# FINAL
# SHEPLEY'S HILL LANDFILL
# GROUNDWATER FLOW MODEL REVISION REPORT
# FORMER FORT DEVENS ARMY INSTALLATION
# DEVENS, MASSACHUSETTS

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***Prepared for***

**Department of the Army**
**U.S. Army Corps of Engineers New England District**
**696 Virginia Road**
**Concord, MA 01742-2751**

***Prepared By***
**Geosyntec Consultants**
**Acton, MA 01720**

***Under Contract with***
**KOMAN Government Solutions, LLC**
**Marlborough, MA 01752**

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## LIST OF ACRONYMS AND ABBREVIATIONS

| | |
|---|---|
| 3PE | three-point estimator |
| AOC | area of contamination |
| ATP | arsenic treatment plant |
| CERCLA | Comprehensive Environmental Response, Compensation, and Liability Act CSM conceptual site model |
| ESI | Environmental Solutions, Inc. |
| EVS | Environmental Visualizations Systems |
| FEMA | Federal Emergency Management Agency |
| ft/day | feet per day |
| $ft^2$/day | square feet per day |
| HSU | hydrostratigraphic unit |
| K | hydraulic conductivity |
| Kxy | model assigned horizontal hydraulic conductivity |
| Kz | model assigned vertical hydraulic conductivity |
| KGS | Koman Government Solutions |
| LiDAR | light detection and ranging |
| MCL | maximum contaminant level |
| MWG | Modeling Work Group |
| NIA | North Impact Area |
| ORD | Office of Research and Development |
| PSP | Plow Shop Pond |
| PVC | polyvinyl chloride |
| RI | remedial investigation |
| ROD | Record of Decision |
| SHL | Shepley's Hill Landfill |
| USACE | United States Army Corps of Engineers |
| USEPA | United States Environmental Protection |
| USGS | United States Geological Survey |

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# 1. INTRODUCTION

The updated draft Shepley's Hill Landfill (SHL) Groundwater Flow Model Report ("the Report") is submitted per requirements set forth in EPA's February 24, 2016, SHL Scope of Work (SOW), Phase 1, Paragraph 4.a, which required Army to submit an updated groundwater flow model that includes the changes noted in Attachment A of Army's December 4, 2015 letter. The SOW also states that within thirty (30) days of Army's issuance of the final updated groundwater flow model and supporting documentation, it shall submit a revised Technical Memorandum that: (1) uses field-measured hydraulic head data and water level measurements to support and validate projections of groundwater flow as predicted in the updated groundwater flow model (SOW, Phase 1, ¶ 4.b), (2) evaluates hydraulic gradient vectors near the extraction wells (SOW, Phase 1, ¶ 4.c), and (3) evaluates upgradient flow lines through plume cross-section (Phase 1, Paragraph 4.d). The SHL Groundwater Flow Model described herein is an update to an interim version of the model that was documented in a May 18, 2016 memorandum (Geosyntec 2016a). In a July 8, 2016 letter, EPA concluded that the documentation needed to evaluate the revised model was inadequate. In October 2016, additional documentation (*Draft Shepley's Hill Landfill Groundwater Flow Model Revision Report*) was submitted to EPA for review (Geosyntec 2016b). On November 9, 2016, a meeting between the Army and its consultants and regulators was held to "assure clear communication of EPA's expectations before Army's issuance of a final SHL Groundwater Flow Model." (EPA November 29, 2016 letter). The outcome of the meeting included documentation of required model revisions followed by a series of meetings attended by representatives from the United States Environmental Protection Agency (USEPA), the United States Army Corp of Engineers (USACE) and their technical consultants. Collectively, this group is referred to herein as the Modeling Work Group (MWG). The model revisions described herein were developed through consensus with the MWG. In May 2018, the Interim Submittal including the draft modeling report table of contents, figures and tables as well as electronic model files was submitted to EPA for review (Geosyntec 2018) and EPA review comments were received on September 13, 2018. The original model, constructed in 1993, has undergone numerous revisions; these are described briefly in Section 4.1 of this report. The "Site" is herein defined as the SHL and surrounding areas as described in Section 1.2.

Section 1 of this report provides the objectives of the current model revisions as well as a summary of historical Site operations, investigations, and remedial actions. Section 2 describes the technical approach used to revise and calibrate the model. The hydrogeologic framework of the Site is described in Section 3. Section 4 provides a description of previous model versions and a summary of current model revisions. Details about the model construction and input parameters are provided in Section 5. Section 6 describes time discretization and boundary conditions. Model calibration to observed water level targets as well as 3PE and ATP shutdown test analyses are included in Sections 7 and 8, respectively. The final calibration results are provided in Section 9 and model assumptions and limitations are discussed in Section 10. Application of the model to evaluate the arsenic treatment plant (ATP) capture zone using particle track analysis is described in Section 11. Conclusions are included in Section 12, and references cited in the text are included in Section 13.

## 1.1 Modeling Objectives

The objective of the groundwater modeling effort is to develop a reliable tool that will support the evaluation of existing and proposed remedies and the designation of arsenic background/baseline wells. The model revisions documented in this report provide an update to the May 2016 and October 2016 interim models and incorporate more recent Site data and a revised calibration process to include automated parameter estimation using PEST and results from three point gradient analyses (3PE). The calibrated model was used to evaluate flow paths at the Site; the modeled flow paths provided the basis to evaluate the performance of the existing groundwater capture system and to better understand groundwater flow downgradient from the capture system.

## 1.2 Site Background

The former Fort Devens Army Base—primarily located in the Towns of Harvard, Shirley, and Ayer in Central Massachusetts—was established in 1917 as a temporary cantonment called Camp Devens, became a permanent base in 1931, and continued service until its closure in 1996. SHL encompasses approximately 84 acres in the northeast corner of the main post of the former Fort Devens (Figure 1.1). The landfill is bordered to the east/northeast by Plow Shop Pond (PSP), to the west by Shepley's Hill, to the south by commercial development, and to the east by land formerly containing a railroad roadhouse. Nonacoicus Brook, which drains PSP, is located north of the landfill (Figure 1.2).

SHL was reportedly operating by the early 1940s, though evidence from test pits suggests earlier usage, possibly as early as the mid-1800s. The landfill contains various waste materials, including ash, demolition debris, asbestos, sanitary waste, and glass. The maximum depth of the waste is estimated to be about 40 feet below ground surface in the central portion of the landfill. The total volume of waste has been estimated at over 1.5 million cubic yards, of which approximately 11% is below the water table (Sovereign 2014).

MassDEP approved the landfill closure plan in 1985, and the landfill was closed in five phases beginning in 1987. MassDEP issued a Landfill Capping Compliance Letter approving the closure in 1996. Closure consisted of capping the landfill with a 30 to 40-mil polyvinyl chloride (PVC) membrane, covering the cap with soil and vegetation, and installing gas vents. After closure, remedial investigations (RIs) completed under the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) confirmed the presence of various contaminants, including arsenic in groundwater, aquifer matrix, and pond bed sediments in PSP.

The Record of Decision (ROD) required the Army to monitor groundwater and conduct five-year reviews to evaluate the effectiveness of the remedy, which at the time relied on the landfill cap to attain groundwater cleanup goals. In 2005, due to persistent arsenic concentrations in groundwater above the maximum contaminant levels (MCLs), a contingency remedy to capture groundwater as stipulated by the ROD was implemented. In 2006, the Army installed and began operating a groundwater extraction and treatment system to address groundwater contamination in the northern portion of the landfill and immediately downgradient of the landfill. The treatment system, referred to as the ATP, draws groundwater from two extraction wells (EW-01 and EW-04)

located just north of the landfill. In 2012, available data indicated landfill capping and groundwater extraction did not eliminate groundwater flow and arsenic migration from SHL into Red Cove/PSP (identified as Area of Contamination [AOC] 72) and a low-permeability groundwater barrier wall was installed between SHL and AOC 72 as part of a Non-Time Critical Removal Action (Sovereign 2013a). In 2014, land use controls were implemented pursuant to an Explanation of Significant Differences to restrict groundwater use and further protect potential receptors in the area north of the landfill referred to as the North Impact Area (NIA) (i.e., the groundwater impacted off-site that includes properties in Ayer along West Main Street, north of the landfill); these protective measures were incorporated into the ROD (Sovereign 2013b).

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# 2. TECHNICAL APPROACH

The modeling effort described in this report updated the previous numerical flow model for the Site described in the *2016 Draft Shepley's Hill Groundwater Model Revision Report* (Geosyntec 2016). The revisions described herein were mutually agreed upon between the Army and USEPA at a series of MWG meetings that took place between November 2016 and March 2018. The second submodel (SHL300T2) of the 2016 groundwater model served as the basis for the model revisions. The 2016 model calibration period was extended from 2015 to 2016 with calibration targets and boundary conditions updated to include available data through 2016. Model layers were revised to incorporate an updated bedrock surface by specifying revised elevations of the layer bottom. Hydraulic conductivity (K) zonation was revised to better match the results from slug test and pumping test analyses of Site monitoring and extraction wells including slug testing conducted by USEPA in November 2017. Recharge zonation was consolidated, and recharge multipliers were applied during the calibration process. In addition, post processing methods were used to evaluate capture including several pathline analysis tools.

## 2.1 Modeling Work Group

The MWG was formed as a collaboration among USEPA and the Army to develop a revised groundwater model to use as a tool to assess the effectiveness of the ATP and future proposed remedies. The MWG includes personnel from USEPA Region 1 and their technical consultants from the USEPA Office of Research and development (ORD) and the United States Geological Survey (USGS), and the USACE and their technical consultants, Koman Government Solutions (KGS) and Geosyntec. The MWG met regularly between November 2016 and March 2018. The objective of the meetings was to integrate real-time review and comment by USEPA into the modeling process to facilitate approval of the final groundwater modeling report.

## 2.2 Model Software

Groundwater flow modeling was performed using MODFLOW_NWT-SWR1 (Version 1.0.9) based on MODFLOW2005 (Version 1.11.0) a successor to the widely used and accepted MODFLOW finite-difference code developed by the United States Geological Survey (Harbaugh 2005). MODFLOW-NWT uses an advanced solver (Version 1.0.9) to improve convergence problems associated with dry cells in the model domain (Niswonger et al. 2011). Pre- and post-processing of model data were accomplished using the graphical user interface Groundwater Vistas (Version 6.96, build 47) developed by Environmental Solutions, Inc. (ESI) (ESI 2011). The model was calibrated using PEST (Version 13.6), an automated parameter estimation code used to determine parameter values for model calibration (Doherty 2016). BEOPEST (Version 13.6), a tool that manages multiple runs in parallel, was used to improve simulation runtimes. Particle tracking analysis was conducted using MODPATH (Version 5). The model software specifications are summarized in Table 2.1, and a detailed description of parameter estimation and model calibration method is presented in Section 7.

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## 3. HYDROGEOLOGIC FRAMEWORK

Regional hydrogeologic units near the SHL consist of glacial deposits overlying metasedimentary rocks, gneisses, and granites. Groundwater in this area flows generally from topographic highs to topographic lows and discharges to wetlands, streams, and the Nashua River. Groundwater discharge maintains the dry weather flow of rivers and streams (Harding ESE 2003).

Shepley's Hill, located directly west of the landfill, is a local topographic high consisting of bedrock thinly overlain by glacial deposits with bedrock outcrops. The landfill is within the bedrock valley defined by Shepley's Hill to the west and a subterranean bedrock rise on the eastern side of the landfill. The overburden deposits beneath the landfill consist of glacially deposited, well-graded to poorly graded sands with silts and gravel and, in some areas, peat from previously existing wetlands. A discontinuous layer of till is present at the base of the sands directly overlying bedrock.

Groundwater beneath the landfill primarily originates from precipitation recharge on Shepley's Hill that flows within the bedrock fracture network toward the east and discharges upward to the overburden beneath the low-permeability landfill cap. The cap limits direct recharge over a large area of the overburden aquifer, making the bedrock pathway from Shepley's Hill an important component of the overall water balance in the overburden relative to precapping conditions (Gannett Fleming 2012). Groundwater beneath the central and northern portion of the landfill generally flows northward within the thick saturated overburden sands that lie within the northwest trending bedrock valley toward Nonacoicus Brook (see Figure 1.2). The brook serves as a discharge boundary and groundwater divide between groundwater flow from the landfill and flow from north of Nonacoicus Brook. A beaver dam is located in the brook northwest of the Site (see Figure 1.2). Streamflow in the brook is from east to west into the Nashua River with a 2-foot head drop upstream to downstream of the beaver dam. Groundwater in the southern portion of the landfill originates from the industrial area south of the landfill as well as recharge from the stormwater collection ponds aligned along the southern landfill border. The source of stormwater to the ponds is surface water runoff from the southern landfill cap. Groundwater in the southeastern portion of the landfill flows eastward and discharges to the southern portion of PSP.

Based on slug testing in Site monitoring wells, the horizontal hydraulic conductivity is reported to be between 0.2 and 176 feet per day (ft/day) in the overburden sands and between 0.1 and 100 ft/day in the bedrock (Sovereign 2013c, USEPA 2017a). Based on previous groundwater model simulations, the horizontal groundwater velocity in the overburden sands downgradient from the landfill is approximately 1 ft/day (Sovereign 2014).

Continuous water level monitoring data from 2007 to 2010 in bedrock and overburden wells N5-P1 and N5-P2 located within the landfill footprint (Figure 1.2) indicate seasonal changes in the direction of the vertical gradient at that location (Gannett Fleming 2012). In periods of high recharge and low evapotranspiration (generally winter/spring), the direction of groundwater flow, primarily derived from precipitation recharge on Shepley's Hill, is reported to be upward from the bedrock to the overburden beneath the landfill. In periods of low recharge and high evapotranspiration (generally summer/fall), the direction of groundwater flow is reported to be

downward from the overburden sands to the underlying bedrock but with a lower gradient than is associated with the upward flows observed in the winter/spring. The long-term average head difference indicates a net upward discharge of bedrock groundwater to overburden (Gannett Fleming 2012).

# 4. MODEL REVISIONS

Groundwater modeling has been relied on to support investigation and remediation decision making at SHL since 1993. The SHL groundwater model has undergone several major revisions and peer reviews since its initial development with significant coordination and input from USEPA and MassDEP (Sovereign 2013c).

## 4.1 Previous Model Versions

In 1995 and 1996, ABB-ES developed the initial model, which was a regional MODFLOW model that provided the basis for a subsequent local SHL model, and, in 2003, ESE revised the model. Subsequently, the local model provided part of the basis for a capture zone evaluation in response to pumping by CH2MHill in 2005 and an evaluation of on-site discharge alternatives by CH2MHill in 2007. In 2009, through collaboration with USEPA and MassDEP, AMEC revised the model to include adjustments to bedrock elevations and model layering (AMEC 2009). AMEC made subsequent model revisions through 2012, and these revisions included updates to the interpreted bedrock surface. Sovereign further revised the model and used it to support remedial design of the barrier wall adjacent to PSP (Sovereign 2012). In 2013, significant revisions were implemented by Sovereign, including model domain expansion and conversion from a steady state simulation to a transient simulation. Details of the model revisions and calibration are included in the SHL Groundwater Model Revision Report (Sovereign 2013c). The model was used for the particle tracking analyses presented in the 2013 and 2014 SHL Annual Report (Sovereign 2014, M2S Joint Venture 2015). In response to USEPA comments, the 2013 model was further modified to include revisions to model layers and recharge and hydraulic conductivity parameter zonation. Also, the calibration target data set was expanded to include additional water level data collected by EPA ORD. The model was divided into two submodels:

1. SHL300T1, which is calibrated for the period 2006 to 2012 after the ATP began operation and before the barrier wall was installed

2. SHL300T2, which is calibrated for the period 2012 to 2015

Details of the model revisions are described in the Draft SHL Groundwater Flow Model Revision Report (Geosyntec 2016).

## 4.2 Summary of Model Revisions

The current model (SHL300T2a) is based on the second submodel (SHL300T2) of the 2016 SHL groundwater flow model. The current model (R88PEST_PU) simulates historical seasonal groundwater conditions in quarterly stress periods from 2012 to 2016 with a final steady state stress period to simulate average groundwater conditions through 2025. The model files are included in Appendix D. The following is a summary of model revisions developed by the MWG. Details of the revisions are provided in Sections 5 and 6.

- Consolidate SHL300T2 recharge Zones 5, 6, 8, 10 and a portion of Zone 3 located north of SHL into Zone 4 (see Figure 4.1 and Figure 6.2).

- Add new recharge Zone 11 near the storm water management basin located south of the landfill (see Figure 6.2).
- Increase recharge to the landfill cap from 0.01 percent (%) to 6% of precipitation.
- Update boundary conditions, including streams (MODFLOW river package), ATP extraction well and municipal supply well pumping rates, and recharge rates through the 4th quarter 2016.
- Revise calibration targets to include manual measurements and new target locations for 2016 (stress periods [SP]14 through 17).
- Convert quarterly transient SP1 (4th quarter 2012) to steady state.
- Consolidate the predictive stress periods simulating 2017 to 2025 (SHL300T2 SP18 to SP53) to a single steady state stress period (SHL300T2a SP18).
- Revise bedrock surface elevations by incorporating additional data collected from 2016 profile borings and light detection and ranging (LiDAR) mapping at bedrock outcrops.
- Adjust model layer elevations to be consistent with revised bedrock surface elevations. Updated model layer surfaces for bedrock, till, and overburden were developed using Environmental Visualizations Systems (EVS) software.
- Revise elevation datum of calibration targets using the 2017 site-wide measuring point survey update (KGS 2017a).
- Remove targets from SP5 (4th quarter 2013) derived from water level data collected shortly after an extended period of PSP dewatering (August 14 to November 7, 2013) because the hydrologic event was not simulated in the model.
- Exclude targets based on water level data collected during ATP shutdown periods and located within the ATP zone of influence because the hydrologic event was not simulated in the model.
- Revise hydraulic conductivity zonation and PEST calibration constraints to reflect available data from estimated hydraulic conductivity from slug testing including recent testing by USEPA ORD in November 2017 (USEPA 2017a) (See Table 5.1).
- Revise vertical anisotropy, defined as the ratio of horizontal to vertical hydraulic conductivity, in zones within the ATP extraction wells zone of influence to better match drawdown measured during a 9-day shutdown test conducted in 2013.
- Adjust head boundary conditions in the river package of MODLFOW from the PSP dam to the westerly bend in Nonacoicus Brook (by the train tracks) to assign a flatter gradient at the westerly bend and a steeper gradient upstream to the PSP dam.

- Revise sediment thickness in the northwest reach of PSP (Reach 13; see Figure 6.4) to a uniform value of 1 foot except in the area just upstream from the dam where a sediment thickness of 5 feet is assigned to simulate accumulation of sediment at the base of the dam.
- Reduce horizontal hydraulic conductivity by a factor of 10 in Layer 1 directly beneath PSP to account for the relatively high incision depth of PSP with respect to layer thickness.

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# 5. MODEL CONSTRUCTION AND INPUT

## 5.1 Model Domain and Boundary Conditions

The model discretization is consistent with the grid from the 2016 model and consists of 318 rows and 312 columns with variable grid spacing from 10 to 500 feet. The finer grid spacing is assigned near the groundwater extraction wells where grid spacing is as fine as 10 feet by 10 feet, in order to better simulate water level changes in response to pumping. The model covers an area of approximately 4.3 square miles and extends approximately 2.5 miles from the Nashua River on the western boundary to the eastern edge of Grove Pond on the eastern boundary (see Figure 5.1). The northern and southern boundaries extend approximately 1 mile in either direction from SHL and align approximately with topographic highs at elevations of approximately 360 feet. Topographic lows of approximately 215 feet align with Nonacoicus Brook and the Nashua River.

## 5.2 Model Discretization

Consistent with the 2016 interim models, Layers 1 to 3 represent the silty sand overburden encountered over much of the Site. This overburden is modeled as three layers of approximately equal thickness in each horizontal grid; this was achieved by dividing the approximate saturated thickness above the till by 3. Layer 4 represents till overlying bedrock with variable thickness near the landfill area and a uniform thickness of 5 feet in the remainder of the model area (see Figure 5.3). Layer 5 is 50 feet thick and represents the upper fractured bedrock overlying more competent bedrock. The competent bedrock is assigned as 200 feet thick in Layer 6. A model cross section depicting the model layering is presented in Figure 5.4.

The layer elevations in the 2016 interim models were revised to reflect updated bedrock and till surfaces based on additional data derived from profile borings installed at AOC 32/43A (provided by USEPA 2017b), additional boring log data from profile wells drilled near the ATP in 2016, and interpretation of bedrock elevation at the intersection of bedrock outcrops and LiDAR data collected in 2011 (FEMA 2011 and KGS 2016a). The revised bedrock and till surfaces were developed through collaboration with the MWG. The EVS model previously used to develop the 2016 model layer surfaces was updated to reflect the new data. A summary of well construction and boring log data is provided in Appendix A. A map of the revised bedrock surface is included in Figure 5.2.

## 5.3 Hydraulic Conductivity

The K zonation in the 2016 model was revised to reflect additional slug test data collected and analyzed by USEPA in November 2017. A listing of observed K data for monitoring wells in the model domain is compiled in Table 5.1. The distribution of K in the overburden (Layers 1 to 4), along with calibrated model parameter zonation, is shown in Figures 5.5 to 5.8, respectively. Except for the extraction wells, all K data was derived from monitoring well slug tests. The estimates for EW-01 and EW-04, included in the K distribution in Layer 4 (Figure 5.7), were derived from pumping tests. The updated K data set was analyzed to refine the zonation of hydraulic conductivity near the landfill. The zonation process included analysis of the three-

dimensional spatial variability of the K data and correlation to glacially deposited surficial geology. The final zonation and initially simulated K parameter values were refined through the calibration process with collaboration from the MWG. Statistics of K data by zone (mean, minimum, maximum) were used to inform PEST constraints during the automated calibration process. The calibrated hydraulic conductivity parameters, along with summary statistics of observed data by zone, is compiled in Table 5.2. Hydraulic conductivity zonation near SHL is illustrated in Figure 5.5 to 5.8 for model overburden Layers 1 to 4, respectively. A uniform hydraulic conductivity was assigned in shallow and deep bedrock, Layers 5 and 6, respectively. The hydraulic conductivity for the 2016 model is included in Figure 5.9 for reference.

In general, the 2016 model K zonation in the overburden sand (Layers 1, 2, and 3) was refined near the landfill area to include additional zones of lower K between the landfill and PSP (Zones 4, 24, and 34) which was informed by assessing the distribution of observed K data (see Figure 5.5, 5.6, and 5.7). In the overburden sand, anisotropy (defined as the ratio of horizontal K to vertical K) generally varies from 4:1 to 10:1. The 4:1 anisotropy is assigned for K zones near the ATP extraction wells (Zones 4, 11, 15, 21, 24, 25, 31, 34, 35) and was adjusted from 10:1 during the calibration process based on results of the shutdown test analyses (see Section 8.2). Anisotropy in the remaining zones in Layers 1 to 3 is 10:1 with exception of K in Layer 1 beneath PSP (Zones 1 and 2). Within the PSP footprint, several adjustments were made to align the assigned model hydraulic conductivity input to more closely represent field conditions. Specifically, to compensate for the relatively deep incision depth of the pond compared to the thickness of Layer 1, it was necessary to decrease the horizontal hydraulic conductivity of the model under the PSP footprint to simulate and mimic the reduced thickness and flow likely found in the field from deep incisions. The reasoning is that the river package, which is used to simulate the PSP, assumes flow under the river (underflow) is independent of incision depth. Further, vertical conductivity was not adjusted so that the resultant horizontal:vertical anisotropy ratio was 1:1. This too had the desired effect of constraining underflow. The parameter estimation for the zones under the river was informed by the PEST automated calibration process by tying the horizontal hydraulic conductivity of the zones beneath PSP (Zones 1 and 2) to the vertical hydraulic conductivity of parent zone (Zones 11 and 6) and maintaining the 1:1 anisotropy ratio. With this configuration, the hydraulic conductivity parameter estimates for zones beneath PSP were indirectly estimated using automated calibration process through the adjustment of the parent parameters (Zone 11 and Zone 6).

Except for an area without till in Layer 4, a uniform horizontal hydraulic conductivity value of 5.0 ft/day was assigned within the model domain for the till. In the area where no till was observed, the same zone from Layer 3 above (Zone 34) was assigned (see Figure 5.8). The horizontal and vertical hydraulic conductivity of the till was allowed to vary during the calibration process. The final calibrated value for vertical hydraulic conductivity in the till was 0.6 ft/day resulting in an anisotropy of 8.3 (Kxy:Kz).

Horizontal K in shallow bedrock (Layer 5) and deep bedrock (Layer 6) was assigned a uniform value of 0.02 ft/day and 0.17 ft/day, respectively. Vertical K for the till and bedrock layers was varied during the automated PEST calibration process. Final calibrated values assigned to vertical K values in Layers 5 and 6 were 1.7 and 0.08, respectively. Consequently, anisotropy was 0.012:1

in Layer 5 and 2.1:1 in Layer 6. The low anisotropy value (i.e., high vertical K relative to horizontal K) assigned to Layer 4 is consistent with the extensive vertical fracturing observed in the upper 50 feet of bedrock (Gannett Fleming 2012)

## 5.4 Storage and Porosity

Specific storage was assigned as 0.0005 $feet^{-1}$ in the overburden sand, Layers 1, 2, and 3. Specific storage was assigned as 0.00004 $feet^{-1}$ in Layers 4 and 5 and 0.00001 $feet^{-1}$ in Layer 6. Specific yield was assigned as 0.3 in Layers 1, 2, and 3 representing the overburden sand; 0.18 in the till (Layer 4); and 0.005 in the upper bedrock (Layer 5). Specific yield was not assigned in Layer 6 because it is configured as a confined layer. Effective porosity was assigned as 0.3, 0.25, and 0.001 in the overburden sand, till, and bedrock respectively. Early in the PEST calibration process the sensitivity coefficient of the storage parameters was relatively low so these parameters were not carried through PEST parameter estimation process. The values of specific storage, specific yield, and effective porosity assigned in the model were based on typical ranges and Site geology. Specific yield in the sand was also informed by results from the shutdown test analysis (see section 8.1.1).

## 5.5 Hydraulic Stresses

Two types of hydraulic stresses or boundary conditions are included in the model; constant flux and head dependent flux. Recharge and pumping wells are assigned as constant flux boundaries. Recharge is distributed over a large area or zone, and pumping is limited to the cell in which the well is located. Surface water fluxes are assigned as head dependent boundaries where flux is calculated using a conductance term and the difference between the assigned boundary head and the model computed head. Details on boundary condition model input are provided in Section 6.2.

## 5.6 Initial Conditions

The initial conditions or starting head distribution for the first stress period were derived from the solution of an earlier model version and considered to be a close approximation to observed water level conditions for that period. Although initial conditions are not a sensitive parameter to the steady-state head solution for SP1, use of starting heads that approximate the model solution serve to decrease the simulation runtime. For the subsequent transient stress period (SP2), the steady-state head solution for SP1 provided the initial head conditions. Subsequent stress periods (SP3 to SP18) relied on the transient final head from the prior stress period, incorporating seasonal variation in the simulation of model-calculated water levels to match observed Site conditions.

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# 6. MODEL SIMULATION PERIOD

## 6.1 Time Discretization

The revised model (SHL300T2a) is derived from the second 2016 submodel (SHL300T2) which extends from the 4th quarter 2012 to the 4th quarter 2025. The first 2016 submodel (SHL300T1), which simulated the period from 2006 to the 3rd quarter 2012, was excluded from the revised model to focus the calibration on current Site conditions and because post-2012 water level data is considered more reliable due to uncertainties in measuring point elevations prior to 2012.

The model start date, October 1, 2012, coincides with the completion of the barrier wall installed along the eastern edge of the landfill. The model was calibrated using water level data from the 4th quarter 2012 through the 4th quarter 2016. The period from 2017 to 2025 is included in the model for predictive model evaluations.

The revised model (SHL300T2a) consists of 18 stress periods. SP1 through SP17 are approximately 90 days in length and represent annual quarters from the 4th quarter 2012 to the 4th quarter 2016. The last stress period (SP18) represents a 9-year period from 2017 to 2025. SP1 and SP18 simulate steady-state conditions and the remaining stress periods simulate transient conditions. The stress periods are summarized in Table 6.1.

For transient stress periods (SP2 through SP16), a single time step was assigned to improve model runtime. The rationale was based on a comparative analysis of the model solution using a single time step per stress period versus ten time steps per period. Table 6.2 includes a comparison of residual statistics for the final calibrated model. The results indicate that differences in residual statistics are minimal. The differences in the maximum and minimum residuals as well as the increase in the sum of the squares is primarily attributed to targets in the bedrock where more extreme water level fluctuation is observed. For 79% of the targets, the differences in calculated water levels were less than 0.1 feet and less than 0.2 feet for 95% of the targets.

## 6.2 Time Varying Stresses

To simulate seasonal variation in Site conditions, boundary conditions were simulated using site-specific data to calculate average quarterly values from 2012 to 2016. Recharge was based on monthly precipitation records. Pumping from municipal supply wells and ATP extraction wells was based on pumping reports. Surface water elevations were based on stream gage measurements from stations in the Nashua River and brooks and ponds within the model domain. Details regarding these data and calculation of average quarterly values are described in the following sections.

### 6.2.1 Recharge

Recharge was based on a percentage of measured precipitation reported through 2016. Two precipitation gauging stations are located near the Site in Ayer and Fitchburg, Massachusetts. Monthly precipitation data for the period from January 2012 to December 2016 was downloaded from the publicly accessible Climate Data Online website maintained by the National Oceanic and

Atmospheric Administration (https://www.ncdc.noaa.gov/cdo-web/) for the two gauging stations. The gauging station at the Fitchburg Municipal Airport in Fitchburg, Massachusetts, (Global Historical Climatology Network Designation: GHCND: USW00004780) is located approximately 7.9 miles west of the SHL. The gauging station located in Ayer, Massachusetts, (GHCND: US1MAMD0025) is located approximately 0.6 miles to the northeast of the Site. A comparison of the precipitation data for the two stations indicated that the data were generally comparable with limited differences attributable to localized precipitation events. The Fitchburg station data was used for model input because it provided the most complete record over the period of interest. However, precipitation records from the Ayer station were used to address data gaps in the Fitchburg station dataset for September 8 through 30, 2016, and October 21, 2016. The total quarterly precipitation in inches is presented on Figure 6.1. The precipitation used for SP18 represents the average quarterly precipitation (8.83 inches) between January 2012 and December 2016.

The raw monthly water-equivalent total precipitation data, which includes snowfall, was converted to quarterly daily average precipitation for each quarter between October 2012 and December 2016. The quarterly daily averages were estimated by summing the total monthly precipitation for the three months of the quarter and dividing by the sum of days within the respective quarter. Future quarterly precipitation was estimated for the period 2017 to 2025 using the average of quarterly values of the previous five years, 2012–2016.

The recharge zonation assigned in the 2016 model was revised to simplify the number of zones north, east, and west of the Site. In addition, a high recharge zone south of the landfill (Zone 11) was added to simulate increased recharge near storm water collection basins located south of the landfill. The revised model zonation is illustrated in Figure 6.2. For reference, the 2016 model recharge zonation map is included as Figure 4.1. Except for Zone 11, all recharge zones were assigned a recharge value as a percentage of total precipitation based on land use. For each stress period, the quarterly recharge was estimated by multiplying the land use percentage for each zone by the average quarterly precipitation. For Zone 11, recharge was assigned as eight times the average precipitation for each stress period. This higher recharge was determined through model calibration and was necessary to better simulate flow directions in the southern portion of the landfill. The source of the recharge is assumed to be surface water drainage from the southern portion of the landfill as well as runoff from the industrial area to the south. The approximate landfill runoff area is depicted on Figure 6.2 and accounts for approximately 30% of the recharge to Zone 11. The remaining 70% is assumed to be derived from the industrial area storm water discharge. In addition, for each stress period, the estimated average quarterly recharge was multiplied by an adjustment factor between 0.5 and 2 to account for deviations from average quarterly rainfall. Model recharge was included in the model calibration by adjusting the recharge multiplier for each stress period. A tabulation of precipitation and recharge rates (in units of feet per day) assigned by stress period in the updated model is included in Table 6.3. The recharge rates for the period 2017 to 2025 (SP18) were set to the average of the recharge rates from the period 2012 to 2016 (SP1 through SP17).

### 6.2.2 Pumping

#### *6.2.2.1 Municipal Supply Wells*

Several public water supply wells within the model domain were in operation during the modeling simulation period (Figure 5.1):

- Grove Pond Well 1 (and Replacement Well 6)
- Grove Pond Well 2 (and Replacement Well 7)
- MacPherson Well
- Well 8 (a.k.a. NSA Well at Grove Pond)

The Public Water System Annual Statistical Reports submitted to MassDEP were obtained for the years 2012 through 2016. The flow rate for each well over the five-year reporting period is illustrated on Figure 6.3. Grove Pond Well 1 and Grove Pond Well 2 were replaced in June 2014 with Well 6 and Well 7, respectively. Well 8 (a.k.a. the NSA Well at Grove Pond) went into operation in June 2014. The pumping data, reported in total gallons per month, were converted to quarterly daily average pumping rates by adding the total volume pumped for each well during the three months within a given quarter and dividing by the total time in the quarter. The pumping rate assigned for each pumping well in SP18 (January 2017 through September 2025) is the average of Q1 2015 through Q4 2016 (2 years) pumping rates (SP10 through SP17).

#### *6.2.2.2 ATP Extraction Wells*

The average effective monthly flow rates reported for the period from October 2012 through December 2016 were analyzed to derive representative pumping rates for extraction wells EW-01 and EW-04 to use in the model simulations. The average effective monthly flow rate is defined as total monthly flow divided by total days in the month. Prior to the ATP system upgrade completed in 2014, the pumping rates were reported as the total pumping rate for both extraction wells and were reported to be distributed evenly between the two wells. In January 2015, flow meters were installed on each extraction well discharge line and individual flow rates were reported for EW-01 and EW-04. The data indicate that generally the flow rate is distributed evenly between the wells until February 2015. The following total ATP flow percent contribution was incorporated into the model input based on communication with the system operator:

- EW-01/EW-04 flow contribution was divided equally between October 2012 and February 11, 2015.
- EW-01/EW-04 flow contribution was set to 55%/45% between February 11, 2015, and September 11, 2015.
- EW-01/EW-04 flow contribution was set to 60%/40% between September 11, 2015, and September 28, 2016.
- EW-01/EW-04 flow contribution was set to 63%/37% between September 28, 2016, and the remainder of 2016 calendar year.

For the stress periods where the distribution of flow changed within a quarter (i.e., on February 11, 2015 in SP10 and on September 11, 2015 in SP12), the time-weighted average was estimated using the following formula:

$$\text{Time-Weighted Average Effective Flow Rate} = \frac{(Q_1 \, x \, T_1) + (Q_2 \, x \, T_2)}{T_1 + T_2}$$

where,

- $Q_1$ is the initial flow rate (cubic feet per day) pumping for initial period $T_1$ (days) between the start of the quarter and the flow rate change; and,
- $Q_2$ is the final flow rate (cubic feet per day) for the final period $T_2$ (days) between the flow rate change and the end of the quarter.

Quarterly pumping rates for EW-01 and EW-04 are listed in Table 6.4. The effective flow rate for Stress Period 18 was estimated by averaging the quarterly flow of the ATP system during 2016 (1-year average) and assigning the EW-01/EW-04 flow contributions to 63%/37% as set on September 28, 2016.

### 6.2.3 Surface Water Boundary Conditions

The surface water bodies within the current model domain were simulated using the river package of MODFLOW (Harbaugh 2005). They include the Nashua River, Cold Spring Brook, Willow Brook, Nonacoicus Brook, PSP, and Grove Pond. The surface water bodies and reach numbers, assigned in the current model, are illustrated on Figure 6.4. The locations of the river boundary condition grid blocks were unchanged from the previous 2013 and 2016 groundwater models. Model input parameters for river boundary conditions include stage elevation and conductance. Conductance is defined as the product of the surface water body area within a grid block and the vertical hydraulic conductivity of the bottom sediment, divided by the sediment thickness. The conductance parameter has units of square feet per day ($ft^2$/day). For the reaches representing the river and brooks, a uniform conductance within each reach was assigned (i.e., a uniform area independent of the grid block dimension, sediment thickness, and vertical hydraulic conductivity was assigned). For the reaches that represent PSP (Reaches 11, 12, 13) and Grove Pond (Reach 14), conductance varied (i.e., uniform hydraulic conductivity was assigned but the area varied with grid block dimensions and sediment thickness varied across the pond area). During the transient simulation, stage elevations were varied by stress period to represent seasonal conditions.

For the pond reaches, conductance was calculated using the area of the grid block and variable sediment thickness based on the results of a 1999 study of the bathymetry and soft sediment thicknesses in the ponds by USGS and USEPA (Mercadante et al. 1999). The study indicated a range of sediment thickness from 1.5 feet around the shallow edges to a maximum of approximately 17 feet in PSP and approximately 7.4 feet in Grove Pond in the deeper central portions. Consistent with the areal distribution reported in the 1999 study, modeled sediment thicknesses in the ponds were assigned as 1.6, 8.2, and 16.4 feet in PSP and 1.6 and 5 feet in Grove Pond. In addition, a uniform sediment thickness of 8.2 feet was assigned in the northwest corner

of PSP to simulate sediment accumulation immediately upstream from the dam. The distribution of sediment thickness assigned in the ponds is illustrated on Figure 6.5.

During the model calibration process, the conductance within each reach was varied by adjusting the vertical hydraulic conductivity. The calibrated model conductance within each reach is listed in Table 6.5. For the Nashua River (Reach 1), the conductance is 112 $ft^2$/day. The conductance for reaches representing Willow Brook - Reach 7 and Reach 8, are 120 and 142 $ft^2$/day, respectively. In Nonacoicus Brook (Reaches 2 through 6), the conductance varies between 98 and 400 $ft^2$/day. Cold Spring Brook (Reach 9) is simulated with a conductance of 557 $ft^2$/day. Conductance in the ponds varies with grid dimensions and sediment thickness such that grid blocks with small grid dimensions and large sediment thickness will have low conductance values and grid blocks with large grid dimensions and small sediment thicknesses will have large conductance values. The conductance in PSP varies from 5 $ft^2$/day to 563 $ft^2$/day and in Grove Pond from 35 $ft^2$/day to 5,244 $ft^2$/day.

Transient surface water stages for the model were based on the long-term stage elevation data reported by USGS for staff gages in the Nashua River located upstream and downstream from the model domain and short-term data collected at several staff gages located within the model domain in the Nashua River, Nonacoicus Brook, PSP, Grove Pond, Willow Creek, and Cold Spring Brook. The locations of the short-term stream gages are shown on Figure 6.4. Stream stage elevations at discrete points on the Nashua River, Nonacoicus Brook, Cold Spring Brook, and Willow Creek were estimated assuming linear gradients derived from available staff gage data. The following sections describe the derivation of the quarterly average stages for these water bodies. The post-2016 quarterly seasonal average stage inputs were set to the five-year average of the 2012 through 2016 stages for each quarter (e.g., the stage during the 2nd quarter for the period 2017 to 2025 [SP18] was estimated to be the average of the 2nd quarter stages from 2012 through 2016).

#### *6.2.3.1 Nashua River*

Long-term data was available for three USGS gaging stations located on the Nashua River within the vicinity of the model area. Two of the gaging stations, designated 01094500 and 01094400, are in Leominster and Fitchburg, approximately 7.0 and 9.2 miles upstream of the Site, respectively. A third gaging station, 01096500, is in East Pepperell approximately 7.9 miles downstream. Stream gage SWEL-105, located along the Nashua River within the model domain, was measured for a limited period between 1998 and 1999. To determine the best gage for estimating long-term average quarterly stage elevations for the Nashua River within the model domain, drainage areas for each USGS gage were estimated using the USGS StreamStats online tool and compared to the drainage area above gage SWEL-105. The respective drainage areas for the Fitchburg and Leominster gages are 64 and 110 square miles, compared to 434 square miles for the East Pepperell gage. The drainage area above gage SWEL-105 was estimated to be 305 square miles. Based on a comparison of drainage areas for the USGS gages and the drainage area of SWEL-105, the East Pepperell gage was chosen as the most appropriate basis for estimating long-term average quarterly stage elevations for the Nashua River within the model domain for the period January 2012 to December 2016.

The Nashua River stage elevation within the model domain was measured at gage SWEL-105 on four dates in 1998 and 1999, specifically, one measurement was collected in each: the 4th quarter 1998 and quarters 1 through 3 of 1999. These elevations were compared to the average daily Nashua River stage elevations recorded by the East Pepperell gage on the same days. The average stage elevation difference between the SWEL-105 stage and the East Pepperell average daily stage for the four measuring events is 33.1 feet. Average quarterly stage elevations for Nashua River at SWEL-105 in model stress periods spanning the period 2012 to 2016 were calculated by adding the stage elevation difference of 33.1 feet to the average quarterly stage elevations for East Pepperell gage. To calculate quarterly stage elevations for Nashua River boundary condition grid blocks across the model domain, the stage gradient was calculated by dividing the average stage elevation difference between SWEL-105 and the East Pepperell gage (33.1 feet) by the estimated linear distance between the two measuring point locations. Using the estimated quarterly stage elevations for SWEL-105 as a reference point, the stage gradient was used to estimate quarterly stage elevations for Nashua River boundary condition grid blocks across the model domain (Figure 6.6). For the period 2017 to 2025, the Nashua River boundary conditions were estimated as the five-year quarterly average for the period Q1 2012 through Q4 2016.

#### *6.2.3.2 Nonacoicus Brook*

The Nashua River stage at the confluence with Nonacoicus Brook was estimated, using a linear gradient, to be 2.06 feet below the stage at gage SWEL-105. Based on historical stage elevation data from gauging locations SWEL-107, SWEL-108, SWEL-109, SWEL-110, SWEL-111, and SWEL-112 monitored from 1998 to 2001 and more recent data from SHMSG-01G, SHMSG-02G, and SHMSG-03G, monitored from 2013 to 2014, an average stage differential was estimated for discrete points along Nonacoicus Brook. The stage differential is the height in feet relative to the Nonacoicus Brook stage at the confluence with Nashua River for upgradient points along Nonacoicus Brook. The stage differentials at the reference points along Nonacoicus Brook are summarized in Figure 6.4.

A two-foot stage drop across the beaver dam was incorporated into the Nonacoicus Brook boundary conditions to simulate the impact on localized groundwater flow near the dam. Review of aerial photos indicates that the dam has likely been in place since at least 2006 and its presence was confirmed during a 2015 Site walk. The quarterly stage elevations for Nonacoicus Brook boundary condition grid blocks were derived by adding their respective stage differentials to the quarterly average Nashua River stage elevations at the confluence with Nonacoicus Brook. The stage for each grid block between the points was estimated assuming a linear gradient.

#### *6.2.3.3 Willow Brook*

Willow Brook is located to the west of SHL and flows in a northerly direction through AOC 69W to drain into Nonacoicus Brook. Stage elevation records for the brook are limited to four measurements at gage SWEL-16 recorded between 2005 and 2007. The stage differential between the average stage at gage SWEL-16 and the average quarterly stage for Nonacoicus Brook at Willow Brook was estimated at 14.4 feet. The quarterly average stage elevations for SWEL-16 were derived by adding the stage differential to the quarterly average stage for Nonacoicus Brook

at the confluence with Willow Brook. Review of aerial photographs shows a storm water basin with standing water in the area at the most upstream point of Willow Brook. The stream stage at this point was set to 242 feet based on USGS topographic elevations in this area.

#### *6.2.3.4 Plow Shop Pond*

The PSP stage has been historically monitored at six locations: SWEL-104, SWEL-106, Staff 1, Staff 2, SWEL-PSP, and PSP-01. A datalogger installed at gage Staff 1 located within Red Cove on the western side of the pond provided continuous stage data, measured at 1-hour intervals, during three periods: August 2006 to September 2009, November 2013 to August 2015, and October 2015 to May 2017. Manual measurements were taken at variable time intervals at Staff 1 during the datalogger operation, and, after the removal of the datalogger, manual measurements were collected on a semiannual to annual basis until 2016 (see Figure 6.7). The daily average stage elevation for each quarter were derived from the average of the datalogger data measured during each quarter. For the period with no datalogger data available, the daily average stage elevations for each quarter were set equal to the average of the 2006 to 2009 datalogger quarterly average elevations for each quarter (Q1 to Q4) to simulate seasonal stage variations. These projected PSP stage elevations are generally within 0.2 feet of the manual measurements at Staff 1 for their respective quarters in the 2009 to 2016 time period.

#### *6.2.3.5 Grove Pond*

Grove Pond is connected to and drains into PSP via a short culvert located under a railroad bridge between the two ponds. Three gaging locations were historically established at Grove Pond: SG-GP, SWEL-05 and SWEL-GRP. However, the available stage records are limited to two measurements recorded in 1992 and four measurements from 1993. Three out of the four 1993 stage measurements were recorded on the same dates as measurements from SWEL-PSP in PSP. On these dates, the Grove Pond stage was 0.5 to 0.8 feet above the PSP stage. The Grove Pond quarterly stage elevations were derived by adding 0.5 feet to the PSP stage elevations. The stage elevations for the culvert connecting the two ponds were set using a linear gradient between the stages of the ponds.

#### *6.2.3.6 Cold Spring Brook*

The stage of the wetland adjacent to Cold Spring Brook in AOC 57 has been monitored at gauging locations SG-01, SG-02 and SG-03. Between 2006 and 2015, the stage was measured on a semiannual basis from 2006 to 2008 and annually between 2009 and 2014, with the exception of 2010 for which no records are available. For the quarters with available data, the stage elevation in the wetlands was estimated as the average of the three gages and as the average of all available data for quarters with no stage measurements (Figure 6.8). The stage elevation in the brook at AOC 57 was set to 0.5 feet below the stage of the wetland assuming drainage toward Cold Spring Brook. Quarterly stage elevations upstream and downstream from AOC 57 were calculated using an estimated gradient derived from the stage elevation difference between AOC 57 and Grove Pond. This stage gradient varies between 0.0005 ft/ft to 0.0009 ft/ft, depending on the stage differences between Cold Spring Brook at AOC 57 and Grove Pond.

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# 7. MODEL CALIBRATION PROCESS

Model calibration was based primarily on hydraulic head data from the period 2012 to 2016. Additionally, the calibration was informed by using two qualitative approaches: evaluation of non-pumping conditions during a 9-day shutdown period in 2013 and evaluation of gradient vector directions near the ATP and in the southern portion of the landfill. The analyses were integrated into the calibration process to inform adjustment of model parameters as well as to evaluate the final calibrated model. The shutdown test and 3PE analysis is described in more detail in Section 8.

Initially, calibration was conducted manually by varying individual parameters and evaluating the model response to help develop a detailed understanding of the model configuration and calibration target sensitivities. During this phase of the calibration, recharge and hydraulic conductivity zonation were adjusted to better match the observed data. In addition, calibration target data was analyzed to identify anomalous values and apply a weight of 0 to exclude these data from the PEST optimization process. Anomalous values were identified by evaluating the temporal and spatial variability of water level elevation data for targets with high residuals. This was accomplished by reviewing hydrographs of the target in question along with surrounding targets.

Then, PEST was run in estimation mode with the most sensitive parameters constrained to ranges of expected values. PEST was initially applied to identify the parameters with the strongest effect on model target residuals (the difference between observed and model-calculated values). The parameters identified were carried through the PEST parameter estimation process to develop the final calibrated parameter values. The process was iterative with successive PEST runs informing adjustments to parameter values and constraints. In general, parameters with sensitivities within two orders of magnitude of the most sensitive parameter can be estimated with reasonable accuracy during the calibration (Hill 1998). It may or may not be possible to estimate accurately the values for parameters having sensitivities within two to three orders of magnitude of the most sensitive parameter. Sensitivities that are more than three orders of magnitude less sensitive than the most sensitive parameter cannot be estimated with reasonable accuracy. Scaled composite sensitivities relative to the most sensitive parameter were reviewed during the calibration process, and final relative composite scaled sensitivities are presented in Section 9.3.

## 7.1 Calibration Targets

Model calibration was based primarily on hydraulic head data from the period 2012 to 2016. Groundwater elevations were estimated using depth to water level data collected during field monitoring events. For monitoring wells included in the 2017 site-wide resurvey, water level elevations were calculated using the updated measuring point elevations. For the remaining wells, measuring point elevations reported in the previous 2013 and 2014 well surveys were used to calculated water level elevations. The data used to calculate model calibration targets is tabulated in Appendix B. For stress periods where more than one water level was reported, the average of the quarterly values was used for the calibration target. Calibration of the SHL300T2a model included head data from 205 monitoring wells with 1,413 calibration targets used to evaluate the fit of observed groundwater elevations to groundwater elevations simulated in quarterly stress

periods. The target locations are depicted on Figures 7.1 and 7.2. The following groundwater elevation data collected in the 2012 to 2016 time frame were excluded from the calibration target set for the reasons listed:

- SP5 (October 1, 2013 through December 31, 2013) data for all wells within the model domain were excluded due to PSP dewatering associated with Red Cove sediment removal.
- Data from 52 wells located within a 0.3-foot drawdown radius of influence of ATP wells EW-01 and EW-04 were excluded from all water level measurement events when the ATP was reported to be offline for at least one hour on a given day. The ATP pumping status was compiled from data reported in the ATP Annual Reports.

The target wells are widely distributed within the model domain and grouped by location as follows:

- Group 1 - Shepley's Hill Landfill and NIA overburden monitoring wells
- Group 2 - Shepley's Hill, Shepley's Hill Landfill, and NIA bedrock monitoring wells
- Group 3 - AOC 32/43A monitoring wells
- Group 4 - AOC 57 monitoring wells
- Group 5 - AOC 69W monitoring wells

Except for the Shepley Hill bedrock targets (Group 2), a weighting factor of 1 was applied to the target wells within each group.

Shepley's Hill has a steep water table slope and extreme water level fluctuations due to the steep surface topography and the nature of bedrock fracture flow. The conditions in this area were difficult to simulate resulting in large localized deviations (residuals) of the hydraulic heads predicted by the model compared to the measured head data. To reduce the degree to which the residuals in this area drove the PEST calibration process, these targets were given a weight of 0 during the PEST calibration simulations.

In addition, a weighting factor of 0 was applied to a limited number of targets that were determined to be anomalous with respect to historical data within the target wells and relative to water levels in surrounding wells. The PEST optimization process, which excludes calibration targets with weighting factors of 0, relied on targets from 199 monitoring wells and 1,393 calibration targets. The calibration water level targets are listed in Table 7.1.

The model-calculated head used for comparison to observed water levels is derived from the node-centered head computed by MODFLOW in the cell containing the target and bilinear interpolation by GWVISTAS to calculate the heads at specific monitoring well locations within the grid block. This cell interpolated model head is used for a direct location comparison to head observed in the monitoring wells.

## 7.2 Parameter Constraints and Initial Estimates

The final calibrated parameters estimated using PEST included horizontal and vertical conductivity and recharge multipliers for each recharge zone (see Section 6.2.1). The distribution of the final zonation and K parameter constraint values were developed through the calibration process with collaboration from the MWG (see Section 5.3). Statistics of K data by zone (mean, minimum, maximum) were used to inform PEST constraints during the automated calibration process. Table 5.2 lists the model parameters with constraints applied during the PEST calibration process and final parameter values. In addition, the model evaluation approach described in Section 8 was implemented iteratively to help guide adjustments of model parameters during the calibration process. Interim calibration results were reviewed and discussed by the MWG periodically to ensure consensus on the final calibration.

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# 8. SHUTDOWN TEST AND 3PE MODEL CALIBRATION ANALYSIS

Model calibration was supported using two approaches: evaluation of the model under non-pumping conditions and evaluation of calculated flow directions using a 3-point gradient vector analyses. These analyses were integrated into the calibration process to inform adjustment of model parameters as well as to evaluate the final calibrated model. The results of the analyses are described in the following sections.

## 8.1 Model Predicted Water Levels

To evaluate the model under non-pumping conditions, water level data from monitoring wells near the ATP collected during a 9-day shutdown period was used to assess the ability of the model to simulate water level recovery. To examine model-calculated flow directions, the 3-point gradient vector analysis was used to evaluate simulated flow directions near the ATP and in the southern portion of the landfill.

### 8.1.1 ATP Shutdown Test

To evaluate model performance under different hydraulic conditions, the calibrated model was used to simulate non-pumping conditions to compare to observed water level recovery after a 9-day shutdown period of the ATP extraction wells in February 2013. The shutdown test simulation (R88PEST Shutdown Test) model files are included in Appendix D. Specifically, the observed water level recovery (i.e., the difference in water levels at observation wells before shutdown on February 6 and at the end of the shutdown period on February 15) was compared to simulated recovery calculated as the difference in water levels simulated in SP2 under pumping and non-pumping conditions. SP2 of the calibrated model (R88PEST_PU) represents a 3-month period from January through March 2013 and provides the most appropriate boundary conditions for river nodes and seasonal recharge from precipitation to simulate the February 2013 shutdown test. The heads calculated at the end of SP2 under pumping conditions were used as the initial heads for the 9-day non-pumping simulation. The model was run in transient mode to evaluate the effects of storage parameter adjustments on model results. Both the pumping (90-day stress period) and non-pumping (9-day stress period) simulations were simulated with a single timestep.

Precipitation during the recovery period (shutdown test) was evaluated to determine whether adjustments to SP2 recharge should be assigned during the 9-day shutdown simulation. The precipitation records from the Fitchburg Municipal Airport for the month of February 2013 is compiled in Table 8. 1. The average precipitation during the shutdown test was 0.0063 ft/day, within 3% of the average precipitation for the first quarter 2013 (0.0065 ft/day) used as a basis for recharge in SP2. Therefore, no adjustment to SP3 recharge was made for the simulation.

The location of the 32 observation wells monitored during the shutdown test are shown on Figure 8.1. Recovery was calculated as the difference between the head at the beginning of the shutdown test subtracted from the head at the end of the test. The results of the analysis for the calibrated model (R88PEST_PU) are summarized in Table 8.2 and presented graphically in recovery versus distance plots for EW-1 and EW-4, Figures 8.2 and 8.3, respectively. The recovery

residual, calculated as the difference between the observed recovery and simulated recovery, is posted for each observation well on Figure 8.1. The difference between the observed and simulated recovery varied between -0.10 and 0.45 feet with an average recovery residual of 0.19 feet. The monitoring wells with the highest residuals are located downgradient from the extraction wells in the NIA. The slope of the observed and model computed residuals as shown in Figure 8.1 and 8.2 are similar suggesting that the estimates of storage and hydraulic conductivity used in the model are reasonable.

### 8.1.2 Hydraulic Gradient Vector Analysis

Hydraulic gradient vector analysis (three-point estimator [3PE]) using continuous water level data collected at 15-minute intervals from dataloggers in a subset of Site monitoring wells provides insight regarding the seasonal variability in the magnitude and direction of groundwater gradients over quarterly time periods. A comparative analysis of observed versus simulated gradient direction was used as a guide during the calibration process to assess the ability of the model to match observed flow directions. Estimated flow directions were calculated from head data using the 3PE spreadsheet program developed by USEPA (2014). To evaluate the range of seasonal conditions, present at the Site, two periods representing high and low recharge rates were selected from the available data set for the analysis. Simulated gradients were calculated from calibration target heads and compared to statistical values of observed gradients (minimum, maximum, 25% and 75% quartiles, and average) calculated with datalogger data collected during the two model stress periods.

#### *8.1.2.1 Evaluation of Model Results*

Two areas were evaluated using the 3-point vector analysis: an area east of the ATP and the southern landfill area. For the area near the ATP, data from SP3 (spring 2013; 4/1/13 to 6/30/13) and SP17 (fall 2016; 9/30/2016 to 12/31/216)) were selected from the available continuous water level data for evaluation of flow conditions that represent relative periods of high and low recharge from precipitation, respectively. The monitoring wells for which datalogger data were available are shown on Figure 8.4. The results of the analysis for the final calibrated model are summarized in Table 8.3. In summary, the analysis indicates that model-calculated flow directions near the ATP are more westerly than the 3PE results and the model-calculated flow directions in the southern part of the landfill are within the range of the 3PE results.

ATP Triangles

Analysis of the observed water level data east of the ATP found that flow direction was northwest and ranged from 309° to 345°. The northern triangles tended to exhibit more westerly flow toward EW-01 and EW-04 compared to the southern triangles which exhibited a more northerly flow direction. Quartile and average statistics for observed flow directions in spring 2013 were between 5° and 12° degrees more northerly than in fall 2016 for 3PE triangles 1 and 2. The model-calculated flow direction for each 3PE triangle was typically 3° to 13° west of the minimum observed flow directions for SP3 and SP17. This apparent bias suggests that the model as currently constructed may overpredict the extent of the ATP's capture zone in this area. A 3PE analysis of the stress

period calibration targets, consisting of one or two measurements used to represent seasonal hydraulic heads, also yielded a bias of westerly flow directions compared to the distribution of observed flow directions (Table 8.3).

Landfill Triangles

For the southern landfill area, datalogger data was limited to the spring 2017, a period of relatively high precipitation and elevated water levels. The comparative analysis was conducted using SP3 (spring 2013) simulated head for comparison with the spring 2017 conditions. The monitoring wells for which datalogger data were available are shown on Figure 8.4. The results of the analysis for the final calibrated model are summarized in Table 8.2. Observed flow directions from the 3PE analysis in Landfill South 2 was more variable than Landfill South 1. The observed flow in Landfill South 1 and 2 triangles was more northerly than those in the ATP area. The 3PE model-calculated flow directions in SP3 was within the range of observed flow directions from datalogger data collected in spring 2017.

#### *8.1.2.2 Evaluation of 3PE and Model Calibration Method*

Two aspects of using 3PE analysis to evaluate model calibration must be considered. First, due to the nature of the datasets used for the 3PE analysis, the seasonally averaged hand measurements relied on for model calibration are not directly comparable to continuous datalogger data. The second is the limiting assumptions for application of 3PE analysis near a pumping well or high recharge zone and the sensitivity of the 3PE results to small changes in water level elevations.

The model calibration (model-wide calibration targets and calculated heads) is based on seasonally averaged observed groundwater elevations and boundary conditions. The target head data are derived from multiple sources and a limited number of sampling events with different sets of monitoring wells. Consequently, the seasonally averaged water levels used for calibration targets, and that form the vertices of a 3PE triangles, are not necessarily created from the same number of observations or observations collected on the same days. These factors introduce some uncertainty into the calibration as well as the gradient analysis using 3PE. In contrast, the datalogger data, measured continuously over the entire stress period, may provide a more complete assessment of seasonally averaged conditions but are limited in aerial extent. Comparison of these head data, either directly or through 3PE analysis, must consider these limiting factors (i.e., targets constrained by limited data points and variable sample dates and correspondingly calibrated heads simulated with average boundary conditions versus continuous water level data).

The second aspect of the 3PE analysis that must be included in the interpretation of the results is limiting assumptions of the 3PE method. A key assumption for the application of 3PE analysis is that the water table within the vertices of the triangle is planar. This assumption of planarity could be challenged when the triangle is within the cone of depression of a pumping system, such as the ATP, or within a water level mound near a high recharge area. A second assumption that could be challenged is that groundwater is predominantly horizontal. Both sets of triangles used in the validation analysis are located in areas where the 3PE assumption are not strictly met. In addition,

the triangles east of the ATP are located side gradient from the zone capturing groundwater flow from the landfill.

To better understand the sensitivity in 3PE-derived flow directions to variations in assigned head, an analysis was conducted where the assigned hydraulic heads in ATP Triangle 1 (wells SHM-10-06, SHM-10-06A, and EPA-PZ-2012-1B) were systematically changed and the flow direction reevaluated. The analysis found that a 0.1-foot change to the head at either well SHM-10-06 or SHM-10-06A resulted in approximately 7° to 11° change in flow direction, whereas a 0.2-foot change in head at either well resulted in approximately 14° to 21° change in flow direction, respectively. Flow direction changes were less sensitive to systematic changes in head at EPA-PZ-2012-1B. Certainly when calibrating to hydraulic heads alone, residuals within 0.2 feet from the target value for a given well are often considered acceptable. However, such a difference in a 3PE evaluation may signify a 20° difference in expected flow direction.

These limitations must be considered when forming conclusions based on the 3PE analysis presented in the previous section.

## 8.2 Estimated Parameters

During the calibration process, the shutdown test approach was used to refine model parameters. Specific yield and vertical anisotropy in hydraulic conductivity zones near the extraction wells were adjusted to better match the observed recovery.

To evaluate storage parameters, model simulations using parameter values within expected ranges for the Site hydrogeology were conducted. The water level recovery residuals and distance drawdown plots were used to identify the parameter that generated the best fit with observed data. Through this process, specific storage was found to be a relatively insensitive parameter for simulating 9-day recovery from the overburden extractions wells. Consequently, a specific storage of 0.005 $ft^{-1}$was chosen for a uniform value in the overburden (Layers 1, 2, and 3). Specific yield in the overburden was evaluated for a range of values between 0.2 and 0.3 by plotting distance drawdown curves for each extraction well and comparing the slopes of the linear regression lines for each simulation to the observed data. The slope of the linear regression line using 0.3 resulted in a better fit to the observed data than the slope using 0.2. Consequently, a value of 0.3 was chosen for the specific yield in the overburden layers.

Anisotropy was evaluated by reviewing the vertical distribution of recovery residuals. Initially, a uniform vertical anisotropy of 10:1 (Kxy:Kz) was assigned for the overburden sand. However, the recovery residuals from the shutdown test simulations demonstrated that in general recovery in the deeper Layer 3 was being undercalculated compared to recovery in the shallower Layers 1 and 2. To address this bias, a vertical anisotropy of 4:1 was assigned in the overburden sand zones near the influence of the ATP (see Table 5.2).

# 9. FINAL CALIBRATION

## 9.1 Final Model-Computed Water Levels

Model calibration was assessed by comparing model-predicted water levels to observed, seasonally averaged target water levels. The differences between the two values are referred to as residuals. Plots of unweighted residuals compared to their target water levels are included in Figures 9.1 and 9.2 for model-wide targets and for a subset of targets in the SHL area (Group 1), respectively. The data are generally well distributed above and below the zero-residual line with 79.5% of the 1,413 residuals within the range of +/- 1.0 feet for the model-wide targets and 83.7% within that range for the 1,150 targets in the SHL area. Summary statistics for the unweighted residuals for model-wide targets and for targets in the SHL area are compiled in Table 9.1. The scaled, unweighted residual standard deviation indicates differences between simulated and target data across the range of target water levels and is commonly used to assess the quality of a model calibration. For a well-calibrated model, values of up to 10% are recommended. This statistic for the model-wide and the local SHL targets is 1.8% and 2.1%, respectively, well within the recommended range of up to 10% (ESI 2011).

Figures 9.3a through 9.3k present unweighted residuals versus target water levels for model-wide targets by stress period. The distribution of the residuals within each stress period exhibit a similar pattern as the full simulation period shown in Figures 9.1 and 9.2 demonstrating that there is no temporal systemic bias in the calibration. In general, the residuals for target water level elevations greater than 230 feet are higher than residuals for lower target water level elevations. In general, the targets associated with observed water levels above 230 feet are in Shepley's Hill bedrock or in overburden near Shepley's Hill where steeper gradients (both horizontally and vertically) are observed. Figure 9.4 is a schematic of an east-west cross section that extends from Shepley's Hill, through the landfill to Red Cove in PSP and illustrates the steep gradients west of the landfill. Target and model-calculated water levels for the second quarter 2016 (SP15) are posted on the section and indicate that the model undercalculates water levels on Shepley's Hill and in the overburden beneath the landfill cap near the submerged slope of Shepley's Hill bedrock.

Model-predicted potentiometric surfaces as well as the distribution of the target residuals within the model domain are presented by layer in Figures 9.5a through 9.5j for the second and fourth quarter of 2016, stress periods SP15 and SP17, respectively. These stress periods were chosen to evaluate model performance under current pumping rates for seasonally wet (spring) and dry (fall) conditions. The residual circles are color-coded green for negative residuals (model overestimate) and blue for positive residuals (model underestimate) and proportionately scaled such that the larger the circles represent larger residuals. The distribution of positive and negative residuals between SP15 and SP17 are similar. One exception is the Shepley's Hill area where higher residuals, positive values in SP15 and negative values in SP17, are evident in the bedrock targets (Figures 9.5e and 9.5j). This suggests that an adjustment to recharge rates in this area (increased in SP15 and decreased in SP17) may improve the calibration in this area. For the remaining areas, the residual distribution illustrated in Figures 9.5a to 9.5j indicate some spatial bias in model-calculated water levels across the model area. Within the landfill, model-calculated water levels

generally overestimate the target water levels in the southern portion of the landfill and generally underestimate the target water levels in the central portion of the landfill. This suggests adjustment to model parameters (hydraulic conductivity and/or recharge) may result in improved calibration in these areas. For example, it's possible that Shepley Hill may contribute some focused recharge along the western edge of the landfill that the model does not simulate. This focused recharge area may be based on anisotropy of the rock in an area toward the middle to northern part of Shepley Hill. In the NIA, model-calculated water levels generally overestimate the target water levels suggesting adjustment to model input parameters in this area including hydraulic conductivity, recharge, and/or conductance to Nonacoicus Brook may result in improved calibration for these targets. For example, an increase in river bed conductance in reaches 3 and 4 located directly downgradient within the NIA may result in lower model-calculated water levels and improve the calibration in this area.

## 9.2 Final Estimated Parameters

Initially, calibration was conducted manually by adjusting individual parameters followed by automated calibration using PEST to estimate hydraulic conductivity and stress period multipliers (see Section 7). Final estimated parameters derived from the final PEST calibration for hydraulic conductivity and recharge multipliers are compiled in Tables 5.2 and 6.3, respectively.

In the overburden, estimated model assigned horizontal hydraulic conductivity (Kxy) values were between 1.0 and 165.9 ft/day with the highest value in the sand and gravel deposits (Zone 6) and the lowest value in areas representing ground moraine (Zone 10). In the overburden sands, estimated Kxy values were in the range of 6.0 to 135.0 ft/day. In the upper and lower bedrock, estimated Kxy values were 1.7 and 0.1 ft/day, respectively. For most hydraulic conductivity estimates the optimized value was within the range of the minimum and maximum constraint assigned for the calibration. However, the Kxy estimate for five zones (Zones 4, 15, 31, 32, 34) was at the maximum constraint, and the Kxy estimate for two zones (Zones 12 and 25) was at the minimum constraint.

PEST-calibrated stress period recharge multipliers for SP1 through SP17 were constrained between a minimum of 0.5 and a maximum of 2.0 (Table 6.3). For most recharge multipliers the optimized estimate was within the range of the minimum and maximum constraint assigned for the calibration. However, the estimated multiplier for five stress periods (SP4, SP5, SP8, SP12, SP16) was at the minimum constraint and the estimated multiplier for four stress periods (SP2, SP10, SP14, and SP15) was at the maximum constraint.

## 9.3 Final Parameter Sensitivities

Figure 9.6 provides a graph of scaled composite model sensitivities for the final model configuration normalized by the composite sensitivity for the most sensitive parameter (RM1, the recharge multiplier for SP1). Except for two parameters, all estimated parameter sensitivities are within two orders of magnitude of RM1, indicating that these parameters can be estimated with reasonable accuracy. The remaining two parameters, horizontal conductivity in the till and upper

bedrock (Kz7 and Kz8), are within two to three orders of magnitude of the most sensitive parameter, indicating that a reasonably accurate estimation of these parameters is uncertain.

Review of Figure 9.6 indicates that the top ten parameters with the highest scaled composite sensitivities include recharge multipliers for stress periods 1, 11, 7, 13, 17, and 3; horizontal hydraulic conductivity for zones 9, 32, and 15; and vertical hydraulic conductivity for zone 9. In general, the more sensitive recharge multipliers are associated with stress periods that have the largest number of calibration targets and residual values contributing to the PEST optimization and calculation of sensitivity coefficients. Hydraulic conductivity zone 9 is uniformly assigned to the deep bedrock Layer 6. Although Layer 6 does not contain calibration targets the horizontal and vertical hydraulic conductivity affects simulated water levels in overlying layers especially the overlying shallow bedrock in Layer 5 where larger residuals are observed. Hydraulic conductivity zone 32 is in the area of AOC43/32 where a bedrock high and groundwater divide contribute to higher residuals (see Figure 5.7). Hydraulic conductivity zone 15 extends from north of Shepley's Hill, along the western edge of the landfill, and south of the landfill in Layer 1 (see Figure 5.5). This zone includes calibration targets in the southern portion of the landfill where the model overpredicts water levels and residuals are higher than average (see Figure 9.5a and 9.5f).

## 9.4 Final Volumetric Budget

The volumetric budget for the calibrated model is summarized in Table 9.2. Groundwater flux is presented by stress period for recharge, pumping, and for each surface water reach. Consistent with the conceptual site model (CSM), recharge is primarily derived from precipitation with groundwater discharge to surface water bodies and pumping wells. Except for the upper reach of Willow Brook (Reach 7), all the brooks (Nonacoicus, Willow, and Cold Spring) and the Nashua River are discharge boundaries. In PSP, discharge occurs in the southern portion of the pond including Red Cove (Reaches 11 and 12), and the northern portion of the pond (Reach 13) represents an area of groundwater recharge. In Grove Pond (Reach 14), flux is discharging to the pond in earlier stress periods, but in later stress periods the pond becomes a source of recharge to the system likely in response to increased pumping in supply Grove Pond Well 8 (located just south of the pond) beginning in SP8 (see Figure 6.3). Within the transient stress periods, the net flux into and out of the groundwater system is generally positive (recharging) during the winter and spring ( Q1, and Q2) and negative (discharging) during the summer (Q3). In the fall (Q4), the net flux varies between positive and negative.

In addition to the model-wide mass balance assessment, evaluation of flow into and out of the overburden beneath the landfill cap as well as a focused analysis of the northwest portion of PSP directly east from the ATP extraction wells was conducted by defining hydrostratigraphic units (HSUs) within the model domain. The concept of defining an HSU within the model provides a way of grouping cells into a single unit. The HSUs are illustrated in Figures 9.7 and 9.8 and flux is compiled in Table 9.3. In the landfill area, HSU2 represents the volume of overburden beneath the landfill cap. The boundaries of HSU2 are represented by HSU1 and HSU3 through HSU9 and were defined to evaluate inflow and outflow beneath the landfill cap. The inflows and outflows for SP18 are summarized in Table 9.3 to assess average conditions under current ATP extraction rates.

The data indicate that approximately 53% of the inflow is through the overburden from the south (HSU5) and 19% is from bedrock beneath the landfill cap (HSU9). The remainder of the inflow is derived from recharge through the cap (9%) and inflow in the northern portion of the landfill in response to ATP pumping (HSU6, HSU7, and HSU8). Much of the inflow to the southern portion of the landfill discharges south of the barrier wall toward the northeast through HSU3 (42%). While 33% of the total outflow exits the landfill along the northern toe of the landfill (HSU7).

HSU11, HSU14, HSU15, HSU24, and HSU34 were defined to evaluate the component of flow contributed to the groundwater system from the area of PSP just upstream from the dam. The HSUs define the volume of overburden sand beneath the northeast portion of the pond. Figure 9.8 provides a map view as well as a schematic cross section with flow directions into and out of the volume defined by the HSUs. The net inflow and outflow, as well as a breakdown by layer is summarized in Table 9.3. Approximately 56% of the flow into the overburden in northwest PSP is from the pond with the remaining inflow derived from upgradient groundwater flow. Most of the out flow (78%) occurs to the northeast along HSU15 with 21% recharging the groundwater to the northwest through HSU11.

## 10. ASSUMPTIONS AND LIMITATIONS

The updated SHL groundwater flow model presented in this report was developed with input from the MWG consisting of personnel from USEPA Region 1 and their technical consultants from the USEPA ORD and USGS, MassDEP, and USACE and their technical consultants from KGS and Geosyntec. This section summarizes key assumptions underlying the flow model and limitations in the model predictions identified by the MWG.

The configuration and calibration of the 2018 SHL groundwater flow model is based on the following key assumptions:

- Water level targets, calculated by stress period using available data, are representative of average quarterly conditions.
- Estimates of average seasonal water levels in surface water bodies within the model domain reasonably represent Site conditions.
- The equivalent porous media approach is a reasonable approximation of groundwater flow in fractured bedrock.
- Model recharge zonation distribution, and estimated percent precipitation based on land use, is a reasonable representation of recharge to the groundwater system. Confirmation of stormwater management in the industrial area south of the landfill would provide support to the model calibrated recharge value for Zone 11, representing the combined runoff from the landfill and the industrial area south of the Site (Section 6.2.1), or inform future model adjustments in this portion of the model.
- Hydraulic conductivity zonation and parameter calibration constraints reasonably represent the hydrogeologic system.

During the model development process, several items were identified as potentially affecting model uncertainty. These items warrant consideration during future application of the model and when planning for future data collection. It may not be possible to address all these issues; however, the following is provided to document the MWG discussions and to provide continuity for future model updates.

- Calibration targets (i.e., average seasonal water levels) were calculated from a data set that varied spatially and temporally for each target location. These data were collected from multiple study areas and therefore do not represent model-wide synoptic gauging events. In addition, the representativeness of the quarterly average target values is limited by the number of measurements per target as well as differences in measurement dates between targets. These spatial and temporal differences introduce some error into the model calibration.
- Some parameters were estimated at their constraint limits during the PEST calibration process indicating that a value outside the expected range may result in an improved match to observed water levels. Although the constraints were set by the MWG at

expected values for the Site, improved calibration may be realized with adjustments to the model input parameter constraints and/or parameter zone configuration.

- The locations of bedrock well screens within the 50-foot thick upper bedrock layer is not accounted for in the model-calculated water levels. Unlike target water levels within each layer, which are calculated in GWVISTAS using bilinear interpolation, water levels are not interpolated vertically. In the bedrock, where relatively steep vertical gradients are observed, the representativeness of the calculated water levels can be affected by the relative location of the screened interval compared to the elevation of the nodal center in the cell containing the target.
- In general, model-computed heads in the central portion of the landfill underestimate target water levels (see section 9.1), suggesting that recharge estimates in this area may be too low. A likely model adjustment to improve the calibration in this area is to assign additional recharge to the landfill cap or along the western edge of the cap.
- In general, model-computed heads in the NIA predict higher water level elevations than observed in monitoring wells. A likely model adjustment to improve the calibration in this area is to increase hydraulic conductivity and/or revise the configuration of hydraulic conductivity zonation in this area. Another likely adjustment is to riverbed conductance in the reaches located downgradient from the NIA.
- The model analysis using 3PE analysis indicated a westerly bias in the model-calculated flow directions east of the ATP compared to the distribution of observed flow directions, suggesting that the model may overestimate groundwater capture by the ATP in this area. However, use of the 3PE analysis to evaluate the model results is limited by the nature of the datasets used for comparison and by the assumptions inherent in the 3PE method (Section 8.1.2)

# 11. MODEL APPLICATION

This section describes a number of scenarios where the calibrated flow model was combined with the particle tracking program MODPATH to examine 1) the simulated fate of overburden groundwater beneath the landfill through an endpoint analysis; 2) the potential historic flow paths of groundwater at monitoring wells with known arsenic MCL exceedances; 3) the combined capture zone of EW-01 and EW-04; and 4) a 90-day simulation to showcase the sensitivity of the simulated EW-01 and EW-04 capture zone to high and low recharge conditions. Conclusions regarding capture by the extraction wells presented in this section are based on the particle tracking results only and do not rely on water quality data.

## 11.1 Current Conditions

The calibrated model (R88PEST_PU) was combined with the particle tracking program MODPATH to investigate the fate of groundwater beneath the landfill in the overburden and till (Layers 1 through 4). A total of 16 particles were released in each model cell in a 2x2 array at relative depths (Z offsets) of 0.2, 0.4, 0.6 and 0.8 of the cell thickness in overburden Layers 1 through 3. The analysis in the till (Layer 4) released a single particle in each cell near the bottom of the layer (Z offset = 0.75). The analysis excludes generating particles in known dry cells. Particles were released at the beginning of SP2 (start time = 93 days) and tracked forward in time through the end of SP18. The duration of SP18 was extended to simulate steady-state conditions for 50 years in order to maximize the number of particles captured. A porosity of 0.3, 0.25 and 0.001 was assigned to the overburden sand (Layers 1, 2, and 3), the till (Layer 4), and the bedrock (Layers 5 and 6), respectively. The MODPATH option always allow particles to pass through cells with weak sinks, so that they will discharge only at discharge boundaries or strong sink cells, was specified. An analysis of the MODPATH endpoint files was conducted to show the spatial pattern of particle destinations beneath the landfill. The model files for the endpoint simulation (R88PEST_PU_Simulation 1) are included in Appendix D. Results are graphically displayed on Figures 11.1 to 11.4 where the particle starting locations for a single Z offset of 0.6 are color coded by capture location. A quantitative comparison detailing the total number of particles captured by each discharge location, the total number of particles captured by starting K zone, and travel time statistics for each layer are presented on Table 11.1. For each layer, results show that approximately 85% to 90% of particles released from beneath the landfill are captured by extraction well EW-01 compared to approximately 4% to 11% of particles captured by extraction well EW-04. The remaining balance of particles in each layer are either captured by Nonacoicus Brook, PSP, or dry cells, or remain active at the end of the simulation in SP18 (54 years).

Reverse particle tracking was used to examine the flow paths of groundwater at monitoring wells with known arsenic MCL exceedances. The model files for the reverse particle tracking from monitoring wells (R88PEST_PU_Simulation 2) are included in Appendix D. At each of these monitoring wells, eight particles were released along 2-foot-diameter circles centered on the well and vertically at 2 feet spacing along the screened interval. The number of vertical release points along each well screen varied as a function of screen length. The number of vertical release points ranged from 2 for a 2-foot well screen to 11 for a 20-foot well screen. Particles were released at

the end of SP18 and tracked backward in time. Individual particle path lines are shown on Figure 11.5. Particles released at wells on the western half of the landfill typically reverse-tracked toward the bedrock from Shepley's Hill. Particles from the eastern half of the landfill and barrier wall area typically reverse-tracked south and remained in the till and/or overburden during the simulation period. Most of the particles released from monitoring wells in the NIA and downgradient of the ATP reverse-tracked southeast toward PSP before either exiting the model at the pond or taking a deeper path through the overburden toward the southern portion of the landfill. A smaller percentage of particles starting in the western portion of the NIA at the toe of Shepley's Hill reverse-tracked through the bedrock from Shepley's Hill.

Reverse particle tracking was also used to evaluate capture of the ATP extraction wells EW-01 and EW-04. The model files for the reverse particle tracking from the ATP extraction wells (R88PEST_PU_Simulation 3) are included in Appendix D. To predict the extent of the capture zone at 2016 pumping rates, particles were tracked in reverse starting at the end of SP18. The particles were released in a 4x4 array for every 2 feet of well screen around each recovery well (224 particles per well). The results of the analysis indicate that at 2016 pumping rates, which are representative of current pumping rates, the zone of capture extends across the full width of the landfill (see Figure 11.6). The particle tracks are consistent with the results of reverse particle tracks from monitoring wells with arsenic concentrations in groundwater exceeding the MCL (Figure 11.5). Results from the 3PE analysis representing average observed conditions in spring 2013 and fall 2016 are also depicted on Figure 11.6 and indicate that the reverse particles from the ATP track in a similar direction to the vectors in the southern two triangles. Consistent with the findings in Section 8.1.2, the 3PE analysis indicates a perceived westerly bias in the model-calculated flow directions. However, limitations of the 3PE analysis for model calibration (described in Section 8.1.2) and capture zone analysis must be considered when comparing datalogger gradient vectors to model results.

## 11.2 Sensitivity to Seasonal Recharge Rates

A sensitivity analysis was performed to further examine the effects of relatively high and low recharge periods on the simulated capture zone of the ATP extraction wells. For this analysis particles were released in a 4x4 array for every 2 feet of well screen around each recovery well (224 particles per well) and tracked in reverse for a period of 90 days, assuming an effective porosity of 0.3. Particles were released at the end of SP6 (spring 2014) and SP13 (fall 2015) to simulate relatively high and low recharge periods, respectively. As an additional analysis of the model sensitivity, particle tracks were also simulated for SP6 and SP13 assuming an effective porosity of 0.03, effectively increasing the particle velocity by a factor of 10 for the 90-day particle tracking period. The purpose of this additional analysis is to generate longer flow paths and extend the capture zone to examine the effect of the high and low recharge periods over a larger area and for an extended time period. The model files for the sensitivity analysis (R88PEST_PU_Simulation 4) are included in Appendix D. Results of the four particle tracking scenarios (SP6 and SP13 with effective porosity = 0.3, and SP6 and SP13 with effective porosity = 0.03) are presented on Figures 11.7 to 11.10. These figures show that the ATP wells capture a larger area under lower recharge conditions than higher recharge conditions. They also depict the

flow paths extended more northerly for the high recharge conditions compared to the low recharge conditions. This is consistent with observed 3PE flow directions where the average statistics for observed flow directions in the fall of 2016 were between 2° and 10° degrees more westerly than in the spring of 2013 for 3PE triangles 1 and 2 (Table 8.2).

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## 12. CONCLUSIONS

The 2018 updated groundwater model reasonably matches target water level elevations in the SHL area and across the model domain. Through the specification of measured temporal boundary conditions and calibration of simulated groundwater elevations to measured targets over the time period October 2012 through 2016, the model provides a reasonable simulation of average quarterly hydraulic conditions over the model period. Consistent with the CSM, the model-predicted mass balance indicates the primary source of recharge to the model domain is from precipitation with discharge to surface water bodies and pumping wells. In addition, based on the shutdown test and 3PE analyses, the model reasonably reproduces the recovery during the 2013 shut-down test and groundwater flow directions calculated using three-point hydraulic gradient analysis. Overall, this flow model honors the conceptual model with respect to the predicted range of hydraulic conductivity as well as observed bedrock elevations.

Additionally, composite sensitivities calculated in PEST indicate that it is possible through calibration to obtain reasonably accurate values for 36 of the 38 PEST-estimated parameters (hydraulic conductivity and recharge multipliers). The two parameters remaining, vertical K in the till and upper bedrock (Kz7 and Kz8), have sensitivities that indicate that it may be possible to obtain reasonably accurate parameter values through calibration. Overall, the calibrated model input parameters are reasonably accurate based on the PEST analysis. The model incorporates extensive site data including hydraulic conductivity and precipitation data for recharge estimates. As with any inverse model, the solution is not unique but estimated hydraulic conductivity parameters are within the range of observed data as well within the range of values typical for the geologic material observed at the site. In general, the model is more sensitive to recharge multipliers than hydraulic conductivity based on the composite scaled sensitivities as indicated by six out of the top ten most sensitive parameters being stress period recharge multipliers (see Section 9.3). The most sensitive hydraulic conductivity parameters are in Zone 9 (deep bedrock) and zones 32 and 15 which correspond to targets in bedrock and south of the landfill. Limitations of the model to simulate groundwater flow conditions at the site include some spatial bias evident in the landfill and the NIA suggesting adjustments to riverbed conductance may improve model results in these areas (see Section 9.1 and Section 10).

The results of flow path analysis using the calibrated model indicate that at the current pumping rates, the zone of capture extends beyond the full width of the landfill. The model analysis using 3PE gradient analysis indicated a westerly bias in the model-calculated flow directions east of the ATP compared to the distribution of observed flow directions, suggesting that the model may overestimate groundwater capture by the ATP in this area.

The revised model is a reasonable representation of the complex hydrogeologic conditions present at the Site. The model will provide a useful tool for future optimization of the current remedial system including evaluation of alternative pumping well locations and analysis of historical groundwater flow paths to evaluate arsenic background wells. Uncertainty in model predicted capture along the eastern edge of the landfill should be considered when relying on the model as one line of evidence to evaluate capture of groundwater flowing from beneath the landfill to the

ATP. Other lines of evidence, including observed hydraulic head data, groundwater quality trends, and mass flux to the ATP from within, and outside the landfill boundary should be relied on as the primary lines of evidence for evaluating groundwater capture by the recovery wells.

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# TABLES

**Table 2.1**
**Modeling Software Specifications**
**Shepley's Hill Landfill Groundwater Model**

| Software | Use | Version |
|---|---|---|
| Grounwater Vistas | Graphical User Interface (GUI) | Version 6.96 Build 47 |
| PEST | Parameter Estimation | BEOPEST Version: 13.6 |
| MODFLOW | Groundwater Flow | MODFLOW-NWT-SWR1 Version 1.0.9 07/01/2014<br>(Based on MODFLOW-2005 Version 1.11.00 08/30/2013) |
| MODPATH | Particle Tracking | Version 5.0 |

**Table 5.1**
**Summary of Hydraulic Conductivity (K) Test Data**
**Shepley's Hill Landfill Groundwater Model**

| AOC | Well | Individual K Estimates[4,5] K (feet/day) | | Average K (feet/day) | Data Source |
|---|---|---|---|---|---|
| SHL | B202-1 | 33.0 | 21.0 | 76.7 | Sovereign 2013c [CDM 1993] |
| | | 176.0 | | | |
| | B202-2 | 2.0 | | 22.5 | Sovereign 2013c [CDM 1993] |
| | | 43.0 | | | |
| | B202-3 | 17.0 | 1.0 | 55.0 | Sovereign 2013c [CDM 1993] |
| | | 147.0 | | | |
| | CH-1S | 22.0 | | 22.0 | USEPA 2017a |
| | CH-1D | 0.1 | | 0.1 | USEPA 2017a |
| | EPA-PZ-2012-1A | 11.0 | | 11.0 | USEPA 2017a |
| | EPA-PZ-2012-1B | 7.0 | | 7.0 | USEPA 2015, USEPA 2017a |
| | | 7.0 | | | |
| | EPA-PZ-2012-2A | 13.0 | | 13.0 | USEPA 2017a |
| | EPA-PZ-2012-2B | 18.0 | | 18.0 | USEPA 2017a |
| | EPA-PZ-2012-3A | 18.0 | | 18.0 | USEPA 2017a |
| | EPA-PZ-2012-3B | 8.0 | | 8.0 | USEPA 2017a |
| | EPA-PZ-2012-4A | 33.0 | | 33.0 | USEPA 2017a |
| | EPA-PZ-2012-4B | 44.0 | | 44.0 | USEPA 2017a |
| | EPA-PZ-2012-5A | 25.0 | | 25.0 | USEPA 2017a |
| | EPA-PZ-2012-5B | 15.0 | | 15.0 | USEPA 2015, USEPA 2017a |
| | | 15.0 | | | |
| | EPA-PZ-2012-6A | 79.0 | | 79.0 | USEPA 2017a |
| | EPA-PZ-2012-6B | 62.0 | | 62.0 | USEPA 2015, USEPA 2017a |
| | | 62.0 | | | |
| | EPA-PZ-2012-7A | 23.0 | | 23.0 | USEPA 2015, USEPA 2017a |
| | | 23.0 | | | |
| | EPA-PZ-2012-7B | 87.0 | | 87.0 | USEPA 2015, USEPA 2017a |
| | | 87.0 | | | |
| | EW-01 | | 27.4 | 27.4 | Sovereign 2013c [CH2M Hill 2006] |
| | EW-04 | | 21.2 | 49.0 | Sovereign 2013c [CH2M Hill 2006] |
| | | 249.5 | 69.3 | | |
| | | 203.9 | 56.6 | | |
| | N1-P1 | 0.9 | | 0.9 | USEPA 2017a |
| | N1-P2 | 15.0 | | 15.0 | USEPA 2017a |
| | N7-P2 | 15.0 | | 15.0 | USEPA 2017a |
| | PZ-12-01 | 37.0 | | 37.0 | USEPA 2017a |
| | PZ-12-02 | 6.0 | | 6.0 | USEPA 2017a |
| | PZ-12-04 | 43.0 | | 43.0 | USEPA 2017a |
| | PZ-12-06 | 60.0 | | 60.0 | USEPA 2017a |
| | PZ-12-08 | 32.0 | | 32.0 | USEPA 2017a |
| | PZ-12-10 | 170.0 | | 170.0 | USEPA 2017a |
| | RSK1 | 65.0 | | 67.0 | Sovereign 2013c [Ford et. al. 2008] |
| | RSK3 | 53.0 | | | Sovereign 2013c [Ford et. al. 2008] |
| | RSK4 | 100.0 | | | Sovereign 2013c [Ford et. al. 2008] |
| | RSK5 | 37.0 | | | Sovereign 2013c [Ford et. al. 2008] |
| | RSK7 | 83.0 | | | Sovereign 2013c [Ford et. al. 2008] |
| | RSK8 | 83.0 | | 83.0 | Sovereign 2013c [Ford et. al. 2008] |
| | RSK9 | 78.0 | | | Sovereign 2013c [Ford et. al. 2008] |
| | RSK10 | 83.0 | | | Sovereign 2013c [Ford et. al. 2008] |
| | RSK11 | 71.0 | | | Sovereign 2013c [Ford et. al. 2008] |
| | RSK12 | 97.0 | | | Sovereign 2013c [Ford et. al. 2008] |
| | RSK13 | 17.0 | | 35.0 | Sovereign 2013c [Ford et. al. 2008] |
| | RSK14 | 17.0 | | | Sovereign 2013c [Ford et. al. 2008] |
| | RSK15 | 68.0 | | | Sovereign 2013c [Ford et. al. 2008] |
| | RSK16 | 87.0 | | 66.0 | Sovereign 2013c [Ford et. al. 2008] |
| | RSK17 | 79.0 | | | Sovereign 2013c [Ford et. al. 2008] |
| | RSK18 | 21.0 | | | Sovereign 2013c [Ford et. al. 2008] |
| | RSK19 | 74.0 | | | Sovereign 2013c [Ford et. al. 2008] |
| | RSK34 | 8.0 | | 8.0 | USEPA 2017a |

**Table 5.1**
**Summary of Hydraulic Conductivity (K) Test Data**
**Shepley's Hill Landfill Groundwater Model**

| AOC | Well | Individual K Estimates[4,5] K (feet/day) | | Average K (feet/day) | Data Source |
|---|---|---|---|---|---|
| SHL | RSK35 | 21.0 | | 21.0 | USEPA 2017a |
| | RSK37 | 86.0 | | 75.0 | Sovereign 2013c [Ford et. al. 2008] |
| | RSK38 | 65.0 | | | Sovereign 2013c [Ford et. al. 2008] |
| | RSK39 | 4.0 | | 4.4 | Sovereign 2013c [Ford et. al. 2008] |
| | RSK40 | 5.0 | | | Sovereign 2013c [Ford et. al. 2008] |
| | RSK41 | 5.0 | | | Sovereign 2013c [Ford et. al. 2008] |
| | SHL-4 | 68.0 | | 68.0 | USEPA 2017a |
| | SHL-5 | 37.0 | | 37.0 | Sovereign 2013c [ENSR 1993] |
| | SHL-7 | 20.0 | | 20.0 | Sovereign 2013c [ENSR 1993] |
| | SHL-8D | 7.0 | 11.0 | 9.0 | Sovereign 2013c [ENSR 1993], USEPA 2017a |
| | SHL-8S | 252.0 | 56.0 | 33.0 | Sovereign 2013c [ENSR 1993, SWETS 1998], USEPA 2017a |
| | | 288.0 | 64.0 | | |
| | | | 9.0 | | |
| | | | 3.0 | | |
| | SHL-9 | 617.0 | 68.6 | 46.9 | Sovereign 2013c [ENSR 1993, CH2M Hill 2006] |
| | | 409.6 | 45.5 | | |
| | | 499.2 | 55.5 | | |
| | | | 18.0 | | |
| | SHL-10 | 15.0 | | 15.0 | Sovereign 2013c [ENSR 1993] |
| | SHL-11 | 0.7 | | 0.7 | Sovereign 2013c [ENSR 1993] |
| | SHL-12 | 31.0 | | 31.0 | Sovereign 2013c [ENSR 1993] |
| | SHL-13 | 1728.0 | 288.0 | 158.0 | Sovereign 2013c [ENSR 1993, SWETS 1998], USEPA 2017a |
| | | 1728.0 | 288.0 | | |
| | | | 7.0 | | |
| | | | 49.0 | | |
| | SHL-15 | 43.0 | | 43.0 | Sovereign 2013c [ENSR 1993] |
| | SHL-17 | 130.0 | | 130.0 | Sovereign 2013c [ENSR 1993] |
| | SHL-18 | 71.0 | | 71.0 | Sovereign 2013c [ENSR 1993] |
| | SHL-20 | 82.0 | | 82.0 | Sovereign 2013c [ENSR 1993] |
| | SHL-21 | 26.0 | | 26.0 | Sovereign 2013c [ENSR 1993] |
| | SHL-23 | 576.0 | 64.0 | 64.0 | Sovereign 2013c [SWETS 1998] |
| | SHM-05-40X | 30.0 | | 30.0 | USEPA 2015, USEPA 2017a |
| | | 30.0 | | | |
| | SHM-05-42A | 59.0 | | 59.0 | USEPA 2017a |
| | SHM-05-42B | 73.0 | | 73.0 | USEPA 2017a |
| | SHM-05-43 | 7.0 | | 7.0 | USEPA 2017a |
| | SHM-05-44 | 3.0 | | 3.0 | USEPA 2017a |
| | SHM-10-06 | 11.0 | | 11.0 | USEPA 2017a |
| | SHM-10-06A | 30.0 | | 30.0 | USEPA 2017a |
| | SHM-10-07 | 4.0 | | 4.0 | USEPA 2015, USEPA 2017a |
| | | 4.0 | | | |
| | SHM-10-11 | 14.0 | | 14.0 | USEPA 2015, USEPA 2017a |
| | | 14.0 | | | |

**Table 5.1**
**Summary of Hydraulic Conductivity (K) Test Data**
**Shepley's Hill Landfill Groundwater Model**

| AOC | Well | Individual K Estimates[4,5] K (feet/day) | | Average K (feet/day) | Data Source |
|---|---|---|---|---|---|
| SHL | SHM-10-12 | 49.0 | | 49.0 | USEPA 2015, USEPA 2017a |
| | | 49.0 | | | |
| | SHM-10-13 | 21.0 | | 21.0 | USEPA 2015, USEPA 2017a |
| | | 21.0 | | | |
| | SHM-10-14 | 6.0 | | 6.0 | USEPA 2015, USEPA 2017a |
| | | 6.0 | | | |
| | SHM-10-15 | 12.0 | | 12.0 | USEPA 2015, USEPA 2017a |
| | | 12.0 | | | |
| | SHM-10-16 | 54.0 | | 54.0 | USEPA 2015, USEPA 2017a |
| | | 54.0 | | | |
| | SHM-11-06 | 4.0 | | 4.0 | USEPA 2017a |
| | SHM-13-04 | 77.0 | | 77.0 | USEPA 2015, USEPA 2017a |
| | | 77.0 | | | |
| | SHM-13-05 | 5.0 | | 5.0 | USEPA 2015, USEPA 2017a |
| | | 5.0 | | | |
| | SHM-13-06 | 110.0 | | 110.0 | USEPA 2017a |
| | SHM-13-07 | 50.0 | | 50.0 | USEPA 2017a |
| | SHM-13-08 | 85.0 | | 85.0 | USEPA 2017a |
| | SHM-93-01A | 3.7 | 11.3 | 11.1 | USARMY 1993 |
| | | 4.0 | 25.5 | | |
| | SHM-93-18B | 1.5 | 11.3 | 6.4 | USARMY 1993 |
| | | 1.5 | 11.3 | | |
| | SHM-93-24A | 45.4 | 56.7 | 65.2 | USARMY 1993 |
| | | 45.4 | 113.4 | | |
| | SHM-96-5B | 230.0 | 26.0 | 29.8 | Sovereign 2013c [SWETS 1998, CH2M Hill 2006], USEPA 2017a |
| | | 259.0 | 29.0 | | |
| | | 530.7 | 59.0 | | |
| | | 750.5 | 5.0 | | |
| | | 83.4 | | | |
| | SHM-96-5C | 1614.0 | 179.3 | 131.9 | Sovereign 2013 [CH2M Hill 2006], USEPA 2017a |
| | | 1581.0 | 175.7 | | |
| | | 1327.0 | 147.4 | | |
| | | | 25.0 | | |

**Table 5.1**
**Summary of Hydraulic Conductivity (K) Test Data**
**Shepley's Hill Landfill Groundwater Model**

| AOC | Well | Individual K Estimates[4,5] K (feet/day) | | Average K (feet/day) | Data Source |
|---|---|---|---|---|---|
| SHL | SHM-96-22B | 403.0 | 45.0 | 73.0 | Sovereign 2013c [SWETS 1998, CH2M Hill 2006], USEPA 2017a |
| | | 403.0 | 45.0 | | |
| | | 795.8 | 88.4 | | |
| | | 1058.0 | 117.6 | | |
| | | | 69.0 | | |
| | SHP-05-45A | 146.2 | 8.1 | 7.0 | Sovereign 2013c [CH2M Hill 2006] |
| | | 110.4 | 6.1 | | |
| | | 123.2 | 6.8 | | |
| | SHP-05-45B | 467.0 | 51.9 | 41.8 | Sovereign 2013c [CH2M Hill 2006] |
| | | 446.0 | 49.6 | | |
| | | 214.5 | 23.8 | | |
| | SHP-05-46A | 164.8 | 9.2 | 8.6 | Sovereign 2013c [CH2M Hill 2006] |
| | | 1896.4 | 105.4 | | |
| | | 144.0 | 8.0 | | |
| | SHP-05-46B | 335.6 | 37.3 | 68.5 | Sovereign 2013c [CH2M Hill 2006] |
| | | 948.2 | 105.4 | | |
| | | 897.3 | 99.7 | | |
| | SHP-95-27X | 7.0 | | 7.0 | USEPA 2017a |
| | SHP-99-29X | 19.0 | | 19.0 | USEPA 2017a |
| | SHP-2016-1A | 0.6 | | 0.6 | USEPA 2017a |
| | SHP-2016-1B | 0.4 | | 0.4 | USEPA 2017a |
| | SHP-2016-2A | 0.7 | | 0.7 | USEPA 2017a |
| | SHP-2016-2B | 7.0 | | 7.0 | USEPA 2017a |
| | SHP-2016-3A | 0.2 | | 0.2 | USEPA 2017a |
| | SHP-2016-3B | 10.0 | | 10.0 | USEPA 2017a |
| | SHP-2016-4A | 0.5 | | 0.5 | USEPA 2017a |
| | SHP-2016-4B | 23.0 | | 23.0 | USEPA 2017a |
| | SHP-2016-5A | 3.0 | | 3.0 | USEPA 2017a |
| | SHP-2016-5B | 7.0 | | 7.0 | USEPA 2017a |
| AOC-32 | 32M-92-01X | 0.4 | | 0.4 | Ecology and Environment 1994 |
| | 32M-92-02X | 18.9 | | 18.9 | Ecology and Environment 1994 |
| | 32M-92-07X | 0.4 | | 0.4 | Ecology and Environment 1994 |
| | 32M-92-06X | 0.9 | | 0.9 | Ecology and Environment 1994 |
| AOC-43 | 43MA93-04X | 10.9 | | 10.9 | Ecology and Environment 1994 |
| | 43MA93-05X | 9.1 | 9.6 | 9.4 | Ecology and Environment 1994 |
| | 43MA93-07X | 15.4 | | 15.4 | Ecology and Environment 1994 |
| | 43MA93-08X | 0.2 | | 0.2 | Ecology and Environment 1994 |
| | POL 1 | 0.7 | 0.9 | 0.8 | Ecology and Environment 1994 |
| | POL 3 | 1.4 | 2.1 | 1.8 | Ecology and Environment 1994 |

**Table 5.1**
**Summary of Hydraulic Conductivity (K) Test Data**
**Shepley's Hill Landfill Groundwater Model**

| AOC | Well | Individual K Estimates[4,5] K (feet/day) | | Average K (feet/day) | Data Source |
|---|---|---|---|---|---|
| AOC-57 | 57M-95-01X | 345.6 | 35.9 | 190.7 | Harding Lawson 2000 |
| | 57M-95-02X | 259.2 | 23.2 | 141.2 | Harding Lawson 2000 |
| | 57M-95-03X | 15.8 | 1.5 | 8.7 | Harding Lawson 2000 |
| | 57M-95-04A | 82.1 | 8.2 | 45.1 | Harding Lawson 2000 |
| | 57M-95-04B | 33.1 | 8.3 | 20.7 | Harding Lawson 2000 |
| | 57M-95-05X | 144.0 | 14.5 | 79.3 | Harding Lawson 2000 |
| | 57M-95-06X | 24.5 | 2.4 | 13.4 | Harding Lawson 2000 |
| | 57M-95-07X | 96.5 | 10.1 | 53.3 | Harding Lawson 2000 |
| | 57M-95-08A | 1.2 | 0.1 | 0.7 | Harding Lawson 2000 |
| | 57M-95-08B | 10.7 | 2.9 | 6.8 | Harding Lawson 2000 |
| | 57M-96-09X | 11.7 | 0.6 | 6.2 | Harding Lawson 2000 |
| | 57M-96-10X | 2.0 | 0.1 | 1.0 | Harding Lawson 2000 |
| | 57M-96-11X | 3.0 | 0.2 | 1.6 | Harding Lawson 2000 |
| | 57M-96-12X | 3.7 | 0.2 | 2.0 | Harding Lawson 2000 |
| | 57M-96-13X | 4.3 | 0.2 | 2.2 | Harding Lawson 2000 |
| AOC-69W | 69W-94-09 | 3.7 | 0.3 | 2.0 | Harding Lawson 1997 |
| | 69W-94-10 | 59.0 | 4.3 | 31.7 | Harding Lawson 1997 |
| | 69W-94-11 | 44.6 | 5.0 | 24.8 | Harding Lawson 1997 |
| | 69W-94-12 | 15.8 | 4.5 | 10.2 | Harding Lawson 1997 |
| | 69W-94-13 | 73.4 | 10.7 | 42.0 | Harding Lawson 1997 |
| | 69W-94-14 | 83.5 | 3.9 | 43.7 | Harding Lawson 1997 |
| | ZWM-95-15X | 83.5 | 8.7 | 46.1 | Harding Lawson 1997 |
| | ZWM-95-16X | 27.4 | 2.8 | 15.1 | Harding Lawson 1997 |
| | ZWM-95-17X | 54.7 | 5.9 | 30.3 | Harding Lawson 1997 |
| | ZWM-95-18X | 77.8 | 6.9 | 42.3 | Harding Lawson 1997 |
| | ZWM-95-19X | 12.2 | 2.1 | 7.1 | Harding Lawson 1997 |
| | ZWM-95-20X | 12.5 | 2.1 | 7.3 | Harding Lawson 1997 |
| | ZWM-95-21X | 12.7 | 2.0 | 7.4 | Harding Lawson 1997 |

**Notes:**

1. Measurements shaded in gray were reported to be "anomalous" (Sovereign 2013c).
2. References within brackets represent the original document the data were reported in.
3. Blank cells indicated that data is not available for a given parameter.
4. Reported values are from slug tests. Multiple values are results from different methods of analysis. Refer to original document for specific methods.
5. EW-01 and EW-04 results are from pumping tests.
6. AOC = Area of Concern, K = Hydraulic Concuctivity; USEPA = United States Environmental Protection Agency.

**Table 5.2**
**Observed and PEST-Calibrated Hydraulic Conductivity by Model Zone**
**Shepley's Hill Landfill Groundwater Model**

| Geologic Unit | Parameter Zone | Observed Hydraulic Conductivity Data (ft/day) | | | | | | | PEST Calibration Input and Optimized Values (ft/day) | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Number of Observations | Geometric Mean | Arithmetic Mean | Standard Deviation | Minimum | Maximum | Range | Initial | Minimum | Maximum | Anisotropy Kxy:Kz | PEST-Calibrated |
| Layer 1 (Kx11 under PSP) | Kxy1[6] | NA | NA | NA | NA | NA | NA | NA | 4.36 | NA[6] | NA[6] | 1 | 4.9 |
| Layer 1 (Kx6 under PSP) | Kxy2[7] | NA | NA | NA | NA | NA | NA | NA | 15.9 | NA[7] | NA[7] | 1 | 16.6 |
| Overburden Sand | Kxy3 | NA | NA | NA | NA | NA | NA | NA | 27.0 | 20.0 | 65.0 | 10 | 31.7 |
| Overburden Sand | Kxy4 | 8.0 | 7.7 | 10.9 | 7.1 | 0.6 | 21.0 | 20.4 | 21.0 | 0.6 | 21.0 | 4 | 21.0 |
| Sand & Gravel | Kxy6 | NA | NA | NA | NA | NA | NA | NA | 159.0 | 140.0 | 260.0 | 10 | 165.9 |
| Till | Kxy7 | 3.0 | 2.0 | 3.1 | 2.4 | 0.4 | 5.0 | 4.6 | 5.0 | 0.4 | 5.0 | 9 | 5.0 |
| Upper Bedrock | Kxy8 | NA | NA | NA | NA | NA | NA | NA | 0.0 | 0.02 | 1.7 | 0 | 0.02 |
| Lower Bedrock | Kxy9 | NA | NA | NA | NA | NA | NA | NA | 0.2 | 0.002 | 0.2 | 2 | 0.2 |
| Ground Moraine | Kxy10 | NA | NA | NA | NA | NA | NA | NA | 1.0 | 1.0 | 13.0 | 10 | 1.0 |
| Overburden Sand | Kxy11 | 6.0 | 39.4 | 42.0 | 16.2 | 25.0 | 68.0 | 43.0 | 43.6 | 25.0 | 68.0 | 4 | 48.8 |
| Overburden Sand | Kxy12 | NA | NA | NA | NA | NA | NA | NA | 22.5 | 22.5 | 100.0 | 10 | 22.5 |
| Overburden Sand | Kxy15 | 8.0 | 50.3 | 59.3 | 35.8 | 22.5 | 130.0 | 107.5 | 130.0 | 22.5 | 130.0 | 4 | 130.0 |
| Overburden Sand | Kxy21 | 15.0 | 60.0 | 64.9 | 23.4 | 21.0 | 100.0 | 79.0 | 53.9 | 21.0 | 100.0 | 4 | 39.2 |
| Overburden Sand | Kxy22 | NA | NA | NA | NA | NA | NA | NA | 40.4 | 33.6 | 100.0 | 10 | 59.0 |
| Overburden Sand | Kxy24 | 11.0 | 3.2 | 7.4 | 7.0 | 0.2 | 18.0 | 17.8 | 8.3 | 0.2 | 18.0 | 4 | 6.0 |
| Overburden Sand | Kxy25 | 5.0 | 43.7 | 49.0 | 23.9 | 19.0 | 79.0 | 60.0 | 19.0 | 19.0 | 79.0 | 4 | 19.0 |
| Overburden Sand | Kxy31 | 15.0 | 76.2 | 80.4 | 29.8 | 37.0 | 170.0 | 133.0 | 135.0 | 37.0 | 135.0 | 4 | 135.0 |
| Overburden Sand | Kxy32 | NA | NA | NA | NA | NA | NA | NA | 135.0 | 22.4 | 135.0 | 10 | 135.0 |
| Overburden Sand | Kxy34 | 28.0 | 8.7 | 11.1 | 7.3 | 0.9 | 30.0 | 29.1 | 30.0 | 0.9 | 30.0 | 4 | 30.0 |
| Overburden Sand | Kxy35 | 13.0 | 27.9 | 43.2 | 23.8 | 0.4 | 87.0 | 86.6 | 18.6 | 0.4 | 87.0 | 4 | 24.1 |
| Till[2] | Kz7 | NA | NA | NA | NA | NA | NA | NA | 0.8 | 0.01 | 10.0 | 9 | 0.6 |
| Upper Bedrock[2] | Kz8 | NA | NA | NA | NA | NA | NA | NA | 1.70 | 0.02 | 1.7 | 0.01 | 1.7 |
| Lower Bedrock[2] | Kz9 | NA | NA | NA | NA | NA | NA | NA | 0.070 | 0.002 | 0.2 | 2 | 0.1 |

Notes:
1. Kxy = horizontal conductivity in the x and y direction (along model rows and columns). All zones were simulated as isotropic.
2. Kz = vertical hydraulic conductivity in z direction. With the exception of the till and bedrock (zones 7, 8, and 9), Kz is tied to the respective Kxy with the reported anisotrpy ratio.
3. Hydraulic conductivity zones are depicted in Figures 5.5 through 5.8.
4. Hydraulic conductivity estimates from field data are summarized on Table 5.1 and posted by layer on Figures 5.5 through 5.8.
5. Initial PEST hydraulic conductivity values represent the calibrated values from the previous simulation SHL300T2a R88.
6. Tied to Kz zone 11.
7. Tied to Kz zone 6.
8. NA = Not Applicable; PSP = Plow Shop Pond; ft/day = feet per day.

**Table 6.1**
**Model Stress Periods**
**Shepley's Hill Landfill Groundwater Model**

| Model SHL300T2a | | | | | |
|---|---|---|---|---|---|
| **Stress Period (SP)** | **Start Date** | **End Date** | **Number of Days (Transient)** | **Number of Time Steps** | **Cumulative Number of Days** |
| 1 | 9/30/2012 | 12/31/2012 | NA | 1 | 92 |
| 2 | 12/31/2012 | 3/31/2013 | 90 | 1 | 182 |
| 3 | 4/1/2013 | 6/30/2013 | 91 | 1 | 273 |
| 4 | 7/1/2013 | 9/30/2013 | 92 | 1 | 365 |
| 5 | 10/1/2013 | 12/31/2013 | 92 | 1 | 457 |
| 6 | 12/31/2013 | 3/31/2014 | 90 | 1 | 547 |
| 7 | 4/1/2014 | 6/30/2014 | 91 | 1 | 638 |
| 8 | 7/1/2014 | 9/30/2014 | 92 | 1 | 730 |
| 9 | 10/1/2014 | 12/31/2014 | 92 | 1 | 822 |
| 10 | 12/31/2014 | 3/31/2015 | 90 | 1 | 912 |
| 11 | 4/1/2015 | 6/30/2015 | 91 | 1 | 1003 |
| 12 | 7/1/2015 | 9/30/2015 | 92 | 1 | 1095 |
| 13 | 9/30/2015 | 12/31/2015 | 92 | 1 | 1187 |
| 14 | 12/31/2015 | 3/31/2016 | 91 | 1 | 1278 |
| 15 | 4/1/2016 | 6/30/2016 | 91 | 1 | 1369 |
| 16 | 7/1/2016 | 9/30/2016 | 92 | 1 | 1461 |
| 17 | 9/30/2016 | 12/31/2016 | 92 | 1 | 1553 |
| 18 | 12/31/2016 | 12/31/2025 | NA | 1 | 4841 |

Notes:

1. SP1 and SP18 are simulated under steady state conditions. SP2 through SP17 are simulated under transient conditions.
2. NA = Not Applicable.

**Table 6.2**
**Residual Statistics - Transient Time Step Evaluation**
**Shepley's Hill Landfill Groundwater Model**

| Statistic | Number of TS = 1 | Number of TS = 10 | Difference |
|---|---|---|---|
| Residual Mean | -0.05 | -0.06 | 0.01 |
| Absolute Residual Mean | 0.72 | 0.73 | -0.01 |
| Residual Standard Deviation | 1.13 | 1.17 | -0.04 |
| Sum of Squares | 1798.07 | 1943.47 | -145.40 |
| Root Mean Square (RMS) Error | 1.13 | 1.17 | -0.04 |
| Minimum Residual | -9.05 | -10.86 | 1.80 |
| Maximum Residual | 7.97 | 8.77 | -0.80 |
| Number of Observations | 1413 | 1413 | 0.00 |
| Range in Observations | 61.66 | 61.66 | 0.00 |
| Scaled Residual Standard Deviation | 0.02 | 0.02 | 0.00 |
| Scaled Absolute Residual Mean | 0.01 | 0.01 | 0.00 |
| Scaled RMS Error | 0.02 | 0.02 | 0.00 |
| Scaled Residual Mean | -0.001 | -0.001 | 0.00 |

Note:
1. TS = Time Step
2. Residual statistics are unweighted and represent model SHL300T2a version R88PEST.
3. Residual statistics are unweighted and represent model SHL300T2a version R88PEST with number of time steps increased to 10 for transient stress periods.

**Table 6.3**
**Calibrated Recharge Rate by Stress Period**
**Shepley's Hill Landfill Groundwater Model**

| Stress Period | Start Date | End Date | Precipitation (ft/d) | Recharge Multiplier | Recharge Rate (ft/d) | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | | | | 6% Precip | 32% Precip | 42% Precip | 42% Precip | 75% Precip |
| | | | | | Zone 2 | Zone 3 | Zone 4 | Zone 7 | Zone 9 |
| 1 | 9/30/2012 | 12/31/2012 | 0.0092 | 1.1 | 0.0006 | 0.0033 | 0.0044 | 0.0044 | 0.0078 |
| 2 | 12/31/2012 | 3/31/2013 | 0.0065 | 2.0 | 0.0008 | 0.0041 | 0.0055 | 0.0055 | 0.0098 |
| 3 | 4/1/2013 | 6/30/2013 | 0.0142 | 1.2 | 0.0010 | 0.0053 | 0.0070 | 0.0070 | 0.0125 |
| 4 | 7/1/2013 | 9/30/2013 | 0.0066 | 0.5 | 0.0002 | 0.0010 | 0.0014 | 0.0014 | 0.0025 |
| 5 | 10/1/2013 | 12/31/2013 | 0.0067 | 0.5 | 0.0002 | 0.0011 | 0.0014 | 0.0014 | 0.0025 |
| 6 | 12/31/2013 | 3/31/2014 | 0.0088 | 1.4 | 0.0007 | 0.0038 | 0.0051 | 0.0051 | 0.0091 |
| 7 | 4/1/2014 | 6/30/2014 | 0.0081 | 1.9 | 0.0009 | 0.0049 | 0.0066 | 0.0066 | 0.0118 |
| 8 | 7/1/2014 | 9/30/2014 | 0.0080 | 0.5 | 0.0002 | 0.0013 | 0.0017 | 0.0017 | 0.0030 |
| 9 | 10/1/2014 | 12/31/2014 | 0.0120 | 0.7 | 0.0005 | 0.0027 | 0.0036 | 0.0036 | 0.0063 |
| 10 | 12/31/2014 | 3/31/2015 | 0.0063 | 2.0 | 0.0008 | 0.0040 | 0.0053 | 0.0053 | 0.0094 |
| 11 | 4/1/2015 | 6/30/2015 | 0.0086 | 1.5 | 0.0008 | 0.0042 | 0.0056 | 0.0056 | 0.0099 |
| 12 | 7/1/2015 | 9/30/2015 | 0.0082 | 0.5 | 0.0002 | 0.0013 | 0.0017 | 0.0017 | 0.0031 |
| 13 | 9/30/2015 | 12/31/2015 | 0.0083 | 1.0 | 0.0005 | 0.0027 | 0.0036 | 0.0036 | 0.0064 |
| 14 | 12/31/2015 | 3/31/2016 | 0.0073 | 2.0 | 0.0009 | 0.0046 | 0.0061 | 0.0061 | 0.0109 |
| 15 | 4/1/2016 | 6/30/2016 | 0.0045 | 2.0 | 0.0005 | 0.0029 | 0.0038 | 0.0038 | 0.0068 |
| 16 | 7/1/2016 | 9/30/2016 | 0.0056 | 0.5 | 0.0002 | 0.0009 | 0.0012 | 0.0012 | 0.0021 |
| 17 | 9/30/2016 | 12/31/2016 | 0.0093 | 1.1 | 0.0006 | 0.0031 | 0.0041 | 0.0041 | 0.0073 |
| 18 | 12/31/2016 | 12/31/2025 | 0.0081 | 1.2 | 0.0006 | 0.0030 | 0.0040 | 0.0040 | 0.0071 |

Notes:

1. The Recharge Rate applied to a zone for a given stress period (SP) = Precipitation * Percent Precipitation * Recharge Multiplier.
2. Precipitation rates represent a daily average of the total recorded rainfall for a given stress period. Precipitation data are primarily from the Fitchburg, MA Municipal Airport (GHCND:USW00004780). Supplementary data from a meteorological station in Ayer, MA (GHCND:US1MAMD0025) were used to address gaps in the recorded data from the Fitchburg Municipal Airport (September 8 to September 30, 2016 and October 21, 2016).
3. Recharge multiplier was an adjusted parameter during the calibration process.
4. Recharge multiplier for SP18 is the average model recharge (SP1 to SP17) divided by average percent precipitation.
5. A map of recharge zones is presented on Figure 6.2.
6. The drainage area assumed to contribute to Zone 11 recharge is eight times the size of the area of Zone 11 (see Figure 6.2).

**Table 6.4**
**Quarterly Pumping Rates for ATP Extraction Wells**
**Shepley's Hill Landfill Groundwater Model**

| Model SHL300T2a | | | | |
|---|---|---|---|---|
| **Stress Period (SP)** | **Start Date** | **End Date** | **EW-01 Average Effective Flow Rate ($ft^3$/day)** | **EW-04 Average Effective Flow Rate ($ft^3$/day)** |
| 1 | 9/30/2012 | 12/31/2012 | 4089.53 | 4089.53 |
| 2 | 12/31/2012 | 3/31/2013 | 3703.91 | 3703.91 |
| 3 | 4/1/2013 | 6/30/2013 | 4125.73 | 4125.73 |
| 4 | 7/1/2013 | 9/30/2013 | 4271.54 | 4271.54 |
| 5 | 10/1/2013 | 12/31/2013 | 4082.13 | 4082.13 |
| 6 | 12/31/2013 | 3/31/2014 | 4298.24 | 4298.24 |
| 7 | 4/1/2014 | 6/30/2014 | 4229.79 | 4229.79 |
| 8 | 7/1/2014 | 9/30/2014 | 4410.23 | 4410.23 |
| 9 | 10/1/2014 | 12/31/2014 | 4054.71 | 4054.71 |
| 10 | 12/31/2014 | 3/31/2015 | 4211.20 | 3784.75 |
| 11 | 4/1/2015 | 6/30/2015 | 5163.01 | 4224.28 |
| 12 | 7/1/2015 | 9/30/2015 | 5723.80 | 4491.32 |
| 13 | 9/30/2015 | 12/31/2015 | 6540.06 | 4360.04 |
| 14 | 12/31/2015 | 3/31/2016 | 6299.41 | 4199.61 |
| 15 | 4/1/2016 | 6/30/2016 | 6068.80 | 4045.86 |
| 16 | 7/1/2016 | 9/30/2016 | 6114.89 | 4065.53 |
| 17 | 9/30/2016 | 12/31/2016 | 6352.28 | 3730.70 |
| 18 | 12/31/2016 | 12/31/2025 | 6438.14 | 3781.13 |

Notes:

1. Arsenic treatment plant (ATP) effective flow rate data was compiled from Table 3-1 Operations Summary - GWTP presented in the Shepley's Hill Landfill Annual Reports for years 2012 through 2016 (Sovereign and Amec 201, Sovereign 2014, M2S Joint Venture 2015, KGS 2016b, KGS 2017b.)
2. The average quarterly effective flow rates for the ATP system were estimated by averaging the effective flow rates for the three months in each quarter.
3. The percent contribution of flow from wells EW-01 and EW-04 in the 2012-2016 time frame was apportioned from the total ATP flow rate based on email communication with system operator (Steven Passafaro) and included the following:
   - EW-04 percentage of flow was set to 50% prior to January 2015 plant upgrades and until 11 February 2015 (EW-01 flow contribution equal to 50%);
   - EW-04 percentage of flow was set to 45% on February 11, 2015 (EW-01 flow contribution equal to 55%);
   - EW-04 percentage of flow was set to 40% on September 11, 2015 (EW-01 flow contribution equal to 60%); and
   - EW-04 percentage of flow was set to 37% on September 28, 2016 and for the remainder of 2016 (EW-01 flow contribution equal to 63%).
4. The quarterly average effective flow rates for EW-01/EW-04 were estimated as the average quarterly effective flow rate multiplied by the percent contribution (e.g. 50%:50%, 45%:55%).
5. For quarters during which a change in flowrate contribution between EW-01 and EW-04 was made, the following time-weighted average formula was used to estimate the average effective flowrate: ((Q1*T1) + (Q2*T2))/ (T1 + T2), where Q1 is the initial flow rate for T1 days, and Q2 is the final flow rate for T2 days remaining in the quarter.
6. The effective flowrate for SP18 (2017 to 2025) was estimated by averaging the quarterly average flow of the ATP during 2016 (1-year average) and assigning the EW-01/EW-04 flow contributions consistent with the 63%:37% as set on 28 September 2016.

**Table 6.5**
**River Boundary Condition Input Parameters**
**Shepley's Hill Landfill Groundwater Model**

| Parameter | Nashua River | Nonacoicus Brook | | | | | Willow Brook | | Cold Spring Brook | PSP/Grove Pond Connector | Plow Shop Pond | | | Grove Pond |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Reach Number | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 |
| Width (feet) | 10 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | variable[1] | variable[1] | variable[1] | variable[1] |
| Length (feet) | 20 | 40 | 40 | 40 | 40 | 40 | 40 | 40 | 40 | 10 | variable[1] | variable[1] | variable[1] | variable[1] |
| Thickness (feet) | 1 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 1 | variable[2] | variable[2] | variable[2] | variable[3] |
| Hydraulic Conductivity (ft/day) | 0.56 | 1.7 | 4 | 4 | 2.73 | 0.98 | 1.19 | 1.42 | 5.6 | 0.74 | variable[4] | 0.43 | 0.43 | 0.43 |
| Conductance ($ft^2$/day) | 112 | 170 | 400 | 400 | 272 | 98 | 120 | 142 | 557 | 37 | 375 to 563 | 5 to 105 | 5 to 420 | 35 to 5244 |

Notes:

1. Length and width is equal to the dimension of the grid blocks which vary within the reach.
2. Thickness varies from 1.6 to 16.4 feet (see Figure 6.5)
3. Thickness varies from 1.6 to 4.9 feet (see Figure 6.5)
4. Hydraulic conductivity varies between 6.2 and 30.8 ft/day.

ft/day = feet per day

$ft^2$/day = feet squared per day

**Table 7.1**
**Model Predicted Water Levels and Residuals**
**Shepley's Hill Landfill Groundwater Model**

| Well Name | Stress Period | Time (days) | Layer | Target Water Level Elevation (Feet) | Predicted Water Level Elevation (Feet) | Weight | Group | Residual (Feet) |
|---|---|---|---|---|---|---|---|---|
| 32M-01-14XBR | 1 | 92 | 5 | 231.78 | 228.51 | 1 | 3 | 3.27 |
| 32M-01-14XOB | 1 | 92 | 3 | 230.33 | 228.15 | 1 | 3 | 2.18 |
| 32M-01-16XBR | 1 | 92 | 5 | 232.31 | 237.48 | 0 | 3 | -5.17 |
| 32M-01-18XBR | 1 | 92 | 5 | 240.79 | 241.02 | 1 | 3 | -0.23 |
| 32M-92-01X | 1 | 92 | 4 | 239.88 | 244.71 | 1 | 3 | -4.83 |
| 32Z-01-05XOB | 1 | 92 | 3 | 230.30 | 231.04 | 1 | 3 | -0.74 |
| 32Z-01-06XBR | 1 | 92 | 5 | 240.20 | 242.18 | 1 | 3 | -1.98 |
| 32Z-01-07XOB | 1 | 92 | 4 | 240.50 | 243.66 | 1 | 3 | -3.16 |
| 32Z-01-08XOB | 1 | 92 | 3 | 239.84 | 244.57 | 1 | 3 | -4.73 |
| 32Z-01-09XOB | 1 | 92 | 2 | 230.01 | 230.60 | 1 | 3 | -0.59 |
| 32Z-01-10XBR | 1 | 92 | 5 | 241.25 | 239.28 | 1 | 3 | 1.97 |
| 32Z-01-12XBR | 1 | 92 | 5 | 235.30 | 238.16 | 1 | 3 | -2.86 |
| 32Z-99-02X | 1 | 92 | 2 | 233.10 | 229.62 | 1 | 3 | 3.48 |
| 43M-01-16XBR | 1 | 92 | 5 | 229.84 | 230.85 | 1 | 3 | -1.01 |
| 43M-01-16XOB | 1 | 92 | 3 | 229.58 | 230.67 | 1 | 3 | -1.09 |
| 43M-01-17XBR | 1 | 92 | 5 | 229.66 | 230.73 | 1 | 3 | -1.07 |
| 43M-01-17XOB | 1 | 92 | 2 | 229.46 | 230.67 | 1 | 3 | -1.21 |
| 43M-01-20XBR | 1 | 92 | 5 | 229.34 | 230.27 | 1 | 3 | -0.93 |
| 43M-01-20XOB | 1 | 92 | 2 | 228.89 | 230.23 | 1 | 3 | -1.34 |
| 69W-94-13 | 1 | 92 | 1 | 219.91 | 219.30 | 1 | 5 | 0.61 |
| 69W-94-14 | 1 | 92 | 1 | 219.25 | 218.53 | 1 | 5 | 0.72 |
| 69WP-08-01 | 1 | 92 | 2 | 217.56 | 216.72 | 1 | 5 | 0.84 |
| EPA-PZ-2012-1A | 1 | 92 | 2 | 212.95 | 212.28 | 1 | 1 | 0.67 |
| EPA-PZ-2012-1B | 1 | 92 | 3 | 212.94 | 212.30 | 1 | 1 | 0.64 |
| EPA-PZ-2012-2A | 1 | 92 | 2 | 213.05 | 212.44 | 1 | 1 | 0.61 |
| EPA-PZ-2012-2B | 1 | 92 | 4 | 212.94 | 212.48 | 1 | 1 | 0.46 |
| EPA-PZ-2012-3A | 1 | 92 | 2 | 212.43 | 211.64 | 1 | 1 | 0.79 |
| EPA-PZ-2012-3B | 1 | 92 | 3 | 212.37 | 211.63 | 1 | 1 | 0.74 |
| EPA-PZ-2012-4A | 1 | 92 | 2 | 212.17 | 211.34 | 1 | 1 | 0.83 |
| EPA-PZ-2012-4B | 1 | 92 | 3 | 212.04 | 211.17 | 1 | 1 | 0.87 |
| EPA-PZ-2012-5A | 1 | 92 | 1 | 212.51 | 211.86 | 1 | 1 | 0.65 |
| EPA-PZ-2012-5B | 1 | 92 | 3 | 212.44 | 211.85 | 1 | 1 | 0.59 |
| EPA-PZ-2012-6A | 1 | 92 | 2 | 212.14 | 211.12 | 1 | 1 | 1.02 |
| EPA-PZ-2012-6B | 1 | 92 | 3 | 212.01 | 210.93 | 1 | 1 | 1.08 |
| EPA-PZ-2012-7A | 1 | 92 | 1 | 212.14 | 211.22 | 1 | 1 | 0.92 |
| EPA-PZ-2012-7B | 1 | 92 | 3 | 212.08 | 211.16 | 1 | 1 | 0.92 |
| N1-P1 | 1 | 92 | 3 | 215.83 | 215.44 | 1 | 1 | 0.39 |
| N1-P2 | 1 | 92 | 2 | 216.06 | 215.62 | 1 | 1 | 0.44 |
| N1-P3 | 1 | 92 | 1 | 216.62 | 215.81 | 1 | 1 | 0.81 |
| N2-P1 | 1 | 92 | 3 | 216.84 | 216.81 | 1 | 1 | 0.03 |
| N2-P2 | 1 | 92 | 2 | 217.00 | 216.82 | 1 | 1 | 0.18 |
| N3-P1 | 1 | 92 | 5 | 216.95 | 217.07 | 1 | 2 | -0.12 |
| N3-P2 | 1 | 92 | 2 | 216.94 | 217.06 | 1 | 1 | -0.12 |
| N5-P1 | 1 | 92 | 5 | 218.29 | 217.74 | 1 | 2 | 0.55 |
| N5-P2 | 1 | 92 | 1 | 217.88 | 217.71 | 1 | 1 | 0.17 |

**Table 7.1**
**Model Predicted Water Levels and Residuals**
**Shepley's Hill Landfill Groundwater Model**

| Well Name | Stress Period | Time (days) | Layer | Target Water Level Elevation (Feet) | Predicted Water Level Elevation (Feet) | Weight | Group | Residual (Feet) |
|---|---|---|---|---|---|---|---|---|
| N6-P1 | 1 | 92 | 5 | 221.12 | 221.88 | 1 | 2 | -0.76 |
| N7-P1 | 1 | 92 | 5 | 223.93 | 224.45 | 1 | 2 | -0.52 |
| N7-P2 | 1 | 92 | 1 | 224.22 | 224.41 | 1 | 1 | -0.19 |
| PZ-12-01 | 1 | 92 | 3 | 216.86 | 216.76 | 1 | 1 | 0.10 |
| PZ-12-02 | 1 | 92 | 3 | 217.22 | 216.70 | 1 | 1 | 0.52 |
| PZ-12-03 | 1 | 92 | 2 | 216.82 | 216.93 | 1 | 1 | -0.11 |
| PZ-12-04 | 1 | 92 | 2 | 217.74 | 217.42 | 1 | 1 | 0.32 |
| PZ-12-05 | 1 | 92 | 3 | 217.02 | 217.01 | 1 | 1 | 0.01 |
| PZ-12-06 | 1 | 92 | 2 | 217.89 | 217.80 | 1 | 1 | 0.09 |
| PZ-12-07 | 1 | 92 | 2 | 217.24 | 217.30 | 1 | 1 | -0.06 |
| PZ-12-08 | 1 | 92 | 2 | 218.46 | 218.57 | 1 | 1 | -0.11 |
| PZ-12-09 | 1 | 92 | 3 | 218.12 | 217.96 | 1 | 1 | 0.16 |
| PZ-12-10 | 1 | 92 | 3 | 219.58 | 219.34 | 1 | 1 | 0.24 |
| RSK1 | 1 | 92 | 3 | 217.54 | 216.85 | 1 | 1 | 0.69 |
| RSK12 | 1 | 92 | 2 | 217.15 | 217.02 | 1 | 1 | 0.13 |
| RSK13 | 1 | 92 | 3 | 217.18 | 217.12 | 1 | 1 | 0.06 |
| RSK15 | 1 | 92 | 2 | 217.22 | 217.12 | 1 | 1 | 0.10 |
| RSK16 | 1 | 92 | 3 | 217.08 | 216.91 | 1 | 1 | 0.17 |
| RSK19 | 1 | 92 | 2 | 217.04 | 216.91 | 1 | 1 | 0.13 |
| RSK37 | 1 | 92 | 2 | 217.03 | 217.12 | 1 | 1 | -0.09 |
| RSK39 | 1 | 92 | 3 | 217.01 | 217.10 | 1 | 1 | -0.09 |
| RSK41 | 1 | 92 | 4 | 217.07 | 217.10 | 1 | 1 | -0.03 |
| RSK42 | 1 | 92 | 3 | 217.02 | 217.10 | 1 | 1 | -0.08 |
| RSK50 | 1 | 92 | 1 | 215.47 | 216.95 | 0 | 1 | -1.48 |
| RSK7 | 1 | 92 | 2 | 216.13 | 216.85 | 0 | 1 | -0.72 |
| RSK8 | 1 | 92 | 5 | 217.13 | 217.03 | 1 | 2 | 0.10 |
| SHL-10 | 1 | 92 | 2 | 217.61 | 217.66 | 1 | 1 | -0.05 |
| SHL-11 | 1 | 92 | 2 | 216.96 | 216.82 | 1 | 1 | 0.14 |
| SHL-12 | 1 | 92 | 1 | 225.68 | 224.71 | 1 | 1 | 0.97 |
| SHL-13 | 1 | 92 | 1 | 214.07 | 213.62 | 1 | 1 | 0.45 |
| SHL-15 | 1 | 92 | 3 | 240.54 | 244.16 | 1 | 1 | -3.62 |
| SHL-17 | 1 | 92 | 1 | 225.66 | 224.33 | 1 | 1 | 1.33 |
| SHL-18 | 1 | 92 | 1 | 218.95 | 218.59 | 1 | 1 | 0.36 |
| SHL-19 | 1 | 92 | 4 | 217.80 | 217.51 | 1 | 1 | 0.29 |
| SHL-20 | 1 | 92 | 3 | 217.50 | 216.97 | 1 | 1 | 0.53 |
| SHL-21 | 1 | 92 | 1 | 214.78 | 213.63 | 1 | 1 | 1.15 |
| SHL-22 | 1 | 92 | 4 | 212.26 | 211.61 | 1 | 1 | 0.65 |
| SHL-23 | 1 | 92 | 2 | 212.93 | 211.81 | 1 | 1 | 1.12 |
| SHL-24 | 1 | 92 | 5 | 223.01 | 220.88 | 1 | 2 | 2.13 |
| SHL-25 | 1 | 92 | 3 | 229.90 | 228.61 | 1 | 1 | 1.29 |
| SHL-3 | 1 | 92 | 3 | 217.03 | 218.58 | 1 | 1 | -1.55 |
| SHL-4 | 1 | 92 | 1 | 217.18 | 217.11 | 1 | 1 | 0.07 |
| SHL-5 | 1 | 92 | 1 | 214.71 | 212.08 | 1 | 1 | 2.63 |
| SHL-8D | 1 | 92 | 4 | 213.32 | 212.90 | 1 | 1 | 0.42 |
| SHL-8S | 1 | 92 | 3 | 213.43 | 212.90 | 1 | 1 | 0.53 |

**Table 7.1**
**Model Predicted Water Levels and Residuals**
**Shepley's Hill Landfill Groundwater Model**

| Well Name | Stress Period | Time (days) | Layer | Target Water Level Elevation (Feet) | Predicted Water Level Elevation (Feet) | Weight | Group | Residual (Feet) |
|---|---|---|---|---|---|---|---|---|
| SHL-9 | 1 | 92 | 1 | 212.29 | 211.52 | 1 | 1 | 0.77 |
| SHM-05-39A | 1 | 92 | 2 | 210.12 | 210.48 | 1 | 1 | -0.36 |
| SHM-05-39B | 1 | 92 | 3 | 209.19 | 210.48 | 1 | 1 | -1.29 |
| SHM-05-40X | 1 | 92 | 3 | 209.13 | 210.11 | 1 | 1 | -0.98 |
| SHM-05-41A | 1 | 92 | 2 | 211.89 | 211.13 | 1 | 1 | 0.76 |
| SHM-05-41B | 1 | 92 | 3 | 211.92 | 211.12 | 1 | 1 | 0.80 |
| SHM-05-41C | 1 | 92 | 4 | 211.91 | 211.14 | 1 | 1 | 0.77 |
| SHM-05-42A | 1 | 92 | 2 | 212.08 | 211.35 | 1 | 1 | 0.73 |
| SHM-05-42B | 1 | 92 | 3 | 212.04 | 211.35 | 1 | 1 | 0.69 |
| SHM-10-01 | 1 | 92 | 4 | 205.50 | 206.12 | 1 | 1 | -0.62 |
| SHM-10-02 | 1 | 92 | 2 | 205.78 | 205.34 | 1 | 1 | 0.44 |
| SHM-10-03 | 1 | 92 | 3 | 205.89 | 205.72 | 1 | 1 | 0.17 |
| SHM-10-04 | 1 | 92 | 3 | 206.36 | 207.00 | 1 | 1 | -0.64 |
| SHM-10-05A | 1 | 92 | 2 | 209.91 | 211.43 | 1 | 1 | -1.52 |
| SHM-10-06 | 1 | 92 | 3 | 214.05 | 213.17 | 1 | 1 | 0.88 |
| SHM-10-06A | 1 | 92 | 3 | 214.24 | 213.43 | 1 | 1 | 0.81 |
| SHM-10-07 | 1 | 92 | 4 | 218.60 | 218.81 | 1 | 1 | -0.21 |
| SHM-10-08 | 1 | 92 | 3 | 205.77 | 205.18 | 1 | 1 | 0.59 |
| SHM-10-10 | 1 | 92 | 3 | 206.60 | 206.87 | 1 | 1 | -0.27 |
| SHM-10-11 | 1 | 92 | 3 | 222.67 | 223.50 | 1 | 1 | -0.83 |
| SHM-10-12 | 1 | 92 | 3 | 220.43 | 219.68 | 1 | 1 | 0.75 |
| SHM-10-13 | 1 | 92 | 3 | 218.32 | 217.64 | 1 | 1 | 0.68 |
| SHM-10-14 | 1 | 92 | 3 | 217.21 | 216.65 | 1 | 1 | 0.56 |
| SHM-10-15 | 1 | 92 | 3 | 218.65 | 218.32 | 1 | 1 | 0.33 |
| SHM-10-16 | 1 | 92 | 3 | 211.95 | 211.09 | 1 | 1 | 0.86 |
| SHM-11-02 | 1 | 92 | 5 | 217.95 | 217.81 | 1 | 2 | 0.14 |
| SHM-11-06 | 1 | 92 | 2 | 216.35 | 215.55 | 1 | 1 | 0.80 |
| SHM-11-07 | 1 | 92 | 3 | 217.88 | 217.61 | 1 | 1 | 0.27 |
| SHM-93-10C | 1 | 92 | 5 | 218.77 | 217.72 | 1 | 2 | 1.05 |
| SHM-93-18B | 1 | 92 | 3 | 218.96 | 218.85 | 1 | 1 | 0.11 |
| SHM-93-22B | 1 | 92 | 3 | 212.23 | 211.65 | 1 | 1 | 0.58 |
| SHM-93-22C | 1 | 92 | 5 | 212.35 | 211.61 | 1 | 2 | 0.74 |
| SHM-93-24A | 1 | 92 | 1 | 222.37 | 220.86 | 1 | 1 | 1.51 |
| SHM-96-5B | 1 | 92 | 3 | 212.64 | 212.01 | 1 | 1 | 0.63 |
| SHM-96-5C | 1 | 92 | 3 | 212.68 | 212.09 | 1 | 1 | 0.59 |
| SHM-99-31A | 1 | 92 | 1 | 212.24 | 210.77 | 1 | 1 | 1.47 |
| SHM-99-31B | 1 | 92 | 2 | 210.53 | 210.79 | 1 | 1 | -0.26 |
| SHM-99-31C | 1 | 92 | 3 | 210.47 | 210.82 | 1 | 1 | -0.35 |
| SHM-99-32X | 1 | 92 | 3 | 211.58 | 211.30 | 1 | 1 | 0.28 |
| SHP-01-36X | 1 | 92 | 1 | 216.70 | 216.32 | 1 | 1 | 0.38 |
| SHP-01-37X | 1 | 92 | 2 | 216.83 | 216.67 | 1 | 1 | 0.16 |
| SHP-01-38A | 1 | 92 | 1 | 217.00 | 216.96 | 1 | 1 | 0.04 |
| SHP-01-38B | 1 | 92 | 3 | 217.03 | 216.94 | 1 | 1 | 0.09 |
| SHP-05-43 | 1 | 92 | 3 | 215.95 | 215.19 | 1 | 1 | 0.76 |
| SHP-05-44 | 1 | 92 | 3 | 216.39 | 216.16 | 1 | 1 | 0.23 |

**Table 7.1**
**Model Predicted Water Levels and Residuals**
**Shepley's Hill Landfill Groundwater Model**

| Well Name | Stress Period | Time (days) | Layer | Target Water Level Elevation (Feet) | Predicted Water Level Elevation (Feet) | Weight | Group | Residual (Feet) |
|---|---|---|---|---|---|---|---|---|
| SHP-05-45A | 1 | 92 | 1 | 212.38 | 211.53 | 1 | 1 | 0.85 |
| SHP-05-45B | 1 | 92 | 3 | 212.23 | 211.08 | 1 | 1 | 1.15 |
| SHP-05-46A | 1 | 92 | 1 | 212.67 | 211.80 | 1 | 1 | 0.87 |
| SHP-05-46B | 1 | 92 | 3 | 212.68 | 211.74 | 1 | 1 | 0.94 |
| SHP-05-47A | 1 | 92 | 1 | 212.68 | 212.98 | 1 | 1 | -0.30 |
| SHP-05-47B | 1 | 92 | 1 | 212.83 | 212.98 | 1 | 1 | -0.15 |
| SHP-05-48A | 1 | 92 | 1 | 211.37 | 211.01 | 1 | 1 | 0.36 |
| SHP-05-48B | 1 | 92 | 1 | 212.43 | 211.01 | 1 | 1 | 1.42 |
| SHP-05-49A | 1 | 92 | 1 | 211.04 | 211.13 | 1 | 1 | -0.09 |
| SHP-05-49B | 1 | 92 | 1 | 211.19 | 211.13 | 1 | 1 | 0.06 |
| SHP-95-27X | 1 | 92 | 1 | 223.07 | 221.60 | 1 | 1 | 1.47 |
| SHP-99-01C | 1 | 92 | 5 | 252.65 | 253.59 | 1 | 2 | -0.94 |
| SHP-99-29X | 1 | 92 | 2 | 218.82 | 218.59 | 1 | 1 | 0.23 |
| SHP-99-34B | 1 | 92 | 3 | 211.65 | 211.68 | 1 | 1 | -0.03 |
| SHP-99-35X | 1 | 92 | 3 | 221.00 | 220.92 | 1 | 1 | 0.08 |
| EPA-PZ-2012-1A | 2 | 182 | 2 | 213.37 | 212.66 | 1 | 1 | 0.71 |
| EPA-PZ-2012-1B | 2 | 182 | 3 | 213.33 | 212.68 | 1 | 1 | 0.65 |
| EPA-PZ-2012-2A | 2 | 182 | 2 | 213.65 | 212.80 | 1 | 1 | 0.85 |
| EPA-PZ-2012-2B | 2 | 182 | 4 | 213.32 | 212.84 | 1 | 1 | 0.48 |
| EPA-PZ-2012-3A | 2 | 182 | 2 | 212.93 | 212.07 | 1 | 1 | 0.86 |
| EPA-PZ-2012-3B | 2 | 182 | 3 | 212.83 | 212.06 | 1 | 1 | 0.77 |
| EPA-PZ-2012-4A | 2 | 182 | 2 | 212.67 | 211.81 | 1 | 1 | 0.86 |
| EPA-PZ-2012-4B | 2 | 182 | 3 | 212.64 | 211.65 | 1 | 1 | 0.99 |
| EPA-PZ-2012-5A | 2 | 182 | 1 | 213.47 | 212.26 | 1 | 1 | 1.21 |
| EPA-PZ-2012-5B | 2 | 182 | 3 | 212.91 | 212.25 | 1 | 1 | 0.66 |
| EPA-PZ-2012-6A | 2 | 182 | 2 | 212.74 | 211.61 | 1 | 1 | 1.13 |
| EPA-PZ-2012-6B | 2 | 182 | 3 | 212.45 | 211.43 | 1 | 1 | 1.02 |
| EPA-PZ-2012-7A | 2 | 182 | 1 | 212.48 | 211.69 | 1 | 1 | 0.79 |
| EPA-PZ-2012-7B | 2 | 182 | 3 | 212.52 | 211.63 | 1 | 1 | 0.89 |
| PZ-12-01 | 2 | 182 | 3 | 216.85 | 216.77 | 1 | 1 | 0.08 |
| PZ-12-02 | 2 | 182 | 3 | 217.19 | 216.86 | 1 | 1 | 0.33 |
| PZ-12-03 | 2 | 182 | 2 | 216.85 | 216.94 | 1 | 1 | -0.09 |
| PZ-12-04 | 2 | 182 | 2 | 217.72 | 217.59 | 1 | 1 | 0.13 |
| PZ-12-05 | 2 | 182 | 3 | 217.04 | 217.03 | 1 | 1 | 0.01 |
| PZ-12-06 | 2 | 182 | 2 | 217.86 | 217.99 | 1 | 1 | -0.13 |
| PZ-12-07 | 2 | 182 | 2 | 217.17 | 217.35 | 1 | 1 | -0.18 |
| PZ-12-08 | 2 | 182 | 2 | 218.41 | 218.77 | 1 | 1 | -0.36 |
| PZ-12-09 | 2 | 182 | 3 | 218.27 | 218.09 | 1 | 1 | 0.18 |
| PZ-12-10 | 2 | 182 | 3 | 219.75 | 219.60 | 1 | 1 | 0.15 |
| SHL-10 | 2 | 182 | 2 | 217.13 | 217.76 | 1 | 1 | -0.63 |
| SHL-11 | 2 | 182 | 2 | 216.76 | 216.83 | 1 | 1 | -0.07 |
| SHL-19 | 2 | 182 | 4 | 217.20 | 217.59 | 1 | 1 | -0.39 |
| SHL-20 | 2 | 182 | 3 | 217.38 | 217.14 | 1 | 1 | 0.24 |
| SHL-21 | 2 | 182 | 1 | 214.73 | 213.93 | 1 | 1 | 0.80 |
| SHL-22 | 2 | 182 | 4 | 212.77 | 212.03 | 1 | 1 | 0.74 |

**Table 7.1**
**Model Predicted Water Levels and Residuals**
**Shepley's Hill Landfill Groundwater Model**

| Well Name | Stress Period | Time (days) | Layer | Target Water Level Elevation (Feet) | Predicted Water Level Elevation (Feet) | Weight | Group | Residual (Feet) |
|---|---|---|---|---|---|---|---|---|
| SHL-23 | 2 | 182 | 2 | 213.22 | 212.27 | 1 | 1 | 0.95 |
| SHL-3 | 2 | 182 | 3 | 217.47 | 218.80 | 1 | 1 | -1.33 |
| SHL-4 | 2 | 182 | 1 | 216.87 | 217.13 | 1 | 1 | -0.26 |
| SHL-5 | 2 | 182 | 1 | 215.98 | 212.47 | 1 | 1 | 3.51 |
| SHL-8D | 2 | 182 | 4 | 213.60 | 213.23 | 1 | 1 | 0.37 |
| SHL-8S | 2 | 182 | 3 | 213.73 | 213.23 | 1 | 1 | 0.50 |
| SHL-9 | 2 | 182 | 1 | 214.83 | 211.95 | 1 | 1 | 2.88 |
| SHM-05-41A | 2 | 182 | 2 | 212.32 | 211.57 | 1 | 1 | 0.75 |
| SHM-05-41B | 2 | 182 | 3 | 212.36 | 211.56 | 1 | 1 | 0.80 |
| SHM-05-41C | 2 | 182 | 4 | 212.26 | 211.58 | 1 | 1 | 0.68 |
| SHM-05-42A | 2 | 182 | 2 | 212.59 | 211.77 | 1 | 1 | 0.82 |
| SHM-05-42B | 2 | 182 | 3 | 212.53 | 211.77 | 1 | 1 | 0.76 |
| SHM-10-06 | 2 | 182 | 3 | 214.34 | 213.50 | 1 | 1 | 0.84 |
| SHM-10-06A | 2 | 182 | 3 | 214.41 | 213.73 | 1 | 1 | 0.68 |
| SHM-10-07 | 2 | 182 | 4 | 219.09 | 219.02 | 1 | 1 | 0.07 |
| SHM-10-11 | 2 | 182 | 3 | 222.63 | 224.21 | 1 | 1 | -1.58 |
| SHM-10-12 | 2 | 182 | 3 | 220.59 | 219.93 | 1 | 1 | 0.66 |
| SHM-10-13 | 2 | 182 | 3 | 218.30 | 217.87 | 1 | 1 | 0.43 |
| SHM-10-14 | 2 | 182 | 3 | 217.54 | 216.91 | 1 | 1 | 0.63 |
| SHM-10-16 | 2 | 182 | 3 | 212.37 | 211.53 | 1 | 1 | 0.84 |
| SHM-11-06 | 2 | 182 | 2 | 216.30 | 215.72 | 1 | 1 | 0.58 |
| SHM-11-07 | 2 | 182 | 3 | 217.87 | 217.79 | 1 | 1 | 0.08 |
| SHM-93-22B | 2 | 182 | 3 | 212.76 | 212.07 | 1 | 1 | 0.69 |
| SHM-93-22C | 2 | 182 | 5 | 213.63 | 212.03 | 1 | 2 | 1.60 |
| SHM-96-5B | 2 | 182 | 3 | 213.10 | 212.41 | 1 | 1 | 0.69 |
| SHM-96-5C | 2 | 182 | 3 | 213.13 | 212.48 | 1 | 1 | 0.65 |
| SHP-05-43 | 2 | 182 | 3 | 215.58 | 215.36 | 1 | 1 | 0.22 |
| SHP-05-44 | 2 | 182 | 3 | 216.10 | 216.24 | 1 | 1 | -0.14 |
| SHP-05-45A | 2 | 182 | 1 | 212.78 | 211.99 | 1 | 1 | 0.79 |
| SHP-05-45B | 2 | 182 | 3 | 212.64 | 211.59 | 1 | 1 | 1.05 |
| SHP-05-46A | 2 | 182 | 1 | 213.03 | 212.24 | 1 | 1 | 0.79 |
| SHP-05-46B | 2 | 182 | 3 | 213.08 | 212.18 | 1 | 1 | 0.90 |
| 32M-01-14XBR | 3 | 273 | 5 | 235.50 | 230.69 | 1 | 3 | 4.81 |
| 32M-01-14XOB | 3 | 273 | 3 | 232.55 | 230.26 | 1 | 3 | 2.29 |
| 32M-01-16XBR | 3 | 273 | 5 | 235.65 | 238.99 | 0 | 3 | -3.34 |
| 32M-01-18XBR | 3 | 273 | 5 | 247.27 | 245.91 | 1 | 3 | 1.36 |
| 32M-92-01X | 3 | 273 | 4 | 242.98 | 246.30 | 1 | 3 | -3.32 |
| 32M-92-03X | 3 | 273 | 3 | 234.67 | 232.37 | 1 | 3 | 2.30 |
| 32Z-01-05XOB | 3 | 273 | 3 | 232.20 | 232.25 | 1 | 3 | -0.05 |
| 32Z-01-06XBR | 3 | 273 | 5 | 246.07 | 244.50 | 1 | 3 | 1.57 |
| 32Z-01-07XOB | 3 | 273 | 4 | 245.17 | 245.12 | 1 | 3 | 0.05 |
| 32Z-01-08XOB | 3 | 273 | 3 | 242.53 | 245.87 | 1 | 3 | -3.34 |
| 32Z-01-09XOB | 3 | 273 | 2 | 232.51 | 231.82 | 1 | 3 | 0.69 |
| 32Z-01-10XBR | 3 | 273 | 5 | 245.21 | 243.97 | 1 | 3 | 1.24 |
| 32Z-01-12XBR | 3 | 273 | 5 | 238.68 | 240.49 | 1 | 3 | -1.81 |

**Table 7.1**
**Model Predicted Water Levels and Residuals**
**Shepley's Hill Landfill Groundwater Model**

| Well Name | Stress Period | Time (days) | Layer | Target Water Level Elevation (Feet) | Predicted Water Level Elevation (Feet) | Weight | Group | Residual (Feet) |
|---|---|---|---|---|---|---|---|---|
| 32Z-99-02X | 3 | 273 | 2 | 235.19 | 231.61 | 1 | 3 | 3.58 |
| 43M-01-16XBR | 3 | 273 | 5 | 232.22 | 232.17 | 1 | 3 | 0.05 |
| 43M-01-16XOB | 3 | 273 | 3 | 232.63 | 232.00 | 1 | 3 | 0.63 |
| 43M-01-17XBR | 3 | 273 | 5 | 231.88 | 232.04 | 1 | 3 | -0.16 |
| 43M-01-17XOB | 3 | 273 | 2 | 231.77 | 231.97 | 1 | 3 | -0.20 |
| 43M-01-20XBR | 3 | 273 | 5 | 231.61 | 231.53 | 1 | 3 | 0.08 |
| 43M-01-20XOB | 3 | 273 | 2 | 231.53 | 231.48 | 1 | 3 | 0.05 |
| 57M-03-01X | 3 | 273 | 1 | 224.14 | 223.63 | 1 | 4 | 0.51 |
| 57M-03-02X | 3 | 273 | 1 | 223.11 | 223.45 | 1 | 4 | -0.34 |
| 57M-03-03X | 3 | 273 | 1 | 223.26 | 223.23 | 1 | 4 | 0.03 |
| 57M-03-04X | 3 | 273 | 1 | 222.27 | 223.17 | 1 | 4 | -0.90 |
| 57M-03-05X | 3 | 273 | 1 | 221.96 | 223.21 | 1 | 4 | -1.25 |
| 57M-03-06X | 3 | 273 | 1 | 222.32 | 223.24 | 1 | 4 | -0.92 |
| 57M-95-05X | 3 | 273 | 1 | 224.16 | 223.84 | 1 | 4 | 0.32 |
| 57M-95-06X | 3 | 273 | 1 | 224.10 | 223.43 | 1 | 4 | 0.67 |
| 57M-95-07X | 3 | 273 | 1 | 222.71 | 223.61 | 1 | 4 | -0.90 |
| 57M-96-11X | 3 | 273 | 1 | 221.67 | 222.64 | 1 | 4 | -0.97 |
| 57M-96-12X | 3 | 273 | 1 | 223.26 | 222.83 | 1 | 4 | 0.43 |
| 57M-96-13X | 3 | 273 | 1 | 223.23 | 222.88 | 1 | 4 | 0.35 |
| 57WP-06-02 | 3 | 273 | 1 | 222.34 | 223.21 | 1 | 4 | -0.87 |
| 57WP-06-03 | 3 | 273 | 1 | 222.14 | 222.69 | 1 | 4 | -0.55 |
| EPA-PZ-2012-1A | 3 | 273 | 2 | 212.69 | 213.03 | 1 | 1 | -0.34 |
| EPA-PZ-2012-1B | 3 | 273 | 3 | 212.67 | 213.04 | 1 | 1 | -0.37 |
| EPA-PZ-2012-2A | 3 | 273 | 2 | 212.79 | 213.17 | 1 | 1 | -0.38 |
| EPA-PZ-2012-2B | 3 | 273 | 4 | 212.70 | 213.19 | 1 | 1 | -0.49 |
| EPA-PZ-2012-3A | 3 | 273 | 2 | 212.13 | 212.46 | 1 | 1 | -0.33 |
| EPA-PZ-2012-3B | 3 | 273 | 3 | 212.11 | 212.43 | 1 | 1 | -0.32 |
| EPA-PZ-2012-4A | 3 | 273 | 2 | 211.94 | 212.17 | 1 | 1 | -0.23 |
| EPA-PZ-2012-4B | 3 | 273 | 3 | 211.81 | 211.98 | 1 | 1 | -0.17 |
| EPA-PZ-2012-5A | 3 | 273 | 1 | 212.40 | 212.66 | 1 | 1 | -0.26 |
| EPA-PZ-2012-5B | 3 | 273 | 3 | 212.17 | 212.64 | 1 | 1 | -0.47 |
| EPA-PZ-2012-6A | 3 | 273 | 2 | 211.96 | 211.98 | 1 | 1 | -0.02 |
| EPA-PZ-2012-6B | 3 | 273 | 3 | 211.80 | 211.77 | 1 | 1 | 0.03 |
| EPA-PZ-2012-7A | 3 | 273 | 1 | 212.15 | 212.11 | 1 | 1 | 0.04 |
| EPA-PZ-2012-7B | 3 | 273 | 3 | 211.86 | 212.03 | 1 | 1 | -0.17 |
| N1-P1 | 3 | 273 | 3 | 216.07 | 215.57 | 1 | 1 | 0.50 |
| N1-P2 | 3 | 273 | 2 | 216.13 | 215.71 | 1 | 1 | 0.42 |
| N1-P3 | 3 | 273 | 1 | 216.21 | 215.87 | 1 | 1 | 0.34 |
| N2-P1 | 3 | 273 | 3 | 217.18 | 216.64 | 1 | 1 | 0.54 |
| N2-P2 | 3 | 273 | 2 | 217.00 | 216.64 | 1 | 1 | 0.36 |
| N3-P1 | 3 | 273 | 5 | 217.14 | 216.94 | 1 | 2 | 0.20 |
| N3-P2 | 3 | 273 | 2 | 216.99 | 216.94 | 1 | 1 | 0.05 |
| N5-P1 | 3 | 273 | 5 | 219.24 | 218.48 | 1 | 2 | 0.76 |
| N5-P2 | 3 | 273 | 1 | 219.04 | 218.43 | 1 | 1 | 0.61 |
| N6-P1 | 3 | 273 | 5 | 222.03 | 223.05 | 1 | 2 | -1.02 |

**Table 7.1**
**Model Predicted Water Levels and Residuals**
**Shepley's Hill Landfill Groundwater Model**

| Well Name | Stress Period | Time (days) | Layer | Target Water Level Elevation (Feet) | Predicted Water Level Elevation (Feet) | Weight | Group | Residual (Feet) |
|---|---|---|---|---|---|---|---|---|
| N7-P1 | 3 | 273 | 5 | 224.53 | 226.99 | 1 | 2 | -2.46 |
| N7-P2 | 3 | 273 | 1 | 224.77 | 226.96 | 1 | 1 | -2.19 |
| PZ-12-02 | 3 | 273 | 3 | 217.53 | 217.15 | 1 | 1 | 0.38 |
| PZ-12-03 | 3 | 273 | 2 | 216.85 | 216.83 | 1 | 1 | 0.02 |
| PZ-12-04 | 3 | 273 | 2 | 218.19 | 217.94 | 1 | 1 | 0.25 |
| PZ-12-05 | 3 | 273 | 3 | 217.24 | 216.93 | 1 | 1 | 0.31 |
| PZ-12-06 | 3 | 273 | 2 | 218.34 | 218.36 | 1 | 1 | -0.02 |
| PZ-12-07 | 3 | 273 | 2 | 217.22 | 217.33 | 1 | 1 | -0.11 |
| PZ-12-08 | 3 | 273 | 2 | 218.90 | 219.17 | 1 | 1 | -0.27 |
| PZ-12-09 | 3 | 273 | 3 | 218.02 | 218.22 | 1 | 1 | -0.20 |
| PZ-12-10 | 3 | 273 | 3 | 219.36 | 220.03 | 1 | 1 | -0.67 |
| RSK1 | 3 | 273 | 3 | 217.21 | 216.68 | 1 | 1 | 0.53 |
| RSK12 | 3 | 273 | 2 | 217.05 | 216.94 | 1 | 1 | 0.11 |
| RSK13 | 3 | 273 | 3 | 217.38 | 217.07 | 1 | 1 | 0.31 |
| RSK15 | 3 | 273 | 2 | 217.05 | 217.07 | 1 | 1 | -0.02 |
| RSK16 | 3 | 273 | 3 | 217.30 | 216.78 | 1 | 1 | 0.52 |
| RSK19 | 3 | 273 | 2 | 216.86 | 216.78 | 1 | 1 | 0.08 |
| RSK24 | 3 | 273 | 1 | 219.01 | 219.04 | 1 | 1 | -0.03 |
| RSK25 | 3 | 273 | 3 | 217.36 | 217.54 | 1 | 1 | -0.18 |
| RSK27 | 3 | 273 | 1 | 219.34 | 218.52 | 1 | 1 | 0.82 |
| RSK28 | 3 | 273 | 1 | 219.24 | 218.20 | 1 | 1 | 1.04 |
| RSK32 | 3 | 273 | 1 | 219.08 | 217.91 | 1 | 1 | 1.17 |
| RSK34 | 3 | 273 | 1 | 217.19 | 216.59 | 1 | 1 | 0.60 |
| RSK35 | 3 | 273 | 1 | 217.98 | 216.32 | 1 | 1 | 1.66 |
| RSK37 | 3 | 273 | 2 | 216.83 | 217.03 | 1 | 1 | -0.20 |
| RSK50 | 3 | 273 | 1 | 214.93 | 216.84 | 0 | 1 | -1.91 |
| RSK7 | 3 | 273 | 2 | 216.01 | 216.67 | 0 | 1 | -0.66 |
| RSK8 | 3 | 273 | 5 | 217.37 | 216.95 | 1 | 2 | 0.42 |
| SHL-10 | 3 | 273 | 2 | 217.19 | 217.80 | 1 | 1 | -0.61 |
| SHL-11 | 3 | 273 | 2 | 216.99 | 216.71 | 1 | 1 | 0.28 |
| SHL-12 | 3 | 273 | 1 | 225.95 | 227.56 | 1 | 1 | -1.61 |
| SHL-13 | 3 | 273 | 1 | 214.16 | 214.14 | 1 | 1 | 0.02 |
| SHL-15 | 3 | 273 | 3 | 242.41 | 245.65 | 1 | 1 | -3.24 |
| SHL-17 | 3 | 273 | 1 | 225.91 | 227.54 | 1 | 1 | -1.63 |
| SHL-18 | 3 | 273 | 1 | 218.58 | 219.02 | 1 | 1 | -0.44 |
| SHL-19 | 3 | 273 | 4 | 217.43 | 217.62 | 1 | 1 | -0.19 |
| SHL-20 | 3 | 273 | 3 | 217.79 | 217.46 | 1 | 1 | 0.33 |
| SHL-21 | 3 | 273 | 1 | 214.62 | 214.25 | 1 | 1 | 0.37 |
| SHL-22 | 3 | 273 | 4 | 212.22 | 212.42 | 1 | 1 | -0.20 |
| SHL-23 | 3 | 273 | 2 | 213.35 | 212.69 | 1 | 1 | 0.66 |
| SHL-24 | 3 | 273 | 5 | 223.15 | 222.24 | 1 | 2 | 0.91 |
| SHL-25 | 3 | 273 | 3 | 232.16 | 230.76 | 1 | 1 | 1.40 |
| SHL-3 | 3 | 273 | 3 | 217.35 | 219.04 | 1 | 1 | -1.69 |
| SHL-4 | 3 | 273 | 1 | 217.05 | 217.06 | 1 | 1 | -0.01 |
| SHL-5 | 3 | 273 | 1 | 214.26 | 212.86 | 1 | 1 | 1.40 |

**Table 7.1**
**Model Predicted Water Levels and Residuals**
**Shepley's Hill Landfill Groundwater Model**

| Well Name | Stress Period | Time (days) | Layer | Target Water Level Elevation (Feet) | Predicted Water Level Elevation (Feet) | Weight | Group | Residual (Feet) |
|---|---|---|---|---|---|---|---|---|
| SHL-7 | 3 | 273 | 1 | 219.24 | 219.76 | 1 | 1 | -0.52 |
| SHL-8D | 3 | 273 | 4 | 213.14 | 213.54 | 1 | 1 | -0.40 |
| SHL-8S | 3 | 273 | 3 | 213.36 | 213.54 | 1 | 1 | -0.18 |
| SHL-9 | 3 | 273 | 1 | 211.16 | 212.36 | 1 | 1 | -1.20 |
| SHM-05-39A | 3 | 273 | 2 | 210.06 | 211.42 | 1 | 1 | -1.36 |
| SHM-05-39B | 3 | 273 | 3 | 209.24 | 211.42 | 1 | 1 | -2.18 |
| SHM-05-40X | 3 | 273 | 3 | 209.09 | 211.10 | 1 | 1 | -2.01 |
| SHM-05-41A | 3 | 273 | 2 | 211.85 | 212.03 | 1 | 1 | -0.18 |
| SHM-05-41B | 3 | 273 | 3 | 211.88 | 212.01 | 1 | 1 | -0.13 |
| SHM-05-41C | 3 | 273 | 4 | 211.73 | 212.03 | 1 | 1 | -0.30 |
| SHM-05-42A | 3 | 273 | 2 | 212.02 | 212.20 | 1 | 1 | -0.18 |
| SHM-05-42B | 3 | 273 | 3 | 212.05 | 212.21 | 1 | 1 | -0.16 |
| SHM-07-03 | 3 | 273 | 3 | 208.35 | 210.11 | 1 | 1 | -1.76 |
| SHM-07-05 | 3 | 273 | 5 | 208.83 | 211.08 | 1 | 2 | -2.25 |
| SHM-10-01 | 3 | 273 | 4 | 206.59 | 207.30 | 1 | 1 | -0.71 |
| SHM-10-02 | 3 | 273 | 2 | 205.50 | 206.51 | 1 | 1 | -1.01 |
| SHM-10-03 | 3 | 273 | 3 | 205.95 | 206.88 | 1 | 1 | -0.93 |
| SHM-10-04 | 3 | 273 | 3 | 206.84 | 208.16 | 1 | 1 | -1.32 |
| SHM-10-05A | 3 | 273 | 2 | 209.81 | 212.25 | 1 | 1 | -2.44 |
| SHM-10-06 | 3 | 273 | 3 | 213.82 | 213.83 | 1 | 1 | -0.01 |
| SHM-10-06A | 3 | 273 | 3 | 214.17 | 214.05 | 1 | 1 | 0.12 |
| SHM-10-07 | 3 | 273 | 4 | 219.67 | 219.47 | 1 | 1 | 0.20 |
| SHM-10-08 | 3 | 273 | 3 | 205.96 | 206.35 | 1 | 1 | -0.39 |
| SHM-10-10 | 3 | 273 | 3 | 206.52 | 208.02 | 1 | 1 | -1.50 |
| SHM-10-11 | 3 | 273 | 3 | 223.45 | 225.29 | 1 | 1 | -1.84 |
| SHM-10-12 | 3 | 273 | 3 | 221.62 | 220.53 | 1 | 1 | 1.09 |
| SHM-10-13 | 3 | 273 | 3 | 219.11 | 218.34 | 1 | 1 | 0.77 |
| SHM-10-14 | 3 | 273 | 3 | 217.89 | 217.38 | 1 | 1 | 0.51 |
| SHM-10-15 | 3 | 273 | 3 | 219.60 | 219.12 | 1 | 1 | 0.48 |
| SHM-10-16 | 3 | 273 | 3 | 211.62 | 211.99 | 1 | 1 | -0.37 |
| SHM-11-02 | 3 | 273 | 5 | 218.31 | 218.33 | 1 | 2 | -0.02 |
| SHM-11-06 | 3 | 273 | 2 | 216.38 | 215.94 | 1 | 1 | 0.44 |
| SHM-11-07 | 3 | 273 | 3 | 218.36 | 218.15 | 1 | 1 | 0.21 |
| SHM-13-02 | 3 | 273 | 3 | 206.62 | 207.62 | 1 | 1 | -1.00 |
| SHM-13-03 | 3 | 273 | 3 | 207.00 | 208.28 | 1 | 1 | -1.28 |
| SHM-13-04 | 3 | 273 | 2 | 208.16 | 209.93 | 1 | 1 | -1.77 |
| SHM-13-05 | 3 | 273 | 3 | 208.70 | 210.88 | 1 | 1 | -2.18 |
| SHM-13-06 | 3 | 273 | 3 | 207.73 | 208.60 | 1 | 1 | -0.87 |
| SHM-13-08 | 3 | 273 | 3 | 208.38 | 209.62 | 1 | 1 | -1.24 |
| SHM-93-10C | 3 | 273 | 5 | 218.72 | 217.86 | 1 | 2 | 0.86 |
| SHM-93-18B | 3 | 273 | 3 | 218.77 | 219.39 | 1 | 1 | -0.62 |
| SHM-93-22B | 3 | 273 | 3 | 211.95 | 212.46 | 1 | 1 | -0.51 |
| SHM-93-22C | 3 | 273 | 5 | 212.20 | 212.42 | 1 | 2 | -0.22 |
| SHM-93-24A | 3 | 273 | 1 | 222.41 | 222.22 | 1 | 1 | 0.19 |
| SHM-96-5B | 3 | 273 | 3 | 212.32 | 212.78 | 1 | 1 | -0.46 |

**Table 7.1**
**Model Predicted Water Levels and Residuals**
**Shepley's Hill Landfill Groundwater Model**

| Well Name | Stress Period | Time (days) | Layer | Target Water Level Elevation (Feet) | Predicted Water Level Elevation (Feet) | Weight | Group | Residual (Feet) |
|---|---|---|---|---|---|---|---|---|
| SHM-96-5C | 3 | 273 | 3 | 212.63 | 212.85 | 1 | 1 | -0.22 |
| SHM-99-31A | 3 | 273 | 1 | 211.69 | 211.69 | 1 | 1 | 0.00 |
| SHM-99-31B | 3 | 273 | 2 | 210.56 | 211.70 | 1 | 1 | -1.14 |
| SHM-99-31C | 3 | 273 | 3 | 210.36 | 211.73 | 1 | 1 | -1.37 |
| SHM-99-32X | 3 | 273 | 3 | 211.53 | 212.15 | 1 | 1 | -0.62 |
| SHP-01-36X | 3 | 273 | 1 | 216.70 | 216.27 | 1 | 1 | 0.43 |
| SHP-01-37X | 3 | 273 | 2 | 216.85 | 216.54 | 1 | 1 | 0.31 |
| SHP-01-38A | 3 | 273 | 1 | 217.09 | 216.85 | 1 | 1 | 0.24 |
| SHP-01-38B | 3 | 273 | 3 | 217.23 | 216.83 | 1 | 1 | 0.40 |
| SHP-05-43 | 3 | 273 | 3 | 215.77 | 215.51 | 1 | 1 | 0.26 |
| SHP-05-44 | 3 | 273 | 3 | 216.35 | 216.26 | 1 | 1 | 0.09 |
| SHP-05-45A | 3 | 273 | 1 | 212.16 | 212.36 | 1 | 1 | -0.20 |
| SHP-05-45B | 3 | 273 | 3 | 212.48 | 211.86 | 1 | 1 | 0.62 |
| SHP-05-46A | 3 | 273 | 1 | 212.62 | 212.61 | 1 | 1 | 0.01 |
| SHP-05-46B | 3 | 273 | 3 | 212.76 | 212.50 | 1 | 1 | 0.26 |
| SHP-05-47A | 3 | 273 | 1 | 211.97 | 213.61 | 1 | 1 | -1.64 |
| SHP-05-47B | 3 | 273 | 1 | 212.62 | 213.62 | 1 | 1 | -1.00 |
| SHP-05-48A | 3 | 273 | 1 | 212.41 | 211.90 | 1 | 1 | 0.51 |
| SHP-05-48B | 3 | 273 | 1 | 212.18 | 211.90 | 1 | 1 | 0.28 |
| SHP-05-49A | 3 | 273 | 1 | 210.93 | 212.01 | 1 | 1 | -1.08 |
| SHP-05-49B | 3 | 273 | 1 | 210.72 | 212.01 | 1 | 1 | -1.29 |
| SHP-95-27X | 3 | 273 | 1 | 222.08 | 223.33 | 1 | 1 | -1.25 |
| SHP-99-01C | 3 | 273 | 5 | 264.03 | 259.03 | 1 | 2 | 5.00 |
| SHP-99-29X | 3 | 273 | 2 | 220.64 | 219.44 | 1 | 1 | 1.20 |
| SHP-99-33A | 3 | 273 | 1 | 210.80 | 211.57 | 1 | 1 | -0.77 |
| SHP-99-34B | 3 | 273 | 3 | 211.95 | 212.49 | 1 | 1 | -0.54 |
| SHP-99-35X | 3 | 273 | 3 | 221.65 | 221.83 | 1 | 1 | -0.18 |
| SHM-13-14D | 6 | 547 | 3 | 207.16 | 207.90 | 1 | 1 | -0.74 |
| SHM-13-15 | 6 | 547 | 3 | 206.92 | 207.51 | 1 | 1 | -0.59 |
| 32M-01-14XBR | 7 | 638 | 5 | 228.29 | 230.09 | 1 | 3 | -1.80 |
| 32M-01-14XOB | 7 | 638 | 3 | 231.85 | 229.69 | 1 | 3 | 2.16 |
| 32M-01-16XBR | 7 | 638 | 5 | 233.14 | 238.77 | 0 | 3 | -5.63 |
| 32M-01-18XBR | 7 | 638 | 5 | 241.47 | 244.73 | 1 | 3 | -3.26 |
| 32M-92-01X | 7 | 638 | 4 | 242.84 | 245.02 | 1 | 3 | -2.18 |
| 32M-92-03X | 7 | 638 | 3 | 231.74 | 231.56 | 1 | 3 | 0.18 |
| 32Z-01-05XOB | 7 | 638 | 3 | 231.70 | 231.23 | 1 | 3 | 0.47 |
| 32Z-01-06XBR | 7 | 638 | 5 | 243.35 | 244.15 | 1 | 3 | -0.80 |
| 32Z-01-07XOB | 7 | 638 | 4 | 243.44 | 243.91 | 1 | 3 | -0.47 |
| 32Z-01-08XOB | 7 | 638 | 3 | 242.58 | 244.85 | 1 | 3 | -2.27 |
| 32Z-01-09XOB | 7 | 638 | 2 | 231.47 | 230.79 | 1 | 3 | 0.68 |
| 32Z-01-10XBR | 7 | 638 | 5 | 239.97 | 242.92 | 1 | 3 | -2.95 |
| 32Z-01-12XBR | 7 | 638 | 5 | 238.61 | 238.49 | 1 | 3 | 0.12 |
| 32Z-99-02X | 7 | 638 | 2 | 235.36 | 230.98 | 1 | 3 | 4.38 |
| 43M-01-16XBR | 7 | 638 | 5 | 231.49 | 231.08 | 1 | 3 | 0.41 |
| 43M-01-16XOB | 7 | 638 | 3 | 231.51 | 230.89 | 1 | 3 | 0.62 |

**Table 7.1**
**Model Predicted Water Levels and Residuals**
**Shepley's Hill Landfill Groundwater Model**

| Well Name | Stress Period | Time (days) | Layer | Target Water Level Elevation (Feet) | Predicted Water Level Elevation (Feet) | Weight | Group | Residual (Feet) |
|---|---|---|---|---|---|---|---|---|
| 43M-01-17XBR | 7 | 638 | 5 | 231.39 | 230.96 | 1 | 3 | 0.43 |
| 43M-01-17XOB | 7 | 638 | 2 | 231.11 | 230.89 | 1 | 3 | 0.22 |
| 43M-01-20XBR | 7 | 638 | 5 | 230.72 | 230.48 | 1 | 3 | 0.24 |
| 43M-01-20XOB | 7 | 638 | 2 | 230.66 | 230.43 | 1 | 3 | 0.23 |
| 57M-03-01X | 7 | 638 | 1 | 223.23 | 222.55 | 1 | 4 | 0.68 |
| 57M-03-02X | 7 | 638 | 1 | 221.79 | 222.27 | 1 | 4 | -0.48 |
| 57M-03-03X | 7 | 638 | 1 | 222.20 | 221.97 | 1 | 4 | 0.23 |
| 57M-03-04X | 7 | 638 | 1 | 221.51 | 221.93 | 1 | 4 | -0.42 |
| 57M-03-05X | 7 | 638 | 1 | 221.55 | 222.01 | 1 | 4 | -0.46 |
| 57M-95-05X | 7 | 638 | 1 | 222.54 | 222.71 | 1 | 4 | -0.17 |
| 57M-95-06X | 7 | 638 | 1 | 223.42 | 222.36 | 1 | 4 | 1.06 |
| 57M-95-07X | 7 | 638 | 1 | 221.68 | 222.39 | 1 | 4 | -0.71 |
| 57M-96-10X | 7 | 638 | 1 | 222.05 | 221.51 | 1 | 4 | 0.54 |
| 57M-96-11X | 7 | 638 | 1 | 220.84 | 221.55 | 1 | 4 | -0.71 |
| 57M-96-12X | 7 | 638 | 1 | 222.37 | 221.77 | 1 | 4 | 0.60 |
| 57M-96-13X | 7 | 638 | 1 | 222.38 | 221.80 | 1 | 4 | 0.58 |
| 57WP-06-02 | 7 | 638 | 1 | 221.57 | 221.95 | 1 | 4 | -0.38 |
| 57WP-06-03 | 7 | 638 | 1 | 221.53 | 221.61 | 1 | 4 | -0.08 |
| EPA-PZ-2012-1A | 7 | 638 | 2 | 213.69 | 212.74 | 1 | 1 | 0.95 |
| EPA-PZ-2012-1B | 7 | 638 | 3 | 213.68 | 212.75 | 1 | 1 | 0.93 |
| EPA-PZ-2012-2A | 7 | 638 | 2 | 213.78 | 212.92 | 1 | 1 | 0.86 |
| EPA-PZ-2012-2B | 7 | 638 | 4 | 213.67 | 212.95 | 1 | 1 | 0.72 |
| EPA-PZ-2012-3A | 7 | 638 | 2 | 213.25 | 212.13 | 1 | 1 | 1.12 |
| EPA-PZ-2012-3B | 7 | 638 | 3 | 213.12 | 212.11 | 1 | 1 | 1.01 |
| EPA-PZ-2012-4A | 7 | 638 | 2 | 213.04 | 211.81 | 1 | 1 | 1.23 |
| EPA-PZ-2012-4B | 7 | 638 | 3 | 213.05 | 211.62 | 1 | 1 | 1.43 |
| EPA-PZ-2012-5A | 7 | 638 | 1 | 213.32 | 212.39 | 1 | 1 | 0.93 |
| EPA-PZ-2012-5B | 7 | 638 | 3 | 213.26 | 212.38 | 1 | 1 | 0.88 |
| EPA-PZ-2012-6A | 7 | 638 | 2 | 212.97 | 211.59 | 1 | 1 | 1.38 |
| EPA-PZ-2012-6B | 7 | 638 | 3 | 212.81 | 211.39 | 1 | 1 | 1.42 |
| EPA-PZ-2012-7A | 7 | 638 | 1 | 213.21 | 211.72 | 1 | 1 | 1.49 |
| EPA-PZ-2012-7B | 7 | 638 | 3 | 213.03 | 211.65 | 1 | 1 | 1.38 |
| N1-P1 | 7 | 638 | 3 | 216.03 | 215.47 | 1 | 1 | 0.56 |
| N1-P2 | 7 | 638 | 2 | 216.08 | 215.62 | 1 | 1 | 0.46 |
| N1-P3 | 7 | 638 | 1 | 216.53 | 215.78 | 1 | 1 | 0.75 |
| N2-P1 | 7 | 638 | 3 | 216.81 | 216.61 | 1 | 1 | 0.20 |
| N2-P2 | 7 | 638 | 2 | 216.76 | 216.61 | 1 | 1 | 0.15 |
| N3-P1 | 7 | 638 | 5 | 216.78 | 216.91 | 1 | 2 | -0.13 |
| N3-P2 | 7 | 638 | 2 | 216.79 | 216.90 | 1 | 1 | -0.11 |
| N5-P1 | 7 | 638 | 5 | 218.78 | 217.98 | 1 | 2 | 0.80 |
| N5-P2 | 7 | 638 | 1 | 218.11 | 217.93 | 1 | 1 | 0.18 |
| N6-P1 | 7 | 638 | 5 | 221.27 | 222.71 | 1 | 2 | -1.44 |
| N7-P1 | 7 | 638 | 5 | 224.14 | 226.55 | 1 | 2 | -2.41 |
| N7-P2 | 7 | 638 | 1 | 224.43 | 226.52 | 1 | 1 | -2.09 |
| PZ-12-01 | 7 | 638 | 3 | 217.00 | 216.61 | 1 | 1 | 0.39 |

**Table 7.1**
**Model Predicted Water Levels and Residuals**
**Shepley's Hill Landfill Groundwater Model**

| Well Name | Stress Period | Time (days) | Layer | Target Water Level Elevation (Feet) | Predicted Water Level Elevation (Feet) | Weight | Group | Residual (Feet) |
|---|---|---|---|---|---|---|---|---|
| PZ-12-02 | 7 | 638 | 3 | 217.39 | 216.84 | 1 | 1 | 0.55 |
| PZ-12-03 | 7 | 638 | 2 | 216.92 | 216.78 | 1 | 1 | 0.14 |
| PZ-12-04 | 7 | 638 | 2 | 217.87 | 217.60 | 1 | 1 | 0.27 |
| PZ-12-05 | 7 | 638 | 3 | 217.09 | 216.88 | 1 | 1 | 0.21 |
| PZ-12-06 | 7 | 638 | 2 | 217.99 | 218.02 | 1 | 1 | -0.03 |
| PZ-12-07 | 7 | 638 | 2 | 217.36 | 217.26 | 1 | 1 | 0.10 |
| PZ-12-08 | 7 | 638 | 2 | 218.69 | 218.87 | 1 | 1 | -0.18 |
| PZ-12-09 | 7 | 638 | 3 | 218.44 | 218.11 | 1 | 1 | 0.33 |
| PZ-12-10 | 7 | 638 | 3 | 219.86 | 219.81 | 1 | 1 | 0.05 |
| SHL-10 | 7 | 638 | 2 | 217.46 | 217.72 | 1 | 1 | -0.26 |
| SHL-11 | 7 | 638 | 2 | 216.92 | 216.67 | 1 | 1 | 0.25 |
| SHL-12 | 7 | 638 | 1 | 225.97 | 227.12 | 1 | 1 | -1.15 |
| SHL-13 | 7 | 638 | 1 | 214.69 | 213.98 | 1 | 1 | 0.71 |
| SHL-15 | 7 | 638 | 3 | 243.13 | 244.38 | 1 | 1 | -1.25 |
| SHL-17 | 7 | 638 | 1 | 226.04 | 227.09 | 1 | 1 | -1.05 |
| SHL-18 | 7 | 638 | 1 | 218.85 | 218.91 | 1 | 1 | -0.06 |
| SHL-19 | 7 | 638 | 4 | 217.52 | 217.54 | 1 | 1 | -0.02 |
| SHL-20 | 7 | 638 | 3 | 217.54 | 217.12 | 1 | 1 | 0.42 |
| SHL-21 | 7 | 638 | 1 | 215.30 | 213.97 | 1 | 1 | 1.33 |
| SHL-22 | 7 | 638 | 4 | 213.03 | 212.13 | 1 | 1 | 0.90 |
| SHL-23 | 7 | 638 | 2 | 214.99 | 212.23 | 1 | 1 | 2.76 |
| SHL-24 | 7 | 638 | 5 | 223.00 | 221.99 | 1 | 2 | 1.01 |
| SHL-25 | 7 | 638 | 3 | 231.61 | 230.16 | 1 | 1 | 1.45 |
| SHL-3 | 7 | 638 | 3 | 217.75 | 218.91 | 1 | 1 | -1.16 |
| SHL-4 | 7 | 638 | 1 | 216.99 | 217.00 | 1 | 1 | -0.01 |
| SHL-5 | 7 | 638 | 1 | 215.05 | 212.58 | 1 | 1 | 2.47 |
| SHL-8D | 7 | 638 | 4 | 213.98 | 213.34 | 1 | 1 | 0.64 |
| SHL-8S | 7 | 638 | 3 | 214.07 | 213.34 | 1 | 1 | 0.73 |
| SHL-9 | 7 | 638 | 1 | 213.24 | 212.04 | 1 | 1 | 1.20 |
| SHM-05-39A | 7 | 638 | 2 | 210.99 | 211.16 | 1 | 1 | -0.17 |
| SHM-05-39B | 7 | 638 | 3 | 210.22 | 211.16 | 1 | 1 | -0.94 |
| SHM-05-40X | 7 | 638 | 3 | 210.23 | 210.80 | 1 | 1 | -0.57 |
| SHM-05-41A | 7 | 638 | 2 | 212.80 | 211.71 | 1 | 1 | 1.09 |
| SHM-05-41B | 7 | 638 | 3 | 212.84 | 211.69 | 1 | 1 | 1.15 |
| SHM-05-41C | 7 | 638 | 4 | 212.75 | 211.71 | 1 | 1 | 1.04 |
| SHM-05-42A | 7 | 638 | 2 | 212.88 | 211.95 | 1 | 1 | 0.93 |
| SHM-05-42B | 7 | 638 | 3 | 212.87 | 211.95 | 1 | 1 | 0.92 |
| SHM-07-03 | 7 | 638 | 3 | 209.67 | 209.76 | 1 | 1 | -0.09 |
| SHM-10-01 | 7 | 638 | 4 | 206.69 | 207.09 | 1 | 1 | -0.40 |
| SHM-10-02 | 7 | 638 | 2 | 205.82 | 206.33 | 1 | 1 | -0.51 |
| SHM-10-03 | 7 | 638 | 3 | 206.37 | 206.66 | 1 | 1 | -0.29 |
| SHM-10-04 | 7 | 638 | 3 | 207.50 | 207.88 | 1 | 1 | -0.38 |
| SHM-10-05A | 7 | 638 | 2 | 210.86 | 212.08 | 1 | 1 | -1.22 |
| SHM-10-06 | 7 | 638 | 3 | 214.41 | 213.51 | 1 | 1 | 0.90 |
| SHM-10-06A | 7 | 638 | 3 | 214.53 | 213.76 | 1 | 1 | 0.77 |

**Table 7.1**
**Model Predicted Water Levels and Residuals**
**Shepley's Hill Landfill Groundwater Model**

| Well Name | Stress Period | Time (days) | Layer | Target Water Level Elevation (Feet) | Predicted Water Level Elevation (Feet) | Weight | Group | Residual (Feet) |
|---|---|---|---|---|---|---|---|---|
| SHM-10-07 | 7 | 638 | 4 | 219.08 | 219.12 | 1 | 1 | -0.04 |
| SHM-10-08 | 7 | 638 | 3 | 205.61 | 206.19 | 1 | 1 | -0.58 |
| SHM-10-10 | 7 | 638 | 3 | 207.21 | 207.82 | 1 | 1 | -0.61 |
| SHM-10-11 | 7 | 638 | 3 | 222.77 | 224.89 | 1 | 1 | -2.12 |
| SHM-10-12 | 7 | 638 | 3 | 220.62 | 220.01 | 1 | 1 | 0.61 |
| SHM-10-13 | 7 | 638 | 3 | 218.68 | 217.87 | 1 | 1 | 0.81 |
| SHM-10-14 | 7 | 638 | 3 | 217.94 | 216.88 | 1 | 1 | 1.06 |
| SHM-10-15 | 7 | 638 | 3 | 219.25 | 218.58 | 1 | 1 | 0.67 |
| SHM-10-16 | 7 | 638 | 3 | 212.83 | 211.69 | 1 | 1 | 1.14 |
| SHM-11-02 | 7 | 638 | 5 | 217.92 | 218.01 | 1 | 2 | -0.09 |
| SHM-11-06 | 7 | 638 | 2 | 216.57 | 215.67 | 1 | 1 | 0.90 |
| SHM-11-07 | 7 | 638 | 3 | 217.94 | 217.81 | 1 | 1 | 0.13 |
| SHM-13-01 | 7 | 638 | 3 | 206.02 | 206.41 | 1 | 1 | -0.39 |
| SHM-13-02 | 7 | 638 | 3 | 206.80 | 207.41 | 1 | 1 | -0.61 |
| SHM-13-03 | 7 | 638 | 3 | 207.71 | 208.09 | 1 | 1 | -0.38 |
| SHM-13-04 | 7 | 638 | 2 | 209.17 | 209.66 | 1 | 1 | -0.49 |
| SHM-13-05 | 7 | 638 | 3 | 209.64 | 210.66 | 1 | 1 | -1.02 |
| SHM-13-06 | 7 | 638 | 3 | 207.53 | 208.36 | 1 | 1 | -0.83 |
| SHM-13-07 | 7 | 638 | 2 | 207.82 | 208.75 | 1 | 1 | -0.93 |
| SHM-13-08 | 7 | 638 | 3 | 208.56 | 209.40 | 1 | 1 | -0.84 |
| SHM-13-14D | 7 | 638 | 3 | 207.77 | 208.81 | 1 | 1 | -1.04 |
| SHM-13-14S | 7 | 638 | 1 | 207.67 | 208.81 | 1 | 1 | -1.14 |
| SHM-13-15 | 7 | 638 | 3 | 207.47 | 208.43 | 1 | 1 | -0.96 |
| SHM-93-10C | 7 | 638 | 5 | 218.65 | 217.78 | 1 | 2 | 0.87 |
| SHM-93-18B | 7 | 638 | 3 | 218.92 | 219.25 | 1 | 1 | -0.33 |
| SHM-93-22B | 7 | 638 | 3 | 211.54 | 212.18 | 1 | 1 | -0.64 |
| SHM-93-22C | 7 | 638 | 5 | 213.19 | 212.12 | 1 | 2 | 1.07 |
| SHM-93-24A | 7 | 638 | 1 | 222.35 | 221.97 | 1 | 1 | 0.38 |
| SHM-96-5B | 7 | 638 | 3 | 212.96 | 212.50 | 1 | 1 | 0.46 |
| SHM-96-5C | 7 | 638 | 3 | 213.39 | 212.57 | 1 | 1 | 0.82 |
| SHM-99-32X | 7 | 638 | 3 | 212.30 | 211.95 | 1 | 1 | 0.35 |
| SHP-01-36X | 7 | 638 | 1 | 216.56 | 216.21 | 1 | 1 | 0.35 |
| SHP-01-37X | 7 | 638 | 2 | 216.67 | 216.50 | 1 | 1 | 0.17 |
| SHP-01-38A | 7 | 638 | 1 | 216.89 | 216.81 | 1 | 1 | 0.08 |
| SHP-01-38B | 7 | 638 | 3 | 216.93 | 216.79 | 1 | 1 | 0.14 |
| SHP-05-43 | 7 | 638 | 3 | 216.14 | 215.32 | 1 | 1 | 0.82 |
| SHP-05-44 | 7 | 638 | 3 | 216.43 | 216.13 | 1 | 1 | 0.30 |
| SHP-05-45A | 7 | 638 | 1 | 213.24 | 211.94 | 1 | 1 | 1.30 |
| SHP-05-45B | 7 | 638 | 3 | 213.21 | 211.46 | 1 | 1 | 1.75 |
| SHP-05-46A | 7 | 638 | 1 | 213.48 | 212.20 | 1 | 1 | 1.28 |
| SHP-05-47A | 7 | 638 | 1 | 212.70 | 213.46 | 1 | 1 | -0.76 |
| SHP-05-47B | 7 | 638 | 1 | 213.48 | 213.46 | 1 | 1 | 0.02 |
| SHP-05-48A | 7 | 638 | 1 | 212.60 | 211.68 | 1 | 1 | 0.92 |
| SHP-05-48B | 7 | 638 | 1 | 212.49 | 211.68 | 1 | 1 | 0.81 |
| SHP-05-49A | 7 | 638 | 1 | 211.04 | 211.85 | 1 | 1 | -0.81 |

**Table 7.1**
**Model Predicted Water Levels and Residuals**
**Shepley's Hill Landfill Groundwater Model**

| Well Name | Stress Period | Time (days) | Layer | Target Water Level Elevation (Feet) | Predicted Water Level Elevation (Feet) | Weight | Group | Residual (Feet) |
|---|---|---|---|---|---|---|---|---|
| SHP-05-49B | 7 | 638 | 1 | 211.29 | 211.84 | 1 | 1 | -0.55 |
| SHP-95-27X | 7 | 638 | 1 | 222.62 | 223.03 | 1 | 1 | -0.41 |
| SHP-99-01C | 7 | 638 | 5 | 266.12 | 258.68 | 1 | 2 | 7.44 |
| SHP-99-29X | 7 | 638 | 2 | 220.00 | 218.86 | 1 | 1 | 1.14 |
| SHP-99-35X | 7 | 638 | 3 | 221.44 | 221.36 | 1 | 1 | 0.08 |
| 69W-94-13 | 9 | 822 | 1 | 219.76 | 219.06 | 1 | 5 | 0.70 |
| 69W-94-14 | 9 | 822 | 1 | 219.09 | 218.34 | 1 | 5 | 0.75 |
| 69WP-08-01 | 9 | 822 | 2 | 217.47 | 216.59 | 1 | 5 | 0.88 |
| EPA-PZ-2012-1A | 9 | 822 | 2 | 211.40 | 212.22 | 1 | 1 | -0.82 |
| EPA-PZ-2012-1B | 9 | 822 | 3 | 211.44 | 212.25 | 1 | 1 | -0.81 |
| EPA-PZ-2012-2A | 9 | 822 | 2 | 211.61 | 212.43 | 1 | 1 | -0.82 |
| EPA-PZ-2012-2B | 9 | 822 | 4 | 211.66 | 212.47 | 1 | 1 | -0.81 |
| EPA-PZ-2012-3A | 9 | 822 | 2 | 210.81 | 211.58 | 1 | 1 | -0.77 |
| EPA-PZ-2012-3B | 9 | 822 | 3 | 211.42 | 211.58 | 1 | 1 | -0.16 |
| EPA-PZ-2012-4A | 9 | 822 | 2 | 210.54 | 211.25 | 1 | 1 | -0.71 |
| EPA-PZ-2012-4B | 9 | 822 | 3 | 210.24 | 211.09 | 1 | 1 | -0.85 |
| EPA-PZ-2012-5A | 9 | 822 | 1 | 210.94 | 211.84 | 1 | 1 | -0.90 |
| EPA-PZ-2012-5B | 9 | 822 | 3 | 211.00 | 211.85 | 1 | 1 | -0.85 |
| EPA-PZ-2012-6A | 9 | 822 | 2 | 210.42 | 211.02 | 1 | 1 | -0.60 |
| EPA-PZ-2012-6B | 9 | 822 | 3 | 210.41 | 210.84 | 1 | 1 | -0.43 |
| EPA-PZ-2012-7A | 9 | 822 | 1 | 210.45 | 211.11 | 1 | 1 | -0.66 |
| EPA-PZ-2012-7B | 9 | 822 | 3 | 210.44 | 211.05 | 1 | 1 | -0.61 |
| N1-P1 | 9 | 822 | 3 | 215.87 | 215.39 | 1 | 1 | 0.48 |
| N1-P2 | 9 | 822 | 2 | 215.98 | 215.57 | 1 | 1 | 0.41 |
| N1-P3 | 9 | 822 | 1 | 216.87 | 215.75 | 1 | 1 | 1.12 |
| N2-P1 | 9 | 822 | 3 | 217.15 | 216.77 | 1 | 1 | 0.38 |
| N2-P2 | 9 | 822 | 2 | 217.17 | 216.77 | 1 | 1 | 0.40 |
| N3-P1 | 9 | 822 | 5 | 217.23 | 217.01 | 1 | 2 | 0.22 |
| N3-P2 | 9 | 822 | 2 | 217.20 | 217.00 | 1 | 1 | 0.20 |
| N5-P1 | 9 | 822 | 5 | 218.43 | 217.54 | 1 | 2 | 0.89 |
| N5-P2 | 9 | 822 | 1 | 217.95 | 217.52 | 1 | 1 | 0.43 |
| N6-P1 | 9 | 822 | 5 | 220.92 | 222.20 | 1 | 2 | -1.28 |
| N7-P1 | 9 | 822 | 5 | 223.38 | 225.25 | 1 | 2 | -1.87 |
| N7-P2 | 9 | 822 | 1 | 223.63 | 225.22 | 1 | 1 | -1.59 |
| PZ-12-01 | 9 | 822 | 3 | 216.94 | 216.69 | 1 | 1 | 0.25 |
| PZ-12-02 | 9 | 822 | 3 | 216.99 | 216.58 | 1 | 1 | 0.41 |
| PZ-12-03 | 9 | 822 | 2 | 217.11 | 216.86 | 1 | 1 | 0.25 |
| PZ-12-04 | 9 | 822 | 2 | 217.47 | 217.32 | 1 | 1 | 0.15 |
| PZ-12-05 | 9 | 822 | 3 | 218.26 | 216.93 | 1 | 1 | 1.33 |
| PZ-12-06 | 9 | 822 | 2 | 217.66 | 217.73 | 1 | 1 | -0.07 |
| PZ-12-07 | 9 | 822 | 2 | 217.02 | 217.19 | 1 | 1 | -0.17 |
| PZ-12-08 | 9 | 822 | 2 | 218.25 | 218.55 | 1 | 1 | -0.30 |
| PZ-12-09 | 9 | 822 | 3 | 217.33 | 217.84 | 1 | 1 | -0.51 |
| PZ-12-10 | 9 | 822 | 3 | 218.70 | 219.32 | 1 | 1 | -0.62 |
| SHL-10 | 9 | 822 | 2 | 216.93 | 217.56 | 1 | 1 | -0.63 |

**Table 7.1**
**Model Predicted Water Levels and Residuals**
**Shepley's Hill Landfill Groundwater Model**

| Well Name | Stress Period | Time (days) | Layer | Target Water Level Elevation (Feet) | Predicted Water Level Elevation (Feet) | Weight | Group | Residual (Feet) |
|---|---|---|---|---|---|---|---|---|
| SHL-11 | 9 | 822 | 2 | 216.98 | 216.75 | 1 | 1 | 0.23 |
| SHL-12 | 9 | 822 | 1 | 224.92 | 225.57 | 1 | 1 | -0.65 |
| SHL-13 | 9 | 822 | 1 | 213.76 | 213.63 | 1 | 1 | 0.13 |
| SHL-15 | 9 | 822 | 3 | 239.69 | 242.99 | 1 | 1 | -3.30 |
| SHL-18 | 9 | 822 | 1 | 217.96 | 218.56 | 1 | 1 | -0.60 |
| SHL-19 | 9 | 822 | 4 | 216.95 | 217.39 | 1 | 1 | -0.44 |
| SHL-20 | 9 | 822 | 3 | 217.16 | 216.86 | 1 | 1 | 0.30 |
| SHL-21 | 9 | 822 | 1 | 213.29 | 213.50 | 1 | 1 | -0.21 |
| SHL-22 | 9 | 822 | 4 | 210.72 | 211.59 | 1 | 1 | -0.87 |
| SHL-23 | 9 | 822 | 2 | 210.94 | 211.62 | 1 | 1 | -0.68 |
| SHL-25 | 9 | 822 | 3 | 229.37 | 228.91 | 1 | 1 | 0.46 |
| SHL-3 | 9 | 822 | 3 | 217.39 | 218.51 | 1 | 1 | -1.12 |
| SHL-4 | 9 | 822 | 1 | 217.08 | 217.01 | 1 | 1 | 0.07 |
| SHL-5 | 9 | 822 | 1 | 211.15 | 212.04 | 1 | 1 | -0.89 |
| SHL-8D | 9 | 822 | 4 | 212.22 | 212.91 | 1 | 1 | -0.69 |
| SHL-8S | 9 | 822 | 3 | 212.40 | 212.91 | 1 | 1 | -0.51 |
| SHL-9 | 9 | 822 | 1 | 210.59 | 211.47 | 1 | 1 | -0.88 |
| SHM-05-39A | 9 | 822 | 2 | 209.18 | 210.52 | 1 | 1 | -1.34 |
| SHM-05-39B | 9 | 822 | 3 | 208.51 | 210.53 | 1 | 1 | -2.02 |
| SHM-05-40X | 9 | 822 | 3 | 208.29 | 210.12 | 1 | 1 | -1.83 |
| SHM-05-41A | 9 | 822 | 2 | 210.37 | 211.09 | 1 | 1 | -0.72 |
| SHM-05-41B | 9 | 822 | 3 | 210.37 | 211.08 | 1 | 1 | -0.71 |
| SHM-05-41C | 9 | 822 | 4 | 210.16 | 211.09 | 1 | 1 | -0.93 |
| SHM-05-42A | 9 | 822 | 2 | 210.68 | 211.38 | 1 | 1 | -0.70 |
| SHM-05-42B | 9 | 822 | 3 | 210.60 | 211.39 | 1 | 1 | -0.79 |
| SHM-07-03 | 9 | 822 | 3 | 207.38 | 208.95 | 1 | 1 | -1.57 |
| SHM-10-01 | 9 | 822 | 4 | 205.56 | 206.38 | 1 | 1 | -0.82 |
| SHM-10-02 | 9 | 822 | 2 | 204.57 | 205.63 | 1 | 1 | -1.06 |
| SHM-10-03 | 9 | 822 | 3 | 204.95 | 205.94 | 1 | 1 | -0.99 |
| SHM-10-04 | 9 | 822 | 3 | 206.37 | 207.14 | 1 | 1 | -0.77 |
| SHM-10-05A | 9 | 822 | 2 | 209.68 | 211.54 | 1 | 1 | -1.86 |
| SHM-10-06 | 9 | 822 | 3 | 212.59 | 213.06 | 1 | 1 | -0.47 |
| SHM-10-06A | 9 | 822 | 3 | 212.87 | 213.33 | 1 | 1 | -0.46 |
| SHM-10-07 | 9 | 822 | 4 | 218.80 | 218.81 | 1 | 1 | -0.01 |
| SHM-10-08 | 9 | 822 | 3 | 204.46 | 205.50 | 1 | 1 | -1.04 |
| SHM-10-10 | 9 | 822 | 3 | 206.29 | 207.13 | 1 | 1 | -0.84 |
| SHM-10-11 | 9 | 822 | 3 | 222.30 | 224.09 | 1 | 1 | -1.79 |
| SHM-10-12 | 9 | 822 | 3 | 220.24 | 219.55 | 1 | 1 | 0.69 |
| SHM-10-13 | 9 | 822 | 3 | 217.85 | 217.47 | 1 | 1 | 0.38 |
| SHM-10-14 | 9 | 822 | 3 | 216.40 | 216.43 | 1 | 1 | -0.03 |
| SHM-10-15 | 9 | 822 | 3 | 218.27 | 218.10 | 1 | 1 | 0.17 |
| SHM-10-16 | 9 | 822 | 3 | 210.43 | 211.08 | 1 | 1 | -0.65 |
| SHM-11-02 | 9 | 822 | 5 | 217.62 | 217.74 | 1 | 2 | -0.12 |
| SHM-11-06 | 9 | 822 | 2 | 215.46 | 215.41 | 1 | 1 | 0.05 |
| SHM-11-07 | 9 | 822 | 3 | 217.57 | 217.53 | 1 | 1 | 0.04 |

**Table 7.1**
**Model Predicted Water Levels and Residuals**
**Shepley's Hill Landfill Groundwater Model**

| Well Name | Stress Period | Time (days) | Layer | Target Water Level Elevation (Feet) | Predicted Water Level Elevation (Feet) | Weight | Group | Residual (Feet) |
|---|---|---|---|---|---|---|---|---|
| SHM-13-01 | 9 | 822 | 3 | 204.72 | 205.66 | 1 | 1 | -0.94 |
| SHM-13-02 | 9 | 822 | 3 | 205.75 | 206.70 | 1 | 1 | -0.95 |
| SHM-13-03 | 9 | 822 | 3 | 206.93 | 207.41 | 1 | 1 | -0.48 |
| SHM-13-04 | 9 | 822 | 2 | 207.47 | 208.94 | 1 | 1 | -1.47 |
| SHM-13-05 | 9 | 822 | 3 | 207.19 | 210.04 | 1 | 1 | -2.85 |
| SHM-13-06 | 9 | 822 | 3 | 206.34 | 207.64 | 1 | 1 | -1.30 |
| SHM-13-07 | 9 | 822 | 2 | 206.67 | 208.04 | 1 | 1 | -1.37 |
| SHM-13-08 | 9 | 822 | 3 | 208.21 | 208.72 | 1 | 1 | -0.51 |
| SHM-13-14D | 9 | 822 | 3 | 207.08 | 208.14 | 1 | 1 | -1.06 |
| SHM-13-14S | 9 | 822 | 1 | 207.23 | 208.14 | 1 | 1 | -0.91 |
| SHM-13-15 | 9 | 822 | 3 | 206.77 | 207.76 | 1 | 1 | -0.99 |
| SHM-93-10C | 9 | 822 | 5 | 217.93 | 217.62 | 1 | 2 | 0.31 |
| SHM-93-18B | 9 | 822 | 3 | 218.01 | 218.84 | 1 | 1 | -0.83 |
| SHM-93-22B | 9 | 822 | 3 | 210.65 | 211.64 | 1 | 1 | -0.99 |
| SHM-93-22C | 9 | 822 | 5 | 210.74 | 211.58 | 1 | 2 | -0.84 |
| SHM-96-5B | 9 | 822 | 3 | 211.15 | 211.98 | 1 | 1 | -0.83 |
| SHM-96-5C | 9 | 822 | 3 | 211.17 | 212.06 | 1 | 1 | -0.89 |
| SHM-99-31A | 9 | 822 | 1 | 209.92 | 210.83 | 1 | 1 | -0.91 |
| SHM-99-31B | 9 | 822 | 2 | 209.54 | 210.86 | 1 | 1 | -1.32 |
| SHM-99-31C | 9 | 822 | 3 | 209.50 | 210.90 | 1 | 1 | -1.40 |
| SHM-99-32X | 9 | 822 | 3 | 210.53 | 211.40 | 1 | 1 | -0.87 |
| SHP-01-36X | 9 | 822 | 1 | 217.06 | 216.26 | 1 | 1 | 0.80 |
| SHP-01-37X | 9 | 822 | 2 | 217.18 | 216.61 | 1 | 1 | 0.57 |
| SHP-01-38A | 9 | 822 | 1 | 217.17 | 216.88 | 1 | 1 | 0.29 |
| SHP-01-38B | 9 | 822 | 3 | 217.16 | 216.87 | 1 | 1 | 0.29 |
| SHP-05-43 | 9 | 822 | 3 | 215.21 | 215.07 | 1 | 1 | 0.14 |
| SHP-05-44 | 9 | 822 | 3 | 216.09 | 216.05 | 1 | 1 | 0.04 |
| SHP-05-45A | 9 | 822 | 1 | 210.59 | 211.39 | 1 | 1 | -0.80 |
| SHP-05-45B | 9 | 822 | 3 | 210.80 | 210.97 | 1 | 1 | -0.17 |
| SHP-05-46A | 9 | 822 | 1 | 210.75 | 211.66 | 1 | 1 | -0.91 |
| SHP-05-46B | 9 | 822 | 3 | 210.45 | 211.63 | 1 | 1 | -1.18 |
| SHP-05-49B | 9 | 822 | 1 | 210.69 | 211.31 | 1 | 1 | -0.62 |
| SHP-95-27X | 9 | 822 | 1 | 220.22 | 221.98 | 1 | 1 | -1.76 |
| SHP-99-01C | 9 | 822 | 5 | 249.96 | 247.83 | 1 | 2 | 2.13 |
| SHP-99-29X | 9 | 822 | 2 | 218.49 | 218.29 | 1 | 1 | 0.20 |
| SHP-99-34B | 9 | 822 | 3 | 211.08 | 211.78 | 1 | 1 | -0.70 |
| SHP-99-35X | 9 | 822 | 3 | 223.59 | 220.85 | 1 | 1 | 2.74 |
| 32M-01-14XOB | 11 | 1003 | 3 | 231.81 | 229.71 | 1 | 3 | 2.10 |
| 32M-01-18XBR | 11 | 1003 | 5 | 239.82 | 243.55 | 1 | 3 | -3.73 |
| 57M-03-01X | 11 | 1003 | 1 | 223.31 | 222.69 | 1 | 4 | 0.62 |
| 57M-03-02X | 11 | 1003 | 1 | 221.85 | 222.45 | 1 | 4 | -0.60 |
| 57M-03-03X | 11 | 1003 | 1 | 222.55 | 222.19 | 1 | 4 | 0.36 |
| 57M-03-04X | 11 | 1003 | 1 | 221.54 | 222.14 | 1 | 4 | -0.60 |
| 57M-03-05X | 11 | 1003 | 1 | 221.51 | 222.20 | 1 | 4 | -0.69 |
| 57M-03-06X | 11 | 1003 | 1 | 221.80 | 222.25 | 1 | 4 | -0.45 |

**Table 7.1**
**Model Predicted Water Levels and Residuals**
**Shepley's Hill Landfill Groundwater Model**

| Well Name | Stress Period | Time (days) | Layer | Target Water Level Elevation (Feet) | Predicted Water Level Elevation (Feet) | Weight | Group | Residual (Feet) |
|---|---|---|---|---|---|---|---|---|
| 57M-95-05X | 11 | 1003 | 1 | 222.63 | 222.86 | 1 | 4 | -0.23 |
| 57M-95-06X | 11 | 1003 | 1 | 222.89 | 222.50 | 1 | 4 | 0.39 |
| 57M-95-07X | 11 | 1003 | 1 | 221.78 | 222.59 | 1 | 4 | -0.81 |
| 57M-96-10X | 11 | 1003 | 1 | 222.06 | 221.65 | 1 | 4 | 0.41 |
| 57M-96-11X | 11 | 1003 | 1 | 221.26 | 221.71 | 1 | 4 | -0.45 |
| 57M-96-12X | 11 | 1003 | 1 | 222.51 | 221.91 | 1 | 4 | 0.60 |
| 57M-96-13X | 11 | 1003 | 1 | 222.49 | 221.95 | 1 | 4 | 0.54 |
| EPA-PZ-2012-1A | 11 | 1003 | 2 | 212.58 | 212.56 | 1 | 1 | 0.02 |
| EPA-PZ-2012-1B | 11 | 1003 | 3 | 212.72 | 212.57 | 1 | 1 | 0.15 |
| EPA-PZ-2012-2A | 11 | 1003 | 2 | 212.93 | 212.75 | 1 | 1 | 0.18 |
| EPA-PZ-2012-2B | 11 | 1003 | 4 | 212.84 | 212.78 | 1 | 1 | 0.06 |
| EPA-PZ-2012-3A | 11 | 1003 | 2 | 212.17 | 211.92 | 1 | 1 | 0.25 |
| EPA-PZ-2012-3B | 11 | 1003 | 3 | 212.12 | 211.89 | 1 | 1 | 0.23 |
| EPA-PZ-2012-4A | 11 | 1003 | 2 | 211.89 | 211.57 | 1 | 1 | 0.32 |
| EPA-PZ-2012-4B | 11 | 1003 | 3 | 211.66 | 211.35 | 1 | 1 | 0.31 |
| EPA-PZ-2012-5A | 11 | 1003 | 1 | 212.30 | 212.20 | 1 | 1 | 0.10 |
| EPA-PZ-2012-5B | 11 | 1003 | 3 | 212.27 | 212.19 | 1 | 1 | 0.08 |
| EPA-PZ-2012-6A | 11 | 1003 | 2 | 212.12 | 211.36 | 1 | 1 | 0.76 |
| EPA-PZ-2012-6B | 11 | 1003 | 3 | 211.81 | 211.13 | 1 | 1 | 0.68 |
| EPA-PZ-2012-7A | 11 | 1003 | 1 | 211.94 | 211.52 | 1 | 1 | 0.42 |
| EPA-PZ-2012-7B | 11 | 1003 | 3 | 211.85 | 211.43 | 1 | 1 | 0.42 |
| N1-P1 | 11 | 1003 | 3 | 215.74 | 215.41 | 1 | 1 | 0.33 |
| N1-P2 | 11 | 1003 | 2 | 216.09 | 215.56 | 1 | 1 | 0.53 |
| N1-P3 | 11 | 1003 | 1 | 216.47 | 215.73 | 1 | 1 | 0.74 |
| N2-P1 | 11 | 1003 | 3 | 216.79 | 216.59 | 1 | 1 | 0.20 |
| N2-P2 | 11 | 1003 | 2 | 216.75 | 216.59 | 1 | 1 | 0.16 |
| N3-P1 | 11 | 1003 | 5 | 216.74 | 216.88 | 1 | 2 | -0.14 |
| N3-P2 | 11 | 1003 | 2 | 216.74 | 216.88 | 1 | 1 | -0.14 |
| N6-P1 | 11 | 1003 | 5 | 222.34 | 222.82 | 1 | 2 | -0.48 |
| N7-P1 | 11 | 1003 | 5 | 225.16 | 226.50 | 1 | 2 | -1.34 |
| N7-P2 | 11 | 1003 | 1 | 225.49 | 226.47 | 1 | 1 | -0.98 |
| PZ-12-01 | 11 | 1003 | 3 | 216.91 | 216.59 | 1 | 1 | 0.32 |
| PZ-12-02 | 11 | 1003 | 3 | 216.60 | 216.88 | 1 | 1 | -0.28 |
| PZ-12-03 | 11 | 1003 | 2 | 216.81 | 216.76 | 1 | 1 | 0.05 |
| PZ-12-04 | 11 | 1003 | 2 | 218.30 | 217.66 | 1 | 1 | 0.64 |
| PZ-12-05 | 11 | 1003 | 3 | 217.09 | 216.85 | 1 | 1 | 0.24 |
| PZ-12-06 | 11 | 1003 | 2 | 218.46 | 218.09 | 1 | 1 | 0.37 |
| PZ-12-07 | 11 | 1003 | 2 | 217.18 | 217.22 | 1 | 1 | -0.04 |
| PZ-12-08 | 11 | 1003 | 2 | 219.30 | 218.93 | 1 | 1 | 0.37 |
| PZ-12-09 | 11 | 1003 | 3 | 217.69 | 218.04 | 1 | 1 | -0.35 |
| PZ-12-10 | 11 | 1003 | 3 | 219.49 | 219.79 | 1 | 1 | -0.30 |
| RSK1 | 11 | 1003 | 3 | 216.52 | 216.63 | 1 | 1 | -0.11 |
| RSK12 | 11 | 1003 | 2 | 216.76 | 216.86 | 1 | 1 | -0.10 |
| RSK13 | 11 | 1003 | 3 | 216.70 | 216.98 | 1 | 1 | -0.28 |
| RSK15 | 11 | 1003 | 2 | 216.66 | 216.98 | 1 | 1 | -0.32 |

**Table 7.1**
**Model Predicted Water Levels and Residuals**
**Shepley's Hill Landfill Groundwater Model**

| Well Name | Stress Period | Time (days) | Layer | Target Water Level Elevation (Feet) | Predicted Water Level Elevation (Feet) | Weight | Group | Residual (Feet) |
|---|---|---|---|---|---|---|---|---|
| RSK16 | 11 | 1003 | 3 | 216.59 | 216.72 | 1 | 1 | -0.13 |
| RSK19 | 11 | 1003 | 2 | 216.58 | 216.72 | 1 | 1 | -0.14 |
| RSK24 | 11 | 1003 | 1 | 219.24 | 218.80 | 1 | 1 | 0.44 |
| RSK25 | 11 | 1003 | 3 | 216.81 | 217.40 | 1 | 1 | -0.59 |
| RSK27 | 11 | 1003 | 1 | 218.52 | 218.25 | 1 | 1 | 0.27 |
| RSK28 | 11 | 1003 | 1 | 218.38 | 217.93 | 1 | 1 | 0.45 |
| RSK32 | 11 | 1003 | 1 | 218.16 | 217.63 | 1 | 1 | 0.53 |
| RSK34 | 11 | 1003 | 1 | 216.99 | 216.30 | 1 | 1 | 0.69 |
| RSK35 | 11 | 1003 | 1 | 216.43 | 216.06 | 1 | 1 | 0.37 |
| RSK37 | 11 | 1003 | 2 | 216.48 | 216.95 | 1 | 1 | -0.47 |
| RSK41 | 11 | 1003 | 4 | 216.51 | 216.92 | 1 | 1 | -0.41 |
| RSK50 | 11 | 1003 | 1 | 216.56 | 216.77 | 1 | 1 | -0.21 |
| RSK7 | 11 | 1003 | 2 | 216.49 | 216.63 | 1 | 1 | -0.14 |
| RSK8 | 11 | 1003 | 5 | 216.81 | 216.87 | 1 | 2 | -0.06 |
| SHL-10 | 11 | 1003 | 2 | 215.44 | 217.65 | 1 | 1 | -2.21 |
| SHL-11 | 11 | 1003 | 2 | 216.85 | 216.64 | 1 | 1 | 0.21 |
| SHL-12 | 11 | 1003 | 1 | 226.87 | 226.98 | 1 | 1 | -0.11 |
| SHL-13 | 11 | 1003 | 1 | 213.92 | 213.84 | 1 | 1 | 0.08 |
| SHL-15 | 11 | 1003 | 3 | 242.06 | 244.44 | 1 | 1 | -2.38 |
| SHL-17 | 11 | 1003 | 1 | 226.64 | 226.83 | 1 | 1 | -0.19 |
| SHL-18 | 11 | 1003 | 1 | 218.35 | 218.83 | 1 | 1 | -0.48 |
| SHL-19 | 11 | 1003 | 4 | 216.95 | 217.48 | 1 | 1 | -0.53 |
| SHL-20 | 11 | 1003 | 3 | 217.85 | 217.18 | 1 | 1 | 0.67 |
| SHL-22 | 11 | 1003 | 4 | 212.08 | 211.92 | 1 | 1 | 0.16 |
| SHL-23 | 11 | 1003 | 2 | 212.71 | 212.04 | 1 | 1 | 0.67 |
| SHL-24 | 11 | 1003 | 5 | 223.29 | 221.88 | 1 | 2 | 1.41 |
| SHL-25 | 11 | 1003 | 3 | 233.85 | 230.23 | 1 | 1 | 3.62 |
| SHL-3 | 11 | 1003 | 3 | 216.90 | 218.83 | 1 | 1 | -1.93 |
| SHL-4 | 11 | 1003 | 1 | 216.87 | 216.97 | 1 | 1 | -0.10 |
| SHL-7 | 11 | 1003 | 1 | 218.95 | 219.52 | 1 | 1 | -0.57 |
| SHM-05-41B | 11 | 1003 | 3 | 211.35 | 211.50 | 1 | 1 | -0.15 |
| SHM-05-41C | 11 | 1003 | 4 | 211.39 | 211.52 | 1 | 1 | -0.13 |
| SHM-07-03 | 11 | 1003 | 3 | 208.18 | 209.61 | 1 | 1 | -1.43 |
| SHM-07-05 | 11 | 1003 | 5 | 208.88 | 210.61 | 1 | 2 | -1.73 |
| SHM-10-01 | 11 | 1003 | 4 | 205.74 | 206.82 | 1 | 1 | -1.08 |
| SHM-10-02 | 11 | 1003 | 2 | 204.95 | 206.05 | 1 | 1 | -1.10 |
| SHM-10-03 | 11 | 1003 | 3 | 205.45 | 206.42 | 1 | 1 | -0.97 |
| SHM-10-04 | 11 | 1003 | 3 | 206.81 | 207.70 | 1 | 1 | -0.89 |
| SHM-10-05A | 11 | 1003 | 2 | 209.83 | 211.86 | 1 | 1 | -2.03 |
| SHM-10-07 | 11 | 1003 | 4 | 219.99 | 219.21 | 1 | 1 | 0.78 |
| SHM-10-08 | 11 | 1003 | 3 | 204.81 | 205.89 | 1 | 1 | -1.08 |
| SHM-10-10 | 11 | 1003 | 3 | 206.64 | 207.55 | 1 | 1 | -0.91 |
| SHM-10-11 | 11 | 1003 | 3 | 224.16 | 224.97 | 1 | 1 | -0.81 |
| SHM-10-12 | 11 | 1003 | 3 | 221.77 | 220.13 | 1 | 1 | 1.64 |
| SHM-10-13 | 11 | 1003 | 3 | 219.26 | 217.95 | 1 | 1 | 1.31 |

**Table 7.1**
**Model Predicted Water Levels and Residuals**
**Shepley's Hill Landfill Groundwater Model**

| Well Name | Stress Period | Time (days) | Layer | Target Water Level Elevation (Feet) | Predicted Water Level Elevation (Feet) | Weight | Group | Residual (Feet) |
|---|---|---|---|---|---|---|---|---|
| SHM-10-15 | 11 | 1003 | 3 | 219.99 | 218.67 | 1 | 1 | 1.32 |
| SHM-11-02 | 11 | 1003 | 5 | 217.91 | 218.08 | 1 | 2 | -0.17 |
| SHM-11-07 | 11 | 1003 | 3 | 218.44 | 217.88 | 1 | 1 | 0.56 |
| SHM-13-01 | 11 | 1003 | 3 | 205.19 | 206.11 | 1 | 1 | -0.92 |
| SHM-13-02 | 11 | 1003 | 3 | 205.87 | 207.15 | 1 | 1 | -1.28 |
| SHM-13-03 | 11 | 1003 | 3 | 206.68 | 207.82 | 1 | 1 | -1.14 |
| SHM-13-04 | 11 | 1003 | 2 | 208.01 | 209.46 | 1 | 1 | -1.45 |
| SHM-13-05 | 11 | 1003 | 3 | 208.62 | 210.44 | 1 | 1 | -1.82 |
| SHM-13-06 | 11 | 1003 | 3 | 206.72 | 208.13 | 1 | 1 | -1.41 |
| SHM-13-07 | 11 | 1003 | 2 | 207.08 | 208.52 | 1 | 1 | -1.44 |
| SHM-13-08 | 11 | 1003 | 3 | 207.42 | 209.16 | 1 | 1 | -1.74 |
| SHM-93-18B | 11 | 1003 | 3 | 218.17 | 219.17 | 1 | 1 | -1.00 |
| SHM-93-22B | 11 | 1003 | 3 | 211.52 | 211.98 | 1 | 1 | -0.46 |
| SHM-93-24A | 11 | 1003 | 1 | 222.11 | 221.85 | 1 | 1 | 0.26 |
| SHM-96-5B | 11 | 1003 | 3 | 212.24 | 212.31 | 1 | 1 | -0.07 |
| SHM-99-32X | 11 | 1003 | 3 | 211.05 | 211.73 | 1 | 1 | -0.68 |
| SHP-01-36X | 11 | 1003 | 1 | 216.59 | 216.18 | 1 | 1 | 0.41 |
| SHP-01-37X | 11 | 1003 | 2 | 216.67 | 216.48 | 1 | 1 | 0.19 |
| SHP-01-38A | 11 | 1003 | 1 | 216.89 | 216.78 | 1 | 1 | 0.11 |
| SHP-01-38B | 11 | 1003 | 3 | 216.91 | 216.76 | 1 | 1 | 0.15 |
| SHP-05-43 | 11 | 1003 | 3 | 215.67 | 215.25 | 1 | 1 | 0.42 |
| SHP-05-44 | 11 | 1003 | 3 | 216.21 | 216.10 | 1 | 1 | 0.11 |
| SHP-05-47A | 11 | 1003 | 1 | 212.98 | 213.28 | 1 | 1 | -0.30 |
| SHP-05-47B | 11 | 1003 | 1 | 211.42 | 213.28 | 1 | 1 | -1.86 |
| SHP-05-49A | 11 | 1003 | 1 | 212.86 | 211.60 | 1 | 1 | 1.26 |
| SHP-05-49B | 11 | 1003 | 1 | 210.57 | 211.60 | 1 | 1 | -1.03 |
| SHP-95-27X | 11 | 1003 | 1 | 221.20 | 222.93 | 1 | 1 | -1.73 |
| SHP-99-01C | 11 | 1003 | 5 | 261.58 | 257.56 | 1 | 2 | 4.02 |
| SHP-99-29X | 11 | 1003 | 2 | 220.61 | 218.95 | 1 | 1 | 1.66 |
| SHP-99-34B | 11 | 1003 | 3 | 211.88 | 212.09 | 1 | 1 | -0.21 |
| SHP-99-35X | 11 | 1003 | 3 | 222.15 | 221.46 | 1 | 1 | 0.69 |
| N1-P1 | 12 | 1095 | 3 | 215.30 | 214.92 | 1 | 1 | 0.38 |
| N1-P3 | 12 | 1095 | 1 | 216.06 | 215.31 | 1 | 1 | 0.75 |
| N2-P1 | 12 | 1095 | 3 | 216.39 | 216.35 | 1 | 1 | 0.04 |
| N2-P2 | 12 | 1095 | 2 | 216.36 | 216.35 | 1 | 1 | 0.01 |
| N3-P1 | 12 | 1095 | 5 | 216.35 | 216.58 | 1 | 2 | -0.23 |
| N3-P2 | 12 | 1095 | 2 | 216.35 | 216.58 | 1 | 1 | -0.23 |
| PZ-12-01 | 12 | 1095 | 3 | 216.63 | 216.29 | 1 | 1 | 0.34 |
| PZ-12-02 | 12 | 1095 | 3 | 217.18 | 216.50 | 1 | 1 | 0.68 |
| PZ-12-03 | 12 | 1095 | 2 | 216.50 | 216.45 | 1 | 1 | 0.05 |
| PZ-12-04 | 12 | 1095 | 2 | 217.90 | 217.33 | 1 | 1 | 0.57 |
| PZ-12-05 | 12 | 1095 | 3 | 216.71 | 216.53 | 1 | 1 | 0.18 |
| PZ-12-06 | 12 | 1095 | 2 | 218.08 | 217.77 | 1 | 1 | 0.31 |
| PZ-12-07 | 12 | 1095 | 2 | 216.67 | 216.82 | 1 | 1 | -0.15 |
| PZ-12-08 | 12 | 1095 | 2 | 218.93 | 218.59 | 1 | 1 | 0.34 |

**Table 7.1**
**Model Predicted Water Levels and Residuals**
**Shepley's Hill Landfill Groundwater Model**

| Well Name | Stress Period | Time (days) | Layer | Target Water Level Elevation (Feet) | Predicted Water Level Elevation (Feet) | Weight | Group | Residual (Feet) |
|---|---|---|---|---|---|---|---|---|
| PZ-12-09 | 12 | 1095 | 3 | 217.52 | 217.49 | 1 | 1 | 0.03 |
| PZ-12-10 | 12 | 1095 | 3 | 219.28 | 219.23 | 1 | 1 | 0.05 |
| RSK1 | 12 | 1095 | 3 | 216.41 | 216.38 | 1 | 1 | 0.03 |
| RSK12 | 12 | 1095 | 2 | 216.61 | 216.54 | 1 | 1 | 0.07 |
| RSK13 | 12 | 1095 | 3 | 216.56 | 216.62 | 1 | 1 | -0.06 |
| RSK15 | 12 | 1095 | 2 | 216.53 | 216.63 | 1 | 1 | -0.10 |
| RSK16 | 12 | 1095 | 3 | 216.47 | 216.43 | 1 | 1 | 0.04 |
| RSK19 | 12 | 1095 | 2 | 216.46 | 216.43 | 1 | 1 | 0.03 |
| RSK24 | 12 | 1095 | 1 | 218.92 | 218.47 | 1 | 1 | 0.45 |
| RSK25 | 12 | 1095 | 3 | 216.68 | 216.95 | 1 | 1 | -0.27 |
| RSK27 | 12 | 1095 | 1 | 218.20 | 217.93 | 1 | 1 | 0.27 |
| RSK28 | 12 | 1095 | 1 | 218.06 | 217.60 | 1 | 1 | 0.46 |
| RSK32 | 12 | 1095 | 1 | 217.85 | 217.30 | 1 | 1 | 0.55 |
| RSK34 | 12 | 1095 | 1 | 216.65 | 215.88 | 1 | 1 | 0.77 |
| RSK35 | 12 | 1095 | 1 | 216.10 | 215.61 | 1 | 1 | 0.49 |
| RSK37 | 12 | 1095 | 2 | 216.39 | 216.62 | 1 | 1 | -0.23 |
| RSK41 | 12 | 1095 | 4 | 216.42 | 216.60 | 1 | 1 | -0.18 |
| RSK50 | 12 | 1095 | 1 | 216.43 | 216.46 | 1 | 1 | -0.03 |
| RSK7 | 12 | 1095 | 2 | 216.40 | 216.38 | 1 | 1 | 0.02 |
| RSK8 | 12 | 1095 | 5 | 216.66 | 216.54 | 1 | 2 | 0.12 |
| SHL-10 | 12 | 1095 | 2 | 216.69 | 217.16 | 1 | 1 | -0.47 |
| SHL-11 | 12 | 1095 | 2 | 216.51 | 216.35 | 1 | 1 | 0.16 |
| SHL-13 | 12 | 1095 | 1 | 213.19 | 213.01 | 1 | 1 | 0.18 |
| SHL-18 | 12 | 1095 | 1 | 217.93 | 218.22 | 1 | 1 | -0.29 |
| SHL-19 | 12 | 1095 | 4 | 216.71 | 217.00 | 1 | 1 | -0.29 |
| SHL-20 | 12 | 1095 | 3 | 217.44 | 216.82 | 1 | 1 | 0.62 |
| SHL-3 | 12 | 1095 | 3 | 217.09 | 218.20 | 1 | 1 | -1.11 |
| SHL-4 | 12 | 1095 | 1 | 216.52 | 216.62 | 1 | 1 | -0.10 |
| SHL-7 | 12 | 1095 | 1 | 218.75 | 218.83 | 1 | 1 | -0.08 |
| SHL-8D | 12 | 1095 | 4 | 212.21 | 212.27 | 1 | 1 | -0.06 |
| SHL-8S | 12 | 1095 | 3 | 212.31 | 212.27 | 1 | 1 | 0.04 |
| SHM-10-07 | 12 | 1095 | 4 | 219.55 | 218.90 | 1 | 1 | 0.65 |
| SHM-11-02 | 12 | 1095 | 5 | 217.78 | 217.75 | 1 | 2 | 0.03 |
| SHM-11-06 | 12 | 1095 | 2 | 215.69 | 215.14 | 1 | 1 | 0.55 |
| SHM-11-07 | 12 | 1095 | 3 | 218.05 | 217.55 | 1 | 1 | 0.50 |
| SHM-93-18B | 12 | 1095 | 3 | 217.99 | 218.53 | 1 | 1 | -0.54 |
| SHP-01-36X | 12 | 1095 | 1 | 216.20 | 215.84 | 1 | 1 | 0.36 |
| SHP-01-37X | 12 | 1095 | 2 | 216.28 | 216.20 | 1 | 1 | 0.08 |
| SHP-01-38A | 12 | 1095 | 1 | 216.47 | 216.47 | 1 | 1 | 0.00 |
| SHP-01-38B | 12 | 1095 | 3 | 216.51 | 216.46 | 1 | 1 | 0.05 |
| SHP-05-43 | 12 | 1095 | 3 | 215.20 | 214.67 | 1 | 1 | 0.53 |
| SHP-05-44 | 12 | 1095 | 3 | 215.79 | 215.68 | 1 | 1 | 0.11 |
| 32M-01-14XOB | 13 | 1187 | 3 | 231.61 | 228.37 | 1 | 3 | 3.24 |
| 32M-01-16XBR | 13 | 1187 | 5 | 231.75 | 236.03 | 0 | 3 | -4.28 |
| 32M-01-18XBR | 13 | 1187 | 5 | 238.57 | 238.87 | 1 | 3 | -0.30 |

**Table 7.1**
**Model Predicted Water Levels and Residuals**
**Shepley's Hill Landfill Groundwater Model**

| Well Name | Stress Period | Time (days) | Layer | Target Water Level Elevation (Feet) | Predicted Water Level Elevation (Feet) | Weight | Group | Residual (Feet) |
|---|---|---|---|---|---|---|---|---|
| 32M-92-01X | 13 | 1187 | 4 | 239.82 | 243.45 | 1 | 3 | -3.63 |
| 32M-92-03X | 13 | 1187 | 3 | 230.28 | 230.44 | 1 | 3 | -0.16 |
| 32Z-01-05XOB | 13 | 1187 | 3 | 230.30 | 230.13 | 1 | 3 | 0.17 |
| 32Z-01-06XBR | 13 | 1187 | 5 | 238.40 | 240.58 | 1 | 3 | -2.18 |
| 32Z-01-07XOB | 13 | 1187 | 4 | 240.03 | 242.47 | 1 | 3 | -2.44 |
| 32Z-01-08XOB | 13 | 1187 | 3 | 239.82 | 243.43 | 1 | 3 | -3.61 |
| 32Z-01-09XOB | 13 | 1187 | 2 | 230.01 | 229.69 | 1 | 3 | 0.32 |
| 32Z-01-10XBR | 13 | 1187 | 5 | 238.86 | 237.28 | 1 | 3 | 1.58 |
| 32Z-01-12XBR | 13 | 1187 | 5 | 235.50 | 236.80 | 1 | 3 | -1.30 |
| 32Z-99-02X | 13 | 1187 | 2 | 232.53 | 229.59 | 1 | 3 | 2.94 |
| 43M-01-16XBR | 13 | 1187 | 5 | 231.24 | 229.90 | 1 | 3 | 1.34 |
| 43M-01-16XOB | 13 | 1187 | 3 | 229.58 | 229.71 | 1 | 3 | -0.13 |
| 43M-01-17XBR | 13 | 1187 | 5 | 230.45 | 229.78 | 1 | 3 | 0.67 |
| 43M-01-17XOB | 13 | 1187 | 2 | 229.53 | 229.72 | 1 | 3 | -0.19 |
| 43M-01-20XBR | 13 | 1187 | 5 | 229.19 | 229.34 | 1 | 3 | -0.15 |
| 43M-01-20XOB | 13 | 1187 | 2 | 229.18 | 229.30 | 1 | 3 | -0.12 |
| 69W-94-13 | 13 | 1187 | 1 | 219.95 | 218.49 | 1 | 5 | 1.46 |
| 69W-94-14 | 13 | 1187 | 1 | 219.27 | 217.73 | 1 | 5 | 1.54 |
| 69WP-08-01 | 13 | 1187 | 2 | 217.66 | 215.93 | 1 | 5 | 1.73 |
| CH-1D | 13 | 1187 | 5 | 230.19 | 230.84 | 0 | 2 | -0.65 |
| EPA-PZ-2012-1A | 13 | 1187 | 2 | 211.46 | 211.49 | 1 | 1 | -0.03 |
| EPA-PZ-2012-1B | 13 | 1187 | 3 | 211.50 | 211.51 | 1 | 1 | -0.01 |
| EPA-PZ-2012-2A | 13 | 1187 | 2 | 211.75 | 211.76 | 1 | 1 | -0.01 |
| EPA-PZ-2012-2B | 13 | 1187 | 4 | 211.74 | 211.80 | 1 | 1 | -0.06 |
| EPA-PZ-2012-3A | 13 | 1187 | 2 | 210.80 | 210.72 | 1 | 1 | 0.08 |
| EPA-PZ-2012-3B | 13 | 1187 | 3 | 210.76 | 210.69 | 1 | 1 | 0.07 |
| EPA-PZ-2012-4A | 13 | 1187 | 2 | 210.55 | 210.26 | 1 | 1 | 0.29 |
| EPA-PZ-2012-4B | 13 | 1187 | 3 | 210.34 | 210.01 | 1 | 1 | 0.33 |
| EPA-PZ-2012-5A | 13 | 1187 | 1 | 210.95 | 211.10 | 1 | 1 | -0.15 |
| EPA-PZ-2012-5B | 13 | 1187 | 3 | 211.03 | 211.10 | 1 | 1 | -0.07 |
| EPA-PZ-2012-6A | 13 | 1187 | 2 | 210.38 | 209.99 | 1 | 1 | 0.39 |
| EPA-PZ-2012-6B | 13 | 1187 | 3 | 210.26 | 209.76 | 1 | 1 | 0.50 |
| EPA-PZ-2012-7A | 13 | 1187 | 1 | 210.40 | 210.18 | 1 | 1 | 0.22 |
| EPA-PZ-2012-7B | 13 | 1187 | 3 | 210.38 | 210.09 | 1 | 1 | 0.29 |
| N1-P1 | 13 | 1187 | 3 | 215.55 | 215.17 | 1 | 1 | 0.38 |
| N1-P2 | 13 | 1187 | 2 | 215.80 | 215.38 | 1 | 1 | 0.42 |
| N1-P3 | 13 | 1187 | 1 | 216.42 | 215.60 | 1 | 1 | 0.82 |
| N2-P1 | 13 | 1187 | 3 | 216.94 | 216.74 | 1 | 1 | 0.20 |
| N2-P2 | 13 | 1187 | 2 | 216.77 | 216.75 | 1 | 1 | 0.02 |
| N3-P1 | 13 | 1187 | 5 | 216.96 | 217.00 | 1 | 2 | -0.04 |
| N3-P2 | 13 | 1187 | 2 | 216.79 | 216.99 | 1 | 1 | -0.20 |
| N5-P1 | 13 | 1187 | 5 | 217.80 | 217.32 | 1 | 2 | 0.48 |
| N5-P2 | 13 | 1187 | 1 | 217.75 | 217.31 | 1 | 1 | 0.44 |
| N6-P1 | 13 | 1187 | 5 | 220.85 | 222.18 | 1 | 2 | -1.33 |
| N7-P1 | 13 | 1187 | 5 | 223.24 | 225.22 | 1 | 2 | -1.98 |

**Table 7.1**
**Model Predicted Water Levels and Residuals**
**Shepley's Hill Landfill Groundwater Model**

| Well Name | Stress Period | Time (days) | Layer | Target Water Level Elevation (Feet) | Predicted Water Level Elevation (Feet) | Weight | Group | Residual (Feet) |
|---|---|---|---|---|---|---|---|---|
| N7-P2 | 13 | 1187 | 1 | 223.53 | 225.19 | 1 | 1 | -1.66 |
| PZ-12-01 | 13 | 1187 | 3 | 217.08 | 216.64 | 1 | 1 | 0.44 |
| PZ-12-02 | 13 | 1187 | 3 | 216.92 | 216.38 | 1 | 1 | 0.54 |
| PZ-12-03 | 13 | 1187 | 2 | 216.82 | 216.83 | 1 | 1 | -0.01 |
| PZ-12-04 | 13 | 1187 | 2 | 215.46 | 217.16 | 1 | 1 | -1.70 |
| PZ-12-05 | 13 | 1187 | 3 | 216.98 | 216.91 | 1 | 1 | 0.07 |
| PZ-12-06 | 13 | 1187 | 2 | 217.66 | 217.60 | 1 | 1 | 0.06 |
| PZ-12-07 | 13 | 1187 | 2 | 216.86 | 217.17 | 1 | 1 | -0.31 |
| PZ-12-08 | 13 | 1187 | 2 | 218.37 | 218.46 | 1 | 1 | -0.09 |
| PZ-12-09 | 13 | 1187 | 3 | 217.42 | 217.82 | 1 | 1 | -0.40 |
| PZ-12-10 | 13 | 1187 | 3 | 218.83 | 219.28 | 1 | 1 | -0.45 |
| RSK1 | 13 | 1187 | 3 | 216.50 | 216.78 | 1 | 1 | -0.28 |
| RSK12 | 13 | 1187 | 2 | 216.64 | 216.92 | 1 | 1 | -0.28 |
| RSK13 | 13 | 1187 | 3 | 216.60 | 217.00 | 1 | 1 | -0.40 |
| RSK15 | 13 | 1187 | 2 | 216.59 | 217.01 | 1 | 1 | -0.42 |
| RSK16 | 13 | 1187 | 3 | 216.54 | 216.82 | 1 | 1 | -0.28 |
| RSK19 | 13 | 1187 | 2 | 216.53 | 216.82 | 1 | 1 | -0.29 |
| RSK25 | 13 | 1187 | 3 | 216.65 | 217.31 | 1 | 1 | -0.66 |
| RSK27 | 13 | 1187 | 1 | 217.66 | 217.76 | 1 | 1 | -0.10 |
| RSK28 | 13 | 1187 | 1 | 217.52 | 217.43 | 1 | 1 | 0.09 |
| RSK32 | 13 | 1187 | 1 | 217.34 | 217.13 | 1 | 1 | 0.21 |
| RSK34 | 13 | 1187 | 1 | 216.26 | 215.78 | 1 | 1 | 0.48 |
| RSK35 | 13 | 1187 | 1 | 215.80 | 215.60 | 1 | 1 | 0.20 |
| RSK37 | 13 | 1187 | 2 | 216.51 | 217.03 | 1 | 1 | -0.52 |
| RSK39 | 13 | 1187 | 3 | 216.49 | 217.02 | 1 | 1 | -0.53 |
| RSK42 | 13 | 1187 | 3 | 216.49 | 217.02 | 1 | 1 | -0.53 |
| RSK50 | 13 | 1187 | 1 | 216.53 | 216.86 | 1 | 1 | -0.33 |
| RSK7 | 13 | 1187 | 2 | 216.49 | 216.78 | 1 | 1 | -0.29 |
| RSK8 | 13 | 1187 | 5 | 216.68 | 216.92 | 1 | 2 | -0.24 |
| SHL-10 | 13 | 1187 | 2 | 216.84 | 217.55 | 1 | 1 | -0.71 |
| SHL-11 | 13 | 1187 | 2 | 216.25 | 216.72 | 1 | 1 | -0.47 |
| SHL-12 | 13 | 1187 | 1 | 224.62 | 225.54 | 1 | 1 | -0.92 |
| SHL-13 | 13 | 1187 | 1 | 213.39 | 213.14 | 1 | 1 | 0.25 |
| SHL-15 | 13 | 1187 | 3 | 239.33 | 242.94 | 1 | 1 | -3.61 |
| SHL-17 | 13 | 1187 | 1 | 224.86 | 225.26 | 1 | 1 | -0.40 |
| SHL-18 | 13 | 1187 | 1 | 217.88 | 218.54 | 1 | 1 | -0.66 |
| SHL-19 | 13 | 1187 | 4 | 216.88 | 217.37 | 1 | 1 | -0.49 |
| SHL-20 | 13 | 1187 | 3 | 217.13 | 216.67 | 1 | 1 | 0.46 |
| SHL-21 | 13 | 1187 | 1 | 213.60 | 212.97 | 1 | 1 | 0.63 |
| SHL-22 | 13 | 1187 | 4 | 210.74 | 210.76 | 1 | 1 | -0.02 |
| SHL-23 | 13 | 1187 | 2 | 210.98 | 210.66 | 1 | 1 | 0.32 |
| SHL-24 | 13 | 1187 | 5 | 221.83 | 221.13 | 1 | 2 | 0.70 |
| SHL-25 | 13 | 1187 | 3 | 229.32 | 228.89 | 1 | 1 | 0.43 |
| SHL-3 | 13 | 1187 | 3 | 217.27 | 218.50 | 1 | 1 | -1.23 |
| SHL-4 | 13 | 1187 | 1 | 216.82 | 216.99 | 1 | 1 | -0.17 |

**Table 7.1**
**Model Predicted Water Levels and Residuals**
**Shepley's Hill Landfill Groundwater Model**

| Well Name | Stress Period | Time (days) | Layer | Target Water Level Elevation (Feet) | Predicted Water Level Elevation (Feet) | Weight | Group | Residual (Feet) |
|---|---|---|---|---|---|---|---|---|
| SHL-5 | 13 | 1187 | 1 | 211.57 | 211.32 | 1 | 1 | 0.25 |
| SHL-7 | 13 | 1187 | 1 | 218.41 | 219.13 | 1 | 1 | -0.72 |
| SHL-8D | 13 | 1187 | 4 | 212.34 | 212.31 | 1 | 1 | 0.03 |
| SHL-8S | 13 | 1187 | 3 | 212.51 | 212.31 | 1 | 1 | 0.20 |
| SHL-9 | 13 | 1187 | 1 | 210.76 | 210.65 | 1 | 1 | 0.11 |
| SHM-05-39A | 13 | 1187 | 2 | 209.02 | 209.75 | 1 | 1 | -0.73 |
| SHM-05-39B | 13 | 1187 | 3 | 208.36 | 209.75 | 1 | 1 | -1.39 |
| SHM-05-40X | 13 | 1187 | 3 | 208.32 | 209.36 | 1 | 1 | -1.04 |
| SHM-05-41A | 13 | 1187 | 2 | 210.38 | 210.28 | 1 | 1 | 0.10 |
| SHM-05-41B | 13 | 1187 | 3 | 210.38 | 210.26 | 1 | 1 | 0.12 |
| SHM-05-41C | 13 | 1187 | 4 | 210.41 | 210.27 | 1 | 1 | 0.14 |
| SHM-05-42A | 13 | 1187 | 2 | 210.73 | 210.61 | 1 | 1 | 0.12 |
| SHM-05-42B | 13 | 1187 | 3 | 210.66 | 210.62 | 1 | 1 | 0.04 |
| SHM-07-03 | 13 | 1187 | 3 | 207.59 | 208.22 | 1 | 1 | -0.63 |
| SHM-07-05 | 13 | 1187 | 5 | 208.57 | 209.34 | 1 | 2 | -0.77 |
| SHM-10-01 | 13 | 1187 | 4 | 205.44 | 205.42 | 1 | 1 | 0.02 |
| SHM-10-05A | 13 | 1187 | 2 | 209.74 | 210.84 | 1 | 1 | -1.10 |
| SHM-10-06 | 13 | 1187 | 3 | 212.67 | 212.40 | 1 | 1 | 0.27 |
| SHM-10-06A | 13 | 1187 | 3 | 212.95 | 212.74 | 1 | 1 | 0.21 |
| SHM-10-07 | 13 | 1187 | 4 | 218.80 | 218.71 | 1 | 1 | 0.09 |
| SHM-10-10 | 13 | 1187 | 3 | 206.30 | 206.18 | 1 | 1 | 0.12 |
| SHM-10-11 | 13 | 1187 | 3 | 222.15 | 224.07 | 1 | 1 | -1.92 |
| SHM-10-12 | 13 | 1187 | 3 | 220.10 | 219.45 | 1 | 1 | 0.65 |
| SHM-10-13 | 13 | 1187 | 3 | 217.83 | 217.26 | 1 | 1 | 0.57 |
| SHM-10-14 | 13 | 1187 | 3 | 216.43 | 216.11 | 1 | 1 | 0.32 |
| SHM-10-15 | 13 | 1187 | 3 | 218.22 | 217.92 | 1 | 1 | 0.30 |
| SHM-10-16 | 13 | 1187 | 3 | 210.43 | 210.29 | 1 | 1 | 0.14 |
| SHM-11-02 | 13 | 1187 | 5 | 217.54 | 217.61 | 1 | 2 | -0.07 |
| SHM-11-06 | 13 | 1187 | 2 | 215.56 | 215.12 | 1 | 1 | 0.44 |
| SHM-11-07 | 13 | 1187 | 3 | 218.43 | 217.38 | 1 | 1 | 1.05 |
| SHM-13-01 | 13 | 1187 | 3 | 204.74 | 204.66 | 1 | 1 | 0.08 |
| SHM-13-02 | 13 | 1187 | 3 | 205.79 | 205.76 | 1 | 1 | 0.03 |
| SHM-13-03 | 13 | 1187 | 3 | 206.30 | 206.46 | 1 | 1 | -0.16 |
| SHM-13-04 | 13 | 1187 | 2 | 207.56 | 208.14 | 1 | 1 | -0.58 |
| SHM-13-05 | 13 | 1187 | 3 | 208.25 | 209.22 | 1 | 1 | -0.97 |
| SHM-13-06 | 13 | 1187 | 3 | 206.48 | 206.75 | 1 | 1 | -0.27 |
| SHM-13-07 | 13 | 1187 | 2 | 206.69 | 207.17 | 1 | 1 | -0.48 |
| SHM-13-08 | 13 | 1187 | 3 | 207.41 | 207.85 | 1 | 1 | -0.44 |
| SHM-93-01A | 13 | 1187 | 3 | 219.21 | 219.81 | 1 | 1 | -0.60 |
| SHM-93-10C | 13 | 1187 | 5 | 218.16 | 217.60 | 1 | 2 | 0.56 |
| SHM-93-18B | 13 | 1187 | 3 | 217.94 | 218.83 | 1 | 1 | -0.89 |
| SHM-93-22B | 13 | 1187 | 3 | 210.68 | 210.83 | 1 | 1 | -0.15 |
| SHM-93-22C | 13 | 1187 | 5 | 210.76 | 210.74 | 1 | 2 | 0.02 |
| SHM-93-24A | 13 | 1187 | 1 | 221.20 | 221.11 | 1 | 1 | 0.09 |
| SHM-96-5B | 13 | 1187 | 3 | 211.24 | 211.21 | 1 | 1 | 0.03 |

**Table 7.1**
**Model Predicted Water Levels and Residuals**
**Shepley's Hill Landfill Groundwater Model**

| Well Name | Stress Period | Time (days) | Layer | Target Water Level Elevation (Feet) | Predicted Water Level Elevation (Feet) | Weight | Group | Residual (Feet) |
|---|---|---|---|---|---|---|---|---|
| SHM-96-5C | 13 | 1187 | 3 | 211.23 | 211.30 | 1 | 1 | -0.07 |
| SHM-99-31A | 13 | 1187 | 1 | 210.77 | 210.06 | 1 | 1 | 0.71 |
| SHM-99-31B | 13 | 1187 | 2 | 209.83 | 210.08 | 1 | 1 | -0.25 |
| SHM-99-31C | 13 | 1187 | 3 | 209.75 | 210.13 | 1 | 1 | -0.38 |
| SHM-99-32X | 13 | 1187 | 3 | 210.67 | 210.65 | 1 | 1 | 0.02 |
| SHP-01-36X | 13 | 1187 | 1 | 216.70 | 216.17 | 1 | 1 | 0.53 |
| SHP-01-37X | 13 | 1187 | 2 | 216.73 | 216.57 | 1 | 1 | 0.16 |
| SHP-01-38A | 13 | 1187 | 1 | 216.84 | 216.86 | 1 | 1 | -0.02 |
| SHP-01-38B | 13 | 1187 | 3 | 217.00 | 216.85 | 1 | 1 | 0.15 |
| SHP-05-43 | 13 | 1187 | 3 | 215.09 | 214.79 | 1 | 1 | 0.30 |
| SHP-05-45A | 13 | 1187 | 1 | 210.53 | 210.33 | 1 | 1 | 0.20 |
| SHP-05-45B | 13 | 1187 | 3 | 210.62 | 209.67 | 1 | 1 | 0.95 |
| SHP-05-46A | 13 | 1187 | 1 | 210.92 | 210.67 | 1 | 1 | 0.25 |
| SHP-05-46B | 13 | 1187 | 3 | 211.29 | 210.58 | 1 | 1 | 0.71 |
| SHP-05-47A | 13 | 1187 | 1 | 212.21 | 212.46 | 1 | 1 | -0.25 |
| SHP-05-47B | 13 | 1187 | 1 | 212.21 | 212.46 | 1 | 1 | -0.25 |
| SHP-05-49A | 13 | 1187 | 1 | 210.82 | 210.52 | 1 | 1 | 0.30 |
| SHP-05-49B | 13 | 1187 | 1 | 210.49 | 210.51 | 1 | 1 | -0.02 |
| SHP-95-27X | 13 | 1187 | 1 | 220.19 | 221.96 | 1 | 1 | -1.77 |
| SHP-99-01C | 13 | 1187 | 5 | 249.20 | 247.60 | 1 | 2 | 1.60 |
| SHP-99-29X | 13 | 1187 | 2 | 218.45 | 218.11 | 1 | 1 | 0.34 |
| SHP-99-34B | 13 | 1187 | 3 | 211.25 | 211.07 | 1 | 1 | 0.18 |
| SHP-99-35X | 13 | 1187 | 3 | 221.41 | 220.79 | 1 | 1 | 0.62 |
| 3-1 | 15 | 1369 | 5 | 240.10 | 243.23 | 0 | 2 | -3.13 |
| 20-1 | 15 | 1369 | 5 | 250.26 | 248.90 | 0 | 2 | 1.36 |
| 32M-01-14XBR | 15 | 1369 | 5 | 233.37 | 229.58 | 1 | 3 | 3.79 |
| 32M-01-14XOB | 15 | 1369 | 3 | 232.25 | 229.30 | 1 | 3 | 2.95 |
| 32M-01-16XBR | 15 | 1369 | 5 | 234.56 | 237.60 | 0 | 3 | -3.04 |
| 32M-01-18XBR | 15 | 1369 | 5 | 241.35 | 240.97 | 1 | 3 | 0.38 |
| 32M-92-01X | 15 | 1369 | 4 | 242.27 | 244.55 | 1 | 3 | -2.28 |
| 32M-92-03X | 15 | 1369 | 3 | 231.13 | 231.07 | 1 | 3 | 0.06 |
| 32Z-01-05XOB | 15 | 1369 | 3 | 230.71 | 230.69 | 1 | 3 | 0.02 |
| 32Z-01-06XBR | 15 | 1369 | 5 | 244.12 | 242.03 | 1 | 3 | 2.09 |
| 32Z-01-07XOB | 15 | 1369 | 4 | 242.86 | 243.51 | 1 | 3 | -0.65 |
| 32Z-01-08XOB | 15 | 1369 | 3 | 242.59 | 244.43 | 1 | 3 | -1.84 |
| 32Z-01-09XOB | 15 | 1369 | 2 | 230.55 | 230.25 | 1 | 3 | 0.30 |
| 32Z-01-10XBR | 15 | 1369 | 5 | 240.45 | 239.20 | 1 | 3 | 1.25 |
| 32Z-01-12XBR | 15 | 1369 | 5 | 238.57 | 237.89 | 1 | 3 | 0.68 |
| 43M-01-16XBR | 15 | 1369 | 5 | 230.66 | 230.52 | 1 | 3 | 0.14 |
| 43M-01-16XOB | 15 | 1369 | 3 | 230.61 | 230.32 | 1 | 3 | 0.29 |
| 43M-01-17XBR | 15 | 1369 | 5 | 230.32 | 230.39 | 1 | 3 | -0.07 |
| 43M-01-17XOB | 15 | 1369 | 2 | 230.21 | 230.32 | 1 | 3 | -0.11 |
| 43M-01-20XBR | 15 | 1369 | 5 | 229.78 | 229.92 | 1 | 3 | -0.14 |
| 43M-01-20XOB | 15 | 1369 | 2 | 229.72 | 229.88 | 1 | 3 | -0.16 |
| 57M-03-01X | 15 | 1369 | 1 | 223.04 | 222.53 | 1 | 4 | 0.51 |

**Table 7.1**
**Model Predicted Water Levels and Residuals**
**Shepley's Hill Landfill Groundwater Model**

| Well Name | Stress Period | Time (days) | Layer | Target Water Level Elevation (Feet) | Predicted Water Level Elevation (Feet) | Weight | Group | Residual (Feet) |
|---|---|---|---|---|---|---|---|---|
| 57M-03-02X | 15 | 1369 | 1 | 221.83 | 222.30 | 1 | 4 | -0.47 |
| 57M-03-03X | 15 | 1369 | 1 | 222.67 | 222.05 | 1 | 4 | 0.62 |
| 57M-03-04X | 15 | 1369 | 1 | 221.62 | 222.00 | 1 | 4 | -0.38 |
| 57M-03-05X | 15 | 1369 | 1 | 221.62 | 222.06 | 1 | 4 | -0.44 |
| 57M-03-06X | 15 | 1369 | 1 | 221.82 | 222.11 | 1 | 4 | -0.29 |
| 57M-95-05X | 15 | 1369 | 1 | 222.42 | 222.70 | 1 | 4 | -0.28 |
| 57M-95-06X | 15 | 1369 | 1 | 223.16 | 222.34 | 1 | 4 | 0.82 |
| 57M-95-07X | 15 | 1369 | 1 | 221.77 | 222.43 | 1 | 4 | -0.66 |
| 57M-96-11X | 15 | 1369 | 1 | 221.42 | 221.58 | 1 | 4 | -0.16 |
| 57M-96-12X | 15 | 1369 | 1 | 222.59 | 221.77 | 1 | 4 | 0.82 |
| 57M-96-13X | 15 | 1369 | 1 | 222.70 | 221.81 | 1 | 4 | 0.89 |
| 57WP-06-02 | 15 | 1369 | 1 | 221.67 | 222.03 | 1 | 4 | -0.36 |
| CAP-2B | 15 | 1369 | 5 | 235.81 | 234.09 | 0 | 2 | 1.72 |
| CH-1D | 15 | 1369 | 5 | 236.43 | 232.12 | 0 | 2 | 4.31 |
| EPA-PZ-2012-1A | 15 | 1369 | 2 | 211.67 | 211.96 | 1 | 1 | -0.29 |
| EPA-PZ-2012-1B | 15 | 1369 | 3 | 211.73 | 211.98 | 1 | 1 | -0.25 |
| EPA-PZ-2012-2A | 15 | 1369 | 2 | 211.79 | 212.20 | 1 | 1 | -0.41 |
| EPA-PZ-2012-2B | 15 | 1369 | 4 | 211.89 | 212.24 | 1 | 1 | -0.35 |
| EPA-PZ-2012-3A | 15 | 1369 | 2 | 211.09 | 211.25 | 1 | 1 | -0.16 |
| EPA-PZ-2012-3B | 15 | 1369 | 3 | 211.08 | 211.22 | 1 | 1 | -0.14 |
| EPA-PZ-2012-4A | 15 | 1369 | 2 | 210.83 | 210.83 | 1 | 1 | 0.00 |
| EPA-PZ-2012-4B | 15 | 1369 | 3 | 210.77 | 210.60 | 1 | 1 | 0.17 |
| EPA-PZ-2012-5A | 15 | 1369 | 1 | 211.16 | 211.59 | 1 | 1 | -0.43 |
| EPA-PZ-2012-5B | 15 | 1369 | 3 | 211.23 | 211.58 | 1 | 1 | -0.35 |
| EPA-PZ-2012-6B | 15 | 1369 | 3 | 210.73 | 210.37 | 1 | 1 | 0.36 |
| EPA-PZ-2012-7A | 15 | 1369 | 1 | 210.85 | 210.77 | 1 | 1 | 0.08 |
| EPA-PZ-2012-7B | 15 | 1369 | 3 | 210.79 | 210.68 | 1 | 1 | 0.11 |
| N1-P1 | 15 | 1369 | 3 | 215.46 | 215.34 | 1 | 1 | 0.12 |
| N1-P2 | 15 | 1369 | 2 | 215.49 | 215.52 | 1 | 1 | -0.03 |
| N1-P3 | 15 | 1369 | 1 | 216.29 | 215.72 | 1 | 1 | 0.57 |
| N2-P2 | 15 | 1369 | 2 | 216.57 | 216.76 | 1 | 1 | -0.19 |
| N3-P1 | 15 | 1369 | 5 | 216.59 | 217.02 | 1 | 2 | -0.43 |
| N3-P2 | 15 | 1369 | 2 | 216.64 | 217.02 | 1 | 1 | -0.38 |
| N5-P1 | 15 | 1369 | 5 | 218.56 | 217.65 | 1 | 2 | 0.91 |
| N5-P2 | 15 | 1369 | 1 | 218.69 | 217.62 | 1 | 1 | 1.07 |
| N6-P1 | 15 | 1369 | 5 | 221.53 | 222.62 | 1 | 2 | -1.09 |
| N7-P1 | 15 | 1369 | 5 | 223.68 | 226.05 | 1 | 2 | -2.37 |
| N7-P2 | 15 | 1369 | 1 | 223.85 | 226.03 | 1 | 1 | -2.18 |
| PZ-12-01 | 15 | 1369 | 3 | 216.81 | 216.69 | 1 | 1 | 0.12 |
| PZ-12-02 | 15 | 1369 | 3 | 217.27 | 216.60 | 1 | 1 | 0.67 |
| PZ-12-03 | 15 | 1369 | 2 | 216.72 | 216.88 | 1 | 1 | -0.16 |
| PZ-12-04 | 15 | 1369 | 2 | 217.93 | 217.39 | 1 | 1 | 0.54 |
| PZ-12-05 | 15 | 1369 | 3 | 216.86 | 216.96 | 1 | 1 | -0.10 |
| PZ-12-06 | 15 | 1369 | 2 | 218.09 | 217.83 | 1 | 1 | 0.26 |
| PZ-12-07 | 15 | 1369 | 2 | 216.90 | 217.28 | 1 | 1 | -0.38 |

**Table 7.1**
**Model Predicted Water Levels and Residuals**
**Shepley's Hill Landfill Groundwater Model**

| Well Name | Stress Period | Time (days) | Layer | Target Water Level Elevation (Feet) | Predicted Water Level Elevation (Feet) | Weight | Group | Residual (Feet) |
|---|---|---|---|---|---|---|---|---|
| PZ-12-08 | 15 | 1369 | 2 | 218.98 | 218.72 | 1 | 1 | 0.26 |
| PZ-12-09 | 15 | 1369 | 3 | 218.07 | 218.01 | 1 | 1 | 0.06 |
| PZ-12-10 | 15 | 1369 | 3 | 219.50 | 219.60 | 1 | 1 | -0.10 |
| Q4-1 | 15 | 1369 | 5 | 249.46 | 243.99 | 0 | 2 | 5.47 |
| Q5-1 | 15 | 1369 | 5 | 247.14 | 241.82 | 0 | 2 | 5.32 |
| RSK1 | 15 | 1369 | 3 | 216.68 | 216.79 | 1 | 1 | -0.11 |
| RSK12 | 15 | 1369 | 2 | 216.88 | 216.97 | 1 | 1 | -0.09 |
| RSK13 | 15 | 1369 | 3 | 216.82 | 217.07 | 1 | 1 | -0.25 |
| RSK15 | 15 | 1369 | 2 | 216.80 | 217.08 | 1 | 1 | -0.28 |
| RSK16 | 15 | 1369 | 3 | 216.73 | 216.85 | 1 | 1 | -0.12 |
| RSK19 | 15 | 1369 | 2 | 216.72 | 216.85 | 1 | 1 | -0.13 |
| RSK24 | 15 | 1369 | 1 | 218.88 | 218.57 | 1 | 1 | 0.31 |
| RSK25 | 15 | 1369 | 3 | 216.98 | 217.44 | 1 | 1 | -0.46 |
| RSK27 | 15 | 1369 | 1 | 218.25 | 218.00 | 1 | 1 | 0.25 |
| RSK28 | 15 | 1369 | 1 | 218.10 | 217.66 | 1 | 1 | 0.44 |
| RSK32 | 15 | 1369 | 1 | 217.93 | 217.36 | 1 | 1 | 0.57 |
| RSK34 | 15 | 1369 | 1 | 216.94 | 216.02 | 1 | 1 | 0.92 |
| RSK35 | 15 | 1369 | 1 | 216.45 | 215.82 | 1 | 1 | 0.63 |
| RSK37 | 15 | 1369 | 2 | 216.65 | 217.07 | 1 | 1 | -0.42 |
| RSK41 | 15 | 1369 | 4 | 216.68 | 217.05 | 1 | 1 | -0.37 |
| RSK50 | 15 | 1369 | 1 | 216.70 | 216.89 | 1 | 1 | -0.19 |
| RSK7 | 15 | 1369 | 2 | 216.64 | 216.79 | 1 | 1 | -0.15 |
| RSK8 | 15 | 1369 | 5 | 216.90 | 216.98 | 1 | 2 | -0.08 |
| SHL-10 | 15 | 1369 | 2 | 216.88 | 217.69 | 1 | 1 | -0.81 |
| SHL-11 | 15 | 1369 | 2 | 216.71 | 216.76 | 1 | 1 | -0.05 |
| SHL-12 | 15 | 1369 | 1 | 224.84 | 226.41 | 1 | 1 | -1.57 |
| SHL-13 | 15 | 1369 | 1 | 213.58 | 213.47 | 1 | 1 | 0.11 |
| SHL-15 | 15 | 1369 | 3 | 241.91 | 244.01 | 1 | 1 | -2.10 |
| SHL-17 | 15 | 1369 | 1 | 225.03 | 226.13 | 1 | 1 | -1.10 |
| SHL-18 | 15 | 1369 | 1 | 217.90 | 218.79 | 1 | 1 | -0.89 |
| SHL-19 | 15 | 1369 | 4 | 217.02 | 217.51 | 1 | 1 | -0.49 |
| SHL-20 | 15 | 1369 | 3 | 217.49 | 216.90 | 1 | 1 | 0.59 |
| SHL-23 | 15 | 1369 | 2 | 211.60 | 211.25 | 1 | 1 | 0.35 |
| SHL-24 | 15 | 1369 | 5 | 221.90 | 221.64 | 1 | 2 | 0.26 |
| SHL-25 | 15 | 1369 | 3 | 230.63 | 229.81 | 1 | 1 | 0.82 |
| SHL-3 | 15 | 1369 | 3 | 217.24 | 218.76 | 1 | 1 | -1.52 |
| SHL-4 | 15 | 1369 | 1 | 216.79 | 217.07 | 1 | 1 | -0.28 |
| SHL-7 | 15 | 1369 | 1 | 218.60 | 219.44 | 1 | 1 | -0.84 |
| SHM-05-40X | 15 | 1369 | 3 | 208.55 | 209.91 | 1 | 1 | -1.36 |
| SHM-05-41B | 15 | 1369 | 3 | 210.66 | 210.81 | 1 | 1 | -0.15 |
| SHM-05-41C | 15 | 1369 | 4 | 210.73 | 210.82 | 1 | 1 | -0.09 |
| SHM-07-03 | 15 | 1369 | 3 | 207.71 | 208.83 | 1 | 1 | -1.12 |
| SHM-10-01 | 15 | 1369 | 4 | 205.52 | 206.00 | 1 | 1 | -0.48 |
| SHM-10-05A | 15 | 1369 | 2 | 209.85 | 211.30 | 1 | 1 | -1.45 |
| SHM-10-07 | 15 | 1369 | 4 | 219.41 | 218.97 | 1 | 1 | 0.44 |

**Table 7.1**
**Model Predicted Water Levels and Residuals**
**Shepley's Hill Landfill Groundwater Model**

| Well Name | Stress Period | Time (days) | Layer | Target Water Level Elevation (Feet) | Predicted Water Level Elevation (Feet) | Weight | Group | Residual (Feet) |
|---|---|---|---|---|---|---|---|---|
| SHM-10-10 | 15 | 1369 | 3 | 206.50 | 206.75 | 1 | 1 | -0.25 |
| SHM-10-11 | 15 | 1369 | 3 | 222.88 | 224.71 | 1 | 1 | -1.83 |
| SHM-10-12 | 15 | 1369 | 3 | 221.05 | 219.81 | 1 | 1 | 1.24 |
| SHM-10-13 | 15 | 1369 | 3 | 218.70 | 217.57 | 1 | 1 | 1.13 |
| SHM-10-15 | 15 | 1369 | 3 | 219.42 | 218.27 | 1 | 1 | 1.15 |
| SHM-10-16 | 15 | 1369 | 3 | 210.68 | 210.82 | 1 | 1 | -0.14 |
| SHM-11-02 | 15 | 1369 | 5 | 217.80 | 217.83 | 1 | 2 | -0.03 |
| SHM-11-07 | 15 | 1369 | 3 | 218.05 | 217.61 | 1 | 1 | 0.44 |
| SHM-13-02 | 15 | 1369 | 3 | 205.91 | 206.33 | 1 | 1 | -0.42 |
| SHM-13-03 | 15 | 1369 | 3 | 206.69 | 207.01 | 1 | 1 | -0.32 |
| SHM-13-04 | 15 | 1369 | 2 | 207.80 | 208.72 | 1 | 1 | -0.92 |
| SHM-13-05 | 15 | 1369 | 3 | 208.52 | 209.74 | 1 | 1 | -1.22 |
| SHM-13-06 | 15 | 1369 | 3 | 206.51 | 207.34 | 1 | 1 | -0.83 |
| SHM-13-07 | 15 | 1369 | 2 | 206.85 | 207.74 | 1 | 1 | -0.89 |
| SHM-13-08 | 15 | 1369 | 3 | 207.63 | 208.41 | 1 | 1 | -0.78 |
| SHM-13-14D | 15 | 1369 | 3 | 207.34 | 207.77 | 1 | 1 | -0.43 |
| SHM-13-14S | 15 | 1369 | 1 | 207.51 | 207.77 | 1 | 1 | -0.26 |
| SHM-13-15 | 15 | 1369 | 3 | 207.03 | 207.36 | 1 | 1 | -0.33 |
| SHM-93-18B | 15 | 1369 | 3 | 217.95 | 219.11 | 1 | 1 | -1.16 |
| SHM-93-22B | 15 | 1369 | 3 | 210.96 | 211.34 | 1 | 1 | -0.38 |
| SHM-93-24A | 15 | 1369 | 1 | 221.28 | 221.61 | 1 | 1 | -0.33 |
| SHM-96-5B | 15 | 1369 | 3 | 211.41 | 211.70 | 1 | 1 | -0.29 |
| SHM-99-32X | 15 | 1369 | 3 | 211.03 | 211.12 | 1 | 1 | -0.09 |
| SHP-01-36X | 15 | 1369 | 1 | 216.50 | 216.24 | 1 | 1 | 0.26 |
| SHP-01-37X | 15 | 1369 | 2 | 216.51 | 216.60 | 1 | 1 | -0.09 |
| SHP-01-38A | 15 | 1369 | 1 | 216.74 | 216.90 | 1 | 1 | -0.16 |
| SHP-01-38B | 15 | 1369 | 3 | 216.77 | 216.89 | 1 | 1 | -0.12 |
| SHP-05-43 | 15 | 1369 | 3 | 215.63 | 215.03 | 1 | 1 | 0.60 |
| SHP-05-44 | 15 | 1369 | 3 | 216.12 | 216.05 | 1 | 1 | 0.07 |
| SHP-05-47B | 15 | 1369 | 1 | 212.65 | 212.83 | 1 | 1 | -0.18 |
| SHP-95-27X | 15 | 1369 | 1 | 220.49 | 222.59 | 1 | 1 | -2.10 |
| SHP-99-01C | 15 | 1369 | 5 | 261.04 | 253.07 | 1 | 2 | 7.97 |
| SHP-99-29X | 15 | 1369 | 2 | 220.13 | 218.52 | 1 | 1 | 1.61 |
| SHP-99-34B | 15 | 1369 | 3 | 211.71 | 211.52 | 1 | 1 | 0.19 |
| SHP-99-35X | 15 | 1369 | 3 | 221.81 | 221.19 | 1 | 1 | 0.62 |
| EPA-PZ-2012-1A | 16 | 1461 | 2 | 210.99 | 211.20 | 1 | 1 | -0.21 |
| EPA-PZ-2012-1B | 16 | 1461 | 3 | 211.02 | 211.23 | 1 | 1 | -0.21 |
| EPA-PZ-2012-2A | 16 | 1461 | 2 | 211.19 | 211.44 | 1 | 1 | -0.25 |
| EPA-PZ-2012-2B | 16 | 1461 | 4 | 211.26 | 211.50 | 1 | 1 | -0.24 |
| EPA-PZ-2012-3A | 16 | 1461 | 2 | 210.35 | 210.46 | 1 | 1 | -0.11 |
| EPA-PZ-2012-3B | 16 | 1461 | 3 | 210.30 | 210.43 | 1 | 1 | -0.13 |
| EPA-PZ-2012-4A | 16 | 1461 | 2 | 210.06 | 210.03 | 1 | 1 | 0.03 |
| EPA-PZ-2012-4B | 16 | 1461 | 3 | 209.90 | 209.80 | 1 | 1 | 0.10 |
| EPA-PZ-2012-5A | 16 | 1461 | 1 | 210.48 | 210.79 | 1 | 1 | -0.31 |
| EPA-PZ-2012-5B | 16 | 1461 | 3 | 210.56 | 210.79 | 1 | 1 | -0.23 |

**Table 7.1**
**Model Predicted Water Levels and Residuals**
**Shepley's Hill Landfill Groundwater Model**

| Well Name | Stress Period | Time (days) | Layer | Target Water Level Elevation (Feet) | Predicted Water Level Elevation (Feet) | Weight | Group | Residual (Feet) |
|---|---|---|---|---|---|---|---|---|
| EPA-PZ-2012-6A | 16 | 1461 | 2 | 210.02 | 209.77 | 1 | 1 | 0.25 |
| EPA-PZ-2012-6B | 16 | 1461 | 3 | 209.94 | 209.56 | 1 | 1 | 0.38 |
| EPA-PZ-2012-7A | 16 | 1461 | 1 | 210.04 | 209.92 | 1 | 1 | 0.12 |
| EPA-PZ-2012-7B | 16 | 1461 | 3 | 210.02 | 209.85 | 1 | 1 | 0.17 |
| N1-P1 | 16 | 1461 | 3 | 215.07 | 214.88 | 1 | 1 | 0.19 |
| N1-P3 | 16 | 1461 | 1 | 215.92 | 215.31 | 1 | 1 | 0.61 |
| N2-P1 | 16 | 1461 | 3 | 216.24 | 216.46 | 1 | 1 | -0.22 |
| N2-P2 | 16 | 1461 | 2 | 216.23 | 216.47 | 1 | 1 | -0.24 |
| N3-P1 | 16 | 1461 | 5 | 216.22 | 216.70 | 1 | 2 | -0.48 |
| N3-P2 | 16 | 1461 | 2 | 216.24 | 216.69 | 1 | 1 | -0.45 |
| N5-P1 | 16 | 1461 | 5 | 217.82 | 217.09 | 1 | 2 | 0.73 |
| N5-P2 | 16 | 1461 | 1 | 218.00 | 217.09 | 1 | 1 | 0.91 |
| N6-P1 | 16 | 1461 | 5 | 220.73 | 222.02 | 1 | 2 | -1.29 |
| N7-P1 | 16 | 1461 | 5 | 222.88 | 224.74 | 1 | 2 | -1.86 |
| N7-P2 | 16 | 1461 | 1 | 223.09 | 224.73 | 1 | 1 | -1.64 |
| PZ-12-01 | 16 | 1461 | 3 | 216.32 | 216.36 | 1 | 1 | -0.04 |
| PZ-12-02 | 16 | 1461 | 3 | 216.65 | 216.20 | 1 | 1 | 0.45 |
| PZ-12-03 | 16 | 1461 | 2 | 216.33 | 216.55 | 1 | 1 | -0.22 |
| PZ-12-04 | 16 | 1461 | 2 | 217.29 | 217.00 | 1 | 1 | 0.29 |
| PZ-12-05 | 16 | 1461 | 3 | 216.50 | 216.62 | 1 | 1 | -0.12 |
| PZ-12-06 | 16 | 1461 | 2 | 217.45 | 217.44 | 1 | 1 | 0.01 |
| PZ-12-07 | 16 | 1461 | 2 | 216.39 | 216.88 | 1 | 1 | -0.49 |
| PZ-12-08 | 16 | 1461 | 2 | 218.19 | 218.30 | 1 | 1 | -0.11 |
| PZ-12-09 | 16 | 1461 | 3 | 217.12 | 217.49 | 1 | 1 | -0.37 |
| PZ-12-10 | 16 | 1461 | 3 | 218.77 | 219.02 | 1 | 1 | -0.25 |
| RSK1 | 16 | 1461 | 3 | 216.28 | 216.50 | 1 | 1 | -0.22 |
| RSK12 | 16 | 1461 | 2 | 216.41 | 216.63 | 1 | 1 | -0.22 |
| RSK15 | 16 | 1461 | 2 | 216.35 | 216.72 | 1 | 1 | -0.37 |
| RSK16 | 16 | 1461 | 3 | 216.30 | 216.53 | 1 | 1 | -0.23 |
| RSK19 | 16 | 1461 | 2 | 216.28 | 216.53 | 1 | 1 | -0.25 |
| RSK24 | 16 | 1461 | 1 | 218.18 | 218.16 | 1 | 1 | 0.02 |
| RSK25 | 16 | 1461 | 3 | 216.39 | 217.00 | 1 | 1 | -0.61 |
| RSK27 | 16 | 1461 | 1 | 217.56 | 217.60 | 1 | 1 | -0.04 |
| RSK28 | 16 | 1461 | 1 | 217.42 | 217.27 | 1 | 1 | 0.15 |
| RSK32 | 16 | 1461 | 1 | 217.24 | 216.97 | 1 | 1 | 0.27 |
| RSK34 | 16 | 1461 | 1 | 216.08 | 215.59 | 1 | 1 | 0.49 |
| RSK35 | 16 | 1461 | 1 | 215.59 | 215.39 | 1 | 1 | 0.20 |
| RSK37 | 16 | 1461 | 2 | 216.27 | 216.72 | 1 | 1 | -0.45 |
| RSK41 | 16 | 1461 | 4 | 216.29 | 216.71 | 1 | 1 | -0.42 |
| RSK50 | 16 | 1461 | 1 | 216.29 | 216.56 | 1 | 1 | -0.27 |
| RSK7 | 16 | 1461 | 2 | 216.27 | 216.50 | 1 | 1 | -0.23 |
| SHL-10 | 16 | 1461 | 2 | 216.39 | 217.21 | 1 | 1 | -0.82 |
| SHL-11 | 16 | 1461 | 2 | 216.27 | 216.44 | 1 | 1 | -0.17 |
| SHL-12 | 16 | 1461 | 1 | 224.22 | 224.89 | 1 | 1 | -0.67 |
| SHL-13 | 16 | 1461 | 1 | 212.88 | 212.80 | 1 | 1 | 0.08 |

**Table 7.1**
**Model Predicted Water Levels and Residuals**
**Shepley's Hill Landfill Groundwater Model**

| Well Name | Stress Period | Time (days) | Layer | Target Water Level Elevation (Feet) | Predicted Water Level Elevation (Feet) | Weight | Group | Residual (Feet) |
|---|---|---|---|---|---|---|---|---|
| SHL-15 | 16 | 1461 | 3 | 239.85 | 242.46 | 1 | 1 | -2.61 |
| SHL-17 | 16 | 1461 | 1 | 224.46 | 224.39 | 1 | 1 | 0.07 |
| SHL-18 | 16 | 1461 | 1 | 217.57 | 218.19 | 1 | 1 | -0.62 |
| SHL-19 | 16 | 1461 | 4 | 216.40 | 217.05 | 1 | 1 | -0.65 |
| SHL-20 | 16 | 1461 | 3 | 216.88 | 216.50 | 1 | 1 | 0.38 |
| SHL-21 | 16 | 1461 | 1 | 212.99 | 212.69 | 1 | 1 | 0.30 |
| SHL-22 | 16 | 1461 | 4 | 210.32 | 210.47 | 1 | 1 | -0.15 |
| SHL-23 | 16 | 1461 | 2 | 210.62 | 210.44 | 1 | 1 | 0.18 |
| SHL-24 | 16 | 1461 | 5 | 221.56 | 220.71 | 1 | 2 | 0.85 |
| SHL-25 | 16 | 1461 | 3 | 228.94 | 228.50 | 1 | 1 | 0.44 |
| SHL-3 | 16 | 1461 | 3 | 216.80 | 218.14 | 1 | 1 | -1.34 |
| SHL-4 | 16 | 1461 | 1 | 216.32 | 216.71 | 1 | 1 | -0.39 |
| SHL-5 | 16 | 1461 | 1 | 210.55 | 211.01 | 1 | 1 | -0.46 |
| SHL-7 | 16 | 1461 | 1 | 218.43 | 218.76 | 1 | 1 | -0.33 |
| SHL-8D | 16 | 1461 | 4 | 211.83 | 211.99 | 1 | 1 | -0.16 |
| SHL-8S | 16 | 1461 | 3 | 211.95 | 211.99 | 1 | 1 | -0.04 |
| SHL-9 | 16 | 1461 | 1 | 210.20 | 210.37 | 1 | 1 | -0.17 |
| SHM-05-39A | 16 | 1461 | 2 | 208.83 | 209.40 | 1 | 1 | -0.57 |
| SHM-05-39B | 16 | 1461 | 3 | 208.17 | 209.40 | 1 | 1 | -1.23 |
| SHM-05-40X | 16 | 1461 | 3 | 207.94 | 209.00 | 1 | 1 | -1.06 |
| SHM-05-41A | 16 | 1461 | 2 | 209.99 | 209.98 | 1 | 1 | 0.01 |
| SHM-05-41B | 16 | 1461 | 3 | 209.99 | 209.96 | 1 | 1 | 0.03 |
| SHM-05-42A | 16 | 1461 | 2 | 210.28 | 210.28 | 1 | 1 | 0.00 |
| SHM-05-42B | 16 | 1461 | 3 | 210.21 | 210.29 | 1 | 1 | -0.08 |
| SHM-07-03 | 16 | 1461 | 3 | 207.04 | 207.82 | 1 | 1 | -0.78 |
| SHM-10-06 | 16 | 1461 | 3 | 212.21 | 212.17 | 1 | 1 | 0.04 |
| SHM-10-06A | 16 | 1461 | 3 | 212.51 | 212.48 | 1 | 1 | 0.03 |
| SHM-10-07 | 16 | 1461 | 4 | 218.73 | 218.56 | 1 | 1 | 0.17 |
| SHM-10-11 | 16 | 1461 | 3 | 222.07 | 223.83 | 1 | 1 | -1.76 |
| SHM-10-12 | 16 | 1461 | 3 | 220.22 | 219.23 | 1 | 1 | 0.99 |
| SHM-10-13 | 16 | 1461 | 3 | 217.81 | 217.06 | 1 | 1 | 0.75 |
| SHM-10-14 | 16 | 1461 | 3 | 216.33 | 215.89 | 1 | 1 | 0.44 |
| SHM-10-15 | 16 | 1461 | 3 | 218.34 | 217.68 | 1 | 1 | 0.66 |
| SHM-10-16 | 16 | 1461 | 3 | 210.01 | 209.97 | 1 | 1 | 0.04 |
| SHM-11-02 | 16 | 1461 | 5 | 217.23 | 217.44 | 1 | 2 | -0.21 |
| SHM-11-06 | 16 | 1461 | 2 | 215.14 | 214.90 | 1 | 1 | 0.24 |
| SHM-11-07 | 16 | 1461 | 3 | 217.42 | 217.21 | 1 | 1 | 0.21 |
| SHM-13-04 | 16 | 1461 | 2 | 207.22 | 207.75 | 1 | 1 | -0.53 |
| SHM-13-05 | 16 | 1461 | 3 | 207.89 | 208.84 | 1 | 1 | -0.95 |
| SHM-93-18B | 16 | 1461 | 3 | 217.61 | 218.48 | 1 | 1 | -0.87 |
| SHM-93-22B | 16 | 1461 | 3 | 210.33 | 210.54 | 1 | 1 | -0.21 |
| SHM-93-22C | 16 | 1461 | 5 | 210.31 | 210.46 | 1 | 2 | -0.15 |
| SHM-93-24A | 16 | 1461 | 1 | 221.07 | 220.68 | 1 | 1 | 0.39 |
| SHM-96-5B | 16 | 1461 | 3 | 210.75 | 210.93 | 1 | 1 | -0.18 |
| SHM-96-5C | 16 | 1461 | 3 | 210.78 | 211.01 | 1 | 1 | -0.23 |

**Table 7.1**
**Model Predicted Water Levels and Residuals**
**Shepley's Hill Landfill Groundwater Model**

| Well Name | Stress Period | Time (days) | Layer | Target Water Level Elevation (Feet) | Predicted Water Level Elevation (Feet) | Weight | Group | Residual (Feet) |
|---|---|---|---|---|---|---|---|---|
| SHM-99-31A | 16 | 1461 | 1 | 209.51 | 209.71 | 1 | 1 | -0.20 |
| SHM-99-31B | 16 | 1461 | 2 | 209.24 | 209.73 | 1 | 1 | -0.49 |
| SHM-99-31C | 16 | 1461 | 3 | 209.15 | 209.77 | 1 | 1 | -0.62 |
| SHM-99-32X | 16 | 1461 | 3 | 210.21 | 210.29 | 1 | 1 | -0.08 |
| SHP-01-36X | 16 | 1461 | 1 | 216.06 | 215.89 | 1 | 1 | 0.17 |
| SHP-01-37X | 16 | 1461 | 2 | 216.18 | 216.29 | 1 | 1 | -0.11 |
| SHP-01-38A | 16 | 1461 | 1 | 216.31 | 216.57 | 1 | 1 | -0.26 |
| SHP-01-38B | 16 | 1461 | 3 | 216.33 | 216.56 | 1 | 1 | -0.23 |
| SHP-05-43 | 16 | 1461 | 3 | 214.72 | 214.52 | 1 | 1 | 0.20 |
| SHP-05-44 | 16 | 1461 | 3 | 215.47 | 215.64 | 1 | 1 | -0.17 |
| SHP-05-45A | 16 | 1461 | 1 | 210.15 | 210.13 | 1 | 1 | 0.02 |
| SHP-05-45B | 16 | 1461 | 3 | 210.27 | 209.53 | 1 | 1 | 0.74 |
| SHP-05-46A | 16 | 1461 | 1 | 210.59 | 210.46 | 1 | 1 | 0.13 |
| SHP-05-46B | 16 | 1461 | 3 | 210.74 | 210.39 | 1 | 1 | 0.35 |
| SHP-05-47B | 16 | 1461 | 1 | 211.38 | 212.10 | 1 | 1 | -0.72 |
| SHP-05-49B | 16 | 1461 | 1 | 210.17 | 210.12 | 1 | 1 | 0.05 |
| SHP-2016-1A | 16 | 1461 | 1 | 210.00 | 209.83 | 1 | 1 | 0.17 |
| SHP-2016-1B | 16 | 1461 | 3 | 209.21 | 207.99 | 1 | 1 | 1.22 |
| SHP-2016-2A | 16 | 1461 | 2 | 210.08 | 210.13 | 1 | 1 | -0.05 |
| SHP-2016-3A | 16 | 1461 | 2 | 209.68 | 210.33 | 1 | 1 | -0.65 |
| SHP-2016-3B | 16 | 1461 | 3 | 210.11 | 210.27 | 1 | 1 | -0.16 |
| SHP-2016-4A | 16 | 1461 | 2 | 210.05 | 210.00 | 1 | 1 | 0.05 |
| SHP-2016-4B | 16 | 1461 | 3 | 210.00 | 209.94 | 1 | 1 | 0.06 |
| SHP-2016-5A | 16 | 1461 | 2 | 210.11 | 210.08 | 1 | 1 | 0.03 |
| SHP-2016-5B | 16 | 1461 | 3 | 210.01 | 209.97 | 1 | 1 | 0.04 |
| SHP-95-27X | 16 | 1461 | 1 | 219.76 | 221.51 | 1 | 1 | -1.75 |
| SHP-99-29X | 16 | 1461 | 2 | 218.59 | 217.83 | 1 | 1 | 0.76 |
| SHP-99-34B | 16 | 1461 | 3 | 210.77 | 210.71 | 1 | 1 | 0.06 |
| SHP-99-35X | 16 | 1461 | 3 | 221.49 | 220.57 | 1 | 1 | 0.92 |
| 3-1 | 17 | 1553 | 5 | 231.31 | 238.61 | 0 | 2 | -7.30 |
| 20-1 | 17 | 1553 | 5 | 234.37 | 243.42 | 0 | 2 | -9.05 |
| 32M-01-14XOB | 17 | 1553 | 3 | 229.90 | 228.06 | 1 | 3 | 1.84 |
| 32M-92-01X | 17 | 1553 | 4 | 239.76 | 242.98 | 1 | 3 | -3.22 |
| 32Z-01-07XOB | 17 | 1553 | 4 | 240.89 | 241.97 | 1 | 3 | -1.08 |
| 69W-94-13 | 17 | 1553 | 1 | 219.10 | 218.16 | 1 | 5 | 0.94 |
| 69W-94-14 | 17 | 1553 | 1 | 218.55 | 217.44 | 1 | 5 | 1.11 |
| 69WP-08-01 | 17 | 1553 | 2 | 216.88 | 215.66 | 1 | 5 | 1.22 |
| EPA-PZ-2012-1A | 17 | 1553 | 2 | 212.12 | 211.37 | 1 | 1 | 0.75 |
| EPA-PZ-2012-1B | 17 | 1553 | 3 | 211.53 | 211.40 | 1 | 1 | 0.13 |
| EPA-PZ-2012-2A | 17 | 1553 | 2 | 212.52 | 211.64 | 1 | 1 | 0.88 |
| EPA-PZ-2012-2B | 17 | 1553 | 4 | 211.85 | 211.68 | 1 | 1 | 0.17 |
| EPA-PZ-2012-3A | 17 | 1553 | 2 | 211.47 | 210.64 | 1 | 1 | 0.83 |
| EPA-PZ-2012-3B | 17 | 1553 | 3 | 210.79 | 210.61 | 1 | 1 | 0.18 |
| EPA-PZ-2012-4A | 17 | 1553 | 2 | 211.27 | 210.20 | 1 | 1 | 1.07 |
| EPA-PZ-2012-4B | 17 | 1553 | 3 | 210.49 | 209.98 | 1 | 1 | 0.51 |

**Table 7.1**
**Model Predicted Water Levels and Residuals**
**Shepley's Hill Landfill Groundwater Model**

| Well Name | Stress Period | Time (days) | Layer | Target Water Level Elevation (Feet) | Predicted Water Level Elevation (Feet) | Weight | Group | Residual (Feet) |
|---|---|---|---|---|---|---|---|---|
| EPA-PZ-2012-5A | 17 | 1553 | 1 | 211.80 | 211.01 | 1 | 1 | 0.79 |
| EPA-PZ-2012-5B | 17 | 1553 | 3 | 211.10 | 211.01 | 1 | 1 | 0.09 |
| EPA-PZ-2012-6A | 17 | 1553 | 2 | 211.07 | 209.95 | 1 | 1 | 1.12 |
| EPA-PZ-2012-6B | 17 | 1553 | 3 | 210.44 | 209.75 | 1 | 1 | 0.69 |
| EPA-PZ-2012-7A | 17 | 1553 | 1 | 211.09 | 210.12 | 1 | 1 | 0.97 |
| EPA-PZ-2012-7B | 17 | 1553 | 3 | 210.55 | 210.05 | 1 | 1 | 0.50 |
| N1-P1 | 17 | 1553 | 3 | 215.90 | 214.88 | 1 | 1 | 1.02 |
| N1-P2 | 17 | 1553 | 2 | 216.09 | 215.07 | 1 | 1 | 1.02 |
| N1-P3 | 17 | 1553 | 1 | 216.80 | 215.28 | 1 | 1 | 1.52 |
| N2-P1 | 17 | 1553 | 3 | 216.98 | 216.35 | 1 | 1 | 0.63 |
| N2-P2 | 17 | 1553 | 2 | 216.76 | 216.35 | 1 | 1 | 0.41 |
| N3-P1 | 17 | 1553 | 5 | 217.12 | 216.62 | 1 | 2 | 0.50 |
| N3-P2 | 17 | 1553 | 2 | 217.10 | 216.61 | 1 | 1 | 0.49 |
| N5-P1 | 17 | 1553 | 5 | 217.64 | 216.97 | 1 | 2 | 0.67 |
| N6-P1 | 17 | 1553 | 5 | 220.16 | 221.88 | 1 | 2 | -1.72 |
| N7-P1 | 17 | 1553 | 5 | 222.58 | 224.98 | 1 | 2 | -2.40 |
| N7-P2 | 17 | 1553 | 1 | 222.81 | 224.95 | 1 | 1 | -2.14 |
| PZ-12-01 | 17 | 1553 | 3 | 216.64 | 216.28 | 1 | 1 | 0.36 |
| PZ-12-02 | 17 | 1553 | 3 | 217.02 | 216.08 | 1 | 1 | 0.94 |
| PZ-12-03 | 17 | 1553 | 2 | 216.76 | 216.47 | 1 | 1 | 0.29 |
| PZ-12-04 | 17 | 1553 | 2 | 217.44 | 216.86 | 1 | 1 | 0.58 |
| PZ-12-05 | 17 | 1553 | 3 | 217.03 | 216.55 | 1 | 1 | 0.48 |
| PZ-12-06 | 17 | 1553 | 2 | 217.56 | 217.29 | 1 | 1 | 0.27 |
| PZ-12-07 | 17 | 1553 | 2 | 216.88 | 216.85 | 1 | 1 | 0.03 |
| PZ-12-08 | 17 | 1553 | 2 | 218.25 | 218.18 | 1 | 1 | 0.07 |
| PZ-12-09 | 17 | 1553 | 3 | 217.52 | 217.56 | 1 | 1 | -0.04 |
| PZ-12-10 | 17 | 1553 | 3 | 219.21 | 219.07 | 1 | 1 | 0.14 |
| Q4-1 | 17 | 1553 | 5 | 233.67 | 239.26 | 0 | 2 | -5.59 |
| Q5-1 | 17 | 1553 | 5 | 230.17 | 237.40 | 0 | 2 | -7.23 |
| RSK12 | 17 | 1553 | 2 | 216.43 | 216.56 | 1 | 1 | -0.13 |
| RSK15 | 17 | 1553 | 2 | 216.41 | 216.67 | 1 | 1 | -0.26 |
| RSK19 | 17 | 1553 | 2 | 216.34 | 216.45 | 1 | 1 | -0.11 |
| RSK25 | 17 | 1553 | 3 | 216.46 | 217.01 | 1 | 1 | -0.55 |
| RSK35 | 17 | 1553 | 1 | 215.41 | 215.31 | 1 | 1 | 0.10 |
| RSK37 | 17 | 1553 | 2 | 216.36 | 216.67 | 1 | 1 | -0.31 |
| RSK50 | 17 | 1553 | 1 | 216.35 | 216.49 | 1 | 1 | -0.14 |
| RSK7 | 17 | 1553 | 2 | 216.33 | 216.39 | 1 | 1 | -0.06 |
| SHL-11 | 17 | 1553 | 2 | 216.65 | 216.35 | 1 | 1 | 0.30 |
| SHL-12 | 17 | 1553 | 1 | 224.03 | 225.34 | 1 | 1 | -1.31 |
| SHL-13 | 17 | 1553 | 1 | 213.37 | 212.95 | 1 | 1 | 0.42 |
| SHL-15 | 17 | 1553 | 3 | 239.46 | 242.43 | 1 | 1 | -2.97 |
| SHL-17 | 17 | 1553 | 1 | 224.05 | 225.14 | 1 | 1 | -1.09 |
| SHL-18 | 17 | 1553 | 1 | 218.17 | 218.27 | 1 | 1 | -0.10 |
| SHL-19 | 17 | 1553 | 4 | 217.31 | 217.08 | 1 | 1 | 0.23 |
| SHL-20 | 17 | 1553 | 3 | 217.19 | 216.37 | 1 | 1 | 0.82 |

**Table 7.1**
**Model Predicted Water Levels and Residuals**
**Shepley's Hill Landfill Groundwater Model**

| Well Name | Stress Period | Time (days) | Layer | Target Water Level Elevation (Feet) | Predicted Water Level Elevation (Feet) | Weight | Group | Residual (Feet) |
|---|---|---|---|---|---|---|---|---|
| SHL-21 | 17 | 1553 | 1 | 212.86 | 212.79 | 1 | 1 | 0.07 |
| SHL-22 | 17 | 1553 | 4 | 211.41 | 210.68 | 1 | 1 | 0.73 |
| SHL-23 | 17 | 1553 | 2 | 211.03 | 210.58 | 1 | 1 | 0.45 |
| SHL-24 | 17 | 1553 | 5 | 221.65 | 220.91 | 1 | 2 | 0.74 |
| SHL-25 | 17 | 1553 | 3 | 229.01 | 228.53 | 1 | 1 | 0.48 |
| SHL-3 | 17 | 1553 | 3 | 217.71 | 218.25 | 1 | 1 | -0.54 |
| SHL-5 | 17 | 1553 | 1 | 213.33 | 211.21 | 1 | 1 | 2.12 |
| SHL-8D | 17 | 1553 | 4 | 212.31 | 212.17 | 1 | 1 | 0.14 |
| SHL-8S | 17 | 1553 | 3 | 212.96 | 212.17 | 1 | 1 | 0.79 |
| SHL-9 | 17 | 1553 | 1 | 211.47 | 210.57 | 1 | 1 | 0.90 |
| SHM-05-39B | 17 | 1553 | 3 | 208.25 | 209.68 | 1 | 1 | -1.43 |
| SHM-05-40X | 17 | 1553 | 3 | 208.43 | 209.27 | 1 | 1 | -0.84 |
| SHM-05-41A | 17 | 1553 | 2 | 211.10 | 210.21 | 1 | 1 | 0.89 |
| SHM-05-41B | 17 | 1553 | 3 | 210.50 | 210.19 | 1 | 1 | 0.31 |
| SHM-05-41C | 17 | 1553 | 4 | 211.14 | 210.20 | 1 | 1 | 0.94 |
| SHM-05-42A | 17 | 1553 | 2 | 211.43 | 210.53 | 1 | 1 | 0.90 |
| SHM-05-42B | 17 | 1553 | 3 | 210.73 | 210.54 | 1 | 1 | 0.19 |
| SHM-07-03 | 17 | 1553 | 3 | 207.50 | 208.10 | 1 | 1 | -0.60 |
| SHM-10-05A | 17 | 1553 | 2 | 210.06 | 210.77 | 1 | 1 | -0.71 |
| SHM-10-06 | 17 | 1553 | 3 | 212.71 | 212.24 | 1 | 1 | 0.47 |
| SHM-10-06A | 17 | 1553 | 3 | 213.03 | 212.57 | 1 | 1 | 0.46 |
| SHM-10-07 | 17 | 1553 | 4 | 218.45 | 218.40 | 1 | 1 | 0.05 |
| SHM-10-11 | 17 | 1553 | 3 | 221.55 | 223.77 | 1 | 1 | -2.22 |
| SHM-10-12 | 17 | 1553 | 3 | 219.55 | 219.08 | 1 | 1 | 0.47 |
| SHM-10-13 | 17 | 1553 | 3 | 217.65 | 216.92 | 1 | 1 | 0.73 |
| SHM-10-14 | 17 | 1553 | 3 | 216.50 | 215.79 | 1 | 1 | 0.71 |
| SHM-10-15 | 17 | 1553 | 3 | 217.96 | 217.54 | 1 | 1 | 0.42 |
| SHM-10-16 | 17 | 1553 | 3 | 210.53 | 210.21 | 1 | 1 | 0.32 |
| SHM-11-02 | 17 | 1553 | 5 | 217.77 | 217.30 | 1 | 2 | 0.47 |
| SHM-13-01 | 17 | 1553 | 3 | 205.37 | 204.67 | 1 | 1 | 0.70 |
| SHM-93-18B | 17 | 1553 | 3 | 218.24 | 218.57 | 1 | 1 | -0.33 |
| SHM-93-22B | 17 | 1553 | 3 | 210.79 | 210.75 | 1 | 1 | 0.04 |
| SHM-93-22C | 17 | 1553 | 5 | 211.42 | 210.66 | 1 | 2 | 0.76 |
| SHM-93-24A | 17 | 1553 | 1 | 221.07 | 220.89 | 1 | 1 | 0.18 |
| SHM-96-5B | 17 | 1553 | 3 | 211.24 | 211.11 | 1 | 1 | 0.13 |
| SHM-96-5C | 17 | 1553 | 3 | 211.82 | 211.19 | 1 | 1 | 0.63 |
| SHM-99-31C | 17 | 1553 | 3 | 209.13 | 210.06 | 1 | 1 | -0.93 |
| SHM-99-32X | 17 | 1553 | 3 | 210.72 | 210.58 | 1 | 1 | 0.14 |
| SHP-01-36X | 17 | 1553 | 1 | 216.57 | 215.82 | 1 | 1 | 0.75 |
| SHP-01-37X | 17 | 1553 | 2 | 216.70 | 216.19 | 1 | 1 | 0.51 |
| SHP-01-38A | 17 | 1553 | 1 | 216.85 | 216.50 | 1 | 1 | 0.35 |
| SHP-05-44 | 17 | 1553 | 3 | 215.83 | 215.60 | 1 | 1 | 0.23 |
| SHP-05-45A | 17 | 1553 | 1 | 210.02 | 210.26 | 1 | 1 | -0.24 |
| SHP-05-45B | 17 | 1553 | 3 | 210.07 | 209.65 | 1 | 1 | 0.42 |
| SHP-05-46A | 17 | 1553 | 1 | 210.42 | 210.57 | 1 | 1 | -0.15 |

**Table 7.1**
**Model Predicted Water Levels and Residuals**
**Shepley's Hill Landfill Groundwater Model**

| Well Name | Stress Period | Time (days) | Layer | Target Water Level Elevation (Feet) | Predicted Water Level Elevation (Feet) | Weight | Group | Residual (Feet) |
|---|---|---|---|---|---|---|---|---|
| SHP-05-46B | 17 | 1553 | 3 | 210.51 | 210.51 | 1 | 1 | 0.00 |
| SHP-05-47A | 17 | 1553 | 1 | 212.85 | 212.33 | 1 | 1 | 0.52 |
| SHP-05-47B | 17 | 1553 | 1 | 212.99 | 212.33 | 1 | 1 | 0.66 |
| SHP-2016-1A | 17 | 1553 | 1 | 209.90 | 209.98 | 1 | 1 | -0.08 |
| SHP-2016-1B | 17 | 1553 | 3 | 208.79 | 208.13 | 1 | 1 | 0.66 |
| SHP-2016-2A | 17 | 1553 | 2 | 209.99 | 210.35 | 1 | 1 | -0.36 |
| SHP-2016-2B | 17 | 1553 | 3 | 209.98 | 210.32 | 1 | 1 | -0.34 |
| SHP-2016-3A | 17 | 1553 | 2 | 210.11 | 210.54 | 1 | 1 | -0.43 |
| SHP-2016-3B | 17 | 1553 | 3 | 210.05 | 210.48 | 1 | 1 | -0.43 |
| SHP-2016-4A | 17 | 1553 | 2 | 209.97 | 210.21 | 1 | 1 | -0.24 |
| SHP-2016-4B | 17 | 1553 | 3 | 209.98 | 210.15 | 1 | 1 | -0.17 |
| SHP-2016-5A | 17 | 1553 | 2 | 209.98 | 210.28 | 1 | 1 | -0.30 |
| SHP-2016-5B | 17 | 1553 | 3 | 209.95 | 210.16 | 1 | 1 | -0.21 |
| SHP-95-27X | 17 | 1553 | 1 | 220.60 | 221.77 | 1 | 1 | -1.17 |
| SHP-99-01C | 17 | 1553 | 5 | 249.07 | 248.23 | 1 | 2 | 0.84 |
| SHP-99-29X | 17 | 1553 | 2 | 218.12 | 217.73 | 1 | 1 | 0.39 |
| SHP-99-34B | 17 | 1553 | 3 | 210.76 | 210.99 | 1 | 1 | -0.23 |
| SHP-99-35X | 17 | 1553 | 3 | 220.79 | 220.46 | 1 | 1 | 0.33 |

Notes
1. Target and predicted water levels are relative to the NAVD88 (North American Vertical Datum 1988).
2. Predicted water levels and residuals are reflective of model revision SHL300T2a R88PEST.
3. Target weights of zero were used to exclude individual targets from the PEST calibration. Targets that were identified as anomalous based on long term data and/or surrounding monitoring well data or located in Shepley's Hill bedrock were assigned a weight of zero.
4. Group numbers were used to organize targets by location as follows:
   - Group 1 = Shepley's Hill Landfill and NIA overburden monitoring wells
   - Group 2 = Shepley's Hill, Shepley's Hill Landfill, and NIA bedrock monitoring wells
   - Group 3 = AOC 32/43A monitoring wells
   - Group 4 = AOC 57 monitoring wells
   - Group 5 = AOC 69W monitoring wells
5. Residual values = Target Water Level Elevation - Predicted Water Level Elevation.
6. Target water level elevations represent the average of measurements within each stress period.

**Table 8.1**
**February 2013 Precipitation**
**Shepley's Hill Landfill Groundwater Model**

| Date | Minimum Daily Temperature (F) | Maximum Daily Temperature (F) | Rain, melted snow, etc. (in) | Snow, Ice Pellets, Hail (in) |
|---|---|---|---|---|
| 2/1/2013 | 21 | 32 | 0 | - |
| 2/2/2013 | 16 | 29 | T | - |
| 2/3/2013 | 17 | 28 | T | - |
| 2/4/2013 | 19 | 29 | 0 | - |
| 2/5/2013 | 19 | 31 | T | - |
| 2/6/2013 | 20 | 38 | T | - |
| 2/7/2013 | 12 | 31 | 0 | - |
| 2/8/2013 | 18 | 25 | 0.37 | - |
| 2/9/2013 | 14 | 24 | 0.12 | - |
| 2/10/2013 | 6 | 39 | 0 | - |
| 2/11/2013 | 7 | 42 | 0.19 | - |
| 2/12/2013 | 34 | 42 | 0 | - |
| 2/13/2013 | 25 | 42 | 0 | - |
| 2/14/2013 | 21 | 44 | 0 | - |
| 2/15/2013 | 19 | 51 | 0 | - |
| 2/16/2013 | 27 | 39 | 0.06 | - |
| 2/17/2013 | 16 | 27 | 0.01 | - |
| 2/18/2013 | 13 | 31 | 0 | - |
| 2/19/2013 | 22 | 46 | 0.17 | - |
| 2/20/2013 | 26 | 40 | 0.01 | - |
| 2/21/2013 | 23 | 32 | 0 | - |
| 2/22/2013 | 19 | 40 | 0 | - |
| 2/23/2013 | 27 | 37 | 0.02 | - |
| 2/24/2013 | 32 | 35 | 0.81 | - |
| 2/25/2013 | 18 | 39 | T | - |
| 2/26/2013 | 31 | 41 | 0 | - |
| 2/27/2013 | 34 | 41 | 1.26 | - |
| 2/28/2013 | 31 | 45 | T | - |
| ATP Shutdown Period Total Precipitation | | | 0.68 | 0.0 |
| Total Precipitation for the Month | | | 3.02 | 0.0 |

Notes:
1. Precipitation data are from the Fitchburg, MA Municipal Airport station (GHCND:USW00004780).
2. Snow, ice pellets and hail precipitation was not reported.
3. Precipitation data for days coinciding with the Arsenic Treatment Plan (ATP) shutdown are shaded.
4. F = Degrees Fahrenheit, in = inches, T = Trace precipitation defined as less than 0.01 inches;
"-" = data not reported.

**Table 8.2**
**Shutdown Test Validation Results**
**Shepley's Hill Landfill Groundwater Model**

| Well | Layer | Distance from EW-01 (feet) | Distance from EW-04 (feet) | ATP ShutDown Test Observed Water Levels (feet) | | | Simulated Water Levels (feet) | | | Residual (feet) |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | | Beginning | End | Recovery | Beginning | End | Recovery After 9 Days of ATP Pumps Off | |
| | | | | 2/6/13 10:45 | 2/15/13 14:30 | | SP2 - 90 Days | SP2 - 9 Days ATP Pumps Off | | |
| EPA-PZ-2012-1A | 2 | 267.45 | 304.32 | 212.41 | 212.82 | 0.41 | 212.66 | 212.84 | 0.18 | 0.23 |
| EPA-PZ-2012-1B | 3 | 269.57 | 306.34 | 212.39 | 212.80 | 0.42 | 212.68 | 212.90 | 0.22 | 0.20 |
| EPA-PZ-2012-2A | 2 | 383.40 | 415.72 | 212.55 | 212.67 | 0.12 | 212.80 | 212.88 | 0.08 | 0.04 |
| EPA-PZ-2012-2B | 4 | 386.20 | 418.67 | 212.43 | 212.72 | 0.29 | 212.84 | 212.94 | 0.10 | 0.19 |
| EPA-PZ-2012-3A | 2 | 178.12 | 194.98 | 211.85 | 212.49 | 0.64 | 212.07 | 212.42 | 0.35 | 0.29 |
| EPA-PZ-2012-3B | 3 | 178.12 | 195.85 | 211.82 | 212.52 | 0.70 | 212.06 | 212.50 | 0.44 | 0.26 |
| EPA-PZ-2012-4A | 2 | 101.93 | 112.61 | 211.63 | 212.53 | 0.90 | 211.81 | 212.38 | 0.58 | 0.33 |
| EPA-PZ-2012-4B | 3 | 99.53 | 109.93 | 211.53 | 212.53 | 1.00 | 211.65 | 212.49 | 0.84 | 0.16 |
| EPA-PZ-2012-5B | 3 | 313.06 | 326.68 | 211.93 | 212.39 | 0.46 | 212.25 | 212.40 | 0.15 | 0.30 |
| EPA-PZ-2012-6A | 2 | 120.37 | 76.25 | 211.68 | 212.43 | 0.75 | 211.61 | 212.27 | 0.66 | 0.09 |
| EPA-PZ-2012-6B | 3 | 123.23 | 79.24 | 211.47 | 212.34 | 0.86 | 211.43 | 212.33 | 0.90 | -0.03 |
| EPA-PZ-2012-7B | 3 | 208.99 | 151.28 | 211.57 | 212.28 | 0.71 | 211.63 | 212.17 | 0.54 | 0.17 |
| SHL-8D | 4 | 494.45 | 530.96 | 212.78 | 212.95 | 0.17 | 213.23 | 213.27 | 0.04 | 0.13 |
| SHL-8S | 3 | 494.45 | 530.96 | 212.90 | 212.99 | 0.09 | 213.23 | 213.27 | 0.04 | 0.04 |
| SHL-9 | 1 | 202.12 | 194.82 | 211.98 | 212.38 | 0.40 | 211.95 | 212.17 | 0.22 | 0.17 |
| SHL-21 | 1 | 427.03 | 481.71 | 214.26 | 214.20 | -0.06 | 213.93 | 213.96 | 0.04 | -0.10 |
| SHL-22 | 4 | 236.06 | 237.31 | 211.76 | 212.34 | 0.57 | 212.03 | 212.32 | 0.29 | 0.29 |
| SHL-23 | 2 | 233.68 | 195.78 | 212.55 | 213.02 | 0.48 | 212.27 | 212.73 | 0.46 | 0.02 |
| SHM-05-41A | 2 | 365.62 | 316.35 | 211.42 | 211.92 | 0.50 | 211.57 | 211.74 | 0.16 | 0.33 |
| SHM-05-41B | 3 | 373.28 | 324.30 | 211.42 | 211.92 | 0.50 | 211.56 | 211.74 | 0.18 | 0.32 |
| SHM-05-41C | 4 | 360.86 | 311.36 | 211.39 | 211.85 | 0.45 | 211.58 | 211.77 | 0.19 | 0.26 |
| SHM-05-42A | 2 | 426.72 | 405.45 | 211.54 | 211.93 | 0.38 | 211.77 | 211.86 | 0.09 | 0.29 |
| SHM-05-42B | 3 | 426.72 | 405.45 | 211.52 | 211.97 | 0.45 | 211.77 | 211.87 | 0.10 | 0.36 |
| SHM-10-06 | 3 | 282.34 | 339.10 | 213.53 | 213.83 | 0.29 | 213.50 | 213.70 | 0.20 | 0.09 |
| SHM-10-06A | 3 | 362.75 | 417.49 | 213.73 | 213.90 | 0.17 | 213.73 | 213.85 | 0.12 | 0.05 |
| SHM-93-22B | 3 | 249.76 | 253.03 | 211.74 | 212.28 | 0.54 | 212.07 | 212.30 | 0.23 | 0.31 |
| SHM-93-22C | 5 | 227.14 | 226.80 | 211.84 | 212.30 | 0.46 | 212.03 | 212.34 | 0.31 | 0.15 |
| SHM-96-5B | 3 | 266.30 | 291.35 | 212.11 | 212.58 | 0.47 | 212.41 | 212.63 | 0.22 | 0.25 |
| SHM-96-5C | 3 | 274.02 | 301.66 | 212.11 | 212.56 | 0.45 | 212.48 | 212.69 | 0.21 | 0.24 |
| SHP-05-45B | 3 | 52.46 | 106.75 | 211.73 | 212.90 | 1.17 | 211.59 | 212.82 | 1.23 | -0.06 |
| SHP-05-46A | 1 | 99.58 | 155.35 | 212.14 | 213.01 | 0.87 | 212.24 | 212.66 | 0.42 | 0.45 |
| SHP-05-46B | 3 | 99.28 | 154.07 | 212.20 | 213.09 | 0.90 | 212.18 | 212.96 | 0.78 | 0.12 |

Note:
1. Residual represent observed recovery minus calculated recovery.
2. Water level elevations are referenced to North American Vertical Datum 1988.
3. Observed data was collected from water levels collected during the 9-day ATP shutdown test in February 2013.
4. SP = Stress Period.
5. Shutdown test validation results are reflective of model version SHL300T2a R88PEST.
6. Simulated water level elevations were collected from the end of SP2 in R88PEST with EW-01 and EW-04 pumping (90 days). The head file from the end of SP2 serves as the initial heads for a 9-day transient stress period with no pumping from the ATP wells. Simulated heads at the end of the 9-day transient stress period represent the end of the simulated shutdown test.
7. ATP = Arsenic treatment plant

**Table 8.3**
**3PE Flow Direction Validation Results**
**Shepley's Hill Landfill Groundwater Model**

| Triangle | Well A | Well B | Well C | Spring 2013 | | | | | | | | | Fall 2016 | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | Min | 25% | 50% | 75% | Average | Max | SP3 Target | SP3 Calc | Targ - Calc | Min | 25% | 50% | 75% | Average | Max | SP17 Target | SP17 Calc | Targ - Calc |
| ATP 1 | SHM-10-06 | SHM-10-06A | EPA-PZ-2012-1B | 326 | 330 | 334 | 336 | 333 | 345 | 320 | 322 | -3 | 322 | 323 | 325 | 326 | 325 | 334 | 323 | 314 | 9 |
| ATP 2 | EPA-PZ-2012-1B | SHM-10-06A | EPA-PZ-2012-2B | 317 | 323 | 326 | 328 | 326 | 335 | 323 | 311 | 12 | 309 | 312 | 313 | 316 | 314 | 324 | 306 | 304 | 2 |
| ATP 3 | EPA-PZ-2012-2B | SHM-96-5B | EPA-PZ-2012-1B | 316 | 325 | 328 | 330 | 328 | 341 | 323 | 307 | 15 | NA | NA | NA | NA | NA | NA | 295 | 296 | -1 |
| ATP 4 | EPA-PZ-2012-2B | SHM-96-5B | EPA-PZ-2012-5B | 311 | 320 | 322 | 324 | 323 | 340 | 302 | 299 | 4 | NA | NA | NA | NA | NA | NA | 290 | 287 | 3 |
| ATP 5 | SHM-93-22B | SHM-96-5B | EPA-PZ-2012-5B | 309 | 313 | 315 | 318 | 316 | 327 | 303 | 306 | -3 | NA | NA | NA | NA | NA | NA | 293 | 292 | 1 |
| LF South 1[7] | SHL 12 | SHL 17 | 32Z-99-02X | 337 | 346 | 349 | 350 | 348 | 353 | 351 | 351 | 0 | NA | NA | NA | NA | NA | NA | NA | 356 | NA |
| LF South 2[7] | SHL 12 | SHL 17 | N7-P2 | 313 | 336 | 346 | 349 | 342 | 359 | 352 | 352 | 0 | NA | NA | NA | NA | NA | NA | 349 | 18 | -29 |

Note:
1. See Figure 8.4 for a map of 3PE triangle locations.
2. Estimated flow directions were calculated from head data using the 3PE spreadsheet program developed by USEPA (2014).
3. Statistical results (minimum, average, maximum, and quartiles) of estimated flow directions were derived from continuous hydraulic head data collected by USEPA ORD.
4. Estimated "Target" flow directions were derived from heads used as calibration targets in the model. Estimated "Calc" flow directions were derived from model output heads.
5. SP3 (spring 2013) and SP17 (fall 2016) were selected for validation as they represent flow conditions during relative periods of high and low recharge from precipitation, respectively.
6. Results are reported as degrees azimuth where north equals 0° and 360°.
7. No transducer data were available for the LF South wells in spring 2013. Statistical values reported under spring 2013 were derived from tranducer data collected during the spring of 2017, a period of relatively high precipitation and elevated water table conditions.
8. ATP = Arsenic treatment plant, Calc = model calculated (SHL300T2a R88PEST), LF = landfill, Max = maximum, Min = minimum, NA = no answer, SP = stress period, LF = landfill, Targ = target, USEPA ORD = United States Environmental Protection Agency Office of Resaerch and Development, and 3PE = three-point estimator.
9. Well A, Well B, and Well C are generic location terms used to define the verticies of each 3PE triangle.
10. Quartiles of estimated flow directions are shown under the 25%, 50%, and 75% column headings.

**Table 9.1**
**Model Residual Statistics – All Targets and SHL Targets Only (Group 1)**
**Shepley's Hill Landfill Groundwater Model**

| Statistic | All Targets | Group 1 Targets |
|---|---|---|
| Residual Mean | -0.05 | -0.04 |
| Absolute Residual Mean | 0.72 | 0.58 |
| Residual Standard Deviation | 1.13 | 0.79 |
| Sum of Squares | 1798.07 | 724.75 |
| Root Mean Square (RMS) Error | 1.13 | 0.79 |
| Minimum Residual | -9.05 | -3.62 |
| Maximum Residual | 7.97 | 3.62 |
| Number of Observations | 1413 | 1150 |
| Range in Observations | 61.66 | 38.67 |
| Scaled Residual Standard Deviation | 0.02 | 0.02 |
| Scaled Absolute Residual Mean | 0.01 | 0.01 |
| Scaled RMS Error | 0.02 | 0.02 |
| Scaled Residual Mean | -0.001 | -0.001 |

Note:
1. Group 1 targets include Shepley's Hill Landfill Site overburden monitoring wells only.
2. Residual statistics are unweighted and represent model SHL300T2a version R88PEST.

**Table 9.2**
**Mass Balance Summary**
**Shepley's Hill Landfill Groundwater Model**

| Stress Period | Time (days) | Surface Water by Reach | | | | | | | | | | | | | | Surface Water[8] | Recharge | Pumping | Net Storage |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | | | | |
| 1 | 92 | -587 | -150 | -155 | -44 | -197 | -86 | 55 | -133 | -261 | 0 | -2 | -53 | 122 | -75 | -1567 | 2091 | -524 | 0 |
| 2 | 182 | -570 | -142 | -144 | -36 | -184 | -75 | 69 | -134 | -284 | -1 | -3 | -64 | 101 | -127 | -1595 | 2684 | -526 | 563 |
| 3 | 273 | -582 | -146 | -159 | -43 | -192 | -71 | 54 | -157 | -243 | -1 | -7 | -85 | 65 | -138 | -1706 | 3442 | -725 | 1011 |
| 4 | 365 | -608 | -154 | -167 | -51 | -200 | -84 | 41 | -140 | -277 | 0 | -2 | -56 | 109 | -7 | -1594 | 678 | -642 | -1558 |
| 5 | 457 | -590 | -149 | -148 | -42 | -191 | -89 | 60 | -113 | -198 | 0 | 3 | -28 | 162 | 90 | -1232 | 693 | -489 | -1028 |
| 6 | 547 | -549 | -136 | -129 | -28 | -173 | -74 | 87 | -109 | -242 | 0 | -2 | -54 | 126 | -35 | -1319 | 2506 | -534 | 653 |
| 7 | 638 | -553 | -140 | -138 | -29 | -172 | -64 | 80 | -125 | -330 | -1 | -6 | -78 | 79 | -139 | -1615 | 3239 | -590 | 1034 |
| 8 | 730 | -630 | -171 | -182 | -59 | -210 | -93 | 24 | -128 | -209 | 0 | -1 | -53 | 121 | 94 | -1496 | 828 | -698 | -1366 |
| 9 | 822 | -513 | -123 | -112 | -17 | -156 | -63 | 112 | -96 | -209 | 0 | 0 | -41 | 135 | 166 | -916 | 1746 | -654 | 176 |
| 10 | 912 | -574 | -151 | -154 | -41 | -187 | -78 | 64 | -118 | -249 | -1 | -3 | -61 | 110 | 97 | -1345 | 2595 | -722 | 528 |
| 11 | 1003 | -574 | -149 | -158 | -43 | -190 | -75 | 59 | -131 | -277 | -1 | -5 | -74 | 87 | 47 | -1484 | 2732 | -813 | 436 |
| 12 | 1095 | -592 | -153 | -174 | -59 | -211 | -95 | 40 | -126 | -214 | 0 | -1 | -50 | 128 | 228 | -1279 | 843 | -941 | -1377 |
| 13 | 1187 | -546 | -133 | -140 | -40 | -190 | -87 | 77 | -112 | -209 | 0 | 1 | -37 | 157 | 179 | -1081 | 1763 | -728 | -46 |
| 14 | 1278 | -518 | -124 | -125 | -27 | -174 | -70 | 98 | -116 | -266 | -1 | -3 | -62 | 117 | -25 | -1297 | 3008 | -662 | 1050 |
| 15 | 1369 | -568 | -145 | -159 | -49 | -202 | -88 | 58 | -126 | -250 | 0 | -2 | -57 | 125 | 117 | -1344 | 1878 | -829 | -295 |
| 16 | 1461 | -566 | -144 | -152 | -47 | -199 | -94 | 47 | -106 | -181 | 0 | 1 | -42 | 151 | 276 | -1057 | 575 | -873 | -1355 |
| 17 | 1553 | -521 | -128 | -124 | -28 | -174 | -77 | 97 | -95 | -218 | 0 | -1 | -52 | 132 | 79 | -1113 | 2017 | -680 | 224 |
| 18 | 4841 | -539 | -136 | -142 | -37 | -183 | -77 | 82 | -108 | -230 | 0 | -1 | -54 | 124 | 138 | -1163 | 1945 | -782 | 0 |

Notes:
1. SP1 and SP18 are steady state.
2. Units are in gallons per minute (gpm).
3. Negative values represent flow out of the model whereas positive values represent flow into the model.
4. Refer to Figure 6.4 for surface water reach locations.
5. Pumping includes ATP extraction wells (EW-01 and EW-04), the McPherson and Grove Pond Supply Wells.
6. Recharge represents the sum total of all recharge zones.
7. ATP = Arsenic treatment plant
8. Surface Water is the sum of discharge/recharge for surface water reaches 1 to 14.

| | |
|---|---|
| | Steady State |
| | Q1 Winter |
| | Q2 Spring |
| | Q3 Summer |
| | Q4 Fall |

**Table 9.3**
**HSU Mass Balance Analysis**
**Shepley's Hill Landfill Groundwater Model**

**Northwest Plow Shop Pond by Layer**

| Layer | Zone | Inflow | Outflow | Percent Outflow | Net Flow |
|---|---|---|---|---|---|
| 1 (HSU14) | River | 59.4 | 0.0 | 0% | 59.4 |
| | HSU1 | 0.5 | 0.0 | 0% | 0.5 |
| | HSU11 | 0.0 | 7.2 | 7% | -7.2 |
| | HSU15 | 0.0 | 16.9 | 16% | -16.9 |
| 2 (HSU24) | HSU1 | 6.3 | 0.2 | 0% | 6.1 |
| | HSU11 | 0.5 | 3.6 | 3% | -3.0 |
| | HSU15 | 2.2 | 21.5 | 20% | -19.4 |
| 3 (HSU34) | HSU1 | 21.5 | 1.1 | 1% | 20.4 |
| | HSU11 | 3.5 | 11.0 | 10% | -7.5 |
| | HSU15 | 12.4 | 44.8 | 42% | -32.4 |
| Total | | 106.3 | 106.3 | 100% | 0.0 |

**Northwest Plow Shop Pond (HSUs 14+24+34) by Bounding HSU**

| Zone | Inflow | Outflow | Percent Out | Netflow |
|---|---|---|---|---|
| River (NW PSP) | 59.4 | 0.0 | 0% | 59.4 |
| HSU1 | 28.3 | 1.3 | 1% | 27.0 |
| HSU11 | 4.1 | 21.8 | 21% | -17.7 |
| HSU15 | 14.6 | 83.2 | 78% | -68.6 |
| Total | 106.3 | 106.3 | 100% | 0.0 |

**Landfill Area (HSU2)**

| HSU Number | Inflow | Outflow | Percent Out | Netflow |
|---|---|---|---|---|
| HSU1 | 2.5 | 0.4 | 0% | 2.1 |
| HSU3 | 0.3 | 43.5 | 42% | -43.2 |
| HSU4 | 0.0 | 0.0 | 0% | 0.0 |
| HSU5 | 53.2 | 7.7 | 8% | 45.5 |
| HSU6 | 6.2 | 9.7 | 9% | -3.5 |
| HSU7 | 4.0 | 33.0 | 32% | -29.0 |
| HSU8 | 8.7 | 6.5 | 6% | 2.2 |
| HSU9 | 18.8 | 1.9 | 2% | 16.9 |
| Recharge | 9.1 | 0.0 | 0% | 9.1 |
| Total | 102.7 | 102.7 | 100% | 0.0 |

Notes:

1. HSU = hydrostratigraphic unit; PSP = Plow Shop Pond.
2. Hydrostratigraphic Units are used as a zone budget emulator in Groundwater Vistas to quantify the exchange of groundwater between user defined zone.
3. Presented net flow values are calculated by subtracting outflow from inflow. Positive net flow values signifies greater flow into the zone. Negative net flow values signify greater flow out of the zone.
4. Percent out is calculated from outflow values.
5. HSU zone distribution is shown on Figures 9.7 and 9.8. HSU1 represents the overburden outside HSU2 through HSU8
6. Units are gallons per minute (GPM).
7. Mass balance analysis was conducted for SP18 of SHL300T2a R88PEST.

**Table 11.1**
**Endpoint Particle Tracking Summary**
**Shepley's Hill Landfill Groundwater Model**

| Layer 1 | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| Capture Zone | Number of Particles | Percent of Total Particles | Number of Particles by Starting K Zone Number | | | | Travel Time (Years) | | |
| | | | | Zone 4 K= 21 ft/d | Zone 11 K=49 ft/d | Zone 15 K=130 ft/d | Minimum | Average | Maximum |
| EW-01 | 147772 | 90.2 | | 133688 | 4176 | 9908 | 0.3 | 8.9 | 39.8 |
| EW-04 | 6852 | 4.2 | | 4276 | 0 | 2576 | 0.2 | 4.7 | 52.0 |
| Nonacoicus Brook (Reach 3) | 3912 | 2.4 | | 1972 | 0 | 1940 | 13.3 | 22.8 | 53.8 |
| Plow Shop Pond (Reach 12) | 568 | 0.3 | | 0 | 0 | 568 | 4.4 | 14.7 | 33.3 |
| Dry Cell | 384 | 0.2 | | 284 | 0 | 100 | 0.5 | 0.5 | 0.7 |
| Active | 4360 | 2.7 | | 52 | | 4308 | 54 | 54 | 54 |

| Layer 2 | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| Capture Zone | Number of Particles | Percent of Total Particles | Number of Particles by Starting K Zone Number | | | | Travel Time (Years) | | |
| | | | | Zone 21 K=39 ft/d | Zone 24 K= 6 ft/d | Zone 25 K= 19 ft/d | Minimum | Average | Maximum |
| EW-01 | 168468 | 86.5% | | 6480 | 142536 | 19452 | 0.0 | 9.8 | 41.0 |
| EW-04 | 16522 | 8.5% | | 0 | 8552 | 7970 | 0.0 | 2.9 | 50.1 |
| Nonacoicus Brook (Reach 3) | 9280 | 4.8% | | 0 | 1264 | 8016 | 12.5 | 24.0 | 52.7 |
| Dry Cell | 238 | 0.1% | | 0 | 0 | 238 | 0.5 | 0.6 | 1.5 |
| Active | 148 | 0.1% | | 0 | 48 | 100 | 54 | 54 | 54 |

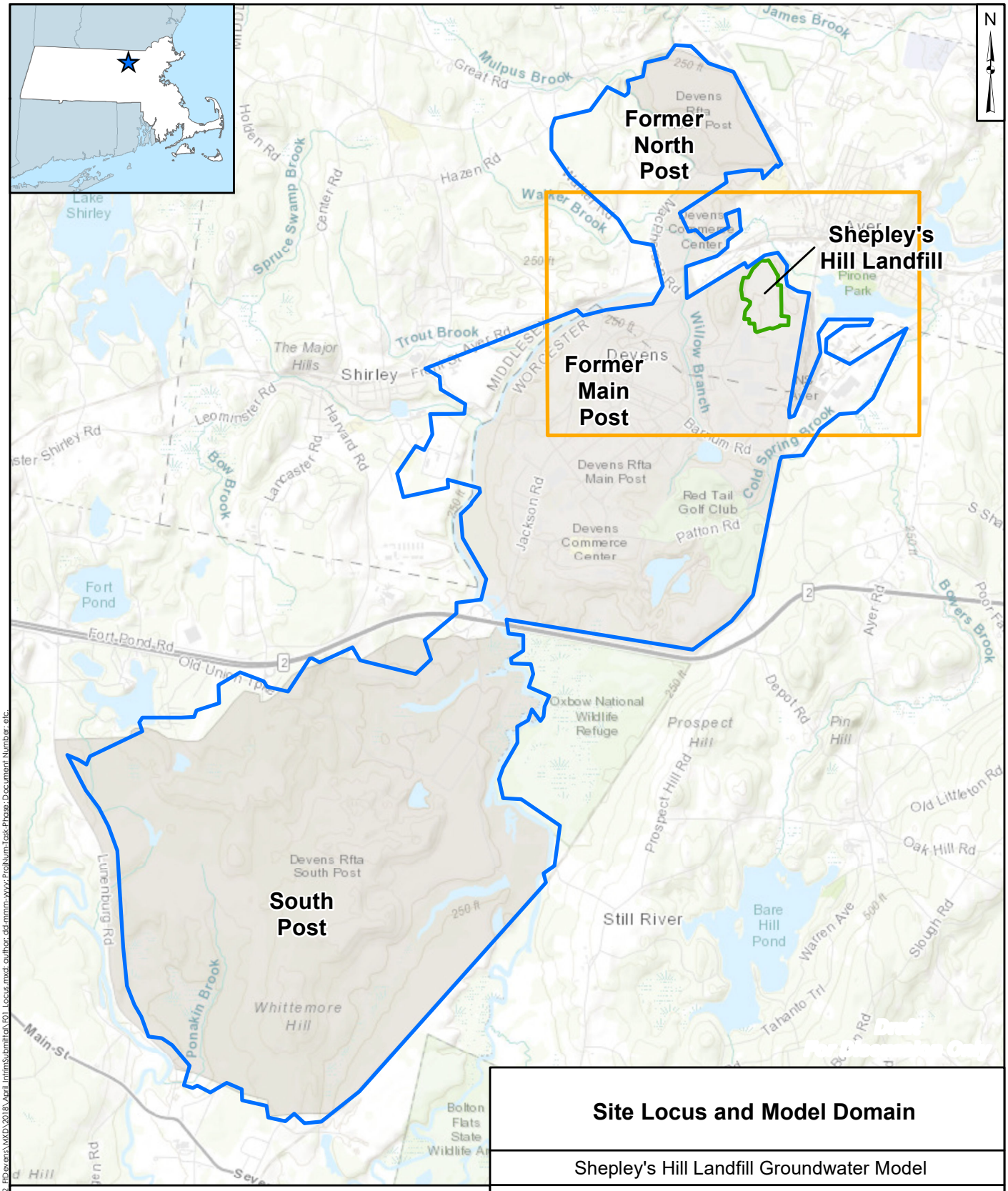
| Layer 3 | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| Capture Zone | Number of Particles | Percent of Total Particles | Number of Particles by Starting K Zone Number | | | | Travel Time (Years) | | |
| | | | Zone 10 K= 1 ft/d | Zone 31 K= 135 ft/d | Zone 34 K= 30 ft/d | Zone 35 K=24 ft/d | Minimum | Average | Maximum |
| EW-01 | 171842 | 84.9% | 32 | 3904 | 138444 | 29462 | 0.0 | 4.6 | 44.9 |
| EW-04 | 20826 | 10.3% | 0 | 0 | 7548 | 13278 | 0.0 | 2.1 | 49.3 |
| Nonacoicus Brook (Reach 3) | 9072 | 4.5% | 0 | 0 | 1260 | 7812 | 12.3 | 22.1 | 53.8 |
| Dry Cell | 92 | 0.0% | 0 | 0 | 0 | 92 | 0.5 | 1.5 | 2.5 |
| Active | 376 | 0.2% | 0 | 0 | 124 | 252 | 54 | 54 | 54 |

| Layer 4 | | | | | | | |
|---|---|---|---|---|---|---|---|
| Capture Zone | Number of Particles | Percent of Total Particles | Number of Particles by Starting K Zone Number | | Travel Time (Years) | | |
| | | | | Zone 7 K= 5 ft/d | Minimum | Average | Maximum |
| EW-01 | 10936 | 84.3% | | 10936 | 0.3 | 9.2 | 53.7 |
| EW-04 | 1332 | 10.3% | | 1332 | 0.4 | 3.9 | 54.1 |
| Nonacoicus Brook (Reach 3) | 376 | 2.9% | | 376 | 23.0 | 32.6 | 54.0 |
| Active | 325 | 2.5% | | 325 | 54 | 54 | 54 |

Notes:

1. Particles were released in SP2 and tracked until the end of SP18.
2. The duration of SP18 (steady-state) was extended to simulate 50 years to maximize the number of particles captured.
3. Particle starting locations beneath the landfill were limited near the western boundary due to simulated dry cells.
4. A total of 16 particles were released into each model cell in a 2X2 array with Z offsets = 0.2, 0.4, 0.6, and 0.8 for Layers 1 through 3. Only one particle per cell was released into Layer 4 with a Z offset = 0.25.
5. The effective porosity was assumed to equal 0.30.
6. K = hydraulic condcutivity in ft/d, SP = stress period.

# FIGURES




## Site Locus and Model Domain

Shepley's Hill Landfill Groundwater Model

Former Fort Devens Army Installation
Devens, Massachusetts

**Legend**

- Former Fort Devens (Approximate)
- Shepley's Hill Landfill (Approximate)
- Model Domain Extent

Geosyntec consultants

Acton, MA | January 2019

Figure 1.1

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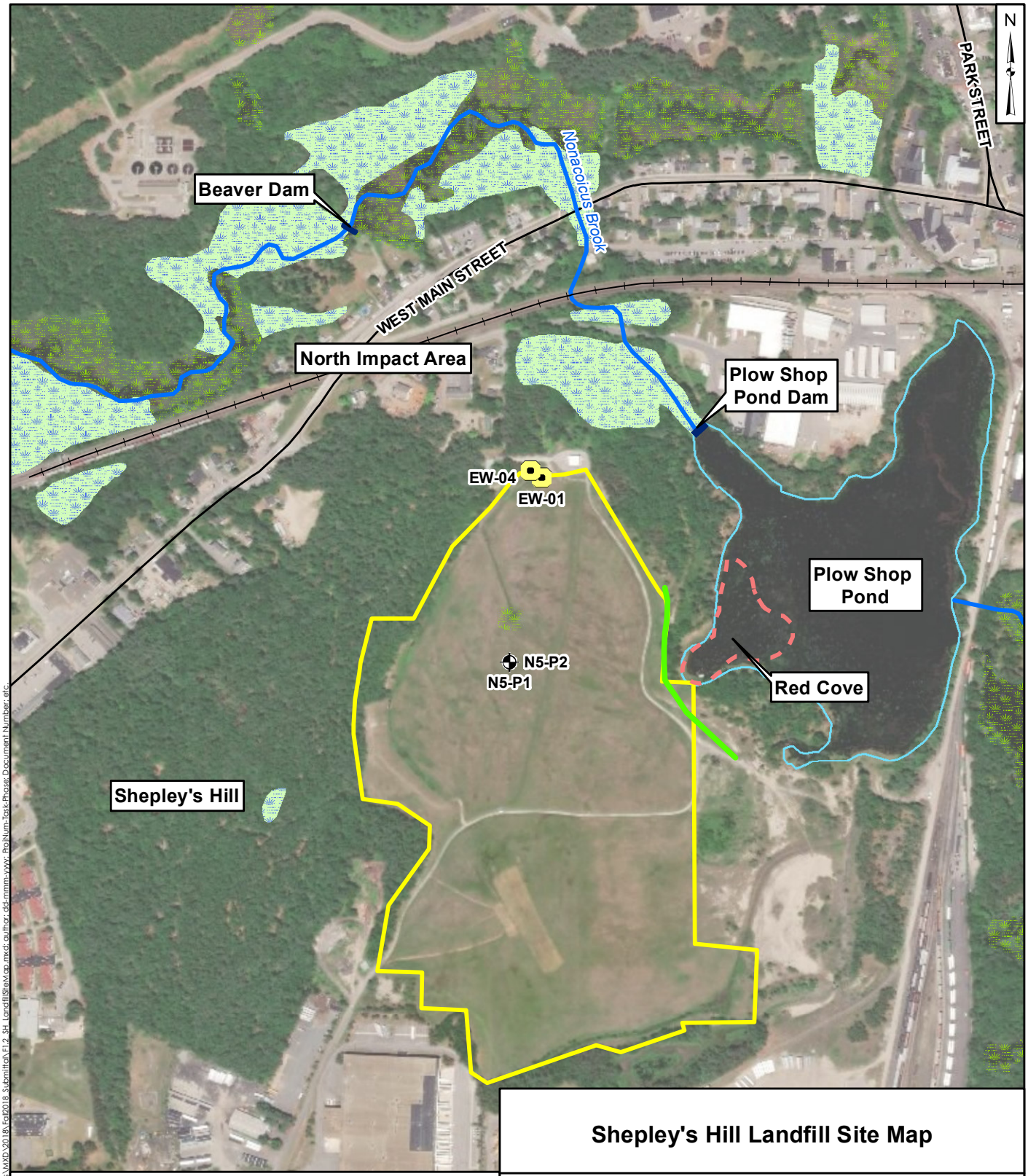


**Legend**

- Shepley's Hill Landfill
- Dam
- Red Cove
- Barrier Wall
- Marsh/Bog
- Wooded Marsh
- Waterbody
- Nonacoicus Brook
- Major Roads
- Railroad Tracks

Notes:
- Marsh/bog, wooded marsh, waterbody, Nonacoicous Brook, and major roads obtained from MassGIS.
- Imagery obtained from ESRI.

# Shepley's Hill Landfill Site Map

Shepley's Hill Landfill Groundwater Model

Former Fort Devens Army Installation
Devens, Massachusetts

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Acton, MA | January 2019

Figure 1.2

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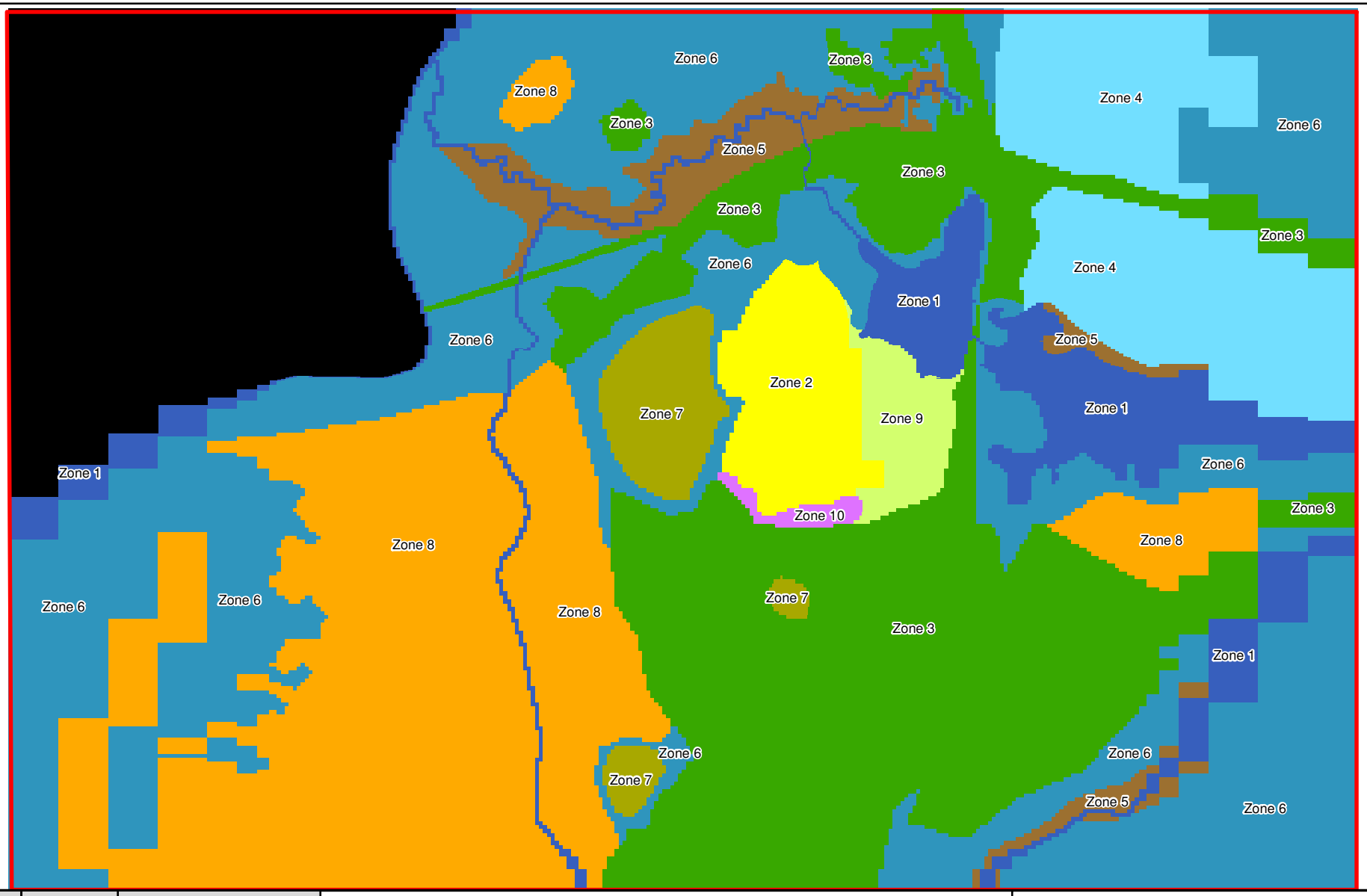


| Recharge Zone Number | Percent Total Precipitation | Description |
|---|---|---|
| 1 | 0% | Surface Water |
| 2 | 0.01% | Landfill Cap |
| 3 | 32% | Dense Commercial |
| 4 | 35% | Residential |
| 5 | 25% | Non-forested Wetland |
| 6 | 36% | Forest/Forested Wetland |
| 7 | 64% | Forested Bedrock Outcrop |
| 8 | 32% | Light Commercial/Open Land |
| 9 | 55% | Open Land [1] |
| 10 | 165% | Recharge Basin Area [2] |

**Legend**

Model Boundary

No Flow

**Recharge Zone**

Zone 1, Zone 2, Zone 3, Zone 4, Zone 5, Zone 6, Zone 7, Zone 8, Zone 9, Zone 10

Notes:
1. Assumed Landfill runoff diversion pathway.
2. Assumed runoff from landfill/commercial.

0 2,000 Feet

# 2016 Model Recharge Zonation

Shepley's Hill Landfill Groundwater Model

Former Fort Devens Army Installation
Devens, Massachusetts

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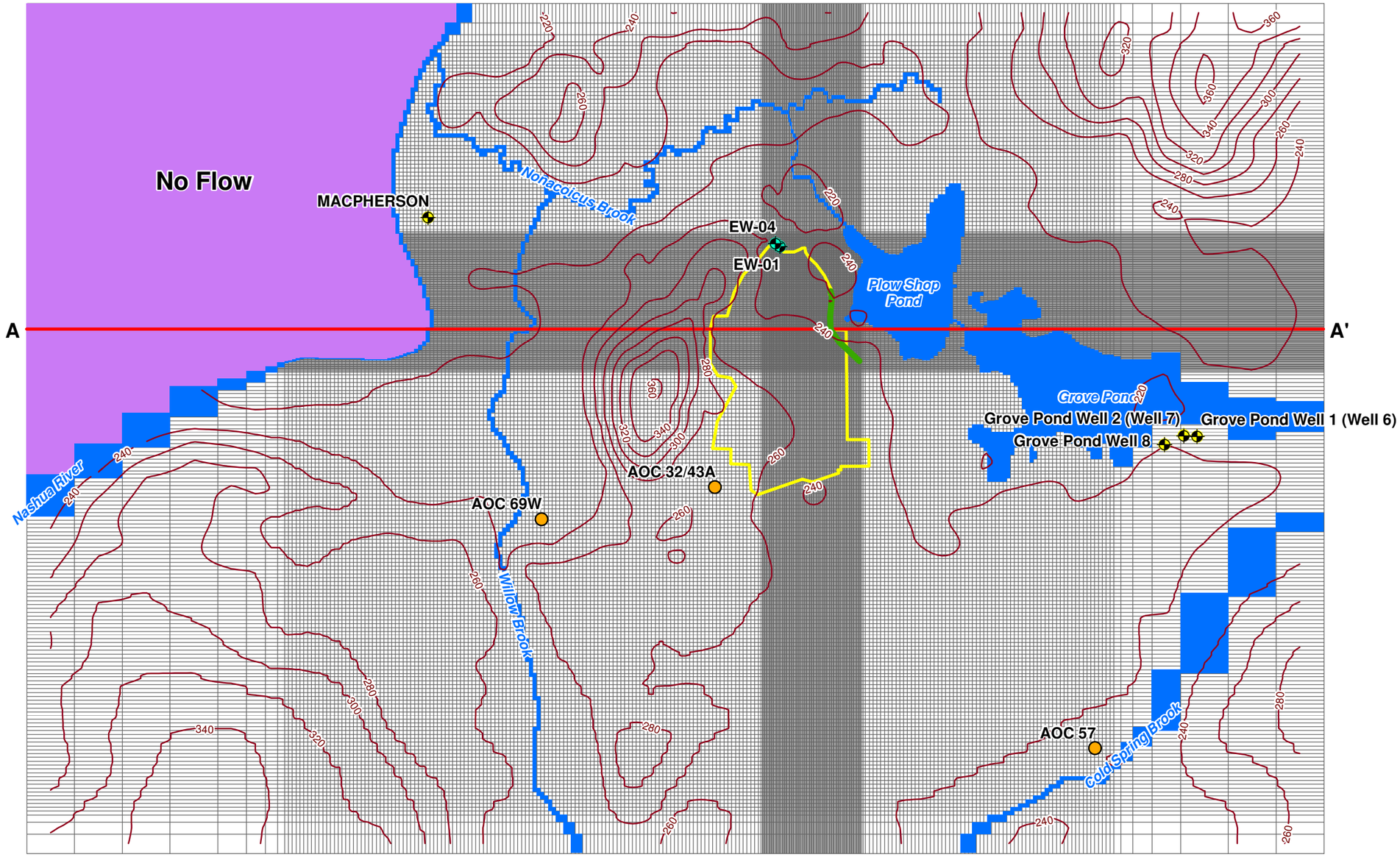
Acton, MA | August 2019

Figure 4.1

Document Path: Q:\GISProjects\BR0302_FtDevens\MXD\2018\Fall2018_Submittal\F4.1_Model_Recharge_Zonation.mxd




**Legend**

- AOC Location
- ATP Extraction Wells
- Municipal Supply Wells
- Model Ground Surface Elevation (ft)
- Shepley's Hill Landfill
- Section A-A'
- Barrier Wall
- Model Grid
- No Flow
- River Node Cells

1,000 500 0 1,000 Feet

Notes:
1. Refined model grid cell resolution = 10 ft by 10 ft.
2. Coarse model grid cell resolution = 500 ft by 200 ft.
3. AOC = Area of Contamination.
4. Section A-A' is shown on Figure 5.4.

**Model Extent, Grid, and Boundary Conditions**

Shepley's Hill Landfill Groundwater Model

Former Fort Devens Army Installation
Devens, Massachusetts

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Figure **5.1**

G:\GIS\Projects\WR0302_FtDevens\MXD\2018\Feb\2018_6\grmillett\F5-1_Model Extent Grid.mxd author dfs mmm,yyyy Position Tool Phase Document Number etc.

N

650 325 0 650 Feet

**Legend**

- Overburden Monitoring Well/Piezometer
- Monitoring Well - Destroyed
- Groundwater Profiling Location/Monitoring Well
- 240.7 Observed Bedrock Elevation (ft NAVD88)
- 16.5 Lidar elevation at inferred outcrop minus model bedrock elevation
- Groundwater Profiling Location
- Bedrock Monitoring Well
- Bedrock Study Core
- Extraction Well
- Soil Boring
- 2007 EPA Wells - Installed
- Bedrock Outcrop or Area of Shallow Bedrock (within 3 meters of surface) (Kopera, 2008)
- Barrier Wall
- Waterbody
- Approximate Extent of Historic Wetlands
- Wetlands
- Model Bedrock Elevation (ft NAVD88)
- Outcrop (Location of Strike and Dip of Foliation from Kopera 2008)

# Model Bedrock Surface Elevations

Shepley's Hill Landfill Groundwater Model

Former Fort Devens Army Installation
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Figure 5.2

G:\GISProjects\BR0302_Hillevens\MXD_2018\Fig2018_SubmittalV5.2_Model\BR_Elevation.mxd author: dd-mmm-yyyy ProjNum Task Phase, Document Number etc.

SHM-10-04 (20)
SHM-13-06 (0)
SHM-13-04 (2)
SB-2016-21 (0)
SB-2016-14 (0)
SHM-13-08 (3)
SHM-13-03 (3)
SHM-05-40X (0)
SB-2016-15 (0)
SHM-10-03 (2)
SHM-10-10 (9.5)
SHM-07-05 (0)
SB-2016-19 (0)
SHM-13-02 (0)
SHM-10-02 (0)
SHM-10-01 (10)
SB-2016-13 (0)
SHM-10-08 (7.5)
SHM-07-03 (0)
SHM-10-09 (22)
SB-2016-20 (2)
SHP-2016-2A (3)
SHM-13-01 (2)
SHP-2016-4A (10)
SHP-2016-5B (5)
EW-04 (12)
SHP-2016-1A (1)
SHP-2016-06A (2)
SB-2016-06 (2)
SB-2016-07 (6)
SB-2016-08 (1)
27-30B-1 (0)
SHM-10-14 (10)
CAP-1B (0)
27-1 (0)
20-2 (0)
SHP-99-29X (3.5)
Q5-1 (0)
Q4-1 (0)
Q4-2 (0)
CAP-2B (0)
3-2 (0)
SHP-2016-07A (0)
SHL-14 (0)
SHP-99-01C (0)
SHL-1 (9.7)
CAP-4 (0)
CH-1D (4.31)
CH-1S (4.38)
CAP-3 (0)
3A-2 (0)
SHL-15 (>5.0)
32Z-01-07XOB (>13.2)
SHL-16 (>4.0)
32Z-01-11XBR (0)
32Z-01-08XOB (>5.5)
32M-01-13XBR (2.5)
32Z-01-12XBR (10)
32M-01-18XBR (1.5)
32Z-01-10XBR (0)
32Z-01-04X (0)
SB-2016-09 (2)
SB-2016-10 (3)
EW-01 (6)
SHM-10-13 (4)
SHM-10-15 (5)
SHM-10-07 (6.5)
SHM-10-12 (12.5)
SHP-99-35X (0)
N6-P1 (9)
SHB-99-30X (0)
SHM-10-11 (2)
32Z-01-06XBR (4.2)
N7-P2 (2)
32M-01-14XOB (> 5.4)
Former Well SHL-2 (0)
SHL-25 (>6.0)
32M-01-17XBR (4)
32M-01-15XBR (0)
32M-01-16XBR (1.2)
SHM-13-05 (2)
SHM-10-05A (0)
SB-2016-16 (1)
SHM-05-39A (0)
SHM-99-31A (23)
SB-2016-18 (9)
SHM-99-32X (4)
SB-2016-17 (3)
SHM-05-41A (10)
SHP-2016-2B (3)
SHP-2016-3B (2.5)
SHL-22 (30)
SHL-5 (0)
SHM-96-5B (23.5)
N1-P1 (2.5)
SHM-10-06A (0)
SHM-10-06 (0)
SB-2016-12 (0.5)
SB-2016-11 (4)
SHM-11-06 (0)
SHM-12-05 (11)
SHM-11-01 (6.2)
SHM-11-04 (0)
N2-P2 (0)
N5-P1 (3.5)
SHM-12-04 (3)
N3-P2 (0)
SHL-4 (1.7)
SHM-93-10C (0)
N4-P3 (0)
SHL-3 (0)
SHM-93-18B (0)
SHM-12-01 (1)
PZ-12-09 (0)
SHM-93-01A (0)
SHM-11-03 (0)
SHM-11-05 (2.5)
SHM-11-08 (1)
SHM-11-02 (4.5)
SHM-12-06 (2)
SHM-12-02 (11.5)
SHM-11-07 (1)
SHL-24 (0)
PARK STREET
PARK STREET
MAIN STREET
WEST MAIN STREET
N

500 250 0 500 Feet

**Legend**

- Overburden Monitoring Well/Piezometer
- Monitoring Well - Destroyed
- Groundwater Profiling Location/Monitoring Well
- Groundwater Profiling Location
- Bedrock Monitoring Well
- Bedrock Study Core
- Extraction Well
- Soil Boring

(4.5) Till Thickness from boring log (feet)
(23.5) Till thickness inferred from drilling rig observations
Water Features
Major Roads
Barrier Wall
Shepley's Hill Landfill

**Model Till Thickness (feet)**
2
4
6
8
10
15
20
25

Notes:
1. Model till thickness represents the bedrock topography (bottom of layer 4) subtracted from the bottom of the overburden sands represented with layer 3.
2. Till thicknesses from inventoried boring logs are posted for comparison. Till thicknesses represented with a ">" indicate that the bottom of till was not identified in the boring log.

# Model Till Thickness

Shepley's Hill Landfill Groundwater Model

Former Fort Devens Army Installation
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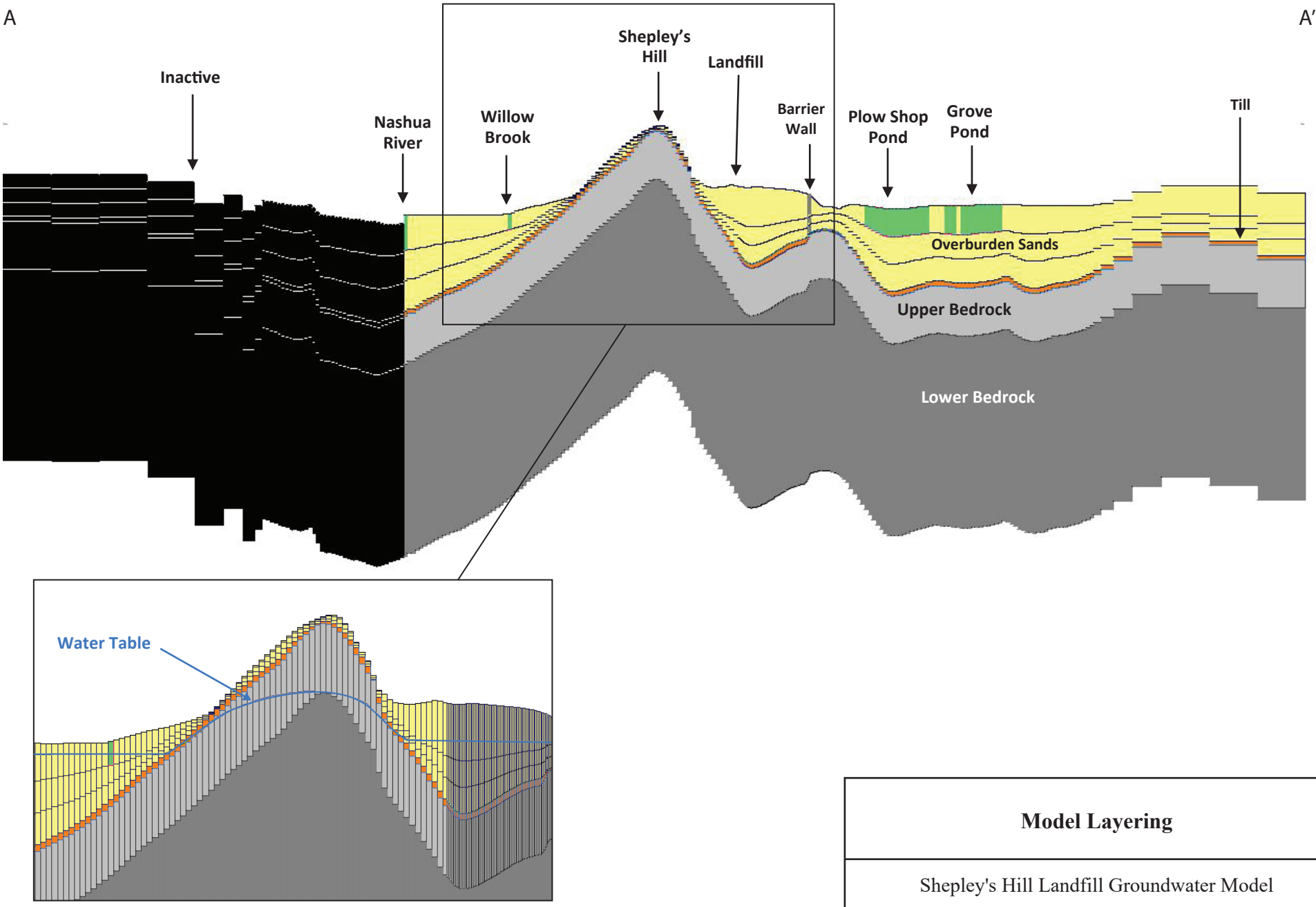
Figure 5.3

Document Path: Q:\GISProjects\BR0302_FtDevens\MXD\2018\Fall2018_Submittal\F5.3_Model Till Thickness.mxd




Notes:

1. East-West Cross Section through Shepley's Hill Landfill along model row 155.
2. Vertical exaggeration = 10x.
3. Water table from SHL300T2a R88PEST, SP18.
4. See Figure 5.1 for transect location.

**Model Layering**

Shepley's Hill Landfill Groundwater Model

Former Fort Devens Army Installation
Devens, Massachusetts

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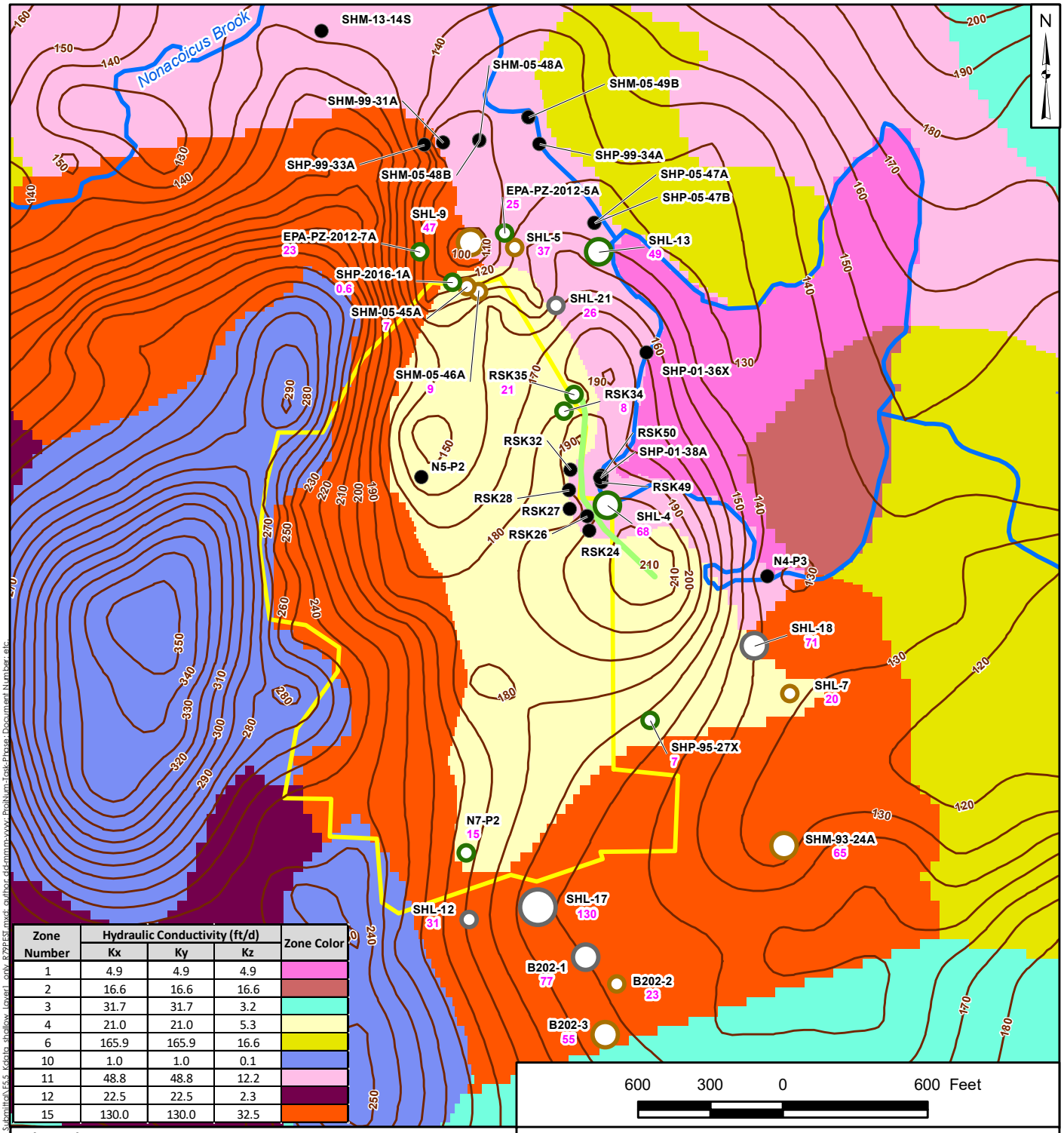
Figure **5.4**




| Zone Number | Hydraulic Conductivity (ft/d) Kx | Ky | Kz | Zone Color |
|---|---|---|---|---|
| 1 | 4.9 | 4.9 | 4.9 | |
| 2 | 16.6 | 16.6 | 16.6 | |
| 3 | 31.7 | 31.7 | 3.2 | |
| 4 | 21.0 | 21.0 | 5.3 | |
| 6 | 165.9 | 165.9 | 16.6 | |
| 10 | 1.0 | 1.0 | 0.1 | |
| 11 | 48.8 | 48.8 | 12.2 | |
| 12 | 22.5 | 22.5 | 2.3 | |
| 15 | 130.0 | 130.0 | 32.5 | |

**Legend**

- Monitoring Wells
- Shepley's Hill Landfill
- Model Bedrock Elevation (ft NAVD88)
- Barrier Wall
- Surface Water
- 36 Hydraulic Conductivity (ft/day)
- < 40 ft/day
- 40 - 80 ft/day
- > 80 ft/day
- Brown Sand*
- Gray Sand*
- Hydraulic Conductivity Data Received on 12/08/2017

* Lithology interpreted from boring logs or data from adjacent borings with available boring logs.
- Brown vs. Gray interpretation is based on a broad range of sample descriptions evident in boring logs recorded by multiple inspectors.

# Hydraulic Conductivity Data and Final Model Zonation for Layer 1

Shepley's Hill Landfill Groundwater Model

Former Fort Devens Army Installation
Devens, Massachusetts

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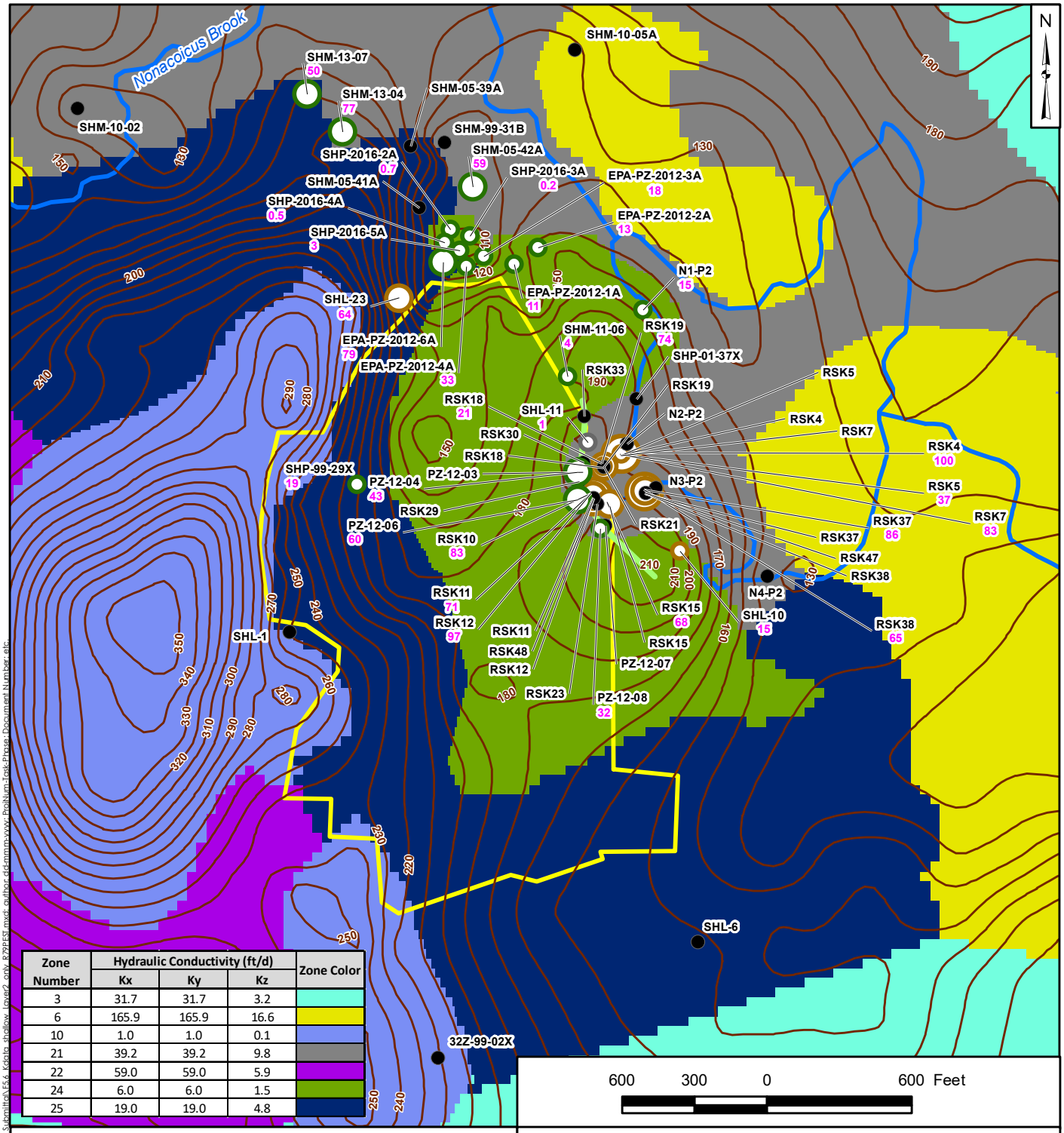
Figure 5.5

(Q:\ = \\boston01\GIS$\) Q:\GIS\Projects\BR0302_FtDevens\MXD\2018\Fall2018_Submittal\Fall2018_Submittal_Figure5.5_Kdistn_shallow_layer1_only_R79PEST.mxd; author.dd-mmm-yyyy; ProjNum-Task-Phase-Document Number, etc.




| Zone Number | Hydraulic Conductivity (ft/d) | | | Zone Color |
|---|---|---|---|---|
| | Kx | Ky | Kz | |
| 3 | 31.7 | 31.7 | 3.2 | |
| 6 | 165.9 | 165.9 | 16.6 | |
| 10 | 1.0 | 1.0 | 0.1 | |
| 21 | 39.2 | 39.2 | 9.8 | |
| 22 | 59.0 | 59.0 | 5.9 | |
| 24 | 6.0 | 6.0 | 1.5 | |
| 25 | 19.0 | 19.0 | 4.8 | |

**Legend**

- Monitoring Wells
- Shepley's Hill Landfill
- Model Bedrock Elevation (ft NAVD88)
- Barrier Wall
- Surface Water
- 36 Hydraulic Conductivity (ft/day)
  - < 40 ft/day
  - 40 - 80 ft/day
  - > 80 ft/day
- Brown Sand*
- Gray Sand*
- Hydraulic Conductivity Data Received on 12/08/2017

* Lithology interpreted from boring logs or data from adjacent borings with available boring logs.
- Brown vs. Gray interpretation is based on a broad range of sample descriptions evident in boring logs recorded by multiple inspectors.

# Hydraulic Conductivity Data and Final Model Zonation for Layer 2

Shepley's Hill Landfill Groundwater Model

Former Fort Devens Army Installation
Devens, Massachusetts

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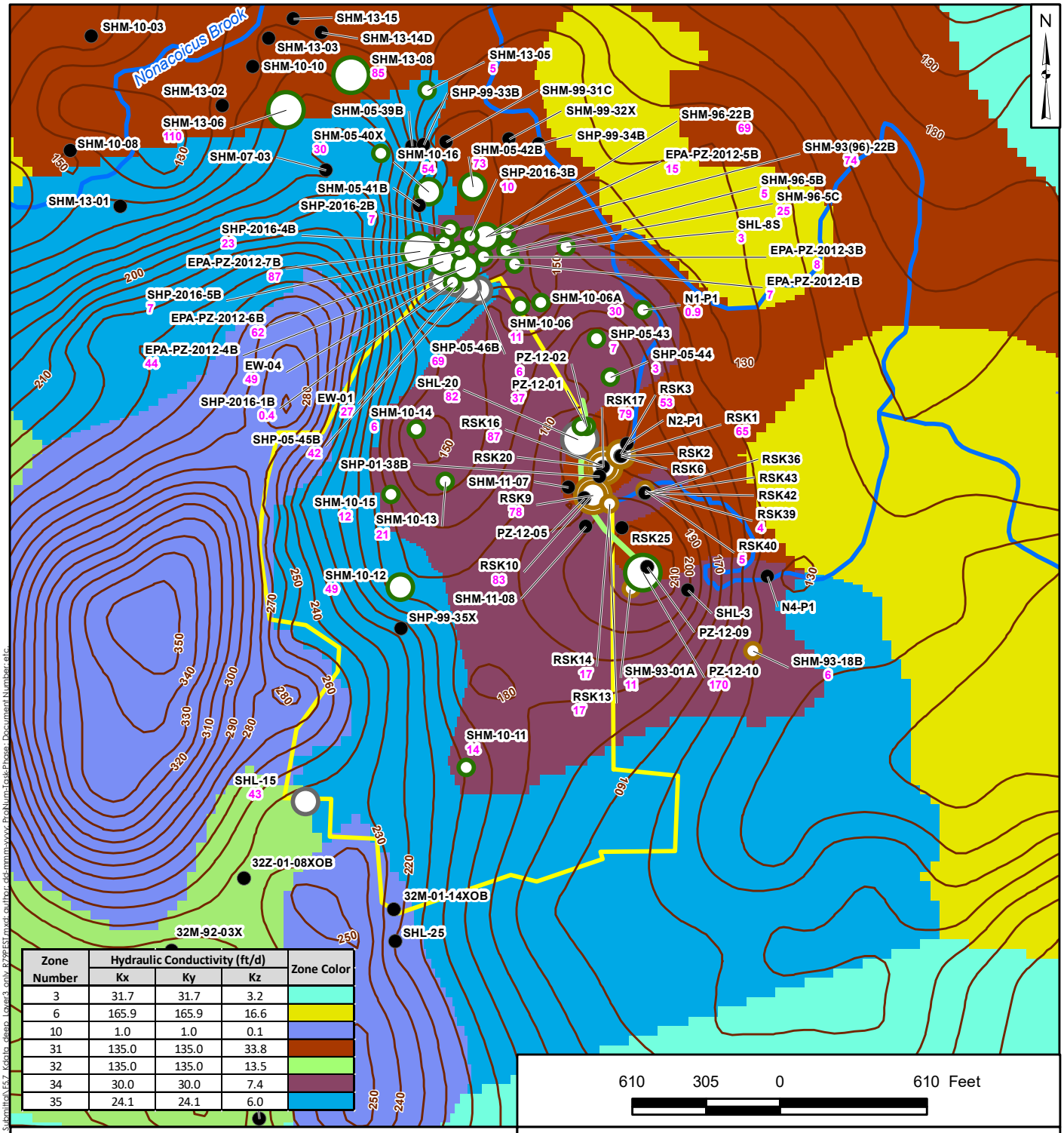
Figure 5.6

(O:\ = \\boston-01\GIS$\) G:\GIS\Projects\BR0302_FtDevens\MXD\2018\Submittal\F5-6_Kzone_shallow_layer2_only_R79PEST.mxd; author.dd-mmm-yyyy; ProjNum-Task-Phase; Document Number, etc.




| Zone Number | Hydraulic Conductivity (ft/d) | | | Zone Color |
|---|---|---|---|---|
| | Kx | Ky | Kz | |
| 3 | 31.7 | 31.7 | 3.2 | |
| 6 | 165.9 | 165.9 | 16.6 | |
| 10 | 1.0 | 1.0 | 0.1 | |
| 31 | 135.0 | 135.0 | 33.8 | |
| 32 | 135.0 | 135.0 | 13.5 | |
| 34 | 30.0 | 30.0 | 7.4 | |
| 35 | 24.1 | 24.1 | 6.0 | |

**Legend**

- Monitoring Wells
- Shepley's Hill Landfill
- Model Bedrock Elevation (ft NAVD88)
- Barrier Wall
- Surface Water
- 36 Hydraulic Conductivity (ft/day)
  - < 40 ft/day
  - 40 - 80 ft/day
  - > 80 ft/day
- Brown Sand*
- Partially Till*
- Gray Sand*
- Hydraulic Conductivity Data Received on 12/08/2017

* Lithology interpreted from boring logs or data from adjacent borings with available boring logs.
- Brown vs. Gray interpretation is based on a broad range of sample descriptions evident in boring logs recorded by multiple inspectors.

# Hydraulic Conductivity Data and Final Model Zonation for Layer 3

Shepley's Hill Landfill Groundwater Model

Former Fort Devens Army Installation
Devens, Massachusetts

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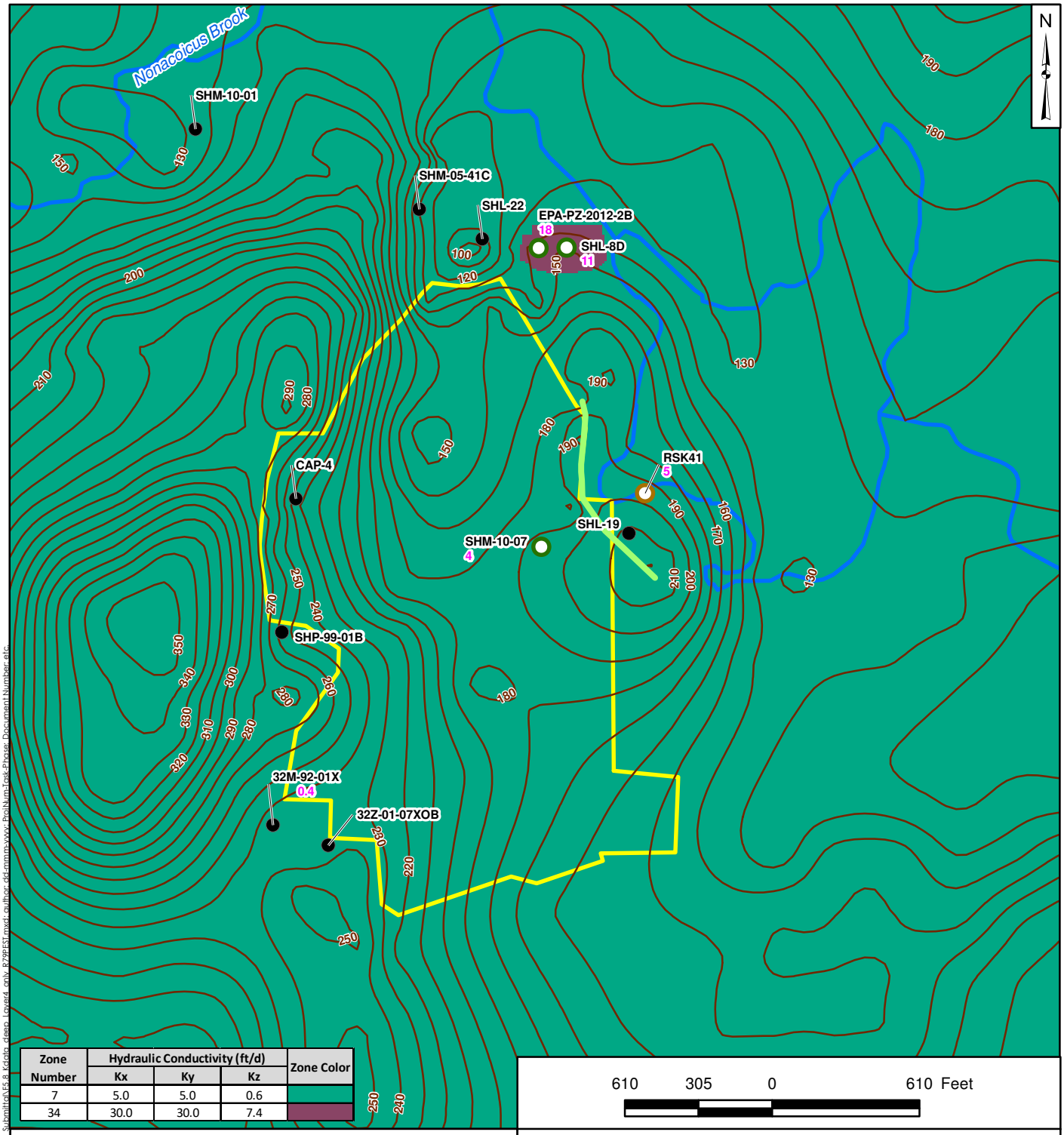
Figure 5.7

(Q:\ = \\boston01\GIS$\) Q:\GIS\Projects\BR0302_FtDevens\MXD\2018\Fcst2018_Submittal\Fig5.7_Kdistn_deep_Layer3_only_B79PEST.mxd; author: dds-mmm-yyyy; ProNum=Task-Phase; Document Number: etc.




| Zone Number | Hydraulic Conductivity (ft/d) | | | Zone Color |
|---|---|---|---|---|
| | Kx | Ky | Kz | |
| 7 | 5.0 | 5.0 | 0.6 | |
| 34 | 30.0 | 30.0 | 7.4 | |

**Legend**

- Monitoring Wells
- Shepley's Hill Landfill
- Model Bedrock Elevation (ft NAVD88)
- Barrier Wall
- Surface Water
- 36 Hydraulic Conductivity (ft/day)
  - < 40 ft/day
  - 40 - 80 ft/day
  - > 80 ft/day
- Brown Sand*
- Gray Sand*
- Hydraulic Conductivity Data Received on 12/08/2017

* Lithology interpreted from boring logs or data from adjacent borings with available boring logs.
- Brown vs. Gray interpretation is based on a broad range of sample descriptions evident in boring logs recorded by multiple inspectors.

# Hydraulic Conductivity Data and Final Model Zonation for Layer 4

Shepley's Hill Landfill Groundwater Model

Former Fort Devens Army Installation
Devens, Massachusetts

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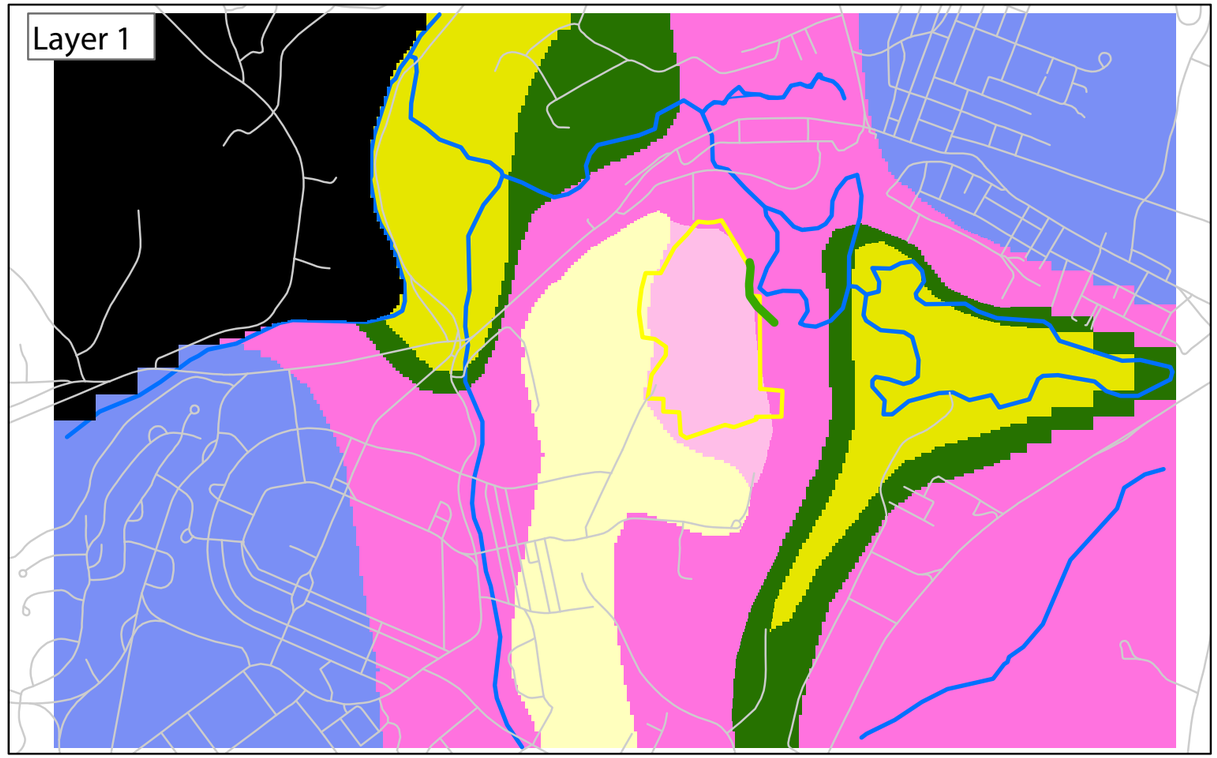
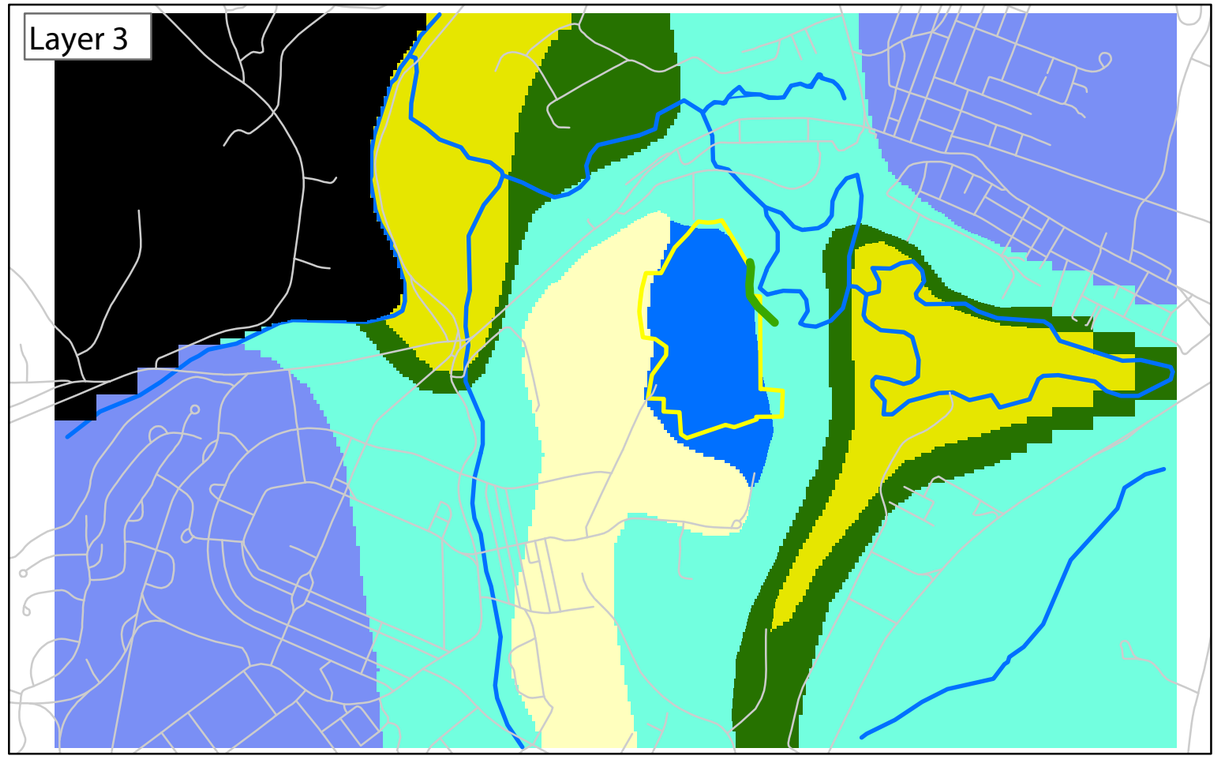
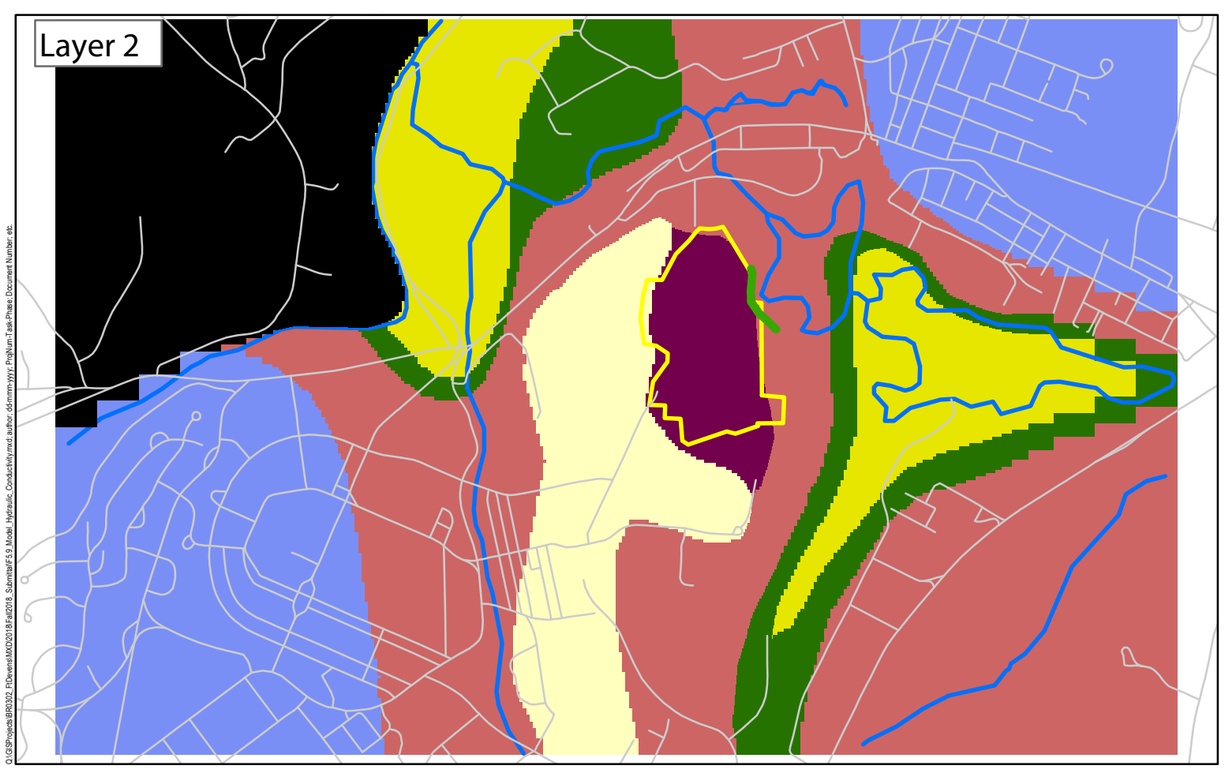
Figure **5.8**

(Q:\\ = \\boston-01\GIS$\) Q:\GISProjects\BR0302_FtDevens\MXD\2018\Fall2018_Submittal\LF5.8_Kzlofg_deep_Layer4_only_R79PEST.mxd; author: dd-mmm-yyyy; BrolNum-Trek-Phase; Document Number; etc.




| Zone Number | Geologic Unit | Hydraulic Conductivity (ft/d) | | Zone Color |
|---|---|---|---|---|
| | | Kxy | Kz | |
| 1 | Overburden Sand - Layer 1 | 35.10 | 3.51 | |
| 2 | Overburden Sand - Layer 2 | 55.08 | 5.51 | |
| 3 | Overburden Sand - Layer 3 | 72.10 | 7.21 | |
| 4 | Overburden Sand in higher Bedrock Elevations - Layers 1 to 3 | 91.85 | 9.18 | |
| 5 | Deep Valley Sand and Gravel - Layers 1 to 3 | 11.13 | 1.11 | |
| 6 | Deep Valley Sand and Gravel - Layers 1 to 3 | 300.00 | 30.00 | |
| 10 | Overburden Sand in higher Bedrock Elevations - Layers 1 to 3 | 35.00 | 3.50 | |
| 11 | Overburden Sand Below Landfill Cap - Layer 1 | 5.63 | 0.56 | |
| 12 | Overburden Sand Below Landfill Cap - Layer 2 | 5.15 | 0.51 | |
| 13 | Overburden Sand Below Landfill Cap - Layer 3 | 80.33 | 8.03 | |

Legend

- Shepley's Hill Landfill
- Barrier Wall
- Roads
- Surface Water

2,000 1,000 0 2,000 Feet

Notes:

1. Kxy = horizontal hydraulic conductivity in x and y direction.
2. Kz = vertical hydraulic conductivity in z direction.
3. Uniform zonation in layers 4,5, and 6 (not shown) corresponds to Zones 7,8, and 9 which represent till, shallow bedrock, and deep bedrock, respectively.
4. Zonation shown is for 2016 model versions SHL300T1 and SHL300T2.

**Final Model Hydraulic Conductivity Zonation Values for October 2016 Model**

Shepley's Hill Landfill Groundwater Model

Former Fort Devens Army Installation
Devens, Massachusetts

Geosyntec consultants

Acton, MA | May 2020

Figure 5.9

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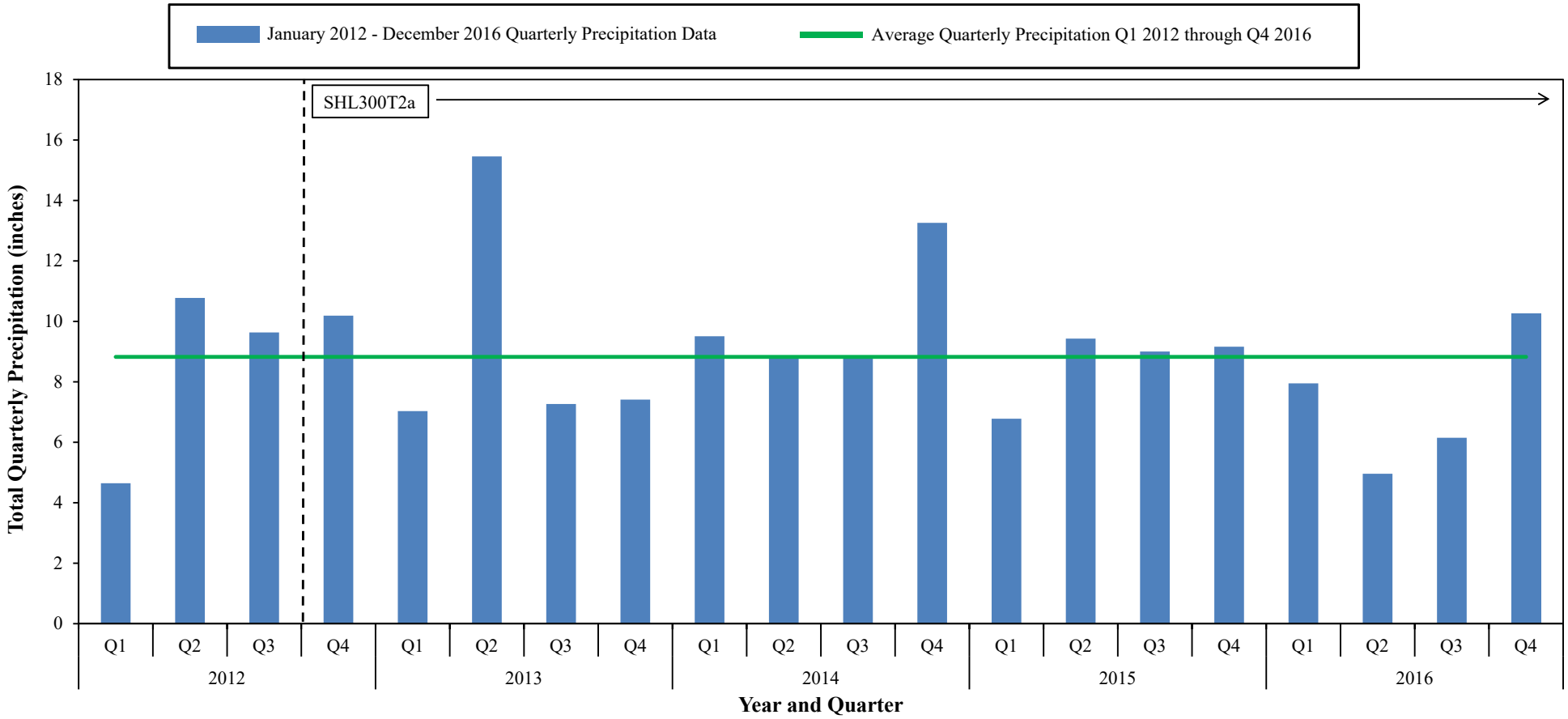



Notes:

1. Total quarterly precipitation data from Fitchburg Municipal Airport, Fitchburg, Massachusetts. (GHCND: USW00004780). Supplementary data during Q3 and Q4 2016 were downloaded from a meteorological station in Ayer, Massachussetts (GHCND: US1MAMD0025) to address gaps in recorded data at Fitchburg Municipal Airport (September 8 to 30, 2016 and October 21, 2016).
2. Average quarterly precipitation (8.83 inches) is an arithmetic mean of total quarterly precipitation from Q1 2012 through Q4 2016.

**Quarterly Precipitation Data Used for Model Input**

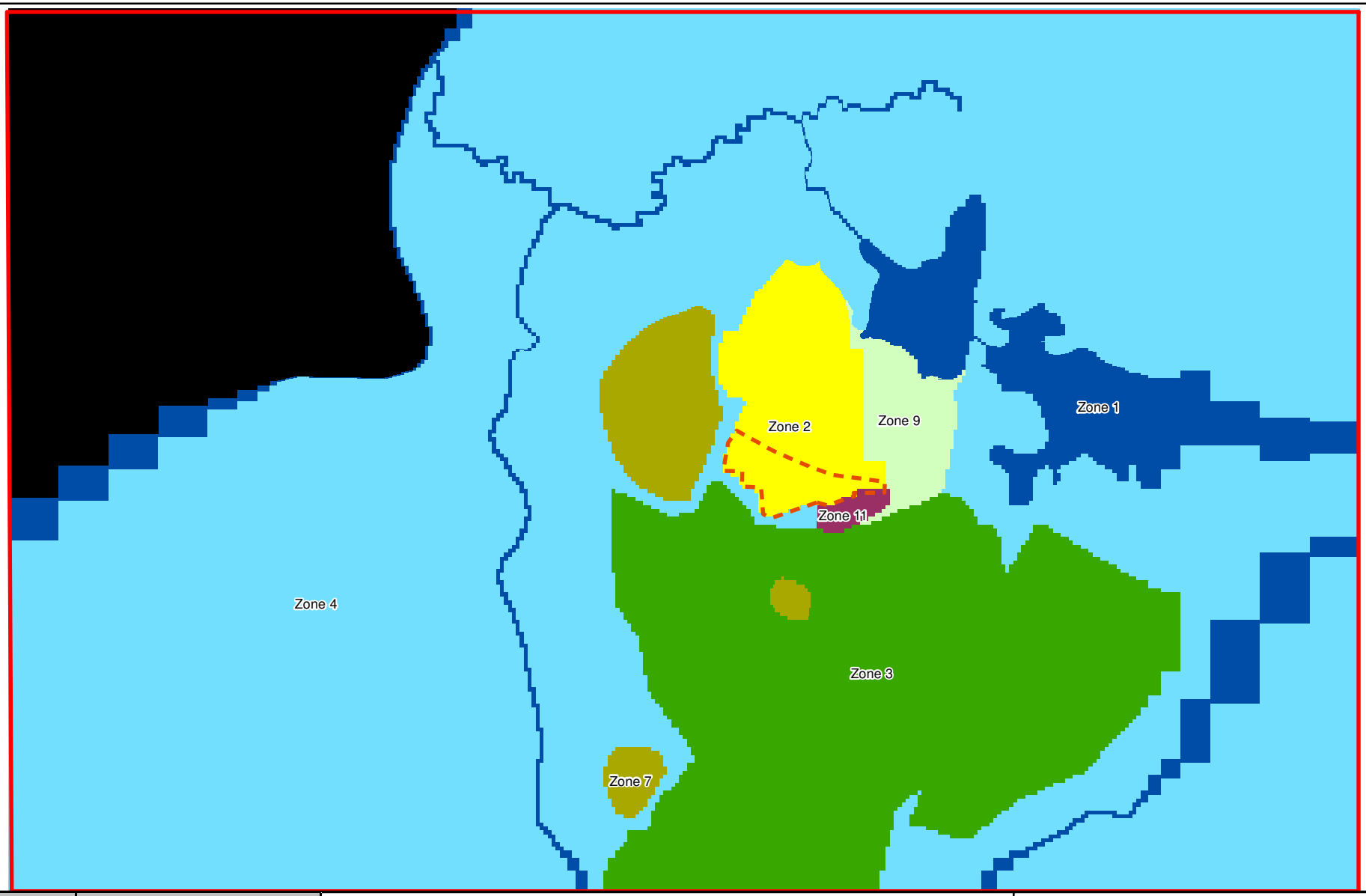
Shepley's Hill Landfill Groundwater Model

Former Fort Devens Army Installation
Devens, Massachusetts

Geosyntec consultants

Acton, MA | January 2019

Figure **6.1**




| Recharge Zone Number | Percent Total Precipitation | Description |
|---|---|---|
| 1 | 0% | Surface Water |
| 2 | 6% | Landfill Cap |
| 3 | 32% | Commercial, densely developed |
| 4 | 42% | Residential |
| 5 | NA [3,4] | Non-forested wetland |
| 6 | NA [3,4] | Forest, forested wetland |
| 7 | 42% | Forested bedrock outcrop |
| 8 | NA [3,4] | Lightly developed commercial, openland |
| 9 | 75% | Other, landfill SW drainage [1] |
| 10 | NA [3,5] | Recharge basin area |
| 11 | 800% | Recharge basin area [2] |

**Legend**

Model Boundary

No Flow

**Recharge Zone**

Zone 1, Zone 2, Zone 3, Zone 4, Zone 7, Zone 9, Zone 11

Estimated Zone 11 drainage area

1,000 0 1,000 Feet

Notes:
1. Assumed landfill runoff diversion pathway.
2. Assumed runoff from landfill/commercial.
3. Recharge zone specified in the October 2016 Model (depicted on Figure 4.1).
4. Revised to Zone 4.
5. Revised to zones 4, 9, and 11.
6. Model version SHL300T2a R88PEST SP2 through 18, November 2018. Zone 11 has a reduced area in steady-state SP1.

# Final Model Recharge Zonation

Shepley's Hill Landfill Groundwater Model

Former Fort Devens Army Installation
Devens, Massachusetts

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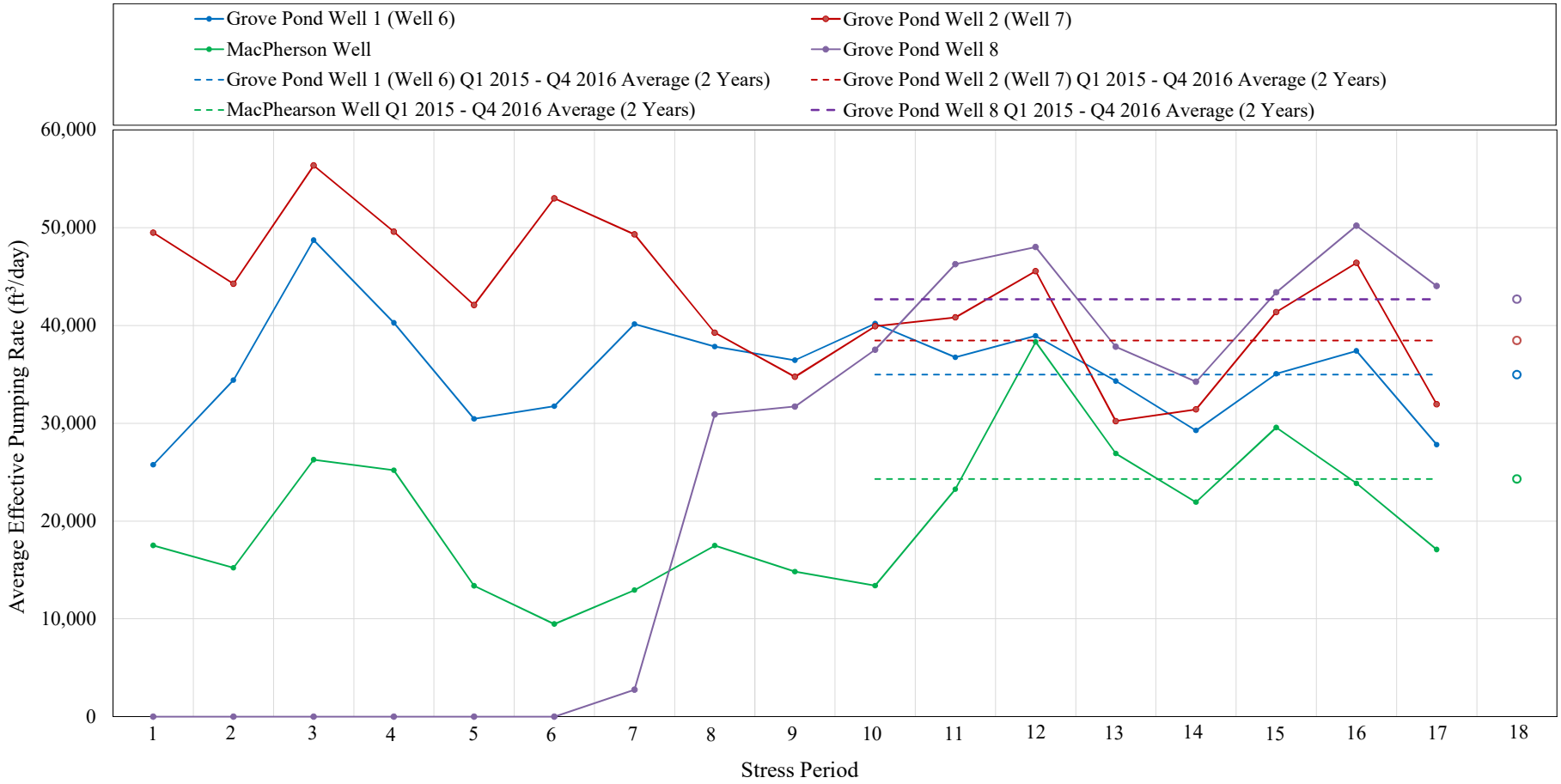
Acton, MA | August 2019

Figure 6.2

Document Path: Q:\GISProjects\BR0302_FtDevens\MXD\2018\Fall2018_Submittal\F6.2_Model_Recharge_Zonation.mxd




Notes:

1. Model pumping rates in stress period18 (depicted by open circles) are the average reported value for the previous two years (Q1 2015 through Q4 2016).
2. Municipal well locations are shown on Figure 1.2.
3. Municipal well pumping data was compiled from Massachusetts Department of Environmental Protection (Mass DEP) Public Water System Annual Static Reports (PWS ASRs) for PWS IDs 2019000 and 2019001.
4. The average effective pumping rates for each quarter were estimated by dividing the total volume pumped in the three months within each quarter by the total number of days in the quarter.
5. Grove Pond Wells 1 and 2 were replaced by Wells 6 and 7, respectively in June 2014. Grove Pond Wells 1 and 2 were taken offline on June 10, 2014 as pumping commenced in Wells 6 and 7. June 2014 flow rates are additive (e.g. Grove Pond Well 1 June 2014 average flow rate was estimated from total volume pumped by Grove Pond Well 1 and Well 6).

**Model Pumping Rates for Municipal Wells**

Shepley's Hill Landfill Groundwater Model

Former Fort Devens Army Installation
Devens, Massachusetts

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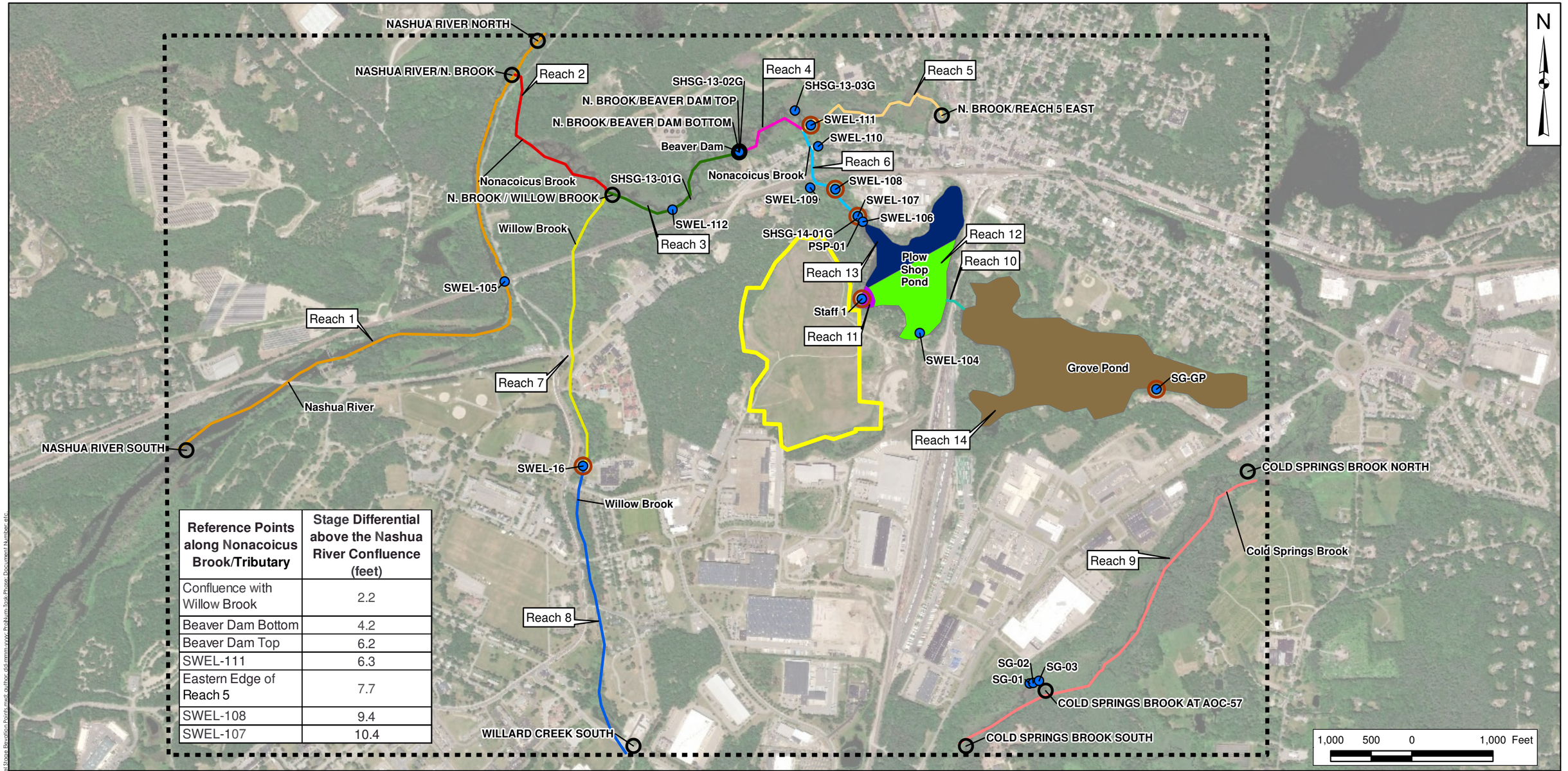
Figure **6.3**




| Reference Points along Nonacoicus Brook/Tributary | Stage Differential above the Nashua River Confluence (feet) |
|---|---|
| Confluence with Willow Brook | 2.2 |
| Beaver Dam Bottom | 4.2 |
| Beaver Dam Top | 6.2 |
| SWEL-111 | 6.3 |
| Eastern Edge of Reach 5 | 7.7 |
| SWEL-108 | 9.4 |
| SWEL-107 | 10.4 |

**Legend**

- Shepley's Hill Landfill
- Estimated Model Stage Elevation Point
- Historical and Existing Stream Gaging Location
- Historical and Existing Stream Gaging Location / Model Stage Elevation Point
- Model Domain

Note:
- PSP = Plow Shop Pond.

| Surface Water | Reach | Color | Surface Water | Reach | Color |
|---|---|---|---|---|---|
| Nashua River | 1 | | Upper Willow Brook | 8 | |
| Nonacoicus Brook | 2 | | Cold Spring Brook | 9 | |
| Nonacoicus Brook | 3 | | PSP/Grove Pond Connector | 10 | |
| Nonacoicus Brook | 4 | | Plow Shop Pond (Red Cove) | 11 | |
| Nonacoicus Brook | 5 | | Plow Shop Pond | 12 | |
| Tributary from PSP | 6 | | Plow Shop Pond | 13 | |
| Lower Willow Brook | 7 | | Grove Pond | 14 | |

**Surface Water Stage Points and Model Reach Designations**

Shepley's Hill Landfill Groundwater Model

Former Fort Devens Army Installation
Devens, Massachusetts

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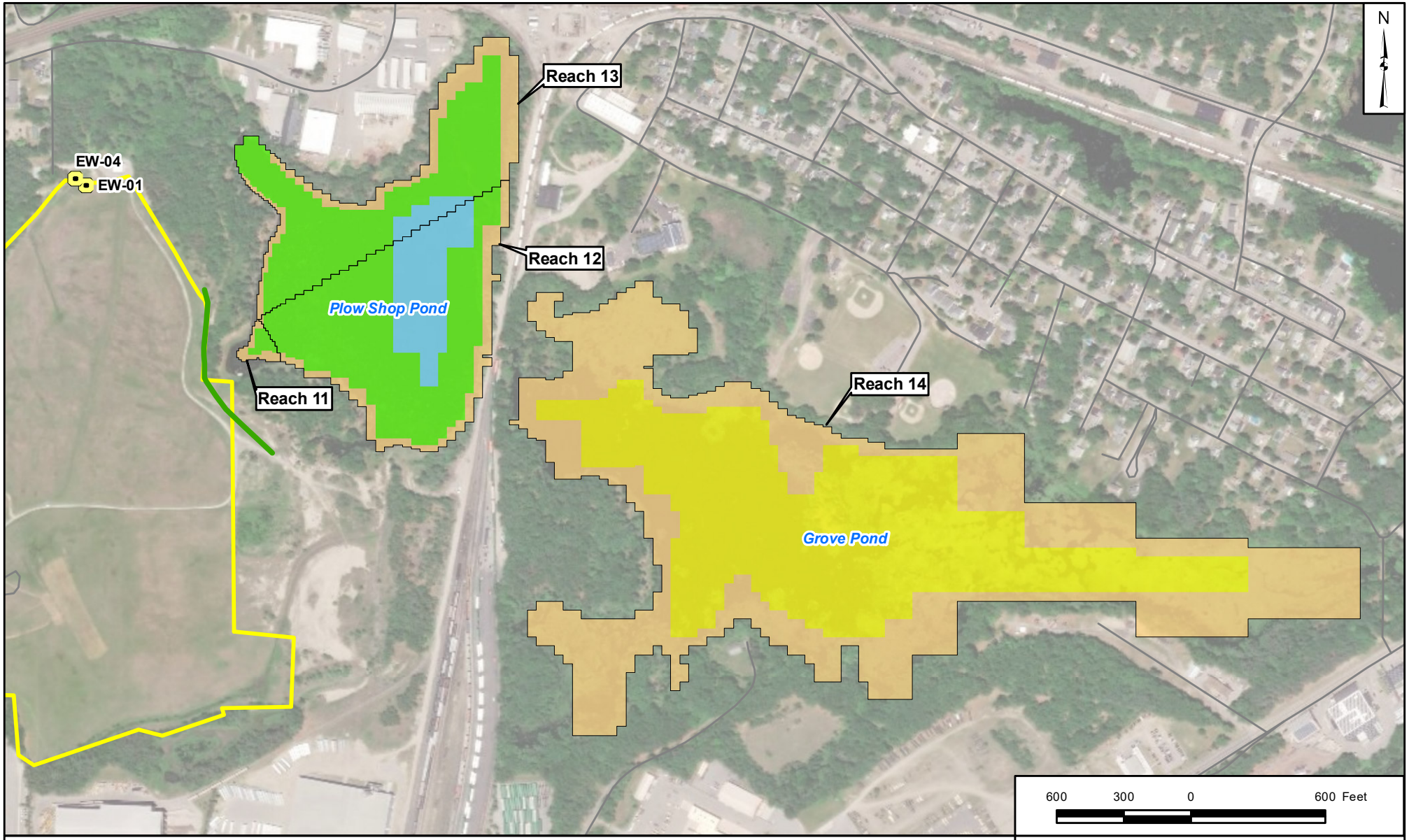
Acton, MA | January 2019

Figure 6.4

Q:\GIS\Projects\MB0302_FtDevens\MXD\2018\Sept2018_Submittal\6.4_XY Model Stage Elevation Points mxd author dfrimm www.PrtNm_brief Phase Document Number etc.




**Legend**

- Extraction well
- Shepley's Hill Landfill
- Barrier Wall

**Model Sediment Thickness (ft)**

- 1.64
- 4.92
- 8.2
- 16.4

# Model Sediment Thickness in Plow Shop Pond and Grove Pond

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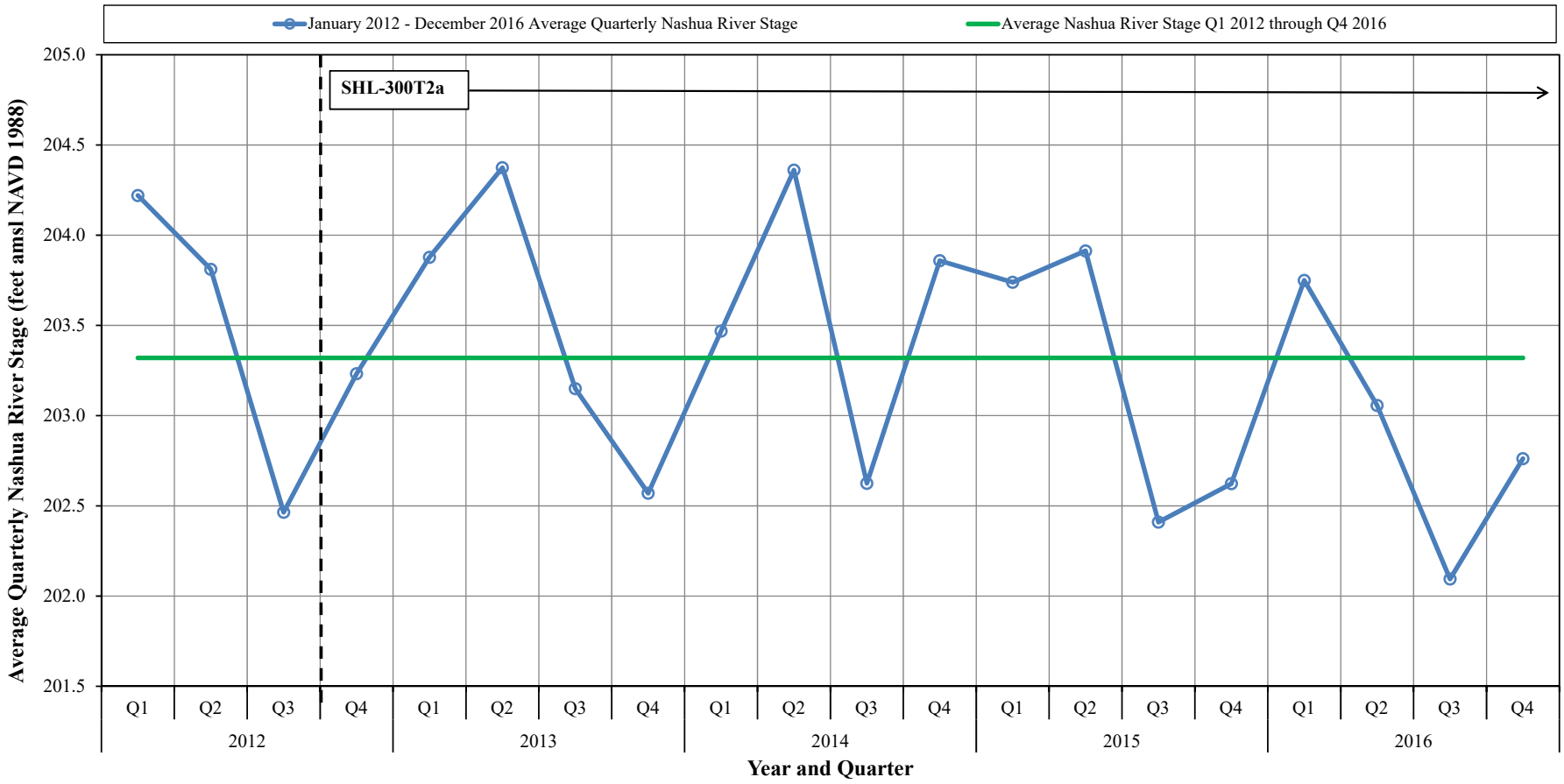
Figure 6.5

Document Path: Q:\GISProjects\BR0302_FtDevens\MXD\2018\Fall2018_Submittal\F6.5_Model Sediment Thickness PSP Grove Pond.mxd




Notes:

1. Nashua River stage at SWEL-105 was estimated by extrapolation from United States Geological Survey gaging station 01096500 located in East Pepperell, Massachusetts.
2. The Average Quarterly Nashua River Stage is an arithmetic mean of all 15-minute interval stage records within a given quarter.
3. The Average Nashua River stage is an arithmetic mean of average quarterly stages from Q1 2012 through Q4 2016 (5 years).
4. amsl = above mean sea level, NAVD = North American Vertical Datum.

**Average Quarterly Nashua River Stage at SWEL-105**

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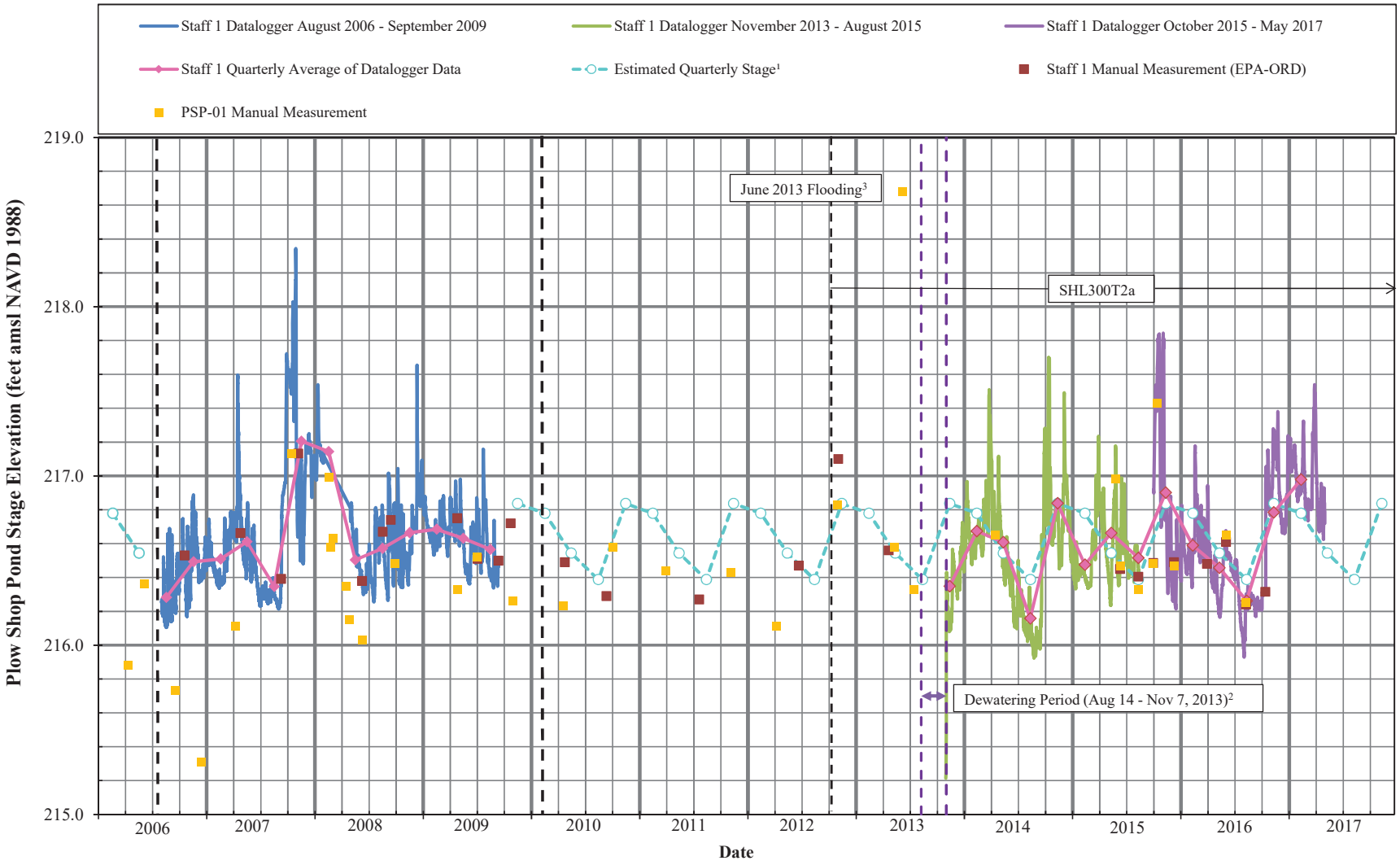
Figure **6.6**




Notes:

1. Estimated Quarterly Stages = Average of Estimated Quarterly Stages Calculated with Staff 1 Datalogger record from August 2006 - September 2009.
2. Sovereign, 2014. Removal Action Completion Report - Railroad Round House and Red Cove, Plow Shop Pond (AOC 72), June.
3. Sovereign, 2013. Wetland Delineation Report for Plow Shop Pond, Appendix B, June.
4. Q4 2013 Staff 1 Quarterly Average Datalogger data excludes datapoints collected between November 5th and 7th 2013 due to water level recovery following sediment removal activities.
5. Staff 1 and PSP-01 manual measurements in 2015 and 2016 were provided by USEPA-Office of Research and Development (ORD) on a CD in November 2016.
6. Staff 1 and PSP-01 locations are shown on Figure 6.4.
7. amsl = above mean sea level, NAVD = North American Vertical Datum.

**Plow Shop Pond Quarterly Stage Elevations**

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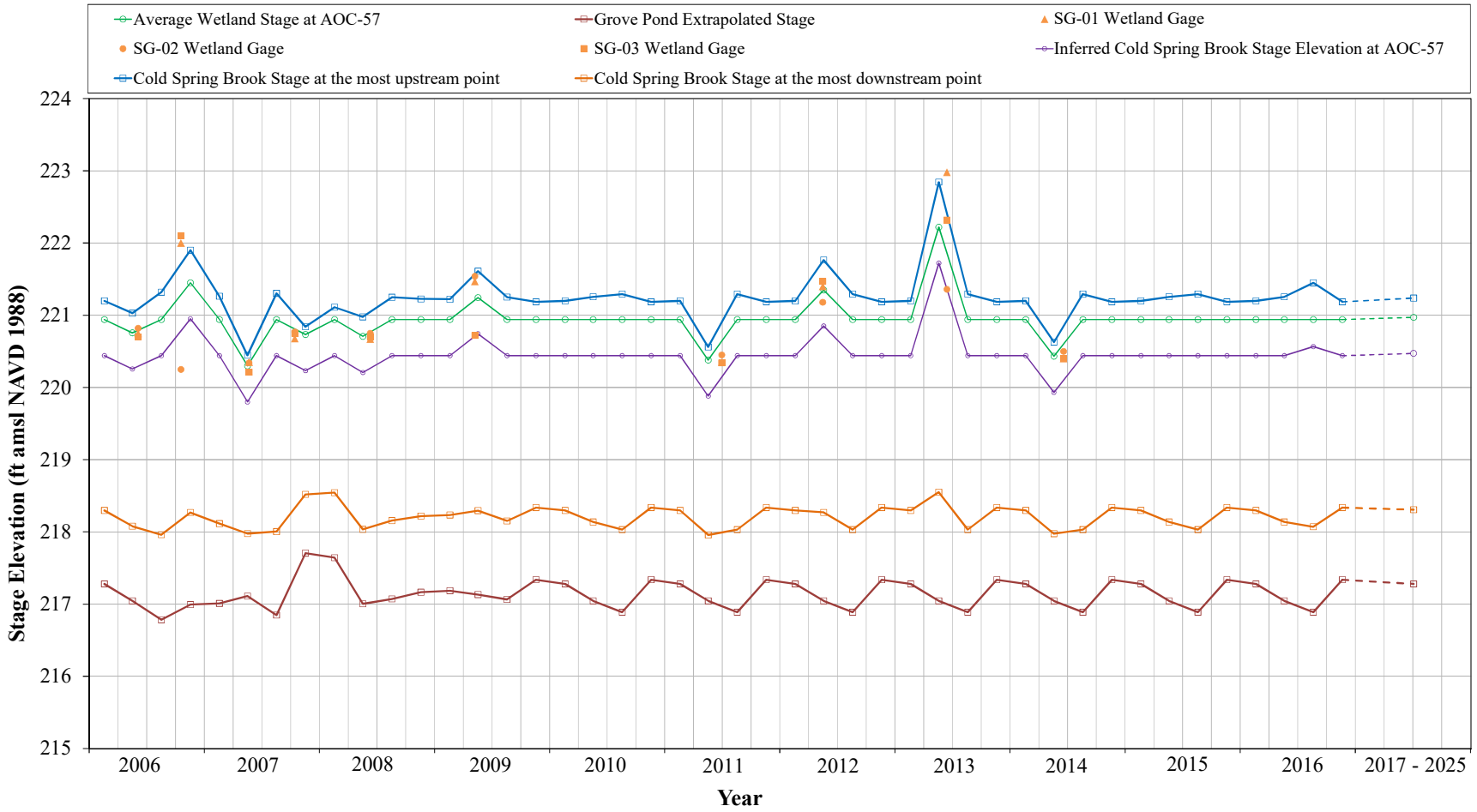
Figure **6.7**




Notes:

1. Solid data markers are used for measured surface water elevations.
2. Open data markers are used for projected quarterly stage elevations.
3. Cold Springs Brook stage - South represents the most upstream location for the brook in the model.
4. Cold Springs Brook stage - North represents the most downstream location for the brook in the model.
5. Stage elevation locations are shown on Figure 6.4.
6. amsl = above mean sea level, NAVD = North American Vertical Datum.

**Cold Spring Brook Quarterly Stage Elevations**

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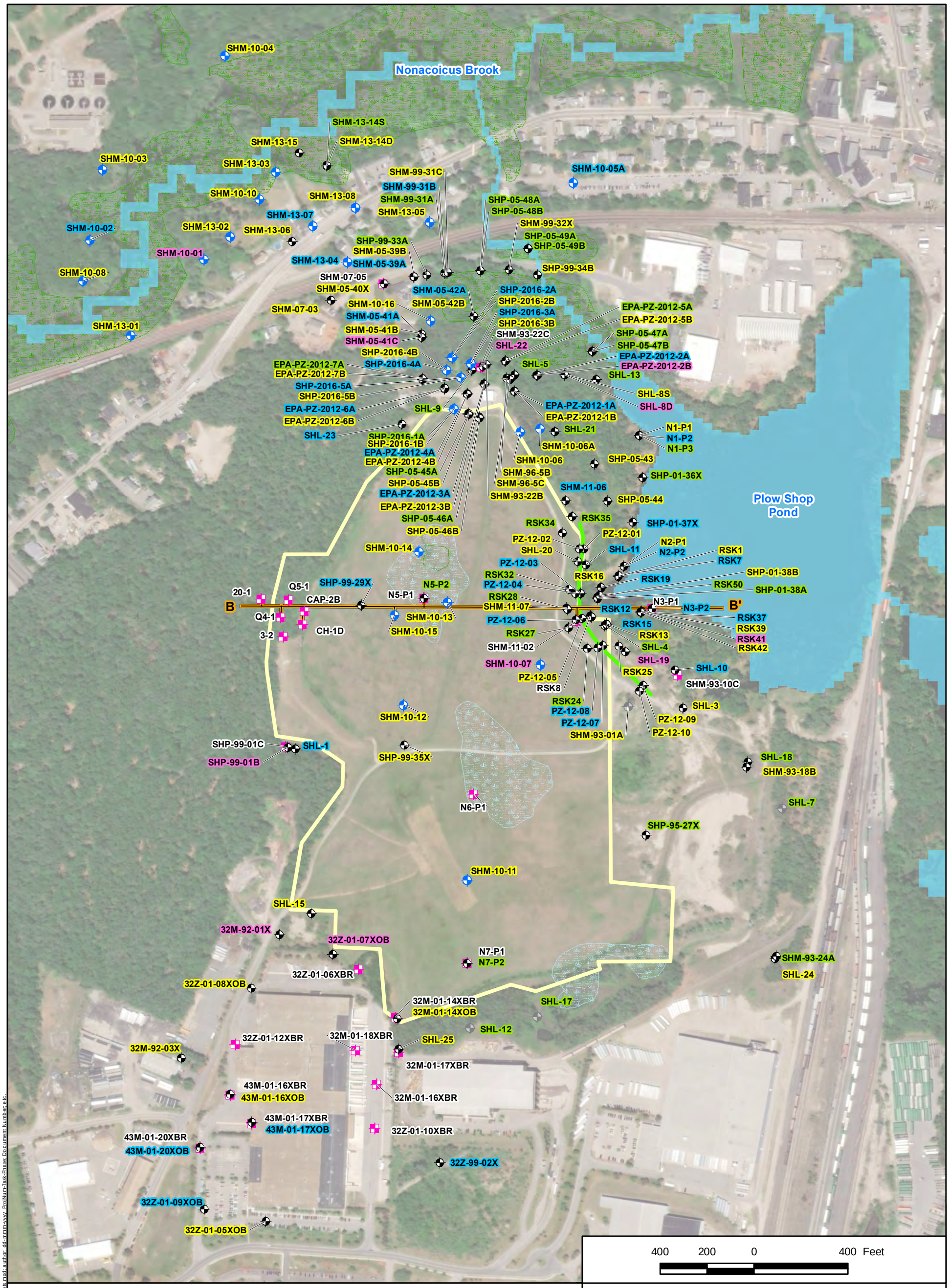
Figure **6.8**




**Legend**

- Overburden Monitoring Well/Piezometer
- Monitoring Well - Destroyed
- Groundwater Profiling Location/Monitoring Well
- Bedrock Monitoring Well
- Section B-B'
- Barrier Wall
- Shepley's Hill Landfill
- Approximate Extent of Historic Wetlands
- Wetlands
- 57WP-06-02 Model Calibration Targets Layer 1
- 43M-01-20XOB Model Calibration Targets Layer 2
- 32M-01-14XOB Model Calibration Targets Layer 3
- SHP-99-01B Model Calibration Targets Layer 4
- 43M-01-16XBR Model Calibration Targets Layer 5

Notes:
1. Base Map obtained from ESRI World Imagery.
2. Locations and wetlands obtained from shapefiles created by Sovereign Consulting, Inc.

# Shepley's Hill Landfill
# Calibration Target Location Map

Shepley's Hill Landfill Groundwater Model

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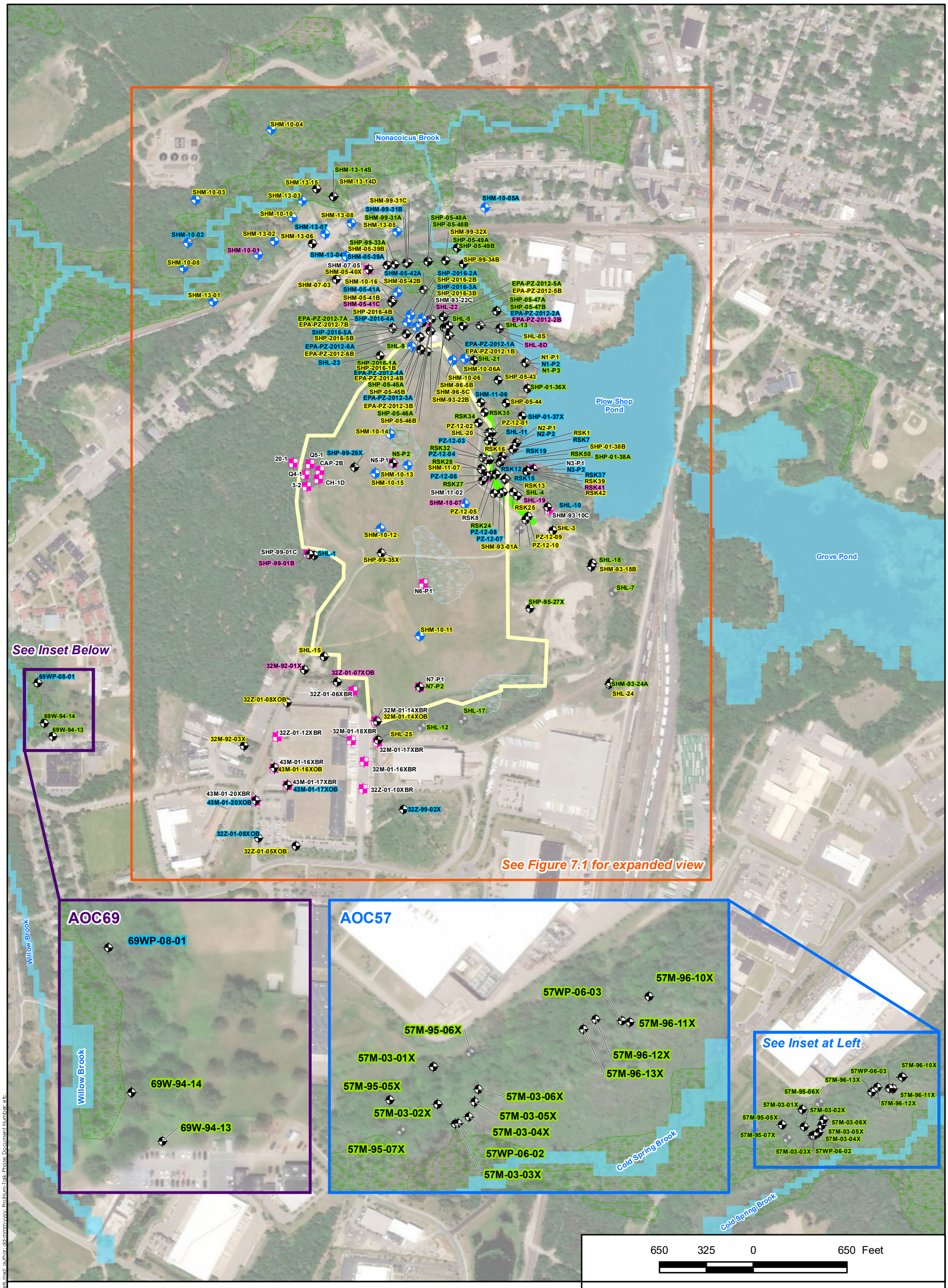
Figure 7.1

Q:\GIS\Projects\WB0302_FtDevens\MXD\2018\Fig\2018_Submittal\F7.1_CalibrationTargets.mxd - author: dd-mmm-yyyy ProjNum-Task-Phase-Document Number etc.




## Legend

- Overburden Monitoring Well/Piezometer
- Monitoring Well - Destroyed
- Groundwater Profiling Location/Monitoring Well
- Bedrock Monitoring Well
- Barrier Wall
- Shepley's Hill Landfill
- Approximate Extent of Historic Wetlands
- Wetlands
- 57WP-06-02 Model Calibration Targets Layer 1
- 43M-01-20XOB Model Calibration Targets Layer 2
- 32M-01-14XOB Model Calibration Targets Layer 3
- SHP-99-01B Model Calibration Targets Layer 4
- 43M-01-16XBR Model Calibration Targets Layer 5

Notes:
1. Base Map obtained from ESRI World Imagery.
2. Locations and wetlands obtained from shapefiles created by Sovereign Consulting, Inc.

# Model-Wide Calibration Target Location Map

Shepley's Hill Landfill Groundwater Model

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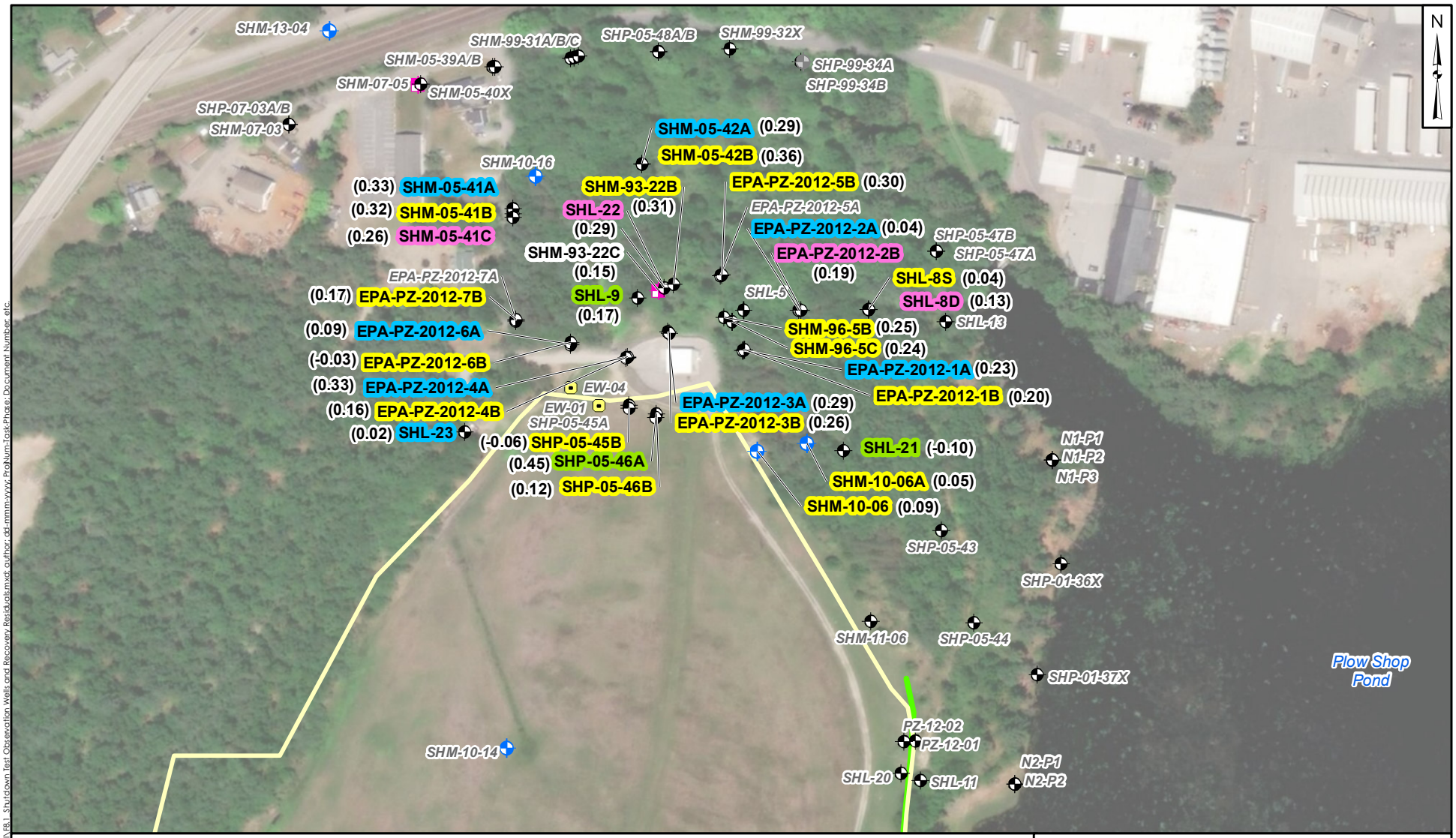
Figure 7.2

G:\GIS\Projects\WR0307_FtDevens\MXD\2018\Feb2018_Submittal\F7.2_CalibrationTargets.mxd; author: cld-mmm-www-ProjNum-Task-Phase_Document Number.e.tc




**Legend**

- Overburden Monitoring Well/Piezometer
- Monitoring Well - Destroyed
- Groundwater Profiling Location/Monitoring Well
- Bedrock Monitoring Well
- Extraction Well
- Landfill Cap Boundary
- Barrier Wall
- **(0.09)** Recovery Residual (Feet)

| | |
|---|---|
| 57WP-06-02 | Model Calibration Targets Layer 1 |
| 43M-01-20XOB | Model Calibration Targets Layer 2 |
| 32M-01-14XOB | Model Calibration Targets Layer 3 |
| SHP-99-01B | Model Calibration Targets Layer 4 |
| 43M-01-16XBR | Model Calibration Targets Layer 5 |

Notes:
1) Base Map obtained from ESRI World Imagery.
2) Recovery residual = observed recovery - model calculated recovery.
3) Observed water level recovery was measured during a 9-day shutdown period in February 2013.
4) Highlighted wells were measured during the shutdown test.

200 100 0 200 FEET

# Shutdown Test Observation Wells and Residuals

Shepley's Hill Landfill Groundwater Model

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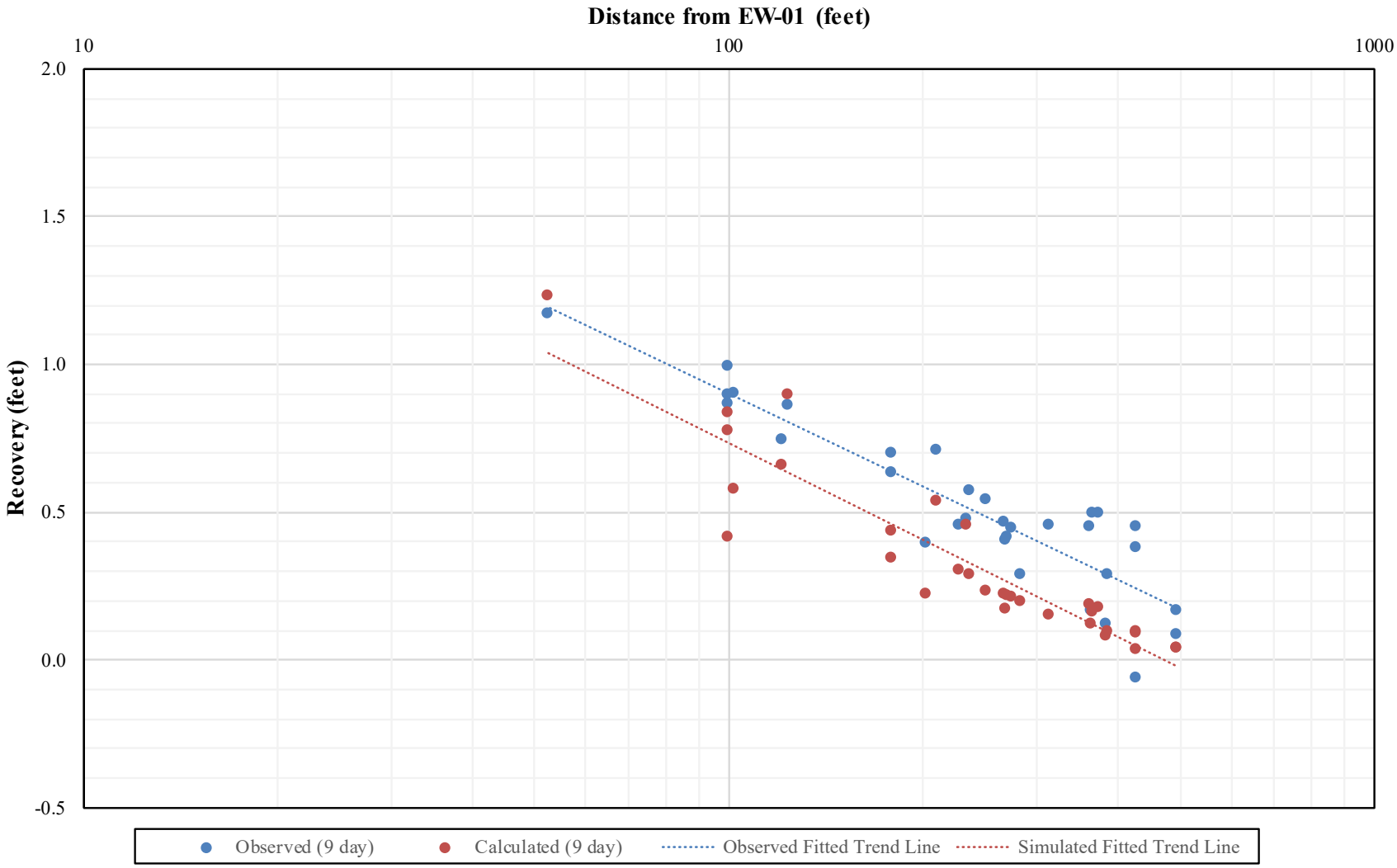
Figure 8.1

Q:\GIS\Projects\WR0302_FtDevens\MXD\2018_Submittal\F8.1_Shutdown Test Observation Wells and Recovery Residuals.mxd; author: dd-mmm-yyyy; ProjNum-Task-Phase; Document Number, etc.




Notes:

1. Observed data was derived from continuous water level data collected during the 9-day ATP shutdown test in February 2013.
2. Simulated water level elevations were calculated at the end of SP2 in R88PEST with EW-01 and EW-04 pumping (90 days). The head file from the end of stress period 2 serves as the initial heads for a 9-day transient stress period with no pumping from the ATP wells. Simulated heads at the end of the 9-day transient stress period represent the end of the simulated shutdown test.
3. Recovery represents the head at the beginning of the shutdown test subtracted from the head at the end of the shutdown test.

**Shutdown Test Validation - Distance vs. Recovery for EW-01**

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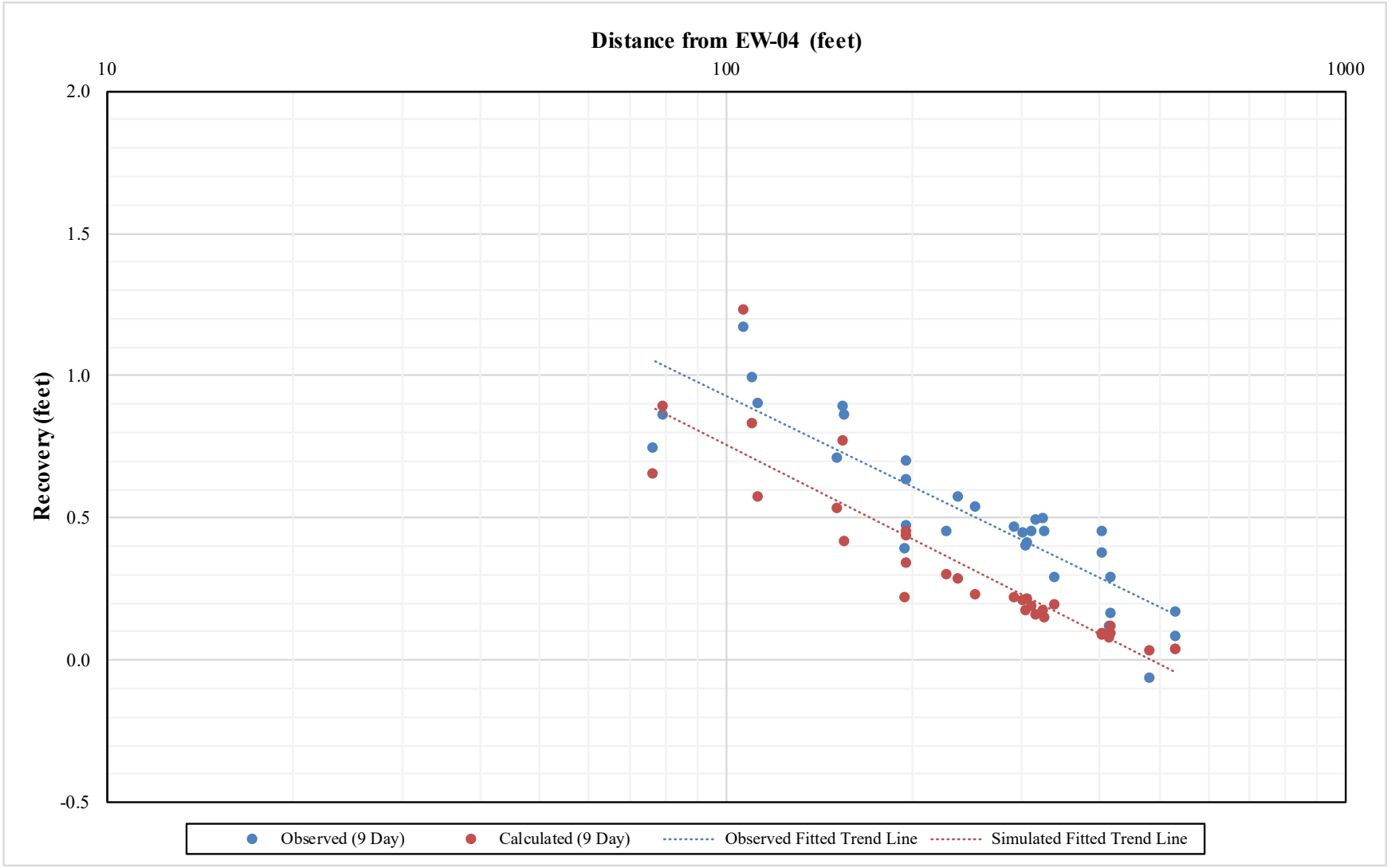
Figure **8.2**




Notes:

1. Observed data was derived from continuous water level data collected during the 9-day ATP shutdown test in February 2013.
2. Simulated water level elevations were calculated at the end of SP2 in R88PEST with EW-01 and EW-04 pumping (90 days). The head file from the end of stress period 2 serves as the initial heads for a 9-day transient stress period with no pumping from the ATP wells. Simulated heads at the end of the 9-day transient stress period represent the end of the simulated shutdown test.
3. Recovery represents the head at the beginning of the shutdown test subtracted from the head at the end of the shutdown test.

**Shutdown Test Validation Distance Recovery Plot for EW-04**

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Figure **8.3**

ATP 5
EPA-PZ-2012-5B
SHM-93-22B
ATP 4
SHM-96-5B
EPA-PZ-2012-2B
ATP 3
EPA-PZ-2012-1B
ATP2
EW-04
ATP 1
EW-01
SHM-10-06
SHM-10-06A
N
Plow Shop Pond
N1-P2
LF South 2
SHL-17
SHL-12
LF South 1
32Z-99-02X

# Triangle Locations for 3PE Validation Analysis

Shepley's Hill Landfill Groundwater Model

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**Legend**

- Extraction Well
- Overburden Monitoring Well/Piezometer
- 3PE Triangles
- Barrier Wall
- Approximate Extent of Historic Wetlands
- Wetlands
- Water Body
- Shepley's Hill Landfill

Notes:
1. See Table 8.2 for 3PE flow direction validation results.
2. 3PE refers to three point estimator.
3. "LF" refers to landfill.

300 150 0 300 Feet

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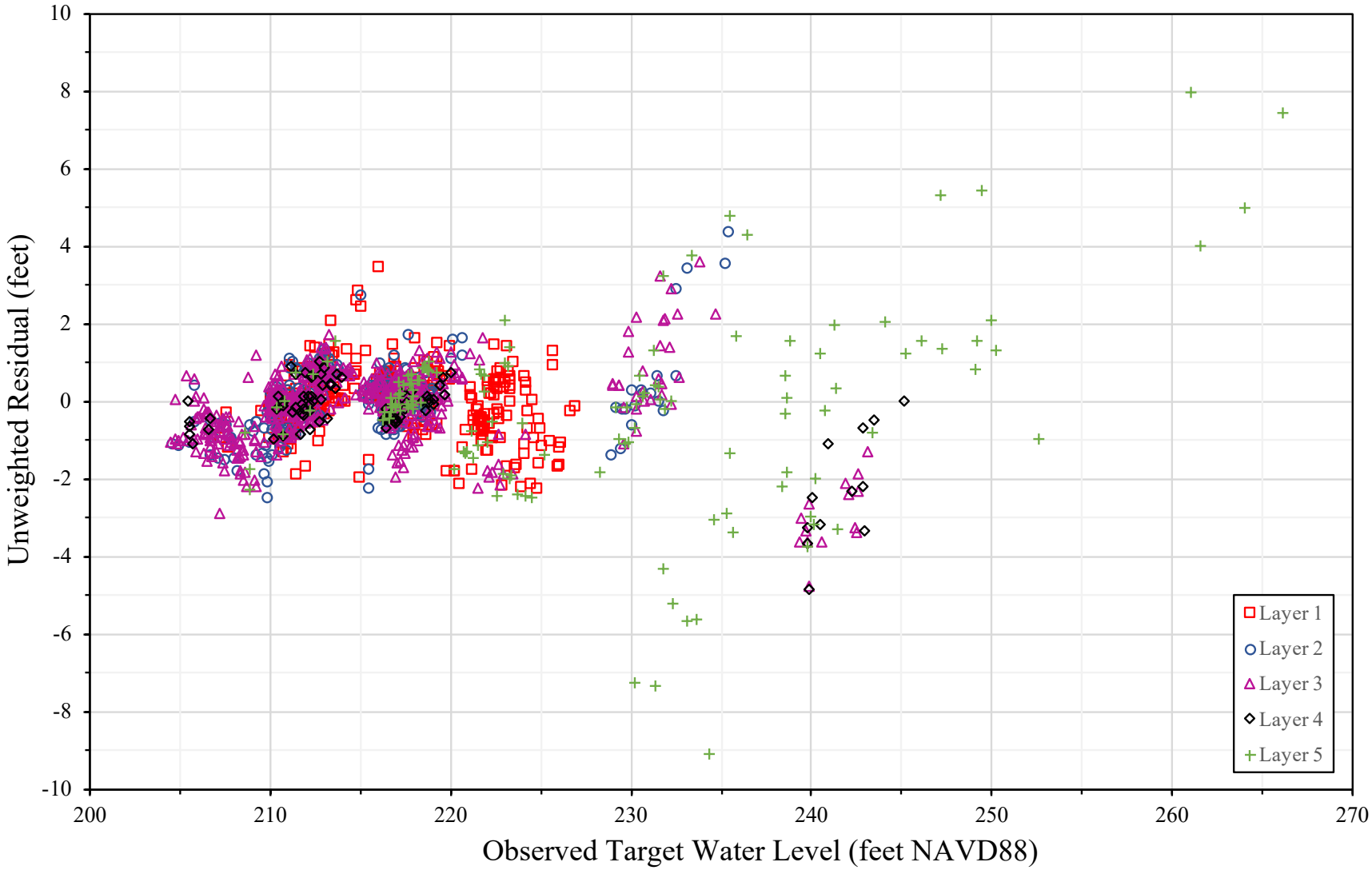
Figure 8.4




**Observed Target Water Levels vs. Residuals (Model Wide) for All Stress Periods**

Shepley's Hill Landfill Groundwater Model

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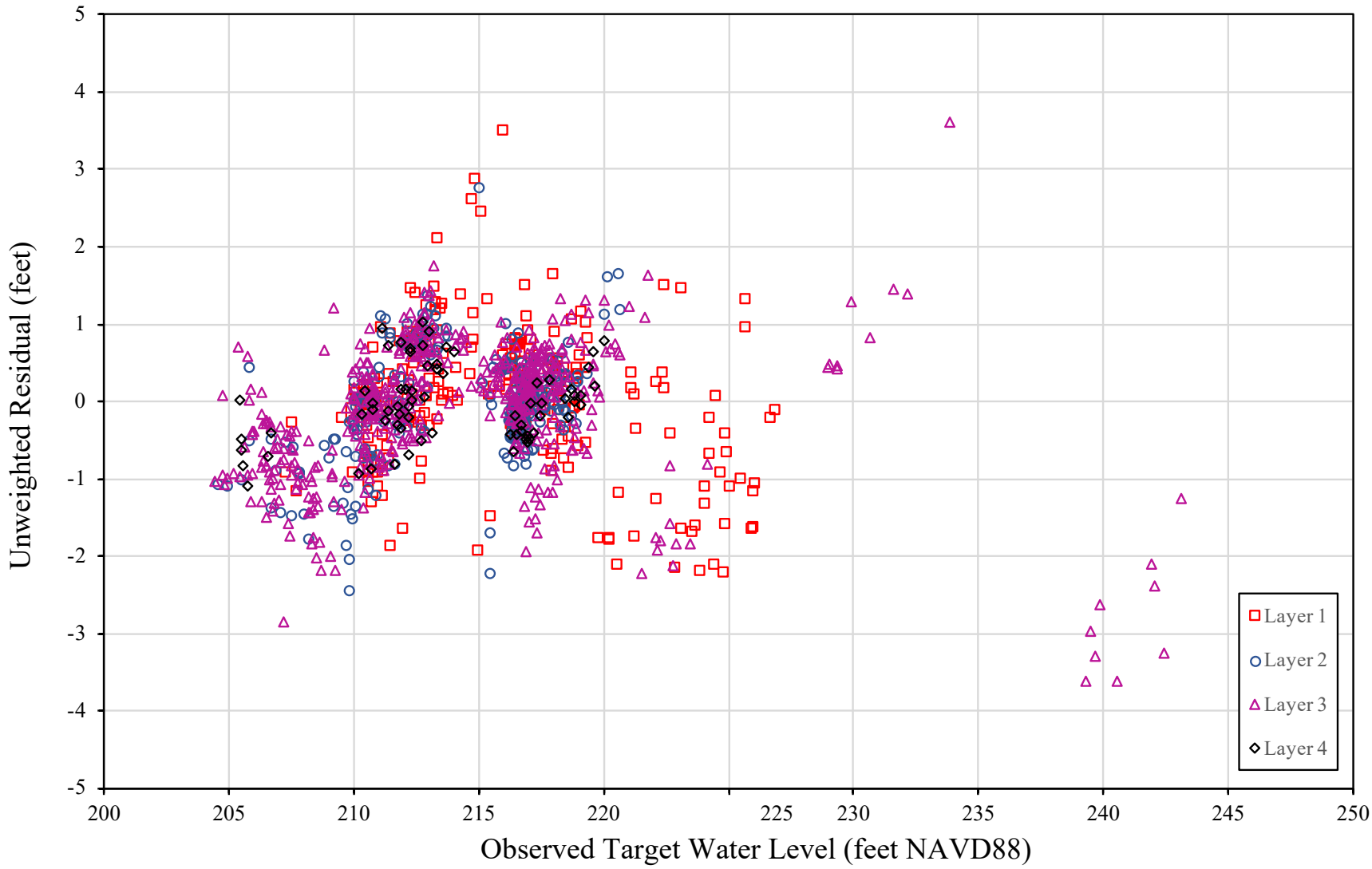
Figure **9.1**

Notes:

1. Residual = Target Water Level - Predicted Water Level
2. Predicted water levels were exported from model revision SHL300T2a R88PEST.
3. Target water level elevations represent the average of manually recorded water level elevations for a location during a given stress period.
4. Tabulated values are presented in Table 7.1.
5. Target water levels are relative to the North American Vertical Datum 1988.




Notes:

1. Residual = Target Water Level - Predicted Water Level.
2. Group 1 targets include SHL Site overburden monitoring wells only.
3. Predicted water levels were exported from model revision SHL300T2a R88PEST.
4. Target water level elevations represent the average of manually recorded water level elevations for a location during a given stress period.
5. Tabulated values are presented in Table 7.1.
5. Target water levels are relative to the North American Vertical Datum 1988.

**Observed Target Water Levels vs. Residuals for SHL Area Targets (Group 1) All Stress Periods**

Shepley's Hill Landfill Groundwater Model

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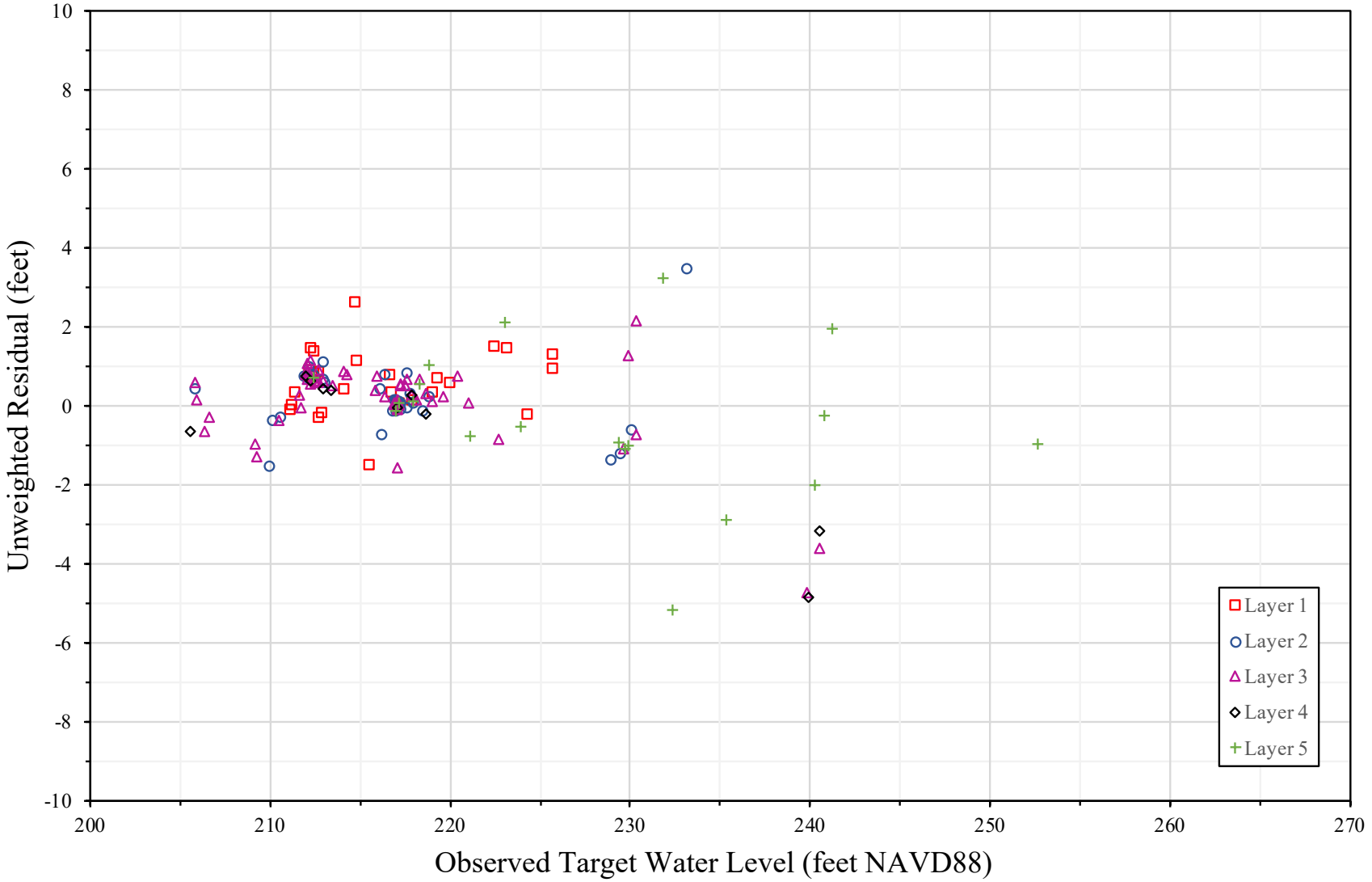
Figure **9.2**




Notes:

1. Residual = Target Water Level - Predicted Water Level.
2. Predicted water levels were exported from model revision SHL300T2a R88PEST.
3. Target water level elevations represent the average of manually recorded water level elevations for a location during a given stress period.
4. Tabulated values are presented in Table 7.1.
5. Target water levels are relative to the North American Vertical Datum 1988.

**Observed Target Water Levels vs. Residuals (Model Wide) for Stress Period 1**

Shepley's Hill Landfill Groundwater Model

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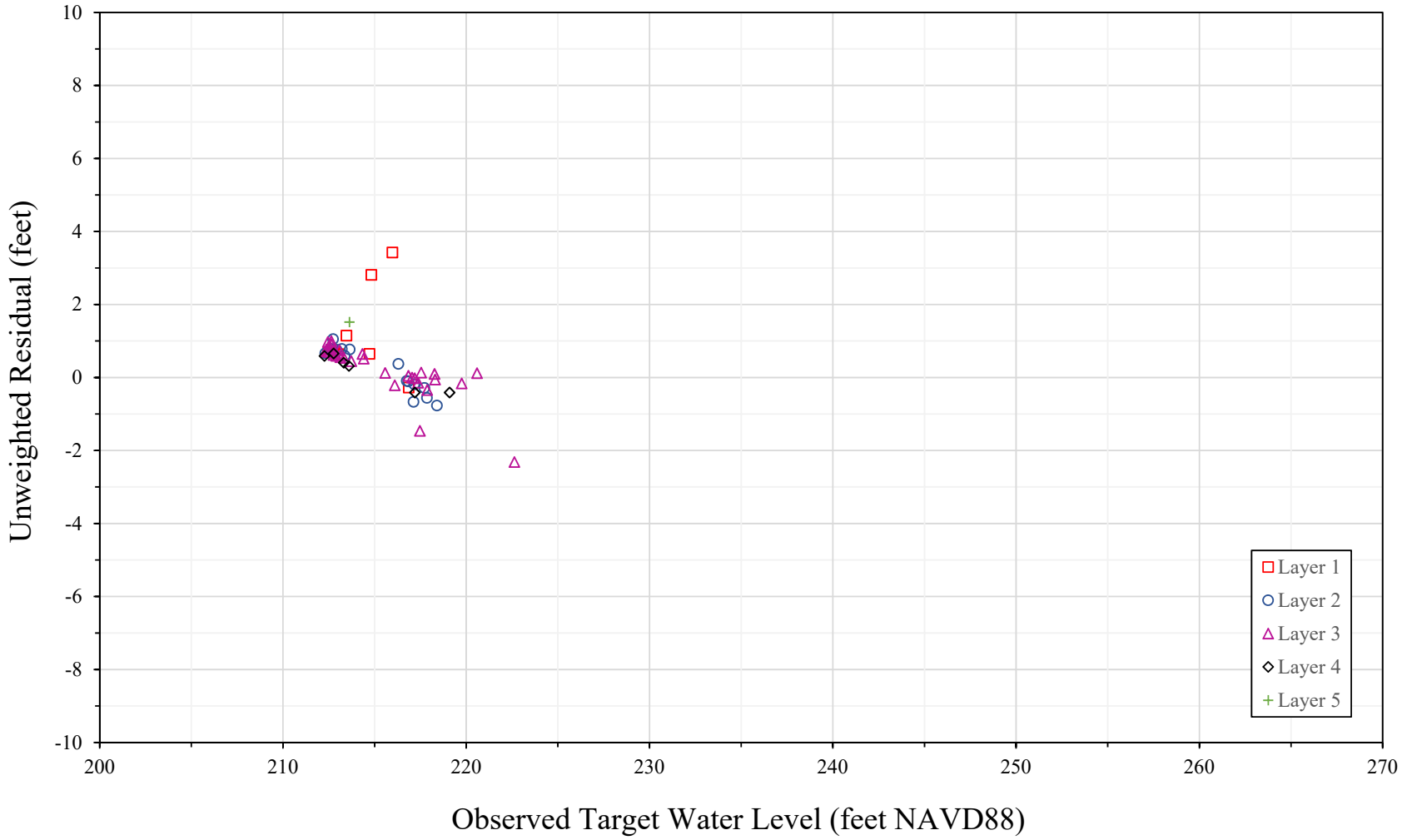
Figure **9.3a**




Notes:

1. Residual = Target Water Level - Predicted Water Level.
2. Predicted water levels were exported from model revision SHL300T2a R88PEST.
3. Target water level elevations represent the average of manually recorded water level elevations for a location during a given stress period.
4. Tabulated values are presented in Table 7.1.
5. Target water levels are relative to the North American Vertical Datum 1988.

**Observed Target Water Levels vs. Residuals (Model Wide) for Stress Period 2**

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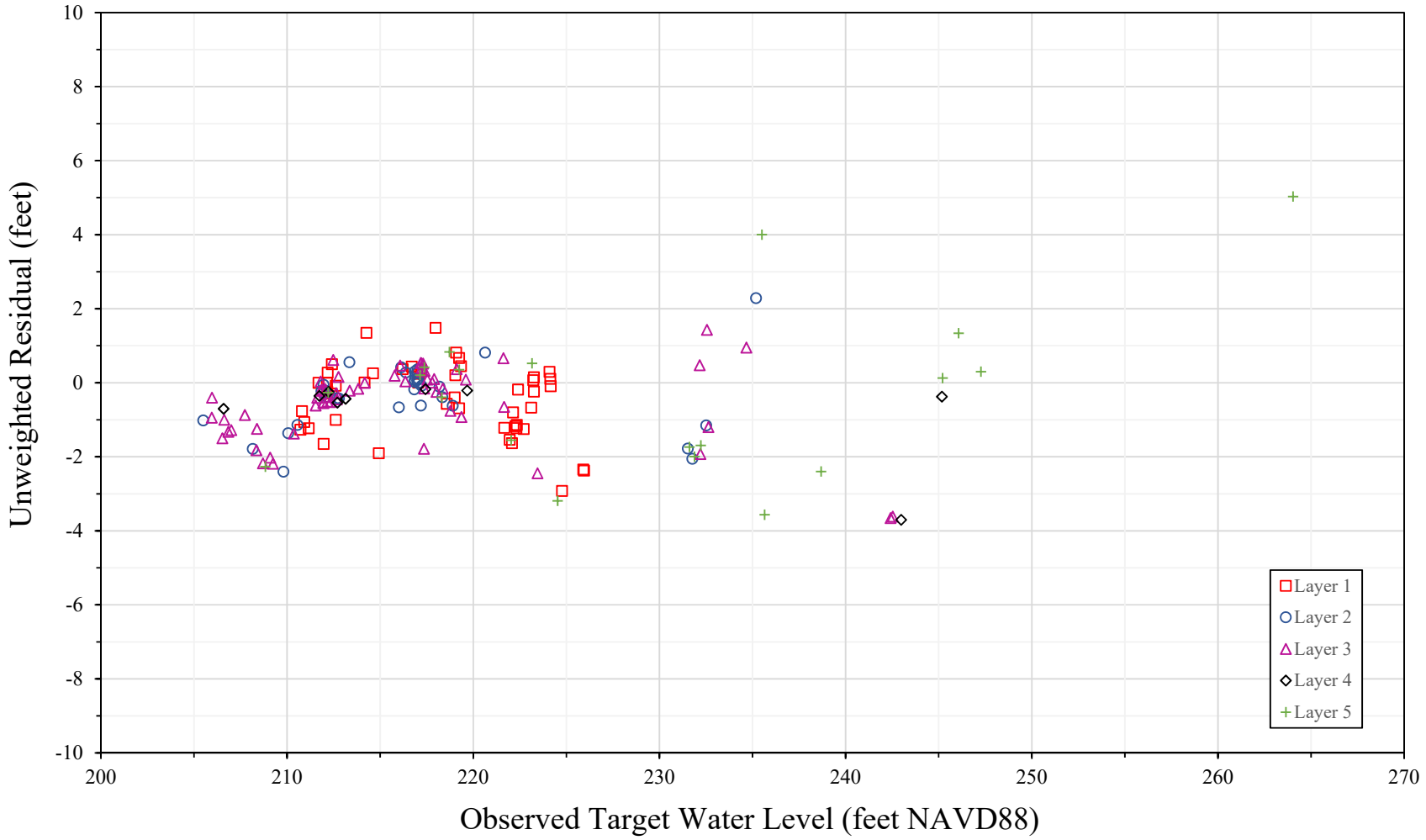
Figure **9.3b**




Notes:

1. Residual = Target Water Level - Predicted Water Level.
2. Predicted water levels were exported from model revision SHL300T2a R88PEST.
3. Target water level elevations represent the average of manually recorded water level elevations for a location during a given stress period.
4. Tabulated values are presented in Table 7.1.
5. Target water levels are relative to the North American Vertical Datum 1988.

**Observed Target Water Levels vs. Residuals (Model Wide) for Stress Period 3**

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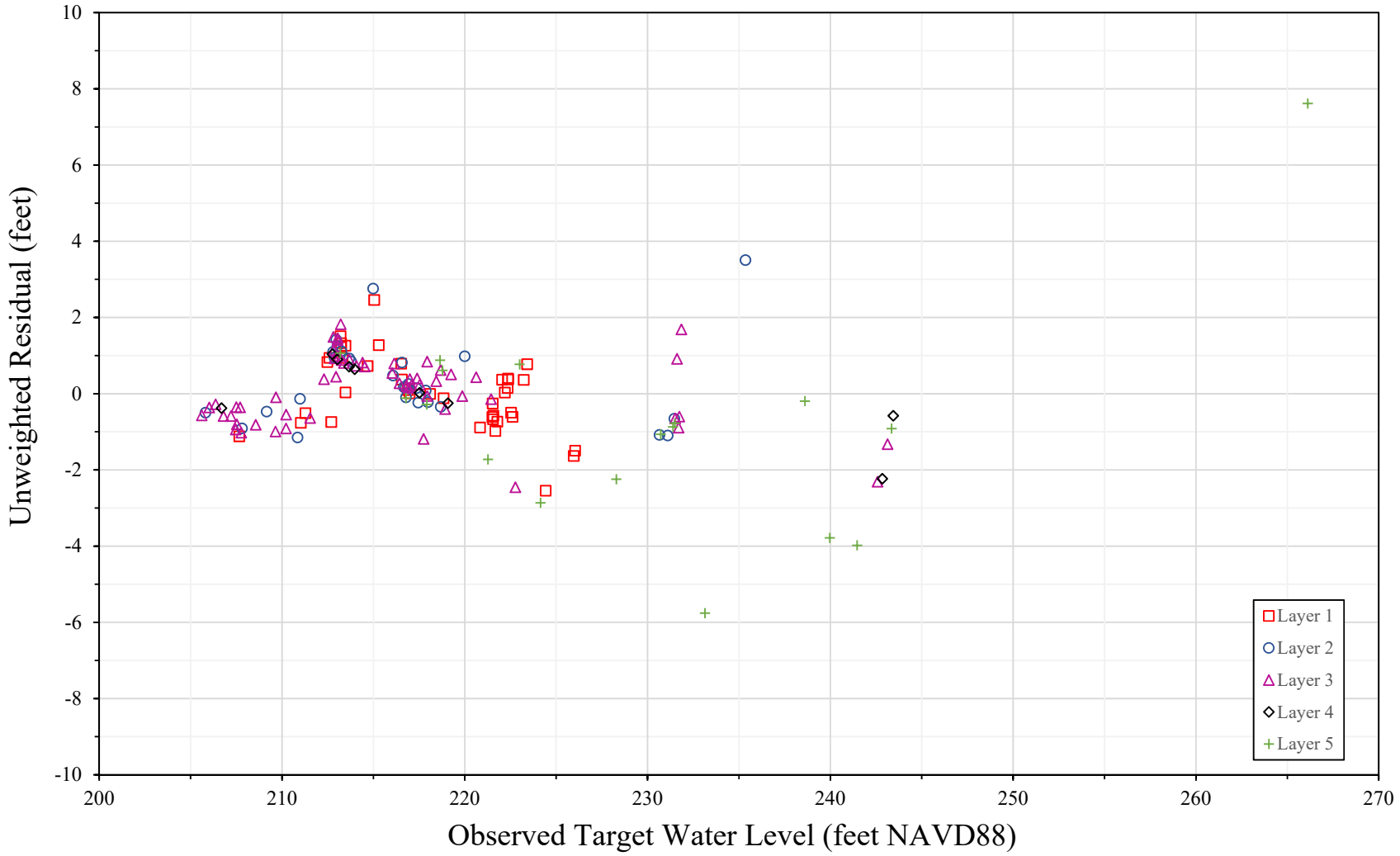
Figure **9.3c**




**Observed Target Water Levels vs. Residuals (Model Wide) for Stress Period 7**

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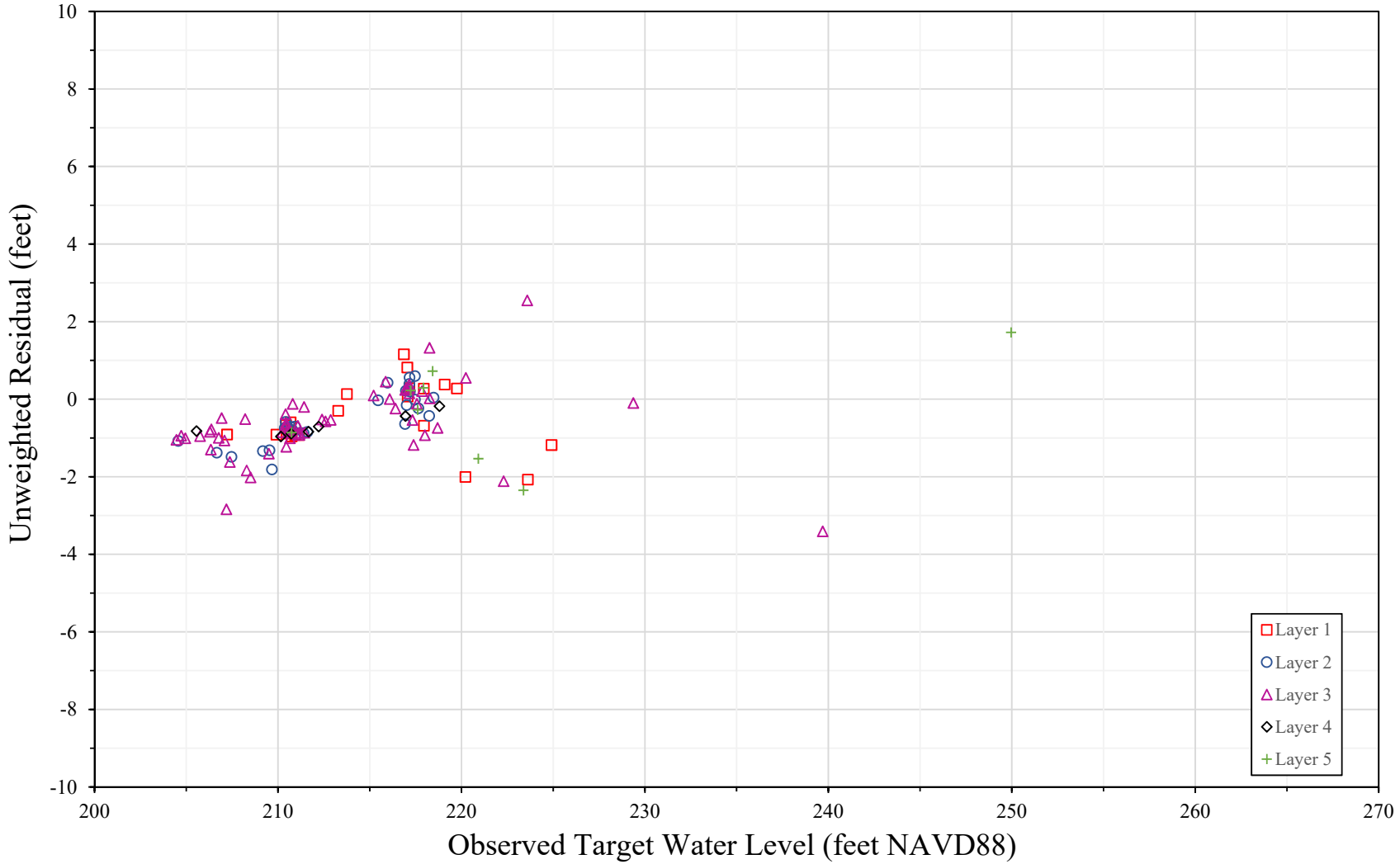
Figure **9.3d**

Notes:

1. Residual = Target Water Level - Predicted Water Level.
2. Predicted water levels were exported from model revision SHL300T2a R88PEST.
3. Target water level elevations represent the average of manually recorded water level elevations for a location during a given stress period.
4. Tabulated values are presented in Table 7.1.
5. Target water levels are relative to the North American Vertical Datum 1988.




**Observed Target Water Levels vs. Residuals (Model Wide) for Stress Period 9**

Shepley's Hill Landfill Groundwater Model

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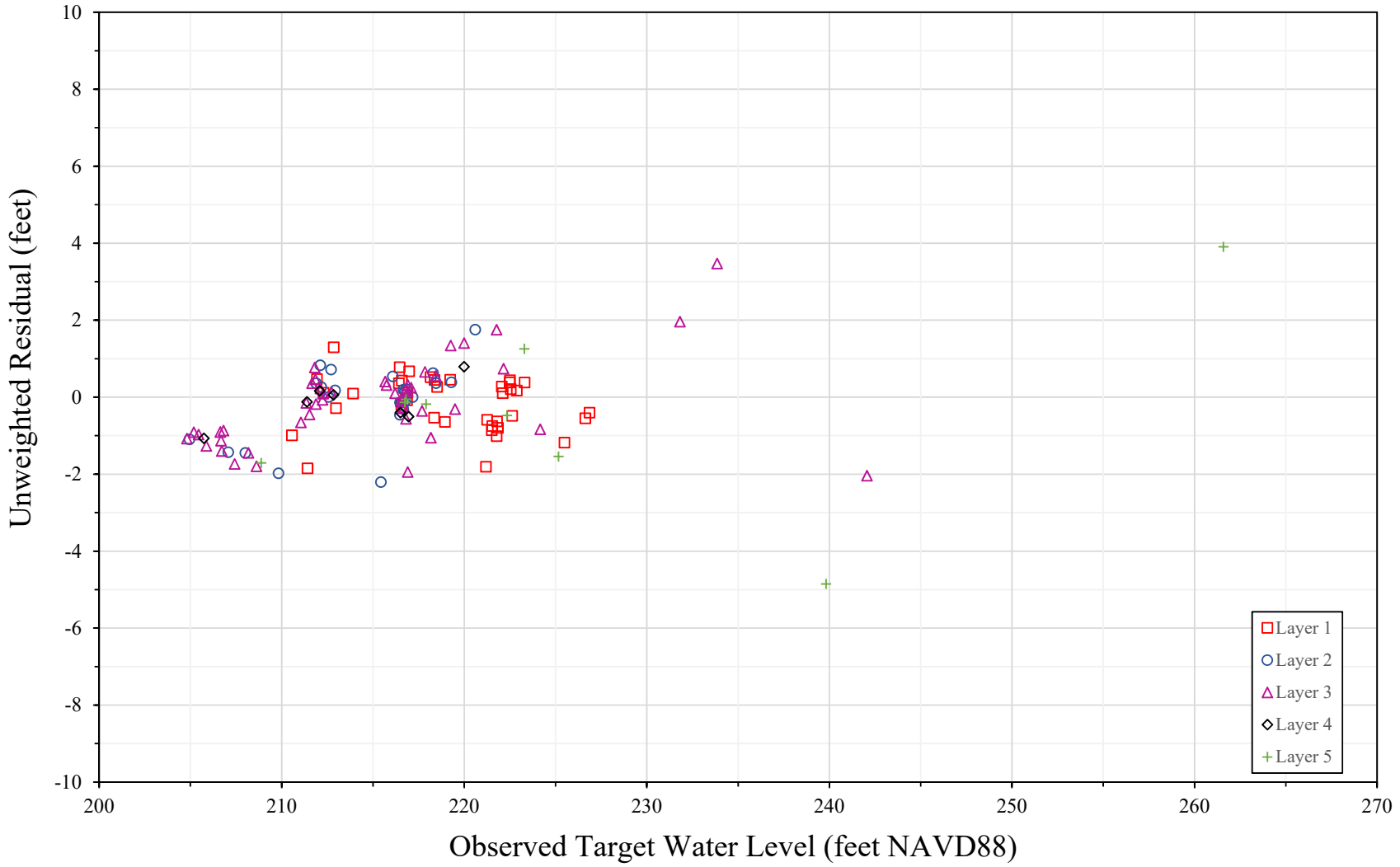
Figure **9.3e**

Notes:

1. Residual = Target Water Level - Predicted Water Level.
2. Predicted water levels were exported from model revision SHL300T2a R88PEST.
3. Target water level elevations represent the average of manually recorded water level elevations for a location during a given stress period.
4. Tabulated values are presented in Table 7.1.
5. Target water levels are relative to the North American Vertical Datum 1988.




Notes:

1. Residual = Target Water Level - Predicted Water Level.
2. Predicted water levels were exported from model revision SHL300T2a R88PEST.
3. Target water level elevations represent the average of manually recorded water level elevations for a location during a given stress period.
4. Tabulated values are presented in Table 7.1.
5. Target water levels are relative to the North American Vertical Datum 1988.

**Observed Target Water Levels vs. Residuals (Model Wide) for Stress Period 11**

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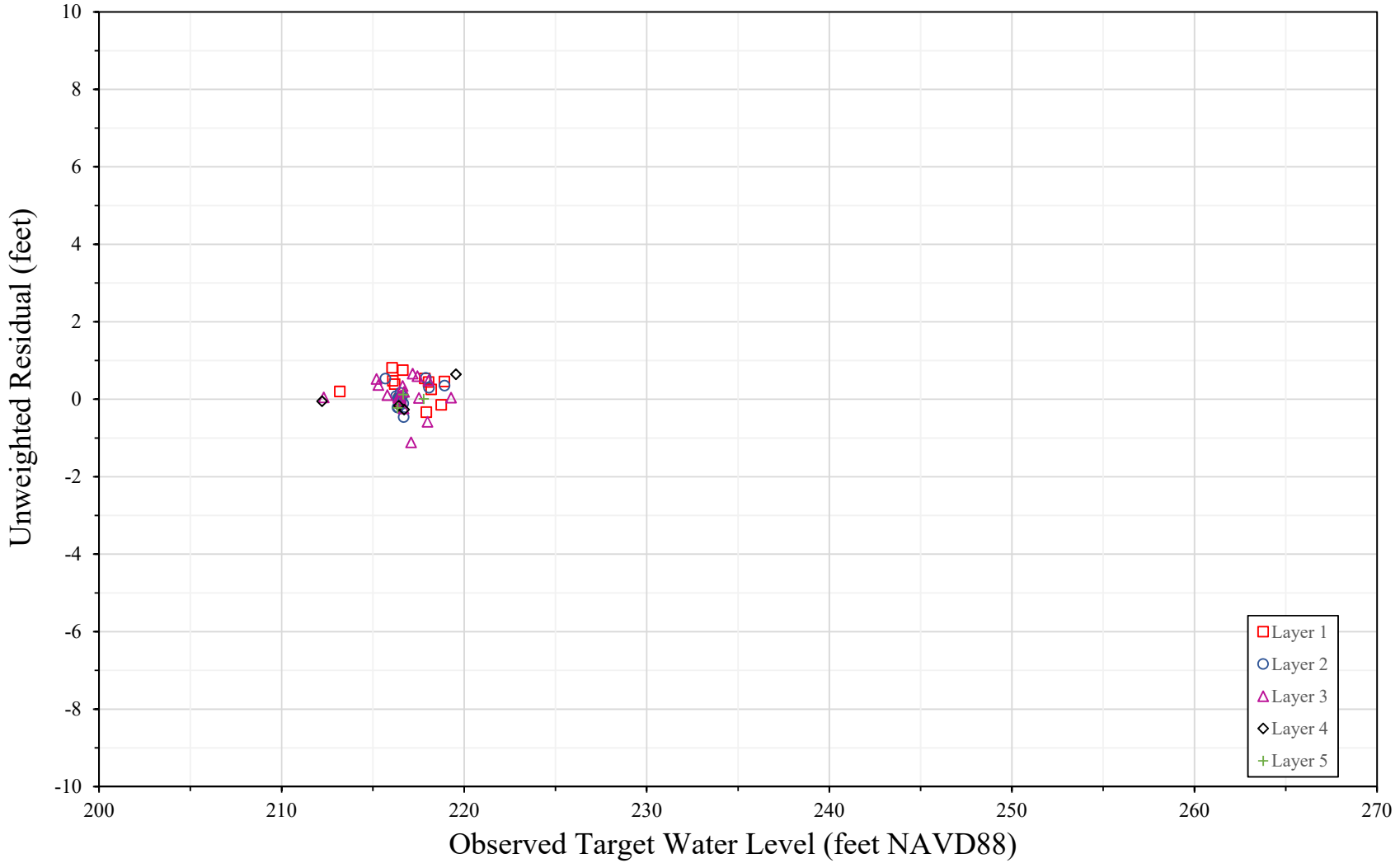
Figure **9.3f**




**Observed Target Water Levels vs. Residuals (Model Wide) for Stress Period 12**

Shepley's Hill Landfill Groundwater Model

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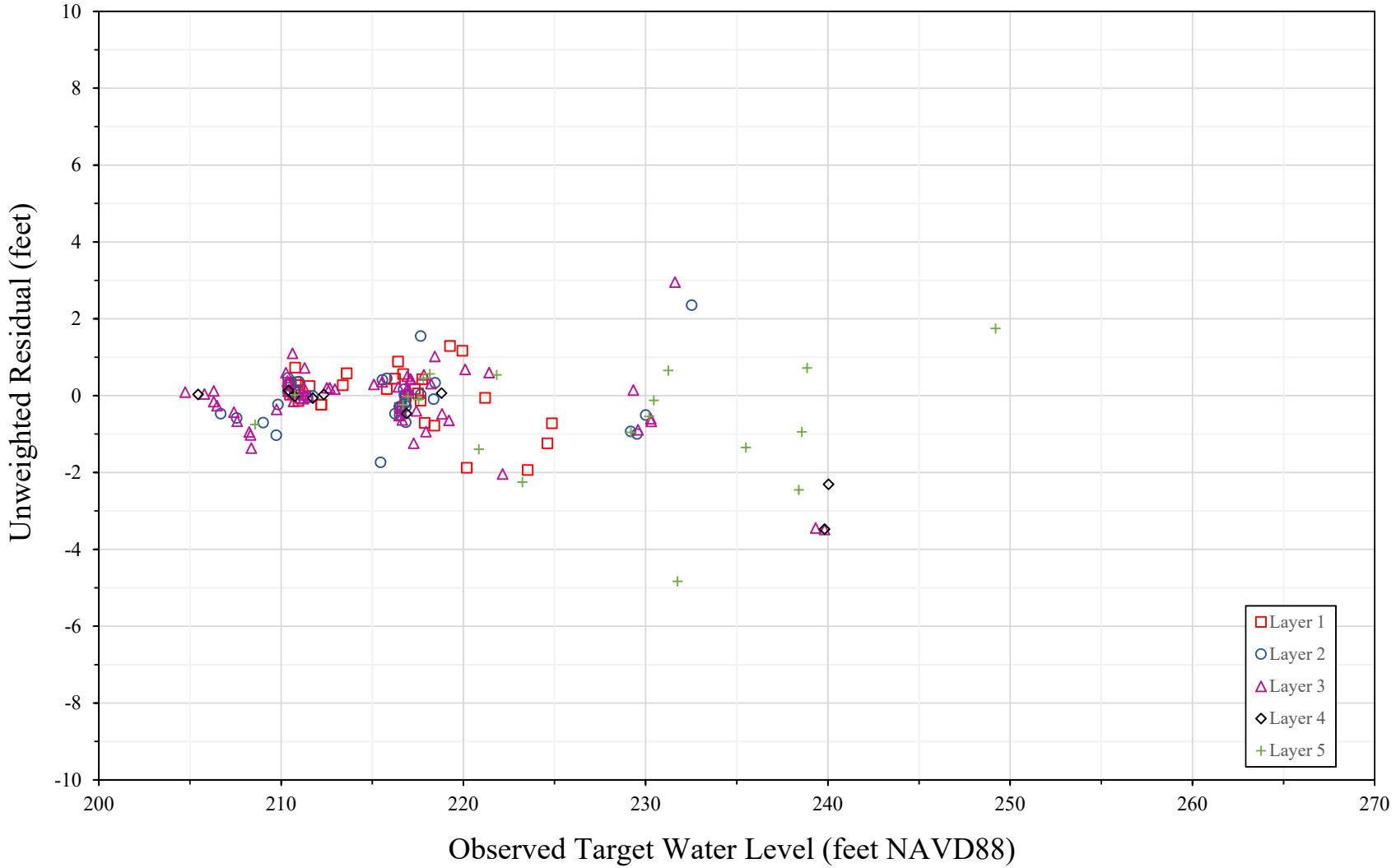
Figure **9.3g**

Notes:

1. Residual = Target Water Level - Predicted Water Level.
2. Predicted water levels were exported from model revision SHL300T2a R88PEST.
3. Target water level elevations represent the average of manually recorded water level elevations for a location during a given stress period.
4. Tabulated values are presented in Table 7.1.
5. Target water levels are relative to the North American Vertical Datum 1988.




Notes:

1. Residual = Target Water Level - Predicted Water Level.
2. Predicted water levels were exported from model revision SHL300T2a R88PEST.
3. Target water level elevations represent the average of manually recorded water level elevations for a location during a given stress period.
4. Tabulated values are presented in Table 7.1.
5. Target water levels are relative to the North American Vertical Datum 1988.

**Observed Target Water Levels vs. Residuals (Model Wide) for Stress Period 13**

Shepley's Hill Landfill Groundwater Model

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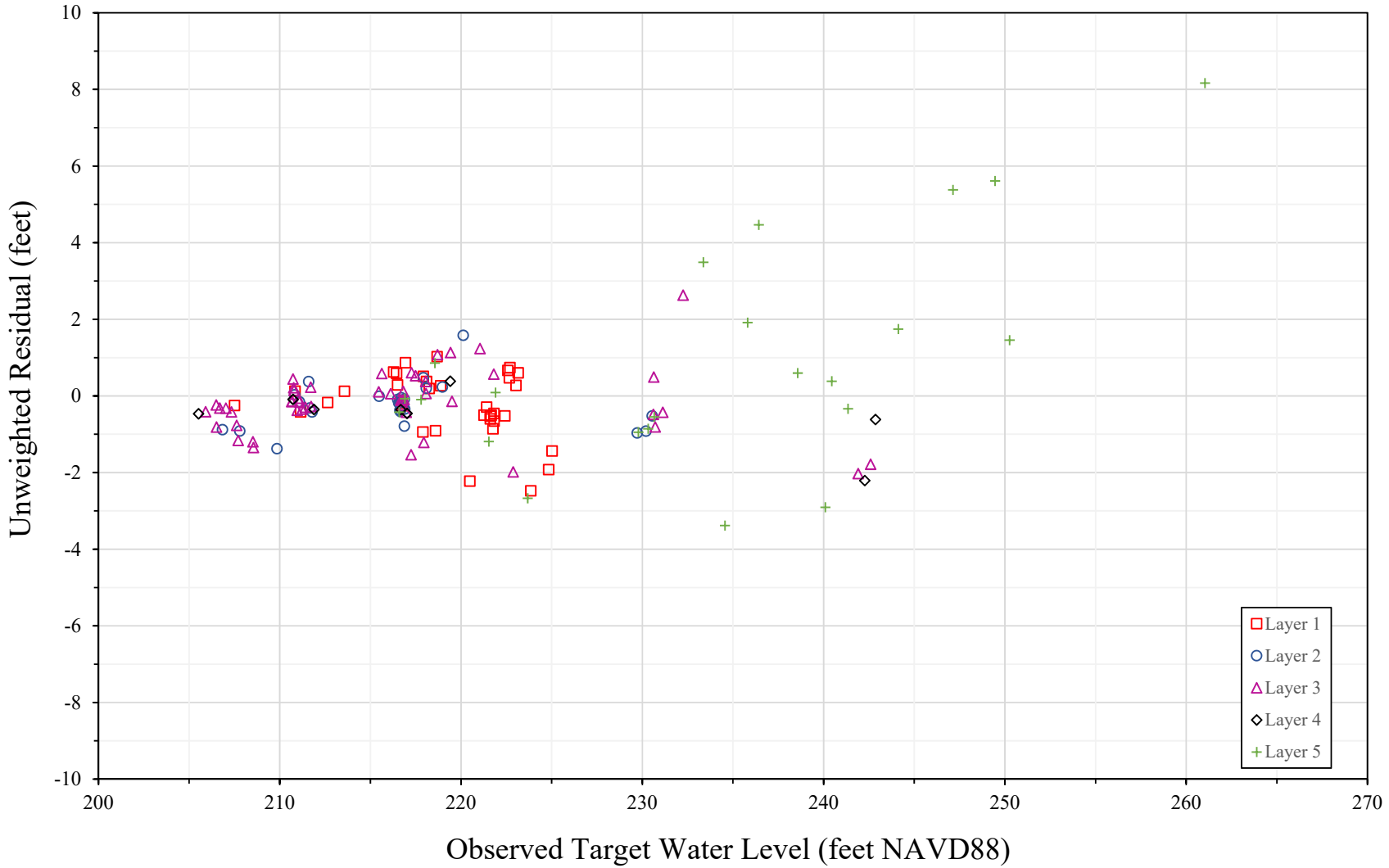
Figure **9.3h**




Notes:

1. Residual = Target Water Level - Predicted Water Level.
2. Predicted water levels were exported from model revision SHL300T2a R88PEST.
3. Target water level elevations represent the average of manually recorded water level elevations for a location during a given stress period.
4. Tabulated values are presented in Table 7.1.
5. Target water levels are relative to the North American Vertical Datum 1988.

**Observed Target Water Levels vs. Residuals (Model Wide) for Stress Period 15**

Shepley's Hill Landfill Groundwater Model

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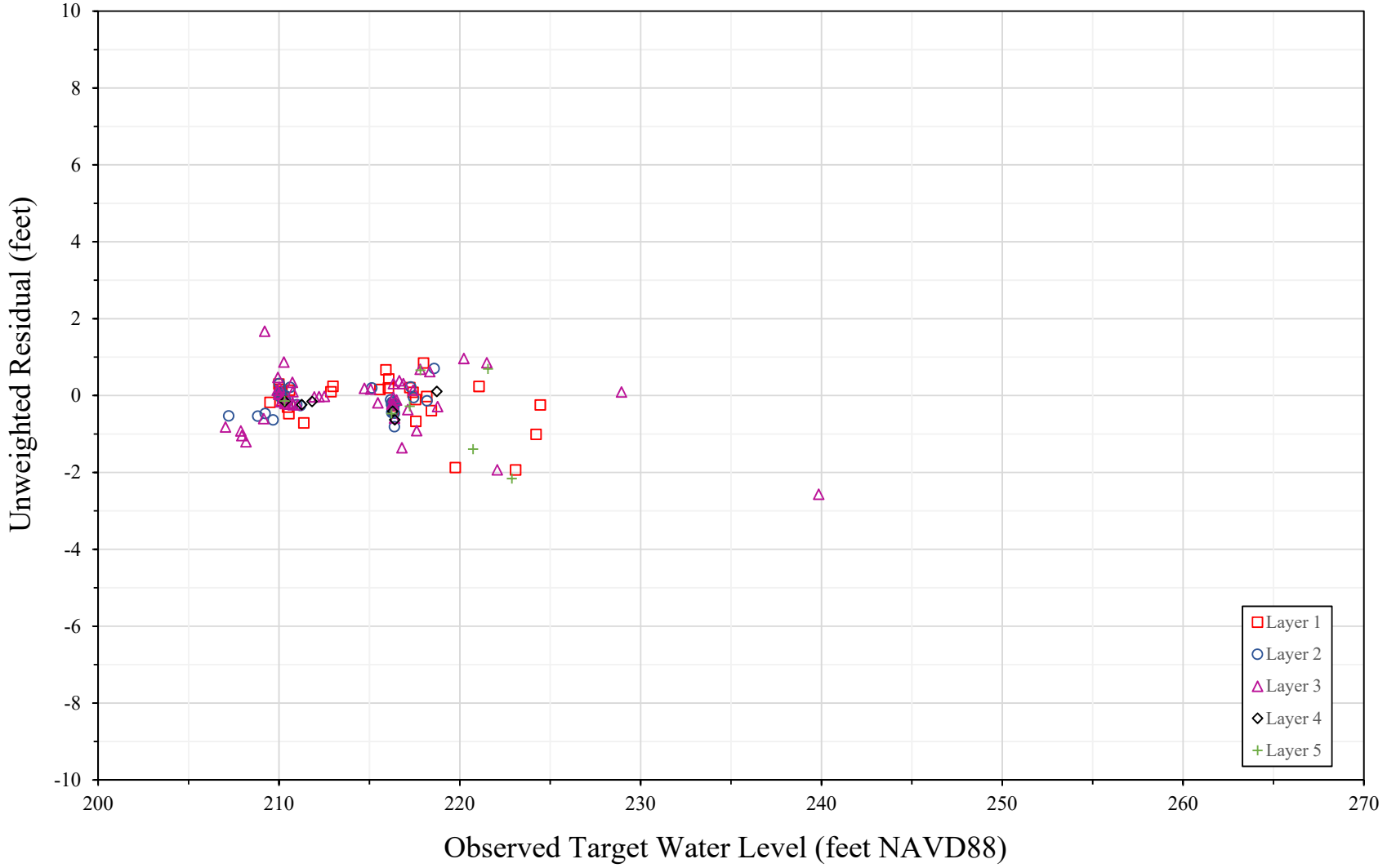
Figure **9.3i**




Notes:

1. Residual = Target Water Level - Predicted Water Level.
2. Predicted water levels were exported from model revision SHL300T2a R88PEST.
3. Target water level elevations represent the average of manually recorded water level elevations for a location during a given stress period.
4. Tabulated values are presented in Table 7.1.
5. Target water levels are relative to the North American Vertical Datum 1988.

**Observed Target Water Levels vs. Residuals (Model Wide) for Stress Period 16**

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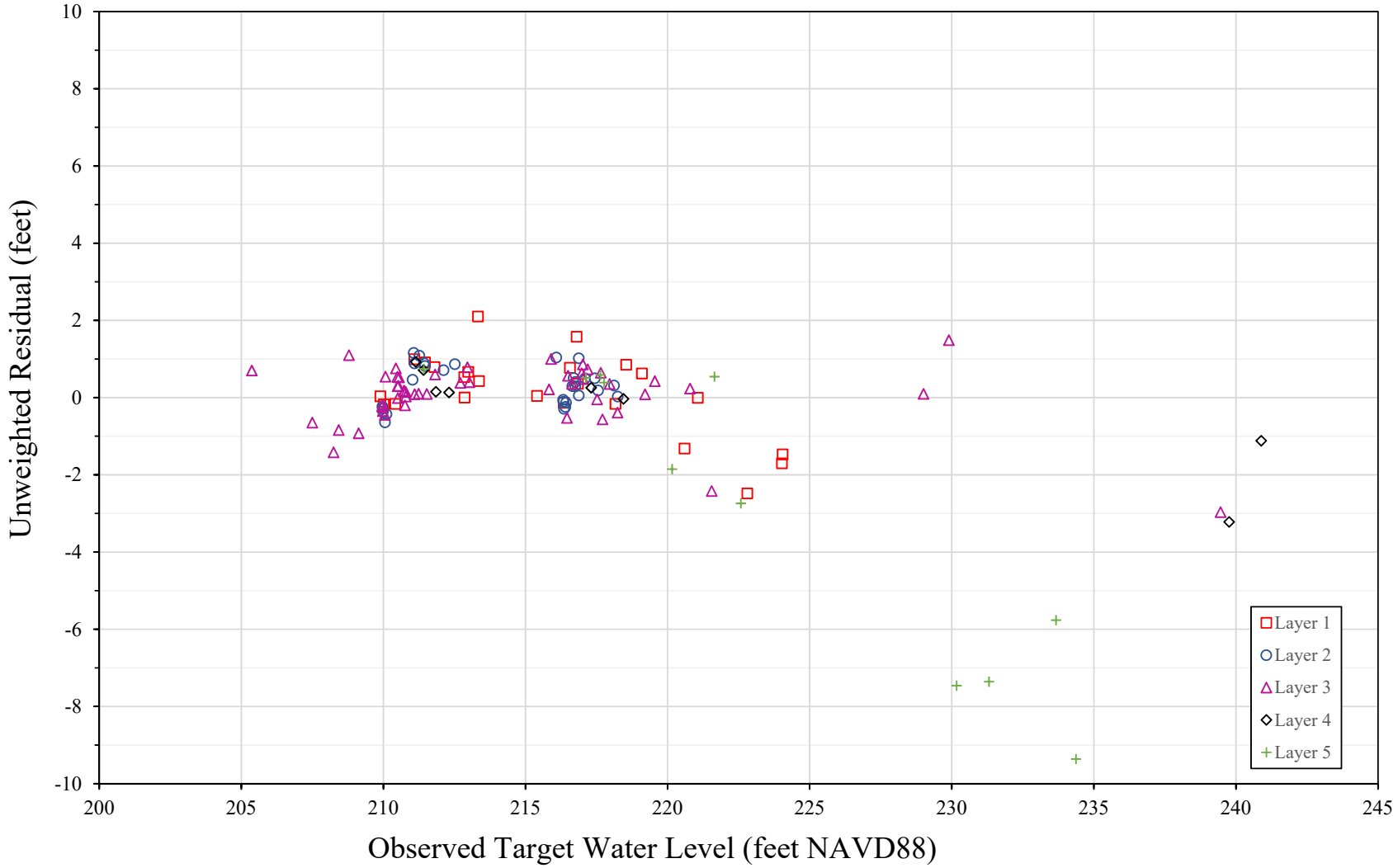
Figure **9.3j**




**Observed Target Water Levels vs. Residuals (Model Wide) for Stress Period 17**

Shepley's Hill Landfill Groundwater Model

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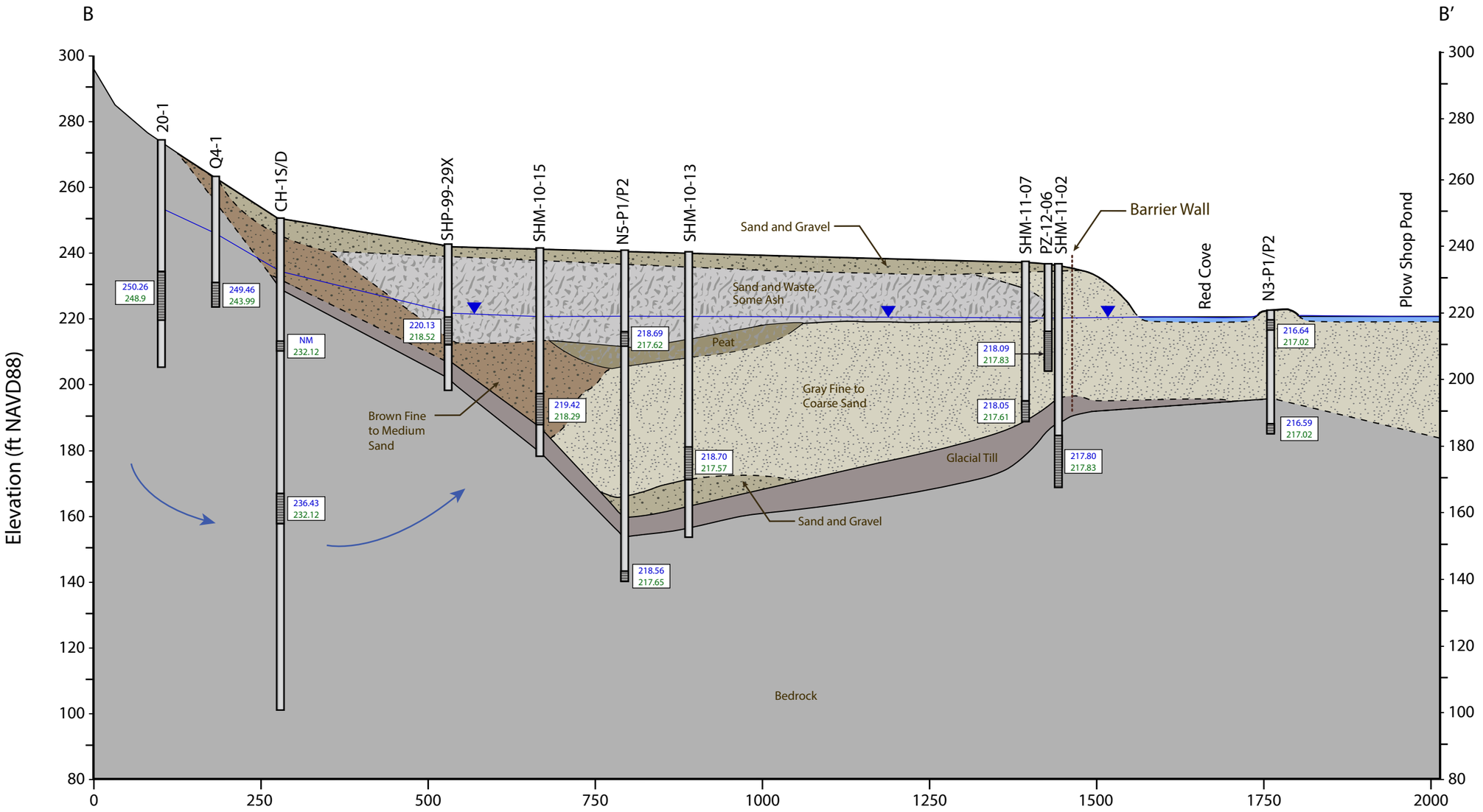
Figure **9.3k**

Notes:

1. Residual = Target Water Level - Predicted Water Level.
2. Predicted water levels were exported from model revision SHL300T2a R88PEST.
3. Target water level elevations represent the average of manually recorded water level elevations for a location during a given stress period.
4. Tabulated values are presented in Table 7.1.
5. Target water levels are relative to the North American Vertical Datum 1988.




Vertical Exaggeration 5:1

Notes:

1. Plow Shop Pond surface elevation specified as 216.4 ft (NAVD88) in 2nd Quarter 2016 (SP15).
2. Calculated water levels are from SHL300T2a R88PEST.
3. See Figure 7.1 for transect B-B' location.

Legend

2nd Quarter 2016 Water Levels (Stress Period 15)

249.46
243.85

Target
Calculated

Barrier Wall

Well Screen

NM Not Measured

Water Level Elevation (ft NAVD88)

Groundwater Flow Direction

# East-West Section Cross Section with Flow Directions

Shepley's Hill Landfill Groundwater Model

Former Fort Devens Army Installation

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FIGURE 9.4

N

Nonacoicus Brook

SHM-13-14S (-0.26)

EPA-PZ-2012-5A (-0.43)

SHP-05-47B (-0.18)

EPA-PZ-2012-7A (0.08)

SHL-13 (0.11)

EW-04

EW-01

N1-P3 (0.57)

SHP-01-36X (0.26)

RSK35 (0.63)

RSK34 (0.92)

Plow Shop Pond

RSK32 (0.57)

SHP-01-38A (-0.16)

N5-P2 (1.07)

RSK50 (-0.19)

RSK28 (0.44)

SHL-4 (-0.28)

RSK27 (0.25)

Grove Pond

RSK24 (0.31)

SHL-18 (-0.89)

SHL-7 (-0.84)

SHP-95-27X (-2.10)

SHM-93-24A (-0.33)

N7-P2 (-2.18)

SHL-17 (-1.10)

SHL-12 (-1.57)

AOC 57

57M-96-13X (0.89)

57M-95-06X (0.82)

57M-96-12X (0.82)

57M-03-01X (0.51)

57M-03-02X (-0.47)

57M-96-11X (-0.16)

57M-95-05X (-0.28)

57M-03-06X (-0.29)

57M-95-07X (-0.66)

57M-03-05X (-0.44)

57M-03-04X (-0.38)

57M-03-03X (0.62)

57WP-06-02 (-0.36)

## Legend

**Calibration Target Residual Value (ft)**

- ≤ -5.01 ft
- -2.01 to -5.00 ft
- -1.00 to -2.00 ft
- -0.99 to -0.01 ft
- 0 to 0.99 ft
- 1.00 to 2.00 ft
- 2.01 to 5.00 ft
- ≥ 5.01 ft

- Extraction Well
- Barrier Wall
- Approximate Extent of Historic Wetlands
- Wetlands
- Shepley's Hill Landfill
- Surface Water
- Dry Cells in SP18 for Layer 1
- Pond
- Simulated Equipotential Contour (ft) - SP15 Layer 1 (highest saturated layer in area of Layer 1 dry cells)
- (2.82) Calibration Target Residual Value (ft)

Notes:
1. Residual = Target – Calculated.
2. Positive residual values shown in blue indicate that the model simulated head is less than the target value. Negative residual values shown in green indicate that the model simulated head is greater than target value.

0 750 Feet

# Calibration Target Residuals for Stress Period 15 Layer 1

Shepley's Hill Landfill Groundwater Model

Former Fort Devens Army Installation
Devens, Massachusetts

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Figure 9.5a

N

Nonacoicus Brook

SHM-10-05A (-1.45)
SHM-13-07 (-0.89)
SHM-13-04 (-0.92)
EPA-PZ-2012-3A (-0.16)
EPA-PZ-2012-4A (0.00)
EPA-PZ-2012-2A (-0.41)
EW-04
EW-01
EPA-PZ-2012-1A (-0.29)
N1-P2 (-0.03)
SHL-23 (0.35)
SHP-01-37X (-0.09)
SHL-11 (-0.05)
RSK19 (-0.13)
N2-P2 (-0.19)
PZ-12-03 (-0.16)
RSK7 (-0.15)
SHP-99-29X (1.61)
PZ-12-04 (0.54)
N3-P2 (-0.38)
PZ-12-06 (0.26)
RSK37 (-0.42)
RSK15 (-0.28)
RSK12 (-0.09)
PZ-12-07 (-0.38)
SHL-10 (-0.81)
PZ-12-08 (0.26)
43M-01-17XOB (-0.11)
43M-01-20XOB (-0.16)
32Z-01-09XOB (0.30)

Plow Shop Pond

Grove Pond

## Legend

**Calibration Target Residual Value (ft)**

- ≤ -5.01 ft
- -2.01 to -5.00 ft
- -1.00 to -2.00 ft
- -0.99 to -0.01 ft
- 0 to 0.99 ft
- 1.00 to 2.00 ft
- 2.01 to 5.00 ft
- ≥ 5.01 ft

- Extraction Well
- Barrier Wall
- Approximate Extent of Historic Wetlands
- Wetlands
- Shepley's Hill Landfill
- Surface Water
- Dry Cells in SP18 for Layer 2
- Pond
- Simulated Equipotential Contour (ft) - SP15 Layer 2 (highest saturated layer in area of Layer 2 dry cells)
- (2.82) Calibration Target Residual Value (ft)

Notes:
1. Residual = Target – Calculated.
2. Positive residual values shown in blue indicate that the model simulated head is less than the target value. Negative residual values shown in green indicate that the model simulated head is greater than target value.

0 750 Feet

# Calibration Target Residuals for Stress Period 15 Layer 2

Shepley's Hill Landfill Groundwater Model

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Figure 9.5b

N

SHM-13-15 (-0.33)
SHM-13-14D (-0.43)
SHM-13-03 (-0.32)
SHM-13-08 (-0.78)
SHM-10-10 (-0.25)
SHM-13-05 (-1.22)
SHM-13-02 (-0.42)
SHM-13-06 (-0.83)
SHM-99-32X (-0.09)
SHP-99-34B (0.19)
SHM-05-40X (-1.36)
SHM-07-03 (-1.12)
SHM-05-41B (-0.15)
SHM-10-16 (-0.14)
SHM-93-22B (-0.38)
EPA-PZ-2012-5B (-0.35)
EPA-PZ-2012-6B (0.36)
SHM-96-5B (-0.29)
EPA-PZ-2012-7B (0.11)
EPA-PZ-2012-1B (-0.25)
EW-04
EW-01
EPA-PZ-2012-3B (-0.14)
N1-P1 (0.12)
EPA-PZ-2012-4B (0.17)
SHP-05-43 (0.60)
SHP-05-44 (0.07)
PZ-12-02 (0.67)
PZ-12-01 (0.12)
SHL-20 (0.59)
RSK1 (-0.11)
RSK16 (-0.12)
SHM-10-13 (1.13)
SHP-01-38B (-0.12)
SHM-11-07 (0.44)
SHM-10-15 (1.15)
RSK13 (-0.25)
PZ-12-05 (-0.10)
RSK25 (-0.46)
SHM-10-12 (1.24)
PZ-12-09 (0.06)
PZ-12-10 (-0.10)
SHL-3 (-1.52)
SHP-99-35X (0.62)
SHM-93-18B (-1.16)
SHM-10-11 (-1.83)
SHL-15 (-2.10)
32Z-01-08XOB (-1.84)
32M-01-14XOB (2.95)
SHL-25 (0.82)
32M-92-03X (0.06)
43M-01-16XOB (0.29)
32Z-01-05XOB (0.02)

Nonacoicus Brook

Plow Shop Pond

Grove Pond

## Legend

**Calibration Target Residual Value (ft)**

- ≤ -5.01 ft
- -2.01 to -5.00 ft
- -1.00 to -2.00 ft
- -0.99 to -0.01 ft
- 0 to 0.99 ft
- 1.00 to 2.00 ft
- 2.01 to 5.00 ft
- ≥ 5.01 ft

- Extraction Well
- Barrier Wall
- Approximate Extent of Historic Wetlands
- Wetlands
- Shepley's Hill Landfill
- Surface Water
- Dry Cells in SP18 for Layer 3
- Pond
- Simulated Equipotential Contour (ft) - SP15 Layer 3 (highest saturated layer in area of Layer 3 dry cells)
- (2.82) Calibration Target Residual Value (ft)

Notes:
1. Residual = Target – Calculated.
2. Positive residual values shown in blue indicate that the model simulated head is less than the target value. Negative residual values shown in green indicate that the model simulated head is greater than target value.

0 750 Feet

# Calibration Target Residuals for Stress Period 15 Layer 3

Shepley's Hill Landfill Groundwater Model

Former Fort Devens Army Installation
Devens, Massachusetts

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Figure 9.5c

N

Nonacoicus Brook

SHM-10-01
(-0.48)

SHM-05-41C
(-0.09)

EPA-PZ-2012-2B
(-0.35)

EW-04

EW-01

Plow Shop Pond

RSK41
(-0.37)

SHM-10-07
(0.44)

SHL-19
(-0.49)

Grove Pond

32M-92-01X
(-2.28)

32Z-01-07XOB
(-0.65)

## Legend

**Calibration Target Residual Value (ft)**

- ≤ -5.01 ft
- -2.01 to -5.00 ft
- -1.00 to -2.00 ft
- -0.99 to -0.01 ft
- 0 to 0.99 ft
- 1.00 to 2.00 ft
- 2.01 to 5.00 ft
- ≥ 5.01 ft

- Extraction Well
- Barrier Wall
- Approximate Extent of Historic Wetlands
- Wetlands
- Shepley's Hill Landfill
- Surface Water
- Dry Cells in SP18 for Layer 4
- Pond
- Simulated Equipotential Contour (ft) - SP15 Layer 4 (highest saturated layer in area of Layer 4 dry cells)
- (2.82) Calibration Target Residual Value (ft)

Notes:
1. Residual = Target – Calculated.
2. Positive residual values shown in blue indicate that the model simulated head is less than the target value. Negative residual values shown in green indicate that the model simulated head is greater than target value.

0 750 Feet

# Calibration Target Residuals for Stress Period 15 Layer 4

Shepley's Hill Landfill Groundwater Model

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Figure **9.5d**

N

Nonacoicus Brook

Plow Shop Pond

Grove Pond

EW-04

EW-01

20-1 (1.36)

Q5-1 (5.32)

CAP-2B (1.72)

Q4-1 (5.47)

CH-1D (4.31)

3-1 (-3.13)

N5-P1 (0.91)

SHM-11-02 (-0.03)

RSK8 (-0.08)

N3-P1 (-0.43)

SHP-99-01C (7.97)

N6-P1 (-1.09)

32Z-01-06XBR (2.09)

N7-P1 (-2.37)

SHL-24 (0.26)

32M-01-14XBR (3.79)

32Z-01-12XBR (0.68)

32M-01-18XBR (0.38)

32M-01-16XBR (-3.04)

43M-01-16XBR (0.14)

43M-01-20XBR (-0.14)

43M-01-17XBR (-0.07)

32Z-01-10XBR (1.25)

## Legend

**Calibration Target Residual Value (ft)**

- ≤ -5.01 ft
- -2.01 to -5.00 ft
- -1.00 to -2.00 ft
- -0.99 to -0.01 ft
- 0 to 0.99 ft
- 1.00 to 2.00 ft
- 2.01 to 5.00 ft
- ≥ 5.01 ft

- Extraction Well
- Barrier Wall
- Approximate Extent of Historic Wetlands
- Wetlands
- Shepley's Hill Landfill
- Surface Water
- Dry Cells in SP18 for Layer 5
- Pond
- Simulated Equipotential Contour (ft) - SP15 Layer 5 (highest saturated layer in area of Layer 5 dry cells)
- (2.82) Calibration Target Residual Value (ft)

Notes:
1. Residual = Target – Calculated.
2. Positive residual values shown in blue indicate that the model simulated head is less than the target value. Negative residual values shown in green indicate that the model simulated head is greater than target value.

0 750 Feet

# Calibration Target Residuals for Stress Period 15 Layer 5

Shepley's Hill Landfill Groundwater Model

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Figure 9.5e

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N

Nonacoicus Brook

EPA-PZ-2012-5A (0.79)
SHP-05-47A (0.52)
SHP-05-47B (0.66)
SHL-9 (0.90)
EPA-PZ-2012-7A (0.97)
SHL-5 (2.12)
SHL-13 (0.42)
EW-04
EW-01
SHP-2016-1A (-0.08)
SHL-21 (0.07)
N1-P3 (1.52)
SHP-05-46A (-0.15)
SHP-05-45A (-0.24)
SHP-01-36X (0.75)
RSK35 (0.10)
Plow Shop Pond
RSK50 (-0.14)
SHP-01-38A (0.35)
Grove Pond
SHL-18 (-0.10)
SHP-95-27X (-1.17)
N7-P2 (-2.14)
SHM-93-24A (0.18)
SHL-17 (-1.09)
SHL-12 (-1.31)

## Legend

**Calibration Target Residual Value (ft)**

- ≤ -5.01 ft
- -2.01 to -5.00 ft
- -1.00 to -2.00 ft
- -0.99 to -0.01 ft
- 0 to 0.99 ft
- 1.00 to 2.00 ft
- 2.01 to 5.00 ft
- ≥ 5.01 ft

- Extraction Well
- Barrier Wall
- Approximate Extent of Historic Wetlands
- Wetlands
- Shepley's Hill Landfill
- Surface Water
- Dry Cells in SP18 for Layer 1
- Pond
- Simulated Equipotential Contour (ft) - SP17 Layer 1 (highest saturated layer in area of Layer 1 dry cells)
- (2.82) Calibration Target Residual Value (ft)

Notes:
1. Residual = Target – Calculated.
2. Positive residual values shown in blue indicate that the model simulated head is less than the target value. Negative residual values shown in green indicate that the model simulated head is greater than target value.

0 750 Feet

# Calibration Target Residuals for Stress Period 17 Layer 1

Shepley's Hill Landfill Groundwater Model

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Figure 9.5f

G:\GIS\Projects\438002_FDevens\MXD\2018\438002_Submittal\SP17_Calibration Target Residuals for Stress Period 17 Layer 1.mxd, author:jdrummey, ywx, ProName, Task, Phase, Document Number etc.

N

Nonacoicus Brook

SHM-10-05A (-0.71)

SHP-2016-2A (-0.36)

SHM-05-42A (0.90)

SHM-05-41A (0.89)

SHP-2016-4A (-0.24)

SHP-2016-3A (-0.43)

SHP-2016-5A (-0.30)

EPA-PZ-2012-2A (0.88)

EPA-PZ-2012-1A (0.75)

EPA-PZ-2012-6A (1.12)

EW-04

EPA-PZ-2012-3A (0.83)

N1-P2 (1.02)

SHL-23 (0.45)

EW-01

EPA-PZ-2012-4A (1.07)

RSK19 (-0.11)

SHP-01-37X (0.51)

SHL-11 (0.30)

PZ-12-03 (0.29)

Plow Shop Pond

N2-P2 (0.41)

PZ-12-04 (0.58)

RSK7 (-0.06)

SHP-99-29X (0.39)

RSK12 (-0.13)

N3-P2 (0.49)

RSK37 (-0.31)

PZ-12-06 (0.27)

RSK15 (-0.26)

Grove Pond

PZ-12-08 (0.07)

PZ-12-07 (0.03)

## Legend

**Calibration Target Residual Value (ft)**

- ≤ -5.01 ft
- -2.01 to -5.00 ft
- -1.00 to -2.00 ft
- -0.99 to -0.01 ft
- 0 to 0.99 ft
- 1.00 to 2.00 ft
- 2.01 to 5.00 ft
- ≥ 5.01 ft

- Extraction Well
- Barrier Wall
- Approximate Extent of Historic Wetlands
- Wetlands
- Shepley's Hill Landfill
- Surface Water
- Dry Cells in SP18 for Layer 2
- Pond
- Simulated Equipotential Contour (ft) - SP17 Layer 2 (highest saturated layer in area of Layer 2 dry cells)
- (2.82) Calibration Target Residual Value (ft)

Notes:
1. Residual = Target – Calculated.
2. Positive residual values shown in blue indicate that the model simulated head is less than the target value. Negative residual values shown in green indicate that the model simulated head is greater than target value.

0 750 Feet

# Calibration Target Residuals for Stress Period 17 Layer 2

Shepley's Hill Landfill Groundwater Model

Former Fort Devens Army Installation
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Figure 9.5g

N

Nonacoicus Brook

SHM-99-31C (-0.93)
SHM-05-42B (0.19)
SHM-05-39B (-1.43)
SHP-2016-3B (-0.43)
SHM-10-16 (0.32)
SHM-99-32X (0.14)
SHP-99-34B (-0.23)
SHM-05-40X (-0.84)
SHM-07-03 (-0.60)
SHM-05-41B (0.31)
SHM-93-22B (0.04)
SHM-13-01 (0.70)
SHP-2016-2B (-0.34)
EPA-PZ-2012-5B (0.09)
SHP-2016-4B (-0.17)
SHM-96-5B (0.13)
SHM-96-5C (0.63)
EPA-PZ-2012-7B (0.50)
SHL-8S (0.79)
SHP-2016-5B (-0.21)
EPA-PZ-2012-1B (0.13)
EPA-PZ-2012-6B (0.69)
EPA-PZ-2012-3B (0.18)
EW-04
EW-01
N1-P1 (1.02)
SHP-2016-1B (0.66)
SHM-10-06A (0.46)
SHP-05-45B (0.42)
SHM-10-06 (0.47)
SHP-05-44 (0.23)
EPA-PZ-2012-4B (0.51)
SHP-05-46B (0.00)
PZ-12-01 (0.36)
Plow Shop Pond
PZ-12-02 (0.94)
N2-P1 (0.63)
SHM-10-14 (0.71)
SHM-10-13 (0.73)
SHL-20 (0.82)
SHM-10-15 (0.42)
PZ-12-05 (0.48)
RSK25 (-0.55)
Grove Pond
SHM-10-12 (0.47)
PZ-12-09 (-0.04)
PZ-12-10 (0.14)
SHL-3 (-0.54)
SHP-99-35X (0.33)
SHM-93-18B (-0.33)
SHM-10-11 (-2.22)
SHL-15 (-2.97)
32M-01-14XOB (1.84)
SHL-25 (0.48)

## Legend

**Calibration Target Residual Value (ft)**

- ≤ -5.01 ft
- -2.01 to -5.00 ft
- -1.00 to -2.00 ft
- -0.99 to -0.01 ft
- 0 to 0.99 ft
- 1.00 to 2.00 ft
- 2.01 to 5.00 ft
- ≥ 5.01 ft

- Extraction Well
- Barrier Wall
- Approximate Extent of Historic Wetlands
- Wetlands
- Shepley's Hill Landfill
- Surface Water
- Dry Cells in SP18 for Layer 3
- Pond
- Simulated Equipotential Contour (ft) - SP17 Layer 3 (highest saturated layer in area of Layer 3 dry cells)
- (2.82) Calibration Target Residual Value (ft)

Notes:
1. Residual = Target – Calculated.
2. Positive residual values shown in blue indicate that the model simulated head is less than the target value. Negative residual values shown in green indicate that the model simulated head is greater than target value.

0 750 Feet

# Calibration Target Residuals for Stress Period 17 Layer 3

Shepley's Hill Landfill Groundwater Model

Former Fort Devens Army Installation
Devens, Massachusetts

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Figure 9.5h

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N

Nonacoicus Brook

SHM-05-41C (0.94)

SHL-22 (0.73)

SHL-8D (0.14)

EW-04

EPA-PZ-2012-2B (0.17)

EW-01

Plow Shop Pond

Grove Pond

SHM-10-07 (0.05)

SHL-19 (0.23)

32M-92-01X (-3.22)

32Z-01-07XOB (-1.08)

## Legend

**Calibration Target Residual Value (ft)**

- ≤ -5.01 ft
- -2.01 to -5.00 ft
- -1.00 to -2.00 ft
- -0.99 to -0.01 ft
- 0 to 0.99 ft
- 1.00 to 2.00 ft
- 2.01 to 5.00 ft
- ≥ 5.01 ft

- Extraction Well
- Barrier Wall
- Approximate Extent of Historic Wetlands
- Wetlands
- Shepley's Hill Landfill
- Surface Water
- Dry Cells in SP18 for Layer 4
- Pond
- Simulated Equipotential Contour (ft) - SP17 Layer 4 (highest saturated layer in area of Layer 4 dry cells)
- (2.82) Calibration Target Residual Value (ft)

Notes:
1. Residual = Target – Calculated.
2. Positive residual values shown in blue indicate that the model simulated head is less than the target value.
   Negative residual values shown in green indicate that the model simulated head is greater than target value.

0 750 Feet

# Calibration Target Residuals for Stress Period 17 Layer 4

Shepley's Hill Landfill Groundwater Model

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Figure 9.5i

G:\GIS\Projects\438302_FDevens\WRD\2018\Jul\mxd\Fig 9.3_Calibration Target Residuals for Stress Period 17 Layer 4.mxd aaharon 4/dd/mmm/yyyy ProPoint Task/Phase Document Number etc.

N

Nonacoicus Brook

Plow Shop Pond

Grove Pond

SHM-93-22C (0.76)

EW-04

EW-01

20-1 (-9.05)

Q5-1 (-7.23)

Q4-1 (-5.59)

3-1 (-7.30)

N5-P1 (0.67)

SHM-11-02 (0.47)

N3-P1 (0.50)

SHP-99-01C (0.84)

N6-P1 (-1.72)

N7-P1 (-2.40)

SHL-24 (0.74)

## Legend

**Calibration Target Residual Value (ft)**

- ≤ -5.01 ft
- -2.01 to -5.00 ft
- -1.00 to -2.00 ft
- -0.99 to -0.01 ft
- 0 to 0.99 ft
- 1.00 to 2.00 ft
- 2.01 to 5.00 ft
- ≥ 5.01 ft

- Extraction Well
- Barrier Wall
- Approximate Extent of Historic Wetlands
- Wetlands
- Shepley's Hill Landfill
- Surface Water
- Dry Cells in SP18 for Layer 5
- Pond
- Simulated Equipotential Contour (ft) - SP17 Layer 5 (highest saturated layer in area of Layer 5 dry cells)
- (2.82) Calibration Target Residual Value (ft)

Notes:
1. Residual = Target – Calculated.
2. Positive residual values shown in blue indicate that the model simulated head is less than the target value. Negative residual values shown in green indicate that the model simulated head is greater than target value.

0 750 Feet

# Calibration Target Residuals for Stress Period 17 Layer 5

Shepley's Hill Landfill Groundwater Model

Former Fort Devens Army Installation
Devens, Massachusetts

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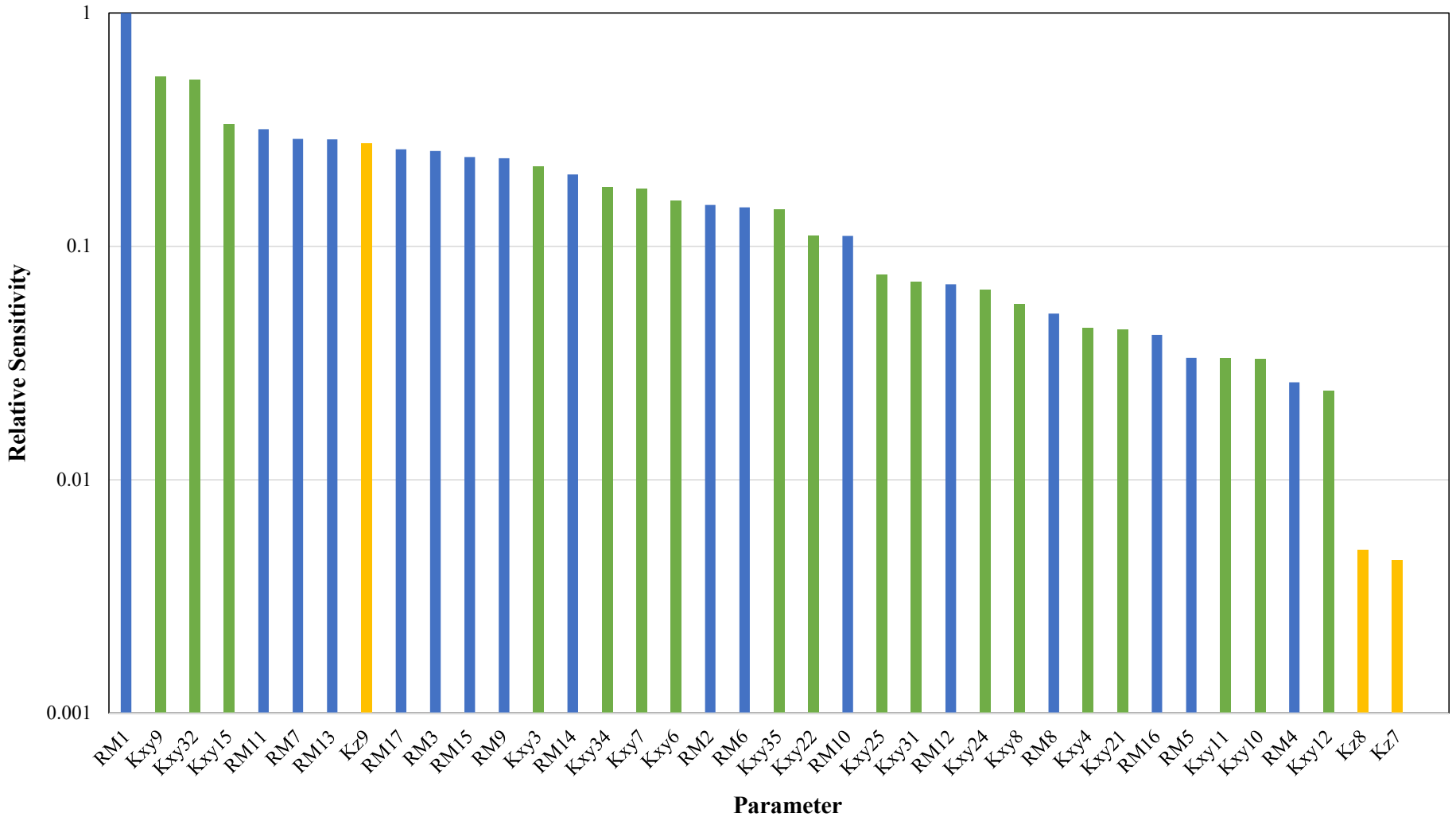
Figure 9.5j




Notes:

1. Kxy = Horizontal hydraulic conductivity in x and y direction by zone (green)
   Kz = Vertical hydraulic conductivity in z direction by zone (orange)
   RM = Recharge multiplier by stress period (blue)
2. Recharge multiplier values for each stress period are presented on Table 6.3.
3. Hydraulic conductivity values are shown on Table 5.2 and zonation depicted in Figures 5.5 to 5.8.
4. Composite sensitivity values were generated using PEST and include all model parameters adjusted during the calibration process.
5. Relative composite sensitivity coefficients equal the individual parameter's composite sensitivity divided by the maximum composite sensitivity.
6. Relative composite sensitivity coefficients that are less than 0.01 are considered to be relatively insensitive.
7. Relative composite sensitivities are reflective of model revision SHL300T2a R88PEST.

**Final PEST Scaled Composite Sensitivity Coefficients**

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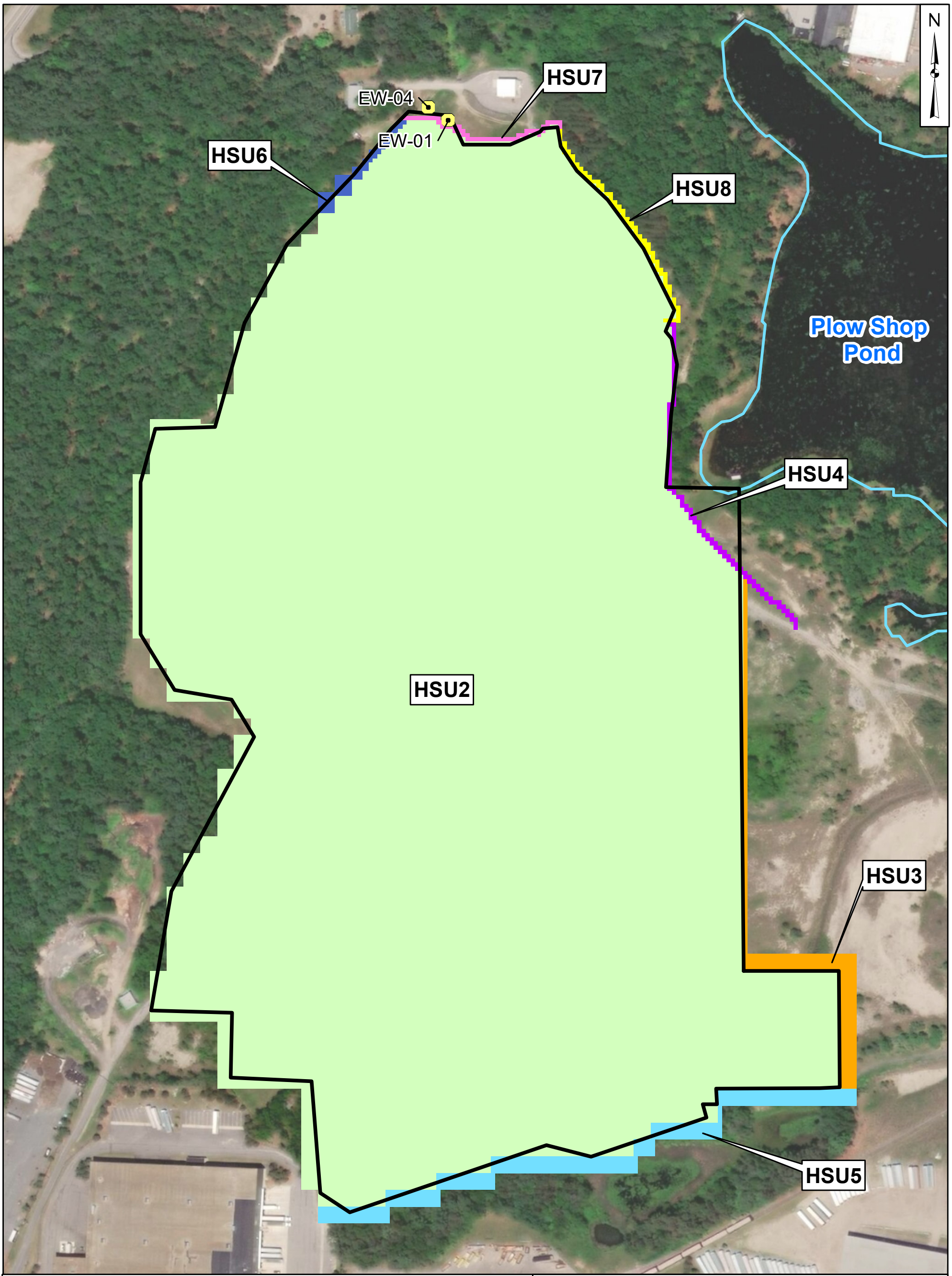
Figure **9.6**




## Legend

Extraction Well

Shepley's Hill Landfill

200 100 0 200 Feet

| HSU | Description | Zone Color |
|---|---|---|
| 1 | Overburden Area Outside HSU2 Through HSU8 | Not Shown |
| 2 | Overburden Beneath the Landfill Cap | |
| 3 | Southeast Landfill Boundary | |
| 4 | Barrier Wall | |
| 5 | Southern Landfill Boundary | |
| 6 | Northwest Landfill Boundary | |
| 7 | Northern Landfill Boundary | |
| 8 | Northeast Landfill Boundary | |
| 9 | Shallow Bedrock (Layer 5) Beneath the Landfill Cap | Not Shown |

Notes:
1. HSU = Hydrostratigraphic Unit.
2. HSU2 through HSU8 extend from model layer 1 to layer 4.

# Landfill Hydrostratigraphic Units

Shepley's Hill Landfill Groundwater Model

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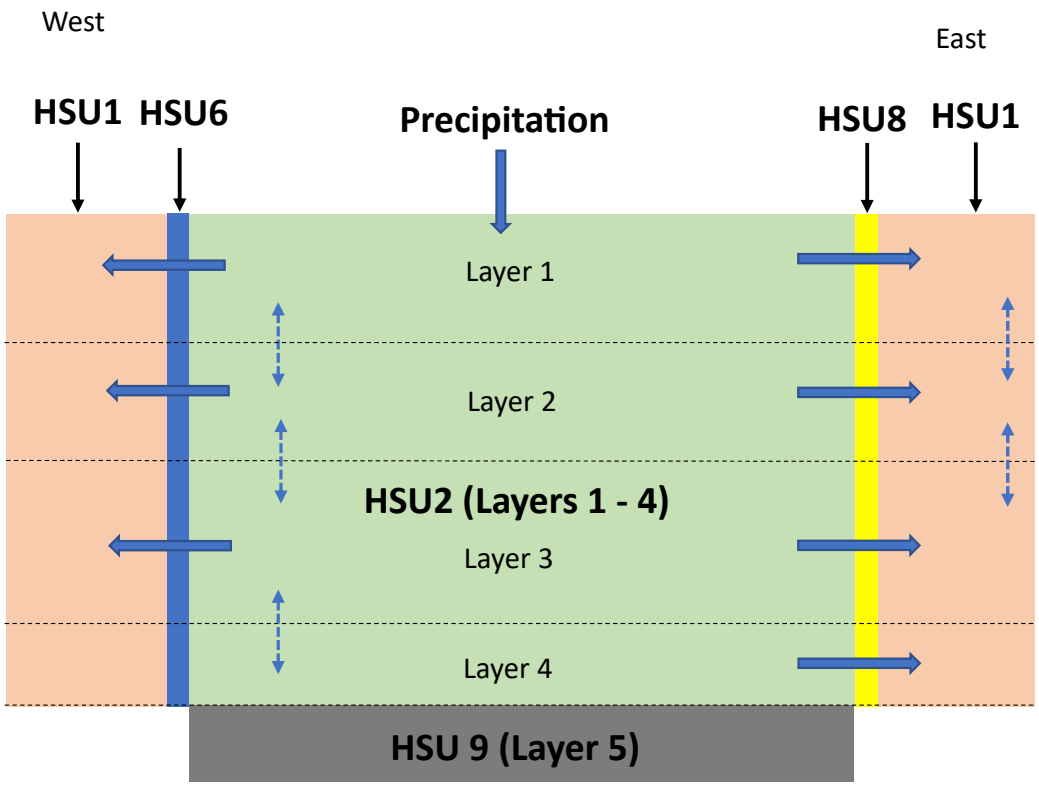
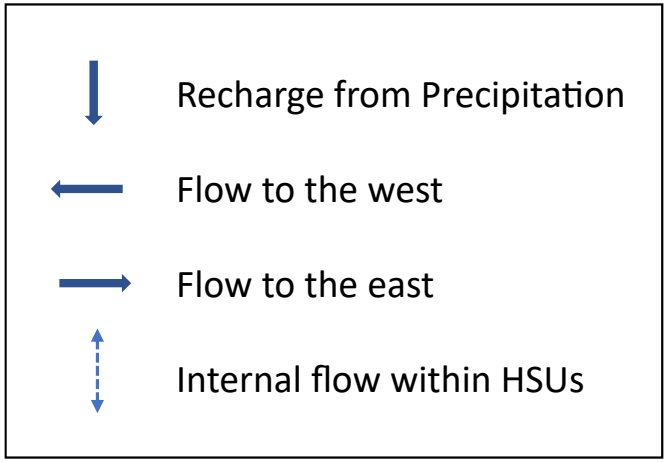
Figure 9.7

G:\GIS\Projects\LF38302_FDevens\MXD\2019\04\02_Submittal\HYU_Landfill_HydrostratigraphicUnits.mxd author: dsimmons Project: Task/Phase: Document Number: etc.




Note:
1. HSU – Hydrostratigraphic unit

**Landfill Hydrostratigraphic Unit Cross Section Schematic**

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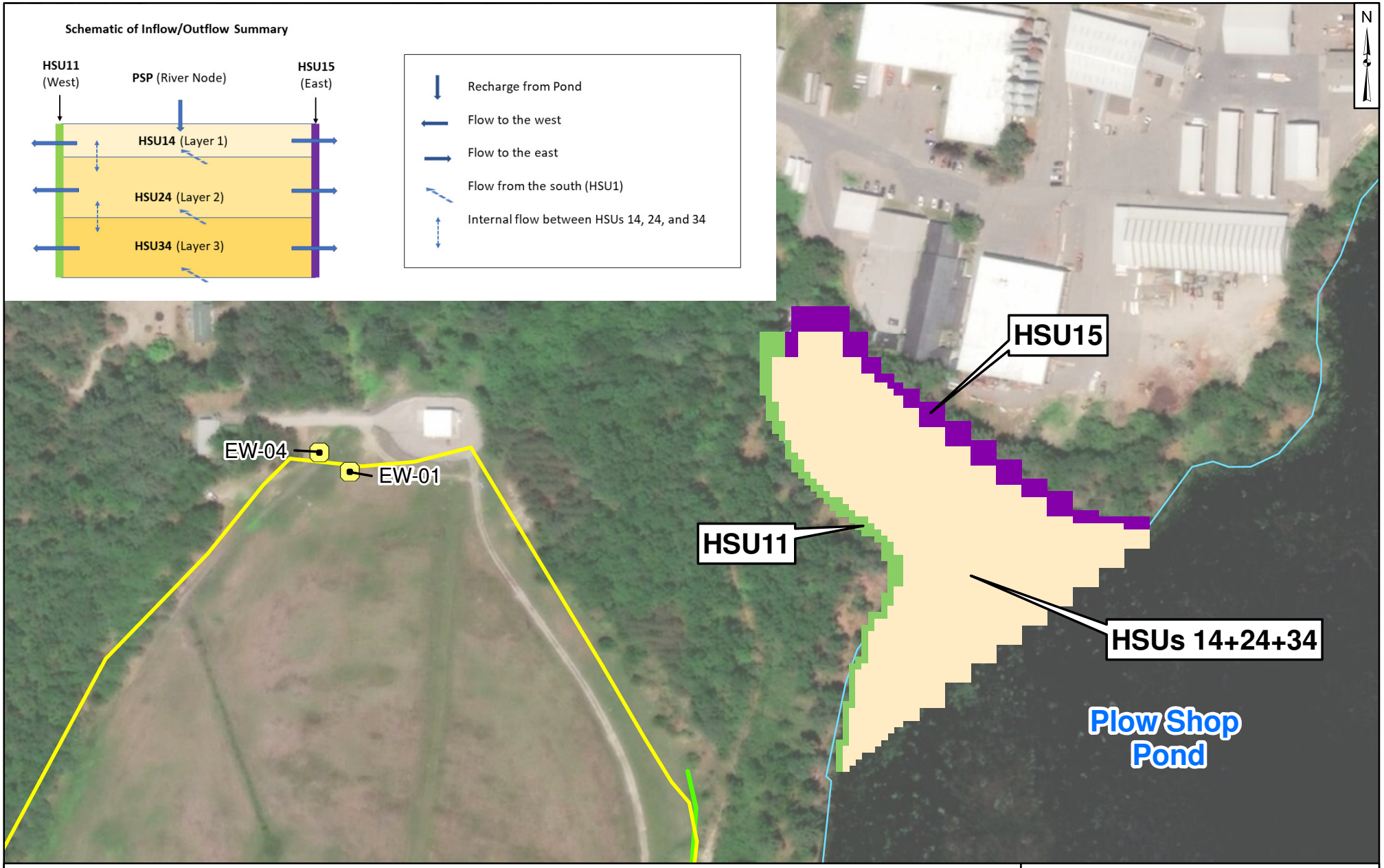
Figure **9.7a**




**Legend**

- Extraction Well
- Barrier Wall
- Shepley's Hill Landfill

| HSU | Zone Color |
|---|---|
| 11 | |
| 14 | |
| 15 | |

Notes:
1. HSU = Hydrostratigraphic Unit.
2. HSU1 is the area outside HSU11, 15 and HSU 14+24+34 and extends from model layer 1 to layer 3.

200 100 0 200 Feet

**Northwest Plow Shop Pond Hydrostratigraphic Units**

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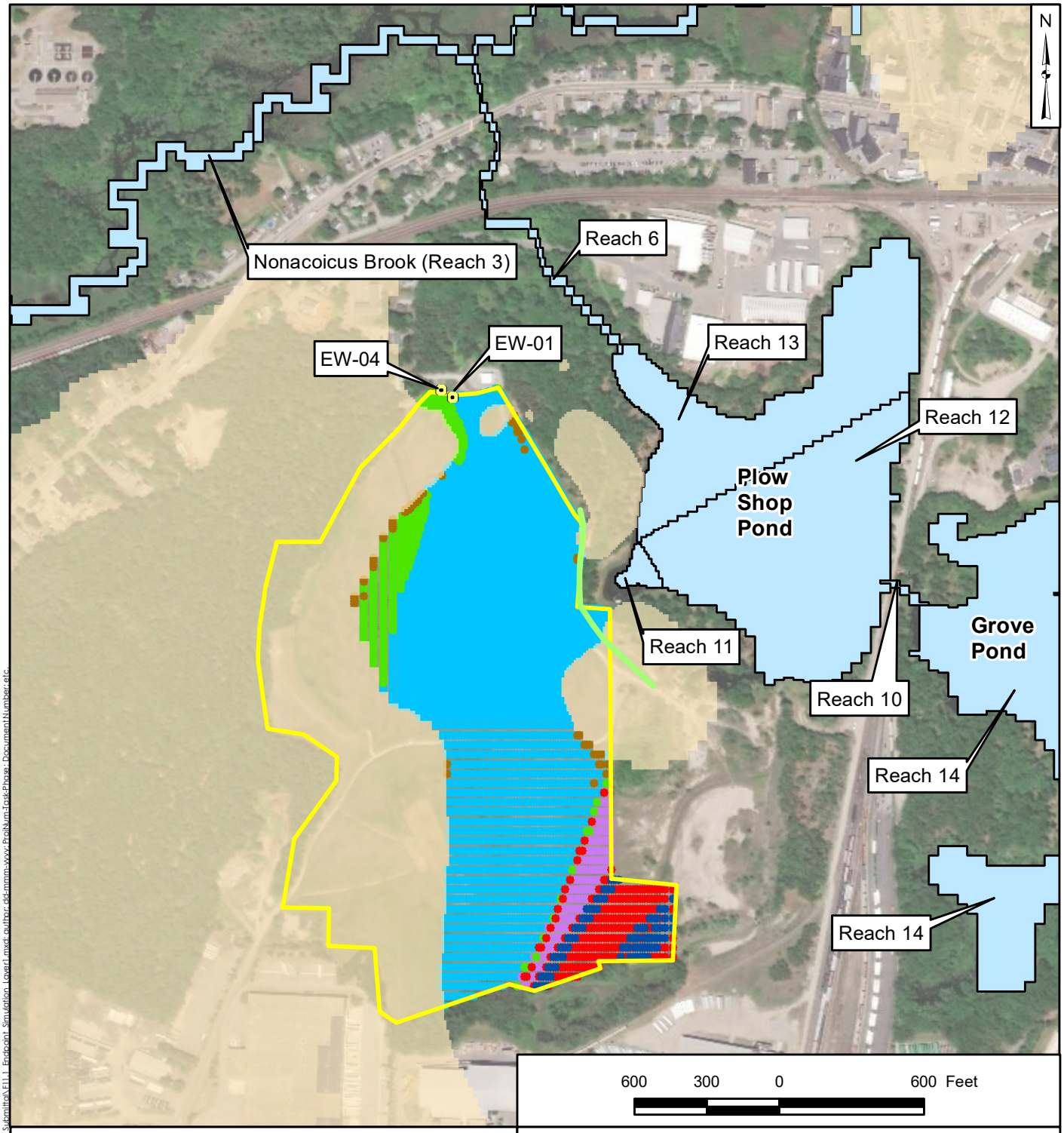
Figure 9.8




**Legend**

- Extraction Well Location
- Shepley's Hill Landfill
- Barrier Wall
- Dry Cells in SP18 for Layer 1

**Endpoint Location**

- EW-01
- EW-04
- Reach 12
- Nonacoicus Brook (Reach 3)
- Dry Cell
- Active Particles

Notes:
1. Particles were released in SP2 and tracked until the end of SP18.
2. The duration of SP18 (steady-state) was extended to simulate 50 years to maximize the number of particles captured.
3. Particle starting locations beneath the landfill were limited near the western boundary due to simulated dry cells.
4. A total of 16 particles were released into each model cell in a 2x2 array with Z offsets = 0.2, 0.4, 0.6, and 0.8. For visualization the results shown here are limited to the Z offset of 0.6. Refer to Table 11.1 for additional analysis details.
5. The effective porosity was assumed to equal 0.30.

# Endpoint Analysis for Particles Generated Beneath the Landfill in Layer 1 (Z Offset = 0.6)

Shepley's Hill Landfill Groundwater Model

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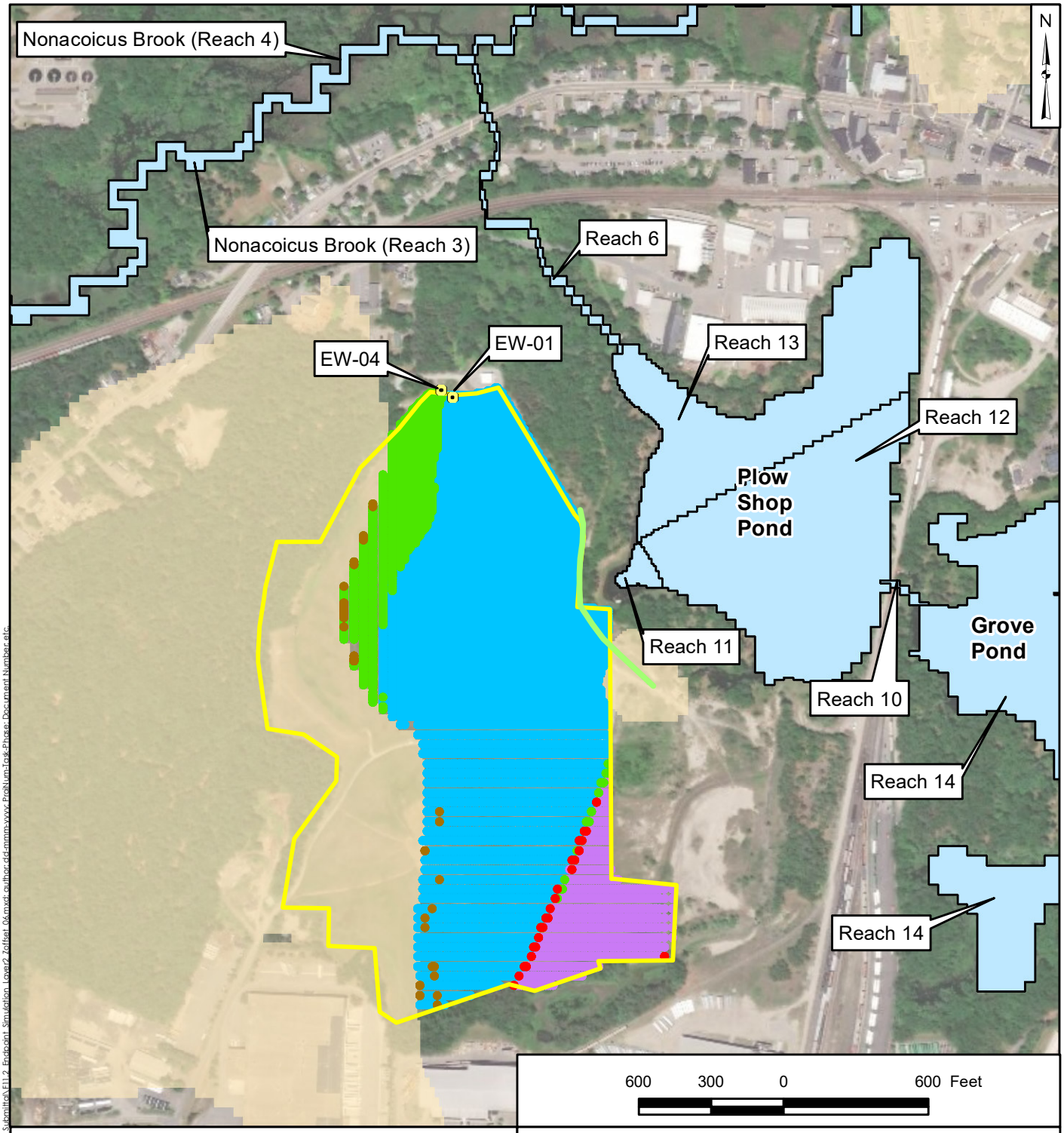
Figure 11.1

(Q:\ = \\boston-01\Gis$\ Q:\GIS\Projects\BR0302_FtDevens\MXD\2018\Submittal\F11.1_Endpoint_Simulation_Layer1.mxd; author: dds-mmm-www; ProjNum-Task-Phase; DocumentNumber; etc.




**Legend**

- Extraction Well Location
- Shepley's Hill Landfill
- Barrier Wall
- Dry Cells in SP18 for Layer 2

**Endpoint Location**

- EW-01
- EW-04
- Nonacoicus Brook (Reach 3)
- Dry Cell
- Active Particles

Notes:
1. Particles were released in SP2 and tracked until the end of SP18.
2. The duration of SP18 (steady-state) was extended to simulate 50 years to maximize the number of particles captured.
3. Particle starting locations beneath the landfill were limited near the western boundary due to simulated dry cells.
4. A total of 16 particles were released into each model cell in a 2x2 array with Z offsets = 0.2, 0.4, 0.6, and 0.8. For visualization the results shown here are limited to the Z offset of 0.6. Refer to Table 11.1 for additional analysis details.
5. The effective porosity was assumed to equal 0.30.

# Endpoint Analysis for Particles Generated Beneath the Landfill in Layer 2 (Z Offset = 0.6)

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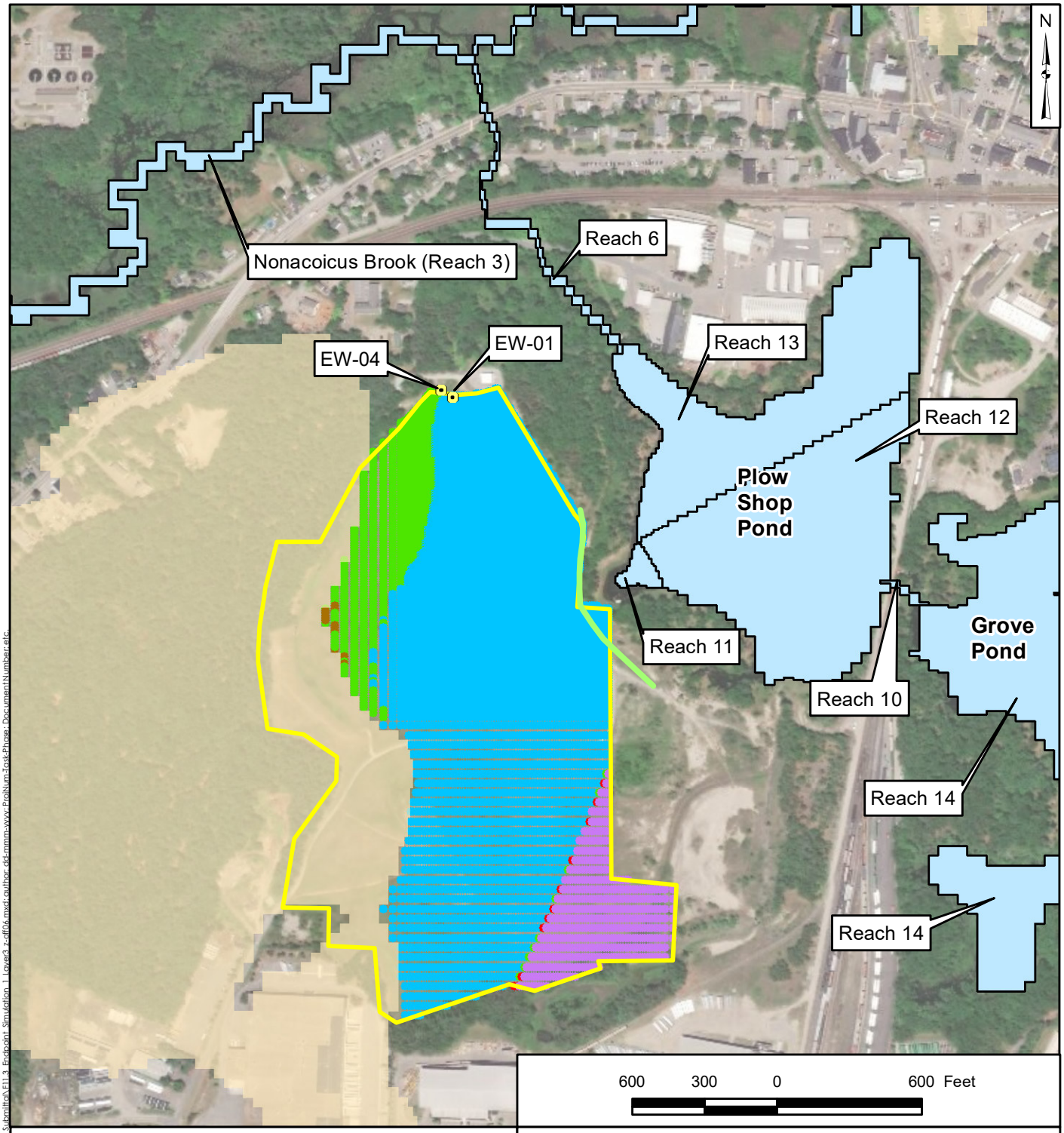
Figure 11.2

(Q:\ = \\boston01\Gis$\) Q:\GisProjects\BR0302_FtDevens\MXD\2018\Submittal\F11.2_Endpoint_Simulation_Layer2_Zoffset_06.mxd; author; dd-mmm-yyyy; ProjNum-Task-Phase; Document Number, etc.




600 300 0 600 Feet

**Legend**

- Extraction Well Location
- Shepley's Hill Landfill
- Barrier Wall
- Dry Cells in SP18 for Layer 3

**Endpoint Location**

- EW-01
- EW-04
- Nonacoicus Brook (Reach 3)
- Active Particles
- Dry Cell

Notes:
1. Particles were released in SP2 and tracked until the end of SP18.
2. The duration of SP18 (steady-state) was extended to simulate 50 years to maximize the number of particles captured.
3. Particle starting locations beneath the landfill were limited near the western boundary due to simulated dry cells.
4. A total of 16 particles were released into each model cell in a 2x2 array with Z offsets = 0.2, 0.4, 0.6, and 0.8. For visualization the results shown here are limited to the Z offset of 0.6. Refer to Table 11.1 for additional analysis details..
5. The effective porosity was assumed to equal 0.30.

# Endpoint Analysis for Particles Generated Beneath the Landfill in Layer 3 (Z Offset = 0.6)

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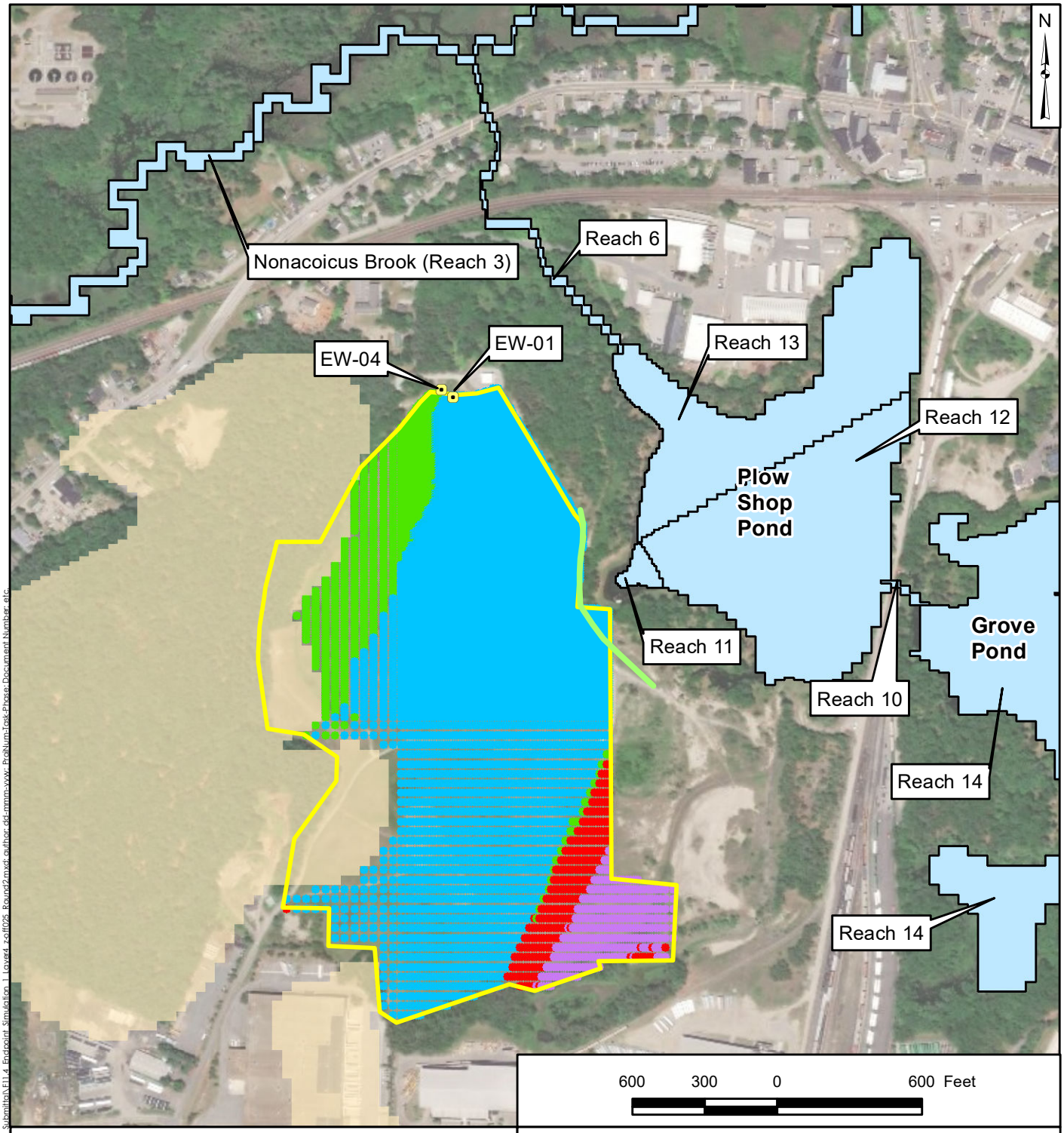
Figure 11.3

(Q:\ = \\boston01\Gis$\) Q:\GisProjects\BR0302_FtDevens\MXD\2018\Ft2018_SubmittalFig\F11.3_Endpoint_Simulation_1_Layer3_z-off06.mxd; author: dd-mmm-yyyy; ProjNum-Task-Phase; DocumentNumber.etc.




**Legend**

- Extraction Well Location
- Shepley's Hill Landfill
- Barrier Wall
- Dry Cells in SP18 for Layer 4

**Endpoint Location**

- EW-01
- EW-04
- Nonacoicus Brook (Reach 3)
- Active Particles

Notes:
1. Particles were released in SP2 and tracked until the end of SP18.
2. The duration of SP18 (steady-state) was extended to simulate 50 years to maximize the number of particles captured.
3. Particle starting locations beneath the landfill were limited near the western boundary due to simulated dry cells.
4. A single particle was released into each model cell with a Z offset = 0.25. Refer to Table 11.1 for additional analysis details.
5. The effective porosity was assumed to equal 0.30.

# Endpoint Analysis for Particles Generated Beneath the Landfill in Layer 4 (Z Offset = 0.25)

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Figure 11.4

(Q:\ = \\boston01\GIS$\) Q:\GISProjects\BR0302_FtDevens\MXD\2018\Submittal\F11.4_Endpoint_Simulation_1_Layer4_zoff025_Round2.mxd; author: dd-mmm-yyyy; ProjNum-Task-Phase; Document Number; etc.

N

Nonacoicus Brook

Plow Shop Pond

SHM-13-03
SHM-13-14D
SHM-13-08
SHM-13-07
SHM-13-06
SHM-13-04
SHM-07-05
SHM-05-40X
SHM-99-31C
SHM-99-32X
SHM-10-16
SHM-05-42B
SHM-05-41A
SHM-05-41B
SHM-05-41C
SHP-2016-2A
SHP-2016-2B
SHP-2016-3B
SHP-2016-4B
SHL-9
SHM-93-22B
EPA-PZ-2012-7B
SHM-96-5B
SHM-96-5C
SHP-2016-5B
EPA-PZ-2012-1B
EPA-PZ-2012-6B
EW-04
EW-01
EPA-PZ-2012-3A
EPA-PZ-2012-3B
SHP-2016-06A
SHP-2016-06B
SHP-2016-06C
EPA-PZ-2012-4B
SHP-2016-1B
SHM-10-06A
SHM-10-06
SHP-01-36X
SHM-11-06
SHP-01-37X
PZ-12-02
PZ-12-01
SHL-20
SHL-11
SHM-10-14
PZ-12-04
PZ-12-03
N5-P1
SHM-10-13
SHP-99-29X
SHP-01-38A
SHM-10-15
PZ-12-05
PZ-12-06
SHL-4
SHM-10-07
SHP-2016-07A
SHP-2016-07B
SHM-10-12
SHM-10-11
SHL-15

206 208 210 212 214 216 218 220 222 224 226 228 230 232 234 236 238 240 242 244 246 248 250 252

## Legend

- Monitoring Wells with Arsenic Exceedances
- Extraction Well Location
- Barrier Wall
- Shepley's Hill Landfill
- River Node Cells
- Water Level Contours - SP18

**Particle Tracks**

- Layer 1
- Layer 2
- Layer 3
- Layer 4
- Layer 5
- Layer 6

Notes:
1. Particles were released at the end of Stress Period 18 and tracked backwards in time (reverse) at monitoring wells with arsenic concentrations in groundwater exceeding the maximum contamination level (MCL).
2. Eight particles were generated as a 2-foot diameter circle centered along each well screen. The number of vertical release points for each well screen was a function of screen length. The number of vertical release points varied between 2 for a 2-foot well screen and 11 for a 20-foot well screen.

400 200 0 400 Feet

# Reverse Particle Tracks from Monitoring Wells Exceeding Arsenic MCL

Shepley's Hill Landfill Groundwater Model

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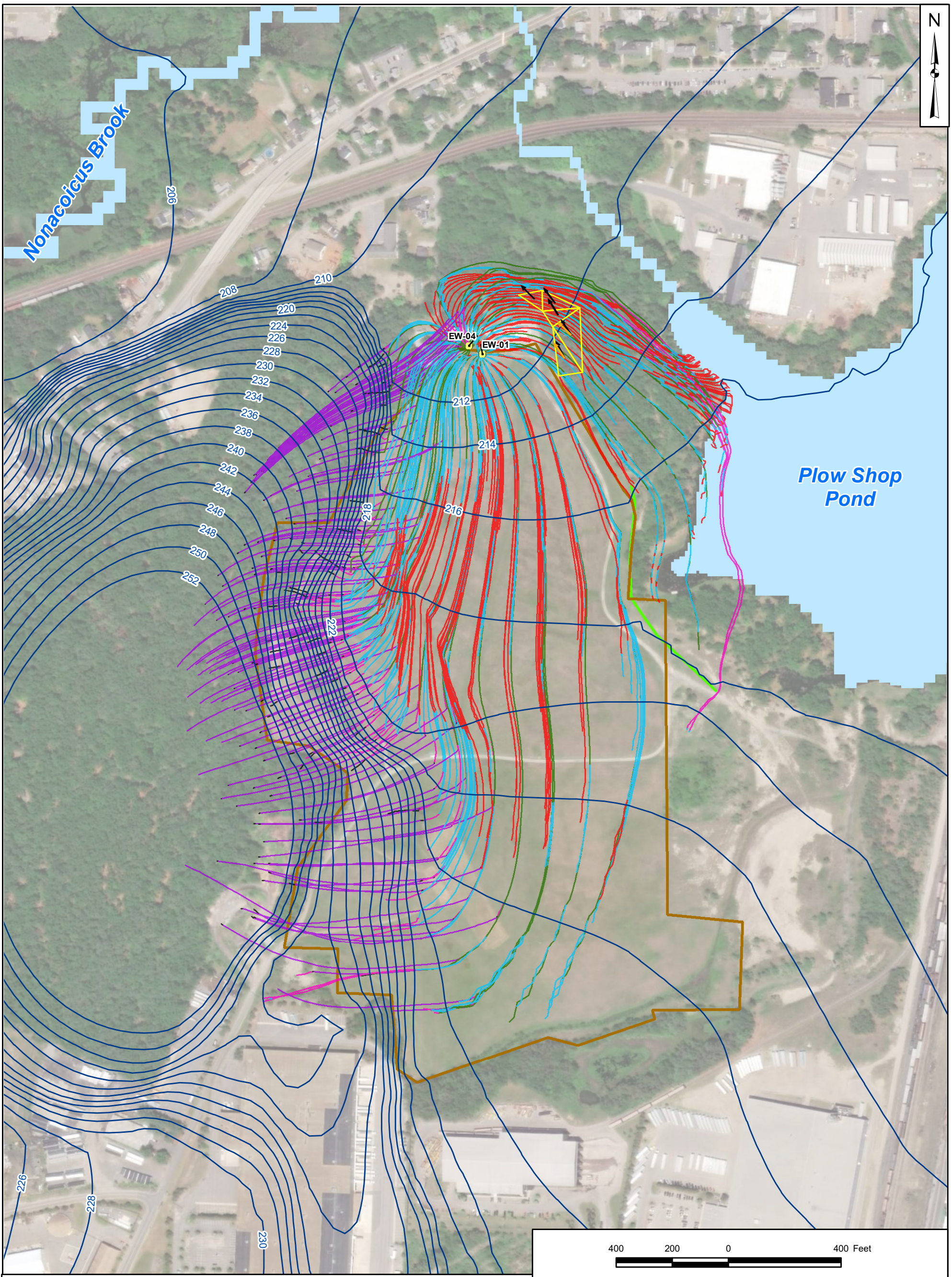
Figure 11.5

D:\GIS\Projects\365002_2\Devens\WORD\2018\Fall2018_Submittal\F11.5_Reverse Particle Tracks from Monitoring Well Exceeding Arsenic.MXD_mod.ou.thor.dd.mmm.yyyy Pro\Arm Oak Private Document Number etc.




**Legend**

- Spring 2013 Vectors
- Fall 2016 Vectors
- Monitoring Wells with Arsenic Exceedances
- Extraction Well Location
- Barrier Wall
- 3PE Triangles
- Shepley's Hill Landfill
- River Node Cells
- Water Level Contours - SP18

**Particle Tracks**

- Layer 1
- Layer 2
- Layer 3
- Layer 4
- Layer 5
- Layer 6

Notes:

1. Particles were released at the end of Stress Period 18 and tracked backwards in time (reverse) at ATP extraction wells EW-01 and EW-04.
2. Particles were generated at each extraction well as a 4x4 horizontal array for every two feet of screen for a total of 224 particles starting at each well.
3. Vectors shown for ATP triangles represent average flow directions interpreted from the 3PE (three-point estimator) analysis (Table 8.2) of observed continuous water level data for spring 2013 and fall 2016 (ATP (arsenic treatment plant) triangles 1 and 2 only). Vector length is arbitrary.

400 200 0 400 Feet

**Reverse Particle Tracks from Extraction Wells EW-01 and EW-04**

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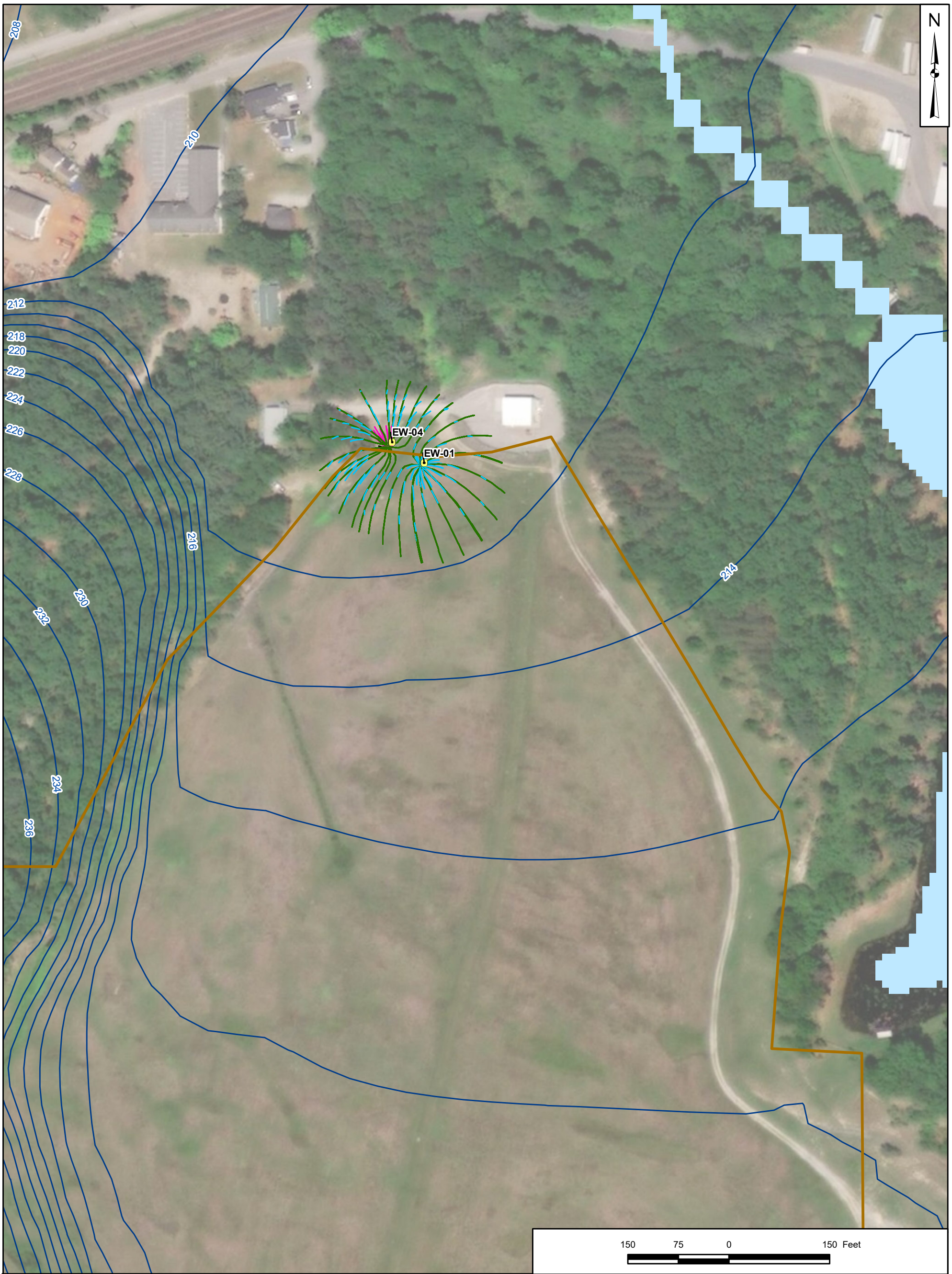
Figure **11.6**




150 75 0 150 Feet

**Legend**

- Extraction Well Location
- Shepley's Hill Landfill
- River Node Cells
- Water Level Contours - SP18

**Particle Tracks**

- Layer 1
- Layer 2
- Layer 3
- Layer 4
- Layer 5
- Layer 6

Notes:
1. Particles were released at the end of Stress Period (SP) 6 and tracked backwards in time (reverse) for a maximum of 90 days at ATP (arsenic treatment plant) extraction wells EW-01 and EW-04.
2. This simulation represents relatively high recharge conditions with an effective porosity of 0.30.
3. Particles were generated at each extraction well as a 4x4 horizontal array for every 2 feet of screen for a total of 224 particles starting at each well.

# Reverse Particle Tracks from Extraction Wells EW-01 and EW-04 in High Recharge Stress Period (SP6) with Porosity Equal to 0.30

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Figure 11.7

N

EW-04

EW-01

208
210
212
218
220
222
224
226
228
216
230
232
234
236
212

150 75 0 150 Feet

**Legend**

- Extraction Well Location
- Shepley's Hill Landfill
- River Node Cells
- Water Level Contours - SP18

**Particle Tracks**

- Layer 1
- Layer 2
- Layer 3
- Layer 4
- Layer 5
- Layer 6

Notes:
1. Particles were released at the end of Stress Period (SP) 13 and tracked backwards in time (reverse) for a maximum of 92 days at ATP (arsenic treatment plant) extraction wells EW-01 and EW-04.
2. This simulation represents relatively low recharge conditions with an effective porosity of 0.30.
3. Particles were generated at each extraction well as a 4x4 horizontal array for every 2 feet of screen for a total of 224 particles starting at each well.

# Reverse Particle Tracks from Extraction Wells EW-01 and EW-04 in Low Recharge Stress Period (SP13) with Porosity Equal to 0.30

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Figure **11.8**

N

EW-04

EW-01

208
210
212
218
220
222
224
226
228
216
230
232
234
236
214

150 75 0 150 Feet

**Legend**

- Extraction Well Location
- Shepley's Hill Landfill
- River Node Cells
- Water Level Contours - SP18

**Particle Tracks**

- Layer 1
- Layer 2
- Layer 3
- Layer 4
- Layer 5
- Layer 6

Notes:
1. Particles were released at the end of Stress Period (SP) 6 and tracked backwards in time (reverse) for a maximum of 90 days at ATP (arsenic treatment plant) extraction wells EW-01 and EW-04.
2. This simulation represents relatively high recharge conditions with an effective porosity of 0.03.
3. Particles were generated at each extraction well as a 4x4 horizontal array for every 2 feet of screen for a total of 224 particles starting at each well.

**Reverse Particle Tracks from Extraction Wells EW-01 and EW-04 in High Recharge Stress Period (SP6) with Porosity Equal to 0.03**

Shepley's Hill Landfill Groundwater Model

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Figure **11.9**

N

208
210
212
218
220
222
224
226
228
216
230
232
234
236
214

EW-04
EW-01

150 75 0 150 Feet

**Legend**

Extraction Well Location
Shepley's Hill Landfill
River Node Cells
Water Level Contours - SP18

**Particle Tracks**

Layer 1
Layer 2
Layer 3
Layer 4
Layer 5
Layer 6

Notes:
1. Particles were released at the end of Stress Period (SP) 13 and tracked backwards in time (reverse) for a maximum of 92 days at ATP (arsenic treatment plant) extraction wells EW-01 and EW-04.
2. This simulation represents relatively low recharge conditions with an effective porosity of 0.03.
3. Particles were generated at each extraction well as a 4x4 horizontal array for every 2 feet of screen for a total of 224 particles starting at each well.

# Reverse Particle Tracks from Extraction Wells EW-01 and EW-04 in Low Recharge Stress Period (SP13) with Porosity Equal to 0.03

Shepley's Hill Landfill Groundwater Model

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Figure 11.10

# APPENDIX A

# MONITORING WELL CONSTRUCTION SUMMARY

# Appendix A
## Boring and Monitoring Well Construction Summary
## Shepley's Hill Landfill Groundwater Model

| Well Name | X Coordinate (feet) | Y Coordinate (feet) | Area | 2017 Survey Surface Elevation (feet amsl) NAVD 1988 | Top of Screen Elevation (feet amsl) NAVD 1988 | Bottom of screen elevation (feet amsl) NAVD 1988 | Bottom of borehole elevation (feet amsl) NAVD 1988 | Till Elevation (feet amsl) NAVD 1988 | Bedrock Elevation (feet amsl) NAVD 1988 | Installation Oversight |
|---|---|---|---|---|---|---|---|---|---|---|
| 3-2 | 629207 | 3027010 | SHL | 267.28 | 213.3 | 208.3 | 208.4 | NA | 267.3 | Gannett Fleming |
| 20-1 | 629112 | 3027171 | SHL | 277.78 | 237.8 | 222.8 | 209.1 | NA | 277.8 | Gannett Fleming |
| 20-2 | 629111 | 3027167 | SHL | 277.30 | 277.3 | 252.1 | 252.1 | NA | 277.3 | Gannet Fleming |
| 27-1 | 629165 | 3027215 | SHL | 268.09 | 209.8 | 204.8 | 189.1 | NA | 268.1 | Gannett Fleming |
| 27-2 | 629173 | 3027241 | SHL | 273.07 | 215.1 | 205.1 | 201.5 | NA | 273.1 | Gannett Fleming |
| 27-30B-1 | 629204 | 3027281 | SHL | 271.56 | 236.6 | 226.6 | 212.4 | NA | 271.6 | Gannett Fleming |
| 27-30B-2 | 629206 | 3027285 | SHL | 271.75 | 271.8 | 249.5 | 249.5 | NA | 271.8 | Gannett Fleming |
| 32-3 | NA | NA | AOC 32/43A | NA | NA | NA | NA | NA | 225.0 | US EPA ORD |
| 32-4 | NA | NA | AOC 32/43A | NA | NA | NA | NA | NA | 223.1 | US EPA ORD |
| 32M-01-13XBR | 629547 | 3025296 | AOC 32/43A | 258.30 | 244.6 | 234.6 | 232.8 | 253.8 | 251.3 | Haley & Aldrich |
| 32M-01-14XBR | 629685 | 3025386 | AOC 32/43A | 254.11 | 220.3 | 210.3 | 208.9 | NA | 224.9 | Haley & Aldrich |
| 32M-01-14XOB | 629693 | 3025382 | AOC 32/43A | 254.30 | 237.1 | 227.1 | 225.5 | 230.9 | <225.5 | Haley & Aldrich |
| 32M-01-15XBR | 629568 | 3025254 | AOC 32/43A | 258.03 | 223.4 | 213.4 | 212.9 | NA | 253.2 | Haley & Aldrich |
| 32M-01-16XBR | 629604 | 3025102 | AOC 32/43A | 257.70 | 236.7 | 226.7 | 226.7 | 241.9 | 240.7 | Haley & Aldrich |
| 32M-01-17XBR | 629699 | 3025238 | AOC 32/43A | 256.85 | 214.9 | 204.9 | 204.8 | 222.3 | 218.3 | Haley & Aldrich |
| 32M-01-18XBR | 629515 | 3025247 | AOC 32/43A | 258.61 | 244.6 | 234.6 | 234.6 | 250.1 | 248.6 | Haley & Aldrich |
| 32M-92-01X | 629190 | 3025740 | AOC 32/43A | 258.26 | 243.9 | 233.9 | 233.6 | NA | <233.6 | Technical Drilling Services |
| 32M-92-03X | 628772 | 3025213 | AOC 32/43A | 258.23 | 234.8 | 224.8 | 223.5 | NA | <223.6 | Technical Drilling Services |
| 32Z-01-04XBR | 629579 | 3024502 | AOC 32/43A | 260.70 | 235.7 | 225.7 | 224.4 | NA | 252.7 | Haley & Aldrich |
| 32Z-01-05XOB | 629132 | 3024517 | AOC 32/43A | 260.95 | 235.4 | 225.4 | 224.9 | NA | <224.9 | Haley & Aldrich |
| 32Z-01-06XBR | 629526 | 3025592 | AOC 32/43A | 259.82 | 243.3 | 233.3 | 232.5 | 253.0 | 248.8 | Haley & Aldrich |
| 32Z-01-07XOB | 629418 | 3025656 | AOC 32/43A | 257.68 | 244.5 | 234.5 | 232.0 | 245.2 | <232.0 | Haley & Aldrich |
| 32Z-01-08XOB | 629071 | 3025512 | AOC 32/43A | 258.59 | 246.0 | 236.0 | 235.5 | 241.0 | <235.5 | Haley & Aldrich |
| 32Z-01-09XOB | 628871 | 3024571 | AOC 32/43A | 257.75 | 234.2 | 224.2 | 223.7 | NA | <223.7 | Haley & Aldrich |
| 32Z-01-10XBR | 629597 | 3024914 | AOC 32/43A | 257.76 | 245.3 | 235.3 | 230.8 | NA | 250.3 | Haley & Aldrich |
| 32Z-01-11XBR | 629316 | 3025496 | AOC 32/43A | 262.07 | 253.0 | 243.0 | 241.0 | NA | 254.0 | Haley & Aldrich |
| 32Z-01-12XBR | 629002 | 3025273 | AOC 32/43A | 258.24 | 230.1 | 220.1 | 218.8 | 241.3 | 231.3 | Haley & Aldrich |
| 32Z-99-02X | 629874 | 3024769 | AOC 32/43A | 257.48 | 243.1 | 228.1 | 228.1 | NA | <228.1 | Stone & Webster Eng. Corp. |
| 3A-2 | 629233 | 3027046 | SHL | 263.27 | 263.3 | 208.4 | 208.4 | NA | 263.3 | Gannett Fleming |
| 43-1 | NA | NA | AOC 32/43A | NA | NA | NA | NA | NA | 226.8 | US EPA ORD |
| 43-2 | NA | NA | AOC 32/43A | NA | NA | NA | NA | NA | 192.8 | US EPA ORD |
| 43-3 | NA | NA | AOC 32/43A | NA | NA | NA | NA | NA | 196.4 | US EPA ORD |
| 43-4 | NA | NA | AOC 32/43A | NA | NA | NA | NA | NA | 226.0 | US EPA ORD |
| 43-5 | NA | NA | AOC 32/43A | NA | NA | NA | NA | NA | 227.4 | US EPA ORD |
| 43M-01-16XBR | 628981 | 3025055 | AOC 32/43A | 257.04 | 209.5 | 199.5 | 198.7 | 225.0 | 211.5 | Haley & Aldrich |
| 43M-01-16XOB | 628981 | 3025060 | AOC 32/43A | 257.11 | 233.1 | 223.1 | 222.1 | 225.1 | <222.1 | Haley & Aldrich |
| 43M-01-17XBR | 629073 | 3024935 | AOC 32/43A | 258.53 | 211.0 | 201.0 | 200.5 | 218.5 | 214.0 | Haley & Aldrich |
| 43M-01-17XOB | 629073 | 3024941 | AOC 32/43A | 258.51 | 235.1 | 225.1 | 224.6 | NA | <224.6 | Haley & Aldrich |
| 43M-01-20XBR | 628852 | 3024830 | AOC 32/43A | 257.78 | 189.6 | 179.6 | 179.6 | 203.9 | 193.4 | Haley & Aldrich |
| 43M-01-20XOB | 628852 | 3024834 | AOC 32/43A | 257.78 | 233.9 | 223.9 | 223.9 | NA | <223.9 | Haley & Aldrich |
| 57M-03-01X | 632642 | 3022692 | AOC-57 | 234.7 | 224.7 | 214.7 | NA | NA | NA | NA |
| 57M-03-02X | 632655 | 3022571 | AOC-57 | 224.5 | 222.5 | 212.5 | NA | NA | NA | NA |
| 57M-03-03X | 632712 | 3022508 | AOC-57 | 221.5 | 219.5 | 209.5 | NA | NA | NA | NA |
| 57M-03-04X | 632756 | 3022531 | AOC-57 | 221.4 | 219.4 | 209.4 | NA | NA | NA | NA |
| 57M-03-05X | 632773 | 3022578 | AOC-57 | 221.6 | 219.6 | 209.6 | NA | NA | NA | NA |
| 57M-03-06X | 632786 | 3022619 | AOC-57 | 222.3 | 220.3 | 210.3 | NA | NA | NA | NA |
| 57M-95-03X | 633273 | 3022981 | AOC-57 | 231.7 | NA | NA | NA | NA | NA | NA |
| 57M-95-05X | 632502 | 3022584 | AOC-57 | 234.1 | 224.1 | 214.1 | NA | NA | NA | NA |
| 57M-95-06X | 632760 | 3022737 | AOC-57 | 233.6 | 221.5 | 211.5 | NA | NA | NA | NA |
| 57M-95-07X | 632538 | 3022486 | AOC-57 | 222.6 | 219.6 | 209.6 | NA | NA | NA | NA |
| 57M-96-10X | 633332 | 3022916 | AOC-57 | 226.3 | 223.3 | 213.3 | NA | NA | NA | NA |
| 57M-96-11X | 633270 | 3022834 | AOC-57 | 221.4 | 219.4 | 209.4 | NA | NA | NA | NA |
| 57M-96-12X | 633161 | 3022842 | AOC-57 | 224.0 | 222.0 | 212.0 | NA | NA | NA | NA |
| 57M-96-13X | 633122 | 3022811 | AOC-57 | 224.3 | 222.3 | 212.3 | NA | NA | NA | NA |
| 57P-98-03X | 633318 | 3022812 | AOC-57 | NA | NA | NA | NA | NA | NA | NA |
| 57P-98-04X | 633252 | 3022811 | AOC-57 | NA | NA | NA | NA | NA | NA | NA |
| 57WP-06-02 | 632722 | 3022510 | AOC-57 | NA | 202.1 | 197.1 | NA | NA | NA | NA |
| 57WP-06-03 | 633245 | 3022838 | AOC-57 | NA | 206.9 | 201.9 | NA | NA | NA | NA |
| 69W-94-12 | 627514 | 3025285 | AOC-69W | 225.6 | NA | NA | NA | NA | NA | NA |
| 69W-94-13 | 627446 | 3025277 | AOC-69W | 224.5 | 220.5 | 210.5 | NA | NA | NA | NA |
| 69W-94-14 | 627387 | 3025370 | AOC-69W | 224.7 | 221.7 | 211.7 | NA | NA | NA | NA |
| 69WP-08-01 | 627342 | 3025648 | AOC-69W | NA | 210.7 | 207.7 | NA | NA | NA | NA |
| CAP-1B | 629319 | 3027165 | SHL | 243.13 | 236.1 | 188.2 | 188.2 | NA | 236.1 | Gannett Fleming |

**Appendix A**
**Boring and Monitoring Well Construction Summary**
**Shepley's Hill Landfill Groundwater Model**

| Well Name | X Coordinate (feet) | Y Coordinate (feet) | Area | 2017 Survey Surface Elevation (feet amsl) NAVD 1988 | Top of Screen Elevation (feet amsl) NAVD 1988 | Bottom of screen elevation (feet amsl) NAVD 1988 | Bottom of borehole elevation (feet amsl) NAVD 1988 | Till Elevation (feet amsl) NAVD 1988 | Bedrock Elevation (feet amsl) NAVD 1988 | Installation Oversight |
|---|---|---|---|---|---|---|---|---|---|---|
| CAP-2B | 629296 | 3027119 | SHL | 248.66 | 196.7 | 191.7 | 189.7 | NA | 240.7 | Gannett Fleming |
| CAP-3 | 629270 | 3027048 | SHL | 251.45 | 245.5 | 210.5 | 210.5 | NA | 245.5 | Gannett Fleming |
| CAP-4 | 629285 | 3027089 | SHL | 246.73 | 237.7 | 232.9 | 232.9 | NA | 237.7 | Gannett Fleming |
| CH-1D | 629288 | 3027063 | SHL | 248.46 | 163.5 | 153.5 | 97.5 | 234.8 | 230.5 | Gannett Fleming |
| CH-1S | 629288 | 3027063 | SHL | 248.46 | 212.5 | 207.5 | 97.5 | 234.8 | 230.5 | Gannett Fleming |
| CSM-93-01A | 628512 | 3018407 | Cold Spring Brook | 254.10 | 200.5 | 190.5 | 186.6 | NA | <186.6 | ABB Env. Services, Inc. |
| CSM-93-02A | 628076 | 3018164 | Cold Spring Brook | 261.90 | 240.4 | 230.4 | 132.3 | 132.9 | 132.3 | ABB Env. Services, Inc. |
| CSM-93-02B | 628062 | 3018167 | Cold Spring Brook | 261.60 | 204.6 | 194.6 | 193.6 | NA | <193.6 | ABB Env. Services, Inc. |
| EPA-PZ-2012-1A | 630191 | 3028056 | SHL | 219.91 | 199.4 | 194.4 | NA | NA | NA | US EPA ORD |
| EPA-PZ-2012-1B | 630193 | 3028057 | SHL | 219.81 | 149.4 | 144.4 | NA | NA | NA | US EPA ORD |
| EPA-PZ-2012-2A | 630287 | 3028125 | SHL | 219.72 | 198.8 | 193.8 | NA | NA | NA | US EPA ORD |
| EPA-PZ-2012-2B | 630290 | 3028125 | SHL | 219.76 | 144.0 | 139.0 | NA | NA | NA | US EPA ORD |
| EPA-PZ-2012-3A | 630063 | 3028088 | SHL | 219.20 | 199.2 | 194.2 | NA | NA | NA | US EPA ORD |
| EPA-PZ-2012-3B | 630065 | 3028086 | SHL | 219.25 | 149.3 | 144.3 | NA | NA | NA | US EPA ORD |
| EPA-PZ-2012-4A | 629992 | 3028045 | SHL | 223.30 | 203.4 | 198.4 | NA | NA | NA | US EPA ORD |
| EPA-PZ-2012-4B | 629990 | 3028044 | SHL | 223.51 | 153.5 | 148.5 | NA | NA | NA | US EPA ORD |
| EPA-PZ-2012-5A | 630152 | 3028185 | SHL | 216.33 | 195.4 | 190.4 | NA | NA | NA | US EPA ORD |
| EPA-PZ-2012-5B | 630155 | 3028186 | SHL | 216.20 | 135.2 | 130.2 | NA | NA | NA | US EPA ORD |
| EPA-PZ-2012-6A | 629895 | 3028066 | SHL | 230.71 | 205.7 | 200.7 | NA | NA | NA | US EPA ORD |
| EPA-PZ-2012-6B | 629894 | 3028069 | SHL | 230.85 | 155.8 | 150.8 | NA | NA | NA | US EPA ORD |
| EPA-PZ-2012-7A | 629801 | 3028106 | SHL | 234.42 | 209.4 | 204.4 | NA | NA | NA | US EPA ORD |
| EPA-PZ-2012-7B | 629801 | 3028109 | SHL | 234.28 | 174.2 | 169.2 | NA | NA | NA | US EPA ORD |
| EW-01 | 629943 | 3027960 | SHL | 226.97 | 166.95 | 142.0 | 131.0 | 137.0 | 131.0 | CH2MHill |
| EW-04 | 629895 | 3027991 | SHL | 227.36 | 157.4 | 132.4 | 120.4 | 132.4 | 120.4 | CH2MHill |
| MCPH-SENTINEL | 626456 | 3028050 | Nashua | NA | 112.3 | 107.3 | NA | NA | NA | NA |
| MNG-2 | 632859 | 3025555 | Other-West | NA | 219.3 | 200.3 | NA | NA | NA | NA |
| MNG-3 | 634064 | 3025616 | Other-West | NA | 208.4 | 189.4 | NA | NA | NA | NA |
| MNG-5 | 633011 | 3025277 | Other-West | NA | 216.9 | 207.9 | NA | NA | NA | NA |
| MNG-6 | 633485 | 3025222 | Other-West | NA | 222.0 | 203.0 | NA | NA | NA | NA |
| N1-P1 | 630723 | 3027868 | SHL | 227.78 | 162.78 | 157.8 | 150.8 | 158.8 | 156.3 | Stone & Webster Eng. Corp. |
| N1-P2 | 630723 | 3027868 | SHL | 227.78 | 187.78 | 182.8 | 181.8 | NA | 156.3 | Stone & Webster Eng. Corp. |
| N1-P3 | 630723 | 3027868 | SHL | 227.78 | 215.78 | 210.8 | 209.8 | NA | 156.3 | Stone & Webster Eng. Corp. |
| N2-P1 | 630659 | 3027311 | SHL | 220.55 | 185.53 | 180.5 | 174.5 | NA | 178.0 | Stone & Webster Eng. Corp. |
| N2-P2 | 630659 | 3027311 | SHL | 220.55 | 216.53 | 211.5 | 174.5 | NA | 178.0 | Stone & Webster Eng. Corp. |
| N3-P1 | 630778 | 3027130 | SHL | 218.81 | 185.73 | 183.7 | 181.7 | NA | 192.2 | Stone & Webster Eng. Corp. |
| N3-P2 | 630778 | 3027130 | SHL | 218.81 | 214.73 | 209.7 | 181.7 | NA | 192.2 | Stone & Webster Eng. Corp. |
| N4-P1 | 631241 | 3026764 | SHL | 216.60 | 139.10 | 134.1 | 133.1 | NA | 133.1 | Stone & Webster Eng. Corp. |
| N4-P2 | 631241 | 3026764 | SHL | 216.60 | 177.10 | 172.1 | 171.1 | NA | 133.1 | Stone & Webster Eng. Corp. |
| N4-P3 | 631241 | 3026764 | SHL | 216.60 | 213.60 | 208.6 | 123.1 | NA | 133.1 | Stone & Webster Eng. Corp. |
| N5-P1 | 629806 | 3027173 | SHL | 240.46 | 144.89 | 142.9 | 141.4 | 155.4 | 151.9 | Stone & Webster Eng. Corp. |
| N5-P2 | 629806 | 3027173 | SHL | 240.46 | 217.39 | 212.4 | 211.4 | NA | 151.9 | Stone & Webster Eng. Corp. |
| N6-P1 | 630017 | 3026339 | SHL | 256.13 | 170.28 | 168.3 | 166.8 | 185.8 | 176.8 | Stone & Webster Eng. Corp. |
| N7-P1 | 629991 | 3025618 | SHL | 253.18 | 187.51 | 185.5 | 183.5 | 195.5 | 193.5 | Stone & Webster Eng. Corp. |
| N7-P2 | 629991 | 3025618 | SHL | 253.18 | 224.51 | 219.5 | 218.5 | 195.5 | 193.5 | Stone & Webster Eng. Corp. |
| PZ-12-01 | 630488 | 3027384 | SHL | 233.85 | 209.8 | 199.8 | 199.8 | NA | <199.8 | Sovereign Consulting Inc. |
| PZ-12-02 | 630468 | 3027384 | SHL | 233.75 | 209.66 | 199.7 | 199.7 | NA | <199.7 | Sovereign Consulting Inc. |
| PZ-12-03 | 630474 | 3027193 | SHL | 232.85 | 208.76 | 198.8 | 198.8 | NA | <198.8 | Sovereign Consulting Inc. |
| PZ-12-04 | 630453 | 3027194 | SHL | 235.05 | 210.97 | 201.0 | 201.0 | NA | <201 | Sovereign Consulting Inc. |
| PZ-12-05 | 630479 | 3027087 | SHL | 236.08 | 210.05 | 200.1 | 200.1 | NA | <200.0 | Sovereign Consulting Inc. |
| PZ-12-06 | 630455 | 3027082 | SHL | 238.42 | 213.35 | 203.4 | 203.4 | NA | <203.3 | Sovereign Consulting Inc. |
| PZ-12-07 | 630568 | 3026972 | SHL | 240.80 | 220.79 | 210.8 | 208.8 | NA | <208.8 | Sovereign Consulting Inc. |
| PZ-12-08 | 630546 | 3026962 | SHL | 241.74 | 219.7 | 209.7 | 209.7 | NA | <209.7 | Sovereign Consulting Inc. |
| PZ-12-09 | 630741 | 3026801 | SHL | 238.43 | 218.26 | 208.3 | 208.3 | NA | 208.3 | Sovereign Consulting Inc. |
| PZ-12-10 | 630724 | 3026778 | SHL | 238.98 | 218.83 | 208.8 | 206.8 | NA | <206.8 | Sovereign Consulting Inc. |
| Q4-1 | 629195 | 3027092 | SHL | 266.20 | 236.2 | 226.2 | 215.7 | NA | 266.2 | Gannett Fleming |
| Q4-2 | 629173 | 3027060 | SHL | 271.05 | 262.6 | 218.1 | 218.1 | NA | 262.6 | Gannett Fleming |
| Q5-1 | 629228 | 3027166 | SHL | 259.32 | 212.3 | 207.3 | 204.2 | NA | 259.3 | Gannett Fleming |
| RHM-94-01X | 631399 | 3026742 | Round House | 220.10 | 217.1 | 207.1 | 207.1 | NA | <207.1 | ABB Env. Services, Inc. |
| RHM-94-02X | 631557 | 3026622 | Round House | 233.30 | 219.3 | 209.3 | 207.3 | NA | <207.3 | ABB Env. Services, Inc. |
| RSK1 | 630633 | 3027260 | SHL | 221.44 | 189.8 | 184.8 | NA | NA | NA | US EPA ORD |
| RSK10 | 630517 | 3027091 | SHL | 225.62 | 206.8 | 201.8 | NA | NA | NA | US EPA ORD |
| RSK11 | 630516 | 3027090 | SHL | 226.07 | 212.1 | 207.1 | NA | NA | NA | US EPA ORD |
| RSK12 | 630519 | 3027088 | SHL | 225.63 | 216.0 | 211.0 | NA | NA | NA | US EPA ORD |

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**Boring and Monitoring Well Construction Summary**
**Shepley's Hill Landfill Groundwater Model**

| Well Name | X Coordinate (feet) | Y Coordinate (feet) | Area | 2017 Survey Surface Elevation (feet amsl) NAVD 1988 | Top of Screen Elevation (feet amsl) NAVD 1988 | Bottom of screen elevation (feet amsl) NAVD 1988 | Bottom of borehole elevation (feet amsl) NAVD 1988 | Till Elevation (feet amsl) NAVD 1988 | Bedrock Elevation (feet amsl) NAVD 1988 | Installation Oversight |
|---|---|---|---|---|---|---|---|---|---|---|
| RSK13 | 630583 | 3027057 | SHL | 224.58 | 206.7 | 201.7 | NA | NA | NA | US EPA ORD |
| RSK14 | 630585 | 3027057 | SHL | 224.47 | 210.5 | 205.5 | NA | NA | NA | US EPA ORD |
| RSK15 | 630584 | 3027055 | SHL | 224.69 | 215.8 | 210.8 | NA | NA | NA | US EPA ORD |
| RSK16 | 630560 | 3027212 | SHL | 218.04 | 199.7 | 194.7 | NA | NA | NA | US EPA ORD |
| RSK17 | 630558 | 3027211 | SHL | 217.72 | 203.9 | 198.9 | NA | NA | NA | US EPA ORD |
| RSK18 | 630557 | 3027213 | SHL | 217.97 | 209.2 | 204.2 | NA | NA | NA | US EPA ORD |
| RSK19 | 630559 | 3027214 | SHL | 217.78 | 214.1 | 209.1 | NA | NA | NA | US EPA ORD |
| RSK2 | 630631 | 3027261 | SHL | 221.57 | 194.9 | 189.9 | NA | NA | NA | US EPA ORD |
| RSK20 | 630559 | 3027215 | SHL | 218.05 | 204.3 | 199.3 | NA | NA | NA | US EPA ORD |
| RSK21 | 630561 | 3027215 | SHL | 218.05 | 215.1 | 195.1 | NA | NA | NA | US EPA ORD |
| RSK23 | 630534 | 3027064 | SHL | 227.53 | 220.6 | 195.6 | NA | NA | NA | US EPA ORD |
| RSK24 | 630501 | 3026953 | SHL | 240.38 | 220.6 | 215.6 | NA | NA | NA | US EPA ORD |
| RSK25 | 630635 | 3026963 | SHL | 239.53 | 217.7 | 212.7 | NA | NA | NA | US EPA ORD |
| RSK26 | 630494 | 3027013 | SHL | NA | 219.5 | 214.5 | NA | NA | NA | US EPA ORD |
| RSK27 | 630421 | 3027042 | SHL | 240.23 | 220.4 | 215.4 | NA | NA | NA | US EPA ORD |
| RSK28 | 630417 | 3027119 | SHL | 238.24 | 218.0 | 213.0 | NA | NA | NA | US EPA ORD |
| RSK29 | 630461 | 3027155 | SHL | NA | 215.1 | 210.1 | NA | NA | NA | US EPA ORD |
| RSK3 | 630629 | 3027262 | SHL | 221.83 | 200.2 | 195.2 | NA | NA | NA | US EPA ORD |
| RSK30 | 630478 | 3027234 | SHL | NA | 211.6 | 206.6 | NA | NA | NA | US EPA ORD |
| RSK32 | 630424 | 3027205 | SHL | 235.87 | 215.8 | 210.8 | NA | NA | NA | US EPA ORD |
| RSK33 | 630480 | 3027425 | SHL | NA | 214.3 | 209.3 | NA | NA | NA | US EPA ORD |
| RSK34 | 630395 | 3027445 | SHL | 233.55 | 213.7 | 208.7 | NA | NA | NA | US EPA ORD |
| RSK35 | 630438 | 3027516 | SHL | 232.99 | 211.6 | 206.6 | NA | NA | NA | US EPA ORD |
| RSK36 | 630731 | 3027104 | SHL | 220.05 | 214.9 | 194.9 | NA | NA | NA | US EPA ORD |
| RSK37 | 630731 | 3027104 | SHL | 219.64 | 216.8 | 211.8 | NA | NA | NA | US EPA ORD |
| RSK38 | 630730 | 3027107 | SHL | 219.61 | 213.8 | 208.8 | NA | NA | NA | US EPA ORD |
| RSK39 | 630732 | 3027108 | SHL | 219.56 | 208.8 | 203.8 | NA | NA | NA | US EPA ORD |
| RSK4 | 630630 | 3027265 | SHL | 221.69 | 205.4 | 200.4 | NA | NA | NA | US EPA ORD |
| RSK40 | 630733 | 3027110 | SHL | 219.57 | 203.7 | 198.7 | NA | NA | NA | US EPA ORD |
| RSK41 | 630732 | 3027111 | SHL | 219.53 | 198.7 | 193.7 | NA | NA | NA | US EPA ORD |
| RSK42 | 630730 | 3027109 | SHL | 219.66 | 208.8 | 203.8 | NA | NA | NA | US EPA ORD |
| RSK43 | 630732 | 3027106 | SHL | 219.62 | 214.9 | 194.9 | NA | NA | NA | US EPA ORD |
| RSK47 | 630734 | 3027109 | SHL | 225.87 | 214.0 | 209.0 | NA | NA | NA | US EPA ORD |
| RSK48 | 630520 | 3027086 | SHL | NA | 214.8 | 214.3 | NA | NA | NA | US EPA ORD |
| RSK49 | 630553 | 3027153 | SHL | NA | 216.3 | 215.8 | NA | NA | NA | US EPA ORD |
| RSK5 | 630631 | 3027263 | SHL | 221.68 | 210.1 | 205.1 | NA | NA | NA | US EPA ORD |
| RSK50 | 630554 | 3027179 | SHL | 218.04 | 215.1 | 214.1 | NA | NA | NA | US EPA ORD |
| RSK6 | 630633 | 3027262 | SHL | 221.54 | 199.8 | 194.8 | NA | NA | NA | US EPA ORD |
| RSK7 | 630634 | 3027264 | SHL | 221.56 | 215.7 | 210.7 | NA | NA | NA | US EPA ORD |
| RSK8 | 630514 | 3027092 | SHL | 225.98 | 196.3 | 191.3 | NA | NA | NA | US EPA ORD |
| RSK9 | 630516 | 3027093 | SHL | 225.71 | 201.8 | 196.8 | NA | NA | NA | US EPA ORD |
| SHL-1 | 629259 | 3026532 | SHL | 271.76 | 267.0 | 262.0 | 262.0 | 255.0 | 245.3 | SEA Consultants Inc. |
| SHL-10 | 630877 | 3026868 | SHL | 246.62 | 225.1 | 210.1 | 201.6 | NA | 207.6 | Con-Test Inc. |
| SHL-11 | 630496 | 3027316 | SHL | 233.95 | 222.4 | 207.4 | 189.0 | NA | 194.0 | Con-Test Inc. |
| SHL-12 | 630003 | 3025342 | SHL | 247.22 | 232.4 | 217.4 | 187.4 | NA | <187.4 | Con-Test Inc. |
| SHL-13 | 630540 | 3028105 | SHL | 218.98 | 213.5 | 198.5 | 197.0 | NA | <197.0 | Con-Test Inc. |
| SHL-15 | 629326 | 3025829 | SHL | 259.02 | 244.8 | 234.8 | 233.8 | 238.8 | <233.8 | Ecology and Environment, Inc. |
| SHL-17 | 630287 | 3025391 | SHL | 231.88 | 225.3 | 215.3 | 214.3 | NA | <214.7 | Ecology and Environment, Inc. |
| SHL-18 | 631186 | 3026475 | SHL | 235.67 | 219.7 | 209.7 | 205.7 | NA | <205.7 | Ecology and Environment, Inc. |
| SHL-19 | 630665 | 3026946 | SHL | 238.59 | 218.4 | 208.4 | 207.4 | NA | <207.4 | Ecology and Environment, Inc. |
| SHL-2 | 629618 | 3025289 | SHL | 255.67 | 240.7 | 230.7 | 218.2 | NA | NA | SEA Consultants Inc. |
| SHL-20 | 630463 | 3027330 | SHL | 234.72 | 195.8 | 185.8 | 183.7 | NA | 186.7 | Ecology and Environment, Inc. |
| SHL-21 | 630364 | 3027884 | SHL | 258.14 | 216.1 | 206.1 | 205.1 | NA | <205.1 | Ecology and Environment, Inc. |
| SHL-22 | 630056 | 3028163 | SHL | 218.90 | 114.1 | 104.1 | 89.6 | 134.1 | 104.1 | Ecology and Environment, Inc. |
| SHL-23 | 629713 | 3027916 | SHL | 239.44 | 216.4 | 206.4 | 204.4 | NA | <204.4 | Ecology and Environment, Inc. |
| SHL-24 | 631303 | 3025639 | SHL | 236.79 | 126.7 | 116.7 | 107.2 | NA | 122.2 | Ecology and Environment, Inc. |
| SHL-25 | 629699 | 3025252 | SHL | 256.28 | 232.8 | 222.8 | 221.3 | 227.3 | <221.3 | Ecology and Environment, Inc. |
| SHL-3 | 630911 | 3026705 | SHL | 245.80 | 222.4 | 212.4 | 211.4 | NA | NA | SEA Consultants Inc. |
| SHL-3/BAR-3 | NA | NA | SHL | 246.36 | NA | NA | 203.9 | NA | NA | SEA Consultants Inc. |
| SHL-4 | 630576 | 3027057 | SHL | 226.08 | 222.5 | 212.5 | 196.3 | NA | NA | SEA Consultants Inc. |
| SHL-5 | 630192 | 3028125 | SHL | 216.81 | 213.8 | 203.8 | 201.8 | NA | NA | SEA Consultants Inc. |
| SHL-6 | 630951 | 3025249 | SHL | 252.05 | 202.5 | 192.5 | 150.5 | NA | <150.6 | SEA Consultants Inc. |
| SHL-7 | 631333 | 3026278 | SHL | 234.79 | 223.4 | 213.4 | 132.9 | NA | <132.9 | SEA Consultants Inc. |

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**Shepley's Hill Landfill Groundwater Model**

| Well Name | X Coordinate (feet) | Y Coordinate (feet) | Area | 2017 Survey Surface Elevation (feet amsl) NAVD 1988 | Top of Screen Elevation (feet amsl) NAVD 1988 | Bottom of screen elevation (feet amsl) NAVD 1988 | Bottom of borehole elevation (feet amsl) NAVD 1988 | Till Elevation (feet amsl) NAVD 1988 | Bedrock Elevation (feet amsl) NAVD 1988 | Installation Oversight |
|---|---|---|---|---|---|---|---|---|---|---|
| SHL-8D | 630407 | 3028127 | SHL | 218.83 | 149.5 | 148.0 | 147.0 | NA | 147.0 | Con-Test Inc. |
| SHL-8S | 630407 | 3028127 | SHL | 218.83 | 166.5 | 165.3 | 147.0 | NA | 147.0 | Con-Test Inc. |
| SHL-9 | 630010 | 3028147 | SHL | 220.72 | 205.88 | 195.9 | 119.4 | NA | NA | SEA Consultants Inc. |
| SHM-05-39A | 629761 | 3028544 | SHL | 221.79 | 184.79 | 182.8 | 182.8 | NA | 152.8 | CH2MHill |
| SHM-05-39B | 629765 | 3028544 | SHL | 221.77 | 155.78 | 153.8 | 153.8 | NA | 152.8 | CH2MHill |
| SHM-05-40X | 629637 | 3028514 | SHL | 223.41 | 191.55 | 189.6 | 185.6 | NA | 185.6 | CH2MHill |
| SHM-05-41A | 629796 | 3028291 | SHL | 222.72 | 180.78 | 178.8 | 178.8 | NA | NA | CH2MHill |
| SHM-05-41B | 629796 | 3028299 | SHL | 222.50 | 160.6 | 158.6 | 152.6 | NA | NA | CH2MHill |
| SHM-05-41C | 629796 | 3028285 | SHL | 222.91 | 134.94 | 129.9 | 126.9 | NA | NA | CH2MHill |
| SHM-05-42A | 630018 | 3028376 | SHL | 213.65 | 173.66 | 171.7 | 171.7 | NA | NA | CH2MHill |
| SHM-05-42B | 630018 | 3028376 | SHL | 213.65 | 143.66 | 141.7 | 141.7 | NA | NA | CH2MHill |
| SHM-07-03 | 629411 | 3028445 | SHL | 227.96 | 203.01 | 193.0 | 191.0 | NA | 174.0 | AMEC |
| SHM-07-05 | 629632 | 3028513 | SHL | 223.57 | 167.62 | 158.6 | 157.6 | NA | 177.6 | AMEC |
| SHM-10-01 | 628868 | 3028617 | SHL | 206.69 | 146.14 | 136.1 | 136.1 | 141.6 | 131.6 | Sovereign Consulting Inc. |
| SHM-10-02 | 628381 | 3028700 | SHL | 220.19 | 167.12 | 157.1 | 118.1 | NA | 118.1 | Sovereign Consulting Inc. |
| SHM-10-03 | 628436 | 3029000 | SHL | 229.77 | 171.2 | 161.2 | 157.7 | 159.7 | 157.7 | Sovereign Consulting Inc. |
| SHM-10-04 | 628959 | 3029485 | SHL | 210.00 | 154.73 | 144.7 | 114.7 | 134.7 | 114.7 | Sovereign Consulting Inc. |
| SHM-10-05A | 630442 | 3028943 | SHL | 235.41 | 185.24 | 175.2 | 125.2 | NA | 125.2 | Sovereign Consulting Inc. |
| SHM-10-06 | 630216 | 3027883 | SHL | 230.03 | 160.49 | 150.5 | 150.0 | NA | 150.0 | Sovereign Consulting Inc. |
| SHM-10-06A | 630301 | 3027896 | SHL | 245.96 | 169 | 159.0 | 135.5 | NA | 135.5 | Sovereign Consulting Inc. |
| SHM-10-07 | 630301 | 3026890 | SHL | 244.98 | 204.76 | 194.8 | 189.8 | 203.3 | 196.8 | Sovereign Consulting Inc. |
| SHM-10-08 | 628352 | 3028526 | SHL | 211.86 | 165.68 | 155.7 | 154.7 | 156.7 | 149.2 | Sovereign Consulting Inc. |
| SHM-10-10 | 629105 | 3028874 | SHL | 215.40 | 159.43 | 149.4 | 148.4 | 152.9 | 143.4 | Sovereign Consulting Inc. |
| SHM-10-11 | 629991 | 3025972 | SHL | 261.16 | 210.86 | 200.9 | 195.9 | 201.9 | 199.9 | Sovereign Consulting Inc. |
| SHM-10-12 | 629717 | 3026719 | SHL | 252.57 | 207.02 | 197.0 | 182.0 | 195.0 | 182.5 | Sovereign Consulting Inc. |
| SHM-10-13 | 629906 | 3027157 | SHL | 241.51 | 181.4 | 171.4 | 154.4 | 161.4 | 157.4 | Sovereign Consulting Inc. |
| SHM-10-14 | 629785 | 3027373 | SHL | 234.80 | 174.8 | 154.8 | 138.8 | 154.8 | 144.8 | Sovereign Consulting Inc. |
| SHM-10-15 | 629681 | 3027101 | SHL | 241.95 | 196.9 | 186.9 | 178.9 | 186.9 | 181.9 | Sovereign Consulting Inc. |
| SHM-10-16 | 629834 | 3028355 | SHL | 216.72 | 141.7 | 131.7 | 120.7 | 122.7 | 121.7 | Sovereign Consulting Inc. |
| SHM-11-02 | 630458 | 3027076 | SHL | 238.66 | 186.6 | 172.6 | 172.6 | 199.1 | 194.6 | Sovereign Consulting Inc. |
| SHM-11-06 | 630411 | 3027590 | SHL | 233.33 | 208.3 | 198.3 | 168.3 | NA | 181.3 | Sovereign Consulting Inc. |
| SHM-11-07 | 630415 | 3027133 | SHL | 238.22 | 197.2 | 192.2 | 192.2 | 193.2 | 192.2 | Sovereign Consulting Inc. |
| SHM-11-08 | 630487 | 3026971 | SHL | 240.48 | 204.5 | 199.5 | 199.5 | 200.5 | 199.5 | Sovereign Consulting Inc. |
| SHM-13-01 | 628557 | 3028295 | SHL | 205.77 | 166.8 | 156.8 | 149.8 | 156.8 | 154.8 | Sovereign Consulting Inc. |
| SHM-13-02 | 628981 | 3028714 | SHL | 216.92 | 156.9 | 146.9 | 139.9 | NA | 145.9 | Sovereign Consulting Inc. |
| SHM-13-03 | 629173 | 3028991 | SHL | 209.91 | 167.8 | 157.8 | 151.8 | 159.8 | 156.8 | Sovereign Consulting Inc. |
| SHM-13-04 | 629480 | 3028606 | SHL | 227.34 | 208.3 | 198.3 | 178.3 | 166.9 | 182.3 | Sovereign Consulting Inc. |
| SHM-13-05 | 629829 | 3028777 | SHL | 225.39 | 150.6 | 140.6 | 133.6 | 142.6 | 140.6 | Sovereign Consulting Inc. |
| SHM-13-06 | 629245 | 3028695 | SHL | 224.23 | 188.2 | 178.2 | 161.7 | NA | 167.2 | Sovereign Consulting Inc. |
| SHM-13-07 | 629331 | 3028761 | SHL | 226.11 | 198.7 | 188.7 | 188.7 | NA | <188.7 | Sovereign Consulting Inc. |
| SHM-13-08 | 629515 | 3028838 | SHL | 228.19 | 173.2 | 163.2 | 151.7 | 160.2 | 157.2 | Sovereign Consulting Inc. |
| SHM-13-14D | 629392 | 3029017 | SHL | 207.48 | 162.9 | 152.9 | 152.9 | NA | <152.9 | Sovereign Consulting Inc. |
| SHM-13-14S | 629392 | 3029021 | SHL | 207.67 | 203.0 | 193.0 | 193.0 | NA | <193.0 | Sovereign Consulting Inc. |
| SHM-13-15 | 629273 | 3029072 | SHL | 205.98 | 157.0 | 147.0 | 147.0 | NA | <147 | Sovereign Consulting Inc. |
| SHM-93-01A | 630677 | 3026712 | SHL | 240.68 | 224.6 | 214.6 | 214.1 | NA | 214.1 | ABB Env. Services, Inc. |
| SHM-93-10C | 630886 | 3026846 | SHL | 246.06 | 201.8 | 191.8 | 186.3 | NA | 209.3 | ABB Env. Services, Inc. |
| SHM-93-18B | 631180 | 3026453 | SHL | 235.21 | 156.8 | 146.8 | 141.8 | NA | 141.8 | ABB Env. Services, Inc. |
| SHM-93-22B | 630072 | 3028170 | SHL | 218.84 | 136.6 | 126.6 | 125.9 | NA | <125.9 | NA |
| SHM-93-22C | 630046 | 3028159 | SHL | 218.92 | 94.7 | 84.7 | 84.0 | NA | 104.0 | ABB Env. Services, Inc. |
| SHM-93-24A | 631308 | 3025647 | SHL | 235.39 | 222.9 | 212.9 | 212.1 | NA | <212.1 | ABB Env. Services, Inc. |
| SHM-96-22B | 630072 | 3028170 | SHL | 218.92 | 136.6 | 126.6 | 125.9 | NA | NA | Stone & Webster Eng. Corp. |
| SHM-96-5B | 630158 | 3028113 | SHL | 217.38 | 137.4 | 127.4 | 120.4 | 149.4 | 125.9 | Stone & Webster Eng. Corp. |
| SHM-96-5C | 630173 | 3028105 | SHL | 217.39 | 167.4 | 157.4 | 132.4 | 147.4 | <132.4 | Hydro Group |
| SHM-99-31A | 629895 | 3028559 | SHL | 212.82 | 208.8 | 198.8 | 198.8 | NA | NA | Harding Lawson Associates |
| SHM-99-31B | 629901 | 3028559 | SHL | 212.52 | 162.4 | 152.4 | 152.4 | NA | NA | Harding Lawson Associates |
| SHM-99-31C | 629909 | 3028562 | SHL | 212.64 | 142.0 | 132.0 | 101.0 | NA | NA | Harding Lawson Associates |
| SHM-99-32X | 630169 | 3028575 | SHL | 219.12 | 147.1 | 137.1 | 126.1 | 135.1 | 131.1 | Harding Lawson Associates |
| SHP-01-36X | 630738 | 3027689 | SHL | 219.97 | 217.1 | 212.1 | NA | NA | NA | NA |
| SHP-01-37X | 630697 | 3027498 | SHL | 218.67 | 217.6 | 212.6 | NA | NA | NA | NA |
| SHP-01-38A | 630546 | 3027171 | SHL | 218.77 | 217.3 | 212.3 | NA | NA | NA | NA |
| SHP-01-38B | 630544 | 3027178 | SHL | 218.88 | 200.9 | 195.9 | NA | NA | NA | NA |
| SHP-05-43 | 630533 | 3027747 | SHL | 258.38 | 207.8 | 197.8 | 197.8 | NA | <197.8 | CH2MHill |
| SHP-05-44 | 630588 | 3027588 | SHL | 255.56 | 204.5 | 194.5 | 194.5 | NA | <194.5 | CH2MHill |

**Appendix A**
**Boring and Monitoring Well Construction Summary**
**Shepley's Hill Landfill Groundwater Model**

| Well Name | X Coordinate (feet) | Y Coordinate (feet) | Area | 2017 Survey Surface Elevation (feet amsl) NAVD 1988 | Top of Screen Elevation (feet amsl) NAVD 1988 | Bottom of screen elevation (feet amsl) NAVD 1988 | Bottom of borehole elevation (feet amsl) NAVD 1988 | Till Elevation (feet amsl) NAVD 1988 | Bedrock Elevation (feet amsl) NAVD 1988 | Installation Oversight |
|---|---|---|---|---|---|---|---|---|---|---|
| SHP-05-45A | 629995 | 3027962 | SHL | 226.32 | 206.3 | 201.3 | 201.3 | NA | NA | CH2MHill |
| SHP-05-45B | 629995 | 3027957 | SHL | 226.72 | 161.7 | 151.7 | 151.7 | NA | <151.7 | CH2MHill |
| SHP-05-46A | 630041 | 3027941 | SHL | 226.31 | 206.1 | 201.1 | 201.1 | NA | NA | CH2MHill |
| SHP-05-46B | 630042 | 3027947 | SHL | 226.03 | 161.4 | 151.4 | 151.4 | NA | <151.3 | CH2MHill |
| SHP-05-47A | 630523 | 3028226 | SHL | 213.35 | 212.5 | 211.5 | 211.5 | NA | NA | CH2MHill |
| SHP-05-47B | 630524 | 3028226 | SHL | 213.33 | 210.5 | 209.5 | 209.5 | NA | NA | CH2MHill |
| SHP-05-48A | 630046 | 3028570 | SHL | 213.09 | 212.09 | 211.1 | 211.1 | NA | NA | CH2MHill |
| SHP-05-48B | 630046 | 3028570 | SHL | 213.03 | 211.03 | 210.0 | 210.0 | NA | <210.0 | CH2MHill |
| SHP-05-49A | 630251 | 3028664 | SHL | 212.34 | 211.26 | 210.3 | 210.3 | NA | NA | CH2MHill |
| SHP-05-49B | 630250 | 3028664 | SHL | 212.39 | 209.66 | 208.7 | 208.7 | NA | <208.7 | CH2MHill |
| SHP-2016-06A | 629710 | 3027906 | SHL | 240.05 | 159.1 | 154.1 | 52.1 | NA | 173.1 | Koman Government Soulutions, LLC |
| SHP-2016-06B | 629710 | 3027906 | SHL | 240.05 | 138.1 | 128.1 | 52.1 | NA | NA | Koman Government Soulutions, LLC |
| SHP-2016-06C | 629710 | 3027906 | SHL | 240.05 | 117.1 | 107.1 | 52.1 | NA | NA | Koman Government Soulutions, LLC |
| SHP-2016-07A | 629220 | 3026882 | SHL | 262.98 | 241.0 | 231.0 | 134.5 | NA | 255.0 | Koman Government Soulutions, LLC |
| SHP-2016-07B | 629220 | 3026882 | SHL | 262.98 | 193.0 | 183.0 | 134.5 | NA | NA | Koman Government Soulutions, LLC |
| SHP-2016-1A | 629934 | 3027980 | SHL | 224.69 | 211.7 | 201.7 | 119.7 | 123.7 | 122.7 | Koman Government Soulutions, LLC |
| SHP-2016-1B | 629934 | 3027980 | SHL | 224.69 | 149.7 | 139.7 | 119.7 | 123.7 | 122.7 | Koman Government Soulutions, LLC |
| SHP-2016-2A | 629926 | 3028200 | SHL | 223.73 | 203.7 | 198.7 | 108.7 | 113.7 | 110.7 | Koman Government Soulutions, LLC |
| SHP-2016-2B | 629926 | 3028200 | SHL | 223.73 | 143.7 | 138.7 | 108.7 | 113.7 | 110.7 | Koman Government Soulutions, LLC |
| SHP-2016-3A | 630007 | 3028174 | SHL | 221.13 | 201.1 | 196.1 | 105.6 | 110.6 | 108.1 | Koman Government Soulutions, LLC |
| SHP-2016-3B | 630007 | 3028174 | SHL | 221.13 | 141.1 | 136.1 | 105.6 | 110.6 | 108.1 | Koman Government Soulutions, LLC |
| SHP-2016-4A | 629902 | 3028147 | SHL | 227.57 | 202.6 | 197.6 | 111.6 | 122.6 | 112.6 | Koman Government Soulutions, LLC |
| SHP-2016-4B | 629902 | 3028147 | SHL | 227.57 | 142.6 | 137.6 | 111.6 | 122.6 | 112.6 | Koman Government Soulutions, LLC |
| SHP-2016-5A | 629964 | 3028113 | SHL | 224.88 | 199.9 | 194.9 | 102.4 | 107.4 | 102.4 | Koman Government Soulutions, LLC |
| SHP-2016-5B | 629964 | 3028113 | SHL | 224.88 | 139.9 | 134.9 | 102.4 | 107.4 | 102.4 | Koman Government Soulutions, LLC |
| SHP-95-27X | 630753 | 3026165 | SHL | 235.31 | NA | NA | NA | NA | NA | NA |
| SHP-99-01B | 629227 | 3026537 | SHL | 271.76 | 267.1 | 263.1 | 262.9 | NA | <262.9 | Harding Lawson Associates |
| SHP-99-01C | 629216 | 3026541 | SHL | 272.16 | 251.7 | 241.7 | 241.4 | NA | 262.4 | Harding Lawson Associates |
| SHP-99-29X | 629539 | 3027143 | SHL | 241.46 | 222.4 | 212.4 | 198.9 | 207.4 | 203.9 | Harding Lawson Associates |
| SHP-99-33A | 629818 | 3028552 | SHL | 221.06 | 209.9 | 204.9 | NA | NA | NA | NA |
| SHP-99-33B | 629816 | 3028550 | SHL | 221.16 | 146.6 | 141.6 | NA | NA | NA | NA |
| SHP-99-34A | 630294 | 3028552 | SHL | 222.50 | 210.0 | 205 | NA | NA | NA | NA |
| SHP-99-34B | 630291 | 3028552 | SHL | 222.69 | 148.1 | 143.05 | NA | NA | NA | NA |
| SHP-99-35X | 629723 | 3026547 | SHL | 256.73 | 226.0 | 215.99 | 206.7 | NA | 220.7 | Harding Lawson Associates |
| SHW-07-03 | 630024 | 3029388 | SHL | 228.01 | 203.0 | 193.01 | 191.0 | NA | NA | AMEC |
| SHW-07-05 | 628555 | 3028455 | SHL | 223.62 | 167.6 | 158.62 | 157.6 | NA | 177.6 | AMEC |

**NOTES**
1. NA - Not Available.
2. Shaded surface elevation values were reported prior to 2017.
2. amsl - above mean seal level.
3. NAVD 1988 - North American Vertical Datum of 1988.

# APPENDIX B

# WATER LEVEL CALIBRATION TARGETS

# Appendix B
# Water Level Data (CD)
# Shepley's Hill Landfill Groundwater Model

| Location Name | X Coordinate (feet) | Y Coordinate (feet) | Measuring Point Elevation (feet amsl) NAVD 1988 | Model Stress Period | Measurement Date | Depth to Water (feet) | Groundwater Elevation (feet amsl) NAVD 1988 |
|---|---|---|---|---|---|---|---|
| 20-1 | 629112 | 3027171 | 278.52 | 15 | 6/24/2016 | 28.26 | 250.26 |
| 20-1 | 629112 | 3027171 | 278.52 | 17 | 11/15/2016 | 44.15 | 234.37 |
| 3-2 | 629207 | 3027010 | 268.20 | 15 | 6/24/2016 | 28.10 | 240.10 |
| 3-2 | 629207 | 3027010 | 268.20 | 17 | 11/15/2016 | 36.89 | 231.31 |
| 32M-01-14XBR | 629685 | 3025386 | 256.06 | 1 | 10/22/2012 | 24.28 | 231.78 |
| 32M-01-14XBR | 629685 | 3025386 | 256.06 | 3 | 6/11/2013 | 20.56 | 235.50 |
| 32M-01-14XBR | 629685 | 3025386 | 256.06 | 7 | 6/17/2014 | 27.77 | 228.29 |
| 32M-01-14XBR | 629685 | 3025386 | 256.06 | 15 | 5/17/2016 | 22.69 | 233.37 |
| 32M-01-14XOB | 629693 | 3025382 | 256.56 | 1 | 10/22/2012 | 26.23 | 230.33 |
| 32M-01-14XOB | 629693 | 3025382 | 256.56 | 3 | 6/11/2013 | 24.01 | 232.55 |
| 32M-01-14XOB | 629693 | 3025382 | 256.56 | 7 | 6/17/2014 | 24.71 | 231.85 |
| 32M-01-14XOB | 629693 | 3025382 | 256.56 | 11 | 6/28/2015 | 24.75 | 231.81 |
| 32M-01-14XOB | 629693 | 3025382 | 256.56 | 13 | 10/8/2015 | 24.95 | 231.61 |
| 32M-01-14XOB | 629693 | 3025382 | 256.56 | 15 | 5/17/2016 | 24.68 | 231.88 |
| 32M-01-14XOB | 629693 | 3025382 | 256.56 | 15 | 6/24/2016 | 23.93 | 232.63 |
| 32M-01-14XOB | 629693 | 3025382 | 256.56 | 17 | 11/15/2016 | 26.66 | 229.90 |
| 32M-01-16XBR | 629604 | 3025102 | 257.50 | 1 | 10/22/2012 | 25.19 | 232.31 |
| 32M-01-16XBR | 629604 | 3025102 | 257.50 | 3 | 6/11/2013 | 21.85 | 235.65 |
| 32M-01-16XBR | 629604 | 3025102 | 257.50 | 7 | 6/17/2014 | 24.36 | 233.14 |
| 32M-01-16XBR | 629604 | 3025102 | 257.50 | 13 | 10/8/2015 | 25.75 | 231.75 |
| 32M-01-16XBR | 629604 | 3025102 | 257.50 | 15 | 5/17/2016 | 22.94 | 234.56 |
| 32M-01-18XBR | 629515 | 3025247 | 258.32 | 1 | 10/22/2012 | 17.53 | 240.79 |
| 32M-01-18XBR | 629515 | 3025247 | 258.32 | 3 | 6/11/2013 | 11.05 | 247.27 |
| 32M-01-18XBR | 629515 | 3025247 | 258.32 | 7 | 6/17/2014 | 16.85 | 241.47 |
| 32M-01-18XBR | 629515 | 3025247 | 258.32 | 11 | 6/28/2015 | 18.50 | 239.82 |
| 32M-01-18XBR | 629515 | 3025247 | 258.32 | 13 | 10/8/2015 | 19.75 | 238.57 |
| 32M-01-18XBR | 629515 | 3025247 | 258.32 | 15 | 5/17/2016 | 16.97 | 241.35 |
| 32M-92-01X | 629190 | 3025740 | 260.17 | 1 | 10/22/2012 | 20.29 | 239.88 |
| 32M-92-01X | 629190 | 3025740 | 260.17 | 3 | 6/11/2013 | 17.19 | 242.98 |
| 32M-92-01X | 629190 | 3025740 | 260.17 | 7 | 6/17/2014 | 17.33 | 242.84 |
| 32M-92-01X | 629190 | 3025740 | 260.17 | 13 | 10/8/2015 | 20.35 | 239.82 |
| 32M-92-01X | 629190 | 3025740 | 260.17 | 15 | 5/17/2016 | 17.33 | 242.84 |
| 32M-92-01X | 629190 | 3025740 | 260.17 | 15 | 6/24/2016 | 18.48 | 241.69 |
| 32M-92-01X | 629190 | 3025740 | 260.17 | 17 | 11/15/2016 | 20.41 | 239.76 |
| 32M-92-03X | 628772 | 3025213 | 260.02 | 3 | 6/11/2013 | 25.35 | 234.67 |
| 32M-92-03X | 628772 | 3025213 | 260.02 | 7 | 6/17/2014 | 28.28 | 231.74 |
| 32M-92-03X | 628772 | 3025213 | 260.02 | 13 | 10/8/2015 | 29.74 | 230.28 |
| 32M-92-03X | 628772 | 3025213 | 260.02 | 15 | 5/17/2016 | 28.89 | 231.13 |
| 32Z-01-05XOB | 629132 | 3024517 | 261.40 | 1 | 10/17/2012 | 31.10 | 230.30 |
| 32Z-01-05XOB | 629132 | 3024517 | 261.40 | 1 | 10/22/2012 | 31.10 | 230.30 |
| 32Z-01-05XOB | 629132 | 3024517 | 261.40 | 3 | 6/11/2013 | 29.20 | 232.20 |
| 32Z-01-05XOB | 629132 | 3024517 | 261.40 | 7 | 6/17/2014 | 29.70 | 231.70 |
| 32Z-01-05XOB | 629132 | 3024517 | 261.40 | 13 | 10/8/2015 | 31.10 | 230.30 |
| 32Z-01-05XOB | 629132 | 3024517 | 261.40 | 15 | 5/17/2016 | 30.69 | 230.71 |
| 32Z-01-06XBR | 629526 | 3025592 | 261.85 | 1 | 10/22/2012 | 21.65 | 240.20 |
| 32Z-01-06XBR | 629526 | 3025592 | 261.85 | 3 | 6/11/2013 | 15.78 | 246.07 |
| 32Z-01-06XBR | 629526 | 3025592 | 261.85 | 7 | 6/17/2014 | 18.50 | 243.35 |
| 32Z-01-06XBR | 629526 | 3025592 | 261.85 | 13 | 10/8/2015 | 23.45 | 238.40 |
| 32Z-01-06XBR | 629526 | 3025592 | 261.85 | 15 | 5/17/2016 | 17.73 | 244.12 |
| 32Z-01-07XOB | 629418 | 3025656 | 259.48 | 1 | 10/22/2012 | 18.98 | 240.50 |

# Appendix B
# Water Level Data (CD)
# Shepley's Hill Landfill Groundwater Model

| Location Name | X Coordinate (feet) | Y Coordinate (feet) | Measuring Point Elevation (feet amsl) NAVD 1988 | Model Stress Period | Measurement Date | Depth to Water (feet) | Groundwater Elevation (feet amsl) NAVD 1988 |
|---|---|---|---|---|---|---|---|
| 32Z-01-07XOB | 629418 | 3025656 | 259.48 | 3 | 6/11/2013 | 14.31 | 245.17 |
| 32Z-01-07XOB | 629418 | 3025656 | 259.48 | 7 | 6/17/2014 | 16.04 | 243.44 |
| 32Z-01-07XOB | 629418 | 3025656 | 259.48 | 13 | 10/8/2015 | 19.45 | 240.03 |
| 32Z-01-07XOB | 629418 | 3025656 | 259.48 | 15 | 5/17/2016 | 15.91 | 243.57 |
| 32Z-01-07XOB | 629418 | 3025656 | 259.48 | 15 | 6/24/2016 | 17.33 | 242.15 |
| 32Z-01-07XOB | 629418 | 3025656 | 259.48 | 17 | 11/15/2016 | 18.59 | 240.89 |
| 32Z-01-08XOB | 629071 | 3025512 | 260.49 | 1 | 10/22/2012 | 20.65 | 239.84 |
| 32Z-01-08XOB | 629071 | 3025512 | 260.49 | 3 | 6/11/2013 | 17.96 | 242.53 |
| 32Z-01-08XOB | 629071 | 3025512 | 260.49 | 7 | 6/17/2014 | 17.91 | 242.58 |
| 32Z-01-08XOB | 629071 | 3025512 | 260.49 | 13 | 10/8/2015 | 20.67 | 239.82 |
| 32Z-01-08XOB | 629071 | 3025512 | 260.49 | 15 | 5/17/2016 | 17.90 | 242.59 |
| 32Z-01-09XOB | 628871 | 3024571 | 258.17 | 1 | 10/22/2012 | 28.16 | 230.01 |
| 32Z-01-09XOB | 628871 | 3024571 | 258.17 | 3 | 6/11/2013 | 25.66 | 232.51 |
| 32Z-01-09XOB | 628871 | 3024571 | 258.17 | 7 | 6/17/2014 | 26.70 | 231.47 |
| 32Z-01-09XOB | 628871 | 3024571 | 258.17 | 13 | 10/8/2015 | 28.16 | 230.01 |
| 32Z-01-09XOB | 628871 | 3024571 | 258.17 | 15 | 5/17/2016 | 27.62 | 230.55 |
| 32Z-01-10XBR | 629597 | 3024914 | 257.41 | 1 | 10/22/2012 | 16.16 | 241.25 |
| 32Z-01-10XBR | 629597 | 3024914 | 257.41 | 3 | 6/11/2013 | 12.20 | 245.21 |
| 32Z-01-10XBR | 629597 | 3024914 | 257.41 | 7 | 6/17/2014 | 17.44 | 239.97 |
| 32Z-01-10XBR | 629597 | 3024914 | 257.41 | 13 | 10/8/2015 | 18.55 | 238.86 |
| 32Z-01-10XBR | 629597 | 3024914 | 257.41 | 15 | 5/17/2016 | 16.96 | 240.45 |
| 32Z-01-12XBR | 629002 | 3025273 | 257.85 | 1 | 10/22/2012 | 22.55 | 235.30 |
| 32Z-01-12XBR | 629002 | 3025273 | 257.85 | 3 | 6/11/2013 | 19.17 | 238.68 |
| 32Z-01-12XBR | 629002 | 3025273 | 257.85 | 7 | 6/17/2014 | 19.24 | 238.61 |
| 32Z-01-12XBR | 629002 | 3025273 | 257.85 | 13 | 10/8/2015 | 22.35 | 235.50 |
| 32Z-01-12XBR | 629002 | 3025273 | 257.85 | 15 | 5/17/2016 | 19.28 | 238.57 |
| 32Z-99-02X | 629874 | 3024769 | 259.71 | 1 | 10/22/2012 | 26.61 | 233.10 |
| 32Z-99-02X | 629874 | 3024769 | 259.71 | 3 | 6/11/2013 | 24.52 | 235.19 |
| 32Z-99-02X | 629874 | 3024769 | 259.71 | 7 | 6/17/2014 | 24.35 | 235.36 |
| 32Z-99-02X | 629874 | 3024769 | 259.71 | 13 | 10/8/2015 | 26.70 | 233.01 |
| 32Z-99-02X | 629874 | 3024769 | 259.71 | 13 | 12/16/2015 | 27.65 | 232.06 |
| 43M-01-16XBR | 628981 | 3025055 | 256.84 | 1 | 10/22/2012 | 27.00 | 229.84 |
| 43M-01-16XBR | 628981 | 3025055 | 256.84 | 3 | 6/11/2013 | 24.62 | 232.22 |
| 43M-01-16XBR | 628981 | 3025055 | 256.84 | 7 | 6/17/2014 | 25.35 | 231.49 |
| 43M-01-16XBR | 628981 | 3025055 | 256.84 | 13 | 10/8/2015 | 25.60 | 231.24 |
| 43M-01-16XBR | 628981 | 3025055 | 256.84 | 15 | 5/17/2016 | 26.18 | 230.66 |
| 43M-01-16XOB | 628981 | 3025060 | 256.88 | 1 | 10/22/2012 | 27.30 | 229.58 |
| 43M-01-16XOB | 628981 | 3025060 | 256.88 | 3 | 6/11/2013 | 24.25 | 232.63 |
| 43M-01-16XOB | 628981 | 3025060 | 256.88 | 7 | 6/17/2014 | 25.37 | 231.51 |
| 43M-01-16XOB | 628981 | 3025060 | 256.88 | 13 | 10/8/2015 | 27.30 | 229.58 |
| 43M-01-16XOB | 628981 | 3025060 | 256.88 | 15 | 5/17/2016 | 26.27 | 230.61 |
| 43M-01-17XBR | 629073 | 3024935 | 258.29 | 1 | 10/22/2012 | 28.63 | 229.66 |
| 43M-01-17XBR | 629073 | 3024935 | 258.29 | 3 | 6/11/2013 | 26.41 | 231.88 |
| 43M-01-17XBR | 629073 | 3024935 | 258.29 | 7 | 6/17/2014 | 26.90 | 231.39 |
| 43M-01-17XBR | 629073 | 3024935 | 258.29 | 13 | 10/8/2015 | 27.84 | 230.45 |
| 43M-01-17XBR | 629073 | 3024935 | 258.29 | 15 | 5/17/2016 | 27.97 | 230.32 |
| 43M-01-17XOB | 629073 | 3024941 | 258.08 | 1 | 10/22/2012 | 28.62 | 229.46 |
| 43M-01-17XOB | 629073 | 3024941 | 258.08 | 3 | 6/11/2013 | 26.31 | 231.77 |
| 43M-01-17XOB | 629073 | 3024941 | 258.08 | 7 | 6/17/2014 | 26.97 | 231.11 |
| 43M-01-17XOB | 629073 | 3024941 | 258.08 | 13 | 10/8/2015 | 28.55 | 229.53 |

# Appendix B
# Water Level Data (CD)
# Shepley's Hill Landfill Groundwater Model

| Location Name | X Coordinate (feet) | Y Coordinate (feet) | Measuring Point Elevation (feet amsl) NAVD 1988 | Model Stress Period | Measurement Date | Depth to Water (feet) | Groundwater Elevation (feet amsl) NAVD 1988 |
|---|---|---|---|---|---|---|---|
| 43M-01-17XOB | 629073 | 3024941 | 258.08 | 15 | 5/17/2016 | 27.87 | 230.21 |
| 43M-01-20XBR | 628852 | 3024830 | 257.30 | 1 | 10/22/2012 | 27.96 | 229.34 |
| 43M-01-20XBR | 628852 | 3024830 | 257.30 | 3 | 6/11/2013 | 25.69 | 231.61 |
| 43M-01-20XBR | 628852 | 3024830 | 257.30 | 7 | 6/17/2014 | 26.58 | 230.72 |
| 43M-01-20XBR | 628852 | 3024830 | 257.30 | 13 | 10/8/2015 | 28.11 | 229.19 |
| 43M-01-20XBR | 628852 | 3024830 | 257.30 | 15 | 5/17/2016 | 27.52 | 229.78 |
| 43M-01-20XOB | 628852 | 3024834 | 257.40 | 1 | 10/22/2012 | 28.51 | 228.89 |
| 43M-01-20XOB | 628852 | 3024834 | 257.40 | 3 | 6/11/2013 | 25.87 | 231.53 |
| 43M-01-20XOB | 628852 | 3024834 | 257.40 | 7 | 6/17/2014 | 26.74 | 230.66 |
| 43M-01-20XOB | 628852 | 3024834 | 257.40 | 13 | 10/8/2015 | 28.22 | 229.18 |
| 43M-01-20XOB | 628852 | 3024834 | 257.40 | 15 | 5/17/2016 | 27.68 | 229.72 |
| 57M-03-01X | 632642 | 3022692 | 237.90 | 3 | 6/13/2013 | 13.76 | 224.14 |
| 57M-03-01X | 632642 | 3022692 | 237.90 | 7 | 6/18/2014 | 14.67 | 223.23 |
| 57M-03-01X | 632642 | 3022692 | 237.90 | 11 | 6/21/2015 | 14.59 | 223.31 |
| 57M-03-01X | 632642 | 3022692 | 237.90 | 15 | 5/19/2016 | 14.86 | 223.04 |
| 57M-03-02X | 632655 | 3022571 | 227.10 | 3 | 6/13/2013 | 3.99 | 223.11 |
| 57M-03-02X | 632655 | 3022571 | 227.10 | 7 | 6/18/2014 | 5.31 | 221.79 |
| 57M-03-02X | 632655 | 3022571 | 227.10 | 11 | 6/21/2015 | 5.25 | 221.85 |
| 57M-03-02X | 632655 | 3022571 | 227.10 | 15 | 5/19/2016 | 5.27 | 221.83 |
| 57M-03-03X | 632712 | 3022508 | 223.64 | 3 | 6/13/2013 | 0.38 | 223.26 |
| 57M-03-03X | 632712 | 3022508 | 223.64 | 7 | 6/18/2014 | 1.44 | 222.20 |
| 57M-03-03X | 632712 | 3022508 | 223.64 | 11 | 6/21/2015 | 1.09 | 222.55 |
| 57M-03-03X | 632712 | 3022508 | 223.64 | 15 | 5/19/2016 | 0.97 | 222.67 |
| 57M-03-04X | 632756 | 3022531 | 224.02 | 3 | 6/13/2013 | 1.75 | 222.27 |
| 57M-03-04X | 632756 | 3022531 | 224.02 | 7 | 6/18/2014 | 2.51 | 221.51 |
| 57M-03-04X | 632756 | 3022531 | 224.02 | 11 | 6/21/2015 | 2.48 | 221.54 |
| 57M-03-04X | 632756 | 3022531 | 224.02 | 15 | 5/19/2016 | 2.40 | 221.62 |
| 57M-03-05X | 632773 | 3022578 | 224.33 | 3 | 6/13/2013 | 2.37 | 221.96 |
| 57M-03-05X | 632773 | 3022578 | 224.33 | 7 | 6/18/2014 | 2.78 | 221.55 |
| 57M-03-05X | 632773 | 3022578 | 224.33 | 11 | 6/21/2015 | 2.82 | 221.51 |
| 57M-03-05X | 632773 | 3022578 | 224.33 | 15 | 5/19/2016 | 2.71 | 221.62 |
| 57M-03-06X | 632786 | 3022619 | 224.56 | 3 | 6/13/2013 | 2.24 | 222.32 |
| 57M-03-06X | 632786 | 3022619 | 224.56 | 11 | 6/21/2015 | 2.76 | 221.80 |
| 57M-03-06X | 632786 | 3022619 | 224.56 | 15 | 5/19/2016 | 2.74 | 221.82 |
| 57M-95-05X | 632502 | 3022584 | 237.31 | 3 | 6/13/2013 | 13.15 | 224.16 |
| 57M-95-05X | 632502 | 3022584 | 237.31 | 7 | 6/18/2014 | 14.77 | 222.54 |
| 57M-95-05X | 632502 | 3022584 | 237.31 | 11 | 6/21/2015 | 14.68 | 222.63 |
| 57M-95-05X | 632502 | 3022584 | 237.31 | 15 | 5/19/2016 | 14.89 | 222.42 |
| 57M-95-06X | 632760 | 3022737 | 236.56 | 3 | 6/13/2013 | 12.46 | 224.10 |
| 57M-95-06X | 632760 | 3022737 | 236.56 | 7 | 6/18/2014 | 13.14 | 223.42 |
| 57M-95-06X | 632760 | 3022737 | 236.56 | 11 | 6/21/2015 | 13.67 | 222.89 |
| 57M-95-06X | 632760 | 3022737 | 236.56 | 15 | 5/19/2016 | 13.40 | 223.16 |
| 57M-95-07X | 632538 | 3022486 | 224.57 | 3 | 6/13/2013 | 1.86 | 222.71 |
| 57M-95-07X | 632538 | 3022486 | 224.57 | 7 | 6/18/2014 | 2.89 | 221.68 |
| 57M-95-07X | 632538 | 3022486 | 224.57 | 11 | 6/21/2015 | 2.79 | 221.78 |
| 57M-95-07X | 632538 | 3022486 | 224.57 | 15 | 5/19/2016 | 2.80 | 221.77 |
| 57M-96-10X | 633332 | 3022916 | 229.55 | 7 | 6/18/2014 | 7.50 | 222.05 |
| 57M-96-10X | 633332 | 3022916 | 229.55 | 11 | 6/21/2015 | 7.49 | 222.06 |
| 57M-96-11X | 633270 | 3022834 | 224.38 | 3 | 6/13/2013 | 2.71 | 221.67 |
| 57M-96-11X | 633270 | 3022834 | 224.38 | 7 | 6/18/2014 | 3.54 | 220.84 |

# Appendix B
# Water Level Data (CD)
# Shepley's Hill Landfill Groundwater Model

| Location Name | X Coordinate (feet) | Y Coordinate (feet) | Measuring Point Elevation (feet amsl) NAVD 1988 | Model Stress Period | Measurement Date | Depth to Water (feet) | Groundwater Elevation (feet amsl) NAVD 1988 |
|---|---|---|---|---|---|---|---|
| 57M-96-11X | 633270 | 3022834 | 224.38 | 11 | 6/21/2015 | 3.12 | 221.26 |
| 57M-96-11X | 633270 | 3022834 | 224.38 | 15 | 5/19/2016 | 2.96 | 221.42 |
| 57M-96-12X | 633161 | 3022842 | 227.87 | 3 | 6/13/2013 | 4.61 | 223.26 |
| 57M-96-12X | 633161 | 3022842 | 227.87 | 7 | 6/18/2014 | 5.50 | 222.37 |
| 57M-96-12X | 633161 | 3022842 | 227.87 | 11 | 6/21/2015 | 5.36 | 222.51 |
| 57M-96-12X | 633161 | 3022842 | 227.87 | 15 | 5/19/2016 | 5.28 | 222.59 |
| 57M-96-13X | 633122 | 3022811 | 227.73 | 3 | 6/13/2013 | 4.50 | 223.23 |
| 57M-96-13X | 633122 | 3022811 | 227.73 | 7 | 6/18/2014 | 5.35 | 222.38 |
| 57M-96-13X | 633122 | 3022811 | 227.73 | 11 | 6/21/2015 | 5.24 | 222.49 |
| 57M-96-13X | 633122 | 3022811 | 227.73 | 15 | 5/19/2016 | 5.03 | 222.70 |
| 57WP-06-02 | 632722 | 3022510 | 222.91 | 3 | 6/13/2013 | 0.57 | 222.34 |
| 57WP-06-02 | 632722 | 3022510 | 222.91 | 7 | 6/18/2014 | 1.34 | 221.57 |
| 57WP-06-02 | 632722 | 3022510 | 222.91 | 15 | 5/19/2016 | 1.24 | 221.67 |
| 57WP-06-03 | 633245 | 3022838 | 222.69 | 3 | 6/13/2013 | 0.55 | 222.14 |
| 57WP-06-03 | 633245 | 3022838 | 222.69 | 7 | 6/18/2014 | 1.16 | 221.53 |
| 69W-94-13 | 627446 | 3025277 | 227.79 | 1 | 10/22/2012 | 7.88 | 219.91 |
| 69W-94-13 | 627446 | 3025277 | 227.79 | 9 | 10/20/2014 | 8.03 | 219.76 |
| 69W-94-13 | 627446 | 3025277 | 227.79 | 13 | 10/7/2015 | 7.84 | 219.95 |
| 69W-94-13 | 627446 | 3025277 | 227.79 | 17 | 10/25/2016 | 8.69 | 219.10 |
| 69W-94-14 | 627387 | 3025370 | 228.02 | 1 | 10/22/2012 | 8.77 | 219.25 |
| 69W-94-14 | 627387 | 3025370 | 228.02 | 9 | 10/20/2014 | 8.93 | 219.09 |
| 69W-94-14 | 627387 | 3025370 | 228.02 | 13 | 10/7/2015 | 8.75 | 219.27 |
| 69W-94-14 | 627387 | 3025370 | 228.02 | 17 | 10/25/2016 | 9.47 | 218.55 |
| 69WP-08-01 | 627342 | 3025648 | 221.50 | 1 | 10/22/2012 | 3.94 | 217.56 |
| 69WP-08-01 | 627342 | 3025648 | 221.50 | 9 | 10/20/2014 | 4.03 | 217.47 |
| 69WP-08-01 | 627342 | 3025648 | 221.50 | 13 | 10/7/2015 | 3.84 | 217.66 |
| 69WP-08-01 | 627342 | 3025648 | 221.50 | 17 | 10/25/2016 | 4.62 | 216.88 |
| CAP-2B | 629296 | 3027119 | 250.21 | 15 | 6/24/2016 | 14.40 | 235.81 |
| CH-1D | 629288 | 3027063 | 250.59 | 13 | 10/7/2015 | 21.95 | 228.64 |
| CH-1D | 629288 | 3027063 | 250.59 | 13 | 12/16/2015 | 18.84 | 231.75 |
| CH-1D | 629288 | 3027063 | 250.59 | 15 | 6/24/2016 | 14.16 | 236.43 |
| EPA-PZ-2012-1A | 630191 | 3028056 | 223.79 | 1 | 11/5/2012 | 10.85 | 212.94 |
| EPA-PZ-2012-1A | 630191 | 3028056 | 223.79 | 1 | 11/6/2012 | 10.83 | 212.96 |
| EPA-PZ-2012-1A | 630191 | 3028056 | 223.79 | 2 | 3/13/2013 | 10.42 | 213.37 |
| EPA-PZ-2012-1A | 630191 | 3028056 | 223.79 | 3 | 4/23/2013 | 11.07 | 212.72 |
| EPA-PZ-2012-1A | 630191 | 3028056 | 223.79 | 3 | 4/25/2013 | 11.07 | 212.72 |
| EPA-PZ-2012-1A | 630191 | 3028056 | 223.79 | 3 | 5/15/2013 | 11.59 | 212.20 |
| EPA-PZ-2012-1A | 630191 | 3028056 | 223.79 | 3 | 5/30/2013 | 10.69 | 213.10 |
| EPA-PZ-2012-1A | 630191 | 3028056 | 223.79 | 7 | 4/22/2014 | 10.10 | 213.69 |
| EPA-PZ-2012-1A | 630191 | 3028056 | 223.79 | 9 | 10/6/2014 | 12.39 | 211.40 |
| EPA-PZ-2012-1A | 630191 | 3028056 | 223.79 | 11 | 6/4/2015 | 11.21 | 212.58 |
| EPA-PZ-2012-1A | 630191 | 3028056 | 223.79 | 13 | 10/20/2015 | 12.53 | 211.26 |
| EPA-PZ-2012-1A | 630191 | 3028056 | 223.79 | 13 | 12/16/2015 | 12.13 | 211.66 |
| EPA-PZ-2012-1A | 630191 | 3028056 | 223.79 | 15 | 6/23/2016 | 12.12 | 211.67 |
| EPA-PZ-2012-1A | 630191 | 3028056 | 223.79 | 16 | 8/16/2016 | 12.80 | 210.99 |
| EPA-PZ-2012-1A | 630191 | 3028056 | 223.79 | 17 | 11/16/2016 | 11.67 | 212.12 |
| EPA-PZ-2012-1B | 630193 | 3028057 | 223.53 | 1 | 11/5/2012 | 10.57 | 212.96 |
| EPA-PZ-2012-1B | 630193 | 3028057 | 223.53 | 1 | 11/6/2012 | 10.62 | 212.91 |
| EPA-PZ-2012-1B | 630193 | 3028057 | 223.53 | 2 | 3/13/2013 | 10.20 | 213.33 |
| EPA-PZ-2012-1B | 630193 | 3028057 | 223.53 | 3 | 4/23/2013 | 10.82 | 212.71 |

# Appendix B
# Water Level Data (CD)
# Shepley's Hill Landfill Groundwater Model

| Location Name | X Coordinate (feet) | Y Coordinate (feet) | Measuring Point Elevation (feet amsl) NAVD 1988 | Model Stress Period | Measurement Date | Depth to Water (feet) | Groundwater Elevation (feet amsl) NAVD 1988 |
|---|---|---|---|---|---|---|---|
| EPA-PZ-2012-1B | 630193 | 3028057 | 223.53 | 3 | 4/25/2013 | 10.84 | 212.69 |
| EPA-PZ-2012-1B | 630193 | 3028057 | 223.53 | 3 | 5/15/2013 | 11.34 | 212.19 |
| EPA-PZ-2012-1B | 630193 | 3028057 | 223.53 | 3 | 5/30/2013 | 10.47 | 213.06 |
| EPA-PZ-2012-1B | 630193 | 3028057 | 223.53 | 7 | 4/22/2014 | 9.85 | 213.68 |
| EPA-PZ-2012-1B | 630193 | 3028057 | 223.53 | 9 | 10/6/2014 | 12.09 | 211.44 |
| EPA-PZ-2012-1B | 630193 | 3028057 | 223.53 | 11 | 6/4/2015 | 10.81 | 212.72 |
| EPA-PZ-2012-1B | 630193 | 3028057 | 223.53 | 13 | 10/20/2015 | 12.21 | 211.32 |
| EPA-PZ-2012-1B | 630193 | 3028057 | 223.53 | 13 | 12/16/2015 | 11.86 | 211.67 |
| EPA-PZ-2012-1B | 630193 | 3028057 | 223.53 | 15 | 6/23/2016 | 11.80 | 211.73 |
| EPA-PZ-2012-1B | 630193 | 3028057 | 223.53 | 16 | 8/16/2016 | 12.51 | 211.02 |
| EPA-PZ-2012-1B | 630193 | 3028057 | 223.53 | 17 | 10/20/2016 | 12.63 | 210.90 |
| EPA-PZ-2012-1B | 630193 | 3028057 | 223.53 | 17 | 11/16/2016 | 11.37 | 212.16 |
| EPA-PZ-2012-2A | 630287 | 3028125 | 223.38 | 1 | 11/5/2012 | 10.38 | 213.00 |
| EPA-PZ-2012-2A | 630287 | 3028125 | 223.38 | 1 | 11/6/2012 | 10.27 | 213.11 |
| EPA-PZ-2012-2A | 630287 | 3028125 | 223.38 | 2 | 3/13/2013 | 9.73 | 213.65 |
| EPA-PZ-2012-2A | 630287 | 3028125 | 223.38 | 3 | 4/23/2013 | 10.59 | 212.79 |
| EPA-PZ-2012-2A | 630287 | 3028125 | 223.38 | 3 | 4/25/2013 | 10.62 | 212.76 |
| EPA-PZ-2012-2A | 630287 | 3028125 | 223.38 | 3 | 5/15/2013 | 11.11 | 212.27 |
| EPA-PZ-2012-2A | 630287 | 3028125 | 223.38 | 3 | 5/30/2013 | 10.02 | 213.36 |
| EPA-PZ-2012-2A | 630287 | 3028125 | 223.38 | 7 | 4/22/2014 | 9.60 | 213.78 |
| EPA-PZ-2012-2A | 630287 | 3028125 | 223.38 | 9 | 10/6/2014 | 11.77 | 211.61 |
| EPA-PZ-2012-2A | 630287 | 3028125 | 223.38 | 11 | 6/4/2015 | 10.45 | 212.93 |
| EPA-PZ-2012-2A | 630287 | 3028125 | 223.38 | 13 | 10/20/2015 | 11.81 | 211.57 |
| EPA-PZ-2012-2A | 630287 | 3028125 | 223.38 | 13 | 12/16/2015 | 11.45 | 211.93 |
| EPA-PZ-2012-2A | 630287 | 3028125 | 223.38 | 15 | 6/23/2016 | 11.59 | 211.79 |
| EPA-PZ-2012-2A | 630287 | 3028125 | 223.38 | 16 | 8/16/2016 | 12.19 | 211.19 |
| EPA-PZ-2012-2A | 630287 | 3028125 | 223.38 | 17 | 11/16/2016 | 10.86 | 212.52 |
| EPA-PZ-2012-2B | 630290 | 3028125 | 223.37 | 1 | 11/5/2012 | 10.44 | 212.93 |
| EPA-PZ-2012-2B | 630290 | 3028125 | 223.37 | 1 | 11/6/2012 | 10.42 | 212.95 |
| EPA-PZ-2012-2B | 630290 | 3028125 | 223.37 | 2 | 3/13/2013 | 10.05 | 213.32 |
| EPA-PZ-2012-2B | 630290 | 3028125 | 223.37 | 3 | 4/23/2013 | 10.65 | 212.72 |
| EPA-PZ-2012-2B | 630290 | 3028125 | 223.37 | 3 | 4/25/2013 | 10.68 | 212.69 |
| EPA-PZ-2012-2B | 630290 | 3028125 | 223.37 | 3 | 5/15/2013 | 11.10 | 212.27 |
| EPA-PZ-2012-2B | 630290 | 3028125 | 223.37 | 3 | 5/30/2013 | 10.28 | 213.09 |
| EPA-PZ-2012-2B | 630290 | 3028125 | 223.37 | 7 | 4/22/2014 | 9.70 | 213.67 |
| EPA-PZ-2012-2B | 630290 | 3028125 | 223.37 | 9 | 10/6/2014 | 11.71 | 211.66 |
| EPA-PZ-2012-2B | 630290 | 3028125 | 223.37 | 11 | 6/4/2015 | 10.53 | 212.84 |
| EPA-PZ-2012-2B | 630290 | 3028125 | 223.37 | 13 | 10/20/2015 | 11.77 | 211.60 |
| EPA-PZ-2012-2B | 630290 | 3028125 | 223.37 | 13 | 12/16/2015 | 11.51 | 211.87 |
| EPA-PZ-2012-2B | 630290 | 3028125 | 223.37 | 15 | 6/23/2016 | 11.48 | 211.89 |
| EPA-PZ-2012-2B | 630290 | 3028125 | 223.37 | 16 | 8/16/2016 | 12.12 | 211.26 |
| EPA-PZ-2012-2B | 630290 | 3028125 | 223.37 | 17 | 10/20/2016 | 12.22 | 211.16 |
| EPA-PZ-2012-2B | 630290 | 3028125 | 223.37 | 17 | 11/16/2016 | 10.84 | 212.53 |
| EPA-PZ-2012-3A | 630063 | 3028088 | 222.65 | 1 | 11/5/2012 | 10.16 | 212.49 |
| EPA-PZ-2012-3A | 630063 | 3028088 | 222.65 | 1 | 11/6/2012 | 10.27 | 212.38 |
| EPA-PZ-2012-3A | 630063 | 3028088 | 222.65 | 2 | 3/13/2013 | 9.72 | 212.93 |
| EPA-PZ-2012-3A | 630063 | 3028088 | 222.65 | 3 | 4/23/2013 | 10.46 | 212.19 |
| EPA-PZ-2012-3A | 630063 | 3028088 | 222.65 | 3 | 4/25/2013 | 10.46 | 212.19 |
| EPA-PZ-2012-3A | 630063 | 3028088 | 222.65 | 3 | 5/15/2013 | 11.03 | 211.62 |
| EPA-PZ-2012-3A | 630063 | 3028088 | 222.65 | 3 | 5/30/2013 | 10.12 | 212.53 |

# Appendix B
# Water Level Data (CD)
# Shepley's Hill Landfill Groundwater Model

| Location Name | X Coordinate (feet) | Y Coordinate (feet) | Measuring Point Elevation (feet amsl) NAVD 1988 | Model Stress Period | Measurement Date | Depth to Water (feet) | Groundwater Elevation (feet amsl) NAVD 1988 |
|---|---|---|---|---|---|---|---|
| EPA-PZ-2012-3A | 630063 | 3028088 | 222.65 | 7 | 4/22/2014 | 9.40 | 213.25 |
| EPA-PZ-2012-3A | 630063 | 3028088 | 222.65 | 9 | 10/6/2014 | 11.84 | 210.81 |
| EPA-PZ-2012-3A | 630063 | 3028088 | 222.65 | 11 | 6/4/2015 | 10.48 | 212.17 |
| EPA-PZ-2012-3A | 630063 | 3028088 | 222.65 | 13 | 10/20/2015 | 12.08 | 210.57 |
| EPA-PZ-2012-3A | 630063 | 3028088 | 222.65 | 13 | 12/16/2015 | 11.62 | 211.03 |
| EPA-PZ-2012-3A | 630063 | 3028088 | 222.65 | 15 | 6/23/2016 | 11.56 | 211.09 |
| EPA-PZ-2012-3A | 630063 | 3028088 | 222.65 | 16 | 8/16/2016 | 12.30 | 210.35 |
| EPA-PZ-2012-3A | 630063 | 3028088 | 222.65 | 17 | 11/16/2016 | 11.18 | 211.47 |
| EPA-PZ-2012-3B | 630065 | 3028086 | 222.57 | 1 | 11/5/2012 | 10.17 | 212.40 |
| EPA-PZ-2012-3B | 630065 | 3028086 | 222.57 | 1 | 11/6/2012 | 10.24 | 212.33 |
| EPA-PZ-2012-3B | 630065 | 3028086 | 222.57 | 2 | 3/13/2013 | 9.74 | 212.83 |
| EPA-PZ-2012-3B | 630065 | 3028086 | 222.57 | 3 | 4/23/2013 | 10.36 | 212.21 |
| EPA-PZ-2012-3B | 630065 | 3028086 | 222.57 | 3 | 4/25/2013 | 10.43 | 212.14 |
| EPA-PZ-2012-3B | 630065 | 3028086 | 222.57 | 3 | 5/15/2013 | 10.95 | 211.62 |
| EPA-PZ-2012-3B | 630065 | 3028086 | 222.57 | 3 | 5/30/2013 | 10.11 | 212.46 |
| EPA-PZ-2012-3B | 630065 | 3028086 | 222.57 | 7 | 4/22/2014 | 9.45 | 213.12 |
| EPA-PZ-2012-3B | 630065 | 3028086 | 222.57 | 9 | 10/6/2014 | 11.15 | 211.42 |
| EPA-PZ-2012-3B | 630065 | 3028086 | 222.57 | 11 | 6/4/2015 | 10.45 | 212.12 |
| EPA-PZ-2012-3B | 630065 | 3028086 | 222.57 | 13 | 10/20/2015 | 12.02 | 210.55 |
| EPA-PZ-2012-3B | 630065 | 3028086 | 222.57 | 13 | 12/16/2015 | 11.60 | 210.97 |
| EPA-PZ-2012-3B | 630065 | 3028086 | 222.57 | 15 | 6/23/2016 | 11.49 | 211.08 |
| EPA-PZ-2012-3B | 630065 | 3028086 | 222.57 | 16 | 8/16/2016 | 12.27 | 210.30 |
| EPA-PZ-2012-3B | 630065 | 3028086 | 222.57 | 17 | 10/20/2016 | 12.37 | 210.20 |
| EPA-PZ-2012-3B | 630065 | 3028086 | 222.57 | 17 | 11/16/2016 | 11.18 | 211.39 |
| EPA-PZ-2012-4A | 629992 | 3028045 | 226.60 | 1 | 11/5/2012 | 14.45 | 212.15 |
| EPA-PZ-2012-4A | 629992 | 3028045 | 226.60 | 1 | 11/6/2012 | 14.42 | 212.18 |
| EPA-PZ-2012-4A | 629992 | 3028045 | 226.60 | 2 | 3/13/2013 | 13.93 | 212.67 |
| EPA-PZ-2012-4A | 629992 | 3028045 | 226.60 | 3 | 4/23/2013 | 14.61 | 211.99 |
| EPA-PZ-2012-4A | 629992 | 3028045 | 226.60 | 3 | 4/25/2013 | 14.59 | 212.01 |
| EPA-PZ-2012-4A | 629992 | 3028045 | 226.60 | 3 | 5/15/2013 | 15.18 | 211.42 |
| EPA-PZ-2012-4A | 629992 | 3028045 | 226.60 | 3 | 5/30/2013 | 14.25 | 212.35 |
| EPA-PZ-2012-4A | 629992 | 3028045 | 226.60 | 7 | 4/22/2014 | 13.56 | 213.04 |
| EPA-PZ-2012-4A | 629992 | 3028045 | 226.60 | 9 | 10/6/2014 | 16.06 | 210.54 |
| EPA-PZ-2012-4A | 629992 | 3028045 | 226.60 | 11 | 6/4/2015 | 14.71 | 211.89 |
| EPA-PZ-2012-4A | 629992 | 3028045 | 226.60 | 13 | 10/20/2015 | 16.25 | 210.35 |
| EPA-PZ-2012-4A | 629992 | 3028045 | 226.60 | 13 | 12/16/2015 | 15.86 | 210.74 |
| EPA-PZ-2012-4A | 629992 | 3028045 | 226.60 | 15 | 6/23/2016 | 15.77 | 210.83 |
| EPA-PZ-2012-4A | 629992 | 3028045 | 226.60 | 16 | 8/16/2016 | 16.54 | 210.06 |
| EPA-PZ-2012-4A | 629992 | 3028045 | 226.60 | 17 | 11/16/2016 | 15.33 | 211.27 |
| EPA-PZ-2012-4B | 629990 | 3028044 | 226.39 | 1 | 11/5/2012 | 14.36 | 212.03 |
| EPA-PZ-2012-4B | 629990 | 3028044 | 226.39 | 1 | 11/6/2012 | 14.34 | 212.05 |
| EPA-PZ-2012-4B | 629990 | 3028044 | 226.39 | 2 | 3/13/2013 | 13.75 | 212.64 |
| EPA-PZ-2012-4B | 629990 | 3028044 | 226.39 | 3 | 4/23/2013 | 14.52 | 211.87 |
| EPA-PZ-2012-4B | 629990 | 3028044 | 226.39 | 3 | 4/25/2013 | 14.51 | 211.88 |
| EPA-PZ-2012-4B | 629990 | 3028044 | 226.39 | 3 | 5/15/2013 | 15.09 | 211.30 |
| EPA-PZ-2012-4B | 629990 | 3028044 | 226.39 | 3 | 5/30/2013 | 14.20 | 212.19 |
| EPA-PZ-2012-4B | 629990 | 3028044 | 226.39 | 7 | 4/22/2014 | 13.34 | 213.05 |
| EPA-PZ-2012-4B | 629990 | 3028044 | 226.39 | 9 | 10/6/2014 | 16.15 | 210.24 |
| EPA-PZ-2012-4B | 629990 | 3028044 | 226.39 | 11 | 6/4/2015 | 14.73 | 211.66 |
| EPA-PZ-2012-4B | 629990 | 3028044 | 226.39 | 13 | 10/20/2015 | 16.30 | 210.09 |

# Appendix B
# Water Level Data (CD)
# Shepley's Hill Landfill Groundwater Model

| Location Name | X Coordinate (feet) | Y Coordinate (feet) | Measuring Point Elevation (feet amsl) NAVD 1988 | Model Stress Period | Measurement Date | Depth to Water (feet) | Groundwater Elevation (feet amsl) NAVD 1988 |
|---|---|---|---|---|---|---|---|
| EPA-PZ-2012-4B | 629990 | 3028044 | 226.39 | 13 | 12/16/2015 | 15.81 | 210.58 |
| EPA-PZ-2012-4B | 629990 | 3028044 | 226.39 | 15 | 6/23/2016 | 15.62 | 210.77 |
| EPA-PZ-2012-4B | 629990 | 3028044 | 226.39 | 16 | 8/16/2016 | 16.49 | 209.90 |
| EPA-PZ-2012-4B | 629990 | 3028044 | 226.39 | 17 | 10/20/2016 | 16.57 | 209.82 |
| EPA-PZ-2012-4B | 629990 | 3028044 | 226.39 | 17 | 11/16/2016 | 15.24 | 211.15 |
| EPA-PZ-2012-5A | 630152 | 3028185 | 220.01 | 1 | 11/5/2012 | 7.50 | 212.51 |
| EPA-PZ-2012-5A | 630152 | 3028185 | 220.01 | 1 | 11/6/2012 | 7.50 | 212.51 |
| EPA-PZ-2012-5A | 630152 | 3028185 | 220.01 | 2 | 3/13/2013 | 6.54 | 213.47 |
| EPA-PZ-2012-5A | 630152 | 3028185 | 220.01 | 3 | 4/23/2013 | 7.75 | 212.26 |
| EPA-PZ-2012-5A | 630152 | 3028185 | 220.01 | 3 | 4/25/2013 | 7.77 | 212.24 |
| EPA-PZ-2012-5A | 630152 | 3028185 | 220.01 | 3 | 5/30/2013 | 7.31 | 212.70 |
| EPA-PZ-2012-5A | 630152 | 3028185 | 220.01 | 7 | 4/22/2014 | 6.69 | 213.32 |
| EPA-PZ-2012-5A | 630152 | 3028185 | 220.01 | 9 | 10/6/2014 | 9.07 | 210.94 |
| EPA-PZ-2012-5A | 630152 | 3028185 | 220.01 | 11 | 6/4/2015 | 7.71 | 212.30 |
| EPA-PZ-2012-5A | 630152 | 3028185 | 220.01 | 13 | 10/20/2015 | 9.33 | 210.68 |
| EPA-PZ-2012-5A | 630152 | 3028185 | 220.01 | 13 | 12/16/2015 | 8.79 | 211.22 |
| EPA-PZ-2012-5A | 630152 | 3028185 | 220.01 | 15 | 6/23/2016 | 8.85 | 211.16 |
| EPA-PZ-2012-5A | 630152 | 3028185 | 220.01 | 16 | 8/16/2016 | 9.53 | 210.48 |
| EPA-PZ-2012-5A | 630152 | 3028185 | 220.01 | 17 | 11/16/2016 | 8.21 | 211.80 |
| EPA-PZ-2012-5B | 630155 | 3028186 | 219.38 | 1 | 11/5/2012 | 6.93 | 212.45 |
| EPA-PZ-2012-5B | 630155 | 3028186 | 219.38 | 1 | 11/6/2012 | 6.95 | 212.43 |
| EPA-PZ-2012-5B | 630155 | 3028186 | 219.38 | 2 | 3/13/2013 | 6.47 | 212.91 |
| EPA-PZ-2012-5B | 630155 | 3028186 | 219.38 | 3 | 4/23/2013 | 7.15 | 212.23 |
| EPA-PZ-2012-5B | 630155 | 3028186 | 219.38 | 3 | 4/25/2013 | 7.19 | 212.19 |
| EPA-PZ-2012-5B | 630155 | 3028186 | 219.38 | 3 | 5/15/2013 | 7.68 | 211.70 |
| EPA-PZ-2012-5B | 630155 | 3028186 | 219.38 | 3 | 5/30/2013 | 6.84 | 212.54 |
| EPA-PZ-2012-5B | 630155 | 3028186 | 219.38 | 7 | 4/22/2014 | 6.12 | 213.26 |
| EPA-PZ-2012-5B | 630155 | 3028186 | 219.38 | 9 | 10/6/2014 | 8.38 | 211.00 |
| EPA-PZ-2012-5B | 630155 | 3028186 | 219.38 | 11 | 6/4/2015 | 7.11 | 212.27 |
| EPA-PZ-2012-5B | 630155 | 3028186 | 219.38 | 13 | 10/20/2015 | 8.52 | 210.86 |
| EPA-PZ-2012-5B | 630155 | 3028186 | 219.38 | 13 | 12/16/2015 | 8.19 | 211.19 |
| EPA-PZ-2012-5B | 630155 | 3028186 | 219.38 | 15 | 6/23/2016 | 8.15 | 211.23 |
| EPA-PZ-2012-5B | 630155 | 3028186 | 219.38 | 16 | 8/16/2016 | 8.82 | 210.56 |
| EPA-PZ-2012-5B | 630155 | 3028186 | 219.38 | 17 | 10/20/2016 | 8.93 | 210.45 |
| EPA-PZ-2012-5B | 630155 | 3028186 | 219.38 | 17 | 11/16/2016 | 7.64 | 211.74 |
| EPA-PZ-2012-6A | 629895 | 3028066 | 234.25 | 1 | 11/5/2012 | 22.10 | 212.15 |
| EPA-PZ-2012-6A | 629895 | 3028066 | 234.25 | 1 | 11/6/2012 | 22.11 | 212.14 |
| EPA-PZ-2012-6A | 629895 | 3028066 | 234.25 | 2 | 3/13/2013 | 21.51 | 212.74 |
| EPA-PZ-2012-6A | 629895 | 3028066 | 234.25 | 3 | 4/23/2013 | 22.22 | 212.03 |
| EPA-PZ-2012-6A | 629895 | 3028066 | 234.25 | 3 | 4/25/2013 | 22.24 | 212.01 |
| EPA-PZ-2012-6A | 629895 | 3028066 | 234.25 | 3 | 5/15/2013 | 22.82 | 211.43 |
| EPA-PZ-2012-6A | 629895 | 3028066 | 234.25 | 3 | 5/30/2013 | 21.88 | 212.37 |
| EPA-PZ-2012-6A | 629895 | 3028066 | 234.25 | 7 | 4/22/2014 | 21.28 | 212.97 |
| EPA-PZ-2012-6A | 629895 | 3028066 | 234.25 | 9 | 10/6/2014 | 23.83 | 210.42 |
| EPA-PZ-2012-6A | 629895 | 3028066 | 234.25 | 11 | 6/4/2015 | 22.13 | 212.12 |
| EPA-PZ-2012-6A | 629895 | 3028066 | 234.25 | 13 | 10/20/2015 | 24.20 | 210.05 |
| EPA-PZ-2012-6A | 629895 | 3028066 | 234.25 | 13 | 12/16/2015 | 23.53 | 210.72 |
| EPA-PZ-2012-6A | 629895 | 3028066 | 234.25 | 16 | 8/16/2016 | 24.23 | 210.02 |
| EPA-PZ-2012-6A | 629895 | 3028066 | 234.25 | 17 | 11/16/2016 | 23.18 | 211.07 |
| EPA-PZ-2012-6B | 629894 | 3028069 | 234.08 | 1 | 11/5/2012 | 22.05 | 212.03 |

# Appendix B
# Water Level Data (CD)
# Shepley's Hill Landfill Groundwater Model

| Location Name | X Coordinate (feet) | Y Coordinate (feet) | Measuring Point Elevation (feet amsl) NAVD 1988 | Model Stress Period | Measurement Date | Depth to Water (feet) | Groundwater Elevation (feet amsl) NAVD 1988 |
|---|---|---|---|---|---|---|---|
| EPA-PZ-2012-6B | 629894 | 3028069 | 234.08 | 1 | 11/6/2012 | 22.10 | 211.98 |
| EPA-PZ-2012-6B | 629894 | 3028069 | 234.08 | 2 | 3/13/2013 | 21.63 | 212.45 |
| EPA-PZ-2012-6B | 629894 | 3028069 | 234.08 | 3 | 4/23/2013 | 22.20 | 211.88 |
| EPA-PZ-2012-6B | 629894 | 3028069 | 234.08 | 3 | 4/25/2013 | 22.22 | 211.86 |
| EPA-PZ-2012-6B | 629894 | 3028069 | 234.08 | 3 | 5/15/2013 | 22.78 | 211.30 |
| EPA-PZ-2012-6B | 629894 | 3028069 | 234.08 | 3 | 5/30/2013 | 21.92 | 212.16 |
| EPA-PZ-2012-6B | 629894 | 3028069 | 234.08 | 7 | 4/22/2014 | 21.27 | 212.81 |
| EPA-PZ-2012-6B | 629894 | 3028069 | 234.08 | 9 | 10/6/2014 | 23.67 | 210.41 |
| EPA-PZ-2012-6B | 629894 | 3028069 | 234.08 | 11 | 6/4/2015 | 22.27 | 211.81 |
| EPA-PZ-2012-6B | 629894 | 3028069 | 234.08 | 13 | 10/20/2015 | 24.10 | 209.98 |
| EPA-PZ-2012-6B | 629894 | 3028069 | 234.08 | 13 | 12/16/2015 | 23.53 | 210.55 |
| EPA-PZ-2012-6B | 629894 | 3028069 | 234.08 | 15 | 6/23/2016 | 23.35 | 210.73 |
| EPA-PZ-2012-6B | 629894 | 3028069 | 234.08 | 16 | 8/16/2016 | 24.14 | 209.94 |
| EPA-PZ-2012-6B | 629894 | 3028069 | 234.08 | 17 | 10/20/2016 | 24.25 | 209.83 |
| EPA-PZ-2012-6B | 629894 | 3028069 | 234.08 | 17 | 11/16/2016 | 23.02 | 211.06 |
| EPA-PZ-2012-7A | 629801 | 3028106 | 234.16 | 1 | 11/5/2012 | 22.01 | 212.15 |
| EPA-PZ-2012-7A | 629801 | 3028106 | 234.16 | 1 | 11/6/2012 | 22.03 | 212.13 |
| EPA-PZ-2012-7A | 629801 | 3028106 | 234.16 | 2 | 3/13/2013 | 21.68 | 212.48 |
| EPA-PZ-2012-7A | 629801 | 3028106 | 234.16 | 3 | 4/23/2013 | 22.06 | 212.10 |
| EPA-PZ-2012-7A | 629801 | 3028106 | 234.16 | 3 | 4/25/2013 | 22.09 | 212.07 |
| EPA-PZ-2012-7A | 629801 | 3028106 | 234.16 | 3 | 5/30/2013 | 21.87 | 212.29 |
| EPA-PZ-2012-7A | 629801 | 3028106 | 234.16 | 7 | 4/22/2014 | 20.95 | 213.21 |
| EPA-PZ-2012-7A | 629801 | 3028106 | 234.16 | 9 | 10/6/2014 | 23.71 | 210.45 |
| EPA-PZ-2012-7A | 629801 | 3028106 | 234.16 | 11 | 6/4/2015 | 22.22 | 211.94 |
| EPA-PZ-2012-7A | 629801 | 3028106 | 234.16 | 13 | 10/20/2015 | 24.06 | 210.10 |
| EPA-PZ-2012-7A | 629801 | 3028106 | 234.16 | 13 | 12/16/2015 | 23.45 | 210.71 |
| EPA-PZ-2012-7A | 629801 | 3028106 | 234.16 | 15 | 6/23/2016 | 23.31 | 210.85 |
| EPA-PZ-2012-7A | 629801 | 3028106 | 234.16 | 16 | 8/16/2016 | 24.12 | 210.04 |
| EPA-PZ-2012-7A | 629801 | 3028106 | 234.16 | 17 | 11/16/2016 | 23.07 | 211.09 |
| EPA-PZ-2012-7B | 629801 | 3028109 | 234.03 | 1 | 11/5/2012 | 21.92 | 212.11 |
| EPA-PZ-2012-7B | 629801 | 3028109 | 234.03 | 1 | 11/6/2012 | 21.99 | 212.04 |
| EPA-PZ-2012-7B | 629801 | 3028109 | 234.03 | 2 | 3/13/2013 | 21.51 | 212.52 |
| EPA-PZ-2012-7B | 629801 | 3028109 | 234.03 | 3 | 4/23/2013 | 22.04 | 211.99 |
| EPA-PZ-2012-7B | 629801 | 3028109 | 234.03 | 3 | 4/25/2013 | 22.10 | 211.93 |
| EPA-PZ-2012-7B | 629801 | 3028109 | 234.03 | 3 | 5/15/2013 | 22.72 | 211.31 |
| EPA-PZ-2012-7B | 629801 | 3028109 | 234.03 | 3 | 5/30/2013 | 21.82 | 212.21 |
| EPA-PZ-2012-7B | 629801 | 3028109 | 234.03 | 7 | 4/22/2014 | 21.00 | 213.03 |
| EPA-PZ-2012-7B | 629801 | 3028109 | 234.03 | 9 | 10/6/2014 | 23.59 | 210.44 |
| EPA-PZ-2012-7B | 629801 | 3028109 | 234.03 | 11 | 6/4/2015 | 22.18 | 211.85 |
| EPA-PZ-2012-7B | 629801 | 3028109 | 234.03 | 13 | 10/20/2015 | 23.94 | 210.09 |
| EPA-PZ-2012-7B | 629801 | 3028109 | 234.03 | 13 | 12/16/2015 | 23.35 | 210.68 |
| EPA-PZ-2012-7B | 629801 | 3028109 | 234.03 | 15 | 6/23/2016 | 23.24 | 210.79 |
| EPA-PZ-2012-7B | 629801 | 3028109 | 234.03 | 16 | 8/16/2016 | 24.01 | 210.02 |
| EPA-PZ-2012-7B | 629801 | 3028109 | 234.03 | 17 | 10/20/2016 | 24.13 | 209.90 |
| EPA-PZ-2012-7B | 629801 | 3028109 | 234.03 | 17 | 11/16/2016 | 22.84 | 211.19 |
| N1-P1 | 630723 | 3027868 | 229.92 | 1 | 11/5/2012 | 14.24 | 215.68 |
| N1-P1 | 630723 | 3027868 | 229.92 | 1 | 11/6/2012 | 13.95 | 215.97 |
| N1-P1 | 630723 | 3027868 | 229.92 | 3 | 5/15/2013 | 14.39 | 215.53 |
| N1-P1 | 630723 | 3027868 | 229.92 | 3 | 6/11/2013 | 13.31 | 216.61 |
| N1-P1 | 630723 | 3027868 | 229.92 | 7 | 4/22/2014 | 13.89 | 216.03 |

# Appendix B
# Water Level Data (CD)
# Shepley's Hill Landfill Groundwater Model

| Location Name | X Coordinate (feet) | Y Coordinate (feet) | Measuring Point Elevation (feet amsl) NAVD 1988 | Model Stress Period | Measurement Date | Depth to Water (feet) | Groundwater Elevation (feet amsl) NAVD 1988 |
|---|---|---|---|---|---|---|---|
| N1-P1 | 630723 | 3027868 | 229.92 | 9 | 10/6/2014 | 14.05 | 215.87 |
| N1-P1 | 630723 | 3027868 | 229.92 | 11 | 6/2/2015 | 13.88 | 216.04 |
| N1-P1 | 630723 | 3027868 | 229.92 | 11 | 6/17/2015 | 14.48 | 215.44 |
| N1-P1 | 630723 | 3027868 | 229.92 | 12 | 8/18/2015 | 14.63 | 215.30 |
| N1-P1 | 630723 | 3027868 | 229.92 | 13 | 10/7/2015 | 14.65 | 215.27 |
| N1-P1 | 630723 | 3027868 | 229.92 | 13 | 10/20/2015 | 13.86 | 216.06 |
| N1-P1 | 630723 | 3027868 | 229.92 | 13 | 12/16/2015 | 14.61 | 215.31 |
| N1-P1 | 630723 | 3027868 | 229.92 | 15 | 6/9/2016 | 14.40 | 215.52 |
| N1-P1 | 630723 | 3027868 | 229.92 | 15 | 6/24/2016 | 14.53 | 215.39 |
| N1-P1 | 630723 | 3027868 | 229.92 | 16 | 8/16/2016 | 14.85 | 215.07 |
| N1-P1 | 630723 | 3027868 | 229.92 | 17 | 11/15/2016 | 14.02 | 215.90 |
| N1-P2 | 630723 | 3027868 | 229.93 | 1 | 11/5/2012 | 13.89 | 216.04 |
| N1-P2 | 630723 | 3027868 | 229.93 | 1 | 11/6/2012 | 13.84 | 216.09 |
| N1-P2 | 630723 | 3027868 | 229.93 | 3 | 5/15/2013 | 14.34 | 215.59 |
| N1-P2 | 630723 | 3027868 | 229.93 | 3 | 6/11/2013 | 13.26 | 216.67 |
| N1-P2 | 630723 | 3027868 | 229.93 | 7 | 4/22/2014 | 13.85 | 216.08 |
| N1-P2 | 630723 | 3027868 | 229.93 | 9 | 10/6/2014 | 13.95 | 215.98 |
| N1-P2 | 630723 | 3027868 | 229.93 | 11 | 6/2/2015 | 13.84 | 216.09 |
| N1-P2 | 630723 | 3027868 | 229.93 | 13 | 10/7/2015 | 14.53 | 215.40 |
| N1-P2 | 630723 | 3027868 | 229.93 | 13 | 10/20/2015 | 13.74 | 216.19 |
| N1-P2 | 630723 | 3027868 | 229.93 | 15 | 6/24/2016 | 14.44 | 215.49 |
| N1-P2 | 630723 | 3027868 | 229.93 | 17 | 11/15/2016 | 13.84 | 216.09 |
| N1-P3 | 630723 | 3027868 | 230.08 | 1 | 11/5/2012 | 13.48 | 216.60 |
| N1-P3 | 630723 | 3027868 | 230.08 | 1 | 11/6/2012 | 13.44 | 216.64 |
| N1-P3 | 630723 | 3027868 | 230.08 | 3 | 4/25/2013 | 13.99 | 216.09 |
| N1-P3 | 630723 | 3027868 | 230.08 | 3 | 5/15/2013 | 13.81 | 216.27 |
| N1-P3 | 630723 | 3027868 | 230.08 | 3 | 6/11/2013 | 13.80 | 216.28 |
| N1-P3 | 630723 | 3027868 | 230.08 | 7 | 4/22/2014 | 13.55 | 216.53 |
| N1-P3 | 630723 | 3027868 | 230.08 | 9 | 10/6/2014 | 13.21 | 216.87 |
| N1-P3 | 630723 | 3027868 | 230.08 | 11 | 6/2/2015 | 13.29 | 216.79 |
| N1-P3 | 630723 | 3027868 | 230.08 | 11 | 6/17/2015 | 13.92 | 216.16 |
| N1-P3 | 630723 | 3027868 | 230.08 | 12 | 8/18/2015 | 14.03 | 216.06 |
| N1-P3 | 630723 | 3027868 | 230.08 | 13 | 10/7/2015 | 13.96 | 216.12 |
| N1-P3 | 630723 | 3027868 | 230.08 | 13 | 10/20/2015 | 13.02 | 217.06 |
| N1-P3 | 630723 | 3027868 | 230.08 | 13 | 12/16/2015 | 13.99 | 216.09 |
| N1-P3 | 630723 | 3027868 | 230.08 | 15 | 6/9/2016 | 13.72 | 216.36 |
| N1-P3 | 630723 | 3027868 | 230.08 | 15 | 6/24/2016 | 13.85 | 216.23 |
| N1-P3 | 630723 | 3027868 | 230.08 | 16 | 8/16/2016 | 14.16 | 215.92 |
| N1-P3 | 630723 | 3027868 | 230.08 | 17 | 11/15/2016 | 13.28 | 216.80 |
| N2-P1 | 630659 | 3027311 | 222.01 | 1 | 11/5/2012 | 5.15 | 216.86 |
| N2-P1 | 630659 | 3027311 | 222.01 | 1 | 11/6/2012 | 5.19 | 216.82 |
| N2-P1 | 630659 | 3027311 | 222.01 | 3 | 5/15/2013 | 5.35 | 216.66 |
| N2-P1 | 630659 | 3027311 | 222.01 | 3 | 6/11/2013 | 4.31 | 217.70 |
| N2-P1 | 630659 | 3027311 | 222.01 | 7 | 4/22/2014 | 5.20 | 216.81 |
| N2-P1 | 630659 | 3027311 | 222.01 | 9 | 10/6/2014 | 4.86 | 217.15 |
| N2-P1 | 630659 | 3027311 | 222.01 | 11 | 6/2/2015 | 4.92 | 217.09 |
| N2-P1 | 630659 | 3027311 | 222.01 | 11 | 6/17/2015 | 5.51 | 216.50 |
| N2-P1 | 630659 | 3027311 | 222.01 | 12 | 8/18/2015 | 5.62 | 216.39 |
| N2-P1 | 630659 | 3027311 | 222.01 | 13 | 10/20/2015 | 4.60 | 217.41 |
| N2-P1 | 630659 | 3027311 | 222.01 | 13 | 12/16/2015 | 5.53 | 216.48 |

# Appendix B
# Water Level Data (CD)
# Shepley's Hill Landfill Groundwater Model

| Location Name | X Coordinate (feet) | Y Coordinate (feet) | Measuring Point Elevation (feet amsl) NAVD 1988 | Model Stress Period | Measurement Date | Depth to Water (feet) | Groundwater Elevation (feet amsl) NAVD 1988 |
|---|---|---|---|---|---|---|---|
| N2-P1 | 630659 | 3027311 | 222.01 | 16 | 8/16/2016 | 5.77 | 216.24 |
| N2-P1 | 630659 | 3027311 | 222.01 | 17 | 11/15/2016 | 5.03 | 216.98 |
| N2-P2 | 630659 | 3027311 | 222.16 | 1 | 11/5/2012 | 5.30 | 216.86 |
| N2-P2 | 630659 | 3027311 | 222.16 | 1 | 11/6/2012 | 5.02 | 217.14 |
| N2-P2 | 630659 | 3027311 | 222.16 | 3 | 4/25/2013 | 5.76 | 216.40 |
| N2-P2 | 630659 | 3027311 | 222.16 | 3 | 5/15/2013 | 5.59 | 216.57 |
| N2-P2 | 630659 | 3027311 | 222.16 | 3 | 5/30/2013 | 4.81 | 217.35 |
| N2-P2 | 630659 | 3027311 | 222.16 | 3 | 6/11/2013 | 4.49 | 217.67 |
| N2-P2 | 630659 | 3027311 | 222.16 | 7 | 4/22/2014 | 5.40 | 216.76 |
| N2-P2 | 630659 | 3027311 | 222.16 | 9 | 10/6/2014 | 4.99 | 217.17 |
| N2-P2 | 630659 | 3027311 | 222.16 | 11 | 6/2/2015 | 5.12 | 217.04 |
| N2-P2 | 630659 | 3027311 | 222.16 | 11 | 6/17/2015 | 5.70 | 216.46 |
| N2-P2 | 630659 | 3027311 | 222.16 | 12 | 8/18/2015 | 5.80 | 216.36 |
| N2-P2 | 630659 | 3027311 | 222.16 | 13 | 10/7/2015 | 5.70 | 216.46 |
| N2-P2 | 630659 | 3027311 | 222.16 | 13 | 10/20/2015 | 4.79 | 217.37 |
| N2-P2 | 630659 | 3027311 | 222.16 | 13 | 12/16/2015 | 5.68 | 216.48 |
| N2-P2 | 630659 | 3027311 | 222.16 | 15 | 4/6/2016 | 5.59 | 216.57 |
| N2-P2 | 630659 | 3027311 | 222.16 | 16 | 8/16/2016 | 5.93 | 216.23 |
| N2-P2 | 630659 | 3027311 | 222.16 | 17 | 10/20/2016 | 5.87 | 216.29 |
| N2-P2 | 630659 | 3027311 | 222.16 | 17 | 11/15/2016 | 4.94 | 217.22 |
| N3-P1 | 630778 | 3027130 | 220.83 | 1 | 11/5/2012 | 3.93 | 216.90 |
| N3-P1 | 630778 | 3027130 | 220.83 | 1 | 11/6/2012 | 3.84 | 216.99 |
| N3-P1 | 630778 | 3027130 | 220.83 | 3 | 5/15/2013 | 4.20 | 216.63 |
| N3-P1 | 630778 | 3027130 | 220.83 | 3 | 6/11/2013 | 3.18 | 217.65 |
| N3-P1 | 630778 | 3027130 | 220.83 | 7 | 4/22/2014 | 4.05 | 216.78 |
| N3-P1 | 630778 | 3027130 | 220.83 | 9 | 10/6/2014 | 3.60 | 217.23 |
| N3-P1 | 630778 | 3027130 | 220.83 | 11 | 6/2/2015 | 3.77 | 217.06 |
| N3-P1 | 630778 | 3027130 | 220.83 | 11 | 6/17/2015 | 4.40 | 216.43 |
| N3-P1 | 630778 | 3027130 | 220.83 | 12 | 8/18/2015 | 4.48 | 216.35 |
| N3-P1 | 630778 | 3027130 | 220.83 | 13 | 10/20/2015 | 3.39 | 217.44 |
| N3-P1 | 630778 | 3027130 | 220.83 | 13 | 12/16/2015 | 4.35 | 216.48 |
| N3-P1 | 630778 | 3027130 | 220.83 | 15 | 6/9/2016 | 4.24 | 216.59 |
| N3-P1 | 630778 | 3027130 | 220.83 | 16 | 8/16/2016 | 4.61 | 216.22 |
| N3-P1 | 630778 | 3027130 | 220.83 | 17 | 11/15/2016 | 3.71 | 217.12 |
| N3-P2 | 630778 | 3027130 | 220.84 | 1 | 11/5/2012 | 3.96 | 216.88 |
| N3-P2 | 630778 | 3027130 | 220.84 | 1 | 11/6/2012 | 3.84 | 217.00 |
| N3-P2 | 630778 | 3027130 | 220.84 | 3 | 4/25/2013 | 4.42 | 216.42 |
| N3-P2 | 630778 | 3027130 | 220.84 | 3 | 5/15/2013 | 4.22 | 216.62 |
| N3-P2 | 630778 | 3027130 | 220.84 | 3 | 5/30/2013 | 3.65 | 217.19 |
| N3-P2 | 630778 | 3027130 | 220.84 | 3 | 6/11/2013 | 3.12 | 217.72 |
| N3-P2 | 630778 | 3027130 | 220.84 | 7 | 4/22/2014 | 4.05 | 216.79 |
| N3-P2 | 630778 | 3027130 | 220.84 | 9 | 10/6/2014 | 3.64 | 217.20 |
| N3-P2 | 630778 | 3027130 | 220.84 | 11 | 6/2/2015 | 3.81 | 217.03 |
| N3-P2 | 630778 | 3027130 | 220.84 | 11 | 6/17/2015 | 4.39 | 216.45 |
| N3-P2 | 630778 | 3027130 | 220.84 | 12 | 8/18/2015 | 4.49 | 216.35 |
| N3-P2 | 630778 | 3027130 | 220.84 | 13 | 10/7/2015 | 4.36 | 216.48 |
| N3-P2 | 630778 | 3027130 | 220.84 | 13 | 10/20/2015 | 3.43 | 217.41 |
| N3-P2 | 630778 | 3027130 | 220.84 | 13 | 12/16/2015 | 4.37 | 216.47 |
| N3-P2 | 630778 | 3027130 | 220.84 | 15 | 6/9/2016 | 4.20 | 216.64 |
| N3-P2 | 630778 | 3027130 | 220.84 | 16 | 8/16/2016 | 4.60 | 216.24 |

# Appendix B
# Water Level Data (CD)
# Shepley's Hill Landfill Groundwater Model

| Location Name | X Coordinate (feet) | Y Coordinate (feet) | Measuring Point Elevation (feet amsl) NAVD 1988 | Model Stress Period | Measurement Date | Depth to Water (feet) | Groundwater Elevation (feet amsl) NAVD 1988 |
|---|---|---|---|---|---|---|---|
| N3-P2 | 630778 | 3027130 | 220.84 | 17 | 10/20/2016 | 3.80 | 217.04 |
| N3-P2 | 630778 | 3027130 | 220.84 | 17 | 11/15/2016 | 3.68 | 217.16 |
| N5-P1 | 629806 | 3027173 | 242.65 | 1 | 11/5/2012 | 24.36 | 218.29 |
| N5-P1 | 629806 | 3027173 | 242.65 | 3 | 5/15/2013 | 23.54 | 219.11 |
| N5-P1 | 629806 | 3027173 | 242.65 | 3 | 6/11/2013 | 23.27 | 219.38 |
| N5-P1 | 629806 | 3027173 | 242.65 | 7 | 4/22/2014 | 23.87 | 218.78 |
| N5-P1 | 629806 | 3027173 | 242.65 | 9 | 10/6/2014 | 24.22 | 218.43 |
| N5-P1 | 629806 | 3027173 | 242.65 | 13 | 10/20/2015 | 24.80 | 217.85 |
| N5-P1 | 629806 | 3027173 | 242.65 | 13 | 12/16/2015 | 24.90 | 217.75 |
| N5-P1 | 629806 | 3027173 | 242.65 | 15 | 6/24/2016 | 24.09 | 218.56 |
| N5-P1 | 629806 | 3027173 | 242.65 | 16 | 8/16/2016 | 24.83 | 217.82 |
| N5-P1 | 629806 | 3027173 | 242.65 | 17 | 11/16/2016 | 25.01 | 217.64 |
| N5-P2 | 629806 | 3027173 | 242.69 | 1 | 11/5/2012 | 24.88 | 217.81 |
| N5-P2 | 629806 | 3027173 | 242.69 | 1 | 11/6/2012 | 24.75 | 217.94 |
| N5-P2 | 629806 | 3027173 | 242.69 | 3 | 4/25/2013 | 23.77 | 218.92 |
| N5-P2 | 629806 | 3027173 | 242.69 | 3 | 5/15/2013 | 23.70 | 218.99 |
| N5-P2 | 629806 | 3027173 | 242.69 | 3 | 6/11/2013 | 23.47 | 219.22 |
| N5-P2 | 629806 | 3027173 | 242.69 | 7 | 4/22/2014 | 24.58 | 218.11 |
| N5-P2 | 629806 | 3027173 | 242.69 | 9 | 10/6/2014 | 24.74 | 217.95 |
| N5-P2 | 629806 | 3027173 | 242.69 | 13 | 10/20/2015 | 24.75 | 217.94 |
| N5-P2 | 629806 | 3027173 | 242.69 | 13 | 12/16/2015 | 25.14 | 217.55 |
| N5-P2 | 629806 | 3027173 | 242.69 | 15 | 6/24/2016 | 24.00 | 218.69 |
| N5-P2 | 629806 | 3027173 | 242.69 | 16 | 8/16/2016 | 24.69 | 218.00 |
| N6-P1 | 630017 | 3026339 | 259.02 | 1 | 11/5/2012 | 37.95 | 221.07 |
| N6-P1 | 630017 | 3026339 | 259.02 | 1 | 11/6/2012 | 37.85 | 221.17 |
| N6-P1 | 630017 | 3026339 | 259.02 | 3 | 4/25/2013 | 37.00 | 222.02 |
| N6-P1 | 630017 | 3026339 | 259.02 | 3 | 5/15/2013 | 37.04 | 221.98 |
| N6-P1 | 630017 | 3026339 | 259.02 | 3 | 6/11/2013 | 36.94 | 222.08 |
| N6-P1 | 630017 | 3026339 | 259.02 | 7 | 4/22/2014 | 37.75 | 221.27 |
| N6-P1 | 630017 | 3026339 | 259.02 | 9 | 10/6/2014 | 38.10 | 220.92 |
| N6-P1 | 630017 | 3026339 | 259.02 | 11 | 6/3/2015 | 36.62 | 222.40 |
| N6-P1 | 630017 | 3026339 | 259.02 | 11 | 6/17/2015 | 36.75 | 222.27 |
| N6-P1 | 630017 | 3026339 | 259.02 | 13 | 10/7/2015 | 37.92 | 221.10 |
| N6-P1 | 630017 | 3026339 | 259.02 | 13 | 10/20/2015 | 38.10 | 220.92 |
| N6-P1 | 630017 | 3026339 | 259.02 | 13 | 12/16/2015 | 38.51 | 220.51 |
| N6-P1 | 630017 | 3026339 | 259.02 | 15 | 6/9/2016 | 37.49 | 221.53 |
| N6-P1 | 630017 | 3026339 | 259.02 | 16 | 8/16/2016 | 38.29 | 220.73 |
| N6-P1 | 630017 | 3026339 | 259.02 | 17 | 11/15/2016 | 38.86 | 220.16 |
| N7-P1 | 629991 | 3025618 | 255.59 | 1 | 11/5/2012 | 31.70 | 223.89 |
| N7-P1 | 629991 | 3025618 | 255.59 | 1 | 11/6/2012 | 31.62 | 223.97 |
| N7-P1 | 629991 | 3025618 | 255.59 | 3 | 5/15/2013 | 31.29 | 224.30 |
| N7-P1 | 629991 | 3025618 | 255.59 | 3 | 6/11/2013 | 30.83 | 224.76 |
| N7-P1 | 629991 | 3025618 | 255.59 | 7 | 4/22/2014 | 31.45 | 224.14 |
| N7-P1 | 629991 | 3025618 | 255.59 | 9 | 10/6/2014 | 32.21 | 223.38 |
| N7-P1 | 629991 | 3025618 | 255.59 | 11 | 6/3/2015 | 30.27 | 225.32 |
| N7-P1 | 629991 | 3025618 | 255.59 | 11 | 6/17/2015 | 30.58 | 225.01 |
| N7-P1 | 629991 | 3025618 | 255.59 | 13 | 10/7/2015 | 32.07 | 223.52 |
| N7-P1 | 629991 | 3025618 | 255.59 | 13 | 10/20/2015 | 32.30 | 223.29 |
| N7-P1 | 629991 | 3025618 | 255.59 | 13 | 12/16/2015 | 32.68 | 222.91 |
| N7-P1 | 629991 | 3025618 | 255.59 | 15 | 6/9/2016 | 31.91 | 223.68 |

# Appendix B
# Water Level Data (CD)
# Shepley's Hill Landfill Groundwater Model

| Location Name | X Coordinate (feet) | Y Coordinate (feet) | Measuring Point Elevation (feet amsl) NAVD 1988 | Model Stress Period | Measurement Date | Depth to Water (feet) | Groundwater Elevation (feet amsl) NAVD 1988 |
|---|---|---|---|---|---|---|---|
| N7-P1 | 629991 | 3025618 | 255.59 | 16 | 8/16/2016 | 32.71 | 222.88 |
| N7-P1 | 629991 | 3025618 | 255.59 | 17 | 11/15/2016 | 33.01 | 222.58 |
| N7-P2 | 629991 | 3025618 | 256.04 | 1 | 11/5/2012 | 31.85 | 224.19 |
| N7-P2 | 629991 | 3025618 | 256.04 | 1 | 11/6/2012 | 31.79 | 224.25 |
| N7-P2 | 629991 | 3025618 | 256.04 | 3 | 4/25/2013 | 31.23 | 224.81 |
| N7-P2 | 629991 | 3025618 | 256.04 | 3 | 5/15/2013 | 31.49 | 224.55 |
| N7-P2 | 629991 | 3025618 | 256.04 | 3 | 6/11/2013 | 31.09 | 224.95 |
| N7-P2 | 629991 | 3025618 | 256.04 | 7 | 4/22/2014 | 31.61 | 224.43 |
| N7-P2 | 629991 | 3025618 | 256.04 | 9 | 10/6/2014 | 32.41 | 223.63 |
| N7-P2 | 629991 | 3025618 | 256.04 | 11 | 6/3/2015 | 30.43 | 225.61 |
| N7-P2 | 629991 | 3025618 | 256.04 | 11 | 6/17/2015 | 30.67 | 225.37 |
| N7-P2 | 629991 | 3025618 | 256.04 | 13 | 10/7/2015 | 32.24 | 223.80 |
| N7-P2 | 629991 | 3025618 | 256.04 | 13 | 10/21/2015 | 32.43 | 223.61 |
| N7-P2 | 629991 | 3025618 | 256.04 | 13 | 12/16/2015 | 32.85 | 223.19 |
| N7-P2 | 629991 | 3025618 | 256.04 | 15 | 6/9/2016 | 32.10 | 223.94 |
| N7-P2 | 629991 | 3025618 | 256.04 | 15 | 6/24/2016 | 32.28 | 223.76 |
| N7-P2 | 629991 | 3025618 | 256.04 | 16 | 8/16/2016 | 32.95 | 223.09 |
| N7-P2 | 629991 | 3025618 | 256.04 | 17 | 11/15/2016 | 33.23 | 222.81 |
| PZ-12-01 | 630488 | 3027384 | 237.55 | 1 | 11/5/2012 | 20.51 | 217.04 |
| PZ-12-01 | 630488 | 3027384 | 237.55 | 1 | 11/16/2012 | 20.63 | 216.92 |
| PZ-12-01 | 630488 | 3027384 | 237.55 | 1 | 11/21/2012 | 20.59 | 216.96 |
| PZ-12-01 | 630488 | 3027384 | 237.55 | 1 | 11/28/2012 | 20.72 | 216.83 |
| PZ-12-01 | 630488 | 3027384 | 237.55 | 1 | 12/13/2012 | 21.00 | 216.55 |
| PZ-12-01 | 630488 | 3027384 | 237.55 | 2 | 1/16/2013 | 20.65 | 216.90 |
| PZ-12-01 | 630488 | 3027384 | 237.55 | 2 | 2/14/2013 | 20.89 | 216.66 |
| PZ-12-01 | 630488 | 3027384 | 237.55 | 2 | 3/12/2013 | 20.57 | 216.98 |
| PZ-12-01 | 630488 | 3027384 | 237.55 | 3 | 4/22/2013 | 20.80 | 216.75 |
| PZ-12-01 | 630488 | 3027384 | 237.55 | 3 | 5/15/2013 | 20.67 | 216.88 |
| PZ-12-01 | 630488 | 3027384 | 237.55 | 3 | 5/28/2013 | 34.00 | 203.55 |
| PZ-12-01 | 630488 | 3027384 | 237.55 | 3 | 6/11/2013 | 19.90 | 217.65 |
| PZ-12-01 | 630488 | 3027384 | 237.55 | 7 | 4/22/2014 | 20.55 | 217.00 |
| PZ-12-01 | 630488 | 3027384 | 237.55 | 9 | 10/6/2014 | 20.61 | 216.94 |
| PZ-12-01 | 630488 | 3027384 | 237.55 | 11 | 6/3/2015 | 20.52 | 217.03 |
| PZ-12-01 | 630488 | 3027384 | 237.55 | 11 | 6/17/2015 | 20.76 | 216.79 |
| PZ-12-01 | 630488 | 3027384 | 237.55 | 12 | 8/18/2015 | 20.92 | 216.63 |
| PZ-12-01 | 630488 | 3027384 | 237.55 | 13 | 10/7/2015 | 21.02 | 216.53 |
| PZ-12-01 | 630488 | 3027384 | 237.55 | 13 | 10/20/2015 | 19.37 | 218.18 |
| PZ-12-01 | 630488 | 3027384 | 237.55 | 13 | 12/16/2015 | 21.03 | 216.52 |
| PZ-12-01 | 630488 | 3027384 | 237.55 | 15 | 4/6/2016 | 20.64 | 216.91 |
| PZ-12-01 | 630488 | 3027384 | 237.55 | 15 | 6/9/2016 | 20.72 | 216.83 |
| PZ-12-01 | 630488 | 3027384 | 237.55 | 15 | 6/23/2016 | 20.86 | 216.69 |
| PZ-12-01 | 630488 | 3027384 | 237.55 | 16 | 8/16/2016 | 21.23 | 216.32 |
| PZ-12-01 | 630488 | 3027384 | 237.55 | 17 | 10/20/2016 | 21.30 | 216.25 |
| PZ-12-01 | 630488 | 3027384 | 237.55 | 17 | 11/15/2016 | 20.53 | 217.02 |
| PZ-12-02 | 630468 | 3027384 | 237.79 | 1 | 11/5/2012 | 20.47 | 217.32 |
| PZ-12-02 | 630468 | 3027384 | 237.79 | 1 | 11/16/2012 | 20.52 | 217.27 |
| PZ-12-02 | 630468 | 3027384 | 237.79 | 1 | 11/21/2012 | 20.49 | 217.30 |
| PZ-12-02 | 630468 | 3027384 | 237.79 | 1 | 11/28/2012 | 20.56 | 217.23 |
| PZ-12-02 | 630468 | 3027384 | 237.79 | 1 | 12/13/2012 | 20.83 | 216.96 |
| PZ-12-02 | 630468 | 3027384 | 237.79 | 2 | 1/16/2013 | 20.61 | 217.18 |

# Appendix B
# Water Level Data (CD)
# Shepley's Hill Landfill Groundwater Model

| Location Name | X Coordinate (feet) | Y Coordinate (feet) | Measuring Point Elevation (feet amsl) NAVD 1988 | Model Stress Period | Measurement Date | Depth to Water (feet) | Groundwater Elevation (feet amsl) NAVD 1988 |
|---|---|---|---|---|---|---|---|
| PZ-12-02 | 630468 | 3027384 | 237.79 | 2 | 2/14/2013 | 20.72 | 217.07 |
| PZ-12-02 | 630468 | 3027384 | 237.79 | 2 | 3/12/2013 | 20.46 | 217.33 |
| PZ-12-02 | 630468 | 3027384 | 237.79 | 3 | 4/22/2013 | 20.41 | 217.38 |
| PZ-12-02 | 630468 | 3027384 | 237.79 | 3 | 5/15/2013 | 20.37 | 217.42 |
| PZ-12-02 | 630468 | 3027384 | 237.79 | 3 | 5/21/2013 | 20.36 | 217.43 |
| PZ-12-02 | 630468 | 3027384 | 237.79 | 3 | 6/11/2013 | 19.88 | 217.91 |
| PZ-12-02 | 630468 | 3027384 | 237.79 | 7 | 4/22/2014 | 20.40 | 217.39 |
| PZ-12-02 | 630468 | 3027384 | 237.79 | 9 | 10/6/2014 | 20.80 | 216.99 |
| PZ-12-02 | 630468 | 3027384 | 237.79 | 11 | 6/3/2015 | 22.02 | 215.77 |
| PZ-12-02 | 630468 | 3027384 | 237.79 | 11 | 6/17/2015 | 20.35 | 217.44 |
| PZ-12-02 | 630468 | 3027384 | 237.79 | 12 | 8/18/2015 | 20.62 | 217.18 |
| PZ-12-02 | 630468 | 3027384 | 237.79 | 13 | 10/7/2015 | 20.97 | 216.82 |
| PZ-12-02 | 630468 | 3027384 | 237.79 | 13 | 10/20/2015 | 20.65 | 217.14 |
| PZ-12-02 | 630468 | 3027384 | 237.79 | 13 | 12/16/2015 | 21.00 | 216.79 |
| PZ-12-02 | 630468 | 3027384 | 237.79 | 15 | 4/6/2016 | 20.37 | 217.43 |
| PZ-12-02 | 630468 | 3027384 | 237.79 | 15 | 6/9/2016 | 20.54 | 217.25 |
| PZ-12-02 | 630468 | 3027384 | 237.79 | 15 | 6/23/2016 | 20.66 | 217.13 |
| PZ-12-02 | 630468 | 3027384 | 237.79 | 16 | 8/16/2016 | 21.14 | 216.65 |
| PZ-12-02 | 630468 | 3027384 | 237.79 | 17 | 11/15/2016 | 20.77 | 217.02 |
| PZ-12-03 | 630474 | 3027193 | 236.40 | 1 | 11/5/2012 | 19.37 | 217.03 |
| PZ-12-03 | 630474 | 3027193 | 236.40 | 1 | 11/16/2012 | 19.52 | 216.88 |
| PZ-12-03 | 630474 | 3027193 | 236.40 | 1 | 11/21/2012 | 19.45 | 216.95 |
| PZ-12-03 | 630474 | 3027193 | 236.40 | 1 | 11/28/2012 | 19.64 | 216.76 |
| PZ-12-03 | 630474 | 3027193 | 236.40 | 1 | 12/13/2012 | 19.91 | 216.49 |
| PZ-12-03 | 630474 | 3027193 | 236.40 | 2 | 1/16/2013 | 19.42 | 216.98 |
| PZ-12-03 | 630474 | 3027193 | 236.40 | 2 | 2/14/2013 | 19.79 | 216.61 |
| PZ-12-03 | 630474 | 3027193 | 236.40 | 2 | 3/12/2013 | 19.43 | 216.97 |
| PZ-12-03 | 630474 | 3027193 | 236.40 | 3 | 4/22/2013 | 19.81 | 216.59 |
| PZ-12-03 | 630474 | 3027193 | 236.40 | 3 | 5/15/2013 | 19.63 | 216.77 |
| PZ-12-03 | 630474 | 3027193 | 236.40 | 3 | 5/24/2013 | 19.21 | 217.19 |
| PZ-12-03 | 630474 | 3027193 | 236.40 | 3 | 6/11/2013 | 19.55 | 216.85 |
| PZ-12-03 | 630474 | 3027193 | 236.40 | 7 | 4/22/2014 | 19.48 | 216.92 |
| PZ-12-03 | 630474 | 3027193 | 236.40 | 9 | 10/6/2014 | 19.29 | 217.11 |
| PZ-12-03 | 630474 | 3027193 | 236.40 | 11 | 6/3/2015 | 19.42 | 216.98 |
| PZ-12-03 | 630474 | 3027193 | 236.40 | 11 | 6/17/2015 | 19.75 | 216.65 |
| PZ-12-03 | 630474 | 3027193 | 236.40 | 12 | 8/18/2015 | 19.90 | 216.50 |
| PZ-12-03 | 630474 | 3027193 | 236.40 | 13 | 10/7/2015 | 19.86 | 216.54 |
| PZ-12-03 | 630474 | 3027193 | 236.40 | 13 | 10/20/2015 | 19.06 | 217.34 |
| PZ-12-03 | 630474 | 3027193 | 236.40 | 13 | 12/16/2015 | 19.83 | 216.57 |
| PZ-12-03 | 630474 | 3027193 | 236.40 | 15 | 4/6/2016 | 19.60 | 216.80 |
| PZ-12-03 | 630474 | 3027193 | 236.40 | 15 | 6/9/2016 | 19.64 | 216.76 |
| PZ-12-03 | 630474 | 3027193 | 236.40 | 15 | 6/23/2016 | 19.79 | 216.61 |
| PZ-12-03 | 630474 | 3027193 | 236.40 | 16 | 8/16/2016 | 20.07 | 216.33 |
| PZ-12-03 | 630474 | 3027193 | 236.40 | 17 | 10/20/2016 | 20.05 | 216.35 |
| PZ-12-03 | 630474 | 3027193 | 236.40 | 17 | 11/15/2016 | 19.24 | 217.16 |
| PZ-12-04 | 630453 | 3027194 | 238.20 | 1 | 11/5/2012 | 20.42 | 217.78 |
| PZ-12-04 | 630453 | 3027194 | 238.20 | 1 | 11/16/2012 | 20.42 | 217.78 |
| PZ-12-04 | 630453 | 3027194 | 238.20 | 1 | 11/21/2012 | 20.37 | 217.83 |
| PZ-12-04 | 630453 | 3027194 | 238.20 | 1 | 11/28/2012 | 20.42 | 217.78 |
| PZ-12-04 | 630453 | 3027194 | 238.20 | 1 | 12/13/2012 | 20.68 | 217.52 |

# Appendix B
# Water Level Data (CD)
# Shepley's Hill Landfill Groundwater Model

| Location Name | X Coordinate (feet) | Y Coordinate (feet) | Measuring Point Elevation (feet amsl) NAVD 1988 | Model Stress Period | Measurement Date | Depth to Water (feet) | Groundwater Elevation (feet amsl) NAVD 1988 |
|---|---|---|---|---|---|---|---|
| PZ-12-04 | 630453 | 3027194 | 238.20 | 2 | 1/16/2013 | 20.50 | 217.70 |
| PZ-12-04 | 630453 | 3027194 | 238.20 | 2 | 2/14/2013 | 20.57 | 217.63 |
| PZ-12-04 | 630453 | 3027194 | 238.20 | 2 | 3/12/2013 | 20.36 | 217.84 |
| PZ-12-04 | 630453 | 3027194 | 238.20 | 3 | 4/22/2013 | 20.14 | 218.06 |
| PZ-12-04 | 630453 | 3027194 | 238.20 | 3 | 5/15/2013 | 20.10 | 218.10 |
| PZ-12-04 | 630453 | 3027194 | 238.20 | 3 | 5/24/2013 | 20.09 | 218.11 |
| PZ-12-04 | 630453 | 3027194 | 238.20 | 3 | 6/11/2013 | 19.73 | 218.47 |
| PZ-12-04 | 630453 | 3027194 | 238.20 | 7 | 4/22/2014 | 20.33 | 217.87 |
| PZ-12-04 | 630453 | 3027194 | 238.20 | 9 | 10/6/2014 | 20.73 | 217.47 |
| PZ-12-04 | 630453 | 3027194 | 238.20 | 11 | 6/3/2015 | 19.81 | 218.39 |
| PZ-12-04 | 630453 | 3027194 | 238.20 | 11 | 6/17/2015 | 19.99 | 218.21 |
| PZ-12-04 | 630453 | 3027194 | 238.20 | 12 | 8/18/2015 | 20.30 | 217.90 |
| PZ-12-04 | 630453 | 3027194 | 238.20 | 13 | 10/7/2015 | 20.75 | 217.45 |
| PZ-12-04 | 630453 | 3027194 | 238.20 | 13 | 10/20/2015 | 26.60 | 211.60 |
| PZ-12-04 | 630453 | 3027194 | 238.20 | 13 | 12/16/2015 | 20.87 | 217.33 |
| PZ-12-04 | 630453 | 3027194 | 238.20 | 15 | 4/6/2016 | 20.17 | 218.03 |
| PZ-12-04 | 630453 | 3027194 | 238.20 | 15 | 6/9/2016 | 20.30 | 217.90 |
| PZ-12-04 | 630453 | 3027194 | 238.20 | 15 | 6/23/2016 | 20.33 | 217.87 |
| PZ-12-04 | 630453 | 3027194 | 238.20 | 16 | 8/16/2016 | 20.91 | 217.29 |
| PZ-12-04 | 630453 | 3027194 | 238.20 | 17 | 11/15/2016 | 20.76 | 217.44 |
| PZ-12-05 | 630479 | 3027087 | 238.73 | 1 | 11/5/2012 | 21.49 | 217.24 |
| PZ-12-05 | 630479 | 3027087 | 238.73 | 1 | 11/16/2012 | 21.66 | 217.07 |
| PZ-12-05 | 630479 | 3027087 | 238.73 | 1 | 11/21/2012 | 21.59 | 217.14 |
| PZ-12-05 | 630479 | 3027087 | 238.73 | 1 | 11/28/2012 | 21.77 | 216.96 |
| PZ-12-05 | 630479 | 3027087 | 238.73 | 1 | 12/13/2012 | 22.05 | 216.68 |
| PZ-12-05 | 630479 | 3027087 | 238.73 | 2 | 1/16/2013 | 21.57 | 217.16 |
| PZ-12-05 | 630479 | 3027087 | 238.73 | 2 | 2/14/2013 | 21.92 | 216.81 |
| PZ-12-05 | 630479 | 3027087 | 238.73 | 2 | 3/12/2013 | 21.58 | 217.15 |
| PZ-12-05 | 630479 | 3027087 | 238.73 | 3 | 4/22/2013 | 21.91 | 216.82 |
| PZ-12-05 | 630479 | 3027087 | 238.73 | 3 | 5/15/2013 | 21.73 | 217.00 |
| PZ-12-05 | 630479 | 3027087 | 238.73 | 3 | 5/22/2013 | 21.60 | 217.13 |
| PZ-12-05 | 630479 | 3027087 | 238.73 | 3 | 6/11/2013 | 20.70 | 218.03 |
| PZ-12-05 | 630479 | 3027087 | 238.73 | 7 | 4/22/2014 | 21.64 | 217.09 |
| PZ-12-05 | 630479 | 3027087 | 238.73 | 9 | 10/6/2014 | 20.47 | 218.26 |
| PZ-12-05 | 630479 | 3027087 | 238.73 | 11 | 6/3/2015 | 21.52 | 217.21 |
| PZ-12-05 | 630479 | 3027087 | 238.73 | 11 | 6/17/2015 | 21.76 | 216.97 |
| PZ-12-05 | 630479 | 3027087 | 238.73 | 12 | 8/18/2015 | 22.02 | 216.71 |
| PZ-12-05 | 630479 | 3027087 | 238.73 | 13 | 10/7/2015 | 22.01 | 216.72 |
| PZ-12-05 | 630479 | 3027087 | 238.73 | 13 | 10/20/2015 | 21.24 | 217.49 |
| PZ-12-05 | 630479 | 3027087 | 238.73 | 13 | 12/16/2015 | 22.00 | 216.73 |
| PZ-12-05 | 630479 | 3027087 | 238.73 | 15 | 4/6/2016 | 21.74 | 216.99 |
| PZ-12-05 | 630479 | 3027087 | 238.73 | 15 | 6/9/2016 | 21.78 | 216.95 |
| PZ-12-05 | 630479 | 3027087 | 238.73 | 15 | 6/23/2016 | 22.10 | 216.63 |
| PZ-12-05 | 630479 | 3027087 | 238.73 | 16 | 8/16/2016 | 22.23 | 216.50 |
| PZ-12-05 | 630479 | 3027087 | 238.73 | 17 | 10/20/2016 | 22.13 | 216.60 |
| PZ-12-05 | 630479 | 3027087 | 238.73 | 17 | 11/16/2016 | 21.27 | 217.46 |
| PZ-12-06 | 630455 | 3027082 | 242.18 | 1 | 11/5/2012 | 24.24 | 217.94 |
| PZ-12-06 | 630455 | 3027082 | 242.18 | 1 | 11/16/2012 | 24.26 | 217.92 |
| PZ-12-06 | 630455 | 3027082 | 242.18 | 1 | 11/21/2012 | 24.20 | 217.98 |
| PZ-12-06 | 630455 | 3027082 | 242.18 | 1 | 11/28/2012 | 24.24 | 217.94 |

# Appendix B
# Water Level Data (CD)
# Shepley's Hill Landfill Groundwater Model

| Location Name | X Coordinate (feet) | Y Coordinate (feet) | Measuring Point Elevation (feet amsl) NAVD 1988 | Model Stress Period | Measurement Date | Depth to Water (feet) | Groundwater Elevation (feet amsl) NAVD 1988 |
|---|---|---|---|---|---|---|---|
| PZ-12-06 | 630455 | 3027082 | 242.18 | 1 | 12/13/2012 | 24.51 | 217.67 |
| PZ-12-06 | 630455 | 3027082 | 242.18 | 2 | 1/16/2013 | 24.33 | 217.85 |
| PZ-12-06 | 630455 | 3027082 | 242.18 | 2 | 2/14/2013 | 24.42 | 217.76 |
| PZ-12-06 | 630455 | 3027082 | 242.18 | 2 | 3/12/2013 | 24.21 | 217.97 |
| PZ-12-06 | 630455 | 3027082 | 242.18 | 3 | 4/22/2013 | 23.99 | 218.19 |
| PZ-12-06 | 630455 | 3027082 | 242.18 | 3 | 5/15/2013 | 23.91 | 218.27 |
| PZ-12-06 | 630455 | 3027082 | 242.18 | 3 | 5/24/2013 | 23.91 | 218.27 |
| PZ-12-06 | 630455 | 3027082 | 242.18 | 3 | 6/11/2013 | 23.54 | 218.64 |
| PZ-12-06 | 630455 | 3027082 | 242.18 | 7 | 4/22/2014 | 24.19 | 217.99 |
| PZ-12-06 | 630455 | 3027082 | 242.18 | 9 | 10/6/2014 | 24.52 | 217.66 |
| PZ-12-06 | 630455 | 3027082 | 242.18 | 11 | 6/3/2015 | 23.64 | 218.54 |
| PZ-12-06 | 630455 | 3027082 | 242.18 | 11 | 6/17/2015 | 23.79 | 218.39 |
| PZ-12-06 | 630455 | 3027082 | 242.18 | 12 | 8/18/2015 | 24.10 | 218.08 |
| PZ-12-06 | 630455 | 3027082 | 242.18 | 13 | 10/7/2015 | 24.54 | 217.64 |
| PZ-12-06 | 630455 | 3027082 | 242.18 | 13 | 10/20/2015 | 24.36 | 217.82 |
| PZ-12-06 | 630455 | 3027082 | 242.18 | 13 | 12/16/2015 | 24.67 | 217.51 |
| PZ-12-06 | 630455 | 3027082 | 242.18 | 15 | 4/6/2016 | 23.98 | 218.20 |
| PZ-12-06 | 630455 | 3027082 | 242.18 | 15 | 6/9/2016 | 24.10 | 218.08 |
| PZ-12-06 | 630455 | 3027082 | 242.18 | 15 | 6/23/2016 | 24.19 | 217.99 |
| PZ-12-06 | 630455 | 3027082 | 242.18 | 16 | 8/16/2016 | 24.73 | 217.45 |
| PZ-12-06 | 630455 | 3027082 | 242.18 | 17 | 11/16/2016 | 24.62 | 217.56 |
| PZ-12-07 | 630568 | 3026972 | 244.59 | 1 | 11/5/2012 | 26.89 | 217.70 |
| PZ-12-07 | 630568 | 3026972 | 244.59 | 1 | 11/16/2012 | 27.34 | 217.25 |
| PZ-12-07 | 630568 | 3026972 | 244.59 | 1 | 11/21/2012 | 27.32 | 217.27 |
| PZ-12-07 | 630568 | 3026972 | 244.59 | 1 | 11/28/2012 | 27.42 | 217.17 |
| PZ-12-07 | 630568 | 3026972 | 244.59 | 1 | 12/13/2012 | 27.77 | 216.82 |
| PZ-12-07 | 630568 | 3026972 | 244.59 | 2 | 1/16/2013 | 27.30 | 217.29 |
| PZ-12-07 | 630568 | 3026972 | 244.59 | 2 | 2/14/2013 | 27.68 | 216.91 |
| PZ-12-07 | 630568 | 3026972 | 244.59 | 2 | 3/12/2013 | 27.27 | 217.32 |
| PZ-12-07 | 630568 | 3026972 | 244.59 | 3 | 4/22/2013 | 27.62 | 216.97 |
| PZ-12-07 | 630568 | 3026972 | 244.59 | 3 | 5/15/2013 | 27.49 | 217.10 |
| PZ-12-07 | 630568 | 3026972 | 244.59 | 3 | 5/24/2013 | 27.41 | 217.18 |
| PZ-12-07 | 630568 | 3026972 | 244.59 | 3 | 6/11/2013 | 26.95 | 217.64 |
| PZ-12-07 | 630568 | 3026972 | 244.59 | 7 | 4/22/2014 | 27.23 | 217.36 |
| PZ-12-07 | 630568 | 3026972 | 244.59 | 9 | 10/6/2014 | 27.57 | 217.02 |
| PZ-12-07 | 630568 | 3026972 | 244.59 | 11 | 6/3/2015 | 27.05 | 217.54 |
| PZ-12-07 | 630568 | 3026972 | 244.59 | 11 | 6/17/2015 | 27.78 | 216.81 |
| PZ-12-07 | 630568 | 3026972 | 244.59 | 12 | 8/18/2015 | 27.93 | 216.67 |
| PZ-12-07 | 630568 | 3026972 | 244.59 | 13 | 10/7/2015 | 27.96 | 216.63 |
| PZ-12-07 | 630568 | 3026972 | 244.59 | 13 | 10/20/2015 | 27.30 | 217.29 |
| PZ-12-07 | 630568 | 3026972 | 244.59 | 13 | 12/16/2015 | 27.93 | 216.66 |
| PZ-12-07 | 630568 | 3026972 | 244.59 | 15 | 4/6/2016 | 27.51 | 217.08 |
| PZ-12-07 | 630568 | 3026972 | 244.59 | 15 | 6/9/2016 | 27.73 | 216.86 |
| PZ-12-07 | 630568 | 3026972 | 244.59 | 15 | 6/23/2016 | 27.83 | 216.76 |
| PZ-12-07 | 630568 | 3026972 | 244.59 | 16 | 8/16/2016 | 28.20 | 216.39 |
| PZ-12-07 | 630568 | 3026972 | 244.59 | 17 | 10/20/2016 | 28.14 | 216.45 |
| PZ-12-07 | 630568 | 3026972 | 244.59 | 17 | 11/15/2016 | 27.28 | 217.31 |
| PZ-12-08 | 630546 | 3026962 | 244.83 | 1 | 11/5/2012 | 26.26 | 218.57 |
| PZ-12-08 | 630546 | 3026962 | 244.83 | 1 | 11/16/2012 | 26.31 | 218.52 |
| PZ-12-08 | 630546 | 3026962 | 244.83 | 1 | 11/21/2012 | 26.29 | 218.54 |

# Appendix B
# Water Level Data (CD)
# Shepley's Hill Landfill Groundwater Model

| Location Name | X Coordinate (feet) | Y Coordinate (feet) | Measuring Point Elevation (feet amsl) NAVD 1988 | Model Stress Period | Measurement Date | Depth to Water (feet) | Groundwater Elevation (feet amsl) NAVD 1988 |
|---|---|---|---|---|---|---|---|
| PZ-12-08 | 630546 | 3026962 | 244.83 | 1 | 11/28/2012 | 26.35 | 218.48 |
| PZ-12-08 | 630546 | 3026962 | 244.83 | 1 | 12/13/2012 | 26.63 | 218.20 |
| PZ-12-08 | 630546 | 3026962 | 244.83 | 2 | 1/16/2013 | 26.44 | 218.39 |
| PZ-12-08 | 630546 | 3026962 | 244.83 | 2 | 2/14/2013 | 26.55 | 218.28 |
| PZ-12-08 | 630546 | 3026962 | 244.83 | 2 | 3/12/2013 | 26.27 | 218.56 |
| PZ-12-08 | 630546 | 3026962 | 244.83 | 3 | 4/22/2013 | 26.05 | 218.78 |
| PZ-12-08 | 630546 | 3026962 | 244.83 | 3 | 5/15/2013 | 26.02 | 218.81 |
| PZ-12-08 | 630546 | 3026962 | 244.83 | 3 | 5/24/2013 | 26.06 | 218.77 |
| PZ-12-08 | 630546 | 3026962 | 244.83 | 3 | 6/11/2013 | 25.59 | 219.24 |
| PZ-12-08 | 630546 | 3026962 | 244.83 | 7 | 4/22/2014 | 26.14 | 218.69 |
| PZ-12-08 | 630546 | 3026962 | 244.83 | 9 | 10/6/2014 | 26.58 | 218.25 |
| PZ-12-08 | 630546 | 3026962 | 244.83 | 11 | 6/3/2015 | 25.51 | 219.32 |
| PZ-12-08 | 630546 | 3026962 | 244.83 | 11 | 6/17/2015 | 25.56 | 219.27 |
| PZ-12-08 | 630546 | 3026962 | 244.83 | 12 | 8/18/2015 | 25.90 | 218.93 |
| PZ-12-08 | 630546 | 3026962 | 244.83 | 13 | 10/7/2015 | 26.43 | 218.40 |
| PZ-12-08 | 630546 | 3026962 | 244.83 | 13 | 10/20/2015 | 26.40 | 218.43 |
| PZ-12-08 | 630546 | 3026962 | 244.83 | 13 | 12/16/2015 | 26.56 | 218.27 |
| PZ-12-08 | 630546 | 3026962 | 244.83 | 15 | 4/6/2016 | 25.66 | 219.17 |
| PZ-12-08 | 630546 | 3026962 | 244.83 | 15 | 6/9/2016 | 25.92 | 218.91 |
| PZ-12-08 | 630546 | 3026962 | 244.83 | 15 | 6/23/2016 | 25.97 | 218.86 |
| PZ-12-08 | 630546 | 3026962 | 244.83 | 16 | 8/16/2016 | 26.64 | 218.19 |
| PZ-12-08 | 630546 | 3026962 | 244.83 | 17 | 11/15/2016 | 26.58 | 218.25 |
| PZ-12-09 | 630741 | 3026801 | 241.93 | 1 | 11/5/2012 | 23.03 | 218.90 |
| PZ-12-09 | 630741 | 3026801 | 241.93 | 1 | 11/16/2012 | 23.76 | 218.17 |
| PZ-12-09 | 630741 | 3026801 | 241.93 | 1 | 11/21/2012 | 23.89 | 218.04 |
| PZ-12-09 | 630741 | 3026801 | 241.93 | 1 | 11/28/2012 | 24.01 | 217.92 |
| PZ-12-09 | 630741 | 3026801 | 241.93 | 1 | 12/13/2012 | 24.37 | 217.56 |
| PZ-12-09 | 630741 | 3026801 | 241.93 | 2 | 1/16/2013 | 23.11 | 218.82 |
| PZ-12-09 | 630741 | 3026801 | 241.93 | 2 | 2/14/2013 | 24.19 | 217.74 |
| PZ-12-09 | 630741 | 3026801 | 241.93 | 2 | 3/12/2013 | 23.67 | 218.26 |
| PZ-12-09 | 630741 | 3026801 | 241.93 | 3 | 4/22/2013 | 24.11 | 217.82 |
| PZ-12-09 | 630741 | 3026801 | 241.93 | 3 | 5/15/2013 | 24.32 | 217.61 |
| PZ-12-09 | 630741 | 3026801 | 241.93 | 3 | 5/21/2013 | 24.40 | 217.53 |
| PZ-12-09 | 630741 | 3026801 | 241.93 | 3 | 6/11/2013 | 22.80 | 219.13 |
| PZ-12-09 | 630741 | 3026801 | 241.93 | 7 | 4/22/2014 | 23.49 | 218.44 |
| PZ-12-09 | 630741 | 3026801 | 241.93 | 9 | 10/6/2014 | 24.60 | 217.33 |
| PZ-12-09 | 630741 | 3026801 | 241.93 | 11 | 6/3/2015 | 24.28 | 217.65 |
| PZ-12-09 | 630741 | 3026801 | 241.93 | 11 | 6/17/2015 | 24.19 | 217.74 |
| PZ-12-09 | 630741 | 3026801 | 241.93 | 12 | 8/18/2015 | 24.41 | 217.52 |
| PZ-12-09 | 630741 | 3026801 | 241.93 | 13 | 10/7/2015 | 24.62 | 217.31 |
| PZ-12-09 | 630741 | 3026801 | 241.93 | 13 | 10/20/2015 | 24.40 | 217.53 |
| PZ-12-09 | 630741 | 3026801 | 241.93 | 13 | 12/16/2015 | 24.51 | 217.42 |
| PZ-12-09 | 630741 | 3026801 | 241.93 | 15 | 4/6/2016 | 23.84 | 218.09 |
| PZ-12-09 | 630741 | 3026801 | 241.93 | 15 | 6/9/2016 | 24.38 | 217.55 |
| PZ-12-09 | 630741 | 3026801 | 241.93 | 15 | 6/23/2016 | 23.36 | 218.57 |
| PZ-12-09 | 630741 | 3026801 | 241.93 | 16 | 8/16/2016 | 24.81 | 217.12 |
| PZ-12-09 | 630741 | 3026801 | 241.93 | 17 | 10/20/2016 | 24.88 | 217.06 |
| PZ-12-09 | 630741 | 3026801 | 241.93 | 17 | 11/16/2016 | 23.94 | 217.99 |
| PZ-12-10 | 630724 | 3026778 | 242.28 | 1 | 11/5/2012 | 22.35 | 219.93 |
| PZ-12-10 | 630724 | 3026778 | 242.28 | 1 | 11/16/2012 | 22.62 | 219.66 |

# Appendix B
# Water Level Data (CD)
# Shepley's Hill Landfill Groundwater Model

| Location Name | X Coordinate (feet) | Y Coordinate (feet) | Measuring Point Elevation (feet amsl) NAVD 1988 | Model Stress Period | Measurement Date | Depth to Water (feet) | Groundwater Elevation (feet amsl) NAVD 1988 |
|---|---|---|---|---|---|---|---|
| PZ-12-10 | 630724 | 3026778 | 242.28 | 1 | 11/21/2012 | 22.69 | 219.59 |
| PZ-12-10 | 630724 | 3026778 | 242.28 | 1 | 11/28/2012 | 22.77 | 219.51 |
| PZ-12-10 | 630724 | 3026778 | 242.28 | 1 | 12/13/2012 | 23.06 | 219.22 |
| PZ-12-10 | 630724 | 3026778 | 242.28 | 2 | 1/16/2013 | 22.58 | 219.70 |
| PZ-12-10 | 630724 | 3026778 | 242.28 | 2 | 2/14/2013 | 22.83 | 219.45 |
| PZ-12-10 | 630724 | 3026778 | 242.28 | 2 | 3/12/2013 | 22.19 | 220.09 |
| PZ-12-10 | 630724 | 3026778 | 242.28 | 3 | 4/22/2013 | 22.69 | 219.59 |
| PZ-12-10 | 630724 | 3026778 | 242.28 | 3 | 5/15/2013 | 22.89 | 219.39 |
| PZ-12-10 | 630724 | 3026778 | 242.28 | 3 | 5/22/2013 | 22.94 | 219.34 |
| PZ-12-10 | 630724 | 3026778 | 242.28 | 3 | 6/11/2013 | 23.16 | 219.12 |
| PZ-12-10 | 630724 | 3026778 | 242.28 | 7 | 4/22/2014 | 22.42 | 219.86 |
| PZ-12-10 | 630724 | 3026778 | 242.28 | 9 | 10/6/2014 | 23.58 | 218.70 |
| PZ-12-10 | 630724 | 3026778 | 242.28 | 11 | 6/3/2015 | 22.84 | 219.44 |
| PZ-12-10 | 630724 | 3026778 | 242.28 | 11 | 6/17/2015 | 22.74 | 219.54 |
| PZ-12-10 | 630724 | 3026778 | 242.28 | 12 | 8/18/2015 | 23.01 | 219.28 |
| PZ-12-10 | 630724 | 3026778 | 242.28 | 13 | 10/7/2015 | 23.41 | 218.87 |
| PZ-12-10 | 630724 | 3026778 | 242.28 | 13 | 10/20/2015 | 23.45 | 218.83 |
| PZ-12-10 | 630724 | 3026778 | 242.28 | 13 | 12/16/2015 | 23.48 | 218.80 |
| PZ-12-10 | 630724 | 3026778 | 242.28 | 15 | 4/6/2016 | 22.37 | 219.92 |
| PZ-12-10 | 630724 | 3026778 | 242.28 | 15 | 6/9/2016 | 22.91 | 219.37 |
| PZ-12-10 | 630724 | 3026778 | 242.28 | 15 | 6/24/2016 | 23.07 | 219.21 |
| PZ-12-10 | 630724 | 3026778 | 242.28 | 16 | 8/16/2016 | 23.51 | 218.77 |
| PZ-12-10 | 630724 | 3026778 | 242.28 | 17 | 11/16/2016 | 23.07 | 219.21 |
| Q4-1 | 629195 | 3027092 | 268.38 | 15 | 6/24/2016 | 18.92 | 249.46 |
| Q4-1 | 629195 | 3027092 | 268.38 | 17 | 11/15/2016 | 34.71 | 233.67 |
| Q5-1 | 629228 | 3027166 | 260.99 | 15 | 6/24/2016 | 13.85 | 247.14 |
| Q5-1 | 629228 | 3027166 | 260.99 | 17 | 11/15/2016 | 30.82 | 230.17 |
| RSK1 | 630633 | 3027260 | 222.58 | 1 | 11/6/2012 | 5.04 | 217.54 |
| RSK1 | 630633 | 3027260 | 222.58 | 3 | 5/30/2013 | 5.37 | 217.21 |
| RSK1 | 630633 | 3027260 | 222.58 | 11 | 6/17/2015 | 6.06 | 216.52 |
| RSK1 | 630633 | 3027260 | 222.58 | 12 | 8/18/2015 | 6.17 | 216.41 |
| RSK1 | 630633 | 3027260 | 222.58 | 13 | 12/16/2015 | 6.08 | 216.50 |
| RSK1 | 630633 | 3027260 | 222.58 | 15 | 6/9/2016 | 5.90 | 216.68 |
| RSK1 | 630633 | 3027260 | 222.58 | 16 | 8/16/2016 | 6.30 | 216.28 |
| RSK12 | 630519 | 3027088 | 226.42 | 1 | 11/6/2012 | 9.27 | 217.15 |
| RSK12 | 630519 | 3027088 | 226.42 | 3 | 4/25/2013 | 9.73 | 216.69 |
| RSK12 | 630519 | 3027088 | 226.42 | 3 | 5/30/2013 | 9.02 | 217.40 |
| RSK12 | 630519 | 3027088 | 226.42 | 11 | 6/17/2015 | 9.66 | 216.76 |
| RSK12 | 630519 | 3027088 | 226.42 | 12 | 8/18/2015 | 9.81 | 216.61 |
| RSK12 | 630519 | 3027088 | 226.42 | 13 | 10/7/2015 | 9.78 | 216.64 |
| RSK12 | 630519 | 3027088 | 226.42 | 13 | 12/16/2015 | 9.77 | 216.65 |
| RSK12 | 630519 | 3027088 | 226.42 | 15 | 4/6/2016 | 9.53 | 216.89 |
| RSK12 | 630519 | 3027088 | 226.42 | 15 | 6/9/2016 | 9.56 | 216.86 |
| RSK12 | 630519 | 3027088 | 226.42 | 16 | 8/16/2016 | 10.01 | 216.41 |
| RSK12 | 630519 | 3027088 | 226.42 | 17 | 10/20/2016 | 9.99 | 216.43 |
| RSK13 | 630583 | 3027057 | 225.37 | 1 | 11/6/2012 | 8.19 | 217.18 |
| RSK13 | 630583 | 3027057 | 225.37 | 3 | 5/30/2013 | 7.99 | 217.38 |
| RSK13 | 630583 | 3027057 | 225.37 | 11 | 6/17/2015 | 8.67 | 216.70 |
| RSK13 | 630583 | 3027057 | 225.37 | 12 | 8/18/2015 | 8.81 | 216.56 |
| RSK13 | 630583 | 3027057 | 225.37 | 13 | 10/7/2015 | 8.77 | 216.60 |

# Appendix B
# Water Level Data (CD)
# Shepley's Hill Landfill Groundwater Model

| Location Name | X Coordinate (feet) | Y Coordinate (feet) | Measuring Point Elevation (feet amsl) NAVD 1988 | Model Stress Period | Measurement Date | Depth to Water (feet) | Groundwater Elevation (feet amsl) NAVD 1988 |
|---|---|---|---|---|---|---|---|
| RSK13 | 630583 | 3027057 | 225.37 | 15 | 6/9/2016 | 8.55 | 216.82 |
| RSK15 | 630584 | 3027055 | 225.54 | 1 | 11/6/2012 | 8.32 | 217.22 |
| RSK15 | 630584 | 3027055 | 225.54 | 3 | 4/25/2013 | 8.84 | 216.70 |
| RSK15 | 630584 | 3027055 | 225.54 | 3 | 5/30/2013 | 8.13 | 217.41 |
| RSK15 | 630584 | 3027055 | 225.54 | 11 | 6/17/2015 | 8.88 | 216.66 |
| RSK15 | 630584 | 3027055 | 225.54 | 12 | 8/18/2015 | 9.01 | 216.53 |
| RSK15 | 630584 | 3027055 | 225.54 | 13 | 10/7/2015 | 8.96 | 216.58 |
| RSK15 | 630584 | 3027055 | 225.54 | 13 | 12/16/2015 | 8.94 | 216.60 |
| RSK15 | 630584 | 3027055 | 225.54 | 15 | 4/6/2016 | 8.72 | 216.82 |
| RSK15 | 630584 | 3027055 | 225.54 | 15 | 6/9/2016 | 8.76 | 216.78 |
| RSK15 | 630584 | 3027055 | 225.54 | 16 | 8/16/2016 | 9.19 | 216.35 |
| RSK15 | 630584 | 3027055 | 225.54 | 17 | 10/20/2016 | 9.13 | 216.41 |
| RSK16 | 630560 | 3027212 | 218.58 | 1 | 11/6/2012 | 1.50 | 217.08 |
| RSK16 | 630560 | 3027212 | 218.58 | 3 | 5/30/2013 | 1.28 | 217.30 |
| RSK16 | 630560 | 3027212 | 218.58 | 11 | 6/17/2015 | 1.99 | 216.59 |
| RSK16 | 630560 | 3027212 | 218.58 | 12 | 8/18/2015 | 2.11 | 216.47 |
| RSK16 | 630560 | 3027212 | 218.58 | 13 | 12/16/2015 | 2.04 | 216.54 |
| RSK16 | 630560 | 3027212 | 218.58 | 15 | 6/9/2016 | 1.85 | 216.73 |
| RSK16 | 630560 | 3027212 | 218.58 | 16 | 8/16/2016 | 2.28 | 216.30 |
| RSK19 | 630559 | 3027214 | 218.76 | 1 | 11/6/2012 | 1.72 | 217.04 |
| RSK19 | 630559 | 3027214 | 218.76 | 3 | 4/25/2013 | 2.25 | 216.51 |
| RSK19 | 630559 | 3027214 | 218.76 | 3 | 5/30/2013 | 1.56 | 217.20 |
| RSK19 | 630559 | 3027214 | 218.76 | 11 | 6/17/2015 | 2.18 | 216.58 |
| RSK19 | 630559 | 3027214 | 218.76 | 12 | 8/18/2015 | 2.30 | 216.46 |
| RSK19 | 630559 | 3027214 | 218.76 | 13 | 10/7/2015 | 2.23 | 216.53 |
| RSK19 | 630559 | 3027214 | 218.76 | 13 | 12/16/2015 | 2.23 | 216.53 |
| RSK19 | 630559 | 3027214 | 218.76 | 15 | 4/6/2016 | 2.05 | 216.71 |
| RSK19 | 630559 | 3027214 | 218.76 | 15 | 6/9/2016 | 2.04 | 216.72 |
| RSK19 | 630559 | 3027214 | 218.76 | 16 | 8/16/2016 | 2.48 | 216.28 |
| RSK19 | 630559 | 3027214 | 218.76 | 17 | 10/20/2016 | 2.42 | 216.34 |
| RSK24 | 630501 | 3026953 | 240.10 | 3 | 4/25/2013 | 21.09 | 219.01 |
| RSK24 | 630501 | 3026953 | 240.10 | 11 | 6/17/2015 | 20.86 | 219.24 |
| RSK24 | 630501 | 3026953 | 240.10 | 12 | 8/18/2015 | 21.19 | 218.92 |
| RSK24 | 630501 | 3026953 | 240.10 | 15 | 6/9/2016 | 21.22 | 218.88 |
| RSK24 | 630501 | 3026953 | 240.10 | 16 | 8/16/2016 | 21.92 | 218.18 |
| RSK25 | 630635 | 3026963 | 239.21 | 3 | 4/25/2013 | 22.21 | 217.00 |
| RSK25 | 630635 | 3026963 | 239.21 | 3 | 5/30/2013 | 21.50 | 217.71 |
| RSK25 | 630635 | 3026963 | 239.21 | 11 | 6/17/2015 | 22.40 | 216.81 |
| RSK25 | 630635 | 3026963 | 239.21 | 12 | 8/18/2015 | 22.54 | 216.68 |
| RSK25 | 630635 | 3026963 | 239.21 | 13 | 10/7/2015 | 22.58 | 216.63 |
| RSK25 | 630635 | 3026963 | 239.21 | 13 | 12/16/2015 | 22.53 | 216.68 |
| RSK25 | 630635 | 3026963 | 239.21 | 15 | 4/6/2016 | 22.13 | 217.09 |
| RSK25 | 630635 | 3026963 | 239.21 | 15 | 6/9/2016 | 22.34 | 216.87 |
| RSK25 | 630635 | 3026963 | 239.21 | 16 | 8/16/2016 | 22.82 | 216.39 |
| RSK25 | 630635 | 3026963 | 239.21 | 17 | 10/20/2016 | 22.75 | 216.46 |
| RSK27 | 630421 | 3027042 | 241.45 | 3 | 4/25/2013 | 21.28 | 220.17 |
| RSK27 | 630421 | 3027042 | 241.45 | 3 | 5/30/2013 | 22.93 | 218.52 |
| RSK27 | 630421 | 3027042 | 241.45 | 11 | 6/17/2015 | 22.93 | 218.52 |
| RSK27 | 630421 | 3027042 | 241.45 | 12 | 8/18/2015 | 23.25 | 218.20 |
| RSK27 | 630421 | 3027042 | 241.45 | 13 | 10/7/2015 | 23.71 | 217.74 |

# Appendix B
# Water Level Data (CD)
# Shepley's Hill Landfill Groundwater Model

| Location Name | X Coordinate (feet) | Y Coordinate (feet) | Measuring Point Elevation (feet amsl) NAVD 1988 | Model Stress Period | Measurement Date | Depth to Water (feet) | Groundwater Elevation (feet amsl) NAVD 1988 |
|---|---|---|---|---|---|---|---|
| RSK27 | 630421 | 3027042 | 241.45 | 13 | 12/16/2015 | 23.87 | 217.58 |
| RSK27 | 630421 | 3027042 | 241.45 | 15 | 4/6/2016 | 23.16 | 218.29 |
| RSK27 | 630421 | 3027042 | 241.45 | 15 | 6/9/2016 | 23.25 | 218.20 |
| RSK27 | 630421 | 3027042 | 241.45 | 16 | 8/16/2016 | 23.89 | 217.56 |
| RSK28 | 630417 | 3027119 | 239.24 | 3 | 4/25/2013 | 19.21 | 220.03 |
| RSK28 | 630417 | 3027119 | 239.24 | 3 | 5/30/2013 | 20.79 | 218.45 |
| RSK28 | 630417 | 3027119 | 239.24 | 11 | 6/17/2015 | 20.86 | 218.38 |
| RSK28 | 630417 | 3027119 | 239.24 | 12 | 8/18/2015 | 21.18 | 218.06 |
| RSK28 | 630417 | 3027119 | 239.24 | 13 | 10/7/2015 | 21.65 | 217.59 |
| RSK28 | 630417 | 3027119 | 239.24 | 13 | 12/16/2015 | 21.80 | 217.44 |
| RSK28 | 630417 | 3027119 | 239.24 | 15 | 4/6/2016 | 21.08 | 218.16 |
| RSK28 | 630417 | 3027119 | 239.24 | 15 | 6/9/2016 | 21.19 | 218.05 |
| RSK28 | 630417 | 3027119 | 239.24 | 16 | 8/16/2016 | 21.82 | 217.42 |
| RSK32 | 630424 | 3027205 | 236.91 | 3 | 4/25/2013 | 17.00 | 219.91 |
| RSK32 | 630424 | 3027205 | 236.91 | 3 | 5/30/2013 | 18.66 | 218.25 |
| RSK32 | 630424 | 3027205 | 236.91 | 11 | 6/17/2015 | 18.75 | 218.16 |
| RSK32 | 630424 | 3027205 | 236.91 | 12 | 8/18/2015 | 19.06 | 217.85 |
| RSK32 | 630424 | 3027205 | 236.91 | 13 | 10/7/2015 | 19.51 | 217.40 |
| RSK32 | 630424 | 3027205 | 236.91 | 13 | 12/16/2015 | 19.63 | 217.28 |
| RSK32 | 630424 | 3027205 | 236.91 | 15 | 4/6/2016 | 18.92 | 217.99 |
| RSK32 | 630424 | 3027205 | 236.91 | 15 | 6/9/2016 | 19.05 | 217.86 |
| RSK32 | 630424 | 3027205 | 236.91 | 16 | 8/16/2016 | 19.67 | 217.24 |
| RSK34 | 630395 | 3027445 | 233.16 | 3 | 4/25/2013 | 16.06 | 217.10 |
| RSK34 | 630395 | 3027445 | 233.16 | 3 | 5/30/2013 | 15.89 | 217.27 |
| RSK34 | 630395 | 3027445 | 233.16 | 11 | 6/17/2015 | 16.17 | 216.99 |
| RSK34 | 630395 | 3027445 | 233.16 | 12 | 8/18/2015 | 16.51 | 216.65 |
| RSK34 | 630395 | 3027445 | 233.16 | 13 | 10/7/2015 | 16.93 | 216.24 |
| RSK34 | 630395 | 3027445 | 233.16 | 13 | 12/16/2015 | 16.87 | 216.29 |
| RSK34 | 630395 | 3027445 | 233.16 | 15 | 4/6/2016 | 16.02 | 217.14 |
| RSK34 | 630395 | 3027445 | 233.16 | 15 | 6/9/2016 | 16.42 | 216.74 |
| RSK34 | 630395 | 3027445 | 233.16 | 16 | 8/16/2016 | 17.08 | 216.08 |
| RSK35 | 630438 | 3027516 | 233.64 | 3 | 4/25/2013 | 14.53 | 219.11 |
| RSK35 | 630438 | 3027516 | 233.64 | 3 | 5/30/2013 | 16.78 | 216.86 |
| RSK35 | 630438 | 3027516 | 233.64 | 11 | 6/17/2015 | 17.21 | 216.43 |
| RSK35 | 630438 | 3027516 | 233.64 | 12 | 8/18/2015 | 17.54 | 216.10 |
| RSK35 | 630438 | 3027516 | 233.64 | 13 | 10/7/2015 | 17.89 | 215.75 |
| RSK35 | 630438 | 3027516 | 233.64 | 13 | 12/16/2015 | 17.78 | 215.86 |
| RSK35 | 630438 | 3027516 | 233.64 | 15 | 4/6/2016 | 16.99 | 216.65 |
| RSK35 | 630438 | 3027516 | 233.64 | 15 | 6/9/2016 | 17.39 | 216.25 |
| RSK35 | 630438 | 3027516 | 233.64 | 16 | 8/16/2016 | 18.05 | 215.59 |
| RSK35 | 630438 | 3027516 | 233.64 | 17 | 10/20/2016 | 18.23 | 215.41 |
| RSK37 | 630731 | 3027104 | 220.55 | 1 | 11/6/2012 | 3.52 | 217.03 |
| RSK37 | 630731 | 3027104 | 220.55 | 3 | 4/25/2013 | 4.11 | 216.44 |
| RSK37 | 630731 | 3027104 | 220.55 | 3 | 5/30/2013 | 3.33 | 217.22 |
| RSK37 | 630731 | 3027104 | 220.55 | 11 | 6/17/2015 | 4.07 | 216.48 |
| RSK37 | 630731 | 3027104 | 220.55 | 12 | 8/18/2015 | 4.16 | 216.39 |
| RSK37 | 630731 | 3027104 | 220.55 | 13 | 10/7/2015 | 4.05 | 216.50 |
| RSK37 | 630731 | 3027104 | 220.55 | 13 | 12/16/2015 | 4.03 | 216.52 |
| RSK37 | 630731 | 3027104 | 220.55 | 15 | 4/6/2016 | 3.91 | 216.64 |
| RSK37 | 630731 | 3027104 | 220.55 | 15 | 6/9/2016 | 3.89 | 216.66 |

# Appendix B
# Water Level Data (CD)
# Shepley's Hill Landfill Groundwater Model

| Location Name | X Coordinate (feet) | Y Coordinate (feet) | Measuring Point Elevation (feet amsl) NAVD 1988 | Model Stress Period | Measurement Date | Depth to Water (feet) | Groundwater Elevation (feet amsl) NAVD 1988 |
|---|---|---|---|---|---|---|---|
| RSK37 | 630731 | 3027104 | 220.55 | 16 | 8/16/2016 | 4.28 | 216.27 |
| RSK37 | 630731 | 3027104 | 220.55 | 17 | 10/20/2016 | 4.19 | 216.36 |
| RSK39 | 630732 | 3027108 | 220.33 | 1 | 11/6/2012 | 3.32 | 217.01 |
| RSK39 | 630732 | 3027108 | 220.33 | 13 | 10/7/2015 | 3.84 | 216.49 |
| RSK41 | 630732 | 3027111 | 220.41 | 1 | 11/6/2012 | 3.34 | 217.07 |
| RSK41 | 630732 | 3027111 | 220.41 | 11 | 6/17/2015 | 3.90 | 216.51 |
| RSK41 | 630732 | 3027111 | 220.41 | 12 | 8/18/2015 | 4.00 | 216.42 |
| RSK41 | 630732 | 3027111 | 220.41 | 15 | 6/9/2016 | 3.73 | 216.68 |
| RSK41 | 630732 | 3027111 | 220.41 | 16 | 8/16/2016 | 4.12 | 216.29 |
| RSK42 | 630730 | 3027109 | 220.57 | 1 | 11/6/2012 | 3.55 | 217.02 |
| RSK42 | 630730 | 3027109 | 220.57 | 13 | 10/7/2015 | 4.08 | 216.49 |
| RSK50 | 630554 | 3027179 | 220.98 | 1 | 11/6/2012 | 4.01 | 215.47 |
| RSK50 | 630554 | 3027179 | 220.98 | 3 | 4/25/2013 | 4.55 | 214.93 |
| RSK50 | 630554 | 3027179 | 220.23 | 11 | 6/17/2015 | 3.67 | 216.56 |
| RSK50 | 630554 | 3027179 | 220.23 | 12 | 8/18/2015 | 3.80 | 216.43 |
| RSK50 | 630554 | 3027179 | 220.23 | 13 | 10/7/2015 | 3.70 | 216.53 |
| RSK50 | 630554 | 3027179 | 220.23 | 13 | 12/16/2015 | 3.69 | 216.54 |
| RSK50 | 630554 | 3027179 | 220.23 | 15 | 4/6/2016 | 3.54 | 216.69 |
| RSK50 | 630554 | 3027179 | 220.23 | 15 | 6/9/2016 | 3.52 | 216.71 |
| RSK50 | 630554 | 3027179 | 220.23 | 16 | 8/16/2016 | 3.94 | 216.29 |
| RSK50 | 630554 | 3027179 | 220.23 | 17 | 10/20/2016 | 3.89 | 216.35 |
| RSK7 | 630634 | 3027264 | 222.40 | 1 | 11/6/2012 | 5.49 | 216.13 |
| RSK7 | 630634 | 3027264 | 222.40 | 3 | 4/25/2013 | 6.00 | 215.62 |
| RSK7 | 630634 | 3027264 | 222.40 | 3 | 5/30/2013 | 5.22 | 216.40 |
| RSK7 | 630634 | 3027264 | 222.01 | 11 | 6/17/2015 | 5.52 | 216.49 |
| RSK7 | 630634 | 3027264 | 222.01 | 12 | 8/18/2015 | 5.61 | 216.40 |
| RSK7 | 630634 | 3027264 | 222.01 | 13 | 10/7/2015 | 5.52 | 216.49 |
| RSK7 | 630634 | 3027264 | 222.01 | 13 | 12/16/2015 | 5.51 | 216.50 |
| RSK7 | 630634 | 3027264 | 222.01 | 15 | 4/6/2016 | 5.40 | 216.61 |
| RSK7 | 630634 | 3027264 | 222.01 | 15 | 6/9/2016 | 5.34 | 216.67 |
| RSK7 | 630634 | 3027264 | 222.01 | 16 | 8/16/2016 | 5.74 | 216.27 |
| RSK7 | 630634 | 3027264 | 222.01 | 17 | 10/20/2016 | 5.68 | 216.33 |
| RSK8 | 630514 | 3027092 | 226.96 | 1 | 11/6/2012 | 9.83 | 217.13 |
| RSK8 | 630514 | 3027092 | 226.96 | 3 | 5/30/2013 | 9.59 | 217.37 |
| RSK8 | 630514 | 3027092 | 226.96 | 11 | 6/17/2015 | 10.15 | 216.81 |
| RSK8 | 630514 | 3027092 | 226.96 | 12 | 8/18/2015 | 10.30 | 216.66 |
| RSK8 | 630514 | 3027092 | 226.96 | 13 | 10/7/2015 | 10.28 | 216.68 |
| RSK8 | 630514 | 3027092 | 226.96 | 15 | 6/9/2016 | 10.06 | 216.90 |
| SHL-10 | 630877 | 3026868 | 248.02 | 1 | 11/5/2012 | 30.28 | 217.74 |
| SHL-10 | 630877 | 3026868 | 248.02 | 1 | 11/6/2012 | 30.55 | 217.47 |
| SHL-10 | 630877 | 3026868 | 248.02 | 2 | 2/14/2013 | 31.11 | 216.91 |
| SHL-10 | 630877 | 3026868 | 248.02 | 2 | 3/12/2013 | 30.66 | 217.36 |
| SHL-10 | 630877 | 3026868 | 248.02 | 3 | 4/22/2013 | 31.07 | 216.95 |
| SHL-10 | 630877 | 3026868 | 248.02 | 3 | 4/25/2013 | 31.04 | 216.98 |
| SHL-10 | 630877 | 3026868 | 248.02 | 3 | 5/15/2013 | 31.04 | 216.98 |
| SHL-10 | 630877 | 3026868 | 248.02 | 3 | 5/22/2013 | 31.00 | 217.02 |
| SHL-10 | 630877 | 3026868 | 248.02 | 3 | 6/11/2013 | 30.01 | 218.01 |
| SHL-10 | 630877 | 3026868 | 248.02 | 7 | 4/22/2014 | 30.56 | 217.46 |
| SHL-10 | 630877 | 3026868 | 248.02 | 9 | 10/6/2014 | 31.09 | 216.93 |
| SHL-10 | 630877 | 3026868 | 248.02 | 11 | 6/2/2015 | 33.94 | 214.08 |

# Appendix B
# Water Level Data (CD)
# Shepley's Hill Landfill Groundwater Model

| Location Name | X Coordinate (feet) | Y Coordinate (feet) | Measuring Point Elevation (feet amsl) NAVD 1988 | Model Stress Period | Measurement Date | Depth to Water (feet) | Groundwater Elevation (feet amsl) NAVD 1988 |
|---|---|---|---|---|---|---|---|
| SHL-10 | 630877 | 3026868 | 248.02 | 11 | 6/17/2015 | 31.23 | 216.79 |
| SHL-10 | 630877 | 3026868 | 248.02 | 12 | 8/18/2015 | 31.33 | 216.69 |
| SHL-10 | 630877 | 3026868 | 248.02 | 13 | 10/7/2015 | 31.39 | 216.63 |
| SHL-10 | 630877 | 3026868 | 248.02 | 13 | 10/20/2015 | 30.78 | 217.24 |
| SHL-10 | 630877 | 3026868 | 248.02 | 13 | 12/16/2015 | 31.36 | 216.66 |
| SHL-10 | 630877 | 3026868 | 248.02 | 15 | 6/9/2016 | 31.14 | 216.88 |
| SHL-10 | 630877 | 3026868 | 248.02 | 16 | 8/16/2016 | 31.63 | 216.39 |
| SHL-11 | 630496 | 3027316 | 235.47 | 1 | 11/5/2012 | 18.55 | 216.92 |
| SHL-11 | 630496 | 3027316 | 235.47 | 1 | 11/6/2012 | 18.47 | 217.00 |
| SHL-11 | 630496 | 3027316 | 235.47 | 2 | 2/14/2013 | 18.88 | 216.59 |
| SHL-11 | 630496 | 3027316 | 235.47 | 2 | 3/12/2013 | 18.55 | 216.92 |
| SHL-11 | 630496 | 3027316 | 235.47 | 3 | 4/22/2013 | 18.87 | 216.60 |
| SHL-11 | 630496 | 3027316 | 235.47 | 3 | 4/25/2013 | 18.84 | 216.63 |
| SHL-11 | 630496 | 3027316 | 235.47 | 3 | 5/15/2013 | 18.70 | 216.77 |
| SHL-11 | 630496 | 3027316 | 235.47 | 3 | 5/23/2013 | 18.51 | 216.96 |
| SHL-11 | 630496 | 3027316 | 235.47 | 3 | 5/30/2013 | 18.16 | 217.31 |
| SHL-11 | 630496 | 3027316 | 235.47 | 3 | 6/11/2013 | 17.81 | 217.66 |
| SHL-11 | 630496 | 3027316 | 235.47 | 7 | 4/22/2014 | 18.50 | 216.97 |
| SHL-11 | 630496 | 3027316 | 235.47 | 7 | 4/23/2014 | 18.60 | 216.87 |
| SHL-11 | 630496 | 3027316 | 235.47 | 9 | 10/6/2014 | 18.49 | 216.98 |
| SHL-11 | 630496 | 3027316 | 235.47 | 11 | 6/4/2015 | 18.42 | 217.05 |
| SHL-11 | 630496 | 3027316 | 235.47 | 11 | 6/17/2015 | 18.82 | 216.65 |
| SHL-11 | 630496 | 3027316 | 235.47 | 12 | 8/18/2015 | 18.96 | 216.51 |
| SHL-11 | 630496 | 3027316 | 235.47 | 13 | 10/7/2015 | 18.98 | 216.49 |
| SHL-11 | 630496 | 3027316 | 235.47 | 13 | 10/20/2015 | 19.70 | 215.77 |
| SHL-11 | 630496 | 3027316 | 235.47 | 13 | 12/16/2015 | 18.97 | 216.50 |
| SHL-11 | 630496 | 3027316 | 235.47 | 15 | 4/6/2016 | 18.68 | 216.80 |
| SHL-11 | 630496 | 3027316 | 235.47 | 15 | 6/9/2016 | 18.73 | 216.74 |
| SHL-11 | 630496 | 3027316 | 235.47 | 15 | 6/23/2016 | 18.88 | 216.59 |
| SHL-11 | 630496 | 3027316 | 235.47 | 16 | 8/16/2016 | 19.20 | 216.27 |
| SHL-11 | 630496 | 3027316 | 235.47 | 17 | 10/20/2016 | 19.20 | 216.27 |
| SHL-11 | 630496 | 3027316 | 235.47 | 17 | 11/15/2016 | 18.43 | 217.04 |
| SHL-12 | 630003 | 3025342 | 248.62 | 1 | 11/6/2012 | 22.94 | 225.68 |
| SHL-12 | 630003 | 3025342 | 248.62 | 3 | 4/25/2013 | 22.67 | 225.95 |
| SHL-12 | 630003 | 3025342 | 248.62 | 7 | 4/22/2014 | 22.65 | 225.97 |
| SHL-12 | 630003 | 3025342 | 248.62 | 9 | 10/6/2014 | 23.70 | 224.92 |
| SHL-12 | 630003 | 3025342 | 248.62 | 11 | 6/8/2015 | 21.61 | 227.01 |
| SHL-12 | 630003 | 3025342 | 248.62 | 11 | 6/9/2015 | 21.61 | 227.01 |
| SHL-12 | 630003 | 3025342 | 248.62 | 11 | 6/17/2015 | 22.02 | 226.60 |
| SHL-12 | 630003 | 3025342 | 248.62 | 13 | 10/7/2015 | 23.71 | 224.91 |
| SHL-12 | 630003 | 3025342 | 248.62 | 13 | 12/16/2015 | 24.29 | 224.33 |
| SHL-12 | 630003 | 3025342 | 248.62 | 15 | 6/9/2016 | 23.66 | 224.96 |
| SHL-12 | 630003 | 3025342 | 248.62 | 15 | 6/24/2016 | 23.91 | 224.71 |
| SHL-12 | 630003 | 3025342 | 248.62 | 16 | 8/16/2016 | 24.40 | 224.22 |
| SHL-12 | 630003 | 3025342 | 248.62 | 17 | 11/15/2016 | 24.59 | 224.03 |
| SHL-13 | 630540 | 3028105 | 220.71 | 1 | 11/5/2012 | 6.61 | 214.10 |
| SHL-13 | 630540 | 3028105 | 220.71 | 1 | 11/6/2012 | 6.68 | 214.03 |
| SHL-13 | 630540 | 3028105 | 220.71 | 3 | 4/25/2013 | 7.09 | 213.62 |
| SHL-13 | 630540 | 3028105 | 220.71 | 3 | 5/15/2013 | 7.30 | 213.41 |
| SHL-13 | 630540 | 3028105 | 220.71 | 3 | 5/30/2013 | 6.21 | 214.50 |

# Appendix B
# Water Level Data (CD)
# Shepley's Hill Landfill Groundwater Model

| Location Name | X Coordinate (feet) | Y Coordinate (feet) | Measuring Point Elevation (feet amsl) NAVD 1988 | Model Stress Period | Measurement Date | Depth to Water (feet) | Groundwater Elevation (feet amsl) NAVD 1988 |
|---|---|---|---|---|---|---|---|
| SHL-13 | 630540 | 3028105 | 220.71 | 3 | 6/11/2013 | 5.58 | 215.13 |
| SHL-13 | 630540 | 3028105 | 220.71 | 7 | 4/22/2014 | 6.02 | 214.69 |
| SHL-13 | 630540 | 3028105 | 220.71 | 9 | 10/6/2014 | 6.95 | 213.76 |
| SHL-13 | 630540 | 3028105 | 220.71 | 11 | 6/2/2015 | 6.36 | 214.35 |
| SHL-13 | 630540 | 3028105 | 220.71 | 11 | 6/17/2015 | 7.21 | 213.50 |
| SHL-13 | 630540 | 3028105 | 220.71 | 12 | 8/18/2015 | 7.52 | 213.19 |
| SHL-13 | 630540 | 3028105 | 220.71 | 13 | 10/7/2015 | 7.72 | 212.99 |
| SHL-13 | 630540 | 3028105 | 220.71 | 13 | 10/20/2015 | 6.83 | 213.88 |
| SHL-13 | 630540 | 3028105 | 220.71 | 13 | 12/16/2015 | 7.40 | 213.31 |
| SHL-13 | 630540 | 3028105 | 220.71 | 15 | 6/9/2016 | 7.13 | 213.58 |
| SHL-13 | 630540 | 3028105 | 220.71 | 16 | 8/16/2016 | 7.83 | 212.88 |
| SHL-13 | 630540 | 3028105 | 220.71 | 17 | 10/20/2016 | 7.95 | 212.76 |
| SHL-13 | 630540 | 3028105 | 220.71 | 17 | 11/15/2016 | 6.73 | 213.98 |
| SHL-15 | 629326 | 3025829 | 259.92 | 1 | 10/22/2012 | 20.36 | 239.56 |
| SHL-15 | 629326 | 3025829 | 259.92 | 1 | 11/5/2012 | 18.87 | 241.05 |
| SHL-15 | 629326 | 3025829 | 259.92 | 1 | 11/6/2012 | 18.90 | 241.02 |
| SHL-15 | 629326 | 3025829 | 259.92 | 3 | 5/15/2013 | 17.58 | 242.34 |
| SHL-15 | 629326 | 3025829 | 259.92 | 3 | 6/11/2013 | 17.44 | 242.48 |
| SHL-15 | 629326 | 3025829 | 259.92 | 7 | 4/22/2014 | 16.11 | 243.81 |
| SHL-15 | 629326 | 3025829 | 259.92 | 7 | 6/17/2014 | 17.47 | 242.45 |
| SHL-15 | 629326 | 3025829 | 259.92 | 9 | 10/6/2014 | 20.23 | 239.69 |
| SHL-15 | 629326 | 3025829 | 259.92 | 11 | 6/8/2015 | 17.81 | 242.11 |
| SHL-15 | 629326 | 3025829 | 259.92 | 11 | 6/9/2015 | 17.81 | 242.11 |
| SHL-15 | 629326 | 3025829 | 259.92 | 11 | 6/17/2015 | 17.97 | 241.95 |
| SHL-15 | 629326 | 3025829 | 259.92 | 13 | 10/7/2015 | 20.42 | 239.50 |
| SHL-15 | 629326 | 3025829 | 259.92 | 13 | 10/8/2015 | 20.47 | 239.45 |
| SHL-15 | 629326 | 3025829 | 259.92 | 13 | 12/16/2015 | 20.87 | 239.05 |
| SHL-15 | 629326 | 3025829 | 259.92 | 15 | 5/17/2016 | 17.46 | 242.46 |
| SHL-15 | 629326 | 3025829 | 259.92 | 15 | 6/9/2016 | 18.09 | 241.83 |
| SHL-15 | 629326 | 3025829 | 259.92 | 15 | 6/24/2016 | 18.49 | 241.43 |
| SHL-15 | 629326 | 3025829 | 259.92 | 16 | 8/16/2016 | 20.07 | 239.85 |
| SHL-15 | 629326 | 3025829 | 259.92 | 17 | 11/15/2016 | 20.46 | 239.46 |
| SHL-17 | 630287 | 3025391 | 233.79 | 1 | 11/6/2012 | 8.13 | 225.66 |
| SHL-17 | 630287 | 3025391 | 233.79 | 3 | 4/25/2013 | 7.88 | 225.91 |
| SHL-17 | 630287 | 3025391 | 233.79 | 7 | 4/22/2014 | 7.75 | 226.04 |
| SHL-17 | 630287 | 3025391 | 233.79 | 11 | 6/17/2015 | 7.15 | 226.64 |
| SHL-17 | 630287 | 3025391 | 233.79 | 13 | 10/7/2015 | 8.87 | 224.92 |
| SHL-17 | 630287 | 3025391 | 233.79 | 13 | 12/16/2015 | 9.00 | 224.79 |
| SHL-17 | 630287 | 3025391 | 233.79 | 15 | 6/9/2016 | 8.76 | 225.03 |
| SHL-17 | 630287 | 3025391 | 233.79 | 16 | 8/16/2016 | 9.33 | 224.46 |
| SHL-17 | 630287 | 3025391 | 233.79 | 17 | 11/15/2016 | 9.74 | 224.05 |
| SHL-18 | 631186 | 3026475 | 237.56 | 1 | 11/5/2012 | 18.61 | 218.95 |
| SHL-18 | 631186 | 3026475 | 237.56 | 1 | 11/6/2012 | 18.61 | 218.95 |
| SHL-18 | 631186 | 3026475 | 237.56 | 3 | 4/25/2013 | 19.24 | 218.32 |
| SHL-18 | 631186 | 3026475 | 237.56 | 3 | 5/15/2013 | 19.39 | 218.17 |
| SHL-18 | 631186 | 3026475 | 237.56 | 3 | 6/11/2013 | 18.30 | 219.26 |
| SHL-18 | 631186 | 3026475 | 237.56 | 7 | 4/22/2014 | 18.71 | 218.85 |
| SHL-18 | 631186 | 3026475 | 237.56 | 9 | 10/6/2014 | 19.60 | 217.96 |
| SHL-18 | 631186 | 3026475 | 237.56 | 11 | 6/2/2015 | 18.97 | 218.59 |
| SHL-18 | 631186 | 3026475 | 237.56 | 11 | 6/17/2015 | 19.46 | 218.10 |

# Appendix B
# Water Level Data (CD)
# Shepley's Hill Landfill Groundwater Model

| Location Name | X Coordinate (feet) | Y Coordinate (feet) | Measuring Point Elevation (feet amsl) NAVD 1988 | Model Stress Period | Measurement Date | Depth to Water (feet) | Groundwater Elevation (feet amsl) NAVD 1988 |
|---|---|---|---|---|---|---|---|
| SHL-18 | 631186 | 3026475 | 237.56 | 12 | 8/18/2015 | 19.63 | 217.93 |
| SHL-18 | 631186 | 3026475 | 237.56 | 13 | 10/7/2015 | 19.82 | 217.74 |
| SHL-18 | 631186 | 3026475 | 237.56 | 13 | 10/20/2015 | 19.38 | 218.18 |
| SHL-18 | 631186 | 3026475 | 237.56 | 13 | 12/16/2015 | 19.85 | 217.71 |
| SHL-18 | 631186 | 3026475 | 237.56 | 15 | 6/9/2016 | 19.57 | 217.99 |
| SHL-18 | 631186 | 3026475 | 237.56 | 15 | 6/24/2016 | 19.76 | 217.80 |
| SHL-18 | 631186 | 3026475 | 237.56 | 16 | 8/16/2016 | 19.99 | 217.57 |
| SHL-18 | 631186 | 3026475 | 237.56 | 17 | 11/15/2016 | 19.39 | 218.17 |
| SHL-19 | 630665 | 3026946 | 240.50 | 1 | 11/5/2012 | 22.61 | 217.89 |
| SHL-19 | 630665 | 3026946 | 240.50 | 1 | 11/6/2012 | 22.78 | 217.72 |
| SHL-19 | 630665 | 3026946 | 240.50 | 2 | 2/14/2013 | 23.51 | 216.99 |
| SHL-19 | 630665 | 3026946 | 240.50 | 2 | 3/12/2013 | 23.08 | 217.42 |
| SHL-19 | 630665 | 3026946 | 240.50 | 3 | 4/22/2013 | 23.45 | 217.05 |
| SHL-19 | 630665 | 3026946 | 240.50 | 3 | 4/25/2013 | 23.42 | 217.08 |
| SHL-19 | 630665 | 3026946 | 240.50 | 3 | 5/15/2013 | 23.39 | 217.11 |
| SHL-19 | 630665 | 3026946 | 240.50 | 3 | 5/24/2013 | 23.30 | 217.20 |
| SHL-19 | 630665 | 3026946 | 240.50 | 3 | 5/30/2013 | 22.73 | 217.77 |
| SHL-19 | 630665 | 3026946 | 240.50 | 3 | 6/11/2013 | 22.14 | 218.36 |
| SHL-19 | 630665 | 3026946 | 240.50 | 7 | 4/22/2014 | 22.98 | 217.52 |
| SHL-19 | 630665 | 3026946 | 240.50 | 9 | 10/6/2014 | 23.55 | 216.95 |
| SHL-19 | 630665 | 3026946 | 240.50 | 11 | 6/4/2015 | 23.47 | 217.03 |
| SHL-19 | 630665 | 3026946 | 240.50 | 11 | 6/17/2015 | 23.64 | 216.86 |
| SHL-19 | 630665 | 3026946 | 240.50 | 12 | 8/18/2015 | 23.79 | 216.71 |
| SHL-19 | 630665 | 3026946 | 240.50 | 13 | 10/7/2015 | 23.86 | 216.64 |
| SHL-19 | 630665 | 3026946 | 240.50 | 13 | 10/20/2015 | 23.20 | 217.30 |
| SHL-19 | 630665 | 3026946 | 240.50 | 13 | 12/16/2015 | 23.81 | 216.69 |
| SHL-19 | 630665 | 3026946 | 240.50 | 15 | 4/6/2016 | 23.34 | 217.16 |
| SHL-19 | 630665 | 3026946 | 240.50 | 15 | 6/9/2016 | 23.61 | 216.89 |
| SHL-19 | 630665 | 3026946 | 240.50 | 16 | 8/16/2016 | 24.10 | 216.40 |
| SHL-19 | 630665 | 3026946 | 240.50 | 17 | 11/15/2016 | 23.19 | 217.31 |
| SHL-20 | 630463 | 3027330 | 235.95 | 1 | 11/5/2012 | 18.48 | 217.47 |
| SHL-20 | 630463 | 3027330 | 235.95 | 1 | 11/6/2012 | 18.43 | 217.52 |
| SHL-20 | 630463 | 3027330 | 235.95 | 2 | 2/14/2013 | 18.68 | 217.27 |
| SHL-20 | 630463 | 3027330 | 235.95 | 2 | 3/12/2013 | 18.45 | 217.50 |
| SHL-20 | 630463 | 3027330 | 235.95 | 3 | 4/22/2013 | 18.34 | 217.61 |
| SHL-20 | 630463 | 3027330 | 235.95 | 3 | 5/15/2013 | 18.30 | 217.65 |
| SHL-20 | 630463 | 3027330 | 235.95 | 3 | 5/22/2013 | 18.30 | 217.65 |
| SHL-20 | 630463 | 3027330 | 235.95 | 3 | 5/30/2013 | 18.04 | 217.91 |
| SHL-20 | 630463 | 3027330 | 235.95 | 3 | 6/11/2013 | 17.84 | 218.11 |
| SHL-20 | 630463 | 3027330 | 235.95 | 7 | 4/22/2014 | 18.40 | 217.55 |
| SHL-20 | 630463 | 3027330 | 235.95 | 7 | 4/23/2014 | 18.42 | 217.53 |
| SHL-20 | 630463 | 3027330 | 235.95 | 9 | 10/6/2014 | 18.79 | 217.16 |
| SHL-20 | 630463 | 3027330 | 235.95 | 11 | 6/4/2015 | 18.07 | 217.88 |
| SHL-20 | 630463 | 3027330 | 235.95 | 11 | 6/5/2015 | 18.02 | 217.93 |
| SHL-20 | 630463 | 3027330 | 235.95 | 11 | 6/17/2015 | 18.22 | 217.73 |
| SHL-20 | 630463 | 3027330 | 235.95 | 12 | 8/18/2015 | 18.51 | 217.44 |
| SHL-20 | 630463 | 3027330 | 235.95 | 13 | 10/7/2015 | 18.90 | 217.05 |
| SHL-20 | 630463 | 3027330 | 235.95 | 13 | 10/20/2015 | 18.58 | 217.37 |
| SHL-20 | 630463 | 3027330 | 235.95 | 13 | 12/16/2015 | 18.97 | 216.98 |
| SHL-20 | 630463 | 3027330 | 235.95 | 15 | 4/6/2016 | 18.31 | 217.64 |

# Appendix B
# Water Level Data (CD)
# Shepley's Hill Landfill Groundwater Model

| Location Name | X Coordinate (feet) | Y Coordinate (feet) | Measuring Point Elevation (feet amsl) NAVD 1988 | Model Stress Period | Measurement Date | Depth to Water (feet) | Groundwater Elevation (feet amsl) NAVD 1988 |
|---|---|---|---|---|---|---|---|
| SHL-20 | 630463 | 3027330 | 235.95 | 15 | 6/9/2016 | 18.47 | 217.48 |
| SHL-20 | 630463 | 3027330 | 235.95 | 15 | 6/23/2016 | 18.60 | 217.35 |
| SHL-20 | 630463 | 3027330 | 235.95 | 16 | 8/16/2016 | 19.07 | 216.88 |
| SHL-20 | 630463 | 3027330 | 235.95 | 17 | 11/15/2016 | 18.76 | 217.19 |
| SHL-21 | 630364 | 3027884 | 260.00 | 1 | 11/5/2012 | 45.24 | 214.76 |
| SHL-21 | 630364 | 3027884 | 260.00 | 1 | 11/6/2012 | 45.20 | 214.80 |
| SHL-21 | 630364 | 3027884 | 260.00 | 2 | 3/13/2013 | 45.27 | 214.73 |
| SHL-21 | 630364 | 3027884 | 260.00 | 3 | 4/23/2013 | 45.41 | 214.59 |
| SHL-21 | 630364 | 3027884 | 260.00 | 3 | 4/25/2013 | 45.42 | 214.58 |
| SHL-21 | 630364 | 3027884 | 260.00 | 3 | 5/15/2013 | 45.89 | 214.11 |
| SHL-21 | 630364 | 3027884 | 260.00 | 3 | 5/30/2013 | 45.22 | 214.78 |
| SHL-21 | 630364 | 3027884 | 260.00 | 3 | 6/11/2013 | 44.94 | 215.06 |
| SHL-21 | 630364 | 3027884 | 260.00 | 7 | 4/22/2014 | 44.70 | 215.30 |
| SHL-21 | 630364 | 3027884 | 260.00 | 9 | 10/6/2014 | 46.71 | 213.29 |
| SHL-21 | 630364 | 3027884 | 260.00 | 13 | 10/20/2015 | 46.41 | 213.59 |
| SHL-21 | 630364 | 3027884 | 260.00 | 13 | 12/16/2015 | 46.39 | 213.61 |
| SHL-21 | 630364 | 3027884 | 260.00 | 16 | 8/16/2016 | 47.01 | 212.99 |
| SHL-21 | 630364 | 3027884 | 260.00 | 17 | 10/20/2016 | 47.14 | 212.86 |
| SHL-22 | 630056 | 3028163 | 219.58 | 1 | 11/5/2012 | 7.32 | 212.26 |
| SHL-22 | 630056 | 3028163 | 219.58 | 1 | 11/6/2012 | 7.32 | 212.26 |
| SHL-22 | 630056 | 3028163 | 219.58 | 2 | 3/13/2013 | 6.81 | 212.77 |
| SHL-22 | 630056 | 3028163 | 219.58 | 3 | 4/23/2013 | 7.49 | 212.09 |
| SHL-22 | 630056 | 3028163 | 219.58 | 3 | 5/15/2013 | 8.09 | 211.49 |
| SHL-22 | 630056 | 3028163 | 219.58 | 3 | 5/30/2013 | 7.19 | 212.39 |
| SHL-22 | 630056 | 3028163 | 219.58 | 3 | 6/11/2013 | 6.67 | 212.91 |
| SHL-22 | 630056 | 3028163 | 219.58 | 7 | 4/22/2014 | 6.46 | 213.12 |
| SHL-22 | 630056 | 3028163 | 219.58 | 7 | 4/24/2014 | 6.64 | 212.94 |
| SHL-22 | 630056 | 3028163 | 219.58 | 9 | 10/6/2014 | 8.86 | 210.72 |
| SHL-22 | 630056 | 3028163 | 219.58 | 11 | 6/4/2015 | 7.50 | 212.08 |
| SHL-22 | 630056 | 3028163 | 219.58 | 13 | 10/20/2015 | 9.07 | 210.51 |
| SHL-22 | 630056 | 3028163 | 219.58 | 13 | 12/16/2015 | 8.61 | 210.97 |
| SHL-22 | 630056 | 3028163 | 219.58 | 16 | 8/16/2016 | 9.26 | 210.32 |
| SHL-22 | 630056 | 3028163 | 219.58 | 17 | 11/16/2016 | 8.17 | 211.41 |
| SHL-23 | 629713 | 3027916 | 241.29 | 1 | 11/5/2012 | 28.35 | 212.94 |
| SHL-23 | 629713 | 3027916 | 241.29 | 1 | 11/6/2012 | 28.36 | 212.93 |
| SHL-23 | 629713 | 3027916 | 241.29 | 2 | 3/13/2013 | 28.07 | 213.22 |
| SHL-23 | 629713 | 3027916 | 241.29 | 3 | 4/23/2013 | 27.68 | 213.61 |
| SHL-23 | 629713 | 3027916 | 241.29 | 3 | 4/25/2013 | 27.71 | 213.58 |
| SHL-23 | 629713 | 3027916 | 241.29 | 3 | 5/15/2013 | 28.69 | 212.60 |
| SHL-23 | 629713 | 3027916 | 241.29 | 3 | 5/30/2013 | 27.93 | 213.36 |
| SHL-23 | 629713 | 3027916 | 241.29 | 3 | 6/11/2013 | 27.70 | 213.59 |
| SHL-23 | 629713 | 3027916 | 241.29 | 7 | 4/22/2014 | 26.30 | 214.99 |
| SHL-23 | 629713 | 3027916 | 241.29 | 9 | 10/6/2014 | 30.35 | 210.94 |
| SHL-23 | 629713 | 3027916 | 241.29 | 11 | 6/9/2015 | 28.58 | 212.71 |
| SHL-23 | 629713 | 3027916 | 241.29 | 11 | 6/10/2015 | 28.58 | 212.71 |
| SHL-23 | 629713 | 3027916 | 241.29 | 13 | 10/20/2015 | 30.71 | 210.58 |
| SHL-23 | 629713 | 3027916 | 241.29 | 13 | 12/16/2015 | 29.91 | 211.38 |
| SHL-23 | 629713 | 3027916 | 241.29 | 15 | 6/24/2016 | 29.69 | 211.60 |
| SHL-23 | 629713 | 3027916 | 241.29 | 16 | 8/16/2016 | 30.67 | 210.62 |
| SHL-23 | 629713 | 3027916 | 241.29 | 17 | 10/20/2016 | 30.90 | 210.39 |

# Appendix B
# Water Level Data (CD)
# Shepley's Hill Landfill Groundwater Model

| Location Name | X Coordinate (feet) | Y Coordinate (feet) | Measuring Point Elevation (feet amsl) NAVD 1988 | Model Stress Period | Measurement Date | Depth to Water (feet) | Groundwater Elevation (feet amsl) NAVD 1988 |
|---|---|---|---|---|---|---|---|
| SHL-23 | 629713 | 3027916 | 241.29 | 17 | 11/16/2016 | 29.63 | 211.66 |
| SHL-24 | 631303 | 3025639 | 238.75 | 1 | 11/5/2012 | 15.74 | 223.01 |
| SHL-24 | 631303 | 3025639 | 238.75 | 1 | 11/6/2012 | 15.74 | 223.01 |
| SHL-24 | 631303 | 3025639 | 238.75 | 3 | 5/15/2013 | 16.27 | 222.48 |
| SHL-24 | 631303 | 3025639 | 238.75 | 3 | 6/11/2013 | 14.93 | 223.82 |
| SHL-24 | 631303 | 3025639 | 238.75 | 7 | 4/22/2014 | 15.75 | 223.00 |
| SHL-24 | 631303 | 3025639 | 238.75 | 11 | 6/9/2015 | 15.24 | 223.51 |
| SHL-24 | 631303 | 3025639 | 238.75 | 11 | 6/10/2015 | 15.24 | 223.51 |
| SHL-24 | 631303 | 3025639 | 238.75 | 11 | 6/17/2015 | 15.91 | 222.84 |
| SHL-24 | 631303 | 3025639 | 238.75 | 13 | 10/7/2015 | 16.80 | 221.95 |
| SHL-24 | 631303 | 3025639 | 238.75 | 13 | 10/20/2015 | 16.89 | 221.86 |
| SHL-24 | 631303 | 3025639 | 238.75 | 13 | 12/16/2015 | 17.07 | 221.68 |
| SHL-24 | 631303 | 3025639 | 238.75 | 15 | 6/9/2016 | 16.74 | 222.01 |
| SHL-24 | 631303 | 3025639 | 238.75 | 15 | 6/24/2016 | 16.97 | 221.78 |
| SHL-24 | 631303 | 3025639 | 238.75 | 16 | 8/16/2016 | 17.19 | 221.56 |
| SHL-24 | 631303 | 3025639 | 238.75 | 17 | 11/15/2016 | 17.10 | 221.65 |
| SHL-25 | 629699 | 3025252 | 258.01 | 1 | 10/22/2012 | 28.11 | 229.90 |
| SHL-25 | 629699 | 3025252 | 258.01 | 3 | 6/11/2013 | 25.85 | 232.16 |
| SHL-25 | 629699 | 3025252 | 258.01 | 7 | 4/22/2014 | 26.08 | 231.93 |
| SHL-25 | 629699 | 3025252 | 258.01 | 7 | 6/17/2014 | 26.73 | 231.28 |
| SHL-25 | 629699 | 3025252 | 258.01 | 9 | 10/6/2014 | 28.64 | 229.37 |
| SHL-25 | 629699 | 3025252 | 258.01 | 11 | 6/17/2015 | 24.16 | 233.85 |
| SHL-25 | 629699 | 3025252 | 258.01 | 13 | 10/7/2015 | 28.32 | 229.69 |
| SHL-25 | 629699 | 3025252 | 258.01 | 13 | 10/8/2015 | 28.39 | 229.62 |
| SHL-25 | 629699 | 3025252 | 258.01 | 13 | 12/16/2015 | 29.36 | 228.65 |
| SHL-25 | 629699 | 3025252 | 258.01 | 15 | 5/17/2016 | 26.82 | 231.19 |
| SHL-25 | 629699 | 3025252 | 258.01 | 15 | 6/9/2016 | 27.50 | 230.51 |
| SHL-25 | 629699 | 3025252 | 258.01 | 15 | 6/24/2016 | 27.83 | 230.18 |
| SHL-25 | 629699 | 3025252 | 258.01 | 16 | 8/16/2016 | 29.07 | 228.94 |
| SHL-25 | 629699 | 3025252 | 258.01 | 17 | 11/15/2016 | 29.00 | 229.01 |
| SHL-3 | 630911 | 3026705 | 246.95 | 1 | 11/5/2012 | 29.05 | 217.90 |
| SHL-3 | 630911 | 3026705 | 246.95 | 1 | 11/6/2012 | 30.79 | 216.16 |
| SHL-3 | 630911 | 3026705 | 246.95 | 2 | 2/14/2013 | 29.72 | 217.23 |
| SHL-3 | 630911 | 3026705 | 246.95 | 2 | 3/12/2013 | 29.25 | 217.70 |
| SHL-3 | 630911 | 3026705 | 246.95 | 3 | 4/22/2013 | 29.60 | 217.35 |
| SHL-3 | 630911 | 3026705 | 246.95 | 3 | 4/25/2013 | 30.39 | 216.56 |
| SHL-3 | 630911 | 3026705 | 246.95 | 3 | 5/15/2013 | 29.70 | 217.25 |
| SHL-3 | 630911 | 3026705 | 246.95 | 3 | 6/11/2013 | 28.71 | 218.24 |
| SHL-3 | 630911 | 3026705 | 246.95 | 7 | 4/22/2014 | 29.20 | 217.75 |
| SHL-3 | 630911 | 3026705 | 246.95 | 9 | 10/6/2014 | 29.56 | 217.39 |
| SHL-3 | 630911 | 3026705 | 246.95 | 11 | 6/2/2015 | 30.33 | 216.62 |
| SHL-3 | 630911 | 3026705 | 246.95 | 11 | 6/17/2015 | 29.77 | 217.18 |
| SHL-3 | 630911 | 3026705 | 246.95 | 12 | 8/18/2015 | 29.86 | 217.09 |
| SHL-3 | 630911 | 3026705 | 246.95 | 13 | 10/7/2015 | 29.93 | 217.02 |
| SHL-3 | 630911 | 3026705 | 246.95 | 13 | 10/20/2015 | 29.20 | 217.75 |
| SHL-3 | 630911 | 3026705 | 246.95 | 13 | 12/16/2015 | 29.92 | 217.03 |
| SHL-3 | 630911 | 3026705 | 246.95 | 15 | 6/9/2016 | 29.71 | 217.24 |
| SHL-3 | 630911 | 3026705 | 246.95 | 16 | 8/16/2016 | 30.15 | 216.80 |
| SHL-3 | 630911 | 3026705 | 246.95 | 17 | 11/15/2016 | 29.24 | 217.71 |
| SHL-4 | 630576 | 3027057 | 227.48 | 1 | 11/5/2012 | 10.29 | 217.19 |

# Appendix B
# Water Level Data (CD)
# Shepley's Hill Landfill Groundwater Model

| Location Name | X Coordinate (feet) | Y Coordinate (feet) | Measuring Point Elevation (feet amsl) NAVD 1988 | Model Stress Period | Measurement Date | Depth to Water (feet) | Groundwater Elevation (feet amsl) NAVD 1988 |
|---|---|---|---|---|---|---|---|
| SHL-4 | 630576 | 3027057 | 227.48 | 1 | 11/6/2012 | 10.32 | 217.16 |
| SHL-4 | 630576 | 3027057 | 227.48 | 2 | 2/14/2013 | 10.79 | 216.69 |
| SHL-4 | 630576 | 3027057 | 227.48 | 2 | 3/12/2013 | 10.44 | 217.04 |
| SHL-4 | 630576 | 3027057 | 227.48 | 3 | 4/22/2013 | 10.81 | 216.67 |
| SHL-4 | 630576 | 3027057 | 227.48 | 3 | 5/15/2013 | 10.62 | 216.86 |
| SHL-4 | 630576 | 3027057 | 227.48 | 3 | 5/24/2013 | 10.38 | 217.10 |
| SHL-4 | 630576 | 3027057 | 227.48 | 3 | 6/11/2013 | 9.89 | 217.59 |
| SHL-4 | 630576 | 3027057 | 227.48 | 7 | 4/22/2014 | 10.49 | 216.99 |
| SHL-4 | 630576 | 3027057 | 227.48 | 9 | 10/6/2014 | 10.40 | 217.08 |
| SHL-4 | 630576 | 3027057 | 227.48 | 11 | 6/2/2015 | 10.38 | 217.10 |
| SHL-4 | 630576 | 3027057 | 227.48 | 11 | 6/17/2015 | 10.84 | 216.64 |
| SHL-4 | 630576 | 3027057 | 227.48 | 12 | 8/18/2015 | 10.96 | 216.52 |
| SHL-4 | 630576 | 3027057 | 227.48 | 13 | 10/7/2015 | 10.93 | 216.55 |
| SHL-4 | 630576 | 3027057 | 227.48 | 13 | 10/20/2015 | 10.13 | 217.35 |
| SHL-4 | 630576 | 3027057 | 227.48 | 13 | 12/16/2015 | 10.91 | 216.57 |
| SHL-4 | 630576 | 3027057 | 227.48 | 15 | 4/6/2016 | 10.66 | 216.82 |
| SHL-4 | 630576 | 3027057 | 227.48 | 15 | 6/9/2016 | 10.72 | 216.76 |
| SHL-4 | 630576 | 3027057 | 227.48 | 16 | 8/16/2016 | 11.16 | 216.32 |
| SHL-5 | 630192 | 3028125 | 217.60 | 1 | 11/5/2012 | 2.86 | 214.74 |
| SHL-5 | 630192 | 3028125 | 217.60 | 1 | 11/6/2012 | 2.93 | 214.67 |
| SHL-5 | 630192 | 3028125 | 217.60 | 2 | 3/12/2013 | 1.63 | 215.97 |
| SHL-5 | 630192 | 3028125 | 217.60 | 2 | 3/13/2013 | 1.62 | 215.98 |
| SHL-5 | 630192 | 3028125 | 217.60 | 3 | 4/22/2013 | 3.59 | 214.01 |
| SHL-5 | 630192 | 3028125 | 217.60 | 3 | 4/23/2013 | 3.59 | 214.01 |
| SHL-5 | 630192 | 3028125 | 217.60 | 3 | 5/15/2013 | 4.79 | 212.81 |
| SHL-5 | 630192 | 3028125 | 217.60 | 3 | 5/21/2013 | 4.95 | 212.65 |
| SHL-5 | 630192 | 3028125 | 217.60 | 3 | 5/30/2013 | 1.64 | 215.96 |
| SHL-5 | 630192 | 3028125 | 217.60 | 3 | 6/11/2013 | 1.50 | 216.10 |
| SHL-5 | 630192 | 3028125 | 217.60 | 7 | 4/22/2014 | 2.55 | 215.05 |
| SHL-5 | 630192 | 3028125 | 217.60 | 9 | 10/6/2014 | 6.45 | 211.15 |
| SHL-5 | 630192 | 3028125 | 217.60 | 13 | 10/20/2015 | 6.56 | 211.04 |
| SHL-5 | 630192 | 3028125 | 217.60 | 13 | 12/16/2015 | 5.50 | 212.10 |
| SHL-5 | 630192 | 3028125 | 217.60 | 16 | 8/16/2016 | 7.05 | 210.55 |
| SHL-5 | 630192 | 3028125 | 217.60 | 17 | 11/15/2016 | 4.27 | 213.33 |
| SHL-7 | 631333 | 3026278 | 236.33 | 3 | 4/25/2013 | 17.09 | 219.24 |
| SHL-7 | 631333 | 3026278 | 236.33 | 11 | 6/17/2015 | 17.38 | 218.95 |
| SHL-7 | 631333 | 3026278 | 236.33 | 12 | 8/18/2015 | 17.58 | 218.75 |
| SHL-7 | 631333 | 3026278 | 236.33 | 13 | 10/7/2015 | 17.88 | 218.45 |
| SHL-7 | 631333 | 3026278 | 236.33 | 13 | 12/16/2015 | 17.97 | 218.36 |
| SHL-7 | 631333 | 3026278 | 236.33 | 15 | 6/9/2016 | 17.55 | 218.78 |
| SHL-7 | 631333 | 3026278 | 236.33 | 15 | 6/24/2016 | 17.92 | 218.41 |
| SHL-7 | 631333 | 3026278 | 236.33 | 16 | 8/16/2016 | 17.90 | 218.43 |
| SHL-8D | 630407 | 3028127 | 220.78 | 1 | 11/5/2012 | 7.46 | 213.32 |
| SHL-8D | 630407 | 3028127 | 220.78 | 1 | 11/6/2012 | 7.46 | 213.32 |
| SHL-8D | 630407 | 3028127 | 220.78 | 2 | 3/13/2013 | 7.18 | 213.60 |
| SHL-8D | 630407 | 3028127 | 220.78 | 3 | 4/23/2013 | 7.78 | 213.00 |
| SHL-8D | 630407 | 3028127 | 220.78 | 3 | 4/25/2013 | 7.75 | 213.03 |
| SHL-8D | 630407 | 3028127 | 220.78 | 3 | 5/15/2013 | 8.11 | 212.67 |
| SHL-8D | 630407 | 3028127 | 220.78 | 3 | 5/21/2013 | 8.09 | 212.69 |
| SHL-8D | 630407 | 3028127 | 220.78 | 3 | 5/30/2013 | 7.32 | 213.46 |

# Appendix B
# Water Level Data (CD)
# Shepley's Hill Landfill Groundwater Model

| Location Name | X Coordinate (feet) | Y Coordinate (feet) | Measuring Point Elevation (feet amsl) NAVD 1988 | Model Stress Period | Measurement Date | Depth to Water (feet) | Groundwater Elevation (feet amsl) NAVD 1988 |
|---|---|---|---|---|---|---|---|
| SHL-8D | 630407 | 3028127 | 220.78 | 3 | 6/11/2013 | 6.80 | 213.98 |
| SHL-8D | 630407 | 3028127 | 220.78 | 7 | 4/22/2014 | 6.80 | 213.98 |
| SHL-8D | 630407 | 3028127 | 220.78 | 9 | 10/6/2014 | 8.56 | 212.22 |
| SHL-8D | 630407 | 3028127 | 220.78 | 12 | 8/18/2015 | 8.57 | 212.21 |
| SHL-8D | 630407 | 3028127 | 220.78 | 13 | 10/20/2015 | 8.48 | 212.30 |
| SHL-8D | 630407 | 3028127 | 220.78 | 13 | 12/16/2015 | 8.41 | 212.37 |
| SHL-8D | 630407 | 3028127 | 220.78 | 16 | 8/16/2016 | 8.95 | 211.83 |
| SHL-8D | 630407 | 3028127 | 220.78 | 17 | 10/20/2016 | 9.01 | 211.77 |
| SHL-8D | 630407 | 3028127 | 220.78 | 17 | 11/15/2016 | 7.94 | 212.84 |
| SHL-8S | 630407 | 3028127 | 220.97 | 1 | 11/5/2012 | 7.54 | 213.43 |
| SHL-8S | 630407 | 3028127 | 220.97 | 1 | 11/6/2012 | 7.53 | 213.44 |
| SHL-8S | 630407 | 3028127 | 220.97 | 2 | 3/13/2013 | 7.24 | 213.73 |
| SHL-8S | 630407 | 3028127 | 220.97 | 3 | 4/23/2013 | 7.82 | 213.15 |
| SHL-8S | 630407 | 3028127 | 220.97 | 3 | 4/25/2013 | 7.84 | 213.13 |
| SHL-8S | 630407 | 3028127 | 220.97 | 3 | 5/15/2013 | 8.21 | 212.76 |
| SHL-8S | 630407 | 3028127 | 220.97 | 3 | 5/30/2013 | 7.35 | 213.62 |
| SHL-8S | 630407 | 3028127 | 220.97 | 3 | 6/11/2013 | 6.81 | 214.16 |
| SHL-8S | 630407 | 3028127 | 220.97 | 7 | 4/22/2014 | 6.90 | 214.07 |
| SHL-8S | 630407 | 3028127 | 220.97 | 9 | 10/6/2014 | 8.57 | 212.40 |
| SHL-8S | 630407 | 3028127 | 220.97 | 12 | 8/18/2015 | 8.66 | 212.31 |
| SHL-8S | 630407 | 3028127 | 220.97 | 13 | 10/20/2015 | 8.48 | 212.49 |
| SHL-8S | 630407 | 3028127 | 220.97 | 13 | 12/16/2015 | 8.45 | 212.52 |
| SHL-8S | 630407 | 3028127 | 220.97 | 16 | 8/16/2016 | 9.02 | 211.95 |
| SHL-8S | 630407 | 3028127 | 220.97 | 17 | 11/15/2016 | 8.01 | 212.96 |
| SHL-9 | 630010 | 3028147 | 221.95 | 1 | 11/5/2012 | 9.68 | 212.27 |
| SHL-9 | 630010 | 3028147 | 221.95 | 1 | 11/6/2012 | 9.63 | 212.32 |
| SHL-9 | 630010 | 3028147 | 221.95 | 2 | 3/12/2013 | 5.85 | 216.10 |
| SHL-9 | 630010 | 3028147 | 221.95 | 2 | 3/13/2013 | 8.40 | 213.55 |
| SHL-9 | 630010 | 3028147 | 221.95 | 3 | 4/22/2013 | 9.72 | 212.23 |
| SHL-9 | 630010 | 3028147 | 221.95 | 3 | 4/23/2013 | 9.62 | 212.33 |
| SHL-9 | 630010 | 3028147 | 221.95 | 3 | 4/25/2013 | 9.66 | 212.29 |
| SHL-9 | 630010 | 3028147 | 221.95 | 3 | 5/15/2013 | 10.31 | 211.64 |
| SHL-9 | 630010 | 3028147 | 221.95 | 3 | 5/30/2013 | 9.32 | 212.63 |
| SHL-9 | 630010 | 3028147 | 221.95 | 3 | 6/11/2013 | 16.09 | 205.86 |
| SHL-9 | 630010 | 3028147 | 221.95 | 7 | 4/22/2014 | 8.67 | 213.28 |
| SHL-9 | 630010 | 3028147 | 221.95 | 7 | 4/23/2014 | 8.75 | 213.20 |
| SHL-9 | 630010 | 3028147 | 221.95 | 9 | 10/6/2014 | 11.36 | 210.59 |
| SHL-9 | 630010 | 3028147 | 221.95 | 13 | 10/20/2015 | 11.46 | 210.49 |
| SHL-9 | 630010 | 3028147 | 221.95 | 13 | 12/16/2015 | 10.92 | 211.03 |
| SHL-9 | 630010 | 3028147 | 221.95 | 16 | 8/16/2016 | 11.75 | 210.20 |
| SHL-9 | 630010 | 3028147 | 221.95 | 17 | 10/16/2016 | 10.48 | 211.47 |
| SHM-05-39A | 629761 | 3028544 | 221.53 | 1 | 11/5/2012 | 11.41 | 210.12 |
| SHM-05-39A | 629761 | 3028544 | 221.53 | 3 | 4/25/2013 | 11.60 | 209.93 |
| SHM-05-39A | 629761 | 3028544 | 221.53 | 3 | 5/15/2013 | 11.92 | 209.61 |
| SHM-05-39A | 629761 | 3028544 | 221.53 | 3 | 5/30/2013 | 11.41 | 210.12 |
| SHM-05-39A | 629761 | 3028544 | 221.53 | 3 | 6/11/2013 | 10.93 | 210.60 |
| SHM-05-39A | 629761 | 3028544 | 221.53 | 7 | 4/22/2014 | 10.54 | 210.99 |
| SHM-05-39A | 629761 | 3028544 | 221.53 | 9 | 10/6/2014 | 12.35 | 209.18 |
| SHM-05-39A | 629761 | 3028544 | 221.53 | 13 | 10/20/2015 | 12.51 | 209.02 |
| SHM-05-39A | 629761 | 3028544 | 221.53 | 16 | 8/16/2016 | 12.71 | 208.83 |

# Appendix B
# Water Level Data (CD)
# Shepley's Hill Landfill Groundwater Model

| Location Name | X Coordinate (feet) | Y Coordinate (feet) | Measuring Point Elevation (feet amsl) NAVD 1988 | Model Stress Period | Measurement Date | Depth to Water (feet) | Groundwater Elevation (feet amsl) NAVD 1988 |
|---|---|---|---|---|---|---|---|
| SHM-05-39B | 629765 | 3028544 | 221.51 | 1 | 11/5/2012 | 12.32 | 209.19 |
| SHM-05-39B | 629765 | 3028544 | 221.51 | 3 | 4/25/2013 | 12.37 | 209.14 |
| SHM-05-39B | 629765 | 3028544 | 221.51 | 3 | 5/15/2013 | 12.71 | 208.80 |
| SHM-05-39B | 629765 | 3028544 | 221.51 | 3 | 5/30/2013 | 12.24 | 209.27 |
| SHM-05-39B | 629765 | 3028544 | 221.51 | 3 | 6/11/2013 | 11.77 | 209.74 |
| SHM-05-39B | 629765 | 3028544 | 221.51 | 7 | 4/22/2014 | 11.29 | 210.22 |
| SHM-05-39B | 629765 | 3028544 | 221.51 | 9 | 10/6/2014 | 13.00 | 208.51 |
| SHM-05-39B | 629765 | 3028544 | 221.51 | 13 | 10/20/2015 | 13.15 | 208.36 |
| SHM-05-39B | 629765 | 3028544 | 221.51 | 16 | 8/16/2016 | 13.34 | 208.17 |
| SHM-05-39B | 629765 | 3028544 | 221.51 | 17 | 10/20/2016 | 13.26 | 208.25 |
| SHM-05-40X | 629637 | 3028514 | 223.34 | 1 | 11/5/2012 | 14.21 | 209.13 |
| SHM-05-40X | 629637 | 3028514 | 223.34 | 3 | 4/25/2013 | 14.27 | 209.07 |
| SHM-05-40X | 629637 | 3028514 | 223.34 | 3 | 5/15/2013 | 14.65 | 208.69 |
| SHM-05-40X | 629637 | 3028514 | 223.34 | 3 | 5/30/2013 | 14.23 | 209.11 |
| SHM-05-40X | 629637 | 3028514 | 223.34 | 3 | 6/11/2013 | 13.86 | 209.48 |
| SHM-05-40X | 629637 | 3028514 | 223.34 | 7 | 4/22/2014 | 13.11 | 210.23 |
| SHM-05-40X | 629637 | 3028514 | 223.34 | 9 | 10/6/2014 | 15.05 | 208.29 |
| SHM-05-40X | 629637 | 3028514 | 223.34 | 13 | 10/20/2015 | 15.19 | 208.15 |
| SHM-05-40X | 629637 | 3028514 | 223.34 | 13 | 12/16/2015 | 14.86 | 208.48 |
| SHM-05-40X | 629637 | 3028514 | 223.34 | 15 | 6/23/2016 | 14.79 | 208.55 |
| SHM-05-40X | 629637 | 3028514 | 223.34 | 16 | 8/16/2016 | 15.40 | 207.94 |
| SHM-05-40X | 629637 | 3028514 | 223.34 | 17 | 10/20/2016 | 15.33 | 208.02 |
| SHM-05-40X | 629637 | 3028514 | 223.34 | 17 | 11/16/2016 | 14.49 | 208.85 |
| SHM-05-41A | 629796 | 3028291 | 222.48 | 1 | 11/5/2012 | 10.60 | 211.88 |
| SHM-05-41A | 629796 | 3028291 | 222.48 | 1 | 11/6/2012 | 10.58 | 211.90 |
| SHM-05-41A | 629796 | 3028291 | 222.48 | 2 | 3/13/2013 | 10.16 | 212.32 |
| SHM-05-41A | 629796 | 3028291 | 222.48 | 3 | 4/23/2013 | 10.71 | 211.77 |
| SHM-05-41A | 629796 | 3028291 | 222.48 | 3 | 4/25/2013 | 10.72 | 211.76 |
| SHM-05-41A | 629796 | 3028291 | 222.48 | 3 | 5/15/2013 | 11.29 | 211.19 |
| SHM-05-41A | 629796 | 3028291 | 222.48 | 3 | 5/30/2013 | 10.48 | 212.00 |
| SHM-05-41A | 629796 | 3028291 | 222.48 | 3 | 6/11/2013 | 9.95 | 212.53 |
| SHM-05-41A | 629796 | 3028291 | 222.48 | 7 | 4/22/2014 | 9.66 | 212.82 |
| SHM-05-41A | 629796 | 3028291 | 222.48 | 7 | 4/23/2014 | 9.71 | 212.77 |
| SHM-05-41A | 629796 | 3028291 | 222.48 | 9 | 10/6/2014 | 12.11 | 210.37 |
| SHM-05-41A | 629796 | 3028291 | 222.48 | 13 | 10/20/2015 | 12.35 | 210.13 |
| SHM-05-41A | 629796 | 3028291 | 222.48 | 13 | 12/16/2015 | 11.85 | 210.63 |
| SHM-05-41A | 629796 | 3028291 | 222.48 | 16 | 8/16/2016 | 12.49 | 209.99 |
| SHM-05-41A | 629796 | 3028291 | 222.48 | 17 | 11/16/2016 | 11.38 | 211.10 |
| SHM-05-41B | 629796 | 3028299 | 222.33 | 1 | 11/5/2012 | 10.40 | 211.93 |
| SHM-05-41B | 629796 | 3028299 | 222.33 | 1 | 11/6/2012 | 10.42 | 211.91 |
| SHM-05-41B | 629796 | 3028299 | 222.33 | 2 | 3/13/2013 | 9.97 | 212.36 |
| SHM-05-41B | 629796 | 3028299 | 222.33 | 3 | 4/23/2013 | 10.55 | 211.78 |
| SHM-05-41B | 629796 | 3028299 | 222.33 | 3 | 4/25/2013 | 10.56 | 211.77 |
| SHM-05-41B | 629796 | 3028299 | 222.33 | 3 | 5/15/2013 | 11.09 | 211.24 |
| SHM-05-41B | 629796 | 3028299 | 222.33 | 3 | 5/30/2013 | 10.28 | 212.05 |
| SHM-05-41B | 629796 | 3028299 | 222.33 | 3 | 6/11/2013 | 9.79 | 212.54 |
| SHM-05-41B | 629796 | 3028299 | 222.33 | 7 | 4/22/2014 | 9.48 | 212.85 |
| SHM-05-41B | 629796 | 3028299 | 222.33 | 7 | 4/23/2014 | 9.51 | 212.82 |
| SHM-05-41B | 629796 | 3028299 | 222.33 | 9 | 10/6/2014 | 11.96 | 210.37 |
| SHM-05-41B | 629796 | 3028299 | 222.33 | 11 | 6/8/2015 | 10.98 | 211.35 |

# Appendix B
# Water Level Data (CD)
# Shepley's Hill Landfill Groundwater Model

| Location Name | X Coordinate (feet) | Y Coordinate (feet) | Measuring Point Elevation (feet amsl) NAVD 1988 | Model Stress Period | Measurement Date | Depth to Water (feet) | Groundwater Elevation (feet amsl) NAVD 1988 |
|---|---|---|---|---|---|---|---|
| SHM-05-41B | 629796 | 3028299 | 222.33 | 13 | 10/20/2015 | 12.20 | 210.13 |
| SHM-05-41B | 629796 | 3028299 | 222.33 | 13 | 12/16/2015 | 11.70 | 210.63 |
| SHM-05-41B | 629796 | 3028299 | 222.33 | 15 | 6/23/2016 | 11.67 | 210.66 |
| SHM-05-41B | 629796 | 3028299 | 222.33 | 16 | 8/16/2016 | 12.34 | 209.99 |
| SHM-05-41B | 629796 | 3028299 | 222.33 | 17 | 10/20/2016 | 12.43 | 209.90 |
| SHM-05-41B | 629796 | 3028299 | 222.33 | 17 | 11/16/2016 | 11.22 | 211.11 |
| SHM-05-41C | 629796 | 3028285 | 222.57 | 1 | 11/5/2012 | 10.67 | 211.90 |
| SHM-05-41C | 629796 | 3028285 | 222.57 | 1 | 11/6/2012 | 10.65 | 211.92 |
| SHM-05-41C | 629796 | 3028285 | 222.57 | 2 | 3/13/2013 | 10.31 | 212.26 |
| SHM-05-41C | 629796 | 3028285 | 222.57 | 3 | 4/23/2013 | 10.83 | 211.74 |
| SHM-05-41C | 629796 | 3028285 | 222.57 | 3 | 5/15/2013 | 11.42 | 211.15 |
| SHM-05-41C | 629796 | 3028285 | 222.57 | 3 | 5/21/2013 | 11.29 | 211.28 |
| SHM-05-41C | 629796 | 3028285 | 222.57 | 3 | 5/30/2013 | 10.57 | 212.00 |
| SHM-05-41C | 629796 | 3028285 | 222.57 | 3 | 6/11/2013 | 10.09 | 212.48 |
| SHM-05-41C | 629796 | 3028285 | 222.57 | 7 | 4/22/2014 | 9.78 | 212.79 |
| SHM-05-41C | 629796 | 3028285 | 222.57 | 7 | 4/23/2014 | 9.85 | 212.72 |
| SHM-05-41C | 629796 | 3028285 | 222.57 | 9 | 10/6/2014 | 12.41 | 210.16 |
| SHM-05-41C | 629796 | 3028285 | 222.57 | 11 | 6/8/2015 | 11.18 | 211.39 |
| SHM-05-41C | 629796 | 3028285 | 222.57 | 13 | 10/20/2015 | 12.41 | 210.16 |
| SHM-05-41C | 629796 | 3028285 | 222.57 | 13 | 12/16/2015 | 11.91 | 210.66 |
| SHM-05-41C | 629796 | 3028285 | 222.57 | 15 | 6/23/2016 | 11.84 | 210.73 |
| SHM-05-41C | 629796 | 3028285 | 222.57 | 17 | 11/16/2016 | 11.43 | 211.14 |
| SHM-05-42A | 630018 | 3028376 | 216.81 | 1 | 11/5/2012 | 4.71 | 212.10 |
| SHM-05-42A | 630018 | 3028376 | 216.81 | 1 | 11/6/2012 | 4.75 | 212.06 |
| SHM-05-42A | 630018 | 3028376 | 216.81 | 2 | 3/13/2013 | 4.22 | 212.59 |
| SHM-05-42A | 630018 | 3028376 | 216.81 | 3 | 4/23/2013 | 4.93 | 211.88 |
| SHM-05-42A | 630018 | 3028376 | 216.81 | 3 | 4/25/2013 | 4.95 | 211.86 |
| SHM-05-42A | 630018 | 3028376 | 216.81 | 3 | 5/15/2013 | 5.45 | 211.36 |
| SHM-05-42A | 630018 | 3028376 | 216.81 | 3 | 5/30/2013 | 4.61 | 212.20 |
| SHM-05-42A | 630018 | 3028376 | 216.81 | 3 | 6/11/2013 | 4.00 | 212.81 |
| SHM-05-42A | 630018 | 3028376 | 216.81 | 7 | 4/22/2014 | 3.90 | 212.91 |
| SHM-05-42A | 630018 | 3028376 | 216.81 | 7 | 4/23/2014 | 3.95 | 212.86 |
| SHM-05-42A | 630018 | 3028376 | 216.81 | 9 | 10/6/2014 | 6.13 | 210.68 |
| SHM-05-42A | 630018 | 3028376 | 216.81 | 13 | 10/20/2015 | 6.28 | 210.53 |
| SHM-05-42A | 630018 | 3028376 | 216.81 | 13 | 12/16/2015 | 5.87 | 210.94 |
| SHM-05-42A | 630018 | 3028376 | 216.81 | 16 | 8/16/2016 | 6.53 | 210.28 |
| SHM-05-42A | 630018 | 3028376 | 216.81 | 17 | 11/16/2016 | 5.38 | 211.43 |
| SHM-05-42B | 630018 | 3028376 | 216.80 | 1 | 11/5/2012 | 4.73 | 212.07 |
| SHM-05-42B | 630018 | 3028376 | 216.80 | 1 | 11/6/2012 | 4.78 | 212.02 |
| SHM-05-42B | 630018 | 3028376 | 216.80 | 2 | 3/13/2013 | 4.27 | 212.53 |
| SHM-05-42B | 630018 | 3028376 | 216.80 | 3 | 4/23/2013 | 4.91 | 211.89 |
| SHM-05-42B | 630018 | 3028376 | 216.80 | 3 | 5/15/2013 | 5.45 | 211.35 |
| SHM-05-42B | 630018 | 3028376 | 216.80 | 3 | 5/30/2013 | 4.62 | 212.18 |
| SHM-05-42B | 630018 | 3028376 | 216.80 | 3 | 6/11/2013 | 4.04 | 212.76 |
| SHM-05-42B | 630018 | 3028376 | 216.80 | 7 | 4/22/2014 | 3.90 | 212.90 |
| SHM-05-42B | 630018 | 3028376 | 216.80 | 7 | 4/23/2014 | 3.95 | 212.85 |
| SHM-05-42B | 630018 | 3028376 | 216.80 | 9 | 10/6/2014 | 6.20 | 210.60 |
| SHM-05-42B | 630018 | 3028376 | 216.80 | 13 | 10/20/2015 | 6.35 | 210.45 |
| SHM-05-42B | 630018 | 3028376 | 216.80 | 13 | 12/16/2015 | 5.93 | 210.87 |
| SHM-05-42B | 630018 | 3028376 | 216.80 | 16 | 8/16/2016 | 6.59 | 210.21 |

# Appendix B
# Water Level Data (CD)
# Shepley's Hill Landfill Groundwater Model

| Location Name | X Coordinate (feet) | Y Coordinate (feet) | Measuring Point Elevation (feet amsl) NAVD 1988 | Model Stress Period | Measurement Date | Depth to Water (feet) | Groundwater Elevation (feet amsl) NAVD 1988 |
|---|---|---|---|---|---|---|---|
| SHM-05-42B | 630018 | 3028376 | 216.80 | 17 | 10/20/2016 | 6.68 | 210.12 |
| SHM-05-42B | 630018 | 3028376 | 216.80 | 17 | 11/16/2016 | 5.47 | 211.33 |
| SHM-07-03 | 629411 | 3028445 | 227.90 | 3 | 5/15/2013 | 19.85 | 208.05 |
| SHM-07-03 | 629411 | 3028445 | 227.90 | 3 | 6/11/2013 | 19.24 | 208.66 |
| SHM-07-03 | 629411 | 3028445 | 227.90 | 7 | 4/22/2014 | 18.23 | 209.67 |
| SHM-07-03 | 629411 | 3028445 | 227.90 | 9 | 10/6/2014 | 20.52 | 207.38 |
| SHM-07-03 | 629411 | 3028445 | 227.90 | 11 | 6/9/2015 | 19.72 | 208.18 |
| SHM-07-03 | 629411 | 3028445 | 227.90 | 11 | 6/10/2015 | 19.72 | 208.18 |
| SHM-07-03 | 629411 | 3028445 | 227.90 | 13 | 12/16/2015 | 20.31 | 207.59 |
| SHM-07-03 | 629411 | 3028445 | 227.90 | 15 | 6/23/2016 | 20.19 | 207.71 |
| SHM-07-03 | 629411 | 3028445 | 227.90 | 16 | 8/16/2016 | 20.86 | 207.04 |
| SHM-07-03 | 629411 | 3028445 | 227.90 | 17 | 10/20/2016 | 20.69 | 207.21 |
| SHM-07-03 | 629411 | 3028445 | 227.90 | 17 | 11/16/2016 | 20.10 | 207.80 |
| SHM-07-05 | 629632 | 3028513 | 223.40 | 3 | 5/15/2013 | 14.57 | 208.83 |
| SHM-07-05 | 629632 | 3028513 | 223.40 | 11 | 6/9/2015 | 14.52 | 208.88 |
| SHM-07-05 | 629632 | 3028513 | 223.40 | 13 | 12/16/2015 | 14.83 | 208.57 |
| SHM-10-01 | 628868 | 3028617 | 209.65 | 1 | 11/5/2012 | 4.15 | 205.50 |
| SHM-10-01 | 628868 | 3028617 | 209.65 | 3 | 5/15/2013 | 3.52 | 206.13 |
| SHM-10-01 | 628868 | 3028617 | 209.65 | 3 | 5/29/2013 | 3.21 | 206.44 |
| SHM-10-01 | 628868 | 3028617 | 209.65 | 3 | 6/11/2013 | 2.45 | 207.20 |
| SHM-10-01 | 628868 | 3028617 | 209.65 | 7 | 4/22/2014 | 2.96 | 206.69 |
| SHM-10-01 | 628868 | 3028617 | 209.65 | 9 | 10/6/2014 | 4.09 | 205.56 |
| SHM-10-01 | 628868 | 3028617 | 209.65 | 11 | 6/1/2015 | 3.65 | 206.00 |
| SHM-10-01 | 628868 | 3028617 | 209.65 | 11 | 6/9/2015 | 3.94 | 205.71 |
| SHM-10-01 | 628868 | 3028617 | 209.65 | 11 | 6/17/2015 | 4.15 | 205.50 |
| SHM-10-01 | 628868 | 3028617 | 209.65 | 13 | 10/20/2015 | 4.35 | 205.30 |
| SHM-10-01 | 628868 | 3028617 | 209.65 | 13 | 12/16/2015 | 4.08 | 205.57 |
| SHM-10-01 | 628868 | 3028617 | 209.65 | 15 | 6/9/2016 | 4.13 | 205.52 |
| SHM-10-02 | 628381 | 3028700 | 223.03 | 1 | 11/5/2012 | 17.25 | 205.78 |
| SHM-10-02 | 628381 | 3028700 | 223.03 | 3 | 5/15/2013 | 18.64 | 204.39 |
| SHM-10-02 | 628381 | 3028700 | 223.03 | 3 | 5/29/2013 | 17.45 | 205.58 |
| SHM-10-02 | 628381 | 3028700 | 223.03 | 3 | 6/11/2013 | 16.50 | 206.53 |
| SHM-10-02 | 628381 | 3028700 | 223.03 | 7 | 4/22/2014 | 17.21 | 205.82 |
| SHM-10-02 | 628381 | 3028700 | 223.03 | 9 | 10/6/2014 | 18.46 | 204.57 |
| SHM-10-02 | 628381 | 3028700 | 223.03 | 11 | 6/8/2015 | 18.08 | 204.95 |
| SHM-10-02 | 628381 | 3028700 | 223.03 | 11 | 6/9/2015 | 18.08 | 204.95 |
| SHM-10-03 | 628436 | 3029000 | 232.05 | 1 | 11/5/2012 | 26.16 | 205.89 |
| SHM-10-03 | 628436 | 3029000 | 232.05 | 3 | 5/15/2013 | 26.38 | 205.67 |
| SHM-10-03 | 628436 | 3029000 | 232.05 | 3 | 5/24/2013 | 26.44 | 205.61 |
| SHM-10-03 | 628436 | 3029000 | 232.05 | 3 | 6/11/2013 | 25.47 | 206.58 |
| SHM-10-03 | 628436 | 3029000 | 232.05 | 7 | 4/22/2014 | 25.68 | 206.37 |
| SHM-10-03 | 628436 | 3029000 | 232.05 | 9 | 10/6/2014 | 27.10 | 204.95 |
| SHM-10-03 | 628436 | 3029000 | 232.05 | 11 | 6/9/2015 | 26.60 | 205.45 |
| SHM-10-03 | 628436 | 3029000 | 232.05 | 11 | 6/10/2015 | 26.60 | 205.45 |
| SHM-10-04 | 628959 | 3029485 | 212.61 | 1 | 11/5/2012 | 6.25 | 206.36 |
| SHM-10-04 | 628959 | 3029485 | 212.61 | 3 | 5/15/2013 | 6.11 | 206.50 |
| SHM-10-04 | 628959 | 3029485 | 212.61 | 3 | 5/29/2013 | 5.94 | 206.67 |
| SHM-10-04 | 628959 | 3029485 | 212.61 | 3 | 6/11/2013 | 5.26 | 207.35 |
| SHM-10-04 | 628959 | 3029485 | 212.61 | 7 | 4/22/2014 | 5.11 | 207.50 |
| SHM-10-04 | 628959 | 3029485 | 212.61 | 9 | 10/6/2014 | 6.24 | 206.37 |

# Appendix B
# Water Level Data (CD)
# Shepley's Hill Landfill Groundwater Model

| Location Name | X Coordinate (feet) | Y Coordinate (feet) | Measuring Point Elevation (feet amsl) NAVD 1988 | Model Stress Period | Measurement Date | Depth to Water (feet) | Groundwater Elevation (feet amsl) NAVD 1988 |
|---|---|---|---|---|---|---|---|
| SHM-10-04 | 628959 | 3029485 | 212.61 | 11 | 6/8/2015 | 5.80 | 206.81 |
| SHM-10-04 | 628959 | 3029485 | 212.61 | 11 | 6/9/2015 | 5.80 | 206.81 |
| SHM-10-05A | 630442 | 3028943 | 235.09 | 1 | 11/5/2012 | 25.18 | 209.91 |
| SHM-10-05A | 630442 | 3028943 | 235.09 | 3 | 5/15/2013 | 25.56 | 209.53 |
| SHM-10-05A | 630442 | 3028943 | 235.09 | 3 | 5/22/2013 | 25.61 | 209.48 |
| SHM-10-05A | 630442 | 3028943 | 235.09 | 3 | 6/11/2013 | 24.67 | 210.42 |
| SHM-10-05A | 630442 | 3028943 | 235.09 | 7 | 4/22/2014 | 24.23 | 210.86 |
| SHM-10-05A | 630442 | 3028943 | 235.09 | 9 | 10/6/2014 | 25.41 | 209.68 |
| SHM-10-05A | 630442 | 3028943 | 235.09 | 11 | 6/9/2015 | 25.20 | 209.89 |
| SHM-10-05A | 630442 | 3028943 | 235.09 | 11 | 6/10/2015 | 25.20 | 209.89 |
| SHM-10-05A | 630442 | 3028943 | 235.09 | 11 | 6/17/2015 | 25.39 | 209.70 |
| SHM-10-05A | 630442 | 3028943 | 235.09 | 13 | 12/16/2015 | 25.35 | 209.74 |
| SHM-10-05A | 630442 | 3028943 | 235.09 | 15 | 6/9/2016 | 25.24 | 209.85 |
| SHM-10-05A | 630442 | 3028943 | 235.09 | 17 | 11/16/2016 | 25.03 | 210.06 |
| SHM-10-06 | 630216 | 3027883 | 232.91 | 1 | 11/5/2012 | 18.84 | 214.07 |
| SHM-10-06 | 630216 | 3027883 | 232.91 | 1 | 11/6/2012 | 18.89 | 214.02 |
| SHM-10-06 | 630216 | 3027883 | 232.91 | 2 | 3/13/2013 | 18.57 | 214.34 |
| SHM-10-06 | 630216 | 3027883 | 232.91 | 3 | 4/23/2013 | 19.02 | 213.89 |
| SHM-10-06 | 630216 | 3027883 | 232.91 | 3 | 4/25/2013 | 19.03 | 213.88 |
| SHM-10-06 | 630216 | 3027883 | 232.91 | 3 | 5/15/2013 | 19.46 | 213.45 |
| SHM-10-06 | 630216 | 3027883 | 232.91 | 3 | 5/23/2013 | 19.16 | 213.75 |
| SHM-10-06 | 630216 | 3027883 | 232.91 | 3 | 5/30/2013 | 18.71 | 214.20 |
| SHM-10-06 | 630216 | 3027883 | 232.91 | 3 | 6/11/2013 | 19.18 | 213.73 |
| SHM-10-06 | 630216 | 3027883 | 232.91 | 7 | 4/22/2014 | 18.23 | 214.68 |
| SHM-10-06 | 630216 | 3027883 | 232.91 | 7 | 5/21/2014 | 18.77 | 214.14 |
| SHM-10-06 | 630216 | 3027883 | 232.91 | 9 | 10/6/2014 | 20.32 | 212.59 |
| SHM-10-06 | 630216 | 3027883 | 232.91 | 13 | 10/20/2015 | 20.42 | 212.49 |
| SHM-10-06 | 630216 | 3027883 | 232.91 | 13 | 12/16/2015 | 20.07 | 212.84 |
| SHM-10-06 | 630216 | 3027883 | 232.91 | 16 | 8/16/2016 | 20.70 | 212.21 |
| SHM-10-06 | 630216 | 3027883 | 232.91 | 17 | 10/20/2016 | 20.87 | 212.04 |
| SHM-10-06 | 630216 | 3027883 | 232.91 | 17 | 11/16/2016 | 19.52 | 213.39 |
| SHM-10-06A | 630301 | 3027896 | 248.54 | 1 | 11/5/2012 | 34.29 | 214.25 |
| SHM-10-06A | 630301 | 3027896 | 248.54 | 1 | 11/6/2012 | 34.30 | 214.24 |
| SHM-10-06A | 630301 | 3027896 | 248.54 | 2 | 3/12/2013 | 34.20 | 214.34 |
| SHM-10-06A | 630301 | 3027896 | 248.54 | 2 | 3/13/2013 | 34.06 | 214.48 |
| SHM-10-06A | 630301 | 3027896 | 248.54 | 3 | 4/22/2013 | 34.51 | 214.03 |
| SHM-10-06A | 630301 | 3027896 | 248.54 | 3 | 4/23/2013 | 34.49 | 214.05 |
| SHM-10-06A | 630301 | 3027896 | 248.54 | 3 | 4/25/2013 | 34.51 | 214.03 |
| SHM-10-06A | 630301 | 3027896 | 248.54 | 3 | 5/15/2013 | 34.93 | 213.61 |
| SHM-10-06A | 630301 | 3027896 | 248.54 | 3 | 5/30/2013 | 34.12 | 214.42 |
| SHM-10-06A | 630301 | 3027896 | 248.54 | 3 | 6/11/2013 | 33.64 | 214.90 |
| SHM-10-06A | 630301 | 3027896 | 248.54 | 7 | 4/22/2014 | 33.77 | 214.77 |
| SHM-10-06A | 630301 | 3027896 | 248.54 | 7 | 5/21/2014 | 34.24 | 214.30 |
| SHM-10-06A | 630301 | 3027896 | 248.54 | 9 | 10/6/2014 | 35.67 | 212.87 |
| SHM-10-06A | 630301 | 3027896 | 248.54 | 13 | 10/20/2015 | 35.76 | 212.78 |
| SHM-10-06A | 630301 | 3027896 | 248.54 | 13 | 12/16/2015 | 35.42 | 213.12 |
| SHM-10-06A | 630301 | 3027896 | 248.54 | 16 | 8/16/2016 | 36.03 | 212.51 |
| SHM-10-06A | 630301 | 3027896 | 248.54 | 17 | 10/20/2016 | 36.19 | 212.35 |
| SHM-10-06A | 630301 | 3027896 | 248.54 | 17 | 11/16/2016 | 34.84 | 213.70 |
| SHM-10-07 | 630301 | 3026890 | 246.82 | 1 | 11/5/2012 | 28.76 | 218.06 |

# Appendix B
# Water Level Data (CD)
# Shepley's Hill Landfill Groundwater Model

| Location Name | X Coordinate (feet) | Y Coordinate (feet) | Measuring Point Elevation (feet amsl) NAVD 1988 | Model Stress Period | Measurement Date | Depth to Water (feet) | Groundwater Elevation (feet amsl) NAVD 1988 |
|---|---|---|---|---|---|---|---|
| SHM-10-07 | 630301 | 3026890 | 246.82 | 1 | 11/6/2012 | 27.68 | 219.14 |
| SHM-10-07 | 630301 | 3026890 | 246.82 | 2 | 2/14/2013 | 27.79 | 219.03 |
| SHM-10-07 | 630301 | 3026890 | 246.82 | 2 | 3/12/2013 | 27.66 | 219.16 |
| SHM-10-07 | 630301 | 3026890 | 246.82 | 3 | 4/22/2013 | 27.19 | 219.63 |
| SHM-10-07 | 630301 | 3026890 | 246.82 | 3 | 4/25/2013 | 27.11 | 219.71 |
| SHM-10-07 | 630301 | 3026890 | 246.82 | 3 | 5/15/2013 | 27.07 | 219.75 |
| SHM-10-07 | 630301 | 3026890 | 246.82 | 3 | 5/23/2013 | 27.45 | 219.37 |
| SHM-10-07 | 630301 | 3026890 | 246.82 | 3 | 6/11/2013 | 26.95 | 219.87 |
| SHM-10-07 | 630301 | 3026890 | 246.82 | 7 | 4/22/2014 | 27.74 | 219.08 |
| SHM-10-07 | 630301 | 3026890 | 246.82 | 9 | 10/6/2014 | 28.02 | 218.80 |
| SHM-10-07 | 630301 | 3026890 | 246.82 | 11 | 6/3/2015 | 26.78 | 220.04 |
| SHM-10-07 | 630301 | 3026890 | 246.82 | 11 | 6/17/2015 | 26.87 | 219.95 |
| SHM-10-07 | 630301 | 3026890 | 246.82 | 12 | 8/18/2015 | 27.27 | 219.55 |
| SHM-10-07 | 630301 | 3026890 | 246.82 | 13 | 10/7/2015 | 27.85 | 218.97 |
| SHM-10-07 | 630301 | 3026890 | 246.82 | 13 | 10/20/2015 | 28.00 | 218.82 |
| SHM-10-07 | 630301 | 3026890 | 246.82 | 13 | 12/16/2015 | 28.22 | 218.60 |
| SHM-10-07 | 630301 | 3026890 | 246.82 | 15 | 4/6/2016 | 27.43 | 219.40 |
| SHM-10-07 | 630301 | 3026890 | 246.82 | 15 | 6/9/2016 | 27.40 | 219.42 |
| SHM-10-07 | 630301 | 3026890 | 246.82 | 16 | 8/16/2016 | 28.09 | 218.73 |
| SHM-10-07 | 630301 | 3026890 | 246.82 | 17 | 11/16/2016 | 28.37 | 218.45 |
| SHM-10-08 | 628352 | 3028526 | 214.36 | 1 | 11/5/2012 | 8.59 | 205.77 |
| SHM-10-08 | 628352 | 3028526 | 214.36 | 3 | 5/15/2013 | 9.01 | 205.35 |
| SHM-10-08 | 628352 | 3028526 | 214.36 | 3 | 6/11/2013 | 7.78 | 206.58 |
| SHM-10-08 | 628352 | 3028526 | 214.36 | 7 | 4/22/2014 | 8.75 | 205.61 |
| SHM-10-08 | 628352 | 3028526 | 214.36 | 9 | 10/6/2014 | 9.90 | 204.46 |
| SHM-10-08 | 628352 | 3028526 | 214.36 | 11 | 6/8/2015 | 9.55 | 204.81 |
| SHM-10-10 | 629105 | 3028874 | 217.11 | 1 | 11/5/2012 | 10.51 | 206.60 |
| SHM-10-10 | 629105 | 3028874 | 217.11 | 3 | 5/15/2013 | 10.63 | 206.48 |
| SHM-10-10 | 629105 | 3028874 | 217.11 | 3 | 5/29/2013 | 11.41 | 205.70 |
| SHM-10-10 | 629105 | 3028874 | 217.11 | 3 | 6/11/2013 | 9.74 | 207.37 |
| SHM-10-10 | 629105 | 3028874 | 217.11 | 7 | 4/22/2014 | 9.90 | 207.21 |
| SHM-10-10 | 629105 | 3028874 | 217.11 | 9 | 10/6/2014 | 10.82 | 206.29 |
| SHM-10-10 | 629105 | 3028874 | 217.11 | 11 | 6/3/2015 | 10.22 | 206.89 |
| SHM-10-10 | 629105 | 3028874 | 217.11 | 11 | 6/17/2015 | 10.72 | 206.39 |
| SHM-10-10 | 629105 | 3028874 | 217.11 | 13 | 10/20/2015 | 10.93 | 206.18 |
| SHM-10-10 | 629105 | 3028874 | 217.11 | 13 | 12/16/2015 | 10.69 | 206.42 |
| SHM-10-10 | 629105 | 3028874 | 217.11 | 15 | 6/9/2016 | 10.61 | 206.50 |
| SHM-10-11 | 629991 | 3025972 | 263.76 | 1 | 11/5/2012 | 41.14 | 222.62 |
| SHM-10-11 | 629991 | 3025972 | 263.76 | 1 | 11/6/2012 | 41.04 | 222.72 |
| SHM-10-11 | 629991 | 3025972 | 263.76 | 2 | 2/14/2013 | 41.25 | 222.51 |
| SHM-10-11 | 629991 | 3025972 | 263.76 | 2 | 3/12/2013 | 41.01 | 222.75 |
| SHM-10-11 | 629991 | 3025972 | 263.76 | 3 | 4/22/2013 | 40.31 | 223.45 |
| SHM-10-11 | 629991 | 3025972 | 263.76 | 3 | 4/25/2013 | 40.23 | 223.53 |
| SHM-10-11 | 629991 | 3025972 | 263.76 | 3 | 5/15/2013 | 40.36 | 223.40 |
| SHM-10-11 | 629991 | 3025972 | 263.76 | 3 | 5/23/2013 | 40.45 | 223.31 |
| SHM-10-11 | 629991 | 3025972 | 263.76 | 3 | 6/11/2013 | 40.22 | 223.54 |
| SHM-10-11 | 629991 | 3025972 | 263.76 | 7 | 4/22/2014 | 40.99 | 222.77 |
| SHM-10-11 | 629991 | 3025972 | 263.76 | 9 | 10/6/2014 | 41.46 | 222.30 |
| SHM-10-11 | 629991 | 3025972 | 263.76 | 11 | 6/3/2015 | 39.32 | 224.44 |
| SHM-10-11 | 629991 | 3025972 | 263.76 | 11 | 6/17/2015 | 39.88 | 223.88 |

# Appendix B
# Water Level Data (CD)
# Shepley's Hill Landfill Groundwater Model

| Location Name | X Coordinate (feet) | Y Coordinate (feet) | Measuring Point Elevation (feet amsl) NAVD 1988 | Model Stress Period | Measurement Date | Depth to Water (feet) | Groundwater Elevation (feet amsl) NAVD 1988 |
|---|---|---|---|---|---|---|---|
| SHM-10-11 | 629991 | 3025972 | 263.76 | 13 | 10/20/2015 | 41.40 | 222.36 |
| SHM-10-11 | 629991 | 3025972 | 263.76 | 13 | 12/16/2015 | 41.81 | 221.95 |
| SHM-10-11 | 629991 | 3025972 | 263.76 | 15 | 6/9/2016 | 40.88 | 222.88 |
| SHM-10-11 | 629991 | 3025972 | 263.76 | 16 | 8/16/2016 | 41.69 | 222.07 |
| SHM-10-11 | 629991 | 3025972 | 263.76 | 17 | 11/15/2016 | 42.21 | 221.55 |
| SHM-10-12 | 629717 | 3026719 | 255.17 | 1 | 11/5/2012 | 34.80 | 220.37 |
| SHM-10-12 | 629717 | 3026719 | 255.17 | 1 | 11/6/2012 | 34.68 | 220.49 |
| SHM-10-12 | 629717 | 3026719 | 255.17 | 2 | 2/14/2013 | 34.65 | 220.52 |
| SHM-10-12 | 629717 | 3026719 | 255.17 | 2 | 3/12/2013 | 34.51 | 220.66 |
| SHM-10-12 | 629717 | 3026719 | 255.17 | 3 | 4/22/2013 | 33.72 | 221.45 |
| SHM-10-12 | 629717 | 3026719 | 255.17 | 3 | 4/25/2013 | 33.64 | 221.53 |
| SHM-10-12 | 629717 | 3026719 | 255.17 | 3 | 5/15/2013 | 33.09 | 222.08 |
| SHM-10-12 | 629717 | 3026719 | 255.17 | 3 | 5/23/2013 | 33.70 | 221.47 |
| SHM-10-12 | 629717 | 3026719 | 255.17 | 3 | 6/11/2013 | 33.62 | 221.55 |
| SHM-10-12 | 629717 | 3026719 | 255.17 | 7 | 4/22/2014 | 34.55 | 220.62 |
| SHM-10-12 | 629717 | 3026719 | 255.17 | 9 | 10/6/2014 | 34.93 | 220.24 |
| SHM-10-12 | 629717 | 3026719 | 255.17 | 11 | 6/3/2015 | 33.35 | 221.82 |
| SHM-10-12 | 629717 | 3026719 | 255.17 | 11 | 6/17/2015 | 33.45 | 221.72 |
| SHM-10-12 | 629717 | 3026719 | 255.17 | 13 | 10/20/2015 | 34.88 | 220.29 |
| SHM-10-12 | 629717 | 3026719 | 255.17 | 13 | 12/16/2015 | 35.25 | 219.92 |
| SHM-10-12 | 629717 | 3026719 | 255.17 | 15 | 6/9/2016 | 34.12 | 221.05 |
| SHM-10-12 | 629717 | 3026719 | 255.17 | 16 | 8/16/2016 | 34.95 | 220.22 |
| SHM-10-12 | 629717 | 3026719 | 255.17 | 17 | 11/15/2016 | 35.62 | 219.55 |
| SHM-10-13 | 629906 | 3027157 | 244.77 | 1 | 11/5/2012 | 26.51 | 218.26 |
| SHM-10-13 | 629906 | 3027157 | 244.77 | 1 | 11/6/2012 | 26.39 | 218.38 |
| SHM-10-13 | 629906 | 3027157 | 244.77 | 2 | 2/14/2013 | 26.73 | 218.04 |
| SHM-10-13 | 629906 | 3027157 | 244.77 | 2 | 3/12/2013 | 26.20 | 218.57 |
| SHM-10-13 | 629906 | 3027157 | 244.77 | 3 | 4/22/2013 | 25.65 | 219.12 |
| SHM-10-13 | 629906 | 3027157 | 244.77 | 3 | 5/15/2013 | 25.73 | 219.04 |
| SHM-10-13 | 629906 | 3027157 | 244.77 | 3 | 5/23/2013 | 25.78 | 218.99 |
| SHM-10-13 | 629906 | 3027157 | 244.77 | 3 | 6/11/2013 | 25.47 | 219.30 |
| SHM-10-13 | 629906 | 3027157 | 244.77 | 7 | 4/22/2014 | 26.09 | 218.68 |
| SHM-10-13 | 629906 | 3027157 | 244.77 | 9 | 10/6/2014 | 26.92 | 217.85 |
| SHM-10-13 | 629906 | 3027157 | 244.77 | 11 | 6/3/2015 | 25.47 | 219.30 |
| SHM-10-13 | 629906 | 3027157 | 244.77 | 11 | 6/17/2015 | 25.56 | 219.21 |
| SHM-10-13 | 629906 | 3027157 | 244.77 | 13 | 10/20/2015 | 26.85 | 217.92 |
| SHM-10-13 | 629906 | 3027157 | 244.77 | 13 | 12/16/2015 | 27.03 | 217.74 |
| SHM-10-13 | 629906 | 3027157 | 244.77 | 15 | 6/9/2016 | 26.07 | 218.70 |
| SHM-10-13 | 629906 | 3027157 | 244.77 | 16 | 8/16/2016 | 26.96 | 217.81 |
| SHM-10-13 | 629906 | 3027157 | 244.77 | 17 | 11/16/2016 | 27.12 | 217.65 |
| SHM-10-14 | 629785 | 3027373 | 237.62 | 1 | 11/5/2012 | 20.49 | 217.13 |
| SHM-10-14 | 629785 | 3027373 | 237.62 | 1 | 11/6/2012 | 20.33 | 217.29 |
| SHM-10-14 | 629785 | 3027373 | 237.62 | 2 | 3/12/2013 | 20.08 | 217.54 |
| SHM-10-14 | 629785 | 3027373 | 237.62 | 3 | 4/22/2013 | 19.64 | 217.98 |
| SHM-10-14 | 629785 | 3027373 | 237.62 | 3 | 4/25/2013 | 19.63 | 217.99 |
| SHM-10-14 | 629785 | 3027373 | 237.62 | 3 | 5/15/2013 | 19.93 | 217.69 |
| SHM-10-14 | 629785 | 3027373 | 237.62 | 3 | 5/23/2013 | 20.00 | 217.62 |
| SHM-10-14 | 629785 | 3027373 | 237.62 | 3 | 6/11/2013 | 19.46 | 218.16 |
| SHM-10-14 | 629785 | 3027373 | 237.62 | 7 | 4/22/2014 | 19.68 | 217.94 |
| SHM-10-14 | 629785 | 3027373 | 237.62 | 9 | 10/6/2014 | 21.22 | 216.40 |

# Appendix B
# Water Level Data (CD)
# Shepley's Hill Landfill Groundwater Model

| Location Name | X Coordinate (feet) | Y Coordinate (feet) | Measuring Point Elevation (feet amsl) NAVD 1988 | Model Stress Period | Measurement Date | Depth to Water (feet) | Groundwater Elevation (feet amsl) NAVD 1988 |
|---|---|---|---|---|---|---|---|
| SHM-10-14 | 629785 | 3027373 | 237.62 | 13 | 10/20/2015 | 21.25 | 216.37 |
| SHM-10-14 | 629785 | 3027373 | 237.62 | 13 | 12/16/2015 | 21.14 | 216.48 |
| SHM-10-14 | 629785 | 3027373 | 237.62 | 16 | 8/16/2016 | 21.29 | 216.33 |
| SHM-10-14 | 629785 | 3027373 | 237.62 | 17 | 11/16/2016 | 21.12 | 216.50 |
| SHM-10-15 | 629681 | 3027101 | 243.68 | 1 | 11/5/2012 | 25.09 | 218.59 |
| SHM-10-15 | 629681 | 3027101 | 243.68 | 1 | 11/6/2012 | 24.98 | 218.70 |
| SHM-10-15 | 629681 | 3027101 | 243.68 | 3 | 4/25/2013 | 23.75 | 219.93 |
| SHM-10-15 | 629681 | 3027101 | 243.68 | 3 | 5/15/2013 | 23.86 | 219.82 |
| SHM-10-15 | 629681 | 3027101 | 243.68 | 3 | 5/24/2013 | 23.97 | 219.71 |
| SHM-10-15 | 629681 | 3027101 | 243.68 | 3 | 6/11/2013 | 24.74 | 218.94 |
| SHM-10-15 | 629681 | 3027101 | 243.68 | 7 | 4/22/2014 | 24.43 | 219.25 |
| SHM-10-15 | 629681 | 3027101 | 243.68 | 9 | 10/6/2014 | 25.41 | 218.27 |
| SHM-10-15 | 629681 | 3027101 | 243.68 | 11 | 6/3/2015 | 23.58 | 220.10 |
| SHM-10-15 | 629681 | 3027101 | 243.68 | 11 | 6/17/2015 | 23.79 | 219.89 |
| SHM-10-15 | 629681 | 3027101 | 243.68 | 13 | 10/20/2015 | 25.36 | 218.32 |
| SHM-10-15 | 629681 | 3027101 | 243.68 | 13 | 12/16/2015 | 25.56 | 218.12 |
| SHM-10-15 | 629681 | 3027101 | 243.68 | 15 | 6/9/2016 | 24.26 | 219.42 |
| SHM-10-15 | 629681 | 3027101 | 243.68 | 16 | 8/16/2016 | 25.34 | 218.34 |
| SHM-10-15 | 629681 | 3027101 | 243.68 | 17 | 11/16/2016 | 25.72 | 217.96 |
| SHM-10-16 | 629834 | 3028355 | 219.23 | 1 | 11/5/2012 | 7.31 | 211.92 |
| SHM-10-16 | 629834 | 3028355 | 219.23 | 1 | 11/6/2012 | 7.25 | 211.98 |
| SHM-10-16 | 629834 | 3028355 | 219.23 | 2 | 3/13/2013 | 6.86 | 212.37 |
| SHM-10-16 | 629834 | 3028355 | 219.23 | 3 | 4/25/2013 | 7.50 | 211.73 |
| SHM-10-16 | 629834 | 3028355 | 219.23 | 3 | 5/15/2013 | 8.03 | 211.20 |
| SHM-10-16 | 629834 | 3028355 | 219.23 | 3 | 5/30/2013 | 7.20 | 212.03 |
| SHM-10-16 | 629834 | 3028355 | 219.23 | 3 | 6/11/2013 | 7.70 | 211.53 |
| SHM-10-16 | 629834 | 3028355 | 219.23 | 7 | 4/22/2014 | 6.40 | 212.83 |
| SHM-10-16 | 629834 | 3028355 | 219.23 | 9 | 10/6/2014 | 8.80 | 210.43 |
| SHM-10-16 | 629834 | 3028355 | 219.23 | 13 | 10/20/2015 | 9.02 | 210.21 |
| SHM-10-16 | 629834 | 3028355 | 219.23 | 13 | 12/16/2015 | 8.58 | 210.65 |
| SHM-10-16 | 629834 | 3028355 | 219.23 | 15 | 6/23/2016 | 8.55 | 210.68 |
| SHM-10-16 | 629834 | 3028355 | 219.23 | 16 | 8/16/2016 | 9.22 | 210.01 |
| SHM-10-16 | 629834 | 3028355 | 219.23 | 17 | 10/20/2016 | 9.32 | 209.92 |
| SHM-10-16 | 629834 | 3028355 | 219.23 | 17 | 11/16/2016 | 8.08 | 211.15 |
| SHM-11-02 | 630458 | 3027076 | 240.73 | 1 | 11/5/2012 | 22.81 | 217.92 |
| SHM-11-02 | 630458 | 3027076 | 240.73 | 1 | 11/6/2012 | 22.76 | 217.97 |
| SHM-11-02 | 630458 | 3027076 | 240.73 | 3 | 5/15/2013 | 22.74 | 217.99 |
| SHM-11-02 | 630458 | 3027076 | 240.73 | 3 | 5/30/2013 | 22.43 | 218.30 |
| SHM-11-02 | 630458 | 3027076 | 240.73 | 3 | 6/11/2013 | 22.10 | 218.63 |
| SHM-11-02 | 630458 | 3027076 | 240.73 | 7 | 4/22/2014 | 22.83 | 217.90 |
| SHM-11-02 | 630458 | 3027076 | 240.73 | 7 | 4/24/2014 | 22.80 | 217.93 |
| SHM-11-02 | 630458 | 3027076 | 240.73 | 9 | 10/6/2014 | 23.11 | 217.62 |
| SHM-11-02 | 630458 | 3027076 | 240.73 | 11 | 6/2/2015 | 22.53 | 218.20 |
| SHM-11-02 | 630458 | 3027076 | 240.73 | 11 | 6/5/2015 | 23.21 | 217.52 |
| SHM-11-02 | 630458 | 3027076 | 240.73 | 11 | 6/17/2015 | 22.71 | 218.02 |
| SHM-11-02 | 630458 | 3027076 | 240.73 | 12 | 8/18/2015 | 22.95 | 217.78 |
| SHM-11-02 | 630458 | 3027076 | 240.73 | 13 | 10/7/2015 | 23.27 | 217.46 |
| SHM-11-02 | 630458 | 3027076 | 240.73 | 13 | 10/20/2015 | 22.92 | 217.81 |
| SHM-11-02 | 630458 | 3027076 | 240.73 | 13 | 12/16/2015 | 23.37 | 217.36 |
| SHM-11-02 | 630458 | 3027076 | 240.73 | 15 | 6/9/2016 | 22.91 | 217.82 |

# Appendix B
# Water Level Data (CD)
# Shepley's Hill Landfill Groundwater Model

| Location Name | X Coordinate (feet) | Y Coordinate (feet) | Measuring Point Elevation (feet amsl) NAVD 1988 | Model Stress Period | Measurement Date | Depth to Water (feet) | Groundwater Elevation (feet amsl) NAVD 1988 |
|---|---|---|---|---|---|---|---|
| SHM-11-02 | 630458 | 3027076 | 240.73 | 15 | 6/23/2016 | 22.95 | 217.78 |
| SHM-11-02 | 630458 | 3027076 | 240.73 | 16 | 8/16/2016 | 23.50 | 217.23 |
| SHM-11-02 | 630458 | 3027076 | 240.73 | 17 | 11/16/2016 | 22.96 | 217.77 |
| SHM-11-06 | 630411 | 3027590 | 236.17 | 1 | 11/5/2012 | 19.82 | 216.35 |
| SHM-11-06 | 630411 | 3027590 | 236.17 | 1 | 11/6/2012 | 19.83 | 216.34 |
| SHM-11-06 | 630411 | 3027590 | 236.17 | 2 | 3/12/2013 | 19.87 | 216.30 |
| SHM-11-06 | 630411 | 3027590 | 236.17 | 3 | 4/22/2013 | 19.92 | 216.25 |
| SHM-11-06 | 630411 | 3027590 | 236.17 | 3 | 4/25/2013 | 19.90 | 216.27 |
| SHM-11-06 | 630411 | 3027590 | 236.17 | 3 | 5/15/2013 | 20.11 | 216.06 |
| SHM-11-06 | 630411 | 3027590 | 236.17 | 3 | 5/30/2013 | 19.62 | 216.55 |
| SHM-11-06 | 630411 | 3027590 | 236.17 | 3 | 6/11/2013 | 19.39 | 216.78 |
| SHM-11-06 | 630411 | 3027590 | 236.17 | 7 | 4/22/2014 | 19.60 | 216.57 |
| SHM-11-06 | 630411 | 3027590 | 236.17 | 9 | 10/6/2014 | 20.71 | 215.46 |
| SHM-11-06 | 630411 | 3027590 | 236.17 | 12 | 8/18/2015 | 20.48 | 215.69 |
| SHM-11-06 | 630411 | 3027590 | 236.17 | 13 | 10/20/2015 | 20.55 | 215.62 |
| SHM-11-06 | 630411 | 3027590 | 236.17 | 13 | 12/16/2015 | 20.67 | 215.50 |
| SHM-11-06 | 630411 | 3027590 | 236.17 | 16 | 8/16/2016 | 21.03 | 215.14 |
| SHM-11-07 | 630415 | 3027133 | 240.83 | 1 | 11/5/2012 | 22.95 | 217.88 |
| SHM-11-07 | 630415 | 3027133 | 240.83 | 2 | 2/14/2013 | 23.10 | 217.73 |
| SHM-11-07 | 630415 | 3027133 | 240.83 | 2 | 3/12/2013 | 22.90 | 217.93 |
| SHM-11-07 | 630415 | 3027133 | 240.83 | 2 | 3/13/2013 | 22.87 | 217.96 |
| SHM-11-07 | 630415 | 3027133 | 240.83 | 3 | 4/22/2013 | 22.65 | 218.18 |
| SHM-11-07 | 630415 | 3027133 | 240.83 | 3 | 5/15/2013 | 22.61 | 218.22 |
| SHM-11-07 | 630415 | 3027133 | 240.83 | 3 | 5/30/2013 | 22.42 | 218.41 |
| SHM-11-07 | 630415 | 3027133 | 240.83 | 3 | 6/11/2013 | 22.19 | 218.64 |
| SHM-11-07 | 630415 | 3027133 | 240.83 | 7 | 4/22/2014 | 22.89 | 217.94 |
| SHM-11-07 | 630415 | 3027133 | 240.83 | 9 | 10/6/2014 | 23.26 | 217.57 |
| SHM-11-07 | 630415 | 3027133 | 240.83 | 11 | 6/3/2015 | 22.33 | 218.50 |
| SHM-11-07 | 630415 | 3027133 | 240.83 | 11 | 6/17/2015 | 22.45 | 218.38 |
| SHM-11-07 | 630415 | 3027133 | 240.83 | 12 | 8/18/2015 | 22.78 | 218.05 |
| SHM-11-07 | 630415 | 3027133 | 240.83 | 13 | 10/7/2015 | 23.24 | 217.59 |
| SHM-11-07 | 630415 | 3027133 | 240.83 | 13 | 10/20/2015 | 20.55 | 220.28 |
| SHM-11-07 | 630415 | 3027133 | 240.83 | 13 | 12/16/2015 | 23.40 | 217.43 |
| SHM-11-07 | 630415 | 3027133 | 240.83 | 15 | 6/9/2016 | 22.78 | 218.05 |
| SHM-11-07 | 630415 | 3027133 | 240.83 | 16 | 8/16/2016 | 23.41 | 217.42 |
| SHM-13-01 | 628557 | 3028295 | 208.08 | 7 | 4/22/2014 | 2.06 | 206.02 |
| SHM-13-01 | 628557 | 3028295 | 208.08 | 9 | 10/6/2014 | 3.36 | 204.72 |
| SHM-13-01 | 628557 | 3028295 | 208.08 | 11 | 6/3/2015 | 2.89 | 205.19 |
| SHM-13-01 | 628557 | 3028295 | 208.08 | 13 | 10/20/2015 | 3.46 | 204.62 |
| SHM-13-01 | 628557 | 3028295 | 208.08 | 13 | 12/16/2015 | 3.21 | 204.87 |
| SHM-13-01 | 628557 | 3028295 | 208.08 | 17 | 11/16/2016 | 2.71 | 205.37 |
| SHM-13-02 | 628981 | 3028714 | 218.72 | 3 | 5/15/2013 | 12.50 | 206.22 |
| SHM-13-02 | 628981 | 3028714 | 218.72 | 3 | 5/29/2013 | 12.29 | 206.43 |
| SHM-13-02 | 628981 | 3028714 | 218.72 | 3 | 6/11/2013 | 11.50 | 207.22 |
| SHM-13-02 | 628981 | 3028714 | 218.72 | 7 | 4/22/2014 | 11.92 | 206.80 |
| SHM-13-02 | 628981 | 3028714 | 218.72 | 9 | 10/6/2014 | 12.97 | 205.75 |
| SHM-13-02 | 628981 | 3028714 | 218.72 | 11 | 6/17/2015 | 12.85 | 205.87 |
| SHM-13-02 | 628981 | 3028714 | 218.72 | 13 | 10/20/2015 | 13.05 | 205.67 |
| SHM-13-02 | 628981 | 3028714 | 218.72 | 13 | 12/16/2015 | 12.82 | 205.90 |
| SHM-13-02 | 628981 | 3028714 | 218.72 | 15 | 6/9/2016 | 12.81 | 205.91 |

# Appendix B
# Water Level Data (CD)
# Shepley's Hill Landfill Groundwater Model

| Location Name | X Coordinate (feet) | Y Coordinate (feet) | Measuring Point Elevation (feet amsl) NAVD 1988 | Model Stress Period | Measurement Date | Depth to Water (feet) | Groundwater Elevation (feet amsl) NAVD 1988 |
|---|---|---|---|---|---|---|---|
| SHM-13-03 | 629173 | 3028991 | 212.05 | 3 | 5/15/2013 | 5.10 | 206.95 |
| SHM-13-03 | 629173 | 3028991 | 212.05 | 3 | 5/29/2013 | 5.83 | 206.22 |
| SHM-13-03 | 629173 | 3028991 | 212.05 | 3 | 6/11/2013 | 4.23 | 207.82 |
| SHM-13-03 | 629173 | 3028991 | 212.05 | 7 | 4/22/2014 | 4.33 | 207.72 |
| SHM-13-03 | 629173 | 3028991 | 212.05 | 7 | 4/23/2014 | 4.35 | 207.70 |
| SHM-13-03 | 629173 | 3028991 | 212.05 | 9 | 10/6/2014 | 5.12 | 206.93 |
| SHM-13-03 | 629173 | 3028991 | 212.05 | 11 | 6/2/2015 | 5.14 | 206.91 |
| SHM-13-03 | 629173 | 3028991 | 212.05 | 11 | 6/8/2015 | 5.40 | 206.65 |
| SHM-13-03 | 629173 | 3028991 | 212.05 | 11 | 6/17/2015 | 5.56 | 206.49 |
| SHM-13-03 | 629173 | 3028991 | 212.05 | 13 | 10/20/2015 | 5.75 | 206.30 |
| SHM-13-03 | 629173 | 3028991 | 212.05 | 15 | 6/9/2016 | 5.29 | 206.76 |
| SHM-13-03 | 629173 | 3028991 | 212.05 | 15 | 6/23/2016 | 5.42 | 206.63 |
| SHM-13-04 | 629480 | 3028606 | 227.02 | 3 | 5/15/2013 | 19.15 | 207.87 |
| SHM-13-04 | 629480 | 3028606 | 227.02 | 3 | 5/28/2013 | 18.95 | 208.07 |
| SHM-13-04 | 629480 | 3028606 | 227.02 | 3 | 6/11/2013 | 18.49 | 208.53 |
| SHM-13-04 | 629480 | 3028606 | 227.02 | 7 | 4/22/2014 | 17.79 | 209.23 |
| SHM-13-04 | 629480 | 3028606 | 227.02 | 7 | 4/24/2014 | 17.90 | 209.12 |
| SHM-13-04 | 629480 | 3028606 | 227.02 | 9 | 10/6/2014 | 19.55 | 207.47 |
| SHM-13-04 | 629480 | 3028606 | 227.02 | 11 | 6/2/2015 | 19.00 | 208.02 |
| SHM-13-04 | 629480 | 3028606 | 227.02 | 11 | 6/9/2015 | 18.90 | 208.12 |
| SHM-13-04 | 629480 | 3028606 | 227.02 | 11 | 6/17/2015 | 19.12 | 207.90 |
| SHM-13-04 | 629480 | 3028606 | 227.02 | 13 | 10/20/2015 | 19.60 | 207.42 |
| SHM-13-04 | 629480 | 3028606 | 227.02 | 13 | 12/16/2015 | 19.32 | 207.70 |
| SHM-13-04 | 629480 | 3028606 | 227.02 | 15 | 6/9/2016 | 19.15 | 207.87 |
| SHM-13-04 | 629480 | 3028606 | 227.02 | 15 | 6/24/2016 | 19.29 | 207.73 |
| SHM-13-04 | 629480 | 3028606 | 227.02 | 16 | 8/16/2016 | 19.80 | 207.22 |
| SHM-13-05 | 629829 | 3028777 | 225.14 | 3 | 5/15/2013 | 16.78 | 208.36 |
| SHM-13-05 | 629829 | 3028777 | 225.14 | 3 | 5/28/2013 | 16.55 | 208.59 |
| SHM-13-05 | 629829 | 3028777 | 225.14 | 3 | 6/11/2013 | 15.99 | 209.15 |
| SHM-13-05 | 629829 | 3028777 | 225.14 | 7 | 4/22/2014 | 15.50 | 209.64 |
| SHM-13-05 | 629829 | 3028777 | 225.14 | 9 | 10/6/2014 | 17.95 | 207.19 |
| SHM-13-05 | 629829 | 3028777 | 225.14 | 11 | 6/2/2015 | 16.41 | 208.73 |
| SHM-13-05 | 629829 | 3028777 | 225.14 | 11 | 6/17/2015 | 16.63 | 208.51 |
| SHM-13-05 | 629829 | 3028777 | 225.14 | 13 | 10/20/2015 | 17.00 | 208.14 |
| SHM-13-05 | 629829 | 3028777 | 225.14 | 13 | 12/16/2015 | 16.77 | 208.37 |
| SHM-13-05 | 629829 | 3028777 | 225.14 | 15 | 6/9/2016 | 16.62 | 208.52 |
| SHM-13-05 | 629829 | 3028777 | 225.14 | 16 | 8/16/2016 | 17.25 | 207.89 |
| SHM-13-06 | 629245 | 3028695 | 223.89 | 3 | 6/11/2013 | 16.39 | 207.50 |
| SHM-13-06 | 629245 | 3028695 | 223.89 | 3 | 6/13/2013 | 15.93 | 207.96 |
| SHM-13-06 | 629245 | 3028695 | 223.89 | 7 | 4/22/2014 | 16.32 | 207.57 |
| SHM-13-06 | 629245 | 3028695 | 223.89 | 7 | 4/24/2014 | 16.40 | 207.49 |
| SHM-13-06 | 629245 | 3028695 | 223.89 | 9 | 10/6/2014 | 17.55 | 206.34 |
| SHM-13-06 | 629245 | 3028695 | 223.89 | 11 | 6/2/2015 | 17.03 | 206.86 |
| SHM-13-06 | 629245 | 3028695 | 223.89 | 11 | 6/8/2015 | 17.11 | 206.78 |
| SHM-13-06 | 629245 | 3028695 | 223.89 | 11 | 6/17/2015 | 17.36 | 206.53 |
| SHM-13-06 | 629245 | 3028695 | 223.89 | 13 | 12/16/2015 | 17.39 | 206.50 |
| SHM-13-06 | 629245 | 3028695 | 223.89 | 13 | 12/22/2015 | 17.44 | 206.45 |
| SHM-13-06 | 629245 | 3028695 | 223.89 | 15 | 6/9/2016 | 17.29 | 206.60 |
| SHM-13-06 | 629245 | 3028695 | 223.89 | 15 | 6/24/2016 | 17.47 | 206.42 |
| SHM-13-07 | 629331 | 3028761 | 225.64 | 7 | 4/22/2014 | 17.79 | 207.85 |

# Appendix B
# Water Level Data (CD)
# Shepley's Hill Landfill Groundwater Model

| Location Name | X Coordinate (feet) | Y Coordinate (feet) | Measuring Point Elevation (feet amsl) NAVD 1988 | Model Stress Period | Measurement Date | Depth to Water (feet) | Groundwater Elevation (feet amsl) NAVD 1988 |
|---|---|---|---|---|---|---|---|
| SHM-13-07 | 629331 | 3028761 | 225.64 | 7 | 4/24/2014 | 17.85 | 207.79 |
| SHM-13-07 | 629331 | 3028761 | 225.64 | 9 | 10/6/2014 | 18.97 | 206.67 |
| SHM-13-07 | 629331 | 3028761 | 225.64 | 11 | 6/2/2015 | 18.35 | 207.29 |
| SHM-13-07 | 629331 | 3028761 | 225.64 | 11 | 6/8/2015 | 18.55 | 207.09 |
| SHM-13-07 | 629331 | 3028761 | 225.64 | 11 | 6/17/2015 | 18.79 | 206.85 |
| SHM-13-07 | 629331 | 3028761 | 225.64 | 13 | 10/20/2015 | 19.08 | 206.56 |
| SHM-13-07 | 629331 | 3028761 | 225.64 | 13 | 12/16/2015 | 18.83 | 206.81 |
| SHM-13-07 | 629331 | 3028761 | 225.64 | 15 | 6/9/2016 | 18.71 | 206.93 |
| SHM-13-07 | 629331 | 3028761 | 225.64 | 15 | 6/24/2016 | 18.87 | 206.77 |
| SHM-13-08 | 629515 | 3028838 | 227.90 | 3 | 6/11/2013 | 19.71 | 208.19 |
| SHM-13-08 | 629515 | 3028838 | 227.90 | 3 | 6/13/2013 | 19.34 | 208.56 |
| SHM-13-08 | 629515 | 3028838 | 227.90 | 7 | 4/22/2014 | 19.33 | 208.57 |
| SHM-13-08 | 629515 | 3028838 | 227.90 | 7 | 4/24/2014 | 19.35 | 208.55 |
| SHM-13-08 | 629515 | 3028838 | 227.90 | 9 | 10/6/2014 | 19.69 | 208.21 |
| SHM-13-08 | 629515 | 3028838 | 227.90 | 11 | 6/2/2015 | 20.07 | 207.83 |
| SHM-13-08 | 629515 | 3028838 | 227.90 | 11 | 6/8/2015 | 21.08 | 206.82 |
| SHM-13-08 | 629515 | 3028838 | 227.90 | 11 | 6/17/2015 | 20.30 | 207.60 |
| SHM-13-08 | 629515 | 3028838 | 227.90 | 13 | 10/20/2015 | 20.60 | 207.30 |
| SHM-13-08 | 629515 | 3028838 | 227.90 | 13 | 12/16/2015 | 20.37 | 207.53 |
| SHM-13-08 | 629515 | 3028838 | 227.90 | 15 | 6/9/2016 | 20.20 | 207.70 |
| SHM-13-08 | 629515 | 3028838 | 227.90 | 15 | 6/24/2016 | 20.33 | 207.57 |
| SHM-13-14D | 629392 | 3029017 | 210.68 | 6 | 2/19/2014 | 3.52 | 207.16 |
| SHM-13-14D | 629392 | 3029017 | 210.68 | 7 | 4/23/2014 | 2.91 | 207.77 |
| SHM-13-14D | 629392 | 3029017 | 210.68 | 9 | 10/6/2014 | 3.60 | 207.08 |
| SHM-13-14D | 629392 | 3029017 | 210.68 | 15 | 6/9/2016 | 3.34 | 207.34 |
| SHM-13-14S | 629392 | 3029021 | 211.03 | 7 | 4/23/2014 | 3.36 | 207.67 |
| SHM-13-14S | 629392 | 3029021 | 211.03 | 9 | 10/6/2014 | 3.80 | 207.23 |
| SHM-13-14S | 629392 | 3029021 | 211.03 | 15 | 6/9/2016 | 3.52 | 207.51 |
| SHM-13-15 | 629273 | 3029072 | 210.58 | 6 | 2/19/2014 | 3.66 | 206.92 |
| SHM-13-15 | 629273 | 3029072 | 210.58 | 7 | 4/23/2014 | 3.11 | 207.47 |
| SHM-13-15 | 629273 | 3029072 | 210.58 | 9 | 10/6/2014 | 3.81 | 206.77 |
| SHM-13-15 | 629273 | 3029072 | 210.58 | 15 | 6/9/2016 | 3.55 | 207.03 |
| SHM-93-01A | 630677 | 3026712 | 242.42 | 13 | 10/7/2015 | 23.21 | 219.21 |
| SHM-93-10C | 630886 | 3026846 | 247.68 | 1 | 11/5/2012 | 28.93 | 218.75 |
| SHM-93-10C | 630886 | 3026846 | 247.68 | 1 | 11/6/2012 | 28.90 | 218.78 |
| SHM-93-10C | 630886 | 3026846 | 247.68 | 3 | 5/15/2013 | 29.45 | 218.23 |
| SHM-93-10C | 630886 | 3026846 | 247.68 | 3 | 6/11/2013 | 28.47 | 219.21 |
| SHM-93-10C | 630886 | 3026846 | 247.68 | 7 | 4/22/2014 | 29.03 | 218.65 |
| SHM-93-10C | 630886 | 3026846 | 247.68 | 9 | 10/6/2014 | 29.75 | 217.93 |
| SHM-93-10C | 630886 | 3026846 | 247.68 | 13 | 10/20/2015 | 29.52 | 218.16 |
| SHM-93-18B | 631180 | 3026453 | 237.31 | 1 | 11/5/2012 | 18.35 | 218.96 |
| SHM-93-18B | 631180 | 3026453 | 237.31 | 1 | 11/6/2012 | 18.35 | 218.96 |
| SHM-93-18B | 631180 | 3026453 | 237.31 | 3 | 5/15/2013 | 19.12 | 218.19 |
| SHM-93-18B | 631180 | 3026453 | 237.31 | 3 | 6/11/2013 | 17.96 | 219.35 |
| SHM-93-18B | 631180 | 3026453 | 237.31 | 7 | 4/22/2014 | 18.39 | 218.92 |
| SHM-93-18B | 631180 | 3026453 | 237.31 | 9 | 10/6/2014 | 19.30 | 218.01 |
| SHM-93-18B | 631180 | 3026453 | 237.31 | 11 | 6/17/2015 | 19.14 | 218.17 |
| SHM-93-18B | 631180 | 3026453 | 237.31 | 12 | 8/18/2015 | 19.32 | 217.99 |
| SHM-93-18B | 631180 | 3026453 | 237.31 | 13 | 10/7/2015 | 19.52 | 217.80 |
| SHM-93-18B | 631180 | 3026453 | 237.31 | 13 | 10/20/2015 | 19.05 | 218.26 |

# Appendix B
# Water Level Data (CD)
# Shepley's Hill Landfill Groundwater Model

| Location Name | X Coordinate (feet) | Y Coordinate (feet) | Measuring Point Elevation (feet amsl) NAVD 1988 | Model Stress Period | Measurement Date | Depth to Water (feet) | Groundwater Elevation (feet amsl) NAVD 1988 |
|---|---|---|---|---|---|---|---|
| SHM-93-18B | 631180 | 3026453 | 237.31 | 13 | 12/16/2015 | 19.54 | 217.77 |
| SHM-93-18B | 631180 | 3026453 | 237.31 | 15 | 6/9/2016 | 19.26 | 218.05 |
| SHM-93-18B | 631180 | 3026453 | 237.31 | 15 | 6/24/2016 | 19.45 | 217.86 |
| SHM-93-18B | 631180 | 3026453 | 237.31 | 16 | 8/16/2016 | 19.70 | 217.61 |
| SHM-93-18B | 631180 | 3026453 | 237.31 | 17 | 11/15/2016 | 19.07 | 218.24 |
| SHM-93-22B | 630072 | 3028170 | 219.39 | 1 | 11/5/2012 | 7.15 | 212.24 |
| SHM-93-22B | 630072 | 3028170 | 219.39 | 1 | 11/6/2012 | 7.17 | 212.22 |
| SHM-93-22B | 630072 | 3028170 | 219.39 | 2 | 3/13/2013 | 6.63 | 212.76 |
| SHM-93-22B | 630072 | 3028170 | 219.39 | 3 | 4/23/2013 | 7.34 | 212.05 |
| SHM-93-22B | 630072 | 3028170 | 219.39 | 3 | 4/25/2013 | 7.36 | 212.03 |
| SHM-93-22B | 630072 | 3028170 | 219.39 | 3 | 5/15/2013 | 8.92 | 210.47 |
| SHM-93-22B | 630072 | 3028170 | 219.39 | 3 | 5/30/2013 | 7.03 | 212.36 |
| SHM-93-22B | 630072 | 3028170 | 219.39 | 3 | 6/11/2013 | 6.53 | 212.86 |
| SHM-93-22B | 630072 | 3028170 | 219.39 | 7 | 4/22/2014 | 9.30 | 210.09 |
| SHM-93-22B | 630072 | 3028170 | 219.39 | 7 | 4/24/2014 | 6.40 | 212.99 |
| SHM-93-22B | 630072 | 3028170 | 219.39 | 9 | 10/6/2014 | 8.74 | 210.65 |
| SHM-93-22B | 630072 | 3028170 | 219.39 | 11 | 6/8/2015 | 7.87 | 211.52 |
| SHM-93-22B | 630072 | 3028170 | 219.39 | 13 | 10/20/2015 | 9.00 | 210.39 |
| SHM-93-22B | 630072 | 3028170 | 219.39 | 13 | 12/16/2015 | 8.42 | 210.97 |
| SHM-93-22B | 630072 | 3028170 | 219.39 | 15 | 6/23/2016 | 8.43 | 210.96 |
| SHM-93-22B | 630072 | 3028170 | 219.39 | 16 | 8/16/2016 | 9.06 | 210.33 |
| SHM-93-22B | 630072 | 3028170 | 219.39 | 17 | 10/20/2016 | 9.17 | 210.22 |
| SHM-93-22B | 630072 | 3028170 | 219.39 | 17 | 11/16/2016 | 8.02 | 211.37 |
| SHM-93-22C | 630046 | 3028159 | 220.69 | 1 | 11/5/2012 | 8.33 | 212.36 |
| SHM-93-22C | 630046 | 3028159 | 220.69 | 1 | 11/6/2012 | 8.35 | 212.34 |
| SHM-93-22C | 630046 | 3028159 | 220.69 | 2 | 3/13/2013 | 7.06 | 213.63 |
| SHM-93-22C | 630046 | 3028159 | 220.69 | 3 | 4/23/2013 | 8.47 | 212.22 |
| SHM-93-22C | 630046 | 3028159 | 220.69 | 3 | 5/15/2013 | 9.10 | 211.59 |
| SHM-93-22C | 630046 | 3028159 | 220.69 | 3 | 5/30/2013 | 8.57 | 212.12 |
| SHM-93-22C | 630046 | 3028159 | 220.69 | 3 | 6/11/2013 | 7.81 | 212.88 |
| SHM-93-22C | 630046 | 3028159 | 220.69 | 7 | 4/22/2014 | 7.42 | 213.27 |
| SHM-93-22C | 630046 | 3028159 | 220.69 | 7 | 4/24/2014 | 7.57 | 213.12 |
| SHM-93-22C | 630046 | 3028159 | 220.69 | 9 | 10/6/2014 | 9.95 | 210.74 |
| SHM-93-22C | 630046 | 3028159 | 220.69 | 13 | 10/20/2015 | 10.19 | 210.50 |
| SHM-93-22C | 630046 | 3028159 | 220.69 | 13 | 12/16/2015 | 9.68 | 211.01 |
| SHM-93-22C | 630046 | 3028159 | 220.69 | 16 | 8/16/2016 | 10.38 | 210.31 |
| SHM-93-22C | 630046 | 3028159 | 220.69 | 17 | 11/16/2016 | 9.27 | 211.42 |
| SHM-93-24A | 631308 | 3025647 | 238.42 | 1 | 11/6/2012 | 16.05 | 222.37 |
| SHM-93-24A | 631308 | 3025647 | 238.42 | 3 | 4/25/2013 | 16.38 | 222.04 |
| SHM-93-24A | 631308 | 3025647 | 238.42 | 3 | 5/15/2013 | 16.64 | 221.78 |
| SHM-93-24A | 631308 | 3025647 | 238.42 | 3 | 6/11/2013 | 15.00 | 223.42 |
| SHM-93-24A | 631308 | 3025647 | 238.42 | 7 | 4/22/2014 | 16.07 | 222.35 |
| SHM-93-24A | 631308 | 3025647 | 238.42 | 11 | 6/17/2015 | 16.31 | 222.11 |
| SHM-93-24A | 631308 | 3025647 | 238.42 | 13 | 10/7/2015 | 17.12 | 221.30 |
| SHM-93-24A | 631308 | 3025647 | 238.42 | 13 | 12/16/2015 | 17.31 | 221.11 |
| SHM-93-24A | 631308 | 3025647 | 238.42 | 15 | 6/9/2016 | 17.02 | 221.40 |
| SHM-93-24A | 631308 | 3025647 | 238.42 | 15 | 6/24/2016 | 17.25 | 221.17 |
| SHM-93-24A | 631308 | 3025647 | 238.42 | 16 | 8/16/2016 | 17.35 | 221.07 |
| SHM-93-24A | 631308 | 3025647 | 238.42 | 17 | 11/15/2016 | 17.35 | 221.07 |
| SHM-96-5B | 630158 | 3028113 | 218.92 | 1 | 11/5/2012 | 6.26 | 212.66 |

# Appendix B
# Water Level Data (CD)
# Shepley's Hill Landfill Groundwater Model

| Location Name | X Coordinate (feet) | Y Coordinate (feet) | Measuring Point Elevation (feet amsl) NAVD 1988 | Model Stress Period | Measurement Date | Depth to Water (feet) | Groundwater Elevation (feet amsl) NAVD 1988 |
|---|---|---|---|---|---|---|---|
| SHM-96-5B | 630158 | 3028113 | 218.92 | 1 | 11/6/2012 | 6.29 | 212.63 |
| SHM-96-5B | 630158 | 3028113 | 218.92 | 2 | 3/13/2013 | 5.82 | 213.10 |
| SHM-96-5B | 630158 | 3028113 | 218.92 | 3 | 4/23/2013 | 6.48 | 212.44 |
| SHM-96-5B | 630158 | 3028113 | 218.92 | 3 | 4/25/2013 | 6.51 | 212.41 |
| SHM-96-5B | 630158 | 3028113 | 218.92 | 3 | 5/15/2013 | 7.01 | 211.91 |
| SHM-96-5B | 630158 | 3028113 | 218.92 | 3 | 5/21/2013 | 6.91 | 212.01 |
| SHM-96-5B | 630158 | 3028113 | 218.92 | 3 | 5/30/2013 | 6.14 | 212.78 |
| SHM-96-5B | 630158 | 3028113 | 218.92 | 3 | 6/11/2013 | 6.56 | 212.36 |
| SHM-96-5B | 630158 | 3028113 | 218.92 | 7 | 4/22/2014 | 5.73 | 213.19 |
| SHM-96-5B | 630158 | 3028113 | 218.92 | 7 | 5/21/2014 | 6.19 | 212.73 |
| SHM-96-5B | 630158 | 3028113 | 218.92 | 9 | 10/6/2014 | 7.77 | 211.15 |
| SHM-96-5B | 630158 | 3028113 | 218.92 | 11 | 6/5/2015 | 6.68 | 212.24 |
| SHM-96-5B | 630158 | 3028113 | 218.92 | 13 | 10/20/2015 | 7.82 | 211.10 |
| SHM-96-5B | 630158 | 3028113 | 218.92 | 13 | 12/16/2015 | 7.53 | 211.39 |
| SHM-96-5B | 630158 | 3028113 | 218.92 | 15 | 6/23/2016 | 7.51 | 211.41 |
| SHM-96-5B | 630158 | 3028113 | 218.92 | 16 | 8/16/2016 | 8.17 | 210.75 |
| SHM-96-5B | 630158 | 3028113 | 218.92 | 17 | 10/20/2016 | 8.26 | 210.66 |
| SHM-96-5B | 630158 | 3028113 | 218.92 | 17 | 11/15/2016 | 7.09 | 211.83 |
| SHM-96-5C | 630173 | 3028105 | 218.39 | 1 | 11/5/2012 | 5.69 | 212.70 |
| SHM-96-5C | 630173 | 3028105 | 218.39 | 1 | 11/6/2012 | 5.73 | 212.66 |
| SHM-96-5C | 630173 | 3028105 | 218.39 | 2 | 3/13/2013 | 5.26 | 213.13 |
| SHM-96-5C | 630173 | 3028105 | 218.39 | 3 | 4/23/2013 | 5.97 | 212.42 |
| SHM-96-5C | 630173 | 3028105 | 218.39 | 3 | 5/15/2013 | 6.46 | 211.93 |
| SHM-96-5C | 630173 | 3028105 | 218.39 | 3 | 5/30/2013 | 5.58 | 212.81 |
| SHM-96-5C | 630173 | 3028105 | 218.39 | 3 | 6/11/2013 | 5.04 | 213.35 |
| SHM-96-5C | 630173 | 3028105 | 218.39 | 7 | 4/22/2014 | 5.00 | 213.39 |
| SHM-96-5C | 630173 | 3028105 | 218.39 | 9 | 10/6/2014 | 7.22 | 211.17 |
| SHM-96-5C | 630173 | 3028105 | 218.39 | 13 | 10/20/2015 | 7.35 | 211.04 |
| SHM-96-5C | 630173 | 3028105 | 218.39 | 13 | 12/16/2015 | 6.98 | 211.41 |
| SHM-96-5C | 630173 | 3028105 | 218.39 | 16 | 8/16/2016 | 7.61 | 210.78 |
| SHM-96-5C | 630173 | 3028105 | 218.39 | 17 | 11/15/2016 | 6.57 | 211.82 |
| SHM-99-31A | 629895 | 3028559 | 214.34 | 1 | 11/5/2012 | 2.10 | 212.24 |
| SHM-99-31A | 629895 | 3028559 | 214.34 | 3 | 4/25/2013 | 3.17 | 211.17 |
| SHM-99-31A | 629895 | 3028559 | 214.34 | 3 | 5/30/2013 | 2.13 | 212.21 |
| SHM-99-31A | 629895 | 3028559 | 214.34 | 9 | 10/6/2014 | 4.42 | 209.92 |
| SHM-99-31A | 629895 | 3028559 | 214.34 | 13 | 12/16/2015 | 3.57 | 210.77 |
| SHM-99-31A | 629895 | 3028559 | 214.34 | 16 | 8/16/2016 | 4.83 | 209.51 |
| SHM-99-31B | 629901 | 3028559 | 214.39 | 1 | 11/5/2012 | 3.86 | 210.53 |
| SHM-99-31B | 629901 | 3028559 | 214.39 | 3 | 5/30/2013 | 3.83 | 210.56 |
| SHM-99-31B | 629901 | 3028559 | 214.39 | 9 | 10/6/2014 | 4.85 | 209.54 |
| SHM-99-31B | 629901 | 3028559 | 214.39 | 13 | 12/16/2015 | 4.56 | 209.83 |
| SHM-99-31B | 629901 | 3028559 | 214.39 | 16 | 8/16/2016 | 5.15 | 209.24 |
| SHM-99-31C | 629909 | 3028562 | 214.60 | 1 | 11/5/2012 | 4.13 | 210.47 |
| SHM-99-31C | 629909 | 3028562 | 214.60 | 3 | 4/25/2013 | 4.34 | 210.26 |
| SHM-99-31C | 629909 | 3028562 | 214.60 | 3 | 5/30/2013 | 4.13 | 210.47 |
| SHM-99-31C | 629909 | 3028562 | 214.60 | 9 | 10/6/2014 | 5.10 | 209.50 |
| SHM-99-31C | 629909 | 3028562 | 214.60 | 13 | 12/16/2015 | 4.85 | 209.75 |
| SHM-99-31C | 629909 | 3028562 | 214.60 | 16 | 8/16/2016 | 5.45 | 209.15 |
| SHM-99-31C | 629909 | 3028562 | 214.60 | 17 | 10/20/2016 | 5.48 | 209.13 |
| SHM-99-32X | 630169 | 3028575 | 221.28 | 1 | 11/5/2012 | 9.70 | 211.58 |

# Appendix B
# Water Level Data (CD)
# Shepley's Hill Landfill Groundwater Model

| Location Name | X Coordinate (feet) | Y Coordinate (feet) | Measuring Point Elevation (feet amsl) NAVD 1988 | Model Stress Period | Measurement Date | Depth to Water (feet) | Groundwater Elevation (feet amsl) NAVD 1988 |
|---|---|---|---|---|---|---|---|
| SHM-99-32X | 630169 | 3028575 | 221.28 | 3 | 4/25/2013 | 9.95 | 211.33 |
| SHM-99-32X | 630169 | 3028575 | 221.28 | 3 | 5/15/2013 | 10.32 | 210.96 |
| SHM-99-32X | 630169 | 3028575 | 221.28 | 3 | 5/30/2013 | 9.65 | 211.63 |
| SHM-99-32X | 630169 | 3028575 | 221.28 | 3 | 6/11/2013 | 9.09 | 212.19 |
| SHM-99-32X | 630169 | 3028575 | 221.28 | 7 | 4/22/2014 | 8.98 | 212.30 |
| SHM-99-32X | 630169 | 3028575 | 221.28 | 9 | 10/6/2014 | 10.75 | 210.53 |
| SHM-99-32X | 630169 | 3028575 | 221.28 | 11 | 6/17/2015 | 10.23 | 211.05 |
| SHM-99-32X | 630169 | 3028575 | 221.28 | 13 | 10/20/2015 | 10.80 | 210.48 |
| SHM-99-32X | 630169 | 3028575 | 221.28 | 13 | 12/16/2015 | 10.41 | 210.87 |
| SHM-99-32X | 630169 | 3028575 | 221.28 | 15 | 6/9/2016 | 10.25 | 211.03 |
| SHM-99-32X | 630169 | 3028575 | 221.28 | 16 | 8/16/2016 | 11.07 | 210.21 |
| SHM-99-32X | 630169 | 3028575 | 221.28 | 17 | 10/20/2016 | 11.12 | 210.16 |
| SHM-99-32X | 630169 | 3028575 | 221.28 | 17 | 11/16/2016 | 10.00 | 211.28 |
| SHP-01-36X | 630738 | 3027689 | 223.95 | 1 | 11/5/2012 | 7.27 | 216.68 |
| SHP-01-36X | 630738 | 3027689 | 223.95 | 1 | 11/6/2012 | 7.24 | 216.71 |
| SHP-01-36X | 630738 | 3027689 | 223.95 | 3 | 4/25/2013 | 7.76 | 216.19 |
| SHP-01-36X | 630738 | 3027689 | 223.95 | 3 | 5/15/2013 | 7.55 | 216.40 |
| SHP-01-36X | 630738 | 3027689 | 223.95 | 3 | 6/11/2013 | 6.43 | 217.52 |
| SHP-01-36X | 630738 | 3027689 | 223.95 | 7 | 4/22/2014 | 7.39 | 216.56 |
| SHP-01-36X | 630738 | 3027689 | 223.95 | 9 | 10/6/2014 | 6.89 | 217.06 |
| SHP-01-36X | 630738 | 3027689 | 223.95 | 11 | 6/3/2015 | 7.07 | 216.88 |
| SHP-01-36X | 630738 | 3027689 | 223.95 | 11 | 6/17/2015 | 7.64 | 216.31 |
| SHP-01-36X | 630738 | 3027689 | 223.95 | 12 | 8/18/2015 | 7.75 | 216.20 |
| SHP-01-36X | 630738 | 3027689 | 223.95 | 13 | 10/7/2015 | 7.66 | 216.29 |
| SHP-01-36X | 630738 | 3027689 | 223.95 | 13 | 10/20/2015 | 6.42 | 217.53 |
| SHP-01-36X | 630738 | 3027689 | 223.95 | 13 | 12/16/2015 | 7.67 | 216.28 |
| SHP-01-36X | 630738 | 3027689 | 223.95 | 15 | 6/9/2016 | 7.45 | 216.50 |
| SHP-01-36X | 630738 | 3027689 | 223.95 | 16 | 8/16/2016 | 7.89 | 216.06 |
| SHP-01-36X | 630738 | 3027689 | 223.95 | 17 | 10/20/2016 | 7.83 | 216.13 |
| SHP-01-36X | 630738 | 3027689 | 223.95 | 17 | 11/15/2016 | 6.93 | 217.02 |
| SHP-01-37X | 630697 | 3027498 | 222.79 | 1 | 11/5/2012 | 5.98 | 216.81 |
| SHP-01-37X | 630697 | 3027498 | 222.79 | 1 | 11/6/2012 | 5.94 | 216.85 |
| SHP-01-37X | 630697 | 3027498 | 222.79 | 3 | 4/25/2013 | 6.47 | 216.32 |
| SHP-01-37X | 630697 | 3027498 | 222.79 | 3 | 5/15/2013 | 6.21 | 216.58 |
| SHP-01-37X | 630697 | 3027498 | 222.79 | 3 | 6/11/2013 | 5.15 | 217.64 |
| SHP-01-37X | 630697 | 3027498 | 222.79 | 7 | 4/22/2014 | 6.12 | 216.67 |
| SHP-01-37X | 630697 | 3027498 | 222.79 | 9 | 10/6/2014 | 5.61 | 217.18 |
| SHP-01-37X | 630697 | 3027498 | 222.79 | 11 | 6/3/2015 | 5.84 | 216.95 |
| SHP-01-37X | 630697 | 3027498 | 222.79 | 11 | 6/17/2015 | 6.40 | 216.39 |
| SHP-01-37X | 630697 | 3027498 | 222.79 | 12 | 8/18/2015 | 6.52 | 216.28 |
| SHP-01-37X | 630697 | 3027498 | 222.79 | 13 | 10/7/2015 | 6.38 | 216.41 |
| SHP-01-37X | 630697 | 3027498 | 222.79 | 13 | 10/20/2015 | 5.42 | 217.37 |
| SHP-01-37X | 630697 | 3027498 | 222.79 | 13 | 12/16/2015 | 6.38 | 216.41 |
| SHP-01-37X | 630697 | 3027498 | 222.79 | 15 | 4/6/2016 | 6.35 | 216.44 |
| SHP-01-37X | 630697 | 3027498 | 222.79 | 15 | 6/9/2016 | 6.22 | 216.57 |
| SHP-01-37X | 630697 | 3027498 | 222.79 | 16 | 8/16/2016 | 6.61 | 216.18 |
| SHP-01-37X | 630697 | 3027498 | 222.79 | 17 | 10/20/2016 | 6.52 | 216.27 |
| SHP-01-37X | 630697 | 3027498 | 222.79 | 17 | 11/15/2016 | 5.66 | 217.13 |
| SHP-01-38A | 630546 | 3027171 | 220.86 | 1 | 11/5/2012 | 3.86 | 217.00 |
| SHP-01-38A | 630546 | 3027171 | 220.86 | 3 | 4/25/2013 | 4.31 | 216.55 |

# Appendix B
# Water Level Data (CD)
# Shepley's Hill Landfill Groundwater Model

| Location Name | X Coordinate (feet) | Y Coordinate (feet) | Measuring Point Elevation (feet amsl) NAVD 1988 | Model Stress Period | Measurement Date | Depth to Water (feet) | Groundwater Elevation (feet amsl) NAVD 1988 |
|---|---|---|---|---|---|---|---|
| SHP-01-38A | 630546 | 3027171 | 220.86 | 3 | 5/15/2013 | 4.11 | 216.75 |
| SHP-01-38A | 630546 | 3027171 | 220.86 | 3 | 5/23/2013 | 3.80 | 217.06 |
| SHP-01-38A | 630546 | 3027171 | 220.86 | 3 | 5/30/2013 | 3.59 | 217.27 |
| SHP-01-38A | 630546 | 3027171 | 220.86 | 3 | 6/11/2013 | 3.06 | 217.80 |
| SHP-01-38A | 630546 | 3027171 | 220.86 | 7 | 4/22/2014 | 3.97 | 216.89 |
| SHP-01-38A | 630546 | 3027171 | 220.86 | 9 | 10/6/2014 | 3.69 | 217.17 |
| SHP-01-38A | 630546 | 3027171 | 220.86 | 11 | 6/3/2015 | 3.67 | 217.19 |
| SHP-01-38A | 630546 | 3027171 | 220.86 | 11 | 6/17/2015 | 4.26 | 216.60 |
| SHP-01-38A | 630546 | 3027171 | 220.86 | 12 | 8/18/2015 | 4.39 | 216.47 |
| SHP-01-38A | 630546 | 3027171 | 220.86 | 13 | 10/7/2015 | 4.31 | 216.55 |
| SHP-01-38A | 630546 | 3027171 | 220.86 | 13 | 10/20/2015 | 3.45 | 217.41 |
| SHP-01-38A | 630546 | 3027171 | 220.86 | 13 | 12/16/2015 | 4.30 | 216.56 |
| SHP-01-38A | 630546 | 3027171 | 220.86 | 15 | 4/6/2016 | 4.13 | 216.73 |
| SHP-01-38A | 630546 | 3027171 | 220.86 | 15 | 6/9/2016 | 4.12 | 216.74 |
| SHP-01-38A | 630546 | 3027171 | 220.86 | 16 | 8/16/2016 | 4.55 | 216.31 |
| SHP-01-38A | 630546 | 3027171 | 220.86 | 17 | 10/20/2016 | 4.50 | 216.37 |
| SHP-01-38A | 630546 | 3027171 | 220.86 | 17 | 11/16/2016 | 3.52 | 217.34 |
| SHP-01-38B | 630544 | 3027178 | 221.03 | 1 | 11/5/2012 | 4.00 | 217.03 |
| SHP-01-38B | 630544 | 3027178 | 221.03 | 3 | 5/15/2013 | 4.23 | 216.80 |
| SHP-01-38B | 630544 | 3027178 | 221.03 | 3 | 5/23/2013 | 3.98 | 217.05 |
| SHP-01-38B | 630544 | 3027178 | 221.03 | 3 | 6/11/2013 | 3.19 | 217.84 |
| SHP-01-38B | 630544 | 3027178 | 221.03 | 7 | 4/22/2014 | 4.10 | 216.93 |
| SHP-01-38B | 630544 | 3027178 | 221.03 | 9 | 10/6/2014 | 3.87 | 217.16 |
| SHP-01-38B | 630544 | 3027178 | 221.03 | 11 | 6/3/2015 | 3.84 | 217.19 |
| SHP-01-38B | 630544 | 3027178 | 221.03 | 11 | 6/17/2015 | 4.40 | 216.63 |
| SHP-01-38B | 630544 | 3027178 | 221.03 | 12 | 8/18/2015 | 4.52 | 216.51 |
| SHP-01-38B | 630544 | 3027178 | 221.03 | 13 | 10/20/2015 | 3.61 | 217.42 |
| SHP-01-38B | 630544 | 3027178 | 221.03 | 13 | 12/16/2015 | 4.46 | 216.57 |
| SHP-01-38B | 630544 | 3027178 | 221.03 | 15 | 6/9/2016 | 4.26 | 216.77 |
| SHP-01-38B | 630544 | 3027178 | 221.03 | 16 | 8/16/2016 | 4.70 | 216.33 |
| SHP-05-43 | 630533 | 3027747 | 260.66 | 1 | 11/5/2012 | 44.68 | 215.98 |
| SHP-05-43 | 630533 | 3027747 | 260.66 | 1 | 11/6/2012 | 44.74 | 215.92 |
| SHP-05-43 | 630533 | 3027747 | 260.66 | 2 | 2/14/2013 | 45.28 | 215.38 |
| SHP-05-43 | 630533 | 3027747 | 260.66 | 2 | 3/12/2013 | 44.88 | 215.78 |
| SHP-05-43 | 630533 | 3027747 | 260.66 | 3 | 4/22/2013 | 45.04 | 215.62 |
| SHP-05-43 | 630533 | 3027747 | 260.66 | 3 | 4/25/2013 | 44.97 | 215.69 |
| SHP-05-43 | 630533 | 3027747 | 260.66 | 3 | 5/15/2013 | 45.15 | 215.51 |
| SHP-05-43 | 630533 | 3027747 | 260.66 | 3 | 6/11/2013 | 44.39 | 216.27 |
| SHP-05-43 | 630533 | 3027747 | 260.66 | 7 | 4/22/2014 | 44.52 | 216.14 |
| SHP-05-43 | 630533 | 3027747 | 260.66 | 9 | 10/6/2014 | 45.45 | 215.21 |
| SHP-05-43 | 630533 | 3027747 | 260.66 | 11 | 6/2/2015 | 44.82 | 215.84 |
| SHP-05-43 | 630533 | 3027747 | 260.66 | 11 | 6/17/2015 | 45.15 | 215.51 |
| SHP-05-43 | 630533 | 3027747 | 260.66 | 12 | 8/18/2015 | 45.46 | 215.20 |
| SHP-05-43 | 630533 | 3027747 | 260.66 | 13 | 10/7/2015 | 45.76 | 214.90 |
| SHP-05-43 | 630533 | 3027747 | 260.66 | 13 | 10/20/2015 | 45.35 | 215.31 |
| SHP-05-43 | 630533 | 3027747 | 260.66 | 13 | 12/16/2015 | 45.59 | 215.07 |
| SHP-05-43 | 630533 | 3027747 | 260.66 | 15 | 4/6/2016 | 44.80 | 215.86 |
| SHP-05-43 | 630533 | 3027747 | 260.66 | 15 | 6/9/2016 | 45.26 | 215.40 |
| SHP-05-43 | 630533 | 3027747 | 260.66 | 16 | 8/16/2016 | 45.94 | 214.72 |
| SHP-05-44 | 630588 | 3027588 | 258.08 | 1 | 11/5/2012 | 41.68 | 216.40 |

# Appendix B
# Water Level Data (CD)
# Shepley's Hill Landfill Groundwater Model

| Location Name | X Coordinate (feet) | Y Coordinate (feet) | Measuring Point Elevation (feet amsl) NAVD 1988 | Model Stress Period | Measurement Date | Depth to Water (feet) | Groundwater Elevation (feet amsl) NAVD 1988 |
|---|---|---|---|---|---|---|---|
| SHP-05-44 | 630588 | 3027588 | 258.08 | 1 | 11/6/2012 | 41.70 | 216.38 |
| SHP-05-44 | 630588 | 3027588 | 258.08 | 2 | 2/14/2013 | 42.15 | 215.93 |
| SHP-05-44 | 630588 | 3027588 | 258.08 | 2 | 3/12/2013 | 41.80 | 216.28 |
| SHP-05-44 | 630588 | 3027588 | 258.08 | 3 | 4/22/2013 | 42.01 | 216.07 |
| SHP-05-44 | 630588 | 3027588 | 258.08 | 3 | 4/25/2013 | 41.97 | 216.11 |
| SHP-05-44 | 630588 | 3027588 | 258.08 | 3 | 5/15/2013 | 42.04 | 216.04 |
| SHP-05-44 | 630588 | 3027588 | 258.08 | 3 | 5/30/2013 | 41.45 | 216.63 |
| SHP-05-44 | 630588 | 3027588 | 258.08 | 3 | 6/11/2013 | 41.20 | 216.88 |
| SHP-05-44 | 630588 | 3027588 | 258.08 | 7 | 4/22/2014 | 41.65 | 216.43 |
| SHP-05-44 | 630588 | 3027588 | 258.08 | 9 | 10/6/2014 | 41.99 | 216.09 |
| SHP-05-44 | 630588 | 3027588 | 258.08 | 11 | 6/2/2015 | 41.66 | 216.42 |
| SHP-05-44 | 630588 | 3027588 | 258.08 | 11 | 6/17/2015 | 42.08 | 216.00 |
| SHP-05-44 | 630588 | 3027588 | 258.08 | 12 | 8/18/2015 | 42.29 | 215.79 |
| SHP-05-44 | 630588 | 3027588 | 258.08 | 15 | 4/6/2016 | 41.86 | 216.22 |
| SHP-05-44 | 630588 | 3027588 | 258.08 | 15 | 6/9/2016 | 42.06 | 216.02 |
| SHP-05-44 | 630588 | 3027588 | 258.08 | 16 | 8/16/2016 | 42.61 | 215.47 |
| SHP-05-44 | 630588 | 3027588 | 258.08 | 17 | 10/20/2016 | 42.64 | 215.45 |
| SHP-05-44 | 630588 | 3027588 | 258.08 | 17 | 11/15/2016 | 41.87 | 216.21 |
| SHP-05-45A | 629995 | 3027962 | 228.48 | 1 | 11/5/2012 | 16.12 | 212.36 |
| SHP-05-45A | 629995 | 3027962 | 228.48 | 1 | 11/6/2012 | 16.07 | 212.41 |
| SHP-05-45A | 629995 | 3027962 | 228.48 | 2 | 3/13/2013 | 15.70 | 212.78 |
| SHP-05-45A | 629995 | 3027962 | 228.48 | 3 | 4/23/2013 | 16.24 | 212.24 |
| SHP-05-45A | 629995 | 3027962 | 228.48 | 3 | 4/25/2013 | 16.99 | 211.49 |
| SHP-05-45A | 629995 | 3027962 | 228.48 | 3 | 5/15/2013 | 16.82 | 211.66 |
| SHP-05-45A | 629995 | 3027962 | 228.48 | 3 | 5/30/2013 | 15.97 | 212.51 |
| SHP-05-45A | 629995 | 3027962 | 228.48 | 3 | 6/11/2013 | 15.57 | 212.91 |
| SHP-05-45A | 629995 | 3027962 | 228.48 | 7 | 4/22/2014 | 15.24 | 213.24 |
| SHP-05-45A | 629995 | 3027962 | 228.48 | 9 | 10/6/2014 | 17.89 | 210.59 |
| SHP-05-45A | 629995 | 3027962 | 228.48 | 13 | 10/20/2015 | 18.23 | 210.25 |
| SHP-05-45A | 629995 | 3027962 | 228.48 | 13 | 12/16/2015 | 17.67 | 210.81 |
| SHP-05-45A | 629995 | 3027962 | 228.48 | 16 | 8/16/2016 | 18.33 | 210.15 |
| SHP-05-45A | 629995 | 3027962 | 228.48 | 17 | 10/20/2016 | 18.46 | 210.02 |
| SHP-05-45B | 629995 | 3027957 | 229.11 | 1 | 11/5/2012 | 16.85 | 212.26 |
| SHP-05-45B | 629995 | 3027957 | 229.11 | 1 | 11/6/2012 | 16.91 | 212.20 |
| SHP-05-45B | 629995 | 3027957 | 229.11 | 2 | 3/13/2013 | 16.47 | 212.64 |
| SHP-05-45B | 629995 | 3027957 | 229.11 | 3 | 4/23/2013 | 16.97 | 212.14 |
| SHP-05-45B | 629995 | 3027957 | 229.11 | 3 | 4/25/2013 | 15.67 | 213.44 |
| SHP-05-45B | 629995 | 3027957 | 229.11 | 3 | 5/15/2013 | 17.53 | 211.58 |
| SHP-05-45B | 629995 | 3027957 | 229.11 | 3 | 5/30/2013 | 16.72 | 212.39 |
| SHP-05-45B | 629995 | 3027957 | 229.11 | 3 | 6/11/2013 | 16.25 | 212.86 |
| SHP-05-45B | 629995 | 3027957 | 229.11 | 7 | 4/22/2014 | 15.90 | 213.21 |
| SHP-05-45B | 629995 | 3027957 | 229.11 | 9 | 10/6/2014 | 18.31 | 210.80 |
| SHP-05-45B | 629995 | 3027957 | 229.11 | 13 | 10/20/2015 | 18.75 | 210.36 |
| SHP-05-45B | 629995 | 3027957 | 229.11 | 13 | 12/16/2015 | 18.23 | 210.88 |
| SHP-05-45B | 629995 | 3027957 | 229.11 | 16 | 8/16/2016 | 18.84 | 210.27 |
| SHP-05-45B | 629995 | 3027957 | 229.11 | 17 | 10/20/2016 | 19.04 | 210.07 |
| SHP-05-46A | 630041 | 3027941 | 228.18 | 1 | 11/5/2012 | 15.48 | 212.70 |
| SHP-05-46A | 630041 | 3027941 | 228.18 | 1 | 11/6/2012 | 15.55 | 212.63 |
| SHP-05-46A | 630041 | 3027941 | 228.18 | 2 | 3/13/2013 | 15.15 | 213.03 |
| SHP-05-46A | 630041 | 3027941 | 228.18 | 3 | 4/23/2013 | 15.61 | 212.57 |

# Appendix B
# Water Level Data (CD)
# Shepley's Hill Landfill Groundwater Model

| Location Name | X Coordinate (feet) | Y Coordinate (feet) | Measuring Point Elevation (feet amsl) NAVD 1988 | Model Stress Period | Measurement Date | Depth to Water (feet) | Groundwater Elevation (feet amsl) NAVD 1988 |
|---|---|---|---|---|---|---|---|
| SHP-05-46A | 630041 | 3027941 | 228.18 | 3 | 4/25/2013 | 15.67 | 212.51 |
| SHP-05-46A | 630041 | 3027941 | 228.18 | 3 | 5/15/2013 | 16.23 | 211.95 |
| SHP-05-46A | 630041 | 3027941 | 228.18 | 3 | 5/30/2013 | 15.37 | 212.81 |
| SHP-05-46A | 630041 | 3027941 | 228.18 | 3 | 6/11/2013 | 14.91 | 213.27 |
| SHP-05-46A | 630041 | 3027941 | 228.18 | 7 | 4/22/2014 | 14.70 | 213.48 |
| SHP-05-46A | 630041 | 3027941 | 228.18 | 9 | 10/6/2014 | 17.43 | 210.75 |
| SHP-05-46A | 630041 | 3027941 | 228.18 | 13 | 10/20/2015 | 17.50 | 210.68 |
| SHP-05-46A | 630041 | 3027941 | 228.18 | 13 | 12/16/2015 | 17.01 | 211.17 |
| SHP-05-46A | 630041 | 3027941 | 228.18 | 16 | 8/16/2016 | 17.59 | 210.59 |
| SHP-05-46A | 630041 | 3027941 | 228.18 | 17 | 10/20/2016 | 17.76 | 210.42 |
| SHP-05-46B | 630042 | 3027947 | 227.60 | 1 | 11/6/2012 | 14.92 | 212.68 |
| SHP-05-46B | 630042 | 3027947 | 227.60 | 2 | 3/13/2013 | 14.52 | 213.08 |
| SHP-05-46B | 630042 | 3027947 | 227.60 | 3 | 4/23/2013 | 14.96 | 212.64 |
| SHP-05-46B | 630042 | 3027947 | 227.60 | 3 | 5/30/2013 | 14.73 | 212.87 |
| SHP-05-46B | 630042 | 3027947 | 227.60 | 9 | 10/6/2014 | 17.15 | 210.45 |
| SHP-05-46B | 630042 | 3027947 | 227.60 | 13 | 12/16/2015 | 16.31 | 211.29 |
| SHP-05-46B | 630042 | 3027947 | 227.60 | 16 | 8/16/2016 | 16.86 | 210.74 |
| SHP-05-46B | 630042 | 3027947 | 227.60 | 17 | 10/20/2016 | 17.09 | 210.51 |
| SHP-05-47A | 630523 | 3028226 | 217.39 | 1 | 11/5/2012 | 4.79 | 212.60 |
| SHP-05-47A | 630523 | 3028226 | 217.39 | 1 | 11/6/2012 | 4.63 | 212.76 |
| SHP-05-47A | 630523 | 3028226 | 217.39 | 3 | 5/15/2013 | 5.39 | 212.00 |
| SHP-05-47A | 630523 | 3028226 | 217.39 | 3 | 5/30/2013 | 5.45 | 211.94 |
| SHP-05-47A | 630523 | 3028226 | 217.39 | 7 | 4/22/2014 | 4.69 | 212.70 |
| SHP-05-47A | 630523 | 3028226 | 217.39 | 11 | 6/3/2015 | 4.41 | 212.98 |
| SHP-05-47A | 630523 | 3028226 | 217.39 | 13 | 10/7/2015 | 5.95 | 211.44 |
| SHP-05-47A | 630523 | 3028226 | 217.39 | 13 | 10/20/2015 | 5.06 | 212.33 |
| SHP-05-47A | 630523 | 3028226 | 217.39 | 13 | 12/16/2015 | 4.53 | 212.86 |
| SHP-05-47A | 630523 | 3028226 | 217.39 | 17 | 11/15/2016 | 4.54 | 212.85 |
| SHP-05-47B | 630524 | 3028226 | 215.40 | 1 | 11/5/2012 | 2.63 | 212.77 |
| SHP-05-47B | 630524 | 3028226 | 215.40 | 1 | 11/6/2012 | 2.50 | 212.90 |
| SHP-05-47B | 630524 | 3028226 | 215.40 | 3 | 5/15/2013 | 2.82 | 212.58 |
| SHP-05-47B | 630524 | 3028226 | 215.40 | 3 | 5/30/2013 | 2.74 | 212.66 |
| SHP-05-47B | 630524 | 3028226 | 215.40 | 7 | 4/22/2014 | 1.92 | 213.48 |
| SHP-05-47B | 630524 | 3028226 | 215.40 | 11 | 6/3/2015 | 4.41 | 210.99 |
| SHP-05-47B | 630524 | 3028226 | 215.40 | 11 | 6/17/2015 | 3.55 | 211.85 |
| SHP-05-47B | 630524 | 3028226 | 215.40 | 13 | 10/7/2015 | 3.96 | 211.44 |
| SHP-05-47B | 630524 | 3028226 | 215.40 | 13 | 10/20/2015 | 3.05 | 212.35 |
| SHP-05-47B | 630524 | 3028226 | 215.40 | 13 | 12/16/2015 | 2.55 | 212.85 |
| SHP-05-47B | 630524 | 3028226 | 215.40 | 15 | 6/9/2016 | 2.75 | 212.65 |
| SHP-05-47B | 630524 | 3028226 | 215.40 | 16 | 8/16/2016 | 4.02 | 211.38 |
| SHP-05-47B | 630524 | 3028226 | 215.40 | 17 | 11/15/2016 | 2.41 | 212.99 |
| SHP-05-48A | 630046 | 3028570 | 217.31 | 1 | 11/5/2012 | 5.94 | 211.37 |
| SHP-05-48A | 630046 | 3028570 | 217.31 | 3 | 5/30/2013 | 4.90 | 212.41 |
| SHP-05-48A | 630046 | 3028570 | 217.31 | 7 | 4/22/2014 | 4.71 | 212.60 |
| SHP-05-48B | 630046 | 3028570 | 215.96 | 1 | 11/5/2012 | 3.53 | 212.43 |
| SHP-05-48B | 630046 | 3028570 | 215.96 | 3 | 5/15/2013 | 4.03 | 211.93 |
| SHP-05-48B | 630046 | 3028570 | 215.96 | 3 | 5/30/2013 | 3.53 | 212.43 |
| SHP-05-48B | 630046 | 3028570 | 215.96 | 7 | 4/22/2014 | 3.47 | 212.49 |
| SHP-05-49A | 630251 | 3028664 | 216.67 | 1 | 11/5/2012 | 5.63 | 211.04 |
| SHP-05-49A | 630251 | 3028664 | 216.67 | 3 | 4/25/2013 | 5.74 | 210.93 |

# Appendix B
# Water Level Data (CD)
# Shepley's Hill Landfill Groundwater Model

| Location Name | X Coordinate (feet) | Y Coordinate (feet) | Measuring Point Elevation (feet amsl) NAVD 1988 | Model Stress Period | Measurement Date | Depth to Water (feet) | Groundwater Elevation (feet amsl) NAVD 1988 |
|---|---|---|---|---|---|---|---|
| SHP-05-49A | 630251 | 3028664 | 216.67 | 7 | 4/22/2014 | 5.63 | 211.04 |
| SHP-05-49A | 630251 | 3028664 | 216.67 | 11 | 6/3/2015 | 3.81 | 212.86 |
| SHP-05-49A | 630251 | 3028664 | 216.67 | 13 | 12/16/2015 | 5.85 | 210.82 |
| SHP-05-49B | 630250 | 3028664 | 215.14 | 1 | 11/5/2012 | 3.95 | 211.19 |
| SHP-05-49B | 630250 | 3028664 | 215.14 | 3 | 5/15/2013 | 4.42 | 210.72 |
| SHP-05-49B | 630250 | 3028664 | 215.14 | 7 | 4/22/2014 | 3.85 | 211.29 |
| SHP-05-49B | 630250 | 3028664 | 215.14 | 9 | 10/6/2014 | 4.45 | 210.69 |
| SHP-05-49B | 630250 | 3028664 | 215.14 | 11 | 6/3/2015 | 4.46 | 210.68 |
| SHP-05-49B | 630250 | 3028664 | 215.14 | 11 | 6/17/2015 | 4.68 | 210.46 |
| SHP-05-49B | 630250 | 3028664 | 215.14 | 13 | 10/20/2015 | 4.72 | 210.42 |
| SHP-05-49B | 630250 | 3028664 | 215.14 | 13 | 12/16/2015 | 4.59 | 210.55 |
| SHP-05-49B | 630250 | 3028664 | 215.14 | 16 | 8/16/2016 | 4.98 | 210.17 |
| SHP-2016-1A | 629934 | 3027980 | 227.27 | 16 | 8/16/2016 | 17.28 | 210.00 |
| SHP-2016-1A | 629934 | 3027980 | 227.27 | 17 | 10/20/2016 | 17.38 | 209.90 |
| SHP-2016-1B | 629934 | 3027980 | 227.24 | 16 | 8/16/2016 | 18.04 | 209.21 |
| SHP-2016-1B | 629934 | 3027980 | 227.24 | 17 | 10/20/2016 | 18.46 | 208.79 |
| SHP-2016-2A | 629926 | 3028200 | 225.93 | 16 | 8/16/2016 | 15.85 | 210.08 |
| SHP-2016-2A | 629926 | 3028200 | 225.93 | 17 | 10/20/2016 | 15.94 | 209.99 |
| SHP-2016-2B | 629926 | 3028200 | 225.95 | 17 | 10/20/2016 | 15.96 | 209.98 |
| SHP-2016-3A | 630007 | 3028174 | 223.18 | 16 | 8/16/2016 | 13.50 | 209.68 |
| SHP-2016-3A | 630007 | 3028174 | 223.18 | 17 | 10/20/2016 | 13.07 | 210.11 |
| SHP-2016-3B | 630007 | 3028174 | 223.18 | 16 | 8/16/2016 | 13.07 | 210.11 |
| SHP-2016-3B | 630007 | 3028174 | 223.18 | 17 | 10/20/2016 | 13.13 | 210.05 |
| SHP-2016-4A | 629902 | 3028147 | 229.97 | 16 | 8/16/2016 | 19.93 | 210.05 |
| SHP-2016-4A | 629902 | 3028147 | 229.97 | 17 | 10/20/2016 | 20.00 | 209.97 |
| SHP-2016-4B | 629902 | 3028147 | 229.75 | 16 | 8/16/2016 | 19.75 | 210.00 |
| SHP-2016-4B | 629902 | 3028147 | 229.75 | 17 | 10/20/2016 | 19.78 | 209.98 |
| SHP-2016-5A | 629964 | 3028113 | 227.01 | 16 | 8/16/2016 | 16.90 | 210.11 |
| SHP-2016-5A | 629964 | 3028113 | 227.01 | 17 | 10/20/2016 | 17.03 | 209.98 |
| SHP-2016-5B | 629964 | 3028113 | 226.95 | 16 | 8/16/2016 | 16.95 | 210.01 |
| SHP-2016-5B | 629964 | 3028113 | 226.95 | 17 | 10/20/2016 | 17.01 | 209.95 |
| SHP-95-27X | 630753 | 3026165 | 237.45 | 1 | 11/5/2012 | 14.23 | 223.22 |
| SHP-95-27X | 630753 | 3026165 | 237.45 | 1 | 11/6/2012 | 14.53 | 222.92 |
| SHP-95-27X | 630753 | 3026165 | 237.45 | 3 | 4/25/2013 | 15.77 | 221.68 |
| SHP-95-27X | 630753 | 3026165 | 237.45 | 3 | 5/15/2013 | 16.45 | 221.00 |
| SHP-95-27X | 630753 | 3026165 | 237.45 | 3 | 6/11/2013 | 13.88 | 223.57 |
| SHP-95-27X | 630753 | 3026165 | 237.45 | 7 | 4/22/2014 | 14.83 | 222.62 |
| SHP-95-27X | 630753 | 3026165 | 237.45 | 9 | 10/6/2014 | 17.23 | 220.22 |
| SHP-95-27X | 630753 | 3026165 | 237.45 | 11 | 6/17/2015 | 16.25 | 221.20 |
| SHP-95-27X | 630753 | 3026165 | 237.45 | 13 | 10/7/2015 | 17.29 | 220.16 |
| SHP-95-27X | 630753 | 3026165 | 237.45 | 13 | 10/20/2015 | 17.28 | 220.17 |
| SHP-95-27X | 630753 | 3026165 | 237.45 | 13 | 12/16/2015 | 17.20 | 220.25 |
| SHP-95-27X | 630753 | 3026165 | 237.45 | 15 | 6/9/2016 | 16.90 | 220.55 |
| SHP-95-27X | 630753 | 3026165 | 237.45 | 15 | 6/24/2016 | 17.02 | 220.43 |
| SHP-95-27X | 630753 | 3026165 | 237.45 | 16 | 8/16/2016 | 17.69 | 219.76 |
| SHP-95-27X | 630753 | 3026165 | 237.45 | 17 | 11/15/2016 | 16.85 | 220.60 |
| SHP-99-01C | 629216 | 3026541 | 274.15 | 1 | 11/6/2012 | 21.50 | 252.65 |
| SHP-99-01C | 629216 | 3026541 | 274.15 | 3 | 5/15/2013 | 11.00 | 263.15 |
| SHP-99-01C | 629216 | 3026541 | 274.15 | 3 | 6/11/2013 | 9.25 | 264.90 |
| SHP-99-01C | 629216 | 3026541 | 274.15 | 7 | 4/22/2014 | 8.03 | 266.12 |

# Appendix B
# Water Level Data (CD)
# Shepley's Hill Landfill Groundwater Model

| Location Name | X Coordinate (feet) | Y Coordinate (feet) | Measuring Point Elevation (feet amsl) NAVD 1988 | Model Stress Period | Measurement Date | Depth to Water (feet) | Groundwater Elevation (feet amsl) NAVD 1988 |
|---|---|---|---|---|---|---|---|
| SHP-99-01C | 629216 | 3026541 | 274.15 | 9 | 10/6/2014 | 24.19 | 249.96 |
| SHP-99-01C | 629216 | 3026541 | 274.15 | 11 | 6/2/2015 | 12.00 | 262.15 |
| SHP-99-01C | 629216 | 3026541 | 274.15 | 11 | 6/17/2015 | 13.13 | 261.02 |
| SHP-99-01C | 629216 | 3026541 | 274.15 | 13 | 10/20/2015 | 24.60 | 249.55 |
| SHP-99-01C | 629216 | 3026541 | 274.15 | 13 | 12/16/2015 | 25.31 | 248.84 |
| SHP-99-01C | 629216 | 3026541 | 274.15 | 15 | 6/9/2016 | 12.30 | 261.85 |
| SHP-99-01C | 629216 | 3026541 | 274.15 | 15 | 6/24/2016 | 13.91 | 260.24 |
| SHP-99-01C | 629216 | 3026541 | 274.15 | 17 | 11/15/2016 | 25.08 | 249.07 |
| SHP-99-29X | 629539 | 3027143 | 243.34 | 1 | 11/5/2012 | 24.58 | 218.76 |
| SHP-99-29X | 629539 | 3027143 | 243.34 | 1 | 11/6/2012 | 24.47 | 218.87 |
| SHP-99-29X | 629539 | 3027143 | 243.34 | 3 | 4/25/2013 | 22.57 | 220.77 |
| SHP-99-29X | 629539 | 3027143 | 243.34 | 3 | 5/15/2013 | 22.79 | 220.55 |
| SHP-99-29X | 629539 | 3027143 | 243.34 | 3 | 6/11/2013 | 22.73 | 220.61 |
| SHP-99-29X | 629539 | 3027143 | 243.34 | 7 | 4/22/2014 | 23.34 | 220.00 |
| SHP-99-29X | 629539 | 3027143 | 243.34 | 9 | 10/6/2014 | 24.85 | 218.49 |
| SHP-99-29X | 629539 | 3027143 | 243.34 | 11 | 6/3/2015 | 22.61 | 220.73 |
| SHP-99-29X | 629539 | 3027143 | 243.34 | 11 | 6/17/2015 | 22.84 | 220.50 |
| SHP-99-29X | 629539 | 3027143 | 243.34 | 13 | 10/7/2015 | 24.73 | 218.61 |
| SHP-99-29X | 629539 | 3027143 | 243.34 | 13 | 10/20/2015 | 24.90 | 218.44 |
| SHP-99-29X | 629539 | 3027143 | 243.34 | 13 | 12/16/2015 | 25.03 | 218.31 |
| SHP-99-29X | 629539 | 3027143 | 243.34 | 15 | 6/9/2016 | 23.21 | 220.13 |
| SHP-99-29X | 629539 | 3027143 | 243.34 | 16 | 8/16/2016 | 24.75 | 218.59 |
| SHP-99-29X | 629539 | 3027143 | 243.34 | 17 | 11/16/2016 | 25.22 | 218.12 |
| SHP-99-33A | 629818 | 3028552 | 223.03 | 3 | 4/25/2013 | 12.48 | 210.55 |
| SHP-99-33A | 629818 | 3028552 | 223.03 | 3 | 5/30/2013 | 11.99 | 211.04 |
| SHP-99-34B | 630291 | 3028552 | 224.91 | 1 | 11/5/2012 | 13.26 | 211.65 |
| SHP-99-34B | 630291 | 3028552 | 224.91 | 3 | 4/25/2013 | 12.84 | 212.07 |
| SHP-99-34B | 630291 | 3028552 | 224.91 | 3 | 5/15/2013 | 13.29 | 211.62 |
| SHP-99-34B | 630291 | 3028552 | 224.91 | 3 | 5/30/2013 | 13.05 | 211.86 |
| SHP-99-34B | 630291 | 3028552 | 224.91 | 3 | 6/11/2013 | 12.66 | 212.25 |
| SHP-99-34B | 630291 | 3028552 | 224.91 | 9 | 10/6/2014 | 13.83 | 211.08 |
| SHP-99-34B | 630291 | 3028552 | 224.91 | 11 | 6/3/2015 | 12.91 | 212.00 |
| SHP-99-34B | 630291 | 3028552 | 224.91 | 11 | 6/17/2015 | 13.14 | 211.77 |
| SHP-99-34B | 630291 | 3028552 | 224.91 | 13 | 10/20/2015 | 13.90 | 211.01 |
| SHP-99-34B | 630291 | 3028552 | 224.91 | 13 | 12/16/2015 | 13.42 | 211.49 |
| SHP-99-34B | 630291 | 3028552 | 224.91 | 15 | 6/9/2016 | 13.20 | 211.71 |
| SHP-99-34B | 630291 | 3028552 | 224.91 | 16 | 8/16/2016 | 14.14 | 210.77 |
| SHP-99-34B | 630291 | 3028552 | 224.91 | 17 | 10/20/2016 | 14.15 | 210.76 |
| SHP-99-35X | 629723 | 3026547 | 258.49 | 1 | 11/5/2012 | 37.50 | 220.99 |
| SHP-99-35X | 629723 | 3026547 | 258.49 | 1 | 11/6/2012 | 37.48 | 221.01 |
| SHP-99-35X | 629723 | 3026547 | 258.49 | 3 | 4/25/2013 | 36.80 | 221.69 |
| SHP-99-35X | 629723 | 3026547 | 258.49 | 3 | 5/15/2013 | 36.85 | 221.64 |
| SHP-99-35X | 629723 | 3026547 | 258.49 | 3 | 6/11/2013 | 36.87 | 221.62 |
| SHP-99-35X | 629723 | 3026547 | 258.49 | 7 | 4/22/2014 | 37.05 | 221.44 |
| SHP-99-35X | 629723 | 3026547 | 258.49 | 9 | 10/6/2014 | 34.90 | 223.59 |
| SHP-99-35X | 629723 | 3026547 | 258.49 | 11 | 6/3/2015 | 36.32 | 222.17 |
| SHP-99-35X | 629723 | 3026547 | 258.49 | 11 | 6/17/2015 | 36.36 | 222.13 |
| SHP-99-35X | 629723 | 3026547 | 258.49 | 13 | 10/20/2015 | 35.55 | 222.94 |
| SHP-99-35X | 629723 | 3026547 | 258.49 | 13 | 12/16/2015 | 38.61 | 219.88 |
| SHP-99-35X | 629723 | 3026547 | 258.49 | 15 | 6/9/2016 | 36.68 | 221.81 |

# Appendix B
# Water Level Data (CD)
# Shepley's Hill Landfill Groundwater Model

| Location Name | X Coordinate (feet) | Y Coordinate (feet) | Measuring Point Elevation (feet amsl) NAVD 1988 | Model Stress Period | Measurement Date | Depth to Water (feet) | Groundwater Elevation (feet amsl) NAVD 1988 |
|---|---|---|---|---|---|---|---|
| SHP-99-35X | 629723 | 3026547 | 258.49 | 16 | 8/16/2016 | 37.00 | 221.49 |
| SHP-99-35X | 629723 | 3026547 | 258.49 | 17 | 11/15/2016 | 37.70 | 220.79 |

# APPENDIX C

# 3PE ANALYSIS

(Transmitted electronically)

# APPENDIX D

# MODEL INPUT

(Transmitted electronically)

**Table D.1**
**Model File Index**
**Shepley's Hill Landfill Groundwater Model**

| Simulation | Folder | GroundwaterVista File (.GWV) | Description | Model Files | Report Section |
|---|---|---|---|---|---|
| Calibration | R88PEST | R88PEST | Final PEST calibration simulation | GWV, MODFLOW, PEST | 5 to 7 |
| | R88PEST/slave | R88PEST/slave | Model files for PEST parallel processing using Beopest | GWV, MODFLOW, PEST | 5 to 7 |
| | R88PEST/R88PEST_PU | R88PEST/R88PEST_PU | Final calibrated model with parameters updated from R88PEST simualtion | GWV, MODFLOW | 5 to 7 |
| Sensitivity | R88PEST/R88PEST_PU_TS_Eval | R88PEST/R88PEST_PU_TS_Eval | Final calibrated time step sesnitivity analysis | GWV, MODFLOW | 6.1 |
| Shutdown Test | R88PEST Shutdown Test | SHL300T2a_R88PEST_PU_SP2_NoPump | 9-day transient simulatio with initial heads = R88PEST SP2 heads | GWV, MODFLOW | 8.1.1 |
| Particle Tracking | R88 PEST PU_Particle Tracking/R88PEST_PU_Simulation 1 | R88PEST/R88PEST_PU | MODPATH endpoint analysis of groundwater beneath the cap | GWV, MODFLOW, MODPATH | 11.1 |
| | R88 PEST PU_Particle Tracking/R88PEST_PU_Simulation 2 | R88PEST/R88PEST_PU_PT_Sim2 | MODPATH forward tracking pathline anlaysis from monitoring wells with As > MCL | GWV, MODFLOW, MODPATH | 11.1 |
| | R88 PEST PU_Particle Tracking/R88PEST_PU_Simulation 3 | R88PEST/R88PEST_PU_PT_Sim3 | MODPATH reverse particle tracking from extravtions wells EW-01 and EW-04 | GWV, MODFLOW, MODPATH | 11.1 |
| | R88 PEST PU_Particle Tracking/R88PEST_PU_Simulation 4_R1 SP6 | R88PEST/R88PEST_PU_PT_Sim4_R1_SP6 | MODPATH sensitivity analysis - reverse tracking from extraction wells in SP6, porosity = 0.3 | GWV, MODFLOW, MODPATH | 11.2 |
| | R88 PEST PU_Particle Tracking/R88PEST_PU_Simulation 4_R2 SP6 | R88PEST/R88PEST_PU_PT_Sim4_R2_SP6 | MODPATH sensitivity analysis - reverse tracking from extraction wells in SP6, porosity = 0.03 | GWV, MODFLOW, MODPATH | 11.2 |
| | R88 PEST PU_Particle Tracking/R88PEST_PU_Simulation 4_R1_SP13 | R88PEST/R88PEST_PU_PT_Sim4_R1_SP13 | MODPATH sensitivity analysis - reverse tracking from extraction wells in SP13, porosity = 0.3 | GWV, MODFLOW, MODPATH | 11.2 |
| | R88 PEST PU_Particle Tracking/R88PEST_PU_Simulation 4_R1 SP13 | R88PEST/R88PEST_PU_PT_Sim4_R2_SP13 | MODPATH sensitivity analysis - reverse tracking from extraction wells in SP13, porosity =0.03 | GWV, MODFLOW, MODPATH | 11.2 |

# APPENDIX E

# RESPONSE TO COMMENTS

**ARMY RESPONSES TO EPA COMMENTS ON THE DRAFT SHEPLEY'S HILL LANDFILL GROUNDWATER FLOW MODEL REVISION REPORT FORMER FORT DEVENS ARMY INSTALLATION DEVENS, MASSACHUSETTS January 2019**

## GENERAL COMMENTS

1. The Report and model package represent a comprehensive description of the model revision. For the most part, the Report represents an accurate account of the modeling effort. However, the Report would benefit from a technical edit with emphasis on the consistent and clear use of terms. For example, the apparent interchange of terms such as assigned vs specified creates some uncertainty by the reader if the intent is the same.

   *Response: Specified has been replaced with assigned throughout the document.*

2. Please amend the Report to include an initial description, at the beginning of individual sections, of how to interpret each type of model run given the different stress periods (periods in time) evaluated across different parts of the document.

   *Response: Additional information has been added to the text to provide a cross reference to Table D1 which includes descriptions of the model simulations and a listing of associated modeling files in Appendix D.*

3. Due to the complex hydrogeological setting at the SHL site and currently available data set for model development, it's unlikely that additional model scenarios would resolve the model uncertainties identified in the Report. The model should be updated with new data, as it becomes available, to continue to improve the predictive capability of this tool

   *Response: Comment noted.*

4. Please confirm that available water quality data was used to support model results and the Conclusions rendered in Section 10 (e.g., approximately 85 to 90 percent of particles released from beneath the landfill are captured by extraction well EW-01) and include a statement acknowledging this in the Report. If, on the other hand, the data were not used, the Report should acknowledge this as well.

   *Response: Particle tracking results were reported in Section 11, not Section 10. Assuming the reviewer intended to comment on Section 11, the following statement was added to the introductory paragraph of Section 11: "Conclusions regarding capture by the extraction wells presented in this section are based on the particle tracking results only and do not rely on water quality data."*

5. A major concern identified in the Report is that, according to the 3PE analysis, the model may be overestimating the groundwater capture by the extraction system. This concern not be ignored because of the 3PE assumptions. This potential bias in model results implies that evaluation of observed hydraulic head data and groundwater chemistry trends using a variety of tools will continue to be the primary lines of evidence in the evaluation of the remedial system at this site, as is the case at most sites.

*Response: Comment noted.*

6. The Report lacks details needed to interpret model run output as it relates to the evaluation of downgradient transfer behavior and understand how current model realizations might be applied to interpretations of arsenic transport that occurred in prior years, both prior to and during early years of ATP operations.

   *Response: The objective of the modeling effort was to provide a tool for potential hydrogeologic evaluations. In the future, the model can be used to consider realizations for the evaluation of historical flow conditions. The updated model and analyses described in the report focused on Site conditions after the installation of the barrier wall.*

7. The application of a regional model, such as the Shepley's Hill Model, to local scale problems is one of the greatest challenges in any modeling effort. The model was expanded to include as many natural boundaries as possible and yet it is intended to resolve such issues as the impact of a barrier wall on the groundwater flow near extraction wells and surface water bodies. Moving forward, the limitations of a regional model to provide answers to local groundwater issues should always be considered whenever such a model is used for a given purpose.

   *Response: Comment noted. If a finer level of detail was determined to be necessary, a local model of the SHL groundwater system can be constructed from the existing model using the telescopic mesh refinement (TMR) method.*

8. Although the parameter estimation of the hydraulic conductivity field solved for optimal parameters, several were constrained by lower and upper limits specified. It's possible that the zones used for the recharge and hydraulic conductivity may not produce the best realization of field conditions.

   *Response: Comment noted.*

9. Published guidance (USEPA, 2008: A Systematic Approach for Evaluation of Capture Zones at Pump and Treat Systems, EPA/600/R-08/003) regarding evaluation of a capture zone recommends that the particle track analysis be used as one of the components in the "line-of-evidence" approach for the capture zone analysis. Because of the uncertainties associated with any groundwater model, the model results alone are insufficient proof to conclusively determine the degree of capture occurring at a site. As stated in General Comment (GC) 5 above, the most compelling evidence that the required degree of capture exists for the SHL groundwater plume will come from evaluation of field-measured hydraulic head data and trends in groundwater quality parameters.

   *Response: Comment noted.*

10. Appendices D should include a summary listing of the model files, contents, simulation overviews, how the files are structured, and enough description to allow for an independent operation of the model. Simulations reported in the model should be easily referenced to the model files to allow for confirmation of results.

*Response: An index was added to Appendix D to provide a road map to the model simulations discussed in the text. In appropriate sections, reference to the index and supporting model files are added.*

11. The Report represents a substantial amount of work that has identified some important features of this complex groundwater flow system that would otherwise have been overlooked. The model appears to be an appropriate tool for delineating flow paths and capture areas. The information should prove helpful in evaluating performance of the extraction system and its ability to provide sufficient containment/capture of the contamination migrating from SHL, as required per EPA's February 24, 2016 SHL Scope of Work.

    *Response: Comment noted.*

12. Further discussion is warranted to ensure that the Report satisfactorily addresses the following items, as identified in EPA's November 29, 2016 memorandum to Army entitled "November 9, 2016 Shepley's Hill Landfill (SHL) Groundwater Flow Model Meeting – Final Summary". If they are not addressed in the Report, Army should explain their omission:

    - Model calibration will include results of 3PE vector analysis at areas identified by Steve Acree (i.e., near the extractions wells, in the vicinity of SHM-10-06, in the vicinity of the barrier wall, south of the landfill, and others to be determined).

    - Monitoring well transducer data (with small recording intervals) will be used to evaluate water level variability in response to ATP operation.

    - Residuals need to be reassessed and should be based on measurement precision/accuracy and not difficulty of calibration. Higher weights are needed for heads at higher elevations.

    - Completion of the groundwater flow model revision will be conducted using only sub- model SHL300T2 (i.e., the period of time since the barrier wall was installed).

    - Several parameter adjustments will be made for model calibration:

        - Adjust recharge to Shepley's Hill to align more with the other model recharge areas;

        - Reduce storage in the bedrock (Layers 5 and 6); ck this

        - Adjust Kv in shallow bedrock (Layer 5) such that Kv>Kh to represent increased vertical fracturing;

        - The Kh of layer 5 (shallow rock) and layer 6 (deep rock) may need to be reduced from present levels; ck this

        - Increase recharge for Zones 9 and 10 located south and southeast of the landfill in the vicinity of stormwater discharge;

- New WL data provided by EPA ORD will be used to evaluate and adjust the model configuration to resolve dry cells in the vicinity of the barrier wall; and,

- Reduce number of recharge zones by consolidating some of the current zones.

- Forward tracking particles require multiple particles per model cell (try 27 per cell); start point locations will be color coded based on final discharge location and time;

- Model documentation will include the following:

  - Description of the model domain;

  - Model specifications including solver options and model software version numbers;

  - Pest files for parameter estimation-should be in the *.rec file;

  - More detail regarding the calibration process (e.g., clearly identify sensitive parameters that were adjusted during calibration and show what parameters were allowed to vary and were estimated vs what was kept constant (include in a table);

  - Key model output files;

  - Water budget for each major stress period;

  - Dry cells of model per layer; and,

  - Confidence intervals for estimated parameters (based on information regarding method of analysis provided by USGS (Phil Harte))

*Response: The recommendations included in EPA's November 29, 2016 letter (and listed above) were addressed during the modeling update process overseen by the modeling work group (MWG). All recommendations were implemented with the exception of the last bullet regarding confidence intervals. Ninety-five percent confidence intervals are reported in the PEST output (*.rec file) but were not considered in the calibration process because their usefulness to quantify parameter uncertainty is limited. This has been discussed with MWG members and an alternative approach was not provided.*

## PAGE-SPECIFIC COMMENTS

*1.* Page iv, List of Acronyms and Abbreviations – Please include model parameter abbreviations in this list or create a separate table with a master list to help the reader follow the abbreviations contained in the Report.

*Response: Added modeling acronyms to list of Acronyms and Abbreviations.*

*2.* Page 1, § 1 – Please replace the first two sentences with the following, "The updated draft Shepley's Hill Landfill (SHL) Groundwater Flow Model Report ("the Report") is submitted per requirements set forth in EPA's February 24, 2016, SHL Scope of Work (SOW), Phase 1, Paragraph 4.a, which required Army to submit an updated groundwater flow model that includes the changes noted in Attachment A of Army's December 4, 2015 letter. The SOW also states that within thirty (30) days of Army's issuance of the final updated groundwater

flow model and supporting documentation, it shall submit a revised Technical Memorandum that: (1) uses field-measured hydraulic head data and water level measurements support and validate projections of groundwater flow as predicted in the updated groundwater flow model (SOW, Phase 1, ¶ 4.b), (2) evaluates hydraulic gradient vectors near the extraction wells (SOW, Phase 1, ¶ 4.c), and (3) evaluates upgradient flow lines through plume cross-section (Phase 1, Paragraph 4.d)." While the Reports attempts to address these issues, a separate submittal is required, per the February 24, 2016 SHL SOW, to more specifically and more thoroughly address each of the model-related tasks. Also, references to Army's 2016 "Draft SHL Groundwater Flow Model Revision Report" (Geosyntec, 2016) as a "previous version of the model" and the official recognition of a "SHL Modeling Work Group" are a bit misleading and should be omitted from the Report.

*Response: The text in quotes (shaded in gray) above were inserted before the first line of Section 1. The remaining text in the first paragraph was revised to include more detail about the evolution of the model update including the May 2016 and October 2016 submittals and EPA responses to document interim versions. This was deemed necessary for continuity within the text. For example, the October 2016 submittal is referred to in the November 29th EPA letter cited in General Comment #12 above as "October 7, 2016 draft "Groundwater Flow Model Revision Report" and provides the basis for the revisions listed by EPA in that letter. Also, rather than omitting references to the MWG, the text was revised to describe the process by which the model revisions were developed without implying that the group was "officially" sanctioned.*

3. Page 1, § 1.1 – Please include a statement reflecting the fact that the model revisions included a revised calibration procedure based on automating PEST and on 3PE. *ok*

*Response: The text was revised as suggested.*

4. Page 1, § 1.1 - While EPA agrees that the groundwater flow model can be used as one line of evidence to support designation of arsenic background/baseline wells, implementation of additional model realizations that reflect historical flow conditions that have existed prior to and during the operation of the groundwater extraction system are warranted. The current distribution of arsenic in the overburden aquifer reflects the net result of periods during which there was no extraction near the toe of the landfill, as well as extended periods with effective extraction rates less than those that are currently being implemented. For example, flow path projections presented in Figure 11.6 reflect what the flow model predicts as likely flow paths under more recent extraction rates. These do not necessarily reflect historical flow paths that were in place during the complete lifetime of plume migration. Further discussion is warranted to develop agreement on the technical approach for making use of the flow model to inform analysis of background/baseline conditions in different parts of the impacted aquifer. This information could then be used with other lines of evidence, such as groundwater chemistry trends, to minimize uncertainty in background/baseline well designations.

Groundwater chemistry can provide a view of the net response of the aquifer in areas within and outside of the effective capture zone. For example, a review of arsenic trends in well SHM-93-22B show a rapid decline of arsenic concentrations as the ATP operation started and ramped up to a monthly, average volume of about 60,000 gallons per month. The concentrations stayed relatively constant during operation years 3-9, then started to decline again after the monthly rate was increased recently to a consistent average of about 75,000

gallons per month. Arsenic concentrations at EPA-PZ-2012-1B showed a similar response after the increase in extraction rate. EPA also observed a decline in arsenic concentration at well SHM-10-06 which is consistent with an increasing contribution from an area within the landfill that is monitored by well SHM-10-07. Over time, EPA's anticipates that SHM-10-06 water chemistry will eventually become more consistent with what is observed at SHM-10-07 (e.g., arsenic concentration will decline to <1000 ug/L). If the current extraction rate is maintained, one would expect to see the same response at more wells downgradient of SHM-93-22B.

Unfortunately, the area of model-computed capture as represented in the Report does not incorporate historical site conditions. The best approach would be one that combines both field observations and model projections. Further discussion is recommended, upon approval of current model calibration, to identify the types of model runs that best represent both current and historic site conditions.

*Response: Comment noted.*

5. Page 2, § 1.2. ¶ 1 - The total volume of the waste in the landfill is estimated at 1.5 million cubic yards, of which 11 percent is below water table. The landfill cover has reduced infiltration from the top (i.e., closure consisted of capping with a 30 to 40-mil PVC membrane, soil, and vegetation). The current model assumes the recharge is 6 percent of precipitation, which is relatively high for a synthetic cap and is recognized as one of the parameters that may require further re-examination in the future. However, the horizontal groundwater flow through the waste may also need to be revisited. In the future, it may be advisable to do additional particle tracking analysis with particles that originate from the submerged waste area. One of the questions that may need to be addressed relates to what area corresponds to the 11 percent below the water table and how does that area change with seasonal fluctuations of the water table.

   *Response: Comment noted.*

6. Page 2, § 1.2. ¶ 2 – The last sentence refers to the presence of arsenic in groundwater and sediments in PSP suggesting that there is no arsenic in aquifer sediments. Please explain. Also, please clarify that the sediments in PSP are the Pond bed sediments.

   *Response: The Remedial Investigations summary is not addressing sediments. The sentence has been revised as follows: "After closure, remedial investigations (RIs) completed under the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) confirmed the presence of various contaminants, including arsenic in groundwater, aquifer matrix, and pond bed sediments in PSP."*

7. Page 2, § 2. - Some of this calibration discussion should be included in § 1.1. *Page 3? Shift text to present historical perspective of modeling in Site Background section.*

   Supplemental comment from P. Harte 8/19/19 - The comment attributed to page 2, sec. 2. is actually p3, sec 2, last sentence. More specifically the comment should read: "This sentence, as it reads now, should be moved up front to sec. 1.1 in modeling objectives. In its place, I would suggest mentioning that several flowpath post processing methods were used to evaluate capture including several pathline analysis tools. "

*Response: The last sentence of Section 2 was moved to Section 1.1 and replaced with the following sentence: "In addition, post processing methods were used to evaluate capture including several pathline analysis tools."*

8. Page 3, § 2., ¶ 1 - Please modify the fifth sentence to read, "Model layers were revised to incorporate an updated bedrock surface *by specifying revised elevations of the layer bottom*".

   *Response: The text was revised as suggested.*

9. Page 3, ¶ 2., ¶ 1 - Please replace "K testing" in the sixth sentence with the specific type of hydraulic testing performed. Also, please explain that hydraulic testing provides estimates of hydraulic conductivity.

   *Response: The text was revised as suggested.*

10. Page 4, § 3.,¶ 3 – Please explain why there is no discussion of flow from the southern boundary of the landfill.

    *Response: The text was added to § 3.,¶ 3 to discuss GW flow from the south.*

11. Page 4, ¶ 4 – Please specify the type of testing and analysis method when referencing ranges of hydraulic conductivity. Also, please mention that it is primarily a horizontal or radial measurement.

    *Response: The text was revised as suggested.*

12. Page 5, § 4.1, ¶ 1 - Please identify the type of zonation in the last sentence where "parameter zonation" is mentioned.

    *Response: "recharge and hydraulic conductivity" was added before "parameter zonation"*

13. Page 5, § 4.1, ¶ 1 - The revision of calibration targets should not be referred to as "model refinement". Details regarding the revision of calibration targets should be provided in a separate sentence.

    *Response: The text was revised as suggested.*

14. Page 6, § 4.2, 1st bullet – Please specify the zone number of the recharge.

    *Response: The text was revised as suggested.*

15. Page 6, § 4.2, 3rd bullet – Please amend the text to reflect the fact that only streams (river package) was updated.

    *Response: All boundary conditions including streams, pumping rates and recharge were updated. The text was revised to add "streams (river package)" to the list.*

16. Page 6, § 4.2, 9th bullet – Please modify the first part of the sentence to read, "Revise *elevation datum of* calibration targets….".

    *Response: The text was revised as suggested.*

17. Page 6, § 4.2, 10th and 11th bullets. – Please amend the text to indicate that they were removed because the hydrologic event was not simulated in the model.

    *Response: The text was revised as suggested.*

18. Page 6, § 4.2, 12th bullet – Please insert "estimated hydraulic conductivity from" prior to "slug testing".

    *Response: The text was revised as suggested.*

19. Page 6, § 4.2, 14th bullet – Please insert "in the river package of Modflow" after "head boundary conditions".

    *Response: The text was revised as suggested.*

20. Page 6, § 4.2, 15th bullet - Include reference to the reach map.

    *Response: The text was revised as suggested.*

21. Page 7, § 5.2 – The first two sentences that discuss discretization should be moved to top of § 5.2.

    *Response: The text was revised as suggested.*

22. Page 7, § 5.1, last sentence – Please specify the relief in elevation.

    *Response: The text was revised as suggested.*

23. Page 7, § 5.2 - The till appears to be scoured where there are bedrock highs or knobs and thickest in bedrock lows.

    *Response: Comment noted.*

24. Page 7, § 5.3 – Please differentiate and label the type of hydraulic conductivity estimates so the reader knows what numbers are associated with what type of analysis.

    *Response: The text was revised as suggested.*

25. Page 8, § 5.3, , ¶ 1, 1st sentence – Please insert the "initially simulated" prior to "K parameter values"

    *Response: The text was revised as suggested.*

26. Page 8, § 5.3, , ¶ 1, 2nd sentence – Please include a description of how zones were formed.

    *The text was revised as suggested.*

*27.* Page 8, § 5.3, , ¶ 3, last sentence - This sentence needs clarification. Is the current text suggesting that the results of the model calibration showed that an isotropic horizontal to vertical hydraulic conductivity resulted in the best solution or is it suggesting that for the given conceptualization of flow under the PSP, an isotropic relation between horizontal to vertical best represents the conceptualized process?

*Response: The text does not suggest isotropic conditions. It has been reorganized to more clearly present the zonation in Layer 4 based on observed geology and the treatment of vertical hydraulic conductivity of the till in the calibration process. The calibrated values for horizontal and vertical hydraulic conductivity resulted in an anisotropy of 8.3 (Kh:Kv).*

28. Page 8, § 5.3, , ¶ 3, 1st sentence – Please replace "a limited zone" with "an area without till"

    *Response: The text was revised as suggested.*

29. Page 8, § 5.3 – Please exercise caution when differentiating between what's specified as initial conditions, what was allowed to be adjusted, and what was kept constant. For instance, use of the term *specified* for a K value of the till of 5 ft/d is somewhat confusing and might be more accurately referred to as term "*assigned*". In addition, while the term *assigned* may be used appropriately in the fourth paragraph, it is best described as "*initially assigned*." Please review the entire document for use of the term word "specified" and/or "assigned" and amend, as/if necessary, to more accurately identify/describe the specific task performed.

    *Response: The text was revised as suggested.*

30. Pages 8 and 9, § 5.4 - Same comment as above with regards to "specified" storage and porosity values and "specified" constant flux and head dependent boundaries.

    *Response: The text was revised as suggested.*

31. Pages 8, § 5.4 - Specific storage is specified as 0.0005 in the overburden sand (Layers 1, 2, and 3), 0.00004 (Layers 4 and 5), and 0.00001 (Layer 6). The unit for the specific storage is I/ft (the storage coefficient is dimensionless). Specific yield defines the storage parameter for unconfined aquifers. What was the assumed (effective) porosity in the model? The basis for the assumed storage parameters is not provided in the Report. It would a helpful addition to the Report to provide this documentation.

    *Response: The basis for the storage values was added.*

32. Page 9, § 6. – Please include mention of modeled time unit in rate….e.g. days.

    *Response: The model time unit was added to the third paragraph of section 6.*

33. Page 10, § 6.2.1, ¶ 2 - The first sentence uses "quarterly average precipitation" to describe value assigned to a seasonal stress period. Because a daily value is assigned to the model, EPA recommends using "daily average for the quarter" or "quarterly daily average".

    *Response: The text was revised to read "quarterly daily average".*

34. Page 11, § 6.2.2.1 - Same comment as prior one but for pumping rates (i.e. use "daily average for the quarter" or "quarterly daily average" instead of "average quarterly rates).

    *Response: The text was revised to read "quarterly daily average".*

35. Page 13, § 6.2.3, 1st sentence – Please replace "river boundary conditions" with "river package of MODFLOW (ref.)".

*Response: The text was revised as suggested.*

36. Page 15, § 6.2.3.3, last sentence - Please explain why the stream stage was set to 242 feet.

    *Response: The text has been revised to indicate that the elevation of 242 feet was based on USGS topographic elevations in the area.*

37. Page 15, § 6.2.3.4 – Please specify the frequency of data logging measurements. The discussion is confusing as presented. For instance, when all measurements taken in a quarter are averaged, then it is presented as the average for that quarter. If you take a daily reading and average that for the entire quarter, then it's the daily average for that quarter. The discussion is confusing as presented.

    *Response: The datalogger interval was added and the paragraph was revised for clarity.*

38. Page 16, § 6.2.3.5 – Because the culvert is impermeable, it should not be simulated.

    *Response: This condition was inadvertently overlooked during model construction. While it is agreed that the culvert should not be simulated as river boundary condition, the effect on model results are expected to be negligible given the relative size of the reach with respect to PSP and Grove Pond. It will be noted as a revision for the next model update.*

39. Page 16, § 7. - As discussed in prior reviews, while the 3PE analysis is useful tool in the model calibration process, it is not appropriate and should not be used to validate the model. Model validation should be performed using a unique set of hydrologic stresses and associated observed data sets to allow for a new condition to be tested (simulated). Please amend the discussion accordingly.

    *Response: The discussion has been amended to exclude the use of the term validation when referring to the 3PE and shutdown test analyses.*

40. Page 17, § 7., 1st sentence – Please elaborate on the analyses performed to identify "anomalous values".

    *Response: Text was added to describe process.*

41. Page 17, § 7.1, 2nd sentence – Please change "depth to water *data*" to "depth to water *level*".

    *Response: The text was revised as suggested.*

42. Page 18, § 7.1, ¶ 2, last sentence – Please explain the application of zero weight to water levels below Shepley's Hill. A weight of less than 1, perhaps, approximately 0.25, would seem more appropriate than zero. Were PEST simulations run with different weights?

    *Response: Due to the steep gradients and the nature of groundwater flow in fractured rock the residuals for targets in Shepley's Hill were large compared to the overburden targets. The multiplier for targets in SH were set to zero to prevent the SH target residuals from dominating the PEST objective function and adversely affecting the fit to targets in the landfill and NIA. A weight greater than 0 can be considered in future model updates.*

43. Page 19, §§ 8.1.2.1 and 8.1.2.2 – The Report compares hydraulic gradients computed using the model with gradients calculated from observed hydraulic head data using the 3PEspreadsheet tool. As noted in the Report, the groundwater velocity vectors calculated from the model output are more westerly, potentially indicating greater influence of the extraction wells than vectors calculated using observed hydraulic head data obtained from pressure transducers. The Report correctly notes that the datalogger data, which are continuous over a large portion of the stress period, may provide a more complete assessment of seasonally averaged conditions than the limited dataset available for calibration of the model in any given stress period. This is the most likely explanation for most of the differences between modeled and observed flow vectors.

    A limited analysis of the effects of uncertainty in hydraulic head values and planarity of the potentiometric surface on vectors calculated using the three-point problem approach utilized in the 3PE tool in also included. This type of analysis should always be performed to allow evaluation of the potential uncertainty inherent in the use of any given interpretation tool. However, in this case, it is noted that the uncertainty in head values chosen for this example *(i.e.,* 0.1 to 0.2 ft) is relatively high. Assuming the recent survey of the well reference point elevations performed by the Army is accurate to approximately 0.01 ft and that careful,

    synchronous monitoring of the depth to groundwater was performed in each well, the measurement uncertainty will likely be significantly less than 0.1 to 0.2 ft. Therefore, the potential variability in calculated flow direction due to measurement uncertainty in this case appears to be overstated.

    The Report also suggests that the potentiometric surface may not be sufficiently planar for application of the three-point gradient calculation method. However, examination of potentiometric surfaces produced from data obtained from different times during the past decade generally indicates that the surface is relatively planar in the areas where the three-point evaluation has been applied. It is considered unlikely that the effects of a nonplanar surface would produce any significant effects on calculated flow vector directions in the areas chosen for application of the 3PE tool. In this case, it appears the estimation of observed hydraulic gradients utilized as a guide during the calibration process provided helpful information. However, the utility of this analysis was limited by the limited amount of continuous hydraulic head data from pressure transducers available during the model calibration period. Future revisions to the model should consider acquisition of additional such data to better define average groundwater conditions to serve as more appropriate model calibration targets and potentially, further reduce bias in the model.

    *Response: Comment noted. Please note that the 0.1 to 0.2 ft elevation differences discussed in the text related to model calculated water levels and 3PE sensitivity, not field measurements recognized to be accurate to approximately 0.01 feet.*

44. Page 19, § 8.1.1, ¶ 1 - The description of the simulated recovery is unclear. Specifically, the fifth line of the paragraph states "the observed water level recovery… was compared to simulated recovery calculated as the difference in water levels simulated in SP2 under pumping and non-pumping conditions; however, SP2 did not simulate non-pumping conditions. While the simulated shutdown tests correctly show no pumping of the extraction wells for the 9-day period (file: SHL300T2A.lst in R88_PEST_SHUTDOWN folder; see appendices A1 budget), the SP2 stress period for the R88 calibration simulation show

pumping of these wells (see appendices A2 budget). Please investigate and amend, as necessary.

*Response: SP2 is not intended to simulate non-pumping conditions. It is intended to simulate the heads prior to shutting down the ATP for 9 days – which would be represent pre-shutdown conditions when the ATP was operating. This difference between the heads in SP2 under pumping conditions and the head after 9 days of no pumping is the simulated recovery.*

*45.* Page 19, § 8.1.1, ¶ 1, last sentence - A one-day time step is atypical particularly for simulation of pump tests and recovery. Please explain.

*Response: Comparison of continuous water level data from a one-day shutdown test conducted in October 2016 and a shutdown test in 2008 indicated that recovery in the 2016 one-day test was comparable to recovery after 8 days in the 2008 test. Based on the observed recovery rate, a single time step for the 2013 shutdown test was deemed acceptable to simulate recovery after 9 days.*

46. Page 19, § 8.1.1, ¶ 2 - Please confirm whether there was or wasn't precipitation during the period of February 9-15, 2013. Based on the text, since the daily rate for the shutdown 9-day period was similar to the quarterly daily rate, no adjustments to SP3 recharge were made. This suggests that there was precipitation during the 9-day period. Please investigate and amend, as necessary.

*Response: Review of precipitation records from the Fitchburg Municipal Airport indicated that there was precipitation during the period of February 9-15, 2013.*

47. Page 20, § 8.1.1, top of page - The residual fit is not particularly close, so the statement that there was a relatively close match is incorrect. However, the slope of the observed and model computed residuals as shown in Figure 8.1 and 8.2 are similar suggesting that the hydraulic conductivity estimates used in the model are reasonable. Please investigate and amend the discussion, as necessary. In addition, the text should be expanded to discuss both hydraulic conductivity estimates and the effect of storage on results.

*Response: During the calibration process, only the storage parameters were evaluated with the shutdown test analysis. The text has been revised as suggested.*

48. Page 20, § 8.1.2 - Please include the frequency of continuous records of water levels (i.e. 15 minutes).

*Response: The text was revised as suggested.*

49. Page 20, § 8.1.2.1, ¶ 1, first sentence. "SP3" does not represent a high recharge period. Although it is one of the few periods in which continuous water level data were available for comparisons of simulated and calculated gradients, it was also a period when was a fair amount of ATP down-time. EPA requests, therefore, that "SP3" be replaced with "SP13" and that the sentence be amended to read, "The observed water levels from the continuous measurements that coincided or best represented a high and low recharge period for the simulation period were used. This corresponded to SP13 (provide DATES 9/3015 to 12/31/15) and SP17 (provide DATES 9/30/16 to 12/31/16). The model-computed heads from

that period were analyzed for 3PE and compared to the observed data sets. Because of the high frequency of measurements in the continuous data set, data were summarized as such."

*Response: Review of precipitation (Figure 6.1) and recharge (Table 6.3) indicates that the recharge in SP13 is less than the recharge in SP17 and would not represent a higher recharge period. The stress periods chosen for the 3PE analysis (SP3 and SP17) were agreed upon during meetings with the MWG. Initially, the Spring 2017 datalogger data was considered but the model quarterly stress periods do not extend beyond the 4$^{th}$ quarter 2016. Using the results from spring 2016 (SP15) to compare to observed 2017 spring data was considered, but recharge in Q2 2016 was relatively low and not representative of a relatively wet period (see Figure 6.1). Therefore, spring of 2013 (SP3) which had the highest precipitation period on record, was chosen as the stress period to represent spring conditions. From a modeling perspective it represents a spring condition (high river stage elevations and precipitation) see Figures 6.6 to 6.8.*

50. Page 20, § 8.1.2.1, ¶ 1, last sentence - Please include a brief explanation/summary of the "results of the analysis… summarized in Table 8.2".

    *Response: A sentence was added briefly summarizing the findings.*

51. Page 20, § 8.1.2.1, ¶ 2 - The wording used to describe and reference the various data sets warrants attention. For example, there are 3 data sets: model-computed, calibration target from 1 or 2 measurements per stress period, and the high frequency observed water level data. Referring to the 1 or 2 measurement data set as a seasonal average is a little confusing and not entirely correct. Referring to it as "a stress period calibration target" seems more appropriate.

    *Response: The text was changed to clarify the calibration target data set.*

52. Page 21, § 8.1.2.2, ¶ 3 – Please omit the last two sentences of the paragraph. EPA disagrees that a limitation of the 3PE can be associated with disproportionate responses to stresses at one of the three adjoining wells of a triangle. While EPA agrees with the principle of unique response per well, this should not be viewed or referred to as limitation. Same is true for the following sentence. Neither represents a "limitation."

    *Response: The sentence regarding transience has been deleted from the paragraph.*

*53.* Page 22, § 8.1.2.2, ¶ 1 - To follow-up on the previous comment, a limitation that is not discussed is differences in vertical flow at each well. This concept lead into the analysis presented in this paragraph. *Comment noted?*

    *Response: The text has been revised to include the assumption that groundwater is predominantly horizontal.*

54. Page 22, § 9. – Please change the section title to "Final Model-Computed Water Levels".

    *Response: Assuming intended heading was 9.1, the requested edit was made.*

55. Page 23, § 9.1, ¶ 1, second to last sentence - Please provide a reference for recommended calibration targets of < 10%.

*Response: The references, ESI 2011, was added to the text.*

56. Page 23, § 9.1, ¶ 3 - Please provide an explanation for the spatial bias in residuals for southern landfill area.

*Response: This area is down gradient from a zone of commercial and industrial development and stormwater retention/recharge structures. Limited data is available regarding stormwater management (e.g., building roof drain discharge and stormwater pond operation). If additional information regarding stormwater management becomes available, it could be used for future model updates.*

57. Page 24, § 9.2, ¶ 2 – Please define "Kxy". Also, please include model parameters in the list of abbreviations on page vi.

*Response: Text was added to define Kxy and the definition was added to the acronym and abbreviation list.*

58. Page 26, § 10., last bullet – Please replace "simulated water levels" with "model-computed heads".

*Response: The text was revised as suggested.*

59. Page 27, § 10. 2nd bullet – Another possible model adjustment would be to increase riverbed conductance in reach 4. That reach shows relatively low discharge rates per table.

*Response: Comment noted.*

60. Page 27, § 11.1 - While this model realization is useful from the perspective of projecting groundwater capture under maintenance of current pumping rates, it does not represent capture that may or may not have occurred under pumping rates that were realized prior to 31 December 2016 (see Review Figure 1). Relative to the stated objective to examine "potential historic flow paths of groundwater at monitoring wells with known arsenic MCL exceedances", it should be clarified that the model-computed particle paths shown in Figures 11.1 through 11.4 do not reflect particle capture points that may have differed in prior years. This issue also applies to potential application of the model as a line of evidence to support designation of arsenic background/baseline wells. (SP18 is 12/31/2016 to 12/31/2025 (steady-state); time period extended to 50 years for the model realizations shown in Figures 11.1 – 11.4.)

*Response: Comment noted.*

61. Page 27, § 11.1 - This model realization is useful from the perspective of projecting groundwater flow paths under ATP pumping conditions that have been realized following modifications and upgrades implemented over the past 2-3 years. Relative to the stated objective to examine "potential historic flow paths of groundwater at monitoring wells with known arsenic MCL exceedances", it should be clarified that the model-computed particle paths shown on Figure 11.5 do not reflect potential upgradient areas that were the source of groundwater for several well locations in prior years. This could be clarified by the addition

of time stamps for every 3-year period on the displayed flow paths. It would then be possible to verify the reliability of assigning the model-realized flow paths shown in Figure 11.5 to prior years of ATP operation by comparing concentration trends observed at upgradient and downgradient wells for conservatively-transported chemical constituents (e.g., chloride). This issue also applies to potential application of the model as a line of evidence to support designation of arsenic background/baseline wells.

*Response: Comment noted. For the analysis depicted in Figure 11.5, multiple particles were released at each monitoring well (eight particles were released along 2-foot-diameter circles centered on the well and vertically at 2 feet spacing along the screened interval) such that time postings would overlap and be unreadable. Future particle track analyses using fewer particles can be conducted to evaluate historical flow paths.*

62. Page 27, § 11.1 - Please indicate if the capture by weak sink option was used. Also please specify porosity options.

    *Response: Porosity and election of the option to pass through a weak sink was added to the text.*

63. Page 28, § 11.1, ¶ 2 – Please delete the last sentence. As previously discussed (see Page-Specific Comment (PSC) 39 above), while 3PE analysis is a useful tool in the model calibration process, it is not appropriate and should not be used to validate the model. Model validation should be performed using a unique set of hydrologic stresses and associated observed data sets to allow for a new condition to be tested (simulated). Please amend the discussion accordingly.

    *Response: The last sentence has been revised to indicate that 3PE was used for model calibration and capture zone analysis.*

64. Page 28, § 11.2 – Please change the section title to "sensitivity to seasonal recharge rates".

    *Response: The text was revised as suggested.*

65. Page 29, § 11.2, ¶ 1 – Please insert "and for an extended time period" after "larger area" in the first full sentence.

    *Response: The text was revised as suggested.*

66. Page 29, § 11.1, ¶ 1 – The discussion should also note that higher recharge produces a more northerly flow direction by the extraction wells.

    *Response: The text was revised as suggested*.

67. Page 29, § 12. – While EPA generally agrees with the conclusions as presented, there should have been a much larger discussion on the reliability of estimated parameters. In addition, the section should also recognize that the model is generally more sensitive to recharge multipliers than hydraulic conductivity based on the composite scaled sensitivities.

*Response: The discussion was expanded to discuss the reliability of estimated parameters and model sensitivity to recharge.*

68. Page 29, § 12., ¶ 3 – Please delete the current text and replace it with, "The results of flow path analysis using the calibrated model and comparison of particle track capture zone analysis with 3PE analyses indicate that at the current pumping rates, the extraction system captures part of the landfill footprint."

    *Response: The suggested edit was not made because the flow path analysis does not indicate that the system captures part of the landfill footprint as the 3PE analysis indicates. The second sentence was edited to indicate that the model-calculated capture may be overestimated.*

**FIGURES**

The following represents Figures with requested modifications and/or noteworthy comments.

1. Figure 4-1 – Since recharge zones are discontinuous, several more of the zones should be labeled to help clarify the information presented.

   *Response: The text was revised as suggested.*

2. Figure 5.3 - The till appears to be scoured where there are bedrock highs or knobs and thickest in bedrock lows.

   *Response: Comment noted.*

3. Figure 5.4 – While it is helpful that an expanded view of the hillside was presented, it appears that some of the adjacent cells in the distorted grid are displaced. A discussion of distorted grids and its effect on simulated flow can be found in Harte, P.T. (1994; Comparison of vertical discretization techniques in finite-difference models of ground-water flow: Example from a hypothetical New England setting. USGS Open-File Report 94-343).Fig. 5.5-5.9. Insert the word "Final" before the word Modeled in caption of figure.

   *Response: Comment noted. The word "Final" was inserted before the word Model in Figures 5.5 to 5.9.*

4. Figure 5.9 – Please add a reference. See PSC 1 above.

   *Response: An explanation of Kxy and Kz was added to the legend.*

5. Figure 6.2 - Insert "Final" in caption.

   *Response: The text was revised as suggested.*

6. Figures 9.5a to 9.5j – These figures provide useful details on head residuals. They also show some spatial bias in areas of the model. The areas can be broken out into zones, that for both high (SP15) and low recharge rates (SP17), show a similar tendency to overpredict (model heads> observed heads) or underpredict (model heads < observed heads) residuals. The first of two areas -- Nonacoicus Brook -- is an area where the model consistently overpredicts heads which might be the result of riverbed conductance being set too low. The second area

is the landfill area where the model underpredicts heads. For this area, it's possible that Shepley Hill may contribute some focused recharge along the western edge of the landfill that the model does not simulate. The focused recharge may be channeled based on anisotropy of the rock toward the middle to northern part of Shepley Hill.

*Response: Comment noted.*

7. Figure 9.6 - See PSC 1 above.

   *Response: Abbreviations are already included in the legend, so no edits were made to figure, however, abbreviations from the figure were added to the acronym list.*

8. Figure 9.6 - The results show the model is most sensitive to recharge multipliers and therefore recharge rates. Eight of the top twelve most sensitive parameters are recharge multipliers, 4 of the next 10, and 5 of the last 16.

   *Response: Comment noted.*

9. Figure 9.7 – Please provide an expanded view of a vertical slice of the HSUs as was done in Figure 9.8.

   *Response: An additional Figure 9.7a was added with a vertical slice schematic of the HSUs.*

10. Figures 11-1 through 11-4 – See PSC 60 above.

    *Response: Comment noted.*

11. Figure 11-5 – See PSC 61 above.

    *Response: Comment noted.*

**TABLES**

The following represents Tables with requested modifications and/or noteworthy comments.

1. Table 5.1. – Please label the headers per type of hydraulic analyses or footnote the numbers specifically.

   *Response: Footnote 4 was revised to indicate type of hydraulic testing.*

2. Table 5.2 – Please add a reference. See GC 1 above.

   *Response: Definition of parameter abbreviations were added to the footnotes.*

3. Table 6.3 – Please include dates for the stress periods.

   *Response: The text was revised as suggested.*

4. Table 8.2 – Please explain why the table doesn't compare the range between SP13 and SP17 of the target vector of the 3PE and the model-computed vector for SP13 and SP17. Also, for ATP1, the target range is 3 degrees (320:323) and the model-computed range is 8 degrees (322:314). The average range is 8 degrees (333:325).

*Response: See response to PSC #49 above. The comment regarding the average range for ATP1 is noted.*

5. Table 9.2 - Label the last column "Net Storage". Also include a composite river leakage in and out value in addition to the breakdown.

   *Response: The text was revised as suggested.*

6. Table 11.1 - Particles discharging to reach 3 are on average 25 years old. This suggest that sampling groundwater discharging to this reach can provide insight into earlier concentrations of arsenic from the landfill.

   *Response: Comment noted.*

**MODEL FILES AND SIMULATION CHECK**

1. A more thorough description of the various model data sets is necessary to allow for an independent modeler to run the model in the future. The model files in the folder R88_PEST_PU were imported into an independent GUI (MODEL MUSE version 3.10; Winston, 2009) and later exported into ascii files. The ascii files were then run externally, using MODFLOW-NWT 1.14 (downloaded March 6, 2019) and model results of the model-computed water budget were checked against the water budget presented in Table 9.2. Reported values in Table 9.2 were confirmed. This indicates that the model can be run, and results confirmed. It also means that all the files provided were correctly listed in the folder to allow for the replication with an external GUI. The output file (*.LST files) from the model runs provided by Geosyntec indicates that the model code MODFLOW-NWT version 1.09 (derived from MODFLOW-2005, version 1.11) was used (Niswonger and others, 2011). MODFLOW-NWT is the Newton-Raphson formulation of MODFLOW-2005 (Harbaugh, 2005). The PEST output file (*.rec files) indicate PEST version 13.6 was used (http://www.pesthomepage.org/Home.php).

   *Response: An index of model files was added to Appendix D.*

2. Slug tests were used to inform the model of hydraulic conductivity values and tendencies. Different interpolation schemes may produce different realizations of hydraulic conductivity for use in the model, which may improve the calibration. However, future applications of the model may want to focus on improving estimates of recharge in critical areas of the model by the remedial extraction wells and along the western edge of the landfill. This could be done by calibrating the model to a higher data collection frequency of water levels and an associated higher time discretization (monthly stress periods and high number of time steps) of the model.

   *Response: Comment noted.*

3. The hydraulic conductivity zonation from the model was independently plotted from the model data sets and compared to the reported values in figures contained in the draft Shepley's Hill Landfill (SHL) Groundwater Flow Model Revision Report ("the Report"). The values from the Report were confirmed.

   *Response: Comment noted.*

## REFERENCES

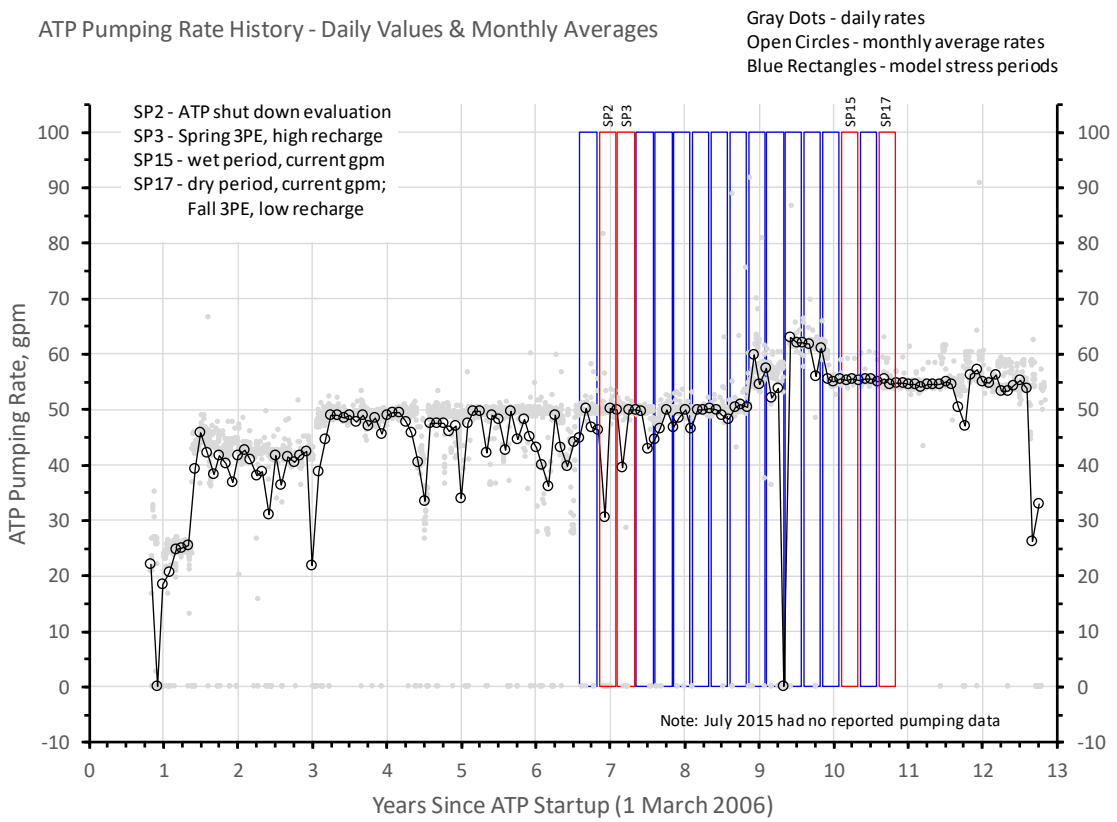
Harbaugh, A.W., 2005, MODFLOW-2005, the U.S. Geological Survey modular ground-water model -- the Ground-Water Flow Process: U.S. Geological Survey Techniques and Methods 6-A16.

Harte, P.T. 1994. Comparison of vertical discretization techniques in finite-difference models of ground-water flow: Example from a hypothetical New England setting. USGS Open-File Report 94-343.

Niswonger, R.G., Panday, Sorab, and Ibaraki, Motomu, 2011, MODFLOW-NWT, A Newton formulation for MODFLOW-2005: U.S. Geological Survey Techniques and Methods 6-A37, 44 p.

Winston, R.B., 2009, ModelMuse—A graphical user interface for MODFLOW-2005 and PHAST: U.S. Geological Survey Techniques and Methods 6-A29, 52p.

Review Figure 1. Historical record of ATP pumping rates derived from SHL Annual Reports.



# APPENDICES

## A1. Shutdown test budget

VOLUMETRIC BUDGET FOR ENTIRE MODEL AT END OF TIME STEP 1, STRESS PERIOD 1

| CUMULATIVE VOLUMES | L**3 | RATES FOR THIS TIME STEP | L**3/T |
|---|---|---|---|
| IN: | | IN: | |
| STORAGE = | 983179.6875 | STORAGE = | 109242.1875 |
| CONSTANT HEAD = | 0.0000 | CONSTANT HEAD = | 0.0000 |
| WELLS = | 0.0000 | WELLS = | 0.0000 |
| RIVER LEAKAGE = | 662371.1250 | RIVER LEAKAGE = | 73596.7891 |
| HEAD DEP BOUNDS = | 0.0000 | HEAD DEP BOUNDS = | 0.0000 |
| RECHARGE = | 2620808.0000 | RECHARGE = | 291200.8750 |
| TOTAL IN = | 4266359.0000 | TOTAL IN = | 474039.8438 |
| OUT: | | OUT: | |
| STORAGE = | 73355.5703 | STORAGE = | 8150.6187 |
| CONSTANT HEAD = | 0.0000 | CONSTANT HEAD = | 0.0000 |
| WELLS = | 845101.6875 | WELLS = | 93900.1875 |
| RIVER LEAKAGE = | 3347898.0000 | RIVER LEAKAGE = | 371988.6562 |
| HEAD DEP BOUNDS = | 0.0000 | HEAD DEP BOUNDS = | 0.0000 |
| RECHARGE = | 0.0000 | RECHARGE = | 0.0000 |
| TOTAL OUT = | 4266355.0000 | TOTAL OUT = | 474039.4688 |
| IN - OUT = | 4.0000 | IN - OUT = | 0.3750 |
| PERCENT DISCREPANCY = | 0.00 | PERCENT DISCREPANCY = | 0.00 |

Pumping rates of remedial wells for shutdown tests

| WELL NO. | LAYER | ROW | COL | STRESS RATE | IFACE |
|---|---|---|---|---|---|
| 1 | 3 | 66 | 148 | 0.000 | 0.000 |
| 2 | 2 | 69 | 153 | 0.000 | 0.000 |
| 3 | 3 | 69 | 153 | 0.000 | 0.000 |

## A2. SP2 simulation

```
  VOLUMETRIC BUDGET FOR ENTIRE MODEL AT END OF TIME STEP    1, STRESS PERIOD   2
  ------------------------------------------------------------------------------

     CUMULATIVE VOLUMES      L**3       RATES FOR THIS TIME STEP      L**3/T
     ------------------              ------------------------

           IN:                                IN:
           ---                                ---
             STORAGE =       71593.1562         STORAGE =         795.4795
      CONSTANT HEAD =           0.0000  CONSTANT HEAD =           0.0000
               WELLS =           0.0000           WELLS =           0.0000
       RIVER LEAKAGE =    13151363.0000   RIVER LEAKAGE =       71359.7656
    HEAD DEP BOUNDS =           0.0000  HEAD DEP BOUNDS =           0.0000
          RECHARGE =    83535848.0000         RECHARGE =      516684.5938

           TOTAL IN =    96758800.0000         TOTAL IN =      588839.8125

          OUT:                               OUT:
          ----                               ----
             STORAGE =     9821017.0000         STORAGE =      109122.4062
      CONSTANT HEAD =           0.0000  CONSTANT HEAD =           0.0000
               WELLS =    18403536.0000           WELLS =      101308.0078
       RIVER LEAKAGE =    68534600.0000   RIVER LEAKAGE =      378409.5000
    HEAD DEP BOUNDS =           0.0000  HEAD DEP BOUNDS =           0.0000
          RECHARGE =           0.0000         RECHARGE =           0.0000

          TOTAL OUT =    96759152.0000         TOTAL OUT =      588839.8750

           IN - OUT =        -352.0000          IN - OUT =     -6.2500E-02

 PERCENT DISCREPANCY =           0.00   PERCENT DISCREPANCY =           0.00
```

Pumping rates of remedial wells for stress period

| WELL NO. | LAYER | ROW | COL | STRESS RATE | IFACE |
|---|---|---|---|---|---|
| 1 | 3 | 66 | 148 | -3704. | 0.000 |
| 2 | 2 | 69 | 153 | -125.7 | 0.000 |
| 3 | 3 | 69 | 153 | -3578. | 0.000 |

## A3. Output from 3PE for ATP 1 for sp13 and sp17

| Well Location | | | |
|---|---|---|---|
| Well Name | X Coordinate (L) | Y Coordinate (L) | |
| epa-pz-2012-1b | 630,193.00 | 3,028,057.00 | 1 |
| shm-10-06 | 630,216.00 | 3,027,883.00 | 1 |
| shm-10-06a | 630,301.00 | 3,027,896.00 | 1 |

| Principal Hydraulic Conductivity Components | | |
|---|---|---|
| $K_{max}$ = | 10.0000 | (L/T) |
| $K_{min}$ = | 10.0000 | (L/T) |
| Orientation of $K_{max}$ = | 90.00 | (degrees from N) |
| θ = | 0.00 | (degrees from X axis |

| | | |
|---|---|---|
| Effective Porosity = | 0.20 | (-) |

**User input cells are shaded green.**

HYDRAULIC HEAD DATA SET MUST NOT CONTAIN BLANK LINES

Vector Inspector Row of Interest: 22

Must be between 22 and 21

| Statistics | | | |
|---|---|---|---|
| Head (L) | epa-pz-2012-1b | shm-10-06 | shm-10-06a |
| Maximum = | 211.32 | 212.49 | 212.78 |
| Minimum = | 211.32 | 212.49 | 212.78 |
| Average = | 211.32 | 212.49 | 212.78 |
| Range = | 0.00 | 0.00 | 0.00 |

| | Hyd. Grad. (L/L) | Velocity (L/T) |
|---|---|---|
| Maximum = | 0.007533 | 0.376662 |
| Minimum = | 0.007533 | 0.376662 |
| Average = | 0.007533 | 0.376662 |

Hydraulic G
Groundwate
Hyd. Grad. Scal
Velocity Scale

| | Hydraulic Head (L) | | | Hydraulic Gradient | | Groundwater Velocity | | Angle Between Vectors |
|---|---|---|---|---|---|---|---|---|
| Date/Time | epa-pz-2012-1b | shm-10-06 | shm-10-06a | Magnitude (L/L) | Direction (deg) | Magnitude (L/T) | Direction (deg) | (deg) |
| sp13a | 211.32 | 212.49 | 212.78 | 0.007533 | 324.71 | 0.376662 | 324.71 | 0.00 |
| sp13b | 211.67 | 212.84 | 213.12 | 0.007480 | 325.50 | 0.373989 | 325.50 | 0.00 |
| sp17a | 210.90 | 212.04 | 212.35 | 0.007494 | 322.55 | 0.374703 | 322.55 | 0.00 |
| sp17b | 212.16 | 213.39 | 213.70 | 0.007948 | 324.33 | 0.397376 | 324.33 | 0.00 |

Check on vector directions for ATP triangle 1. Results show a variation of 322.5 to 324.7 azimuth.

## R88

```
  VOLUMETRIC BUDGET FOR ENTIRE MODEL AT END OF TIME STEP    1, STRESS PERIOD  18
  ---------------------------------------------------------------------------

     CUMULATIVE VOLUMES      L**3       RATES FOR THIS TIME STEP      L**3/T
     ------------------                 ------------------------

           IN:                                IN:
           ---                                ---
             STORAGE =   138288976.0000         STORAGE =           0.0000
      CONSTANT HEAD =           0.0000  CONSTANT HEAD =           0.0000
               WELLS =           0.0000           WELLS =           0.0000
       RIVER LEAKAGE =   514006272.0000   RIVER LEAKAGE =      111193.4062
    HEAD DEP BOUNDS =           0.0000 HEAD DEP BOUNDS =           0.0000
            RECHARGE =  1810993152.0000        RECHARGE =      374501.1875

           TOTAL IN =  2463288320.0000        TOTAL IN =      485694.5938

          OUT:                               OUT:
          ----                               ----
             STORAGE =    95553952.0000         STORAGE =           0.0000
      CONSTANT HEAD =           0.0000  CONSTANT HEAD =           0.0000
               WELLS =   699854272.0000           WELLS =      150628.8281
       RIVER LEAKAGE =  1667722752.0000   RIVER LEAKAGE =      335017.7188
    HEAD DEP BOUNDS =           0.0000 HEAD DEP BOUNDS =           0.0000
            RECHARGE =           0.0000        RECHARGE =           0.0000

           TOTAL OUT =  2463131136.0000        TOTAL OUT =      485646.5625

            IN - OUT =      157184.0000         IN - OUT =          48.0312

 PERCENT DISCREPANCY =           0.01  PERCENT DISCREPANCY =           0.01



         TIME SUMMARY AT END OF TIME STEP    1 IN STRESS PERIOD   18
                     SECONDS     MINUTES      HOURS       DAYS        YEARS
                     -----------------------------------------------------------
   TIME STEP LENGTH 2.84083E+08 4.73472E+06  78912.      3288.0      9.0021
 STRESS PERIOD TIME 2.84083E+08 4.73472E+06  78912.      3288.0      9.0021
         TOTAL TIME 4.18262E+08 6.97104E+06 1.16184E+05  4841.0      13.254
1

 Run end date and time (yyyy/mm/dd hh:mm:ss): 2018/03/20 12:25:13
 Elapsed run time:  8 Minutes,  8.656 Seconds
```

## R88_V2

VOLUMETRIC BUDGET FOR ENTIRE MODEL AT END OF TIME STEP 1, STRESS PERIOD 18

| CUMULATIVE VOLUMES | L**3 | RATES FOR THIS TIME STEP | L**3/T |
|---|---|---|---|
| IN: | | IN: | |
| STORAGE = | 139389888.0000 | STORAGE = | 0.0000 |
| CONSTANT HEAD = | 0.0000 | CONSTANT HEAD = | 0.0000 |
| WELLS = | 0.0000 | WELLS = | 0.0000 |
| RIVER LEAKAGE = | 517469152.0000 | RIVER LEAKAGE = | 112052.2891 |
| HEAD DEP BOUNDS = | 0.0000 | HEAD DEP BOUNDS = | 0.0000 |
| RECHARGE = | 1815877376.0000 | RECHARGE = | 374501.1875 |
| TOTAL IN = | 2472736256.0000 | TOTAL IN = | 486553.4688 |
| OUT: | | OUT: | |
| STORAGE = | 97761536.0000 | STORAGE = | 0.0000 |
| CONSTANT HEAD = | 0.0000 | CONSTANT HEAD = | 0.0000 |
| WELLS = | 699854272.0000 | WELLS = | 150628.8281 |
| RIVER LEAKAGE = | 1674956544.0000 | RIVER LEAKAGE = | 335874.8125 |
| HEAD DEP BOUNDS = | 0.0000 | HEAD DEP BOUNDS = | 0.0000 |
| RECHARGE = | 0.0000 | RECHARGE = | 0.0000 |
| TOTAL OUT = | 2472572416.0000 | TOTAL OUT = | 486503.6250 |
| IN - OUT = | 163840.0000 | IN - OUT = | 49.8438 |
| PERCENT DISCREPANCY = | 0.01 | PERCENT DISCREPANCY = | 0.01 |

TIME SUMMARY AT END OF TIME STEP 1 IN STRESS PERIOD 18

| | SECONDS | MINUTES | HOURS | DAYS | YEARS |
|---|---|---|---|---|---|
| TIME STEP LENGTH | 2.84083E+08 | 4.73472E+06 | 78912. | 3288.0 | 9.0021 |
| STRESS PERIOD TIME | 2.84083E+08 | 4.73472E+06 | 78912. | 3288.0 | 9.0021 |
| TOTAL TIME | 4.18262E+08 | 6.97104E+06 | 1.16184E+05 | 4841.0 | 13.254 |

## R86_PU2

VOLUMETRIC BUDGET FOR ENTIRE MODEL AT END OF TIME STEP 1, STRESS PERIOD 18

| CUMULATIVE VOLUMES | L**3 | RATES FOR THIS TIME STEP | L**3/T |
|---|---|---|---|
| IN: | | IN: | |
| STORAGE = | 134269504.0000 | STORAGE = | 0.0000 |
| CONSTANT HEAD = | 0.0000 | CONSTANT HEAD = | 0.0000 |
| WELLS = | 0.0000 | WELLS = | 0.0000 |
| RIVER LEAKAGE = | 559971456.0000 | RIVER LEAKAGE = | 124648.0703 |
| HEAD DEP BOUNDS = | 0.0000 | HEAD DEP BOUNDS = | 0.0000 |
| RECHARGE = | 1634502400.0000 | RECHARGE = | 319891.8438 |
| TOTAL IN = | 2328743424.0000 | TOTAL IN = | 444539.9062 |
| OUT: | | OUT: | |
| STORAGE = | 103673656.0000 | STORAGE = | 0.0000 |
| CONSTANT HEAD = | 0.0000 | CONSTANT HEAD = | 0.0000 |
| WELLS = | 699854272.0000 | WELLS = | 150628.8281 |
| RIVER LEAKAGE = | 1525251712.0000 | RIVER LEAKAGE = | 293922.0625 |
| HEAD DEP BOUNDS = | 0.0000 | HEAD DEP BOUNDS = | 0.0000 |
| RECHARGE = | 0.0000 | RECHARGE = | 0.0000 |
| TOTAL OUT = | 2328779776.0000 | TOTAL OUT = | 444550.8750 |
| IN - OUT = | -36352.0000 | IN - OUT = | -10.9688 |
| PERCENT DISCREPANCY = | 0.00 | PERCENT DISCREPANCY = | 0.00 |

TIME SUMMARY AT END OF TIME STEP 1 IN STRESS PERIOD 18

| | SECONDS | MINUTES | HOURS | DAYS | YEARS |
|---|---|---|---|---|---|
| TIME STEP LENGTH | 2.84083E+08 | 4.73472E+06 | 78912. | 3288.0 | 9.0021 |
| STRESS PERIOD TIME | 2.84083E+08 | 4.73472E+06 | 78912. | 3288.0 | 9.0021 |
| TOTAL TIME | 4.18262E+08 | 6.97104E+06 | 1.16184E+05 | 4841.0 | 13.254 |

1

Run end date and time (yyyy/mm/dd hh:mm:ss): 2018/05/18 11:00:59
Elapsed run time: 8 Minutes, 19.209 Seconds

## R88_NOPTMAX

```
  VOLUMETRIC BUDGET FOR ENTIRE MODEL AT END OF TIME STEP    1, STRESS PERIOD  18
 ---------------------------------------------------------------------------

    CUMULATIVE VOLUMES      L**3       RATES FOR THIS TIME STEP      L**3/T
    ------------------                 ------------------------

          IN:                                IN:
          ---                                ---
            STORAGE =   138288944.0000         STORAGE =           0.0000
      CONSTANT HEAD =           0.0000   CONSTANT HEAD =           0.0000
              WELLS =           0.0000           WELLS =           0.0000
      RIVER LEAKAGE =   514006336.0000   RIVER LEAKAGE =      111193.3984
    HEAD DEP BOUNDS =           0.0000 HEAD DEP BOUNDS =           0.0000
            RECHARGE =  1810992640.0000         RECHARGE =      374501.1875

           TOTAL IN =  2463287808.0000          TOTAL IN =      485694.5938

         OUT:                               OUT:
         ----                               ----
            STORAGE =    95553896.0000         STORAGE =           0.0000
      CONSTANT HEAD =           0.0000   CONSTANT HEAD =           0.0000
              WELLS =   699854272.0000           WELLS =      150628.8281
      RIVER LEAKAGE =  1667722240.0000   RIVER LEAKAGE =      335017.6875
    HEAD DEP BOUNDS =           0.0000 HEAD DEP BOUNDS =           0.0000
            RECHARGE =           0.0000         RECHARGE =           0.0000

           TOTAL OUT =  2463130368.0000          TOTAL OUT =      485646.5000

            IN - OUT =      157440.0000           IN - OUT =          48.0938

PERCENT DISCREPANCY =           0.01     PERCENT DISCREPANCY =           0.01



         TIME SUMMARY AT END OF TIME STEP    1 IN STRESS PERIOD   18
                     SECONDS     MINUTES      HOURS       DAYS        YEARS
                     -----------------------------------------------------------
   TIME STEP LENGTH 2.84083E+08 4.73472E+06  78912.      3288.0      9.0021
 STRESS PERIOD TIME 2.84083E+08 4.73472E+06  78912.      3288.0      9.0021
         TOTAL TIME 4.18262E+08 6.97104E+06 1.16184E+05  4841.0      13.254
1
```

**ARMY RESPONSES TO MASSDEP COMMENTS ON THE DRAFT GROUNDWATER FLOW MODEL REVISION REPORT SHEPLEY'S HILL LANDFILL FORMER FORT DEVENS ARMY INSTALLATION DEVENS MASSACHUSSETTS January 2019**

The following U.S. Army responses pertain to the Massachusetts Department of Environmental Protection (MassDEP) comments, dated 15 February 2019, on the draft *Shepley's Hill Landfill Groundwater Flow Model Revision Report*, dated 11 January 2019.

**Comment 1** – Sections 1 and 2.1: The statement indicating that a MassDEP representative was part of the Model Working Group that developed the model revisions through consensus should be corrected. Though a MassDEP representative attended some of the model-related meetings, model decisions were made by others.

> ***Response:*** *In Sections 1 and 2.1, the statement was revised to exclude MassDEP from the list of modeling work group members that provided consensus for model revisions.*

**Comment 2** – Section 5.3, Last Paragraph: The assumed bedrock hydraulic conductivities appear to be inconsistent with one another and inconsistent with site data. The assumed conductivity of Layer 5 (0.02 ft/day), representing shallow, relatively fractured bedrock, should be higher than the assumed conductivity of Layer 6 (0.17 ft/day), which represents deeper, less fractured bedrock. Site data indicate that the bedrock conductivities used in the model are lower than those that exist at the site. As noted in Section 3, measured site bedrock conductivities ranged from 0.1 to 100 ft/day, and measurements listed for shallow bedrock well CH-1S (22.5 ft/day) in Table 5.1 are significantly higher than the values used in the model.

> ***Response:*** *In the model, fractured bedrock is represented as an equivalent porous media (EPM) by replacing hydraulic conductivity distributions with a continuous porous medium having equivalent effective hydraulic properties. The hydraulic conductivity calibrated through PEST, including vertical hydraulic conductivity to account for observed vertical fracturing, were selected to provide a similar flow pattern observed in the fractured system and therefore vary from hydraulic conductivity measurements of specific fracture zones. The EPM approach, concurred to by the modeling work group members, resulted in reasonable simulation of heads observed in bedrock monitoring wells without having to simulate a fracture network.*

**Comment 3** – Section 6.2.2.1: The MacPherson well was taken out of service during 2018. Was the model adjusted to account for this during the final stress period (SP18: 2017 through 2025)? If not, would adjustments to account for the shutdown of the well alter the model results significantly?

> ***Response:*** *In SP18, the flow rate of the McPherson well is estimated to be less than 25,000 cubic feet per day (cfd) (130 gallons per minute [gpm]) (see Figure 6.3). Although the model input did not account for the McPherson well being taken of service in 2018, the effects on the model results and conclusions regarding the ATP capture zone are expected to be negligible due to the relative location of the McPherson well with respect to the ATP (approximately 0.8 miles downgradient).*

**Comment 4** – Section 8.1.2.2: The detailed discussion of limitations entailed in the use of 3PE analyses to evaluate the model calibration is appreciated; however, it the leaves the reliability of the model for capture zone analysis in doubt. Further, a comparison of water level contours

generated by the model for Layer 1 (Figures 9.5a and 9.5f) to contoured water level measurements presented in annual reports indicates that the 3PE results are more representative of actual conditions. **Figure 1** (attached) compares inferred flowpaths based on water level contours predicted by the model for Spring 2016 (SP 15) to inferred flowpaths based on the Spring 2016 contoured water level measurements (**Figure 2**) and Spring 2017 contoured water level measurements (**Figure 3**, included because Spring 2016 measurements were relatively sparse). **Figure 4** compares inferred flowpaths based on water level contours predicted by the model for Fall 2017 (SP 17) to inferred flowpaths based on the Fall 2017 contoured water level measurements (**Figure 5**). Groundwater flow directions inferred from the annual report contour maps, which integrate and extend the 3PE analysis to additional wells in the vicinity of the 3PE triangles and beyond, are consistent with the 3PE results in both seasons, indicating that the 3PE results provide a more accurate representation of actual site conditions, rather than a bias attributable to seasonal averaging of measurements or non-planarity.

> ***Response:*** *The 2018 updated groundwater model incorporates the most current site data and reasonably simulates target water level elevations in the SHL area and across the three-dimensional model domain to provide a reliable tool for hydrogeologic analysis at the site. Manually generated contour maps of observed data are limited by the extent and distribution of the data points, especially near discharge or recharge boundaries. In this case, the effects of recharge from Plow Shop Pond are not incorporated into the interpolated contours presented in the annual reports. This introduces some uncertainty to the interpretation of equipotential lines and subsequent conclusions based on flow line analysis in this area. Like the limitations of the 3PE analysis, conclusions regarding the reliability of the groundwater model by comparing with the results of hand contoured data must take into account the inherent limitations of the analysis.*

**Comment 5** – Section 11: Field data indicate that the actual capture zone is smaller than predicted by the model:

- As acknowledged in the report, the apparent westward bias in modeled flowpaths indicated by 3PE analysis suggest the model may over-predict the extent of the capture zone (Section 8.1.2.1).
- As shown in **Figure 6**, the distribution of dissolved arsenic in groundwater near the extraction wells indicates that groundwater from beneath the east side of the landfill flows northwestward past the extraction wells, rather than being hydraulically contained by a capture zone that extends to the northwest corner of Plow Shop Pond as indicated by the model (e.g., Figure 11.6). In particular, the eastern boundary of the plume (approximated by the 100 ug/L contour line in **Figure 6**) is not aligned with the westward trending flowpaths determined by the model in the vicinity of the extraction wells; instead, the eastern boundary of the plume trends parallel to the groundwater flow direction indicated by 3PE calculations and contoured water level measurements presented in the annual reports (**Figures 1 and 4**
- As shown in **Figure 7**, the distribution of PFAS in groundwater near the extraction wells is similar to the distribution of dissolved arsenic, indicating that groundwater flowing from beneath the east side of the landfill is outside of the capture zone. Because the distribution of PFAS is not affected by the same oxidation-reduction reactions and microbial reactions that might cause arsenic distributions to deviate from groundwater flowpaths - essentially PFAS are a relatively conservative tracer - these

results provide independent geochemical evidence indicating that the capture zone does not extend as far east as indicated by the model.

- Modeled flowpaths through arsenic-impacted and PFAS-impacted wells located east of the extraction wells extend to surface water in Plow Shop Pond (Figure 11.5), where relatively low arsenic and PFAS concentrations exist, rather than extending to the landfill, where relatively high arsenic and PFAS concentrations exist (**Figures 6 and 7**).

***Response:*** *The distribution of arsenic in Figure 6 does not provide a reliable basis for evaluating groundwater flow paths because spatial and temporal variations in oxidation-reduction and microbial reactions (noted in your third bullet), along with anthropogenic sources of arsenic, complicate the use of advective plume analysis for evaluating the fate and transport of arsenic from the landfill. It is premature to form conclusions about ATP capture using the distribution of PFAS (Figure 7) before the RI is completed and a CSM (e.g., sources and fate and transport) is developed. In the area east of the landfill where capture effectiveness is less certain, and arsenic concentrations are substantially lower than concentrations within the landfill footprint, the mass of As that could be bypassing is a small portion of the total arsenic migrating from beneath the landfill cap.*

**Comment 6** – Section 12, Third Paragraph: Based on the inconsistencies between the modeled flowpaths and the flowpaths indicated by site data (Comment 7), the model does not appear to be reliable for capture zone analysis. Perhaps some unknown essential feature of the flow system (e.g., bedrock fracture, sand and gravel deposit, or source of recharge) was not captured by the model. The discussion in Section 8.1.2.2 describes how invalid assumptions in the 3PE calculations might explain the differences between the model results and the 3PE results. MassDEP suggests that an analogous analysis of the model calculations be undertaken – how can the model be adjusted to more closely match the 3PE results and field data, and how do those adjustments affect the modeled capture zone?

***Response****: Considerable effort has been expended by the model working group (MWG) to address the potential bias along the eastern edge of the landfill. This includes a detailed analysis of hydraulic conductivity zonation and configuration of Plow Shop Pond. The differences between the Model and the 3PE results are inherent in the calibration method which was established by the MWG early in the model revision process (i.e., use of seasonally averaged observed conditions for boundary conditions and calibration targets). All models include uncertainty due to the inability to define exact spatial and temporal parameter distributions and boundary conditions over the model domain. Regardless of the potential westward bias along the eastern edge when comparing the model results to the results from the 3PE analysis, the model provides a reliable tool for estimating flow paths and evaluating the complicated flow system at the Site.*

# ARMY RESPONSES TO EPA COMMENTS ON THE DRAFT FINAL GROUNDWATER FLOW MODEL REVISION REPORT SHEPLEY'S HILL LANDFILL FORMER FORT DEVENS ARMY INSTALLATION, DEVENS, MASSACHUSETTS

The following U.S. Army responses pertain to the U.S. Environmental Protection Agency (EPA) comments, dated 14 April 2020, on the draft final *Shepley's Hill Landfill Groundwater Flow Model Revision Report*, dated November 2019.

## GENERAL COMMENTS

1. The revised groundwater flow model appears to be an appropriate tool for evaluating general groundwater flow patterns under differing hydrologic conditions, such as periods with differences in recharge or different pumping conditions. This type of evaluation is useful in conceptualizing the importance of various controls on the groundwater flow field.

   *Response: The Army agrees.*

2. While the revised report attempts to explain the many decisions incorporated into the model simulations and the modeling procedures, there are several noteworthy topics in the report and in Army's responses to comments that should be expanded upon and/or included in the final report to enhance and more clearly describe the model process and some of the overall modeling analyses.

   *Response: Comment acknowledged. See responses to specific comments below.*

3. Several previously raised comments/concerns remain unaddressed in the draft final report (i.e. what form of precipitation occurred during the 9-day shutdown test and accurate assignment of recharge). EPA recommends that a short conference call be convened to discuss/resolve these issues prior to issuance of the final report.

   *Response: See responses to comments below as a basis for discussion. A conference call between EPA and Army will be scheduled to discuss/resolve these issues prior to issuance of the final report.*

## SUBJECT-SPECIFIC COMMENTS

1. Comparison of Remedial Alternatives - The revised model should be an improved tool for evaluating the relative effects of alternative remedial system designs (*e.g.*, the number and the locations of additional extraction wells, increases in extraction rates, installation of a reactive barrier, northward extension of the current slurry wall).

   *Response: The Army agrees that the model, in its current state, provides a useful tool for evaluating potential remedial design refinements.*

2. Evaluation of Background Conditions/Well Locations – The revised model can be used to identify areas hydraulically upgradient of the landfill under a likely range of recharge conditions and, therefore, potential candidate locations for investigation of the range of natural or background conditions.

However, it must be noted that current conditions will not fully reflect the full range of historical groundwater flow, specifically flow directions prior to installation of the landfill cap and pumping system. Although the model could be a useful tool in these evaluations, additional discussions are warranted to develop the most appropriate technical approach for its use.

*Response: The Army agrees that the model is a useful tool for simulating historical groundwater conditions to evaluate a range of historical groundwater flow paths. The Army will initiate discussions with EPA when developing potential plans for investigating natural or background conditions.*

3. Generalized Estimation of Groundwater Travel Times - The revised model should also be a useful tool for improved estimates of the potential range of groundwater travel times through various parts of the site. In a general sense, such estimates may be useful in the evaluation of contaminant concentration trends observed within the NIA. However, detailed estimates of flow paths and travel times to individual wells will likely be less useful due to site complexity and other factors.

   *Response: The Army agrees that the model is useful for calculating ranges of travel time estimates from various parts of the Site. The Army will consider ranges of travel times from upgradient areas in future evaluations regarding concentration trends in monitoring wells. However, arsenic migration is subject to ORP conditions of the aquifer that are not accounted for in advective groundwater flow modeling.*

4. Detailed Specification of Capture Zone Dimensions - Based on differences in groundwater flow vectors calculated from observed data using potentiometric surfaces/three-point assessments and results predicted by the model, it appears that the model may not be fully replicate the capture zone of the pumping wells as indicated by the field data. As noted in Sections 8 and 10 of the report, the observed data indicate there appears to be a westerly bias in model predicted flow directions east of the ATP that may indicate an overestimate of the extent of capture in this area. However, comparisons are limited to the limited observed data, particularly data from pressure transducer/dataloggers available during the model calibration time period. In addition, Section 10 of the report also correctly notes that model-computed heads in the central portion of the landfill are lower than observed heads, suggesting that recharge estimates may be too low. Increased recharge in this area, as well as along the western edge of the landfill from upland recharge from Shepley's Hill, would likely reduce the model-predicted extent of capture of the extraction wells. Additional validation using more recent and extensive observed data sets would be needed to increase confidence in model-predicted capture zone dimensions. Currently, it appears that the most compelling evidence regarding the degree of capture provided by the pumping wells will likely come from evaluation of observed hydraulic head data and trends in groundwater quality parameters.

   *Response: The Army recognizes the uncertainty in model predicted capture along the eastern edge of the landfill based on the 3PE assessment in monitoring wells north east of the landfill and that model-computed heads in the central portion of the landfill are lower than observed heads, suggesting that recharge estimates may be too low. The Army will consider that uncertainty when relying on the model as one line of evidence to evaluate capture of groundwater flowing from beneath the landfill. Other lines of evidence, including observed hydraulic head data, groundwater quality trends, and groundwater and arsenic mass flux to the ATP and the NIA from within and outside the landfill boundary will be relied on as the primary lines of evidence for evaluating groundwater capture by the recovery wells.*

5. Groundwater Flux to Red Cove - In the Red Cove area, it is not clear that the model fully replicates observed flow patterns east of the slurry wall. Additional calibration using detailed observed datasets would be needed to better evaluate the limitations of the model with respect to estimating groundwater flow to Red Cove under the current range of hydraulic conditions.

*Response: The Army agrees that future model calibration using more detailed data sets in the Red Cove area would decrease uncertainty regarding flow patterns in this area.*

6. Groundwater Flow Directions in Areas Lacking Observed Hydraulic Head Data - As with any groundwater flow model, caution should be used in evaluation of model-predicted hydraulic gradients in areas of the model domain where observed hydraulic head data are not available. Although the model may be a useful tool for projecting groundwater flow directions that should be observed under the current hydrologic conceptual model, actual hydraulic gradients may be significantly different due to differences in recharge rates/areas, hydraulic conductivity distribution, etc.

   *Response: The Army agrees that there is some uncertainty in all groundwater model predicted gradients and groundwater flow directions. The Army will consider this uncertainty in future evaluations in areas where observed head is not available.*

**PAGE-SPECIFIC COMMENTS**

1. Page 9, § 5.3, ¶ 2, last sentence - The proposed revision doesn't address/resolve previously raised concerns regarding the assignment of modified hydraulic conductivity values under PSP (i.e. whether conceptual values were used, resulting in constrained and assigned parameters or whether the values were adjusted through the model calibration process). Specifically, the current text states "*Within the PSP footprint, horizontal K was reduced by an order of magnitude to compensate for the relatively deep incision depth of the pond compared to the thickness of Layer 1. The result is an anisotropy ratio of 1:1 and a reduction in assigned transmissivity to prevent overcalculating horizontal flow beneath the pond*." EPA requests that this text be replaced with the following**:** "*Within the PSP footprint, several adjustments were made to align the assigned model hydraulic conductivity input to more closely represent field conditions. Specifically, to compensate for the relatively deep incision depth of the pond compared to the thickness of Layer 1, it was necessary to decrease the horizontal hydraulic conductivity of the model under the PSP footprint to simulate and mimic the reduced thickness and flow likely found in the field from deep incisions. The reasoning is that the river package, which is used to simulate the PSP, assumes flow under the river (underflow) is independent of incision depth. Further, vertical conductivity was not adjusted so that the resultant horizontal:vertical anisotropy ratio was 1:1. This too had the desired effect of constraining underflow. The parameter estimation for the zones under the river were… "* In addition, please add text explaining whether the K parameters were solved with these constraints (allowed to vary in parameter estimation) or whether they were fixed based on the conceptual approach.

   *Response: The requested text replacement was made in Section 5.3 and additional text was provided to explain that the K values beneath the pond were included in the parameter estimation process and therefore allowed to vary.*

2. Page 18, § 7., ¶ 2 – EPA recommends that a weighting factor closer to 0.25 be used for water levels below Shepley's Hill instead of zero. Also, it does not appear that the effects of smaller weights were evaluated as indicated in Army's response to comments. Were simulations run using different weights? EPA recommends that a short conference call be convened to discuss/resolve these issues prior to issuance of the final report.

   *Response: No, the PEST simulations were not run with weights other than zero for the Shepley Hill targets. However, the residuals were included in the evaluation of model revisions after each PEST simulation. Due to the complex nature of bedrock flow and the steep topography, it was more difficult to simulate the observed water levels in this area than in other areas of the model. A weight of zero was given to the monitoring wells on Shepley's Hill because the higher residuals would dominate the parameter estimation process and limit the calibration in areas of concern (e.g., upgradient and down*

*gradient from the ATP). Also, the group of monitoring wells on Shepley's Hill are clustered in a relatively small area which would further contribute to bias for this area in the parameter estimation process. The remaining 11 bedrock monitoring wells distributed across the site were assigned a weighting factor of 1. This can be further discussed on the conference call between EPA and Army to be scheduled to discuss/resolve specific responses prior to issuance of the final report.*

3. Page 21, § 8.1.1., ¶ 2 – It is unclear why adjustments to SP2 recharge assigned during the 9-day shutdown simulation in February 2013 were being evaluated – there either was, or wasn't, precipitation during the 9-day timeframe. According to the current text, adjustments to recharge weren't necessary because the daily precipitation rate for the shutdown 9-day period was similar to the quarterly daily precipitation rate. Specifically, the response to comments states "*Precipitation during the recovery period (shutdown test) was evaluated to determine whether adjustments to SP2 recharge should be assigned during the 9-day shutdown simulation. Review of precipitation records from the Fitchburg Municipal Airport indicated the average precipitation during the shutdown test was 0.0063 ft/day, within 3% of the average precipitation for the first quarter 2013 (0.0065 ft/day) used as a basis for recharge in SP2. Therefore, no adjustment to SP3 recharge was made for the validation simulation*." The text suggests that there was precipitation, possibly in the form of rain, and that the sum of the rain divided by nine days produced an average daily rate similar to the rate for the 2013 1st quarter. If, on the other hand, "precipitation" refers to snow (and not rain), then recharge is likely zero and should be simulated as such. Please clarify this discussion and amend, as/if necessary. Also, EPA requests that a rainfall graph or table for that time period be included in the final groundwater flow model report.

   *Response: Precipitation recorded during the shutdown period at the closest NOAA weather station (Fitchburg Airport) is summarized in Table 1 (attached). This table is incorporated in the final report as Table 8.1. Precipitation was reported in inches of "rain, melted snow, etc (in)". Observations of snow were not reported. The maximum temperatures during the shutdown period ranged from 24 to 51 degrees with a general warming trend from February 6 to February 15. Based on these data it is likely that the precipitation reported early in the shutdown period was in the form of snow and precipitation reported later in the shutdown period was in the form of rain. It is also likely that snowfall early in the shutdown period would have melted by the end of the period.*

**FIGURES**

1. Figure 5.9 – Please include a reference to the abbreviations used on the figure. Specifically, in instances where a full description/name cannot be shown on a figure (or included in a table), it should, at a minimum, refer to a master list of abbreviations/descriptions included in another section/appendix of the model revision report.

   *Response: The notes within the table were revised to provide a more comprehensive description of abbreviations and the table insert was revised to provide geologic descriptions of each zone depicted on the maps.*

2. Figures 9.5a to 9.5j – The figures provide very useful maps of head residuals, illustrating spatial bias in areas of the model. The areas can be broken out into zones that for both high (SP15) and low recharge rates (SP17) show a similar tendency to overpredict (model heads> observed heads) or underpredict (model heads < observed heads) residuals. Specifically, the model consistently overpredicts heads in the area by Nonacoicus Brook which could be the result of the riverbed conductance being set too low. The other area is the landfill area where the model underpredicts heads. For this area, it's possible that Shepley Hill may contribute some focused recharge along the western edge of the landfill that the model does not simulate. The focused recharge may be channeled based on anisotropy of the rock toward the middle to northern part of Shepley Hill. EPA requests that a critical discussion of the spatial tendencies be included where/when the graphs are introduced and then again in the conclusions section.

*Response: Section 9.1 and Section 10 (Assumptions and Limitations) were revised to include an expanded discussion of the spatial tendencies evident in different areas of the model based on residual distributions presented in Figures 9.5a to 9.5j. Spatial bias within the landfill and the NIA was summarized in the model conclusions (Section 12) with reference to Section 9.1 for a more detailed discussion.*

3. Figure 9.6 - It is very difficult to track parameter abbreviations on the figure. As stated previously, please include a reference to a master list of abbreviations/descriptions in another section/appendix of the model revision report.

   *Response: The notes of the table were revised to provide a more comprehensive description of abbreviations and to refer the reader to other tables and figures in the report that describe the charted parameters. Also, the chart symbols were color coded by parameter type to make it easier to view.*

4. Figure 9.6 - The results show the model is most sensitive to recharge multipliers and therefore recharge rates. Eight of the top twelve most sensitive parameters are recharge multipliers, 4 of the next 10, and 5 of the last 16. EPA requests that a critical discussion of the parameter sensitivities and tendencies be included where/when the graphs are introduced and then again in the conclusions section**.**

   *Response: Section 9.3 was revised to include an expanded discussion of the parameter sensitivities and recharge multipliers. Parameter sensitivities were summarized in the model conclusions (Section 12) with reference to Section 9.3 for a more detailed discussion of the issue.*

**TABLES**

1. Table 5-2 - In instances where a full description/name cannot be included in a table (or shown on a figure), it should refer the reader to a master list of abbreviations/descriptions provided in another section/appendix of the model revision report.

   *Response: The notes of the table were revised to provide a more comprehensive description of abbreviations and to refer the reader to other tables and figures in the report that describe the tabulated data.*

**COMMENTS ON ARMY'S 11/08/19 RESPONSES TO EPA'S 08/04/19 COMMENTS ON THE DRAFT SHL GROUNDWATER FLOW MODEL REVISION REPORT**

1. Page-Specific Comment (PSC) 4 – EPA commented that implementation of additional model realizations reflective of historical flow conditions that have existed prior to and during operation of the groundwater extraction system are warranted. EPA also recommended that discussions commence to develop and reach consensus on a technical approach by which the model could be used to inform analysis of background/baseline conditions in different parts of the impacted aquifer and suggested that this information, in conjunction with other lines of evidence (i.e. groundwater chemistry trends), could be used to minimize uncertainty in background/baseline well designations. Upon approval of current model calibration, model runs could be developed to represent both current and historic site conditions. Army's "Comment noted" response is unacceptable. EPA recommends that a short conference call be convened to discuss/resolve this matter prior to issuance of the final report.

   *Response: The Army recognizes that the model simulated capture zones and flow paths presented in the report represent conditions under the current remedy (i.e., landfill cap, barrier wall, and ATP pumping conditions). The Army agrees that the model will be useful to simulate historical flow conditions that have existed prior to 2013 which will be needed to assess historical flow paths that were*

*in place during the complete lifetime arsenic mobilization. Further discussion to develop a technical approach to make use of the model to evaluate background/baseline conditions in specific areas of the Site will be included in the conference call between EPA and Army to be scheduled to discuss/resolve specific responses prior to issuance of the final report.*

2. PSC 45 – Army's response is unacceptable in that it addresses a field response over time not how the model solution would differ between a short time step (hours) to a longtime step (days). Further discussion is warranted prior to issuing the final SHL model revision report.

   *Response: Two additional shutdown test simulations were run using 20 time steps, one to simulate the 9-day recovery period and another with no recharge during the recovery period. Charts comparing the model calculated recovery to the observed recovery are presented in Figures 1 through 4 (attached). The charts demonstrate that the model-calculated recovery using 20 time steps improves the match with the observed data compared to the single time step simulation. Comparison of Figures 1 and 2 with Figures 3 and 4 demonstrates that for both simulations using 20 steps, the model-calculated recovery with recharge provided a better match to observed recovery than the model without recharge. The findings can be further discussed in the conference call between EPA and Army to be scheduled to discuss/resolve specific responses prior to issuance of the final report .*

3. PSC 60 and 61 - See PSC 4.

   *Response: See response to Comment # 1 (PSC-4) above.*

4. PSC 63 - Because of the high-resolution time frequency in data collection for the 3PE, the water-level data captures a more comprehensive range of hydrologic conditions than possible with the coarse time scale (based on stress periods) of the model and resulting model-computed heads. For this reason, the comparison maybe partly qualitative in nature but nevertheless informative when comparing statistical tendencies between the two sets of water levels.

   *Response: Notwithstanding the limitations described in Section 8.1.2.2, the Army agrees that a more comprehensive range of hydrologic conditions can be observed with higher resolution data and recognizes the utility of a qualitative comparison of 3PE gradient directions using average quarterly model results and statistics from the 3PE results assessed continuously over the full period of the model simulation.*

5. PSC 68 - The proposed revised text is inconsistent with other sections of the model revision report and is in complete contrast to EPA's interpretation of the calibrated model and comparison of particle track capture zone analysis with 3PE analyses. Although Army's response seems to suggest that any and all discussion of capture zone should be omitted from the model revision report and included instead in the technical memorandum to be prepared in accordance with EPA's SHL SOW Phase 1 Task 4, its revised, proposed text suggests otherwise. This is a major issue that must be addressed/resolved prior to issuing the final model revision report.

   *Response: The revised text has been edited to be consistent with text in Section 10 regarding interpretation of model predicted capture. In addition to adding a discussion regarding model sensitivities to Section 12, the following text has been added to address potential model capture zone bias.*

   *"*The model analysis using 3PE gradient analysis indicated a westerly bias in the model-calculated flow directions east of the ATP compared to the distribution of observed flow directions, suggesting that the model may overestimate groundwater capture by the ATP in this area."

## SUMMARY AND CONCLUSIONS

While the revised SHL groundwater flow model is acceptable and allows Army to proceed with the remaining work required per EPA's February 24, 2016, SHL Scope of Work, there are additional adjustments and opportunities for further refinement that are worthy of further evaluation/consideration by the Army/EPA modeling team. For example, the model is generally sensitive to recharge rates and the most sensitive parameters tended to be recharge multipliers associated with the stress periods. Therefore, future applications of the model may want to focus on improving estimates of recharge in critical areas of the model by the remedial extraction wells and along the western edge of the landfill. This could be done by calibration to a higher data collection frequency of water levels and an associated higher time discretization (monthly stress periods and high number of time steps) of the model.

There are several hydraulic conductivity zones that are also sensitive. A large data set of slug tests were used to inform the model of hydraulic conductivity values and tendencies. Additional improvements could be seen by using different interpolation schemes that would produce different realizations of hydraulic conductivity for use in the model.

An important model result is that the remedial extraction wells capture a larger area under low recharge conditions than high. This suggests that seasonal dependent extraction rates may be in useful in plume capture. Further examination of this finding in subsequent efforts would be beneficial.

While the updated groundwater flow model reflects a much improved understanding of the highly complex hydrogeologic conditions and groundwater flow patterns associated with the SHL site, there are several areas of the model where adjustments could be made to better support statements regarding ATP performance (i.e. plume capture) and more accurately evaluate the relative effects of an alternative, long-term remediation strategy. While critical for improving future applications of the model, EPA will identify/address these issues in a separate, subsequent submittal so that completion of the SHL model revision report can move forward.

*Response: Comment acknowledged. Issues identified for improving future applications of the groundwater model will be discussed in the conference call to be scheduled to discuss/resolve specific responses prior to issuance of the final report and summarized in the conclusions section of the report. The EPA submittal will be added to the report in Appendix E.*

**Table 1**
**February 2013 Precipitation**
**Shepley's Hill Landfill Groundwater Model**

| Date | Minimum Daily Temperature (F) | Maximum Daily Temperature (F) | Rain, melted snow, etc. (in) | Snow, Ice Pellets, Hail (in) |
|---|---|---|---|---|
| 2/1/2013 | 21 | 32 | 0 | - |
| 2/2/2013 | 16 | 29 | T | - |
| 2/3/2013 | 17 | 28 | T | - |
| 2/4/2013 | 19 | 29 | 0 | - |
| 2/5/2013 | 19 | 31 | T | - |
| 2/6/2013 | 20 | 38 | T | - |
| 2/7/2013 | 12 | 31 | 0 | - |
| 2/8/2013 | 18 | 25 | 0.37 | - |
| 2/9/2013 | 14 | 24 | 0.12 | - |
| 2/10/2013 | 6 | 39 | 0 | - |
| 2/11/2013 | 7 | 42 | 0.19 | - |
| 2/12/2013 | 34 | 42 | 0 | - |
| 2/13/2013 | 25 | 42 | 0 | - |
| 2/14/2013 | 21 | 44 | 0 | - |
| 2/15/2013 | 19 | 51 | 0 | - |
| 2/16/2013 | 27 | 39 | 0.06 | - |
| 2/17/2013 | 16 | 27 | 0.01 | - |
| 2/18/2013 | 13 | 31 | 0 | - |
| 2/19/2013 | 22 | 46 | 0.17 | - |
| 2/20/2013 | 26 | 40 | 0.01 | - |
| 2/21/2013 | 23 | 32 | 0 | - |
| 2/22/2013 | 19 | 40 | 0 | - |
| 2/23/2013 | 27 | 37 | 0.02 | - |
| 2/24/2013 | 32 | 35 | 0.81 | - |
| 2/25/2013 | 18 | 39 | T | - |
| 2/26/2013 | 31 | 41 | 0 | - |
| 2/27/2013 | 34 | 41 | 1.26 | - |
| 2/28/2013 | 31 | 45 | T | - |
| ATP Shutdown Period Total Precipitation | | | 0.68 | 0.0 |
| Total Precipitation for the Month | | | 3.02 | 0.0 |

Notes:
1. Precipitation data are from the Fitchburg, MA Municipal Airport station (GHCND:USW00004780).
2. Snow, ice pellets and hail precipitation was not reported.
3. Precipitation data for days coinciding with the Arsenic Treatment Plan (ATP) shutdown are shaded.
4. F = Degrees Fahrenheit, in = inches, T = Trace precipitation defined as less than 0.01 inches;
"-" = data not reported.

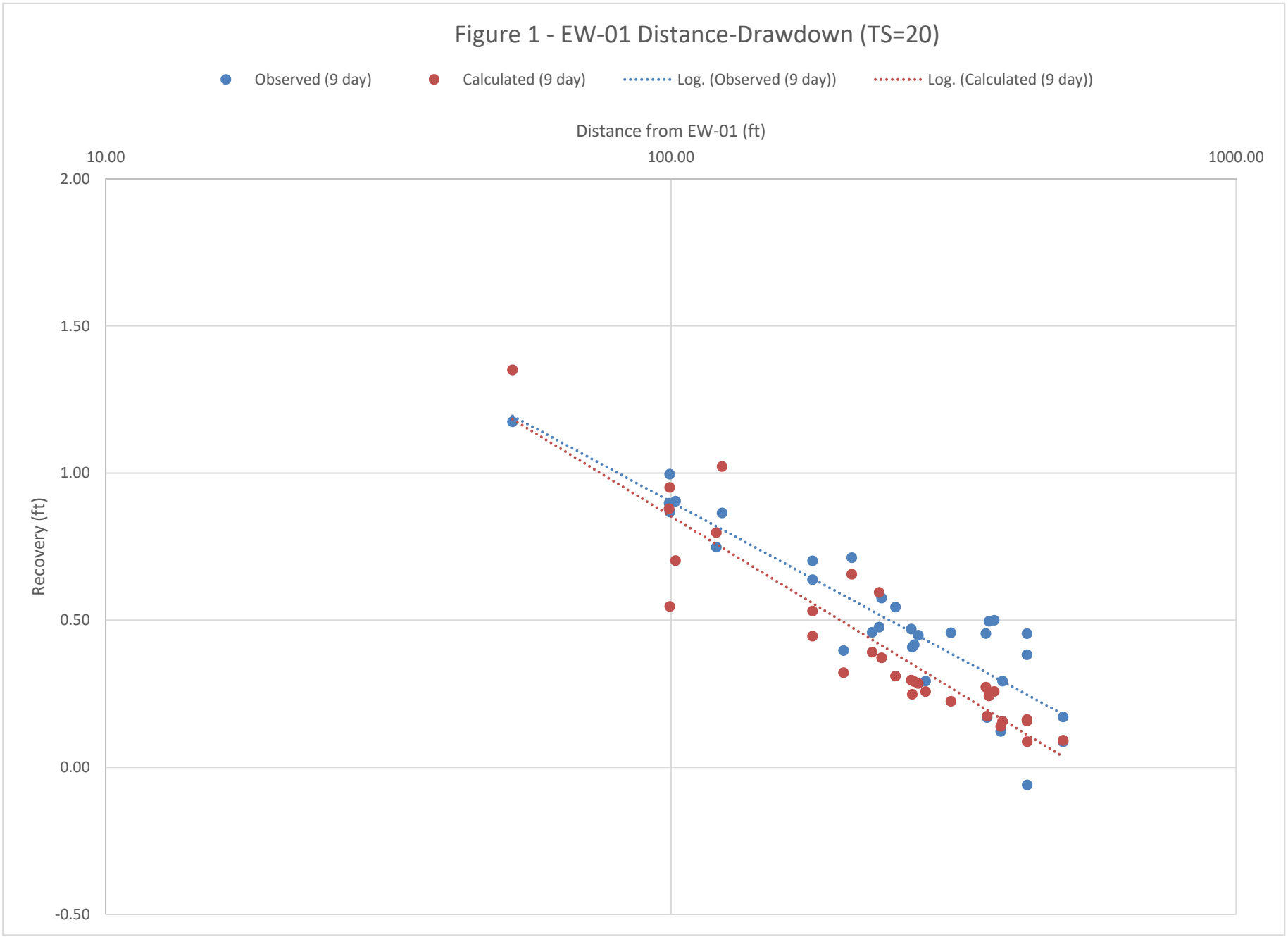


Figure 1 - EW-01 Distance-Drawdown (TS=20)
Observed (9 day)
Calculated (9 day)
Log. (Observed (9 day))
Log. (Calculated (9 day))
Distance from EW-01 (ft)
10.00
100.00
1000.00
2.00
1.50
1.00
0.50
0.00
-0.50
Recovery (ft)

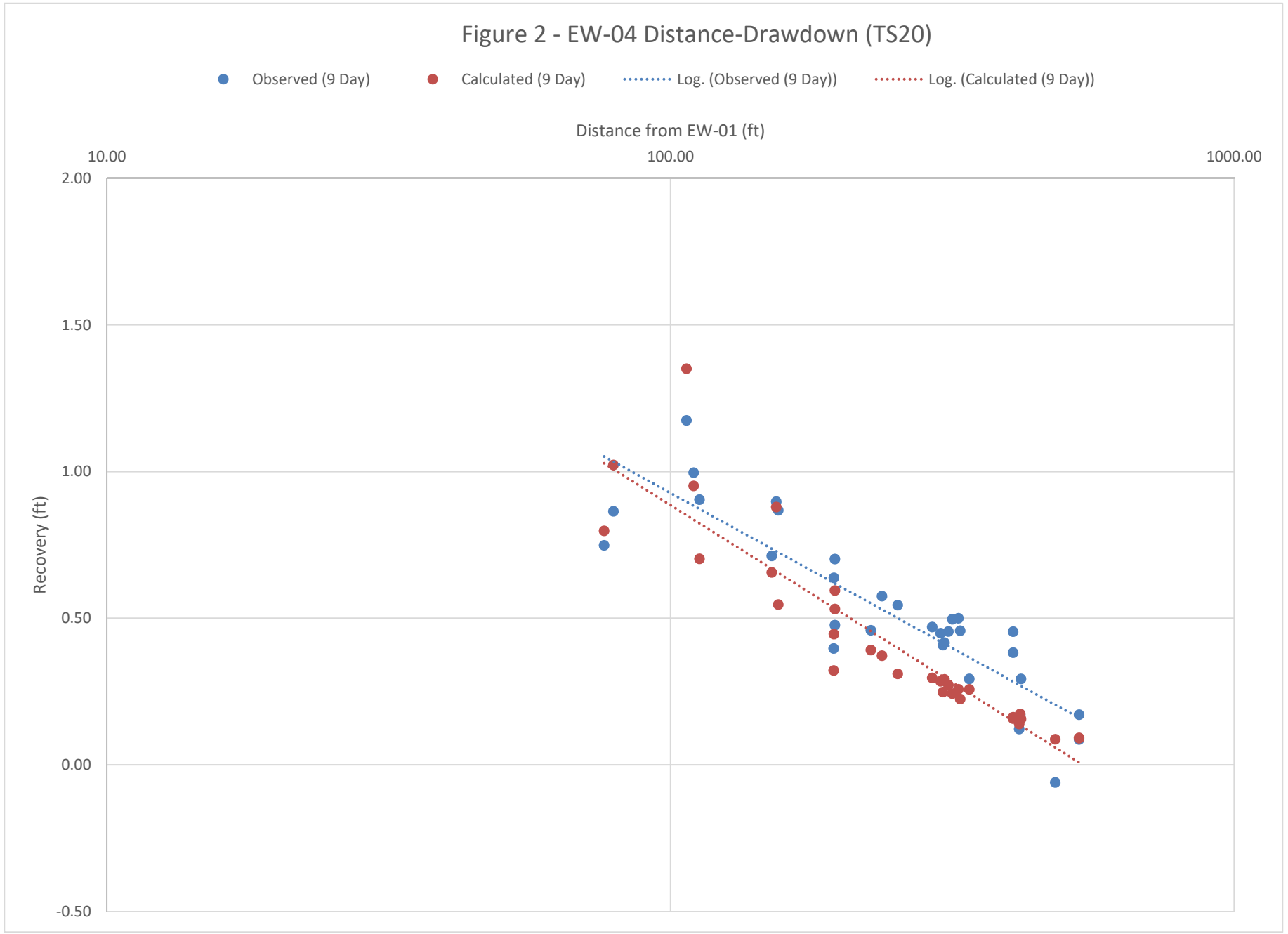


Figure 2 - EW-04 Distance-Drawdown (TS20)
Observed (9 Day)
Calculated (9 Day)
Log. (Observed (9 Day))
Log. (Calculated (9 Day))
Distance from EW-01 (ft)
10.00
100.00
1000.00
Recovery (ft)
2.00
1.50
1.00
0.50
0.00
-0.50

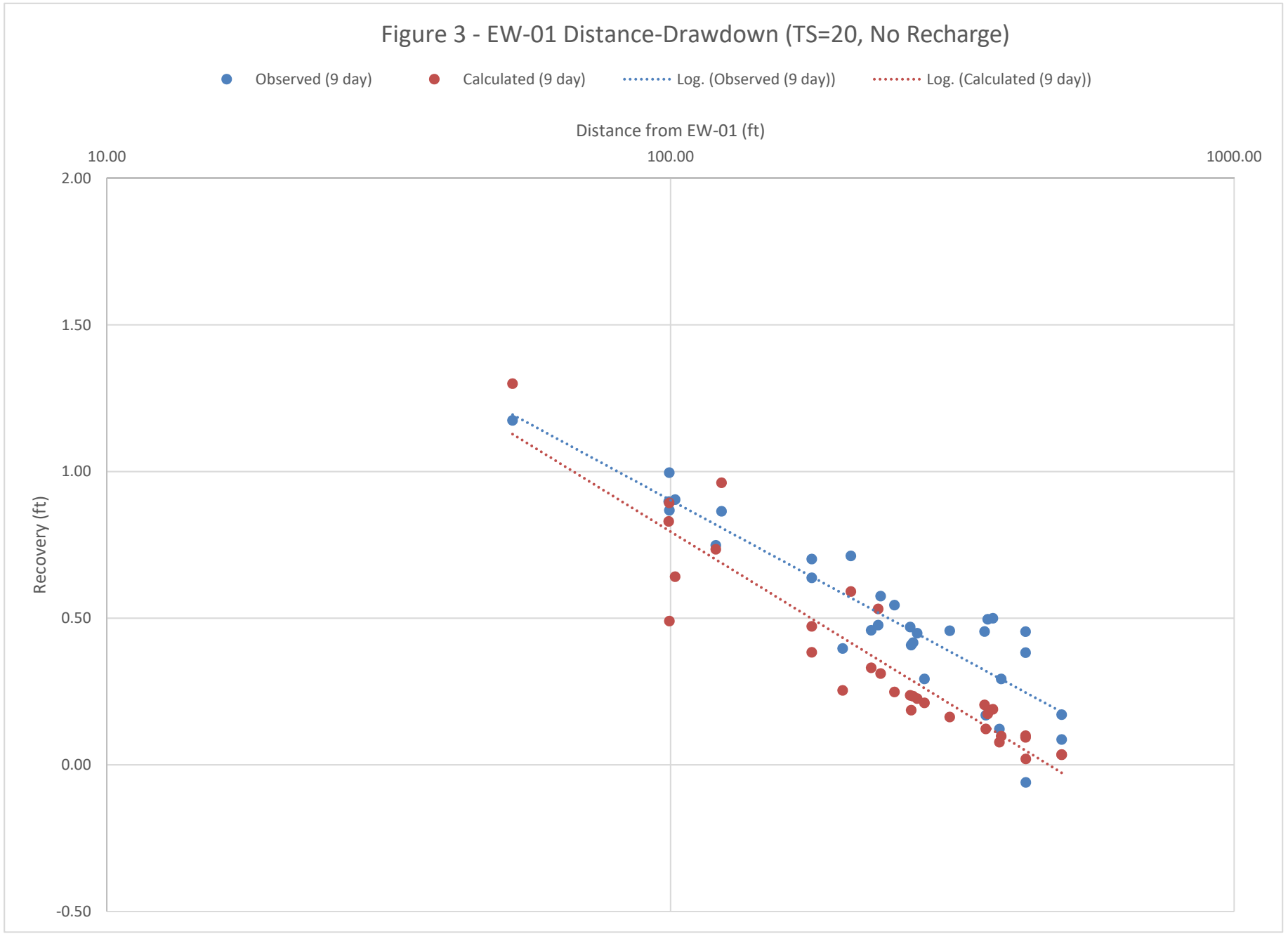


Figure 3 - EW-01 Distance-Drawdown (TS=20, No Recharge)
Observed (9 day)
Calculated (9 day)
Log. (Observed (9 day))
Log. (Calculated (9 day))
Distance from EW-01 (ft)
10.00
100.00
1000.00
2.00
1.50
1.00
0.50
0.00
-0.50
Recovery (ft)

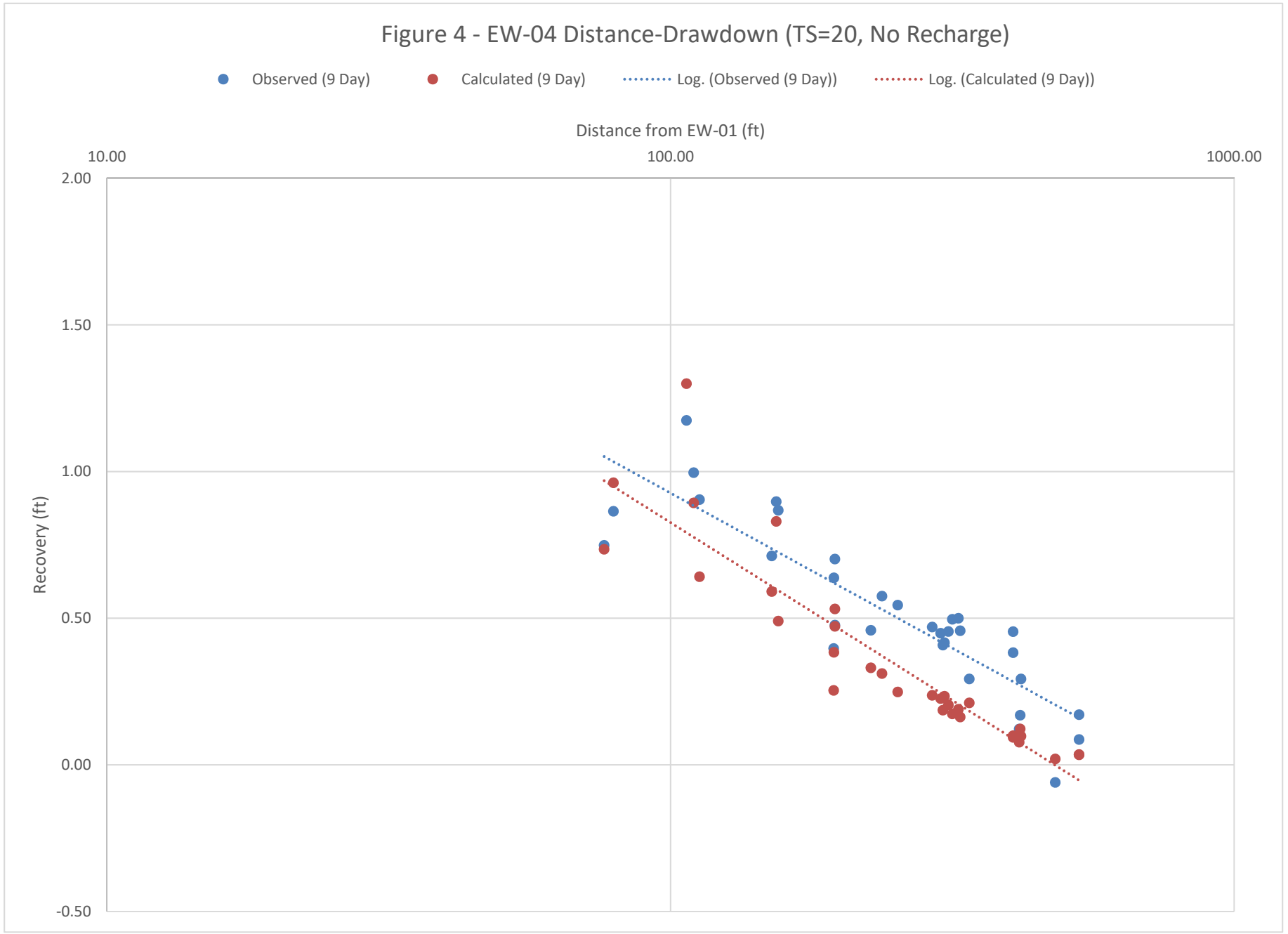


Figure 4 - EW-04 Distance-Drawdown (TS=20, No Recharge)
Observed (9 Day)
Calculated (9 Day)
Log. (Observed (9 Day))
Log. (Calculated (9 Day))
Distance from EW-01 (ft)
10.00
100.00
1000.00
2.00
1.50
1.00
0.50
0.00
-0.50
Recovery (ft)

# ARMY RESPONSES TO MASSDEP COMMENTS ON THE DRAFT FINAL GROUNDWATER FLOW MODEL REVISION REPORT SHEPLEY'S HILL LANDFILL FORMER FORT DEVENS ARMY INSTALLATION DEVENS MASSACHUSSETTS

The following U.S. Army responses pertain to the Massachusetts Department of Environmental Protection (MassDEP) comments, dated 18 December 2019, on the draft final *Shepley's Hill Landfill Groundwater Flow Model Revision Report*, dated November 2019.

**MassDEP Comment 1** – The responses to MassDEP comments and the revised report do not resolve the concerns raised in MassDEP Comments 2, 4, 5, and 6 on the draft report. The considerable effort expended to update the model is recognized and appreciated; nevertheless, significant differences between on-site measurements and simulated output from the model cast doubt on the reliability of the model for conducting capture zone analysis.

***Army Response****: The Army recognizes uncertainty in model predicted capture along the eastern edge of the landfill and will consider that uncertainty when relying on the model as one line of evidence to evaluate capture of groundwater flowing from beneath the landfill to the ATP. Other lines of evidence include observed hydraulic head data, groundwater quality trends, and mass flux to the ATP and the NIA from within, and outside the landfill boundary. These will be the primary lines of evidence relied on for evaluating groundwater capture by the recovery wells.*