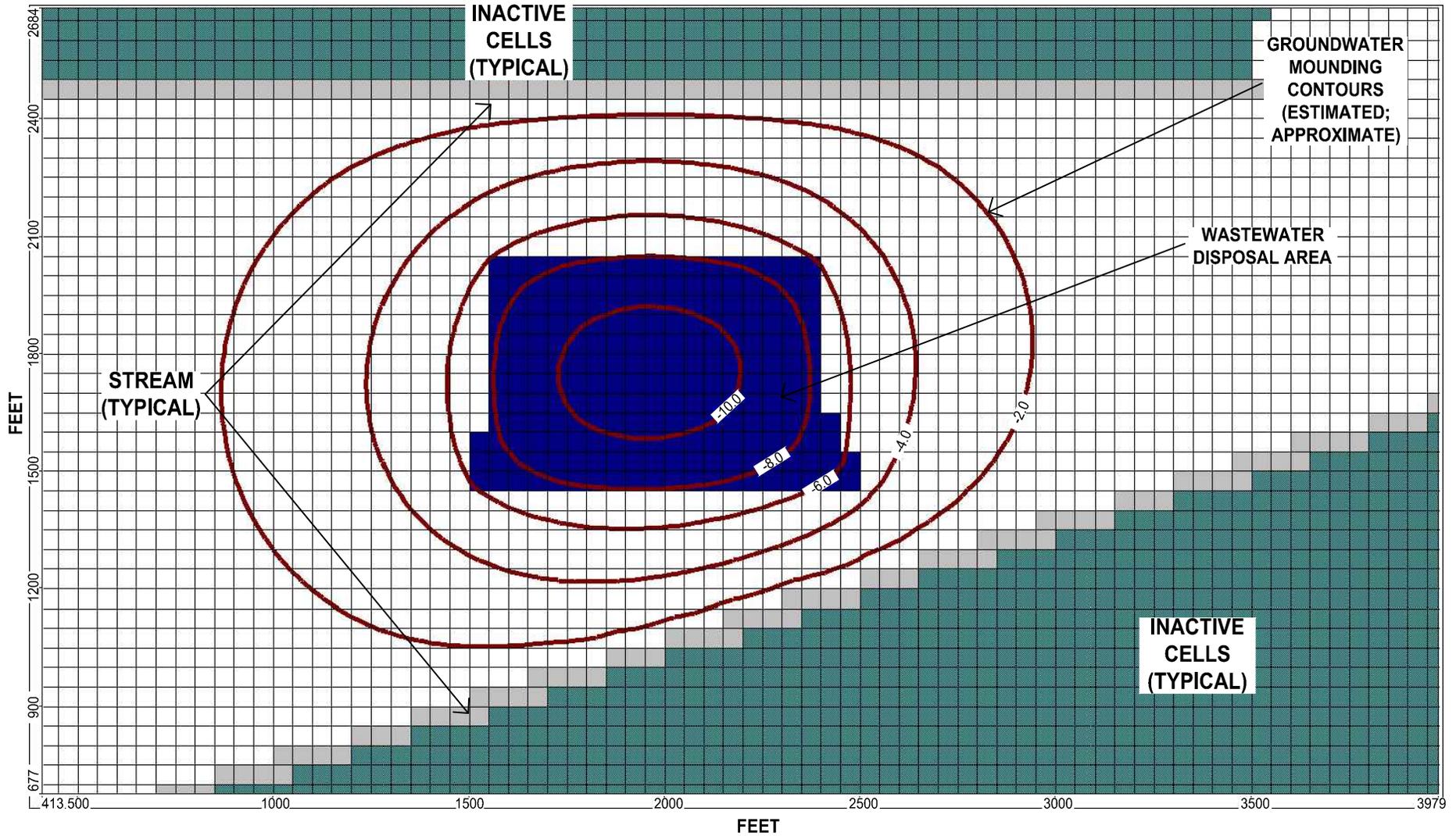
Comments

JC25567: Chain of Custody

Page 2 of 2

4.1
4

APPENDIX E
GROUNDWATER MOUNDING ANALYSIS
RESULTS



G:\GTA\31161348 - Crebilly Farm\plot\31161348-Site Plan.dwg

SOURCE: THIS FIGURE WAS CREATED USING OUTPUT RESULTS MODFLOW (MCDONALD AND HARBAUGH, 1988) AS INCORPORATED INTO VISUAL MODFLOW, VERSION 2011 BY SCHLUMBERGER WATER SERVICES



GEO-TECHNOLOGY ASSOCIATES, INC.

GEOTECHNICAL AND ENVIRONMENTAL CONSULTANTS

3445-A BOX HILL CORPORATE CENTER DRIVE

ABINGDON, MARYLAND 21009

410-515-9446

FAX: 410-515-4895

WWW.GTAENG.COM

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**GROUNDWATER MOUNDING ANALYSIS RESULTS;
10-YEAR LOADING PERIOD
EVALUATED AREA; FLOWS ASSOCIATED
WITH 317 UNITS**

CREBILLY FARM

Chester County, Pennsylvania

JOB NO. 31161348

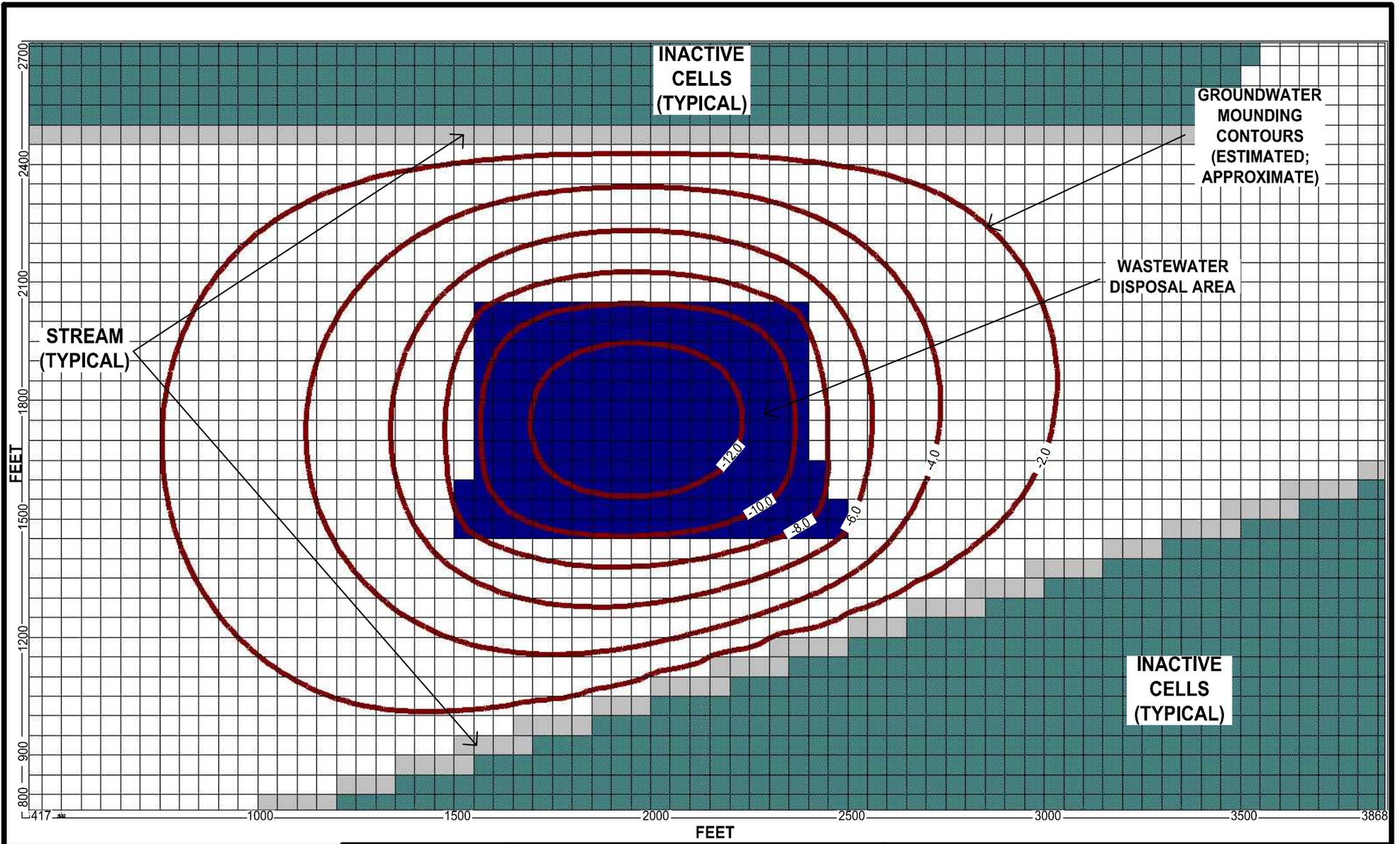
SCALE: NTS

DATE: MARCH 2017

DRAWN BY: GMM

REVIEW BY: PSS

FIGURE:



G:\GTA\31161348 - Crebilly Farm\plot\31161348-Site Plan.dwg

SOURCE: THIS FIGURE WAS CREATED USING OUTPUT RESULTS MODFLOW (MCDONALD AND HARBAUGH, 1988) AS INCORPORATED INTO VISUAL MODFLOW, VERSION 2011 BY SCHLUMBERGER WATER SERVICES



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GROUNDWATER MOUNDING ANALYSIS RESULTS;
10-YEAR LOADING PERIOD
EVALUATED AREA; FLOWS ASSOCIATED WITH 397 UNITS
CREBILLY FARM
 Chester County, Pennsylvania

JOB NO.	31161348	SCALE:	NTS	DATE:	MARCH 2017	DRAWN BY:	GMM	REVIEW BY:	PSS	FIGURE:	2
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