APPENDIX G

STERLING, APRIL 4, 2014, ORANGE COUNTY LANDFILL - CHEECHUNK CANAL / LANDFILL SEEP EVALUATION RESULTS

STERLING
Sterling Environmental Engineering, P.C.

April 4, 2014

Mr. Bradford Shaw, P.E.
NYS Department of Environmental Conservation
RCRA Permitting Section
Division of Environmental Remediation
Remedial Bureau E, 12th Floor
625 Broadway
Albany, New York 12233-7017

Subject: Orange County Landfill
Cheechunk Canal/Landfill Seep Evaluation
STERLING File #2010-15 (Task 313)

Dear Mr. Shaw,

Sterling Environmental Engineering, P.C. (STERLING) provides this letter report to summarize results from our recent investigation to determine if the seeps are impacted by the Landfill, located in the Town of New Hampton, New York (Figure 1). The following includes a summary of work performed, a characterization of the geologic and hydrogeologic setting, recommendations for additional field investigation, and the proposed design of a mitigation system.

SUMMARY OF WORK PERFORMED:

On February 19 and 20, 2014, six (6) temporary piezometers (PZ-14-1 through PZ-14-6) were installed between the Landfill's perimeter access road and the seeps near the Cheechunk Canal bank (referred to as "Project Area") to better understand the subsurface hydrology between the limit of waste and the seeps (Figure 2).

The temporary piezometers were installed using a track-mounted Geoprobe® to a depth sufficient to encounter the glaciolacustrine sand aquifer, which underlies the Cheechunk Canal (Figure 3). At each location, soil samples were collected on a continuous basis from ground surface to termination depth using the Macro-core® MC5 soil sampler. Each borehole was logged to define the local model of the critical site stratigraphy as it relates to the Landfill and the Cheechunk Canal (Appendix A).

Upon completion of sampling, each borehole was either converted into a 1¼-inch (PZ-14-1, PZ-14-2, PZ-14-4, and PZ-14-6) or a 2-inch inside diameter (I.D.) temporary piezometer (PZ-14-3 and PZ-14-5) with a five (5) foot long section of 0.01-inch (10 slot) machine slotted PVC well. As detailed in Table 1, the total depths ranged from 28.91 feet below ground surface (bgs) at PZ-14-4 to 39.5 feet bgs at PZ-14-1. The screened intervals were set in the uppermost portion of the overburden hydrogeologic unit (glaciolacustrine fine sand) to obtain basic aquifer data (groundwater flow direction, gradients, horizontal hydraulic conductivity, aquifer transmissivity, and aquifer yield) and define the hydrogeologic relationship between the Landfill and the seeps identified on the northern bank of the Cheechunk Canal.

The elevation for the top of the piezometer casings (measuring points) were measured with an engineer's level from the measuring point of nearby monitoring well MW-3B to allow for direct comparison of groundwater level measurements routinely collected at the Landfill. The apparent elevations of the Canal bank seeps downgradient from the piezometers, as well as the water level of the Canal, were also collected in the same manner. It should be noted that the slope in the Project Area ranged from 24% to 28%.

Following installation, three (3) synoptic rounds of groundwater elevation measurements were collected on February 20, March 18, and March 27, 2014 to gain a complete understanding of the local hydrostratigraphy, define groundwater flow direction and gradients, and build a conceptual profile between the Landfill and the Cheechunk Canal.

In addition, field hydraulic conductivity testing was performed on two (2) of the temporary piezometers (PZ-14-3 and PZ-14-5) to characterize the horizontal hydraulic conductivity of the aquifer and a short-term two (2) hour constant rate pumping test was performed at temporary piezometer PZ-14-3 to further define aquifer characteristics, such as yield and transmissivity (Appendix B).

Groundwater in each temporary piezometer between the Landfill and the seeps were also sampled for 6 NYCRR Part 360 field parameters (specific conductivity, temperature, pH, and Eh). Due to weather conditions, the subject seep area could not be evaluated as it was covered with ice or meltwater runoff.

FIELD INVESTIGATION FINDINGS:

The field investigation, performed between February and March 2014, was used to define the local geologic conditions, hydrogeologic setting, and environmental parameters in the Project Area as well as serve as the core of understanding to remediate the subject seep. Findings are detailed below:

- **Geologic Setting**

  The critical site stratigraphy in the vicinity of the Project Area has been defined as follows:

  Glaciolacustrine Silt and Clay: Moist grayish brown clayey silt to silty clay; stiff to moderately stiff; occasionally to frequently varved; lowly permeable; and moderately plastic. As presented in Table 1, this unit was encountered at surface to depths ranging from 24.4 to 34.1 feet bgs, which is consistent with historical data collected near this portion of the Landfill and the Cheechunk Canal. Stearns & Wheler reported that this silt and clay layer thins toward the northeast from approximately 60 feet to 20 feet. The base of the glaciolacustrine silt and clay unit is approximately three (3) to five (5) feet below the subject seep(s).

  Glaciolacustrine Sand: Wet fine sand; medium dense; moderately permeable; and laminated. The top of this water-bearing unit is between 65.25 (PZ-14-1) and 66.81 (PZ-14-3) feet in elevation (site datum) and slightly tilts to the north away from the Cheechunk Canal (Table 1 and Figure 3). Again, this field data is consistent with historic geoenvironmental data collected near the Project Area which reports this unit as being 25 to 35 feet in thickness. The base of the glaciolacustrine sand unit was not encountered during the course of this investigation.

Glacial Till: Basal lodgement till is a dense, unstratified diamict of poorly sorted sediment emplaced on bedrock by the base of the glacier during ice advance. It often has large erratics oriented in the direction of the ice movement. The glacial till unit, which was not encountered during this investigation, is lowly permeable and is not considered a water bearing zone.

- **Hydrogeologic Setting**

The hydrogeologic nature of the Project Area was interpreted using historic well logs, slug tests, groundwater elevation data, geologic cross sections, and publications. The hydrogeologic setting for the Project Area was further refined from information obtained from the recent drilling, surveying, overburden groundwater measurements, hydraulic conductivity testing, and the short-term pumping test.

Complex vertical and horizontal stratigraphic relationships exist between the glacial deposits on the site and Project Area. As shown in Figure 3, the Cheechunk Canal dissects the glacially-derived overburden in the vicinity of the Project Area, often cutting down through the glaciolacustrine silt and clay deposits, creating a hydraulic connection between the overburden groundwater unit (glaciolacustrine sand) and the Cheechunk Canal (Wallkill River). In general, the low hydraulic conductivity of the glaciolacustrine silt and clay, which underlies a large portion of the Landfill, limits recharge to underlying hydrogeologic units such as the glaciolacustrine sand (encountered) and ice contact sand and gravel deposits (not encountered). The glaciolacustrine silt and clay unit is not a water-bearing zone.

Hydraulic conductivity estimates in the overburden hydrogeologic unit (glaciolacustrine sand) were determined using slug tests. The data obtained from the Project Area were analyzed using the Bouwer and Rice method (1989). This method consists of quickly lowering or raising water levels in a well and measuring its rate of recovery (Appendix B). Although originally designed for use in unconfined aquifers, the authors (Bouwer and Rice) determined that most of the head difference "y" between the static water table and water level in the piezometer is dissipated in the vicinity of the piezometer around the screen and slotted section, the method is also applicable to confined or semi-confined conditions, such as in the Project Area. Hydraulic conductivity of the overburden hydrogeologic unit ranged from 9.29×10^{-6} feet/min (4.72×10^{-6} cm/sec) to 2.35×10^{-5} feet/min (1.19×10^{-5} cm/sec).

Groundwater flow in the overburden hydrogeologic unit was determined using depth to groundwater measurements collected from temporary piezometers on February 20, March 18, and March 27, 2014 (Table 2). This data, in conjunction with historical well log data and plots of changes in groundwater elevation over time, suggest that the glaciolacustrine sand unit is currently in semi-confined to confined conditions in the Project Area. Therefore, the directions of groundwater flow are based on the potentiometric surface of the glaciolacustrine sand, not strictly elevations of the water table surface.

Groundwater flow in the overburden west or north of the Canal is to the east-southeast (Figure 4), discharging to the Canal that acts as a discharge zone and a groundwater flow boundary separating flow regimes on either side of the Canal. Overburden piezometer PZ-14-4 is located immediately upgradient of the subject seep(s); although the subject seep could not be directly

measured it is likely less than one (1) foot lower than the potentiometric surface observed at PZ-14-4. The actual location of the piezometer array was successful at locating the groundwater that is likely causing the subject seeps. There is little potential for contamination to flow between the Canal and to areas east or south of the Canal based on previous investigations conducted at the Landfill. The direction of groundwater movement can be understood in the fact that groundwater always flows in the direction of decreasing head. The rate of movement, on the other hand, is dependent on the hydraulic gradient, which is the change in head per unit distance. The change in head measurement is ideally in the direction where the maximum difference of head decrease occurs. In the Project Area, the hydraulic gradient (the change in head divided by the change in distance) ranged from 0.00769 ft./ft. to 0.0133 ft./ft. based on data collected from March 18, 2014 (Figure 4).

An aquifer overlain by a bed of material that has a significantly lower hydraulic conductivity is termed as confined. As was observed during the field investigation, the potentiometric surface of the confined aquifer was 6.5 to 8.5 feet above the base of the overlying confining layer (Tables 1 and 2 and Figure 3). Water levels in confined aquifers are typically slow to respond to storm events or droughts and therefore typically exhibit minor fluctuations. A semi-confined or "leaky" confined aquifer is characterized by a low permeability layer (i.e., glaciolacustrine silt and clay) that permits water to slowly flow through it. Groundwater in these aquifers responds more quickly to changes in precipitation. The similarity between the potentiometric surface elevation and the subject seep(s) elevation suggests that there is seasonal hydraulic connection between the Cheechunk Canal and site groundwater. If groundwater was confined, no hydraulic connection would exist between the Canal and site groundwater. The semi-confinement can be the result of leakage through the saturated overlying low permeability layer (glaciolacustrine silt and clay) or through fractures/varved planes in the silt and clay.

Seepage velocities were also calculated in this overburden hydrogeologic unit using the following equation:

$$V = \frac{KI}{n}$$

Where "V" is the seepage velocity in distance per unit time; "K" is the hydraulic conductivity at the borehole (in distance per unit time); "I" is the hydraulic gradient (dimensionless); and, "n" is the estimated effective porosity. The lowest possible values for "n" were used to estimate highest seepage velocities. Seepage velocities at the Project Area indicate a range from 2.57×10^{-4} feet/day (0.094 feet/year) to 1.2×10^{-3} feet/day (0.438 feet/year).

On March 18, 2014, a two (2) hour constant flow rate pumping test was conducted on PZ-14-3 (Figure 2). Initial pumping at 2 gallons per minute (gpm) resulted in complete drawdown at piezometer PZ-14-3; the pumping rate was reduced to provide further evaluation of the overburden aquifer characteristics. Pump flow rate (0.38 to 0.4 gpm) and overburden piezometer water levels were monitored every 15 minutes throughout the two (2) hour test. A drawdown of 7.8 feet was observed during the pumping period, dropping 7.33 feet in the first five (5) minutes and steadily dropped 0.46 foot over the remainder of the pumping test period (Appendix B). Based on this information, the specific capacity was calculated as being 0.05 gpm/ft with a transmissivity of 75 ft^2/day. The adjacent piezometers were lowered by 0.19 foot (PZ-14-6) to

0.29 foot (PZ-14-2), demonstrating good connection to the localized low rate pumping activity (Appendix B).

- **Environmental Setting**

On March 27, 2014 overburden groundwater in each temporary piezometer, between the Landfill and the seeps, were sampled for 6 NYCRR Part 360 field parameters, including specific conductivity, temperature, pH, and Eh (Table 3). Due to weather conditions, the subject seep area could not be evaluated as it was covered with ice or submerged during this period.

As detailed in Table 3, the specific conductance from overburden groundwater ranged from 0.607 millisiemens per centimeter (mS/cm) at PZ-14-4 to 1.230 mS/cm at PZ-14-5. The specific conductance of the water sample is the measure of its ability to carry an electrical current under specific conditions and is typically an indication of the concentration of total dissolved solids (TDS) in the groundwater. A specific conductance value that is markedly different (anomalous) from those obtained in nearby piezometers may indicate a different source of the groundwater or leakage from a formation that contains water of a different quality. Specific conductance values from 2012 and 2013 seep sampling ranged from 0.695 mS/cm at Seep 03 on August 22, 2012 to 1.339 mS/cm at GW-03 on August 21, 2013. The specific conductance at PZ-14-5 is considered the most anomalous from the set of field parameters collected on March 27, 2014.

As detailed in Table 3, the redox potential in the overburden aquifer is sensitive to organic matter associated with landfill leachate and of concentrations of redox-active components such as the mineralization of the groundwater. Oxidizing-reducing reactions result in a change of the charge of an ion as it gains or loses an electron. These reactions are almost always facilitated by bacteria that are able to gain energy from the reactions. The most common cause of reducing reactions is organic matter, either in solid form or as dissolved organic carbon. Water in contact with air will have an Eh in the range of 350 milliVolts (mV) to 500mV. Microbially mediated redox processes may decrease the redox potential to values as low as -300mV. The redox potential from overburden groundwater ranged from -90.2 mV at PZ-14-1 to 214.8 mV at PZ-14-5. Oxidation Reduction Potential (ORP) values from 2012 and 2013 seep sampling ranged from 9.6 mV at Seep GW-A on August 21, 2013 to -90.6 mV at GW-01 on August 22, 2012. The redox potential at PZ-14-5 is considered the most irregular while the reading at PZ-14-1 is consistent with ORP values at one of the historical seeps.

At any given temperature, there is a specific concentration of a dissolved mineral's constituents in the groundwater that is in contact with that mineral. Even minor changes in groundwater temperature can cause detectable changes in TDS. It should be noted that the temperature of the upper piezometers (PZ-14-1, PZ-14-5, and PZ-14-6) were over 2° Fahrenheit warmer than the lower piezometers (PZ-14-2, PZ-14-3, and PZ-14-4). The temperature at PZ-14-5 is decidedly higher than others collected on March 27, 2014.

The pH is actually a measure of the hydrogen ion (H+) availability (activity). The hydrogen ion is very small and is able to enter and disrupt mineral structures so that they can contribute dissolved constituents to groundwater. Consequently, the greater the hydrogen ion availability the lower the pH and the higher the TDS in groundwater. The pH readings collected from

overburden groundwater ranged from 7.0 standard units (s.u.) at PZ-14-1 to 7.41 s.u. at PZ-14-2. In comparison, 2012 and 2013 seep sampling reported pH readings that ranged from 7.03 s.u. (Seep GW-01) on August 22, 2012 to 7.48 s.u. (GW-A) on August 21, 2013. No direct conclusions can be made based on comparison of pH readings obtained within the Project Area.

Two (2) one (1) liter samples were collected for comparison of water quality field parameters at the start and end of the short-term pumping test, which was performed at PZ-14-3. No significant changes or fluctuations were observed in the field parameters.

The current New York State Department of Environmental Conservation (NYSDEC) approved Post-Closure Monitoring (PCM) Program provides for an annual monitoring schedule consisting of sampling twenty six (26) monitoring wells, four (4) surface water locations, and two (2) leachate manholes for field parameters. Annual sampling is performed in accordance with the Field Sampling Plan, Sampling QA/QC protocol, 1999 revision of the Orange County Landfill Post Closure Monitoring and Maintenance Operations Manual, and the 2003 Orange County PCM variance request approved by the NYSDEC.

Orange County provided the NYSDEC with a Site Management Plan (SMP) for the closed landfill. The SMP also included a request to modify the annual PCM Program. Under the prior (6 NYCRR Part 360) closure, the County performed PCM and annual reporting. During 2014, the annual sampling event is to be performed in October. At present, the NYSDEC has not approved or commented upon the SMP and proposed modification to the annual monitoring program. In prior negotiation with the NYSDEC regarding the need for a SMP, Orange County and the NYSDEC agreed the existing post-closure monitoring program should be carefully evaluated in light of the substantial body of available information. The data allows assessment of long-term trends by well location. Overall, the Landfill monitoring data indicates that the system is stable with some wells showing gradual improvement with time.

Design of a seep mitigation system solely based on limited field parameter data is questionable and may not reflect leachate impacted groundwater given that many of these field parameters are also within the observed range of naturally occurring waters. 2013 field parameter and leachate indicator analytical results from nearby environmental monitoring points (four (4) overburden groundwater monitoring wells (MW-3B, PZ-4, MW-220, MW-222), two (2) surface water locations (SW-5 and SW-8), and one (1) leachate location (MH-7)) were reviewed to further evaluate the potential presence of leachate impacted groundwater. Only total dissolved solids (TDS) exceeded the class GA standard (500 mg/L) at these select monitoring wells, ranging from 730 mg/L (MW-3B) to 860 mg/L (MW-222). Ammonia was only detected slightly above the NYSDEC GA standard (2 mg/L) at monitoring wells MW-3B (4.4 mg/L) and MW-222 (12 mg/L). In comparison, 2013 results for TDS and ammonia from nearby leachate (MH-7) was 3,900 mg/L and 0.64 mg/L, respectively. This environmental monitoring data does not reveal that leachate-impacted groundwater exists in this portion of the Landfill. Further, other reliable leachate indicators, such as chloride, field pH, nitrate (as N), phenols, sulfate, and Volatile Organic Compounds (VOCs) were either nondetect or below their respective NYSDEC GA standard.

Review of historical surface water analytical results (water quality parameters) for nearby surface water samples SW-5 and SW-8 revealed no exceedances of Class C Surface Water Quality standards, except for one (1) minor exceedance of field pH (9.33 s.u.) and phenols (0.0072 mg/L) at SW-5 in 1999 and 2000, respectively, and field pH (8.81 s.u.) and phenols (0.0115 mg/L) at SW-8 in 1999 and September 2002, respectively.

CONCLUSIONS:

Six (6) shallow borings were completed on a moderate to steep slope (24 to 28%) to define the geologic conditions within the Project Area. A lowly permeable glaciolacustrine silt and clay unit exists at surface to depths ranging from 24.4 to 34.1 feet bgs and is characterized as moist grayish brown clayey silt to silty clay that is stiff to moderately stiff and occasionally to frequently varved. The base of this geologic unit is approximately three (3) to five (5) feet below the subject seep(s), which is located along the north or west bank of the Cheechunk Canal. This geologic contact actually tilts to the north away from the Cheechunk Canal. Underlying the silt and clay unit is moderately permeable glaciolacustrine sand, which is wet fine sand that is medium dense, laminated, and typically 25 to 35 feet in thickness.

Each boring was converted into temporary overburden piezometers, screening the uppermost portion of the overburden hydrogeologic unit (glaciolacustrine fine sand). The overlying glaciolacustrine silt and clay unit is not a water-bearing zone and limits recharge to underlying hydrogeologic units. The overburden hydrogeologic unit discharges into and is hydraulically connected to the Cheechunk Canal. Hydraulic conductivity of the overburden hydrogeologic unit ranged from 9.29×10^{-6} feet/min (4.72×10^{-6} cm/sec) to 2.35×10^{-5} feet/min (1.19×10^{-5} cm/sec) in the Project Area. Groundwater in the glaciolacustrine sand unit reveals semi-confined conditions with groundwater flow being to the east-southeast with a moderate hydraulic gradient in the Project Area. Two (2) hours of constant rate pumping (0.38 to 0.4 gpm) at PZ-14-3 revealed the following: 1). A drawdown of 7.8 feet at the wellhead; 2). Lowering of the potentiometric surface between 0.19 foot (PZ-14-6) to 0.29 foot (PZ-14-2) within the piezometer array (Project Area), demonstrating a good connection within the overburden hydrogeologic unit and the Cheechunk Canal (at low pumping rates); 3). The specific capacity and transmissivity values are low for the overburden hydrogeologic unit in the Project Area; and, 4). The actual location of the piezometer array was successful at locating the groundwater that is connected to the subject seep(s).

At the time of the field investigation the seep area was covered with ice and/or submerged. Review of field parameter data from the recently installed overburden piezometers revealed elevated temperature, specific conductivity, and ORP at PZ-14-5, which is located in the center of the piezometer array. Figure 4 presents likely groundwater flowlines from the piezometers to the vicinity of SEEP-3, indicating a continuity of groundwater, which was observed to be most anomalous at PZ-14-5.

2013 field parameter and leachate indicator analytical results from nearby environmental monitoring points (four (4) overburden groundwater monitoring wells (MW-3B, PZ-4, MW-220, MW-222), two (2) surface water locations (SW-5 and SW-8), and one (1) leachate location (MH-7)) were reviewed to further evaluate the potential presence of leachate impacted groundwater in the vicinity of the seep. Ammonia was only detected slightly above the NYSDEC GA standard (2 mg/L) at monitoring wells MW-3B (4.4 mg/L) and MW-222 (12 mg/L). In comparison, 2013 results for TDS and ammonia from nearby leachate (MH-7) was 3,900 mg/L and 0.64 mg/L, respectively. This environmental monitoring data does not reveal that leachate-impacted groundwater exists in this portion of the Landfill. Other

reliable leachate indicators, such as chloride, field pH, nitrate (as N), phenols, sulfate, and Volatile Organic Compounds (VOCs) were either nondetect or below their respective NYSDEC GA standard.

RECOMMENDATIONS:

Prior seep sampling results were from grab samples. Once the Cheechunk Canal recedes, such that the seep(s) are accessible, a well point should be hand driven (or a concrete/brick containment should be installed) to enable collection of seep samples that are an accurate representation of water quality.

A sample from each overburden piezometer, the subject seep, and the Cheechunk Canal should be collected and analyzed for 6 NYCRR Part 360 leachate indicator parameters to supplement available data in order to develop a clearer picture and to finalize selection and design of a mitigation system. This supplemental data will be coordinated with the ongoing environmental monitoring program and results will be compared to the extensive historic environmental monitoring database and data from the ongoing sampling of leachate, surface water, and groundwater monitoring program, as outlined in the Draft SMP, dated December 13, 2013. The Draft SMP provides that contingency measures are in-place if offsite contaminant migration is identified and, through assessment, is considered a potential threat to human health and the environment.

Additionally, we recommend that static groundwater levels should be periodically measured to better understand the seasonal variability and hydrogeologic relationship between the overburden hydrogeologic unit and the seep(s)/Cheechunk Canal. In addition, additional readings should be collected from the seep(s) and a staff gauge on the Cheechunk Canal.

MITIGATION SYSTEM:

The following mitigation measures are under consideration at this time.

- *No Action* - Continue regular monitoring of the Cheechunk Canal upstream and downstream of the Landfill to assess impacts to surface water.

- *Intercept Impacted Water Upslope of Seep* - Install a dry well or recovery well upslope of the seep above the flood elevation to be located along the flowpath indicating the greatest potential impact to groundwater. Use controlled pumping to dewater the seep(s) so it is not discharging at surface.

- *Alter Redox Potential of Groundwater in Project Area* - Reduction/oxidation (redox) processes affect the quality of groundwater in all aquifer systems. Redox processes can alternately mobilize or immobilize potentially toxic metals associated with naturally occurring aquifer materials, contribute to the degradation or preservation of anthropogenic contaminants, and generate undesirable byproducts, such as dissolved manganese (Mn^{2+}), ferrous iron (Fe^{2+}), hydrogen sulfide (H_2S), and methane (CH_4). Changing the redox processes that occur in an aquifer system and documenting the spatial distribution may positively influence the concentrations of natural or anthropogenic contaminants observed in historical seeps along the northern bank of the Cheechunk Canal.

Please contact me should you have any questions or require additional clarification.

Very truly yours,

STERLING ENVIRONMENTAL ENGINEERING, P.C.

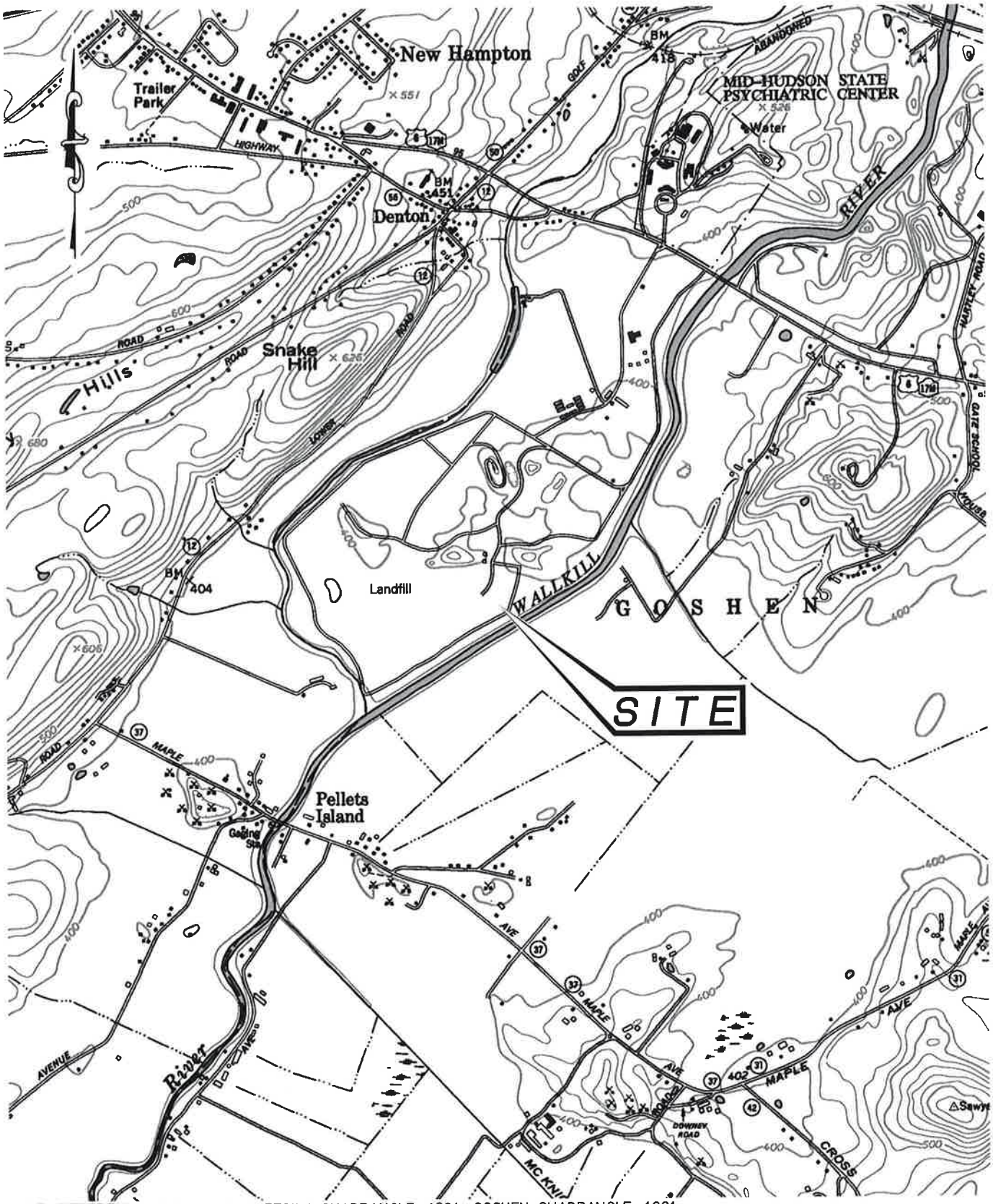
Mark P. Millspaugh, P.E.
President
mark.millspaugh@sterlingenvironmental.com

MPM/bc
Email/First Class Mail
Attachments

cc: Peter S. Hammond, Orange County
Joseph F. Mahoney Esq.

S:\Sterling\Projects\2010 Projects\Orange County - 2010-15\Correspondence\NYSDEC_Summary of Seep Evaluation_ltr_04_04_2014.docx

FIGURES



MAP REFERENCE: NYSDOT MIDDLETOWN QUADRANGLE, 1991, GOSHEN QUADRANGLE, 1991.

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24 Wade Road ♦ Latham, New York 12110

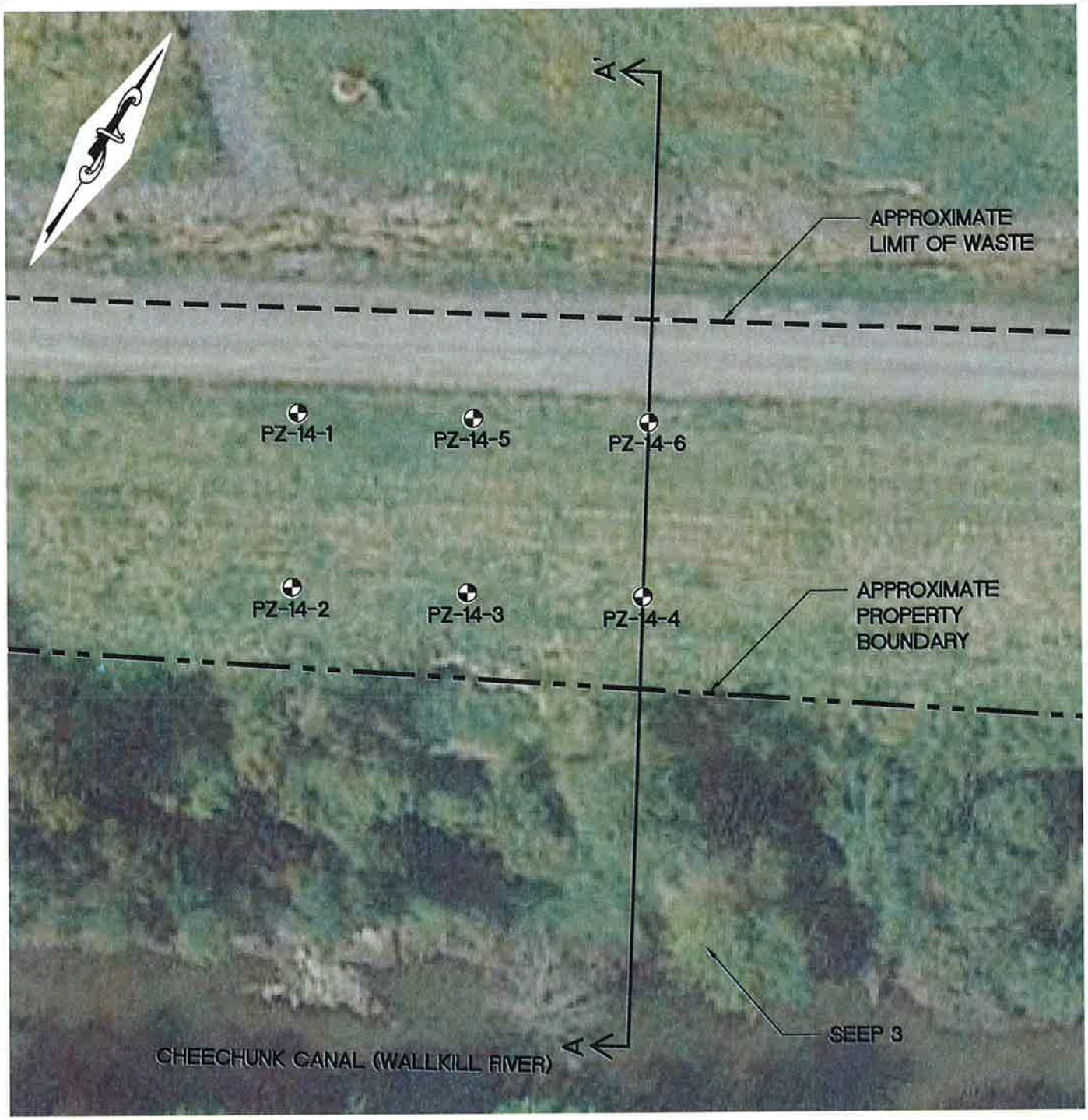
SITE LOCATION MAP

ORANGE COUNTY LANDFILL

21 TRAINING CENTER LANE

TOWN OF NEW HAMPTON ORANGE CO., N.Y.

PROJ. No.: 2010–15	DATE: 3/28/14	SCALE: 1" = 2000'	DWG. NO. 2010–15014	FIGURE 1



LEGEND:

——— - - - ———	PROPERTY BOUNDARY
- - - - - - -	LIMIT OF WASTE
⊕ PZ-14-1	APPROXIMATE PIEZOMETER LOCATION

0 15 30 60

(IN FEET)
1 inch = 30 ft.

MAP REFERENCES:
1. PROPERTY BOUNDARY AND LIMIT OF WASTE FROM DRAWINGS ENTITLED "OVERALL PLAN AND RESTRICTED PARCEL," BY THOMAS J. BARRY, DATED FEBRUARY 14, 2013.
2. AERIAL PHOTOGRAPH FROM GOOGLE EARTH IMAGERY, DATED 2013.

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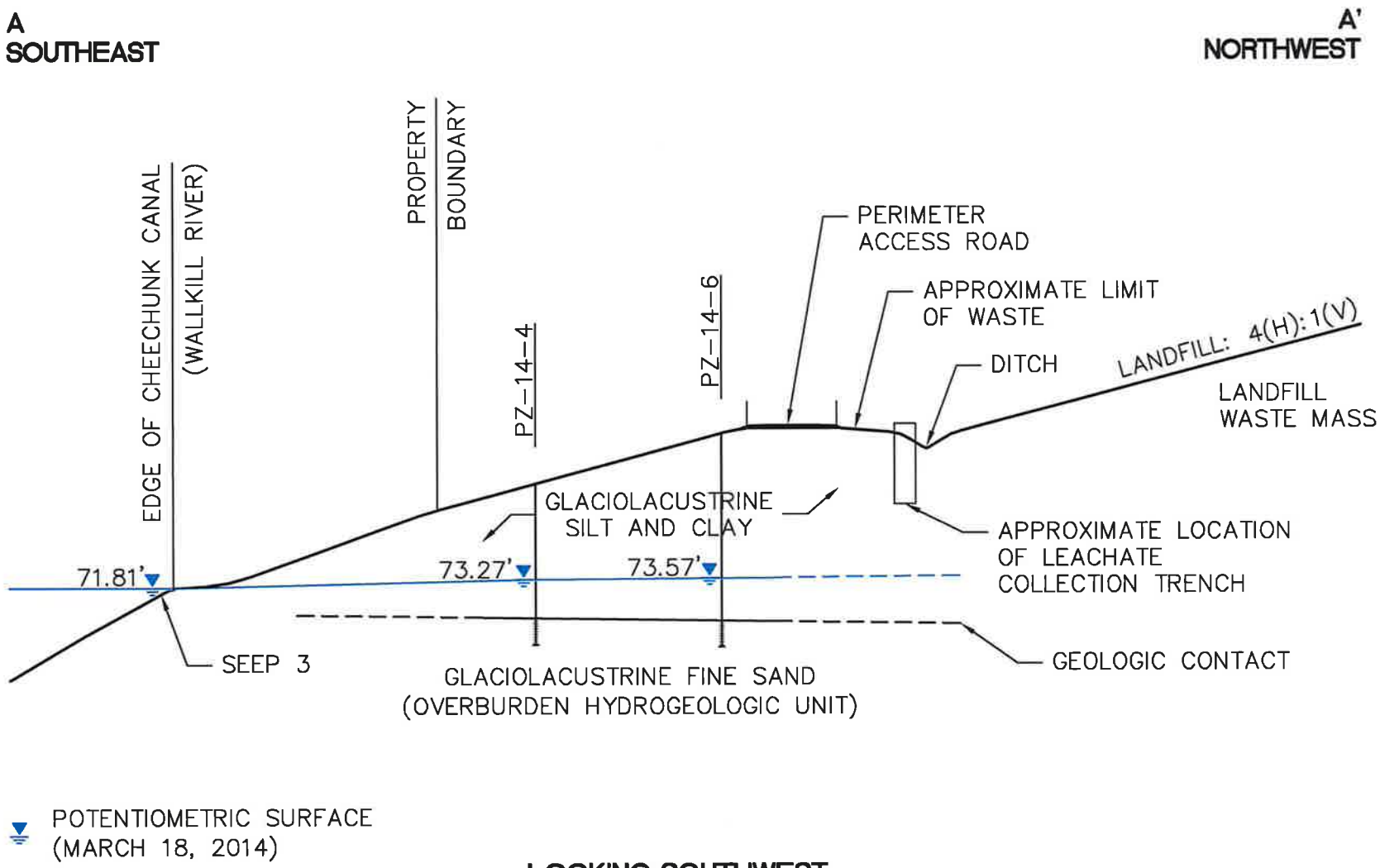
BORING/PIEZOMETER LOCATION MAP
ORANGE CO. DEPT. OF PUBLIC WORKS
ORANGE CO. LANDFILL

TOWN OF NEW HAMPTON ORANGE CO., N.Y.

PROJ. No.: 2010-15	DATE: 3/28/14	SCALE: 1" = 30'	DWG. NO. 2010-15015	FIGURE 2



LOOKING SOUTHWEST

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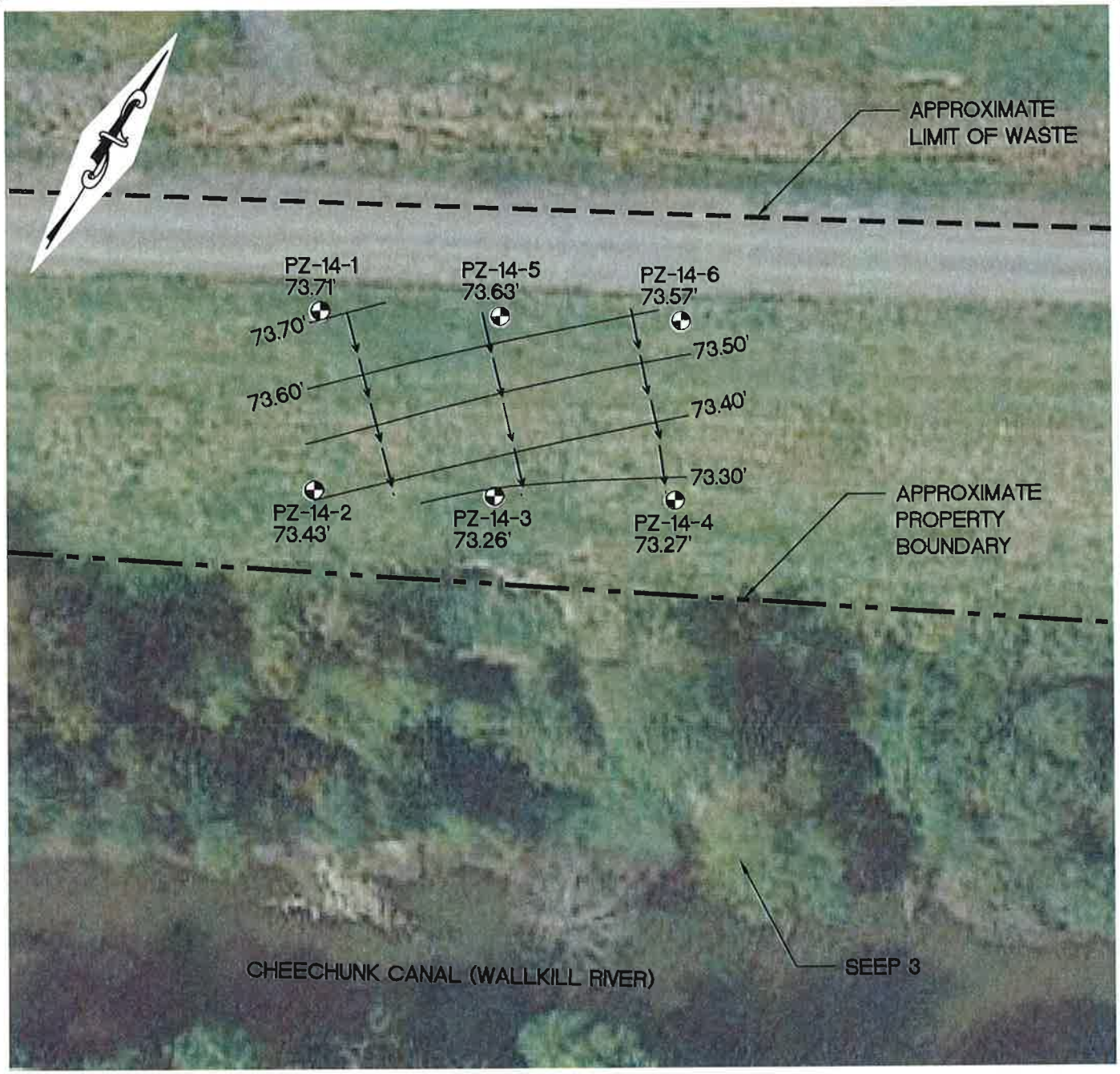
CONCEPTUAL PROFILE
ORANGE CO. DEPT. OF PUBLIC WORKS
ORANGE CO. LANDFILL

TOWN OF NEW HAMPTON — ORANGE CO., N.Y.

PROJ. No.:	2010-15	DATE:	4/1/14	SCALE:	NOT TO SCALE	DWG. NO.	2010-15016	FIGURE	3



LEGEND:

- PROPERTY BOUNDARY
- LIMIT OF WASTE
- PZ-14-1 73.50 — PIEZOMETER LOCATION WITH GROUNDWATER ELEVATION (SITE DATUM)
- GROUNDWATER ELEVATION CONTOURS
- INFERRED GROUNDWATER FLOW DIRECTION

0 15 30 60

(IN FEET)
1 inch = 30 ft.

MAP REFERENCES:
1. PROPERTY BOUNDARY AND LIMIT OF WASTE FROM DRAWINGS ENTITLED "OVERALL PLAN AND RESTRICTED PARCEL," BY THOMAS J. BARRY, DATED FEBRUARY 14, 2013.
2. AERIAL PHOTOGRAPH FROM GOOGLE EARTH IMAGERY, DATED 2013.

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GROUNDWATER CONTOUR MAP
(OVERBURDEN HYDROGEOLOGIC UNIT)–MARCH 18, 2014
ORANGE CO. DEPT. OF PUBLIC WORKS
ORANGE CO. LANDFILL
TOWN OF NEW HAMPTON ORANGE CO., N.Y.

PROJ. No.: 2010–15	DATE: 3/28/14	SCALE: 1" = 30'	DWG. NO. 2010–15017	FIGURE 4

TABLES

Table 1

Summary of Borings/Piezometer Information
Orange County Landfill, New Hampton, New York

Piezometer I.D.	Ground Surface Elevation (Site Datum)	Piezometer Stickup (feet)	Assumed MP Elevation* (Site Datum)	Screened Interval / [Screened Elevation]	Total Depth (Feet BGS) / [Bottom Elevation]	Glaciolacustrine (Silt and Clay)/Glaciolacustrine Sand (Fine Sand) Interface (feet BGS) / [Geologic Contact Elevation]
PZ-14-1	99.35	0.65	100.00	34.5-39.5 / [64.85 - 59.85]	39.5 / [59.85]	34.1 / [65.25]
PZ-14-2	90.87	0.80	91.67	24.5-29.5 / [66.37 - 61.37]	30.26 / [60.61]	24.6 / [66.27]
PZ-14-3	91.21	0.35	91.56	24.92 -29.92 / [66.29 - 61.29]	29.92 / [61.29]	24.4 / [66.81]
PZ-14-4	90.15	1.35	91.50	23.91-28.91 / [66.24 - 61.24]	28.91 / [61.24]	23.9 / [66.25]
PZ-14-5	99.78	2.17	101.95	32.9-37.9 / [66.88 - 61.88]	37.86 / [61.92]	33.5 / [66.28]
PZ-14-6	99.96	0.88	100.84	34.2-39.2 / [65.76 - 60.76]	39.20 / [60.76]	33.85 / [66.11]

* Assume PZ-14-1 MP (Top of PVC) is elevation 100.00 feet.

Table 2

Summary of Groundwater Elevation Data
Orange County Landfill, New Hampton, New York

Piezometer I.D.	February 20, 2014 Depth to Groundwater (feet BMP {Top of PVC}) / [Groundwater Elevation]	March 18, 2014 Depth to Groundwater (feet BMP {Top of PVC}) / [Groundwater Elevation]	March 27, 2014 Depth to Groundwater (feet BMP {Top of PVC}) / [Groundwater Elevation]
PZ-14-1	27.69 / [72.31]	26.29 / [73.71]	26.27 / [73.73]
PZ-14-2	20.21 / [71.46]	18.24 / [73.43]	18.37 / [73.30]
PZ-14-3	20.10 / [71.46]	18.30 / [73.26]	18.31 / [73.25]
PZ-14-4	19.88 / [71.62]	18.23 / [73.27]	18.39 / [73.11]
PZ-14-5	29.58 / [72.37]	28.32 / [73.63]	28.31 / [73.64]
PZ-14-6	28.61 / [72.23]	27.27 / [73.57]	27.15 / [73.69]

Table 3

Summary of Water Quality Information
Orange County Landfill, New Hampton, New York

Sample ID	Temperature (^{0}F)	Conductivity (mS/cm)	Dissolved Oxygen (mg/L)	pH (s.u.)	Oxidation Reduction Potential (mV)	Turbidity (NTU)
PZ-14-1	56.41	1.113	1.76	7.00	-90.2	24.3
PZ-14-2	54.82	0.698	2.77	7.41	3.1	39.0
PZ-14-3	55.33	0.859	1.19	7.03	38.2	102.7
PZ-14-4	54.25	0.607	1.44	7.21	47.5	33.0
PZ-14-5	57.47	1.230	1.29	7.03	214.8	37.8
PZ-14-6	56.59	1.011	1.72	7.12	-15.9	117.0

APPENDIX A

Sterling Environmental Engineering, P.C.

BORING LOG

Boring No. PZ-14-1

Project Name:	Orange County Landfill – Cheechunk Canal/Seep Evaluation	**Project No.:**	2010-15
Client Name:	Orange County Department of Public Works	**Date:**	February 19, 2014
Location:	Goshen, NY	**Logged By:**	Mark Williams
Weather/Temp.:	12°F - 40°F, 1.55" Precip (wintry mix) Winds (1-3mph)	**Checked By:**	Peter Kelleher, P.E.

Drilling Co.:	Zebra Environmental Corp.	**Depth:**	39.5' bgs
Driller:	Jason Frederick	**Equipment:**	Geoprobe® 7720 DT
Date Started:	February 19, 2014	**Surface Elev.:**	99.35' (Site Datum)
Date Completed:	February 19, 2014	**Depth Elev.:**	59.85' (Site Datum)

Depth	Sample No.	Blow Counts	Graphic Log 1"=5'	Unified Soil Classification	DESCRIPTIVE LOG (color, grain size and amount, texture, moisture) DEPOSITIONAL UNIT (outwash, till, lacustrine, muck, fill)	COMMENTS
					BrGr Cy$; occ. mtld; no odor; med. stiff; moist (ML/CL).	
			5		BrGr Cy$l, fS; no odor; med. stiff; moist (ML).	
			10		BrGr C&$; no odor; med. stiff; low to mod. plasticity; moist (ML/CL).	
			15		BrGr $&Cl(-),vfS($); no odor; stiff; occ. to freq. vvd; low to mod. plasticity; moist (ML/CL).	
			20		Gr C&$; no odor; stiff to hard; occ. to freq. vvd (partings 0.4 – 0.1'); mod. plasticity; moist (ML/CL).	
			25		(GLACIOLACUSTRINE SILT AND CLAY)	

Sterling Environmental Engineering, P.C.

BORING LOG

Boring No. PZ-14-1

Project Name:	Orange County Landfill – Cheechunk Canal/Seep Evaluation	**Project No.:**	2010-15
Client Name:	Orange County Department of Public Works	**Date:**	February 19/20, 2014
Location:	Goshen, NY	**Logged By:**	Mark Williams
Weather/Temp.:	See page 1 of 2	**Checked By:**	Peter Kelleher, P.E.

Drilling Co.:	Zebra Environmental Corp.	**Depth:**	39.5'bgs
Driller:	Jason Frederick	**Equipment:**	Geoprobe® 7720 DT
Date Started:	February 19, 2014	**Surface Elev.:**	99.35' (Site Datum)
Date Completed:	February 19, 2014	**Depth/Datum:**	59.85' (Site Datum)

Depth	Sample No.	Blow Counts	Graphic Log 1"=5'	Unified Soil Classification	DESCRIPTIVE LOG (color, grain size and amount, texture, moisture) DEPOSITIONAL UNIT (outwash, till, lacustrine, muck, fill)	COMMENTS
					Gr C&$; no odor; soft to mod. stiff; occ. to freq. vvd; mod. plasticity; moist (ML/CL).	Depth to Groundwater = 26.29' bgs (March 18, 2014)
			30		Gr Cy$; no odor; mod. stiff to soft; freq. vvd; mod. plasticity; moist to wet (ML).	
					(GLACIOLACUSTRINE SILT AND CLAY) 34.1'	
			35		GrfS, sCy$; no odor; med. dense; wet (SM/ML).	
					GrfS, l(-)Cy$; no odor; med. dense; wet (SM/ML).	1¼"I.D. Schedule 40 PVC overburden piezometer installed on February 20, 2014. 10-slot PVC screen: 34.5 -39.5'bgs.
					(GLACIOLACUSTRINE SAND) 39.5'	
			40		Boring terminated at 39.5 feet below ground surface (bgs).	
			45			
			50			

Sterling Environmental Engineering, P.C.

BORING LOG

Boring No. PZ-14-2

Project Name:	Orange County Landfill – Cheechunk Canal/Seep Evaluation	**Project No.:**	2010-15
Client Name:	Orange County Department of Public Works	**Date:**	February 19, 2014
Location:	Goshen, NY	**Logged By:**	Mark Williams
Weather/Temp.:	12°F - 40°F, 1.55" Precip (wintry mix) Winds (1-3mph)	**Checked By:**	Peter Kelleher, P.E.

Drilling Co.:	Zebra Environmental Corp.	**Depth:**	30' bgs
Driller:	Jason Frederick	**Equipment:**	Geoprobe® 7720 DT
Date Started:	February 19, 2014	**Surface Elev.:**	90.87' (Site Datum)
Date Completed:	February 19, 2014	**Depth Elev.:**	60.61' (Site Datum)

Depth	Sample No.	Blow Counts	Graphic Log 1"=5'	Unified Soil Classification	DESCRIPTIVE LOG (color, grain size and amount, texture, moisture) DEPOSITIONAL UNIT (outwash, till, lacustrine, muck, fill)	COMMENTS
					Gr C&$; no odor; mod. stiff; occ. vvd; mod. plasticity; moist (ML/CL).	
			5		Gr $&C; no odor; mod. stiff; occ. to freq. vvd; mod. (0.01' partings); plasticity; moist (ML/CL).	
			10		Gr $&C; no odor; stiff; freq. vvd (0.04 – 0.07' partings); mod. plasticity; moist (ML/CL).	
			15		Gr C&$; no odor; stiff; occ. - freq. vvd); mod. plasticity; moist to wet (ML/CL).	Depth to Groundwater = 18.24' bgs (March 18, 2014)
			20		Gr $&C; no odor; mod. stiff to stiff; occ. - freq. vvd; mod. plasticity; moist to wet (ML/CL).	
					(GLACIOLACUSTRINE SILT AND CLAY) **24.6'**	
			25		GrfS, aCy$; no odor; med. dense; wet (SM/ML) **(GLACIOLACUSTRINE SAND)**	

Sterling Environmental Engineering, P.C.

BORING LOG

Boring No. PZ-14-2

Project Name:	Orange County Landfill – Cheechunk Canal/Seep Evaluation	**Project No.:**	2010-15
Client Name:	Orange County Department of Public Works	**Date:**	February 19, 2014
Location:	Goshen, NY	**Logged By:**	Mark Williams
Weather/Temp.:	See page 1 of 2	**Checked By:**	Peter Kelleher, P.E.

Drilling Co.:	Zebra Environmental Corp.	**Depth:**	30'bgs
Driller:	Jason Frederick	**Equipment:**	Geoprobe® 7720 DT
Date Started:	February 19, 2014	**Surface Elev.:**	90.87' (Site Datum)
Date Completed:	February 19, 2014	**Depth/Datum:**	60.61' (Site Datum)

Depth	Sample No.	Blow Counts	Graphic Log 1"=5'	Unified Soil Classification	DESCRIPTIVE LOG (color, grain size and amount, texture, moisture) DEPOSITIONAL UNIT (outwash, till, lacustrine, muck, fill)	COMMENTS
					GrfS, t$; no odor; med. dense; wet; GrmfS @ 27.6 -28.7' bgs (SM).	1¼"I.D. Schedule 40 PVC overburden piezometer installed on February 20, 2014. 10-slot PVC screen: 24.5 -29.5'bgs.
			30		**(GLACIOLACUSTRINE SAND)** **30.26'**	
					Boring terminated at 30.26 feet below ground surface (bgs).	
			35			
			40			
			45			
			50			

Sterling Environmental Engineering, P.C.

BORING LOG

Boring No. PZ-14-3

Project Name:	Orange County Landfill – Cheechunk Canal/Seep Evaluation	**Project No.:**	2010-15
Client Name:	Orange County Department of Public Works	**Date:**	February 19, 2014
Location:	Goshen, NY	**Logged By:**	Mark Williams
Weather/Temp.:	12°F - 40°F, 1.55" Precip (wintry mix) Winds (1-3mph)	**Checked By:**	Peter Kelleher, P.E.

Drilling Co.:	Zebra Environmental Corp.	**Depth:**	30' bgs
Driller:	Jason Frederick	**Equipment:**	Geoprobe® 7720 DT
Date Started:	February 19, 2014	**Surface Elev.:**	91.21' (Site Datum)
Date Completed:	February 19, 2014	**Depth Elev.:**	61.29' (Site Datum)

Depth	Sample No.	Blow Counts	Graphic Log 1"=5'	Unified Soil Classification	DESCRIPTIVE LOG (color, grain size and amount, texture, moisture) DEPOSITIONAL UNIT (outwash, till, lacustrine, muck, fill)	COMMENTS
					Br-GrBr Cy$; no odor; occ. mtld; mod. stiff; occ. vvd; low to mod. plasticity; dry to moist (ML/CL).	
			5		Gr C&$; no odor; mod. stiff; freq. vvd (partings 0.01'); mod. plasticity; moist to wet (ML/CL).	
			10		BrGr Cy$; no odor; mod. stiff; freq. vvd (partings 0.01'); mod. plasticity; moist to wet (ML/CL).	
			15		BrGr Cy$; no odor; mod. stiff to stiff; freq. vvd (partings <0.01'); mod. plasticity; moist (ML/CL).	Depth to Groundwater = 18.30' bgs (March 18, 2014)
			20		BrGr Cy$; no odor; soft to mod. stiff; massive; mod. plasticity; moist (ML/CL).	
			25		**(GLACIOLACUSTRINE SILT AND CLAY)** **24.4'** DkGrfS, l(-)$; med. dense; wet (SM/ML). **(GLACIOLACUSTRINE SAND)**	

Sterling Environmental Engineering, P.C.

BORING LOG

Boring No. PZ-14-3

Project Name:	Orange County Landfill – Cheechunk Canal/Seep Evaluation	**Project No.:**	2010-15
Client Name:	Orange County Department of Public Works	**Date:**	February 19, 2014
Location:	Goshen, NY	**Logged By:**	Mark Williams
Weather/Temp.:	See page 1 of 2	**Checked By:**	Peter Kelleher, P.E.

Drilling Co.:	Zebra Environmental Corp.	**Depth:**	30'bgs
Driller:	Jason Frederick	**Equipment:**	Geoprobe® 7720 DT
Date Started:	February 19, 2014	**Surface Elev.:**	91.21' (Site Datum)
Date Completed:	February 19, 2014	**Depth/Datum:**	61.29' (Site Datum)

Depth	Sample No.	Blow Counts	Graphic Log 1"=5'	Unified Soil Classification	DESCRIPTIVE LOG (color, grain size and amount, texture, moisture) DEPOSITIONAL UNIT (outwash, till, lacustrine, muck, fill)	COMMENTS
					Grmf(+)S; no odor; med.dense; laminated; wet(SM/ML).	2"I.D. Schedule 40 PVC overburden piezometer installed on February 20, 2014. 10-slot PVC screen: 24.92 -29.92'bgs.
					(GLACIOLACUSTRINE SAND) **29.92'**	
			30		Boring terminated at 29.92 feet below ground surface (bgs).	
			35			
			40			
			45			
			50			

Sterling Environmental Engineering, P.C.

BORING LOG

Boring No. PZ-14-4

Project Name:	Orange County Landfill – Cheechunk Canal/Seep Evaluation	**Project No.:**	2010-15
Client Name:	Orange County Department of Public Works	**Date:**	February 20, 2014
Location:	Goshen, NY	**Logged By:**	Mark Williams
Weather/Temp.:	23°F - 50°F, 0" Precip, Winds (1-4mph)	**Checked By:**	Peter Kelleher, P.E.

Drilling Co.:	Zebra Environmental Corp.	**Depth:**	30' bgs
Driller:	Jason Frederick	**Equipment:**	Geoprobe® 7720 DT
Date Started:	February 20, 2014	**Surface Elev.:**	90.15' (Site Datum)
Date Completed:	February 20, 2014	**Depth Elev.:**	61.24' (Site Datum)

Depth	Sample No.	Blow Counts	Graphic Log 1"=5'	Unified Soil Classification	DESCRIPTIVE LOG (color, grain size and amount, texture, moisture) DEPOSITIONAL UNIT (outwash, till, lacustrine, muck, fill)	COMMENTS
					GrBr Cy$; no odor; occ. mtld; mod. stiff to stiff; occ. vvd (partings 0.01'); low to mod. plasticity; dry to moist (ML).	
			5		BrGr $&C to Cy$; no odor; mod. stiff to stiff; freq. vvd (partings 0.01'); low to mod. plasticity; moist (ML/CL).	
			10		BrGr $&C to $yC; no odor; mod. stiff; occ. to freq. vvd (partings 0.01'); mod. plasticity; moist (ML/CL).	
			15		Gr Cy$ to $&C; no odor; mod. stiff; occ. to freq. vvd (partings 0.02 – 0.07'); mod. plasticity; moist to wet (ML/CL).	Depth to Groundwater = 18.23' bgs (March 18, 2014)
			20		GrCy$ to $&C; no odor; mod. stiff; massive; moist to wet (ML/CL).	
					(GLACIOLACUSTRINE SILT AND CLAY) 23.9'	
			25		DkGrmf(+)fS, l(-)Cy$; no odor; med. dense; wet (SM/ML). **(GLACIOLACUSTRINE SAND)**	

Sterling Environmental Engineering, P.C.

BORING LOG

Boring No. PZ-14-4

Project Name:	Orange County Landfill – Cheechunk Canal/Seep Evaluation	**Project No.:**	2010-15
Client Name:	Orange County Department of Public Works	**Date:**	February 20, 2014
Location:	Goshen, NY	**Logged By:**	Mark Williams
Weather/Temp.:	See page 1 of 2	**Checked By:**	Peter Kelleher, P.E.
Drilling Co.:	Zebra Environmental Corp.	**Depth:**	38.91'bgs
Driller:	Jason Frederick	**Equipment:**	Geoprobe® 7720 DT
Date Started:	February 20, 2014	**Surface Elev.:**	90.15' (Site Datum)
Date Completed:	February 20, 2014	**Depth/Datum:**	61.24' (Site Datum)

Depth	Sample No.	Blow Counts	Graphic Log 1"=5'	Unified Soil Classification	DESCRIPTIVE LOG (color, grain size and amount, texture, moisture) DEPOSITIONAL UNIT (outwash, till, lacustrine, muck, fill)	COMMENTS
					Grmf(+)S; no odor; med.dense; laminated; wet(SM/ML).	2"I.D. Schedule 40 PVC overburden piezometer installed on February 20, 2014. 10-slot PVC screen: 23.91 -28.91'bgs.
					(GLACIOLACUSTRINE SAND) 28.91'	
			30		Boring terminated at 28.91 feet below ground surface (bgs).	
			35			
			40			
			45			
			50			

Sterling Environmental Engineering, P.C.

BORING LOG

Boring No. PZ-14-5

Project Name:	Orange County Landfill – Cheechunk Canal/Seep Evaluation	**Project No.:**	2010-15
Client Name:	Orange County Department of Public Works	**Date:**	February 20, 2014
Location:	Goshen, NY	**Logged By:**	Mark Williams
Weather/Temp.:	23°F - 50°F, 0" Precip, Winds (1-4mph)	**Checked By:**	Peter Kelleher, P.E.
Drilling Co.:	Zebra Environmental Corp.	**Depth:**	38' bgs
Driller:	Jason Frederick	**Equipment:**	Geoprobe® 7720 DT
Date Started:	February 20, 2014	**Surface Elev.:**	99.78' (Site Datum)
Date Completed:	February 20, 2014	**Depth Elev.:**	61.92' (Site Datum)

Depth	Sample No.	Blow Counts	Graphic Log 1"=5'	Unified Soil Classification	DESCRIPTIVE LOG (color, grain size and amount, texture, moisture) DEPOSITIONAL UNIT (outwash, till, lacustrine, muck, fill)	COMMENTS
					BrGr Cy$; no odor; occ. mtld; med. stiff; moist (ML/CL).	
			5		BrGr Cy$; no odor; med. stiff; moist (ML).	
			10		BrGr C&$; no odor; med. stiff; low to mod. plasticity; moist (ML/CL).	
			15		BrGr-Gr $&Ct, vfS($); no odor; mod. stiff; occ.vvd; low to mod. plasticity; moist (ML/CL).	
			20		Gr Cy$ to $&C; no odor; mod. stiff; occ. vvd (partings = 0.04 – 0.07'); low to mod. plasticity; moist (ML/CL).	
			25		(GLACIOLACUSTRINE SILT AND CLAY)	

Sterling Environmental Engineering, P.C.

BORING LOG

Boring No. PZ-14-5

Project Name:	Orange County Landfill – Cheechunk Canal/Seep Evaluation	**Project No.:**	2010-15
Client Name:	Orange County Department of Public Works	**Date:**	February 20, 2014
Location:	Goshen, NY	**Logged By:**	Mark Williams
Weather/Temp.:	See page 1 of 2	**Checked By:**	Peter Kelleher, P.E.

Drilling Co.:	Zebra Environmental Corp.	**Depth:**	38'bgs
Driller:	Jason Frederick	**Equipment:**	Geoprobe® 7720 DT
Date Started:	February 20, 2014	**Surface Elev.:**	99.78' (Site Datum)
Date Completed:	February 20, 2014	**Depth/Datum:**	61.92' (Site Datum)

Depth	Sample No.	Blow Counts	Graphic Log 1"=5'	Unified Soil Classification	DESCRIPTIVE LOG (color, grain size and amount, texture, moisture) DEPOSITIONAL UNIT (outwash, till, lacustrine, muck, fill)	COMMENTS
					Gr Cy$ to $&C; no odor; mod. stiff; occ. to freq. vvd (partings = 0.05'); mod. plasticity; wet to moist (ML/CL).	Depth to Groundwater = 28.32' bgs (March 18, 2014)
			30		Gr Cy$; no odor; soft to mod. stiff; massive; low plasticity; moist to wet (ML).	2"I.D. Schedule 40 PVC overburden piezometer installed on February 20, 2014. 10-slot PVC screen: 32.9 -34.9'bgs.
					(GLACIOLACUSTRINE SILT AND CLAY) 33.5'	
					DkGrmf(+)S, t$; laminated; med. dense to dense; wet (SM).	
			35		Gr-DkGrfS; no odor; dense; wet (SM).	
					(GLACIOLACUSTRINE SAND) 37.86'	
					Boring terminated at 37.86 feet below ground surface (bgs).	
			40			
			45			
			50			

Sterling Environmental Engineering, P.C.

BORING LOG

Boring No. PZ-14-6

Project Name:	Orange County Landfill – Cheechunk Canal/Seep Evaluation	**Project No.:**	2010-15
Client Name:	Orange County Department of Public Works	**Date:**	February 20, 2014
Location:	Goshen, NY	**Logged By:**	Mark Williams
Weather/Temp.:	23°F - 50°F, 0" Precip, Winds (1-4mph)	**Checked By:**	Peter Kelleher, P.E.

Drilling Co.:	Zebra Environmental Corp.	**Depth:**	39.2' bgs
Driller:	Jason Frederick	**Equipment:**	Geoprobe® 7720 DT
Date Started:	February 20, 2014	**Surface Elev.:**	99.96' (Site Datum)
Date Completed:	February 20, 2014	**Depth Elev.:**	60.76' (Site Datum)

Depth	Sample No.	Blow Counts	Graphic Log 1"=5'	Unified Soil Classification	DESCRIPTIVE LOG (color, grain size and amount, texture, moisture) DEPOSITIONAL UNIT (outwash, till, lacustrine, muck, fill)	COMMENTS
					BrGr Cy$; no odor; occ. mtld; mod. stiff; moist (ML).	
			5		BrGr Cy$ to $&C; no odor; mod. stiff; moist (ML/CL).	
			10		BrGr C&$; no odor; mod. stiff; low to mod. plasticity; moist (ML/CL).	
			15		BrGr-Gr $&C to Cy$; no odor; mod. stiff; occ.vvd; low to mod. plasticity; moist (ML/CL).	
			20		Gr Cy$; no odor; mod. stiff; occ.vvd; low to mod. plasticity; moist (ML/CL).	
			25		(GLACIOLACUSTRINE SILT AND CLAY)	

Sterling Environmental Engineering, P.C.

BORING LOG

Boring No. PZ-14-6

Project Name:	Orange County Landfill – Cheechunk Canal/Seep Evaluation	**Project No.:**	2010-15
Client Name:	Orange County Department of Public Works	**Date:**	February 20, 2014
Location:	Goshen, NY	**Logged By:**	Mark Williams
Weather/Temp.:	See page 1 of 2	**Checked By:**	Peter Kelleher, P.E.

Drilling Co.:	Zebra Environmental Corp.	**Depth:**	39.2'bgs
Driller:	Jason Frederick	**Equipment:**	Geoprobe® 7720 DT
Date Started:	February 20, 2014	**Surface Elev.:**	99.96' (Site Datum)
Date Completed:	February 20, 2014	**Depth/Datum:**	60.76' (Site Datum)

Depth	Sample No.	Blow Counts	Graphic Log 1"=5'	Unified Soil Classification	DESCRIPTIVE LOG (color, grain size and amount, texture, moisture) DEPOSITIONAL UNIT (outwash, till, lacustrine, muck, fill)	COMMENTS
					Gr Cy$; no odor; soft to mod. stiff; occ. to freq. vvd (partings = 0.03 – 0.05'); mod. plasticity; moist (ML/CL).	Depth to Groundwater = 27.27' bgs (March 18, 2014)
			30		Gr Cy$; no odor; soft to mod. stiff; massive; low plasticity; moist to wet (ML).	
					(GLACIOLACUSTRINE SILT AND CLAY) **33.85'**	
			35		Gr-DkGrfSl(-), Cy$; no odor; med. dense to dense; wet (SM/ML)	1¼"I.D. Schedule 40 PVC overburden piezometer installed on February 20, 2014. 10-slot PVC screen: 34.2 -39.2'bgs.
					(GLACIOLACUSTRINE SAND) **39.2'**	
			40		Boring terminated at 39.2 feet below ground surface (bgs).	
			45			
			50			

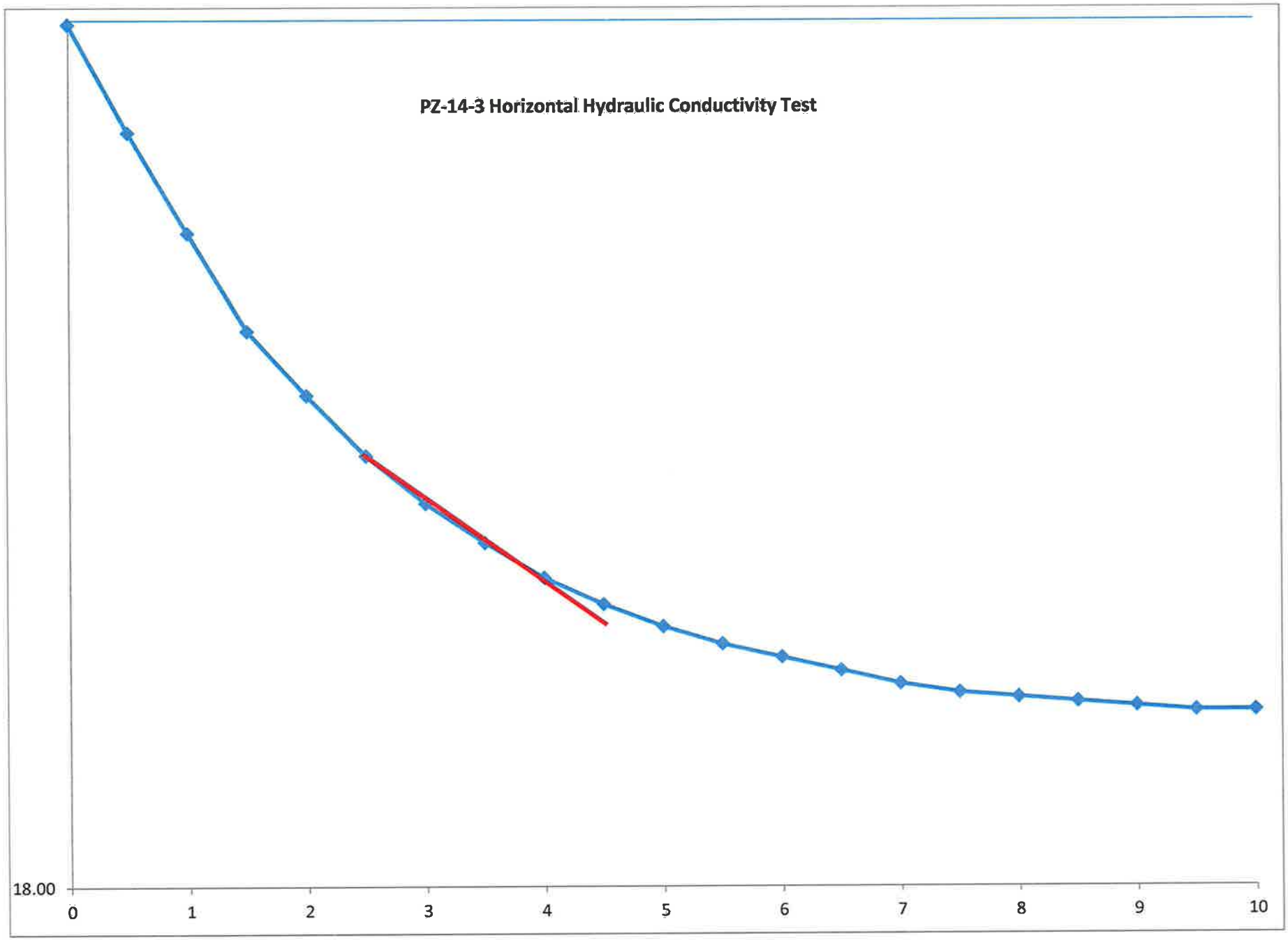
APPENDIX B

Summary of Survey and Project Information - Orange County Landfill Seep Evaluation

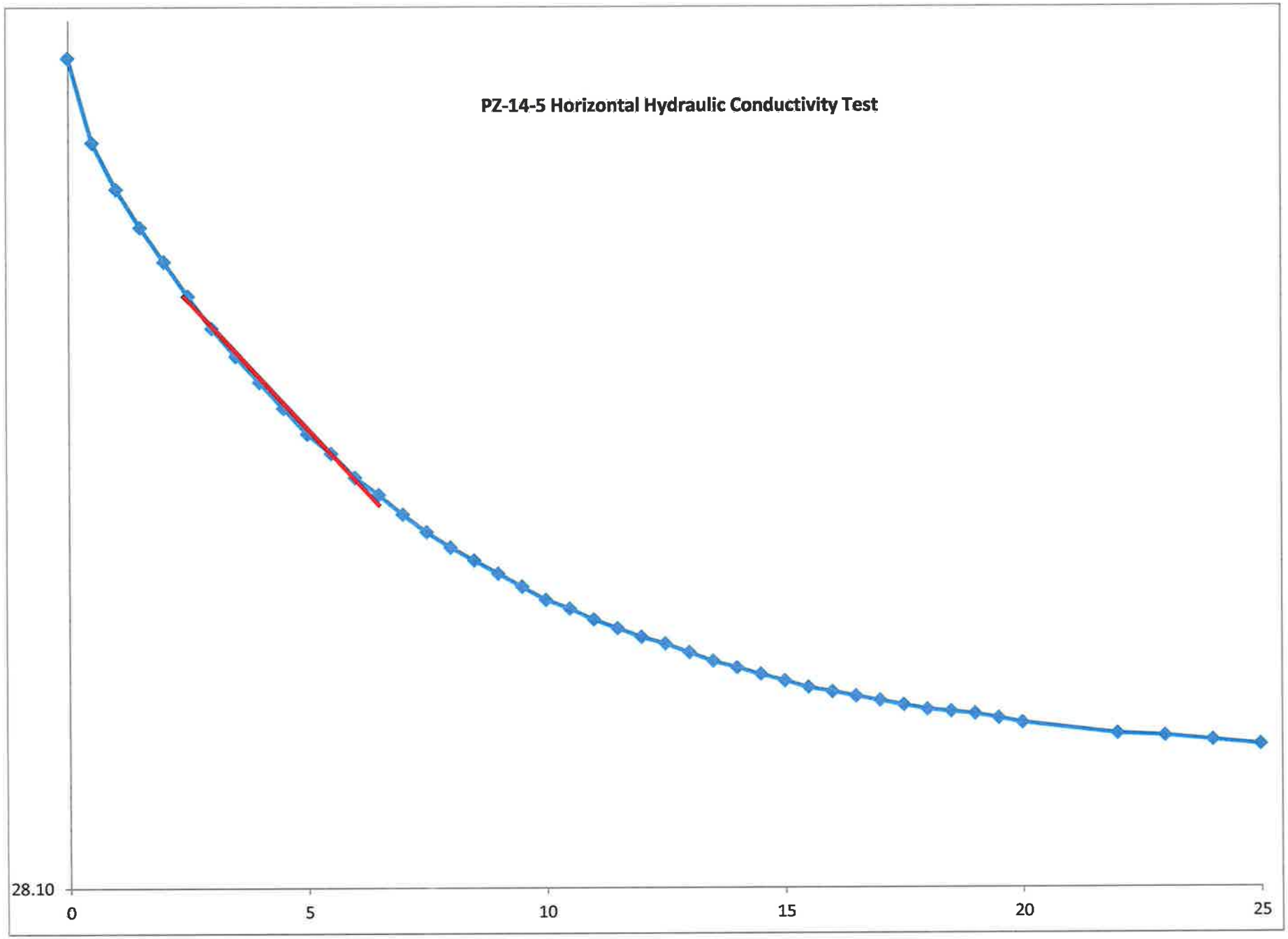
Assign PZ-14-1 MP Elev =	100.00	ft

Piezometer I.D.	Assumed Elevation (Site Datum)	delta Z - 1st Setup	delta Z - 2nd Setup	delta Z - 3rd Setup	Piezometer Stickup (feet)	Ground Surface Elevation (Site Datum)	Glaciolacustrine (Silt and Clay)/Glaciolacustrine (Fine Sand) Interface (feet BGS)/[Geologic Contact Elevation]	Screened Interval / [Screened Elevation]	Total Depth (Feet BGS) / [Bottom Elevation]	February 20, 2014 Depth to Groundwater (feet BMP {Top of PVC}) / [Groundwater Elevation]	March 18, 2014 Depth to Groundwater (feet BMP {Top of PVC}) / [Groundwater Elevation]
	(MP)	(to MP)	(to MP)	(to MP)							
PZ-14-1	100.00	-3.31			0.65	99.35	34.1 / [65.25]	34.5-39.5 / [64.85 - 59.85]	39.5 / [59.85]	27.69 / [72.31]	26.29 / [73.71]
PZ-14-2	91.67	-11.64			0.80	90.87	24.6 / [66.27]	24.5-29.5 / [66.37 - 61.37]	30.26 / [60.61]	20.21 / [71.46]	18.24 / [73.43]
PZ-14-3	91.56	-11.75		0.40	0.35	91.21	24.4 / [66.81]	24.92 -29.92 / [66.29 - 61.29]	29.92 / [61.29]	20.10 / [71.46]	18.30 / [73.26]
PZ-14-4	91.50	-11.81			1.35	90.15	23.9 / [66.25]	23.91-28.91 / [66.24 - 61.24]	28.91 / [61.24]	19.88 / [71.62]	18.23 / [73.27]
PZ-14-5	101.95	-1.36			2.17	99.78	33.5 / [66.28]	32.9-37.9 / [66.88 - 61.88]	37.86 / [61.92]	29.58 / [72.37]	28.32 / [73.63]
PZ-14-6	100.84	-2.47			0.88	99.96	33.85 / [66.11]	34.2-39.2 / [65.76 - 60.76]	39.20 / [60.76]	28.61 / [72.23]	27.27 / [73.57]
MW-3B	96.16	-7.15	-8.19								
MH-5	102.56		-1.80								
Canal	71.81			-19.35							

Time (sec)	PZ-14-3 Water Level (from MP)				
Static	18.33	1.66	1.577	18.41	95% recovery
0	19.99				
0.5	19.73				
1	19.49				
1.5	19.26				
2	19.11				
2.5	18.97				
3	18.86				
3.5	18.77				
4	18.69				
4.5	18.63				
5	18.58				
5.5	18.54				
6	18.51				
6.5	18.48				
7	18.45				
7.5	18.43				
8	18.42				
8.5	18.41				
9	18.40				
9.5	18.39				
10	18.39				


PZ-14-3 Horizontal Hydraulic Conductivity Test
18.00
0
1
2
3
4
5
6
7
8
9
10

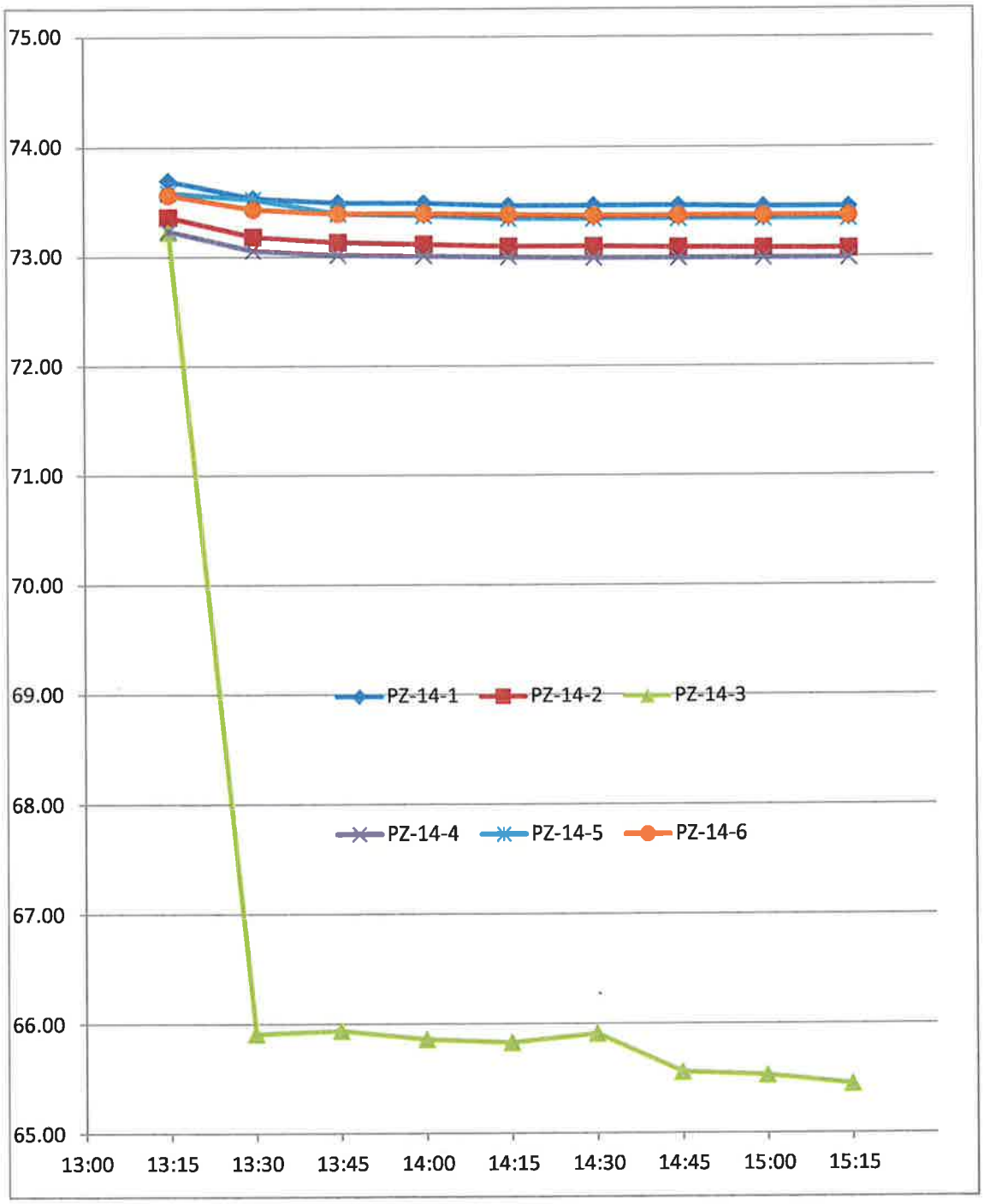
Time (min)	PZ-14-5 Water Level (from MP)				
Static	28.35	1.66	1.577	28.43	95% recovery
0	30.01				
0.5	29.81				
1	29.70				
1.5	29.61				
2	29.53				
2.5	29.45				
3	29.375				
3.5	29.31				
4	29.25				
4.5	29.19				
5	29.13				
5.5	29.09				
6	29.03				
6.5	28.99				
7	28.95				
7.5	28.91				
8	28.87				
8.5	28.84				
9	28.81				
9.5	28.78				
10	28.75				
10.5	28.73				
11	28.71				
11.5	28.69				
12	28.67				
12.5	28.65				
13	28.63				
13.5	28.61				
14	28.60				
14.5	28.58				
15	28.57				
15.5	28.55				
16	28.54				
16.5	28.53				
17	28.52				
17.5	28.51				
18	28.50				
18.5	28.50				
19	28.49				
19.5	28.48				
20	28.47				
22	28.445				
23	28.44				
24	28.43				
25	28.42				


PZ-14-5 Horizontal Hydraulic Conductivity Test
28.10
0
5
10
15
20
25

Pumping Test Data (PZ-14-3)

Time	PZ-14-1 (ft)	PZ-14-2 (ft)	PZ-14-3 (ft)	PZ-14-4 (ft)	PZ-14-5 (ft)	PZ-14-6 (ft)	Pump Rate (gpm)
9:30	26.29	18.24	18.30	18.23	28.32	27.27	
11:50	26.30	18.28	18.33	18.25	28.35	27.27	
13:10	26.30	18.30	18.33	18.26	28.36	27.27	
13:15	26.30	18.30	18.33	18.26	28.36	27.27	0.33
13:30	26.46	18.48	25.65	18.44	28.42	27.40	0.40
13:45	26.50	18.53	25.62	18.48	28.55	27.44	0.38
14:00	26.51	18.55	25.70	18.49	28.57	27.44	0.38
14:15	26.53	18.57	25.73	18.50	28.60	27.45	0.38
14:30	26.53	18.57	25.65	18.51	28.60	27.46	0.36
14:45	26.53	18.58	26.00	18.51	28.60	27.46	0.41
15:00	26.54	18.59	26.03	18.51	28.60	27.46	0.38
15:15	26.54	18.59	26.11	18.51	28.60	27.46	0.40
max delta	-0.24	-0.29	-7.78	-0.25	-0.24	-0.19	
Using water levels as elevations (Canal ~71.8'):							
13:15	73.70	73.37	73.23	73.24	73.59	73.57	
13:30	73.54	73.19	65.91	73.06	73.53	73.44	
13:45	73.50	73.14	65.94	73.02	73.40	73.40	
14:00	73.50	73.12	65.86	73.01	73.38	73.40	
14:15	73.47	73.10	65.83	73.00	73.35	73.39	
14:30	73.47	73.10	65.91	72.99	73.35	73.38	
14:45	73.47	73.09	65.56	72.99	73.35	73.38	
15:00	73.46	73.09	65.53	72.99	73.35	73.38	
15:15	73.46	73.08	65.45	72.99	73.35	73.38	

Pumping Test Data (PZ-14-3)



Sample ID	Time Collected	Time Analyzed	Temp. C	Cond. mS/cm (S)	Cond. mS/cm	DO %	DO mg/L	pH SU	ORP mV	Turbidity NTU
BEFORE	13:20; 3/18/14	16:50; 3/19/14	13.05	1.189	0.918	12.2	1.28	6.92	-51.0	
AFTER	15:15; 3/18/14	17:10; 3/19/14	13.13	1.176	0.910	20.1	2.1	6.93	-34.2	