Hydrogeologic Evaluation Report
Abbyville Commons/The Preserve at Abbyville
Lawrence Street
Norfolk, MA 02056

Transmittal Number #X277029

Prepared by
GeoHydroCycle, Inc.

Prepared for:
Mr. Thomas DiPlacido

December 15, 2017

GeoHydroCycle, Inc.

Hazardous Waste
Water Supply

Assessment
Remediation
Analyses
Permitting
Modeling
Software

December 15, 2017

Mr. David Boyer, P.E.
MassDEP Central Regional Office
8 Bond Street
Worcester, Massachusetts 01608

re: Hydrogeologic Evaluation and Groundwater Mounding Analyses
Abbyville Commons/The Preserve at Abbyville
Lawrence Street, Norfolk, MA 02056
Transmittal No. X277029
GHC #15029

Dear Mr. Boyer:

GeoHydroCycle, Inc. (GHC) is pleased to present the results of our Hydrogeologic Evaluation and Groundwater Mounding Analyses in accordance with our revised Scope of Work dated September 13, 2017 for the proposed treated wastewater discharge at Abbyville Commons on Lawrence Street in Norfolk, Massachusetts (the Site), see Figure 1 in Enclosure 1 for Site Location.

As you recall, a Scope of Work was previously submitted to your office in December of 2015. A Public Notice was submitted to MEPA and published in the December 23, 2015 Environmental Monitor. No comments were received during the 30 day comment period. A pre-application meeting was held at the MassDEP Worcester Office on January 16, 2016.

Thereafter, as a result of exploring alternative project changes, the applicant then examined a proposed reconfiguration of the project in 2016 and early 2017 so that all units could potentially be served by systems conforming to Title V. Subsequently, as a result of input from the Town of Norfolk and based upon our re-examination of the development concept, the applicant decided to revert back to a package wastewater treatment facility involving a proposal that also involved a reduction in wastewater discharge and a change in the location of the leaching area. Accordingly, GHC submitted the revised Scope of Work dated September 13, 2017. After submitting the September 13, 2017 Scope of Work, a second pre-application meeting was held at MassDEP on September 21, 2017.

This Hydrogeologic Evaluation was done in support of a Groundwater Discharge Permit Application (GWDPA) for the Site. As part of the evaluation, GHC completed a groundwater model to conduct a Groundwater Mounding Analyses.

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1.0 Introduction

GHC's scope of work for the Hydrogeologic Evaluation and Groundwater Mounding included: 1) preparing and submitting a Scope of Work and receiving approval of that scope from your office; 2) a review of the available hydrogeologic data; 3) a site reconnaissance; 4) observation of ten soil borings and the installation of seven groundwater monitoring wells at the Site; 5) grain size analyses of two soil samples taken from on site test pits; 6) analyses of grain size curves to estimate hydraulic conductivity values; 7) performance of single well aquifer tests in five of the installed monitoring wells to estimate aquifer hydraulic conductivity; 8) a groundwater mounding analyses to estimate the increase in groundwater height due to the application of 64,000 gallons per day of treated wastewater into leach fields with a total disposal area of 39,327 square feet; 8) conducting a groundwater time-of-travel analysis to estimate the time groundwater would take to flow from the leach fields to nearby public wells; 9) preparation of a Groundwater Monitoring Plan; and 10) preparation of this report.

2.0 Site Description

Abbyville Commons is a proposed residential development located on property on the north side of Lawrence Street in the southwestern portion of Norfolk, MA 02056. The area to be served by a proposed Groundwater Discharge Permit consists of approximately 203 acres of land, of which only a total of approximately 56 acres will be developed to create a cluster development consisting of a total of 204 residential units within two projects which abut one another. The remainder of the land will remain as open space.

The proposed Projects to be subject to the proposed Groundwater Discharge Permit are: (a) Abbyville Commons to be developed by Abbyville Residential, LLC; and, (b) the Preserve at Abbyville to be developed by Abbyville Development, LLC. The principal and Manager of both Abbyville Residential, LLC and Abbyville Development, LLC is Thomas W. DiPlacido, Jr. Each project is a separate and distinct project but both projects, however, will be served by a single package wastewater treatment facility to be designed, constructed and operated in accordance with a Groundwater Discharge Permit.

Abbyville Commons is a fifty-six (56) unit rental community consisting of twelve (12)1-bedroom units, forty (40) 2-bedroom units, and four (4) 3-bedroom units, all of whch will be located on a parcel of land consisting of approximately 8 acres (the "Abbyville Commons Property"), as more particularly shown on the attached site plan. The Preserve at Abbyville is a one hundred forty-eight (148) unit home ownership development consisting of thirty-two (32) 2-bedroom units, sixty (60) 3-bedroom units, and fifty-six (56) 4-bedroom units. The residential units will be located on a parcel of land consisting of approximately 195 acres (the "Preserve at Abbyville Property"), as more particularly shown on the attached site plan (collectively, the "development").

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Water for the new development will be provided by the Town of Norfolk while wastewater from the development will be treated by an on-site wastewater treatment plant and discharged to groundwater under the Massachusetts Groundwater Discharge Permit Program (310 CMR 5.00).

Based on a Title 5 flow calculation using 572 bedrooms, the maximum daily wastewater discharge will be 62,920 gallons per day. For this evaluation, a wastewater discharge rate of 64,000 gpd was used. Based on a total footprint area of 39,327 square feet for the two leach fields, the per-square-foot loading rate used for this evaluation is 1.63 gpd/sf.

The Abbyville Commons Property and The Preserve at Abbyville Property is generally an undeveloped, forested land with sharply rolling topography that is characterized by long winding ridges of stratified sand and gravel referred to as eskers. The topography flattens out in the northwestern portion of the property where past sand and gravel operations removed much of the overburden soil. Field observations have revealed that the past sand and gravel removal exposed bedrock in several locations in the northwest portion of the property.

3.0 Site Reconnaissance

During a February 12, 2016 site reconnaissance, GHC observed three test pits. The test pits were also being observed by Barbara Kickham and Andrew Osei of the Massachusetts DEP. Two soil samples collected during the test pit excavations were sent to a soils laboratory for grain size analysis and will be discussed later in this report.

Another site reconnaissance was conducted on October 18, 2017 to observe three test pits. These new test pits were being observed by Stephen Hallem of the Massachusetts DEP.

4.0 Test Pits

Site test pits were excavated to depths of between 15 and 20 feet, neither bedrock nor groundwater were not encountered in any of the test pits. The test pits revealed soils ranging in texture from coarse sand to sand and gravel. A 11 foot thick layer of fine sand and silt was found in test pits CAQ-109 and CAQ-110.

Test pit data are presented in Enclosure 2.

5.0 Soil Boring and Well Installation

Soil borings were advanced at the site on two occasions, the first between March 17 and 18, 2016, and the second between November 9 and 13, 2017. During March, 2016, four borings were advanced and three wells were installed. During November, 2017, six borings were advanced and four wells were installed.

Borings were advanced by Drilex Environmental Drilling using a hollow stem auger. Soil samples were obtained at five foot intervals during the drilling using a 24-inch split spoon sampler. The installed monitoring wells were constructed using

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2-inch diameter PVC that consisted of 10-slot screens and solid risers. All wells were enclosed in steel standpipes with locks.

Soils encountered during Site drilling were primarily fine to coarse SANDS and GRAVELS. Drilling logs describing the soil samples, the drilling process, and the construction of the wells are included in Enclosure 3. Figure 3 shows a schematic profile of the borings and monitoring wells.

Soil boring and well locations and elevations were surveyed by United Consultants, Inc. UCI also surveyed surface water elevations at Bush Pond, three locations along the Mill River, and at the unnamed Trench that discharges to the Mill River.

6.0 Local Hydrogeology

Figure 4 shows a surficial geologic map from the MassGIS web site. This map shows Site soils as sands and gravels, which is consistent with Site boring data. In addition, the MassGIS map shows several large areas around the Site where bedrock is shallow or where bedrock outcrops, which is consistent with field observations.

GHC personnel were at the Site on November 15, 2017 and December 1, 2017 to take groundwater depth measurements in the Site monitoring wells. Groundwater was detected in wells, MW-11, MW-12 and MW-13, the other wells were dry. Using the surveyed top of well (TOC) elevations, GHC converted the November 15, 2017 depth measurements to water table elevations.

Table 6.0.1. Groundwater Elevation Data, November 15, 2017.

Well	Measuring Point Elevation (feet, MSL)	Depth to Groundwater from TOC, 11/15/17 (feet, MSL)	Groundwater Elevation, 11/15/17 (feet, MSL)
GHC-1	230.44	DRY	N/A
GHC-2	220.70	DRY	N/A
GHC-3	230.90	DRY	N/A
MW-10	207.67	DRY	N/A
MW-11	203.20	39.87	163.33
MW-12	197.29	36.45	160.84
MW-13	202.36	39.02	163.34

Based on the groundwater elevation data presented in Table 6.0.1, GHC has prepared Figure 6. As the figure illustrates, groundwater flows in a northeast direction toward an unnamed Trench at an average horizontal gradient of .010 feet per foot.

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7.0 Seasonal High Groundwater

Because soil mottling was not observed in Site test pits, as a basis to estimate seasonal high groundwater elevation (SHGW) at the Site, GHC used the Frimpter Method. The results of the Frimpter Method indicated that 4.60 feet needed to be added to the measured November 15, 2017 groundwater elevations. Details of the Frimpter Analysis are presented in Enclosure 4.

Estimated SHGW in each of the wells is presented in the Table 7.0.2 below.

Table 7.0.2. Estimated SHGW.

Well	Groundwater Elevations November 15, 2017 (feet, MSL)	Estimated SHGW Elevation (feet, MSL)
MW-11	163.33	167.93
MW-12	160.84	165.44
MW-13	163.34	167.94

Using elevations from the above table and surface water elevations from the Trench and Mill River, GHC prepared Figure 7, a SHGW contour map. In an area of the Site where the leach field is located, Site topography shows a narrow valley oriented northeast/southwest, and sloping down toward the unnamed Trench that discharges to the Mill River. Based on soil boring information, GHC created Figure 5, a bedrock contour map. This map shows a bedrock valley also starting around the location of the proposed leach fields, extending northeasterly toward the Trench and Mill River. Groundwater flows parallel to the centerline of the bedrock valley, and because bedrock elevations along the west side of the valley are greater than seasonal high groundwater elevations, bedrock forms an apparent barrier to groundwater flow to the north.

8.0 Saturated Thickness

The saturated thickness for the aquifer was determined by subtracting the elevation of bedrock in the Site wells from the SHGW elevation and averaging the results. Table 8.0.1 below demonstrates that calculation.

Table 8.0.1. Saturated Thickness.

Well	SHGW Elevation (feet, MSL)	Bottom Elevation (feet, MSL)	Saturated Thickness (feet)
MW-11	167.9	157.2	10.7
MW-12	165.4	153.4	12.0
MW-13	167.9	154.5	13.4
		Average:	12.0

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The resulting average saturated thickness that was used in the MODFLOW model was 12.1 feet.

9.0 Aquifer Testing

GHC conducted single well aquifer testing to estimate the hydraulic conductivity of the overburden aquifer beneath the proposed leach fields.

9.1 Grain Size Data

Two soil samples from on-site test pits CAQ-1 and CAQ-2 in February 2016 and were sent to Alpha Analytical for grain size analyses, see Enclosure 5 for grain size curves. The sample from CAQ-1 was obtained from a depth of 24 inches, while the second sample taken from CAQ-1 was obtained from a depth of 54 inches.

9.2 Single Well Slug Tests

GHC personnel conducted slug tests in monitoring wells at the property on two occasions. The first slug testing was done on March 24, 2016 and included monitoring wells GHC-1 and GHC-2. The second set of tests were done on November 15, 2017 and included monitoring wells MW-11, MW-12 and MW-13. GHC used both rising and falling head tests for each well. All wells were developed by the drilling contractor before slug testing.

Following the well development, the falling head/rising head slug test protocol involved: 1) measuring the depths to groundwater in the well; 2) installing a pressure transducer in the well to be tested; 3) connecting the transducer cable to the data storage unit; 4) recording the static depth of the transducer as the initial reference level; 5) inserting a solid slug into the well and electronically recording a falling head test; 6) allowing the water level to recover to at least 95 percent of pretest level; 7) beginning the rising head test by removing the solid slug from the well and electronically recording the data. Each test was performed using a slug capable of displacing water in the 2-inch diameter well 1.82 feet.

10.0 Aquifer Testing Results

10.1 Grain Size Analyses

Grain size curves from the two test pit soil samples, plus a duplicate curve for sample CAQ-1, were analyzed using a computer program developed by Kasenow and Feng[1] that calculates hydraulic conductivity using six methods: Hazen, Beyer, Kozeny, Sauerbri, USBR, and Pavchich, see Enclosure 5 for grain size analyses summaries.

The hydraulic conductivity results for the CAQ-1 sample were 1,722 and 958 feet per day, and for sample CAQ-2 the hydraulic conductivity is 22.1 feet per day.

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[1] Kasenow, M and Feng, H. *Determination of Hydraulic Conductivity from Grain Size Analysis*. Water Resources Publications, LLC, 2002.

10.2 Slug Test Analyses

The test data from the two wells were analyzed using methods developed by Hvorslev[2] and Bouwer & Rice[3]. Both analyses were completed using GHC's commercially available computer models for the Hvorslev and Bouwer & Rice methods, see Enclosure 6.

10.3 Hydraulic Conductivity Determination

To determine a representative value of hydraulic conductivity for the outwash sands, GHC used a statistical method published by the Connecticut DEP[4]. The method calculates the statistics of the input data and determines whether the results are within confidence limits and eliminates statistical outliers. The statistical analysis calculated a geometric mean hydraulic conductivity of 38.4 feet per day for the esker sands. A table presenting the analysis is shown in Enclosure 6.

11.0 Groundwater Model Development and Simulation

GHC accomplished the groundwater mounding analyses for the Site with the widely used and accepted numeric groundwater model, MODFLOW. Input parameters to the model were obtained from GHC's environmental drilling logs, field observations lab testing, and field testing.

Information concerning the design of the leach fields was obtained from Carlos Quintal and included: 1) the wastewater application rate, and 2) the location and layout of the two leach fields.

11.1 Conceptual Model

In developing the groundwater model to predict the mounding height beneath the proposed SAS area, GHC prepared a conceptual model of the aquifer. Features of the conceptual model include:

1. The aquifer is unconfined with the water table as the upper surface;
2. The unnamed Trench to the north is the local groundwater discharge area;
3. Seasonal high groundwater can be estimated by adding to contours of measured groundwater a Frimpter adjustment;
4. The aquifer lower surface is not known, but can be estimated using the difference between seasonal high groundwater and the depth of the wells;
5. Aquifer hydraulic conductivity can be estimated using single well slug tests and the analyses of grain size curves;

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[2] *Hvorslev, M.J. 1951. Time Lag and Soil Permeability in Groundwater Observations. U.S. Army Corps Engrs. Waterways Exp. Sta. Bull. 36, Vicksburg, Miss.*

[3] *Bouwer, H. and R. C. Rice. A Slug Test for Determining Hydraulic Conductivity of Unconfined Aquifers with Completely or Partially Penetrating Wells. Water Resources Research, Vol. 12, pp. 423-428, 1976.*
Bouwer, H. The Bouwer and Rice Slug Test - An Update. Ground Water, pp. 304-309, Vol. 27, No.3, 1989.

[4] *Connecticut DEP. 2006. Guidance for the Design of Large Scale On-Site Wastewater Renovation Systems, Appendix C - Selecting Hydraulic Conductivity Values for Design.*

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6. An average hydraulic conductivity can be used in the model to be representative of the aquifer; and
7. The simulation can be achieved by modeling the proposed leach field area on a flat water table with the resulting groundwater mound superimposed onto seasonal high groundwater.

11.2 MODFLOW Setup

The following describes the MODFLOW model input parameters. Figures 8a and 8b shows the MODFLOW features

11.2.1 Grid Definition

The MODFLOW model was designed to represent the overburden aquifer as described above using a 4,096 foot by 4096 foot grid. In plan view, the aquifer was gridded using a variable node spacing consisting of 64 by 64 feet at the edges of the model and telescoping to 8 by 8 feet in the area of the leach field. The smaller grid spacing was used in the area directly around the leach field where discharge to groundwater causes steeper gradients. The greater grid resolution allows for a more accurate model prediction of groundwater flow around leach fields.

11.2.2 The Unnamed Trench

The Unnamed Trench to the north of the leach fields acts as a local groundwater discharge area. To simulate the Trench in the model, GHC used the MODFLOW River component. This feature allows groundwater to discharge to a water body when groundwater is above the water body and to receive water from the water body when groundwater falls below the bottom of a water body. As noted, MODFLOW was set up to model wastewater discharge on a flat water table hydraulically connected to the wetland as a flat water body with the same water levels.

The MODFLOW River component requires the following parameters: river stage - the elevation of the water body; river bottom elevation - the elevation of the water body bed; and river bed conductance, a measure of the ability of water body bed to transmit water to or from the aquifer. Trench water elevations were surveyed by UCI in November of 2017.

The river stage elevation was input at the same elevation as the aquifer saturated thickness (12.1 feet), and the river bottom elevation was set one foot below that elevation in the tributary cells (11.1 feet).

River bed conductance was calculated using the following equation:

$COND = (K_v \times W \times L)/M$

where:

COND $\equiv$ the river bed conductance,

$K_v \equiv$ the vertical hydraulic conductivity of the river bed material,

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W ≡ the average width of the river,

L ≡ the length of the river within the cell, and

M ≡ the thickness of the river bottom material.

The hydraulic conductivity of the river bed material was assumed to be one third the horizontal hydraulic conductivity in the model or K_v = 12.8 feet per day. The average width of the drain (W) and the length of the river within the cell (L) varied based on the width and length of the node in which it is located. The thickness of bed materials in the rivers (M) was assumed to be 1 foot.

11.2.3 Wastewater Recharge

To simulate the application of 51,200 gallons per day (80% of 64,000 gpd) of treated wastewater into two leach fields with a total footprint of 39,168 square feet, GHC designated 104 and 508 nodes in the model to simulate the wastewater recharge into the two leach fields. This results in a leach field area in the model of 39,168 square feet which is the same as the design area. The result was that the model application rate of 0.174758 cubic feet per day per square foot.

11.3 MODFLOW Simulation

To predict the groundwater mounding beneath the proposed soil absorption system, GHC ran a 90-day transient MODFLOW simulation. Table 11.3.1 summarizes the parameters used in the model.

Table 11.3.1. MODFLOW Model Input Parameters.

Parameter	Value	Unit
Disposal Rate:	51,200	gallons per day (total)
Model Soil Absorption Area :	39,168	square feet
Model Recharge Rate:	0.174758	cubic feet per day per square foot
Hydraulic Conductivity:	38.4	feet per day
Saturated Thickness:	12.1	feet
Mounding Time	90	days

12.0 MODFLOW Mounding Results

Results of the MODFLOW groundwater mounding simulation indicated that the increase in groundwater elevations due to the application of treated septic wastewater into the soil absorption system would be 5.6 feet beneath the larger of the two proposed leach fields, see Figure 9. Superimposing the mounding on the Seasonal High Groundwater elevations yields simulated groundwater elevations under the proposed primary wastewater disposal conditions, see Figure 10. This figure demonstrates that the predicted mounded groundwater elevation at the Site beneath the SAS will be 173.8 feet, MSL beneath the larger of the two leach fields.

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To illustrate the design separation between mounded seasonal high groundwater and the proposed bottom of the proposed leach fields, GHC prepared Figure 11, a geologic cross-section through the leach field area. The location of the cross-section is presented in Figure 10. As Figure 11 reveals, adding a four foot vertical separation to seasonal high groundwater sets the bottom of the proposed leach field at a minimum elevation of 177.7 MSL. This elevation is more than 20 feet below the current ground surface.

13.0 Sensitive Receptors and Natural Resource Protection

GHC's review of the Priority Resources Map from MassGIS, see Figure 12, shows the following Priority Resources within one mile of the proposed leach fields, including:

- NHESP Certified Vernal Pools (2) located on-site, northwest of the leach fields with the nearest at 1,420 feet. NHESP Certified Vernal Pool located off-site southeast of the leach fields with the nearest at 920 feet. Other NHESP Certified Vernal Pools are located off-site, within one mile;
- NHESP Potential Vernal Pools located on-site north of the leach fields with the nearest at 2,190 feet. NHESP Potential Vernal Pools located off-site south of the leach fields with the nearest at 1,130 feet. Other NHESP Potential Vernal Pools are located off-site, within one mile;
- The leach fields are located within the Zone II Wellhead Protection Area for the Franklin Mill River wells which are 6,740 feet north of the leach fields;
- On-site wetlands are located along the Mill River with the nearest northeast of the leach fields at 760 feet.
- Tests wells for a potential public water supply have been installed on-site north of the leach fields at 1,730 feet.

Groundwater flow under mounded conditions beneath the proposed leach fields is to the northeast toward Unnamed Trench and Mill River, and the amount of treated wastewater proposed to be discharged is 64,000 gallons per day. Changes in groundwater from the proposed leach fields are limited to groundwater in the vicinity of and downgradient of the fields and is not expected to adversely impact Priority Resources within one mile of the fields.

Time-of-Travel Analysis

To assess possible impacts to public wells, GHC conducted groundwater time-of-travel analyses for the Franklin Mill River wells and the on-site test wells.

To calculate the time-of-travel from the leach fields to the public wells, GHC used an analytic solution for the steady-state equation for groundwater flow to a pumping well:

$$Q = 2\pi rT\ dh/dr$$

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solving the equation for the pumping slope, dh/dr:

$dh/dr = Q/2\pi rT$

where:

$dh/dr \equiv$ water table slope due to pumping

$Q \equiv$ the steady well pumping rate

$r \equiv$ the radial distance from the well

$T \equiv$ the transmissivity of the aquifer

By solving this equation for small distance increments between the leach field and the well, a travel time can be calculated for each increment, and a cumulative travel time can be summed. Because the Franklin and Test Wells are downgradient of the leach fields, the local groundwater slope (0.01 ft/ft) was added to the pumping slope to account for natural groundwater movement. Enclosure 7 presents summary sheets for the time-of-travel analyses.

Based on this analytic analysis, GHC calculated a groundwater time-of-travel of 1.09 years from the leach field to the Test Wells, a distance of 1,727 feet. For the nearest Franklin Mill River well a groundwater time-of-travel of 3.61 years, a distance of 6,737 feet. Both these travel times yield average groundwater velocities close to 5 feet per day, which is not typical for groundwater in glacial environments over long distances.

It should also be noted that the bedrock valley that GHC presented in Figure 5, likely constrains groundwater flow from the leach fields toward the Unnamed Trench and Mill River, effectively preventing groundwater flow to either the Test Wells or the Franklin Mill River wells.

Downgradient Abutters

Abutters to the south and east of the proposed leach fields have private wells, with the nearest private well located approximately 420 feet to the southeast of the fields. As shown in Figure 10, groundwater flow from the leach fields is to the north toward the Unnamed Trench and the Mill River, away from the private wells. Based on this flow direction, and that the abutter's wells are located outside town setback for private wells, it is not expected that the leach fields will have an adverse impact on abutter's private wells or their septic systems.

14.0 Groundwater Monitoring Plan

In accordance with 314 CMR 5.00, long-term groundwater monitoring activities are required for groundwater discharges with design flows greater than or equal to 10,000 gallons per day.

The objective of the long-term groundwater monitoring plan (GWMP) is to establish background water quality for the new discharge, and to establish long-term groundwater quality at points near sensitive receptors and/or downgradient property

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boundaries. To accomplish this objective GHC proposes: 1) three groundwater monitoring wells, 2) monitoring well construction details, 3) groundwater quality sampling parameters, and 4) groundwater sampling frequency.

14.1 Compliance Monitoring Well Locations

Proposed compliance monitoring well locations are based on Groundwater Discharge Permit guidelines, such that one well will monitor groundwater quality upgradient and two wells downgradient of the proposed leach fields.

The objective of an upgradient compliance monitoring well is to monitor groundwater quality outside of the influence of the proposed discharge. Based on GHCs hydrogeologic evaluation and mounding analysis for Abbyville Commons, discharge of treated groundwater from the leach fields creates a groundwater flow field as shown in Figure 10. To monitor groundwater quality upgradient of the fields, GHC proposes compliance monitoring well UCW-1, and to monitor groundwater quality downgradient of the discharge, compliance wells DCW-2 and DCW-3, see Figure 13.

Additional compliance monitoring wells may be an added permit condition depending upon the Site's hydrogeologic complexity and the type, number, and proximity of sensitive receptors. These locations will be revised as necessary.

14.2 Monitoring Well Construction

Compliance monitoring wells installed at the Site have been constructed in accordance with the MADEP's Standard Reference for Monitoring Wells[5].

14.3 Groundwater Quality Sampling

The following parameters will be sampled in upgradient and down gradient compliance monitoring wells on the following schedule:

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[5] *The Massachusetts Department of Environmental Protection, Standard Reference for Monitoring Wells, DEP Publication # WSC-310-91, January 1991.*

Table 14.3.1. Compliance Sampling.

Parameter	Schedule
static water level	monthly
pH	monthly
specific conductance	monthly
nitrate nitrogen	quarterly
total nitrogen (nitrate, nitrite, TKN)	quarterly
total phosphorus	quarterly
orthophosphate	quarterly
volatile organic compounds (Method 624)	annually

To establish background water quality, all compliance monitoring wells will be sampled for the parameters of concern before the startup of the wastewater discharge. Monthly results of water quality sampling will be reported to the MADEP Central Regional Office.

If you have any questions, please call me.

Sincerely,
GeoHydroCycle, Inc.

Stephen W. Smith, P.E., P.HGW.

Enclosures:
1 - Figures
2 - Test Pit Logs
3 - Environmental Drilling Logs
4 - Frimpter Analysis
5 - Grain Size Report and Analyses
6 - Slug Test Analyses Summaries
7 - Groundwater Time-of-Travel Analyses
8 - Transmittal Form X277029 and BRP WP 83

cc: Thomas DiPlacido
Rick Goodreau, UCI
Carlos Quintal, CAQ

Abbyville HER.lwp

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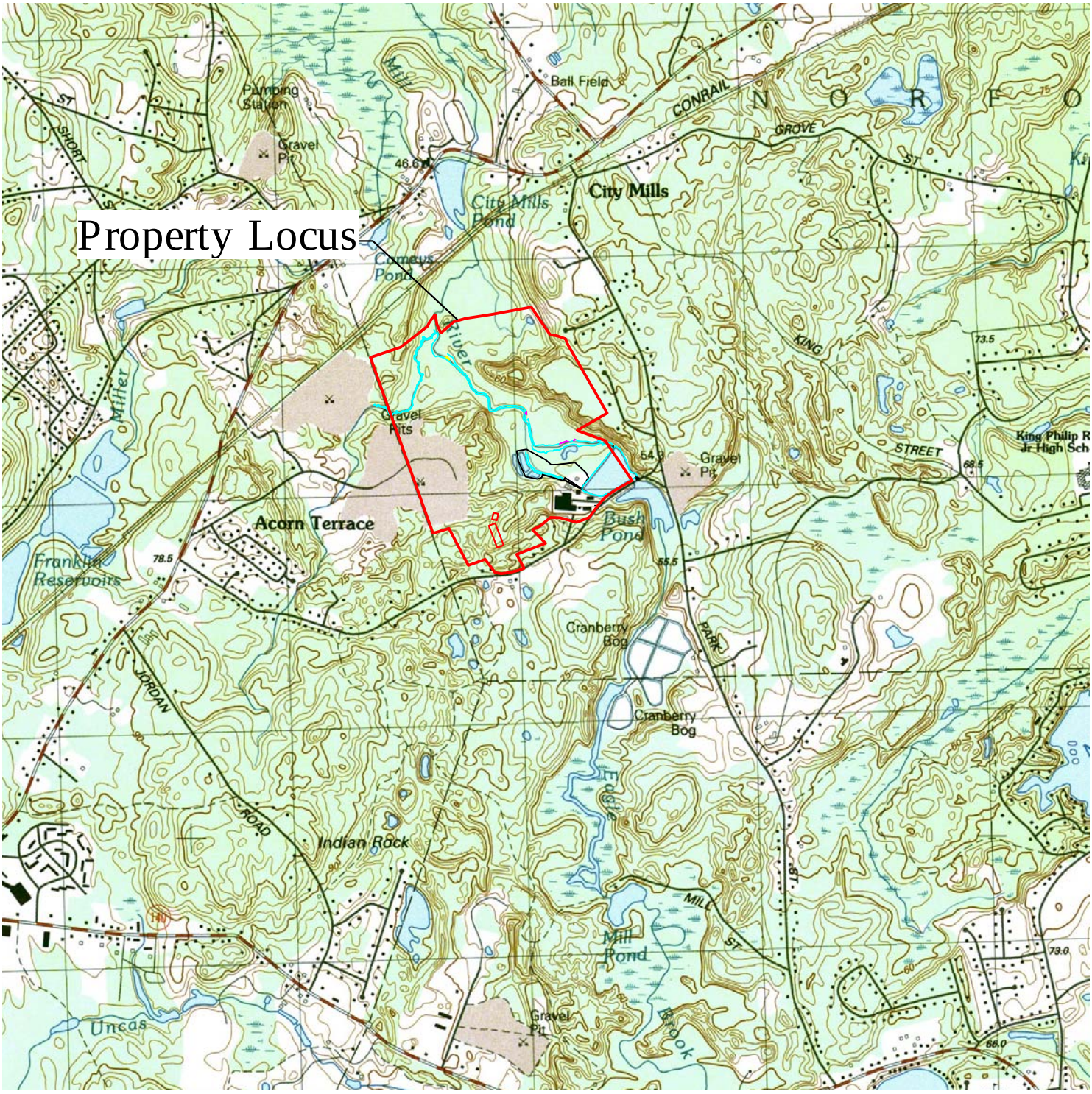
Enclosure 1 - Figures



0 2,000

Scale in feet

Base Map: MassGIS Quads q213870 & q217870.

GeoHydroCycle, Inc.

Figure 1. Site Locus.

Project No. GHC #15029

Drafted SWS Checked

Date 11/10/15 Rev 9/21/17

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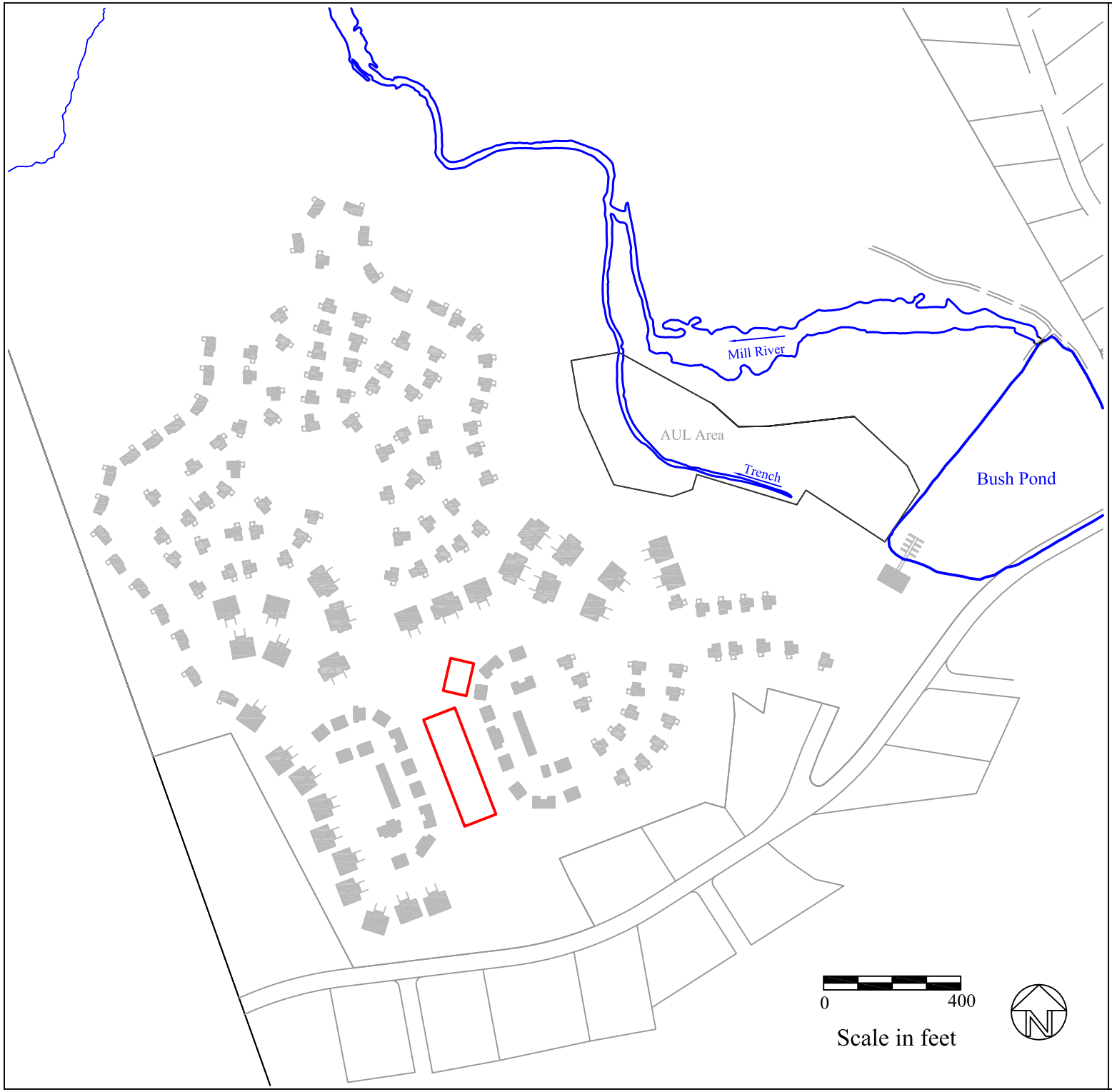

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Figure 2A. Proposed Abbyville Commons Development.

LEGEND:

Proposed Leach Field Locations.

NOTES:

1. Layout of residences is approximate and is subject to change.

Project No. GHC#15029
Drafted SWS Checked
Date 9/12/17 Rev 12/10/17
Base Map: CAD Files
Provided by UCI Engineers.

GeoHydroCycle, Inc.

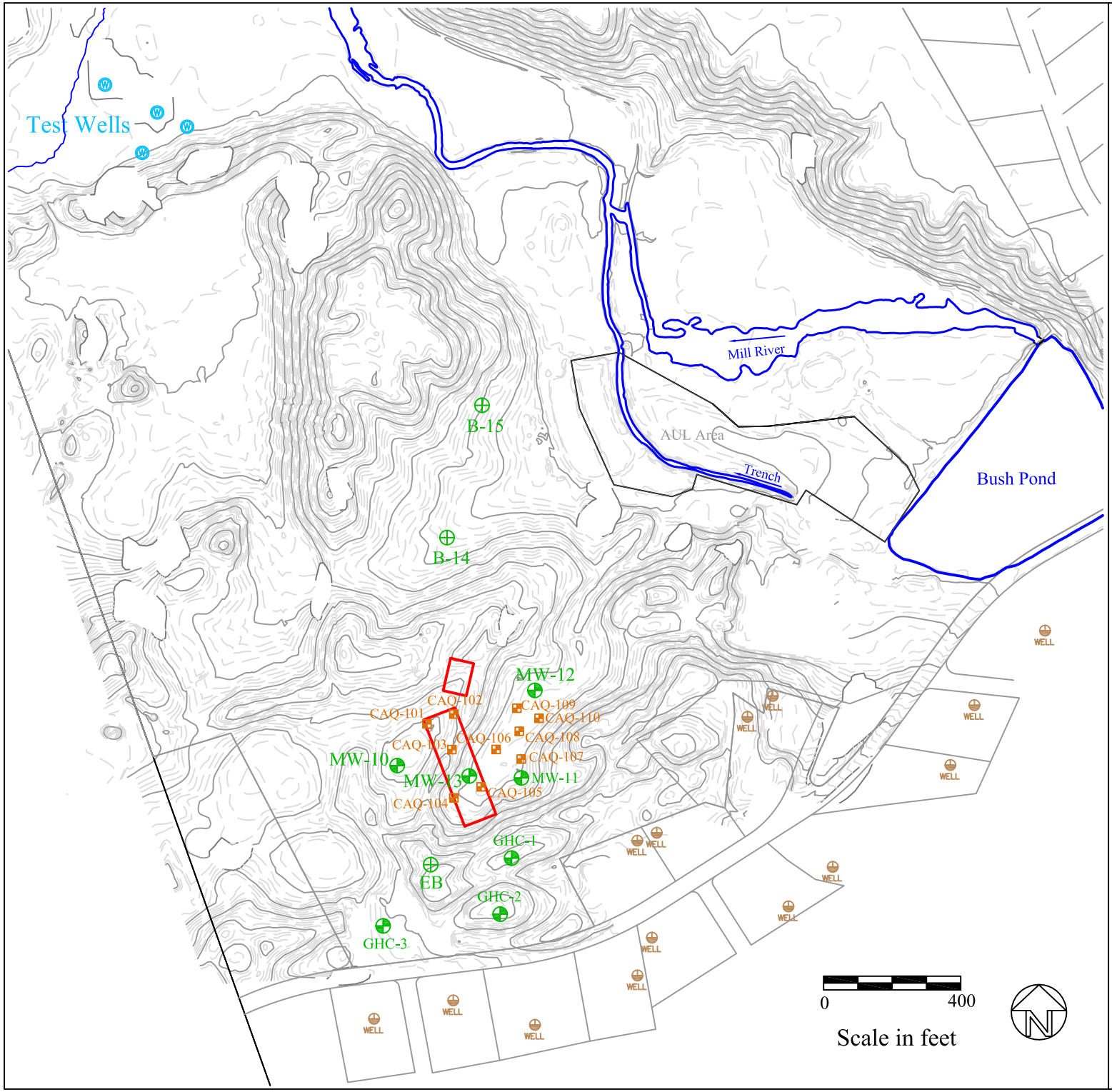

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Figure 2B. Site Features.

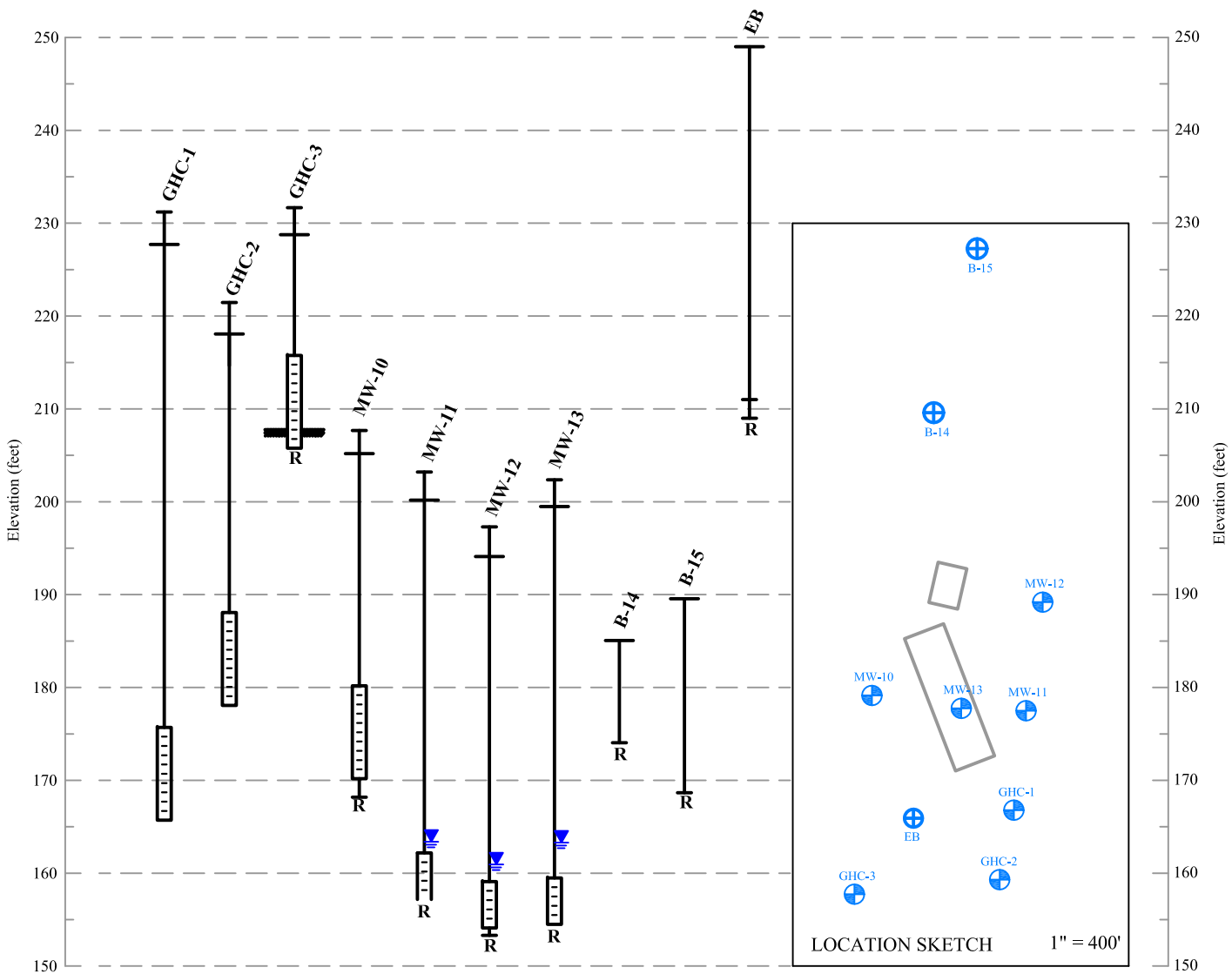
LEGEND:

- Water Supply Test Well Locations.
- Soil Boring Locations.
- Groundwater Monitoring Well Locations.
- Private Well Locations.
- Test Pit Locations.
- Proposed Leach Field Locations.

Project No. GHC#15029
Drafted SWS Checked
Date 9/12/17 Rev 12/10/17
Base Map: CAD Files
Provided by UCI Engineers.

GeoHydroCycle, Inc.

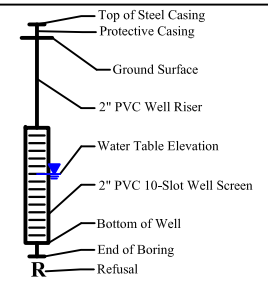
Abbyville Commons
17 Lawrence Street
Norfolk, MA 02056



SCALES AS SHOWN.

Figure 3. Monitoring Well Schematic.

LEGEND:



NOTES:

1. Monitoring wells GHC-1, GHC-2, and GHC-3 completed on 3/17 and 3/18/16. GHC-3 encountered bedrock at 21 feet. The hole was advanced into bedrock 2 feet and the screen set into bedrock.
2. Monitoring wells MW-10, MW-11, MW-12 and MW-13 and borings B-14 and B-15 completed on 11/9, 11/10 and 11/13/17.
3. Depth to groundwater measurements were recorded on 11/15/17.
4. Elevations are based on land surveys conducted by UCI Engineering.

Project No. GHC#15029
Drafted SWS Checked
Date 11/27/17.
Base Map: None.

GeoHydroCycle, Inc.

0 1,000

Scale in feet

Base Map: MassGIS Topographic Maps.

GeoHydroCycle, Inc.

Figure 4. Surficial Geology.

Project No. GHC #15029

Drafted SWS Checked

Date 11/10/15 Rev

Abbyville Commons
17 Lawrence Street
Norfolk, MA 02056

Abbyville Commons
17 Lawrence Street
Norfolk, MA 02056

Figure 5. Site Bedrock Contours.

LEGEND:

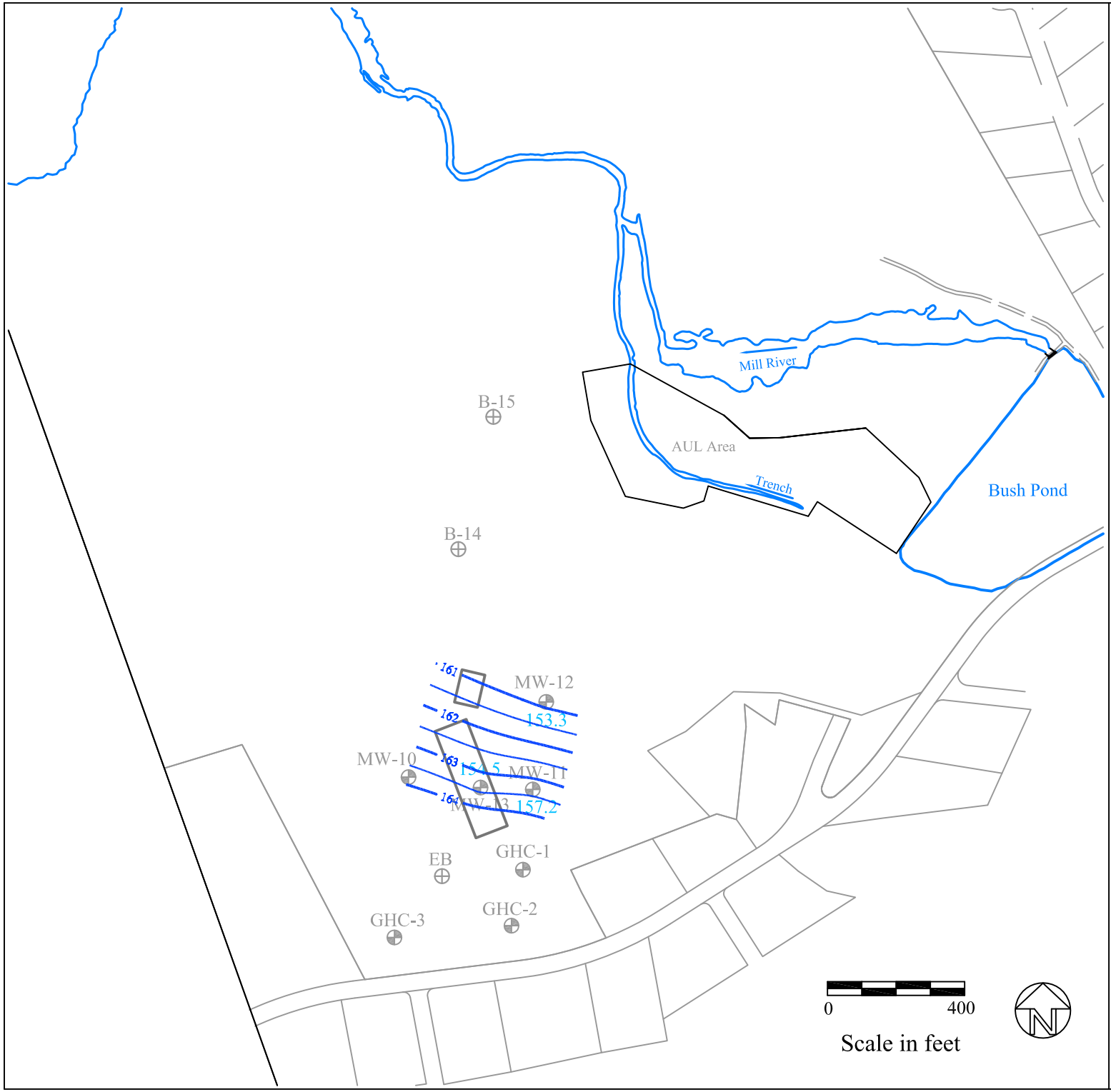
B-14 174.1 — Soil Boring Locations with Bedrock Elevations.

MW-10 168.2 — Monitoring Well Locations with Bedrock Elevations.

160 — Bedrock Elevation Contour, 5-Foot Interval.

Project No. GHC#15029
Drafted SWS Checked
Date 9/12/17 Rev 12/10/17
Base Map: CAD Files
Provided by UCI Engineers.

GeoHydroCycle, Inc.



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Norfolk, MA 02056

Figure 6. Groundwater Contour Elevations, Measured 11/15/17.

LEGEND:

160 Groundwater Elevation Contours. Interval = 0.5 foot.

Inferred Groundwater Flow Direction.

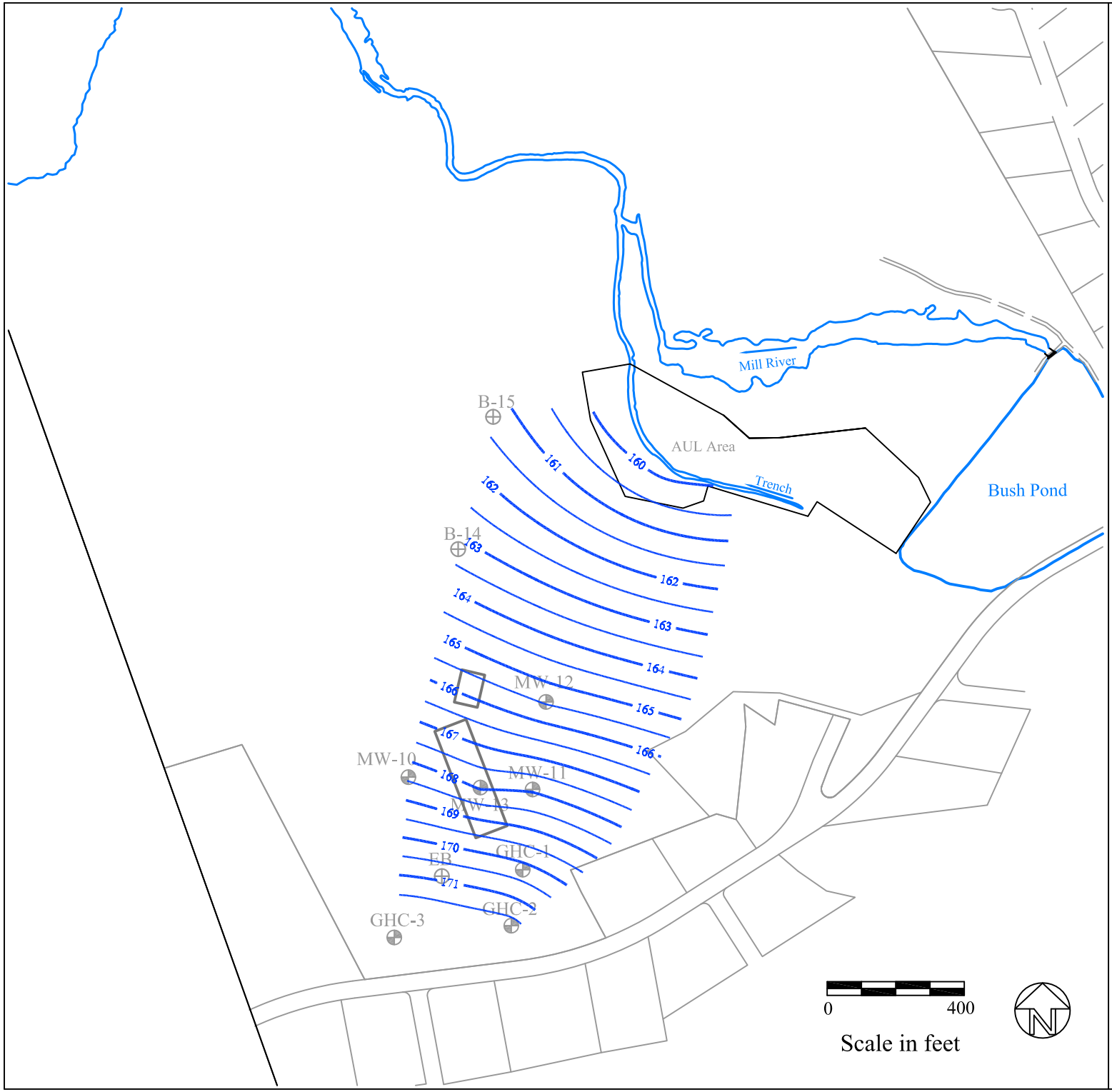
Groundwater Monitoring Well Locations.

NOTES:

1. Groundwater contour data are calculated and interpreted as described in the text.
2. Groundwater contours are based on widely spaced well locations and may not reflect actual groundwater elevations.
3. Groundwater contours are presented for the purposes of this report only.

Project No. GHC#15029
Drafted SWS Checked
Date 12/12/17 Rev
Base Map: CAD File provided by United Consultants, Inc.

GeoHydroCycle, Inc.



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17 Lawrence Street
Norfolk, MA 02056

Figure 7. Estimated Seasonal High Groundwater Contour Elevations.

LEGEND:

160 — Groundwater Elevation Contours. Interval = 0.5 foot.

Inferred Groundwater Flow Direction.

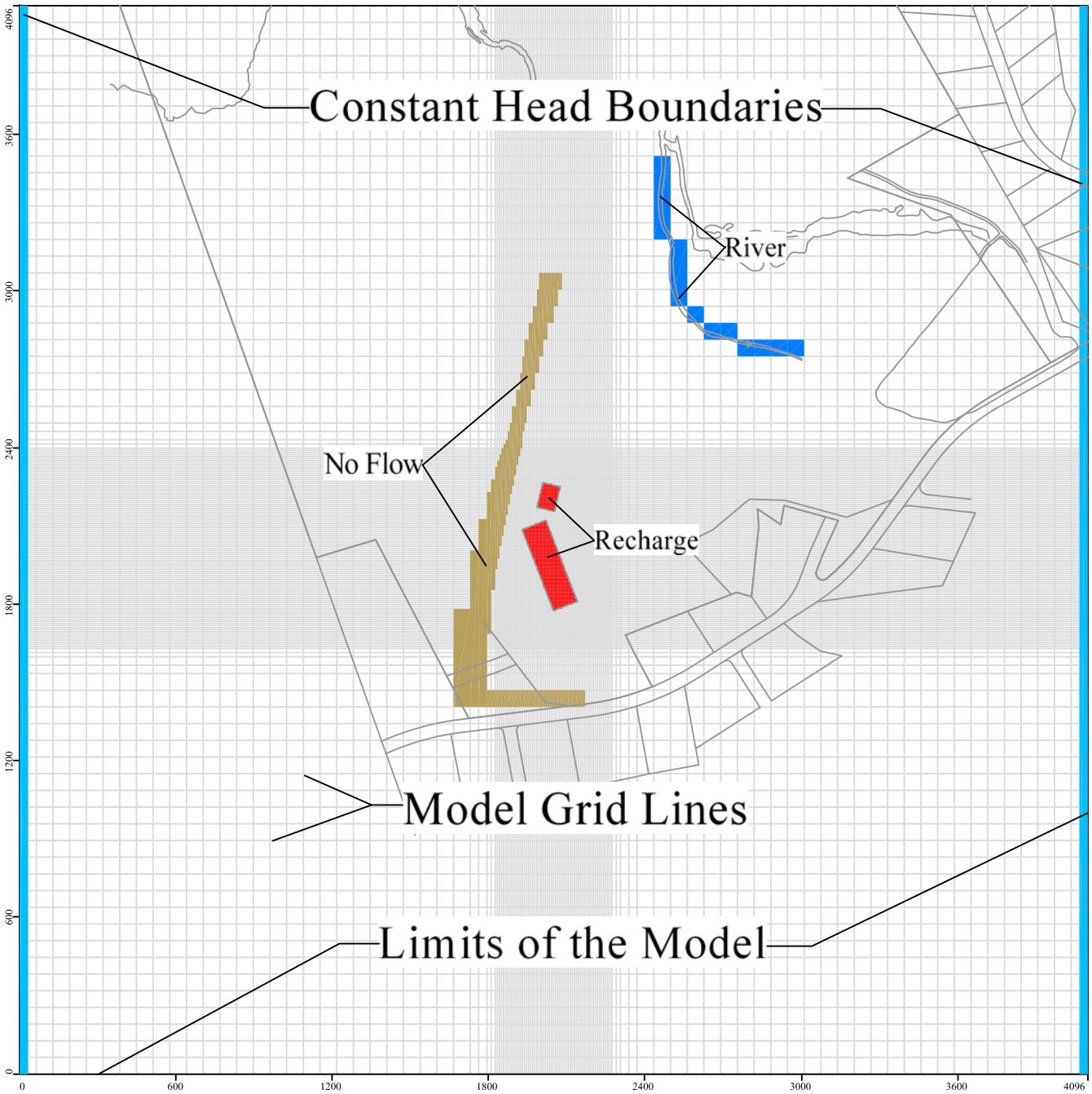
Groundwater Monitoring Well Locations.

NOTES:

1. Groundwater contour data are calculated and interpreted as described in the text.
2. Groundwater contours are based on widely spaced well locations and may not reflect actual groundwater elevations.
3. Groundwater contours are presented for the purposes of this report only.

Project No. GHC#15029
Drafted SWS Checked
Date 12/12/17 Rev
Base Map: CAD File provided by United Consultants, Inc.

GeoHydroCycle, Inc.



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17 Lawrence Street
Norfolk, MA 02056

Figure 8A. MODFLOW Layout.

0 600
Scale in feet

Project No. GHC#15029
Drafted SWS Checked
Date 12/12/17 Rev
Base Map: MODFLOW.

GeoHydroCycle, Inc.

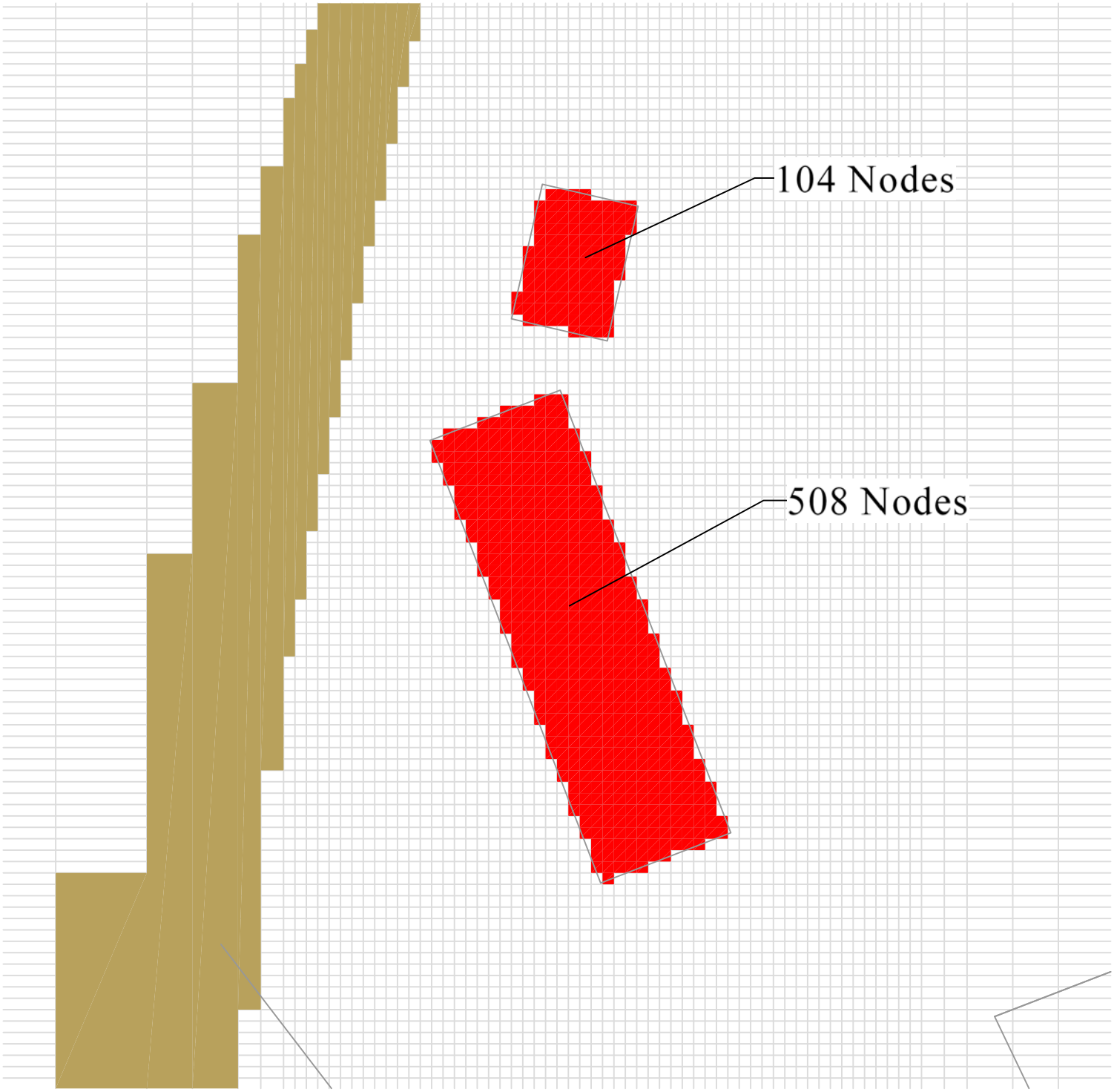

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Figure 8B. Model Recharge.

0 100
Scale in feet

Project No. GHC#15029
Drafted SWS Checked
Date 12/12/17 Rev
Base Map: MODFLOW.

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Figure 9. Simulated Groundwater Mound Height Contours, Wastewater Discharge: 80% of 64,000 GPD.

LEGEND:

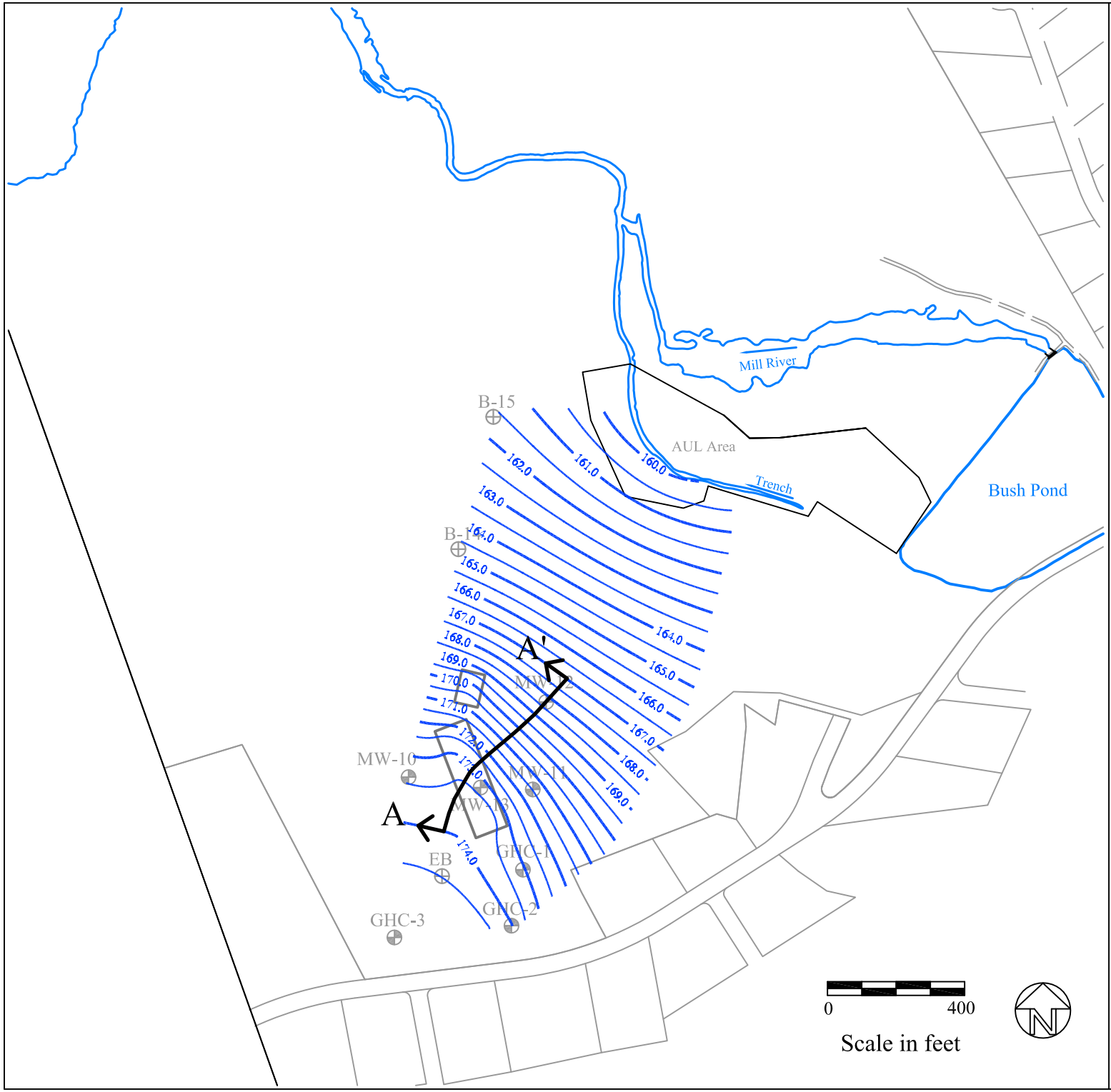
- 1.0 — Groundwater Elevation Contours. Interval = 0.2 foot.
- Inferred Groundwater Flow Direction.
- Groundwater Monitoring Well Locations.

NOTES:

1. Groundwater contour data are calculated and interpreted as described in the text.
2. Treated wastewater discharge = 64,000 gallons per day. Modelled 80% of 64,000 gpd.
3. Total Leaching footprint = 39,168 square feet.

Project No. GHC#15029
Drafted SWS Checked
Date 12/12/17 Rev
Base Map: CAD File provided by United Consultants, Inc.

GeoHydroCycle, Inc.



Abbyville Commons
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Norfolk, MA 02056

Figure 10. Simulated Mounded Seasonal High Groundwater Contour Elevations, Wastewater Discharge: 80% of 64,000 GPD.

LEGEND:

- 306 — Groundwater Elevation Contours. Interval = 0.5 foot.
- Inferred Groundwater Flow Direction.
- Groundwater Monitoring Well Locations.
- X-Section Location.

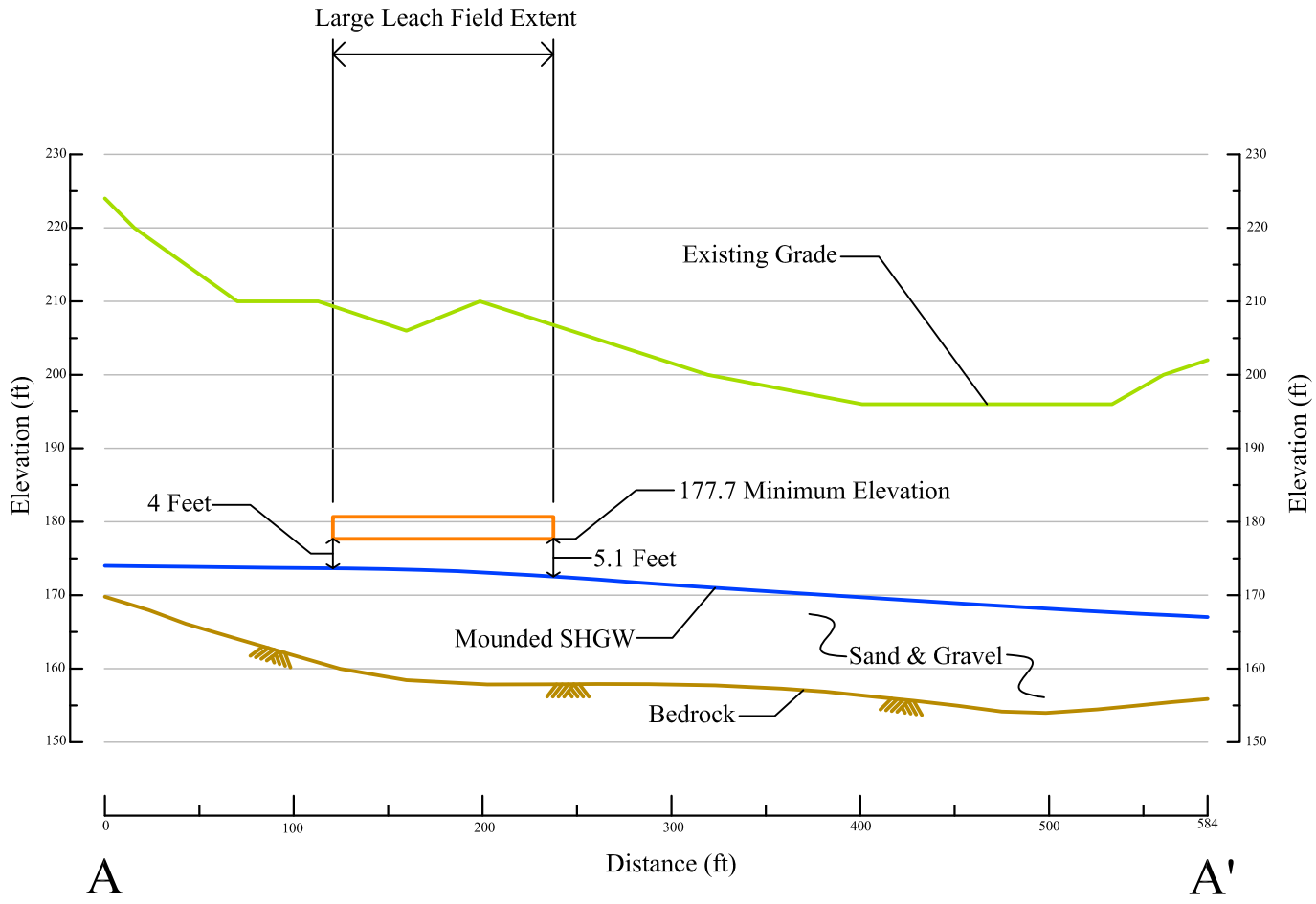
NOTES:

1. Groundwater contour data are calculated and interpreted as described in the text.
2. Treated wastewater discharge = 64,000 gallons per day. Modelled 80% of 64,000 gpd.
3. Total Leaching footprint = 39,168 square feet.
4. Groundwater contours are presented for the purposes of this report only.

Project No. GHC#15029
Drafted SWS Checked
Date 12/12/17 Rev
Base Map: CAD File provided by United Consultants, Inc.

GeoHydroCycle, Inc.

NOT FOR CONSTRUCTION



Scales as Shown

Abbyville Commons
17 Lawrence Street
Norfolk, MA 02056

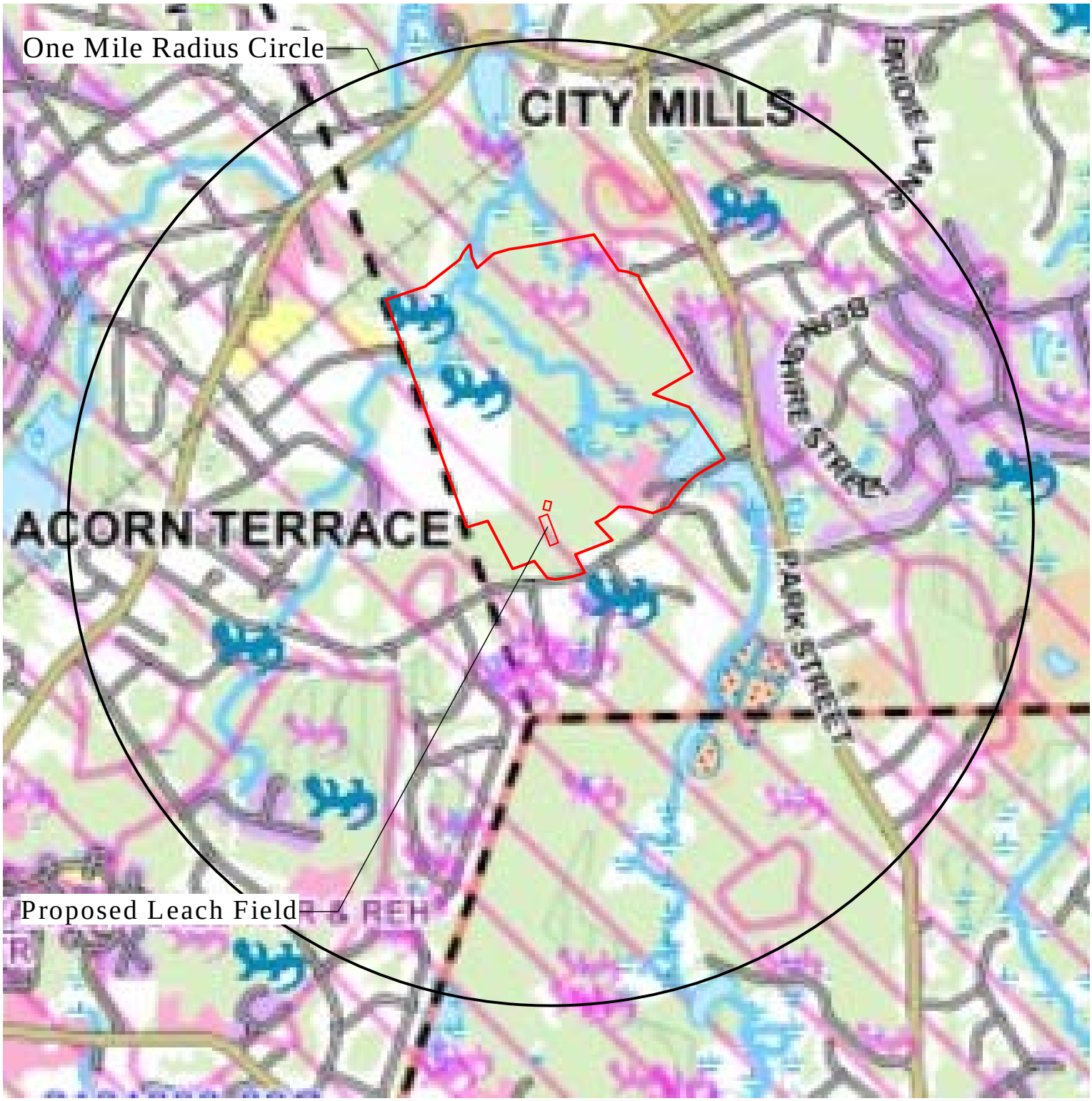
Figure 11.
Cross-Section A-A'.

NOTES

1. See Figure 10 for Cross-Section location.
2. Mounded seasonal high groundwater derived from Figure 10, representing 80% of 64,000 gpd.
3. Leach Field details obtained from Carlos Quintal.

Project No. GHC#15029
Drafted SWS Checked
Date 12/12/17 Rev
Base Map: From UCI CAD Files.

GeoHydroCycle, Inc.



0 1,500

Scale in feet

Base Map: MassGIS Online Download.

GeoHydroCycle, Inc.

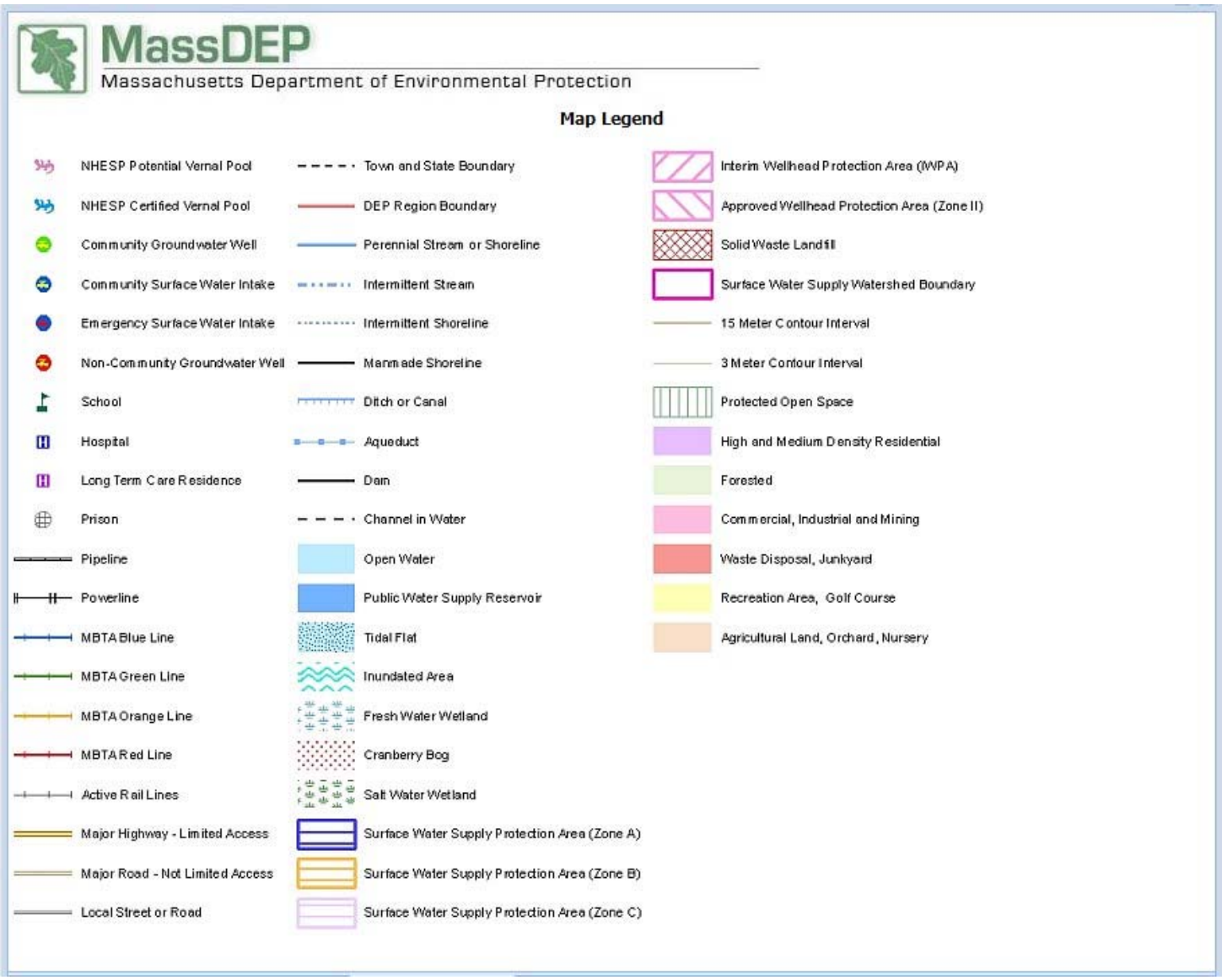
Figure 12A. Priority Resources Map.

Project No. GHC #15029

Drafted SWS Checked

Date 11/10/15 Rev 9/21/17

Abbyville Commons
17 Lawrence Street
Norfolk, MA 02056



No Scale	Figure 12B. Priority Resources Map Legend.
Base Map: MassGIS Online Mapping.	Project No. GHC #15029 Drafted SWS Checked Date 11/10/15 Rev 9/21/17
GeoHydroCycle, Inc.	Abbyville Commons 17 Lawrence Street Norfolk, MA 02056

Abbyville Commons
17 Lawrence Street
Norfolk, MA 02056

Figure 13. Proposed Locations of Compliance Wells.

LEGEND:

160 Groundwater Elevation Contours. Interval = 0.5 foot.

Inferred Groundwater Flow Direction.

Proposed Compliance Monitoring Well Locations.

NOTES:

1. Groundwater contour data are calculated and interpreted as described in the text.
2. Groundwater contours represent mounded seasonal high groundwater, see Figure_.
2. If monitoring wells MW-11 and MW-12 are still present after leach field construction, it is proposed that they serve as Compliance Wells CMW-2 and CMW-3, respectively.
3. Groundwater contours are presented for the purposes of this report only.

Project No. GHC#15029
Drafted SWS Checked
Date 12/12/17 Rev
Base Map: CAD File provided by United Consultants, Inc.

GeoHydroCycle, Inc.

Enclosure 2 - Test Pit Logs

Commonwealth of Massachusetts
City/Town of Norfolk

Form 11 - Soil Suitability Assessment for On-Site Sewage Disposal

A. Facility Information

Abbyville, Lawrencve St - Thoams W. DiPlacido, Jr., Manager
Owner Name

850 Franklin Street - Suite 6
Street Address

Map/Lot #

Wrentham
City

MA
State

02093
Zip Code

B. Site Information

1. (Check one) ☒ New Construction ☐ Upgrade ☐ Repair

2. Soil Survey Available? ☒ Yes ☐ No If yes: NRCS Web Soil Survey (Source) 253D (Soil Map Unit)

   Hinckley Loamy Sand
   Soil Name

   Soil Limitations

   Sandy and Gravelly Glaciofluvial deposits
   Geologic/Parent Material

   Esker
   Landform

3. Surficial Geological Report Available? ☒ Yes ☐ No If yes: 2008/USGS (Year Published/Source) 1:24,000 (Publication Scale) Coarse deposits

4. Flood Rate Insurance Map

   Above the 500-year flood boundary? ☒ Yes ☐ No
   If Yes, continue to #5.

   Within the 100-year flood boundary? ☐ Yes ☐ No

5. Within a velocity zone? ☐ Yes ☒ No

6. Within a Mapped Wetland Area? ☐ Yes ☒ No

   MassGIS Wetland Data Layer:
   Wetland Type

7. Current Water Resource Conditions (USGS): 10/18/17 (Month/Year) Range: ☐ Above Normal ☐ Normal ☒ Below Normal

8. Other references reviewed:

Commonwealth of Massachusetts
City/Town of Norfolk

Form 11 - Soil Suitability Assessment for On-Site Sewage Disposal

C. On-Site Review (*minimum of two holes required at every proposed primary and reserve disposal area)*

Deep Observation Hole Number: CAQ-101 | 10/18/2017 (Date) | 9:00 am (Time) | sunny-65 (Weather)

1. Location

Ground Elevation at Surface of Hole: 209 feet

Latitude/Longitude: 42-04-35.85N / 71-21-17.91W

Description of Location: woods

2. Land Use: woodland (e.g., woodland, agricultural field, vacant lot, etc.)

Surface Stones (e.g., cobbles, stones, boulders, etc.):

Slope (%): 5-10%

Vegetation: woods

Landform: esker

Position on Landscape (SU, SH, BS, FS, TS): refer to Site Plan

3. Distances from:

Open Water Body	NA feet	Drainage Way	NA feet	Wetlands	NA feet
Property Line	>50' feet	Drinking Water Well	NA feet	Other	feet

4. Parent Material: sandy & Gravelly Glaciofluvial Deposits

Unsuitable Materials Present: ☐ Yes ☒ No

If Yes: ☐ Disturbed Soil ☐ Fill Material ☐ Impervious Layer(s) ☐ Weathered/Fractured Rock ☐ Bedrock

5. Groundwater Observed: ☐ Yes ☒ No

If yes: Depth Weeping from Pit: ____ Depth Standing Water in Hole: ____

Estimated Depth to High Groundwater: refer to geohydro study inches ____ elevation

Commonwealth of Massachusetts
City/Town of Norfolk

Form 11 - Soil Suitability Assessment for On-Site Sewage Disposal

C. On-Site Review (continued)

Deep Observation Hole Number: CAQ-101

Depth (in.)	Soil Horizon/ Layer	Soil Matrix: Color-Moist (Munsell)	Redoximorphic Features			Soil Texture (USDA)	Coarse Fragments % by Volume		Soil Structure	Soil Consistence (Moist)	Other
			Depth	Color	Percent		Gravel	Cobbles & Stones			
0-10"	A	10YR4/3				Loamy sand			single grain	loose	
10-24"	B	10YR5/4				loamy sand			single grain	loose	
24"-14.5'	C1	2.5Y5/4				Coarse sand			single grain	loose	
14.5'-15.5'	C2	2.5Y5/2				Sand & Gravel		5-10%	single grain	loose	
15.5'-20'	C3	2.5Y6/3				med. sand			single grain	loose	
no water	no mottles										

Additional Notes:

Commonwealth of Massachusetts
City/Town of Norfolk

Form 11 - Soil Suitability Assessment for On-Site Sewage Disposal

C. On-Site Review (continued)

Deep Observation Hole Number: CAQ-102 | 10/18/2017 (Date) | 10:00 am (Time) | Sunny-65 (Weather)

1. Location

Ground Elevation at Surface of Hole: 218 feet Latitude/Longitude: 42-04-35.85N / 71-21-17.91W

2. Land Use: woodland (e.g., woodland, agricultural field, vacant lot, etc.) | Surface Stones (e.g., cobbles, stones, boulders, etc.) | 5-10% Slope (%)

Vegetation: woods | Landform: esker | Position on Landscape (SU, SH, BS, FS, : refer to Site Plan

3. Distances from:

Open Water Body	NA feet	Drainage Way	NA feet	Wetlands	NA feet
Property Line	>50' feet	Drinking Water Well	NA feet	Other	feet

4. Parent Material: sandy & gravelly glaciofluvial deposits Unsuitable Materials Present: ☐ Yes ☒ No

If Yes: ☐ Disturbed Soil ☐ Fill Material ☐ Impervious Layer(s) ☐ Weathered/Fractured Rock ☐ Bedrock

5. Groundwater Observed: ☐ Yes ☒ No If yes: Depth Weeping from Pit | Depth Standing Water in Hole

Estimated Depth to High Groundwater: refer to geohydro study inches | elevation

Commonwealth of Massachusetts
City/Town of Norfolk

Form 11 - Soil Suitability Assessment for On-Site Sewage Disposal

C. On-Site Review (continued)

Deep Observation Hole Number: CAQ-102

Depth (in.)	Soil Horizon/ Layer	Soil Matrix: Color-Moist (Munsell)	Redoximorphic Features			Soil Texture (USDA)	Coarse Fragments % by Volume		Soil Structure	Soil Consistence (Moist)	Other
			Depth	Color	Percent		Gravel	Cobbles & Stones			
0-12"	A	10YR3/3				loamy sand			single grain	loose	
12-27"	B	10YR6/6				loamy sand			single grain	loose	
27-17'	C	2.5Y5/3				sand & gravel		10%	single grain	loose	
no water	no mottles										

Additional Notes:

Commonwealth of Massachusetts
City/Town of Norfolk

Form 11 - Soil Suitability Assessment for On-Site Sewage Disposal

D. Determination of High Groundwater Elevation

1. Method Used:

	Obs. Hole #CAQ-101	Obs. Hole #CAQ-102
☐ Depth observed standing water in observation hole	NA inches	NA inches
☐ Depth weeping from side of observation hole	NA inches	NA inches
☐ Depth to soil redoximorphic features (mottles)	NA inches	NA inches
☐ Depth to adjusted seasonal high groundwater (S_h) (USGS methodology)	NA inches	NA inches

_____ Index Well Number _____ Reading Date

$S_h = S_c – [S_r \times (OW_c – OW_{max})/OW_r]$

Obs. Hole # _____ S_c _____ S_r _____ OW_c _____ OW_{max} _____ OW_r _____ S_h _____

Obs. Hole # _____ S_c _____ S_r _____ OW_c _____ OW_{max} _____ OW_r _____ S_h _____

E. Depth of Pervious Material

1. Depth of Naturally Occurring Pervious Material

   a. Does at least four feet of naturally occurring pervious material exist in all areas observed throughout the area proposed for the soil absorption system?

   ☒ Yes ☐ No

   b. If yes, at what depth was it observed? Upper boundary: 24" inches Lower boundary: 20' inches

   c. If no, at what depth was impervious material observed? Upper boundary: _____ inches Lower boundary: _____ inches

Commonwealth of Massachusetts
City/Town of Norfolk

Form 11 - Soil Suitability Assessment for On-Site Sewage Disposal

F. Board of Health Witness

Steve Hallem, Andrew Osei - DEP	
Name of Board of Health Witness	Board of Health

G. Soil Evaluator Certification

I certify that I am currently approved by the Department of Environmental Protection pursuant to 310 CMR 15.017 to conduct soil evaluations and that the above analysis has been performed by me consistent with the required training, expertise and experience described in 310 CMR 15.017. I further certify that the results of my soil evaluation, as indicated in the attached Soil Evaluation Form, are accurate and in accordance with 310 CMR 15.100 through 15.107.

	10/18/2017
Signature of Soil Evaluator	Date
Carlos A. Quintal	6/30/2016
Typed or Printed Name of Soil Evaluator / License #	Expiration Date of License

Note: In accordance with 310 CMR 15.018(2) this form must be submitted to the approving authority within 60 days of the date of field testing, and to the designer and the property owner with Percolation Test Form 12.

Field Diagrams

Use this sheet for field diagrams:

Commonwealth of Massachusetts
City/Town of Norfolk

Form 11 - Soil Suitability Assessment for On-Site Sewage Disposal

A. Facility Information

Abbyville, Lawrencve St - Thoams W. DiPlacido, Jr., Manager
Owner Name

850 Franklin Street - Suite 6
Street Address

Map/Lot #

Wrentham
City

MA
State

02093
Zip Code

B. Site Information

1. (Check one) ☒ New Construction ☐ Upgrade ☐ Repair

2. Soil Survey Available? ☒ Yes ☐ No If yes: NRCS Web Soil Survey (Source) 253D (Soil Map Unit)

   Hinckley Loamy Sand
   Soil Name

   Soil Limitations

   Sandy and Gravelly Glaciofluvial deposits
   Geologic/Parent Material

   Esker
   Landform

3. Surficial Geological Report Available? ☒ Yes ☐ No If yes: 2008/USGS (Year Published/Source) 1:24,000 (Publication Scale) Coarse deposits

4. Flood Rate Insurance Map

   Above the 500-year flood boundary? ☒ Yes ☐ No
   If Yes, continue to #5.

   Within the 100-year flood boundary? ☐ Yes ☐ No

5. Within a velocity zone? ☐ Yes ☒ No

6. Within a Mapped Wetland Area? ☐ Yes ☒ No

   MassGIS Wetland Data Layer:
   Wetland Type

7. Current Water Resource Conditions (USGS): 10/18/17 (Month/Year) Range: ☐ Above Normal ☐ Normal ☒ Below Normal

8. Other references reviewed:

Commonwealth of Massachusetts
City/Town of Norfolk

Form 11 - Soil Suitability Assessment for On-Site Sewage Disposal

C. On-Site Review (*minimum of two holes required at every proposed primary and reserve disposal area)*

Deep Observation Hole Number: CAQ-103 | 10/18/2017 (Date) | 11:00 am (Time) | sunny-65 (Weather)

1. Location

Ground Elevation at Surface of Hole: 220.5 feet

Latitude/Longitude: 42-04-35.85N / 71-21-17.91W

Description of Location: woods

2. Land Use: woodland (e.g., woodland, agricultural field, vacant lot, etc.)

Surface Stones (e.g., cobbles, stones, boulders, etc.):

Slope (%): 5-10%

Vegetation: woods

Landform: esker

Position on Landscape (SU, SH, BS, FS, TS): refer to Site Plan

3. Distances from:

Open Water Body	NA feet	Drainage Way	NA feet	Wetlands	NA feet
Property Line	>50' feet	Drinking Water Well	NA feet	Other	feet

4. Parent Material: sandy & Gravelly Glaciofluvial Deposits

Unsuitable Materials Present: ☐ Yes ☒ No

If Yes: ☐ Disturbed Soil ☐ Fill Material ☐ Impervious Layer(s) ☐ Weathered/Fractured Rock ☐ Bedrock

5. Groundwater Observed: ☐ Yes ☒ No

If yes: Depth Weeping from Pit: ____ Depth Standing Water in Hole: ____

Estimated Depth to High Groundwater: refer to geohydro study inches ____ elevation

Commonwealth of Massachusetts
City/Town of Norfolk

Form 11 - Soil Suitability Assessment for On-Site Sewage Disposal

C. On-Site Review (continued)

Deep Observation Hole Number: CAQ-103

Depth (in.)	Soil Horizon/ Layer	Soil Matrix: Color-Moist (Munsell)	Redoximorphic Features			Soil Texture (USDA)	Coarse Fragments % by Volume		Soil Structure	Soil Consistence (Moist)	Other
			Depth	Color	Percent		Gravel	Cobbles & Stones			
0-8"	A	10YR3/3				Loamy sand			single grain	loose	
8-16"	B	10YR5/4				loamy sand			single grain	loose	
16"-17.5'	C1	2.5Y5/6				Sand & Gravel		5-10%	single grain	loose	
no water	no mottles										

Additional Notes:

Commonwealth of Massachusetts
City/Town of Norfolk

Form 11 - Soil Suitability Assessment for On-Site Sewage Disposal

C. On-Site Review (continued)

Deep Observation Hole Number: CAQ-104 | 10/18/2017 (Date) | 10:30 am (Time) | Sunny-65 (Weather)

1. Location

Ground Elevation at Surface of Hole: 200.5 feet Latitude/Longitude: 42-04-35.85N / 71-21-17.91W

2. Land Use: woodland (e.g., woodland, agricultural field, vacant lot, etc.) | Surface Stones (e.g., cobbles, stones, boulders, etc.) | 5-10% Slope (%)

Vegetation: woods | Landform: esker | Position on Landscape (SU, SH, BS, FS, : refer to Site Plan

3. Distances from:

Open Water Body	NA feet	Drainage Way	NA feet	Wetlands	NA feet
Property Line	>50' feet	Drinking Water Well	NA feet	Other	feet

4. Parent Material: sandy & gravelly glaciofluvial deposits Unsuitable Materials Present: ☐ Yes ☒ No

If Yes: ☐ Disturbed Soil ☐ Fill Material ☐ Impervious Layer(s) ☐ Weathered/Fractured Rock ☐ Bedrock

5. Groundwater Observed: ☐ Yes ☒ No If yes: Depth Weeping from Pit | Depth Standing Water in Hole

Estimated Depth to High Groundwater: refer to geohydro study inches | elevation

Commonwealth of Massachusetts
City/Town of Norfolk

Form 11 - Soil Suitability Assessment for On-Site Sewage Disposal

C. On-Site Review (continued)

Deep Observation Hole Number: CAQ-104

Depth (in.)	Soil Horizon/ Layer	Soil Matrix: Color-Moist (Munsell)	Redoximorphic Features			Soil Texture (USDA)	Coarse Fragments % by Volume		Soil Structure	Soil Consistence (Moist)	Other
			Depth	Color	Percent		Gravel	Cobbles & Stones			
0-6"	A	10YR3/3				loamy sand			single grain	loose	
6-18"	B	10YR5/4				loamy sand			single grain	loose	
18"-13'	C1	2.5Y5/6				Coarse sand			single grain	loose	
13-19'	C2	2.5Y5/6				Sand & Gravel		5%	single grain	loose	
no water	no mottles										

Additional Notes:

Commonwealth of Massachusetts
City/Town of Norfolk

Form 11 - Soil Suitability Assessment for On-Site Sewage Disposal

D. Determination of High Groundwater Elevation

1. Method Used:

	Obs. Hole #CAQ-103	Obs. Hole #CAQ-104
☐ Depth observed standing water in observation hole	NA inches	NA inches
☐ Depth weeping from side of observation hole	NA inches	NA inches
☐ Depth to soil redoximorphic features (mottles)	NA inches	NA inches
☐ Depth to adjusted seasonal high groundwater (S_h) (USGS methodology)	NA inches	NA inches

Index Well Number _____ Reading Date _____

$S_h = S_c – [S_r \times (OW_c – OW_{max})/OW_r]$

Obs. Hole # _____ S_c _____ S_r _____ OW_c _____ OW_{max} _____ OW_r _____ S_h _____

Obs. Hole # _____ S_c _____ S_r _____ OW_c _____ OW_{max} _____ OW_r _____ S_h _____

E. Depth of Pervious Material

1. Depth of Naturally Occurring Pervious Material

   a. Does at least four feet of naturally occurring pervious material exist in all areas observed throughout the area proposed for the soil absorption system?

   ☒ Yes ☐ No

   b. If yes, at what depth was it observed? Upper boundary: 18" inches Lower boundary: 19' inches

   c. If no, at what depth was impervious material observed? Upper boundary: _____ inches Lower boundary: _____ inches

Commonwealth of Massachusetts
City/Town of Norfolk

Form 11 - Soil Suitability Assessment for On-Site Sewage Disposal

F. Board of Health Witness

Steve Hallem, Andrew Osei - DEP	
Name of Board of Health Witness	Board of Health

G. Soil Evaluator Certification

I certify that I am currently approved by the Department of Environmental Protection pursuant to 310 CMR 15.017 to conduct soil evaluations and that the above analysis has been performed by me consistent with the required training, expertise and experience described in 310 CMR 15.017. I further certify that the results of my soil evaluation, as indicated in the attached Soil Evaluation Form, are accurate and in accordance with 310 CMR 15.100 through 15.107.

	10/18/2017
Signature of Soil Evaluator	Date
Carlos A. Quintal	6/30/2016
Typed or Printed Name of Soil Evaluator / License #	Expiration Date of License

Note: In accordance with 310 CMR 15.018(2) this form must be submitted to the approving authority within 60 days of the date of field testing, and to the designer and the property owner with Percolation Test Form 12.

Field Diagrams

Use this sheet for field diagrams:

Commonwealth of Massachusetts
City/Town of Norfolk

Form 11 - Soil Suitability Assessment for On-Site Sewage Disposal

A. Facility Information

Abbyville, Lawrencve St - Thoams W. DiPlacido, Jr., Manager
Owner Name

850 Franklin Street - Suite 6
Street Address

Map/Lot #

Wrentham
City

MA
State

02093
Zip Code

B. Site Information

1. (Check one) ☒ New Construction ☐ Upgrade ☐ Repair

2. Soil Survey Available? ☒ Yes ☐ No If yes: NRCS Web Soil Survey (Source) 253D (Soil Map Unit)

   Hinckley Loamy Sand
   Soil Name

   Soil Limitations

   Sandy and Gravelly Glaciofluvial deposits
   Geologic/Parent Material

   Esker
   Landform

3. Surficial Geological Report Available? ☒ Yes ☐ No If yes: 2008/USGS (Year Published/Source) 1:24,000 (Publication Scale) Coarse deposits

4. Flood Rate Insurance Map

   Above the 500-year flood boundary? ☒ Yes ☐ No
   If Yes, continue to #5.

   Within the 100-year flood boundary? ☐ Yes ☐ No

5. Within a velocity zone? ☐ Yes ☒ No

6. Within a Mapped Wetland Area? ☐ Yes ☒ No

   MassGIS Wetland Data Layer:
   Wetland Type

7. Current Water Resource Conditions (USGS): 10/18/17 (Month/Year) Range: ☐ Above Normal ☐ Normal ☒ Below Normal

8. Other references reviewed:

Commonwealth of Massachusetts
City/Town of Norfolk

Form 11 - Soil Suitability Assessment for On-Site Sewage Disposal

C. On-Site Review (*minimum of two holes required at every proposed primary and reserve disposal area)*

Deep Observation Hole Number: CAQ-105 | 10/18/2017 (Date) | 1:00 pm (Time) | sunny-65 (Weather)

1. Location

Ground Elevation at Surface of Hole: 197.7 feet

Latitude/Longitude: 42-04-35.85N / 71-21-17.91W

Description of Location: woods

2. Land Use: woodland (e.g., woodland, agricultural field, vacant lot, etc.)

Surface Stones (e.g., cobbles, stones, boulders, etc.):

Slope (%): 5-10%

Vegetation: woods

Landform: esker

Position on Landscape (SU, SH, BS, FS, TS): refer to Site Plan

3. Distances from:

Open Water Body	NA feet	Drainage Way	NA feet	Wetlands	NA feet
Property Line	>50' feet	Drinking Water Well	NA feet	Other	feet

4. Parent Material: sandy & Gravelly Glaciofluvial Deposits

Unsuitable Materials Present: ☐ Yes ☒ No

If Yes: ☐ Disturbed Soil ☐ Fill Material ☐ Impervious Layer(s) ☐ Weathered/Fractured Rock ☐ Bedrock

5. Groundwater Observed: ☐ Yes ☒ No

If yes: Depth Weeping from Pit: ____ Depth Standing Water in Hole: ____

Estimated Depth to High Groundwater: refer to geohydro study inches ____ elevation

Commonwealth of Massachusetts
City/Town of Norfolk

Form 11 - Soil Suitability Assessment for On-Site Sewage Disposal

C. On-Site Review (continued)

Deep Observation Hole Number: CAQ-105

Depth (in.)	Soil Horizon/ Layer	Soil Matrix: Color-Moist (Munsell)	Redoximorphic Features			Soil Texture (USDA)	Coarse Fragments % by Volume		Soil Structure	Soil Consistence (Moist)	Other
			Depth	Color	Percent		Gravel	Cobbles & Stones			
0-9"	A	10YR3/3				loamy sand			single grain	loose	
9-38"	B	10YR5/4				loamy sand			single grain	loose	
38"-14'	C1	2.5Y5/6				Coarse Sand			single grain	loose	
14'-20'	C2	2.5Y5/6				Sand & Gravel		5-10%	single grain	loose	
no water	no mottles										

Additional Notes:

Commonwealth of Massachusetts
City/Town of Norfolk

Form 11 - Soil Suitability Assessment for On-Site Sewage Disposal

C. On-Site Review (continued)

Deep Observation Hole Number: CAQ-106 | 10/19/2017 (Date) | 8:00 am (Time) | Sunny-65 (Weather)

1. Location

Ground Elevation at Surface of Hole: 196.8 feet Latitude/Longitude: 42-04-35.85N / 71-21-17.91W

2. Land Use: woodland (e.g., woodland, agricultural field, vacant lot, etc.) | Surface Stones (e.g., cobbles, stones, boulders, etc.): | 5-10% Slope (%)

Vegetation: woods | Landform: esker | Position on Landscape (SU, SH, BS, FS, : refer to Site Plan

3. Distances from:

Open Water Body	NA feet	Drainage Way	NA feet	Wetlands	NA feet
Property Line	>50' feet	Drinking Water Well	NA feet	Other	feet

4. Parent Material: sandy & gravelly glaciofluvial deposits Unsuitable Materials Present: ☐ Yes ☒ No

If Yes: ☐ Disturbed Soil ☐ Fill Material ☐ Impervious Layer(s) ☐ Weathered/Fractured Rock ☐ Bedrock

5. Groundwater Observed: ☐ Yes ☒ No If yes: Depth Weeping from Pit | Depth Standing Water in Hole

Estimated Depth to High Groundwater: refer to geohydro study inches | elevation

Commonwealth of Massachusetts
City/Town of Norfolk

Form 11 - Soil Suitability Assessment for On-Site Sewage Disposal

C. On-Site Review (continued)

Deep Observation Hole Number: CAQ-106

Depth (in.)	Soil Horizon/ Layer	Soil Matrix: Color-Moist (Munsell)	Redoximorphic Features			Soil Texture (USDA)	Coarse Fragments % by Volume		Soil Structure	Soil Consistence (Moist)	Other
			Depth	Color	Percent		Gravel	Cobbles & Stones			
0-6"	A	10YR3/3				loamy sand			single grain	loose	
6-21"	B	10YR5/4				loamy sand			single grain	loose	
21"-18'	C	2.5Y5/6				Coarse sand			single grain	loose	
no water	no mottles										

Additional Notes:

Commonwealth of Massachusetts
City/Town of Norfolk

Form 11 - Soil Suitability Assessment for On-Site Sewage Disposal

D. Determination of High Groundwater Elevation

1. Method Used:

	Obs. Hole #CAQ-105	Obs. Hole #CAQ-106
☐ Depth observed standing water in observation hole	NA inches	NA inches
☐ Depth weeping from side of observation hole	NA inches	NA inches
☐ Depth to soil redoximorphic features (mottles)	NA inches	NA inches
☐ Depth to adjusted seasonal high groundwater (S_h) (USGS methodology)	NA inches	NA inches

_____ Index Well Number _____ Reading Date

$S_h = S_c – [S_r \times (OW_c – OW_{max})/OW_r]$

Obs. Hole # _____ S_c _____ S_r _____ OW_c _____ OW_{max} _____ OW_r _____ S_h _____

Obs. Hole # _____ S_c _____ S_r _____ OW_c _____ OW_{max} _____ OW_r _____ S_h _____

E. Depth of Pervious Material

1. Depth of Naturally Occurring Pervious Material

   a. Does at least four feet of naturally occurring pervious material exist in all areas observed throughout the area proposed for the soil absorption system?

   ☒ Yes ☐ No

   b. If yes, at what depth was it observed? Upper boundary: 21" inches Lower boundary: 18' inches

   c. If no, at what depth was impervious material observed? Upper boundary: _____ inches Lower boundary: _____ inches

Commonwealth of Massachusetts
City/Town of Norfolk

Form 11 - Soil Suitability Assessment for On-Site Sewage Disposal

F. Board of Health Witness

Steve Hallem, Andrew Osei - DEP	
Name of Board of Health Witness	Board of Health

G. Soil Evaluator Certification

I certify that I am currently approved by the Department of Environmental Protection pursuant to 310 CMR 15.017 to conduct soil evaluations and that the above analysis has been performed by me consistent with the required training, expertise and experience described in 310 CMR 15.017. I further certify that the results of my soil evaluation, as indicated in the attached Soil Evaluation Form, are accurate and in accordance with 310 CMR 15.100 through 15.107.

	10/19/2017
Signature of Soil Evaluator	Date
Carlos A. Quintal	6/30/2016
Typed or Printed Name of Soil Evaluator / License #	Expiration Date of License

Note: In accordance with 310 CMR 15.018(2) this form must be submitted to the approving authority within 60 days of the date of field testing, and to the designer and the property owner with Percolation Test Form 12.

Field Diagrams

Use this sheet for field diagrams:

Commonwealth of Massachusetts
City/Town of Norfolk

Form 11 - Soil Suitability Assessment for On-Site Sewage Disposal

A. Facility Information

Abbyville, Lawrencve St - Thoams W. DiPlacido, Jr., Manager
Owner Name

850 Franklin Street - Suite 6
Street Address

Map/Lot #

Wrentham
City

MA
State

02093
Zip Code

B. Site Information

1. (Check one) ☒ New Construction ☐ Upgrade ☐ Repair

2. Soil Survey Available? ☒ Yes ☐ No If yes: NRCS Web Soil Survey (Source) 253D (Soil Map Unit)

   Hinckley Loamy Sand
   Soil Name

   Soil Limitations

   Sandy and Gravelly Glaciofluvial deposits
   Geologic/Parent Material

   Esker
   Landform

3. Surficial Geological Report Available? ☒ Yes ☐ No If yes: 2008/USGS (Year Published/Source) 1:24,000 (Publication Scale) Coarse deposits

4. Flood Rate Insurance Map

   Above the 500-year flood boundary? ☒ Yes ☐ No
   If Yes, continue to #5.

   Within the 100-year flood boundary? ☐ Yes ☐ No

5. Within a velocity zone? ☐ Yes ☒ No

6. Within a Mapped Wetland Area? ☐ Yes ☒ No

   MassGIS Wetland Data Layer:
   Wetland Type

7. Current Water Resource Conditions (USGS): 10/19/17 (Month/Year) Range: ☐ Above Normal ☐ Normal ☒ Below Normal

8. Other references reviewed:

Commonwealth of Massachusetts
City/Town of Norfolk

Form 11 - Soil Suitability Assessment for On-Site Sewage Disposal

C. On-Site Review (*minimum of two holes required at every proposed primary and reserve disposal area)*

Deep Observation Hole Number: CAQ-107 | 10/19/2017 (Date) | 9:00 am (Time) | sunny-65 (Weather)

1. Location

Ground Elevation at Surface of Hole: 198.5 feet

Latitude/Longitude: 42-04-35.85N / 71-21-17.91W

Description of Location: woods

2. Land Use: woodland (e.g., woodland, agricultural field, vacant lot, etc.)

Surface Stones (e.g., cobbles, stones, boulders, etc.):

Slope (%): 5-10%

Vegetation: woods

Landform: esker

Position on Landscape (SU, SH, BS, FS, TS): refer to Site Plan

3. Distances from:

Open Water Body	NA feet	Drainage Way	NA feet	Wetlands	NA feet
Property Line	>50' feet	Drinking Water Well	NA feet	Other	feet

4. Parent Material: sandy & Gravelly Glaciofluvial Deposits

Unsuitable Materials Present: ☐ Yes ☒ No

If Yes: ☐ Disturbed Soil ☐ Fill Material ☐ Impervious Layer(s) ☐ Weathered/Fractured Rock ☐ Bedrock

5. Groundwater Observed: ☐ Yes ☒ No

If yes: Depth Weeping from Pit: ____ Depth Standing Water in Hole: ____

Estimated Depth to High Groundwater: refer to geohydro study inches ____ elevation

Commonwealth of Massachusetts
City/Town of Norfolk

Form 11 - Soil Suitability Assessment for On-Site Sewage Disposal

C. On-Site Review (continued)

Deep Observation Hole Number: CAQ-107

Depth (in.)	Soil Horizon/ Layer	Soil Matrix: Color-Moist (Munsell)	Redoximorphic Features			Soil Texture (USDA)	Coarse Fragments % by Volume		Soil Structure	Soil Consistence (Moist)	Other
			Depth	Color	Percent		Gravel	Cobbles & Stones			
0-8"	A	10YR3/3				loamy sand			single grain	loose	
8-28"	B	10YR5/4				loamy sand			single grain	loose	
28"-18'	C	2.5Y5/6				Sand & Gravel		5-10%	single grain	loose	
no water	no mottles										

Additional Notes:

Commonwealth of Massachusetts
City/Town of Norfolk

Form 11 - Soil Suitability Assessment for On-Site Sewage Disposal

C. On-Site Review (continued)

Deep Observation Hole Number: CAQ-108 | 10/19/2017 (Date) | 10:00 am (Time) | Sunny-65 (Weather)

1. Location

Ground Elevation at Surface of Hole: 195.5 feet Latitude/Longitude: 42-04-35.85N / 71-21-17.91W

2. Land Use: woodland (e.g., woodland, agricultural field, vacant lot, etc.) | Surface Stones (e.g., cobbles, stones, boulders, etc.): | 5-10% Slope (%)

Vegetation: woods | Landform: esker | Position on Landscape (SU, SH, BS, FS, : refer to Site Plan

3. Distances from:

Open Water Body	NA feet	Drainage Way	NA feet	Wetlands	NA feet
Property Line	>50' feet	Drinking Water Well	NA feet	Other	feet

4. Parent Material: sandy & gravelly glaciofluvial deposits Unsuitable Materials Present: ☐ Yes ☒ No

If Yes: ☐ Disturbed Soil ☐ Fill Material ☐ Impervious Layer(s) ☐ Weathered/Fractured Rock ☐ Bedrock

5. Groundwater Observed: ☐ Yes ☒ No If yes: Depth Weeping from Pit | Depth Standing Water in Hole

Estimated Depth to High Groundwater: refer to geohydro study inches | elevation

Commonwealth of Massachusetts
City/Town of Norfolk

Form 11 - Soil Suitability Assessment for On-Site Sewage Disposal

C. On-Site Review (continued)

Deep Observation Hole Number: CAQ-108

Depth (in.)	Soil Horizon/ Layer	Soil Matrix: Color-Moist (Munsell)	Redoximorphic Features			Soil Texture (USDA)	Coarse Fragments % by Volume		Soil Structure	Soil Consistence (Moist)	Other
			Depth	Color	Percent		Gravel	Cobbles & Stones			
0-6"	A	10YR3/3				loamy sand			single grain	loose	
6-21"	B	10YR5/4				loamy sand			single grain	loose	
21"-18'	C	2.5Y5/6				Coarse sand			single grain	loose	
no water	no mottles										

Additional Notes:

Commonwealth of Massachusetts
City/Town of Norfolk

Form 11 - Soil Suitability Assessment for On-Site Sewage Disposal

D. Determination of High Groundwater Elevation

1. Method Used:

	Obs. Hole #CAQ-107	Obs. Hole #CAQ-108
☐ Depth observed standing water in observation hole	NA inches	NA inches
☐ Depth weeping from side of observation hole	NA inches	NA inches
☐ Depth to soil redoximorphic features (mottles)	NA inches	NA inches
☐ Depth to adjusted seasonal high groundwater (S_h) (USGS methodology)	NA inches	NA inches

_____ Index Well Number _____ Reading Date

$S_h = S_c – [S_r \times (OW_c – OW_{max})/OW_r]$

Obs. Hole # _____ S_c _____ S_r _____ OW_c _____ OW_{max} _____ OW_r _____ S_h _____

Obs. Hole # _____ S_c _____ S_r _____ OW_c _____ OW_{max} _____ OW_r _____ S_h _____

E. Depth of Pervious Material

1. Depth of Naturally Occurring Pervious Material

   a. Does at least four feet of naturally occurring pervious material exist in all areas observed throughout the area proposed for the soil absorption system?

   ☒ Yes ☐ No

   b. If yes, at what depth was it observed? Upper boundary: 28" inches Lower boundary: 18' inches

   c. If no, at what depth was impervious material observed? Upper boundary: _____ inches Lower boundary: _____ inches

Commonwealth of Massachusetts
City/Town of Norfolk

Form 11 - Soil Suitability Assessment for On-Site Sewage Disposal

F. Board of Health Witness

Steve Hallem, Andrew Osei - DEP	
Name of Board of Health Witness	Board of Health

G. Soil Evaluator Certification

I certify that I am currently approved by the Department of Environmental Protection pursuant to 310 CMR 15.017 to conduct soil evaluations and that the above analysis has been performed by me consistent with the required training, expertise and experience described in 310 CMR 15.017. I further certify that the results of my soil evaluation, as indicated in the attached Soil Evaluation Form, are accurate and in accordance with 310 CMR 15.100 through 15.107.

	10/19/2017
Signature of Soil Evaluator	Date
Carlos A. Quintal	6/30/2016
Typed or Printed Name of Soil Evaluator / License #	Expiration Date of License

Note: In accordance with 310 CMR 15.018(2) this form must be submitted to the approving authority within 60 days of the date of field testing, and to the designer and the property owner with Percolation Test Form 12.

Field Diagrams

Use this sheet for field diagrams:

Commonwealth of Massachusetts
City/Town of Norfolk

Form 11 - Soil Suitability Assessment for On-Site Sewage Disposal

A. Facility Information

Abbyville, Lawrencve St - Thoams W. DiPlacido, Jr., Manager
Owner Name

850 Franklin Street - Suite 6
Street Address

Map/Lot #

Wrentham
City

MA
State

02093
Zip Code

B. Site Information

1. (Check one) ☒ New Construction ☐ Upgrade ☐ Repair

2. Soil Survey Available? ☒ Yes ☐ No If yes: NRCS Web Soil Survey (Source) 253D (Soil Map Unit)

   Hinckley Loamy Sand
   Soil Name

   Soil Limitations

   Sandy and Gravelly Glaciofluvial deposits
   Geologic/Parent Material

   Esker
   Landform

3. Surficial Geological Report Available? ☒ Yes ☐ No If yes: 2008/USGS (Year Published/Source) 1:24,000 (Publication Scale) Coarse deposits

4. Flood Rate Insurance Map

   Above the 500-year flood boundary? ☒ Yes ☐ No
   If Yes, continue to #5.

   Within the 100-year flood boundary? ☐ Yes ☐ No

5. Within a velocity zone? ☐ Yes ☒ No

6. Within a Mapped Wetland Area? ☐ Yes ☒ No

   MassGIS Wetland Data Layer:
   Wetland Type

7. Current Water Resource Conditions (USGS): 10/19/17 (Month/Year) Range: ☐ Above Normal ☐ Normal ☒ Below Normal

8. Other references reviewed:

Commonwealth of Massachusetts
City/Town of Norfolk

Form 11 - Soil Suitability Assessment for On-Site Sewage Disposal

C. On-Site Review (*minimum of two holes required at every proposed primary and reserve disposal area)*

Deep Observation Hole Number: CAQ-109 | 10/19/2017 (Date) | 11:00 am (Time) | sunny-65 (Weather)

1. Location

Ground Elevation at Surface of Hole: 196 feet

Latitude/Longitude: 42-04-35.85N / 71-21-17.91W

Description of Location: woods

2. Land Use: woodland (e.g., woodland, agricultural field, vacant lot, etc.)

Surface Stones (e.g., cobbles, stones, boulders, etc.):

Slope (%): 5-10%

Vegetation: woods

Landform: esker

Position on Landscape (SU, SH, BS, FS, TS): refer to Site Plan

3. Distances from:

Open Water Body	NA feet	Drainage Way	NA feet	Wetlands	NA feet
Property Line	>50' feet	Drinking Water Well	NA feet	Other	feet

4. Parent Material: sandy & Gravelly Glaciofluvial Deposits

Unsuitable Materials Present: ☐ Yes ☒ No

If Yes: ☐ Disturbed Soil ☐ Fill Material ☐ Impervious Layer(s) ☐ Weathered/Fractured Rock ☐ Bedrock

5. Groundwater Observed: ☐ Yes ☒ No

If yes: Depth Weeping from Pit _____ Depth Standing Water in Hole _____

Estimated Depth to High Groundwater: refer to geohydro study inches _____ elevation

Commonwealth of Massachusetts
City/Town of Norfolk

Form 11 - Soil Suitability Assessment for On-Site Sewage Disposal

C. On-Site Review (continued)

Deep Observation Hole Number: CAQ-109

Depth (in.)	Soil Horizon/ Layer	Soil Matrix: Color-Moist (Munsell)	Redoximorphic Features			Soil Texture (USDA)	Coarse Fragments % by Volume		Soil Structure	Soil Consistence (Moist)	Other
			Depth	Color	Percent		Gravel	Cobbles & Stones			
0-7"	A	10YR3/3				loamy sand			single grain	loose	
7-24"	B	10YR5/4				loamy sand			single grain	loose	
24"-6.5'	C1	2.5Y5/6				med. sand			single grain	loose	
6.5'-16'	C2	2.5Y5/6	7'	10YR5/3		VFSand/silt loam			massive	tight	stratified mottles
16'-18'	C3	2.5Y5/6				med. sand			single grain	loose	
no water											

Additional Notes:

Commonwealth of Massachusetts
City/Town of Norfolk

Form 11 - Soil Suitability Assessment for On-Site Sewage Disposal

C. On-Site Review (continued)

Deep Observation Hole Number: CAQ-110 | 10/19/2017 (Date) | 12:00 am (Time) | Sunny-65 (Weather)

1. Location

Ground Elevation at Surface of Hole: 195.5 feet Latitude/Longitude: 42-04-35.85N / 71-21-17.91W

2. Land Use: woodland (e.g., woodland, agricultural field, vacant lot, etc.) | Surface Stones (e.g., cobbles, stones, boulders, etc.): | 5-10% Slope (%)

Vegetation: woods | Landform: esker | Position on Landscape (SU, SH, BS, FS, : refer to Site Plan

3. Distances from:

Open Water Body	NA feet	Drainage Way	NA feet	Wetlands	NA feet
Property Line	>50' feet	Drinking Water Well	NA feet	Other	feet

4. Parent Material: sandy & gravelly glaciofluvial deposits Unsuitable Materials Present: ☐ Yes ☒ No

If Yes: ☐ Disturbed Soil ☐ Fill Material ☐ Impervious Layer(s) ☐ Weathered/Fractured Rock ☐ Bedrock

5. Groundwater Observed: ☐ Yes ☒ No If yes: Depth Weeping from Pit | Depth Standing Water in Hole

Estimated Depth to High Groundwater: refer to geohydro study inches | elevation

Commonwealth of Massachusetts
City/Town of Norfolk

Form 11 - Soil Suitability Assessment for On-Site Sewage Disposal

C. On-Site Review (continued)

Deep Observation Hole Number: CAQ-110

Depth (in.)	Soil Horizon/ Layer	Soil Matrix: Color-Moist (Munsell)	Redoximorphic Features			Soil Texture (USDA)	Coarse Fragments % by Volume		Soil Structure	Soil Consistence (Moist)	Other
			Depth	Color	Percent		Gravel	Cobbles & Stones			
0-8"	A	10YR3/3				loamy sand			single grain	loose	
8-24"	B	10YR5/4				loamy sand			single grain	loose	
24"-9.5'	C1	2.5Y5/6				Sand & Gravel			single grain	loose	
9.5'-11.5'	C2	2.5Y5/6				VFSand/Silt loam			massive	tight	
11.5'-15'	C3	2.5Y5/6				Med. sand			singlegrain	loose	
no water	no mottles										

Additional Notes:

Commonwealth of Massachusetts
City/Town of Norfolk

Form 11 - Soil Suitability Assessment for On-Site Sewage Disposal

D. Determination of High Groundwater Elevation

1. Method Used:

	Obs. Hole #CAQ-109	Obs. Hole #CAQ-110
☐ Depth observed standing water in observation hole	NA inches	NA inches
☐ Depth weeping from side of observation hole	NA inches	NA inches
☐ Depth to soil redoximorphic features (mottles)	NA inches	NA inches
☐ Depth to adjusted seasonal high groundwater (S_h) (USGS methodology)	NA inches	NA inches

_____ Index Well Number _____ Reading Date

$S_h = S_c – [S_r \times (OW_c – OW_{max})/OW_r]$

Obs. Hole # _____ S_c _____ S_r _____ OW_c _____ OW_{max} _____ OW_r _____ S_h _____

Obs. Hole # _____ S_c _____ S_r _____ OW_c _____ OW_{max} _____ OW_r _____ S_h _____

E. Depth of Pervious Material

1. Depth of Naturally Occurring Pervious Material

   a. Does at least four feet of naturally occurring pervious material exist in all areas observed throughout the area proposed for the soil absorption system?

   ☒ Yes ☐ No

   b. If yes, at what depth was it observed? Upper boundary: 24" inches Lower boundary: 18' inches

   c. If no, at what depth was impervious material observed? Upper boundary: _____ inches Lower boundary: _____ inches

Commonwealth of Massachusetts
City/Town of Norfolk

Form 11 - Soil Suitability Assessment for On-Site Sewage Disposal

F. Board of Health Witness

Steve Hallem, Andrew Osei - DEP	
Name of Board of Health Witness	Board of Health

G. Soil Evaluator Certification

I certify that I am currently approved by the Department of Environmental Protection pursuant to 310 CMR 15.017 to conduct soil evaluations and that the above analysis has been performed by me consistent with the required training, expertise and experience described in 310 CMR 15.017. I further certify that the results of my soil evaluation, as indicated in the attached Soil Evaluation Form, are accurate and in accordance with 310 CMR 15.100 through 15.107.

	10/19/2017
Signature of Soil Evaluator	Date
Carlos A. Quintal	6/30/2016
Typed or Printed Name of Soil Evaluator / License #	Expiration Date of License

Note: In accordance with 310 CMR 15.018(2) this form must be submitted to the approving authority within 60 days of the date of field testing, and to the designer and the property owner with Percolation Test Form 12.

Field Diagrams

Use this sheet for field diagrams:

Commonwealth of Massachusetts
City/Town of Norfolk

Percolation Test

Form 12

Percolation test results must be submitted with the Soil Suitability Assessment for On-site Sewage Disposal. DEP has provided this form for use by local Boards of Health. Other forms may be used, but the information must be substantially the same as that provided here. Before using this form, check with the local Board of Health to determine the form they use.

Important: When filling out forms on the computer, use only the tab key to move your cursor - do not use the return key.

A. Site Information

Abbyville, Lawrence St- Thomas W. DiPlacido, Jr., Manager
Owner Name

850 Franklin Street - Suite 6
Street Address or Lot #

Wrentham	MA	02093
City/Town	State	Zip Code

Carlos A. Quintal	978-689-7272
Contact Person (if different from Owner)	Telephone Number

B. Test Results

	11/18/2017	10:45	11/18/2017	10:45
	Date	Time	Date	Time
Observation Hole #	CAQ-101		CAQ-102	
Depth of Perc	42"		29"	
Start Pre-Soak	10:45		10:45	
End Pre-Soak	11:00		11:00	
Time at 12”	11:00		11:00	
Time at 9”	11:02		11:03	
Time at 6”	11:03		11:08	
Time (9”-6”)	1 min		5 min	
Rate (Min./Inch)	< 2 min/in		< 2 min/in	
	Test Passed:	☒	Test Passed:	☒
	Test Failed:	☐	Test Failed:	☐

Carlos A. Quintal
Test Performed By:

Steve Hallem, Andrew Osei-DEP
Board of Health Witness

Comments:

Commonwealth of Massachusetts
City/Town of Norfolk

Percolation Test

Form 12

Percolation test results must be submitted with the Soil Suitability Assessment for On-site Sewage Disposal. DEP has provided this form for use by local Boards of Health. Other forms may be used, but the information must be substantially the same as that provided here. Before using this form, check with the local Board of Health to determine the form they use.

Important: When filling out forms on the computer, use only the tab key to move your cursor - do not use the return key.

A. Site Information

Abbyville, Lawrence St- Thomas W. DiPlacido, Jr., Manager
Owner Name

850 Franklin Street - Suite 6
Street Address or Lot #

Wrentham	MA	02093
City/Town	State	Zip Code

Carlos A. Quintal	978-689-7272
Contact Person (if different from Owner)	Telephone Number

B. Test Results

	11/18/2017	11:45	11/18/2017	12:10
	Date	Time	Date	Time
Observation Hole #	CAQ-103		CAQ-104	
Depth of Perc	37"		24"	
Start Pre-Soak	11:45		12:10	
End Pre-Soak	24 gallons in less than 15 min		12:25	
Time at 12”			12:25	
Time at 9”			12:26	
Time at 6”			12:28	
Time (9”-6”)			2 min	
Rate (Min./Inch)	< 2 min/in		< 2 min/in	
	Test Passed: ☒		Test Passed: ☒	
	Test Failed: ☐		Test Failed: ☐	

Carlos A. Quintal
Test Performed By:

Steve Hallem, Andrew Osei-DEP
Board of Health Witness

Comments:

Commonwealth of Massachusetts
City/Town of Norfolk

Percolation Test

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Percolation test results must be submitted with the Soil Suitability Assessment for On-site Sewage Disposal. DEP has provided this form for use by local Boards of Health. Other forms may be used, but the information must be substantially the same as that provided here. Before using this form, check with the local Board of Health to determine the form they use.

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A. Site Information

Abbyville, Lawrence St- Thomas W. DiPlacido, Jr., Manager
Owner Name

850 Franklin Street - Suite 6
Street Address or Lot #

Wrentham	MA	02093
City/Town	State	Zip Code

Carlos A. Quintal	978-689-7272
Contact Person (if different from Owner)	Telephone Number

B. Test Results

	11/18/2017	12:27	11/19/2017	11:27
	Date	Time	Date	Time
Observation Hole #	CAQ-105		CAQ-106	
Depth of Perc	33"		38"	
Start Pre-Soak	12:27		11:27	
End Pre-Soak	12:42		11:42	
Time at 12”	12:42		11:42	
Time at 9”	12:44		11:45	
Time at 6”	12:47		11:50	
Time (9”-6”)	3 min		5 min	
Rate (Min./Inch)	< 2 min/in		< 2 min/in	
	Test Passed:	☒	Test Passed:	☒
	Test Failed:	☐	Test Failed:	☐

Carlos A. Quintal
Test Performed By:

Steve Hallem, Andrew Osei-DEP
Board of Health Witness

Comments:

Commonwealth of Massachusetts
City/Town of Norfolk

Percolation Test

Form 12

Percolation test results must be submitted with the Soil Suitability Assessment for On-site Sewage Disposal. DEP has provided this form for use by local Boards of Health. Other forms may be used, but the information must be substantially the same as that provided here. Before using this form, check with the local Board of Health to determine the form they use.

Important: When filling out forms on the computer, use only the tab key to move your cursor - do not use the return key.

A. Site Information

Abbyville, Lawrence St- Thomas W. DiPlacido, Jr., Manager
Owner Name

850 Franklin Street - Suite 6
Street Address or Lot #

Wrentham	MA	02093
City/Town	State	Zip Code

Carlos A. Quintal	978-689-7272
Contact Person (if different from Owner)	Telephone Number

B. Test Results

	11/19/2017	11:28	11/19/2017	10:47
	Date	Time	Date	Time
Observation Hole #	CAQ-107		CAQ-108	
Depth of Perc	38"		32"	
Start Pre-Soak	11:28		10:47	
End Pre-Soak	11:43		11:02	
Time at 12”	11:43		11:02	
Time at 9”	11:44		11:05	
Time at 6”	11:45		11:08	
Time (9”-6”)	1 min		3 min	
Rate (Min./Inch)	< 2 min/in		< 2 min/in	
	Test Passed:	☒	Test Passed:	☒
	Test Failed:	☐	Test Failed:	☐

Carlos A. Quintal
Test Performed By:

Steve Hallem, Andrew Osei-DEP
Board of Health Witness

Comments:

Commonwealth of Massachusetts
City/Town of Norfolk

Percolation Test

Form 12

Percolation test results must be submitted with the Soil Suitability Assessment for On-site Sewage Disposal. DEP has provided this form for use by local Boards of Health. Other forms may be used, but the information must be substantially the same as that provided here. Before using this form, check with the local Board of Health to determine the form they use.

Important: When filling out forms on the computer, use only the tab key to move your cursor - do not use the return key.

A. Site Information

Abbyville, Lawrence St- Thomas W. DiPlacido, Jr., Manager
Owner Name

850 Franklin Street - Suite 6
Street Address or Lot #

Wrentham	MA	02093
City/Town	State	Zip Code

Carlos A. Quintal	978-689-7272
Contact Person (if different from Owner)	Telephone Number

B. Test Results

	11/19/2017	10:47	11/19/2017	10:11
	Date	Time	Date	Time
Observation Hole #	CAQ-109		CAQ-110	
Depth of Perc	28"		28"	
Start Pre-Soak	10:47		10:11	
End Pre-Soak	11:02		10:26	
Time at 12”	11:02		10:26	
Time at 9”	11:04		10:33	
Time at 6”	11:08		10:43	
Time (9”-6”)	4 min		10 min	
Rate (Min./Inch)	< 2 min/in		< 5 min/in	
	Test Passed:	☒	Test Passed:	☒
	Test Failed:	☐	Test Failed:	☐

Carlos A. Quintal
Test Performed By:

Steve Hallem, Andrew Osei-DEP
Board of Health Witness

Comments:

Enclosure 3 - Environmental Drilling Logs

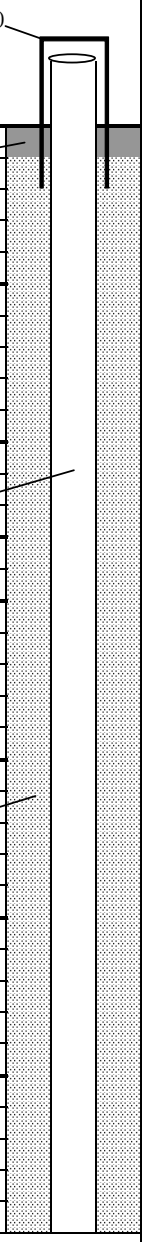
GeoHydroCycle, Inc.

151B California Street Newton, MA 02458 (617)527-8074

Environmental Drilling Log

Project: **Lawrence Street Development, Norfolk, MA**	Project No. GHC #15029	Location No. GHC-1	Sheet 1 of 2
Drilling Location: Furthest monitoring well location down the path, near the norhteast corner of the proposed SAS.	Begun: 3/17/16 @ 08:30		
	Finished: 3/17/16 @ 12:30		
Drill Rig: ATV	Inspector: LCB		
Drill Hole Diameter: 7.25"	Driller: Drilex Corporation- Jason, Rich & Matt	Groundwater Depth @ Completion	
Sampler Type: Split Spoon	Weather: Cloudy	Date/Time	Depth / Measure Pt.
Sampler Length: 24"	Temperature: 50 ^{0} F	3/18/16 @ 12:31	54.67' TOC

Depth	Sample No.	Sample Depth	Sample Recov.	Rock RQD	Soil Blows per 6"	Sample Description/ Detector Readings	Strat. Descrip	Materials Installed
								Stand Pipe (height 3.50 ft)
								Concrete 0'-1'
5								
10	S-1	(10-12')	0.8'		12/22/32/7	S-1 - Medium, gray-brown, f-c SAND, s. Gravel, s. Broken rock pieces, tr. Silt.		
								Solid 2" PVC riser +3 - 52 ft
15								
20	S-2	(20-22')	0.2'		3/9/14/16	S-2 - Medium, light-brown, f-c SAND, s. Gravel, tr. Silt. Note: poor recovery due to broken rock in tip of spoon.		
								Native Sands 1 - 48 ft
25								
30	S-3	(30-32')	0.9'		24/17/18/17	S-3 - Medium, light-brown, f-c SAND, s. Gravel, tr. Silt.		
35								



MINOR COMPONENTS	
and	35 to 50%
some	20 to 35%
little	10 to 20%
trace	1 to 10%

RELATIVE DENSITY	
0-4	very loose
4-10	loose
10-30	medium
30-50	dense
>50	very dense

OVERALL PLASTICITY		
Slight	Clayey SILT	1/4"
Low	SILT & CLAY	1/8"
Medium	CLAY & SILT	1/16"
High	Silty CLAY	1/32"
Very High	CLAY	1/64"

GeoHydroCycle, Inc.

151B California Street Newton, MA 02458 (617)527-8074

Environmental Drilling Log

Project: Lawrence Street Development, Norfolk, MA	Project No. GHC #15029	Boring No. GHC-1	Sheet 2 of 2

Depth	Sample No.	Sample Depth	Sample Recov.	Rock RQD	Soil Blows per 6"	Sample Description	Stratigraphic Description	Materials Installed
40	S-4	(40-42')	1.3'		6/11/14/16	S-4 - Medium, brown, f-c SAND, lt. Gravel, tr. Silt.		Native Sands 1 - 48 ft; Solid 2" PVC riser +3 - 52 ft
45								
50	S-5	(50-52')	1.5'		6/6/6/9	S-5-1 (top 1.1') Loose, brown, f. SAND, tr. C. Sand, saturated.	GW at 51 feet	Bentonite 48 - 50 ft
						S-5-2 (bottom 0.4') Loose, brown, f-m SAND, lt. C, Sand.		
55								10 Slot 2" PVC Well screen 52 - 62 ft
60						No sample at 60 feet due to running sands.		Filter Sand 50 - 62 ft
						EOB - Set well 12 feet into groundwater.		
						End of boring at 62 feet due to running sands.		
65								
70								
75								
80								

Remarks:

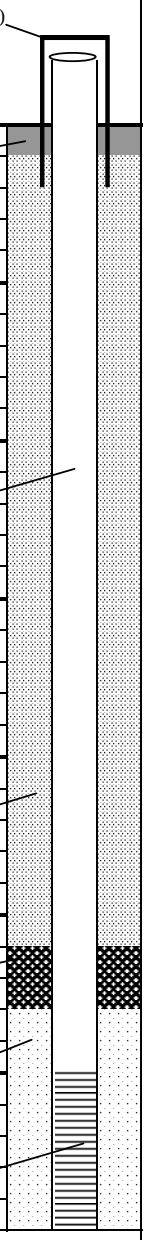
GEOHYDROCYCLE, INC.

151B California Street Newton, MA 02458 (617)527-8074

Environmental Drilling Log

Project: **Lawrence Street Development, Norfolk, MA**	Project No. GHC #15029	Location No. GHC-2	Sheet 1 of 2
Drilling Location: Located in the depression to the east of existing houses, near the southeast corner of the proposed SAS.	Begun: 3/17/16 @ 13:00 Finished: 3/18/16 @ 08:50		
Drill Rig: ATV	Inspector: LCB		
Drill Hole Diameter: 7.25"	Driller: Drilex Corporation- Jason, Rich & Matt	Groundwater Depth @ Completion	
Sampler Type: Split Spoon	Weather: Cloudy	Date/Time	Depth	Measure Pt.
Sampler Length: 24"	Temperature: 50° F	3/18/16 @ 12:41	40.90'	TOC

Depth	Sample No.	Sample Depth	Sample Recov.	Rock RQD	Soil Blows per 6"	Sample Description/ Detector Readings	Strat. Descrip	Materials Installed
								Stand Pipe (height 3.40 ft)
								Concrete 0'-1'
5								
10	S-1	(10-12')	1.1'		11/14/9/9	S-1-1 (top 0.4') Medium, light-brown, f-c SAND, lt. Gravel, lt. Silt, tr. Broken rock pieces.		
						S-1-2 (bottom 0.6') Medium, light-brown, f-c SAND, lt. Gravel, tr. Silt.		Solid 2" PVC riser +3 - 30 ft
15								
20	S-2	(20-22')	0.9'		8/9/16/15	S-2 - Medium, light-brown, f-c SAND and GRAVEL, tr. Cobble, tr. Silt.		Native Sands 1 - 26 ft
25								
							GW at 28 ft	Bentonite 26 - 28 ft
30	S-3	(30-32')	2.0'		7/10/11/11	S-3-1 (top 1.0') Medium, light-brown, f-m SAND, lt. C. Sand, tr. Gravel, saturated. S-3-2 (bottom 1.0') Medium, light-brown, f. SAND, tr. Silt.		Filter Sand 28 - 40 ft
								10 Slot 2" PVC Well screen
35								30 - 40 ft



MINOR COMPONENTS

and	35 to 50%
some	20 to 35%
little	10 to 20%
trace	1 to 10%

RELATIVE DENSITY

0-4	very loose
4-10	loose
10-30	medium
30-50	dense
>50	very dense

OVERALL PLASTICITY

Slight	Clayey SILT	1/4"
Low	SILT & CLAY	1/8"
Medium	CLAY & SILT	1/16"
High	Silty CLAY	1/32"
Very High	CLAY	1/64"

GeoHydroCycle, Inc.

151B California Street Newton, MA 02458 (617)527-8074

Environmental Drilling Log

Project: Lawrence Street Development, Norfolk, MA	Project No. GHC #15029	Boring No. GHC-2	Sheet 2 of 2

Depth	Sample No.	Sample Depth	Sample Recov.	Rock RQD	Soil Blows per 6"	Sample Description	Stratigraphic Description	Materials Installed
								10 Slot 2" PVC
								Well screen
								30 - 40 ft
40						No sample due to running sands.		Filter Sand
						EOB - Set well 12 feet into groundwater.		28 - 40 ft
						End of boring at 40 feet due to running sands.		
45								
50								
55								
60								
65								
70								
75								
80								

Remarks:

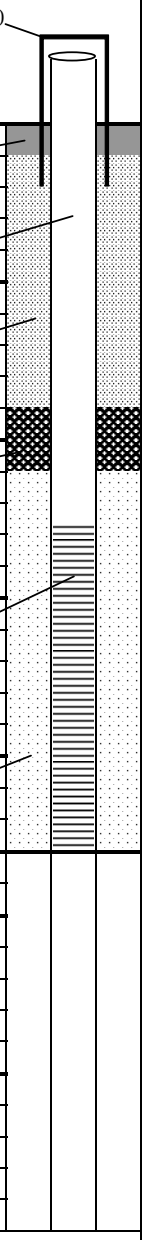
GEOHYDROCYCLE, INC.

151B California Street Newton, MA 02458 (617)527-8074

Environmental Drilling Log

Project: **Lawrence Street Development, Norfolk, MA**	Project No. GHC #15029	Location No. GHC-3	Sheet 1 of 1
Drilling Location: Behind the existing houses at 67 Lawrence Street, near the western side of the proposed SAS.	Begun: 3/18/16 @ 11:30		
	Finished: 3/18/16 @ 15:00		
Drill Rig: ATV	Inspector: LCB		
Drill Hole Diameter: 7.25"	Driller: Drilex Corporation- Jason & Matt	Groundwater Depth @ Completion	
Sampler Type: Split Spoon	Weather: Partly cloudy	Date/Time	Depth / Measure Pt.
Sampler Length: 24"	Temperature: 50 ^{0} F	3/24/16 @ 10:10	Dry / TOC

Depth	Sample No.	Sample Depth	Sample Recov.	Rock RQD	Soil Blows per 6"	Sample Description/ Detector Readings	Strat. Descrip	Materials Installed
								Stand Pipe (height 2.90 ft)
								Concrete 0'-1'
								Solid 2" PVC riser
5								+3 - 13 ft
								Native Sands
								1 - 9 ft
10	S-1	(10-12')	1.2'		39/22/16/16	S-1 - Medium, brown, f-c SAND and GRAVEL, lt. Silt, tr. Broken rock pieces.		
								Bentonite
								9 - 11 ft
15						*Note: First boring encountered refusal at 15 feet, moved 6 feet to the south and started another boring.*		
								10 Slot 2" PVC
								Well screen
								13 - 23 ft
20	S-2	(20-22')	1.1'		29/31/20/37 for 1"	S-2 - Medium, light-brown, f-c SAND and GRAVEL, s. Cobble, lt. Silt.		
								Filter Sand
								11 - 23 ft
						EOB - Auger Refusal at 23 feet.		
25						*Note: Encountered rock at 21 feet, drilled 2 feet into rock and installed the well.*		
30								
35								



MINOR COMPONENTS

and	35 to 50%
some	20 to 35%
little	10 to 20%
trace	1 to 10%

RELATIVE DENSITY

0-4	very loose
4-10	loose
10-30	medium
30-50	dense
>50	very dense

OVERALL PLASTICITY

Slight	Clayey SILT	1/4"
Low	SILT & CLAY	1/8"
Medium	CLAY & SILT	1/16"
High	Silty CLAY	1/32"
Very High	CLAY	1/64"

GEOHYDROCYCLE, INC.

Environmental Drilling Log

151B California Street Newton, MA 02458 (617)527-8074

Project: **Lawrence Street Development, Norfolk, MA**	Project No. GHC #15029	Location No. Esker Boring	Sheet 1 of 2
Drilling Location: At the top of the Esker behind the existing house and to the west of well GHC-2.	Begun: 3/18/16 @ 08:50		
	Finished: 3/18/16 @ 11:00		
Drill Rig: ATV	Inspector: LCB		
Drill Hole Diameter: 7.25"	Driller: Drilex Corporation- Jason & Matt	Groundwater Depth @ Completion	
Sampler Type: Split Spoon	Weather: Partly cloudy	Date/Time	Depth / Measure Pt.
Sampler Length: 24"	Temperature: 50° F		TOC

Depth	Sample No.	Sample Depth	Sample Recov.	Rock RQD	Soil Blows per 6"	Sample Description/ Detector Readings	Strat. Descrip	Materials Installed
						Augered to 38 feet and collected a split spoon sample from 38 to 40 feet.		
5						In general, soils encountered during drilling were f-c SAND		
10								
15								
20								
25								
30								
35								

MINOR COMPONENTS

and	35 to 50%
some	20 to 35%
little	10 to 20%
trace	1 to 10%

RELATIVE DENSITY

0-4	very loose
4-10	loose
10-30	medium
30-50	dense
>50	very dense

OVERALL PLASTICITY

Slight	Clayey SILT	1/4"
Low	SILT & CLAY	1/8"
Medium	CLAY & SILT	1/16"
High	Silty CLAY	1/32"
Very High	CLAY	1/64"

GeoHydroCycle, Inc.

151B California Street Newton, MA 02458 (617)527-8074

Environmental Drilling Log

Project: Lawrence Street Development, Norfolk, MA	Project No. GHC #15029	Boring No. Esker Boring	Sheet 2 of 2

Depth	Sample No.	Sample Depth	Sample Recov.	Rock RQD	Soil Blows per 6"	Sample Description	Stratigraphic Description	Materials Installed
	S-1	(38-40')	1.5'		22/32/38/71 for 4"	S-1 - Dense, light-brown, f-c SAND, little to some Silt, lt. Gravel.		
40						**EOB - Auger refusal at 38 feet. Split spoon EOB at 40 feet.**		
45								
50								
55								
60								
65								
70								
75								
80								

Remarks:

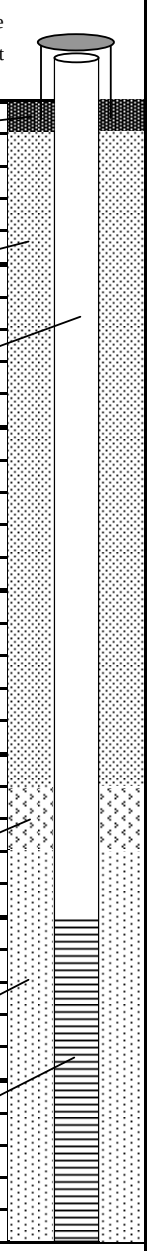
GeoHydroCycle, Inc.

151B California Street Newton, MA 02458 (617)527-8074

Environmental Drilling Log

Project: **Abbyville Commons, Lawrence Street, Norfolk, MA**	Project No. GHC #15029	Location No. MW-10	Sheet 1 of 1
Drilling Location: See Figure 2	Begun: 11/9/17		
	Finished: 11/9/17		
Drill Rig: HSA ATV	Inspector: Carolyn Matthews		
Drill Hole Diameter: 9-inch	Driller: Jamie, Tim and Dave	Groundwater Depth @ Completion	
Sampler Type: Split Spoon	Weather: Partly Cloudy	Date/Time	Depth / Measure Pt.
Sampler Length: 2 feet	Temperature: 50º F	11/15/2017	Not found

Depth	Sample No.	Sample Depth	Sample Recov.	Rock RQD	Soil Blows per 6"	Sample Description/ Detector Readings	Strat. Descrip	Materials Installed
5	S-1	5-7	22"		11,17,18,19	S-1 Brown, med dense, f-m SAND, t Silt.		
10	S-2	10-12	18"		8,12,14,13	S-2 Brown, med dense, f-m SAND, t Silt.		
15	S-3	15-17	22"		5,8,10,11	S-3 Brown, med dense, f-c SAND, t Silt.	GLACIAL OUTWASH SANDS	
20	S-4	20-22	20"		5,6,9,12	S-4 Brown, med dense, f-m SAND, t Silt.		
25	S-5	25-27	16"		23,36,40,33	S-5 Brown, v dense, f-c SAND, t Cobble, t Silt.		
30	S-6	30-32	17"		14,23,34,42	S-6 Top 6" - Tan, v dense, f-m SAND, t Cobble, t Silt. Bot 11" - Brown, v dense, f-c SAND, lit Cobble, t Silt.		
35	S-7	35-37	12"		41,21,22,50	S-7 Brown, dense, f-c SAND, lit Cobble, t Silt.		



MINOR COMPONENTS	
and	35 to 50%
some	20 to 35%
little	10 to 20%
trace	1 to 10%

RELATIVE DENSITY	
0-4	very loose
4-10	loose
10-30	medium
30-50	dense
>50	very dense

OVERALL PLASTICITY		
Slight	Clayey SILT	1/4"
Low	SILT & CLAY	1/8"
Medium	CLAY & SILT	1/16"
High	Silty CLAY	1/32"
Very High	CLAY	1/64"

GeoHydroCycle, Inc.

151B California Street Newton, MA 02458 (617)527-8074

Environmental Drilling Log

Project: **Abbyville Commons, Lawrence Street, Norfolk, MA**	Project No. GHC #15029	Boring No. MW-10	Sheet 2 of 2

Depth	Sample No.	Sample Depth	Sample Recov.	Rock RQD	Soil Blows per 6"	Sample Description	Stratigraphic Description	Materials Installed
						End of Boring at 35 feet (Auger Refusal).		
40								
45								
50								
55								
60								
65								
70								
75								
80								

Remarks:

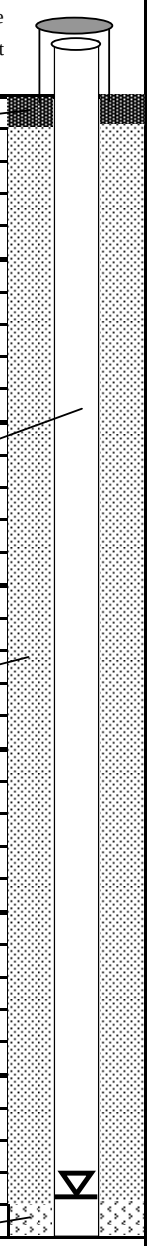
GeoHydroCycle, Inc.

151B California Street Newton, MA 02458 (617)527-8074

Environmental Drilling Log

Project: **Abbyville Commons, Lawrence Street, Norfolk, MA**	Project No. GHC #15029	Location No. MW-11	Sheet 1 of 2
Drilling Location: See Figure 2	Begun: 11/9/17		
	Finished: 11/9/17		
Drill Rig: HSA ATV	Inspector: Carolyn Matthews		
Drill Hole Diameter: 9-inch	Driller: Jamie, Tim and Dave	Groundwater Depth @ Completion	
Sampler Type: Split Spoon	Weather: Partly Cloudy	Date/Time	Depth / Measure Pt.
Sampler Length: 2 feet	Temperature: 50º F	11/15/2017	36.87 TOC

Depth	Sample No.	Sample Depth	Sample Recov.	Rock RQD	Soil Blows per 6"	Sample Description/ Detector Readings	Strat. Descrip	Materials Installed
5	S-1	5-7	9"		13,16,14,13	S-1 Tan, med dense, f-c SAND,lit Cobble, t Silt.	GLACIAL OUTWASH SAND	Concrete 0-1
10	S-2	10-12	14"		6,11,12,14	S-2 Top 4" - Tan, med dense, f SAND, t- Silt. Bot 10" - Brown, med dense, f-c SAND, t Cobble, t Silt.		2" PVC Riser +2.8-38
15	S-3	15-17	14"		13,13,15,15	S-3 Tan, med dense, f SAND, t- Silt.		Native Soil 1-34
20	S-4	20-22	13"		4,7,12,14	S-4 Tan, med dense, f SAND, t- Silt.		
25	S-5	25-27	19"		5,9,10,12	S-5 Tan, med dense, f-m SAND, t- Silt.		
30	S-6	30-32	18"		7,11,12,12	S-6 Tan, med dense, f-m SAND, t- Silt.		
35	S-7	35-37	13"		7,14,14,18	S-7 Brown, med dense, f-c SAND, t+ Cobble, t+ Silt.		Bentonite



MINOR COMPONENTS

and	35 to 50%
some	20 to 35%
little	10 to 20%
trace	1 to 10%

RELATIVE DENSITY

0-4	very loose
4-10	loose
10-30	medium
30-50	dense
>50	very dense

OVERALL PLASTICITY

Slight	Clayey SILT	1/4"
Low	SILT & CLAY	1/8"
Medium	CLAY & SILT	1/16"
High	Silty CLAY	1/32"
Very High	CLAY	1/64"

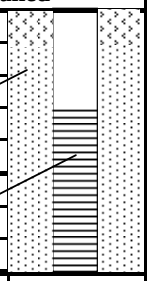
GEOHYDROCYCLE, INC.

151B California Street Newton, MA 02458 (617)527-8074

Environmental Drilling Log

Project: **Abbyville Commons, Lawrence Street, Norfolk, MA**	Project No. GHC #15029	Boring No. MW-11	Sheet 2 of 2

Depth	Sample No.	Sample Depth	Sample Recov.	Rock RQD	Soil Blows per 6"	Sample Description	Stratigraphic Description	Materials Installed
								34-36
							GLACIAL	Filter Sand
							OUTWASH	36-43
40	S-8	40-42	11"		11,16,18,12	S-8 Brown, dense, f-c SAND, t+ Cobble, t Silt.	SAND	
								2" PVC 10-Slot
								Screen
								38-43
						End of Boring at 43 feet (Auger Refusal).		
45								
50								
55								
60								
65								
70								
75								
80								



Remarks:

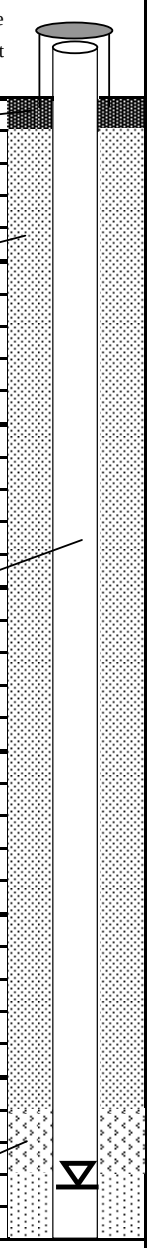
GeoHydroCycle, Inc.

151B California Street Newton, MA 02458 (617)527-8074

Environmental Drilling Log

Project: **Abbyville Commons, Lawrence Street, Norfolk, MA**	Project No. GHC #15029	Location No. MW-12	Sheet 1 of 2
Drilling Location: See Figure 2	Begun: 11/10/17		
	Finished: 11/10/17		
Drill Rig: HSA ATV	Inspector: Carolyn Matthews		
Drill Hole Diameter: 9-inch	Driller: Jamie, Tim and Dave	Groundwater Depth @ Completion	
Sampler Type: Split Spoon	Weather: Partly Cloudy	Date/Time	Depth / Measure Pt.
Sampler Length: 2 feet	Temperature: 45º F	11/15/2017	36.45 / TOC

Depth	Sample No.	Sample Depth	Sample Recov.	Rock RQD	Soil Blows per 6"	Sample Description/ Detector Readings	Strat. Descrip	Materials Installed
5	S-1	5-7	24"		6,9,11,11	S-1 Tan, med dense, f SAND, t- Silt.		
10	S-2	10-12	22"		8,11,10,13	S-2 Brown/tan, med dense, f SAND & SILT.		
15	S-3	15-17	20"		14,15,17,13	S-3 Tan, dense, f-c SAND, t Cobble, t Silt.	GLACIAL OUTWASH SAND	
20	S-4	20-22	19"		14,13,12,12	S-4 Tan, med dense, f SAND, t- Silt.		
25	S-5	25-27	20"		12,20,27,32	S-5 Tan, dense, f-c SAND, t+ Cobble, t- Silt.		
30	S-6	30-32	19"		10,11,11,13	S-6 Brown, med dense, f-c SAND, t Cobble, t Silt.		
35	S-7	35-37	12"		9,14,21,18	S-7 Brown, dense, f-c SAND, lit Cobble, t Silt.		



MINOR COMPONENTS

and	35 to 50%
some	20 to 35%
little	10 to 20%
trace	1 to 10%

RELATIVE DENSITY

0-4	very loose
4-10	loose
10-30	medium
30-50	dense
>50	very dense

OVERALL PLASTICITY

Slight	Clayey SILT	1/4"
Low	SILT & CLAY	1/8"
Medium	CLAY & SILT	1/16"
High	Silty CLAY	1/32"
Very High	CLAY	1/64"

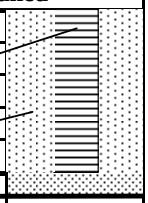
GeoHydroCycle, Inc.

151B California Street Newton, MA 02458 (617)527-8074

Environmental Drilling Log

Project: **Abbyville Commons, Lawrence Street, Norfolk, MA**	Project No. GHC #15029	Boring No. MW-12	Sheet 2 of 2

Depth	Sample No.	Sample Depth	Sample Recov.	Rock RQD	Soil Blows per 6"	Sample Description	Stratigraphic Description	Materials Installed
							GLACIAL OUTWASH SAND	2" PVC 10-Slot Screen 35-40 Filter Sand 38-40
40	S-8	40-40.8	0"		8, 60 for 2"	S-8 Spoon refusal @ 8 inches. No sample recovery.		
						End of Boring at 40.8 feet (Spoon Refusal).		
45								
50								
55								
60								
65								
70								
75								
80								



Remarks:

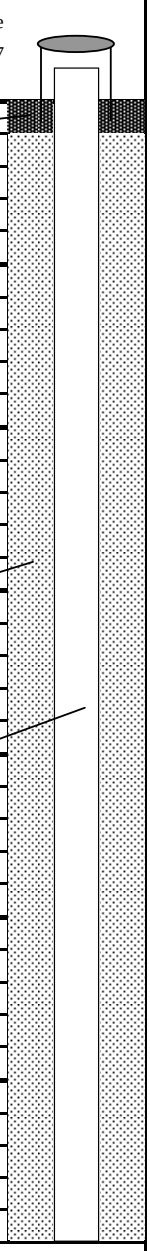
GeoHydroCycle, Inc.

151B California Street Newton, MA 02458 (617)527-8074

Environmental Drilling Log

Project: **Abbyville Commons, Lawrence Street, Norfolk, MA**	Project No. GHC #15029	Location No. MW-13	Sheet 1 of 2
Drilling Location: See Figure 2	Begun: 11/10/17		
	Finished: 11/10/17		
Drill Rig: HSA ATV	Inspector: Carolyn Matthews		
Drill Hole Diameter: 9-inch	Driller: Jamie, Tim and Dave	Groundwater Depth @ Completion	
Sampler Type: Split Spoon	Weather: Partly Cloudy	Date/Time	Depth / Measure Pt.
Sampler Length: 2 feet	Temperature: 45º F	11/15/2017	39.02 TOC

Depth	Sample No.	Sample Depth	Sample Recov.	Rock RQD	Soil Blows per 6"	Sample Description/ Detector Readings	Strat. Descrip	Materials Installed
								Stand Pipe +2.87
								Concrete 0-1
5	S-1	5-7	20"		6,7,11,13	S-1 Tan, med dense, f-m SAND, t Silt.		
10	S-2	10-12	24"		3,10,22,26	S-2 Tan, dense, f-c SAND, t Cobble, t Silt.		
15	S-3	15-17	12"		8,15,20,37	S-3 Tan,dense, f-c SAND, t Cobble, t Silt.	GLACIAL OUTWASH SAND	Native Soil 1-36
20	S-4	20-22	12"		6,5,9,13	S-4 Tan, med dense, f SAND.		2" PVC Riser +2.87-40
25	S-5	25-27	14"		7,15,14,16	S-5 Tan, med dense, f SAND.		
30	S-6	30-32	19"		5,11,12,15	S-6 Tan, med dense, f SAND.		
35	S-7	35-37	17"		5,9,10,10	S-7 Tan, med dense, f SAND.		



MINOR COMPONENTS

and	35 to 50%
some	20 to 35%
little	10 to 20%
trace	1 to 10%

RELATIVE DENSITY

0-4	very loose
4-10	loose
10-30	medium
30-50	dense
>50	very dense

OVERALL PLASTICITY

Slight	Clayey SILT	1/4"
Low	SILT & CLAY	1/8"
Medium	CLAY & SILT	1/16"
High	Silty CLAY	1/32"
Very High	CLAY	1/64"

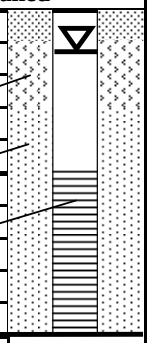
GEOHYDROCYCLE, INC.

151B California Street Newton, MA 02458 (617)527-8074

Environmental Drilling Log

Project: **Abbyville Commons, Lawrence Street, Norfolk, MA**	Project No. GHC #15029	Boring No. MW-13	Sheet 2 of 2

Depth	Sample No.	Sample Depth	Sample Recov.	Rock RQD	Soil Blows per 6"	Sample Description	Stratigraphic Description	Materials Installed
								Bentonite
							GLACIAL	36-38
40	S-8	40-42	14"		8,11,15,16	S-8 Brown, med dense, f-c SAND, lit Cobble, t Silt.	OUTWASH	Filter Sand
							SAND	38-45
								2" PVC 10-Slot
								Screen
								40-45
45						No sample.		
						End of Boring at 45 feet (Auger Refusal).		
50								
55								
60								
65								
70								
75								
80								



Remarks:

GeoHydroCycle, Inc.

151B California Street Newton, MA 02458 (617)527-8074

Environmental Drilling Log

Project: **Abbyville Commons, Lawrence Street, Norfolk, MA**	Project No. GHC #15029	Location No. B-14	Sheet 1 of 1
Drilling Location: See Figure 2	Begun: 11/13/17		
	Finished: 11/13/17		
Drill Rig: HSA ATV	Inspector: Carolyn Matthews		
Drill Hole Diameter: 9-inch	Driller: Jamie, Tim and Dave	Groundwater Depth @ Completion	
Sampler Type: Split Spoon	Weather: Partly Cloudy	Date/Time	Depth / Measure Pt.
Sampler Length: 2 feet	Temperature: 40º F	11/13/2017	Not found

Depth	Sample No.	Sample Depth	Sample Recov.	Rock RQD	Soil Blows per 6"	Sample Description/ Detector Readings	Strat. Descrip	Materials Installed
5	S-1	5-7	4"		31, 60 for 5"	S-1 Grey, f-m SAND, some Cobble, t Silt.	GLACIAL OUTWASH SAND	
10	S-2	10-12	6"		15,42, 60 for 1/2"	S-2 Grey, f-m SAND, some Cobble, t Silt.		
						End of Boring at 11 feet (Spoon Refusal).		
						NO WELL INSTALLED.		
15								
20								
25								
30								
35								

MINOR COMPONENTS

and	35 to 50%
some	20 to 35%
little	10 to 20%
trace	1 to 10%

RELATIVE DENSITY

0-4	very loose
4-10	loose
10-30	medium
30-50	dense
>50	very dense

OVERALL PLASTICITY

Slight	Clayey SILT	1/4"
Low	SILT & CLAY	1/8"
Medium	CLAY & SILT	1/16"
High	Silty CLAY	1/32"
Very High	CLAY	1/64"

GeoHydroCycle, Inc.

151B California Street Newton, MA 02458 (617)527-8074

Environmental Drilling Log

Project: **Abbyville Commons, Lawrence Street, Norfolk, MA**	Project No. GHC #15029	Location No. B-15	Sheet 1 of 1
Drilling Location: See Figure 2	Begun: 11/13/17		
	Finished: 11/13/17		
Drill Rig: HSA ATV	Inspector: Carolyn Matthews		
Drill Hole Diameter: 9-inch	Driller: Jamie, Tim and Dave	Groundwater Depth @ Completion	
Sampler Type: Split Spoon	Weather: Partly Cloudy	Date/Time	Depth / Measure Pt.
Sampler Length: 2 feet	Temperature: 40º F	11/13/2017	Not found

Depth	Sample No.	Sample Depth	Sample Recov.	Rock RQD	Soil Blows per 6"	Sample Description/ Detector Readings	Strat. Descrip	Materials Installed
5	S-1	5-7	22"		13,21,20,14	S-1 Tan, dense, f-c SAND, t+ Cobble, t- Silt.		
10	S-2	10-12	18"		10,20,13,16	S-2 Tan, dense, f SAND, lit Silt.	GLACIAL OUTWASH SAND	
15	S-3	15-17	4"		10,15,15,18	S-3 Brown, dense, f-c SAND, t Silt.		
20	S-4	20-22	6"		12, 60 for 5"	S-4 Brown, f-c SAND, lit Cobble, t+ Silt.		
						End of Boring at 20.9 feet (Spoon Refusal).		
						NO WELL INSTALLED.		
25								
30								
35								

MINOR COMPONENTS

and	35 to 50%
some	20 to 35%
little	10 to 20%
trace	1 to 10%

RELATIVE DENSITY

0-4	very loose
4-10	loose
10-30	medium
30-50	dense
>50	very dense

OVERALL PLASTICITY

Slight	Clayey SILT	1/4"
Low	SILT & CLAY	1/8"
Medium	CLAY & SILT	1/16"
High	Silty CLAY	1/32"
Very High	CLAY	1/64"

Enclosure 4 - Frimpter Analysis

Frimpter Analyses

GHC #15029 Abbyville Commons, Norfolk, MA

Variables

Site	Depths			
Measured depth to groundwater (Sc)	39.87	feet	11/15/2017 MW-11	
Frimpter Ranges				
Range in groundwater levels in similar topography (Sr)	9.00	feet	10 % exceedence	
USGS Well				
Measured depth to groundwater at similar time (OWc)	13.60	feet	USGS Reading Date	11/15/2017
Measured depth to maximum groundwater level (OWmax)	10.28	feet		
Maximum range of groundwater (OWr)	6.50	feet		
Result				
Predicted depth to seasonal high groundwater (Sh)	35.27	feet		
Difference	4.60	feet		

USGS Well: Webster WLW-1

Geology: Sand & Gravel

Topography: Hilltop

Enclosure 5 - Grain Size Report and Analyses

Grain size results:

All De = mm	D10 = .83	D17 = 1.34	D20 = 1.61	D60 = 4.77
C = 5.77	porosity = .34	Mean Permeability = 524.84 (m/day)		

CAQ-1-24

Permeability:

Results	
C = 5.77	
Porosity = .34	
Permeability (m/day)	
Solution	**Value**
Beyer	514.05
Hazen	505.72
Kozeny	340.52
Sauerbrei	414.88
USBR	923.7
Pavachich	450.18
Mean Permeability = 524.84 (m/day)	

CAQ-1-24

Grain size results:

All De = mm	D10 = .68	D17 = 1.03	D20 = 1.22	D60 = 4.88
C = 7.23	porosity = .32	Mean Permeability = 291.94 (m/day)		

CAQ-1-24 dup

Permeability:

Results	
C = 7.23	
Porosity = .32	
Permeability (m/day)	
Solution	**Value**
Beyer	326.93
Hazen	300.22
Kozeny	177.78
Sauerbrei	190.51
USBR	491.04
Pavachich	265.19
Mean Permeability = 291.94 (m/day)	

CAQ-1 -24 dup

Grain size results:

All De = mm	D10 = .12	D17 = .18	D20 = .21	D60 = 1.25
C = 10.55	porosity = .29	Mean Permeability = 6.74 (m/day)		

CAQ-1-54

Permeability:

Results	
C = 10.55	
Porosity = .29	
Permeability (m/day)	
Solution	**Value**
Beyer	9.12
Hazen	7.45
Kozeny	3.69
Sauerbrei	3.84
USBR	8.42
Pavachich	7.9
Mean Permeability = 6.74 (m/day)	

CAQ-1-54

ANALYTICAL REPORT

Lab Number:	L1604032
Client:	GeoHydroCycle, Inc. 151B California Street Newton, MA 02458
ATTN:	Stephen Smith
Phone:	(617) 527-8074
Project Name:	LAWRENCE STREET PROJECT
Project Number:	GHC#15029 NORFOLK
Report Date:	02/26/16

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Certifications & Approvals: NY (11627), CT (PH-0141), NH (2206), NJ NELAP (MA015), RI (LAO00299), ME (MA00030), PA (68-02089), VA (460194), LA NELAP (03090), FL (E87814), TX (T104704419), WA (C954), USFWS (Permit #LE2069641), USDA (Permit #P330-11-00109), US Army Corps of Engineers.

320 Forbes Boulevard, Mansfield, MA 02048-1806
508-822-9300 (Fax) 508-822-3288 800-624-9220 - www.alphalab.com

Project Name: LAWRENCE STREET PROJECT
Project Number: GHC#15029 NORFOLK

Lab Number: L1604032
Report Date: 02/26/16

Alpha Sample ID	Client ID	Matrix	Sample Location	Collection Date/Time	Receive Date
L1604032-01	CAQ-1 AT 24 INCHES	SOIL	17 LAWRENCE ST., NORFOLK, MA	02/12/15 11:20	02/15/16
L1604032-02	CAQ-2 AT 54 INCHES	SOIL	17 LAWRENCE ST., NORFOLK, MA	02/12/15 10:15	02/15/16

Project Name: LAWRENCE STREET PROJECT **Lab Number:** L1604032
Project Number: GHC#15029 NORFOLK **Report Date:** 02/26/16

Case Narrative

The samples were received in accordance with the Chain of Custody and no significant deviations were encountered during the preparation or analysis unless otherwise noted. Sample Receipt, Container Information, and the Chain of Custody are located at the back of the report.

Results contained within this report relate only to the samples submitted under this Alpha Lab Number and meet all of the requirements of NELAC, for all NELAC accredited parameters. The data presented in this report is organized by parameter (i.e. VOC, SVOC, etc.). Sample specific Quality Control data (i.e. Surrogate Spike Recovery) is reported at the end of the target analyte list for each individual sample, followed by the Laboratory Batch Quality Control at the end of each parameter. Tentatively Identified Compounds (TICs), if requested, are reported for compounds identified to be present and are not part of the method/program Target Compound List, even if only a subset of the TCL are being reported. If a sample was re-analyzed or re-extracted due to a required quality control corrective action and if both sets of data are reported, the Laboratory ID of the re-analysis or re-extraction is designated with an "R" or "RE", respectively. When multiple Batch Quality Control elements are reported (e.g. more than one LCS), the associated samples for each element are noted in the grey shaded header line of each data table. Any Laboratory Batch, Sample Specific % recovery or RPD value that is outside the listed Acceptance Criteria is bolded in the report. All specific QC information is also incorporated in the Data Usability format of our Data Merger tool where it can be reviewed along with any associated usability implications. Soil/sediments, solids and tissues are reported on a dry weight basis unless otherwise noted. Definitions of all data qualifiers and acronyms used in this report are provided in the Glossary located at the back of the report.

In reference to questions H (CAM) or 4 (RCP) when "NO" is checked, the performance criteria for CAM and RCP methods allow for some quality control failures to occur and still be within method compliance. In these instances the specific failure is not narrated but noted in the associated QC table. The information is also incorporated in the Data Usability format of our Data Merger tool where it can be reviewed along with any associated usability implications.

Please see the associated ADEx data file for a comparison of laboratory reporting limits that were achieved with the regulatory Numerical Standards requested on the Chain of Custody.

HOLD POLICY
For samples submitted on hold, Alpha's policy is to hold samples (with the exception of Air canisters) free of charge for 21 calendar days from the date the project is completed. After 21 calendar days, we will dispose of all samples submitted including those put on hold unless you have contacted your Client Service Representative and made arrangements for Alpha to continue to hold the samples. Air canisters will be disposed after 3 business days from the date the project is completed.

Please contact Client Services at 800-624-9220 with any questions.

Project Name:	LAWRENCE STREET PROJECT	**Lab Number:**	L1604032
Project Number:	GHC#15029 NORFOLK	**Report Date:**	02/26/16

Case Narrative (continued)

Grain Size Analysis

The WG867679-1 Laboratory Duplicate RPD, performed on L1604032-01, is outside the acceptance criteria for % Fine sand (56%). The elevated RPD has been attributed to the non-homogeneous nature of the native sample.

I, the undersigned, attest under the pains and penalties of perjury that, to the best of my knowledge and belief and based upon my personal inquiry of those responsible for providing the information contained in this analytical report, such information is accurate and complete. This certificate of analysis is not complete unless this page accompanies any and all pages of this report.

Authorized Signature: Elizabeth Porta

Title: Technical Director/Representative

Date: 02/26/16

INORGANICS
&
MISCELLANEOUS

Project Name: LAWRENCE STREET PROJECT
Project Number: GHC#15029 NORFOLK

Lab Number: L1604032
Report Date: 02/26/16

SAMPLE RESULTS

Lab ID: L1604032-01
Client ID: CAQ-1 AT 24 INCHES
Sample Location: 17 LAWRENCE ST., NORFOLK, MA
Matrix: Soil

Date Collected: 02/12/15 11:20
Date Received: 02/15/16
Field Prep: Not Specified

Parameter	Result	Qualifier	Units	RL	MDL	Dilution Factor	Date Prepared	Date Analyzed	Analytical Method	Analyst
Grain Size Analysis - Mansfield Lab										
% Total Gravel	40.2		%	0.100	NA	1	-	02/23/16 00:00	12,D422	L1
% Coarse Sand	35.5		%	0.100	NA	1	-	02/23/16 00:00	12,D422	L1
% Medium Sand	22.2		%	0.100	NA	1	-	02/23/16 00:00	12,D422	L1
% Fine Sand	1.30		%	0.100	NA	1	-	02/23/16 00:00	12,D422	L1
% Total Fines	0.800		%	0.100	NA	1	-	02/23/16 00:00	12,D422	L1

Project Name: LAWRENCE STREET PROJECT
Project Number: GHC#15029 NORFOLK

Lab Number: L1604032
Report Date: 02/26/16

SAMPLE RESULTS

Lab ID: L1604032-02
Client ID: CAQ-2 AT 54 INCHES
Sample Location: 17 LAWRENCE ST., NORFOLK, MA
Matrix: Soil

Date Collected: 02/12/15 10:15
Date Received: 02/15/16
Field Prep: Not Specified

Parameter	Result	Qualifier	Units	RL	MDL	Dilution Factor	Date Prepared	Date Analyzed	Analytical Method	Analyst
Grain Size Analysis - Mansfield Lab										
% Total Gravel	31.0		%	0.100	NA	1	-	02/23/16 00:00	12,D422	L1
% Coarse Sand	4.10		%	0.100	NA	1	-	02/23/16 00:00	12,D422	L1
% Medium Sand	20.2		%	0.100	NA	1	-	02/23/16 00:00	12,D422	L1
% Fine Sand	42.3		%	0.100	NA	1	-	02/23/16 00:00	12,D422	L1
% Total Fines	2.40		%	0.100	NA	1	-	02/23/16 00:00	12,D422	L1

Lab Duplicate Analysis
Batch Quality Control

Project Name: LAWRENCE STREET PROJECT
Project Number: GHC#15029 NORFC

Lab Number: L1604032
Report Date: 02/26/16

Parameter	Native Sample	Duplicate Sample	Units	RPD	Qual	RPD Limits
Grain Size Analysis - Mansfield Lab Associated sample(s): 01-02 QC Batch ID: WG867679-1 QC Sample: L1604032-01 Client ID: CAQ-1 AT 24 INCHES						
% Total Gravel	40.2	41.5	%	3		20
% Coarse Sand	35.5	29.0	%	20		20
% Medium Sand	22.2	26.3	%	17		20
% Fine Sand	1.30	2.30	%	**56**	Q	20
% Total Fines	0.800	0.900	%	12		20

Project Name: LAWRENCE STREET PROJECT
Project Number: GHC#15029 NORFOLK

Lab Number: L1604032
Report Date: 02/26/16

Sample Receipt and Container Information

Were project specific reporting limits specified? YES

Cooler Information Custody Seal

Cooler	
A	Absent

Container Information

Container ID	Container Type	Cooler	pH	Temp deg C	Pres	Seal	Analysis(*)
L1604032-01A	Plastic 8oz unpreserved for Grai	A	N/A	3.6	Y	Absent	A2-HYDRO-TFINE(),A2-HYDRO-FSAND(),A2-HYDRO-MSAND(),A2-HYDRO-TGRAVEL(),A2-HYDRO-CSAND()
L1604032-02A	Plastic 8oz unpreserved for Grai	A	N/A	3.6	Y	Absent	A2-HYDRO-TFINE(),A2-HYDRO-FSAND(),A2-HYDRO-MSAND(),A2-HYDRO-TGRAVEL(),A2-HYDRO-CSAND()

*Values in parentheses indicate holding time in days

Project Name:	LAWRENCE STREET PROJECT	**Lab Number:**	L1604032
Project Number:	GHC#15029 NORFOLK	**Report Date:**	02/26/16

GLOSSARY

Acronyms

EDL	- Estimated Detection Limit: This value represents the level to which target analyte concentrations are reported as estimated values, when those target analyte concentrations are quantified below the reporting limit (RL). The EDL includes any adjustments from dilutions, concentrations or moisture content, where applicable. The use of EDLs is specific to the analysis of PAHs using Solid-Phase Microextraction (SPME).
EPA	- Environmental Protection Agency.
LCS	- Laboratory Control Sample: A sample matrix, free from the analytes of interest, spiked with verified known amounts of analytes or a material containing known and verified amounts of analytes.
LCSD	- Laboratory Control Sample Duplicate: Refer to LCS.
LFB	- Laboratory Fortified Blank: A sample matrix, free from the analytes of interest, spiked with verified known amounts of analytes or a material containing known and verified amounts of analytes.
MDL	- Method Detection Limit: This value represents the level to which target analyte concentrations are reported as estimated values, when those target analyte concentrations are quantified below the reporting limit (RL). The MDL includes any adjustments from dilutions, concentrations or moisture content, where applicable.
MS	- Matrix Spike Sample: A sample prepared by adding a known mass of target analyte to a specified amount of matrix sample for which an independent estimate of target analyte concentration is available.
MSD	- Matrix Spike Sample Duplicate: Refer to MS.
NA	- Not Applicable.
NC	- Not Calculated: Term is utilized when one or more of the results utilized in the calculation are non-detect at the parameter's reporting unit.
NI	- Not Ignitable.
NP	- Non-Plastic: Term is utilized for the analysis of Atterberg Limits in soil.
RL	- Reporting Limit: The value at which an instrument can accurately measure an analyte at a specific concentration. The RL includes any adjustments from dilutions, concentrations or moisture content, where applicable.
RPD	- Relative Percent Difference: The results from matrix and/or matrix spike duplicates are primarily designed to assess the precision of analytical results in a given matrix and are expressed as relative percent difference (RPD). Values which are less than five times the reporting limit for any individual parameter are evaluated by utilizing the absolute difference between the values; although the RPD value will be provided in the report.
SRM	- Standard Reference Material: A reference sample of a known or certified value that is of the same or similar matrix as the associated field samples.
STLP	- Semi-dynamic Tank Leaching Procedure per EPA Method 1315.
TIC	- Tentatively Identified Compound: A compound that has been identified to be present and is not part of the target compound list (TCL) for the method and/or program. All TICs are qualitatively identified and reported as estimated concentrations.

Footnotes

1	- The reference for this analyte should be considered modified since this analyte is absent from the target analyte list of the original method.

Terms

Total: With respect to Organic analyses, a 'Total' result is defined as the summation of results for individual isomers or Aroclors. If a 'Total' result is requested, the results of its individual components will also be reported. This is applicable to 'Total' results for methods 8260, 8081 and 8082.

Analytical Method: Both the document from which the method originates and the analytical reference method. (Example: EPA 8260B is shown as 1,8260B.) The codes for the reference method documents are provided in the References section of the Addendum.

Data Qualifiers

A	- Spectra identified as "Aldol Condensation Product".
B	- The analyte was detected above the reporting limit in the associated method blank. Flag only applies to associated field samples that have detectable concentrations of the analyte at less than ten times (10x) the concentration found in the blank. For MCP-related projects, flag only applies to associated field samples that have detectable concentrations of the analyte at less than ten times (10x) the concentration found in the blank. For DOD-related projects, flag only applies to associated field samples that have detectable concentrations of the analyte at less than ten times (10x) the concentration found in the blank AND the analyte was detected above one-half the reporting limit (or above the reporting limit for common lab contaminants) in the associated method blank. For NJ-Air-related projects, flag only applies to associated field samples that have detectable concentrations of the analyte above the reporting limit. For NJ-related projects (excluding Air), flag only applies to associated field samples that have detectable concentrations of the analyte, which was detected above the reporting limit in the associated method blank or above five times the reporting limit for common lab contaminants (Phthalates, Acetone, Methylene Chloride, 2-Butanone).

Report Format: Data Usability Report

Project Name:	LAWRENCE STREET PROJECT	**Lab Number:**	L1604032
Project Number:	GHC#15029 NORFOLK	**Report Date:**	02/26/16

Data Qualifiers

C - Co-elution: The target analyte co-elutes with a known lab standard (i.e. surrogate, internal standards, etc.) for co-extracted analyses.

D - Concentration of analyte was quantified from diluted analysis. Flag only applies to field samples that have detectable concentrations of the analyte.

E - Concentration of analyte exceeds the range of the calibration curve and/or linear range of the instrument.

G - The concentration may be biased high due to matrix interferences (i.e, co-elution) with non-target compound(s). The result should be considered estimated.

H - The analysis of pH was performed beyond the regulatory-required holding time of 15 minutes from the time of sample collection.

I - The lower value for the two columns has been reported due to obvious interference.

M - Reporting Limit (RL) exceeds the MCP CAM Reporting Limit for this analyte.

NJ - Presumptive evidence of compound. This represents an estimated concentration for Tentatively Identified Compounds (TICs), where the identification is based on a mass spectral library search.

P - The RPD between the results for the two columns exceeds the method-specified criteria.

Q - The quality control sample exceeds the associated acceptance criteria. For DOD-related projects, LCS and/or Continuing Calibration Standard exceedences are also qualified on all associated sample results. Note: This flag is not applicable for matrix spike recoveries when the sample concentration is greater than 4x the spike added or for batch duplicate RPD when the sample concentrations are less than 5x the RL. (Metals only.)

R - Analytical results are from sample re-analysis.

RE - Analytical results are from sample re-extraction.

S - Analytical results are from modified screening analysis.

J - Estimated value. This represents an estimated concentration for Tentatively Identified Compounds (TICs).

ND - Not detected at the reporting limit (RL) for the sample.

Report Format: Data Usability Report

REFERENCES

12 Annual Book of ASTM Standards. (American Society for Testing and Materials) ASTM International.

LIMITATION OF LIABILITIES

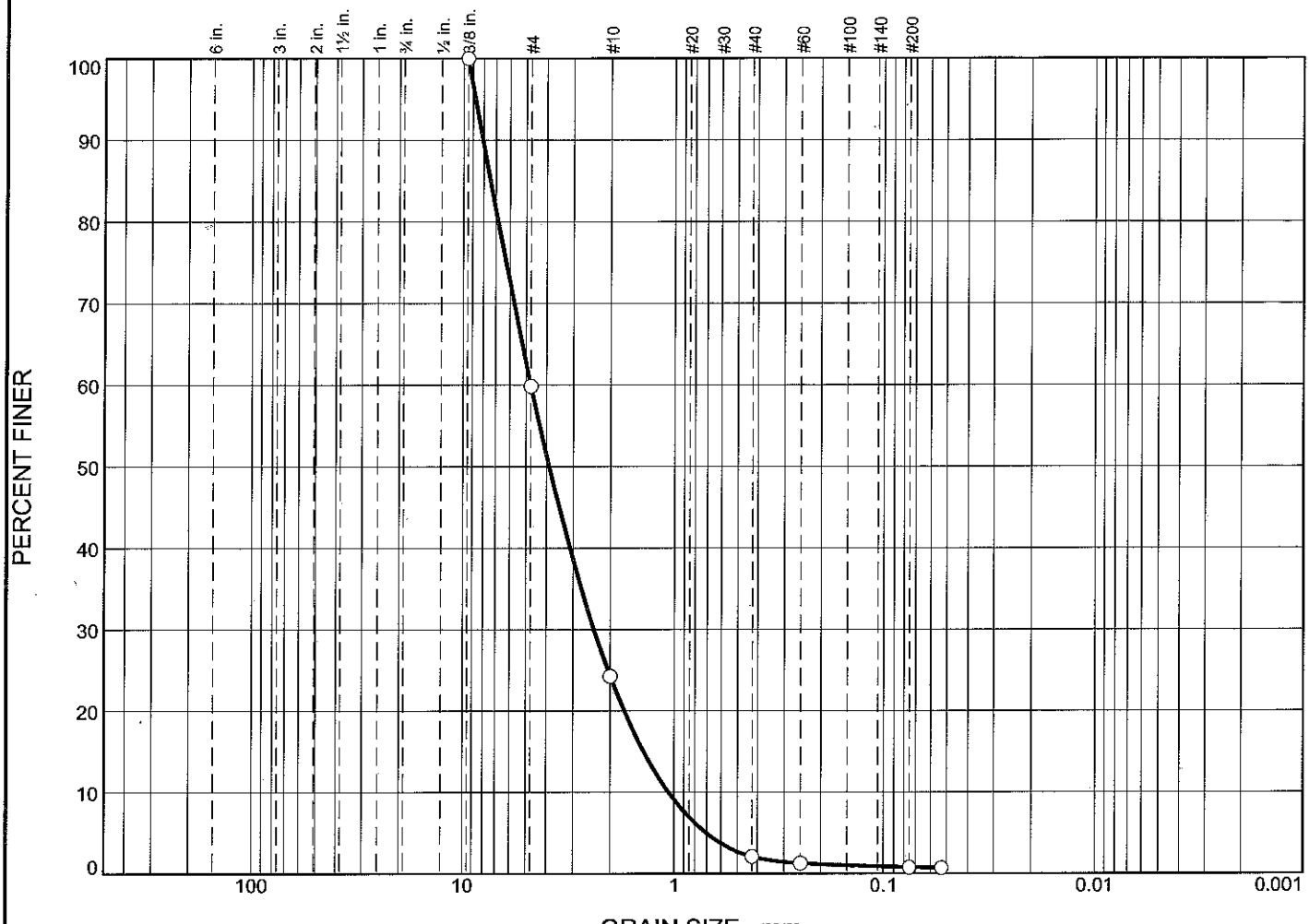
Alpha Analytical performs services with reasonable care and diligence normal to the analytical testing laboratory industry. In the event of an error, the sole and exclusive responsibility of Alpha Analytical shall be to re-perform the work at it's own expense. In no event shall Alpha Analytical be held liable for any incidental, consequential or special damages, including but not limited to, damages in any way connected with the use of, interpretation of, information or analysis provided by Alpha Analytical.

We strongly urge our clients to comply with EPA protocol regarding sample volume, preservation, cooling, containers, sampling procedures, holding time and splitting of samples in the field.

ASTM D422-63

GRAIN SIZE ANALYSIS

Particle Size Distribution Report



	% +3"	% Gravel		% Sand			% Fines	
		Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
○	0.0	0.0	40.2	35.5	22.2	1.3	0.8	

	LL	PL	D_{85}	D_{60}	D_{50}	D_{30}	D_{15}	D_{10}	C_c	C_u
○			7.4243	4.7642	3.8940	2.3880	1.3923	1.0625	1.13	4.48

	Material Description	USCS	AASHTO
○		SP	

Project No. **Client:**

Project:

○ **Source of Sample:** CAQ-1 AT 24 INCHES **Sample Number:** L1604032-01

Remarks:

Alpha Analytical

Mansfield, MA

Figure

GRAIN SIZE DISTRIBUTION TEST DATA

2/25/2016

Location: CAQ-1 AT 24 INCHES
Sample Number: L1604032-01
USCS Classification: SP

Sieve Test Data

Post #200 Wash Test Weights (grams): **Dry Sample and Tare =** 161.20
Tare Wt. = 0.00
Minus #200 from wash = 0.0%

Dry Sample and Tare (grams)	Tare (grams)	Sieve Opening Size	Weight Retained (grams)	Sieve Weight (grams)	Percent Finer
161.20	0.00	.375"	0.00	0.00	100.0
		#4	64.73	0.00	59.8
		#10	57.36	0.00	24.3
		#40	35.77	0.00	2.1
		#60	1.29	0.00	1.3
		#200	0.81	0.00	0.8
		#270	0.12	0.00	0.7

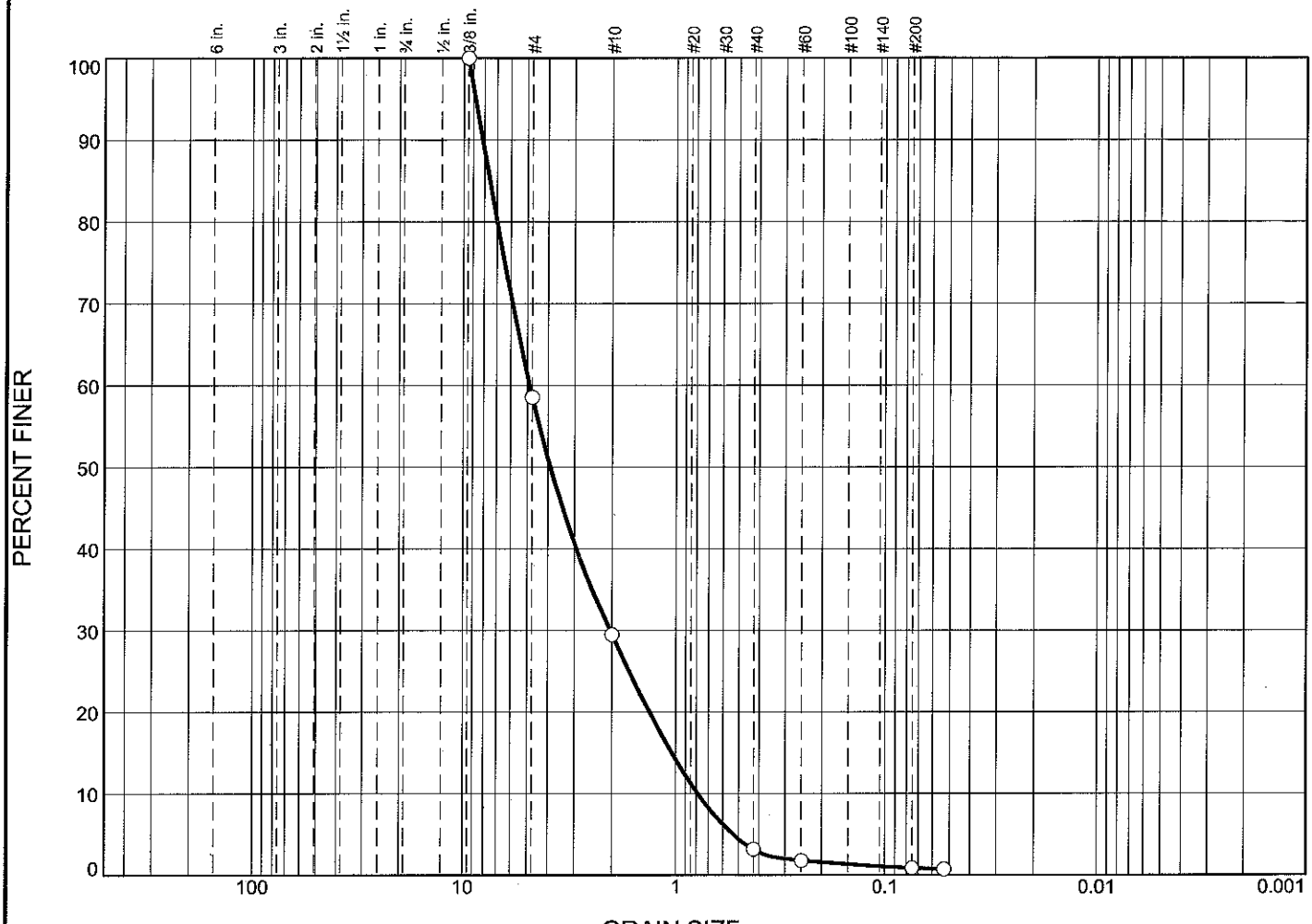
Fractional Components

Cobbles	Gravel			Sand				Fines		
	Coarse	Fine	Total	Coarse	Medium	Fine	Total	Silt	Clay	Total
0.0	0.0	40.2	40.2	35.5	22.2	1.3	59.0			0.8

D_{10}	D_{15}	D_{20}	D_{30}	D_{50}	D_{60}	D_{80}	D_{85}	D_{90}	D_{95}
1.0625	1.3923	1.7187	2.3880	3.8940	4.7642	6.8216	7.4243	8.0718	8.7698

Fineness Modulus	C_u	C_c
4.93	4.48	1.13

Particle Size Distribution Report



	% +3"	% Gravel		% Sand			% Fines	
		Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
○	0.0	0.0	41.5	29.0	26.3	2.3	0.9	

	LL	PL	D_{85}	D_{60}	D_{50}	D_{30}	D_{15}	D_{10}	C_c	C_u
○			7.5502	4.8929	3.9113	2.0402	1.0460	0.7872	1.08	6.22

	Material Description	USCS	AASHTO
○		SW	

Project No. **Client:**

Project:

○ **Source of Sample:** CAQ-1 AT 24 INCHES **Sample Number:** WG867679-1

Remarks:

Alpha Analytical

Mansfield, MA

Figure

GRAIN SIZE DISTRIBUTION TEST DATA

2/25/2016

Location: CAQ-1 AT 24 INCHES
Sample Number: WG867679-1
USCS Classification: SW

Sieve Test Data

Post #200 Wash Test Weights (grams): **Dry Sample and Tare =** 165.00
Tare Wt. = 0.00
Minus #200 from wash = 0.0%

Dry Sample and Tare (grams)	Tare (grams)	Sieve Opening Size	Weight Retained (grams)	Sieve Weight (grams)	Percent Finer
165.00	0.00	.375"	0.00	0.00	100.0
		#4	68.40	0.00	58.5
		#10	47.92	0.00	29.5
		#40	43.47	0.00	3.2
		#60	2.29	0.00	1.8
		#200	1.49	0.00	0.9
		#270	0.23	0.00	0.7

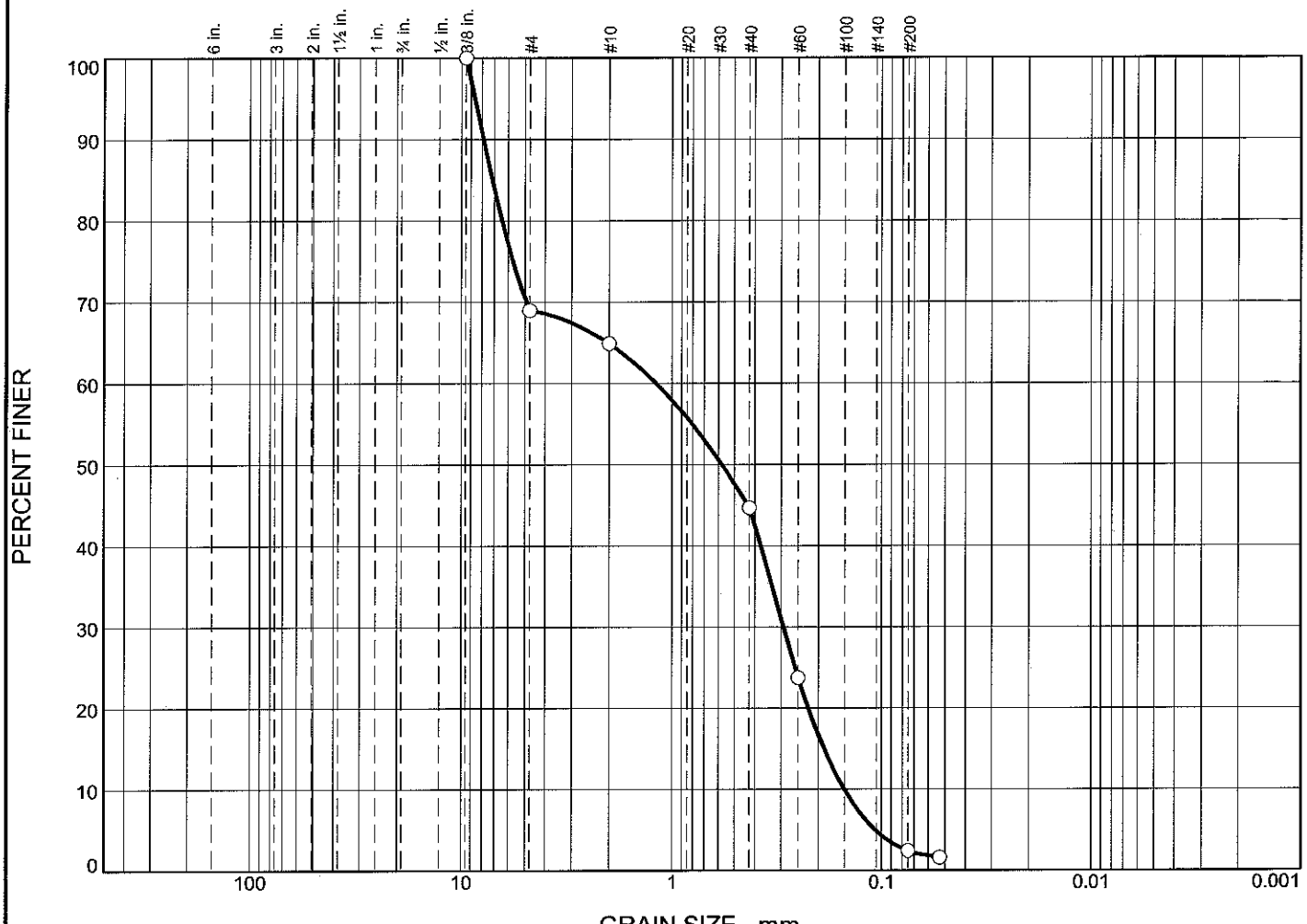
Fractional Components

Cobbles	Gravel			Sand				Fines		
	Coarse	Fine	Total	Coarse	Medium	Fine	Total	Silt	Clay	Total
0.0	0.0	41.5	41.5	29.0	26.3	2.3	57.6			0.9

D_{10}	D_{15}	D_{20}	D_{30}	D_{50}	D_{60}	D_{80}	D_{85}	D_{90}	D_{95}
0.7872	1.0460	1.3335	2.0402	3.9113	4.8929	6.9705	7.5502	8.1650	8.8210

Fineness Modulus	C_u	C_c
4.81	6.22	1.08

Particle Size Distribution Report



	% +3"	% Gravel		% Sand			% Fines	
		Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
○	0.0	0.0	31.0	4.1	20.2	42.3	2.4	

	LL	PL	D_{85}	D_{60}	D_{50}	D_{30}	D_{15}	D_{10}	C_c	C_u
○			7.1483	1.1950	0.5778	0.2940	0.1884	0.1509	0.48	7.92

Material Description	USCS	AASHTO
○	SP	

Project No. **Client:**

Project:

○ **Source of Sample:** CAQ-1 AT 54 INCHES **Sample Number:** L1604032-02

Remarks:

Alpha Analytical

Mansfield, MA

Figure

GRAIN SIZE DISTRIBUTION TEST DATA

2/25/2016

Location: CAQ-1 AT 54 INCHES
Sample Number: L1604032-02
USCS Classification: SP

Sieve Test Data

Post #200 Wash Test Weights (grams): **Dry Sample and Tare =** 115.46
Tare Wt. = 0.00
Minus #200 from wash = 0.0%

Dry Sample and Tare (grams)	Tare (grams)	Sieve Opening Size	Weight Retained (grams)	Sieve Weight (grams)	Percent Finer
115.46	0.00	.375"	0.00	0.00	100.0
		#4	35.80	0.00	69.0
		#10	4.74	0.00	64.9
		#40	23.33	0.00	44.7
		#60	24.17	0.00	23.7
		#200	24.63	0.00	2.4
		#270	0.95	0.00	1.6

Fractional Components

Cobbles	Gravel			Sand				Fines		
	Coarse	Fine	Total	Coarse	Medium	Fine	Total	Silt	Clay	Total
0.0	0.0	31.0	31.0	4.1	20.2	42.3	66.6			2.4

D_{10}	D_{15}	D_{20}	D_{30}	D_{50}	D_{60}	D_{80}	D_{85}	D_{90}	D_{95}
0.1509	0.1884	0.2239	0.2940	0.5778	1.1950	6.4289	7.1483	7.8916	8.6777

Fineness Modulus	C_u	C_c
3.14	7.92	0.48

Certification Information

The following analytes are not included in our Primary NELAP Scope of Accreditation:

Westborough Facility
EPA 524.2: 1,2-Dibromo-3-chloropropane, 1,2-Dibromoethane, m/p-xylene, o-xylene
EPA 624: 2-Butanone (MEK), 1,4-Dioxane, tert-Amylmethyl Ether, tert-Butyl Alcohol, m/p-xylene, o-xylene
EPA 625: Aniline, Benzoic Acid, Benzyl Alcohol, 4-Chloroaniline, 3-Methylphenol, 4-Methylphenol.
EPA 1010A: NPW: Ignitability
EPA 6010C: NPW: Strontium; SCM: Strontium
EPA 8151A: NPW: 2,4-DB, Dicamba, Dichloroprop, MCPA, MCPP; SCM: 2,4-DB, Dichloroprop, MCPA, MCPP
EPA 8260C: NPW: 1,2,4,5-Tetramethylbenzene; 4-Ethyltoluene, Azobenzene, Isopropanol; SCM: Iodomethane (methyl iodide), Methyl methacrylate (soil); 1,2,4,5-Tetramethylbenzene; 4-Ethyltoluene.
EPA 8270D: NPW: Pentachloronitrobenzene, 1-Methylnaphthalene, Dimethylnaphthalene,1,4-Diphenylhydrazine; SCM: Pentachloronitrobenzene, 1-Methylnaphthalene, Dimethylnaphthalene,1,4-Diphenylhydrazine.
EPA 9010: NPW: Amenable Cyanide Distillation, Total Cyanide Distillation
EPA 9038: NPW: Sulfate
EPA 9050A: NPW: Specific Conductance
EPA 9056: NPW: Chloride, Nitrate, Sulfate
EPA 9065: NPW: Phenols
EPA 9251: NPW: Chloride
SM3500: NPW: Ferrous Iron
SM4500: NPW: Amenable Cyanide, Dissolved Oxygen; SCM: Total Phosphorus, TKN, NO2, NO3.
SM5310C: DW: Dissolved Organic Carbon

Mansfield Facility
EPA 8270D: NPW: Biphenyl; SCM: Biphenyl, Caprolactam
EPA 8270D-SIM Isotope Dilution: SCM: 1,4-Dioxane
SM 2540D: TSS
SM2540G: SCM: Percent Solids
EPA 1631E: SCM: Mercury
EPA 7474: SCM: Mercury
EPA 8081B: NPW and SCM: Mirex, Hexachlorobenzene.
EPA 8082A: NPW: PCB: 1, 5, 31, 87,101, 110, 141, 151, 153, 180, 183, 187.
EPA 8270-SIM: NPW and SCM: Alkylated PAHs.
EPA TO-15: Halothane, 2,4,4-Trimethyl-2-pentene, 2,4,4-Trimethyl-1-pentene, Thiophene, 2-Methylthiophene, 3-Methylthiophene, 2-Ethylthiophene, 1,2,3-Trimethylbenzene, Indan, Indene, 1,2,4,5-Tetramethylbenzene, Benzothiophene, 1-Methylnaphthalene, n-Butylbenzene, n-Propylbenzene, sec-Butylbenzene, tert-Butylbenzene.
Biological Tissue Matrix: ***8270D-SIM; 3050B; 3051A; 7471B; 8081B; 8082A; 6020A:*** Lead***; 8270D:*** bis(2-ethylhexyl)phthalate, Butylbenzylphthalate, Diethyl phthalate, Dimethyl phthalate, Di-n-butyl phthalate, Di-n-octyl phthalate, Fluoranthene, Pentachlorophenol.

The following analytes are included in our Massachusetts DEP Scope of Accreditation, Westborough Facility:

Drinking Water
EPA 200.8: Sb,As,Ba,Be,Cd,Cr,Cu,Pb,Ni,Se,Tl; **EPA 200.7**: Ba,Be,Ca,Cd,Cr,Cu,Na; **EPA 245.1:** Mercury;
EPA 300.0: Nitrate-N, Fluoride, Sulfate; **EPA 353.2**: Nitrate-N, Nitrite-N; **SM4500NO3-F**: Nitrate-N, Nitrite-N; **SM4500F-C, SM4500CN-CE, EPA 180.1, SM2130B, SM4500Cl-D, SM2320B, SM2540C, SM4500H-B**
EPA 332: Perchlorate.
Microbiology: **SM9215B; SM9223-P/A, SM9223B-Colilert-QT, Enterolert-QT.**

Non-Potable Water
EPA 200.8: Al,Sb,As,Be,Cd,Cr,Cu,Pb,Mn,Ni,Se,Ag,Tl,Zn;
EPA 200.7: Al,Sb,As,Be,Cd,Ca,Cr,Co,Cu,Fe,Pb,Mg,Mn,Mo,Ni,K,Se,Ag,Na,Sr,Ti,Tl,V,Zn;
EPA 245.1, SM4500H,B, EPA 120.1, SM2510B, SM2540C, SM2340B, SM2320B, SM4500CL-E, SM4500F-BC, SM426C, SM4500NH3-BH, **EPA 350.1**: Ammonia-N, **LACHAT 10-107-06-1-B**: Ammonia-N, **SM4500NO3-F,**
EPA 353.2: Nitrate-N**, SM4500NH3-BC-NES, EPA 351.1, SM4500P-E, SM4500P-B, E, SM5220D, EPA 410.4, SM5210B, SM5310C, SM4500CL-D, EPA 1664, SM14 510AC, EPA 420.1, SM4500-CN-CE, SM2540D.**
EPA 624: Volatile Halocarbons & Aromatics,
EPA 608: Chlordane, Toxaphene, Aldrin, alpha-BHC, beta-BHC, gamma-BHC, delta-BHC, Dieldrin, DDD, DDE, DDT, Endosulfan I, Endosulfan II, Endosulfan sulfate, Endrin, Endrin Aldehyde, Heptachlor, Heptachlor Epoxide, PCBs
EPA 625: SVOC (Acid/Base/Neutral Extractables), **EPA 600/4-81-045**: PCB-Oil.
Microbiology: **SM9223B-Colilert-QT; Enterolert-QT, SM9222D-MF**.

For a complete listing of analytes and methods, please contact your Alpha Project Manager.

CHAIN OF CUSTODY

PAGE 1 OF 1

ALPHA ANALYTICAL

Westborough, MA TEL: 508-898-9220 FAX: 508-898-9193
Mansfield, MA TEL: 508-822-9300 FAX: 508-822-3288

Date Rec'd in Lab: 2/16/16

ALPHA Job #: L1604032

Client Information

Client: GeoHydroCycle, Inc.
Address: 151B California Street
Newton, MA 02458
Phone: (617) 527-8074
Fax:
Email: swsmith@geohydrocycle.com

☐ These samples have been Previously analyzed by Alpha

Project Information

Project Name: Lawrence Street Project
Project Location: 17 Lawrence St., Norfolk, MA
Project #: GHC#15029 Norfolk
Project Manager: Steve SMith
ALPHA Quote #:

Turn-Around Time

☒ Standard ☐ Rush (ONLY IF PRE-APPROVED)

Due Date: Time:

Report Information Data Deliverables

☐ FAX ☒ EMAIL
☐ ADEx ☐ Add'l Deliverables

Billing Information

☒ Same as Client info PO #:

Regulatory Requirements/Report Limits

State/Fed Program | Criteria

Other Project Specific Requirements/Comments/Detection Limits:
Please include a 270 Sieve.
Site is proposed for development.

ANALYSIS

SAMPLE HANDLING
Filtration
☐ Done
☐ Not Needed
☐ Lab to do
Preservation
☐ Lab to do
(Please specify below)

ALPHA Lab ID (Lab Use Only)	Sample ID	Collection Date	Collection Time	Sample Matrix	Sampler's Initials	Grain Size Analyses + 270 Sieve	Sample Specific Comments	TOTAL # BOTTLES
604032-01	CAQ-1 at 24 inche	2/12/16	11:20	Soil	SWS	☒		1
-02	CAQ-2 at 54 inches	2/12/16	10:15	Soil	SWS	☒		1
Container Type						-		
Preservative						-		

Relinquished By:	Date/Time	Received By:	Date/Time
Stephen W. Smith, GHC	2/15/16 1150	MSM AAL	2/15/16 1150
MSM	2/15/16 1232	Jan Thomas	2/05/16 1232
	2/16/16 0300		2/16/16 0300

Please print clearly, legibly and completely. Samples can not be logged in and turnaround time clock will not start until any ambiguities are resolved. All samples submitted are subject to Alpha's Payment Terms.

FORM NO: 01-01(I-NJ) (rev. 5-JAN-12)

Enclosure 6 - Slug Test Analyses Summaries

Abbeyville, Norfolk

Statistics for Hydrauic Conductvity Values

K (ft/day)	Ln K	Function	Statistical Parameter	Antilog of Parameter	Parameter Value
113.0	4.72739	=LN(A6)	Natrural Log of K		
115.0	4.74493				
85.6	4.44969				
116.0	4.75359				
10.9	2.38876				
16.3	2.79117				
15.6	2.74727				
15.9	2.76632				
23.3	3.14845				
13.1	2.57261				
23.8	3.16969				
18.7	2.92852				
274.0	5.61313				
189.0	5.24175				
145.0	4.97673				
198.0	5.28827				
10.9	2.38876				
16.5	2.80336				
14.9	2.70136				
15.2	2.72130				
15.7	2.75366				
12.7	2.54160				
13.6	2.61007				
19.3	2.96011				
238.0	5.47227				
151.0	5.01728				
156.0	5.04986				
158.0	5.06260				
8.6	2.15176				
13.0	2.56495				
11.7	2.45959				
12.0	2.48491				
13.2	2.58022				
12.1	2.49321				
11.9	2.47654				
16.3	2.79117				
53.7	3.98341				
43.0	3.76120				
87.1	4.46706				
41.1	3.71601				
117.0	4.76217				
42.4	3.74715				
63.0	4.14313				
28.2	3.33932				
25.4	3.23475				
64.3	4.16356				
24.4	3.19458				
99.8	4.60317				
40.2	3.69387				
153.0	5.03044				
42.4	3.74715				
39.4	3.67377				
17.4	2.85647				
48.0	3.87120				
22.6	3.11795				
174.0	5.15906				
198.0	5.28827				
	3.64818	Average	Mean of LNs = Geomean		38.4

Abbeyville, Norfolk

3.33932	Median	Median of LNs	28.2
1.03948	Stnd Deviation	Std Dev of Geomean = s	2.8
57	Count	Number of K Values	
2.74727	1st quartile		15.6
3.33932	2nd quartile		28.2
4.72739	3rd quartile		113.0

Confidence Interval for Geomean

57	Count
7.55	Sq Root of Count
2.003	Student's t for 95% Confidence and N-1 Degrees of Freedom
38.4	Mid value of interval, which is Geometric Mean
50.6	High end of the 95% interval
29.1	Low end of the 95% interval

Does the Geometric Mean lie between the Low and High intervals?

Low: **Yes**

High: **Yes**

Check for Outliers

5.61313	Max of LNs
0.92547	LN of T statistic for Highest K value
2.52	T statistic for the Highest K value
2.15176	Min of LNs
0.45695	LN of T statistic for Lowest K value
1.58	T statistic for the Lowest K value
2.96	From Figure 2 for N-1 DoF

274	ft/day	**OK, not an outlier**
8.6	ft/day	**OK, not an outlier**

Calculate 95% Percentile Value of K

5.28827	LN of 95% Percentile Value of K
198.0	95% Percentile Value of K

Calculate Coefficient of Variation C_v

-2.60871	LN of Cv
0.07	Coefficeint of Variation Cv

BOUWER AND RICE INTERACTIVE SLUG TEST ANALYSIS 11-17-2017

Abbeyville, Norfolk
MW-11-1
GeoHydroCycle, Inc.

Results

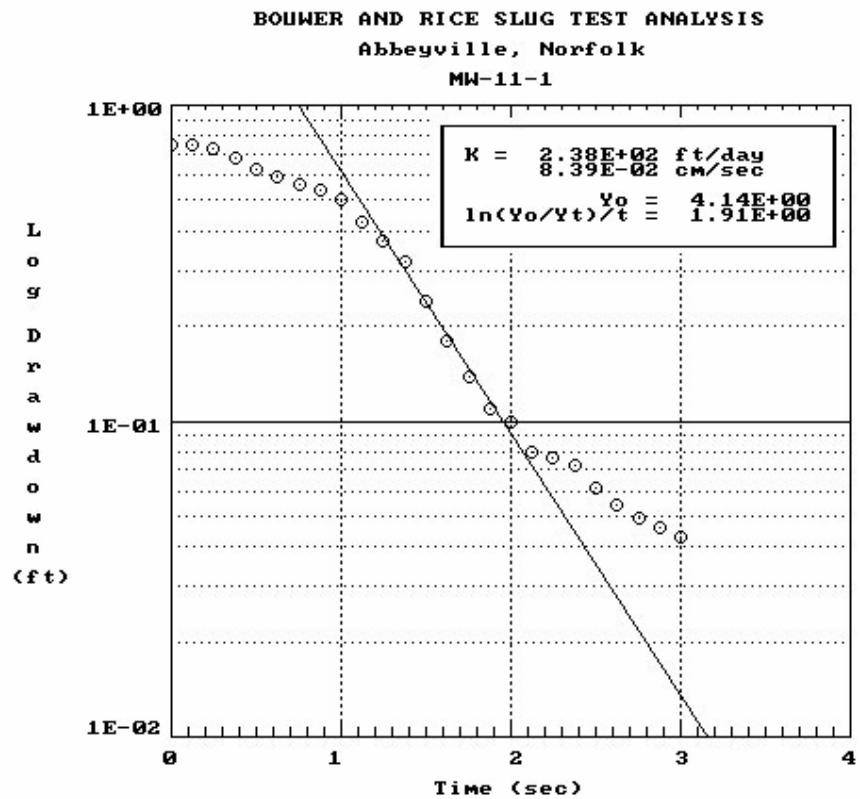
Hydraulic Conductivity:	2.38E+02	ft/day
	8.39E-02	cm/sec
Y-Intercept (Yo):	4.14E+00	ft
Well Screen Ratio (Le/rw):	13.3	
Dimensionless Parameter C:	1.43	
Slope of Line [ln(Yo/Yt)/t]:	1.908E+00	1/sec
Well Parameters (Rc^2 / 2*Le):	6.972E-04	ft
Dimensionless Ratio [ln(Re/rw)]:	2.070	
Effective Radius [Re]:	2.97	ft
Volume Tested [rw<Vol<Re]:	1.37E+02	ft^3

Well/Aquifer Parameters

Depth of well:	7.00	ft
Length of well screen:	5.00	ft
Saturated thickness:	7.00	ft
Diameter of the well casing:	0.167	ft
Diameter of the well filter:	0.750	ft

Time vs Drawdown Data

No.	Time (sec)	Drawdown (ft)	No.	Time (sec)	Drawdown (ft)	No.	Time (sec)	Drawdown (ft)
1	0.0000	0.753	2	0.1250	0.746	3	0.2500	0.726
4	0.3750	0.677	5	0.5000	0.628	6	0.6250	0.592
7	0.7500	0.559	8	0.8750	0.538	9	1.0000	0.506
10	1.1250	0.427	11	1.2500	0.374	12	1.3750	0.321
13	1.5000	0.239	14	1.6250	0.180	15	1.7500	0.138
16	1.8750	0.110	17	2.0000	0.099	18	2.1250	0.080
19	2.2500	0.077	20	2.3750	0.072	21	2.5000	0.061
22	2.6250	0.054	23	2.7500	0.049	24	2.8750	0.046
25	3.0000	0.043						



BOUWER AND RICE INTERACTIVE SLUG TEST ANALYSIS 11-17-2017

Abbeyville, Norfolk
MW-11-2
GeoHydroCycle, Inc.

Results

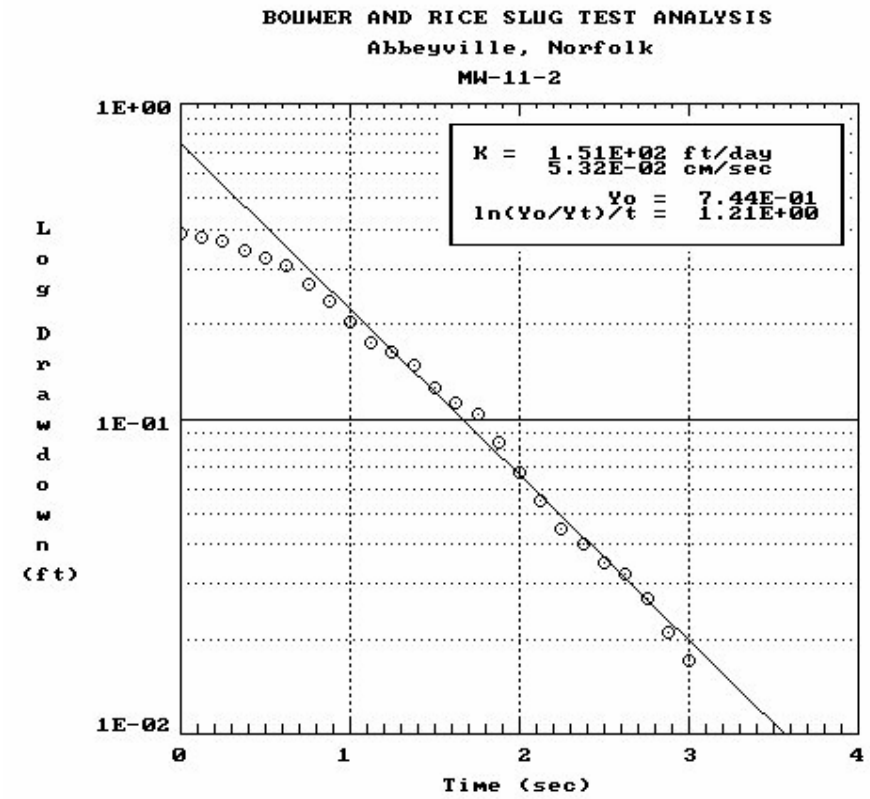
Hydraulic Conductivity:	1.51E+02	ft/day
	5.32E-02	cm/sec
Y-Intercept (Yo):	7.44E-01	ft
Well Screen Ratio (Le/rw):	13.3	
Dimensionless Parameter C:	1.43	
Slope of Line [ln(Yo/Yt)/t]:	1.209E+00	1/sec
Well Parameters (Rc^2 / 2*Le):	6.972E-04	ft
Dimensionless Ratio [ln(Re/rw)]:	2.070	
Effective Radius [Re]:	2.97	ft
Volume Tested [rw<Vol<Re]:	1.37E+02	ft^3

Well/Aquifer Parameters

Depth of well:	7.00	ft
Length of well screen:	5.00	ft
Saturated thickness:	7.00	ft
Diameter of the well casing:	0.167	ft
Diameter of the well filter:	0.750	ft

Time vs Drawdown Data

No.	Time (sec)	Drawdown (ft)	No.	Time (sec)	Drawdown (ft)	No.	Time (sec)	Drawdown (ft)
1	0.0000	0.389	2	0.1250	0.377	3	0.2500	0.367
4	0.3750	0.341	5	0.5000	0.324	6	0.6250	0.305
7	0.7500	0.268	8	0.8750	0.235	9	1.0000	0.203
10	1.1250	0.174	11	1.2500	0.162	12	1.3750	0.148
13	1.5000	0.125	14	1.6250	0.113	15	1.7500	0.103
16	1.8750	0.084	17	2.0000	0.068	18	2.1250	0.055
19	2.2500	0.045	20	2.3750	0.040	21	2.5000	0.035
22	2.6250	0.032	23	2.7500	0.027	24	2.8750	0.021
25	3.0000	0.017						



BOUWER AND RICE INTERACTIVE SLUG TEST ANALYSIS 11-17-2017

Abbeyville, Norfolk
MW-11-3
GeoHydroCycle, Inc.

Results

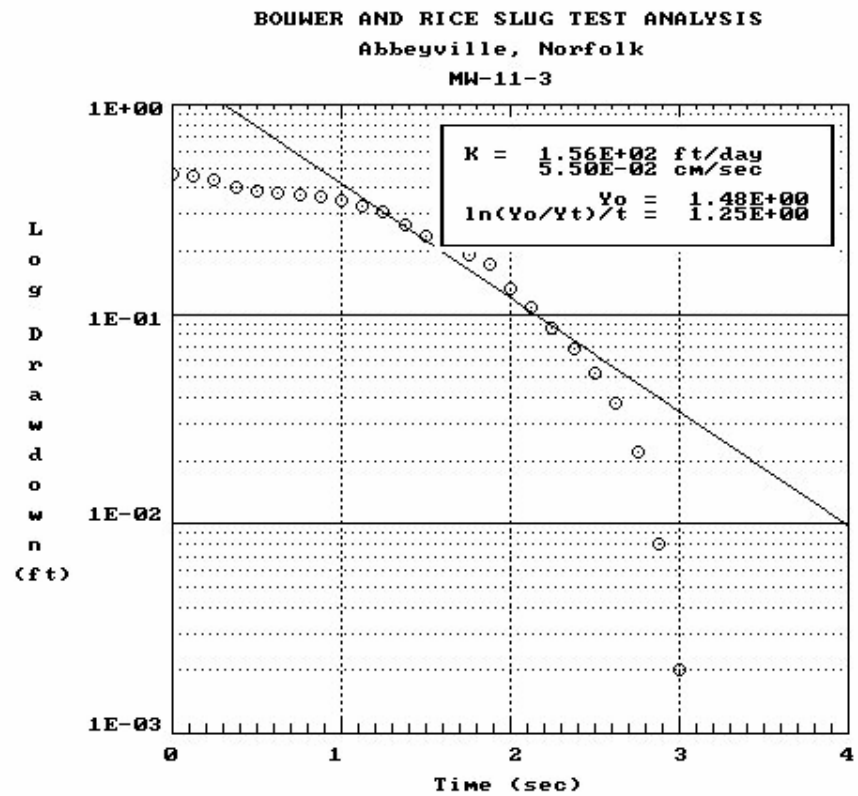
Hydraulic Conductivity:	1.56E+02	ft/day
	5.50E-02	cm/sec
Y-Intercept (Yo):	1.48E+00	ft
Well Screen Ratio (Le/rw):	13.3	
Dimensionless Parameter C:	1.43	
Slope of Line [ln(Yo/Yt)/t]:	1.250E+00	1/sec
Well Parameters (Rc^2 / 2*Le):	6.972E-04	ft
Dimensionless Ratio [ln(Re/rw)]:	2.070	
Effective Radius [Re]:	2.97	ft
Volume Tested [rw<Vol<Re]:	1.37E+02	ft^3

Well/Aquifer Parameters

Depth of well:	7.00	ft
Length of well screen:	5.00	ft
Saturated thickness:	7.00	ft
Diameter of the well casing:	0.167	ft
Diameter of the well filter:	0.750	ft

Time vs Drawdown Data

No.	Time (sec)	Drawdown (ft)	No.	Time (sec)	Drawdown (ft)	No.	Time (sec)	Drawdown (ft)
1	0.0000	0.469	2	0.1250	0.455	3	0.2500	0.435
4	0.3750	0.406	5	0.5000	0.388	6	0.6250	0.382
7	0.7500	0.375	8	0.8750	0.365	9	1.0000	0.350
10	1.1250	0.331	11	1.2500	0.311	12	1.3750	0.265
13	1.5000	0.234	14	1.6250	0.211	15	1.7500	0.193
16	1.8750	0.175	17	2.0000	0.133	18	2.1250	0.108
19	2.2500	0.086	20	2.3750	0.069	21	2.5000	0.052
22	2.6250	0.038	23	2.7500	0.022	24	2.8750	0.008
25	3.0000	0.002						



BOUWER AND RICE INTERACTIVE SLUG TEST ANALYSIS 11-17-2017

Abbeyville, Norfolk
MW-11-4
GeoHydroCycle, Inc.

Results

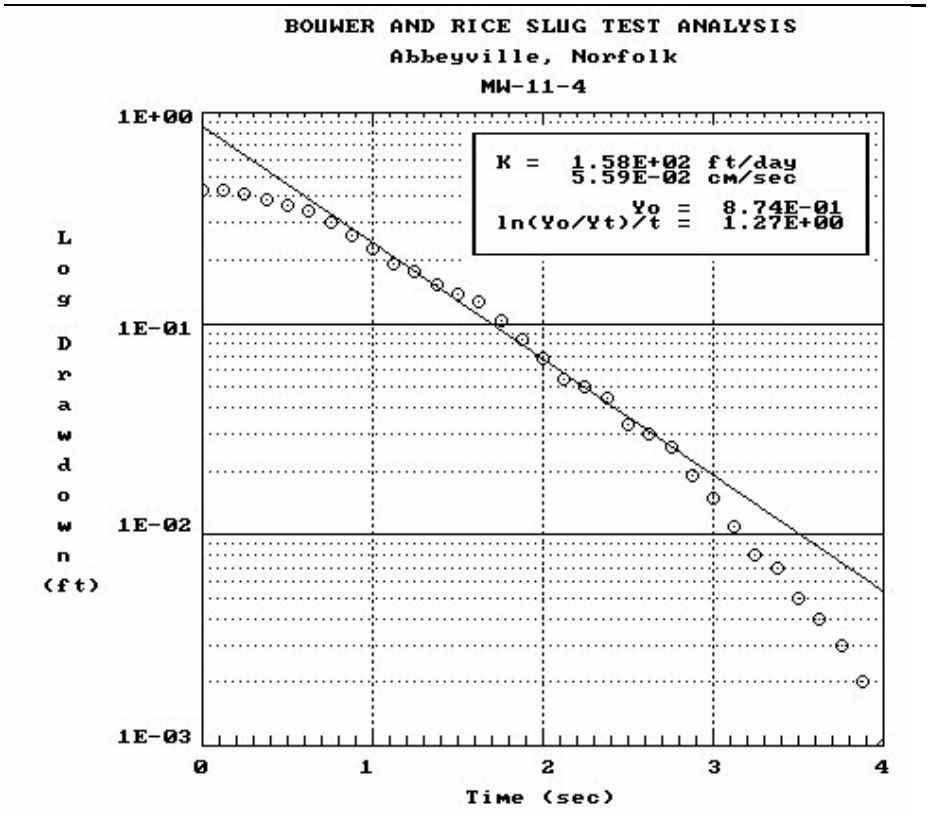
Hydraulic Conductivity:	1.58E+02	ft/day
	5.59E-02	cm/sec
Y-Intercept (Yo):	8.74E-01	ft
Well Screen Ratio (Le/rw):	13.3	
Dimensionless Parameter C:	1.43	
Slope of Line [ln(Yo/Yt)/t]:	1.270E+00	1/sec
Well Parameters (Rc^2 / 2*Le):	6.972E-04	ft
Dimensionless Ratio [ln(Re/rw)]:	2.070	
Effective Radius [Re]:	2.97	ft
Volume Tested [rw<Vol<Re]:	1.37E+02	ft^3

Well/Aquifer Parameters

Depth of well:	7.00	ft
Length of well screen:	5.00	ft
Saturated thickness:	7.00	ft
Diameter of the well casing:	0.167	ft
Diameter of the well filter:	0.750	ft

Time vs Drawdown Data

No.	Time (sec)	Drawdown (ft)	No.	Time (sec)	Drawdown (ft)	No.	Time (sec)	Drawdown (ft)
1	0.0000	0.431	2	0.1250	0.426	3	0.2500	0.414
4	0.3750	0.385	5	0.5000	0.365	6	0.6250	0.343
7	0.7500	0.301	8	0.8750	0.262	9	1.0000	0.226
10	1.1250	0.193	11	1.2500	0.178	12	1.3750	0.152
13	1.5000	0.139	14	1.6250	0.126	15	1.7500	0.104
16	1.8750	0.085	17	2.0000	0.068	18	2.1250	0.055
19	2.2500	0.050	20	2.3750	0.044	21	2.5000	0.033
22	2.6250	0.030	23	2.7500	0.026	24	2.8750	0.019
25	3.0000	0.015	26	3.1250	0.011	27	3.2500	0.008
28	3.3750	0.007	29	3.5000	0.005	30	3.6250	0.004
31	3.7500	0.003	32	3.8750	0.002	33	4.0000	0.001



BOUWER AND RICE INTERACTIVE SLUG TEST ANALYSIS 11-17-2017

Abbeyville, Norfolk
MW-12-1
GeoHydroCycle, Inc.

Results

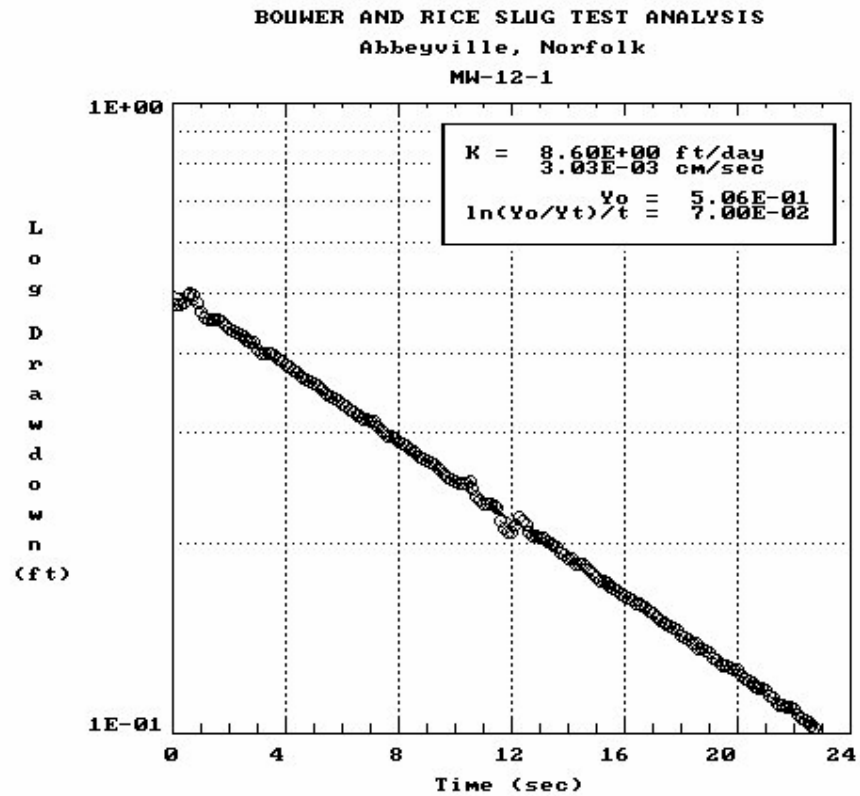
Hydraulic Conductivity:	8.60E+00	ft/day
	3.03E-03	cm/sec
Y-Intercept (Yo):	5.06E-01	ft
Well Screen Ratio (Le/rw):	13.3	
Dimensionless Parameter C:	1.43	
Slope of Line [ln(Yo/Yt)/t]:	7.002E-02	1/sec
Well Parameters (Rc^2 / 2*Le):	6.972E-04	ft
Dimensionless Ratio [ln(Re/rw)]:	2.038	
Effective Radius [Re]:	2.88	ft
Volume Tested [rw<Vol<Re]:	1.28E+02	ft^3

Well/Aquifer Parameters

Depth of well:	6.60	ft
Length of well screen:	5.00	ft
Saturated thickness:	6.60	ft
Diameter of the well casing:	0.167	ft
Diameter of the well filter:	0.750	ft

Time vs Drawdown Data

No.	Time (sec)	Drawdown (ft)	No.	Time (sec)	Drawdown (ft)	No.	Time (sec)	Drawdown (ft)
1	0.0000	0.480	2	0.1250	0.480	3	0.2500	0.479
4	0.3750	0.484	5	0.5000	0.495	6	0.6250	0.500
7	0.7500	0.497	8	0.8750	0.483	9	1.0000	0.465
10	1.1250	0.457	11	1.2500	0.454	12	1.3750	0.455
13	1.5000	0.455	14	1.6250	0.453	15	1.7500	0.450
16	1.8750	0.443	17	2.0000	0.439	18	2.1250	0.435
19	2.2500	0.431	20	2.3750	0.428	21	2.5000	0.426
22	2.6250	0.421	23	2.7500	0.419	24	2.8750	0.417
25	3.0000	0.407	26	3.1250	0.402	27	3.2500	0.402
28	3.3750	0.402	29	3.5000	0.400	30	3.6250	0.397
31	3.7500	0.393	32	3.8750	0.390	33	4.0000	0.385
34	4.1250	0.381	35	4.2500	0.377	36	4.3750	0.373
37	4.5000	0.370	38	4.6250	0.367	39	4.7500	0.364
40	4.8750	0.362	41	5.0000	0.360	42	5.1250	0.356
43	5.2500	0.352	44	5.3750	0.347	45	5.5000	0.344
46	5.6250	0.342	47	5.7500	0.340	48	5.8750	0.337
49	6.0000	0.334	50	6.1250	0.331	51	6.2500	0.327
52	6.3750	0.324	53	6.5000	0.320	54	6.6250	0.319
55	6.7500	0.316	56	6.8750	0.315	57	7.0000	0.313
58	7.1250	0.312	59	7.2500	0.306	60	7.3750	0.302
61	7.5000	0.300	62	7.6250	0.297	63	7.7500	0.296
64	7.8750	0.294	65	8.0000	0.291	66	8.1250	0.288
67	8.2500	0.286	68	8.3750	0.283	69	8.5000	0.280
70	8.6250	0.278	71	8.7500	0.274	72	8.8750	0.273
73	9.0000	0.270	74	9.1250	0.269	75	9.2500	0.267
76	9.3750	0.264	77	9.5000	0.262	78	9.6250	0.258
79	9.7500	0.254	80	9.8750	0.253	81	10.0000	0.252
82	10.1250	0.250	83	10.2500	0.249	84	10.3750	0.250
85	10.5000	0.251	86	10.6250	0.244	87	10.7500	0.237
88	10.8750	0.234	89	11.0000	0.231	90	11.1250	0.231
91	11.2500	0.231	92	11.3750	0.230	93	11.5000	0.228
94	11.6250	0.218	95	11.7500	0.211	96	11.8750	0.208
97	12.0000	0.209	98	12.1250	0.214	99	12.2500	0.220
100	12.3750	0.217	101	12.5000	0.214	102	12.6250	0.208
103	12.7500	0.206	104	12.8750	0.206	105	13.0000	0.205
106	13.1250	0.204	107	13.2500	0.201	108	13.3750	0.200
109	13.5000	0.199	110	13.6250	0.197	111	13.7500	0.194
112	13.8750	0.192	113	14.0000	0.190	114	14.1250	0.189
115	14.2500	0.186	116	14.3750	0.186	117	14.5000	0.185
118	14.6250	0.184	119	14.7500	0.182	120	14.8750	0.179
121	15.0000	0.177	122	15.1250	0.175	123	15.2500	0.175
124	15.3750	0.173	125	15.5000	0.171	126	15.6250	0.170
127	15.7500	0.169	128	15.8750	0.166	129	16.0000	0.165



BOUWER AND RICE INTERACTIVE SLUG TEST ANALYSIS 11-17-2017

Abbeyville, Norfolk
MW-12-2
GeoHydroCycle, Inc.

Results

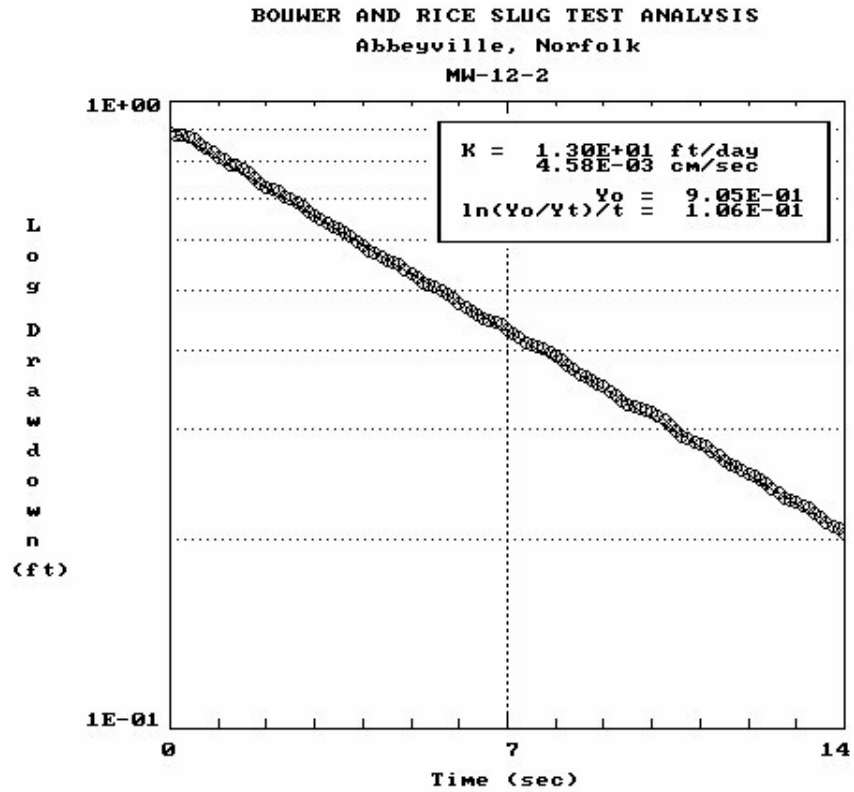
Hydraulic Conductivity:	1.30E+01	ft/day
	4.58E-03	cm/sec
Y-Intercept (Yo):	9.05E-01	ft
Well Screen Ratio (Le/rw):	13.3	
Dimensionless Parameter C:	1.43	
Slope of Line [ln(Yo/Yt)/t]:	1.057E-01	1/sec
Well Parameters (Rc^2 / 2*Le):	6.972E-04	ft
Dimensionless Ratio [ln(Re/rw)]:	2.038	
Effective Radius [Re]:	2.88	ft
Volume Tested [rw<Vol<Re]:	1.28E+02	ft^3

Well/Aquifer Parameters

Depth of well:	6.60	ft
Length of well screen:	5.00	ft
Saturated thickness:	6.60	ft
Diameter of the well casing:	0.167	ft
Diameter of the well filter:	0.750	ft

Time vs Drawdown Data

No.	Time (sec)	Drawdown (ft)	No.	Time (sec)	Drawdown (ft)	No.	Time (sec)	Drawdown (ft)
1	0.0000	0.887	2	0.1250	0.885	3	0.2500	0.881
4	0.3750	0.876	5	0.5000	0.869	6	0.6250	0.856
7	0.7500	0.842	8	0.8750	0.829	9	1.0000	0.814
10	1.1250	0.807	11	1.2500	0.794	12	1.3750	0.789
13	1.5000	0.782	14	1.6250	0.768	15	1.7500	0.754
16	1.8750	0.741	17	2.0000	0.729	18	2.1250	0.724
19	2.2500	0.717	20	2.3750	0.705	21	2.5000	0.699
22	2.6250	0.692	23	2.7500	0.680	24	2.8750	0.668
25	3.0000	0.656	26	3.1250	0.647	27	3.2500	0.641
28	3.3750	0.631	29	3.5000	0.626	30	3.6250	0.619
31	3.7500	0.608	32	3.8750	0.598	33	4.0000	0.588
34	4.1250	0.578	35	4.2500	0.574	36	4.3750	0.565
37	4.5000	0.559	38	4.6250	0.554	39	4.7500	0.549
40	4.8750	0.539	41	5.0000	0.531	42	5.1250	0.523
43	5.2500	0.514	44	5.3750	0.510	45	5.5000	0.506
46	5.6250	0.498	47	5.7500	0.493	48	5.8750	0.485
49	6.0000	0.477	50	6.1250	0.470	51	6.2500	0.462
52	6.3750	0.458	53	6.5000	0.451	54	6.6250	0.447
55	6.7500	0.444	56	6.8750	0.441	57	7.0000	0.433
58	7.1250	0.427	59	7.2500	0.420	60	7.3750	0.413
61	7.5000	0.409	62	7.6250	0.406	63	7.7500	0.403
64	7.8750	0.399	65	8.0000	0.394	66	8.1250	0.386
67	8.2500	0.379	68	8.3750	0.374	69	8.5000	0.367
70	8.6250	0.363	71	8.7500	0.358	72	8.8750	0.355
73	9.0000	0.351	74	9.1250	0.345	75	9.2500	0.340
76	9.3750	0.334	77	9.5000	0.329	78	9.6250	0.327
79	9.7500	0.325	80	9.8750	0.321	81	10.0000	0.319
82	10.1250	0.315	83	10.2500	0.310	84	10.3750	0.304
85	10.5000	0.298	86	10.6250	0.293	87	10.7500	0.291
88	10.8750	0.286	89	11.0000	0.284	90	11.1250	0.282
91	11.2500	0.277	92	11.3750	0.273	93	11.5000	0.267
94	11.6250	0.263	95	11.7500	0.261	96	11.8750	0.259
97	12.0000	0.255	98	12.1250	0.253	99	12.2500	0.250
100	12.3750	0.246	101	12.5000	0.241	102	12.6250	0.237
103	12.7500	0.233	104	12.8750	0.232	105	13.0000	0.230
106	13.1250	0.227	107	13.2500	0.225	108	13.3750	0.220
109	13.5000	0.217	110	13.6250	0.213	111	13.7500	0.210
112	13.8750	0.208	113	14.0000	0.204	114	14.1250	0.189



BOUWER AND RICE INTERACTIVE SLUG TEST ANALYSIS 11-17-2017

Abbeyville, Norfolk
MW-12-3
GeoHydroCycle, Inc.

Results

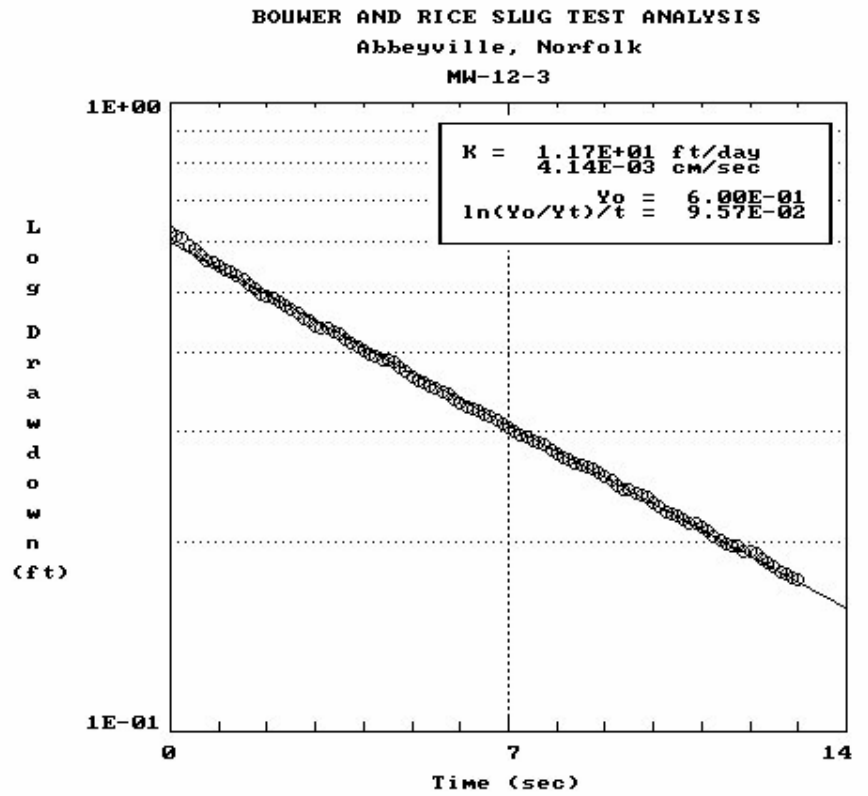
Hydraulic Conductivity:	1.17E+01	ft/day
	4.14E-03	cm/sec
Y-Intercept (Yo):	6.00E-01	ft
Well Screen Ratio (Le/rw):	13.3	
Dimensionless Parameter C:	1.43	
Slope of Line [ln(Yo/Yt)/t]:	9.565E-02	1/sec
Well Parameters (Rc^2 / 2*Le):	6.972E-04	ft
Dimensionless Ratio [ln(Re/rw)]:	2.038	
Effective Radius [Re]:	2.88	ft
Volume Tested [rw<Vol<Re]:	1.28E+02	ft^3

Well/Aquifer Parameters

Depth of well:	6.60	ft
Length of well screen:	5.00	ft
Saturated thickness:	6.60	ft
Diameter of the well casing:	0.167	ft
Diameter of the well filter:	0.750	ft

Time vs Drawdown Data

No.	Time (sec)	Drawdown (ft)	No.	Time (sec)	Drawdown (ft)	No.	Time (sec)	Drawdown (ft)
1	0.0000	0.623	2	0.1250	0.615	3	0.2500	0.608
4	0.3750	0.595	5	0.5000	0.584	6	0.6250	0.572
7	0.7500	0.563	8	0.8750	0.558	9	1.0000	0.549
10	1.1250	0.543	11	1.2500	0.539	12	1.3750	0.533
13	1.5000	0.523	14	1.6250	0.514	15	1.7500	0.505
16	1.8750	0.497	17	2.0000	0.493	18	2.1250	0.489
19	2.2500	0.482	20	2.3750	0.477	21	2.5000	0.470
22	2.6250	0.462	23	2.7500	0.455	24	2.8750	0.449
25	3.0000	0.442	26	3.1250	0.439	27	3.2500	0.437
28	3.3750	0.433	29	3.5000	0.428	30	3.6250	0.421
31	3.7500	0.414	32	3.8750	0.409	33	4.0000	0.403
34	4.1250	0.399	35	4.2500	0.395	36	4.3750	0.391
37	4.5000	0.389	38	4.6250	0.386	39	4.7500	0.379
40	4.8750	0.373	41	5.0000	0.367	42	5.1250	0.361
43	5.2500	0.359	44	5.3750	0.354	45	5.5000	0.352
46	5.6250	0.348	47	5.7500	0.344	48	5.8750	0.338
49	6.0000	0.333	50	6.1250	0.329	51	6.2500	0.326
52	6.3750	0.324	53	6.5000	0.319	54	6.6250	0.317
55	6.7500	0.314	56	6.8750	0.309	57	7.0000	0.304
58	7.1250	0.301	59	7.2500	0.296	60	7.3750	0.294
61	7.5000	0.290	62	7.6250	0.288	63	7.7500	0.286
64	7.8750	0.281	65	8.0000	0.277	66	8.1250	0.273
67	8.2500	0.270	68	8.3750	0.267	69	8.5000	0.266
70	8.6250	0.264	71	8.7500	0.261	72	8.8750	0.259
73	9.0000	0.255	74	9.1250	0.251	75	9.2500	0.246
76	9.3750	0.243	77	9.5000	0.242	78	9.6250	0.239
79	9.7500	0.238	80	9.8750	0.236	81	10.0000	0.231
82	10.1250	0.228	83	10.2500	0.224	84	10.3750	0.222
85	10.5000	0.220	86	10.6250	0.217	87	10.7500	0.215
88	10.8750	0.214	89	11.0000	0.212	90	11.1250	0.208
91	11.2500	0.205	92	11.3750	0.202	93	11.5000	0.199
94	11.6250	0.198	95	11.7500	0.197	96	11.8750	0.194
97	12.0000	0.193	98	12.1250	0.192	99	12.2500	0.188
100	12.3750	0.185	101	12.5000	0.183	102	12.6250	0.179
103	12.7500	0.178	104	12.8750	0.176	105	13.0000	0.175



BOUWER AND RICE INTERACTIVE SLUG TEST ANALYSIS 11-17-2017

Abbeyville, Norfolk
MW-12-4
GeoHydroCycle, Inc.

Results

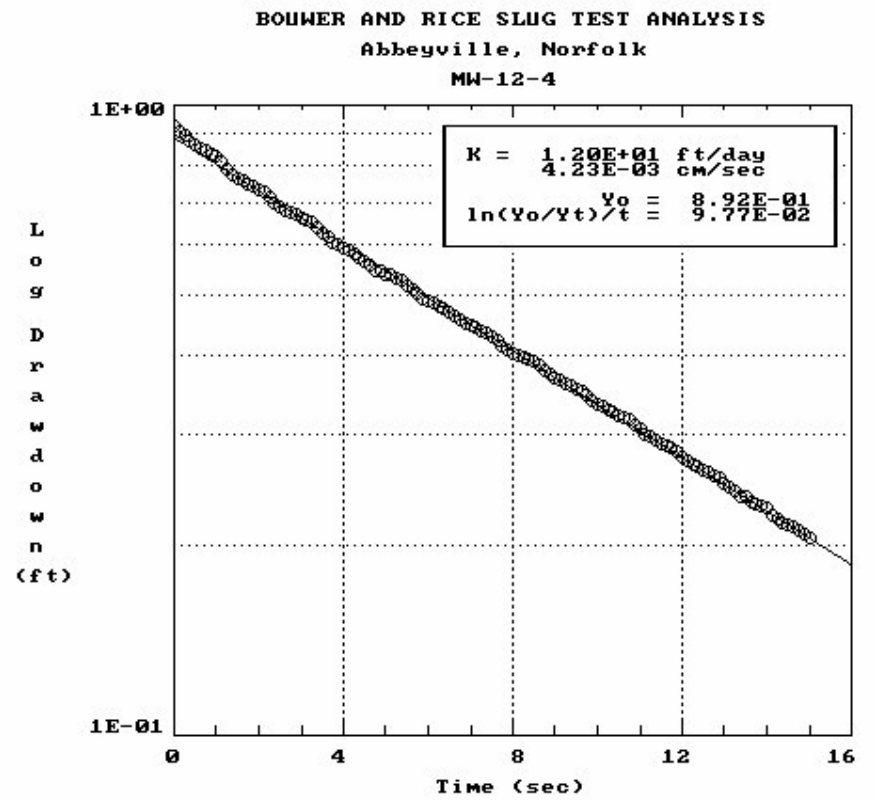
Hydraulic Conductivity:	1.20E+01	ft/day
	4.23E-03	cm/sec
Y-Intercept (Yo):	8.92E-01	ft
Well Screen Ratio (Le/rw):	13.3	
Dimensionless Parameter C:	1.43	
Slope of Line [ln(Yo/Yt)/t]:	9.766E-02	1/sec
Well Parameters (Rc^2 / 2*Le):	6.972E-04	ft
Dimensionless Ratio [ln(Re/rw)]:	2.038	
Effective Radius [Re]:	2.88	ft
Volume Tested [rw<Vol<Re]:	1.28E+02	ft^3

Well/Aquifer Parameters

Depth of well:	6.60	ft
Length of well screen:	5.00	ft
Saturated thickness:	6.60	ft
Diameter of the well casing:	0.167	ft
Diameter of the well filter:	0.750	ft

Time vs Drawdown Data

No.	Time (sec)	Drawdown (ft)	No.	Time (sec)	Drawdown (ft)	No.	Time (sec)	Drawdown (ft)
1	0.0000	0.926	2	0.1250	0.910	3	0.2500	0.895
4	0.3750	0.879	5	0.5000	0.863	6	0.6250	0.856
7	0.7500	0.847	8	0.8750	0.839	9	1.0000	0.830
10	1.1250	0.813	11	1.2500	0.794	12	1.3750	0.778
13	1.5000	0.765	14	1.6250	0.759	15	1.7500	0.748
16	1.8750	0.742	17	2.0000	0.736	18	2.1250	0.729
19	2.2500	0.715	20	2.3750	0.701	21	2.5000	0.690
22	2.6250	0.680	23	2.7500	0.675	24	2.8750	0.669
25	3.0000	0.663	26	3.1250	0.658	27	3.2500	0.651
28	3.3750	0.638	29	3.5000	0.626	30	3.6250	0.617
31	3.7500	0.606	32	3.8750	0.602	33	4.0000	0.592
34	4.1250	0.588	35	4.2500	0.583	36	4.3750	0.574
37	4.5000	0.565	38	4.6250	0.556	39	4.7500	0.548
40	4.8750	0.545	41	5.0000	0.540	42	5.1250	0.537
43	5.2500	0.532	44	5.3750	0.527	45	5.5000	0.518
46	5.6250	0.510	47	5.7500	0.502	48	5.8750	0.494
49	6.0000	0.490	50	6.1250	0.485	51	6.2500	0.480
52	6.3750	0.476	53	6.5000	0.470	54	6.6250	0.463
55	6.7500	0.456	56	6.8750	0.450	57	7.0000	0.446
58	7.1250	0.443	59	7.2500	0.437	60	7.3750	0.434
61	7.5000	0.430	62	7.6250	0.423	63	7.7500	0.416
64	7.8750	0.410	65	8.0000	0.405	66	8.1250	0.402
67	8.2500	0.399	68	8.3750	0.396	69	8.5000	0.393
70	8.6250	0.386	71	8.7500	0.380	72	8.8750	0.374
73	9.0000	0.369	74	9.1250	0.366	75	9.2500	0.361
76	9.3750	0.358	77	9.5000	0.355	78	9.6250	0.352
79	9.7500	0.347	80	9.8750	0.341	81	10.0000	0.336
82	10.1250	0.332	83	10.2500	0.329	84	10.3750	0.326
85	10.5000	0.321	86	10.6250	0.319	87	10.7500	0.317
88	10.8750	0.311	89	11.0000	0.306	90	11.1250	0.301
91	11.2500	0.299	92	11.3750	0.294	93	11.5000	0.291
94	11.6250	0.289	95	11.7500	0.286	96	11.8750	0.282
97	12.0000	0.277	98	12.1250	0.272	99	12.2500	0.269
100	12.3750	0.267	101	12.5000	0.263	102	12.6250	0.261
103	12.7500	0.259	104	12.8750	0.256	105	13.0000	0.252
106	13.1250	0.248	107	13.2500	0.245	108	13.3750	0.240
109	13.5000	0.239	110	13.6250	0.235	111	13.7500	0.233
112	13.8750	0.232	113	14.0000	0.229	114	14.1250	0.224
115	14.2500	0.221	116	14.3750	0.218	117	14.5000	0.216
118	14.6250	0.214	119	14.7500	0.211	120	14.8750	0.209
121	15.0000	0.206						



BOUWER AND RICE INTERACTIVE SLUG TEST ANALYSIS 11-17-2017

Abbeyville, Norfolk
MW-13-1
GeoHydroCycle, Inc.

Results

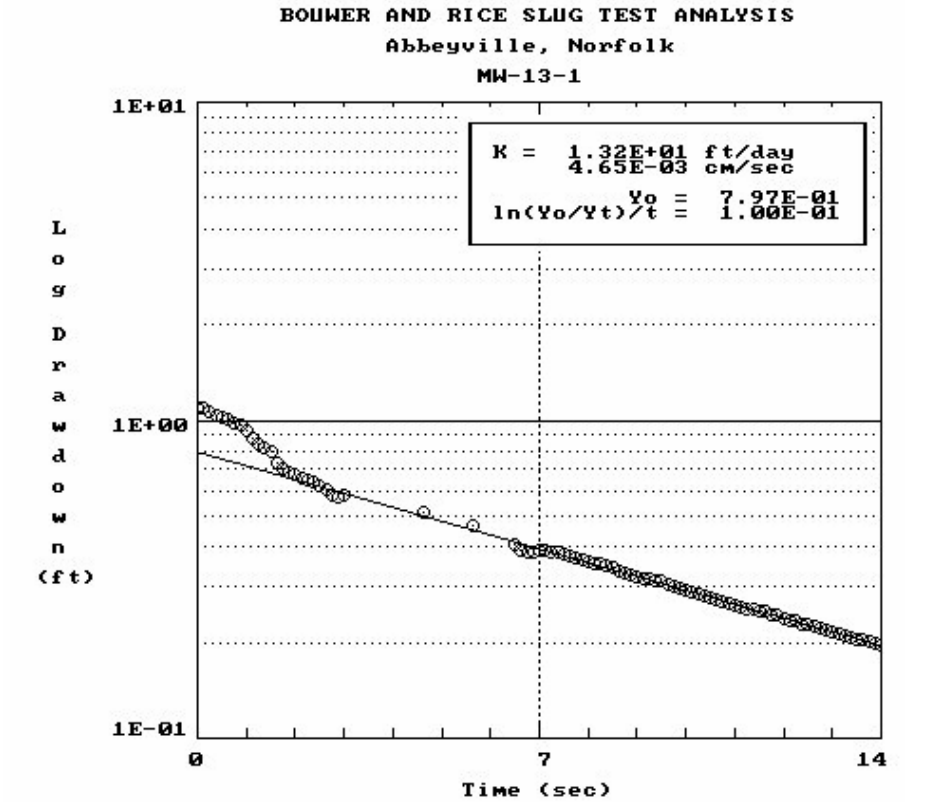
Hydraulic Conductivity:	1.32E+01	ft/day
	4.65E-03	cm/sec
Y-Intercept (Yo):	7.97E-01	ft
Well Screen Ratio (Le/rw):	13.3	
Dimensionless Parameter C:	1.43	
Slope of Line [ln(Yo/Yt)/t]:	1.005E-01	1/sec
Well Parameters (Rc^2 / 2*Le):	6.972E-04	ft
Dimensionless Ratio [ln(Re/rw)]:	2.175	
Effective Radius [Re]:	3.30	ft
Volume Tested [rw<Vol<Re]:	1.69E+02	ft^3

Well/Aquifer Parameters

Depth of well:	8.50	ft
Length of well screen:	5.00	ft
Saturated thickness:	8.50	ft
Diameter of the well casing:	0.167	ft
Diameter of the well filter:	0.750	ft

Time vs Drawdown Data

No.	Time (sec)	Drawdown (ft)	No.	Time (sec)	Drawdown (ft)	No.	Time (sec)	Drawdown (ft)
1	0.0000	1.098	2	0.1250	1.091	3	0.2500	1.062
4	0.3750	1.036	5	0.5000	1.022	6	0.6250	1.005
7	0.7500	0.975	8	0.8750	0.962	9	1.0000	0.927
10	1.1250	0.876	11	1.2500	0.844	12	1.3750	0.822
13	1.5000	0.797	14	1.6250	0.736	15	1.7500	0.701
16	1.8750	0.684	17	2.0000	0.673	18	2.1250	0.656
19	2.2500	0.647	20	2.3750	0.641	21	2.5000	0.623
22	2.6250	0.609	23	2.7500	0.585	24	2.8750	0.570
25	3.0000	0.580	26	4.6250	0.511	27	5.6250	0.469
28	6.5000	0.404	29	6.6250	0.389	30	6.7500	0.386
31	6.8750	0.387	32	7.0000	0.392	33	7.1250	0.389
34	7.2500	0.387	35	7.3750	0.385	36	7.5000	0.379
37	7.6250	0.373	38	7.7500	0.369	39	7.8750	0.363
40	8.0000	0.360	41	8.1250	0.355	42	8.2500	0.352
43	8.3750	0.349	44	8.5000	0.343	45	8.6250	0.337
46	8.7500	0.332	47	8.8750	0.327	48	9.0000	0.323
49	9.1250	0.319	50	9.2500	0.316	51	9.3750	0.313
52	9.5000	0.311	53	9.6250	0.305	54	9.7500	0.300
55	9.8750	0.296	56	10.0000	0.291	57	10.1250	0.289
58	10.2500	0.285	59	10.3750	0.280	60	10.5000	0.278
61	10.6250	0.274	62	10.7500	0.270	63	10.8750	0.265
64	11.0000	0.261	65	11.1250	0.257	66	11.2500	0.256
67	11.3750	0.254	68	11.5000	0.252	69	11.6250	0.250
70	11.7500	0.246	71	11.8750	0.243	72	12.0000	0.239
73	12.1250	0.235	74	12.2500	0.233	75	12.3750	0.229
76	12.5000	0.227	77	12.6250	0.225	78	12.7500	0.223
79	12.8750	0.219	80	13.0000	0.216	81	13.1250	0.212
82	13.2500	0.209	83	13.3750	0.207	84	13.5000	0.204
85	13.6250	0.203	86	13.7500	0.201	87	13.8750	0.198
88	14.0000	0.195						



BOUWER AND RICE INTERACTIVE SLUG TEST ANALYSIS 11-17-2017

Abbeyville, Norfolk
MW-13-2
GeoHydroCycle, Inc.

Results

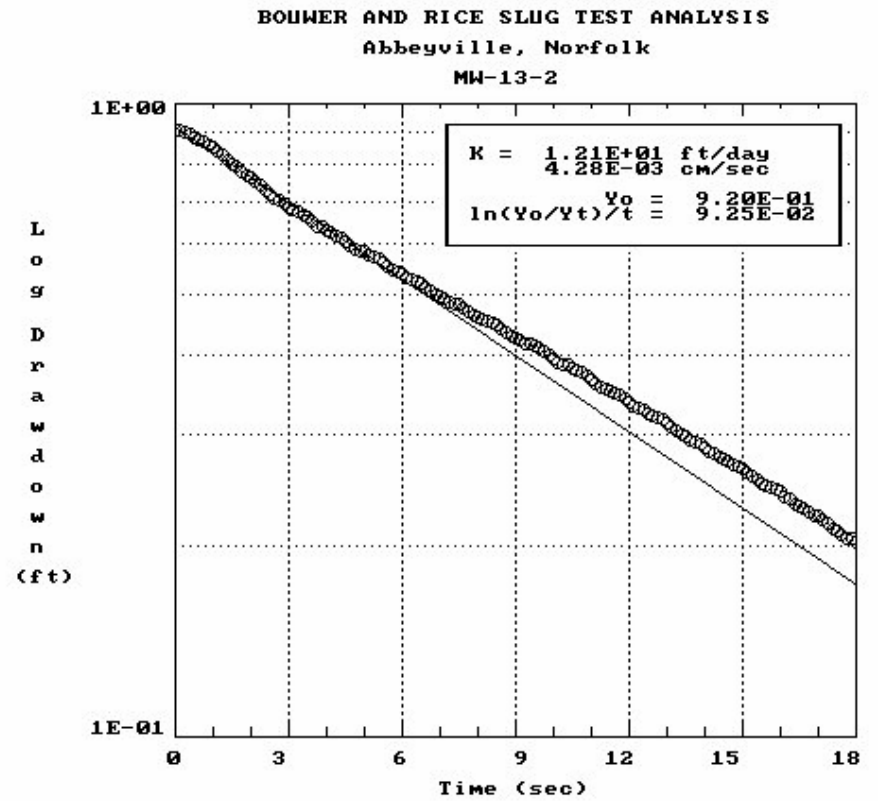
Hydraulic Conductivity:	1.21E+01	ft/day
	4.28E-03	cm/sec
Y-Intercept (Yo):	9.20E-01	ft
Well Screen Ratio (Le/rw):	13.3	
Dimensionless Parameter C:	1.43	
Slope of Line [ln(Yo/Yt)/t]:	9.248E-02	1/sec
Well Parameters (Rc^2 / 2*Le):	6.972E-04	ft
Dimensionless Ratio [ln(Re/rw)]:	2.175	
Effective Radius [Re]:	3.30	ft
Volume Tested [rw<Vol<Re]:	1.69E+02	ft^3

Well/Aquifer Parameters

Depth of well:	8.50	ft
Length of well screen:	5.00	ft
Saturated thickness:	8.50	ft
Diameter of the well casing:	0.167	ft
Diameter of the well filter:	0.750	ft

Time vs Drawdown Data

No.	Time (sec)	Drawdown (ft)	No.	Time (sec)	Drawdown (ft)	No.	Time (sec)	Drawdown (ft)
1	0.0000	0.909	2	0.1250	0.908	3	0.2500	0.903
4	0.3750	0.894	5	0.5000	0.885	6	0.6250	0.879
7	0.7500	0.873	8	0.8750	0.861	9	1.0000	0.852
10	1.1250	0.844	11	1.2500	0.829	12	1.3750	0.815
13	1.5000	0.801	14	1.6250	0.795	15	1.7500	0.781
16	1.8750	0.769	17	2.0000	0.763	18	2.1250	0.755
19	2.2500	0.742	20	2.3750	0.731	21	2.5000	0.719
22	2.6250	0.709	23	2.7500	0.704	24	2.8750	0.694
25	3.0000	0.684	26	3.1250	0.680	27	3.2500	0.675
28	3.3750	0.665	29	3.5000	0.660	30	3.6250	0.651
31	3.7500	0.641	32	3.8750	0.638	33	4.0000	0.630
34	4.1250	0.625	35	4.2500	0.620	36	4.3750	0.612
37	4.5000	0.604	38	4.6250	0.597	39	4.7500	0.590
40	4.8750	0.587	41	5.0000	0.584	42	5.1250	0.577
43	5.2500	0.572	44	5.3750	0.568	45	5.5000	0.560
46	5.6250	0.555	47	5.7500	0.548	48	5.8750	0.541
49	6.0000	0.537	50	6.1250	0.531	51	6.2500	0.528
52	6.3750	0.524	53	6.5000	0.519	54	6.6250	0.512
55	6.7500	0.507	56	6.8750	0.501	57	7.0000	0.497
58	7.1250	0.492	59	7.2500	0.487	60	7.3750	0.484
61	7.5000	0.481	62	7.6250	0.475	63	7.7500	0.470
64	7.8750	0.464	65	8.0000	0.459	66	8.1250	0.457
67	8.2500	0.454	68	8.3750	0.449	69	8.5000	0.446
70	8.6250	0.441	71	8.7500	0.435	72	8.8750	0.430
73	9.0000	0.426	74	9.1250	0.424	75	9.2500	0.419
76	9.3750	0.417	77	9.5000	0.414	78	9.6250	0.411
79	9.7500	0.406	80	9.8750	0.400	81	10.0000	0.395
82	10.1250	0.391	83	10.2500	0.388	84	10.3750	0.386
85	10.5000	0.382	86	10.6250	0.379	87	10.7500	0.376
88	10.8750	0.371	89	11.0000	0.366	90	11.1250	0.362
91	11.2500	0.357	92	11.3750	0.355	93	11.5000	0.352
94	11.6250	0.349	95	11.7500	0.347	96	11.8750	0.342
97	12.0000	0.338	98	12.1250	0.334	99	12.2500	0.330
100	12.3750	0.328	101	12.5000	0.324	102	12.6250	0.322
103	12.7500	0.320	104	12.8750	0.318	105	13.0000	0.313
106	13.1250	0.309	107	13.2500	0.305	108	13.3750	0.300
109	13.5000	0.298	110	13.6250	0.295	111	13.7500	0.293
112	13.8750	0.291	113	14.0000	0.286	114	14.1250	0.283
115	14.2500	0.280	116	14.3750	0.276	117	14.5000	0.275
118	14.6250	0.273	119	14.7500	0.269	120	14.8750	0.267
121	15.0000	0.266	122	15.1250	0.261	123	15.2500	0.259
124	15.3750	0.254	125	15.5000	0.252	126	15.6250	0.250
127	15.7500	0.248	128	15.8750	0.246	129	16.0000	0.244



BOUWER AND RICE INTERACTIVE SLUG TEST ANALYSIS 11-17-2017

Abbeyville, Norfolk
MW-13-3
GeoHydroCycle, Inc.

Results

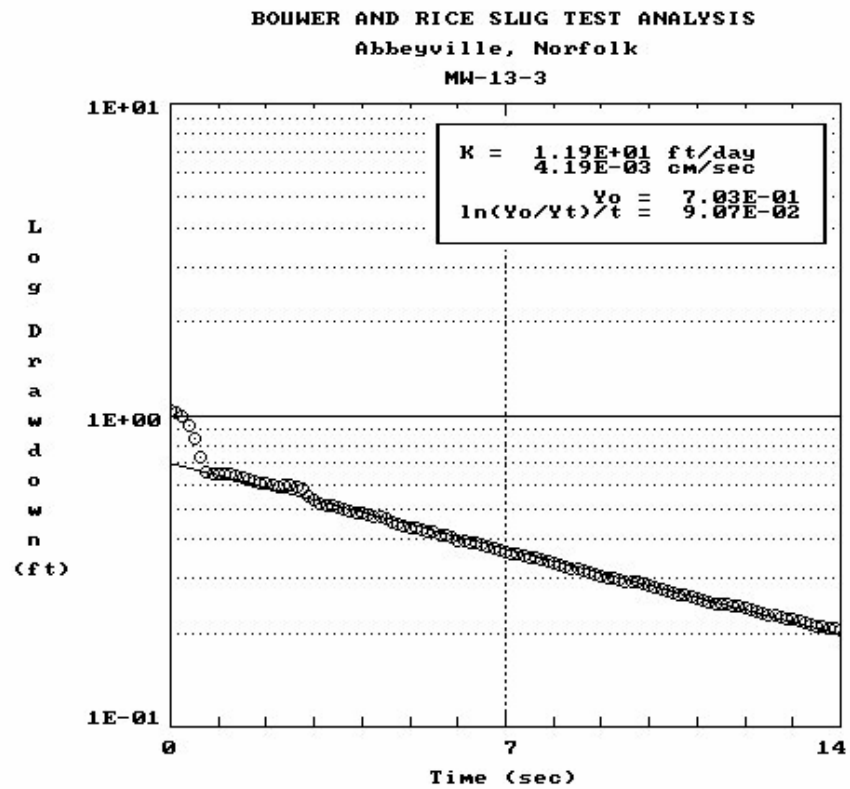
Hydraulic Conductivity:	1.19E+01	ft/day
	4.19E-03	cm/sec
Y-Intercept (Yo):	7.03E-01	ft
Well Screen Ratio (Le/rw):	13.3	
Dimensionless Parameter C:	1.43	
Slope of Line [ln(Yo/Yt)/t]:	9.072E-02	1/sec
Well Parameters (Rc^2 / 2*Le):	6.972E-04	ft
Dimensionless Ratio [ln(Re/rw)]:	2.175	
Effective Radius [Re]:	3.30	ft
Volume Tested [rw<Vol<Re]:	1.69E+02	ft^3

Well/Aquifer Parameters

Depth of well:	8.50	ft
Length of well screen:	5.00	ft
Saturated thickness:	8.50	ft
Diameter of the well casing:	0.167	ft
Diameter of the well filter:	0.750	ft

Time vs Drawdown Data

No.	Time (sec)	Drawdown (ft)	No.	Time (sec)	Drawdown (ft)	No.	Time (sec)	Drawdown (ft)
1	0.0000	1.035	2	0.1250	1.026	3	0.2500	0.998
4	0.3750	0.921	5	0.5000	0.847	6	0.6250	0.732
7	0.7500	0.660	8	0.8750	0.650	9	1.0000	0.649
10	1.1250	0.650	11	1.2500	0.646	12	1.3750	0.638
13	1.5000	0.630	14	1.6250	0.621	15	1.7500	0.613
16	1.8750	0.609	17	2.0000	0.603	18	2.1250	0.595
19	2.2500	0.590	20	2.3750	0.594	21	2.5000	0.595
22	2.6250	0.592	23	2.7500	0.582	24	2.8750	0.553
25	3.0000	0.538	26	3.1250	0.518	27	3.2500	0.515
28	3.3750	0.512	29	3.5000	0.505	30	3.6250	0.498
31	3.7500	0.492	32	3.8750	0.485	33	4.0000	0.484
34	4.1250	0.480	35	4.2500	0.476	36	4.3750	0.471
37	4.5000	0.467	38	4.6250	0.456	39	4.7500	0.448
40	4.8750	0.442	41	5.0000	0.437	42	5.1250	0.433
43	5.2500	0.431	44	5.3750	0.424	45	5.5000	0.421
46	5.6250	0.414	47	5.7500	0.410	48	5.8750	0.404
49	6.0000	0.398	50	6.1250	0.396	51	6.2500	0.391
52	6.3750	0.388	53	6.5000	0.384	54	6.6250	0.382
55	6.7500	0.376	56	6.8750	0.371	57	7.0000	0.365
58	7.1250	0.360	59	7.2500	0.358	60	7.3750	0.352
61	7.5000	0.350	62	7.6250	0.347	63	7.7500	0.344
64	7.8750	0.339	65	8.0000	0.334	66	8.1250	0.330
67	8.2500	0.325	68	8.3750	0.323	69	8.5000	0.320
70	8.6250	0.317	71	8.7500	0.315	72	8.8750	0.310
73	9.0000	0.306	74	9.1250	0.302	75	9.2500	0.299
76	9.3750	0.296	77	9.5000	0.294	78	9.6250	0.293
79	9.7500	0.291	80	9.8750	0.288	81	10.0000	0.284
82	10.1250	0.279	83	10.2500	0.275	84	10.3750	0.271
85	10.5000	0.269	86	10.6250	0.266	87	10.7500	0.265
88	10.8750	0.263	89	11.0000	0.259	90	11.1250	0.256
91	11.2500	0.252	92	11.3750	0.249	93	11.5000	0.248
94	11.6250	0.247	95	11.7500	0.244	96	11.8750	0.243
97	12.0000	0.241	98	12.1250	0.237	99	12.2500	0.234
100	12.3750	0.230	101	12.5000	0.228	102	12.6250	0.227
103	12.7500	0.225	104	12.8750	0.223	105	13.0000	0.221
106	13.1250	0.220	107	13.2500	0.216	108	13.3750	0.214
109	13.5000	0.211	110	13.6250	0.209	111	13.7500	0.207
112	13.8750	0.206	113	14.0000	0.205	114	14.1250	0.283



BOUWER AND RICE INTERACTIVE SLUG TEST ANALYSIS 11-17-2017

Abbeyville, Norfolk
MW-13-4
GeoHydroCycle, Inc.

Results

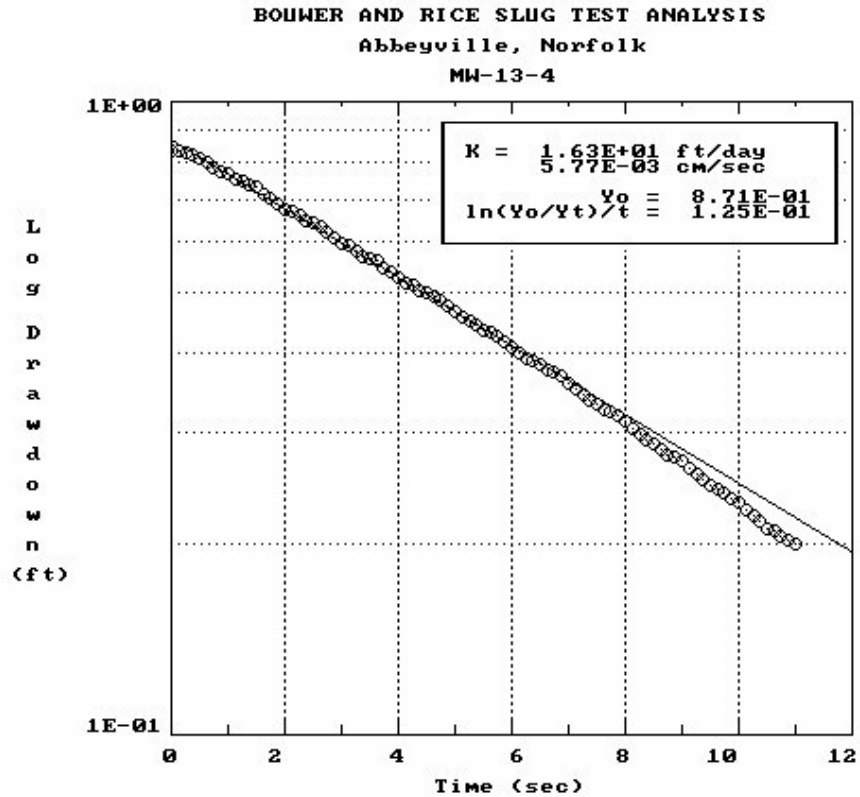
Hydraulic Conductivity:	1.63E+01	ft/day
	5.77E-03	cm/sec
Y-Intercept (Yo):	8.71E-01	ft
Well Screen Ratio (Le/rw):	13.3	
Dimensionless Parameter C:	1.43	
Slope of Line [ln(Yo/Yt)/t]:	1.247E-01	1/sec
Well Parameters (Rc^2 / 2*Le):	6.972E-04	ft
Dimensionless Ratio [ln(Re/rw)]:	2.175	
Effective Radius [Re]:	3.30	ft
Volume Tested [rw<Vol<Re]:	1.69E+02	ft^3

Well/Aquifer Parameters

Depth of well:	8.50	ft
Length of well screen:	5.00	ft
Saturated thickness:	8.50	ft
Diameter of the well casing:	0.167	ft
Diameter of the well filter:	0.750	ft

Time vs Drawdown Data

No.	Time (sec)	Drawdown (ft)	No.	Time (sec)	Drawdown (ft)	No.	Time (sec)	Drawdown (ft)
1	0.0000	0.837	2	0.1250	0.836	3	0.2500	0.831
4	0.3750	0.826	5	0.5000	0.814	6	0.6250	0.801
7	0.7500	0.787	8	0.8750	0.774	9	1.0000	0.768
10	1.1250	0.756	11	1.2500	0.748	12	1.3750	0.741
13	1.5000	0.733	14	1.6250	0.716	15	1.7500	0.702
16	1.8750	0.688	17	2.0000	0.676	18	2.1250	0.670
19	2.2500	0.663	20	2.3750	0.649	21	2.5000	0.643
22	2.6250	0.635	23	2.7500	0.622	24	2.8750	0.610
25	3.0000	0.598	26	3.1250	0.592	27	3.2500	0.582
28	3.3750	0.571	29	3.5000	0.566	30	3.6250	0.560
31	3.7500	0.547	32	3.8750	0.537	33	4.0000	0.526
34	4.1250	0.517	35	4.2500	0.512	36	4.3750	0.503
37	4.5000	0.498	38	4.6250	0.493	39	4.7500	0.487
40	4.8750	0.476	41	5.0000	0.466	42	5.1250	0.457
43	5.2500	0.449	44	5.3750	0.444	45	5.5000	0.436
46	5.6250	0.431	47	5.7500	0.426	48	5.8750	0.417
49	6.0000	0.409	50	6.1250	0.401	51	6.2500	0.393
52	6.3750	0.389	53	6.5000	0.385	54	6.6250	0.377
55	6.7500	0.373	56	6.8750	0.369	57	7.0000	0.360
58	7.1250	0.352	59	7.2500	0.344	60	7.3750	0.337
61	7.5000	0.334	62	7.6250	0.327	63	7.7500	0.323
64	7.8750	0.320	65	8.0000	0.312	66	8.1250	0.305
67	8.2500	0.299	68	8.3750	0.292	69	8.5000	0.289
70	8.6250	0.283	71	8.7500	0.277	72	8.8750	0.275
73	9.0000	0.271	74	9.1250	0.264	75	9.2500	0.258
76	9.3750	0.253	77	9.5000	0.247	78	9.6250	0.244
79	9.7500	0.241	80	9.8750	0.236	81	10.0000	0.233
82	10.1250	0.227	83	10.2500	0.222	84	10.3750	0.217
85	10.5000	0.212	86	10.6250	0.210	87	10.7500	0.206
88	10.8750	0.203	89	11.0000	0.200	90	11.1250	0.256



BOUWER AND RICE INTERACTIVE SLUG TEST ANALYSIS 04-06-2016

Norfolk
ghc1-1
GeoHydroCycle, Inc.

Results

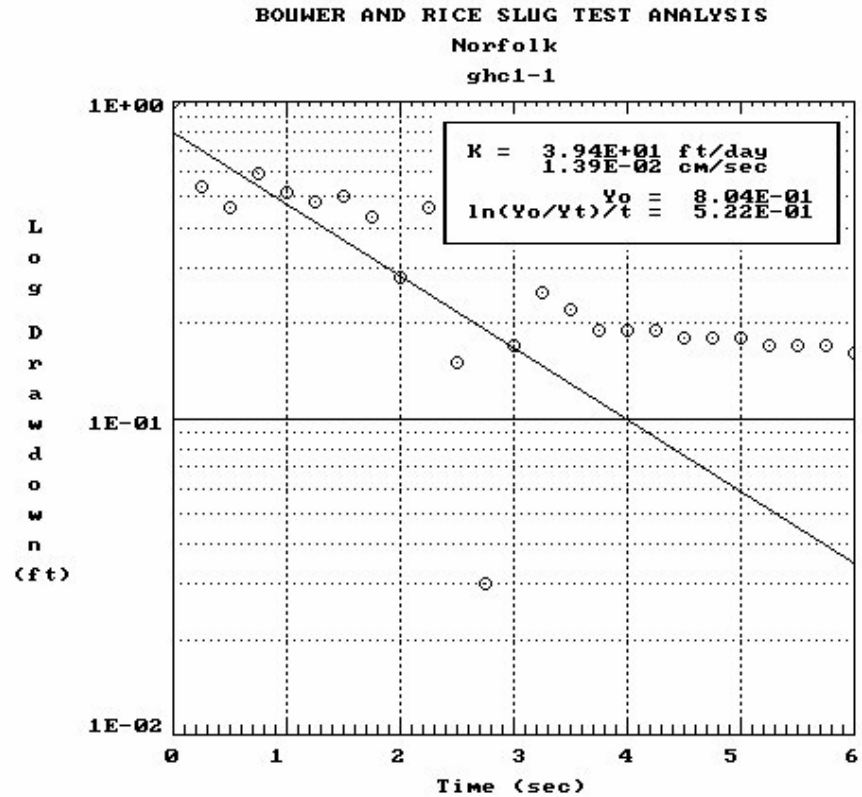
Hydraulic Conductivity:	3.94E+01	ft/day
	1.39E-02	cm/sec
Y-Intercept (Yo):	8.04E-01	ft
Well Screen Ratio (Le/rw):	28.2	
Dimensionless Parameter C:	1.98	
Slope of Line [ln(Yo/Yt)/t]:	5.215E-01	1/sec
Well Parameters (Rc^2 / 2*Le):	3.486E-04	ft
Dimensionless Ratio [ln(Re/rw)]:	2.510	
Effective Radius [Re]:	4.36	ft
Volume Tested [rw<Vol<Re]:	5.93E+02	ft^3

Well/Aquifer Parameters

Depth of well:	10.10	ft
Length of well screen:	10.00	ft
Saturated thickness:	10.10	ft
Diameter of the well casing:	0.167	ft
Diameter of the well filter:	0.708	ft

Time vs Drawdown Data

No.	Time (sec)	Drawdown (ft)	No.	Time (sec)	Drawdown (ft)	No.	Time (sec)	Drawdown (ft)
1	0.0000	1.000	2	0.2500	0.540	3	0.5000	0.460
4	0.7500	0.590	5	1.0000	0.520	6	1.2500	0.480
7	1.5000	0.500	8	1.7500	0.430	9	2.0000	0.280
10	2.2500	0.460	11	2.5000	0.150	12	2.7500	0.030
13	3.0000	0.170	14	3.2500	0.250	15	3.5000	0.220
16	3.7500	0.190	17	4.0000	0.190	18	4.2500	0.190
19	4.5000	0.180	20	4.7500	0.180	21	5.0000	0.180
22	5.2500	0.170	23	5.5000	0.170	24	5.7500	0.170
25	6.0000	0.160						



BOUWER AND RICE INTERACTIVE SLUG TEST ANALYSIS 04-06-2016

Norfolk
ghc1-2
GeoHydroCycle, Inc.

Results

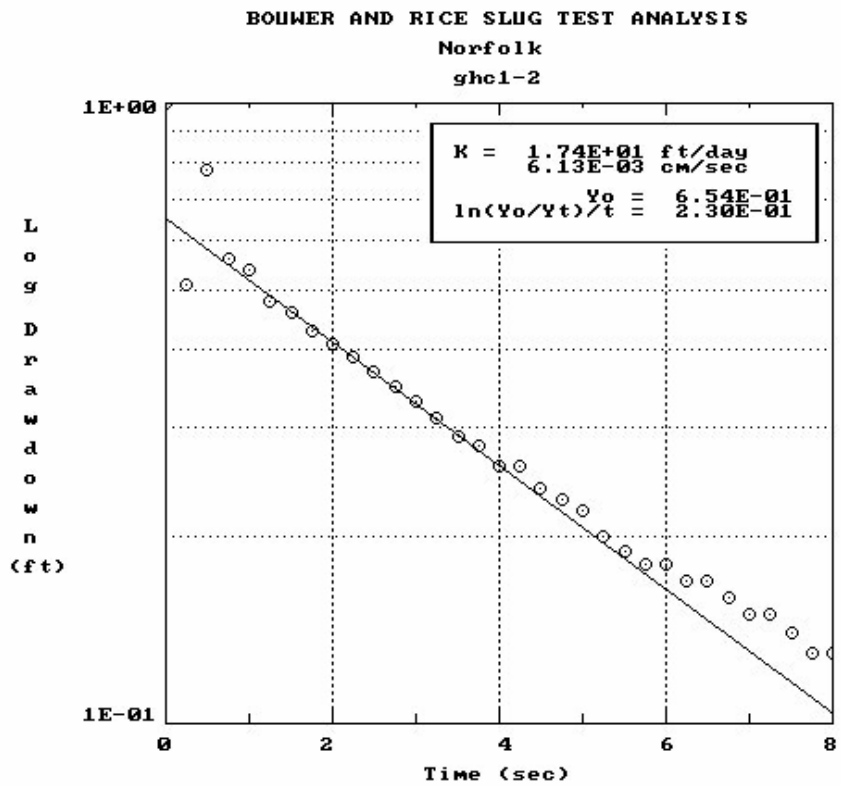
Hydraulic Conductivity:	1.74E+01	ft/day
	6.13E-03	cm/sec
Y-Intercept (Yo):	6.54E-01	ft
Well Screen Ratio (Le/rw):	28.2	
Dimensionless Parameter C:	1.98	
Slope of Line [ln(Yo/Yt)/t]:	2.297E-01	1/sec
Well Parameters (Rc^2 / 2*Le):	3.486E-04	ft
Dimensionless Ratio [ln(Re/rw)]:	2.510	
Effective Radius [Re]:	4.36	ft
Volume Tested [rw<Vol<Re]:	5.93E+02	ft^3

Well/Aquifer Parameters

Depth of well:	10.10	ft
Length of well screen:	10.00	ft
Saturated thickness:	10.10	ft
Diameter of the well casing:	0.167	ft
Diameter of the well filter:	0.708	ft

Time vs Drawdown Data

No.	Time (sec)	Drawdown (ft)	No.	Time (sec)	Drawdown (ft)	No.	Time (sec)	Drawdown (ft)
1	0.0000	1.000	2	0.2500	0.510	3	0.5000	0.780
4	0.7500	0.560	5	1.0000	0.540	6	1.2500	0.480
7	1.5000	0.460	8	1.7500	0.430	9	2.0000	0.410
10	2.2500	0.390	11	2.5000	0.370	12	2.7500	0.350
13	3.0000	0.330	14	3.2500	0.310	15	3.5000	0.290
16	3.7500	0.280	17	4.0000	0.260	18	4.2500	0.260
19	4.5000	0.240	20	4.7500	0.230	21	5.0000	0.220
22	5.2500	0.200	23	5.5000	0.190	24	5.7500	0.180
25	6.0000	0.180	26	6.2500	0.170	27	6.5000	0.170
28	6.7500	0.160	29	7.0000	0.150	30	7.2500	0.150
31	7.5000	0.140	32	7.7500	0.130	33	8.0000	0.130



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BOUWER AND RICE INTERACTIVE SLUG TEST ANALYSIS          04-06-2016
====================================================================

                          Norfolk
                          ghc1-3
                    GeoHydroCycle, Inc.

 Results
--------

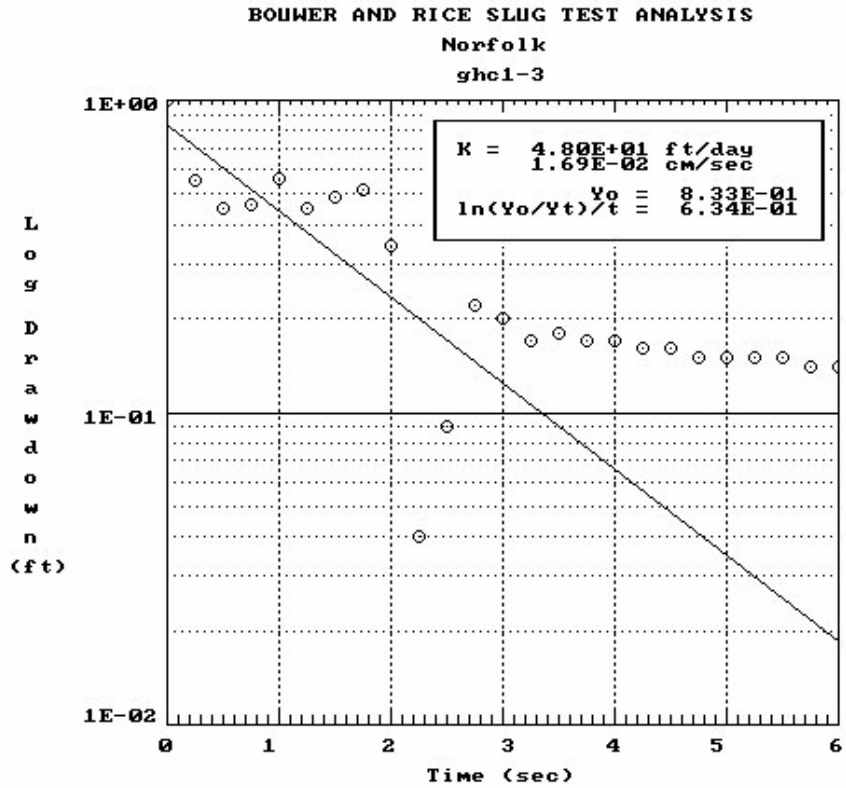
          Hydraulic Conductivity:    4.80E+01  ft/day
                                     1.69E-02  cm/sec
                Y-Intercept (Yo):    8.33E-01  ft
       Well Screen Ratio (Le/rw):   28.2
       Dimensionless Parameter C:    1.98
     Slope of Line [ln(Yo/Yt)/t]:    6.342E-01 1/sec
   Well Parameters (Rc^2 / 2*Le):    3.486E-04 ft
 Dimensionless Ratio [ln(Re/rw)]:    2.510
           Effective Radius [Re]:    4.36      ft
       Volume Tested [rw<Vol<Re]:    5.93E+02  ft^3

 Well/Aquifer Parameters
------------------------

                   Depth of well:   10.10   ft
            Length of well screen:   10.00   ft
              Saturated thickness:   10.10   ft
     Diameter of the well casing:    0.167  ft
     Diameter of the well filter:    0.708  ft

 Time vs Drawdown Data
----------------------

 No.  Time    Drawdown   No.  Time    Drawdown   No.  Time    Drawdown
      (sec)    (ft)           (sec)    (ft)           (sec)    (ft)
--------------------------------------------------------------------
  1   0.0000   1.000      2   0.2500   0.550      3   0.5000   0.450
  4   0.7500   0.460      5   1.0000   0.560      6   1.2500   0.450
  7   1.5000   0.490      8   1.7500   0.520      9   2.0000   0.340
 10   2.2500   0.040     11   2.5000   0.090     12   2.7500   0.220
 13   3.0000   0.200     14   3.2500   0.170     15   3.5000   0.180
 16   3.7500   0.170     17   4.0000   0.170     18   4.2500   0.160
 19   4.5000   0.160     20   4.7500   0.150     21   5.0000   0.150
 22   5.2500   0.150     23   5.5000   0.150     24   5.7500   0.140
 25   6.0000   0.140
```



BOUWER AND RICE INTERACTIVE SLUG TEST ANALYSIS 04-06-2016

Norfolk
ghc1-4
GeoHydroCycle, Inc.

Results

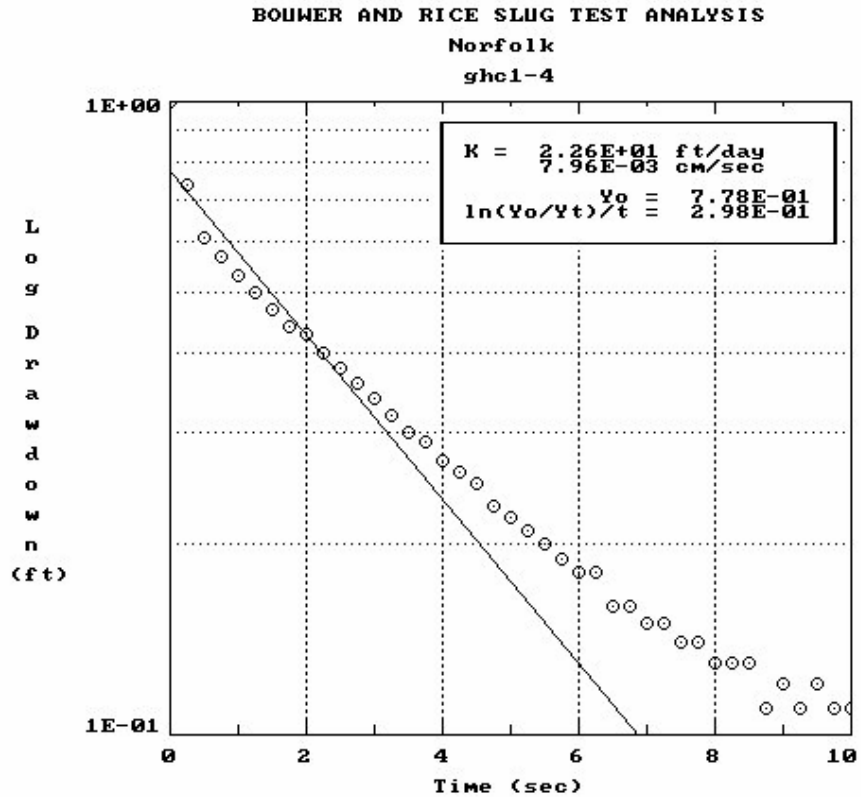
Hydraulic Conductivity:	2.26E+01	ft/day
	7.96E-03	cm/sec
Y-Intercept (Yo):	7.78E-01	ft
Well Screen Ratio (Le/rw):	28.2	
Dimensionless Parameter C:	1.98	
Slope of Line [ln(Yo/Yt)/t]:	2.984E-01	1/sec
Well Parameters (Rc^2 / 2*Le):	3.486E-04	ft
Dimensionless Ratio [ln(Re/rw)]:	2.510	
Effective Radius [Re]:	4.36	ft
Volume Tested [rw<Vol<Re]:	5.93E+02	ft^3

Well/Aquifer Parameters

Depth of well:	10.10	ft
Length of well screen:	10.00	ft
Saturated thickness:	10.10	ft
Diameter of the well casing:	0.167	ft
Diameter of the well filter:	0.708	ft

Time vs Drawdown Data

No.	Time (sec)	Drawdown (ft)	No.	Time (sec)	Drawdown (ft)	No.	Time (sec)	Drawdown (ft)
1	0.0000	1.000	2	0.2500	0.740	3	0.5000	0.610
4	0.7500	0.570	5	1.0000	0.530	6	1.2500	0.500
7	1.5000	0.470	8	1.7500	0.440	9	2.0000	0.430
10	2.2500	0.400	11	2.5000	0.380	12	2.7500	0.360
13	3.0000	0.340	14	3.2500	0.320	15	3.5000	0.300
16	3.7500	0.290	17	4.0000	0.270	18	4.2500	0.260
19	4.5000	0.250	20	4.7500	0.230	21	5.0000	0.220
22	5.2500	0.210	23	5.5000	0.200	24	5.7500	0.190
25	6.0000	0.180	26	6.2500	0.180	27	6.5000	0.160
28	6.7500	0.160	29	7.0000	0.150	30	7.2500	0.150
31	7.5000	0.140	32	7.7500	0.140	33	8.0000	0.130
34	8.2500	0.130	35	8.5000	0.130	36	8.7500	0.110
37	9.0000	0.120	38	9.2500	0.110	39	9.5000	0.120
40	9.7500	0.110	41	10.0000	0.110	42	0.0000	1.000



BOUWER AND RICE INTERACTIVE SLUG TEST ANALYSIS 04-06-2016

Norfolk
ghc2-1
GeoHydroCycle, Inc.

Results

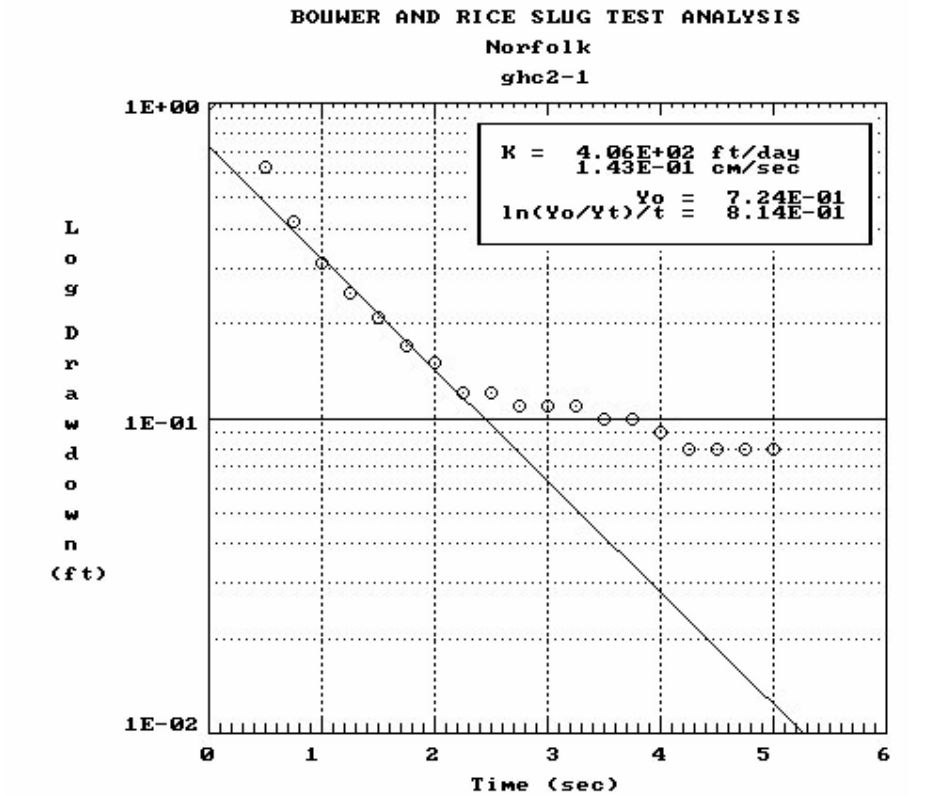
Hydraulic Conductivity:	4.06E+02	ft/day
	1.43E-01	cm/sec
Y-Intercept (Yo):	7.24E-01	ft
Well Screen Ratio (Le/rw):	24.9	
Dimensionless Parameter C:	1.88	
Slope of Line [ln(Yo/Yt)/t]:	8.143E-01	1/sec
Well Parameters (Rc^2 / 2*Le):	2.124E-03	ft
Dimensionless Ratio [ln(Re/rw)]:	2.392	
Effective Radius [Re]:	3.87	ft
Volume Tested [rw<Vol<Re]:	4.67E+02	ft^3

Well/Aquifer Parameters

Depth of well:	8.80	ft
Length of well screen:	10.00	ft
Saturated thickness:	8.80	ft
Diameter of the well casing:	0.167	ft
Diameter of the well filter:	0.708	ft

Time vs Drawdown Data

No.	Time (sec)	Drawdown (ft)	No.	Time (sec)	Drawdown (ft)	No.	Time (sec)	Drawdown (ft)
1	0.0000	1.000	2	0.5000	0.630	3	0.7500	0.420
4	1.0000	0.310	5	1.2500	0.250	6	1.5000	0.210
7	1.7500	0.170	8	2.0000	0.150	9	2.2500	0.120
10	2.5000	0.120	11	2.7500	0.110	12	3.0000	0.110
13	3.2500	0.110	14	3.5000	0.100	15	3.7500	0.100
16	4.0000	0.090	17	4.2500	0.080	18	4.5000	0.080
19	4.7500	0.080	20	5.0000	0.080	21	5.0000	0.220



BOUWER AND RICE INTERACTIVE SLUG TEST ANALYSIS 04-06-2016

Norfolk
ghc2-2
GeoHydroCycle, Inc.

Results

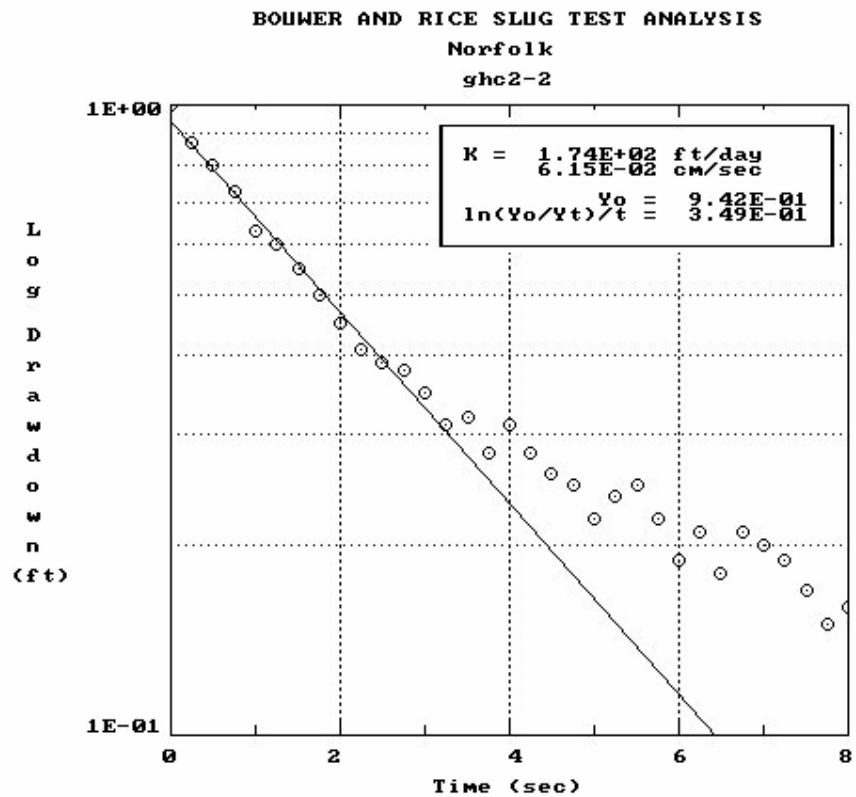
Hydraulic Conductivity:	1.74E+02	ft/day
	6.15E-02	cm/sec
Y-Intercept (Yo):	9.42E-01	ft
Well Screen Ratio (Le/rw):	24.9	
Dimensionless Parameter C:	1.88	
Slope of Line [ln(Yo/Yt)/t]:	3.495E-01	1/sec
Well Parameters (Rc^2 / 2*Le):	2.124E-03	ft
Dimensionless Ratio [ln(Re/rw)]:	2.392	
Effective Radius [Re]:	3.87	ft
Volume Tested [rw<Vol<Re]:	4.67E+02	ft^3

Well/Aquifer Parameters

Depth of well:	8.80	ft
Length of well screen:	10.00	ft
Saturated thickness:	8.80	ft
Diameter of the well casing:	0.167	ft
Diameter of the well filter:	0.708	ft

Time vs Drawdown Data

No.	Time (sec)	Drawdown (ft)	No.	Time (sec)	Drawdown (ft)	No.	Time (sec)	Drawdown (ft)
1	0.0000	1.000	2	0.2500	0.870	3	0.5000	0.800
4	0.7500	0.730	5	1.0000	0.630	6	1.2500	0.600
7	1.5000	0.550	8	1.7500	0.500	9	2.0000	0.450
10	2.2500	0.410	11	2.5000	0.390	12	2.7500	0.380
13	3.0000	0.350	14	3.2500	0.310	15	3.5000	0.320
16	3.7500	0.280	17	4.0000	0.310	18	4.2500	0.280
19	4.5000	0.260	20	4.7500	0.250	21	5.0000	0.220
22	5.2500	0.240	23	5.5000	0.250	24	5.7500	0.220
25	6.0000	0.190	26	6.2500	0.210	27	6.5000	0.180
28	6.7500	0.210	29	7.0000	0.200	30	7.2500	0.190
31	7.5000	0.170	32	7.7500	0.150	33	8.0000	0.160



BOUWER AND RICE INTERACTIVE SLUG TEST ANALYSIS 04-06-2016

Norfolk
ghc2-3
GeoHydroCycle, Inc.

Results

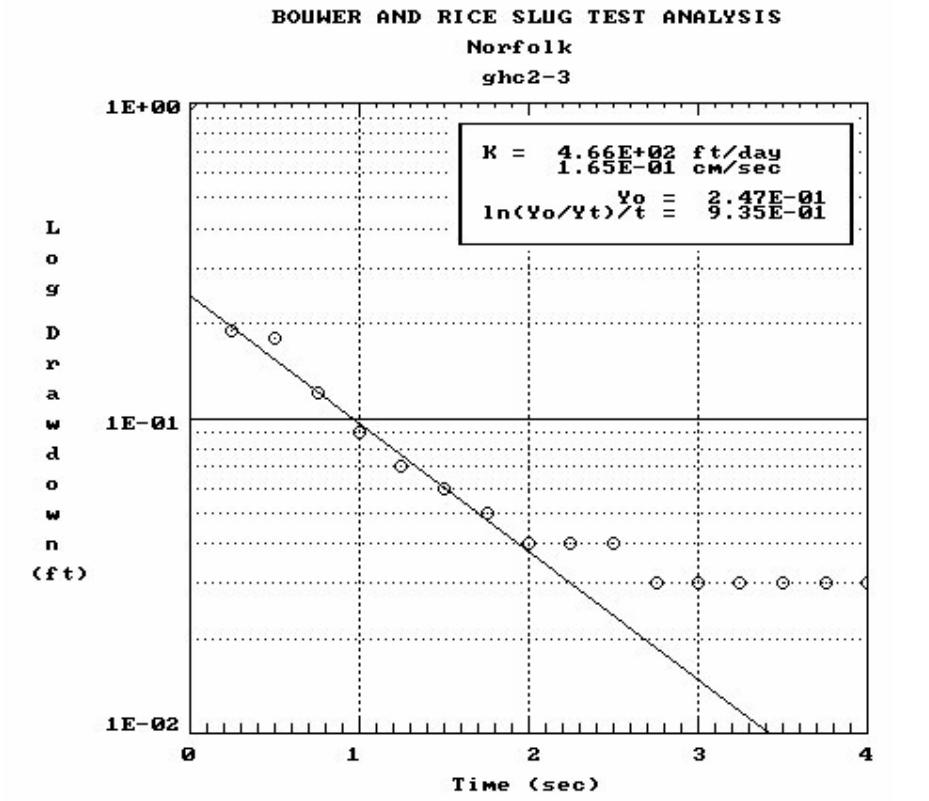
Hydraulic Conductivity:	4.66E+02	ft/day
	1.65E-01	cm/sec
Y-Intercept (Yo):	2.47E-01	ft
Well Screen Ratio (Le/rw):	24.9	
Dimensionless Parameter C:	1.88	
Slope of Line [ln(Yo/Yt)/t]:	9.354E-01	1/sec
Well Parameters (Rc^2 / 2*Le):	2.124E-03	ft
Dimensionless Ratio [ln(Re/rw)]:	2.392	
Effective Radius [Re]:	3.87	ft
Volume Tested [rw<Vol<Re]:	4.67E+02	ft^3

Well/Aquifer Parameters

Depth of well:	8.80	ft
Length of well screen:	10.00	ft
Saturated thickness:	8.80	ft
Diameter of the well casing:	0.167	ft
Diameter of the well filter:	0.708	ft

Time vs Drawdown Data

No.	Time (sec)	Drawdown (ft)	No.	Time (sec)	Drawdown (ft)	No.	Time (sec)	Drawdown (ft)
1	0.0000	1.000	2	0.2500	0.190	3	0.5000	0.180
4	0.7500	0.120	5	1.0000	0.090	6	1.2500	0.070
7	1.5000	0.060	8	1.7500	0.050	9	2.0000	0.040
10	2.2500	0.040	11	2.5000	0.040	12	2.7500	0.030
13	3.0000	0.030	14	3.2500	0.030	15	3.5000	0.030
16	3.7500	0.030	17	4.0000	0.030	18	4.2500	0.280



BOUWER AND RICE INTERACTIVE SLUG TEST ANALYSIS 04-06-2016

Norfolk
ghc2-4
GeoHydroCycle, Inc.

Results

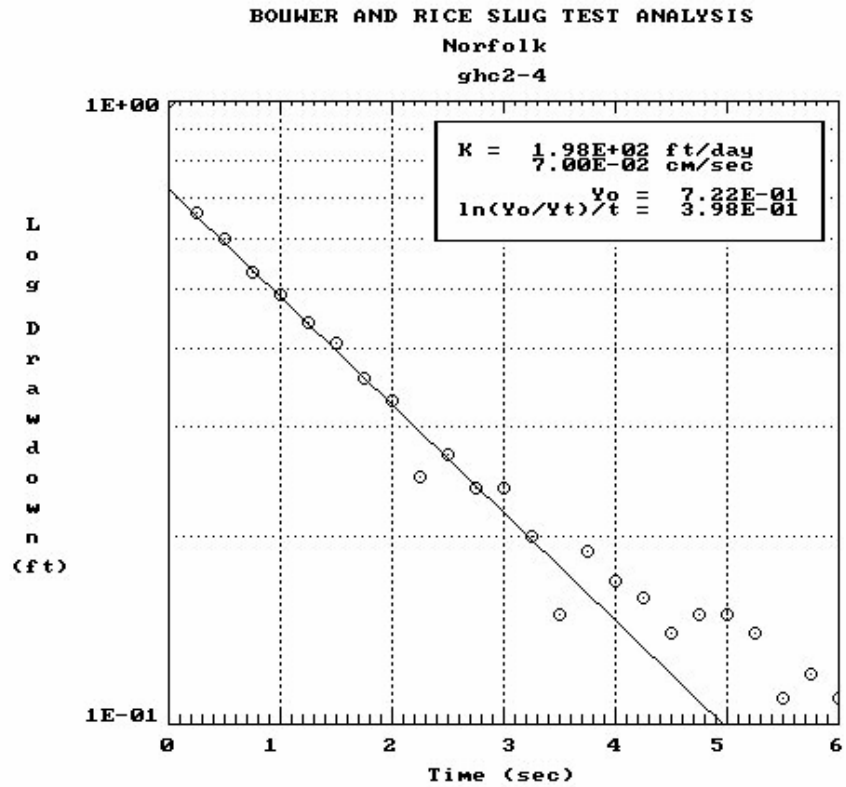
Hydraulic Conductivity:	1.98E+02	ft/day
	7.00E-02	cm/sec
Y-Intercept (Yo):	7.22E-01	ft
Well Screen Ratio (Le/rw):	24.9	
Dimensionless Parameter C:	1.88	
Slope of Line [ln(Yo/Yt)/t]:	3.979E-01	1/sec
Well Parameters (Rc^2 / 2*Le):	2.124E-03	ft
Dimensionless Ratio [ln(Re/rw)]:	2.392	
Effective Radius [Re]:	3.87	ft
Volume Tested [rw<Vol<Re]:	4.67E+02	ft^3

Well/Aquifer Parameters

Depth of well:	8.80	ft
Length of well screen:	10.00	ft
Saturated thickness:	8.80	ft
Diameter of the well casing:	0.167	ft
Diameter of the well filter:	0.708	ft

Time vs Drawdown Data

No.	Time (sec)	Drawdown (ft)	No.	Time (sec)	Drawdown (ft)	No.	Time (sec)	Drawdown (ft)
1	0.0000	1.000	2	0.2500	0.660	3	0.5000	0.600
4	0.7500	0.530	5	1.0000	0.490	6	1.2500	0.440
7	1.5000	0.410	8	1.7500	0.360	9	2.0000	0.330
10	2.2500	0.250	11	2.5000	0.270	12	2.7500	0.240
13	3.0000	0.240	14	3.2500	0.200	15	3.5000	0.150
16	3.7500	0.190	17	4.0000	0.170	18	4.2500	0.160
19	4.5000	0.140	20	4.7500	0.150	21	5.0000	0.150
22	5.2500	0.140	23	5.5000	0.110	24	5.7500	0.120
25	6.0000	0.110						



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HVORSLEV INTERACTIVE SLUG TEST ANALYSIS                    11-17-2017
====================================================================

                    Abbeyville, Norfolk
                          MW-11-1
                    GeoHydroCycle, Inc.

 Results
--------

 Basic Time Lag-
     Hydraulic Conductivity (Kh):     1.13E+02 ft/day
                                      3.97E-02 cm/sec
                  Basic Time Lag:     1.39 sec
        2.3 Times Basic Time Lag:     3.19 sec
        (Equalization Ratio ÷ 0.90)

 Variable Head-
     Hydraulic Conductivity (Kh):     2.74E+02 ft/day
                                      9.66E-02 cm/sec
              Time Coordinate T1:     1.1 sec
              Time Coordinate T2:     3.2 sec
        Head Ratio Coordinate H1:    63.10E-02
        Head Ratio Coordinate H2:    15.85E-03

 Well/Aquifer Parameters
------------------------
           Length of well screen:     5.00   ft
     Diameter of the well casing:     0.167  ft
       Diameter of the well bore:     0.750  ft
                     Kh/Kv ratio:     1.0

 Time vs Drawdown Ratio Data
------------------------
```
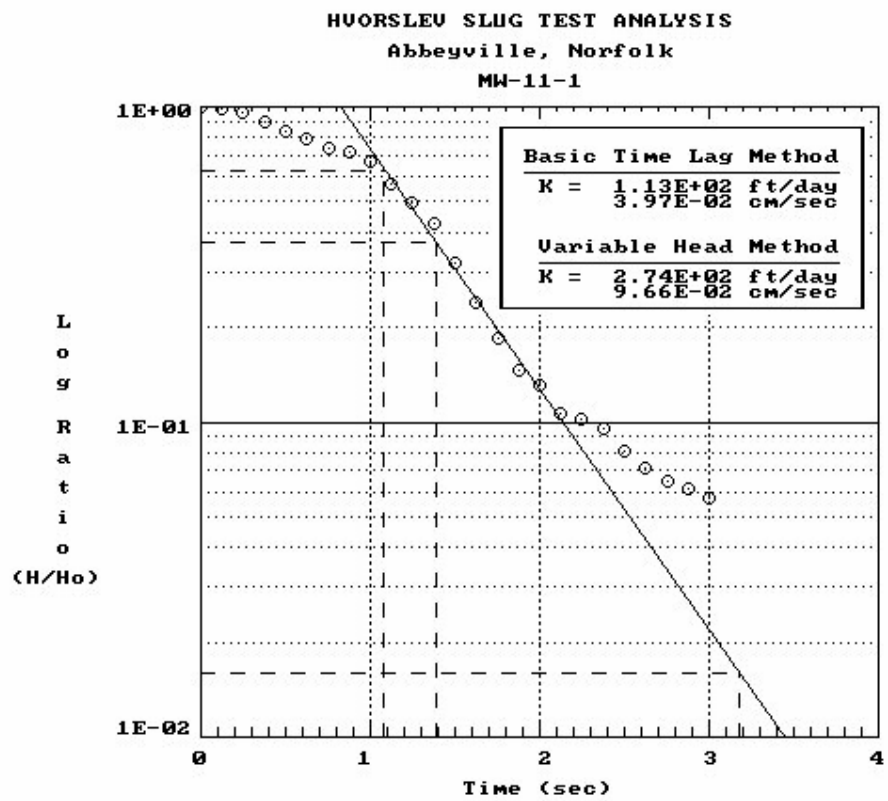

No.	Time (sec)	H/Hmax (ft)	No.	Time (sec)	H/Hmax (ft)	No.	Time (sec)	H/Hmax (ft)
1	0.0000	1.000	2	0.1250	0.991	3	0.2500	0.964
4	0.3750	0.899	5	0.5000	0.834	6	0.6250	0.786
7	0.7500	0.742	8	0.8750	0.714	9	1.0000	0.672
10	1.1250	0.567	11	1.2500	0.497	12	1.3750	0.426
13	1.5000	0.317	14	1.6250	0.239	15	1.7500	0.183
16	1.8750	0.146	17	2.0000	0.131	18	2.1250	0.106
19	2.2500	0.102	20	2.3750	0.096	21	2.5000	0.081
22	2.6250	0.072	23	2.7500	0.065	24	2.8750	0.061
25	3.0000	0.057						



HVORSLEV INTERACTIVE SLUG TEST ANALYSIS 11-17-2017

Abbeyville, Norfolk
MW-11-2
GeoHydroCycle, Inc.

Results

Basic Time Lag-

Hydraulic Conductivity (Kh):	1.15E+02	ft/day
	4.05E-02	cm/sec
Basic Time Lag:	1.36	sec
2.3 Times Basic Time Lag:	3.13	sec
(Equalization Ratio ÷ 0.90)		

Variable Head-

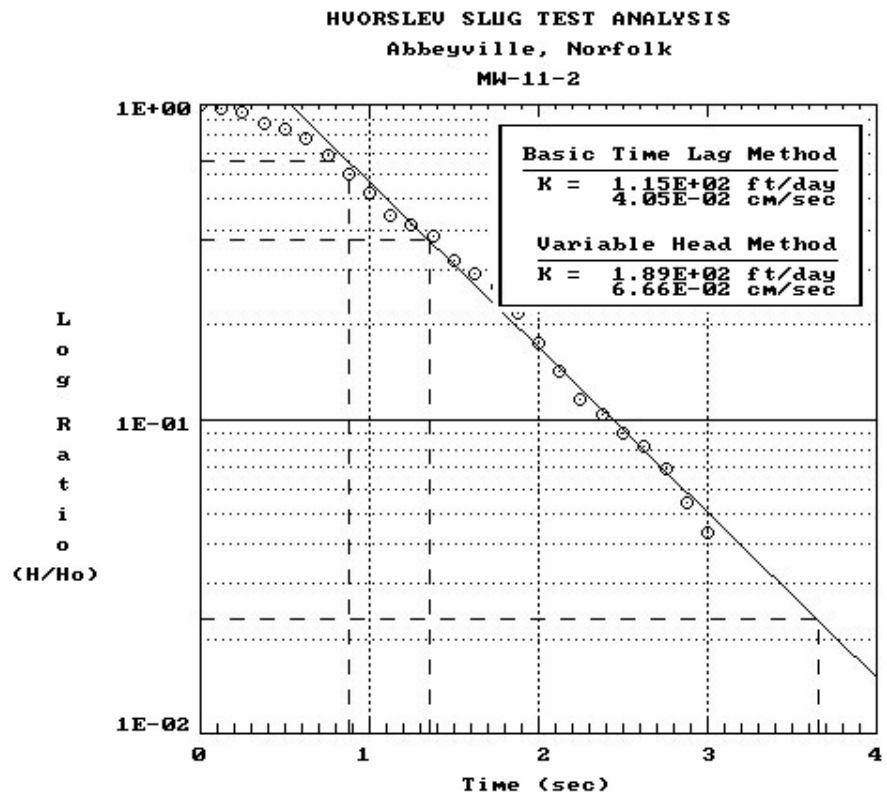
Hydraulic Conductivity (Kh):	1.89E+02	ft/day
	6.66E-02	cm/sec
Time Coordinate T1:	0.9	sec
Time Coordinate T2:	3.7	sec
Head Ratio Coordinate H1:	65.79E-02	
Head Ratio Coordinate H2:	23.09E-03	

Well/Aquifer Parameters

Length of well screen:	5.00	ft
Diameter of the well casing:	0.167	ft
Diameter of the well bore:	0.750	ft
Kh/Kv ratio:	1.0	

Time vs Drawdown Ratio Data

No.	Time (sec)	H/Hmax (ft)	No.	Time (sec)	H/Hmax (ft)	No.	Time (sec)	H/Hmax (ft)
1	0.0000	1.000	2	0.1250	0.969	3	0.2500	0.943
4	0.3750	0.877	5	0.5000	0.833	6	0.6250	0.784
7	0.7500	0.689	8	0.8750	0.604	9	1.0000	0.522
10	1.1250	0.447	11	1.2500	0.416	12	1.3750	0.380
13	1.5000	0.321	14	1.6250	0.290	15	1.7500	0.265
16	1.8750	0.216	17	2.0000	0.175	18	2.1250	0.141
19	2.2500	0.116	20	2.3750	0.103	21	2.5000	0.090
22	2.6250	0.082	23	2.7500	0.069	24	2.8750	0.054
25	3.0000	0.044						



HVORSLEV INTERACTIVE SLUG TEST ANALYSIS 11-17-2017

Abbeyville, Norfolk
MW-11-3
GeoHydroCycle, Inc.

Results

Basic Time Lag-

Hydraulic Conductivity (Kh):	8.56E+01 ft/day
	3.02E-02 cm/sec
Basic Time Lag:	1.82 sec
2.3 Times Basic Time Lag:	4.19 sec
(Equalization Ratio ÷ 0.90)	

Variable Head-

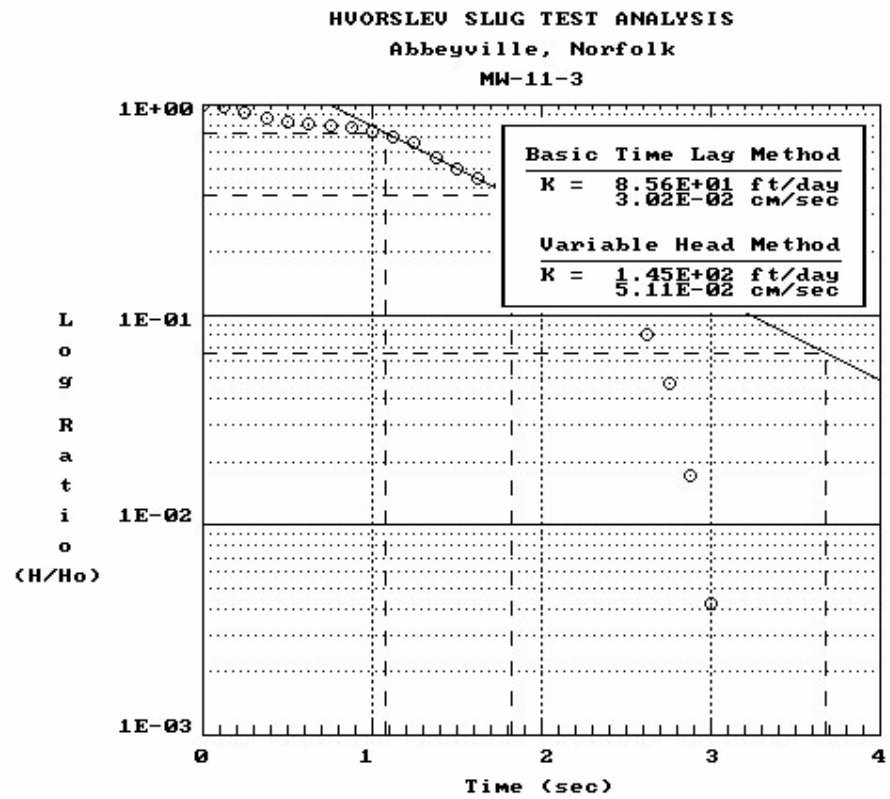
Hydraulic Conductivity (Kh):	1.45E+02 ft/day
	5.11E-02 cm/sec
Time Coordinate T1:	1.1 sec
Time Coordinate T2:	3.7 sec
Head Ratio Coordinate H1:	73.96E-02
Head Ratio Coordinate H2:	66.24E-03

Well/Aquifer Parameters

Length of well screen:	5.00 ft
Diameter of the well casing:	0.167 ft
Diameter of the well bore:	0.750 ft
Kh/Kv ratio:	1.0

Time vs Drawdown Ratio Data

No.	Time (sec)	H/Hmax (ft)	No.	Time (sec)	H/Hmax (ft)	No.	Time (sec)	H/Hmax (ft)
1	0.0000	1.000	2	0.1250	0.970	3	0.2500	0.928
4	0.3750	0.866	5	0.5000	0.827	6	0.6250	0.814
7	0.7500	0.800	8	0.8750	0.778	9	1.0000	0.746
10	1.1250	0.706	11	1.2500	0.663	12	1.3750	0.565
13	1.5000	0.499	14	1.6250	0.450	15	1.7500	0.412
16	1.8750	0.373	17	2.0000	0.284	18	2.1250	0.230
19	2.2500	0.183	20	2.3750	0.147	21	2.5000	0.111
22	2.6250	0.081	23	2.7500	0.047	24	2.8750	0.017
25	3.0000	0.004						



HVORSLEV INTERACTIVE SLUG TEST ANALYSIS 11-17-2017

Abbeyville, Norfolk
MW-11-4
GeoHydroCycle, Inc.

Results

Basic Time Lag-

Hydraulic Conductivity (Kh):	1.16E+02 ft/day
	4.11E-02 cm/sec
Basic Time Lag:	1.34 sec
2.3 Times Basic Time Lag:	3.08 sec
(Equalization Ratio ÷ 0.90)	

Variable Head-

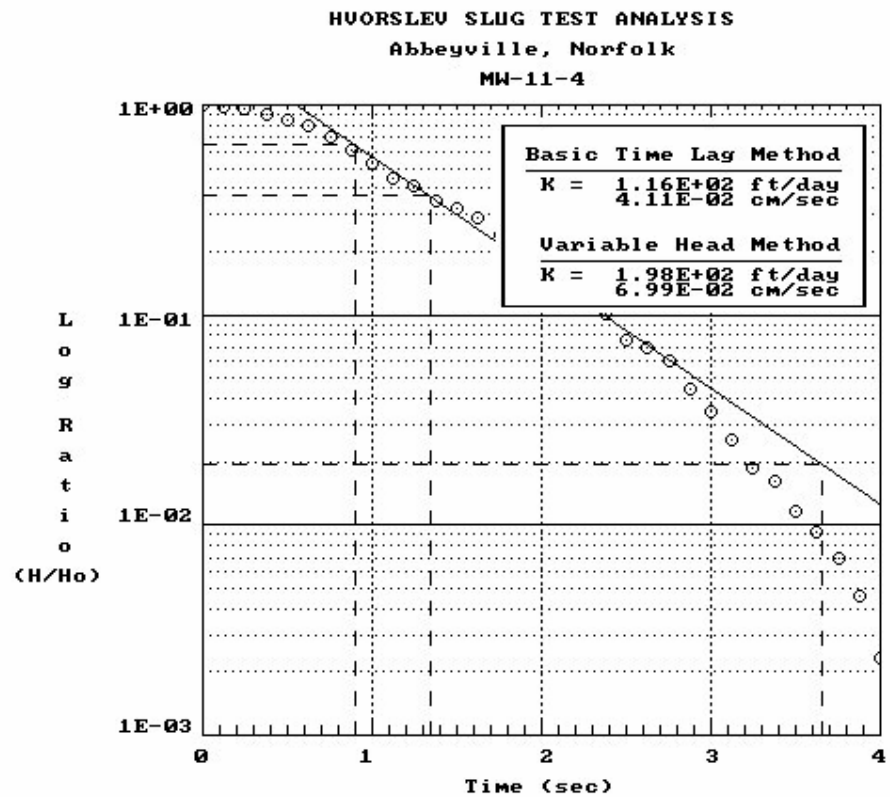
Hydraulic Conductivity (Kh):	1.98E+02 ft/day
	6.99E-02 cm/sec
Time Coordinate T1:	0.9 sec
Time Coordinate T2:	3.7 sec
Head Ratio Coordinate H1:	64.58E-02
Head Ratio Coordinate H2:	19.55E-03

Well/Aquifer Parameters

Length of well screen:	5.00 ft
Diameter of the well casing:	0.167 ft
Diameter of the well bore:	0.750 ft
Kh/Kv ratio:	1.0

Time vs Drawdown Ratio Data

No.	Time (sec)	H/Hmax (ft)	No.	Time (sec)	H/Hmax (ft)	No.	Time (sec)	H/Hmax (ft)
1	0.0000	1.000	2	0.1250	0.988	3	0.2500	0.961
4	0.3750	0.893	5	0.5000	0.847	6	0.6250	0.796
7	0.7500	0.698	8	0.8750	0.608	9	1.0000	0.524
10	1.1250	0.448	11	1.2500	0.413	12	1.3750	0.353
13	1.5000	0.323	14	1.6250	0.292	15	1.7500	0.241
16	1.8750	0.197	17	2.0000	0.158	18	2.1250	0.128
19	2.2500	0.116	20	2.3750	0.102	21	2.5000	0.077
22	2.6250	0.070	23	2.7500	0.060	24	2.8750	0.044
25	3.0000	0.035	26	3.1250	0.026	27	3.2500	0.019
28	3.3750	0.016	29	3.5000	0.012	30	3.6250	0.009
31	3.7500	0.007	32	3.8750	0.005	33	4.0000	0.002



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HVORSLEV INTERACTIVE SLUG TEST ANALYSIS                    11-17-2017
=====================================================================

                    Abbeyville, Norfolk
                          MW-12-1
                    GeoHydroCycle, Inc.

 Results
--------

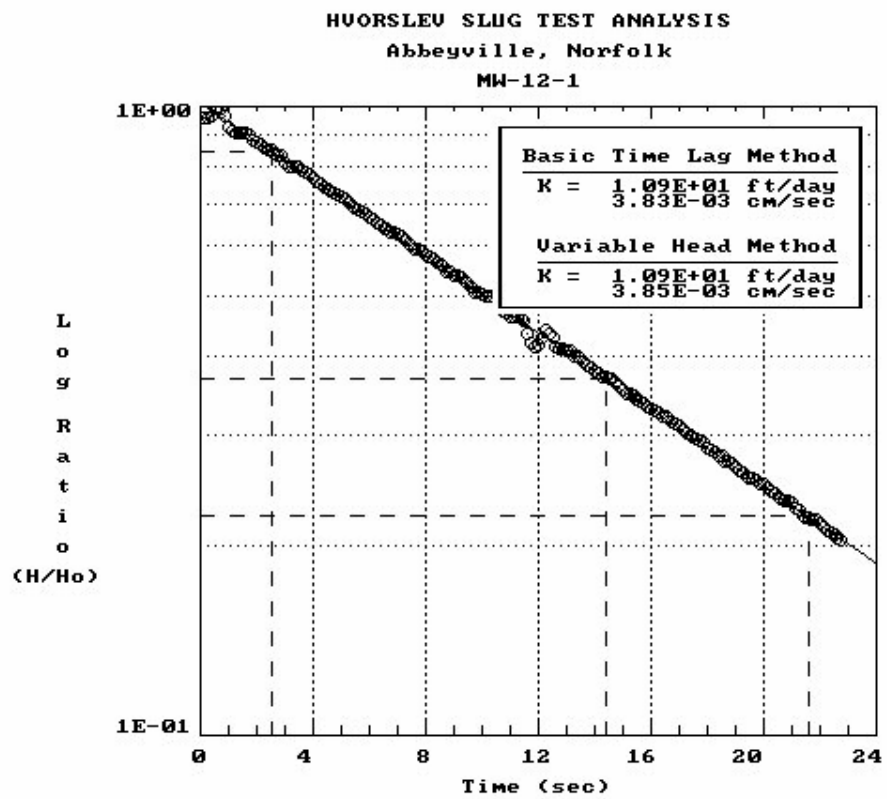
 Basic Time Lag-
     Hydraulic Conductivity (Kh):     1.09E+01 ft/day
                                      3.83E-03 cm/sec
                   Basic Time Lag:    14.38 sec
        2.3 Times Basic Time Lag:     33.07 sec
        (Equalization Ratio ÷ 0.90)

 Variable Head-
     Hydraulic Conductivity (Kh):     1.09E+01 ft/day
                                      3.85E-03 cm/sec
              Time Coordinate T1:     2.6 sec
              Time Coordinate T2:    21.6 sec
        Head Ratio Coordinate H1:    84.64E-02
        Head Ratio Coordinate H2:    22.29E-02

 Well/Aquifer Parameters
------------------------
           Length of well screen:     5.00   ft
     Diameter of the well casing:     0.167  ft
       Diameter of the well bore:     0.750  ft
                     Kh/Kv ratio:     1.0

 Time vs Drawdown Ratio Data
------------------------
```

No.	Time (sec)	H/Hmax (ft)	No.	Time (sec)	H/Hmax (ft)	No.	Time (sec)	H/Hmax (ft)
1	0.0000	0.960	2	0.1250	0.960	3	0.2500	0.958
4	0.3750	0.968	5	0.5000	0.990	6	0.6250	1.000
7	0.7500	0.994	8	0.8750	0.966	9	1.0000	0.930
10	1.1250	0.914	11	1.2500	0.908	12	1.3750	0.910
13	1.5000	0.910	14	1.6250	0.906	15	1.7500	0.900
16	1.8750	0.886	17	2.0000	0.878	18	2.1250	0.870
19	2.2500	0.862	20	2.3750	0.856	21	2.5000	0.852
22	2.6250	0.842	23	2.7500	0.838	24	2.8750	0.834
25	3.0000	0.814	26	3.1250	0.804	27	3.2500	0.804
28	3.3750	0.804	29	3.5000	0.800	30	3.6250	0.794
31	3.7500	0.786	32	3.8750	0.780	33	4.0000	0.770
34	4.1250	0.762	35	4.2500	0.754	36	4.3750	0.746
37	4.5000	0.740	38	4.6250	0.734	39	4.7500	0.728
40	4.8750	0.724	41	5.0000	0.720	42	5.1250	0.712
43	5.2500	0.704	44	5.3750	0.694	45	5.5000	0.688
46	5.6250	0.684	47	5.7500	0.680	48	5.8750	0.674
49	6.0000	0.668	50	6.1250	0.662	51	6.2500	0.654
52	6.3750	0.648	53	6.5000	0.640	54	6.6250	0.638
55	6.7500	0.632	56	6.8750	0.630	57	7.0000	0.626
58	7.1250	0.624	59	7.2500	0.612	60	7.3750	0.604
61	7.5000	0.600	62	7.6250	0.594	63	7.7500	0.592
64	7.8750	0.588	65	8.0000	0.582	66	8.1250	0.576
67	8.2500	0.572	68	8.3750	0.566	69	8.5000	0.560
70	8.6250	0.556	71	8.7500	0.548	72	8.8750	0.546
73	9.0000	0.540	74	9.1250	0.538	75	9.2500	0.534
76	9.3750	0.528	77	9.5000	0.524	78	9.6250	0.516
79	9.7500	0.508	80	9.8750	0.506	81	10.0000	0.504
82	10.1250	0.500	83	10.2500	0.498	84	10.3750	0.500
85	10.5000	0.502	86	10.6250	0.488	87	10.7500	0.474
88	10.8750	0.468	89	11.0000	0.462	90	11.1250	0.462
91	11.2500	0.462	92	11.3750	0.460	93	11.5000	0.456
94	11.6250	0.436	95	11.7500	0.422	96	11.8750	0.416
97	12.0000	0.418	98	12.1250	0.428	99	12.2500	0.440
100	12.3750	0.434	101	12.5000	0.428	102	12.6250	0.416
103	12.7500	0.412	104	12.8750	0.412	105	13.0000	0.410
106	13.1250	0.408	107	13.2500	0.402	108	13.3750	0.400
109	13.5000	0.398	110	13.6250	0.394	111	13.7500	0.388
112	13.8750	0.384	113	14.0000	0.380	114	14.1250	0.378
115	14.2500	0.372	116	14.3750	0.372	117	14.5000	0.370
118	14.6250	0.368	119	14.7500	0.364	120	14.8750	0.358
121	15.0000	0.354	122	15.1250	0.350	123	15.2500	0.350



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HVORSLEV INTERACTIVE SLUG TEST ANALYSIS                    11-17-2017
=====================================================================

                    Abbeyville, Norfolk
                          MW-12-2
                    GeoHydroCycle, Inc.

 Results
--------

 Basic Time Lag-
     Hydraulic Conductivity (Kh):     1.63E+01 ft/day
                                      5.73E-03 cm/sec
                   Basic Time Lag:    9.60 sec
        2.3 Times Basic Time Lag:    22.08 sec
        (Equalization Ratio ÷ 0.90)

 Variable Head-
     Hydraulic Conductivity (Kh):     1.65E+01 ft/day
                                      5.82E-03 cm/sec
              Time Coordinate T1:     1.6 sec
              Time Coordinate T2:    12.6 sec
        Head Ratio Coordinate H1:    86.42E-02
        Head Ratio Coordinate H2:    26.89E-02

 Well/Aquifer Parameters
------------------------
           Length of well screen:     5.00   ft
     Diameter of the well casing:     0.167  ft
       Diameter of the well bore:     0.750  ft
                     Kh/Kv ratio:     1.0

 Time vs Drawdown Ratio Data
------------------------
```
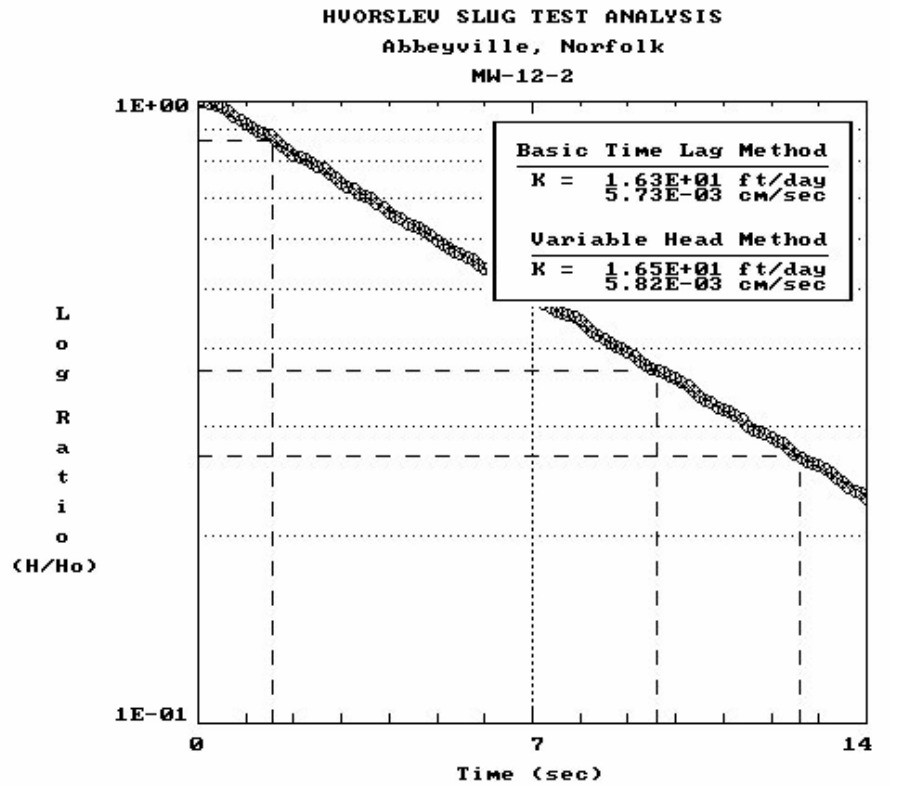

No.	Time (sec)	H/Hmax (ft)	No.	Time (sec)	H/Hmax (ft)	No.	Time (sec)	H/Hmax (ft)
1	0.0000	1.000	2	0.1250	0.998	3	0.2500	0.993
4	0.3750	0.988	5	0.5000	0.980	6	0.6250	0.965
7	0.7500	0.949	8	0.8750	0.935	9	1.0000	0.918
10	1.1250	0.910	11	1.2500	0.895	12	1.3750	0.890
13	1.5000	0.882	14	1.6250	0.866	15	1.7500	0.850
16	1.8750	0.835	17	2.0000	0.822	18	2.1250	0.816
19	2.2500	0.808	20	2.3750	0.795	21	2.5000	0.788
22	2.6250	0.780	23	2.7500	0.767	24	2.8750	0.753
25	3.0000	0.740	26	3.1250	0.729	27	3.2500	0.723
28	3.3750	0.711	29	3.5000	0.706	30	3.6250	0.698
31	3.7500	0.685	32	3.8750	0.674	33	4.0000	0.663
34	4.1250	0.652	35	4.2500	0.647	36	4.3750	0.637
37	4.5000	0.630	38	4.6250	0.625	39	4.7500	0.619
40	4.8750	0.608	41	5.0000	0.599	42	5.1250	0.590
43	5.2500	0.579	44	5.3750	0.575	45	5.5000	0.570
46	5.6250	0.561	47	5.7500	0.556	48	5.8750	0.547
49	6.0000	0.538	50	6.1250	0.530	51	6.2500	0.521
52	6.3750	0.516	53	6.5000	0.508	54	6.6250	0.504
55	6.7500	0.501	56	6.8750	0.497	57	7.0000	0.488
58	7.1250	0.481	59	7.2500	0.474	60	7.3750	0.466
61	7.5000	0.461	62	7.6250	0.458	63	7.7500	0.454
64	7.8750	0.450	65	8.0000	0.444	66	8.1250	0.435
67	8.2500	0.427	68	8.3750	0.422	69	8.5000	0.414
70	8.6250	0.409	71	8.7500	0.404	72	8.8750	0.400
73	9.0000	0.396	74	9.1250	0.389	75	9.2500	0.383
76	9.3750	0.377	77	9.5000	0.371	78	9.6250	0.369
79	9.7500	0.366	80	9.8750	0.362	81	10.0000	0.360
82	10.1250	0.355	83	10.2500	0.349	84	10.3750	0.343
85	10.5000	0.336	86	10.6250	0.330	87	10.7500	0.328
88	10.8750	0.322	89	11.0000	0.320	90	11.1250	0.318
91	11.2500	0.312	92	11.3750	0.308	93	11.5000	0.301
94	11.6250	0.297	95	11.7500	0.294	96	11.8750	0.292
97	12.0000	0.287	98	12.1250	0.285	99	12.2500	0.282
100	12.3750	0.277	101	12.5000	0.272	102	12.6250	0.267
103	12.7500	0.263	104	12.8750	0.262	105	13.0000	0.259
106	13.1250	0.256	107	13.2500	0.254	108	13.3750	0.248
109	13.5000	0.245	110	13.6250	0.240	111	13.7500	0.237
112	13.8750	0.234	113	14.0000	0.230	114	14.1250	0.378



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HVORSLEV INTERACTIVE SLUG TEST ANALYSIS                    11-17-2017
=====================================================================

                    Abbeyville, Norfolk
                          MW-12-3
                    GeoHydroCycle, Inc.

 Results
--------

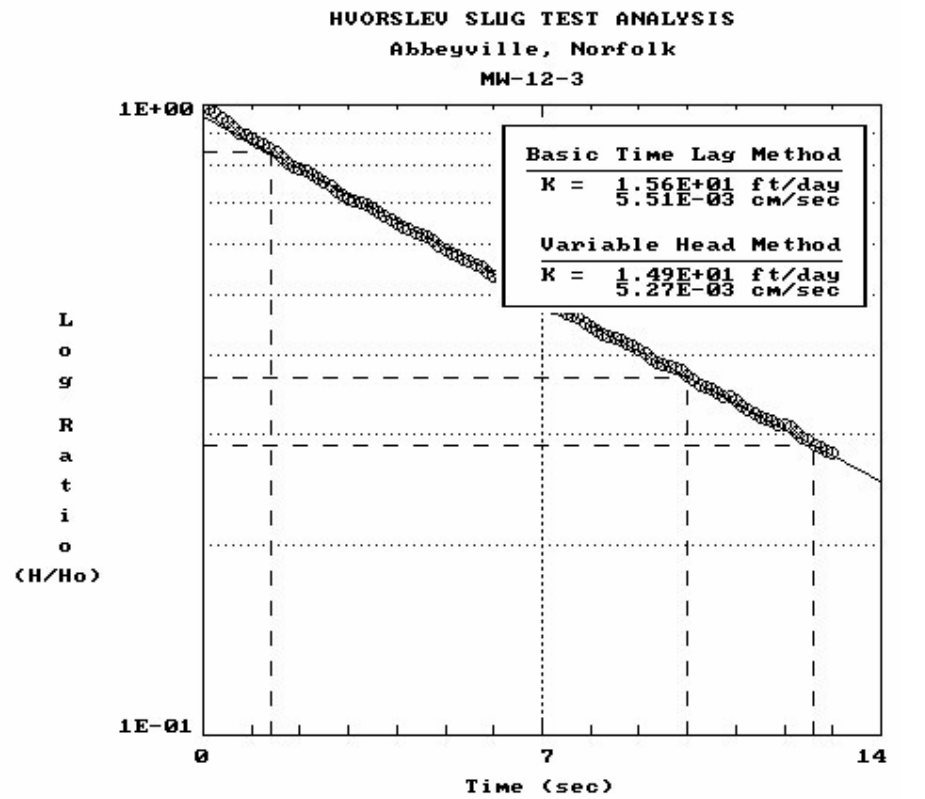
 Basic Time Lag-
     Hydraulic Conductivity (Kh):     1.56E+01 ft/day
                                      5.51E-03 cm/sec
                   Basic Time Lag:    9.99 sec
        2.3 Times Basic Time Lag:    22.98 sec
        (Equalization Ratio ÷ 0.90)

 Variable Head-
     Hydraulic Conductivity (Kh):     1.49E+01 ft/day
                                      5.27E-03 cm/sec
              Time Coordinate T1:     1.4 sec
              Time Coordinate T2:    12.6 sec
        Head Ratio Coordinate H1:    84.18E-02
        Head Ratio Coordinate H2:    28.84E-02

 Well/Aquifer Parameters
------------------------
           Length of well screen:     5.00   ft
     Diameter of the well casing:     0.167  ft
       Diameter of the well bore:     0.750  ft
                     Kh/Kv ratio:     1.0

 Time vs Drawdown Ratio Data
------------------------
```

No.	Time (sec)	H/Hmax (ft)	No.	Time (sec)	H/Hmax (ft)	No.	Time (sec)	H/Hmax (ft)
1	0.0000	1.000	2	0.1250	0.987	3	0.2500	0.976
4	0.3750	0.955	5	0.5000	0.937	6	0.6250	0.918
7	0.7500	0.904	8	0.8750	0.896	9	1.0000	0.881
10	1.1250	0.872	11	1.2500	0.865	12	1.3750	0.856
13	1.5000	0.839	14	1.6250	0.825	15	1.7500	0.811
16	1.8750	0.798	17	2.0000	0.791	18	2.1250	0.785
19	2.2500	0.774	20	2.3750	0.766	21	2.5000	0.754
22	2.6250	0.742	23	2.7500	0.730	24	2.8750	0.721
25	3.0000	0.709	26	3.1250	0.705	27	3.2500	0.701
28	3.3750	0.695	29	3.5000	0.687	30	3.6250	0.676
31	3.7500	0.665	32	3.8750	0.657	33	4.0000	0.647
34	4.1250	0.640	35	4.2500	0.634	36	4.3750	0.628
37	4.5000	0.624	38	4.6250	0.620	39	4.7500	0.608
40	4.8750	0.599	41	5.0000	0.589	42	5.1250	0.579
43	5.2500	0.576	44	5.3750	0.568	45	5.5000	0.565
46	5.6250	0.559	47	5.7500	0.552	48	5.8750	0.543
49	6.0000	0.535	50	6.1250	0.528	51	6.2500	0.523
52	6.3750	0.520	53	6.5000	0.512	54	6.6250	0.509
55	6.7500	0.504	56	6.8750	0.496	57	7.0000	0.488
58	7.1250	0.483	59	7.2500	0.475	60	7.3750	0.472
61	7.5000	0.465	62	7.6250	0.462	63	7.7500	0.459
64	7.8750	0.451	65	8.0000	0.445	66	8.1250	0.438
67	8.2500	0.433	68	8.3750	0.429	69	8.5000	0.427
70	8.6250	0.424	71	8.7500	0.419	72	8.8750	0.416
73	9.0000	0.409	74	9.1250	0.403	75	9.2500	0.395
76	9.3750	0.390	77	9.5000	0.388	78	9.6250	0.384
79	9.7500	0.382	80	9.8750	0.379	81	10.0000	0.371
82	10.1250	0.366	83	10.2500	0.360	84	10.3750	0.356
85	10.5000	0.353	86	10.6250	0.348	87	10.7500	0.345
88	10.8750	0.343	89	11.0000	0.340	90	11.1250	0.334
91	11.2500	0.329	92	11.3750	0.324	93	11.5000	0.319
94	11.6250	0.318	95	11.7500	0.316	96	11.8750	0.311
97	12.0000	0.310	98	12.1250	0.308	99	12.2500	0.302
100	12.3750	0.297	101	12.5000	0.294	102	12.6250	0.287
103	12.7500	0.286	104	12.8750	0.283	105	13.0000	0.281



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HVORSLEV INTERACTIVE SLUG TEST ANALYSIS                    11-17-2017
=====================================================================

                    Abbeyville, Norfolk
                          MW-12-4
                    GeoHydroCycle, Inc.

 Results
--------

 Basic Time Lag-
     Hydraulic Conductivity (Kh):     1.59E+01 ft/day
                                      5.62E-03 cm/sec
                  Basic Time Lag:     9.79 sec
        2.3 Times Basic Time Lag:    22.52 sec
        (Equalization Ratio ÷ 0.90)

 Variable Head-
     Hydraulic Conductivity (Kh):     1.52E+01 ft/day
                                      5.38E-03 cm/sec
              Time Coordinate T1:     1.6 sec
              Time Coordinate T2:    14.4 sec
        Head Ratio Coordinate H1:    82.36E-02
        Head Ratio Coordinate H2:    23.59E-02

 Well/Aquifer Parameters
------------------------
           Length of well screen:     5.00   ft
     Diameter of the well casing:     0.167  ft
       Diameter of the well bore:     0.750  ft
                    Kh/Kv ratio:     1.0

 Time vs Drawdown Ratio Data
------------------------
```
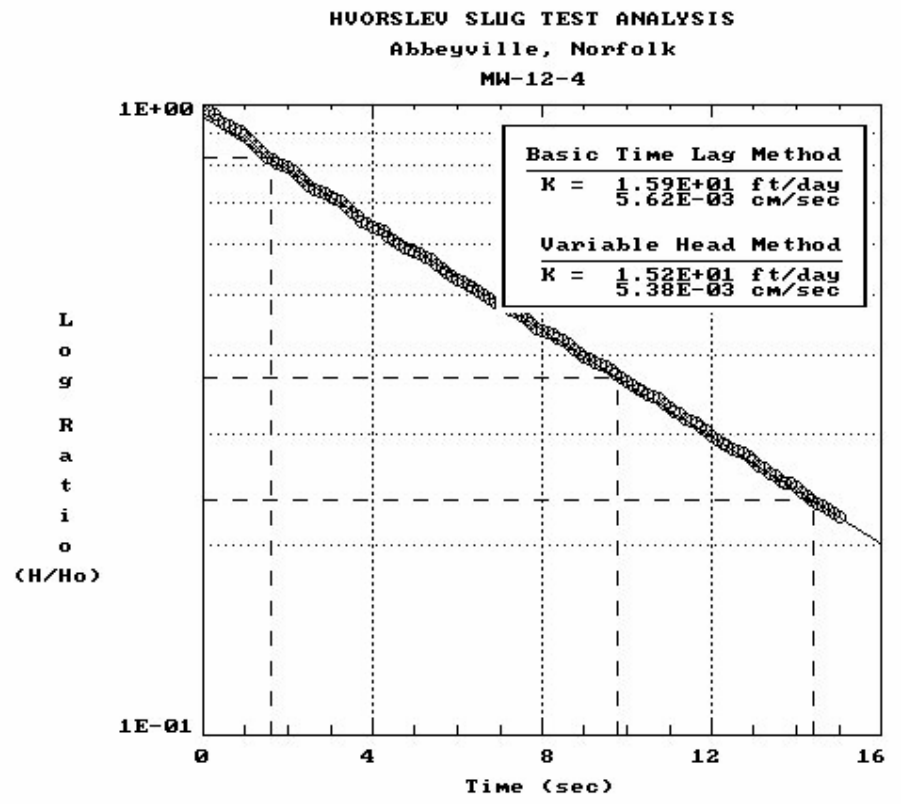

No.	Time (sec)	H/Hmax (ft)	No.	Time (sec)	H/Hmax (ft)	No.	Time (sec)	H/Hmax (ft)
1	0.0000	1.000	2	0.1250	0.983	3	0.2500	0.967
4	0.3750	0.949	5	0.5000	0.932	6	0.6250	0.924
7	0.7500	0.915	8	0.8750	0.906	9	1.0000	0.896
10	1.1250	0.878	11	1.2500	0.857	12	1.3750	0.840
13	1.5000	0.826	14	1.6250	0.820	15	1.7500	0.808
16	1.8750	0.801	17	2.0000	0.795	18	2.1250	0.787
19	2.2500	0.772	20	2.3750	0.757	21	2.5000	0.745
22	2.6250	0.734	23	2.7500	0.729	24	2.8750	0.722
25	3.0000	0.716	26	3.1250	0.711	27	3.2500	0.703
28	3.3750	0.689	29	3.5000	0.676	30	3.6250	0.666
31	3.7500	0.654	32	3.8750	0.650	33	4.0000	0.639
34	4.1250	0.635	35	4.2500	0.630	36	4.3750	0.620
37	4.5000	0.610	38	4.6250	0.600	39	4.7500	0.592
40	4.8750	0.589	41	5.0000	0.583	42	5.1250	0.580
43	5.2500	0.575	44	5.3750	0.569	45	5.5000	0.559
46	5.6250	0.551	47	5.7500	0.542	48	5.8750	0.533
49	6.0000	0.529	50	6.1250	0.524	51	6.2500	0.518
52	6.3750	0.514	53	6.5000	0.508	54	6.6250	0.500
55	6.7500	0.492	56	6.8750	0.486	57	7.0000	0.482
58	7.1250	0.478	59	7.2500	0.472	60	7.3750	0.469
61	7.5000	0.464	62	7.6250	0.457	63	7.7500	0.449
64	7.8750	0.443	65	8.0000	0.437	66	8.1250	0.434
67	8.2500	0.431	68	8.3750	0.428	69	8.5000	0.424
70	8.6250	0.417	71	8.7500	0.410	72	8.8750	0.404
73	9.0000	0.398	74	9.1250	0.395	75	9.2500	0.390
76	9.3750	0.387	77	9.5000	0.383	78	9.6250	0.380
79	9.7500	0.375	80	9.8750	0.368	81	10.0000	0.363
82	10.1250	0.359	83	10.2500	0.355	84	10.3750	0.352
85	10.5000	0.347	86	10.6250	0.344	87	10.7500	0.342
88	10.8750	0.336	89	11.0000	0.330	90	11.1250	0.325
91	11.2500	0.323	92	11.3750	0.317	93	11.5000	0.314
94	11.6250	0.312	95	11.7500	0.309	96	11.8750	0.305
97	12.0000	0.299	98	12.1250	0.294	99	12.2500	0.290
100	12.3750	0.288	101	12.5000	0.284	102	12.6250	0.282
103	12.7500	0.280	104	12.8750	0.276	105	13.0000	0.272
106	13.1250	0.268	107	13.2500	0.265	108	13.3750	0.259
109	13.5000	0.258	110	13.6250	0.254	111	13.7500	0.252
112	13.8750	0.251	113	14.0000	0.247	114	14.1250	0.242
115	14.2500	0.239	116	14.3750	0.235	117	14.5000	0.233
118	14.6250	0.231	119	14.7500	0.228	120	14.8750	0.226
121	15.0000	0.222						



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HVORSLEV INTERACTIVE SLUG TEST ANALYSIS                    11-17-2017
=====================================================================

                    Abbeyville, Norfolk
                          MW-13-1
                    GeoHydroCycle, Inc.

 Results
--------

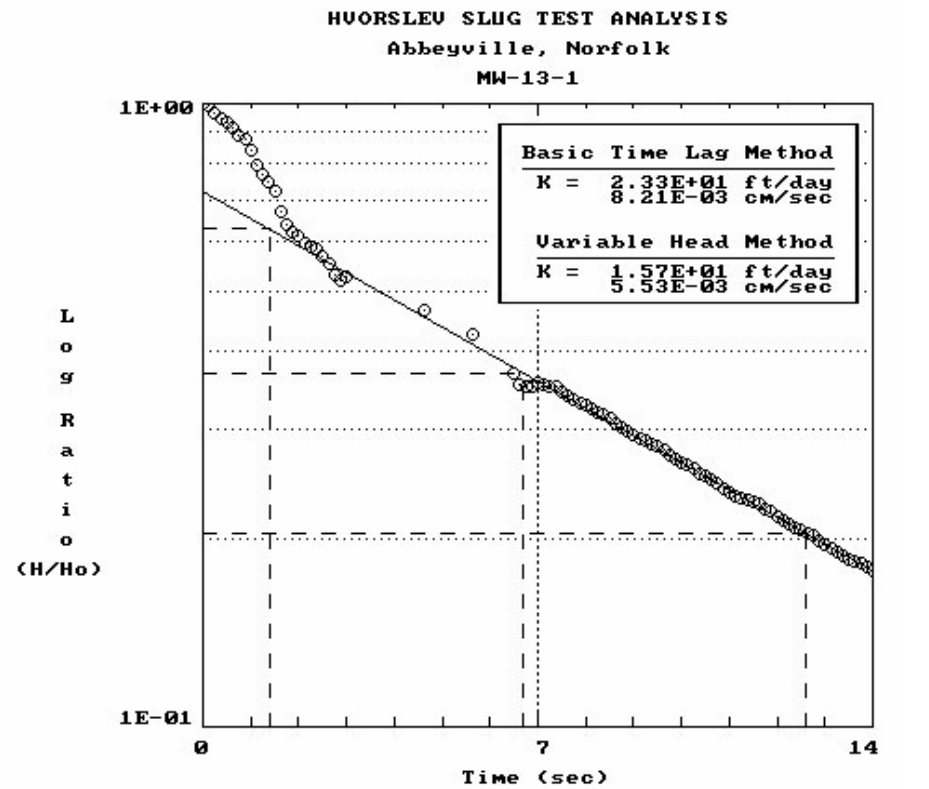
 Basic Time Lag-
     Hydraulic Conductivity (Kh):     2.33E+01 ft/day
                                      8.21E-03 cm/sec
                  Basic Time Lag:     6.71 sec
        2.3 Times Basic Time Lag:    15.43 sec
        (Equalization Ratio ÷ 0.90)

 Variable Head-
     Hydraulic Conductivity (Kh):     1.57E+01 ft/day
                                      5.53E-03 cm/sec
               Time Coordinate T1:    1.4 sec
               Time Coordinate T2:   12.6 sec
        Head Ratio Coordinate H1:    63.08E-02
        Head Ratio Coordinate H2:    20.47E-02

 Well/Aquifer Parameters
------------------------
           Length of well screen:     5.00   ft
     Diameter of the well casing:     0.167  ft
       Diameter of the well bore:     0.750  ft
                     Kh/Kv ratio:     1.0

 Time vs Drawdown Ratio Data
------------------------
```

No.	Time (sec)	H/Hmax (ft)	No.	Time (sec)	H/Hmax (ft)	No.	Time (sec)	H/Hmax (ft)
1	0.0000	1.000	2	0.1250	0.994	3	0.2500	0.967
4	0.3750	0.944	5	0.5000	0.931	6	0.6250	0.915
7	0.7500	0.888	8	0.8750	0.876	9	1.0000	0.844
10	1.1250	0.798	11	1.2500	0.769	12	1.3750	0.749
13	1.5000	0.726	14	1.6250	0.670	15	1.7500	0.638
16	1.8750	0.623	17	2.0000	0.613	18	2.1250	0.597
19	2.2500	0.589	20	2.3750	0.584	21	2.5000	0.567
22	2.6250	0.555	23	2.7500	0.533	24	2.8750	0.519
25	3.0000	0.528	26	4.6250	0.465	27	5.6250	0.427
28	6.5000	0.368	29	6.6250	0.354	30	6.7500	0.352
31	6.8750	0.352	32	7.0000	0.357	33	7.1250	0.354
34	7.2500	0.352	35	7.3750	0.351	36	7.5000	0.345
37	7.6250	0.340	38	7.7500	0.336	39	7.8750	0.331
40	8.0000	0.328	41	8.1250	0.323	42	8.2500	0.321
43	8.3750	0.318	44	8.5000	0.312	45	8.6250	0.307
46	8.7500	0.302	47	8.8750	0.298	48	9.0000	0.294
49	9.1250	0.291	50	9.2500	0.288	51	9.3750	0.285
52	9.5000	0.283	53	9.6250	0.278	54	9.7500	0.273
55	9.8750	0.270	56	10.0000	0.265	57	10.1250	0.263
58	10.2500	0.260	59	10.3750	0.255	60	10.5000	0.253
61	10.6250	0.250	62	10.7500	0.246	63	10.8750	0.241
64	11.0000	0.238	65	11.1250	0.234	66	11.2500	0.233
67	11.3750	0.231	68	11.5000	0.230	69	11.6250	0.228
70	11.7500	0.224	71	11.8750	0.221	72	12.0000	0.218
73	12.1250	0.214	74	12.2500	0.212	75	12.3750	0.209
76	12.5000	0.207	77	12.6250	0.205	78	12.7500	0.203
79	12.8750	0.199	80	13.0000	0.197	81	13.1250	0.193
82	13.2500	0.190	83	13.3750	0.189	84	13.5000	0.186
85	13.6250	0.185	86	13.7500	0.183	87	13.8750	0.180
88	14.0000	0.178						



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HVORSLEV INTERACTIVE SLUG TEST ANALYSIS                    11-17-2017
=====================================================================

                    Abbeyville, Norfolk
                          MW-13-2
                    GeoHydroCycle, Inc.

 Results
--------

 Basic Time Lag-
     Hydraulic Conductivity (Kh):     1.31E+01 ft/day
                                      4.61E-03 cm/sec
                   Basic Time Lag:    11.95 sec
        2.3 Times Basic Time Lag:     27.49 sec
        (Equalization Ratio ÷ 0.90)

 Variable Head-
     Hydraulic Conductivity (Kh):     1.27E+01 ft/day
                                      4.49E-03 cm/sec
              Time Coordinate T1:     1.8 sec
              Time Coordinate T2:    16.2 sec
        Head Ratio Coordinate H1:    84.74E-02
        Head Ratio Coordinate H2:    26.15E-02

 Well/Aquifer Parameters
------------------------
           Length of well screen:     5.00   ft
     Diameter of the well casing:     0.167  ft
       Diameter of the well bore:     0.750  ft
                     Kh/Kv ratio:     1.0

 Time vs Drawdown Ratio Data
------------------------
```
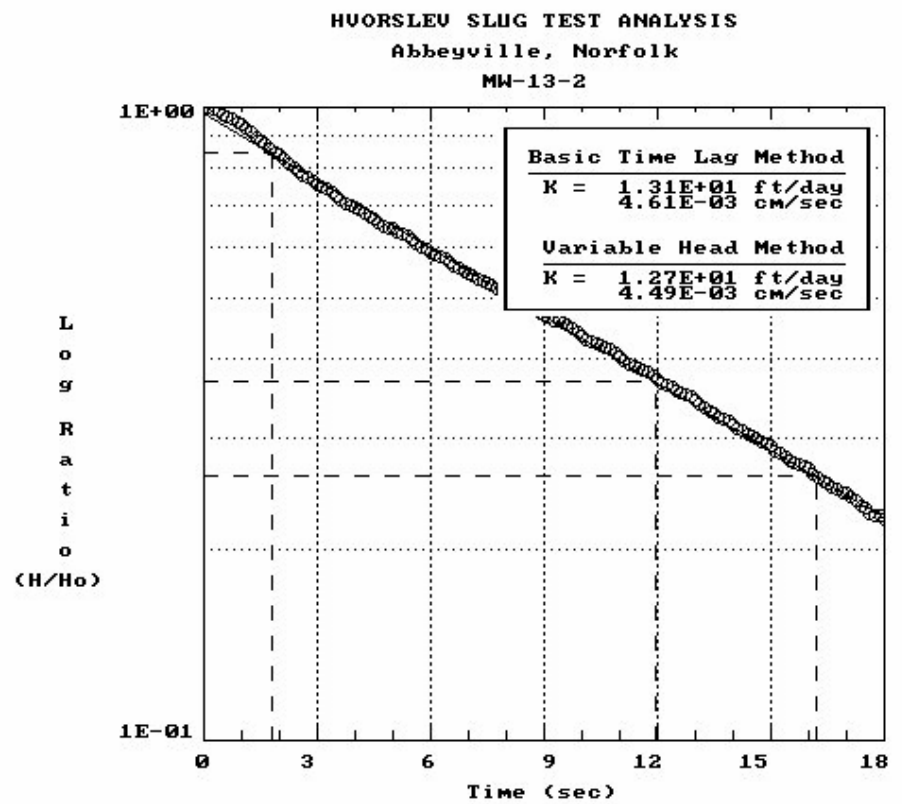

No.	Time (sec)	H/Hmax (ft)	No.	Time (sec)	H/Hmax (ft)	No.	Time (sec)	H/Hmax (ft)
1	0.0000	1.000	2	0.1250	0.999	3	0.2500	0.993
4	0.3750	0.983	5	0.5000	0.974	6	0.6250	0.967
7	0.7500	0.960	8	0.8750	0.947	9	1.0000	0.937
10	1.1250	0.928	11	1.2500	0.912	12	1.3750	0.897
13	1.5000	0.881	14	1.6250	0.875	15	1.7500	0.859
16	1.8750	0.846	17	2.0000	0.839	18	2.1250	0.831
19	2.2500	0.816	20	2.3750	0.804	21	2.5000	0.791
22	2.6250	0.780	23	2.7500	0.774	24	2.8750	0.763
25	3.0000	0.752	26	3.1250	0.748	27	3.2500	0.743
28	3.3750	0.732	29	3.5000	0.726	30	3.6250	0.716
31	3.7500	0.705	32	3.8750	0.702	33	4.0000	0.693
34	4.1250	0.688	35	4.2500	0.682	36	4.3750	0.673
37	4.5000	0.664	38	4.6250	0.657	39	4.7500	0.649
40	4.8750	0.646	41	5.0000	0.642	42	5.1250	0.635
43	5.2500	0.629	44	5.3750	0.625	45	5.5000	0.616
46	5.6250	0.611	47	5.7500	0.603	48	5.8750	0.595
49	6.0000	0.591	50	6.1250	0.584	51	6.2500	0.581
52	6.3750	0.576	53	6.5000	0.571	54	6.6250	0.563
55	6.7500	0.558	56	6.8750	0.551	57	7.0000	0.547
58	7.1250	0.541	59	7.2500	0.536	60	7.3750	0.532
61	7.5000	0.529	62	7.6250	0.523	63	7.7500	0.517
64	7.8750	0.510	65	8.0000	0.505	66	8.1250	0.503
67	8.2500	0.499	68	8.3750	0.494	69	8.5000	0.491
70	8.6250	0.485	71	8.7500	0.479	72	8.8750	0.473
73	9.0000	0.469	74	9.1250	0.466	75	9.2500	0.461
76	9.3750	0.459	77	9.5000	0.455	78	9.6250	0.452
79	9.7500	0.447	80	9.8750	0.440	81	10.0000	0.435
82	10.1250	0.430	83	10.2500	0.427	84	10.3750	0.425
85	10.5000	0.420	86	10.6250	0.417	87	10.7500	0.414
88	10.8750	0.408	89	11.0000	0.403	90	11.1250	0.398
91	11.2500	0.393	92	11.3750	0.391	93	11.5000	0.387
94	11.6250	0.384	95	11.7500	0.382	96	11.8750	0.376
97	12.0000	0.372	98	12.1250	0.367	99	12.2500	0.363
100	12.3750	0.361	101	12.5000	0.356	102	12.6250	0.354
103	12.7500	0.352	104	12.8750	0.350	105	13.0000	0.344
106	13.1250	0.340	107	13.2500	0.336	108	13.3750	0.330
109	13.5000	0.328	110	13.6250	0.325	111	13.7500	0.322
112	13.8750	0.320	113	14.0000	0.315	114	14.1250	0.311
115	14.2500	0.308	116	14.3750	0.304	117	14.5000	0.303
118	14.6250	0.300	119	14.7500	0.296	120	14.8750	0.294
121	15.0000	0.293	122	15.1250	0.287	123	15.2500	0.285



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HVORSLEV INTERACTIVE SLUG TEST ANALYSIS                    11-17-2017
=====================================================================

                    Abbeyville, Norfolk
                          MW-13-3
                    GeoHydroCycle, Inc.

 Results
--------

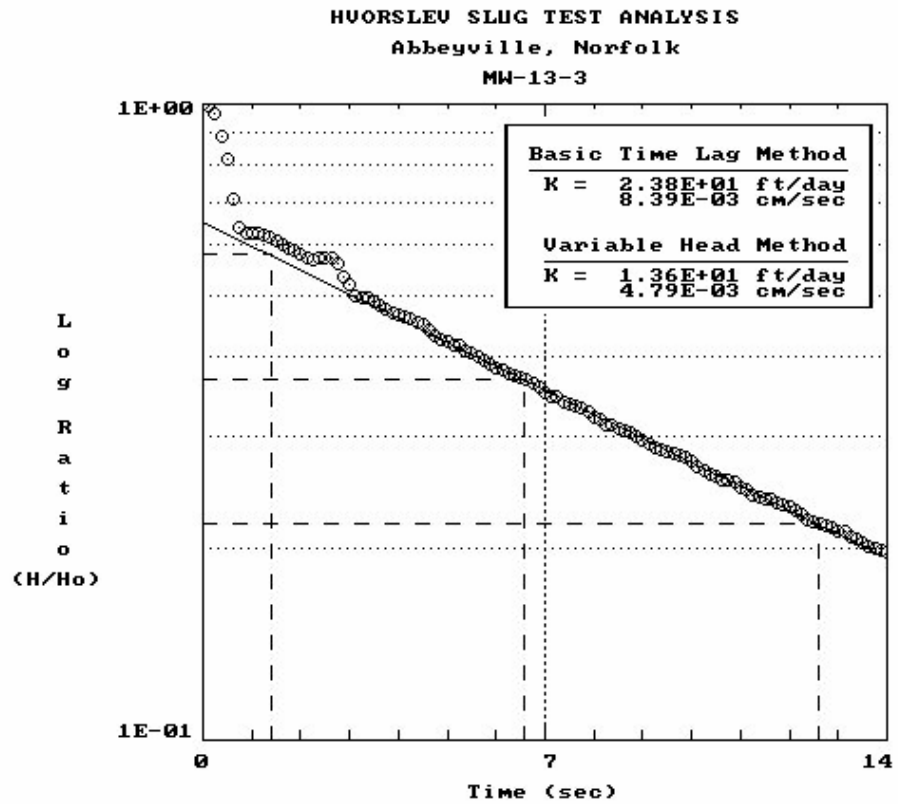
 Basic Time Lag-
     Hydraulic Conductivity (Kh):     2.38E+01 ft/day
                                      8.39E-03 cm/sec
                  Basic Time Lag:     6.56 sec
        2.3 Times Basic Time Lag:    15.08 sec
        (Equalization Ratio ÷ 0.90)

 Variable Head-
     Hydraulic Conductivity (Kh):     1.36E+01 ft/day
                                      4.79E-03 cm/sec
              Time Coordinate T1:     1.4 sec
              Time Coordinate T2:    12.6 sec
        Head Ratio Coordinate H1:    57.99E-02
        Head Ratio Coordinate H2:    21.86E-02

 Well/Aquifer Parameters
------------------------
           Length of well screen:     5.00   ft
     Diameter of the well casing:     0.167  ft
       Diameter of the well bore:     0.750  ft
                     Kh/Kv ratio:     1.0

 Time vs Drawdown Ratio Data
------------------------
```

No.	Time (sec)	H/Hmax (ft)	No.	Time (sec)	H/Hmax (ft)	No.	Time (sec)	H/Hmax (ft)
1	0.0000	1.000	2	0.1250	0.991	3	0.2500	0.964
4	0.3750	0.890	5	0.5000	0.818	6	0.6250	0.707
7	0.7500	0.638	8	0.8750	0.628	9	1.0000	0.627
10	1.1250	0.628	11	1.2500	0.624	12	1.3750	0.616
13	1.5000	0.609	14	1.6250	0.600	15	1.7500	0.592
16	1.8750	0.588	17	2.0000	0.583	18	2.1250	0.575
19	2.2500	0.570	20	2.3750	0.574	21	2.5000	0.575
22	2.6250	0.572	23	2.7500	0.562	24	2.8750	0.534
25	3.0000	0.520	26	3.1250	0.500	27	3.2500	0.498
28	3.3750	0.495	29	3.5000	0.488	30	3.6250	0.481
31	3.7500	0.475	32	3.8750	0.469	33	4.0000	0.468
34	4.1250	0.464	35	4.2500	0.460	36	4.3750	0.455
37	4.5000	0.451	38	4.6250	0.441	39	4.7500	0.433
40	4.8750	0.427	41	5.0000	0.422	42	5.1250	0.418
43	5.2500	0.416	44	5.3750	0.410	45	5.5000	0.407
46	5.6250	0.400	47	5.7500	0.396	48	5.8750	0.390
49	6.0000	0.385	50	6.1250	0.383	51	6.2500	0.378
52	6.3750	0.375	53	6.5000	0.371	54	6.6250	0.369
55	6.7500	0.363	56	6.8750	0.358	57	7.0000	0.353
58	7.1250	0.348	59	7.2500	0.346	60	7.3750	0.340
61	7.5000	0.338	62	7.6250	0.335	63	7.7500	0.332
64	7.8750	0.328	65	8.0000	0.323	66	8.1250	0.319
67	8.2500	0.314	68	8.3750	0.312	69	8.5000	0.309
70	8.6250	0.306	71	8.7500	0.304	72	8.8750	0.300
73	9.0000	0.296	74	9.1250	0.292	75	9.2500	0.289
76	9.3750	0.286	77	9.5000	0.284	78	9.6250	0.283
79	9.7500	0.281	80	9.8750	0.278	81	10.0000	0.274
82	10.1250	0.270	83	10.2500	0.266	84	10.3750	0.262
85	10.5000	0.260	86	10.6250	0.257	87	10.7500	0.256
88	10.8750	0.254	89	11.0000	0.250	90	11.1250	0.247
91	11.2500	0.243	92	11.3750	0.241	93	11.5000	0.240
94	11.6250	0.239	95	11.7500	0.236	96	11.8750	0.235
97	12.0000	0.233	98	12.1250	0.229	99	12.2500	0.226
100	12.3750	0.222	101	12.5000	0.220	102	12.6250	0.219
103	12.7500	0.217	104	12.8750	0.215	105	13.0000	0.214
106	13.1250	0.213	107	13.2500	0.209	108	13.3750	0.207
109	13.5000	0.204	110	13.6250	0.202	111	13.7500	0.200
112	13.8750	0.199	113	14.0000	0.198	114	14.1250	0.311



HVORSLEV INTERACTIVE SLUG TEST ANALYSIS 11-17-2017

Abbeyville, Norfolk
MW-13-4
GeoHydroCycle, Inc.

Results

Basic Time Lag-

Hydraulic Conductivity (Kh):	1.87E+01 ft/day
	6.60E-03 cm/sec
Basic Time Lag:	8.34 sec
2.3 Times Basic Time Lag:	19.17 sec
(Equalization Ratio ÷ 0.90)	

Variable Head-

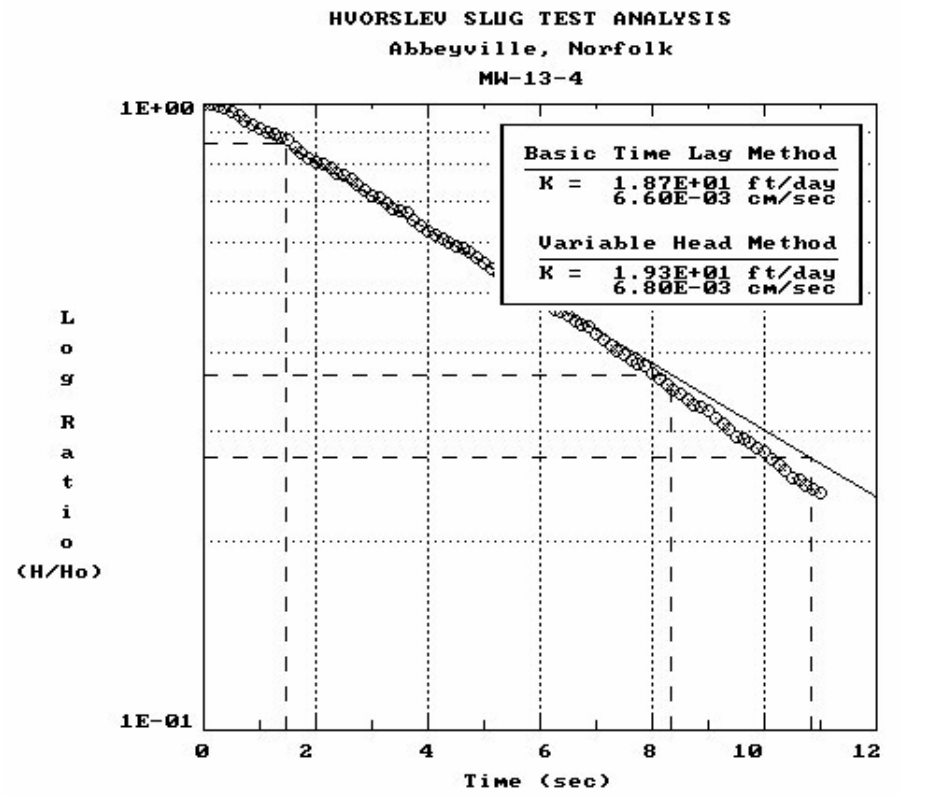
Hydraulic Conductivity (Kh):	1.93E+01 ft/day
	6.80E-03 cm/sec
Time Coordinate T1:	1.5 sec
Time Coordinate T2:	10.8 sec
Head Ratio Coordinate H1:	86.53E-02
Head Ratio Coordinate H2:	27.20E-02

Well/Aquifer Parameters

Length of well screen:	5.00 ft
Diameter of the well casing:	0.167 ft
Diameter of the well bore:	0.750 ft
Kh/Kv ratio:	1.0

Time vs Drawdown Ratio Data

No.	Time (sec)	H/Hmax (ft)	No.	Time (sec)	H/Hmax (ft)	No.	Time (sec)	H/Hmax (ft)
1	0.0000	1.000	2	0.1250	0.999	3	0.2500	0.993
4	0.3750	0.987	5	0.5000	0.973	6	0.6250	0.957
7	0.7500	0.940	8	0.8750	0.925	9	1.0000	0.918
10	1.1250	0.903	11	1.2500	0.894	12	1.3750	0.885
13	1.5000	0.876	14	1.6250	0.855	15	1.7500	0.839
16	1.8750	0.822	17	2.0000	0.808	18	2.1250	0.800
19	2.2500	0.792	20	2.3750	0.775	21	2.5000	0.768
22	2.6250	0.759	23	2.7500	0.743	24	2.8750	0.729
25	3.0000	0.714	26	3.1250	0.707	27	3.2500	0.695
28	3.3750	0.682	29	3.5000	0.676	30	3.6250	0.669
31	3.7500	0.654	32	3.8750	0.642	33	4.0000	0.628
34	4.1250	0.618	35	4.2500	0.612	36	4.3750	0.601
37	4.5000	0.595	38	4.6250	0.589	39	4.7500	0.582
40	4.8750	0.569	41	5.0000	0.557	42	5.1250	0.546
43	5.2500	0.536	44	5.3750	0.530	45	5.5000	0.521
46	5.6250	0.515	47	5.7500	0.509	48	5.8750	0.498
49	6.0000	0.489	50	6.1250	0.479	51	6.2500	0.470
52	6.3750	0.465	53	6.5000	0.460	54	6.6250	0.450
55	6.7500	0.446	56	6.8750	0.441	57	7.0000	0.430
58	7.1250	0.421	59	7.2500	0.411	60	7.3750	0.403
61	7.5000	0.399	62	7.6250	0.391	63	7.7500	0.386
64	7.8750	0.382	65	8.0000	0.373	66	8.1250	0.364
67	8.2500	0.357	68	8.3750	0.349	69	8.5000	0.345
70	8.6250	0.338	71	8.7500	0.331	72	8.8750	0.329
73	9.0000	0.324	74	9.1250	0.315	75	9.2500	0.308
76	9.3750	0.302	77	9.5000	0.295	78	9.6250	0.292
79	9.7500	0.288	80	9.8750	0.282	81	10.0000	0.278
82	10.1250	0.271	83	10.2500	0.265	84	10.3750	0.259
85	10.5000	0.253	86	10.6250	0.251	87	10.7500	0.246
88	10.8750	0.243	89	11.0000	0.239	90	11.1250	0.247



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HVORSLEV INTERACTIVE SLUG TEST ANALYSIS                    04-06-2016
=====================================================================

                          Norfolk
                          ghc1-1
                    GeoHydroCycle, Inc.

 Results
--------

 Basic Time Lag-
     Hydraulic Conductivity (Kh):     5.37E+01 ft/day
                                      1.90E-02 cm/sec
                   Basic Time Lag:    2.00 sec
        2.3 Times Basic Time Lag:     4.60 sec
        (Equalization Ratio ÷ 0.90)

 Variable Head-
     Hydraulic Conductivity (Kh):     2.82E+01 ft/day
                                      9.95E-03 cm/sec
               Time Coordinate T1:    0.6 sec
               Time Coordinate T2:    5.4 sec
        Head Ratio Coordinate H1:    53.42E-02
        Head Ratio Coordinate H2:    15.16E-02

 Well/Aquifer Parameters
------------------------
           Length of well screen:     9.10   ft
     Diameter of the well casing:     0.167  ft
       Diameter of the well bore:     0.708  ft
                    Kh/Kv ratio:      1.0

 Time vs Drawdown Ratio Data
------------------------
```
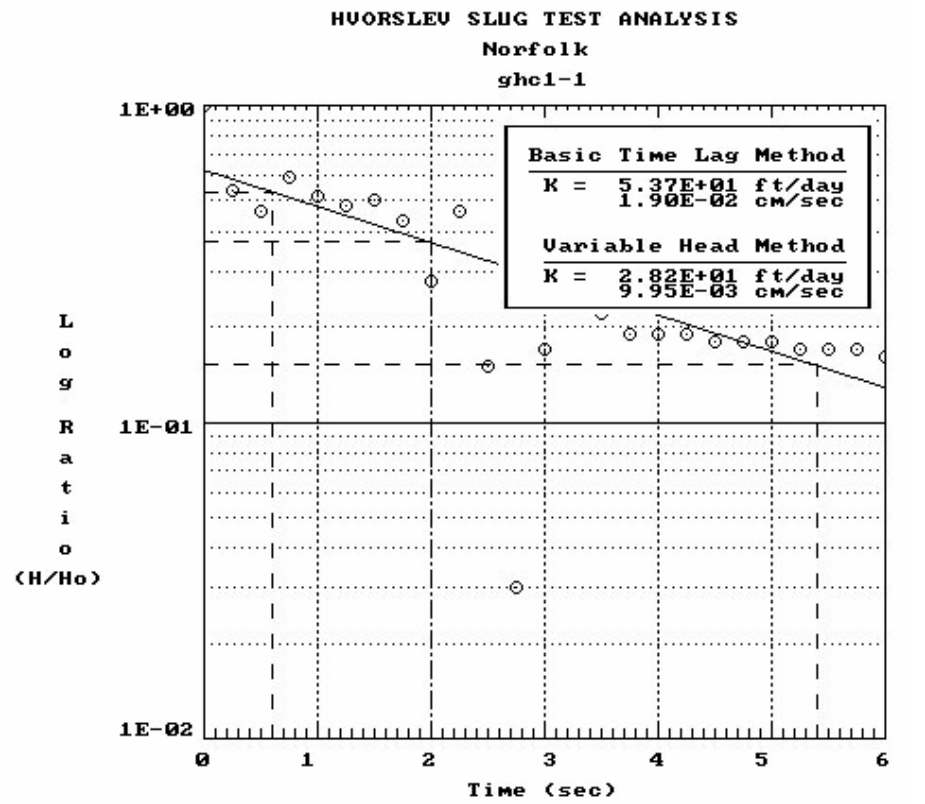

No.	Time (sec)	H/Hmax (ft)	No.	Time (sec)	H/Hmax (ft)	No.	Time (sec)	H/Hmax (ft)
1	0.0000	1.000	2	0.2500	0.540	3	0.5000	0.460
4	0.7500	0.590	5	1.0000	0.520	6	1.2500	0.480
7	1.5000	0.500	8	1.7500	0.430	9	2.0000	0.280
10	2.2500	0.460	11	2.5000	0.150	12	2.7500	0.030
13	3.0000	0.170	14	3.2500	0.250	15	3.5000	0.220
16	3.7500	0.190	17	4.0000	0.190	18	4.2500	0.190
19	4.5000	0.180	20	4.7500	0.180	21	5.0000	0.180
22	5.2500	0.170	23	5.5000	0.170	24	5.7500	0.170
25	6.0000	0.160						



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HVORSLEV INTERACTIVE SLUG TEST ANALYSIS                    04-06-2016
====================================================================

                          Norfolk
                          ghc1-2
                    GeoHydroCycle, Inc.

 Results
--------

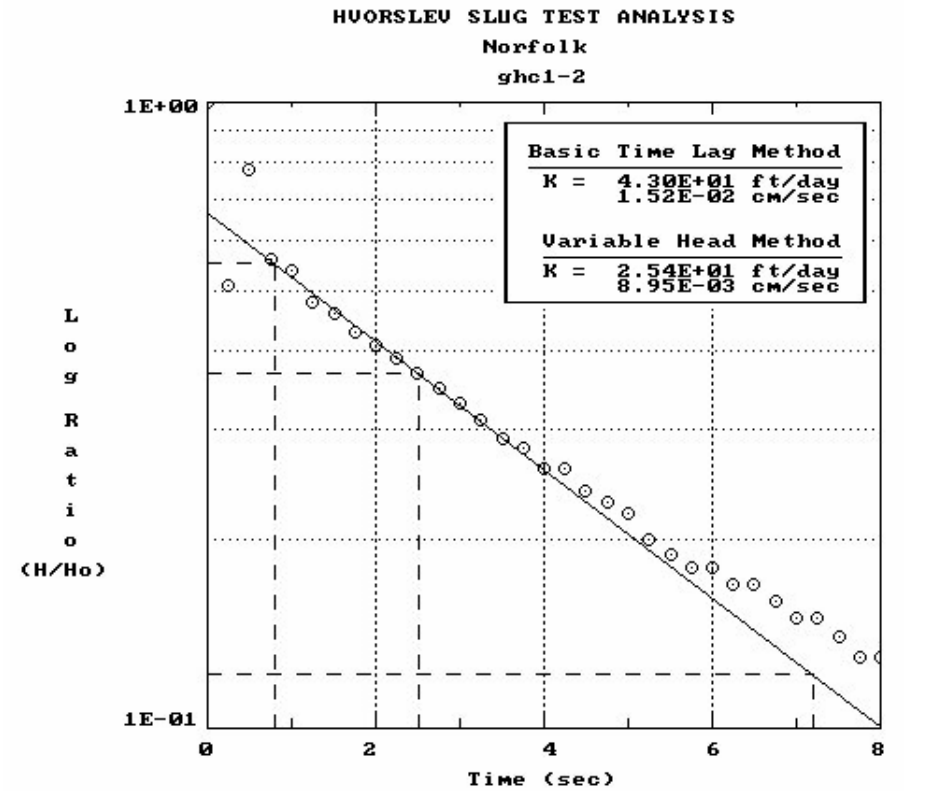
 Basic Time Lag-
     Hydraulic Conductivity (Kh):     4.30E+01 ft/day
                                      1.52E-02 cm/sec
                   Basic Time Lag:    2.50 sec
        2.3 Times Basic Time Lag:     5.75 sec
        (Equalization Ratio ÷ 0.90)

 Variable Head-
     Hydraulic Conductivity (Kh):     2.54E+01 ft/day
                                      8.95E-03 cm/sec
               Time Coordinate T1:    0.8 sec
               Time Coordinate T2:    7.2 sec
        Head Ratio Coordinate H1:    55.29E-02
        Head Ratio Coordinate H2:    12.20E-02

 Well/Aquifer Parameters
------------------------
           Length of well screen:     9.10   ft
     Diameter of the well casing:     0.167  ft
       Diameter of the well bore:     0.708  ft
                    Kh/Kv ratio:      1.0

 Time vs Drawdown Ratio Data
------------------------
```

No.	Time (sec)	H/Hmax (ft)	No.	Time (sec)	H/Hmax (ft)	No.	Time (sec)	H/Hmax (ft)
1	0.0000	1.000	2	0.2500	0.510	3	0.5000	0.780
4	0.7500	0.560	5	1.0000	0.540	6	1.2500	0.480
7	1.5000	0.460	8	1.7500	0.430	9	2.0000	0.410
10	2.2500	0.390	11	2.5000	0.370	12	2.7500	0.350
13	3.0000	0.330	14	3.2500	0.310	15	3.5000	0.290
16	3.7500	0.280	17	4.0000	0.260	18	4.2500	0.260
19	4.5000	0.240	20	4.7500	0.230	21	5.0000	0.220
22	5.2500	0.200	23	5.5000	0.190	24	5.7500	0.180
25	6.0000	0.180	26	6.2500	0.170	27	6.5000	0.170
28	6.7500	0.160	29	7.0000	0.150	30	7.2500	0.150
31	7.5000	0.140	32	7.7500	0.130	33	8.0000	0.130



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HVORSLEV INTERACTIVE SLUG TEST ANALYSIS                    04-06-2016
====================================================================

                          Norfolk
                          ghc1-3
                    GeoHydroCycle, Inc.

 Results
--------

 Basic Time Lag-
     Hydraulic Conductivity (Kh):     8.71E+01 ft/day
                                      3.07E-02 cm/sec
                  Basic Time Lag:     1.23 sec
        2.3 Times Basic Time Lag:     2.84 sec
        (Equalization Ratio ÷ 0.90)

 Variable Head-
     Hydraulic Conductivity (Kh):     6.46E+01 ft/day
                                      2.28E-02 cm/sec
               Time Coordinate T1:    0.6 sec
               Time Coordinate T2:    5.4 sec
        Head Ratio Coordinate H1:    54.17E-02
        Head Ratio Coordinate H2:    30.28E-03

 Well/Aquifer Parameters
------------------------
           Length of well screen:     9.10   ft
     Diameter of the well casing:     0.167  ft
       Diameter of the well bore:     0.708  ft
                    Kh/Kv ratio:      1.0

 Time vs Drawdown Ratio Data
------------------------
```
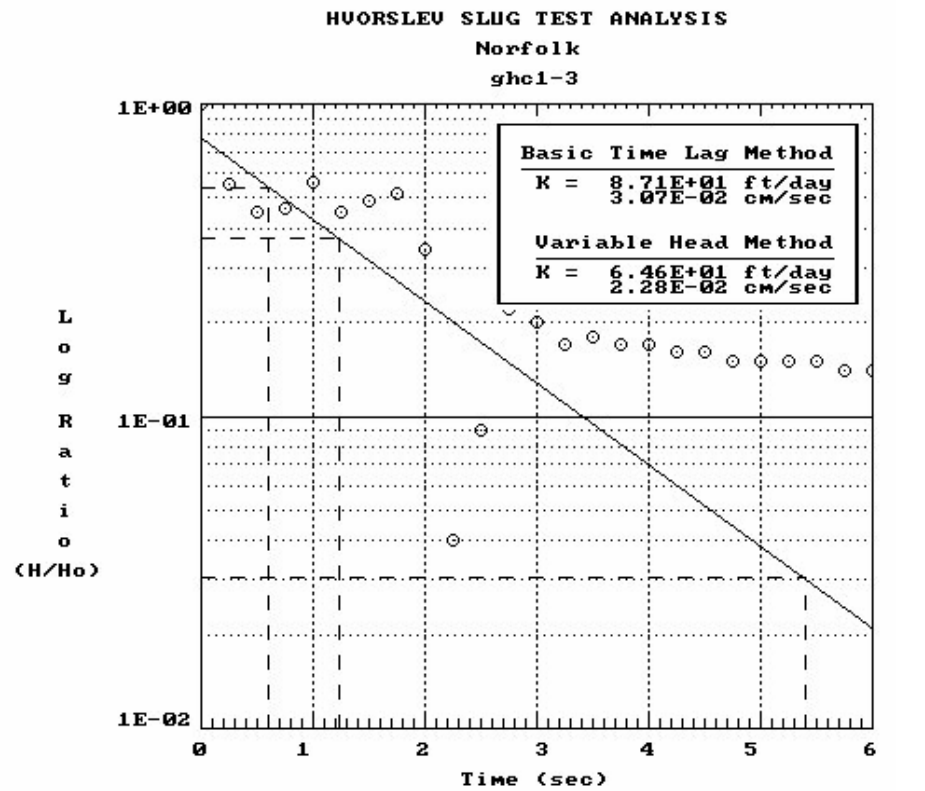

No.	Time (sec)	H/Hmax (ft)	No.	Time (sec)	H/Hmax (ft)	No.	Time (sec)	H/Hmax (ft)
1	0.0000	1.000	2	0.2500	0.550	3	0.5000	0.450
4	0.7500	0.460	5	1.0000	0.560	6	1.2500	0.450
7	1.5000	0.490	8	1.7500	0.520	9	2.0000	0.340
10	2.2500	0.040	11	2.5000	0.090	12	2.7500	0.220
13	3.0000	0.200	14	3.2500	0.170	15	3.5000	0.180
16	3.7500	0.170	17	4.0000	0.170	18	4.2500	0.160
19	4.5000	0.160	20	4.7500	0.150	21	5.0000	0.150
22	5.2500	0.150	23	5.5000	0.150	24	5.7500	0.140
25	6.0000	0.140						



HVORSLEV INTERACTIVE SLUG TEST ANALYSIS 04-06-2016

Norfolk
ghc1-4
GeoHydroCycle, Inc.

Results

Basic Time Lag-

Hydraulic Conductivity (Kh):	4.11E+01	ft/day
	1.45E-02	cm/sec
Basic Time Lag:	2.61	sec
2.3 Times Basic Time Lag:	6.01	sec
(Equalization Ratio ÷ 0.90)		

Variable Head-

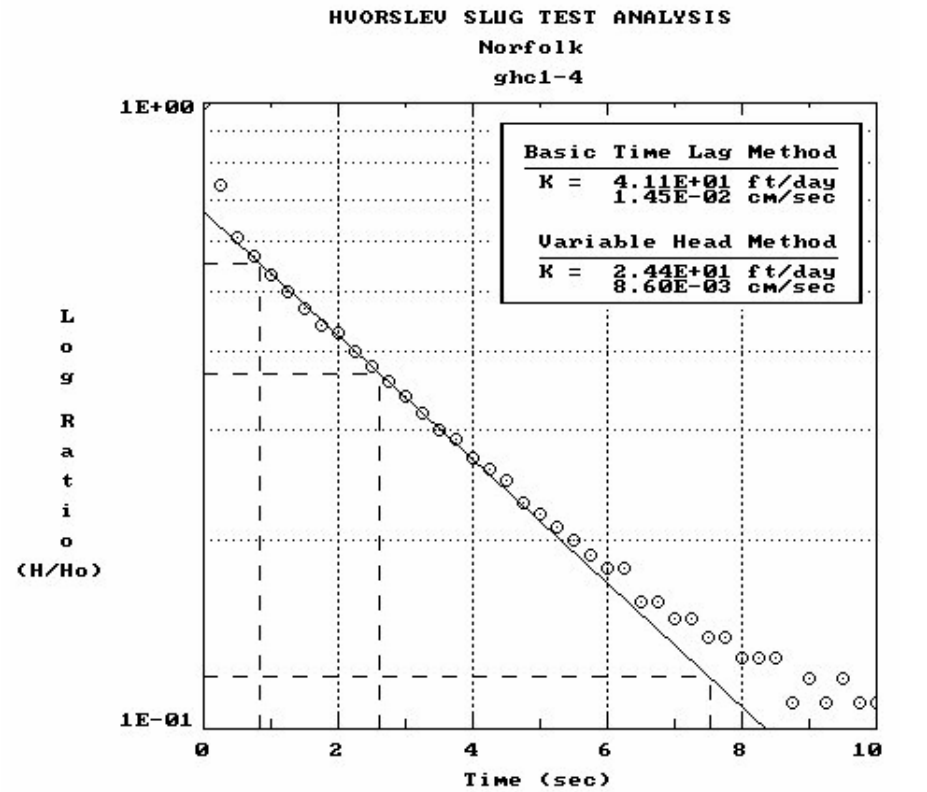
Hydraulic Conductivity (Kh):	2.44E+01	ft/day
	8.60E-03	cm/sec
Time Coordinate T1:	0.8	sec
Time Coordinate T2:	7.5	sec
Head Ratio Coordinate H1:	55.35E-02	
Head Ratio Coordinate H2:	12.09E-02	

Well/Aquifer Parameters

Length of well screen:	9.10	ft
Diameter of the well casing:	0.167	ft
Diameter of the well bore:	0.708	ft
Kh/Kv ratio:	1.0	

Time vs Drawdown Ratio Data

No.	Time (sec)	H/Hmax (ft)	No.	Time (sec)	H/Hmax (ft)	No.	Time (sec)	H/Hmax (ft)
1	0.0000	1.000	2	0.2500	0.740	3	0.5000	0.610
4	0.7500	0.570	5	1.0000	0.530	6	1.2500	0.500
7	1.5000	0.470	8	1.7500	0.440	9	2.0000	0.430
10	2.2500	0.400	11	2.5000	0.380	12	2.7500	0.360
13	3.0000	0.340	14	3.2500	0.320	15	3.5000	0.300
16	3.7500	0.290	17	4.0000	0.270	18	4.2500	0.260
19	4.5000	0.250	20	4.7500	0.230	21	5.0000	0.220
22	5.2500	0.210	23	5.5000	0.200	24	5.7500	0.190
25	6.0000	0.180	26	6.2500	0.180	27	6.5000	0.160
28	6.7500	0.160	29	7.0000	0.150	30	7.2500	0.150
31	7.5000	0.140	32	7.7500	0.140	33	8.0000	0.130
34	8.2500	0.130	35	8.5000	0.130	36	8.7500	0.110
37	9.0000	0.120	38	9.2500	0.110	39	9.5000	0.120
40	9.7500	0.110	41	10.0000	0.110	42	0.0000	1.000



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HVORSLEV INTERACTIVE SLUG TEST ANALYSIS                    04-06-2016
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                          Norfolk
                          ghc2-1
                    GeoHydroCycle, Inc.

 Results
--------

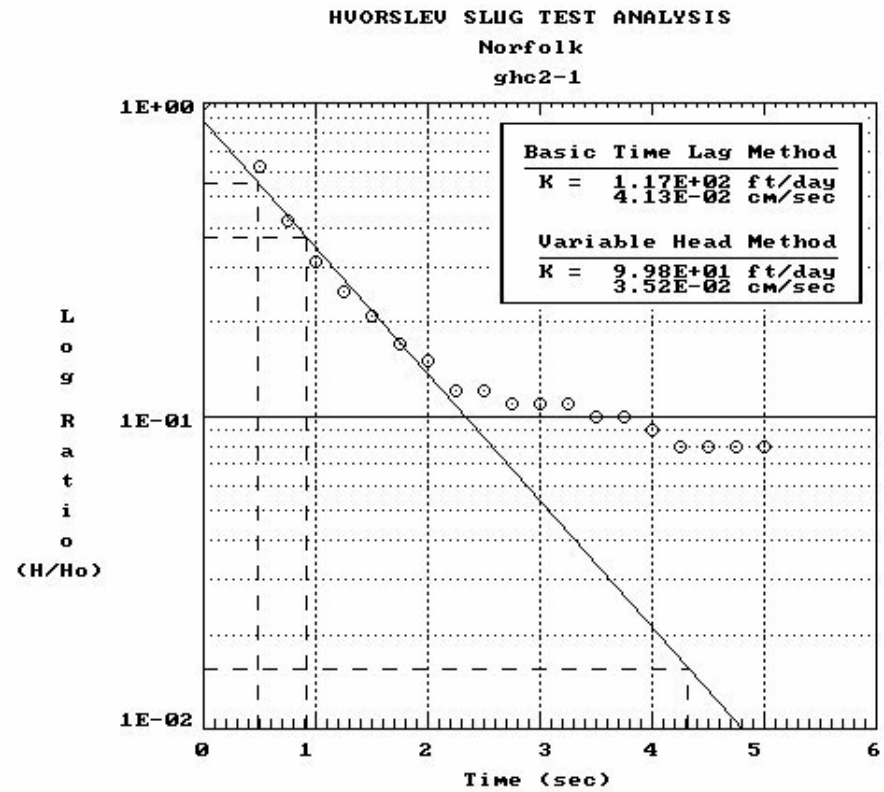
 Basic Time Lag-
     Hydraulic Conductivity (Kh):     1.17E+02 ft/day
                                      4.13E-02 cm/sec
                   Basic Time Lag:    0.92 sec
        2.3 Times Basic Time Lag:     2.11 sec
        (Equalization Ratio ÷ 0.90)

 Variable Head-
     Hydraulic Conductivity (Kh):     9.98E+01 ft/day
                                      3.52E-02 cm/sec
               Time Coordinate T1:    0.5 sec
               Time Coordinate T2:    4.3 sec
        Head Ratio Coordinate H1:    55.57E-02
        Head Ratio Coordinate H2:    15.63E-03

 Well/Aquifer Parameters
------------------------
           Length of well screen:     9.10   ft
     Diameter of the well casing:     0.167  ft
       Diameter of the well bore:     0.708  ft
                     Kh/Kv ratio:     1.0

 Time vs Drawdown Ratio Data
------------------------
```

No.	Time (sec)	H/Hmax (ft)	No.	Time (sec)	H/Hmax (ft)	No.	Time (sec)	H/Hmax (ft)
1	0.0000	1.000	2	0.5000	0.630	3	0.7500	0.420
4	1.0000	0.310	5	1.2500	0.250	6	1.5000	0.210
7	1.7500	0.170	8	2.0000	0.150	9	2.2500	0.120
10	2.5000	0.120	11	2.7500	0.110	12	3.0000	0.110
13	3.2500	0.110	14	3.5000	0.100	15	3.7500	0.100
16	4.0000	0.090	17	4.2500	0.080	18	4.5000	0.080
19	4.7500	0.080	20	5.0000	0.080	21	5.0000	0.220



HVORSLEV INTERACTIVE SLUG TEST ANALYSIS 04-06-2016

Norfolk
ghc2-2
GeoHydroCycle, Inc.

Results

Basic Time Lag-

Hydraulic Conductivity (Kh):	4.24E+01	ft/day
	1.50E-02	cm/sec
Basic Time Lag:	2.53	sec
2.3 Times Basic Time Lag:	5.82	sec
(Equalization Ratio ÷ 0.90)		

Variable Head-

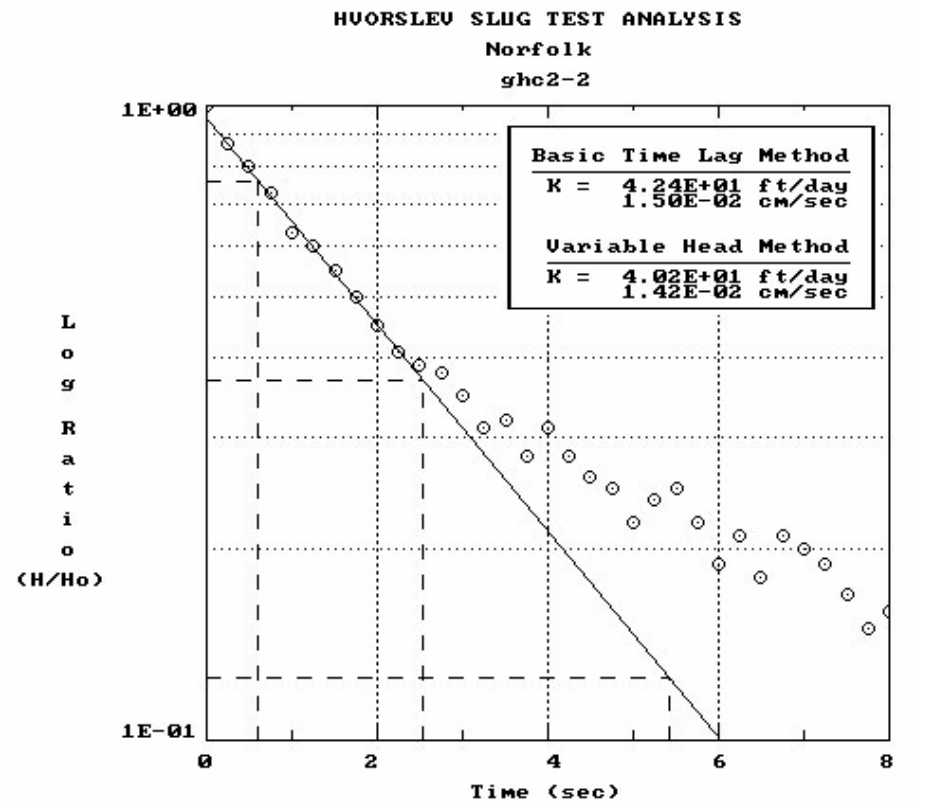
Hydraulic Conductivity (Kh):	4.02E+01	ft/day
	1.42E-02	cm/sec
Time Coordinate T1:	0.6	sec
Time Coordinate T2:	5.4	sec
Head Ratio Coordinate H1:	76.20E-02	
Head Ratio Coordinate H2:	12.53E-02	

Well/Aquifer Parameters

Length of well screen:	9.10	ft
Diameter of the well casing:	0.167	ft
Diameter of the well bore:	0.708	ft
Kh/Kv ratio:	1.0	

Time vs Drawdown Ratio Data

No.	Time (sec)	H/Hmax (ft)	No.	Time (sec)	H/Hmax (ft)	No.	Time (sec)	H/Hmax (ft)
1	0.0000	1.000	2	0.2500	0.870	3	0.5000	0.800
4	0.7500	0.730	5	1.0000	0.630	6	1.2500	0.600
7	1.5000	0.550	8	1.7500	0.500	9	2.0000	0.450
10	2.2500	0.410	11	2.5000	0.390	12	2.7500	0.380
13	3.0000	0.350	14	3.2500	0.310	15	3.5000	0.320
16	3.7500	0.280	17	4.0000	0.310	18	4.2500	0.280
19	4.5000	0.260	20	4.7500	0.250	21	5.0000	0.220
22	5.2500	0.240	23	5.5000	0.250	24	5.7500	0.220
25	6.0000	0.190	26	6.2500	0.210	27	6.5000	0.180
28	6.7500	0.210	29	7.0000	0.200	30	7.2500	0.190
31	7.5000	0.170	32	7.7500	0.150	33	8.0000	0.160



HVORSLEV INTERACTIVE SLUG TEST ANALYSIS 04-06-2016

Norfolk
ghc2-3
GeoHydroCycle, Inc.

Results

Basic Time Lag-

Hydraulic Conductivity (Kh):	7.97E+02	ft/day
	2.81E-01	cm/sec
Basic Time Lag:	0.13	sec
2.3 Times Basic Time Lag:	0.31	sec
(Equalization Ratio ÷ 0.90)		

Variable Head-

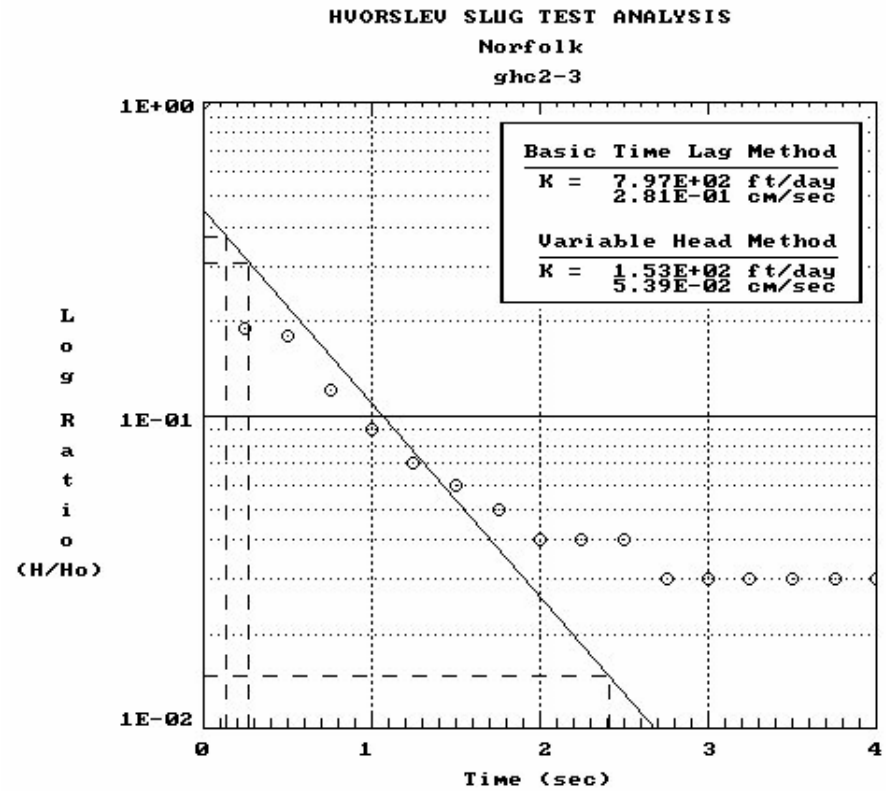
Hydraulic Conductivity (Kh):	1.53E+02	ft/day
	5.39E-02	cm/sec
Time Coordinate T1:	0.3	sec
Time Coordinate T2:	2.4	sec
Head Ratio Coordinate H1:	30.64E-02	
Head Ratio Coordinate H2:	14.63E-03	

Well/Aquifer Parameters

Length of well screen:	9.10	ft
Diameter of the well casing:	0.167	ft
Diameter of the well bore:	0.708	ft
Kh/Kv ratio:	1.0	

Time vs Drawdown Ratio Data

No.	Time (sec)	H/Hmax (ft)	No.	Time (sec)	H/Hmax (ft)	No.	Time (sec)	H/Hmax (ft)
1	0.0000	1.000	2	0.2500	0.190	3	0.5000	0.180
4	0.7500	0.120	5	1.0000	0.090	6	1.2500	0.070
7	1.5000	0.060	8	1.7500	0.050	9	2.0000	0.040
10	2.2500	0.040	11	2.5000	0.040	12	2.7500	0.030
13	3.0000	0.030	14	3.2500	0.030	15	3.5000	0.030
16	3.7500	0.030	17	4.0000	0.030	18	4.2500	0.280



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HVORSLEV INTERACTIVE SLUG TEST ANALYSIS                    04-06-2016
====================================================================

                          Norfolk
                          ghc2-4
                    GeoHydroCycle, Inc.

 Results
--------

 Basic Time Lag-
     Hydraulic Conductivity (Kh):     6.30E+01 ft/day
                                      2.22E-02 cm/sec
                   Basic Time Lag:    1.71 sec
        2.3 Times Basic Time Lag:     3.93 sec
        (Equalization Ratio ÷ 0.90)

 Variable Head-
     Hydraulic Conductivity (Kh):     4.24E+01 ft/day
                                      1.50E-02 cm/sec
               Time Coordinate T1:    0.5 sec
               Time Coordinate T2:    4.5 sec
        Head Ratio Coordinate H1:    59.51E-02
        Head Ratio Coordinate H2:    12.19E-02

 Well/Aquifer Parameters
------------------------
           Length of well screen:     9.10   ft
     Diameter of the well casing:     0.167  ft
       Diameter of the well bore:     0.708  ft
                     Kh/Kv ratio:     1.0

 Time vs Drawdown Ratio Data
------------------------
```
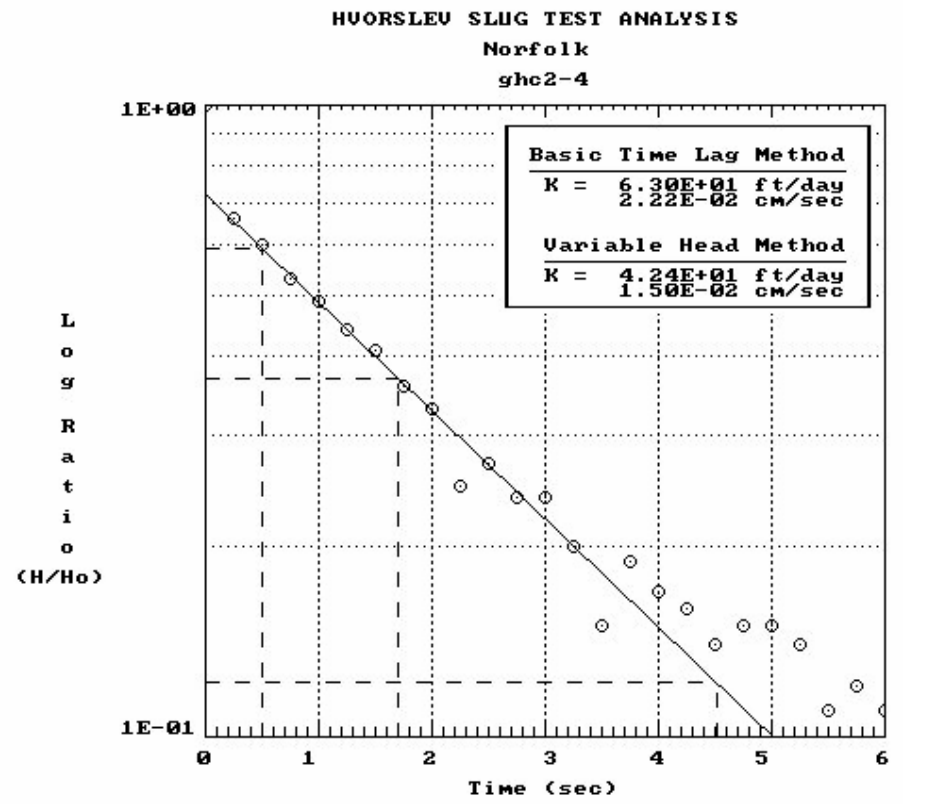

No.	Time (sec)	H/Hmax (ft)	No.	Time (sec)	H/Hmax (ft)	No.	Time (sec)	H/Hmax (ft)
1	0.0000	1.000	2	0.2500	0.660	3	0.5000	0.600
4	0.7500	0.530	5	1.0000	0.490	6	1.2500	0.440
7	1.5000	0.410	8	1.7500	0.360	9	2.0000	0.330
10	2.2500	0.250	11	2.5000	0.270	12	2.7500	0.240
13	3.0000	0.240	14	3.2500	0.200	15	3.5000	0.150
16	3.7500	0.190	17	4.0000	0.170	18	4.2500	0.160
19	4.5000	0.140	20	4.7500	0.150	21	5.0000	0.150
22	5.2500	0.140	23	5.5000	0.110	24	5.7500	0.120
25	6.0000	0.110						



Enclosure 7 - Groundwater Time-of-Travel Analyses

Time of Travel to a Single Pumping Well Calculation

Project: Abbyville Comon
Well: Potential PWS

Input

Pumping Well Parameters

Pumping Rate (Q):	25,258	cf/day	188,928	GPD
Hydraulic Conductivity (K):	100	ft/day	131.2	GPM
Saturated Thickness:	25	ft		
Transmissivity:	2,500	sf/day		

Natural Gradient

Hydraulic Conductivity (K):	38.4	ft/day
Natural Gradient (i_h):	0.0100	ft/ft
Effective Porosity (φ):	0.30	

Calculations

Q/(2*Pi*T) = 1.608 ft

Table Parameters

Start: 1,727 ft
Increment: 34.54 ft

Step	Incremental Distance (feet)		(feet)	Natural Gradient (ft/ft)	Pumping Gradient (ft/ft)	Groundwater Velocity (ft/day)	Incremental Trav Time (days)	Cumulative Travel Time (days)	(years)
1	1,727	to	1,692	0.0100	0.0009	3.647	9.5	9	0.03
2	1,692	to	1,658	0.0100	0.0010	3.653	9.5	19	0.05
3	1,658	to	1,623	0.0100	0.0010	3.660	9.4	28	0.08
4	1,623	to	1,589	0.0100	0.0010	3.667	9.4	38	0.10
5	1,589	to	1,554	0.0100	0.0010	3.674	9.4	47	0.13
6	1,554	to	1,520	0.0100	0.0010	3.682	9.4	57	0.15
7	1,520	to	1,485	0.0100	0.0011	3.690	9.4	66	0.18
8	1,485	to	1,451	0.0100	0.0011	3.698	9.3	75	0.21
9	1,451	to	1,416	0.0100	0.0011	3.707	9.3	85	0.23
10	1,416	to	1,382	0.0100	0.0011	3.716	9.3	94	0.26
11	1,382	to	1,347	0.0100	0.0012	3.726	9.3	103	0.28
12	1,347	to	1,313	0.0100	0.0012	3.736	9.2	112	0.31
13	1,313	to	1,278	0.0100	0.0012	3.747	9.2	122	0.33
14	1,278	to	1,243	0.0100	0.0013	3.758	9.2	131	0.36
15	1,243	to	1,209	0.0100	0.0013	3.770	9.2	140	0.38
16	1,209	to	1,174	0.0100	0.0013	3.783	9.1	149	0.41
17	1,174	to	1,140	0.0100	0.0014	3.797	9.1	158	0.43
18	1,140	to	1,105	0.0100	0.0014	3.811	9.1	167	0.46
19	1,105	to	1,071	0.0100	0.0015	3.826	9.0	176	0.48
20	1,071	to	1,036	0.0100	0.0015	3.842	9.0	185	0.51
21	1,036	to	1,002	0.0100	0.0016	3.859	8.9	194	0.53
22	1,002	to	967	0.0100	0.0016	3.878	8.9	203	0.56
23	967	to	933	0.0100	0.0017	3.898	8.9	212	0.58
24	933	to	898	0.0100	0.0018	3.919	8.8	221	0.60
25	898	to	864	0.0100	0.0018	3.942	8.8	230	0.63
26	864	to	829	0.0100	0.0019	3.967	8.7	238	0.65
27	829	to	794	0.0100	0.0020	3.994	8.6	247	0.68
28	794	to	760	0.0100	0.0021	4.023	8.6	255	0.70
29	760	to	725	0.0100	0.0022	4.055	8.5	264	0.72
30	725	to	691	0.0100	0.0023	4.090	8.4	272	0.75
31	691	to	656	0.0100	0.0024	4.129	8.4	281	0.77
32	656	to	622	0.0100	0.0025	4.172	8.3	289	0.79
33	622	to	587	0.0100	0.0027	4.220	8.2	297	0.81
34	587	to	553	0.0100	0.0028	4.274	8.1	305	0.84
35	553	to	518	0.0100	0.0030	4.334	8.0	313	0.86
36	518	to	484	0.0100	0.0032	4.404	7.8	321	0.88
37	484	to	449	0.0100	0.0034	4.483	7.7	329	0.90
38	449	to	414	0.0100	0.0037	4.575	7.6	336	0.92
39	414	to	380	0.0100	0.0040	4.683	7.4	344	0.94

40	380	to	345	0.0100	0.0044	4.811	7.2	351	0.96
41	345	to	311	0.0100	0.0049	4.967	7.0	358	0.98
42	311	to	276	0.0100	0.0055	5.159	6.7	365	1.00
43	276	to	242	0.0100	0.0062	5.402	6.4	371	1.02
44	242	to	207	0.0100	0.0072	5.721	6.0	377	1.03
45	207	to	173	0.0100	0.0085	6.155	5.6	383	1.05
46	173	to	138	0.0100	0.0103	6.782	5.1	388	1.06
47	138	to	104	0.0100	0.0133	7.767	4.4	392	1.07
48	104	to	69	0.0100	0.0186	9.540	3.6	396	1.08
49	69	to	35	0.0100	0.0310	13.679	2.5	398	1.09
50	35	to	0	0.0100	0.0931	34.369	1.0	399	1.09

Time of Travel to a Single Pumping Well Calculation

Project: Abbyville Commons
Well: Franklin Well 2101000-05G

Input

Pumping Well Parameters

Pumping Rate (Q):	27,184	cf/day	203,337	GPD	2014, 2015 and 2016 average
Hydraulic Conductivity (K):	145	ft/day	141.2	GPM	
Saturated Thickness:	34	ft			
Transmissivity:	4,930	sf/day			

Natural Gradient

Hydraulic Conductivity (K):	38.4	ft/day
Natural Gradient (i_h):	0.0100	ft/ft
Effective Porosity (φ):	0.30	

Calculations

Q/(2*Pi*T) = 0.878 ft

Table Parameters

Start:	6,737	ft
Increment:	134.74	ft

Step	Incremental Distance (feet)		(feet)	Natural Gradient (ft/ft)	Pumping Gradient (ft/ft)	Groundwater Velocity (ft/day)	Incremental Trav Time (days)	Cumulative Travel Time (days)	(years)
1	6,737	to	6,602	0.0100	0.0001	4.897	27.5	28	0.08
2	6,602	to	6,468	0.0100	0.0001	4.898	27.5	55	0.15
3	6,468	to	6,333	0.0100	0.0001	4.900	27.5	83	0.23
4	6,333	to	6,198	0.0100	0.0001	4.901	27.5	110	0.30
5	6,198	to	6,063	0.0100	0.0001	4.903	27.5	137	0.38
6	6,063	to	5,929	0.0100	0.0001	4.904	27.5	165	0.45
7	5,929	to	5,794	0.0100	0.0001	4.906	27.5	192	0.53
8	5,794	to	5,659	0.0100	0.0002	4.907	27.5	220	0.60
9	5,659	to	5,524	0.0100	0.0002	4.909	27.4	247	0.68
10	5,524	to	5,390	0.0100	0.0002	4.911	27.4	275	0.75
11	5,390	to	5,255	0.0100	0.0002	4.913	27.4	302	0.83
12	5,255	to	5,120	0.0100	0.0002	4.915	27.4	330	0.90
13	5,120	to	4,985	0.0100	0.0002	4.917	27.4	357	0.98
14	4,985	to	4,851	0.0100	0.0002	4.920	27.4	384	1.05
15	4,851	to	4,716	0.0100	0.0002	4.922	27.4	412	1.13
16	4,716	to	4,581	0.0100	0.0002	4.925	27.4	439	1.20
17	4,581	to	4,446	0.0100	0.0002	4.927	27.3	466	1.28
18	4,446	to	4,312	0.0100	0.0002	4.930	27.3	494	1.35
19	4,312	to	4,177	0.0100	0.0002	4.933	27.3	521	1.43
20	4,177	to	4,042	0.0100	0.0002	4.937	27.3	548	1.50
21	4,042	to	3,907	0.0100	0.0002	4.940	27.3	576	1.58
22	3,907	to	3,773	0.0100	0.0002	4.944	27.3	603	1.65
23	3,773	to	3,638	0.0100	0.0002	4.948	27.2	630	1.73
24	3,638	to	3,503	0.0100	0.0002	4.952	27.2	657	1.80
25	3,503	to	3,369	0.0100	0.0003	4.957	27.2	685	1.88
26	3,369	to	3,234	0.0100	0.0003	4.962	27.2	712	1.95
27	3,234	to	3,099	0.0100	0.0003	4.967	27.1	739	2.02
28	3,099	to	2,964	0.0100	0.0003	4.973	27.1	766	2.10
29	2,964	to	2,830	0.0100	0.0003	4.980	27.1	793	2.17
30	2,830	to	2,695	0.0100	0.0003	4.987	27.0	820	2.25
31	2,695	to	2,560	0.0100	0.0003	4.995	27.0	847	2.32
32	2,560	to	2,425	0.0100	0.0004	5.003	26.9	874	2.39
33	2,425	to	2,291	0.0100	0.0004	5.013	26.9	901	2.47
34	2,291	to	2,156	0.0100	0.0004	5.024	26.8	928	2.54
35	2,156	to	2,021	0.0100	0.0004	5.036	26.8	954	2.61
36	2,021	to	1,886	0.0100	0.0004	5.050	26.7	981	2.69
37	1,886	to	1,752	0.0100	0.0005	5.067	26.6	1,008	2.76
38	1,752	to	1,617	0.0100	0.0005	5.085	26.5	1,034	2.83
39	1,617	to	1,482	0.0100	0.0006	5.107	26.4	1,061	2.91

40	1,482	to	1,347	0.0100	0.0006	5.133	26.2	1,087	2.98
41	1,347	to	1,213	0.0100	0.0007	5.165	26.1	1,113	3.05
42	1,213	to	1,078	0.0100	0.0008	5.204	25.9	1,139	3.12
43	1,078	to	943	0.0100	0.0009	5.253	25.6	1,164	3.19
44	943	to	808	0.0100	0.0010	5.318	25.3	1,190	3.26
45	808	to	674	0.0100	0.0012	5.406	24.9	1,215	3.33
46	674	to	539	0.0100	0.0014	5.533	24.4	1,239	3.39
47	539	to	404	0.0100	0.0019	5.733	23.5	1,263	3.46
48	404	to	269	0.0100	0.0026	6.093	22.1	1,285	3.52
49	269	to	135	0.0100	0.0043	6.932	19.4	1,304	3.57
50	135	to	0	0.0100	0.0130	11.129	12.1	1,316	3.61

Enclosure 8 - Copies of Transmittal Form X256443 and BRP WP 83

Enter your transmittal number → X277029
Transmittal Number

Your unique Transmittal Number can be accessed online:
http://www.mass.gov/eea/agencies/massdep/service/approvals/transmittal-form-for-payment.html

Massachusetts Department of Environmental Protection

Transmittal Form for Permit Application and Payment

1. Please type or print. A separate Transmittal Form must be completed for each permit application.

2. Make your check payable to the Commonwealth of Massachusetts and mail it with a copy of this form to: MassDEP, P.O. Box 4062, Boston, MA 02211.

3. Three copies of this form will be needed.

Copy 1 - the original must accompany your permit application. **Copy 2** must accompany your fee payment. **Copy 3** should be retained for your records

4. Both fee-paying and exempt applicants must mail a copy of this transmittal form to:

MassDEP
P.O. Box 4062
Boston, MA
02211

*** Note:**
For BWSC Permits, enter the LSP.

A. Permit Information

BRP WP 83
1. Permit Code: 4 to 7 character code from permit instructions

Hydrogeologic Evaluation Report
2. Name of Permit Category

Groundwater Discharge Permit
3. Type of Project or Activity

B. Applicant Information – Firm or Individual

1. Name of Firm - Or, if party needing this approval is an individual enter name below:

2. **Last Name** of Individual	3. **First Name** of Individual	4. MI
DiPlacido	Thomas	W

5. Street Address: 850 Franklin Street, Suite 8

6. City/Town	7. State	8. Zip Code	9. Telephone #	10. Ext. #
Wrentham	MA	02093	508.384.6324	4

11. Contact Person: Thomas DiPlacido
12. e-mail address: tom@diplacidodevelopment.com

C. Facility, Site or Individual Requiring Approval

1. Name of Facility, Site Or Individual: Abbyville Commons
2. Street Address: Lawrence Street

3. City/Town	4. State	5. Zip Code	6. Telephone #	7. Ext. #
Norfolk	MA	02056		

8. DEP Facility Number (if Known)	9. Federal I.D. Number (if Known)	10. BWSC Tracking # (if Known)

D. Application Prepared by (if different from Section B)*

1. Name of Firm Or Individual: GeoHydroCycle, Inc.
2. Address: 151B California Street

3. City/Town	4. State	5. Zip Code	6. Telephone #	7. Ext. #
Newton	MA	02458	617.527.8074	

8. Contact Person: Stephen W. Smith, PE, PHGW
9. LSP Number (BWSC Permits only):

E. Permit - Project Coordination

1. Is this project subject to MEPA review? ☒ yes ☐ no
If yes, enter the project's EOEA file number - assigned when an Environmental Notification Form is submitted to the MEPA unit:

EOEA File Number

F. Amount Due

DEP Use Only

Permit No:

Rec'd Date:

Reviewer:

Special Provisions:

1. ☐ **Fee** Exempt (city, town or municipal housing authority)(state agency if fee is $100 or less).
There are no fee exemptions for BWSC permits, regardless of applicant status.
2. ☐ Hardship Request - payment extensions according to 310 CMR 4.04(3)(c).
3. ☐ Alternative Schedule Project (according to 310 CMR 4.05 and 4.10).
4. ☐ Homeowner (according to 310 CMR 4.02).

Check Number	Dollar Amount	Date
14623	$10,005.	12/15/2017

Massachusetts Department of Environmental Protection
Bureau of Resource Protection–Groundwater Discharge Permit Program

BRP WP 83 Application to Prepare a Hydrogeological Evaluation

X277029
Transmittal Number #

Facility ID/Permit # (if known)

A. General Information

Important: When filling out forms on the computer, use only the tab key to move your cursor - do not use the return key.

1. Applicant Information:

Thomas DiPlacido
Name

Company Name (If applicable)

850 Franklin Street, Suite 8
Address

Wrentham
City/Town

MA
State

508.384.6324
Telephone

02093
Zip Code

tom@diplacidodevelopment.com
Email address

2. Applicant Contact Information (if different from above):

Contact Name

Company Name (If applicable)

Title

Address

City/Town

State

Telephone

Zip Code

email address

B. Project Information

1. Has a pre-scoping meeting been held with MassDEP personnel?

☒ Yes ☐ No If yes, date of pre-scoping meeting: 9/21/2017

2. Has a public notice been placed in the Environmental Monitor that the scope of work has been prepared and will be submitted to MassDEP in accordance with 314 CMR 5.09(1)(b)?

☒ Yes ☐ No If yes, date of Environmental Monitor: 12/23/15

3. Is there a discharge presently located on the site?

☐ Yes ☒ No If yes, answer the following:

When did the discharge begin? Date of startup: _____

Description of discharge:

BRP WP 83 Application to Prepare a Hydrogeological Evaluation

X277029
Transmittal Number #

Facility ID/Permit # (if known)

B. Project Information (cont.)

4. Improvements - Are you required by any Federal, State or local authority to meet any implementation schedule for the construction, upgrading or operation of wastewater treatment equipment or practices or any other environmental programs which may affect the discharges described in this application? This includes, but is not limited to; permit conditions, administrative or enforcement orders, enforcement compliance schedule letters, stipulations, court orders, and grant or loan conditions.

☐ Yes ☒ No

If yes, answer the following:

Description of order or agreement (include enforcement document number, if applicable):

Identification No. of Affected Treatment Facility

Description of Project

Final Compliance Date

C. Site Information

1. GPS Coordinates:

a) Enter Latitude and Longitude to the nearest whole second for the proposed site.

Latitude: 42° 5' 39.82" N Longitude: 71° 21' 33.95" W

b) Provide a narrative description of the site and the feature to be permitted. As an example: "The site is on the west side of Main Street, the third building north of High Street. The disposal field lies 100 feet off the southwest corner of the building."

c) Attach a site map based on the MassGIS Coordinate Information Tool that clearly indicates the site. The Coordinate Information Tool is available at http://maps.massgis.state.ma.us/images/dep/xyinfo/get_xy.html.

BRP WP 83 Application to Prepare a Hydrogeological Evaluation

X277029
Transmittal Number #

Facility ID/Permit # (if known)

C. Site Information (cont.)

2. Provide a topographic map or maps of the area extending at least to one mile beyond the property boundaries of the site which clearly show the following:

   1) The legal boundaries of the site;
   2) All hazardous waste management facilities;
   3) All springs and surface water bodies in the area, plus all drinking water wells within one mile of the facility which are identified in the public record or otherwise known to you.
   4) All Zone II's or IWPA's.

3. Please list any public or private drinking water supply wells within 2,500 feet of the proposed site:

Well Location	Type of Well (Public/Private)	Status (Active/Inactive)	Safe Yield
Franklin Well #4	Public	Active	GPD
Franklin Well #5	Public	Active	GPD

D. Certification

"I certify under penalty of law that this document and all attachments were prepared under my direction or supervision in accordance with a system designed to assure that qualified personnel properly gather and evaluate the information submitted. Based on my inquiry of the person or persons who manage the system, or those persons directly responsible for gathering the information, the information submitted is, to the best of my knowledge and belief, true, accurate, and complete. I am aware that there are significant penalties for submitting false information, including the possibility of fine and imprisonment for knowing violations. I will be responsible for publication of public notice of the applicable permit proceedings identified under 314 CMR 2.06(1)(a) through (d)."

Signature of Applicant — Thomas DiPlacido

12/15/2017
Date Signed

Stephen W. Smith, PE, PHGW
Name of Preparer

617.527.8074
Telephone

President, GeoHydroCycle, Inc.
Title of Preparer

swsmith@geohydrocycle.com
email