AQUIFER PUMPING TEST RESULTS

G&H LANDFILL SITE
MACOMB COUNTY, MICHIGAN

Prepared For:
G&H LANDFILL GROUP

Prepared by:
Conestoga-Rovers & Associates

1880 Assumption St., Unit 200
Windsor, Ontario
Canada N2V 1C2

Office: (519) 966-9886
Fax: (519) 966-3894

web: http://www.CRAworld.com

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1.0 INTRODUCTION

This report was prepared by Conestoga-Rovers & Associates (CRA) on behalf of the G&H Landfill Group (Group) to present the results of the aquifer tests performed at the G&H Landfill Site (Site), located in Macomb County, Michigan. The aquifer tests were conducted in July and August 2012 in accordance with the Aquifer Test Work Plan (Work Plan), submitted in May 2012, unless otherwise specified.

The purposes of the aquifer tests were to collect necessary data and information to assess additional extraction alternatives along the Detroit Water and Sewage District (DWSD) 96-inch watermain present at the Site. The goals were to determine the zone of capture, magnitude of drawdown, assess yields, and to determine aquifer characteristics to determine if vertical extraction wells were deemed appropriate and, if so, provide a reasonable estimate of vertical extraction well spacing distances;.

The following sections summarize the field activity procedures and discuss the results of the aquifer tests:

- Section 1.0 Introduction
- Section 2.0 Field Activities
- Section 3.0 Discussion
- Section 4.0 Conclusions
- Section 5.0 Recommendations

2.0 FIELD ACTIVITIES

Stearns Drilling of Dutton, Michigan performed the drilling, aquifer pumping test set up, and supply and operation of the pump under the full time supervision of CRA personnel. All the water generated during these activities was discharged to the existing Site groundwater treatment system.

The procedure outlined in the Work Plan included the performance of one aquifer test at the Site. However during the first aquifer test on July 4, 2012 pump limitations due to low yields resulted in the termination of the test prior to the completion of 24 hours. The low yield also resulted in minimal drawdown in the observation wells. Therefore a longer duration aquifer test was performed to obtain the sufficient data to complete the assessment.

The monitoring network for the TEW-1-12 pumping tests consisted of the following observation wells, as presented on Figure 1:

- PZ-1-12 (new piezometer)
- PZ-2-12 (new piezometer)
- GH-37A (background monitoring well)
- GH-74
- GH-73
- GH-52
- GW-07
- GH-31A
- GH-31B
- GH-66
- GH-50
- GW-06
- GW-10
- GW-11

Prior to mobilization to the Site, the drill rig and all associated downhole drilling and sampling equipment were thoroughly decontaminated. Also, the location of the

utilities, in particular the 96-inch DWSD watermain and the existing collection system were verified prior to subsurface installations using a private locator.

2.1 EXTRACTION WELL INSTALLATION

One test extraction well (TEW-1-12) was installed on June 29, 2012 in the area between GH73 and GH74, as shown on Figure 1. Well completion details are provided on Table 1 and the stratigraphic and instrumentation log is provided in Appendix A.

The location of TEW-1-12 was selected to target an area where there is a low on top of the Confining Unit (i.e., Till layer) creating a small valley where groundwater could potentially flow beneath the watermain. The depth of TEW-1-12, as shown on Figure 2, extends beneath the watermain to the low point of the Confining Unit at an approximate depth of 36.5 ft bgs (feet below ground surface).

The test extraction well location (TEW-1-12) was drilled and installed employing hollow-stem auger (HSA) drilling techniques to produce a 12-inch borehole. Representative soil samples were collected for geologic characterization purposes only using split-spoon samplers. The stratigraphy was logged in accordance with the Unified Soil Classification System (USCS), in addition to blow counts and penetration resistance values, as well as recorded on standard field log forms. The test extraction well was installed in accordance with the protocols outlined in Section 2.1 of the Aquifer Test Work Plan (CRA, May 2012).

2.2 PIEZOMETER INSTALLATION

Two (2) piezometers (PZ-1-12 and PZ-2-12) were installed on June 25 and June 26, 2012, as shown on Figure 1. Well completion details are provided on Table 1 and stratigraphic and instrumentation logs are provided in Appendix A.

The locations of the two piezometers were selected to provide further hydraulic data in the vicinity of the test extraction well during the aquifer test. The piezometers, as shown on Figure 2, extend to depths of 30 ft bgs.

The piezometers were drilled and installed employing HSA-drilling techniques to produce an 8-inch borehole. Representative soil samples were collected for geologic characterization purposes only using split-spoon samplers. The stratigraphy was logged in accordance with the USCS, in addition to blow counts and penetration resistance

values, as well as recorded on standard field log forms. The piezometers were installed in accordance with the protocols outlined in Section 2.2 of the Aquifer Test Work Plan (CRA, May 2012).

2.3 EXTRACTION WELL AND PIEZOMETER DEVELOPMENT

Following installation, the test extraction well was developed for 6 hours until a visual sediment-free condition was achieved. The purpose of developing the test extraction well was to maximize the efficiency and potential yield from the Fine Sand Unit. The development of the piezometers was also completed following installation.

The development of the test extraction well and piezometers proceeded as detailed in Section 2.3 of the Aquifer Test Work Plan (CRA, May 2012).

2.4 GROUNDWATER LEVEL MONITORING

Pressure transducers were installed in the test extraction well (TEW-1-12), two piezometers (PZ-1-12, and PZ-2-12), and three other monitoring wells included in the monitoring network (GH-31B, GH-37A, and GH-73). The pressure transducers were installed on July 4, 2012 (for aquifer test 1) and July 19, 2012 (for aquifer test 2) and were installed to pre-determined depths, secured, and programmed to collect continuous groundwater depths at 5-second and 1-minute intervals, respectively. Upon completion of the aquifer pumping tests, and after sufficient groundwater recovery, each of the pressure transducers were removed and decontaminated with a potable water rinse. The data was then downloaded to a computer and analyzed using AQTESOLV™ software.

Manual groundwater elevations were collected from all locations within the monitoring network to verify the proper operation of the installed pressure transducers and to monitor locations that did not have pressure transducers installed. All manual groundwater depths were measured using a battery-operated water level indicator. The groundwater depths were measured to the nearest 0.05 foot (ft) and referenced to the top of the well riser pipe, and recorded. The battery-operated water level indicator was decontaminated between monitoring well locations using a potable water rinse.

2.5 STEP-DRAWDOWN TEST

A step-drawdown test was completed at TEW-1-12 on July 4, 2012 to determine the approximate optimum pumping rate for the pumping test.

An average pumping rate of less than 1 gallon per minute (gpm) was determined to be the optimum pumping rate based on the July 4, 2012 step-drawdown pumping test at TEW-1-12.

2.6 AQUIFER PUMPING TESTS

The aquifer test on the newly installed test extraction well (TEW-1-12) was proposed for the purpose of providing sufficient data to assess potential alternatives for the collection system and to determine the design of additional extraction components proposed in the area of the DWSD watermain. However during the first aquifer test (Aquifer Test 1 - July 4, 2012) pump limitations prevented the completion and collection of 24 hours of hydraulic data. Therefore an additional longer duration aquifer test was performed to obtain the required data (Aquifer Test 2 - July 23 to August 3, 2012). The aquifer pumping tests were conducted during relatively dry conditions to minimize any potential effects from precipitation.

There were two stages to monitor during the aquifer pumping test: drawdown and recovery. The drawdown portion spanned the period from the moment the pump was turned on, to the moment the pump was turned off. The recovery portion started from the time the pump was turned off, to a point when all the wells recovered to 80 percent of the original static water level.

The collection system along the DWSD watermain associated with Sump S-5 was shutdown approximately 2 days before and during the aquifer tests to assess drawdown from static conditions. Similarly, the portion of the leachate collection system in the vicinity of GW-07 and GH-52 (i.e., Sump S-6) and the Phase III Toe Drain was also shut down. The collection systems were re-started on July 5, 2012 (Aquifer Test 1) and on August 1, 2012 (Aquifer Test 2) and showed minimal effects on the aquifer test data. Prior to initiating the aquifer tests, one round of hydraulic monitoring was conducted on the test extraction well, newly installed piezometers, and all other monitoring wells included in the monitoring network to establish static (pre-test) conditions.

Aquifer Test 1 took place between July 4, 2012 and July 5, 2012 (22-hours). Transducers were installed in several wells within the monitoring network (TEW-1-12, PZ-1-12,

PZ-2-12, GH31-B, GH-37A, and GH-73) to obtain frequent groundwater data during the aquifer pumping test. Manual groundwater measurements were made in all wells within the monitoring network.

Aquifer Test 2 was originally proposed to begin on July 19, 2012 but was delayed due to storm events. Therefore Aquifer Test 2 took place between July 23, 2012 and August 3, 2012 (11-days). Transducers were installed in only the pumping well (TEW-1-12) and the newly installed piezometers (PZ-1-12, and PZ-2-12). Manual groundwater measurements were made in only selected wells within the monitoring network (TEW-1-12, PZ-1-12, PZ-2-12, GH-73, GH-31B, GH-74, GH-66, GH-52, and GH-50), because these locations would be most likely affected, based on Aquifer Test 1 test results.

Issues with the pump overheating and not functioning properly were encountered during Aquifer Test 1 and therefore it was determined that specialized equipment was required to maintain the low flows prior to initiating Aquifer Test 2. A 3 week delay occurred between Aquifer Test 1 and Aquifer Test 2 in order to obtain the required specialized equipment. The specialized equipment was utilized during Aquifer Test 2 to keep the pump functioning and the pump temperature low; a necessity as a result from the strain of operating the pump at such a low flow rate.

Both aquifer tests were conducted with the average pumping rate determined during the step-drawdown test. After each aquifer pumping test was complete, the pump was turned off and the manual water levels were collected from the selected wells from the monitoring network to monitor the water level recovery in TEW-1-12 and the observation wells.

2.7 DECONTAMINATION WATER

All equipment was decontaminated with a potable water rinse. Decontamination water was then discharged to the groundwater treatment system.

3.0 DISCUSSION

3.1 PRECIPITATION

Precipitation values were recorded at the Site between July 3, 2012 and August 16, 2012 for the purpose of the aquifer tests and are provided in Appendix B. As described in Section 2.6, the aquifer tests were conducted during relatively dry conditions, however precipitation values were recorded as potential explanations for anomalous values or negligible drawdown effects. The precipitation values were recorded in inches per day (or per weekend in some instances).

Overall the highest recorded precipitation values for the time period were on July 5, 2012 with a value of 2.8 inches per day. Since Aquifer Test 1 was completed on July 5, 2012 at 8:00 am, it is unlikely the precipitation affected the results. Additional precipitation events were generally less than 1 inch per day of precipitation during the specified time frame.

3.2 AQUIFER TEST 1 - 22 HOURS

Aquifer Test 1 conducted on TEW-1-12 started on July 4, 2012 at 10:00 am and lasted until July 5, 2012 at 8:00 am, for a total of 22 hours. Aquifer Test 1 groundwater data is provided in Appendix C. During Aquifer Test 1 there were issues encountered with the pump and therefore a variable pumping rate was obtained. The pumping test was ended after only 22-hours due to further pump issues. An average pumping rate of approximately 1 gpm was generally achieved.

Aquifer Test 1 achieved a drawdown of approximately 12.5 ft in the pumping well (TEW-1-12) with minimal drawdown in the observation wells within the monitoring network. The distance to the pumping well and observed drawdown for the monitoring network are presented on Table 2. Drawdown values ranged from a rise in groundwater of 0.05 ft (GH-31A) to a decrease of 0.52 ft (GW-10). Drawdown results for the 22-hour and 11-day aquifer tests are presented on Figure 3.

The drawdown curve (hydrograph) is included in Appendix E as Figure E.1. The hydrograph shows the drawdown in feet prior to, during and immediately after the pumping test for each of the corresponding wells. Hydrographs were generated from the pressure transducer data collected at specified locations within the monitoring network (TEW-1-12, PZ-1-12, PZ-2-12, GH-73, GH-31B, and GH-37A) as well as using manual data from the remaining locations within the monitoring network. Pumping

rate data was also provided on Figure E.1 to convey the fluctuations and representative responses during Aquifer Test 1. The hydrograph shows a fairly substantial drawdown on the pumping well (TEW-1-12), however only minimal influences on the wells within the monitoring network.

In addition to drawdown curves, distance vs. drawdown plots were generated and included in Appendix F as Figure F.1. Drawdown values recorded just prior to shutting the pump off were used in addition to a distance from the pumping well to ascertain whether a pattern existed between drawdown achieved and the proximity to the pumping well. Based on Figure F.1, it appears the majority of the wells had very minimal drawdown as a result of Aquifer Test 1. The minimal influence could be potentially a result of the fine grained sand unit being pumped for too short a duration for affects to resonate beyond the immediate vicinity. This theory is further supported by the drawdown values in Table 2, whereby the newly installed piezometers, had drawdown values of 0.13 ft for PZ-1-12, and 0.32 ft for PZ-2-12, with distances of 45 and 59 ft, respectively.

Due to the short duration of Aquifer Test 1 and minimal drawdown in surrounding observation wells, it was concluded a longer duration aquifer pumping test would be required to accurately determine the aquifer characteristics.

3.3 AQUIFER TEST 2 - 11 DAYS

Aquifer Test 2 conducted on TEW-1-12 started on July 23, 2012 at 11:00 am and lasted until August 3, 2012 at 11:00 am, for a total of 11 days. Aquifer Test 2 groundwater data is provided in Appendix D. During Aquifer Test 2, an average pumping rate of 0.47 gpm was generally achieved.

Aquifer Test 2 achieved a drawdown of approximately 10.6 ft in the pumping well (TEW-1-12) as well as a number of observation wells within the monitoring network. Based on Aquifer Test 1 results it was decided that only a selected number of wells would be included in the monitoring network for Aquifer Test 2. The wells excluded from Aquifer Test 2 showed no drawdown effects. As expected, Aquifer Test 2 generally showed more drawdown in surrounding observation wells than during Aquifer Test 1. The distance to the pumping well and observed drawdown for the wells in the monitoring network are presented in Table 3. Drawdown values in the observation wells ranged from 0.22 ft (GH-52) to 1.10 ft (PZ2-12). Drawdown results for Aquifer Test 1 and Aquifer Test 2 are presented on Figure 3. The drawdown results for

TEW-1-12, PZ-1-12, and PZ-2-12 during Aquifer Test 2 are shown in cross-section on Figure 4.

The drawdown curve (hydrograph) is included in Appendix E as Figure E.2. Hydrographs were generated from the pressure transducer data for the pumping well (TEW-1-12) and newly installed piezometers (PZ-1-12, PZ-2-12) and pumping rate data. The hydrograph shows the drawdown in feet prior to, during and immediately after the pumping test for each of the corresponding wells. Pumping rate data was also provided on Figure E.2 to convey the fluctuations and representative responses during Aquifer Test 2. The hydrograph shows a fairly substantial drawdown on the pumping well (TEW-1-12), and more extensive influences on the wells within the monitoring network than during Aquifer Test 2.

In addition to drawdown curves, distance vs. drawdown plots were generated and included in Appendix F as Figure F.2. Drawdown values recorded just prior to shutting the pump off were used in addition to a distance from the pumping well to ascertain whether a pattern existed between drawdown achieved and the proximity to the pumping well. Based on Figure F.2, it appears the majority of the wells had at least a drawdown of 0.30 ft during Aquifer Test 2. The results were generally consistent with the further the observation well from the pumping well, the smaller the drawdown response.

The background monitoring location GH-37A was not monitored during Aquifer Test 2 since a negligible drawdown was achieved based on Aquifer Test 1. The 0.05 ft of drawdown could be explained by daily variations within the water table and is therefore considered to be unaffected by the pumping of TEW-1-12.

AQTESOLV™ plots were generated for Aquifer Test 2 results and are provided in Appendix G and summarized in Table 4. Based on the AQTESOLV™ calculations, the hydraulic conductivity values for the lithology in the vicinity of TEW-1-12 range from 3.63×10^{-4} cm/sec to 7.94×10^{-4} cm/sec, with an overall hydraulic conductivity value of 4.68×10^{-4} cm/sec. This hydraulic conductivity value is representative of the fine grained silty sand with seams of silty clay observed during the drilling activities.

Although there was a substantial drawdown in the pumping well (TEW-1-12) during both of the aquifer pumping tests, the low hydraulic conductivity value, the fine grained stratigraphy, and low pumping rate resulted in a limited drawdown influence for the observation wells within the monitoring network.

4.0 CONCLUSIONS

Based on the results from the two aquifer pumping tests it is concluded that:

- The stratigraphy at TEW-1-12 in the saturated zone is mainly a fine grained silty sand with seams of silty clay
- The magnitude of drawdown for the pumping well was more than 12.5 ft
- The magnitude of drawdown for the monitoring network ranged from no effect to 1.1 ft (PZ-2-12)
- The pumping well yields could only be maintained at approximately 0.5 gpm
- The mean hydraulic conductivity value in the vicinity of TEW-1-12 is approximately 4.68×10^{-4} cm/sec and is representative of the predominantly fine-grained (silty sand) deposits of the Lower Fine Sand Aquifer
- The fine-grained nature of the sand unit in this area and associated low hydraulic conductivity of the aquifer material resulted in restricted drawdown away from the pumping well

5.0 RECOMMENDATIONS

Based on the aquifer test data presented in this memorandum, short term operation of one vertical extraction well would likely not be able to dewater the area below the bottom of the DWSD watermain, due to the fine-grained nature of the sand deposits in this area.

The Group is currently assessing additional options for improved performance and collection of groundwater in this area. Proposed options will be presented to U.S.EPA and MDEQ for review and comment.

GW-09
GH-49
GH-48
GW-11
GW-10
GW-06
GH-50
GH-51
GH-66
GH-52
GW-07
GH-53
GH-67
GH-68
GH-69
GH-05A
GH-06B
GH-95
RL-29
GH-30A
GH-30B
GH-75
GH-74
PZ-2-12
GH-62
GH-63
GH-31A
GH-31B
TEW-1-12
PZ-1-12
GH-73
GH-37A
ABANDONED RR GRADE
MINI POWER STATION
EXISTING DWSD EASEMENT
EXISTING 8'Ø DWSD WATERMAIN
TREATMENT FACILITY
M.H.
CO
S
W

N

0 40 120ft

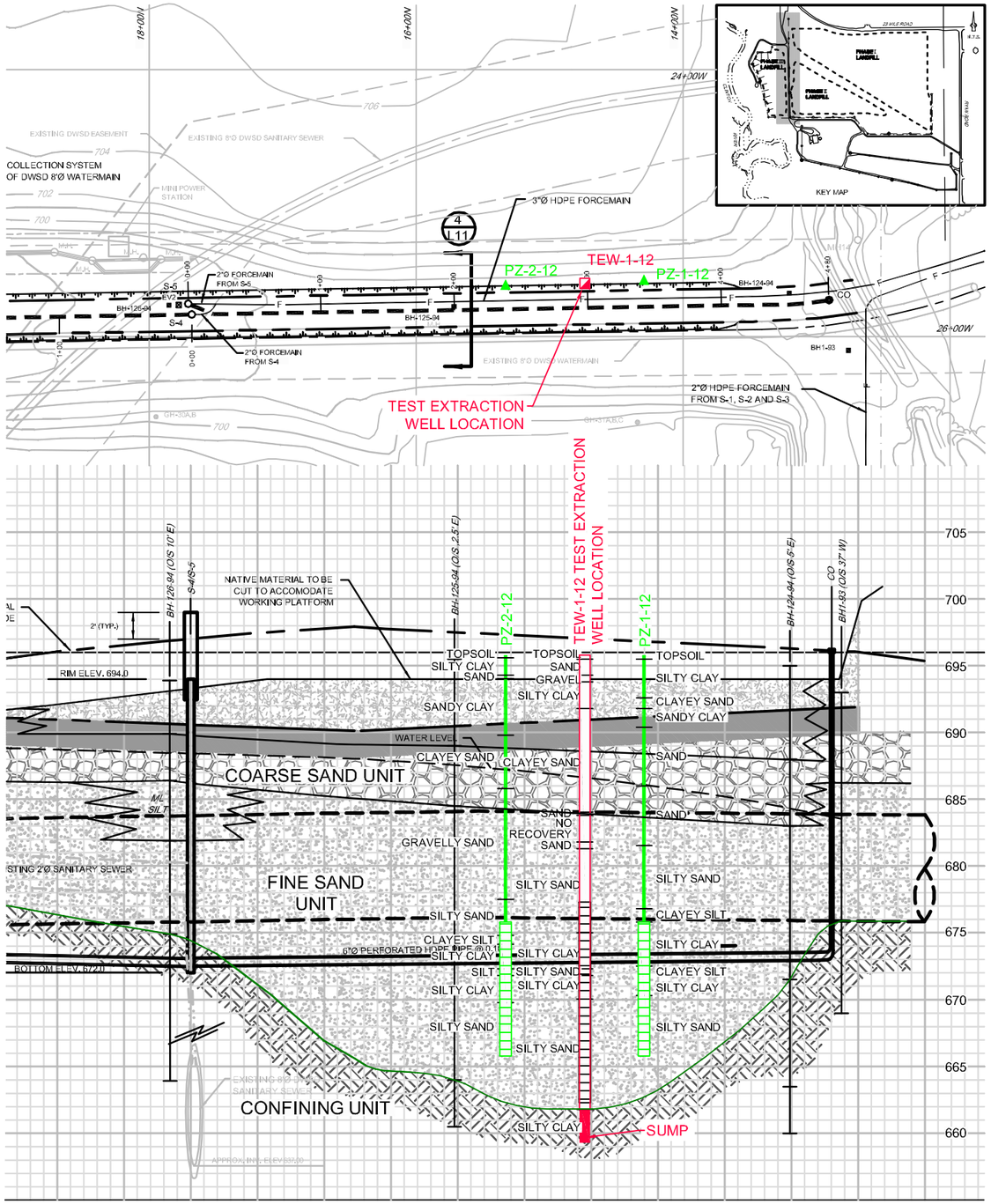
LEGEND

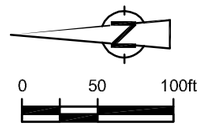
- LANDFILL BOUNDARY
- USEPA SITE FENCE/BOUNDARY
- DITCH, STREAM OR RIVER
- RAILROAD GRADE (ABANDONED)
- S — DWSD SANITARY SEWER
- W — DWSD WATERMAIN
- LEACHATE COLLECTION SYSTEM
- BARRIER WALL ALIGNMENT
- FORCEMAIN
- S-1 — COLLECTION SUMP
- CO — CLEANOUT
- GH-63 — EXISTING MONITORING WELL
- TEW-1-12 — TEST EXTRACTION WELL LOCATION
- PZ-2-12 — LOCATION FOR THE INSTALLATION OF AQUIFER TEST PIEZOMETER
- HYDRAULIC MONITORING LOCATION FOR THE AQUIFER TEST

figure 1

AQUIFER TEST STUDY AREA
G&H LANDFILL
Macomb County, Michigan

51853-2012(MEMO002)GN-WA001 SEP 13/2012





LEGEND

- 700 — CONTOUR AND ELEVATION (ft.AMSL)
- USEPA SITE FENCE/ BOUNDARY
- EDGE OF BUSH/TREELINE
- DITCH, STREAM, CHANNEL OR RIVER
- LIMIT OF WORKING PLATFORM
- LEACHATE COLLECTION DRAIN ALIGNMENT
- BARRIER WALL ALIGNMENT
- F — FORCEMAIN
- APPROX. FINAL CAP GRADE
- DWSD EASEMENT
- BURIED GAS LINE
- GH-30A,B — EXISTING MONITORING WELL
- BH2-93 — EXISTING BOREHOLE
- EV2 — ELECTRICAL VAULT
- S-6 — COLLECTION SUMP
- CO — CLEANOUT
- TEW-1-12 — TEST EXTRACTION WELL
- PZ-1-12 — AQUIFER TEST PIEZOMETER
- NATIVE MATERIAL
- GRANULAR DRAINAGE MEDIA (AGGREGATE TYPE A5)
- CLAY PLUG
- COARSE SAND UNIT
- FINE SAND UNIT
- CONFINING UNIT

figure 2

PLAN AND PROFILE FOR THE TEST EXTRACTION WELL G&H LANDFILL

Macomb County, Michigan

BACKGROUND MONITORING WELL → GH-37A (-0.05 ft) (NM)

ABANDONED RR

MINI POWER STATION

EXISTING DWSD EASEMENT

GW-09

GH-49

GH-48

RL-29

GH-75

GH-30A

GH-30B

M.H.

GW-11 (-0.08 ft) (NM)

GH-74 (-0.02 ft) (-0.34 ft)

PZ-2-12 (-0.32 ft) (-1.10 ft)

GH-62

GH-63

TEW-1-12 (-12.51 ft) (-10.57 ft)

GH-31A (0.05 ft) (NM)

GH-31B (0.02 ft) (-0.49 ft)

PZ-1-12 (-0.13 ft) (-0.67 ft)

GH-73 (0.03 ft) (-0.34 ft)

GW-06 (-0.01 ft) (NM)

GW-10 (A) (NM)

CO

GH-66 (-0.01 ft) (-0.27 ft)

GH-52 (0.02 ft) (-0.22 ft)

GW-07 (0.00 ft) (NM)

(0.03 ft) (-0.24 ft) GH-50

GH-51

GH-53 (-0.06 ft) (NM)

GH-67

GH-68 (0.00 ft) (NM)

GH-69

GH-95

GH-06B

GH-05A

EXISTING 8'Ø DWSD WATERMAIN

TREATMENT FACILITY

0 40 120ft

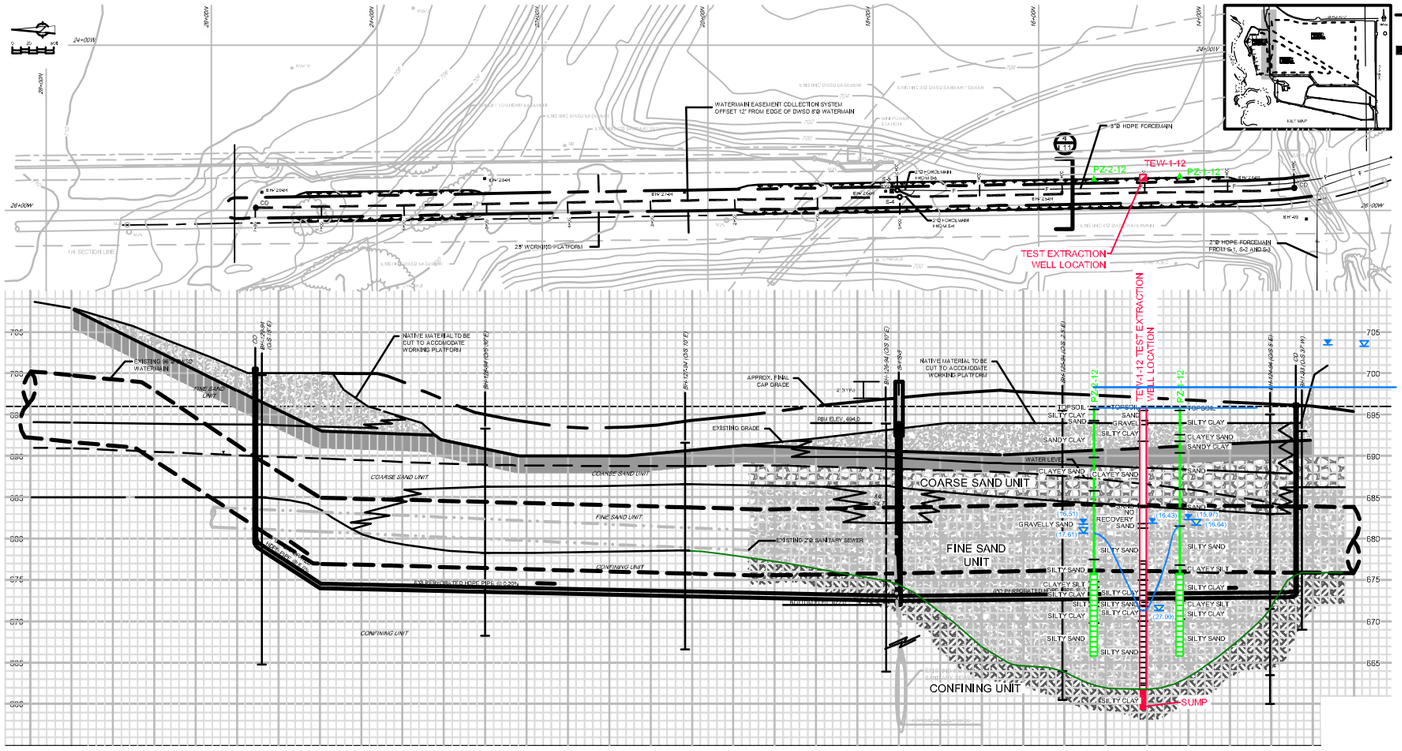
LEGEND

- LANDFILL BOUNDARY
- USEPA SITE FENCE/BOUNDARY
- DITCH, STREAM OR RIVER
- RAILROAD GRADE (ABANDONED)
- S — DWSD SANITARY SEWER
- W — DWSD WATERMAIN
- LEACHATE COLLECTION SYSTEM
- BARRIER WALL ALIGNMENT
- FORCEMAIN
- S-1 COLLECTION SUMP
- CO CLEANOUT
- GH-63 EXISTING MONITORING WELL
- TEW-1-12 TEST EXTRACTION WELL LOCATION
- PZ-2-12 LOCATION FOR THE INSTALLATION OF AQUIFER TEST PIEZOMETER
- HYDRAULIC MONITORING LOCATION FOR THE AQUIFER TEST
- (-0.01 ft) DRAWDOWN VALUES FOR 22 HOUR TEST
- (-0.27 ft) DRAWDOWN VALUES FOR 11-DAY TEST
- (NM) WATER LEVEL NOT MEASURED
- (A) ANOMALOUS READING

figure 3

AQUIFER TEST DRAWDOWN RESULTS
G&H LANDFILL
Macomb County, Michigan

0 92 183ft



LEGEND

- 700 — CONTOUR AND ELEVATION (ft.AMSL)
- USEPA SITE FENCE/ BOUNDARY
- EDGE OF BUSH/TREELINE
- DITCH, STREAM, CHANNEL OR RIVER
- LIMIT OF WORKING PLATFORM
- LEACHATE COLLECTION DRAIN ALIGNMENT
- BARRIER WALL ALIGNMENT
- F — FORCEMAIN
- APPROX. FINAL CAP GRADE
- DWSD EASEMENT
- BURIED GAS LINE
- GH-30A,B — EXISTING MONITORING WELL
- BH2-93 — EXISTING BOREHOLE
- EV2 — ELECTRICAL VAULT
- S-6 — COLLECTION SUMP
- CO — CLEANOUT
- TEW-1-12 — TEST EXTRACTION WELL
- PZ-1-12 — AQUIFER TEST PIEZOMETER
- (16,43) — STATIC WATER LEVEL (FEET BELOW TOP OF RISER)
- (27.00) — WATER LEVEL AT THE END OF 11 DAY TEST (FEET BELOW TOP OF RISER)
- NATIVE MATERIAL
- GRANULAR DRAINAGE MEDIA (AGGREGATE TYPE A5)
- CLAY PLUG
- COARSE SAND UNIT
- FINE SAND UNIT
- CONFINING UNIT

figure 4

DRAWDOWN RESULTS AT THE END OF THE 11 DAY TEST THE TEST EXTRACTION WELL G&H LANDFILL

Macomb County, Michigan

TABLE 1

2012 WELL COMPLETION DETAILS
AQUIFER TEST ASSESSMENT
G&H LANDFILL
MACOMB COUNTY, MICHIGAN

Location	Completion Date	X-Coordinate	Y-Coordinate	Ground Surface Elevation (ft AMSL)	Reference Elevation (ft btor)	Screened Interval Top (ft bgs)	Screened Interval Bottom (ft bgs)	Screened Lithology
TEW-1-12	29-Jun-12	13468542.0	427225.1	Not Surveyed	Not Surveyed	18.50	33.50	SILTY SAND, SOME SILT/CLAY
PZ-1-12	26-Jun-12	13468546.0	427180.7	Not Surveyed	Not Surveyed	20.00	30.00	SILTY SAND, SOME SILT/CLAY
PZ-2-12	26-Jun-12	13468539.0	427284.4	Not Surveyed	Not Surveyed	20.00	30.00	SILTY SAND, SOME SILT/CLAY

Notes:
ft AMSL - feet above mean sea level.
ft btor - feet below top of riser.
NA - Not Available.

TABLE 2

MANUAL GROUNDWATER DATA SUMMARY DURING THE 22-HOUR AQUIFER TEST (JULY 4, 2012)
AQUIFER TEST ASSESSMENT
G&H LANDFILL
MACOMB COUNTY, MICHIGAN

Well I.D.	*Distance From Pumping Well (ft)*	**7/4/12 10:00 AM** *Initial Manual Water Level (ft)* [2]	**7/5/12 8:00 AM** *Final Manual Water Level (ft)* [3]	*Drawdown (ft)* [4]
TEW-1-12[1]	0	16.62	29.13	-12.51
PZ-1-12	45	16.07	16.20	-0.13
PZ-2-12	59	16.62	16.94	-0.32
GH-73	73	16.61	16.58	0.03
GH-31A	78	18.22	18.17	0.05
GH-31B	79	18.23	18.21	0.02
GH-74	106	17.25	17.27	-0.02
GH-66	209	14.81	14.82	-0.01
GH-52	224	13.87	13.85	0.02
GH-53	249	13.21	13.27	-0.06
GW-06	254	31.39	31.40	-0.01
GH-50	260	16.71	16.68	0.03
GW-07	270	14.01	14.01	0.00
GH-68	275	14.67	14.67	0.00
GW-10	403	5.54	6.06	-0.52
GW-11	466	8.35	8.43	-0.08
GH-37A	694	14.90	14.95	-0.05

Notes:
(1) - TEW-1-12 is the Pumping Well.
(2) - "Initial Water Levels" were measured prior to the pumping test (manual water level readings).
(3) - "Final Water Levels" were measured just before the pumping test ended.
(4) - "Drawdown" is the difference between the initial water level and the final water level. Negative values refer to a decrease in water level (i.e., a "drawdown") and positive values refer to an increas in water level.
ft - feet below reference point

TABLE 3

MANUAL GROUNDWATER DATA SUMMARY DURING THE 11-DAY AQUIFER TEST (JULY 23 TO AUGUST 3, 2012)
AQUIFER TEST ASSESSMENT
G&H LANDFILL
MACOMB COUNTY, MICHIGAN

Well I.D.	*Distance From Pumping Well (ft)*	**7/23/12 11:00 AM** *Initial Manual Water Level (ft)* [2]	**8/3/12 11:00 AM** *Final Manual Water Level (ft)* [3]	*Drawdown (ft)* [4]
TEW-1-12	0.0	16.43	27.00	-10.57
PZ-1-12	45	15.97	16.64	-0.67
PZ-2-12	59	16.51	17.61	-1.10
GH-73	73	16.71	17.05	-0.34
GH-31B	79	18.48	18.97	-0.49
GH-74	106	17.62	17.96	-0.34
GH-66	209	15.01	15.28	-0.27
GH-52	224	13.98	14.20	-0.22
GH-50	260	17.16	17.40	-0.24

Notes:
(1) - TEW-1-12 is the Pumping Well.
(2) - "Initial Water Levels" were measured prior to the pumping test (manual water level readings).
(3) - "Final Water Levels" were measured just before the pumping test ended.
(4) - "Drawdown" is the difference between the initial water level and the final water level. Negative values refer to a decrease in water level (i.e., a "drawdown") and positive values refer to an increase in water level.
ft - feet below reference point

TABLE 4

HYDRAULIC PARAMETER SUMMARY - 11-DAY AQUIFER TEST
AQUIFER TEST ASSESSMENT
G&H LANDFILL
MACOMB COUNTY, MICHIGAN

Location	Solution Method	Aquifer Model	Transmissivity (ft^2/sec)	Saturated Thickness (ft)	Hydraulic Conductivity (cm/sec)
TEW-1-12	Cooper-Jacob	Unconfined	2.70E-04	15	5.49E-04
TEW-1-12	Theis	Unconfined	3.91E-04	15	7.94E-04
				Geometric Mean TEW-1-12:	***6.61E-04***
PZ-1-12	Cooper-Jacob	Unconfined	1.87E-04	15	3.80E-04
PZ-1-12	Theis	Unconfined	1.79E-04	15	3.63E-04
				Geometric Mean PZ-1-12:	***3.72E-04***
PZ-2-12	Cooper-Jacob	Unconfined	1.79E-04	15	3.63E-04
PZ-2-12	Theis	Unconfined	2.36E-04	15	4.79E-04
				Geometric Mean PZ-2-12:	***4.17E-04***

Notes:
ft^2/sec - square feet per second.
ft - feet.
cm/sec - centimeters per second.

APPENDIX A

2012 STRATIGRAPHIC AND INSTRUMENTATION LOGS

STRATIGRAPHIC AND INSTRUMENTATION LOG (OVERBURDEN)

PROJECT NAME: G&H LANDFILL
PROJECT NUMBER: 051853
CLIENT: G&H LANDFILL PRP GROUP
LOCATION: SHELBY TOWNSHIP, MI

HOLE DESIGNATION: TEW-1-12
DATE COMPLETED: June 29, 2012
DRILLING METHOD: HSA
FIELD PERSONNEL: C. BONDY

DEPTH ft BGS	STRATIGRAPHIC DESCRIPTION & REMARKS	DEPTH ft BGS
	TOPSOIL	0.30
	SP-SAND (FILL), with silt, trace gravel, fine sand, fine to coarse gravel, poorly graded, compact, brown, moist	1.50 / 2.00
	GP-GRAVEL (FILL), fine to coarse grained, poorly graded, compact, gray, moist	
	CL-SILTY CLAY (FILL), trace sand and gravel, fine to medium sand, fine to coarse gravel, low plasticity, stiff, brown, moist	4.00
	SC-CLAYEY SAND (FILL), with gravel, fine to medium sand, fine to coarse gravel, poorly graded, compact, brown, moist - 2" silty clay lens at 5.3ft BGS - dense at 6.0ft BGS - with silt, compact at 8.0ft BGS	
	SP-SAND, with gravel, fine to coarse sand, fine to coarse gravel, poorly graded, brown, moist	11.75 / 12.00
	NO RECOVERY	
	SP-SAND, with gravel, fine to coarse sand, fine to coarse gravel, poorly graded, brown, wet	14.00 / 14.50
	SM-SILTY SAND, fine grained, compact, brown, wet	
	CL-SILTY CLAY, moderate plasticity, firm, gray, moist	20.80
	SM-SILTY SAND, fine grained, compact, gray, wet	23.50 / 24.00
	CL-SILTY CLAY, moderate plasticity, very stiff, gray, moist	25.75
	SM-SILTY SAND, fine grained, compact, gray, wet - very dense at 28.0ft BGS	

MONITORING WELL: PVC RISER; CONCRETE; 6" STAINLESS STEEL WELL CASING; BENTONITE GROUT; BENTONITE CHIPS; 6" STAINLESS STEEL WELL SCREEN; SAND PACK

SAMPLE NUMBER	INTERVAL	REC (%)	'N' VALUE	PID (ppm)
1SS		80	10	1.6
2SS		75	11	2.3
3SS		70	14	1.5
4SS		80	41	1.9
5SS		90	25	1.3
6SS		80	7	1.5
7SS		0	--	--
8SS		80	20	1.1
9SS		90	25	2.0
10SS		85	17	1.4
11SS		75	6	2.1
12SS		95	14	0.7
13SS		100	20	1.3
14SS		100	21	1.4
15SS		85	73	1.4
16SS		100	--	0.8

NOTES: MEASURING POINT ELEVATIONS MAY CHANGE; REFER TO CURRENT ELEVATION TABLE

STRATIGRAPHIC AND INSTRUMENTATION LOG (OVERBURDEN)

PROJECT NAME: G&H LANDFILL
PROJECT NUMBER: 051853
CLIENT: G&H LANDFILL PRP GROUP
LOCATION: SHELBY TOWNSHIP, MI

HOLE DESIGNATION: TEW-1-12
DATE COMPLETED: June 29, 2012
DRILLING METHOD: HSA
FIELD PERSONNEL: C. BONDY

DEPTH ft BGS	STRATIGRAPHIC DESCRIPTION & REMARKS	DEPTH ft BGS	MONITORING WELL	SAMPLE NUMBER	SAMPLE INTERVAL	SAMPLE REC (%)	SAMPLE 'N' VALUE	SAMPLE PID (ppm)
34				17SS		100	--	1.6
	CL-SILTY CLAY, trace sand and gravel, fine to medium sand, fine gravel, moderate plasticity, stiff, gray, moist	34.00	SUMP	18SS		85	25	0.6
36	END OF BOREHOLE @ 36.5ft BGS	36.50						
38								
40								
42								
44								
46								
48								
50								
52								
54								
56								
58								
60								
62								
64								

WELL DETAILS
Screened interval:
18.50 to 33.50ft BGS
Length: 15ft
Diameter: 6in
Slot Size: 0.010
Material: STAINLESS STEEL
Seal:
11.50 to 13.50ft BGS
Material: BENTONITE CHIPS
Sand Pack:
13.50 to 36.50ft BGS
Material: SAND

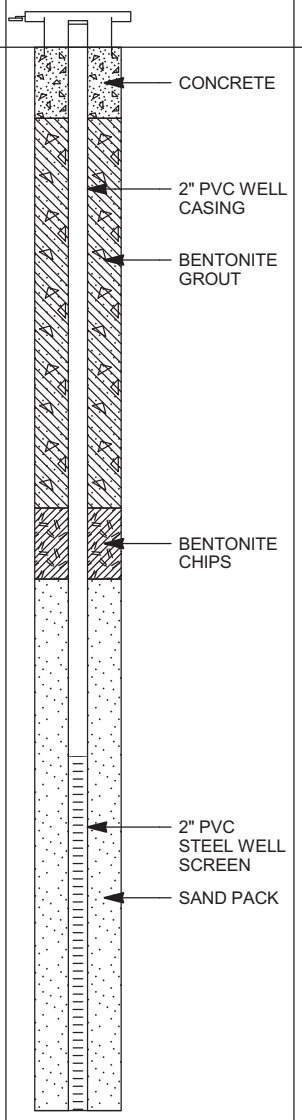
NOTES: MEASURING POINT ELEVATIONS MAY CHANGE; REFER TO CURRENT ELEVATION TABLE

STRATIGRAPHIC AND INSTRUMENTATION LOG (OVERBURDEN)

PROJECT NAME: G&H LANDFILL
PROJECT NUMBER: 051853
CLIENT: G&H LANDFILL PRP GROUP
LOCATION: SHELBY TOWNSHIP, MI

HOLE DESIGNATION: PZ-1-12
DATE COMPLETED: June 26, 2012
DRILLING METHOD: HSA
FIELD PERSONNEL: C. BONDY

DEPTH ft BGS	STRATIGRAPHIC DESCRIPTION & REMARKS	DEPTH ft BGS
	TOPSOIL	0.30
2	CL-SILTY CLAY (FILL), trace sand and gravel, fine to medium sand, fine to coarse gravel, low plasticity, stiff, brown, moist	3.20
4	SC-CLAYEY SAND (FILL), with gravel, fine to medium sand, fine to coarse gravel, poorly graded, compact, brown, very moist	4.00
	- moist at 3.5ft BGS	5.40
6	CL-SANDY CLAY (FILL), with silt, trace gravel, fine to medium sand, fine to coarse gravel, low plasticity, stiff, brown, moist	
8	SP-SAND (FILL), with clay, trace silt and gravel, fine to medium sand, fine to coarse gravel, poorly graded, dense, brown, moist	9.80
10	- compact at 8.0ft BGS	
12	SP-SAND, trace gravel, fine to medium sand, fine to coarse gravel, poorly graded, compact, brown, moist	
	- with gravel at 10.8ft BGS	
14	- trace gravel at 11.3ft BGS	14.25
	- gravelly sand at 12.0ft BGS	
16	SM-SILTY SAND, fine grained, compact, brown, wet	
	- fine to medium grained, poorly graded at 16.0ft BGS	
18	- fine grained at 16.7ft BGS	
	ML-CLAYEY SILT, no plasticity, compact, brown, wet	19.00
20	CL-SILTY CLAY, low plasticity, very stiff, brown, moist	20.00
22		
	ML-CLAYEY SILT, no plasticity, compact, brown, wet	23.30
24	CL-SILTY CLAY, low plasticity, very stiff, brown, moist	24.15
26	SM-SILTY SAND, fine grained, dense, gray, wet	25.50
	- very dense at 28.0ft BGS	
28		
30	END OF BOREHOLE @ 30.0ft BGS	30.00
32		
34		
36		
38		



WELL DETAILS
Screened interval:
20.00 to 30.00ft BGS
Length: 10ft
Diameter: 2in
Slot Size: 0.010
Material: PVC
Seal:
13.00 to 15.00ft BGS
Material: BENTONITE CHIPS
Sand Pack:
15.00 to 30.00ft BGS
Material: SAND

SAMPLE NUMBER	INTERVAL	REC (%)	'N' VALUE	PID (ppm)
1SS		100	14	2.6
2SS		85	15	3.6
3SS		95	11	3.6
4SS		75	34	2.8
5SS		40	27	4.5
6SS		70	21	2.9
7SS		30	51	1.6
8SS		55	17	1.5
9SS		100	22	2.9
10SS		100	10	1.1
11SS		70	16	2.7
12SS		90	15	1.6
13SS		100	29	1.7
14SS		65	32	1.8
15SS		100	73	1.2

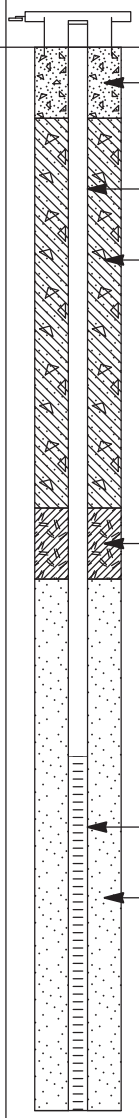
NOTES: MEASURING POINT ELEVATIONS MAY CHANGE; REFER TO CURRENT ELEVATION TABLE

STRATIGRAPHIC AND INSTRUMENTATION LOG (OVERBURDEN)

PROJECT NAME: G&H LANDFILL
PROJECT NUMBER: 051853
CLIENT: G&H LANDFILL PRP GROUP
LOCATION: SHELBY TOWNSHIP, MI

HOLE DESIGNATION: PZ-2-12
DATE COMPLETED: June 26, 2012
DRILLING METHOD: HSA
FIELD PERSONNEL: C. BONDY

DEPTH ft BGS	STRATIGRAPHIC DESCRIPTION & REMARKS	DEPTH ft BGS
	TOPSOIL	0.20
2	CL-SILTY CLAY (FILL), trace sand and gravel, fine sand, fine to coarse gravel, low plasticity, firm to stiff, brown, moist	1.50 1.75
4	SP-SAND (FILL), with gravel, fine to coarse sand, fine to coarse gravel, poorly graded, loose, brown, moist	
6	CL-SANDY CLAY (FILL), with gravel, fine sand, fine to coarse gravel, low plasticity, stiff, brown, moist	6.00
8	- silty clay, trace sand and gravel at 2.0ft BGS - sandy clay, trace silt and gravel at 4.0ft BGS - silty clay, trace sand and gravel at 5.3ft BGS	
10	SC-CLAYEY SAND (FILL), with silt and gravel, fine to medium sand, fine to coarse gravel, poorly graded, compact, brown, moist	10.00
12	- trace glass debris at 7.5ft BGS	
14	SP-GRAVELLY SAND, trace silt, fine to coarse sand, fine to coarse gravel, poorly graded, dense, brown, moist - wet at 14.0ft BGS	
16	- trace gravel at 16.3ft BGS	
18	SM-SILTY SAND, fine grained, dense, brown, wet	18.30
20		21.00
22	ML-CLAYEY SILT, low plasticity, stiff, gray, wet CL-SILTY CLAY, moderate plasticity, stiff, gray, moist	21.65 23.50
24	ML-SILT, with clay and sand, fine grained, no plasticity, compact, gray, wet	24.00
26	CL-SILTY CLAY, low plasticity, stiff, gray, moist SM-SILTY SAND, fine grained, dense, brown, wet	26.00
28		
30	END OF BOREHOLE @ 30.0ft BGS	30.00
32		
34		
36		
38		



WELL DETAILS
Screened interval:
20.00 to 30.00ft BGS
Length: 10ft
Diameter: 2in
Slot Size: 0.010
Material: PVC
Seal:
13.00 to 15.00ft BGS
Material: BENTONITE CHIPS
Sand Pack:
15.00 to 30.00ft BGS
Material: SAND

SAMPLE NUMBER	INTERVAL	REC (%)	'N' VALUE	PID (ppm)
1SS		85	9	0.3
2SS		70	8	0.9
3SS		70	18	1.0
4SS		70	32	1.3
5SS		65	13	1.6
6SS		60	39	1.7
7SS		70	34	1.7
8SS		70	20	2.1
9SS		70	15	2.6
10SS		80	31	2.4
11SS		75	10	1.1
12SS		90	18	1.4
13SS		80	12	1.2
14SS		100	50	0.9
15SS		90	50	0.6

NOTES: MEASURING POINT ELEVATIONS MAY CHANGE; REFER TO CURRENT ELEVATION TABLE

APPENDIX B

PRECIPITATION DATA

CRA
CONESTOGA-ROVERS & ASSOCIATES

PROJECT No.: 051853-2012-24
PROJECT NAME: _____
DATE: _____

DESIGNED BY: DLJ
CHECKED BY: _____
PAGE _____ OF _____

Date	inches/24hr (or weekend)
07/03	0.3
07/05	2.8
07/06	6.6
07/09	6.0 (wkend)
07/10	0.0
07/17	0.0
07/18	6.2
07/19	0.5
07/20	0.3
07/23	0.0 (wkend)
07/24	0.0
07/26	0.8
07/27	0.3
07/30	0.0" (Wkend)
08/01	0.0"
08/02	0.0
08/03	0.0
08/06	0.3
08/07	0.0
08/09	1.2
08/10	0.9
08/13	2.3 (wkend
08/14	1.0
08/15	0.0
08/16	0.0

APPENDIX C

GROUNDWATER DATA FOR THE 22-HOUR AQUIFER TEST

PUMPING TEST - DRAWDOWN DATA

Well No.: TEW-1-12 (transducer S/N - 172154 skot-915)

Project No.: 51853 Project Name: G & H Landfill

Date: 7/9/12 to 7/5/12 Type of Test: _____

CRA Supervisor: D. Rivers / C. Bondy / E. Mickelson Pump Setting: _____ amsl

Pumped Well No.: TEW-1-12

Screened Interval: _____ to _____ Pumping Rate (Q): 0.6 gpm / 1 gpm

Aquifer Thickness: _____ Datum Point: _____ Datum Point Elevation: _____ amsl

Static Water Level: 16.62 (head - 21.81) ☐ Confined ☐ Unconfined

Time			Elapsed Time (min.)	Water Level	Drawdown	Q	Elapsed Time	Q Remarks	Water Level	Time
Day	Hr.	Min.								
7/9	10	00	0	16.62		0.6 gpm	35.0	~1 gpm	21.54	
Start at			0.5	16.93			40		21.56	
	0.6 gpm		1.0	17.15			45		22.03	
			1.5	17.41			50		22.62	
			2.0	17.61			55		23.19	
			2.5	17.82			60		23.68	11:00
			3.0	18.02			80		24.59	
			3.5	18.22			100		25.48	
			4.0	18.39			120		26.13	12:00
			4.5	18.56		adjust flow rate back to 1 gpm	150	0.7	26.73	
			5.0	18.73			180	1.0	27.60	13:00
			6.0	18.96			210		28.18	
			7.0	19.21			240		28.30	14:00
			8.0	19.42					28.45	15:00
			9.0	19.57					28.31	16:00
			10.0	19.74					28.38	17:00
			15.0	20.31					28.52	18:00
	10	20	20.0	20.58					28.17	19:00
			25.0	20.82					28.21	20:00
	10	30	30.0	20.86		1.0			28.13	21:00

Increase flow rate at 30 min to 1 gpm

PUMPING TEST - DRAWDOWN DATA

Well No.: TEW-1-12 (transd. - S/N 172154)

Project No.: 51853 Project Name: G & H Landfill

Date: 7/3/12 to 7/5/12 Type of Test:

CRA Supervisor: D. Rivers / C. Bundy / E. Mickelson Pump Setting: _____ amsl

Pumped Well No.: TEW-1-12

Screened Interval: _____ to _____ Pumping Rate (Q): _____

Aquifer Thickness: _____ Datum Point: _____ Datum Point Elevation: _____ amsl

Static Water Level: 16.62 ☐ Confined ☐ Unconfined

Time			Elapsed Time (min.)	Water Level	Drawdown	Q	Remarks
Day	Hr.	Min.					
	~~42~~	~~00~~ Day	~~0~~				
			~~To~~				
	22	00		27.86		1gpm	
	23	00		27.92			
	00	00		27.12			← adjusted flow back to 1.0 gal/min from ~~2~~ 1.5 gal/min.
7/5	01	00		28.74			
	02	15		29.28			
	03	00		29.04			
	04	15		26.15			← large change even though purge rate has not changed
	05	15		29.72			
	06	10		28.47			
	07	00		29.13			
	7	55		—			755 pump stops pumping - water level / recharge starts - reset pump
Stop	8	04					stops pumping - pump no longer working
Recovery	8	06		27.95			recovery
	8	07		27.78			
	8	08		27.51			
	8	09		27.27			

PUMPING TEST - DRAWDOWN DATA

Well No.: TEW-1-12

Project No.: 51853 Project Name: G & H Landfill

Date: 7/4/12 to 7/5/12 Type of Test: _____

CRA Supervisor: D. Rivers / C. Bondy / E. Mickelson Pump Setting: _____ amsl

Pumped Well No.: TEW-1-12

Screened Interval: _____ to _____ Pumping Rate (Q): _____

Aquifer Thickness: _____ Datum Point: _____ Datum Point Elevation: _____ amsl

Initial
Static Water Level: 16.62 ☐ Confined ☐ Unconfined

Time			Elapsed Time (min.)	Water Level	Drawdown	Q	Remarks
Day	Hr.	Min.					
7/5	8	10		26.97			recovery
	8	15		25.75			
	8	20		24.54			
	9	32		22.30			
	9	00		18.58			
	9	10		17.83			
	9	20		17.32			
	9	30		17.08			
	10	00		16.78			
	11	00		16.70			

PUMPING TEST - DRAWDOWN DATA

Well No.: PZ-1-12 (transducer S/N- 171267) start- 917

Project No.: 51853 Project Name: G & H Landfill

Date: 7/4/12 to 7/5/12 Type of Test: _____

CRA Supervisor: D. Rivers/C. Bondy/E. Mickelson Pump Setting: _____ amsl

Pumped Well No.: TEW-1-12

Screened Interval: _____ to _____ Pumping Rate (Q): _____

Aquifer Thickness: _____ Datum Point: _____ Datum Point Elevation: _____ amsl

Static Water Level: 16.07 (head - 15.81) ☐ Confined ☐ Unconfined

Time			Elapsed Time (min.)	Water Level	Drawdown	Q	Remarks
Day	Hr.	Min.					
7/4	10	00	0			~0.6	
			10	16.09			
	10	20	20	16.10			
increase rate of pump well to 1gpm →			30	16.10			increase Q to 1gpm at pumping well
			40	16.10		~1.0	
			50	16.11			
	11	00	60	16.11			
			80	16.13			
			100	16.14			
	12	00	120	16.15			
			150	16.15		~0.7	adj flow back to 1gpm
			180	16.16		~1.0	
			210	16.17			
	14	00	240	16.18			
	15	00		16.19			
	16	00		16.19			
	17	00		16.19			
	18	00		16.19			
	19	00		16.19			
	20	00		16.22			

PUMPING TEST - DRAWDOWN DATA

Well No.: PZ-1-12

Project No.: 51853 Project Name: G & H Landfill

Date: 7/3/12 to 7/5/12 Type of Test: _____

CRA Supervisor: D. Rivers / C. Bundy / E. Mickelson Pump Setting: _____ amsl

Pumped Well No.: TEW-1-12

Screened Interval: _____ to _____ Pumping Rate (Q): _____

Aquifer Thickness: _____ Datum Point: _____ Datum Point Elevation: _____ amsl

Static Water Level: 16.07 ☐ Confined ☐ Unconfined

Time			Elapsed Time (min.)	Water Level	Drawdown	Q	Remarks
Day	Hr.	Min.					
	21	00		16.21		~1 gpm	
	22	00		16.21			
	23	00		16.21			
	00	00		16.23			
7/5	01	00		16.23			
	02	15		16.23			
	03	00		16.22			
	04	15		16.21			
	05	15		16.23			
	06	10		16.22			
	07	00		16.20			stop pump
	8	10		16.20			stop pumping @ 805
	9	05		16.15			recovery
	9	20		16.14			
	9	30		16.13			
	10	00		16.12			
	11	60		16.09			

PUMPING TEST - DRAWDOWN DATA

Well No.: PZ-2-12 (transducer S/N 171222) start time - 912

Project No.: 51853 Project Name: G & H Landfill

Date: 7/9/12 to 7/5/12 Type of Test: _____

CRA Supervisor: D. Rivers / C. Bondy / E. Mickelson Pump Setting: _____ amsl

Pumped Well No.: TEW-1-12

Screened Interval: _____ to _____ Pumping Rate (Q): _____

Aquifer Thickness: _____ Datum Point: _____ Datum Point Elevation: _____ amsl

Static Water Level: 16.62 (head - 15.37) ☐ Confined ☐ Unconfined

Time			Elapsed Time (min.)	Water Level	Drawdown	Q	Remarks
Day	Hr.	Min.					
7/9	10	00	0			~0.6	
			10	16.65			
			20	16.67			
	10	30	30	16.70			increase Q to 1gpm at pumping well
			40	16.71		~1.0	
			50	16.72			
	11	00	60	16.74			
			80	16.79			
			100	16.82			
	12	00	120	16.85			
			150	16.86		0.7	adj flow back to 1gpm
			180	16.89		1.0	
			210	16.91			
	14	00	240	16.91			
	15	00		16.92			
	16	00		16.93			
	17	00		16.92			
	18	00		16.92			
	19	00		16.93			
	20	00		16.95			

PUMPING TEST - DRAWDOWN DATA

Well No.: PZ-2-12

Project No.: 51853 Project Name: G + H Landfill

Date: 7/3/12 to 7/5/12 Type of Test:

CRA Supervisor: D. Rivers / C. Bundy / E. Mickelson Pump Setting: _____ amsl

Pumped Well No.: TEW-1-12

Screened Interval: _____ to _____ Pumping Rate (Q): _____

Aquifer Thickness: _____ Datum Point: _____ Datum Point Elevation: _____ amsl

Static Water Level: 16.62 ☐ Confined ☐ Unconfined

Time			Elapsed Time (min.)	Water Level	Drawdown	Q	Remarks
Day	Hr.	Min.					
	21	00		16.94		~1gpm	
	22	00		16.93			
	23	00		16.93			
	00	00		16.92			
7/5	01	00		16.96			
	02	15		16.97			
	03	00		16.96			
	04	15		16.95			
	05	15		16.97			
	06	10		16.94			
stop pump →	07	00		16.94			
recovery	8	10		16.92			stop pumping at 805
	9	05		16.75			
	9	20		16.72			
	9	30		16.70			
	10	00		16.65			
	11	00		16.63			

PUMPING TEST - DRAWDOWN DATA

Well No.: GH-73 (transducer S/N - 171277 start - 920)

Project No.: 51853 Project Name: G & H Landfill

Date: 7/4/12 to 7/5/12 Type of Test:

CRA Supervisor: D. Rivers / C. Bondy / E. Mickelson Pump Setting: _____ amsl

Pumped Well No.: TEW-1-12

Screened Interval: _____ to _____ Pumping Rate (Q): _____

Aquifer Thickness: _____ Datum Point: _____ Datum Point Elevation: _____ amsl

Static Water Level: 16.61 (head - 10.79) ☐ Confined ☐ Unconfined

Time			Elapsed Time (min.)	Water Level	Drawdown	Q	Remarks
Day	Hr.	Min.					
7/4	10	00	0			~0.6	
			10	16.62			
			20	16.61			
	10	30	30	16.608			increase Q to 1gpm at pumping well
			40	16.61		~1.0	
			50	16.61			
	11	00	60	16.61			
			80	16.61			
			100	16.61			
	12	00	120	16.61			
			150	16.61		~0.7	adj. flow back to 1gpm
			180	16.60		~1.0	
			210	16.60			
	14	00	240	16.59			
	15	00		16.57			
	16	00		16.56			
	17	00		16.56			
	18	00		16.56			
	19	00		16.57			
	20	00		16.61			

PUMPING TEST - DRAWDOWN DATA

Well No.: GH-73

Project No.: 51853 Project Name: G & H Landfill

Date: 7/4/12 to 7/5/12 Type of Test: _____

CRA Supervisor: D. Rivers / C. Bundy / E. Mickelson Pump Setting: _____ amsl

Pumped Well No.: TEW-1-12

Screened Interval: _____ to _____ Pumping Rate (Q): _____

Aquifer Thickness: _____ Datum Point: _____ Datum Point Elevation: _____ amsl

Static Water Level: _____ ☐ Confined ☐ Unconfined

Time			Elapsed Time (min.)	Water Level	Drawdown	Q	Remarks
Day	Hr.	Min.					
	21	00		16.60		~15gpm	
	22	00		16.58			
	23	00		16.59			
	00	00		16.62			
7/5	01	00		16.62			
	02	15		16.62			
	03	00		16.62			
	04	15		16.62			
	05	15		16.63			
	06	10		16.61			
stop pump	07	00		16.58		→ stop 805	
	8	10		16.58			
recovery	9	35		16.60			
	10	00		16.60			

PUMPING TEST - DRAWDOWN DATA

Well No.: GH-74

Project No.: 51853 Project Name: G & H Landfill

Date: 7/9/12 to 7/5/12 Type of Test: _____

CRA Supervisor: D. Rivers / C. Bondy / E. Mickelson Pump Setting: _____ amsl

Pumped Well No.: TEW-1-12

Screened Interval: _____ to _____ Pumping Rate (Q): _____

Aquifer Thickness: _____ Datum Point: _____ Datum Point Elevation: _____ amsl

Static Water Level: 17.25 ☐ Confined ☐ Unconfined

Time			Elapsed Time (min.)	Water Level	Drawdown	Q	Remarks
Day	Hr.	Min.					
7/9	10	00	0			~0.6	
			10	17.27			
			20	17.27			
	10	30	30	17.28			increase Q to 1gpm at
			40	17.26		~1.0	pumping well
			50	17.28			
	11	00	60	17.28			
			80	17.26			
			100	17.27			
	12	00	120	17.27			
			150	17.26			
			180	17.26			
			210	17.26			
	14	00	240	17.26			
	15	00		17.27			
	16	00		17.28			
	17	00		17.27			
	18	00		17.27			
	19	00		17.27			
	20	00		17.30			

PUMPING TEST - DRAWDOWN DATA

Well No.: GH-74

Project No.: 51853 Project Name: G & H Landfill

Date: 7/3/12 to 7/5/12 Type of Test: _____

CRA Supervisor: D. Rivers / C. Bundy / E. Mickelson Pump Setting: _____ amsl

Pumped Well No.: TEW-1-12

Screened Interval: _____ to _____ Pumping Rate (Q): _____

Aquifer Thickness: _____ Datum Point: _____ Datum Point Elevation: _____ amsl

Static Water Level: _____ ☐ Confined ☐ Unconfined

Time			Elapsed Time (min.)	Water Level	Drawdown	Q	Remarks
Day	Hr.	Min.					
	21	00		17.29		~19gpm	
	22	00		17.28			
	23	00		17.28			
	00	00		17.29			
7/5	01	00		17.30			
	02	15		17.29			
	03	00		17.29			
	04	15		17.28			
	05	15		17.30			
	06	10		17.29			
stop pump →	07	00		17.27		→	stop @05
accidentally	8	10		17.26			
	9	35		17.27			
	10	00		17.26			

PUMPING TEST - DRAWDOWN DATA

Well No.: GH-31B (transducer S/N 171281 start - 923)

Project No.: 51853 Project Name: G & H Landfill

Date: 7/4/12 to 7/5/12 Type of Test:

CRA Supervisor: D.Rivers/C. Bondy / E.Mickelson Pump Setting: _____ amsl

Pumped Well No.: TEW-1-12

Screened Interval: _____ to _____ Pumping Rate (Q): _____

Aquifer Thickness: _____ Datum Point: _____ Datum Point Elevation: _____ amsl

Static Water Level: 18.23 (head - 15.26) ☐ Confined ☐ Unconfined

Time			Elapsed Time (min.)	Water Level	Drawdown	Q	Remarks
Day	Hr.	Min.					
7/4	10	00	0			~0.6	
			12	18.25			
			22	18.25			
	10	32	32	18.24			Increase Q to 1gpm at pumping well
			42	18.24		~1.0	
			52	18.24			
	11	02	62	18.24			
			82	18.24			
			102	18.24			
	12	02	122	18.24			
			152	18.23			
			182	18.22			
			212	18.21			
	14	02	242	18.21			
	15	02		18.21			
	16	02		18.19			
	17	02		18.19			
	18	02		18.19			
	19	02		18.19			
	20	02		18.22			

PUMPING TEST - DRAWDOWN DATA

Well No.: GH-31B

Project No.: 51853 Project Name: G & H Landfill

Date: 7/4/12 to 7/5/12 Type of Test: _____

CRA Supervisor: D. Rivers / C. Bundy / E. Mickelson Pump Setting: _____ amsl

Pumped Well No.: TEW-1-12

Screened Interval: _____ to _____ Pumping Rate (Q): _____

Aquifer Thickness: _____ Datum Point: _____ Datum Point Elevation: _____ amsl

Static Water Level: _____ ☐ Confined ☐ Unconfined

Time			Elapsed Time (min.)	Water Level	Drawdown	Q	Remarks
Day	Hr.	Min.					
	21	02		18.22			
	22	02		18.21			
	23	02		18.20			
	00	00		18.22			
7/5	01	00		18.24			
	02	15		18.23			
	03	00		18.23			
	04	15		18.22			
	05	15		18.24			
	06	10		18.22			
Stop Pump →	07	00		18.21			→ stop @ 5
	8	12		18.20			
	9	36		18.21			
	10	06		18.21			

PUMPING TEST - DRAWDOWN DATA

Well No.: GH-31A

Project No.: 51853 Project Name: G & H Landfill

Date: 7/4/12 to 7/5/12 Type of Test: _____

CRA Supervisor: D. Rivers / C. Bundy / E. Mickelson Pump Setting: _____ amsl

Pumped Well No.: TEW-1-12

Screened Interval: _____ to _____ Pumping Rate (Q): _____

Aquifer Thickness: _____ Datum Point: _____ Datum Point Elevation: _____ amsl

Static Water Level: 18.22 ☐ Confined ☐ Unconfined

Time			Elapsed Time (min.)	Water Level	Drawdown	Q	Remarks
Day	Hr.	Min.					
7/4	10	00	0			~0.6	
			12	18.24			
			22	18.24			
	10	32	32	18.24			increase Q to 1 gpm
			92	18.24		~1.0	at pumping well
			52	18.24			
	11	02	62	18.24			
			82	18.24			
			102	18.24			
	12	02	122	18.24			
			152	18.21			
			182	18.21			
			212	18.20			
	14	02	242	18.19			
	15	02		18.19			
	16	02		18.18			
	17	02		18.17			
	18	02		18.16			
	19	02		18.17			
	20	02		18.20			

PUMPING TEST - DRAWDOWN DATA

Well No.: GH-31A

Project No.: 51853 Project Name: G & H Landfill

Date: 7/4/12 to 7/5/12 Type of Test: _____

CRA Supervisor: D. Rivers / C. Bondy / E. Mickelson Pump Setting: _____ amsl

Pumped Well No.: TEW-1-12

Screened Interval: _____ to _____ Pumping Rate (Q): _____

Aquifer Thickness: _____ Datum Point: _____ Datum Point Elevation: _____ amsl

Static Water Level: _____ ☐ Confined ☐ Unconfined

Time			Elapsed Time (min.)	Water Level	Drawdown	Q	Remarks
Day	Hr.	Min.					
	21	02		18.19		~1gpm	
	22	02		18.18			
	23	02		18.19			
	00	00		18.21			
7/5	01	00		18.22			
	02	15		18.21			
	03	00		18.19			
	04	15		18.21			
	05	15		18.22			
	06	10		18.19			
stop pump →	07	00		18.17		stop	8.5
recovery	8	12		18.16			
	9	36		18.17			
	10	05		18.18			

PUMPING TEST - DRAWDOWN DATA

Well No.: GH-52

Project No.: 51853 Project Name: G & H Landfill

Date: 7/4/12 to 7/5/12 Type of Test: _____

CRA Supervisor: D. Rivers / C. Bondy / E. Mickelson Pump Setting: _____ amsl

Pumped Well No.: TEW-1-12

Screened Interval: _____ to _____ Pumping Rate (Q): _____

Aquifer Thickness: _____ Datum Point: _____ Datum Point Elevation: _____ amsl

Static Water Level: 13.87 ☐ Confined ☐ Unconfined

Time			Elapsed Time (min.)	Water Level	Drawdown	Q	Remarks
Day	Hr.	Min.					
7/4	10	00	0	13.87		~1gpm	
	11	06		13.87			
	12	06		13.87			
	14	06		13.86			
	16	06		13.85			
	18	06		13.85			
	20	06		13.88			
	22	06		13.87			
7/5	00	15		13.86			
	02	00		13.88			
	04	00		13.86			
	06	00		13.85		stop 805	
	8	36		13.85			
	10	35		13.85			

PUMPING TEST - DRAWDOWN DATA

Well No.: GH-53

Project No.: 51853 Project Name: G & H Landfill

Date: 7/4/12 to 7/5/12 Type of Test: _____

CRA Supervisor: D. Rivers / C. Bundy / E. Mickelson Pump Setting: _____ amsl

Pumped Well No.: TEW-1-12

Screened Interval: _____ to _____ Pumping Rate (Q): _____

Aquifer Thickness: _____ Datum Point: _____ Datum Point Elevation: _____ amsl

Static Water Level: 13.21 ☐ Confined ☐ Unconfined

Time			Elapsed Time (min.)	Water Level	Drawdown	Q	Remarks
Day	Hr.	Min.					
7/4	10	00	0	13.21		~1gpm	
	11	06		13.19			
	12	06		13.20			
	14	06		13.24			
	16	06		13.22			
	18	05		13.25			
	20	05		13.25			
	22	05		13.27			
7/5	00	15		13.28			
	02	00		13.26			
	04	00		13.26			
	06	00		13.27			Stop 805
	8	36		13.26			
	10	35		13.24			

PUMPING TEST - DRAWDOWN DATA

Well No.: GW-07

Project No.: 51853 Project Name: G & H Landfill

Date: 7/4/12 to 7/5/12 Type of Test: _____

CRA Supervisor: D. Rivers / C. Bundy / E. Mickelson Pump Setting: _____ amsl

Pumped Well No.: TEW-1-12

Screened Interval: _____ to _____ Pumping Rate (Q): _____

Aquifer Thickness: _____ Datum Point: _____ Datum Point Elevation: _____ amsl

Static Water Level: 14.01 ☐ Confined ☐ Unconfined

Time			Elapsed Time (min.)	Water Level	Drawdown	Q	Remarks
Day	Hr.	Min.					
7/4	10	00	0	14.01		~1 gpm	
	11	08		14.00			
	12	06		14.00			
	14	06		13.98			
	16	06		~~13.85~~ 13.99			
	18	06		14.00			
	20	06		14.02			
	22	06		14.01			
7/5	00	15		14.02			
	02	00		14.02			
	04	00		14.01			
	06	00		14.01			stop 805
	8	36		14.00			
	10	35		14.01			

PUMPING TEST - DRAWDOWN DATA

Well No.: GH-66

Project No.: 51853 Project Name: G & H Landfill

Date: 7/4/12 to 7/5/12 Type of Test: _____

CRA Supervisor: D. Rivers / C. Bundy / E. Mickelson Pump Setting: _____ amsl

Pumped Well No.: TEW-1-12

Screened Interval: _____ to _____ Pumping Rate (Q): _____

Aquifer Thickness: _____ Datum Point: _____ Datum Point Elevation: _____ amsl

Static Water Level: 14.81 ☐ Confined ☐ Unconfined

Time			Elapsed Time (min.)	Water Level	Drawdown	Q	Remarks
Day	Hr.	Min.					
7/4	10	00	0	14.81		~ 1 gpm	
	11	05		14.81			
	12	05		14.81			
	14	10		14.79			
	16	10		14.79			
	18	10		14.79			
	20	10		14.82			
	22	10		14.80			
7/5	00	15		14.80			
	02	00		14.81			
	04	00		14.82			
	06	00		14.82			stop gas
	8	35		14.80			
	10	34		14.80			

PUMPING TEST - DRAWDOWN DATA

Well No.: GW-06

Project No.: 51853 Project Name: G & H Landfill

Date: 7/3/12 to 7/5/12 Type of Test: _____

CRA Supervisor: D. Rivers / C. Bundy / E. Mickelson Pump Setting: _____ amsl

Pumped Well No.: TEW-1-12

Screened Interval: _____ to _____ Pumping Rate (Q): _____

Aquifer Thickness: _____ Datum Point: _____ Datum Point Elevation: _____ amsl

Static Water Level: 31.39 ☐ Confined ☐ Unconfined

Time			Elapsed Time (min.)	Water Level	Drawdown	Q	Remarks
Day	Hr.	Min.					
7/4	10	00	0	31.39		~19gpm	
	11	10		31.39			
	12	10		31.39			
	14	12		31.40			
	16	12 ch.		31.37			
	18	12		31.35			
	20	12		31.35			
	22	12		31.37			
7/5	00	15		31.36			
	02	00		31.40			
	04	00		31.40			
	06	00		31.40			stop pump
	8	39		31.40			
	10	32		31.39			

PUMPING TEST - DRAWDOWN DATA

Well No.: GH-68

Project No.: 51853 Project Name: G&H Landfill

Date: 7/4/12 to 7/5/12 Type of Test:

CRA Supervisor: D. Rivers/C. Bondy/E. Mickelson Pump Setting: ______ amsl

Pumped Well No.: TEW-1-12

Screened Interval: ______ to ______ Pumping Rate (Q): ______

Aquifer Thickness: ______ Datum Point: ______ Datum Point Elevation: ______ amsl

Static Water Level: 14.67 ☐ Confined ☐ Unconfined

Day	Time Hr.	Time Min.	Elapsed Time (min.)	Water Level	Drawdown	Q	Remarks
7/4	10	00	0	14.67		~1gpm	
	11	15		14.67			
	12	15		14.64			
	13	55		14.64			
	16	00		14.63			
	18	00		14.63			
	20	00		14.66			
	22	00		14.67			
7/5	00	15		14.66			
	02	00		14.65			
	04	00		14.66			
	06	00		14.67		stop 805	
	8	45		14.67			
	10	40		14.67			

PUMPING TEST - DRAWDOWN DATA

Well No.: GH-50

Project No.: 51853 Project Name: G & H Landfill

Date: 7/3/12 to 7/5/12 Type of Test: _____

CRA Supervisor: D. Rivers / C. Bundy / E. Mickelson Pump Setting: _____ amsl

Pumped Well No.: TEW-1-12

Screened Interval: _____ to _____ Pumping Rate (Q): _____

Aquifer Thickness: _____ Datum Point: _____ Datum Point Elevation: _____ amsl

Static Water Level: 16.71 ☐ Confined ☐ Unconfined

Time			Elapsed Time (min.)	Water Level	Drawdown	Q	Remarks
Day	Hr.	Min.					
7/3	10	00	0	16.71		~1 gpm	
	11	16		16.71			
	12	15		16.71			
	13	55		16.71			
	16	00		16.69			
	18	00		16.70			
	20	00		16.71			
	22	00		16.71			
7/5	00	15		16.70			
	02	00		16.69			
	04	00		16.68			
	06	00		16.68		→	stop flow
	8	46		16.68			
	10	40		16.68			

PUMPING TEST - DRAWDOWN DATA

Well No.: GH-37A (Bkgd) (transducer S/N - 172104) start - 854

Project No.: 51853 Project Name: G + H Landfill

Date: 7/3/12 to 7/5/12 Type of Test: _____

CRA Supervisor: D. Rivers / C. Bundy / E. Mickelson Pump Setting: _____ amsl

Pumped Well No.: TEW-1-12

Screened Interval: _____ to _____ Pumping Rate (Q): _____

Aquifer Thickness: _____ Datum Point: _____ Datum Point Elevation: _____ amsl

Static Water Level: 14.90 (head - 3.62) ☐ Confined ☐ Unconfined

Time			Elapsed Time (min.)	Water Level	Drawdown	Q	Remarks
Day	Hr.	Min.					
7/3	10	00	0	14.90		~1 gpm	
	13	40		14.90			
	16	40		14.89			
	21	30		14.97			
7/5	06	25		14.95			Stop 805
	10	20		14.95			

PUMPING TEST - DRAWDOWN DATA

Well No.: GW-10

Project No.: 51853 Project Name: G & H Landfill

Date: 7/4/12 to 7/5/12 Type of Test: _____

CRA Supervisor: D. Rivers / C. Bondy / E. Mickelson Pump Setting: _____ amsl

Pumped Well No.: TEW-1-12

Screened Interval: _____ to _____ Pumping Rate (Q): _____

Aquifer Thickness: _____ Datum Point: _____ Datum Point Elevation: _____ amsl

Static Water Level: 5.54 ☐ Confined ☐ Unconfined

Time			Elapsed Time (min.)	Water Level	Drawdown	Q	Remarks
Day	Hr.	Min.					
7/4	00	00	0	5.54		~19pm	
	13	45		5.38			
	16	45		5.79			
	21	25		5.94			out gauge in darkness
7/5	06	30		6.06		step 80%	
	10	25		6.03			

PUMPING TEST - DRAWDOWN DATA

Well No.: GW-11

Project No.: 51853 Project Name: G & H Landfill

Date: 7/3/12 to 7/5/12 Type of Test: _____

CRA Supervisor: D. Rivers / C. Bondy / E. Mickelson Pump Setting: _____ amsl

Pumped Well No.: TEW-1-12

Screened Interval: _____ to _____ Pumping Rate (Q): _____

Aquifer Thickness: _____ Datum Point: _____ Datum Point Elevation: _____ amsl

Static Water Level: 8.35 ☐ Confined ☐ Unconfined

Time			Elapsed Time (min.)	Water Level	Drawdown	Q	Remarks
Day	Hr.	Min.					
7/4	10	00	0	8.35		~1gpm	
	13	43		8.35			
	16	43		8.38			
	21	22		8.41			
7/5	06	30		8.43			not gauged in darkness
	10	25		8.43	→ stop	gos	

APPENDIX D

GROUNDWATER DATA FOR THE 11-DAY AQUIFER TEST

TABLE D.1

MANUAL GROUNDWATER ELEVATIONS DURING 11-DAY AQUIFER TEST (JULY 23 TO AUGUST 3, 2012)
AQUIFER PUMPING TEST RESULTS
G&H LANDFILL
MACOMB COUNTY, MICHIGAN

Location	*7/20/2012 13:00* *Depth to Groundwater (ft btor)*	*7/23/2012 11:00* *Depth to Groundwater (ft btor)*	*7/23/2012 15:00* *Depth to Groundwater (ft btor)*	*7/24/2012 11:20* *Depth to Groundwater (ft btor)*	*7/24/2012 16:00* *Depth to Groundwater (ft btor)*	*7/25/2012 15:20* *Depth to Groundwater (ft btor)*	*7/26/2012 13:10* *Depth to Groundwater (ft btor)*	*7/27/2012 10:40* *Depth to Groundwater (ft btor)*	*7/30/2012 9:50* *Depth to Groundwater (ft btor)*	*7/30/2012 16:40* *Depth to Groundwater (ft btor)*
TEW-1-12	28.06	16.43	26.00	26.72	26.62	26.59	26.65	26.59	26.68	26.64
PZ-1-12	16.25	15.97	16.04	16.10	16.07	16.04	16.22	16.31	16.58	16.47
PZ-2-12	16.94	16.51	16.65	16.25	16.71	16.64	17.14	17.26	17.44	17.41
GH-31B	NM	NM	NM	NM	NM	NM	NM	18.48	18.75	18.72
GH-50	NM	NM	NM	NM	NM	NM	NM	17.16	17.26	17.25
GH-52	NM	NM	NM	NM	NM	NM	NM	13.98	14.08	14.06
GH-62	NM	NM	NM	NM	NM	NM	NM	DRY	DRY	DRY
GH-66	NM	NM	NM	NM	NM	NM	NM	15.01	15.10	15.10
GH-73	NM	NM	NM	NM	NM	NM	NM	16.71	16.87	16.82
GH-74	NM	NM	NM	NM	NM	NM	NM	17.62	17.79	17.75

Notes:
ft AMSL - feet above mean sea level.
ft btor - feet below top of riser.
NM - Not Manually Monitored.

TABLE D.1

MANUAL GROUNDWATER ELEVATIONS DURING 11-DAY AQUIFER TEST (JULY 23 TO AUGUST 3, 2012)
AQUIFER PUMPING TEST RESULTS
G&H LANDFILL
MACOMB COUNTY, MICHIGAN

Location	*7/31/2012 9:58* *Depth to Groundwater (ft btor)*	*7/31/2012 16:00* *Depth to Groundwater (ft btor)*	*8/1/2012 11:00* *Depth to Groundwater (ft btor)*	*8/1/2012 14:30* *Depth to Groundwater (ft btor)*	*8/2/2012 10:40* *Depth to Groundwater (ft btor)*	*8/2/2012 16:10* *Depth to Groundwater (ft btor)*	*8/3/2012 9:40* *Depth to Groundwater (ft btor)*	*8/3/2012 15:30* *Depth to Groundwater (ft btor)*	*8/6/2012 10:40* *Depth to Groundwater (ft btor)*	*8/6/2012 16:00* *Depth to Groundwater (ft btor)*	*8/7/2012 10:50* *Depth to Groundwater (ft btor)*
TEW-1-12	26.68	27.32	27.40	27.31	27.27	27.15	27.00	17.22	17.26	17.21	17.23
PZ-1-12	16.54	16.54	16.57	16.56	16.60	16.58	16.64	16.56	16.64	16.60	16.64
PZ-2-12	17.49	17.47	17.55	17.52	17.56	17.56	17.61	17.41	17.44	17.42	17.45
GH-31B	18.82	NM	NM	NM	NM	NM	18.97	18.97	19.02	18.98	19.01
GH-50	17.23	NM	NM	NM	NM	NM	17.40	17.41	17.59	17.58	17.52
GH-52	14.10	NM	NM	NM	NM	NM	14.20	14.19	14.23	14.22	14.26
GH-62	DRY	NM	NM	NM	NM	NM	DRY	DRY	DRY	DRY	DRY
GH-66	15.12	NM	NM	NM	NM	NM	15.28	15.24	15.35	15.31	15.34
GH-73	16.91	NM	NM	NM	NM	NM	17.05	17.02	17.11	17.04	17.07
GH-74	17.81	NM	NM	NM	NM	NM	17.96	17.88	17.94	17.92	17.94

Notes:
ft AMSL - feet above mean sea level.
ft btor - feet below top of riser.
NM - Not Manually Monitored.

APPENDIX E

HYDROGRAPHS

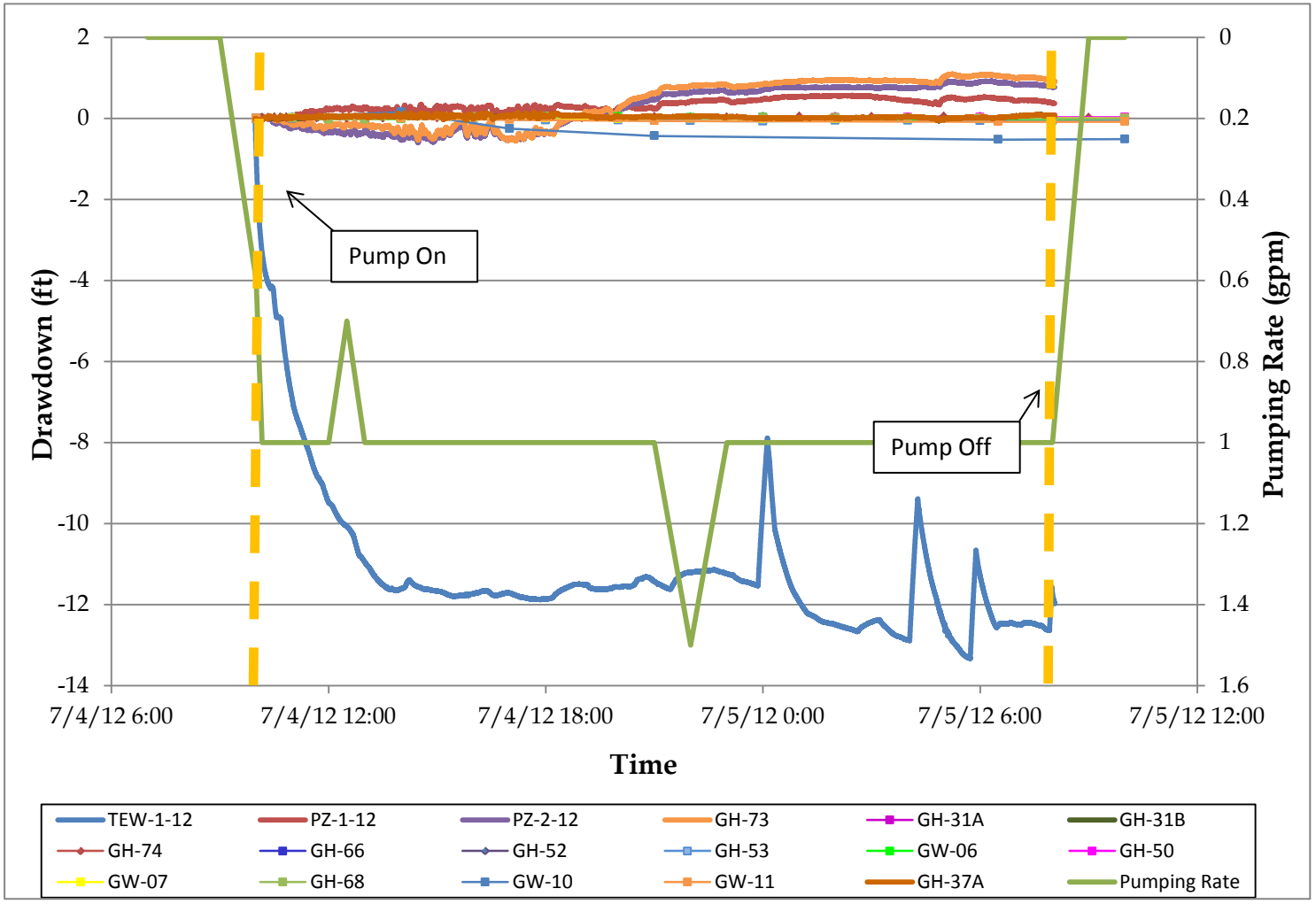


figure E.1
HYDROGRAPH FOR THE 22-HOUR AQUIFER TEST
G&H LANDFILL SITE
Macomb County, Michigan

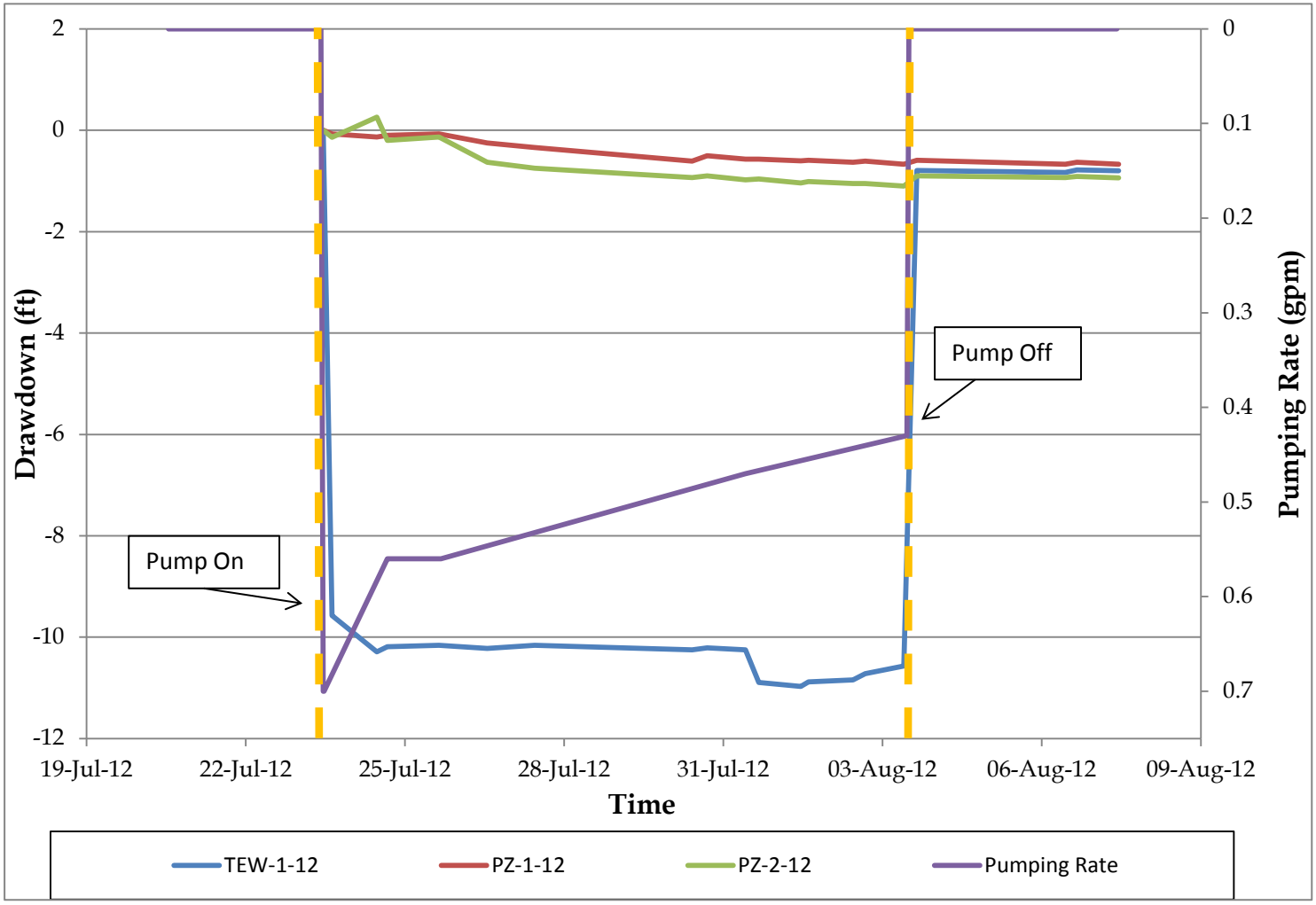


figure E.2
HYDROGRAPH FOR THE 11-DAY AQUIFER TEST
G&H LANDFILL SITE
Macomb County, Michigan

APPENDIX F

DISTANCE DRAWDOWN PLOTS

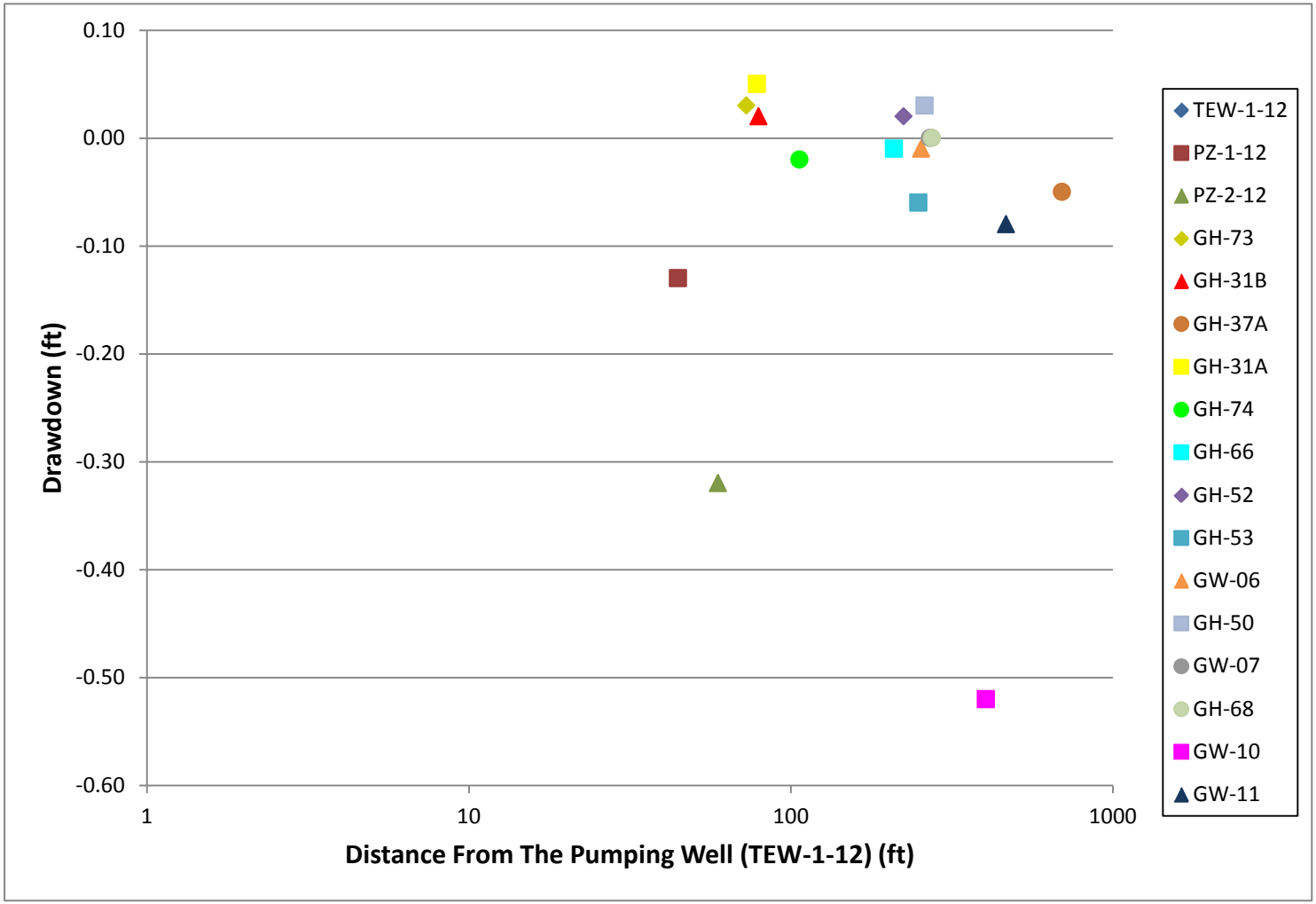


figure F.1
DISTANCE-DRAWDOWN PLOT FOR THE 22-HOUR AQUIFER TEST
G&H LANDFILL SITE
Macomb County, Michigan

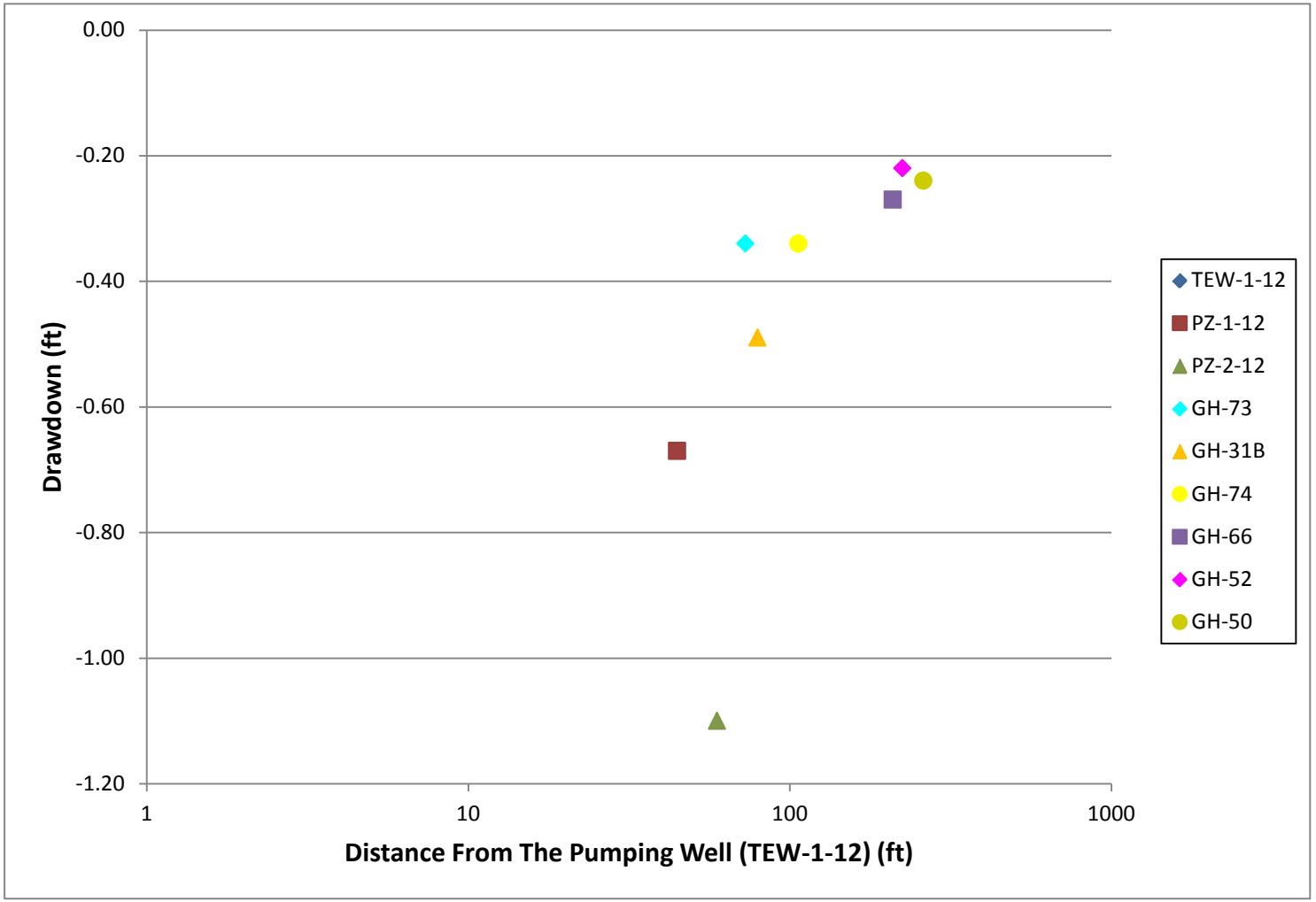
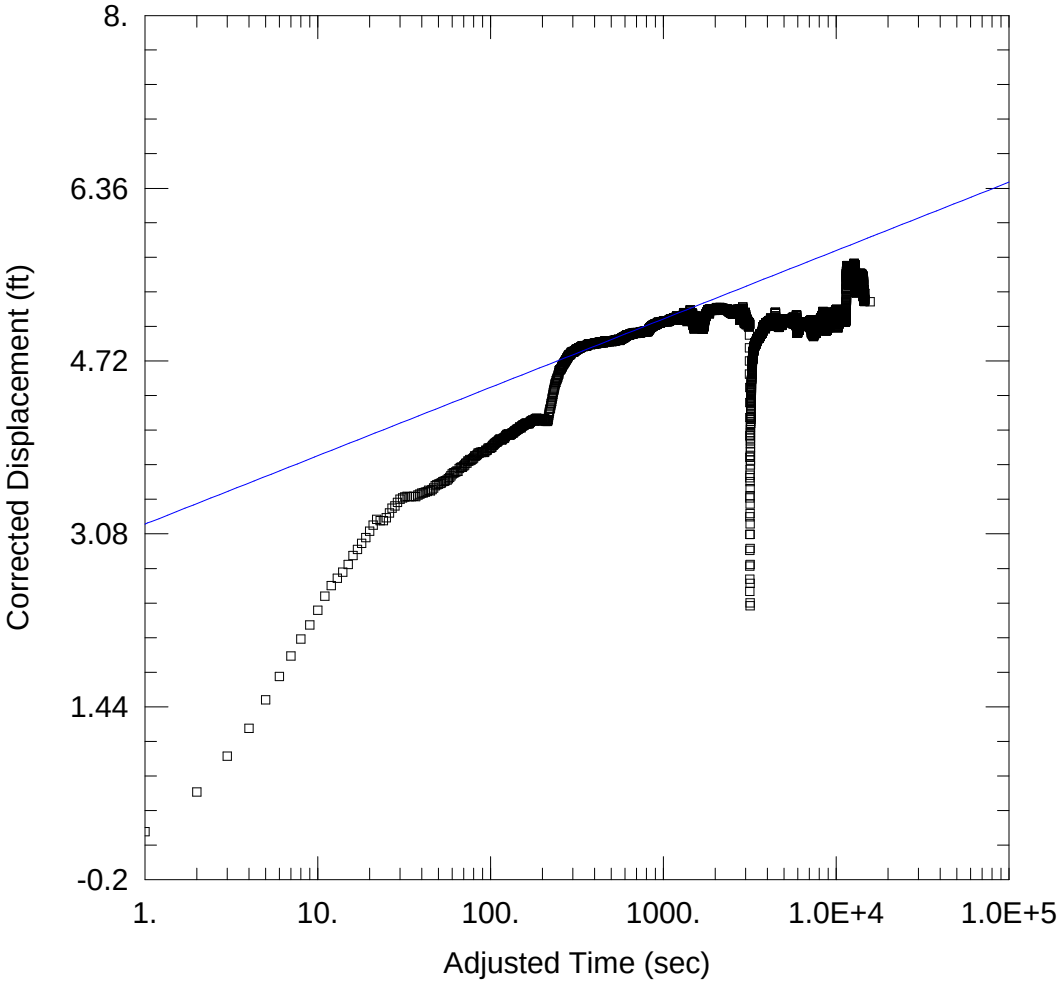


figure F.2
DISTANCE-DRAWDOWN PLOT FOR THE 11-DAY AQUIFER TEST
G&H LANDFILL SITE
Macomb County, Michigan

APPENDIX G

AQTESOLV PLOTS



WELL TEST ANALYSIS

Data Set: I:\Hg\50001 to 54999\51853 G&H\7-day pumping test analysis\7-day test - Cooper-Jacob.aqt
Date: 08/28/12 Time: 07:26:32

PROJECT INFORMATION

Company: Conestoga-Rovers & Associates
Client: G&H Landfill
Project: 051853
Location: Macomb County, Michigan
Test Well: TEW-1-12
Test Date: July 23, 2012

AQUIFER DATA

Saturated Thickness: 15. ft Anisotropy Ratio (Kz/Kr): 1.

WELL DATA

Pumping Wells

Well Name	X (ft)	Y (ft)
TEW-1-12	13468542	427225.1

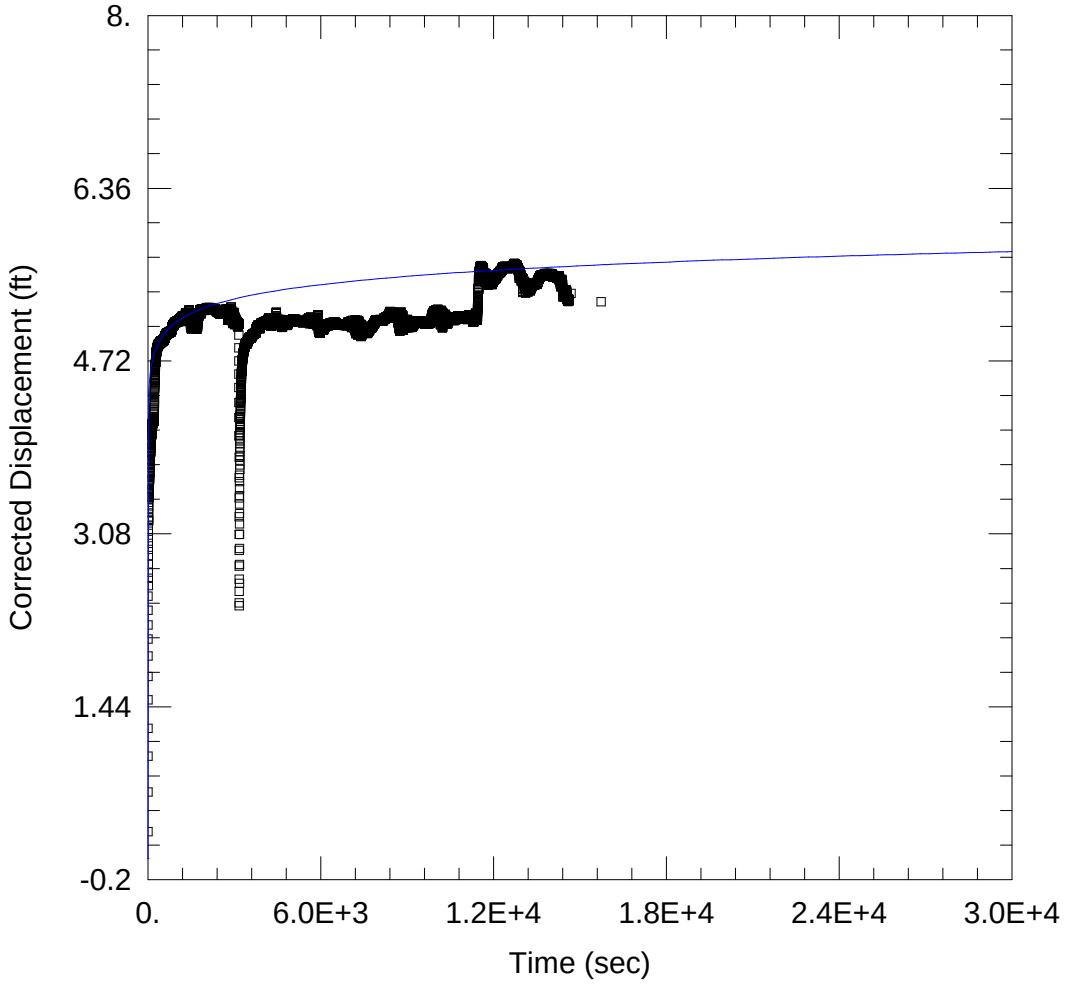
Observation Wells

Well Name	X (ft)	Y (ft)
TEW-1-12	13468542	427225.1

SOLUTION

Aquifer Model: Unconfined Solution Method: Cooper-Jacob

T = 0.0002704 ft^2/sec S = 1.259E-7



WELL TEST ANALYSIS

Data Set: I:\Hg\50001 to 54999\51853 G&H\7-day pumping test analysis\7-day test - Theis.aqt
Date: 08/28/12 Time: 07:23:07

PROJECT INFORMATION

Company: Conestoga-Rovers & Associates
Client: G&H Landfill
Project: 051853
Location: Macomb County, Michigan
Test Well: TEW-1-12
Test Date: July 23, 2012

WELL DATA

Pumping Wells

Well Name	X (ft)	Y (ft)
TEW-1-12	13468542	427225.1

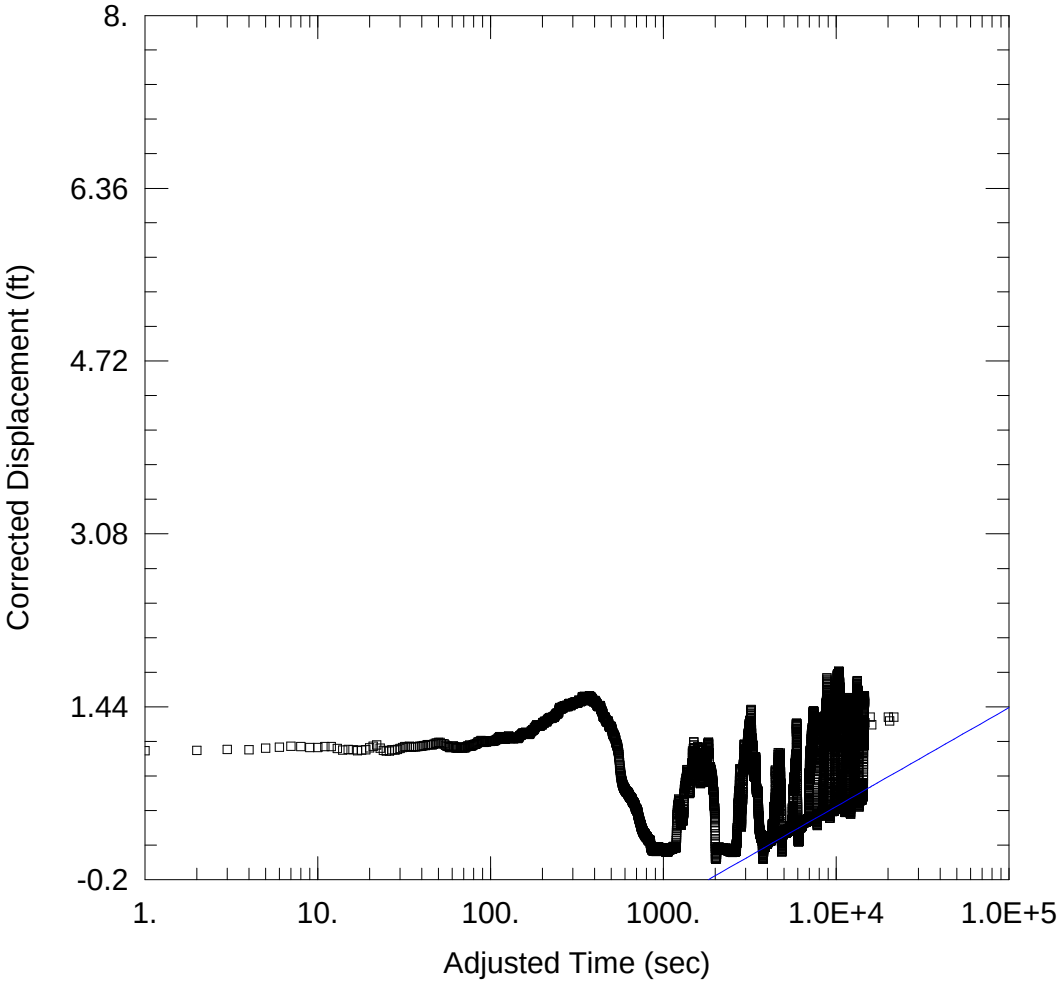
Observation Wells

Well Name	X (ft)	Y (ft)
TEW-1-12	13468542	427225.1

SOLUTION

Aquifer Model: Unconfined
Solution Method: Theis

T = 0.0003909 ft^2/sec
S = 6.31E-11
Kz/Kr = 1.
b = 15. ft



WELL TEST ANALYSIS

Data Set: I:\Hg\50001 to 54999\51853 G&H\7-day pumping test analysis\7-day test - Cooper-Jacob.aqt
Date: 08/28/12 Time: 07:25:23

PROJECT INFORMATION

Company: Conestoga-Rovers & Associates
Client: G&H Landfill
Project: 051853
Location: Macomb County, Michigan
Test Well: TEW-1-12
Test Date: July 23, 2012

AQUIFER DATA

Saturated Thickness: 15. ft Anisotropy Ratio (Kz/Kr): 1.

WELL DATA

Pumping Wells

Well Name	X (ft)	Y (ft)
TEW-1-12	13468542	427225.1

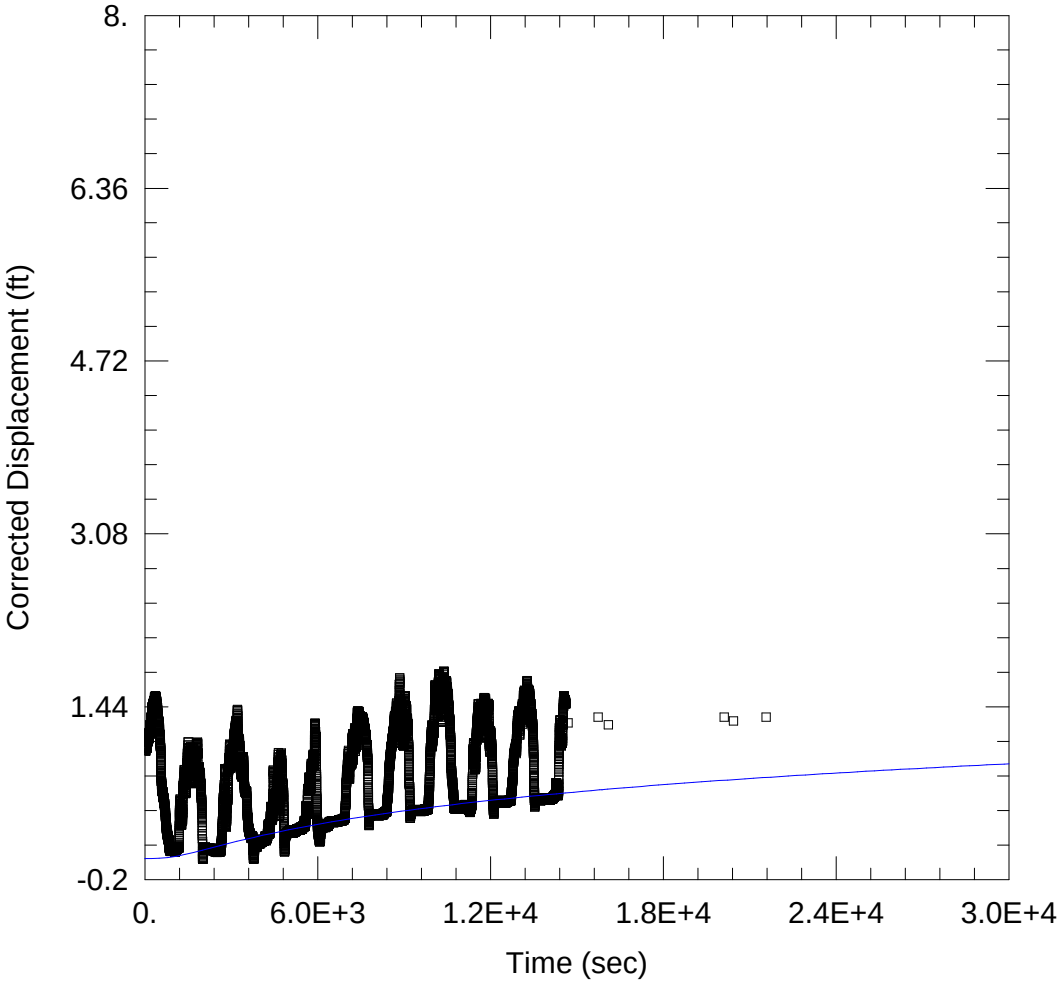
Observation Wells

Well Name	X (ft)	Y (ft)
PZ-1-12	13468546	427180.7

SOLUTION

Aquifer Model: Unconfined Solution Method: Cooper-Jacob

T = 0.0001871 ft^2/sec S = 0.000631



WELL TEST ANALYSIS

Data Set: I:\Hg\50001 to 54999\51853 G&H\7-day pumping test analysis\7-day test - Theis.aqt
Date: 08/28/12 Time: 07:19:08

PROJECT INFORMATION

Company: Conestoga-Rovers & Associates
Client: G&H Landfill
Project: 051853
Location: Macomb County, Michigan
Test Well: TEW-1-12
Test Date: July 23, 2012

WELL DATA

Pumping Wells

Well Name	X (ft)	Y (ft)
TEW-1-12	13468542	427225.1

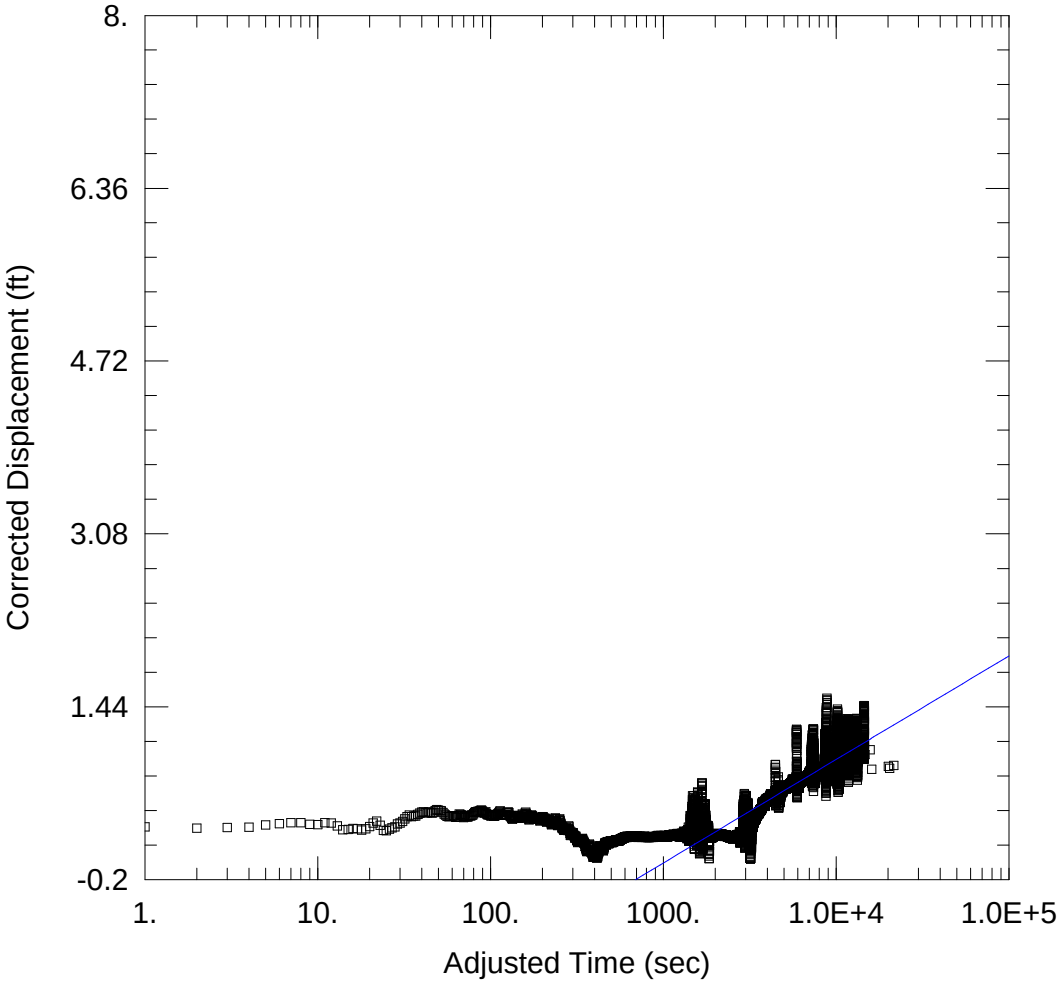
Observation Wells

Well Name	X (ft)	Y (ft)
▫ PZ-1-12	13468546	427180.7

SOLUTION

Aquifer Model: Unconfined
Solution Method: Theis

T = 0.0001787 ft^2/sec
S = 0.0007943
Kz/Kr = 1.
b = 15. ft



WELL TEST ANALYSIS

Data Set: I:\Hg\50001 to 54999\51853 G&H\7-day pumping test analysis\7-day test - Cooper-Jacob.aqt
Date: 08/28/12 Time: 07:24:01

PROJECT INFORMATION

Company: Conestoga-Rovers & Associates
Client: G&H Landfill
Project: 051853
Location: Macomb County, Michigan
Test Well: TEW-1-12
Test Date: July 23, 2012

AQUIFER DATA

Saturated Thickness: 15. ft Anisotropy Ratio (Kz/Kr): 1.

WELL DATA

Pumping Wells

Well Name	X (ft)	Y (ft)
TEW-1-12	13468542	427225.1

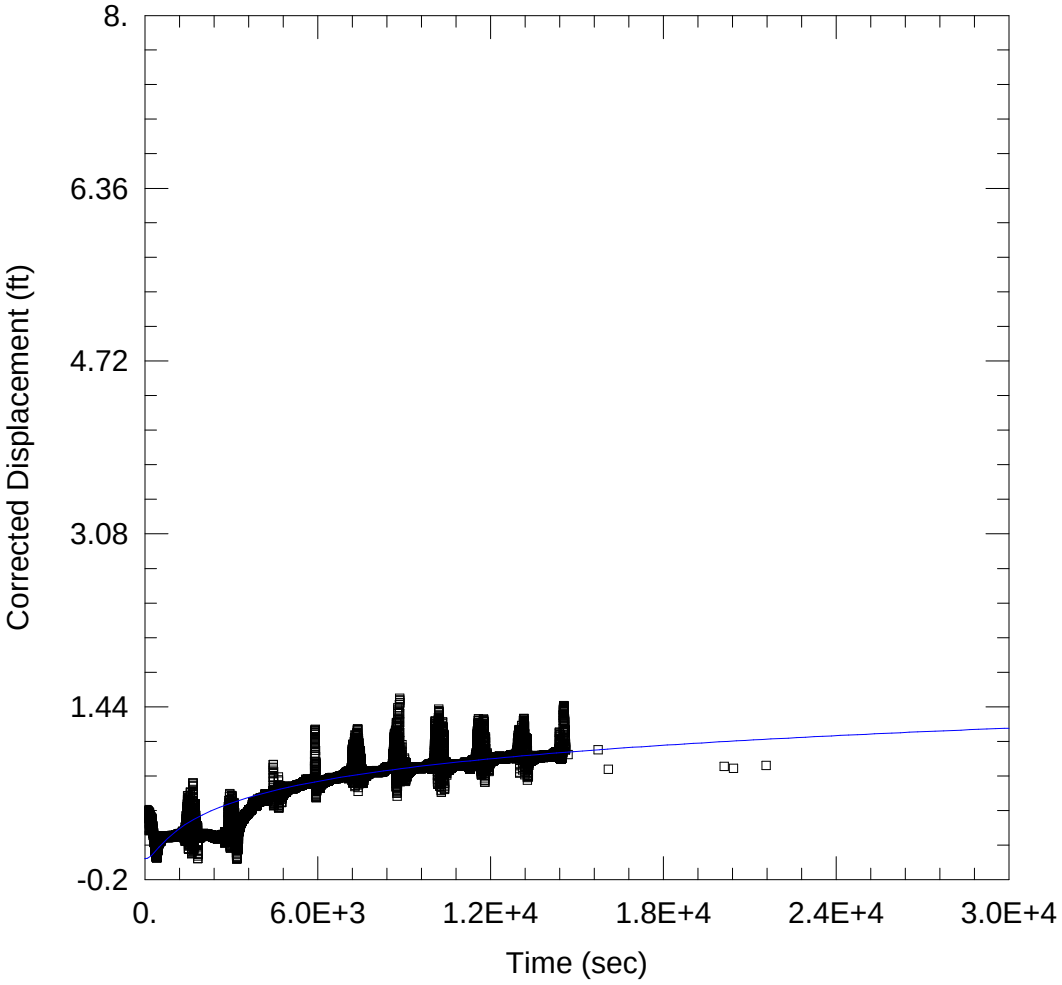
Observation Wells

Well Name	X (ft)	Y (ft)
PZ-2-12	13468539	427284.4

SOLUTION

Aquifer Model: Unconfined Solution Method: Cooper-Jacob

T = 0.0001787 ft^2/sec S = 0.0001259



WELL TEST ANALYSIS

Data Set: I:\Hg\50001 to 54999\51853 G&H\7-day pumping test analysis\7-day test - Theis.aqt
Date: 08/28/12 Time: 07:17:22

PROJECT INFORMATION

Company: Conestoga-Rovers & Associates
Client: G&H Landfill
Project: 051853
Location: Macomb County, Michigan
Test Well: TEW-1-12
Test Date: July 23, 2012

WELL DATA

Pumping Wells

Well Name	X (ft)	Y (ft)
TEW-1-12	13468542	427225.1

Observation Wells

Well Name	X (ft)	Y (ft)
PZ-2-12	13468539	427284.4

SOLUTION

Aquifer Model: Unconfined
Solution Method: Theis

T = 0.0002355 ft^2/sec
S = 0.0001
Kz/Kr = 1.
b = 15. ft