March 25, 2015

Jeffrey Brem, PE
Meisner Brem Corporation
142 Littleton Road, Suite 16
Westford, MA 01886

Re: Groundwater Impact Analysis
Brem Property
100 Long Ridge Road
Carlisle, MA

Dear Mr. Brem:

Northeast Geoscience, Inc. (NGI) has completed a groundwater impact analysis to estimate potential groundwater impacts from wastewater discharges for a proposed 40B residential development the above referenced property (see Figure 1 - Locus Map). It is our understanding that the property currently consists of approximately 10 acres land with an existing single-family home and barn. The proposed development would add 19 new single-family homes and associated roads and utilities. The development would be served by private wells and shared septic systems. It also is our understanding that concerns have been raised regarding: 1) increased nutrient loading from onsite wastewater disposal; and 2) groundwater mounding effects from groundwater discharges. The scope of work described below has been developed to address these concerns.

SITE WORK

Monitoring Well Drilling

In order to assess the hydrogeologic conditions present at the site NGI conducted a subsurface investigation. NGI supervised the installation of a series of groundwater monitoring wells at the site. The wells were installed using a hollow stem auger drilling rig and constructed with two-inch diameter PVC well materials. Standard penetration tests were conducted and spit spoon samples collected at five foot intervals to characterize the thickness and nature of the unconsolidated deposits in the vicinity of the proposed septic system leaching areas. In addition, two wood stakes and a one inch diameter PVC well screen were driven into the nearby wetlands to act as staff gauges for surface water elevation measurements. Logs of the well drilling/testing are included in Appendix A. The locations of the wells and staff gauges are shown on Figure 2 – Site Plan.

As can be seen on the enclosed well logs, unconsolidated deposits encountered at the site in the vicinity of the proposed septic leaching areas consist of fine sand and silt with varying amounts of medium sand, gravel and clay. The split spoon samples observed and observations made during test pit excavation show the materials to be a mixture of glacial till and stratified outwash deposits, suggesting possibly ice contact deposits. At proposed leaching area #1 located at the front of the lot, depth to refusal was encountered at approximately 15 feet (see monitoring wells MW-1-15 and MW-1A-15). At proposed leaching area #2 (see monitoring wells MW-3-15 and MW-3A-15) and leaching area #3 (see monitoring wells MW-2-15 and MW-2A-15), located at the rear of the lot in the riding area, depth to refusal was encountered at 10 feet and 9.5 feet, respectively. No soil mottling was observed in split-spoon samples collected at these locations. Two additional monitoring wells (MW-4-15 and MW-5-15) were installed down gradient of leaching areas #2 and #3. Due to time constraints, no standard penetration tests were conducted or split spoon samples collected at these locations. Soils encountered at these locations were characterized based on soil auger cuttings and the rate of auger advancement. Depth to refusal at monitoring well MW-4-15 was encountered at 24 feet. Depth to refusal at monitoring well MW-5-15 was encountered at 16 feet. Unconsolidated deposits observed at these locations consisted of 8 to 10 feet of fine to medium sand with some silt and clay underlain by saprolite or weathered bedrock consisting of gray silt with varying amounts of fine sand and clay and numerous mica flakes (biotite?). Small stones within the matrix appeared to consist of a schist (quartz-mica-garnet) similar in nature to the nearby bedrock outcrops at the site, likely the Nashoba Formation.

Water Level Gauging

The completed monitoring wells were surveyed and gauged to determine groundwater and surface water elevations across the site and the data are presented on Table 1. The staff gauges and piezometer locations were estimated using a handheld GPS unit and surface water elevations were estimated from topographic contours. The data collected were used to develop a pre-development water table contour map (see Figure 3 – Water Table Contour Map - 01/23/2015). As can be seen on Figure 3, groundwater flow direction at the site is approximately east-southeast toward a small stream that crosses the site with flow from the north to the south along the lower pasture. Hydraulic gradients down gradient of the proposed septic leaching areas ranged from 0.057 (leaching area #1) to 0.078 (leaching areas #2 & #3). The observed saturated thickness in the vicinity of proposed septic leaching area #1 was approximately 9.6 feet. The observed saturated thickness in the vicinity of proposed septic leaching area #2 was approximately 3.2 feet. The observed saturated thickness in the vicinity of proposed septic leaching area #3 was approximately 6.8 feet. A test pit excavated in the upper portion of the site (test pit 306 in the vicinity of proposed septic leaching #1) showed soil

mottling at a depth of 29 inches. Soil mottling was also observed in a test pit excavated in the lower portion of the site (test pit 401 in the vicinity of monitoring wells MW-4-15 and MW-5-15) at a depth of 48 inches. Based on this information, NGI developed estimated seasonal high water table elevations at each monitoring location. The estimated elevations are shown Table 1 and an Estimated Seasonal High Water Table Map is presented on Figure 4.

Permeability Testing

On February 13, 2015 in-situ rising head permeability tests (slug tests) were conducted on monitoring wells at the site. The original approach for determining aquifer permeability was to conduct low flow pumping tests on well pairs but the testing was not possible due to the large amount of snowfall received this winter. Each well was tested by submerging an electronic pressure transducer/data logger along with a disposable polyethylene bailer. The data logger was programmed to record hydraulic head at one second intervals. After allowing the water level to equilibrate for two minutes the bailer was quickly removed from the well and the resulting water level drawdown and recovery were recorded for a period of approximately two minutes. Data were analyzed using the commercial software package AQTESOLV version 4.5 Professional via the Hvorslev Method. With the exception of monitoring well MW-5-15, all of the wells were screened across the water table and were therefore analyzed so as to avoid early time data which typically reflect the effects of the drainage of sand pack around the well screen. Our approach was to attempt to identify log-linear data trends that reflected the lower permeability native deposits. Where interpretation was necessary, we selected a trend resulting in lower permeability estimates to be conservative (i.e. to result in lower permeability values). The slug test curves and analyses are included in Appendix B. As can be seen from the data sheets, hydraulic conductivity values obtained ranged from 2.08 feet/day (MW-4-15) to 23.75 feet/day (MW-1-15) with a geometric mean of 9.0 feet/day. NGI recommends, prior to final design, that consideration of additional permeability testing be conducted at the proposed leaching areas such as low flow pumping tests and/or hydraulic loading tests to verify the permeability of these deposits.

GROUNDWATER MOUNDING ESTIMATES

A groundwater mounding analysis was conducted using observed permeability, saturated thickness, estimated seasonal high water table data, etc. and Title 5 flow estimates for the proposed development. An analytical groundwater mounding model was developed to simulate the proposed leaching fields to determine the capacity of those portions of the site to accept the proposed septic flows. The analytical groundwater mounding model TECMOUND Ver. 2.8 published by TecSoft, Inc. was used for this analysis. The software package can simulate up to 100 rectangular leaching areas of various sizes, orientations,

loading rates and loading times for an aquifer of infinite extent with a uniform thickness, permeability and specific yield.

The observed saturated thickness was modified to consider the estimated seasonal high groundwater conditions described above. Two separate simulations were run to estimate groundwater mounding potential at proposed leaching area #1 (with a saturated thickness of 12.49 feet) and at proposed leaching areas #2 and #3 (with a saturated thickness of 7.13 feet).

The hydraulic conductivity was set at the observed geometric mean or 9 feet/day.

Specific yield was estimated at 0.07 based on a literature value for sandy clay (Fetter, 1988).

Each of the three proposed septic leaching areas have a total area of approximately 2,676 ft^2. Assuming a Title 5 flow rate of 1,980 gpd, the proposed loading rate was set at 0.74 gpd/ft^2 or 0.098 ft/day.

The simulation time was set at 30 days and assumes seasonal high water table conditions and Title 5 flows persist for the entire duration. The estimated groundwater mounds are shown on Figure 5. As can be seen on Figure 5, the estimated groundwater mounding potential at proposed leaching area #1 is estimated at approximately 0.98 feet. The estimated groundwater mounding potential at proposed leaching areas #2 and #3 is estimated at approximately 2.2 feet. It is important to note that the groundwater mounding potential shown on Figure 5 is an estimate of the change in groundwater elevation at the proposed leaching areas under the modeled conditions. The resulting estimated seasonal high water table plus groundwater mound is shown on Figure 6 and shows the resulting groundwater flow paths for these conditions.

A summary of the model input parameters for each simulation is included in Appendix C.

MASS-BALANCE NITROGEN LOADING MODEL

A mass-balance nitrogen loading model was developed to compare the existing and proposed nitrogen contributions to groundwater from the site. The approach uses a simple dilution model that sums all nitrogen loads and dilutes that nitrogen load by the volume of rainwater that percolates down to the water table annually, as follows:

$$NO_3 \text{ in Groundwater (mg/L)} = \frac{\text{Wastewater Loads (mg)} + \text{Non-Wastewater Loads (mg)}}{\text{Groundwater Recharge (L)}}$$

The model was configured to estimate the wastewater and non-wastewater loads using assumptions included in the MassDEP Nitrogen Loading Approach, which are as follows:

Wastewater Loads:
- Existing Conditions: 5.9 lbs/person x 3 people/unit x 1 unit
- Proposed Conditions: 19 mg/L x 55 gpd/person x 3 people/unit x 20 units

Non-Wastewater Loads:
- Precipitation: Pervious Areas x Recharge Rate x 0.3 mg/L
- Stormwater: Impervious Area x Recharge Rate x 1.5 mg/L
- Fertilizer: (Lawn Area + Pasture Area) x 3 lbs/1,000 ft^2 x 25% Leach Rate
- Lawn Area: 5,000 ft^2 per unit
- Livestock: No. Horses x 118 lbs/Animal x 25% Leach Rate

Estimates of existing pervious and impervious areas were obtained from digitizing orthophotos of the site. Estimates of proposed pervious and impervious areas were provided by Meisner Brem Corporation. The model was configured assuming a total of 20% of the annul precipitation to pervious areas recharges groundwater on site. The model was also configured to recharge 50% of the stormwater (precipitation x impervious area) under existing conditions and 100% of the stormwater under proposed conditions. The calculations, references and model results are shown on Table 2. As can be seen on Table 2, the predicted nitrogen contribution to groundwater from the site under existing conditions is 14.7 mg/L and under the proposed conditions is 9.6 mg/L, or a 35% reduction from existing conditions. Therefore, the proposed development represents a reduced nitrogen loading potential, relative to the existing land uses.

NITRATE SOLUTE TRANSPORT MODEL

NGI developed two analytical solute transport models to estimate proposed nitrate plume extent and magnitude from the proposed septic systems. One model simulated leaching area #1 located near the front of the property and the other model simulated leaching areas #2 and #3 located at the rear of the property. The septic systems were simulated using AT123D (Analytical Transient 1-, 2-, and 3-Dimensional Simulation of Waste Transport in the Aquifer System published by G. T. Yeh, 1981) via the SEVIEW 7.1 commercial software package published by Environmental Software Consultants, LLC. The models were configured to simulate the proposed leaching areas assuming similar occupancy and loading rates described in the mass-balance model presented above (i.e. volume = 55 gpd/person x 3 people/unit x 20 units ÷ 3 leaching areas at 19 mg/l) as continuous sources. The models also assume: ESHWT conditions at each site; geometric mean hydraulic conductivity; estimated post-development hydraulic gradients; effective porosity (literature value/estimate); a source thickness of 6 feet

(estimate); a soil bulk density 1,700kg/m^3 (literature value/estimate); a longitudinal dispersivity (α_L) of 10% of the plume length (Pickens and Grisak, 1981) assuming a max plume length for a constant source with a conservative solute would be the distance to the downgradient wetland discharge areas; a transverse dispersivity (α_T) of $0.1\alpha_L$ and a vertical dispersivity of $0.01\alpha_T$; an organic carbon content of 0.5%; a water diffusion coefficient of zero; a first-order decay coefficient (λ) of 0.0000344 hr^{-1} based on half-life ($t_{1/2}$) 2.3 years (Frind et al., 1990) where $\lambda = 0.693/t_{1/2}$; solute specific carbon adsorption and distribution coefficients; and a simulation time of 20 years. The model output results for each point of interest (property lines, wells, wetlands boundaries, etc) are included in Appendix D and are summarized on Table 3. It is noted that an analytical groundwater flow model cannot simulate complex groundwater flow conditions (changes in magnitude and direction) such as observed at the site. For example, the groundwater flow downgradient of proposed septic leaching area #1 is interpreted to flow east southeast toward the property line and then flows northeast toward the stream. The model was configured so that the points of interest were located at their relative distance from the leaching area along the centerline of the plume.

As can be seen on Table 3, the predicted nitrate concentration at the property line downgradient of leaching area #1 is 5.3 mg/L and at the wetland boundary 2.8 mg/L. In addition, the predicted nitrate concentration at the wetland boundary downgradient of leaching areas #2 and #3 is 4.6 mg/L.

PRIVATE WELL WATER QUALITY DATA

A water sample was collected from the well serving the existing house at 100 Long Ridge Road. The well is a bedrock source located near the center of the developed portion of the lot and is surrounded by active paddocks and pasture areas. A yard hydrant located outside the existing barn was opened for approximately 20 minutes to purge the well and a sample was collected and submitted to Alpha Analytical Laboratories for total nitrate analysis. The laboratory data sheets are included in Appendix E. Nitrate was not detected in the sample at or above the method detection limit, suggesting limited impacts to the bedrock aquifer from the existing land uses, including the nitrogen load from the existing horse farm.

In addition to the water quality data obtained for the well serving 100 Long Ridge Road, NGI obtained water quality data for the well serving 90 Long Ridge Road. The well serving 90 Long Ridge road is also a bedrock well. The well was sampled on April 4, 2014 following the Board of Health required pumping test. The well was tested for a variety of parameters and the results are also included in Appendix E. As can be seen from the laboratory data sheets nitrate was detected in the sample collected from the well at a concentration of 0.05 mg/L. It is important to note that this well is located approximately

downgradient from the existing manure pile located on 100 Long Ridge Road. A manure pile has been in place at or near this location since the horse boarding operation began around 2008, further suggesting limited impacts from current land uses on the bedrock aquifer.

Please do not hesitate to call if you have any questions regarding this matter.

Sincerely;
NORTHEAST GEOSCIENCE, INC.

Joel Frisch, P.G.
Hydrogeologist

REFERENCES

Fetter, C.W. 1988, Applied Groundwater Hydrology, 2nd Edition, Merrill Publishing Company, Columbus, OH.

Frind, E., Duynisveld, W., Strebel, O., Boettcher, J., 1990. Modeling of multicomponent transport with microbial transformation in ground water: the Fuhrberg case. Water Resources Research 26 (8), 1707–1719.

Pickens, J.F. and Grisak, G.E., 1981, Scale Dependent Dispersion in a Stratified Granular Aquifer. Water Resources Research. Vol 17, No. 4, pg 1191-1211.

Yeh, G. T., "AT123D: Analytical Transient One-, Two-, and Three-Dimensional Simulation of Waste Transport in the Aquifer System," Oak Ridge National Laboratory, Environmental Sciences Division, Publication No. 1439, March, 1981.

TABLES

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Water Supply & Environmental Consulting

TABLE 1

Water Table Elevation Estimates

100 Long Ridge Road

Carlisle, Massachusetts

Well ID	*Top Casing Elevation (ft)*	-	*Depth to Water (ft)*	=	*Water Table Elevation (ft)*	*Ground Elevation* (ft)	+/-	*ESHWT Depth (ft)*	=	*ESHWT (ft)*
MW-1-15	110.13	-	7.19	=	102.94	108.25	-	2.41	=	105.84
MW-1A-15	110.05	-	6.07	=	103.98	108.24	-	2.41	=	105.83
MW-2-15	118.92	-	5.02	=	113.9	116.00	-	2.41	=	113.59
MW-2A-15	119.07	-	5.13	=	113.94	116.25	-	2.41	=	113.84
MW-3-15	118.44	-	8.97	=	109.47	116.31	-	2.41	=	113.9
MW-3A-15	118.27	-	8.83	=	109.44	115.97	-	2.41	=	113.56
MW-4-15	98.93	-	7.27	=	91.66	95.32	-	4.00	=	91.32
MW-5-15	99.69	-	7.97	=	91.72	95.39	-	4.00	=	91.39
SG-1	-	-	-	=	~90.0	~82.0	+	1.00	=	83.0
SG-2	-	-	-	=	~82.0	~90.0	+	1.00	=	91.0

Note: - SG-1 and SG-2 are estiamtes taken from site plan topographic elevations
- data collected on 1/23/2015

TABLE 2

Mass-Balance Nitrogen Loading Analysis

100 Long Ridge Road

Carlisle, Massachusetts

1) Wastewater Volumes:

	Occupancy (People/Unit)	*x*	*No. Units*	*x*	*Usage (gpd/person)*	*x*	*Days/Yr*	*=*	*Annual Volume (gal)*	*=*	*Annual Volume (L)*
Existing:	3	x	1	x	55	x	365	=	60,225	=	**227,976**
Proposed:	3	x	20	x	55	x	365	=	1,204,500	=	**4,559,528**

Note: water supply from on-site sources, volumes not included in dilution calcs.

2) Wastewater Loads:

	People/Unit	*x*	*No. Units*	*x*	*NO_3 (lbs/person/yr)*	*=*	*Annual Load (lbs)*	*=*	*Annual Load (mg)*
Existing:	3	x	1	x	5.9	=	17.7	=	**8,028,585**

	Wastewater Volume (l/yr)	*x*	*Effluent Concentration (mg/l)*		*Annual Load (mg)*
Proposed:	4,559,528	x	19	x	**86,631,041**

3) Non-Wastewater Volumes & Loads:

Annual Precipitation, ET and Recharge Estimates:

Average Annual Precipitaion=	3.42	ft/yr
Assumed Recharge Rate in Glacial Till =	20%	of Annual Precipitation
Average Annual Recharge =	0.68	ft/yr
Average Evapotranpiration/Runoff =	2.73	ft/yr = 80%

Area Estimates	***Existing***			***Proposed***		
Total Lot Area =	9.84	ac =	428,630 sq.ft	9.84	ac =	428,630 sq.ft
Total Paved Area (Impervious) =	0.46	ac =	20,038 sq.ft	0.85	ac =	37,026 sq.ft
Total Roof Area (Impervious) =	0.12	ac =	5,227 sq.ft	0.78	ac =	33,977 sq.ft
Total Lawn Area (Pervious)=	0.11	ac =	5,000 sq.ft	2.30	ac =	100,000 sq.ft
Total Pasture Area (Pervious) =	1.72	ac =	74,923 sq.ft	0.00	ac =	0 sq.ft
Total Undeveloped Area (Pervious)=	7.43	ac =	323,442 sq.ft	5.91	ac =	257,628 sq.ft

Non-Wastewater Volume & Load Estimates:

3A) Existing:

	Total Area (ft^2)	*x*	*Recharge (ft/yr)*	*x*	*Recharge (ft^3/yr)*	*=*	*Recharge (l/yr)*	*x*	*Precip. Conc. (mg/l)*	*=*	*Load (mg/yr)*
Existing Recharge From Precipitation (Total Area - Impervious = pervious areas)	403,366	x	0.68	x	275,633	=	**7,805,062**	x	0.3		**2,341,519**
Existing Recharge From Stormwater (assume 50%; impervious areas):	25,265	x	1.71	x	43,161	=	**1,222,175**	x	1		**1,833,262**
						Total Existing Groundwater Recharge (l/yr):	**9,027,237**				

	Total Area (ft^2)	*x*	*App. Rate (lbs/1,000 ft^2)*	*=*	*Annual Load (lbs)*	*=*	*Annual Load (mg)*		*Leach Rate (%)*		*Load (mg/yr)*
Existing Fertilizer (lawn and pasture):	79,923	x	3	=	240	=	108,757,661	x	0.25	=	**27,189,415**

	No. Animals	*x*	*Yield (lbs/animal/yr)*	*=*	*Annual Load (lbs/yr)*	*=*	*Annual Load (mg/Yr)*		*Leach Rate (%)*		*Load (mg/yr)*
Existing Livestock (horses)	7	x	118	=	826	=	374,667,298	x	0.25	=	**93,666,824**
								Total Existing Non-Wastewater Load (mg/yr):			**125,031,021**

3B) Proposed:

	Total Area (ft^2)	*x*	*Recharge (ft/yr)*	*x*	*Recharge (ft^3/yr)*	*=*	*Recharge (l/yr)*	*x*	*Precip. Load (mg/l)*	*=*	*Load (mg)*
Proposed Recharge From Precipitation (Total Area - Impervious = pervious areas)	357,628	x	0.68	x	244,379	=	**6,920,039**	x	0.3	=	**2,076,012**
Proposed Recharge From Stormwater (impervious areas):	71,003	x	3.42	x	242,593	=	**6,869,466**	x	1.5	=	**10,304,199**
						Total Existing Groundwater Recharge (l/yr):	**13,789,505**				

	Total Area (ft^2)	*x*	*App. Rate (lbs/1,000 ft^2)*	*=*	*Annual Load (lbs)*	*=*	*Annual Load (mg)*		*Leach Rate (%)*		*Load (mg)*
Proposed Fertilizer (lawn and pasture):	100,000	x	3	=	300	=	136,077,711	x	0.25	=	**34,019,428**

	No. Animals	*x*	*Yield (lbs/animal/yr)*	*=*	*Annual Load (lbs)*	*=*	*Annual Load (mg)*		*Leach Rate (%)*		*Load (mg)*
Proposed Livestock (horses)	0	x	118	=	0	=	0	x	0.25	=	**0**
								Total Proposed Non-Wastewater Load (mg/yr):			**46,399,638**

4) Results

4A) Existing Conditions: $\dfrac{\textit{Wasterwater Load (mg)} + \textit{Non-Wastewater Load (mg)}}{\textit{Groundwater Recharge Volume (liters)}}$ =

8,028,585 mg + 125,031,021 mg = 133,059,606 mg = / *9,027,237 l = 9,027,237 l*

14.7 mg/l

4B) Proposed Conditions: $\dfrac{\textit{Wasterwater Load (mg)} + \textit{Non-Wastewater Load (mg)}}{\textit{Groundwater Recharge Volume (liters)}}$ =

86,631,041 mg + 46,399,638 mg = 133,030,680 mg = / *13,789,505 l 13,789,505 l*

9.6 mg/l

Notes and Assumptions:

- Precipitation data from Simcox, A.C., 1992, Water resources of Massachusetts: U.S. Geological Survey Water-Resources Investigations Report 90-4144, 94 p.
- Model assumes 20% of annual precipitation to pervious areas recharges groundwater.
- Model assume 50% of annual precipitation to impervious areas recharges groundwater under existing conditions and 100% under proposed conditions with enhanced stormwater systems.
- Average recharge estimate for glacial till from: WRI 95-4234 (Bent); WRI 83-4018 (Morrissey); WSP-597B (Meinzer & Stearns)

TABLE 3

Solute Transport Modeling Summary
Lifetime Green Homes
100 Long Ridge Road
Carlisle , Massachusetts

MODEL LOCATION	*Modeled Concentration (mg/l)*	*Approximate Distance from Source (feet)*
Septic System #1	19	0
Property Line	5.3	185
Proposed Unit #1 Well (43 ft centerline offset)	3.7	144
90 Long Ridge Road Well	3.6	307
Wetlands	2.8	374

Septic Systems #2 & #3	19	0
Proposed Unit #11 Well	7.6	197
Proposed Unit #12 and Unit #13 Well	6.2	277
Wetlands	4.6	445

FIGURES

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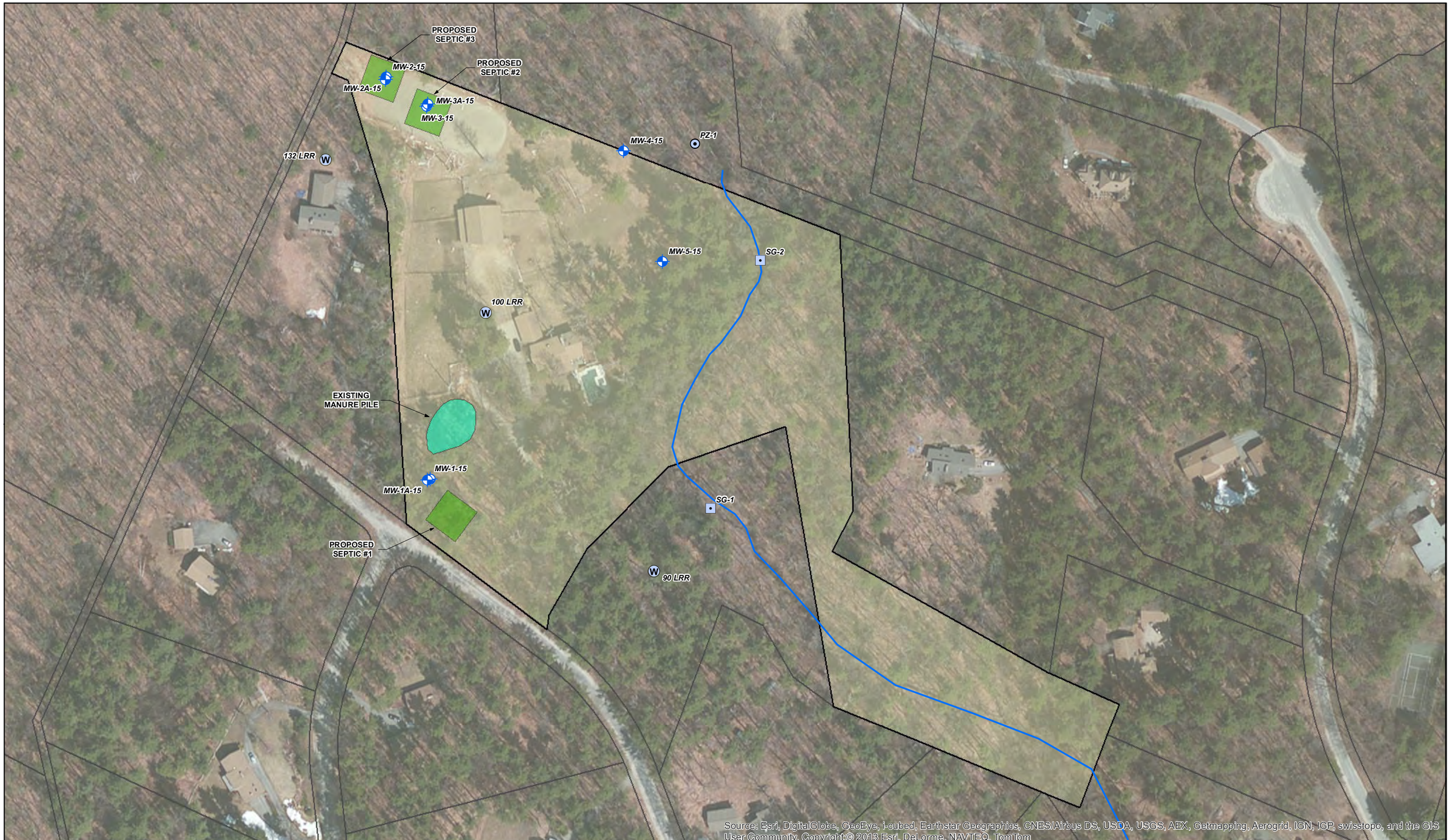
N
W E
S

0 250 500 1,000
Feet

LOCUS MAP
LIFETIME GREEN HOMES
100 LONG RIDGE ROAD
CARLISLE, MASSACHUSETTS

NGI REF: LocusMap_Letter.mxd	
Drafted By: JAF	Date: 03/20/2015
Source: MassGIS, ArcGIS Online	

FIGURE 1



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Clinton, Massachusetts
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- Monitoring Well
- Private Domestic Well
- Staff Gauge
- Piezometer
- Approximate Stream Location
- Parcel Of Interest
- Manure Pile
- Assessors Parcels

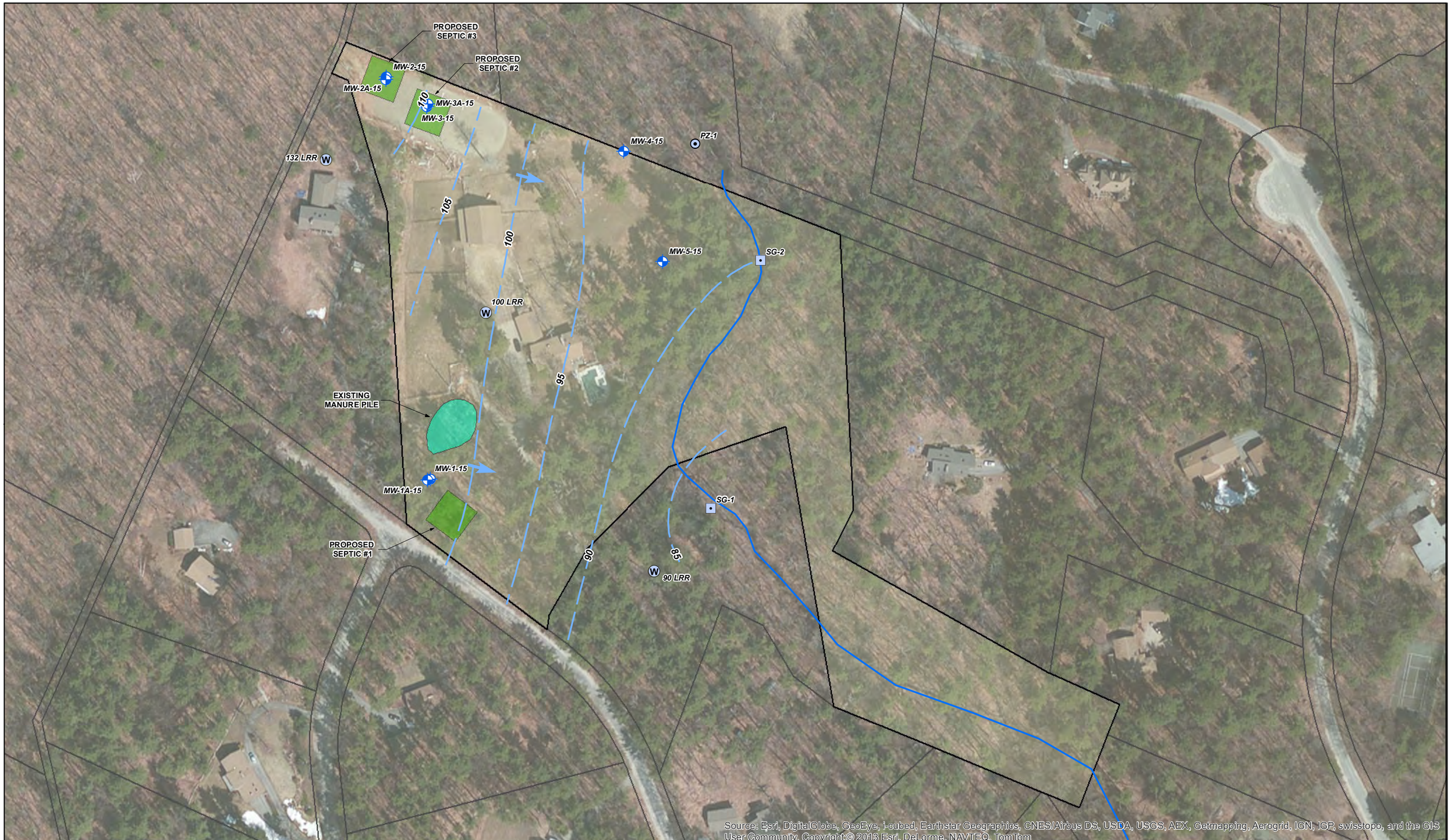
N W E S

0 25 50 100
Feet

SITE PLAN
LIFETIME GREEN HOMES
100 LONG RIDGE ROAD
CARLISLE, MASSACHUSETTS

NGI REF: Fig2SitePlan
Drafted By: JAF | Date: 03/25/2015
Source: Meisner Brem, MassGIS, ArcGIS.com

FIGURE 2



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- Monitoring Well
- Private Domestic Well
- Staff Gauge
- Piezometer
- Parcel Of Interest
- Manure Pile
- Assessors Parcels
- Water Table Contour (ft)
- Estimated Groundwater Flow Direction
- Approximate Stream Location

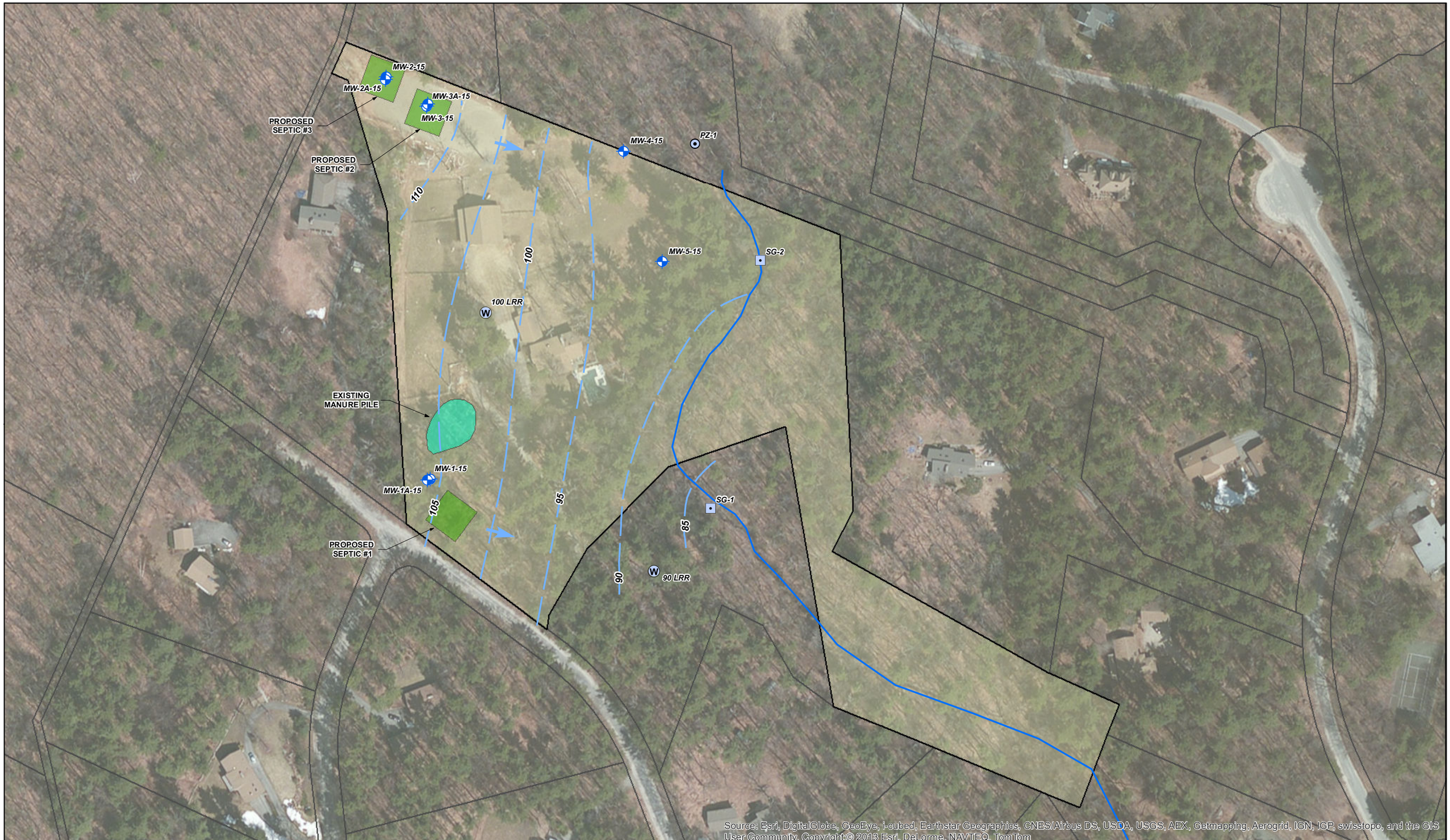
N W E S

0 25 50 100
Feet

WATER TABLE CONTOUR MAP - 1/23/15
LIFETIME GREEN HOMES
100 LONG RIDGE ROAD
CARLISLE, MASSACHUSETTS

NGI REF: Fig3aterTableMap
Drafted By: JAF | Date: 03/25/2015
Source: Meisner Brem, MassGIS, ArcGIS.com

FIGURE 3



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- Monitoring Well
- Private Domestic Well
- Staff Gauge
- Piezometer
- Parcel Of Interest
- Manure Pile
- Assessors Parcels
- Estimated Seasonal High Water Table Contour (ft)
- Estimated Groundwater Flow Direction
- Approximate Stream Location

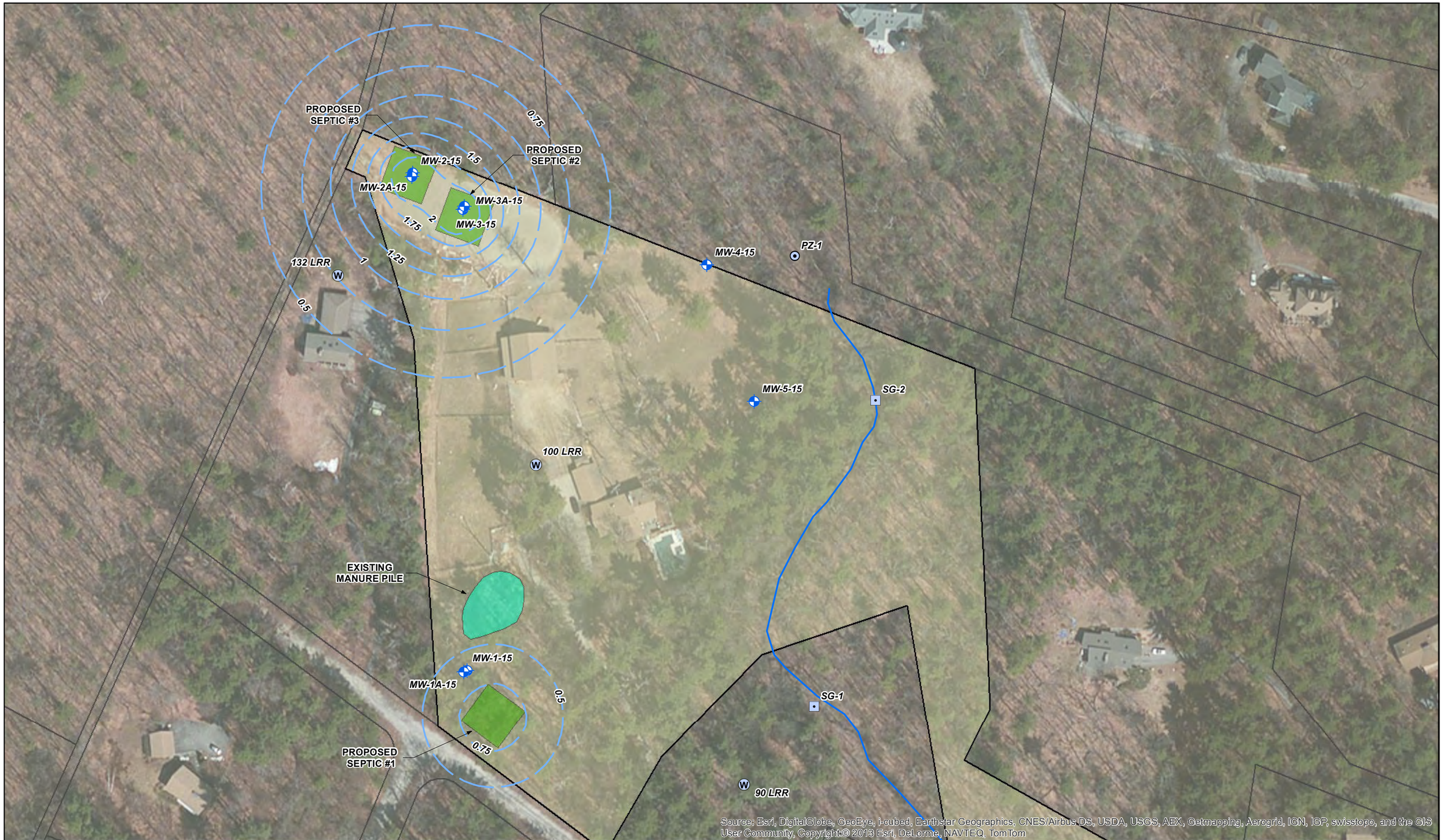
N W E S

0 25 50 100
Feet

ESHWT CONTOUR MAP
LIFETIME GREEN HOMES
100 LONG RIDGE ROAD
CARLISLE, MASSACHUSETTS

NGI REF: Fig4ESHWTMap
Drafted By: JAF | Date: 03/25/2015
Source: Meisner Brem, MassGIS, ArcGIS.com

FIGURE 4



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- Monitoring Well
- Private Domestic Well
- Staff Gauge
- Piezometer
- Parcel Of Interest
- Manure Pile
- Assessors Parcels
- Estimated Groundwater Mound Contour (ft)
- Approximate Stream Location

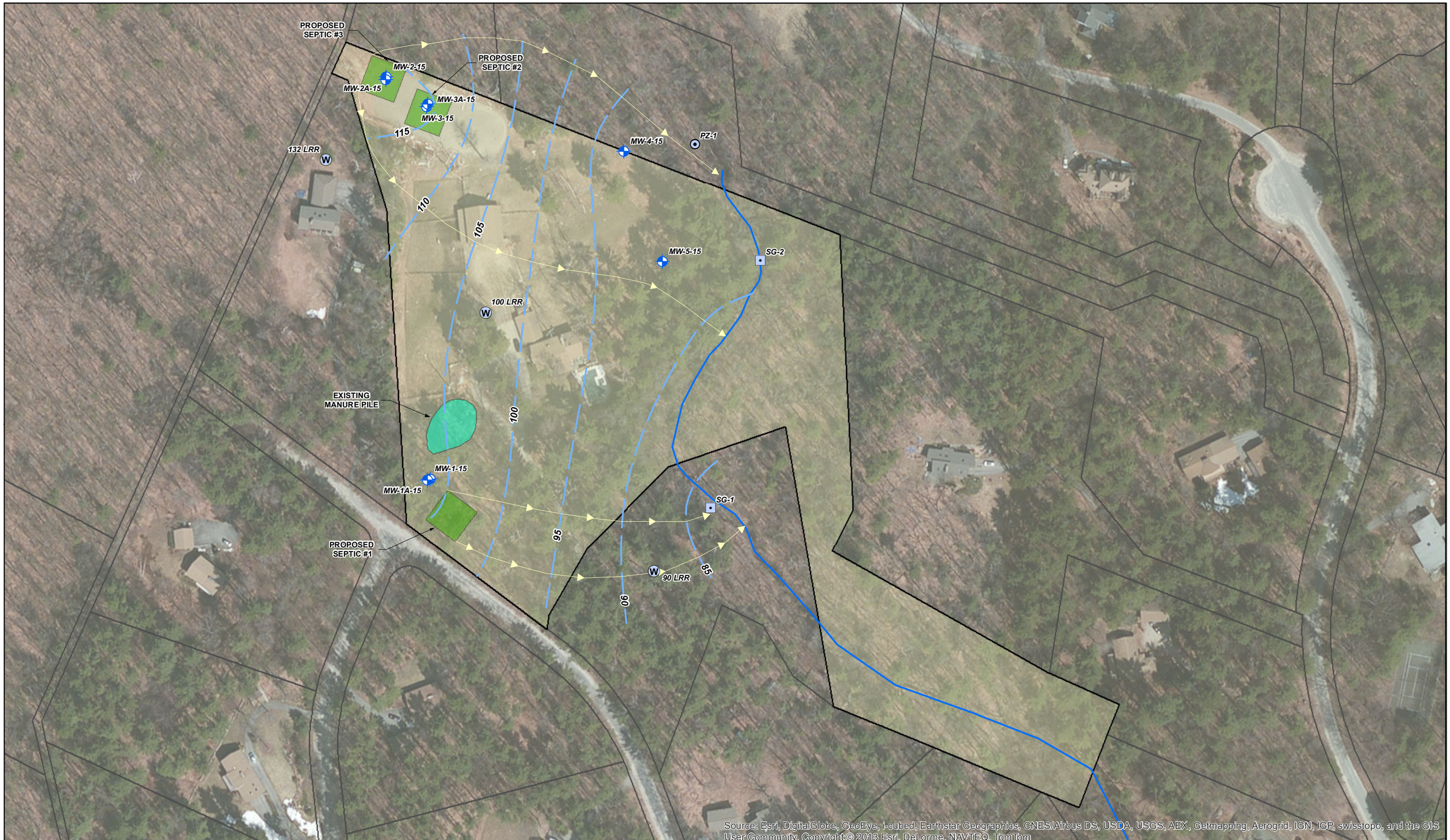
N W E S

0 25 50 100
Feet

ESTIMATED GROUNDWATER MOUND MAP
LIFETIME GREEN HOMES
100 LONG RIDGE ROAD
CARLISLE, MASSACHUSETTS

NGI REF: Fig5GwMoundMap
Drafted By: JAF | Date: 03/25/2015
Source: Meisner Brem, MassGIS, ArcGIS.com

FIGURE 5



NGI
NORTHEAST GEOSCIENCE INC
Water Supply and Environmental Consulting
97 Walnut Street
Clinton, Massachusetts
978.365.9045
www.northeastgeoscience.com

- Monitoring Well
- Private Domestic Well
- Staff Gauge
- Piezometer
- Parcel Of Interest
- Manure Pile
- Assessors Parcels
- Estimated Groundwater Mound Contour (ft)
- Approximate Stream Location
- Estimated Plume Flow Line

N W E S

0 25 50 100
Feet

ESHWT PLUS GROUNDWATER MOUND MAP
LIFETIME GREEN HOMES
100 LONG RIDGE ROAD
CARLISLE, MASSACHUSETTS

NGI REF: Fig6EshwtPlusMound
Drafted By: JAF | Date: 03/25/2015
Source: Meisner Brem, MassGIS, ArcGIS.com

FIGURE 6

APPENDIX A

NGI

NORTHEAST GEOSCIENCE INC

Water Supply & Environmental Consulting

NORTHEAST GEOSCIENCE INC

WATER SUPPLY AND ENVIRONMENTAL CONSULTING

97 WALNUT STREET, CLINTON, MA 01510, 978-365-9045

WELL LOG

MW-1-15 & MW-1A-15

Project:	The Birches	Client:	Lifetime Green Homes
Project #:		Casing Elevation:	
Location:	100 Long Ridge Rd, Carlisle, MA	Total Depth:	15 ft BGS
ID:	MW-1-15 & MW-1A-15	Screen Diameter:	2-inch
Water Level:	~6 ft	Slot Size:	0.010
Screen Length:	10 ft	Casing Diameter:	2-inch
Screen Type:	PVC	Type:	PVC
Casing Length:	6.8 ft	Operator:	
Stick-up:	1.8 ft	Company:	GEOSEARCH
Method:	Hollow Stem Auger/Air Hammer	NGI Inspector:	JAF
Date Start:	1/19/2015	Date End:	1/19/2015

Sketch Map (not to scale)

SEE SITE PLAN

Depth (ft BGS)	Well Construction	Sample ID	Sample Depth (feet)	Sample Blows/6"	Sample Pen/Rec ("/")	Sample Description
0	2" PVC Casing					Ground Surface
	Bentonite Seal					
5	*Water Level*	B-1/S-1	5'-7'	5 - 50/4"	10" / 6"	Grey, fine SAND and SILT some gravel, trace clay (till)
	2" PVC Screen					
10		B-1/S-2	10'-12'	4-9-15-17	24"/24"	Grey, fine SAND and SILT, some fine gravel, trace clay (till)
	Sand Pack					
15	*Refusal (15 ft)*	B-1/S-3	15'-17'	50/1"	1" / 0"	Rock in tip of spoon (mica schist?)
20						
25						
30						

NORTHEAST GEOSCIENCE INC

WATER SUPPLY AND ENVIRONMENTAL CONSULTING
97 WALNUT STREET, CLINTON, MA 01510, 978-365-9045

WELL LOG
MW-2-15 & MW-2A-15

Project:	The Birches	Client:	Lifetime Green Homes
Project #:		Casing Elevation:	
Location:	100 Long Ridge Rd, Carlisle, MA	Total Depth:	9.5 ft BGS
ID:	MW-2-15 & MW-2A-15	Screen Diameter:	2-inch
Water Level:	~5 ft	Slot Size:	0.010
Screen Length:	7 ft	Casing Diameter:	2-inch
Screen Type:	PVC	Type:	PVC
Casing Length:	5.2 ft	Operator:	
Stick-up:	~2.7 ft	Company:	GEOSEARCH
Method:	Hollow Stem Auger/Air Hammer	NGI Inspector:	JAF
Date Start:	1/19/2015	Date End:	1/19/2015

Sketch Map (not to scale)

SEE SITE PLAN

Depth (ft BGS)	Well Construction	Sample ID	Sample Depth (feet)	Sample Blows/6"	Sample Pen/Rec ("/")	Sample Description
0	2" PVC Casing					Ground Surface
	Bentonite Seal		0' - 3'			(from cuttings) Tan, medium SAND some gravel and fine sand
	Water Level					
5		B-3/S-1	5'-7'	4-14-21-23	24" / 24"	Grey, fine SAND and SILT some clay trace gravel (till)
	2" PVC Screen					
10	Sand Pack					
	Refusal (9.5 ft)					
15						
20						
25						
30						

NORTHEAST GEOSCIENCE INC

WATER SUPPLY AND ENVIRONMENTAL CONSULTING
97 WALNUT STREET, CLINTON, MA 01510, 978-365-9045

WELL LOG
MW-3-15 & MW-3A-15

Project:	The Birches	Client:	Lifetime Green Homes
Project #:		Casing Elevation:	
Location:	100 Long Ridge Rd, Carlisle, MA	Total Depth:	10 ft BGS
ID:	MW-3-15 & MW-3A-15	Screen Diameter:	2-inch
Water Level:	~5 ft	Slot Size:	0.010
Screen Length:	7 ft	Casing Diameter:	2-inch
Screen Type:	PVC	Type:	PVC
Casing Length:	5.1 ft	Operator:	
Stick-up:	~2.1 ft	Company:	GEOSEARCH
Method:	Hollow Stem Auger/Air Hammer	NGI Inspector:	JAF
Date Start:	1/19/2015	Date End:	1/19/2015

Sketch Map (not to scale)

SEE SITE PLAN

Depth (ft BGS)	Well Construction	Sample ID	Sample Depth (feet)	Blows/6"	Pen/Rec ("/")	Sample Description
0	2" PVC Casing					Ground Surface
	Bentonite Seal		0' - 3'			(from cuttings) Tan, medium SAND some fine sand and gravel
5	2" PVC Screen	B-5/S-1	5'-7'	8-10-14-20	24" / 24"	Grey, fine SAND and SILT some gravel and clay trace gravel (till)
	Sand Pack					
	Water Level					
10	*Refusal (10 ft)*	B-5/S-2	10' - 12'	47 - 50/5"	11" / 3"	Grey, fine SAND, SILT and CLAY, some gravel (2";till) Rock in tip of spoon (1"; mica schist?)
15						
20						
25						
30						

NORTHEAST GEOSCIENCE INC

WATER SUPPLY AND ENVIRONMENTAL CONSULTING
97 WALNUT STREET, CLINTON, MA 01510, 978-365-9045

WELL LOG
MW-4-15

Project:	The Birches	Client:	Lifetime Green Homes
Project #:		Casing Elevation:	
Location:	100 Long Ridge Rd, Carlisle, MA	Total Depth:	24 ft BGS
ID:	MW-4-15	Screen Diameter:	2-inch
Water Level:	~6.8 ft	Slot Size:	0.010
Screen Length:	15 ft	Casing Diameter:	2-inch
Screen Type:	PVC	Type:	PVC
Casing Length:	12.7 ft	Operator:	
Stick-up:	~3.7 ft	Company:	GEOSEARCH
Method:	Hollow Stem Auger/Air Hammer	NGI Inspector:	JAF
Date Start:	1/19/2015	Date End:	1/19/2015

Sketch Map (not to scale)

SEE SITE PLAN

Depth (ft BGS)	Well Construction	Sample ID	Sample Depth (feet)	Sample Blows/6"	Sample Pen/Rec ("/")	Sample Description
0						Ground Surface
5	2" PVC Casing					(From cuttings) Grey,fine to medium SAND some silt and clay (till)
	Water Level / Sand Pack					
10	Bentonite Seal					(based on auger advance rate)
15						(From cuttings) Dark grey weathered rock including quartz, , mica, garnet (Saprolite)
20	2" PVC Screen					
25	*Refusal (24 ft)*					Competent rock
30						

NORTHEAST GEOSCIENCE INC

WATER SUPPLY AND ENVIRONMENTAL CONSULTING
97 WALNUT STREET, CLINTON, MA 01510, 978-365-9045

WELL LOG
MW-5-15

Project:	The Birches	Client:	Lifetime Green Homes
Project #:		Casing Elevation:	
Location:	100 Long Ridge Rd, Carlisle, MA	Total Depth:	16 ft BGS
ID:	MW-5-15	Screen Diameter:	2-inch
Water Level:	~7.9 ft	Slot Size:	0.010
Screen Length:	10 ft	Casing Diameter:	2-inch
Screen Type:	PVC	Type:	PVC
Casing Length:	10.3 ft	Operator:	
Stick-up:	~4.3 ft	Company:	GEOSEARCH
Method:	Hollow Stem Auger/Air Hammer	NGI Inspector:	JAF
Date Start:	1/19/2015	Date End:	1/19/2015

Sketch Map (not to scale)

SEE SITE PLAN

Depth (ft BGS)	Well Construction	Sample ID	Sample Depth (feet)	Sample Blows/6"	Sample Pen/Rec ("/")	Sample Description
0						Ground Surface
5	2" PVC Csing; Bentonite Seal					(Fromo cuttings) Grey,fine to medium SAND some silt and clay (till)
10	*Water Level*; Sand Pack; 2" PVC Screen					(Based on auger advance rate) (From cuttings) Dark grey weathered rock including quartz, mica, garnet (Saprolite)
15						
20	*Refusal (16 ft)*					Competent rock
25						
30						

APPENDIX B

NGI

NORTHEAST GEOSCIENCE INC

Water Supply & Environmental Consulting

Data Set: W:\DDriveOnGis\NgisFiles\140904-BremCarlisle\PermabilityData\SlugTestData021315\Mw_1_15Results
Date: 02/23/15
Time: 10:49:26

PROJECT INFORMATION

Company: NGI
Client: Brem
Project: 150102
Location: Carlisle, MA
Test Date: 02/13/2015
Test Well: MW-1-15

AQUIFER DATA

Saturated Thickness: 9.58 ft
Anisotropy Ratio (Kz/Kr): 0.1

SLUG TEST WELL DATA

Test Well: MW-1=15

X Location: 0. ft
Y Location: 0. ft

Initial Displacement: 1.75 ft
Static Water Column Height: 9.58 ft
Casing Radius: 0.083 ft
Well Radius: 0.3438 ft
Well Skin Radius: 0.3438 ft
Screen Length: 9.58 ft
Total Well Penetration Depth: 14.91 ft
Corrected Casing Radius (Bouwer-Rice Method): 0.1863 ft
Gravel Pack Porosity: 0.25

No. of Observations: 60

Observation Data

Time (sec)	Displacement (ft)	Time (sec)	Displacement (ft)
1.	1.75	31.	0.59
2.	1.4	32.	0.58
3.	1.33	33.	0.57
4.	1.26	34.	0.56
5.	1.21	35.	0.55
6.	1.16	36.	0.53
7.	1.12	37.	0.52
8.	1.08	38.	0.51
9.	1.05	39.	0.5
10.	1.01	40.	0.49
11.	0.98	41.	0.48
12.	0.95	42.	0.47
13.	0.93	43.	0.46
14.	0.9	44.	0.45
15.	0.88	45.	0.45
16.	0.86	46.	0.44
17.	0.83	47.	0.43
18.	0.81	48.	0.42
19.	0.79	49.	0.41
20.	0.77	50.	0.4
21.	0.75	51.	0.4
22.	0.73	52.	0.39
23.	0.72	53.	0.39
24.	0.7	54.	0.38
25.	0.68	55.	0.37
26.	0.67	56.	0.37
27.	0.65	57.	0.36
28.	0.63	58.	0.36

Time (sec)	Displacement (ft)	Time (sec)	Displacement (ft)
29.	0.62	59.	0.35
30.	0.61	60.	0.34

SOLUTION

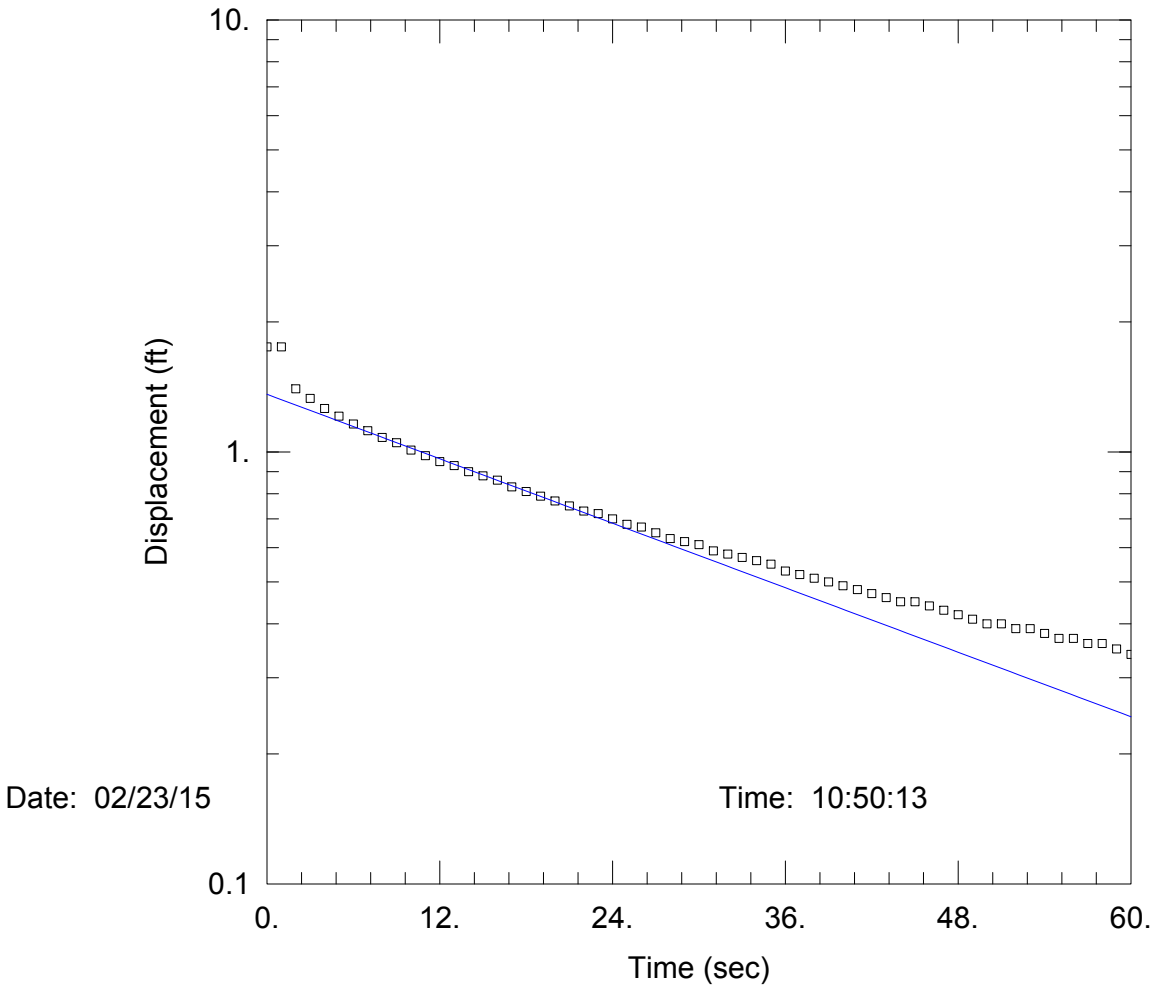
Slug Test
Aquifer Model: Unconfined
Solution Method: Hvorslev
Log Factor: 0.1887

VISUAL ESTIMATION RESULTS

Estimated Parameters

Parameter	Estimate	
K	23.75	ft/day
y0	1.359	ft

K = 0.008377 cm/sec
T = K*b = 227.5 ft²/day (2.446 sq. cm/sec)



WELL TEST ANALYSIS

Data Set: W:\...\Mw_1_15Results.aqt

PROJECT INFORMATION

Company: NGI
Client: Brem
Project: 150102
Location: Carlisle, MA
Test Well: MW-1-15
Test Date: 02/13/2015

AQUIFER DATA

Saturated Thickness: 9.58 ft
Anisotropy Ratio (Kz/Kr): 0.1

WELL DATA (MW-1=15)

Initial Displacement: 1.75 ft
Total Well Penetration Depth: 14.91 ft
Casing Radius: 0.083 ft
Static Water Column Height: 9.58 ft
Screen Length: 9.58 ft
Well Radius: 0.3438 ft
Gravel Pack Porosity: 0.25

SOLUTION

Aquifer Model: Unconfined
Solution Method: Hvorslev
K = 23.75 ft/day
y0 = 1.359 ft

Data Set: W:\DDriveOnGis\NgisFiles\140904-BremCarlisle\PermabilityData\SlugTestData021315\Mw_1A_15Result
Date: 02/23/15
Time: 13:21:28

PROJECT INFORMATION

Company: NGI
Client: Brem
Project: 150102
Location: Carlisle, MA
Test Date: 02/13/2015
Test Well: MW-1A-15

AQUIFER DATA

Saturated Thickness: 9.71 ft
Anisotropy Ratio (Kz/Kr): 0.1

SLUG TEST WELL DATA

Test Well: MW-1A-15

X Location: 0. ft
Y Location: 0. ft

Initial Displacement: 1.87 ft
Static Water Column Height: 9.71 ft
Casing Radius: 0.083 ft
Well Radius: 0.3438 ft
Well Skin Radius: 0.3438 ft
Screen Length: 9.71 ft
Total Well Penetration Depth: 13.92 ft
Corrected Casing Radius (Bouwer-Rice Method): 0.1863 ft
Gravel Pack Porosity: 0.25

No. of Observations: 60

Observation Data

Time (sec)	Displacement (ft)	Time (sec)	Displacement (ft)
1.	1.87	31.	0.09
2.	0.72	32.	0.09
3.	0.32	33.	0.09
4.	0.28	34.	0.09
5.	0.2	35.	0.09
6.	0.16	36.	0.08
7.	0.14	37.	0.09
8.	0.13	38.	0.08
9.	0.13	39.	0.08
10.	0.13	40.	0.08
11.	0.12	41.	0.08
12.	0.11	42.	0.08
13.	0.1	43.	0.08
14.	0.1	44.	0.08
15.	0.1	45.	0.08
16.	0.1	46.	0.08
17.	0.1	47.	0.08
18.	0.1	48.	0.08
19.	0.09	49.	0.08
20.	0.09	50.	0.08
21.	0.09	51.	0.08
22.	0.09	52.	0.08
23.	0.09	53.	0.08
24.	0.09	54.	0.08
25.	0.09	55.	0.08
26.	0.09	56.	0.08
27.	0.09	57.	0.08
28.	0.09	58.	0.08

Time (sec)	Displacement (ft)	Time (sec)	Displacement (ft)
29.	0.09	59.	0.08
30.	0.09	60.	0.08

SOLUTION

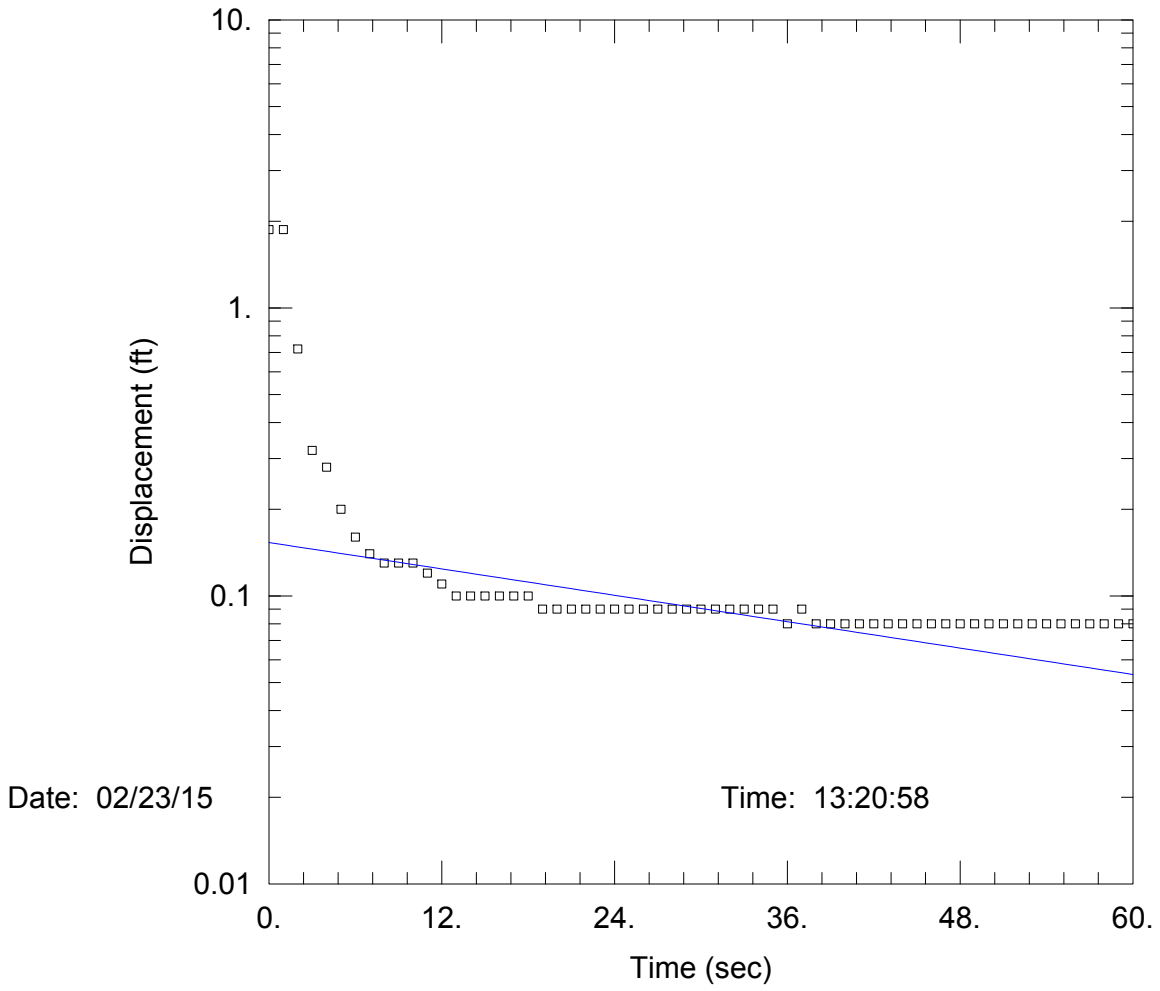
Slug Test
Aquifer Model: Unconfined
Solution Method: Hvorslev
Log Factor: 0.1887

VISUAL ESTIMATION RESULTS

Estimated Parameters

Parameter	Estimate	
K	14.38	ft/day
y0	0.1533	ft

K = 0.005074 cm/sec
T = K*b = 139.7 ft²/day (1.502 sq. cm/sec)



WELL TEST ANALYSIS

Data Set: W:\...\Mw_1A_15Results.aqt

PROJECT INFORMATION

Company: NGI
Client: Brem
Project: 150102
Location: Carlisle, MA
Test Well: MW-1A-15
Test Date: 02/13/2015

AQUIFER DATA

Saturated Thickness: 9.71 ft
Anisotropy Ratio (Kz/Kr): 0.1

WELL DATA (MW-1A-15)

Initial Displacement: 1.87 ft
Total Well Penetration Depth: 13.92 ft
Casing Radius: 0.083 ft
Static Water Column Height: 9.71 ft
Screen Length: 9.71 ft
Well Radius: 0.3438 ft
Gravel Pack Porosity: 0.25

SOLUTION

Aquifer Model: Unconfined
Solution Method: Hvorslev
K = 14.38 ft/day
y0 = 0.1533 ft

Data Set: W:\DDriveOnGis\NgisFiles\140904-BremCarlisle\PermabilityData\SlugTestData021315\Mw_2_15Results
Date: 02/23/15
Time: 13:15:51

PROJECT INFORMATION

Company: NGI
Client: Brem
Project: 150102
Location: Carlisle, MA
Test Date: 02/13/2015
Test Well: MW-2-15

AQUIFER DATA

Saturated Thickness: 6.93 ft
Anisotropy Ratio (Kz/Kr): 0.1

SLUG TEST WELL DATA

Test Well: MW-2-15

X Location: 0. ft
Y Location: 0. ft

Initial Displacement: 1.43 ft
Static Water Column Height: 6.93 ft
Casing Radius: 0.083 ft
Well Radius: 0.3438 ft
Well Skin Radius: 0.3438 ft
Screen Length: 6.93 ft
Total Well Penetration Depth: 9.3 ft
Corrected Casing Radius (Bouwer-Rice Method): 0.1863 ft
Gravel Pack Porosity: 0.25

No. of Observations: 60

Observation Data

Time (sec)	Displacement (ft)	Time (sec)	Displacement (ft)
1.	1.429	31.	0.33
2.	1.037	32.	0.328
3.	0.855	33.	0.328
4.	0.71	34.	0.328
5.	0.599	35.	0.326
6.	0.519	36.	0.326
7.	0.466	37.	0.325
8.	0.43	38.	0.325
9.	0.408	39.	0.325
10.	0.397	40.	0.323
11.	0.387	41.	0.323
12.	0.38	42.	0.323
13.	0.371	43.	0.321
14.	0.367	44.	0.324
15.	0.361	45.	0.324
16.	0.357	46.	0.322
17.	0.352	47.	0.322
18.	0.351	48.	0.322
19.	0.349	49.	0.323
20.	0.345	50.	0.32
21.	0.343	51.	0.323
22.	0.341	52.	0.321
23.	0.339	53.	0.321
24.	0.337	54.	0.319
25.	0.335	55.	0.319
26.	0.335	56.	0.319
27.	0.335	57.	0.32
28.	0.333	58.	0.317

Time (sec)	Displacement (ft)	Time (sec)	Displacement (ft)
29.	0.332	59.	0.316
30.	0.332	60.	0.318

SOLUTION

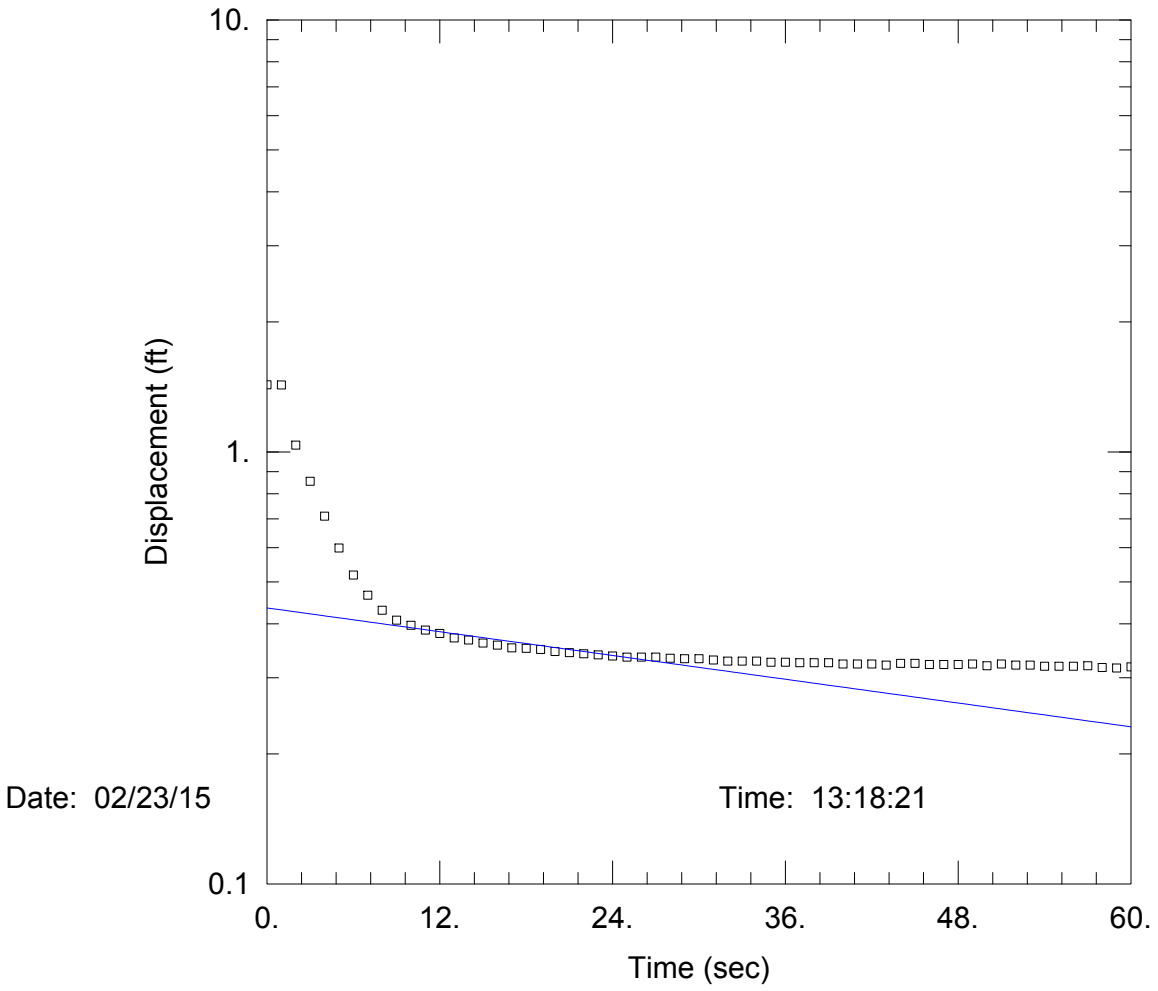
Slug Test
Aquifer Model: Unconfined
Solution Method: Hvorslev
Log Factor: 0.1887

VISUAL ESTIMATION RESULTS

Estimated Parameters

Parameter	Estimate	
K	12.11	ft/day
y0	0.4354	ft

K = 0.004271 cm/sec
T = K*b = 83.9 ft²/day (0.9022 sq. cm/sec)



WELL TEST ANALYSIS

Data Set: W:\...\Mw_2_15Results.aqt

PROJECT INFORMATION

Company: NGI
Client: Brem
Project: 150102
Location: Carlisle, MA
Test Well: MW-2-15
Test Date: 02/13/2015

AQUIFER DATA

Saturated Thickness: 6.93 ft
Anisotropy Ratio (Kz/Kr): 0.1

WELL DATA (MW-2-15)

Initial Displacement: 1.43 ft
Total Well Penetration Depth: 9.3 ft
Casing Radius: 0.083 ft
Static Water Column Height: 6.93 ft
Screen Length: 6.93 ft
Well Radius: 0.3438 ft
Gravel Pack Porosity: 0.25

SOLUTION

Aquifer Model: Unconfined
Solution Method: Hvorslev
K = 12.11 ft/day
y0 = 0.4354 ft

Data Set: W:\DDriveOnGis\NgisFiles\140904-BremCarlisle\PermabilityData\SlugTestData021315\Mw_2A_15Result
Date: 02/23/15
Time: 16:24:53

PROJECT INFORMATION

Company: NGI
Client: Brem
Project: 150102
Location: Carlisle, MA
Test Date: 02/13/2015
Test Well: MW-2A-15

AQUIFER DATA

Saturated Thickness: 6.79 ft
Anisotropy Ratio (Kz/Kr): 0.1

SLUG TEST WELL DATA

Test Well: MW-2A-15

X Location: 0. ft
Y Location: 0. ft

Initial Displacement: 1.11 ft
Static Water Column Height: 6.79 ft
Casing Radius: 0.083 ft
Well Radius: 0.3438 ft
Well Skin Radius: 0.3438 ft
Screen Length: 6.79 ft
Total Well Penetration Depth: 9.15 ft
Corrected Casing Radius (Bouwer-Rice Method): 0.1863 ft
Gravel Pack Porosity: 0.25

No. of Observations: 60

Observation Data

Time (sec)	Displacement (ft)	Time (sec)	Displacement (ft)
1.	1.114	31.	0.23
2.	0.722	32.	0.23
3.	0.606	33.	0.23
4.	0.461	34.	0.23
5.	0.372	35.	0.228
6.	0.327	36.	0.23
7.	0.303	37.	0.228
8.	0.29	38.	0.225
9.	0.276	39.	0.228
10.	0.267	40.	0.228
11.	0.261	41.	0.228
12.	0.256	42.	0.228
13.	0.254	43.	0.228
14.	0.25	44.	0.228
15.	0.247	45.	0.228
16.	0.247	46.	0.226
17.	0.245	47.	0.226
18.	0.243	48.	0.226
19.	0.241	49.	0.226
20.	0.241	50.	0.224
21.	0.238	51.	0.224
22.	0.238	52.	0.224
23.	0.237	53.	0.224
24.	0.236	54.	0.224
25.	0.234	55.	0.224
26.	0.234	56.	0.224
27.	0.234	57.	0.224
28.	0.232	58.	0.224

Time (sec)	Displacement (ft)	Time (sec)	Displacement (ft)
29.	0.232	59.	0.224
30.	0.232	60.	0.221

SOLUTION

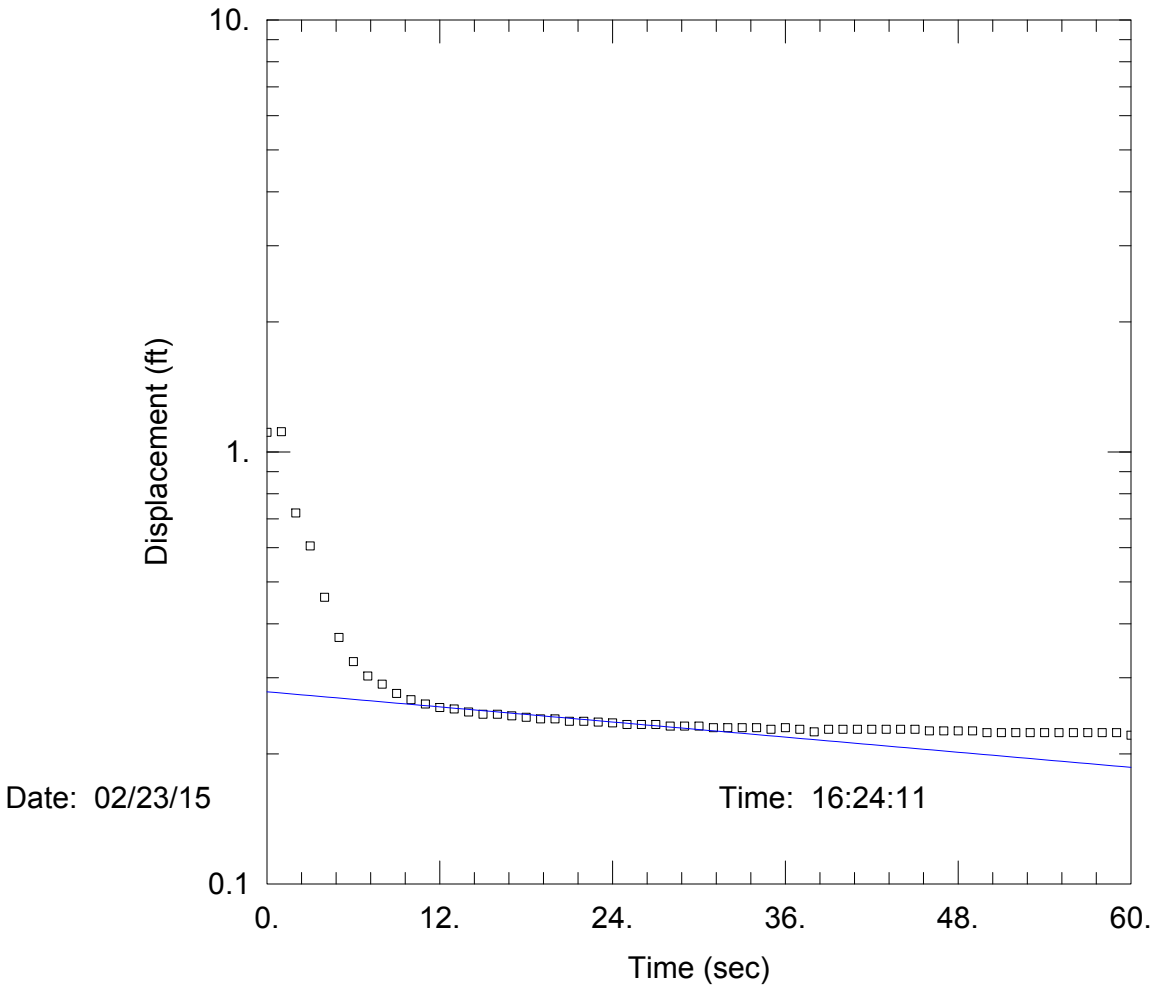
Slug Test
Aquifer Model: Unconfined
Solution Method: Hvorslev
Log Factor: 0.1887

VISUAL ESTIMATION RESULTS

Estimated Parameters

Parameter	Estimate	
K	7.855	ft/day
y0	0.2785	ft

K = 0.002771 cm/sec
T = K*b = 53.33 ft²/day (0.5735 sq. cm/sec)



WELL TEST ANALYSIS

Data Set: W:\...\Mw_2A_15Results.aqt

PROJECT INFORMATION

Company: NGI
Client: Brem
Project: 150102
Location: Carlisle, MA
Test Well: MW-2A-15
Test Date: 02/13/2015

AQUIFER DATA

Saturated Thickness: 6.79 ft
Anisotropy Ratio (Kz/Kr): 0.1

WELL DATA (MW-2A-15)

Initial Displacement: 1.11 ft
Total Well Penetration Depth: 9.15 ft
Casing Radius: 0.083 ft
Static Water Column Height: 6.79 ft
Screen Length: 6.79 ft
Well Radius: 0.3438 ft
Gravel Pack Porosity: 0.25

SOLUTION

Aquifer Model: Unconfined
Solution Method: Hvorslev
K = 7.855 ft/day
y0 = 0.2785 ft

Data Set: W:\DDriveOnGis\NgisFiles\140904-BremCarlisle\PermabilityData\SlugTestData021315\Mw_3_15Results
Date: 02/23/15
Time: 16:49:58

PROJECT INFORMATION

Company: NGI
Client: Brem
Project: 150102
Location: Carlisle, MA
Test Date: 02/13/2015
Test Well: MW-3-15

AQUIFER DATA

Saturated Thickness: 3.32 ft
Anisotropy Ratio (Kz/Kr): 0.1

SLUG TEST WELL DATA

Test Well: MW-3-15

X Location: 0. ft
Y Location: 0. ft

Initial Displacement: 0.79 ft
Static Water Column Height: 3.32 ft
Casing Radius: 0.083 ft
Well Radius: 0.3438 ft
Well Skin Radius: 0.3438 ft
Screen Length: 3.32 ft
Total Well Penetration Depth: 6.19 ft
Corrected Casing Radius (Bouwer-Rice Method): 0.1863 ft
Gravel Pack Porosity: 0.25

No. of Observations: 60

Observation Data

Time (sec)	Displacement (ft)	Time (sec)	Displacement (ft)
1.	0.79	31.	0.23
2.	0.54	32.	0.24
3.	0.44	33.	0.24
4.	0.38	34.	0.24
5.	0.34	35.	0.23
6.	0.32	36.	0.24
7.	0.3	37.	0.23
8.	0.29	38.	0.23
9.	0.27	39.	0.23
10.	0.27	40.	0.23
11.	0.26	41.	0.23
12.	0.26	42.	0.23
13.	0.25	43.	0.23
14.	0.25	44.	0.23
15.	0.25	45.	0.23
16.	0.25	46.	0.23
17.	0.25	47.	0.23
18.	0.24	48.	0.23
19.	0.24	49.	0.23
20.	0.24	50.	0.23
21.	0.24	51.	0.23
22.	0.24	52.	0.23
23.	0.24	53.	0.23
24.	0.24	54.	0.23
25.	0.24	55.	0.23
26.	0.24	56.	0.23
27.	0.24	57.	0.23
28.	0.24	58.	0.23

Time (sec)	Displacement (ft)	Time (sec)	Displacement (ft)
29.	0.24	59.	0.23
30.	0.24	60.	0.23

SOLUTION

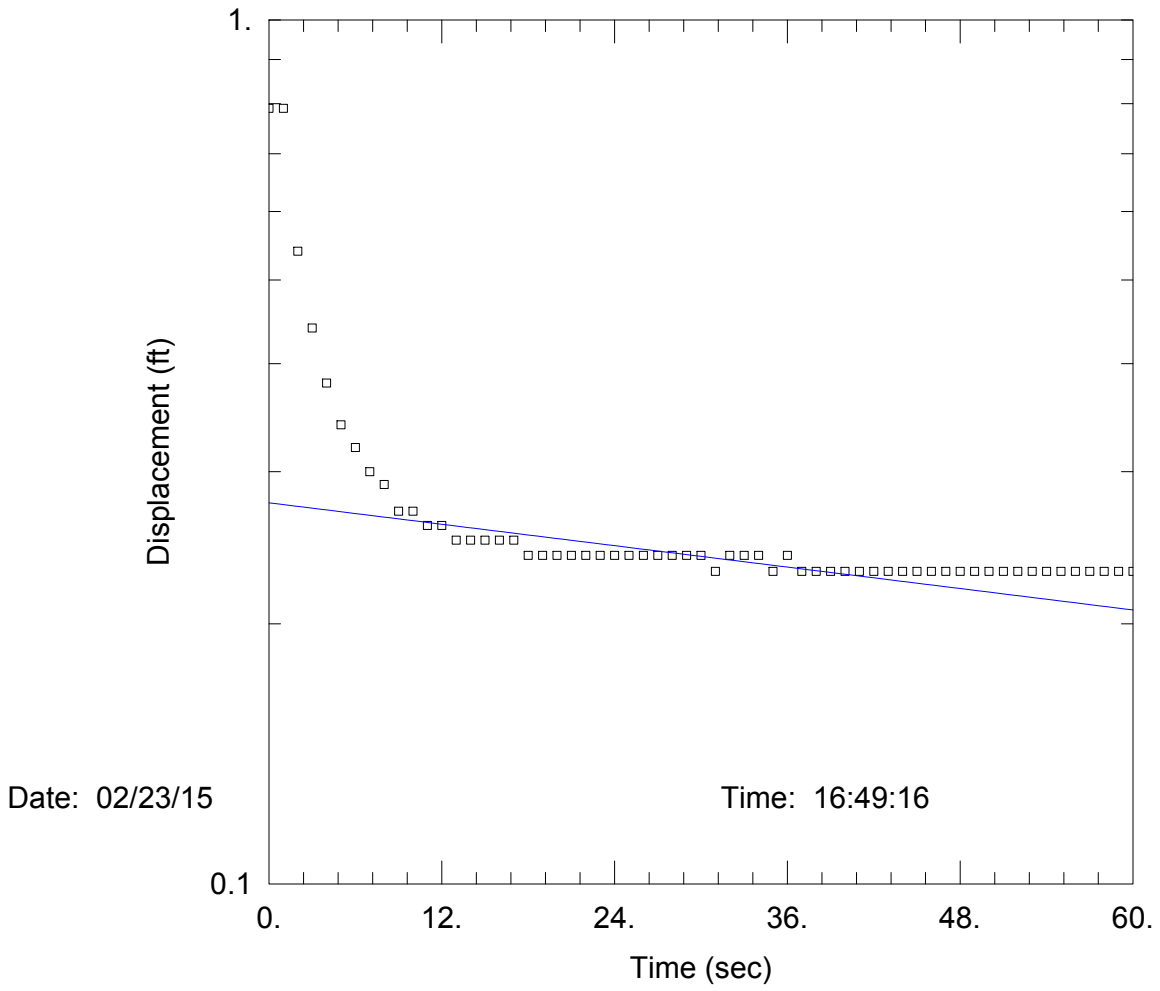
Slug Test
Aquifer Model: Unconfined
Solution Method: Hvorslev
Log Factor: 0.2432

VISUAL ESTIMATION RESULTS

Estimated Parameters

Parameter	Estimate	
K	8.839	ft/day
y0	0.2761	ft

K = 0.003118 cm/sec
T = K*b = 29.35 ft²/day (0.3155 sq. cm/sec)



WELL TEST ANALYSIS

Data Set: W:\...\Mw_3_15Results.aqt

PROJECT INFORMATION

Company: NGI
Client: Brem
Project: 150102
Location: Carlisle, MA
Test Well: MW-3-15
Test Date: 02/13/2015

AQUIFER DATA

Saturated Thickness: 3.32 ft
Anisotropy Ratio (Kz/Kr): 0.1

WELL DATA (MW-3-15)

Initial Displacement: 0.79 ft
Total Well Penetration Depth: 6.19 ft
Casing Radius: 0.083 ft
Static Water Column Height: 3.32 ft
Screen Length: 3.32 ft
Well Radius: 0.3438 ft
Gravel Pack Porosity: 0.25

SOLUTION

Aquifer Model: Unconfined
Solution Method: Hvorslev
K = 8.839 ft/day
y0 = 0.2761 ft

Data Set: W:\DDriveOnGis\NgisFiles\140904-BremCarlisle\PermabilityData\SlugTestData021315\Mw_3A_15Result
Date: 02/23/15
Time: 17:18:07

PROJECT INFORMATION

Company: NGI
Client: Brem
Project: 150102
Location: Carlisle, MA
Test Date: 02/13/2015
Test Well: MW-3A-15

AQUIFER DATA

Saturated Thickness: 3.13 ft
Anisotropy Ratio (Kz/Kr): 0.1

SLUG TEST WELL DATA

Test Well: MW-3A-15

X Location: 0. ft
Y Location: 0. ft

Initial Displacement: 0.9 ft
Static Water Column Height: 3.13 ft
Casing Radius: 0.083 ft
Well Radius: 0.3438 ft
Well Skin Radius: 0.3438 ft
Screen Length: 3.13 ft
Total Well Penetration Depth: 6.03 ft
Corrected Casing Radius (Bouwer-Rice Method): 0.1863 ft
Gravel Pack Porosity: 0.25

No. of Observations: 60

Observation Data

Time (sec)	Displacement (ft)	Time (sec)	Displacement (ft)
1.	0.9	31.	0.24
2.	0.61	32.	0.24
3.	0.43	33.	0.24
4.	0.34	34.	0.24
5.	0.3	35.	0.24
6.	0.28	36.	0.24
7.	0.27	37.	0.24
8.	0.26	38.	0.24
9.	0.26	39.	0.24
10.	0.25	40.	0.24
11.	0.25	41.	0.24
12.	0.25	42.	0.24
13.	0.25	43.	0.24
14.	0.25	44.	0.24
15.	0.24	45.	0.24
16.	0.24	46.	0.24
17.	0.24	47.	0.24
18.	0.24	48.	0.24
19.	0.24	49.	0.24
20.	0.24	50.	0.24
21.	0.24	51.	0.24
22.	0.24	52.	0.24
23.	0.24	53.	0.24
24.	0.24	54.	0.24
25.	0.24	55.	0.24
26.	0.24	56.	0.24
27.	0.24	57.	0.24
28.	0.24	58.	0.24

Time (sec)	Displacement (ft)	Time (sec)	Displacement (ft)
29.	0.24	59.	0.24
30.	0.24	60.	0.24

SOLUTION

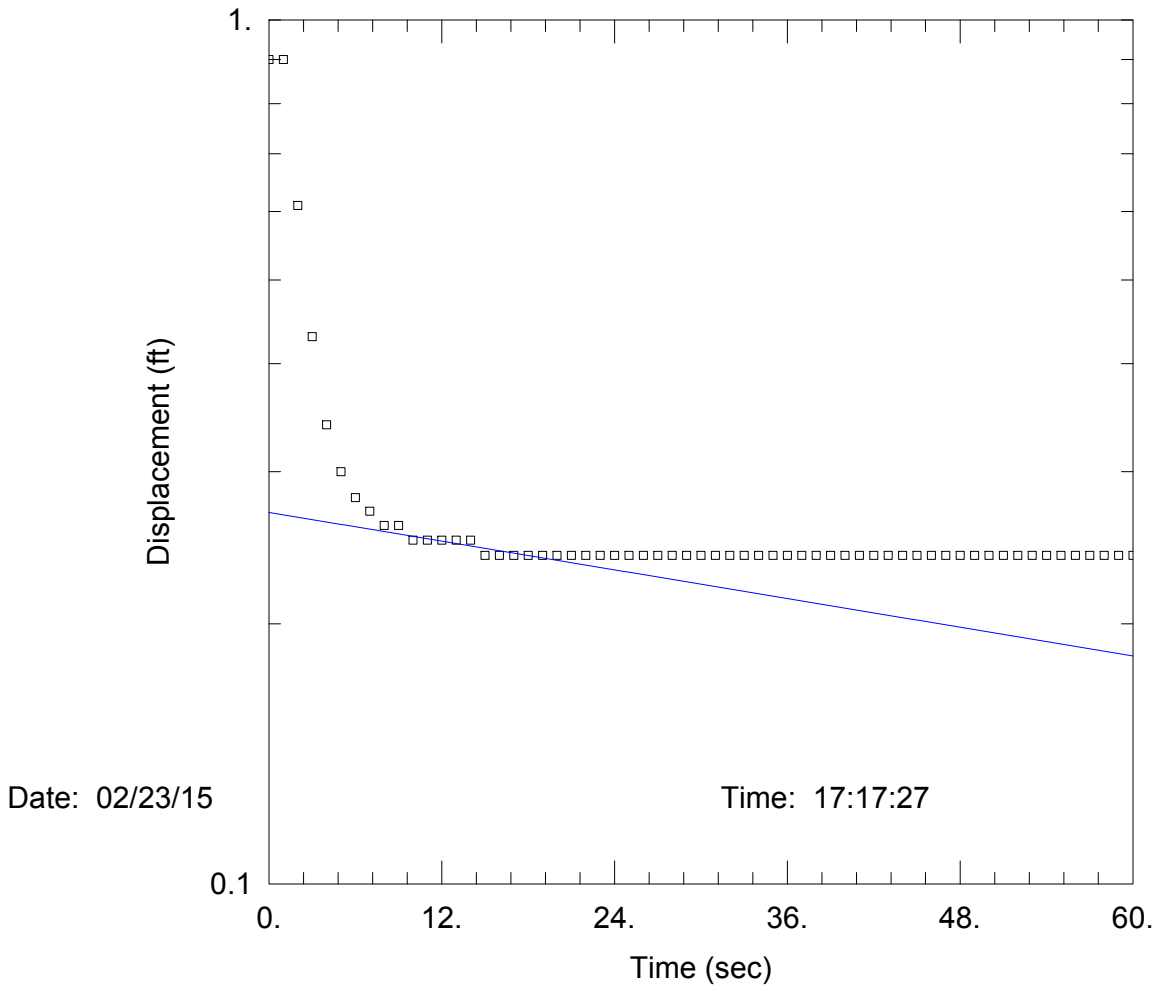
Slug Test
Aquifer Model: Unconfined
Solution Method: Hvorslev
Log Factor: 0.2467

VISUAL ESTIMATION RESULTS

Estimated Parameters

Parameter	Estimate	
K	12.38	ft/day
y0	0.2691	ft

K = 0.004366 cm/sec
T = K*b = 38.74 ft²/day (0.4165 sq. cm/sec)



WELL TEST ANALYSIS

Data Set: W:\...\Mw_3A_15Results.aqt

PROJECT INFORMATION

Company: NGI
Client: Brem
Project: 150102
Location: Carlisle, MA
Test Well: MW-3A-15
Test Date: 02/13/2015

AQUIFER DATA

Saturated Thickness: 3.13 ft
Anisotropy Ratio (Kz/Kr): 0.1

WELL DATA (MW-3A-15)

Initial Displacement: 0.9 ft
Total Well Penetration Depth: 6.03 ft
Casing Radius: 0.083 ft
Static Water Column Height: 3.13 ft
Screen Length: 3.13 ft
Well Radius: 0.3438 ft
Gravel Pack Porosity: 0.25

SOLUTION

Aquifer Model: Unconfined
Solution Method: Hvorslev
K = 12.38 ft/day
y0 = 0.2691 ft

Data Set: W:\DDriveOnGis\NgisFiles\140904-BremCarlisle\PermabilityData\SlugTestData021315\Mw_3A_15Result
Date: 02/23/15
Time: 17:42:03

PROJECT INFORMATION

Company: NGI
Client: Brem
Project: 150102
Location: Carlisle, MA
Test Date: 02/13/2015
Test Well: MW-4-15

AQUIFER DATA

Saturated Thickness: 12.83 ft
Anisotropy Ratio (Kz/Kr): 0.1

SLUG TEST WELL DATA

Test Well: MW-4-15

X Location: 0. ft
Y Location: 0. ft

Initial Displacement: 1.56 ft
Static Water Column Height: 12.83 ft
Casing Radius: 0.083 ft
Well Radius: 0.3438 ft
Well Skin Radius: 0.3438 ft
Screen Length: 12.83 ft
Total Well Penetration Depth: 16.42 ft
Corrected Casing Radius (Bouwer-Rice Method): 0.1863 ft
Gravel Pack Porosity: 0.25

No. of Observations: 60

Observation Data

Time (sec)	Displacement (ft)	Time (sec)	Displacement (ft)
1.	1.56	31.	1.38
2.	1.54	32.	1.38
3.	1.53	33.	1.37
4.	1.52	34.	1.37
5.	1.51	35.	1.37
6.	1.5	36.	1.36
7.	1.49	37.	1.36
8.	1.48	38.	1.35
9.	1.47	39.	1.35
10.	1.46	40.	1.35
11.	1.46	41.	1.34
12.	1.46	42.	1.33
13.	1.46	43.	1.33
14.	1.45	44.	1.32
15.	1.44	45.	1.32
16.	1.44	46.	1.32
17.	1.43	47.	1.31
18.	1.43	48.	1.31
19.	1.42	49.	1.3
20.	1.42	50.	1.3
21.	1.41	51.	1.29
22.	1.4	52.	1.29
23.	1.41	53.	1.28
24.	1.4	54.	1.28
25.	1.4	55.	1.27
26.	1.4	56.	1.27
27.	1.4	57.	1.26
28.	1.39	58.	1.26

Time (sec)	Displacement (ft)	Time (sec)	Displacement (ft)
29.	1.39	59.	1.25
30.	1.38	60.	1.25

SOLUTION

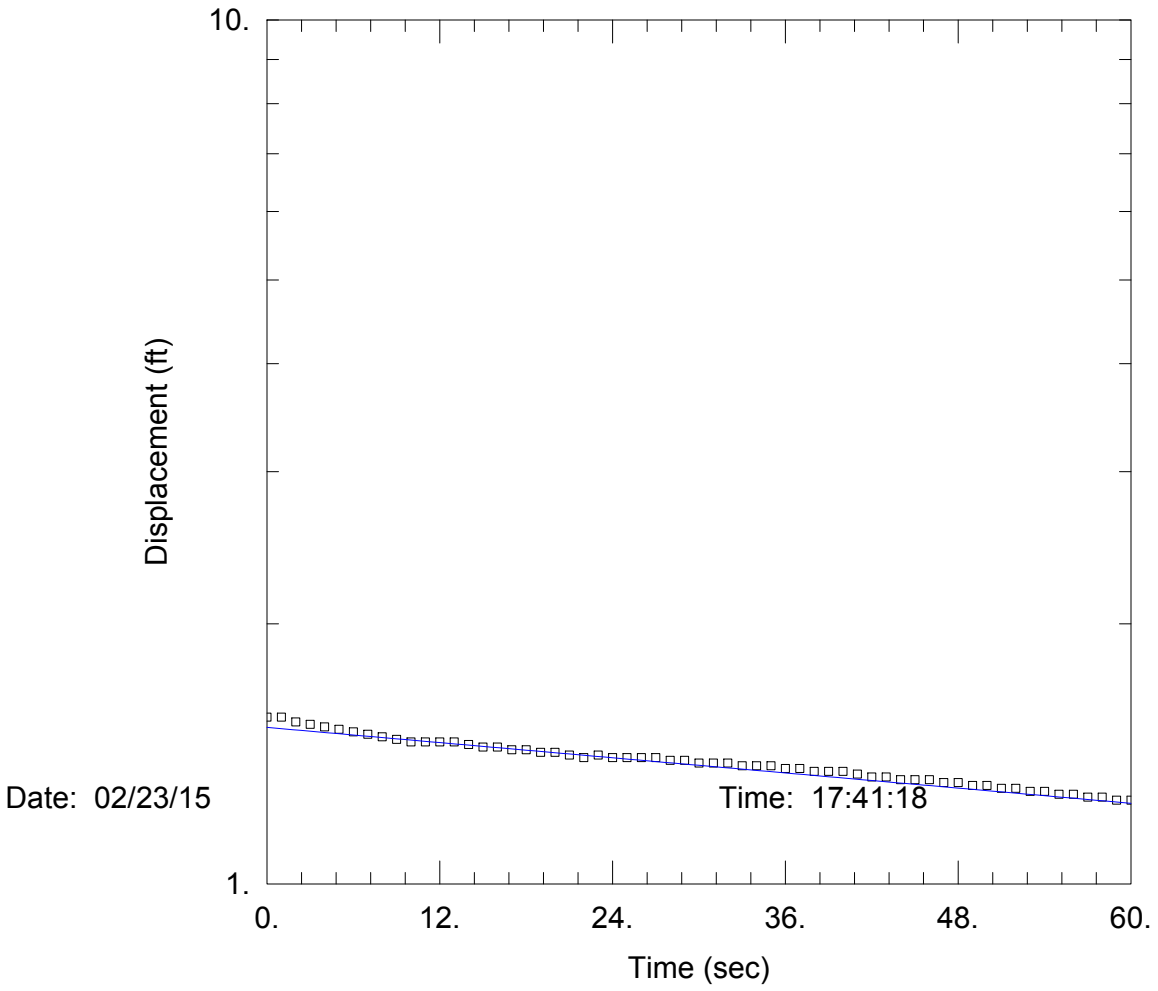
Slug Test
Aquifer Model: Unconfined
Solution Method: Hvorslev
Log Factor: 0.1887

VISUAL ESTIMATION RESULTS

Estimated Parameters

Parameter	Estimate	
K	2.086	ft/day
y0	1.517	ft

K = 0.0007359 cm/sec
T = K*b = 26.76 ft²/day (0.2878 sq. cm/sec)



WELL TEST ANALYSIS

Data Set: W:\...\Mw_3A_15Results.aqt

PROJECT INFORMATION

Company: NGI
Client: Brem
Project: 150102
Location: Carlisle, MA
Test Well: MW-4-15
Test Date: 02/13/2015

AQUIFER DATA

Saturated Thickness: 12.83 ft
Anisotropy Ratio (Kz/Kr): 0.1

WELL DATA (MW-4-15)

Initial Displacement: 1.56 ft
Total Well Penetration Depth: 16.42 ft
Casing Radius: 0.083 ft
Static Water Column Height: 12.83 ft
Screen Length: 12.83 ft
Well Radius: 0.3438 ft
Gravel Pack Porosity: 0.25

SOLUTION

Aquifer Model: Unconfined
Solution Method: Hvorslev
K = 2.086 ft/day
y0 = 1.517 ft

Data Set: W:\DDriveOnGis\NgisFiles\140904-BremCarlisle\PermabilityData\SlugTestData021315\Mw_5_15Results
Date: 02/24/15
Time: 09:21:17

PROJECT INFORMATION

Company: NGI
Client: Brem
Project: 150102
Location: Carlisle, MA
Test Date: 02/13/2015
Test Well: MW-5-15

AQUIFER DATA

Saturated Thickness: 12.83 ft
Anisotropy Ratio (Kz/Kr): 0.1

SLUG TEST WELL DATA

Test Well: MW-5-15

X Location: 0. ft
Y Location: 0. ft

Initial Displacement: 1.61 ft
Static Water Column Height: 12.83 ft
Casing Radius: 0.083 ft
Well Radius: 0.3438 ft
Well Skin Radius: 0.3438 ft
Screen Length: 10. ft
Total Well Penetration Depth: 15.8 ft
Corrected Casing Radius (Bouwer-Rice Method): 0.1863 ft
Gravel Pack Porosity: 0.25

No. of Observations: 60

Observation Data

Time (sec)	Displacement (ft)	Time (sec)	Displacement (ft)
1.	1.61	31.	1.11
2.	1.54	32.	1.1
3.	1.5	33.	1.09
4.	1.48	34.	1.08
5.	1.46	35.	1.08
6.	1.43	36.	1.07
7.	1.41	37.	1.06
8.	1.39	38.	1.05
9.	1.37	39.	1.04
10.	1.36	40.	1.04
11.	1.34	41.	1.03
12.	1.32	42.	1.02
13.	1.31	43.	1.01
14.	1.29	44.	1.
15.	1.28	45.	0.99
16.	1.27	46.	0.98
17.	1.25	47.	0.98
18.	1.24	48.	0.97
19.	1.23	49.	0.96
20.	1.21	50.	0.95
21.	1.2	51.	0.95
22.	1.19	52.	0.94
23.	1.18	53.	0.93
24.	1.17	54.	0.92
25.	1.16	55.	0.92
26.	1.15	56.	0.91
27.	1.14	57.	0.9
28.	1.13	58.	0.9

Time (sec)	Displacement (ft)	Time (sec)	Displacement (ft)
29.	1.13	59.	0.89
30.	1.11	60.	0.88

SOLUTION

Slug Test
Aquifer Model: Unconfined
Solution Method: Hvorslev
Log Factor: 0.1918

VISUAL ESTIMATION RESULTS

Estimated Parameters

Parameter	Estimate	
K	6.058	ft/day
y0	1.403	ft

K = 0.002137 cm/sec
T = K*b = 77.72 ft²/day (0.8357 sq. cm/sec)

Data Set: W:\DDriveOnGis\NgisFiles\140904-BremCarlisle\PermabilityData\SlugTestData021315\Mw_5_15Results
Date: 02/24/15
Time: 09:21:17

PROJECT INFORMATION

Company: NGI
Client: Brem
Project: 150102
Location: Carlisle, MA
Test Date: 02/13/2015
Test Well: MW-5-15

AQUIFER DATA

Saturated Thickness: 12.83 ft
Anisotropy Ratio (Kz/Kr): 0.1

SLUG TEST WELL DATA

Test Well: MW-5-15

X Location: 0. ft
Y Location: 0. ft

Initial Displacement: 1.61 ft
Static Water Column Height: 12.83 ft
Casing Radius: 0.083 ft
Well Radius: 0.3438 ft
Well Skin Radius: 0.3438 ft
Screen Length: 10. ft
Total Well Penetration Depth: 15.8 ft
Corrected Casing Radius (Bouwer-Rice Method): 0.1863 ft
Gravel Pack Porosity: 0.25

No. of Observations: 60

Observation Data

Time (sec)	Displacement (ft)	Time (sec)	Displacement (ft)
1.	1.61	31.	1.11
2.	1.54	32.	1.1
3.	1.5	33.	1.09
4.	1.48	34.	1.08
5.	1.46	35.	1.08
6.	1.43	36.	1.07
7.	1.41	37.	1.06
8.	1.39	38.	1.05
9.	1.37	39.	1.04
10.	1.36	40.	1.04
11.	1.34	41.	1.03
12.	1.32	42.	1.02
13.	1.31	43.	1.01
14.	1.29	44.	1.
15.	1.28	45.	0.99
16.	1.27	46.	0.98
17.	1.25	47.	0.98
18.	1.24	48.	0.97
19.	1.23	49.	0.96
20.	1.21	50.	0.95
21.	1.2	51.	0.95
22.	1.19	52.	0.94
23.	1.18	53.	0.93
24.	1.17	54.	0.92
25.	1.16	55.	0.92
26.	1.15	56.	0.91
27.	1.14	57.	0.9
28.	1.13	58.	0.9

Time (sec)	Displacement (ft)	Time (sec)	Displacement (ft)
29.	1.13	59.	0.89
30.	1.11	60.	0.88

SOLUTION

Slug Test
Aquifer Model: Unconfined
Solution Method: Hvorslev
Log Factor: 0.1918

VISUAL ESTIMATION RESULTS

Estimated Parameters

Parameter	Estimate	
K	6.058	ft/day
y0	1.403	ft

K = 0.002137 cm/sec
T = K*b = 77.72 ft²/day (0.8357 sq. cm/sec)

APPENDIX C

NGI

NORTHEAST GEOSCIENCE INC

Water Supply & Environmental Consulting

----- TECSOFT, INC. TECMOUND PROGRAM

Title: Septic System #1 Groundwater Mounding Analysis

RECHARGE/DISCHARGE (NO STREAM, BOUNDARY)

THE OUTPUT GRID FILE IS C:\TECMOUND\Septic1.GRD
THE HARDCOPY OUTPUT FILE IS C:\TECMOUND\Septic1A.OUT
THE UNITS ARE ENGLISH
THE NUMBER OF RECHARGE AREAS IS 3
THE HANTUSH SOLUTION IS USED
A GRID OF MOUND HEIGHTS WILL BE COMPUTED

THE GRID SIZE IS 100 X 100
THE GRID INTERVAL IS 9.091 FT
STARTING X IS -300.000 FT
ENDING X IS 600.000 FT
STARTING Y IS -800.000 FT
ENDING Y IS 300.000 FT

THE TOTAL TIME IS 30.000 DAYS

THE HYDRAULIC CONDUCTIVITY IS 9.0000 FT/DAY
THE INITIAL SATURATED THICKNESS IS 12.4900 FT
THE SPECIFIC YIELD IS 0.0700

FOR RECHARGE AREA 1:
RECHARGE BEGINS AT: 0.0000 DAYS
DISCHARGE BEGINS AT: 30.0000 DAYS
THE RECHARGE RATE IS 0.0922 FT/DAY
THE LENGTH OF THE RECHARGE AREA IS 51.7300 FT
THE WIDTH OF THE RECHARGE AREA IS 51.7300 FT
THE X-COORDINATE OF THE RECHARGE AREA CENTER IS 32.6200 FT
THE Y-COORDINATE OF THE RECHARGE AREA CENTER IS -569.0600 FT
THE ORIENTATION OF THE RECHARGE AREA IS 36.0000 DEGREES

FOR RECHARGE AREA 2:
RECHARGE BEGINS AT: 0.0000 DAYS
DISCHARGE BEGINS AT: 0.0000 DAYS
THE RECHARGE RATE IS 0.0000 FT/DAY
THE LENGTH OF THE RECHARGE AREA IS 51.7300 FT
THE WIDTH OF THE RECHARGE AREA IS 51.7300 FT
THE X-COORDINATE OF THE RECHARGE AREA CENTER IS 0.0000 FT
THE Y-COORDINATE OF THE RECHARGE AREA CENTER IS 0.0000 FT
THE ORIENTATION OF THE RECHARGE AREA IS 20.0000 DEGREES

FOR RECHARGE AREA 3:
RECHARGE BEGINS AT: 0.0000 DAYS
DISCHARGE BEGINS AT: 0.0000 DAYS
THE RECHARGE RATE IS 0.0000 FT/DAY
THE LENGTH OF THE RECHARGE AREA IS 51.7300 FT
THE WIDTH OF THE RECHARGE AREA IS 51.7300 FT
THE X-COORDINATE OF THE RECHARGE AREA CENTER IS -64.2000 FT
THE Y-COORDINATE OF THE RECHARGE AREA CENTER IS 47.4300 FT
THE ORIENTATION OF THE RECHARGE AREA IS 20.0000 DEGREES

----- TECSOFT, INC. TECMOUND PROGRAM

Title: Septic Systems #2 & #3 Groundwater Mounding Analysis

RECHARGE/DISCHARGE (NO STREAM, BOUNDARY)
THE OUTPUT GRID FILE IS C:\TECMOUND\Septc23a.GRD
THE HARDCOPY OUTPUT FILE IS C:\TECMOUND\Septc23a.OUT

THE UNITS ARE ENGLISH
THE NUMBER OF RECHARGE AREAS IS 3
THE HANTUSH SOLUTION IS USED

A GRID OF MOUND HEIGHTS WILL BE COMPUTED
THE GRID SIZE IS 100 X 100
THE GRID INTERVAL IS 9.091 FT

STARTING X IS -300.000 FT
ENDING X IS 600.000 FT
STARTING Y IS -800.000 FT
ENDING Y IS 300.000 FT

THE TOTAL TIME IS 30.000 DAYS
THE HYDRAULIC CONDUCTIVITY IS 9.0000 FT/DAY
THE INITIAL SATURATED THICKNESS IS 7.1300 FT
THE SPECIFIC YIELD IS 0.0700

FOR RECHARGE AREA 1:
RECHARGE BEGINS AT: 0.0000 DAYS
DISCHARGE BEGINS AT: 30.0000 DAYS
THE RECHARGE RATE IS 0.0000 FT/DAY
THE LENGTH OF THE RECHARGE AREA IS 51.7300 FT
THE WIDTH OF THE RECHARGE AREA IS 51.7300 FT
THE X-COORDINATE OF THE RECHARGE AREA CENTER IS 32.6200 FT
THE Y-COORDINATE OF THE RECHARGE AREA CENTER IS -569.0600 FT
THE ORIENTATION OF THE RECHARGE AREA IS 36.0000 DEGREES

FOR RECHARGE AREA 2:
RECHARGE BEGINS AT: 0.0000 DAYS
DISCHARGE BEGINS AT: 0.0000 DAYS
THE RECHARGE RATE IS 0.0922 FT/DAY
THE LENGTH OF THE RECHARGE AREA IS 51.7300 FT
THE WIDTH OF THE RECHARGE AREA IS 51.7300 FT
THE X-COORDINATE OF THE RECHARGE AREA CENTER IS 0.0000 FT
THE Y-COORDINATE OF THE RECHARGE AREA CENTER IS 0.0000 FT
THE ORIENTATION OF THE RECHARGE AREA IS 20.0000 DEGREES

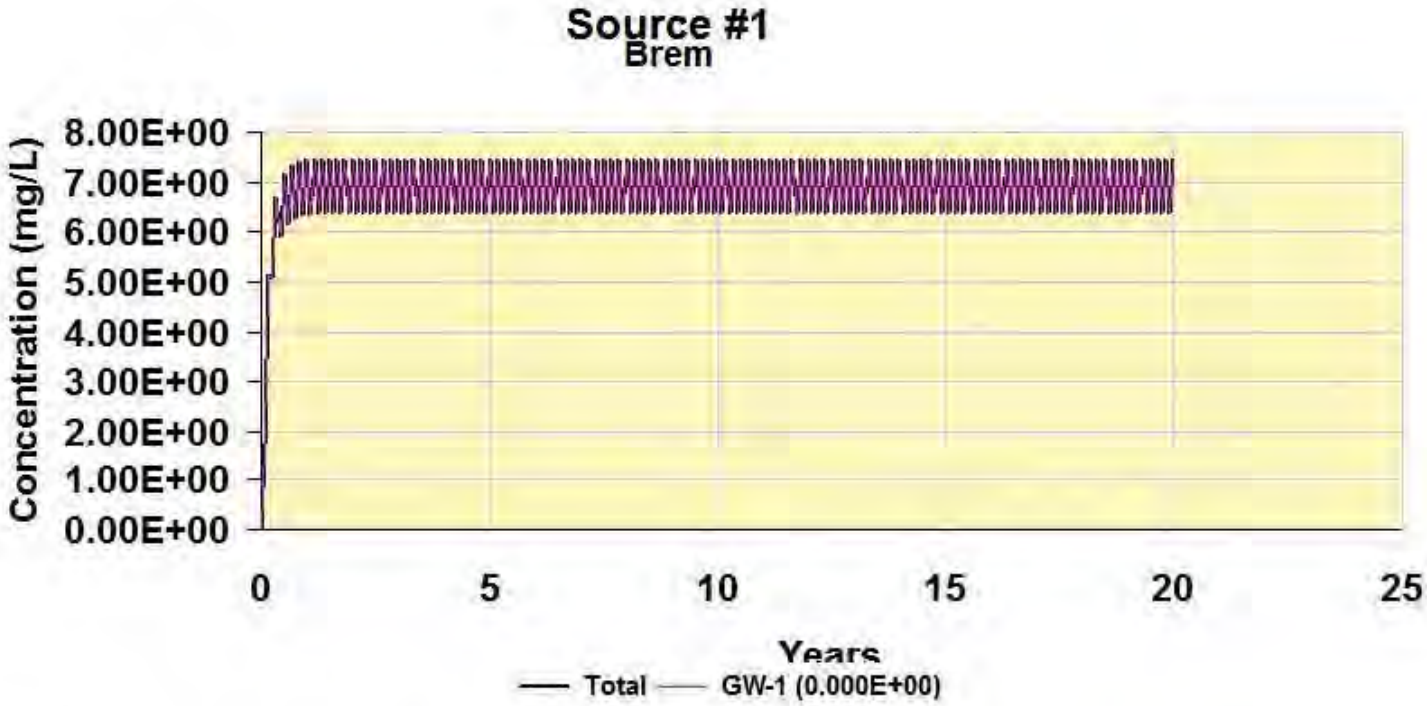
FOR RECHARGE AREA 3:
RECHARGE BEGINS AT: 0.0000 DAYS
DISCHARGE BEGINS AT: 30.0000 DAYS
THE RECHARGE RATE IS 0.0922 FT/DAY
THE LENGTH OF THE RECHARGE AREA IS 51.7300 FT
THE WIDTH OF THE RECHARGE AREA IS 51.7300 FT
THE X-COORDINATE OF THE RECHARGE AREA CENTER IS -64.2000 FT
THE Y-COORDINATE OF THE RECHARGE AREA CENTER IS 47.4300 FT
THE ORIENTATION OF THE RECHARGE AREA IS 20.0000 DEGREES

APPENDIX D

NGI

NORTHEAST GEOSCIENCE INC

Water Supply & Environmental Consulting

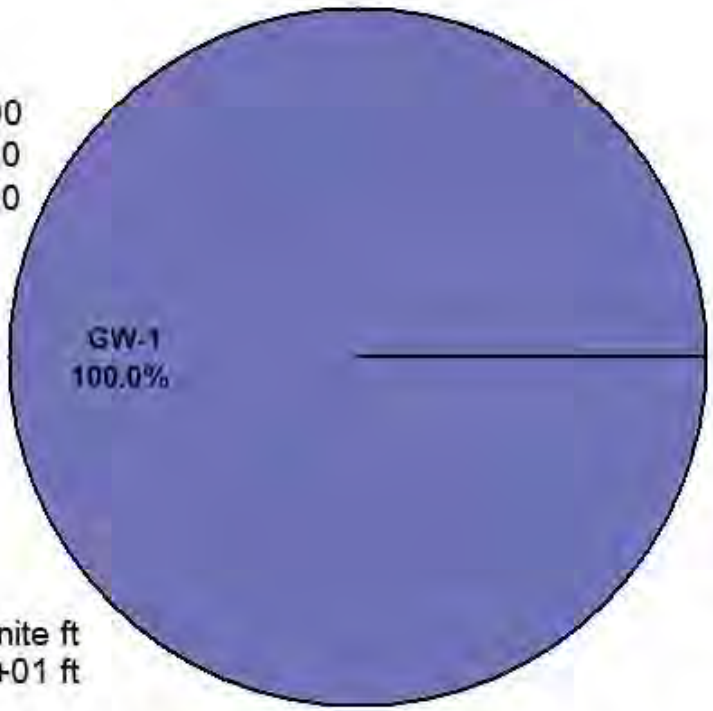


Maximum Concentration: 7.470E+00 mg/L
Year of Maximum Concentration: 2.00

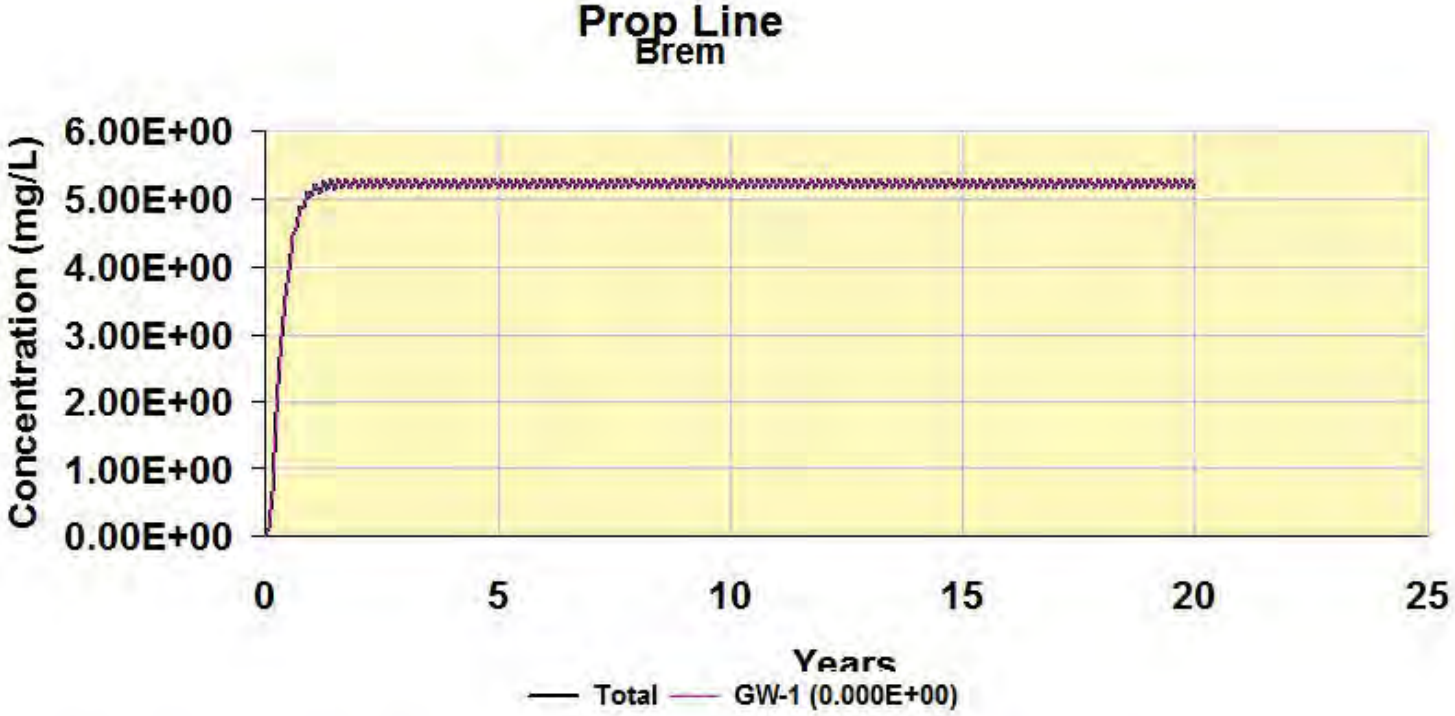
INPUT PARAMETERS

Organic Carbon (percent):	0.50000
Effective Porosity:	0.20000
Hydraulic Gradient (m/m):	0.05700

Dispersivities	Meters	Feet
Longitudinal:	1.400E+01	4.593E+01
Lateral:	1.400E+00	4.593E+00
Vertical:	1.400E-02	4.593E-02



Aquifer Width:	Infinite m	Infinite ft
Aquifer Depth:	3.830E+00 m	1.256E+01 ft
Retardation Factor:	1.608E+00	
Soil Bulk Density:	1.700E+03 kg/m3	1.700E+00 g/cm3
Molecular Diffusion:	0.000E+00 m2/hr	0.000E+00 cm2/sec
Decay Coefficient:	3.440E-05 1/hr	8.256E-04 1/day
Hydraulic Conductivity:	1.143E-01 m/hr	3.175E-03 cm/sec
Carbon Adsorption		0.1430E+02 (ug/g)/(ug/ml)
Kd:	7.000E-05 m3/kg	7.000E-02 (ug/g)/(ug/ml)
Retarded Darcy Velocity:	2.026E-02 m/hr	5.627E-02 cm/sec
Retarded Longitudinal Disp. Coefficient:	2.837E-01 m2/hr	7.880E-01 cm/sec
Retarded Lateral Dispersion Coefficient:	2.837E-02 m2/hr	7.880E-02 cm/sec
Retarded Vertical Dispersion Coefficient:	2.837E-04 m2/hr	7.880E-04 cm/sec

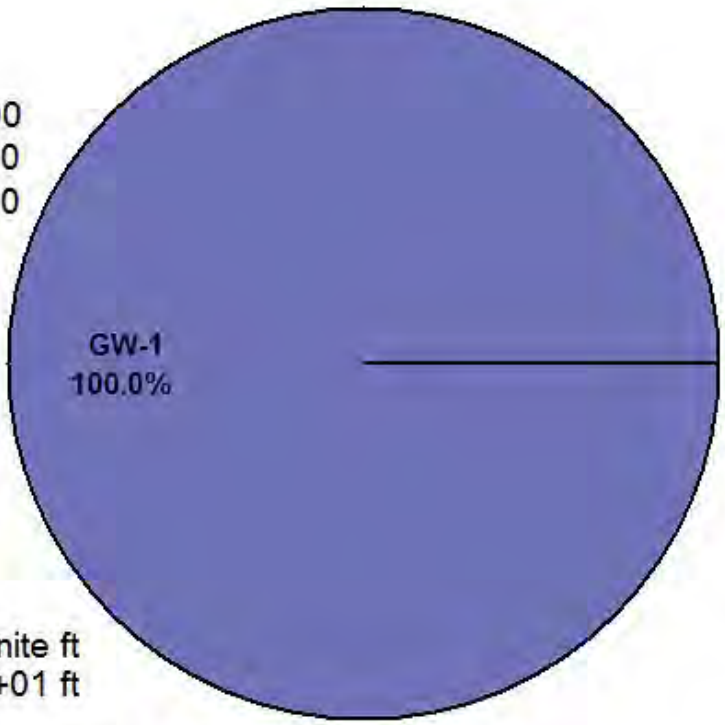


Maximum Concentration: 5.305E+00 mg/L
Year of Maximum Concentration: 1.92

INPUT PARAMETERS

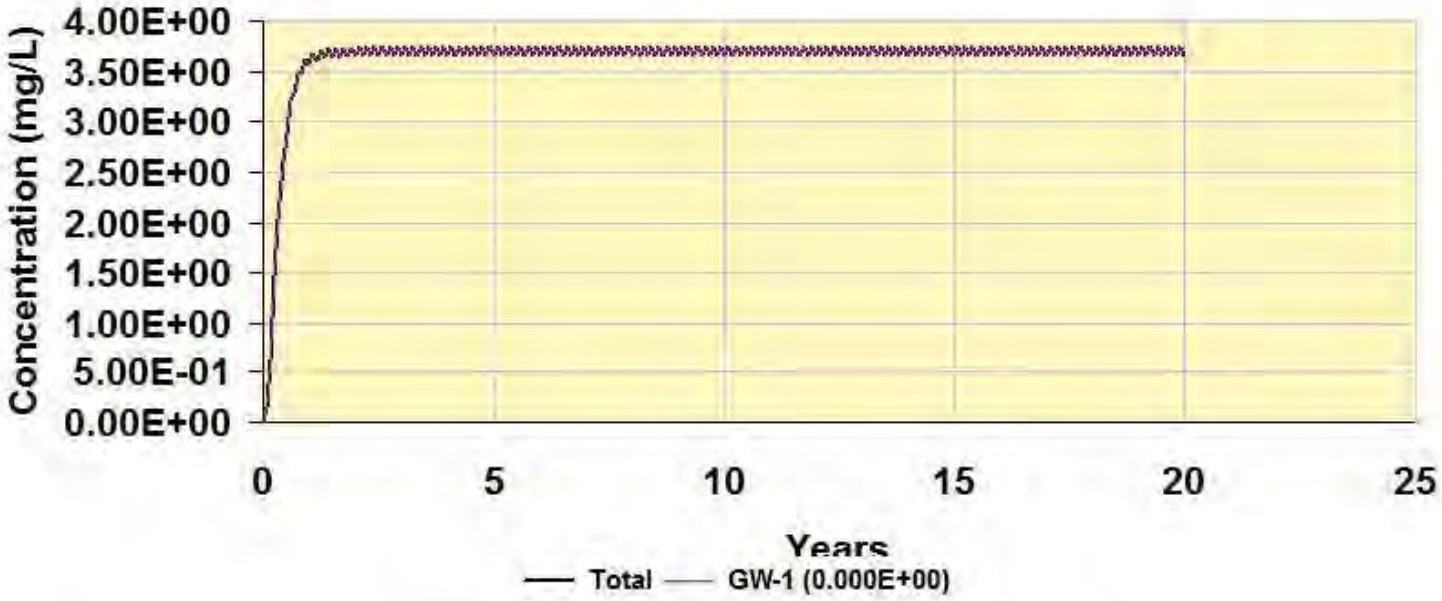
Organic Carbon (percent):	0.50000
Effective Porosity:	0.20000
Hydraulic Gradient (m/m):	0.05700

Dispersivities	**Meters**	**Feet**
Longitudinal:	1.400E+01	4.593E+01
Lateral:	1.400E+00	4.593E+00
Vertical:	1.400E-02	4.593E-02



Aquifer Width:	Infinite	m	Infinite	ft
Aquifer Depth:	3.830E+00	m	1.256E+01	ft
Retardation Factor:	1.608E+00			
Soil Bulk Density:	1.700E+03	kg/m3	1.700E+00	g/cm3
Molecular Diffusion:	0.000E+00	m2/hr	0.000E+00	cm2/sec
Decay Coefficient:	3.440E-05	1/hr	8.256E-04	1/day
Hydraulic Conductivity:			1.143E-01	m/hr 3.175E-03 cm/sec
Carbon Adsorption				0.1430E+02 (ug/g)/(ug/ml)
Kd:			7.000E-05	m3/kg 7.000E-02 (ug/g)/(ug/ml)
Retarded Darcy Velocity:			2.026E-02	m/hr 5.627E-02 cm/sec
Retarded Longitudinal Disp. Coefficient:			2.837E-01	m2/hr 7.880E-01 cm/sec
Retarded Lateral Dispersion Coefficient:			2.837E-02	m2/hr 7.880E-02 cm/sec
Retarded Vertical Dispersion Coefficient:			2.837E-04	m2/hr 7.880E-04 cm/sec

Unit #1
Brem

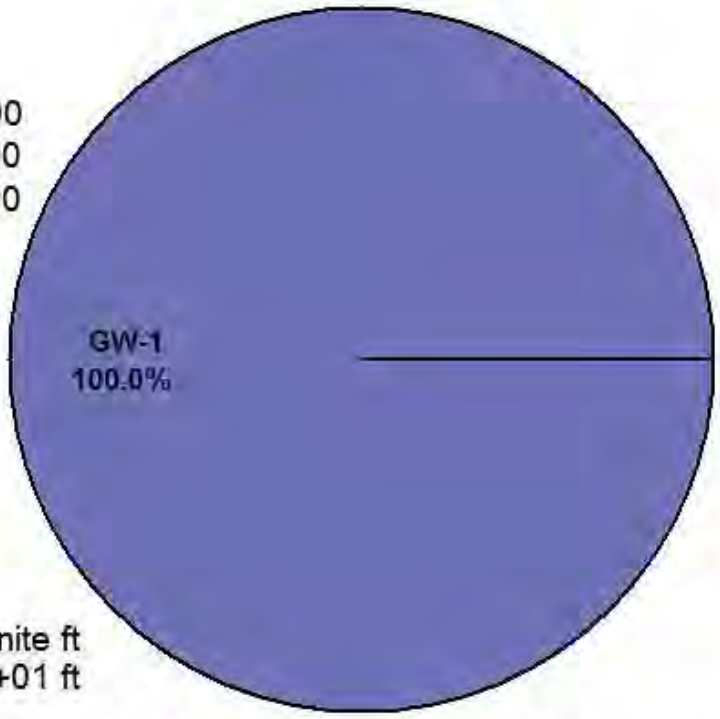


Maximum Concentration: 3.740E+00 mg/L
Year of Maximum Concentration: 2.08

INPUT PARAMETERS

Organic Carbon (percent):	0.50000
Effective Porosity:	0.20000
Hydraulic Gradient (m/m):	0.05700

Dispersivities	Meters	Feet
Longitudinal:	1.400E+01	4.593E+01
Lateral:	1.400E+00	4.593E+00
Vertical:	1.400E-02	4.593E-02



Aquifer Width:	Infinite	m	Infinite	ft
Aquifer Depth:	3.830E+00	m	1.256E+01	ft
Retardation Factor:	1.608E+00			
Soil Bulk Density:	1.700E+03	kg/m3	1.700E+00	g/cm3
Molecular Diffusion:	0.000E+00	m2/hr	0.000E+00	cm2/sec
Decay Coefficient:	3.440E-05	1/hr	8.256E-04	1/day
Hydraulic Conductivity:			1.143E-01	m/hr 3.175E-03 cm/sec
Carbon Adsorption				0.1430E+02 (ug/g)/(ug/ml)
Kd:			7.000E-05	m3/kg 7.000E-02 (ug/g)/(ug/ml)
Retarded Darcy Velocity:			2.026E-02	m/hr 5.627E-02 cm/sec
Retarded Longitudinal Disp. Coefficient:			2.837E-01	m2/hr 7.880E-01 cm/sec
Retarded Lateral Dispersion Coefficient:			2.837E-02	m2/hr 7.880E-02 cm/sec
Retarded Vertical Dispersion Coefficient:			2.837E-04	m2/hr 7.880E-04 cm/sec

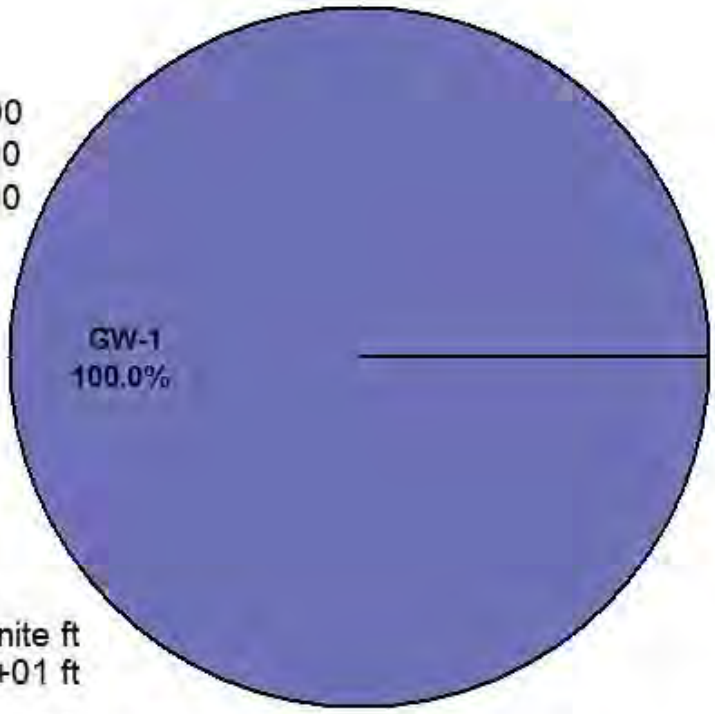
90 Long Ridge Well
Brem

Maximum Concentration: 3.665E+00 mg/L
Year of Maximum Concentration: 2.17

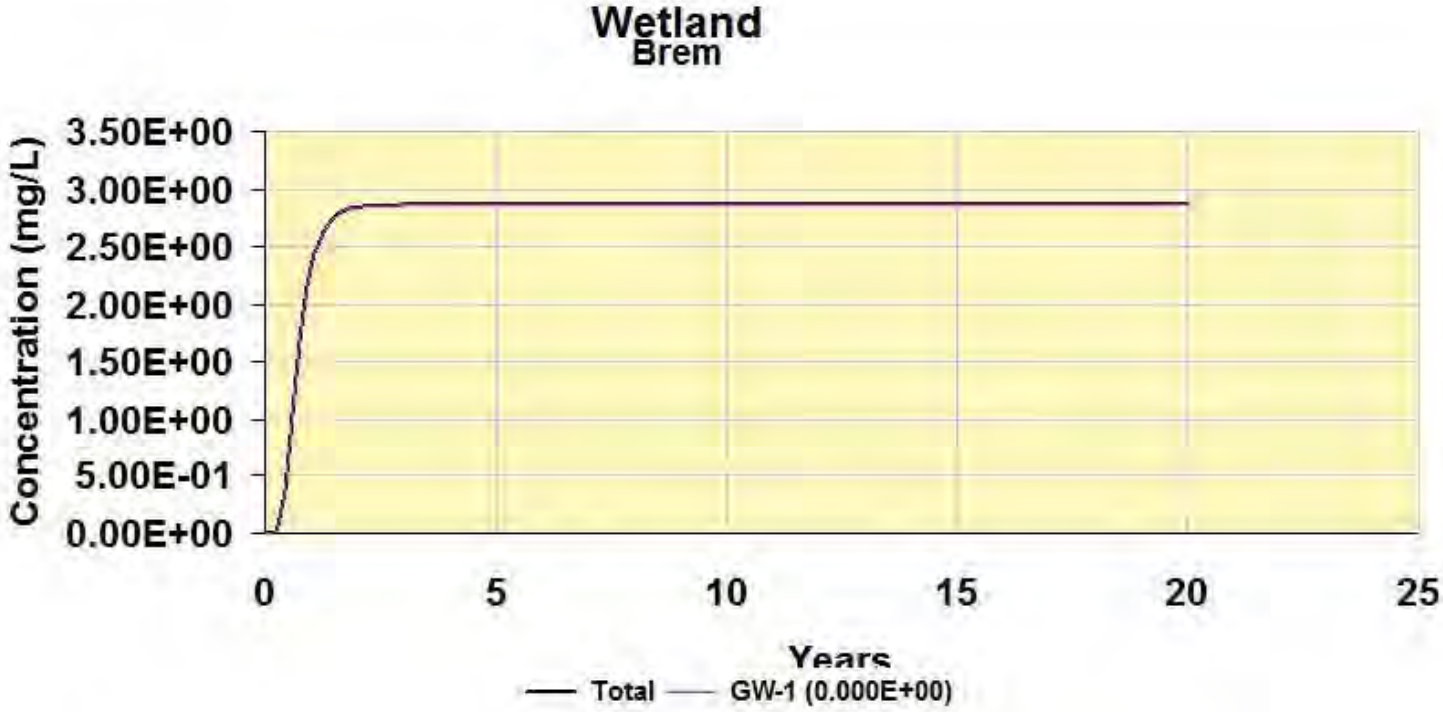
INPUT PARAMETERS

Organic Carbon (percent):	0.50000
Effective Porosity:	0.20000
Hydraulic Gradient (m/m):	0.05700

Dispersivities	**Meters**	**Feet**
Longitudinal:	1.400E+01	4.593E+01
Lateral:	1.400E+00	4.593E+00
Vertical:	1.400E-02	4.593E-02



Aquifer Width:	Infinite	m	Infinite	ft
Aquifer Depth:	3.830E+00	m	1.256E+01	ft
Retardation Factor:	1.608E+00			
Soil Bulk Density:	1.700E+03	kg/m3	1.700E+00	g/cm3
Molecular Diffusion:	0.000E+00	m2/hr	0.000E+00	cm2/sec
Decay Coefficient:	3.440E-05	1/hr	8.256E-04	1/day
Hydraulic Conductivity:			1.143E-01	m/hr 3.175E-03 cm/sec
Carbon Adsorption				0.1430E+02 (ug/g)/(ug/ml)
Kd:			7.000E-05	m3/kg 7.000E-02 (ug/g)/(ug/ml)
Retarded Darcy Velocity:			2.026E-02	m/hr 5.627E-02 cm/sec
Retarded Longitudinal Disp. Coefficient:			2.837E-01	m2/hr 7.880E-01 cm/sec
Retarded Lateral Dispersion Coefficient:			2.837E-02	m2/hr 7.880E-02 cm/sec
Retarded Vertical Dispersion Coefficient:			2.837E-04	m2/hr 7.880E-04 cm/sec

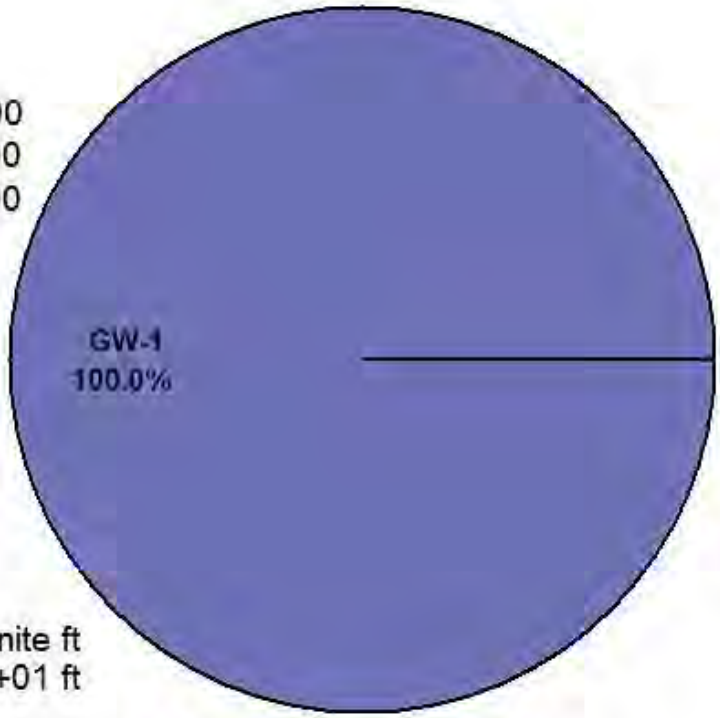


Maximum Concentration: 2.860E+00 mg/L
Year of Maximum Concentration: 2.92

INPUT PARAMETERS

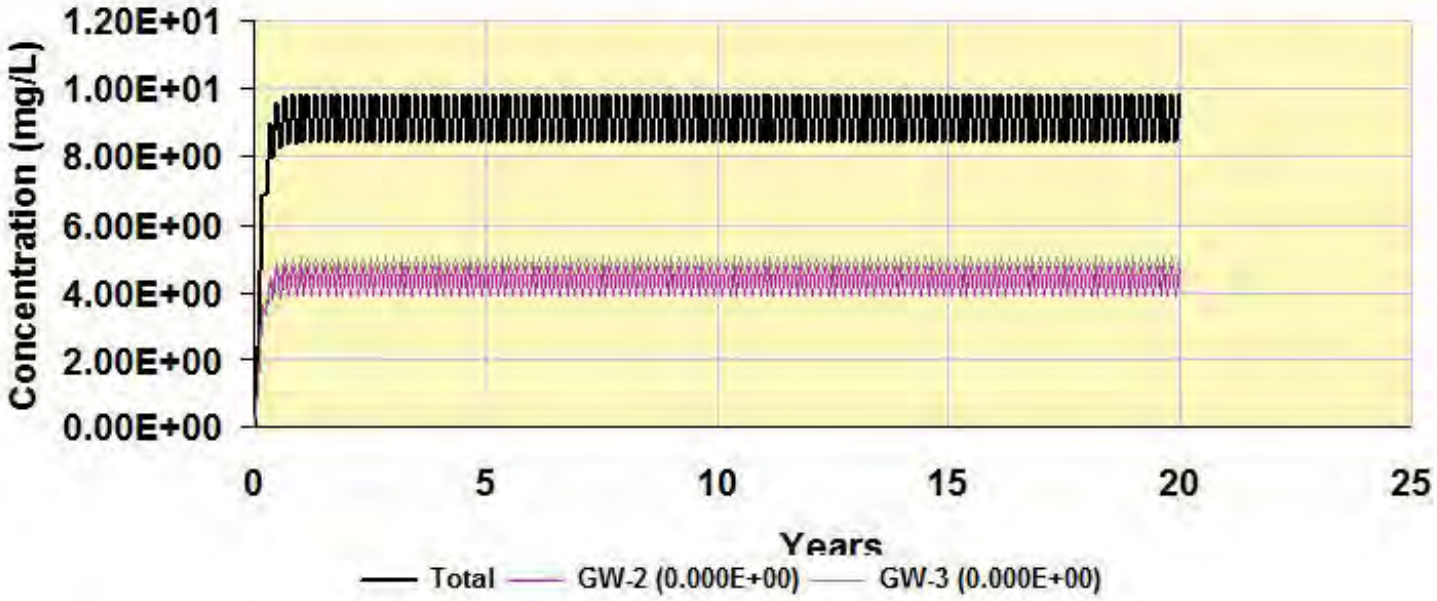
Organic Carbon (percent):	0.50000
Effective Porosity:	0.20000
Hydraulic Gradient (m/m):	0.05700

Dispersivities	**Meters**	**Feet**
Longitudinal:	1.400E+01	4.593E+01
Lateral:	1.400E+00	4.593E+00
Vertical:	1.400E-02	4.593E-02



Aquifer Width:	Infinite	m	Infinite	ft
Aquifer Depth:	3.830E+00	m	1.256E+01	ft
Retardation Factor:	1.608E+00			
Soil Bulk Density:	1.700E+03	kg/m3	1.700E+00	g/cm3
Molecular Diffusion:	0.000E+00	m2/hr	0.000E+00	cm2/sec
Decay Coefficient:	3.440E-05	1/hr	8.256E-04	1/day
Hydraulic Conductivity:			1.143E-01	m/hr 3.175E-03 cm/sec
Carbon Adsorption				0.1430E+02 (ug/g)/(ug/ml)
Kd:			7.000E-05	m3/kg 7.000E-02 (ug/g)/(ug/ml)
Retarded Darcy Velocity:			2.026E-02	m/hr 5.627E-02 cm/sec
Retarded Longitudinal Disp. Coefficient:			2.837E-01	m2/hr 7.880E-01 cm/sec
Retarded Lateral Dispersion Coefficient:			2.837E-02	m2/hr 7.880E-02 cm/sec
Retarded Vertical Dispersion Coefficient:			2.837E-04	m2/hr 7.880E-04 cm/sec

Source #2
Brem

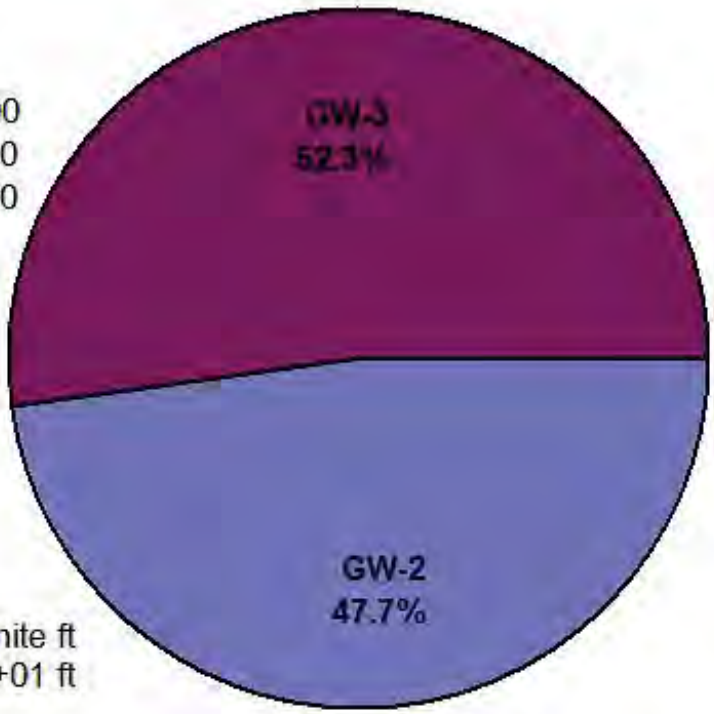


Maximum Concentration: 9.840E+00 mg/L
Year of Maximum Concentration: 1.50

INPUT PARAMETERS

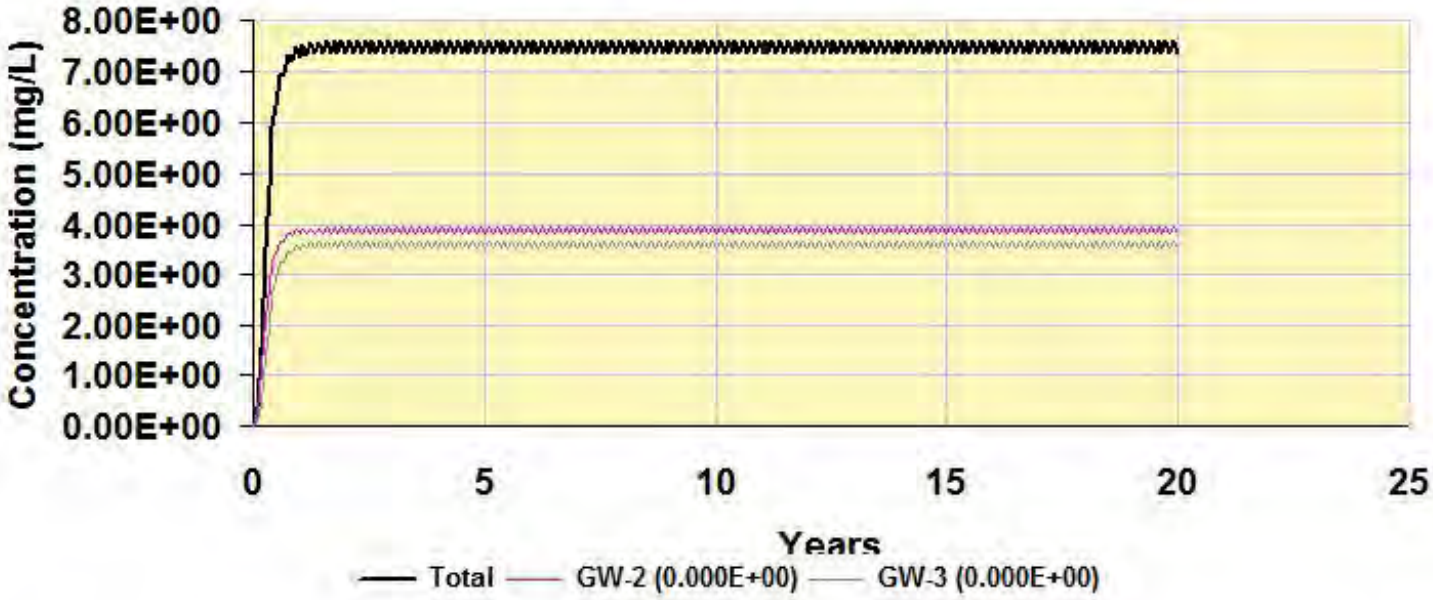
Organic Carbon (percent):	0.50000
Effective Porosity:	0.20000
Hydraulic Gradient (m/m):	0.07800

Dispersivities	Meters	Feet
Longitudinal:	1.370E+01	4.494E+01
Lateral:	1.370E+00	4.494E+00
Vertical:	1.370E-02	4.494E-02



Aquifer Width:	Infinite m	Infinite ft
Aquifer Depth:	3.250E+00 m	1.066E+01 ft
Retardation Factor:	1.608E+00	
Soil Bulk Density:	1.700E+03 kg/m3	1.700E+00 g/cm3
Molecular Diffusion:	0.000E+00 m2/hr	0.000E+00 cm2/sec
Decay Coefficient:	3.440E-05 1/hr	8.256E-04 1/day
Hydraulic Conductivity:	1.143E-01 m/hr	3.175E-03 cm/sec
Carbon Adsorption		0.1430E+02 (ug/g)/(ug/ml)
Kd:	7.000E-05 m3/kg	7.000E-02 (ug/g)/(ug/ml)
Retarded Darcy Velocity:	2.773E-02 m/hr	7.702E-02 cm/sec
Retarded Longitudinal Disp. Coefficient:	3.799E-01 m2/hr	1.055E+00 cm/sec
Retarded Lateral Dispersion Coefficient:	3.799E-02 m2/hr	1.055E-01 cm/sec
Retarded Vertical Dispersion Coefficient:	3.799E-04 m2/hr	1.055E-03 cm/sec

Prop. Well #11
Brem

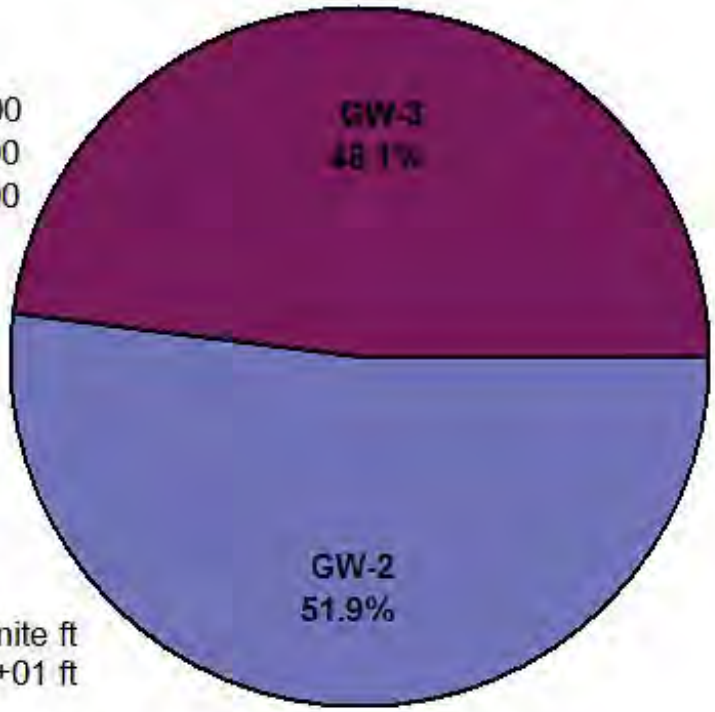


Maximum Concentration: 7.580E+00 mg/L
Year of Maximum Concentration: 1.58

INPUT PARAMETERS

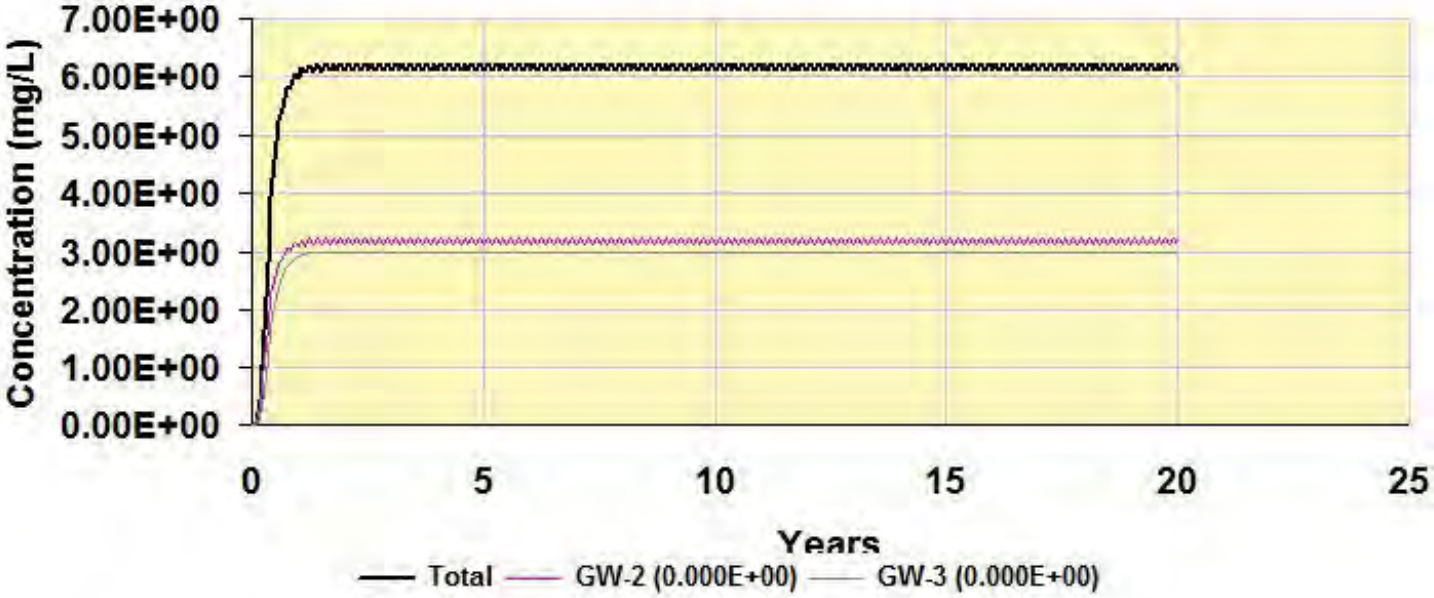
Organic Carbon (percent):	0.50000
Effective Porosity:	0.20000
Hydraulic Gradient (m/m):	0.07800

Dispersivities	Meters	Feet
Longitudinal:	1.370E+01	4.494E+01
Lateral:	1.370E+00	4.494E+00
Vertical:	1.370E-02	4.494E-02



Aquifer Width:	Infinite m	Infinite ft	
Aquifer Depth:	3.250E+00 m	1.066E+01 ft	
Retardation Factor:	1.608E+00		
Soil Bulk Density:	1.700E+03 kg/m3	1.700E+00 g/cm3	
Molecular Diffusion:	0.000E+00 m2/hr	0.000E+00 cm2/sec	
Decay Coefficient:	3.440E-05 1/hr	8.256E-04 1/day	
Hydraulic Conductivity:		1.143E-01 m/hr	3.175E-03 cm/sec
Carbon Adsorption			0.1430E+02 (ug/g)/(ug/ml)
Kd:		7.000E-05 m3/kg	7.000E-02 (ug/g)/(ug/ml)
Retarded Darcy Velocity:		2.773E-02 m/hr	7.702E-02 cm/sec
Retarded Longitudinal Disp. Coefficient:		3.799E-01 m2/hr	1.055E+00 cm/sec
Retarded Lateral Dispersion Coefficient:		3.799E-02 m2/hr	1.055E-01 cm/sec
Retarded Vertical Dispersion Coefficient:		3.799E-04 m2/hr	1.055E-03 cm/sec

Prop Well #12
Brem

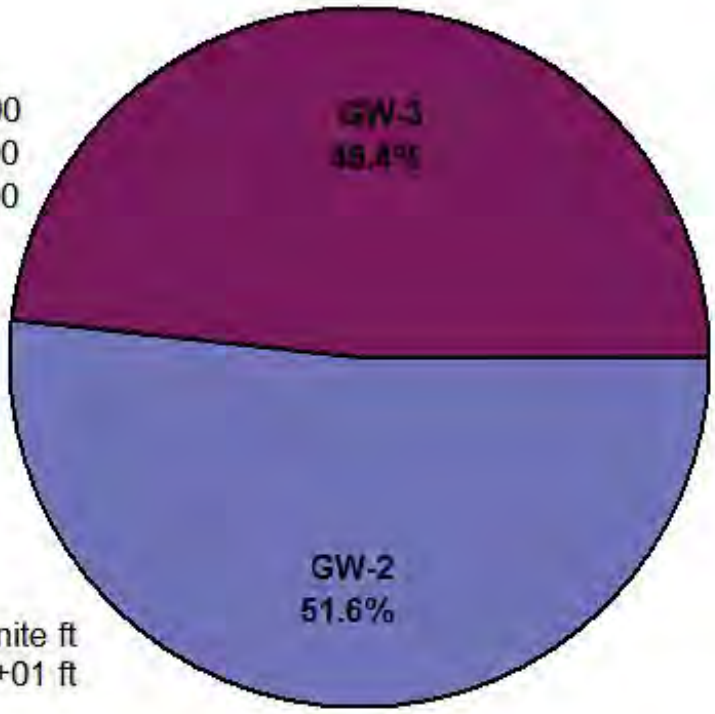


Maximum Concentration: 6.230E+00 mg/L
Year of Maximum Concentration: 1.58

INPUT PARAMETERS

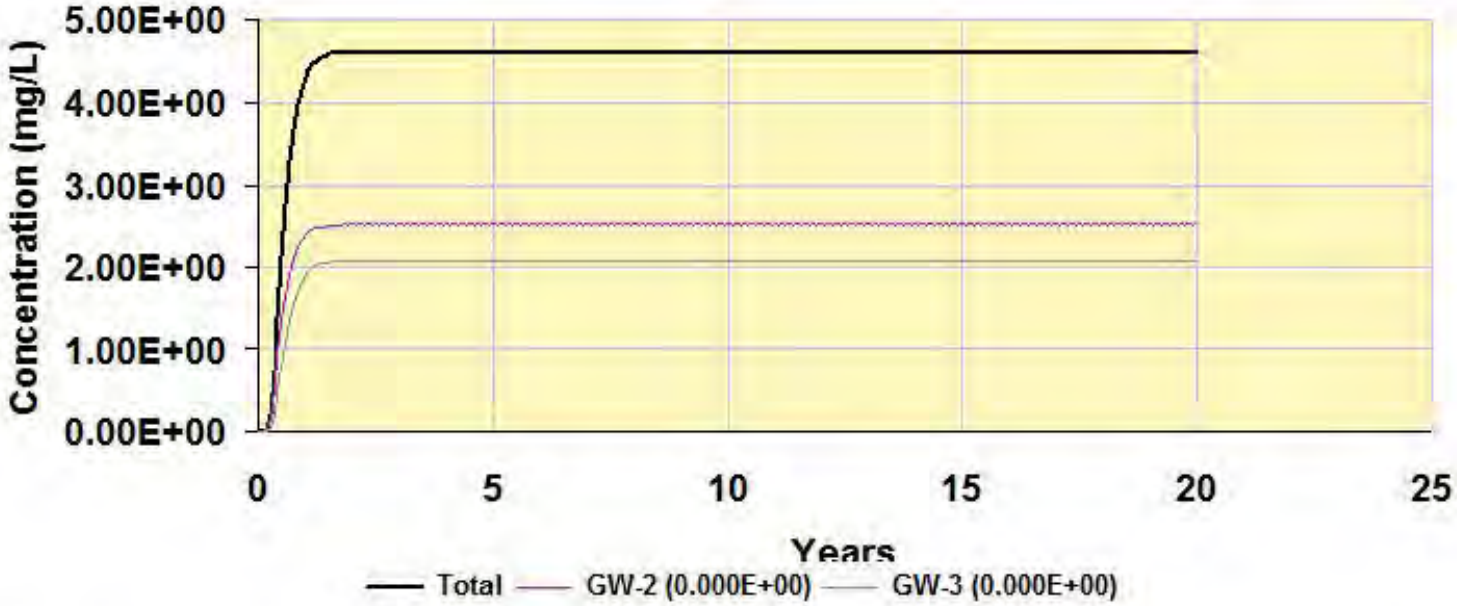
Organic Carbon (percent):	0.50000
Effective Porosity:	0.20000
Hydraulic Gradient (m/m):	0.07800

Dispersivities	Meters	Feet
Longitudinal:	1.370E+01	4.494E+01
Lateral:	1.370E+00	4.494E+00
Vertical:	1.370E-02	4.494E-02



Aquifer Width:	Infinite m	Infinite ft
Aquifer Depth:	3.250E+00 m	1.066E+01 ft
Retardation Factor:	1.608E+00	
Soil Bulk Density:	1.700E+03 kg/m3	1.700E+00 g/cm3
Molecular Diffusion:	0.000E+00 m2/hr	0.000E+00 cm2/sec
Decay Coefficient:	3.440E-05 1/hr	8.256E-04 1/day
Hydraulic Conductivity:	1.143E-01 m/hr	3.175E-03 cm/sec
Carbon Adsorption		0.1430E+02 (ug/g)/(ug/ml)
Kd:	7.000E-05 m3/kg	7.000E-02 (ug/g)/(ug/ml)
Retarded Darcy Velocity:	2.773E-02 m/hr	7.702E-02 cm/sec
Retarded Longitudinal Disp. Coefficient:	3.799E-01 m2/hr	1.055E+00 cm/sec
Retarded Lateral Dispersion Coefficient:	3.799E-02 m2/hr	1.055E-01 cm/sec
Retarded Vertical Dispersion Coefficient:	3.799E-04 m2/hr	1.055E-03 cm/sec

Wetlands
Brem

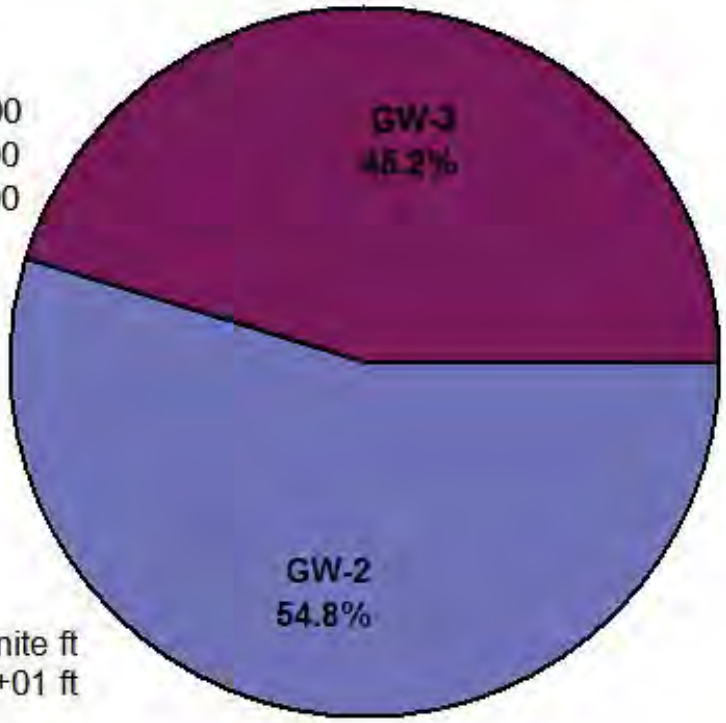


Maximum Concentration: 4.620E+00 mg/L
Year of Maximum Concentration: 2.00

INPUT PARAMETERS

Organic Carbon (percent):	0.50000
Effective Porosity:	0.20000
Hydraulic Gradient (m/m):	0.07800

Dispersivities	Meters	Feet
Longitudinal:	1.370E+01	4.494E+01
Lateral:	1.370E+00	4.494E+00
Vertical:	1.370E-02	4.494E-02



Aquifer Width:	Infinite m	Infinite ft
Aquifer Depth:	3.250E+00 m	1.066E+01 ft
Retardation Factor:	1.608E+00	
Soil Bulk Density:	1.700E+03 kg/m3	1.700E+00 g/cm3
Molecular Diffusion:	0.000E+00 m2/hr	0.000E+00 cm2/sec
Decay Coefficient:	3.440E-05 1/hr	8.256E-04 1/day
Hydraulic Conductivity:	1.143E-01 m/hr	3.175E-03 cm/sec
Carbon Adsorption		0.1430E+02 (ug/g)/(ug/ml)
Kd:	7.000E-05 m3/kg	7.000E-02 (ug/g)/(ug/ml)
Retarded Darcy Velocity:	2.773E-02 m/hr	7.702E-02 cm/sec
Retarded Longitudinal Disp. Coefficient:	3.799E-01 m2/hr	1.055E+00 cm/sec
Retarded Lateral Dispersion Coefficient:	3.799E-02 m2/hr	1.055E-01 cm/sec
Retarded Vertical Dispersion Coefficient:	3.799E-04 m2/hr	1.055E-03 cm/sec

APPENDIX E

NGI

NORTHEAST GEOSCIENCE INC

Water Supply & Environmental Consulting

ANALYTICAL REPORT

Lab Number:	L1501318
Client:	Northeast Geoscience, Inc. 97 Walnut Street Clinton, MA 01510
ATTN:	Joel Frisch
Phone:	(978) 365-9045
Project Name:	BREM
Project Number:	Not Specified
Report Date:	01/27/15

The original project report/data package is held by Alpha Analytical. This report/data package is paginated and should be reproduced only in its entirety. Alpha Analytical holds no responsibility for results and/or data that are not consistent with the original.

Certifications & Approvals: MA (M-MA086), NY (11148), CT (PH-0574), NH (2003), NJ NELAP (MA935), RI (LAO00065), ME (MA00086), PA (68-03671), USDA (Permit #P-330-11-00240), NC (666), TX (T104704476), DOD (L2217), US Army Corps of Engineers.

Eight Walkup Drive, Westborough, MA 01581-1019
508-898-9220 (Fax) 508-898-9193 800-624-9220 - www.alphalab.com

Project Name: BREM
Project Number: Not Specified

Lab Number: L1501318
Report Date: 01/27/15

Alpha Sample ID	Client ID	Matrix	Sample Location	Collection Date/Time	Receive Date
L1501318-01	BREM #100	DW	CARLISLE, MA	01/19/15 17:00	01/21/15

Project Name: BREM
Project Number: Not Specified

Lab Number: L1501318
Report Date: 01/27/15

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. 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: BREM
Project Number: Not Specified

Lab Number: L1501318
Report Date: 01/27/15

Case Narrative (continued)

Nitrogen, Nitrate

L1501318-01 was analyzed for Nitrite within the method required holding time. An aliquot of sample was then preserved and analyzed for Nitrate.

L1501318-01 has an elevated detection limit due to the dilution required by the sample matrix.

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: Bryan Vangel

Title: Technical Director/Representative Date: 01/27/15

INORGANICS
&
MISCELLANEOUS

Project Name: BREM
Project Number: Not Specified

Lab Number: L1501318
Report Date: 01/27/15

SAMPLE RESULTS

Lab ID: L1501318-01
Client ID: BREM #100
Sample Location: CARLISLE, MA
Matrix: Dw

Date Collected: 01/19/15 17:00
Date Received: 01/21/15
Field Prep: Not Specified

Parameter	Result	Qualifier	Units	RL	MDL	Dilution Factor	Date Prepared	Date Analyzed	Analytical Method	Analyst
General Chemistry - Westborough Lab										
Nitrogen, Nitrate	ND		mg/l	0.50	--	5	-	01/22/15 01:12	44,353.2	A1

Project Name: BREM
Project Number: Not Specified

Lab Number: L1501318
Report Date: 01/27/15

Method Blank Analysis
Batch Quality Control

Parameter	Result	Qualifier	Units	RL	MDL	Dilution Factor	Date Prepared	Date Analyzed	Analytical Method	Analyst
General Chemistry - Westborough Lab for sample(s): 01 Batch: WG757546-1										
Nitrogen, Nitrate	ND		mg/l	0.10	--	1	-	01/22/15 00:17	44,353.2	A1

Lab Control Sample Analysis

Batch Quality Control

Project Name: BREM
Project Number: Not Specified

Lab Number: L1501318
Report Date: 01/27/15

Parameter	LCS %Recovery	Qual	LCSD %Recovery	Qual	%Recovery Limits	RPD	Qual	RPD Limits
General Chemistry - Westborough Lab Associated sample(s): 01 Batch: WG757546-2								
Nitrogen, Nitrate	101		-		90-110	-		

Matrix Spike Analysis
Batch Quality Control

Project Name: BREM
Project Number: Not Specified

Lab Number: L1501318
Report Date: 01/27/15

Parameter	Native Sample	MS Added	MS Found	MS %Recovery	Qual	MSD Found	MSD %Recovery	Qual	Recovery Limits	RPD	Qual	RPD Limits
General Chemistry - Westborough Lab Associated sample(s): 01 QC Batch ID: WG757546-4 QC Sample: L1501318-01 Client ID: BREM #100												
Nitrogen, Nitrate	ND	4	3.5	88		-	-		83-113	-		6

Lab Duplicate Analysis
Batch Quality Control

Project Name: BREM
Project Number: Not Specified

Lab Number: L1501318
Report Date: 01/27/15

Parameter	Native Sample	Duplicate Sample	Units	RPD	Qual	RPD Limits
General Chemistry - Westborough Lab Associated sample(s): 01 QC Batch ID: WG757546-3 QC Sample: L1501318-01 Client ID: BREM #100						
Nitrogen, Nitrate	ND	ND	mg/l	NC		6

Project Name: BREM
Project Number: Not Specified

Lab Number: L1501318
Report Date: 01/27/15

Sample Receipt and Container Information

Were project specific reporting limits specified? YES

Reagent H2O Preserved Vials Frozen on: NA

Cooler Information Custody Seal

Cooler	
A	Absent

Container Information

Container ID	Container Type	Cooler	pH	Temp deg C	Pres	Seal	Analysis(*)
L1501318-01A	Plastic 950ml unpreserved	A	7	4.6	Y	Absent	NO3-353(2)

*Values in parentheses indicate holding time in days

Project Name:	BREM	**Lab Number:**	L1501318
Project Number:	Not Specified	**Report Date:**	01/27/15

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.
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.

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).
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.

Report Format: Data Usability Report

Project Name:	BREM	**Lab Number:**	L1501318
Project Number:	Not Specified	**Report Date:**	01/27/15

Data Qualifiers

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

44 Methods for the Determination of Inorganic Substances in Environmental Samples, EPA/600/R-93/100, August 1993.

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.

Certification Information

Last revised December 16, 2014

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

Westborough Facility
EPA 524.2: Acetone, 2-Butanone (Methyl ethyl ketone (MEK)), Tert-butyl alcohol, 2-Hexanone, Tetrahydrofuran, 1,3,5-Trichlorobenzene, 4-Methyl-2-pentanone (MIBK), Carbon disulfide, Diethyl ether.
EPA 8260C: 1,2,4,5-Tetramethylbenzene, 4-Ethyltoluene, Iodomethane (methyl iodide), Methyl methacrylate, Azobenzene.
EPA 8270D: 1-Methylnaphthalene, Dimethylnaphthalene,1,4-Diphenylhydrazine.
EPA 625: 4-Chloroaniline, 4-Methylphenol.
SM4500: Soil: Total Phosphorus, TKN, NO2, NO3.
EPA 9071: Total Petroleum Hydrocarbons, Oil & Grease.

Mansfield Facility
EPA 8270D: Biphenyl.
EPA 2540D: TSS
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.

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 TIDAL
WESTBORO, MA TEL: 508-898-9220 FAX: 508-898-9193
MANSFIELD, MA TEL: 508-822-9300 FAX: 508-822-3288

Date Rec'd in Lab: 1/21/15

ALPHA Job #: L1501318

Client Information

Client: NORTHEAST GEOSCIENCE INC.
Address: 97 WALNUT ST.
CLINTON, MA 01510
Phone: 978-365-9045
Fax:
Email: jfrisch@ngeo.net
☐ These samples have been previously analyzed by Alpha

Project Information

Project Name: BREM
Project Location: CARLISLE, MA
Project #:
Project Manager: JOEL FRISCH
ALPHA Quote #:

Turn-Around Time

☑ Standard ☐ RUSH (only confirmed if pre-approved!)
Date Due: 1/28/15 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

MA MCP PRESUMPTIVE CERTAINTY --- CT REASONABLE CONFIDENCE PROTO

☐ Yes ☐ No Are MCP Analytical Methods Required?
☐ Yes ☐ No Is Matrix Spike (MS) Required on this SDG? (If yes see note in Comments)
☐ Yes ☐ No Are CT RCP (Reasonable Confidence Protocols) Required?

Other Project Specific Requirements/Comments/Detection Limits:

If MS is required , indicate in Sample Specific Comments which samples and what tests MS to be performed.
(Note: All ***CAM*** methods for inorganic analyses require MS every 20 soil samples)

ALPHA Lab ID (Lab Use Only)	Sample ID	Collection Date	Collection Time	Sample Matrix	Sampler's Initials	ANALYSIS NO3	SAMPLE HANDLING	TOTAL # BOTTLES
01318-01	BREM #100	1/19/15	5:00PM	DW	JAF	X		

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

Sample Specific Comments

Container Type P
Preservative

PLEASE ANSWER QUESTIONS ABOVE!

IS YOUR PROJECT MA MCP *or* CT RCP?

Relinquished By:	Date/Time	Received By:	Date/Time
	1/21/15 10:31	AM	1/21/15 10:31

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 Terms and Conditions. See reverse side.

FORM NO: 01-01 (rev. 18-Jan-2010)

FRONTIER RESEARCH
Environmental

15 April 2014

Young Brothers Well & Pump
36 Pelham Road
Salem, N.H.
03079

WATER ANALYSIS REPORT

This is to certify that the below listed water source was sampled by Frontier on the date indicated for analysis with respect to its qualification as a drinking supply.

SOURCE LOCATION: 90 Long Ridge Rd., Carlisle, MA. DATE: 4/4/14

		SDWA Limits
Bacterial:		
Total Coliform / 100 ml	0	0
Background / 100 ml	0	200
Physical:		
Color s.u.	0.5	15
Turbidity n.t.u.	0.80	1.0
Threshold Odor Number T.O.N.	0	na
Conductivity mmhos/l	100	na
Chemical:	mg/l	
pH	6.35	6.5-8.5
Sulphate (SO_4)	18.0	250
Nitrate (NO_3) N	0.05	10
Chloride (Cl)	5.0	250
Metals:		
Sodium (Na)	<20.0	100
Iron (Fe)	4.40	0.30
Manganese (Mn)	0.390	0.05
Lead (Pb)	<0.005	0.015
Arsenic (As)	<0.005	0.010
Radiological:	pCi/l	
Radon (Rn)	1,635	10,000MA

*ND = Not Detected. (All tests according to AWWA Standard Methods). Bact./FRL MA#30151, Phys-Chem-Met./PHO MA-CT007, Rad./NER.

Submitted by: C. P. Panagiotakos
Results Analyst

RECEIVED
APR 17 2014
BOARD OF HEALTH

1 FRONTIER DRIVE
PO BOX 605