

# **THE EFFECTS OF BIOSWALE CONSTRUCTION ON GROUNDWATER ADJACENT TO I-294 IN NORTHERN COOK COUNTY, ILLINOIS**

**Keith W. Carr, James J. Miner, Kathleen E. Bryant, Jessica R.  
Ackerman, Eric T. Plankell, and Colleen M. Long**

**Open File Series 2016-2c 2016**



**ILLINOIS STATE GEOLOGICAL SURVEY**  
Prairie Research Institute  
University of Illinois at Urbana-Champaign

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Prairie Research Institute  
University of Illinois at Urbana-Champaign  
615 E. Peabody Drive  
Champaign, Illinois 61820-6918

<http://www.isgs.illinois.edu>

## EXECUTIVE SUMMARY

This report evaluates effects of bioswale construction on groundwater levels and quality. It is part of a broader, seven-year study undertaken by ISGS to evaluate the effects of bioswales constructed during expansion of I-294 in northern Cook County, Illinois. The groundwater component of this study involved the installation of monitoring wells at two of the monitored bioswales, including one “wet” bioswale design and one “dry” bioswale design (bioswales TB7B and TB15B, respectively). Transects begin within the bioswales and extend into adjacent forest preserves. Groundwater levels and quality were monitored in order to evaluate whether groundwater was altered by roadway runoff or the presence of bioswales.

At both monitoring sites, pre- and post-construction measurements of groundwater levels beneath and adjacent to the bioswales did not reveal any clear increases in groundwater levels due to increased infiltration or decreases in groundwater levels due to more efficient conveyance of surface waters off site. Within the sand of the bioswale backfill, localized increases in water levels were noted directly adjacent to culverts that outlet into the bioswale, where near-constant water discharge creates ponding that can persist for weeks or months. Also, within the backfill at the dry bioswale site, an underdrain was seen to exhibit control on groundwater levels and to limit surface ponding by moving shallowly infiltrated waters out of the system rapidly.

Groundwater quality adjacent to sites TB7B and TB15B showed effects from roadway operations. The majority of groundwater samples collected at both sites exhibit elevated concentrations of roadway-related constituents in wells within, beneath, and directly adjacent to the bioswales, but more distant wells are not affected. At wet bioswale TB7B, adjacent native sediments were dominantly composed of silt, sand, and gravel, and therefore transmitted groundwater readily, but an eastward groundwater flow direction limited movement of contaminants westward into the forest preserve. Wells within and beneath bioswale TB7B showed high levels of chloride and total dissolved solids (TDS) throughout the monitoring period, and other constituents were found at levels that exceed groundwater standards at varying recurrence intervals, including iron, sulfate, selenium, and thallium. Well TB7B-1, located in native sediments approximately 15 ft (5 m) west of bioswale TB7B, was affected by chloride, TDS, and iron during the pre-construction period, but <sup>^</sup><sub>^</sub> of groundwater standards declined steeply after bioswale construction, likely due to improved

channelization of runoff, which diminished flow of impacted surface waters toward the forest preserve and subsequent infiltration. Wells farther from the bioswale did not show frequent ^{c&^{\aa}} &^{\bullet} related to roadway runoff.

At dry bioswale TB15B, geologic deposits below and adjacent to the bioswale were silty clays, although some sand was present at depth in two borings. Despite slower groundwater flow through the silty clay, wells located within the bioswale fill, in the native sediments below the bioswale, and in the wells approximately 50 ft (15 m) west of the bioswale in the forest preserve, were affected by roadway runoff, with regular ^{c&^{\aa}} &^{\bullet} of groundwater standards for TDS, chloride, selenium, and thallium. Slow infiltration for decades of roadway operations had likely allowed buildup of these constituents in groundwater in the fine-grained sediments adjacent to the roadway, and aerial deposition may also have contributed. Some scattered ^{c&^{\aa}} &^{\bullet} of groundwater standards occurred at wells farther west of the bioswale but roadway runoff did not clearly cause any widespread effects. Despite slower groundwater flow, runoff-related constituents have penetrated farther into the forest preserve at TB15B, likely due to westward groundwater flow and lack of forest cover to inhibit aerial transport. Additional investigation of the role of (and potential impacts to) the underlying sand deposit is recommended. After construction of bioswale TB15B, specific conductivity, chloride, and TDS decreased at the wells in the forest preserve adjacent to the bioswale, likely due to the installation of the underdrain, which receives seasonal groundwater discharge during wetter periods of the year, possibly preventing westward flow of high-TDS groundwater or allowing impacted groundwater to flow eastward from the forest preserve and discharge into the underdrain. Although shallow groundwater in the adjacent part of the forest preserve (near wells TB15B-1L and 1U) has declined in chloride and TDS over the study period, groundwater standards were still exceeded regularly.

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## **INTRODUCTION**

In 2007, the Illinois State Geological Survey (ISGS) was contracted by the Illinois State Toll Highway Authority (Illinois Tollway) to monitor the impacts of bioswales to be installed during reconstruction of I-294 in northern Cook County, Illinois, USA. Bioswales are wide, flat ditches designed to reduce the quantity and improve the quality of runoff by slowing or infiltrating water and fostering contact of runoff with soils and vegetation (Mazer et al. 2001). From February 2008 through August 2010, the ISGS developed methods for monitoring the quantity and quality of runoff from I-294 in the existing roadside ditch system, and performed baseline monitoring in locations planned for bioswale construction. It should be noted that roadway construction was already partially underway prior to the beginning of monitoring, so that any discussion of “pre-construction” refers to the construction of the bioswales, not the roadway. Discharge and water-quality results from the pre-existing roadway ditches were previously reported in Miner et al. (2012a). The bioswales were constructed in 2010, and annual post-construction monitoring results were presented in Miner et al. (2012b, 2013, and 2014). This report and companion reports that address other aspects of the larger study (Bryant et al. 2016, Miner et al. 2016, Ackerman et al. 2016, and Plankell et al. 2016) contain all pre- and post-construction data. Data and conclusions presented in the 2016 reports supersede all previous reports due to new methodologies developed during post-construction monitoring that resulted in recalculation of some previously reported results.

This report was prepared under contract #ITHA RR-07-9918 and #ITHA 2015-01230 MINER, and is limited to activities regarding bioswale construction and monitoring along the I-294 corridor between Touhy Avenue and Lake-Cook Road, and does not address other activities contained within the above-referenced contracts. Purpose and scope, methods, data, and conclusions are discussed.

## **PURPOSE AND SCOPE**

As part of the larger study, ISGS investigated groundwater within and adjacent to the bioswales before and after construction to identify bioswale-related impacts. This report contains final data and conclusions regarding impacts to groundwater levels and quality in the vicinity of the ditch or bioswale system, as well as in adjacent forest preserves. Companion reports listed above detail other aspects of the larger study, including surface-water quality, discharge measurement and soil chemistry.

The various bioswales installed for this project were grouped into two design types, “dry” and “wet” bioswales. Dry bioswales were designed to infiltrate runoff through a sand bed into a drainage pipe (underdrain) buried longitudinally along the bioswale (Figure 1), anticipating that infiltrating runoff would remove suspended solids and hence their adsorbed metals. Wet bioswales are similar to the dry bioswales shown in Figure 1, although they lack underdrains because they were designed to retain runoff at land surface. Shallow ponding (less than one foot deep) was anticipated by including regularly spaced check dams. Wet bioswales were expected to have enhanced removal of certain dissolved solids such as nutrients due to denitrification in the saturated conditions, as well as adsorption and transformation of pollutants by extended contact with biota and soil. Deposition of sediment was anticipated due to the slowing of runoff in ponded segments of the wet bioswales, but the efficiency of sediment removal compared to dry bioswales was unknown.

The overall study involved four bioswales instrumented during the pre-construction period that were also monitored after construction; two of those bioswales were targeted for groundwater monitoring (TB7B and TB15B; Figure 2). It was expected that dry and wet bioswales would interact differently with the surrounding groundwater regime, so one bioswale of each type was instrumented for groundwater monitoring before and after construction. The specific purpose of the post-construction groundwater monitoring was to identify any impacts to groundwater compared to pre-construction conditions given the increased runoff and pollutant loading due to the increased lane-miles and traffic volume, and to assess any differences in performance related to bioswale type (wet vs dry).

Previous bioswale research has documented reductions in metals, especially chromium, copper, lead, nickel, and zinc, as well as suspended sediment, nutrients, and hydrocarbons (Crabtree et al. 2006, Mazer et al. 2001, Groves et al. [undated]). Therefore, this study focused on an extensive suite of cations and anions (including metals and nutrients) and other measures such as total dissolved solids (TDS) to evaluate any impacts of the bioswales to groundwater quality.

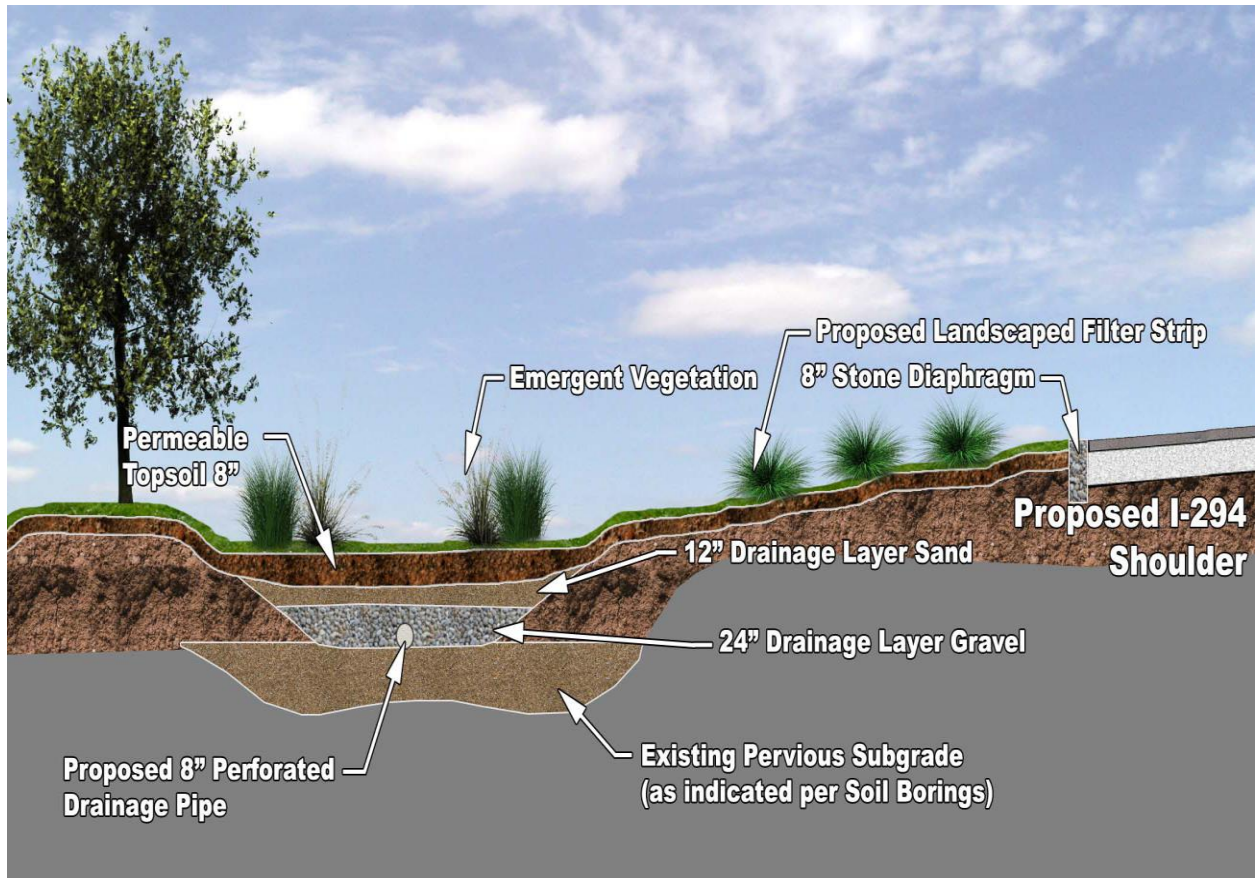


Figure 1. Schematic diagram of a dry bioswale. Dry and wet bioswales installed for this project lacked a gravel layer. Wet bioswales lacked underdrains. Diagram was prepared by Huff and Huff, Incorporated and Transystems and is used by permission.

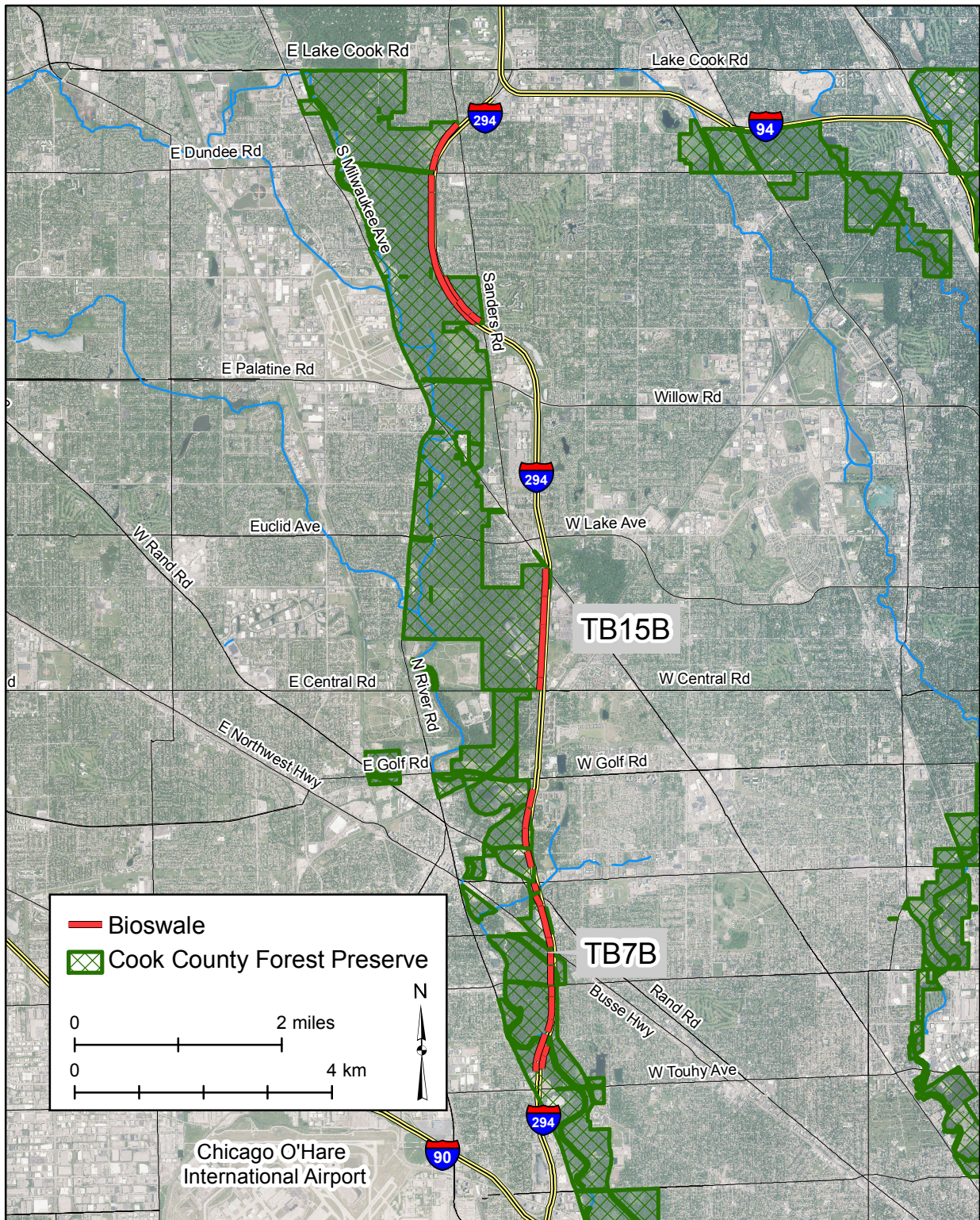


Figure 2. Location of bioswales where groundwater was monitored

## METHODS

Several data sets were collected with the objectives of evaluating groundwater levels, concentrations of any constituents in the groundwater, likely transport mechanisms within the groundwater regime, and the fate of these constituents in the subsurface. Groundwater level and chemistry data were compared to precipitation data to investigate the role of infiltration in groundwater dynamics at the bioswale sites.

## PRECIPITATION

Hourly and daily precipitation data for the groundwater portion of the study were obtained from the Midwestern Regional Climate Center for the Chicago-O'Hare Airport Weather Service Office (WSO) (Midwestern Regional Climate Center 2015). The O'Hare Airport WSO is about 4 miles southwest (Figure 2) of the southernmost bioswale monitoring site (TB7B), and it uses heated precipitation gauges that can record precipitation accurately in all seasons. In 2011, the ISGS installed Isco tipping-bucket rain gauges at TB9A and at bioswale TB15B to help identify the timing and distribution of precipitation, but they are not used for annual totals because they are unheated and therefore cannot record snowfall accurately. Annual snowfall totals were also obtained from the O'Hare Airport WSO to see if a pattern in annual snowfall (and attendant road salt application rates) led to discernible patterns in solute inputs to groundwater.

## GROUNDWATER LEVELS AND QUALITY

In the pre-construction period and for five subsequent years, the ISGS monitored groundwater adjacent to bioswales TB7B and TB15B to determine if infiltrated roadway runoff affected groundwater levels and quality. Monitoring wells were hand-augered and installed using the methods of Miner and Simon (1997), and were constructed of 2-inch diameter PVC casing and screen.

In November 2009, prior to bioswale construction, wells were installed in transects extending into the forest preserve from a point adjacent to each of the future bioswale monitoring sites (for well transect layouts at both sites, see Figures 3 and 4). Each well varied slightly in design, but was installed to screen the uppermost coarse-grained materials, if present. After bioswale construction, in Spring 2011, an additional pair of nested wells was installed within each bioswale. The shallower of these nested wells

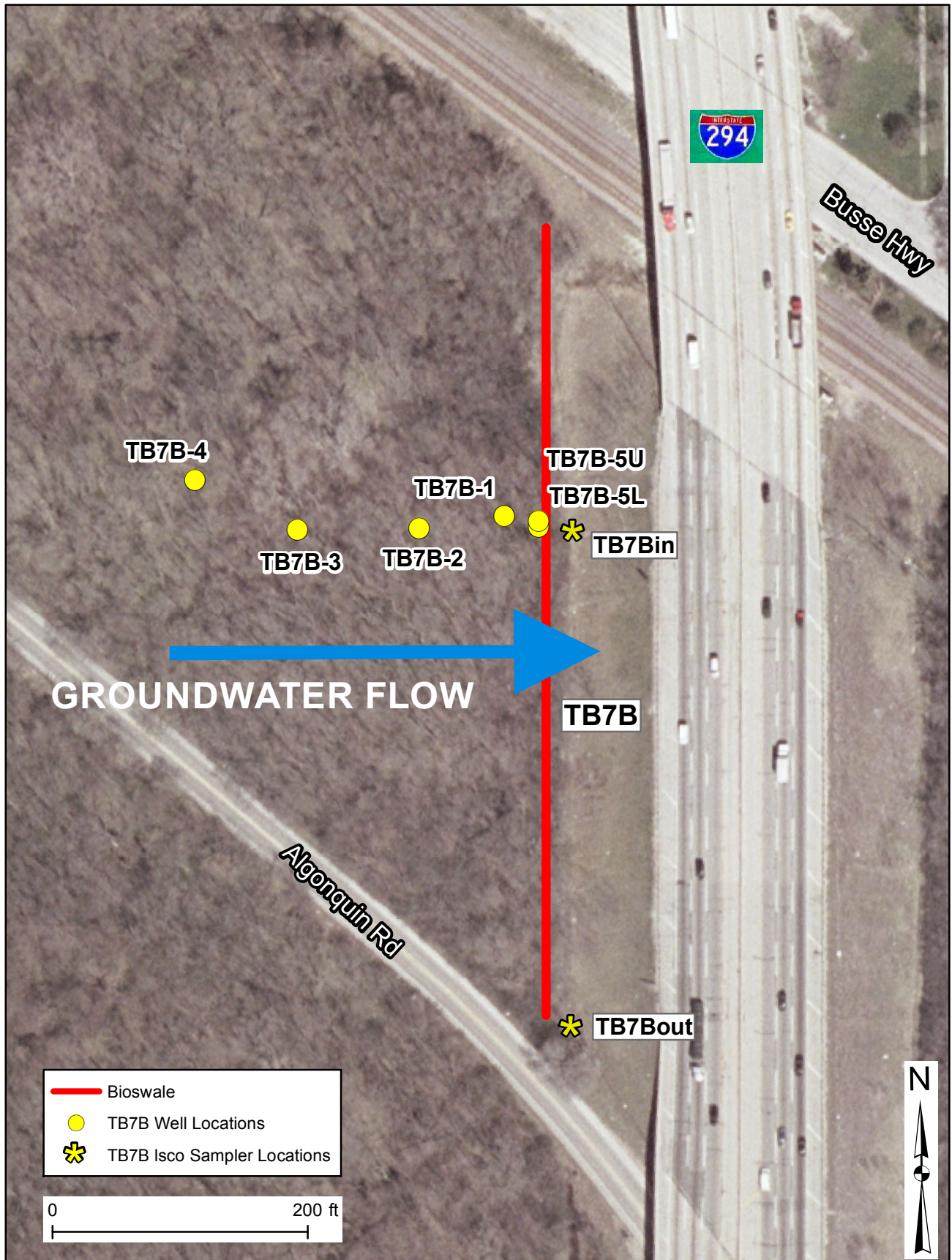


Figure 3. Monitoring well transect at bioswale TB7B



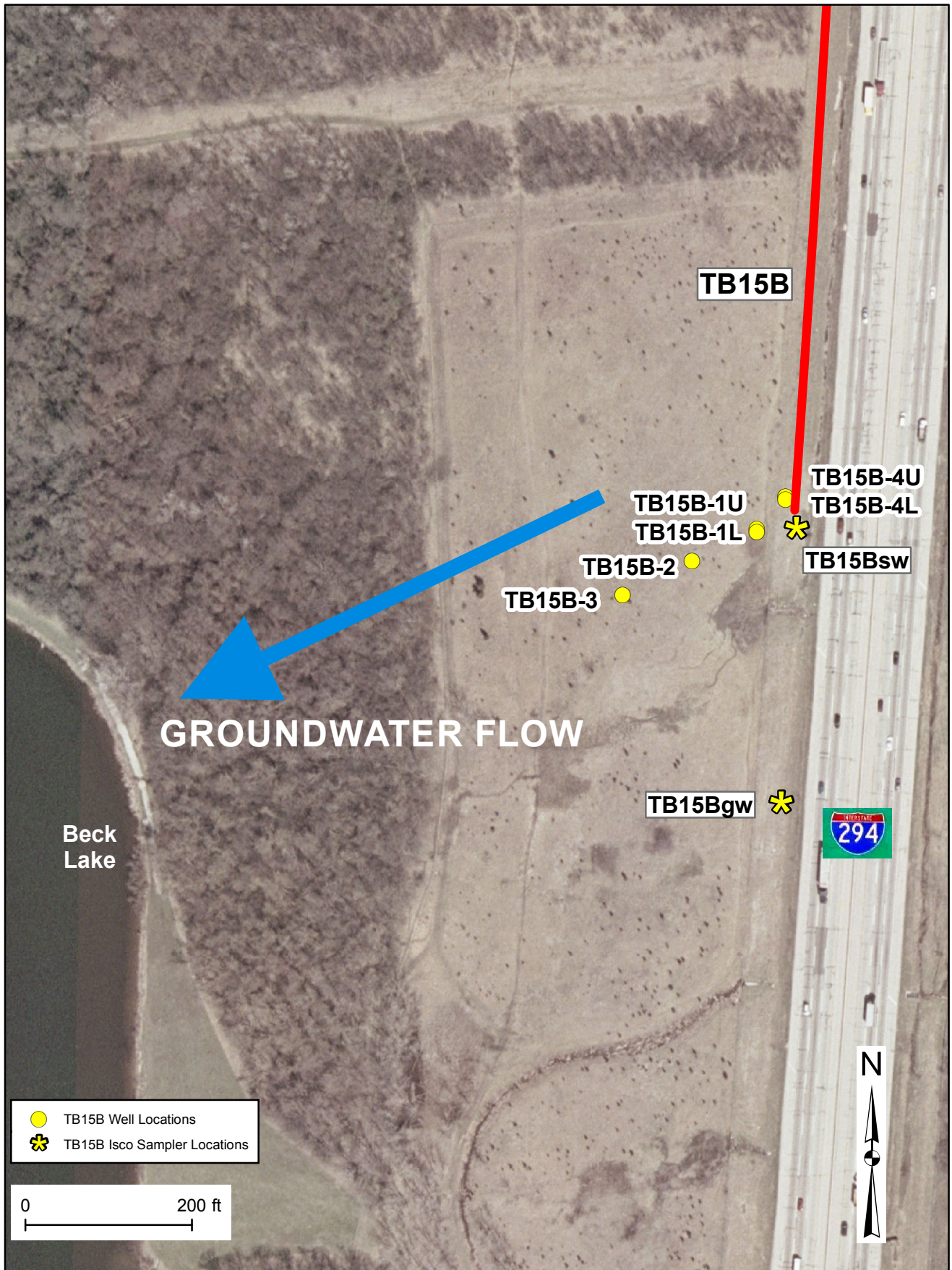


Figure 4. Monitoring well transect at bioswale TB15B

was screened in the coarse sand of the bioswale backfill material, and the deeper well was screened in the native material below the bioswales (silty sand and silt at TB7B and silty clay at TB15B). The well measurement points and land-surface elevations at the wells were surveyed after construction and every two years thereafter, either with an automatic level or with a survey-grade GPS. Well-construction details are provided in Appendix A.

In-Situ AquaTROLL 200 data loggers were deployed in each well and were programmed to record specific conductivity, temperature, and water level on an hourly basis. The groundwater data loggers were calibrated bi-weekly with 12,856  $\mu\text{S}/\text{cm}$  In-Situ conductivity standard, which was appropriate given the expected conductivity range of the waters to be monitored. Data loggers were calibrated according to the In-Situ manual (In-Situ, Inc. 2010). The loggers were calibrated on site except during winter months, when the loggers were calibrated indoors after temperature equilibration. Because some wells occasionally dried out, especially during late Summer and Fall of 2010, 2012, and 2013, some well samples and specific conductivity data could not be collected. Specific conductivity readings were removed from the data set if they were produced when the sensor was not fully submerged.

In addition to the datalogged parameters, water samples were collected from wells bi-weekly through 2013, then monthly through 2015. Groundwater samples were analyzed for the water-quality parameters listed in Appendix B. All groundwater samples were collected using a peristaltic pump with silicone tubing connected to a flow-through cell. A Hydrolab Minisonde 5 multi-parameter water-quality sonde was attached to the flow-through cell and used to measure field temperature, pH, and specific conductivity in all samples, and to identify stabilization of those parameters prior to sampling. The pumping rate was approximately 0.5 L (0.13 gal) per minute or less in accordance with standard low-flow sampling procedures (ASTM Standard D6771-02 [ASTM 2002]). Samples collected for analysis of dissolved non-volatile organic carbon, dissolved metals, anions, TDS, and phosphate were filtered using a 0.45-micron disposable filter; all others were nonfiltered. Samples for dissolved metals, total and dissolved non-volatile organic carbon, and ammonia were preserved with acid (0.2% nitric acid, 0.5% phosphoric acid, 0.5% phosphoric acid, and 0.2% sulfuric acid, respectively), and all others were unacidified. All samples were kept on ice or below 4°C until analysis. Groundwater samples generally were delivered to the laboratory within the appropriate holding times for each type of sample, although some constituents, such as nutrients,

whose samples are not filtered or preserved, have very short (48-hour) holding times that may have been exceeded occasionally by no more than 24 hours (no notable impacts were anticipated). Blank and duplicate samples were collected during all sampling runs as quality-control measures, and those results are presented in Miner et al. (2016).

All groundwater samples were sent to the Illinois State Water Survey Public Service Laboratory for analysis (see Appendix B for a complete list of analytes and methodologies). Total phosphorous values were determined via inductively coupled plasma spectroscopy (ICP) using USEPA Method 200.7, and ortho-phosphate values were determined via colorimetry using USEPA Method 365.1. Total phosphorous values determined by ICP previously were found to be more variable than ortho-phosphate (Miner 2012b), so ortho-phosphate will be utilized where possible for analysis in this report, although total phosphorous is also reported. Where applicable, groundwater samples were compared to Class 2 Groundwater Standards (Illinois Pollution Control Board, part 620, section 620.420), which hereafter will be referred to as Class 2 standards. Class 2 Groundwater is "General Resource Groundwater," which is defined as water not meeting other classes, such as potable water, water contributing to nature preserves, and other groundwater. No official determination has been made that groundwater below and adjacent to the bioswales should be classified as Class 2. Groundwater analyte concentrations will be compared to these groundwater-quality standards to identify any <sup>^cc^edæ</sup>excesses of those standards.

## **DATA AND ANALYSIS**

Data presented in this report include: 1) precipitation, 2) well-construction information and geologic cross-sections, 3) water levels measured through time from both manual water-level meters and AquaTROLL data loggers for all monitoring wells, 4) specific conductivity data for all wells (from AquaTROLL data loggers), 5) concentrations of dissolved constituents found in groundwater, and 6) comparisons of constituent levels to Class 2 groundwater-quality standards.

## PRECIPITATION

Precipitation data for the entire study period are provided in Ackerman et al. (2016). Daily precipitation data from the gauge at the O'Hare Airport WSO (Midwestern Regional Climate Center 2015) are included on graphs of groundwater level and specific conductivity presented later. Annual snowfall totals from the O'Hare Airport WSO are also included for analysis of road-salting patterns; these data are also presented later on graphs of specific conductivity of groundwater.

## GEOLOGY

Geologic cross-sections from each monitoring site are provided in Figures 5 and 6. These cross-sections show the sediments encountered when installing monitoring wells. Subsurface materials at TB7B (Figure 5) are coarse-grained fluvially deposited materials that range from sandy silt to gravelly sand, mapped as part of the Henry Formation (Willman 1971). At TB15B (Figure 6), silty clay sediments occur at land surface and to depths of 6.6-10 ft (2-3 m), possibly glacial till or glaciolacustrine materials, mapped as part of the Wedron Formation (Willman 1971), overlying a sand body of unknown extent at depth.

## GROUNDWATER LEVELS

Groundwater levels were measured within and adjacent to the two bioswales selected for monitoring, as well as in the adjacent forest preserves. The aim was to evaluate whether groundwater levels were affected by roadway runoff, either due to enhanced infiltration of runoff or any enhanced off-site export of surface water caused by the bioswales (possibly due to excavating the bioswale channels or installing any underdrains). Manual and datalogged water-level measurements were plotted by year for each well for the pre-construction period and all five years of post-construction monitoring (see annual plots, Appendix C).

### TB7B Groundwater Levels

Water-level fluctuations in wells at TB7B are presented for the entire period of record from pre-construction of bioswales (from start of monitoring through August 2010) to post-construction of bioswales (Years 1 through 5, September 2010 through August

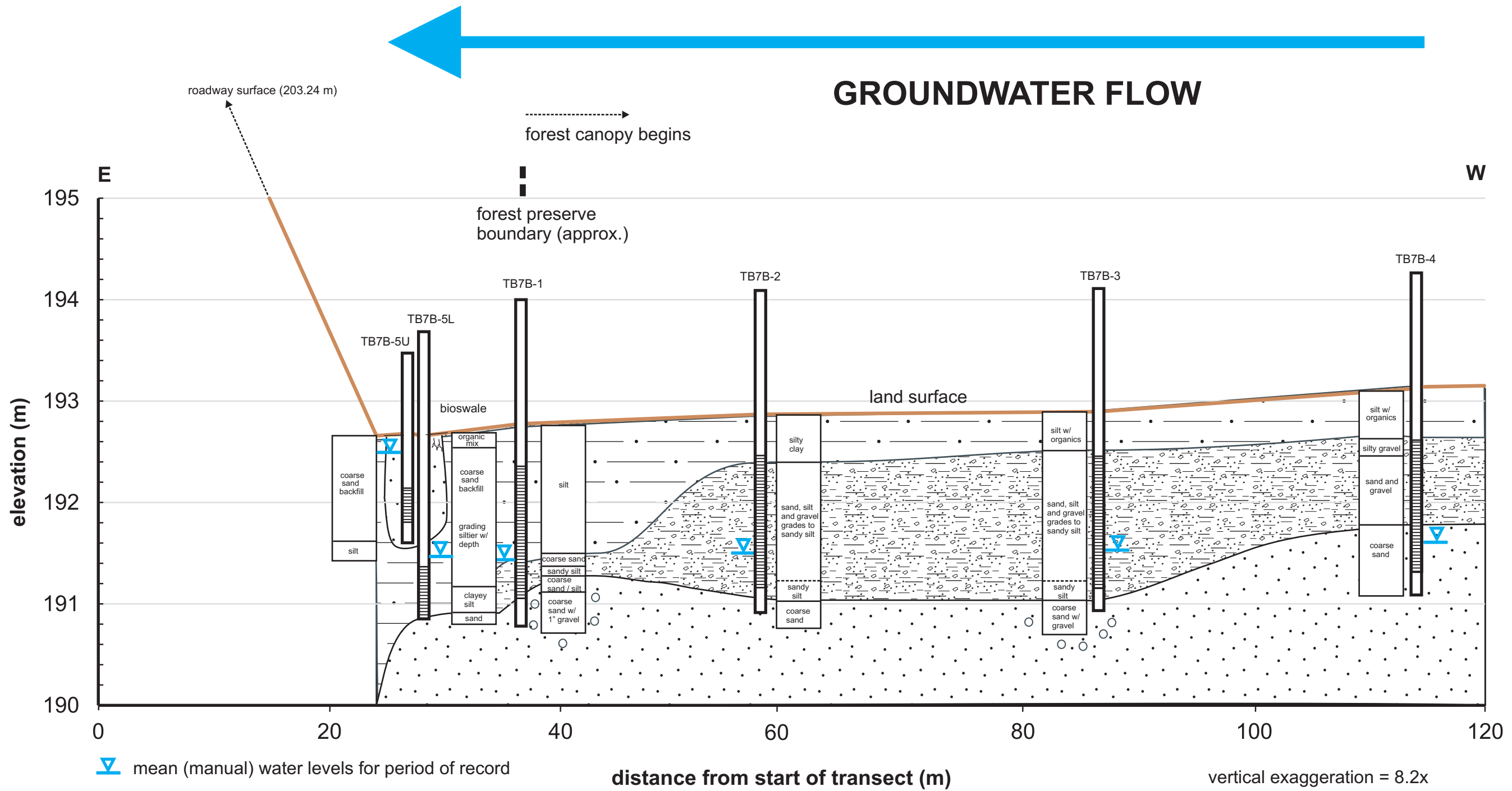


Figure 5. Cross-section along monitoring well transect at site TB7B

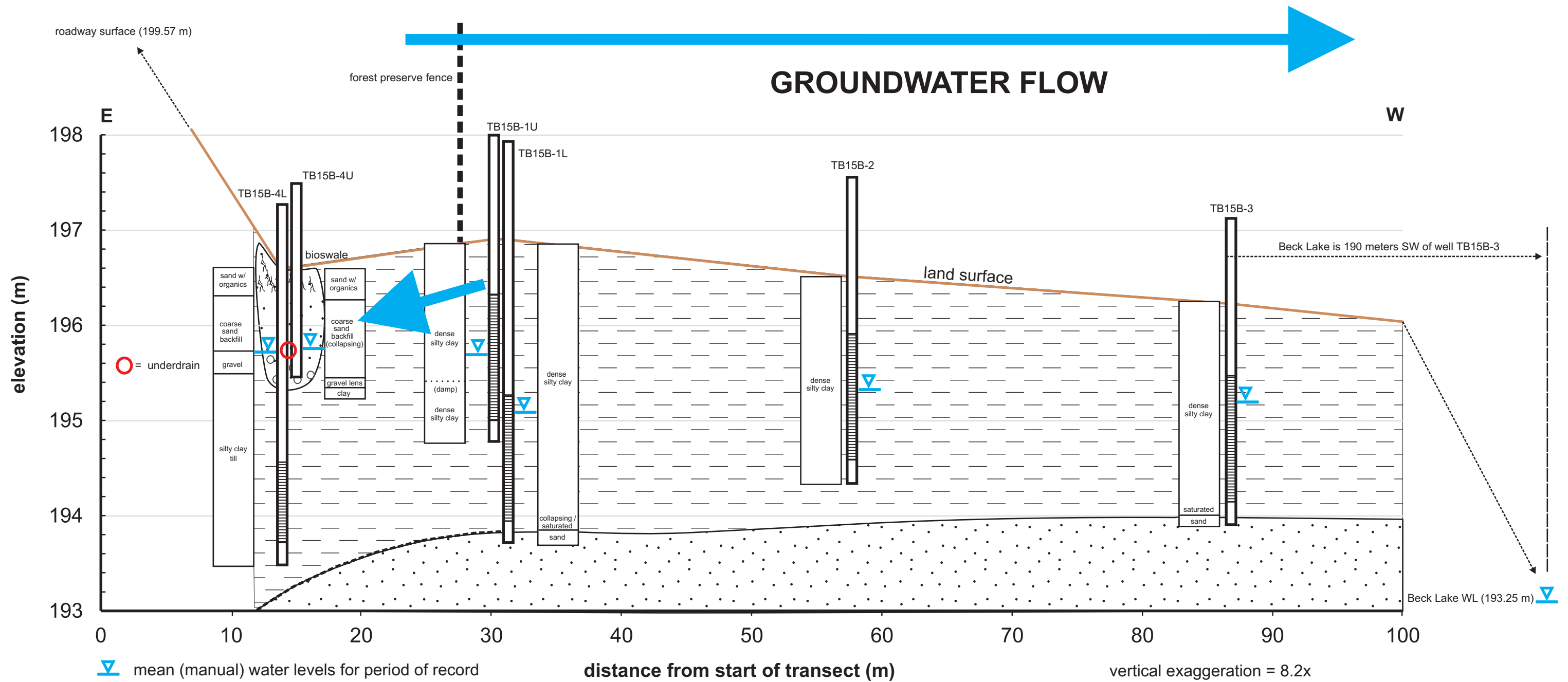


Figure 6. Cross-section along monitoring well transect at site TB15B

2015) in Figures 7 and 8 (shown as water-level elevation and depth-to-water, respectively). Annual graphs are included in Appendix C-1 to C-12 for increased resolution and to also show manual water-level readings. Wells TB7B-1 to TB7B-4 existed before bioswale construction; after construction a well was installed in the coarse sand of the bioswale backfill material (TB7B-5U) and another in the undisturbed silty materials below the bioswale (TB7B-5L).

Water levels were generally highest in spring and summer, typically peaking less than 1.6 ft (0.5 m) below land surface during significant rain events, and occasionally indicating saturation to land surface briefly, although not every year (see Year 3 depth-to-water chart, Figure 9). In the fall and winter, groundwater levels typically declined to about 4.9 ft (1.5 m) or more below land surface (Figure 9). Superimposed on this seasonal variation, rapid increases in groundwater levels were seen at most wells related to precipitation events, sometimes on the scale of hours, with post-precipitation decreases often lasting several days to weeks. Well TB7B-5U, completed after bioswale construction, was the only well that did not follow this pattern; groundwater levels in this well were typically within 1.6 ft (0.5 m) of land surface, and occasionally above land surface, because the well was screened in the coarse sand backfill of the bioswale itself where localized standing water was often present, supported by roadway runoff from a nearby culvert (TB7Bin; for location see Figure 3).

Data were examined to determine whether bioswale construction affected long-term groundwater levels, through either level increases due to enhanced infiltration or level decreases caused by channelization and enhanced off-site drainage longitudinally through the sand backfill. Data for the entire period of record, including all pre-construction data, were examined for trends (Figures 7 and 8). Due to the highly seasonal variation in groundwater levels, regression analysis was less helpful and is not shown, although no strong upward or downward trends were seen. Instead, long-term groundwater levels were examined to see if there were trends in the elevation of seasonal high or low levels and whether seasonal peaks and troughs changed in duration. No strong trends were seen, although the approximate levels of seasonal peaks and troughs varied, most likely responding to climatic patterns. However, it should be noted that only one year of pre-construction data were available, so that the inter-annual variability before construction is not known.

Figure 7. Pre-construction to Year 5 groundwater elevations at bioswale TB7B

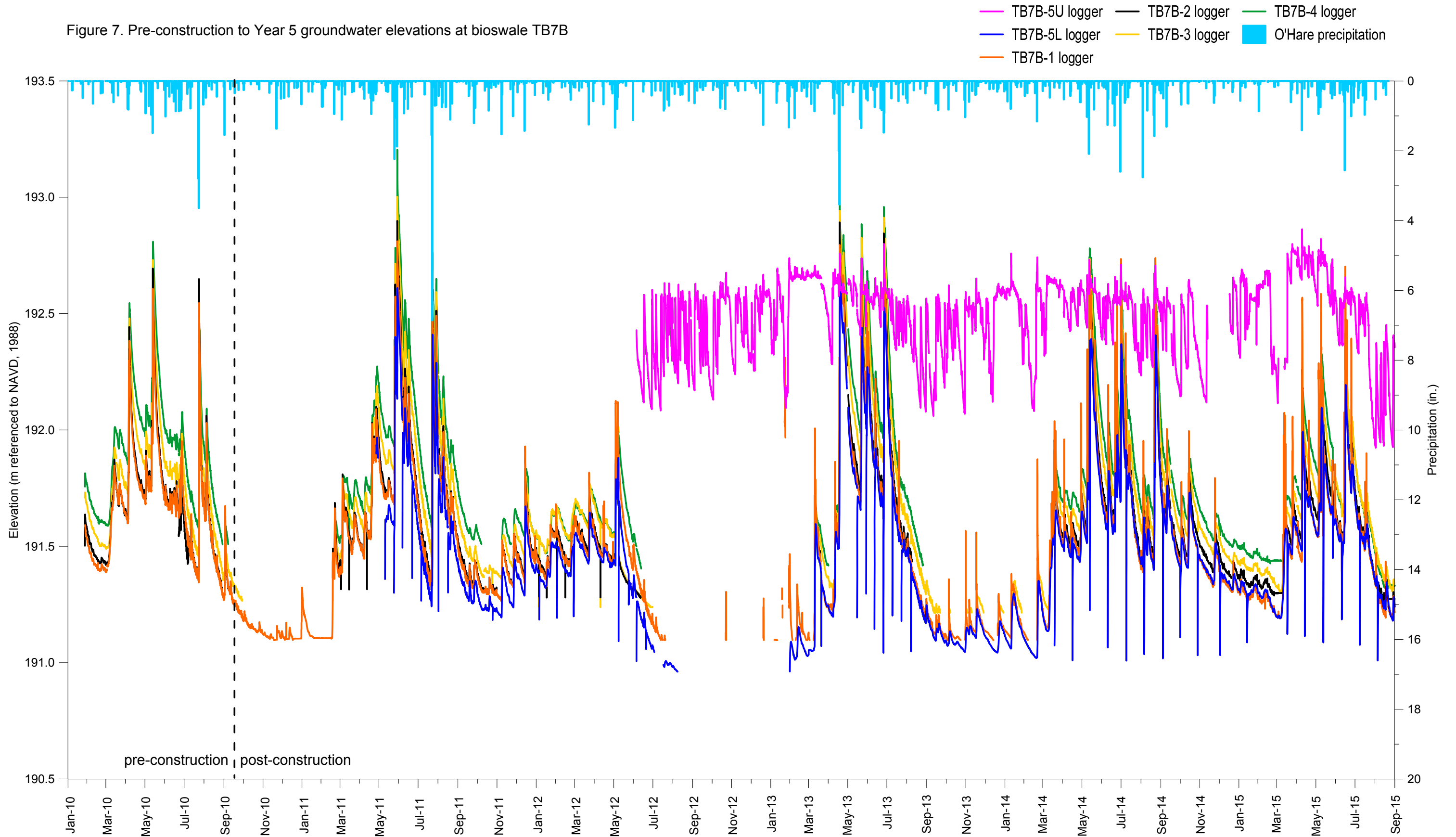
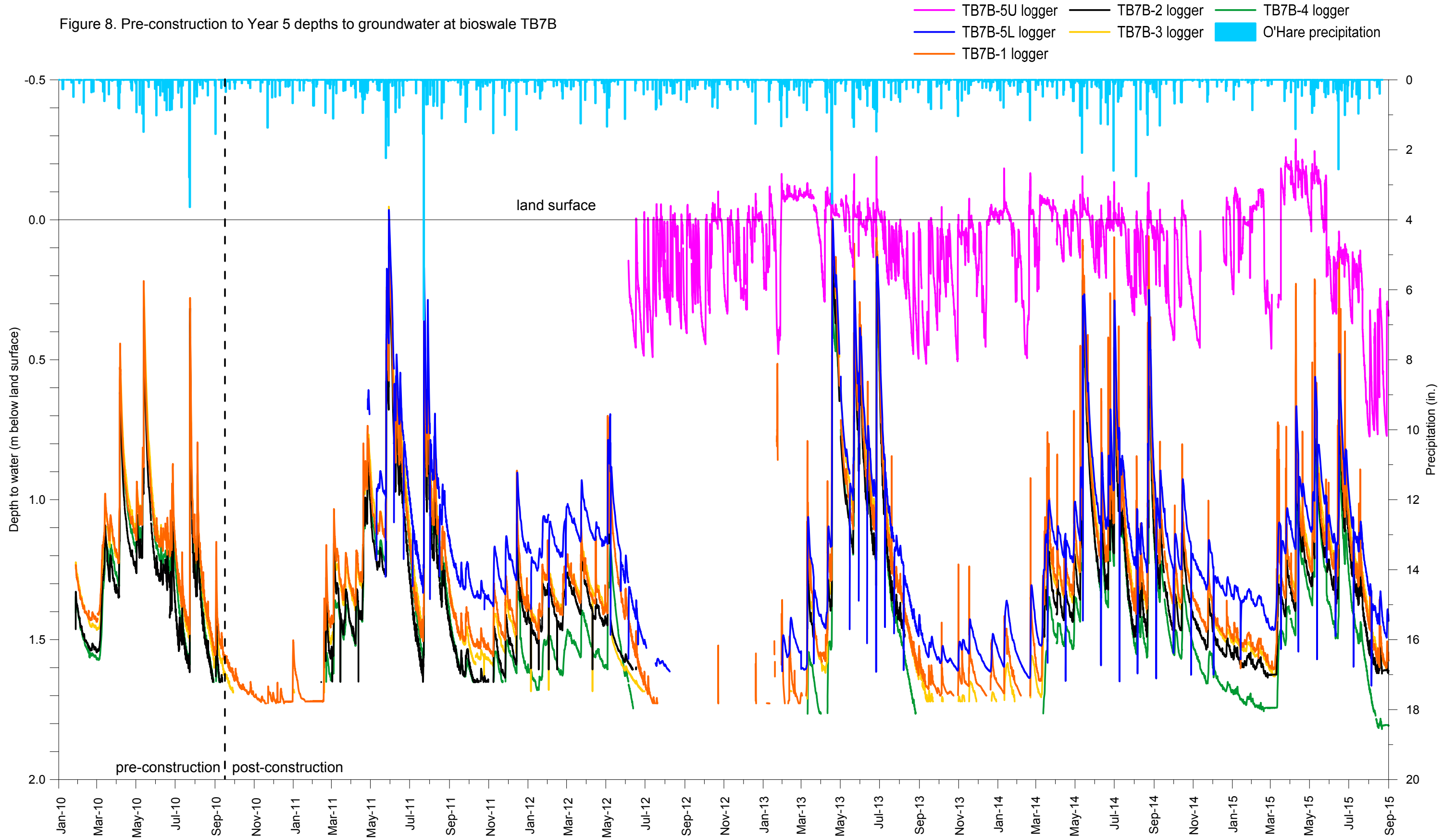




Figure 8. Pre-construction to Year 5 depths to groundwater at bioswale TB7B



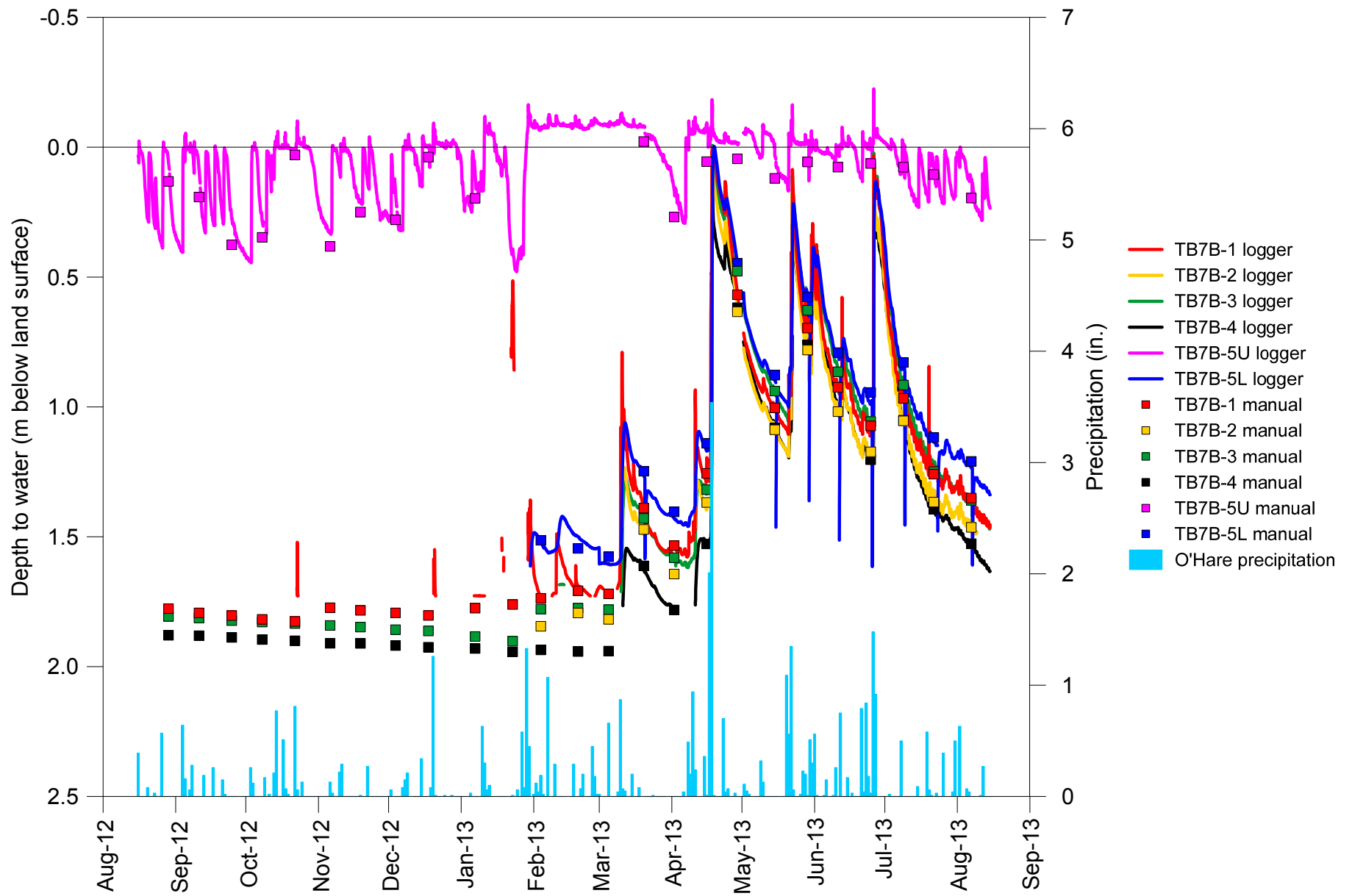


Figure 9. Year 3 depths to groundwater at bioswale TB7B

Other than well TB7B-5U, throughout the monitoring period, water-level elevations were consistently highest at well TB7B-4 at the west end of the transect, declining eastward through well TB7B-1. This water level contrast is visible in Figure 10, a groundwater-level elevation chart from Year 5. The gradient, however, is not steep at only 0.59 ft over 254 ft (0.18 m over 77.5 m). This gradient shows that groundwater flow has an eastward component toward the bioswale/tollway and away from the forest preserve (Figures 3 and 5). Northeastward flow was also determined in Miner et al. (2012a).

As stated above, well TB7B-5U exhibited a groundwater level response pattern different to all the other wells at site TB7B, including the well right beside it but screened deeper (TB7B-5L). TB7B-5U is screened shallower than the other wells and in the coarse sand backfill of the bioswale and has the highest (post-construction) water levels in the transect, with a mean water level roughly 1.6 ft to 3.3 ft (0.5 m to 1.0 m) higher than groundwater in the native sediments below the bioswale (Figures 8 and 9). The contrast between the permeability of the bioswale backfill sands and the native materials below demonstrates a degree of perching in the bioswale but it is not absolute. The groundwater in the sand backfill is supplied by roadway input from the nearby TB7B in culvert, which enters the bioswale near wells TB7B-5U and TB7B-5L (for location, see Figure 3). This input is a high-volume flow during runoff events, but there is also a near-constant input of low flows from the culvert due to drainage from the sewer system and roadway berm. The consistently high water levels in the bioswale sustain a downward groundwater gradient in the bioswale itself, causing infiltration into the native sand and sandy silt sediments, also providing a mechanism for downward transport of any dissolved constituents (discussed later). Because the deeper well (TB7B-5L) has similar water levels, responses to precipitation, and seasonal variations as the other more westward wells in the transect, we conclude that the coarse, native sediments allow infiltration to depth without lengthy delays.

The lack of discernable, long-term trends in these data, coupled with the similarity of groundwater level response to seasonal and event-based runoff prior to and after bioswale construction, suggests that there is no significant impact to groundwater levels from the bioswale constructed at TB7B. However, it should be noted that surface-water levels at the input to TB7B dropped by about 0.5 ft (0.15 m) after bioswale construction (Bryant et al. 2016), likely due to better channelization of runoff, so that groundwater in the bioswale likely also declined slightly, but this cannot be verified because no monitoring wells were present within the confines of the bioswale itself prior to

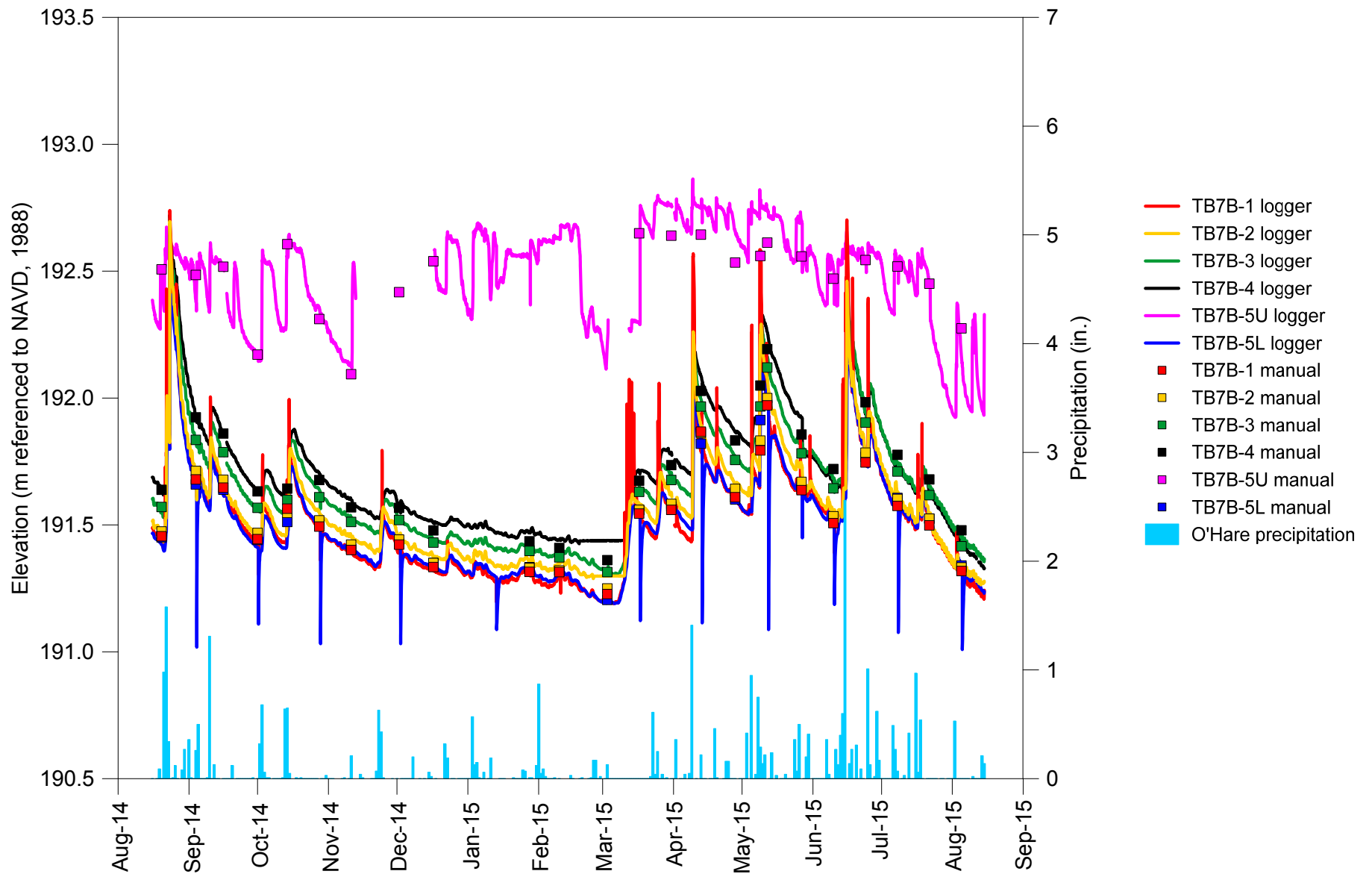


Figure 10. Year 5 groundwater elevations at bioswale TB7B

construction. This decline, if present, did not impact the well in the forest preserve closest to the bioswale, so any impact would have been limited to the bioswale itself.

### TB15B Groundwater Levels

Groundwater levels in wells at TB15B are presented for the entire period of record from pre-construction to Year 5. Data are presented as both water-level elevation and as depth-to-water below land surface (Figures 11 and 12, respectively). For better resolution, groundwater levels in each well for each individual year of the study (2009 through 2015) are shown in Appendix C-13 to C-24, along with local precipitation data.

Prior to bioswale construction, the wells located in the forest preserve showed groundwater levels in the silty clay unit (closest to land surface) were highest adjacent to the roadway ditch in well TB15B-1U and were progressively lower to the west (wells TB15B-2 and TB15B-3), indicating westward groundwater flow (Figures 4 and 6). Figure 13, an annual water-level elevation chart from Year 4, shows the elevation variation driving the westward gradient. The most likely groundwater discharge point is Beck Lake, another 623 ft (190 m) to the west and about 9.4 ft (2.85 m) lower in elevation. Groundwater levels in these wells varied by season, with levels generally increasing in late winter and spring, typically peaking within 1.6 ft (0.5 m) of land surface, with groundwater levels occasionally reaching land surface briefly in response to precipitation events (Figure 14). In the fall and winter, groundwater levels typically declined to roughly 3.2 ft to 8.2 ft (1.0 to 2.5 m) or greater below land surface. Two wells (TB15B-1L and TB15B-3) are screened slightly into the lower sand unit, so we generally separated those wells from others when making water-level conclusions. Groundwater levels adjacent to the lower sand layer had a seasonal response similar to those in the silty clay, but they showed lower amplitude seasonal fluctuations and muted responses to individual precipitation events.

After bioswale construction, groundwater levels were examined to identify any trends in groundwater levels, as well as to compare pre-construction levels to post-construction levels to see if any increases or decreases occurred. After construction, wells were installed in the sand of the bioswale backfill material (TB15B-4U) and in the undisturbed silty clay below the bioswale (TB15B-4L). Groundwater levels in well TB15B-4U remained reasonably constant throughout the monitoring period at about 2.5 ft (0.75 m) below land surface, which is the approximate elevation of the underdrain, which clearly

Figure 11. Pre-construction to Year 5 groundwater elevations at bioswale TB15B

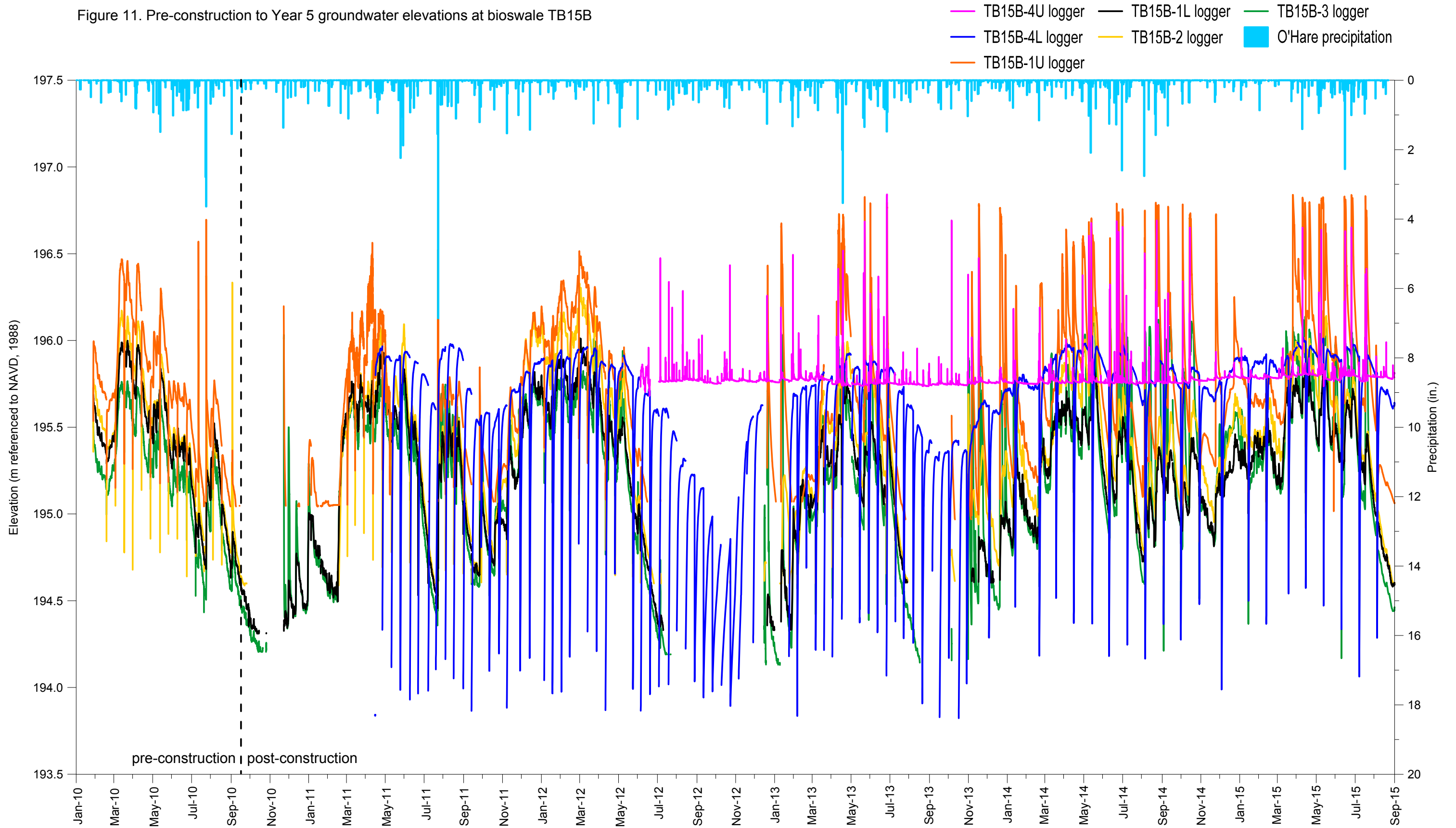
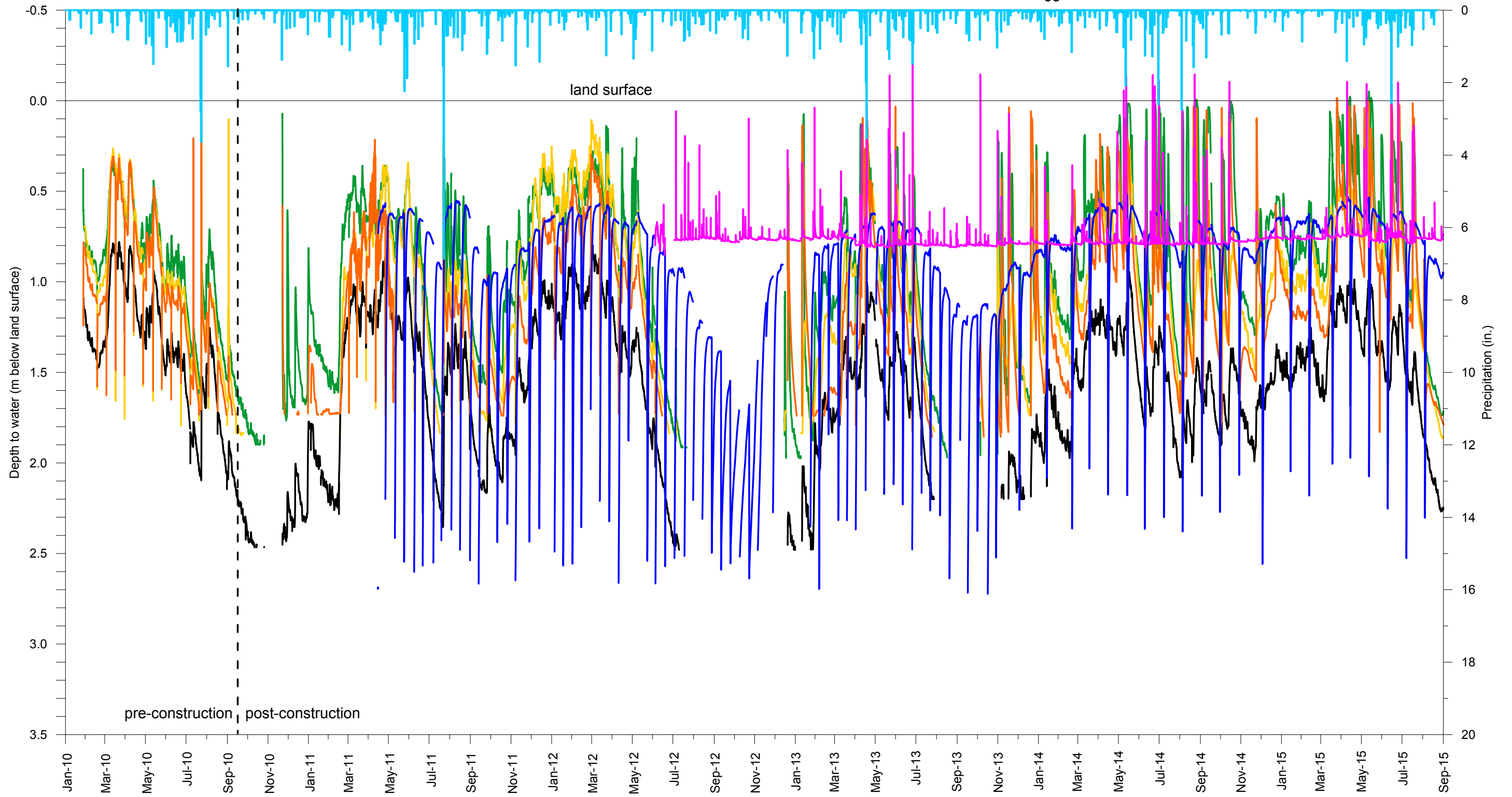


Figure 12. Pre-construction to Year 5 depths to groundwater at bioswale TB15B

- TB15B-4U logger
- TB15B-1L logger
- TB15B-3 logger
- TB15B-4L logger
- TB15B-2 logger
- O'Hare precipitation
- TB15B-1U logger



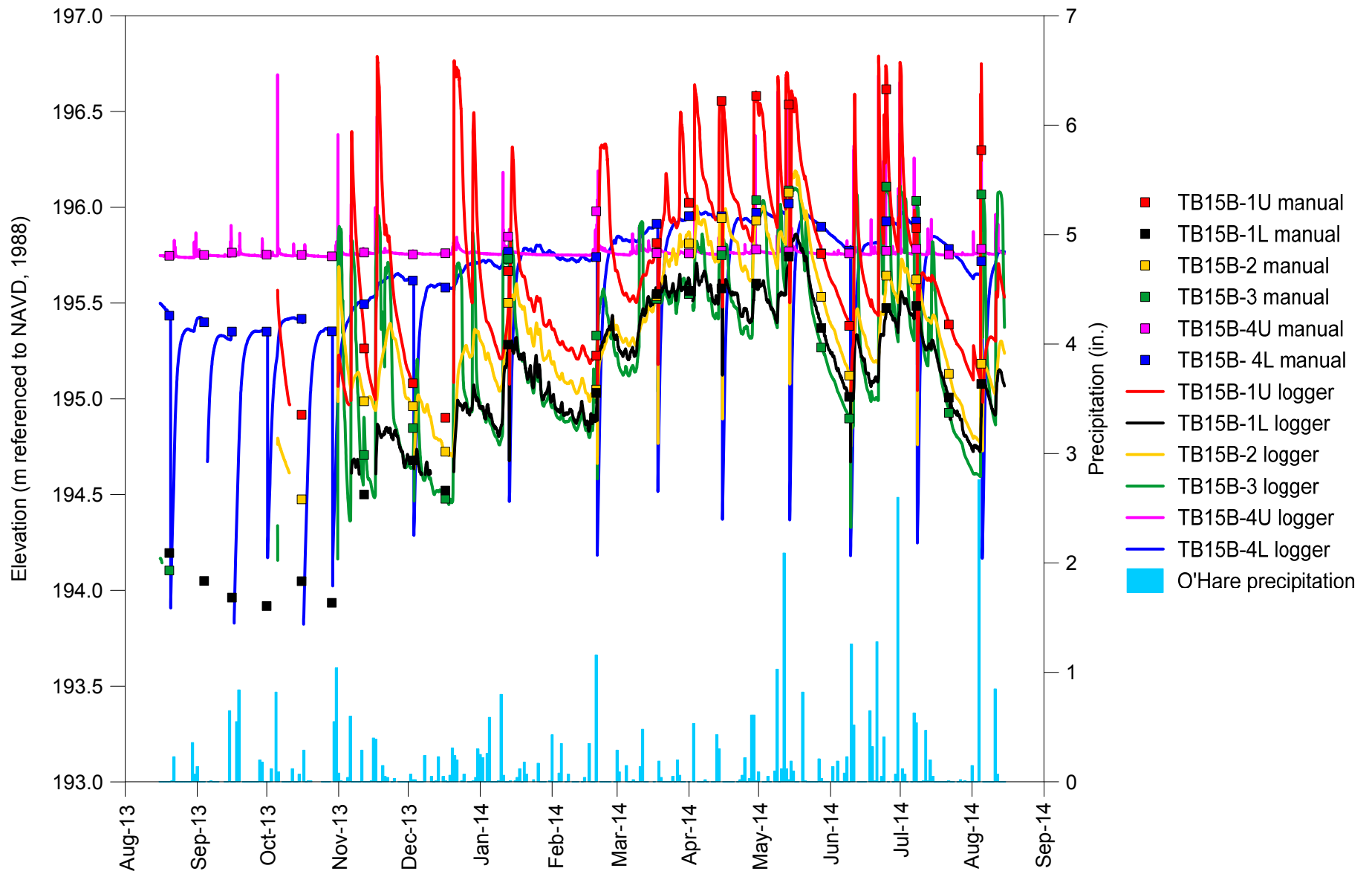


Figure 13. Year 4 groundwater elevations at bioswale TB15B



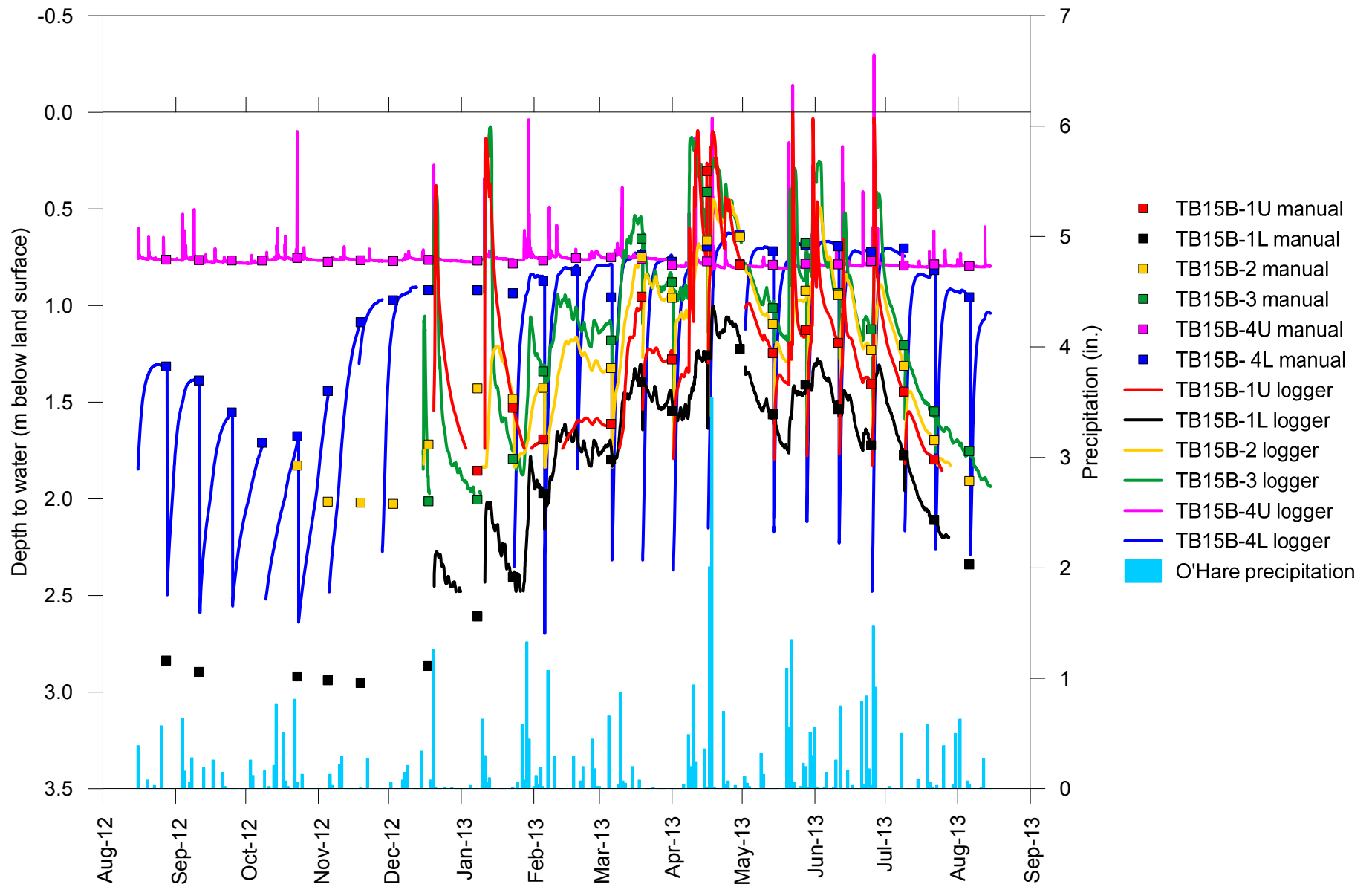


Figure 14. Year 3 depths to groundwater at bioswale TB15B

allowed drainage of bioswale fill materials to that elevation (Figure 12). Despite the drainage, very short-term spikes in groundwater level occurred in response to runoff events from the roadway, although they declined very rapidly. Given that groundwater levels in the ditch before bioswale construction were not measured, it is not possible to determine whether the placement of the underdrain during bioswale construction caused a reduction of groundwater levels, although the underdrain clearly does not allow sustained groundwater levels higher than about 2.5 ft (0.75 m) below land surface. Well TB15B-4L, screened in silty clay below the bioswale, shows a broad seasonal pattern related to spring and precipitation maxima, although it lacks clear responses to individual precipitation events (Figure 12) and it recovers very slowly from the approximately 5 ft (1.5 m) drawdown from sampling. TB15B-4L does not show any evolution in groundwater levels or changes in seasonal patterns from Year 1 to Year 5.

Post-construction groundwater levels were examined in wells adjacent to the bioswale in the forest preserve. Wells TB15B-1L and TB15B-2 show no clear increases or decreases through time after construction, nor any clear changes from pre-construction conditions. As at TB7B, the limited duration of pre-construction monitoring, which was less than one year, increased the difficulty in discerning any changes before and after bioswale construction, especially given the large seasonal variations in groundwater levels. Wells TB15B-1U and TB15B-3 show possible increases in the elevation and recurrences of peak groundwater levels, although the data are not clear. Given that TB15B-3 is the farthest well from the bioswale, and it is screened at depth, it seems likely that, if the frequency of peak levels did actually increase, it is not likely bioswale related. It is more likely that inter-annual variations in precipitation caused any trends. Longer-term monitoring is needed to identify any trends, if present.

Groundwater levels were also examined to identify any relationships between wells. Noteworthy was that water levels in well TB15B-1U regularly rose to elevations greater than the water level in TB15B-4U during spring and summer, causing an eastward hydraulic gradient and possible groundwater flow toward the bioswale underdrain (see Figure 6). Although materials seen during emplacement of the TB15B-1U/1L nest were low-permeability silty clays, the large gradient and the proximity of coarse-grained bioswale fill materials could result in movement of groundwater back toward the underdrain, especially given the likelihood of fractures in the silty clay that would facilitate groundwater flow. Similarly, water levels in TB15B-4L, which is screened in the native material below the bioswale, are regularly higher than levels in TB15B-4U during

spring and summer, suggesting an upward flow of groundwater into the underdrain. During dry periods, there is a downward gradient toward TB15B-4L that may allow bioswale waters to infiltrate and affect deeper groundwater, although infiltration rates are likely low due to fine-grained materials under the bioswale.

Groundwater input to the underdrain also apparently increased discharge from bioswale TB15B, with more discharge measured at the underdrain outlet (TB15B<sub>gw</sub>, for location, see Figure 4) than was calculated to have entered the bioswale via runoff (Miner et al. 2016), indicating that additional water sources such as groundwater were required to account for the measured discharge. The bioswale underdrain flowed for months at a time, even during dry periods, again suggesting groundwater input. This chronic discharge to the underdrain may also provide a mechanism to steadily remove longer residence time (and possibly impacted) groundwater from the bioswale and adjacent areas.

The lack of any apparent long-term trends in these data, coupled with the similarity of groundwater-level response to seasonal and event-based runoff prior to and after bioswale construction, suggests that there was no significant impact to groundwater levels outside of the bioswale itself at TB15B. However, the brevity of pre-construction data limits confidence in any comparisons before and after construction. Longer-term post-construction monitoring may clarify whether there are trends that are obscured by seasonal variations.

## GROUNDWATER QUALITY

Geochemical data were examined to determine whether roadway operations affected the quality of groundwater near the roadway and in adjacent forest preserves, and whether any changes were observed after bioswale construction. Data were examined for temporal and spatial trends that might be seasonal, annual, or show evolution of groundwater over the period of the study, such as before and after construction.

## TB7B Groundwater Quality

### Specific conductivity

Specific conductivity measurements in wells at TB7B graphed with daily precipitation are shown in Figure 15, which shows the entire period of monitoring from pre-construction (from start of monitoring through August 2010) to post-construction Years 1 through 5. Annual graphs are included for increased resolution in Appendix C-25 to C-30. Annual snowfall totals are also plotted in Figure 16 alongside the conductivity record for the two wells within the bioswale.

The highest specific conductivity measurements at site TB7B were made at the bioswale wells (TB7B-5U and TB7B-5L), which are screened in the sand backfill of the bioswale itself and in the undisturbed sediments below the bioswale, respectively. Specific conductivity levels in well TB7B-5U remained above about 4,000  $\mu\text{S}/\text{cm}$  throughout the study period, at times peaking at greater than 40,000  $\mu\text{S}/\text{cm}$  in winter and early spring, then slowly declining in late spring through late summer to values in the 5,000-10,000  $\mu\text{S}/\text{cm}$  range. The typical annual pattern is shown in a plot of Year 4 data (Figure 17). No clear pattern of specific conductivity was noted at TB7B-5U or TB7B-5L with respect to individual precipitation events, although occasional individual peaks or downward spikes were coincident with precipitation or presumed snowmelt events, likely depending on the solute load on the roadway and precipitation totals or intensity. At TB7B-5L, specific conductivity levels had a similar pattern to TB7B-5U, although peaks were attenuated due to the slight delay between runoff and subsequent infiltration to the depth of the well screen at TB7B-5L (Figure 17); typically summertime lows remained above 10,000  $\mu\text{S}/\text{cm}$  and winter/spring peaks were about 25,000  $\mu\text{S}/\text{cm}$ . Given that summertime specific conductivity levels in both TB7B-5U and TB7B-5L remained higher than other wells, a high-solute body of water likely persists within and below the bioswale adjacent to the roadway. This high-TDS body of groundwater is likely fed by the observed continuous discharge of high-salinity water from the TB7B culvert (Miner et al. 2016) and possible discharge of impacted groundwater from the tollway embankment.

The wells within the bioswale were not present during the pre-construction period, so no comparisons can be made before and after construction. Nevertheless, post-construction data showed upward trends of specific conductivity in both the shallow (TB7B-5U) and the deeper well (TB7B-5L) over 5 years. Annual snowfall totals are also

Figure 15. Pre-construction to Year 5 specific conductivity of groundwater at bioswale TB7B

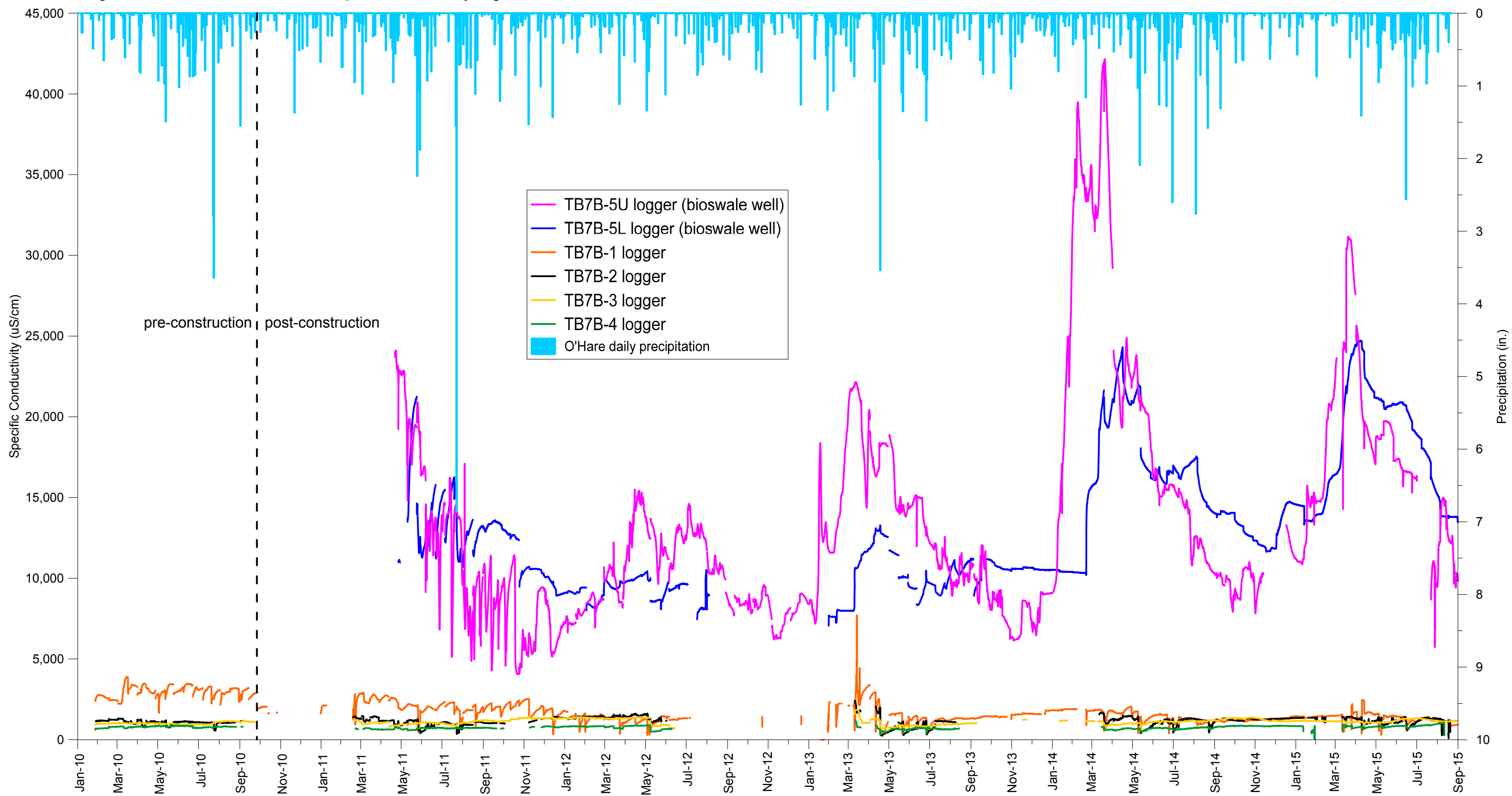
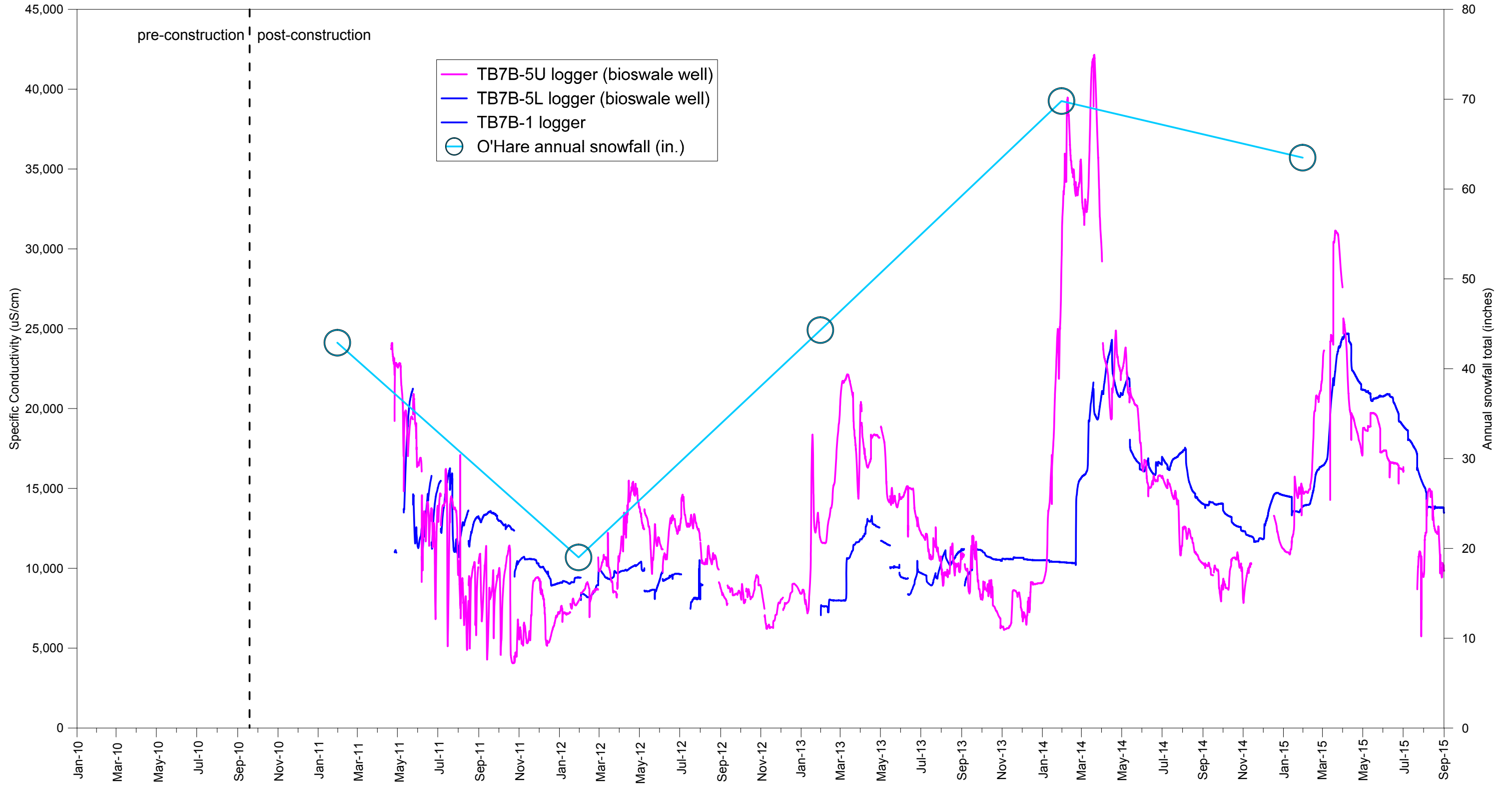


Figure 16. Pre-construction to Year 5 specific conductivity of groundwater in bioswale wells at TB7B with annual snowfall



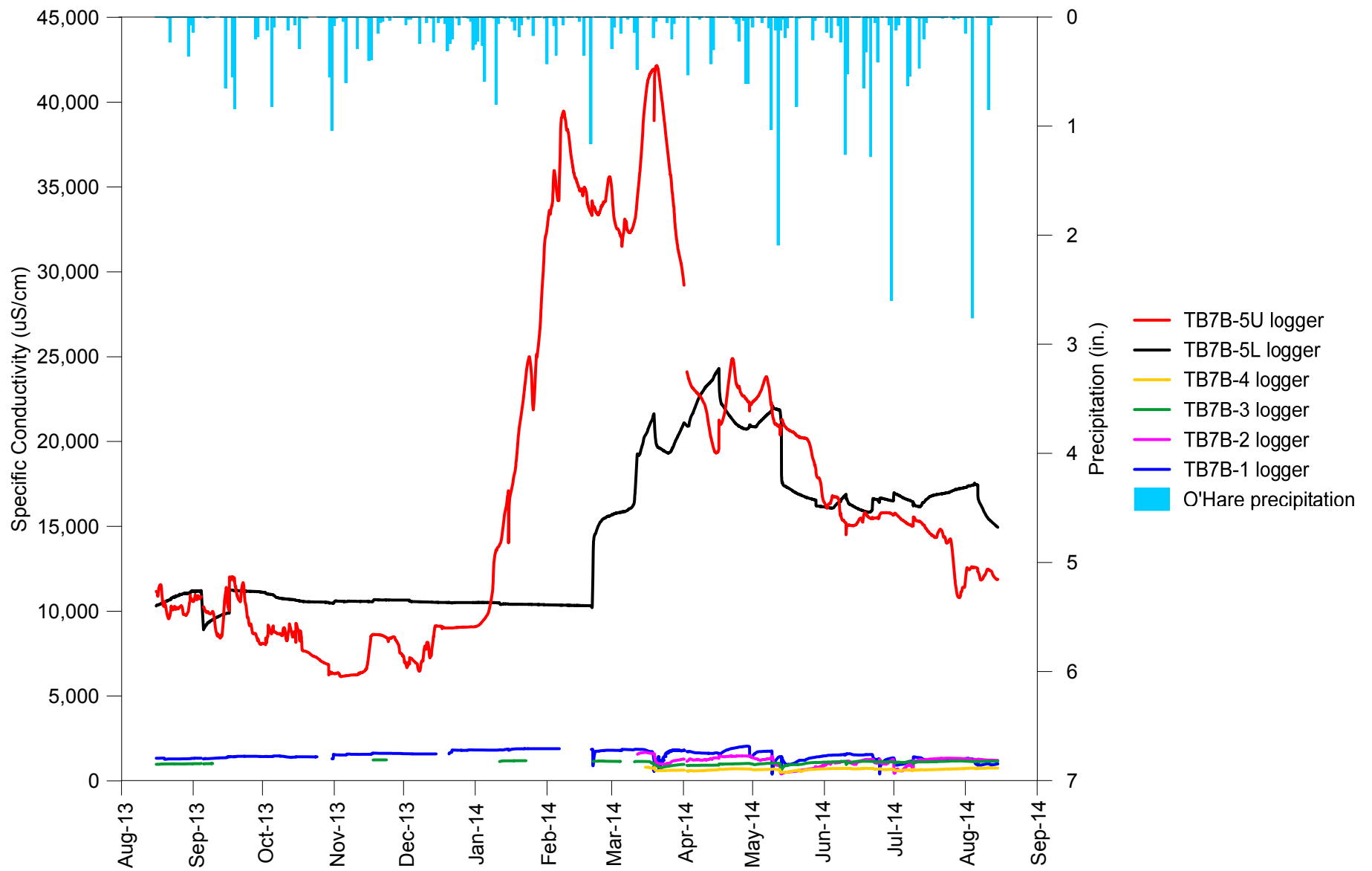


Figure 17. Year 4 specific conductivity of groundwater at bioswale TB7B

plotted on Figure 16, and high snowfall is anticipated to be associated with high salt application totals. Given high snowfall totals in Years 3 through 5, it is likely that the seeming increase is related to road salt application rates rather than a continuous buildup of chloride that is not removed from the system, but this cannot be definitively concluded. Additional years of monitoring may show if specific conductivity declines after a period of low snowfall.

At wells located directly adjacent to the bioswale, specific conductivity was elevated, but far less than wells located in or below the bioswale. At well TB7B-1, located about 4.5 m (15 ft) west of the bioswale, elevated specific conductivity measurements occurred, typically ranging from about 3,000 to 4,000  $\mu\text{S}/\text{cm}$  prior to construction (Figure 15). Seasonal variation was difficult to identify due to the short period of pre-construction monitoring, but there appear to be variations related to individual precipitation or melting events. After construction, specific conductivity declined by about half, gradually throughout the monitoring period, eventually becoming similar to the other wells more distant from the bioswale. This suggests that impacts from runoff diminished after bioswale construction in areas adjacent to the bioswale. One possible explanation is that runoff from the culvert input at TB7Bin may have been better channelized after bioswale construction, preventing occasional overflow and infiltration in the vicinity of well TB7B-1, thus improving groundwater quality along the boundary of the forest preserve.

Specific conductivity measurements were relatively low in wells located in the forest preserve and more distant (ranging from about 98 to 262 ft [30 to 80 m]) from the bioswale (TB7B-2, TB7B-3, and TB7B-4), with measurements often near 1,000 to 1,500  $\mu\text{S}/\text{cm}$  that show little seasonal fluctuation, although individual precipitation events seem to have some dilution effects. No trend or change in behavior was noted at these wells after construction.

Specific conductivity measurements indicate that deeper groundwater below the TB7B bioswale was affected by roadway operations, although the effects will likely be limited to the zone beneath the bioswale and possibly down-gradient and east of the tollway, which was not included in this investigation. At present, there is no indication that the operation of the bioswales has increased specific conductivity of the groundwater beyond the impacts that had already occurred due to infiltration from the preexisting ditch. Bioswale installation may have improved channelization of runoff, which



prevented roadway runoff from entering the forest preserve and infiltrating, and thus improved groundwater quality adjacent to the bioswale.

## Groundwater samples

### *Chloride and TDS*

Similar to specific conductivity, chloride and TDS measurements were highest in wells in and below the bioswale, with lesser impacts at the nearest well in the forest preserve adjacent to the bioswale. Wells TB7B-5U and TB7B-5L, screened within and below the bioswale, respectively, exceeded the 200 mg/L Class 2 groundwater standard for chloride, typically by at least an order of magnitude, at nearly all times in all seasons (115 of 117 samples; see Table 1). The highest lab-measured concentration of chloride in the well samples was 12,652 mg/L (63 times the Class 2 groundwater standard) at TB7B-5U on March 19, 2014 (Appendix B-4).

In the forest preserve adjacent to the bioswale, well TB7B-1 had chloride levels that exceeded the groundwater standard in 100% of the samples taken during the pre-construction period. In Year 1 of post-construction monitoring, <sup>^c&^e</sup>exceedances in this well dropped to 74% of samples taken, and dropped again to 17% and 16% in Years 2 and 3 (respectively), and to 0% and 8% in Years 4 and 5 (respectively). The drop may be related to bioswale construction that created a more clear channel for runoff to enter and traverse the bioswale, resulting in less-frequent flooding of solute-rich runoff to the area around well TB7B-1, and consequently less infiltration to groundwater. Natural groundwater flow to the east, coupled with infiltration of fresh precipitation, also may have reduced chloride levels at well TB7B-1 over the course of post-construction monitoring.

Further from the bioswale (wells TB7B-2, TB7B-3 and TB7B-4), maximum levels of chloride remained below the Class 2 standard of 200 mg/L in all samples in all years. The lowest levels were found at the west end of the transect at TB7B-4 with a mean chloride level of around 10 mg/L, which is expected to be similar to chloride levels in unaltered groundwater in the region (Panno et al. 2006), so impacts from roadway operations are likely limited to the bioswale and directly adjacent parts of the forest preserve.

Table 1. Exceedances of Class 2 Groundwater Standards - TB7B

Exceedance summary for Pre-con to Year 5 - groundwater

TB7B		Class 2 Std	5.0	10	0.024	0.05	0.02	0.1	1,200	200	400					
		total # of	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L				
Monitoring	Well	samples	Fe	Mn	Sb	Se	TI	V	TDS, 180 C	Cl	SO4	#	%	#	%	
Year			#	%	#	%	#	%	#	%	#	%	%	#	%	
PRE-CON	TB7B-5U	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	
Y1	TB7B-5U	9	-	-	-	-	4	44	9	100	9	100	9	100	100	
Y2	TB7B-5U	23	-	-	-	1	4	5	23	100	23	100	19	83	83	
Y3	TB7B-5U	22	-	-	-	10	45	3	22	100	21	95	19	86	86	
Y4	TB7B-5U	14	1	7	-	8	57	3	14	100	14	100	12	86	86	
Y5	TB7B-5U	10	1	10	-	-	-	4	10	100	10	100	10	100	100	
PRE-CON	TB7B-5L	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	
Y1	TB7B-5L	10	2	20	2	20	-	4	10	100	10	100	7	70	70	
Y2	TB7B-5L	4	-	-	-	-	1	25	4	100	4	100	3	75	75	
Y3	TB7B-5L	9	1	11	-	-	7	78	9	100	9	100	9	100	100	
Y4	TB7B-5L	5	1	20	-	-	3	60	5	100	5	100	5	100	100	
Y5	TB7B-5L	11	1	9	-	-	-	4	10	91	10	91	10	91	91	
PRE-CON	TB7B-1	18	9	50	-	-	-	1	18	100	18	100	-	-	-	
Y1	TB7B-1	19	7	37	-	-	-	-	13	68	14	74	-	-	-	
Y2	TB7B-1	22	10	45	-	-	1	5	4	18	4	18	-	-	-	
Y3	TB7B-1	12	2	17	-	-	-	-	2	17	2	17	-	-	-	
Y4	TB7B-1	7	0	0	-	-	-	-	1	14	-	-	-	-	-	
Y5	TB7B-1	12	1	8	-	-	-	-	-	-	1	8	-	-	-	
PRE-CON	TB7B-2	18	-	-	-	-	-	1	-	-	-	-	-	-	-	
Y1	TB7B-2	16	-	-	-	-	-	-	-	-	-	-	-	-	-	
Y2	TB7B-2	20	-	-	-	-	1	5	-	-	-	-	-	-	-	
Y3	TB7B-2	9	-	-	-	-	-	-	-	-	-	-	-	-	-	
Y4	TB7B-2	6	-	-	-	-	-	-	-	-	-	-	-	-	-	
Y5	TB7B-2	10	-	-	-	-	-	-	-	-	-	-	-	-	-	
PRE-CON	TB7B-3	18	-	-	-	-	-	2	-	-	-	-	-	-	-	
Y1	TB7B-3	15	-	-	-	-	-	1	-	-	-	-	-	-	-	
Y2	TB7B-3	22	-	-	-	-	-	-	-	-	-	-	-	-	-	
Y3	TB7B-3	10	-	-	-	-	-	-	-	-	-	-	-	-	-	
Y4	TB7B-3	6	-	-	-	-	-	-	-	-	-	-	-	-	-	
Y5	TB7B-3	10	-	-	-	-	-	-	-	-	-	-	-	-	-	
PRE-CON	TB7B-4	18	-	-	-	-	-	1	-	-	-	-	-	-	-	
Y1	TB7B-4	13	-	-	-	-	-	-	-	-	-	-	-	-	-	
Y2	TB7B-4	18	-	-	-	-	-	-	-	-	-	-	-	-	-	
Y3	TB7B-4	9	-	-	-	-	-	-	-	-	-	-	-	-	-	
Y4	TB7B-4	6	-	-	-	-	-	1	-	-	-	-	-	-	-	
Y5	TB7B-4	10	-	-	-	-	-	-	17	-	-	-	-	-	-	

Standards are Class II "general resource" groundwater (Section 620.420)  
 # is number of exceedances during the stated period  
 % is the percentage of samples taken that exceed during the stated period  
 100% of samples exceed standard  
 50-99% of samples exceed standard  
 well is in the area of the forest preserve boundary  
 well is within the forest preserve  
 NA well had not been constructed during this monitoring period

TDS results mirrored that of chloride, with levels within the bioswale (wells TB7B-5U and TB7B-5L) exceeding the 1,200 mg/L groundwater standard at essentially all times in all seasons (116 of 117 samples exceeded the standard; see Table 1). In well TB7B-1, TDS levels exceeded the standard year round in 100% of the samples taken during the pre-construction period, dropping to 68% of samples taken during Year 1 of post-construction monitoring, 18%, 17% and 14% in years 2, 3, and 4, respectively, and further to 0% of samples taken by Year 5. This decline in TDS is similar to chloride reductions discussed above. In wells farther from the bioswale (Wells TB7B-2, TB7B-3 and TB7B-4), maximum levels of TDS remained below the groundwater standard of 1200 mg/L for all samples in all years.

#### *Roadway metals and other constituents*

In addition to chloride and TDS, groundwater quality also exceeded Class 2 groundwater standards for several other constituents in wells in and adjacent to bioswale TB7B (Table 1), all of which are known constituents or roadway runoff and/or road salt. Well TB7B-1 exceeded standards for iron in 50% of samples in the pre-construction period but this declined steadily to 8% of samples in Year 5. This is likely related to the drop in surface-water levels in the bioswale related to channelization as discussed above, which may have reduced iron inputs or may have decreased saturated conditions, which tend to release iron from the soil into solution. Wells within the bioswale (TB7B-5U, TB7B-5L) had fewer iron exceedances (7 in 117 samples) and wells further away from the bioswale (TB7B-2, TB7B-3 and TB7B-4) had no iron exceedances.

Wells within the bioswale also exceeded the selenium standard in 34 of 117 samples, and two exceedances were recorded in the period of record outside the bioswale in wells TB7B-1 and TB7B-2. Well TB7B-5U showed an increase in selenium exceedances from Year 2 through 4 (4% to 57%) but had no exceedances in Year 5, suggesting no long-term trend. Well TB7B-5L showed variable percentages of samples exceeding the selenium standard from Year 1 through 4 (as low as 28% to as high as 78%) but also had no exceedances in Year 5. The data do not strongly indicate any long-term trend in selenium.

Thallium showed a similarly variable pattern of exceedances with wells within the bioswale (TB7B-5U, TB7B-5L) exceeding the thallium standard in 32 of 117 samples, but only seven exceedances were found in the period of record in wells outside the bioswale (wells TB7B-1 through TB7B-4). Exceedances varied from 14% to 44% in well

TB7B-5U and 20% to 40% in well TB7B-5L but showed no long-term trends over the 5-year post-construction period.

Wells within the bioswale (TB7B-5U, TB7B-5L) exceeded the sulfate standard in 103 of 117 samples. No trends in sulfate concentrations were noted. There were no sulfate exceedances in the period of record outside the bioswale in wells TB7B-1 to TB7B-4.

During the period of record, there were no exceedances at any wells at TB7B of Class 2 groundwater standards for roadway metals chromium, copper, lead, nickel, and zinc. These roadway metals of interest are present in runoff inputs to TB7B, but dominantly are found in particulate or adsorbed form (Miner et al. 2016), suggesting they are less available for transport in groundwater.

Nitrate concentrations in the groundwater samples at the site were generally much higher in wells in the forest preserve, where mean annual values in the 2.2 to 14.3 mg/L range were found at wells TB7B-2, TB7B-3 and TB7B-4. These high values likely indicate nitrate sources other than runoff, likely including animal waste (area is heavily used by deer). In contrast, nitrate in the groundwater samples were often not detected or found at levels around 0.11 to 0.44 mg/L at wells TB7B-5U and TB7B-5L located in the bioswale, despite the large amount of observed deer activity in the bioswale itself. According to Isco sampler and grab samples from the TB7B in culvert, nitrate entered the bioswales from the roadway, but in mean annual concentrations of 0.6 to 1.4 mg/L. It is likely that the nitrate inputs from the roadway and any from deer waste were removed in the bioswale by denitrification due to the reducing conditions (caused by saturation) or interaction with biota in the bioswale, although dilution from runoff also likely contributed. In contrast, ammonia concentrations were consistently higher in TB7B-5U than in any other wells (annual means up to 2.94 mg/L). Because these levels are higher than mean annual values of ammonia entering at TB7B in (annual means all less than 0.7 mg/L), it is likely that ammonia was being produced by biogeochemical processes in the bioswale.

TB7B-5U (screened within the bioswale materials) and TB7B-5L (screened in the silty and native materials below the bioswale), have constituent concentrations that fluctuate widely, most notably with calcium, chloride, sodium and sulfate. This large range suggests that high levels of these constituents enter the bioswale through runoff, but heavy precipitation can dilute the runoff as well, causing rapid decreases in concentration. The oscillations in concentrations at TB7B-5U are generally followed at

TB7B-5L at an attenuated level, with a delay of several weeks, again suggesting steady infiltration from the bioswale to the underlying sediments.

Constituents in wells in or adjacent to the bioswale often peaked in late winter or early spring, including sodium, calcium, magnesium, and potassium, all commonly found in road salt. These other constituents, along with total dissolved solids, peaked in spring at TB7B-5U and then slightly later in TB7B-5L, further indicating a downward migration of affected waters into the native materials from the bioswale above. Manganese and iron both peaked in wells within or adjacent to the bioswale in the spring and into summer, perhaps due to the onset of reducing conditions during the wetter spring season.

These results suggest that runoff high in a wide range of roadway-derived solutes entered the groundwater system in bioswale TB7B via infiltration. The results do not show any detrimental effect of the runoff to groundwater in the adjacent natural area because the direction of groundwater flow is to the east, preventing groundwater transport of contaminants to the forest preserve.

#### Range and mean of solute levels

In order to identify any trends before or after bioswale construction, annual minimum, maximum, and mean levels were compared for selected solutes, including chloride as the primary indicator of road salt, and two roadway metals of interest, copper and zinc, which are commonly found in measurable quantities in groundwater at the study sites.

#### *Chloride*

At bioswale TB7B, the wells within the bioswale (TB7B-5U and 5L) showed no clear trend in annual mean chloride concentration during the post-construction period (Figures 18 and 19). Because these wells are closest to the runoff input at TB7Bin, the pattern here may be more representative of the rate of road salt application, with lower applications (as indicated by snowfall totals) anticipated in Year 2 and the highest application rate in Year 4 (see Figure 16).

Well TB7B-1 showed a steady reduction in mean chloride level from 415 mg/L before construction to less than 100 mg/L in Years 4 and 5 (Figure 20). As noted previously, bioswale construction likely decreased runoff overflow to this site. Wells TB7B-2 and TB7B-3, further from the roadway, showed much lower mean chloride concentrations

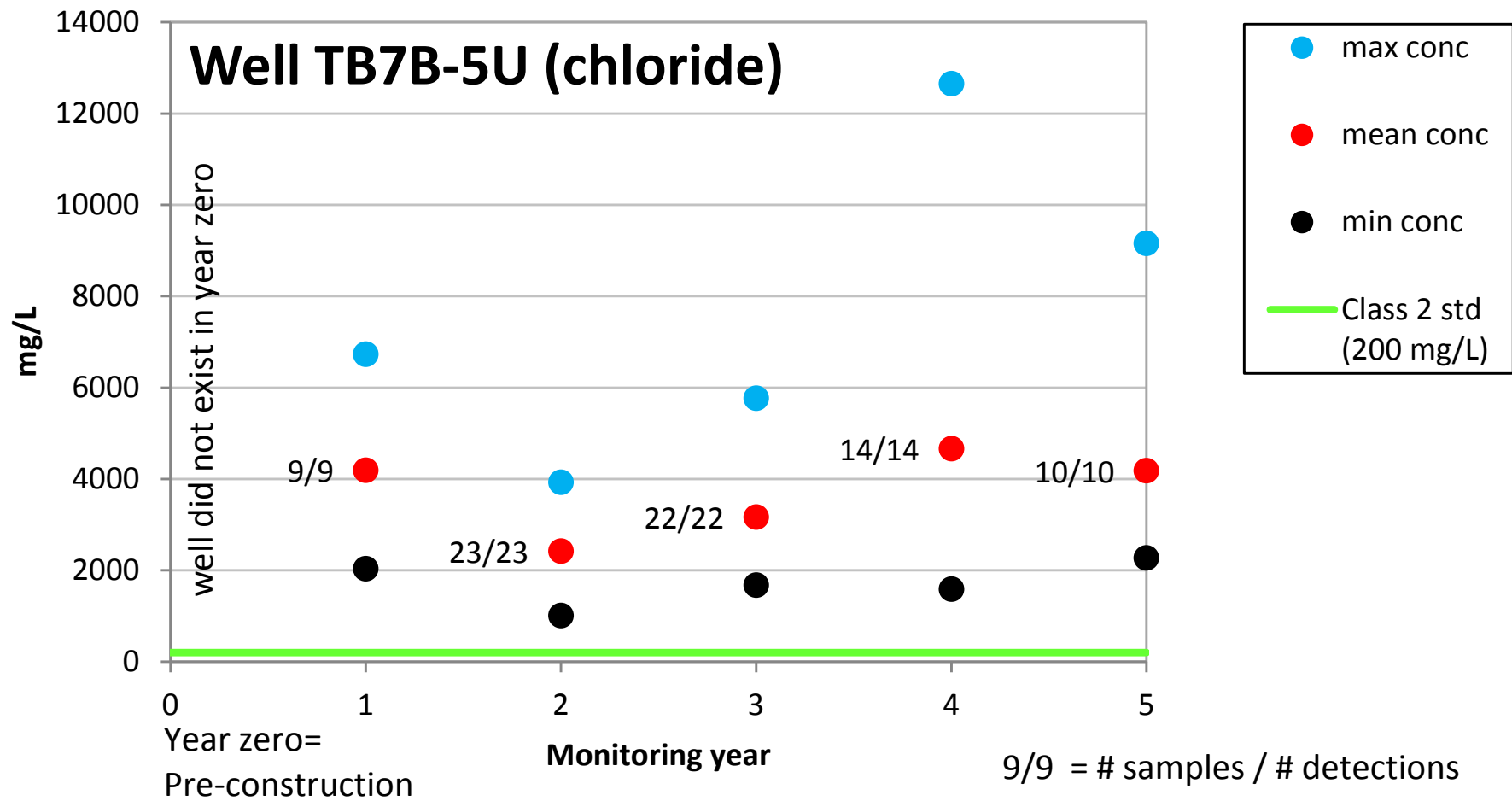


Figure 18. Evolution of chloride min-max-mean concentrations - Well TB7B-5U

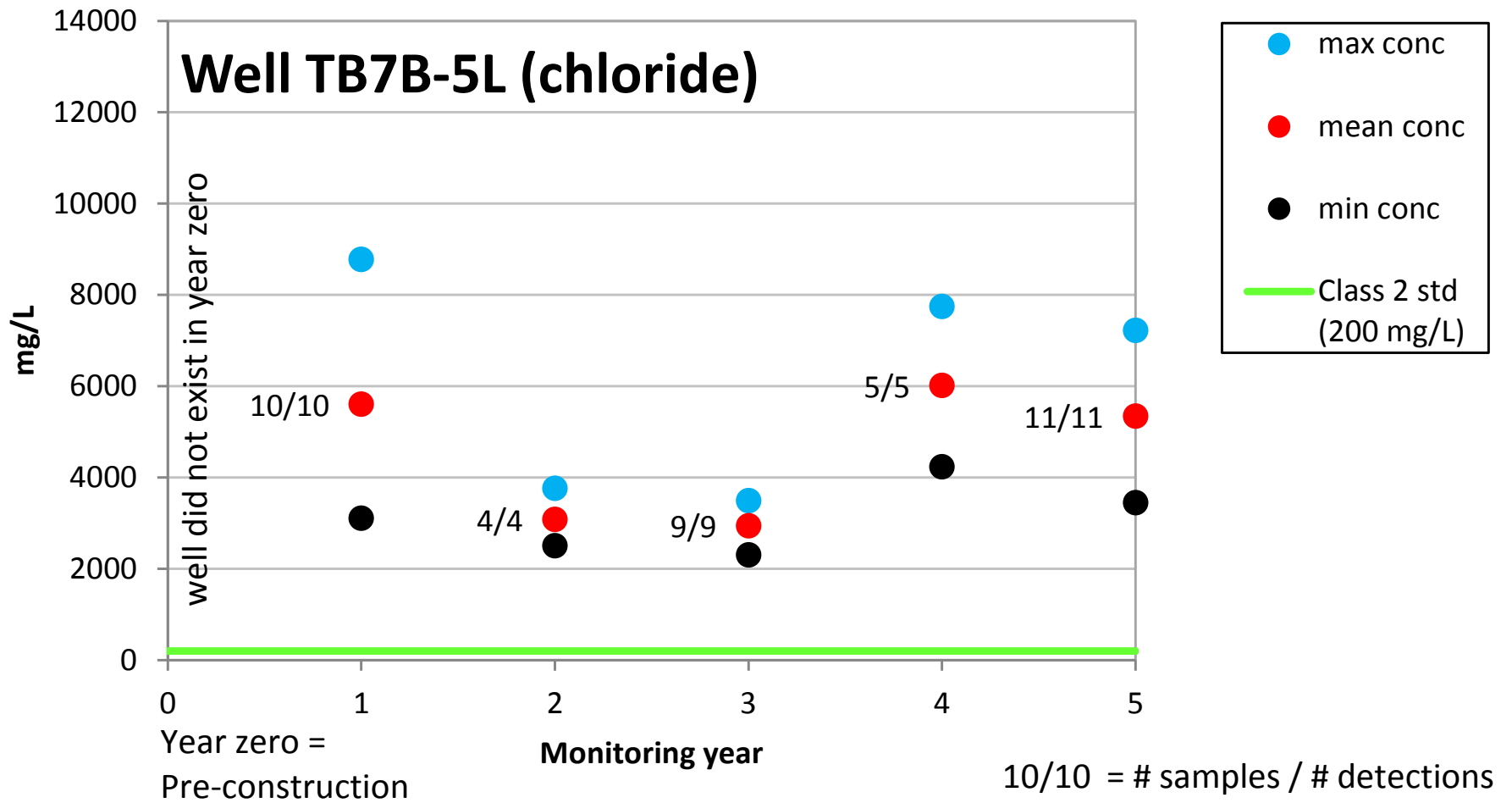


Figure 19. Evolution of chloride min-max-mean concentrations - Well TB7B-5L

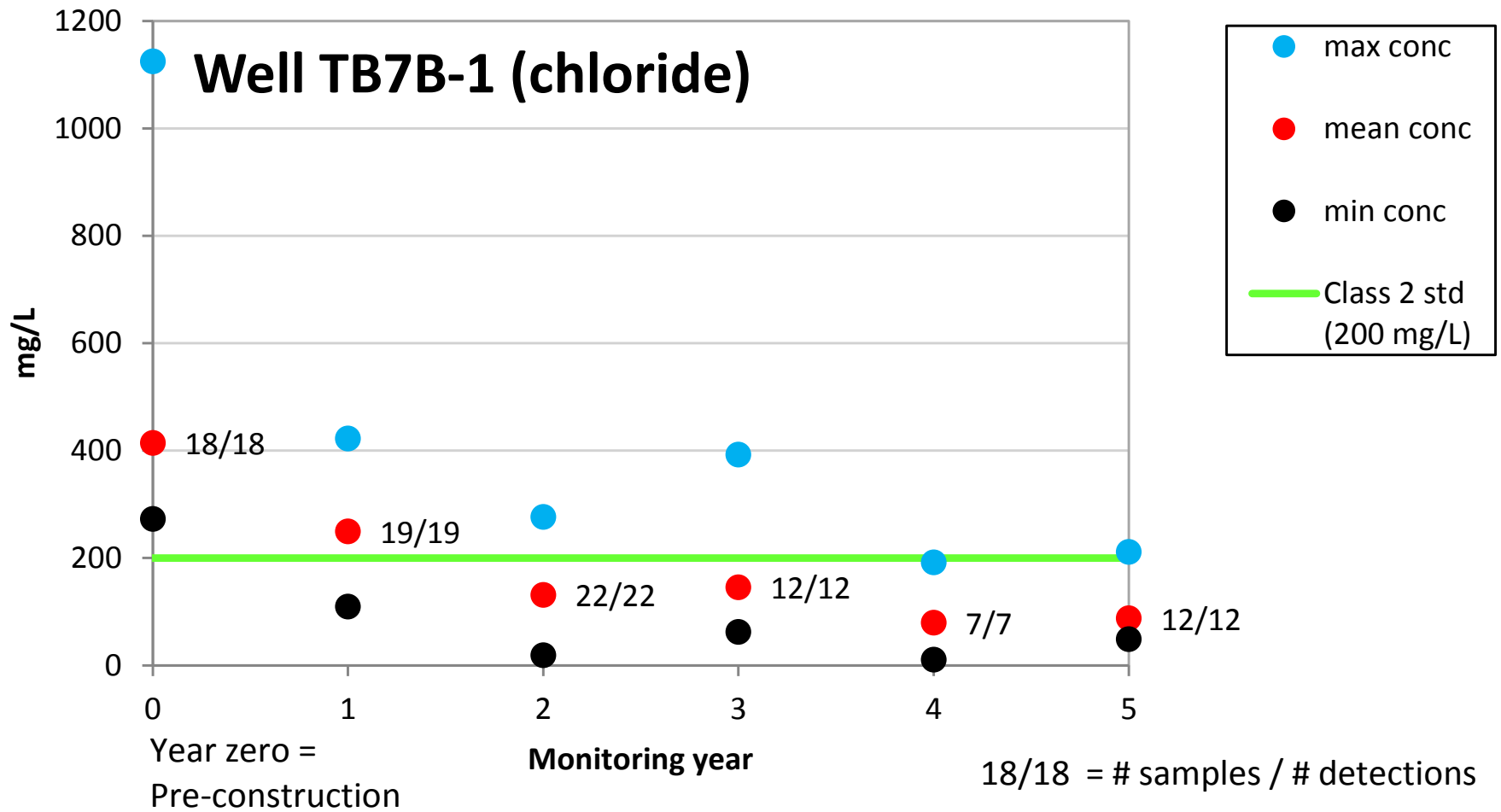


Figure 20. Evolution of chloride min-max-mean concentrations - Well TB7B-1



and no clear trend through time (Figures 21 and 22), although the maximum levels (often exceeding 100 mg/L) suggest some impact during winter, perhaps via aerial deposition of salt. At TB7B-4, furthest from the roadway, mean chloride concentrations were more or less stable over the study period and the range of concentrations was low (Figure 23), indicating this location was likely unaffected by tollway operations before or after construction.

### *Zinc and copper*

The shallow well in the bioswale (TB7B-5U) showed 15 detections of zinc in 78 samples, while the deeper zone (TB7B-5L) showed 36 detections of zinc in 39 samples (Figures 24 and 25); in addition, annual mean zinc levels in the deeper well (TB7B-5L) are higher than in the shallow bioswale well (TB7B-5U) or the well adjacent to the bioswale (TB7B-1; Figure 26). No clear trends through time were seen other than a weak upward trend at TB7B-1. Maximum levels of zinc are also highest in TB7B-5L, including a measurement of approximately 0.1 mg/L, close to the maximum level seen at the TB7Bin input culvert to bioswale TB7B (0.08 mg/L), suggesting roadway runoff as the likely source for zinc in the groundwater at TB7B-5L, although zinc levels in TB7B-5U were not similarly elevated. None of the other wells more distant from the bioswale showed a trend in zinc concentration and some had too few detections of zinc to see a trend.

Although the sample with the single highest concentration of copper detected was at well TB7B-5U, copper typically was detected at low levels at both bioswale wells or was not detected at all (Figures 27 and 28). More frequent detections were made at wells bordering and within in the forest preserve, with the well closest to the bioswale (TB7B-1) having the highest mean and maximum annual levels of the forest preserve wells (Figures 29 through 31), although there is no discernible trend. Well TB7B-1 (Figure 29), has slightly higher copper levels in the period after construction, but the trend is not strong. Given that the highest levels of copper are found in TB7B-5U in close proximity to TB7Bin, runoff from the roadway via the culvert is the likely source of copper to the groundwater at this site.

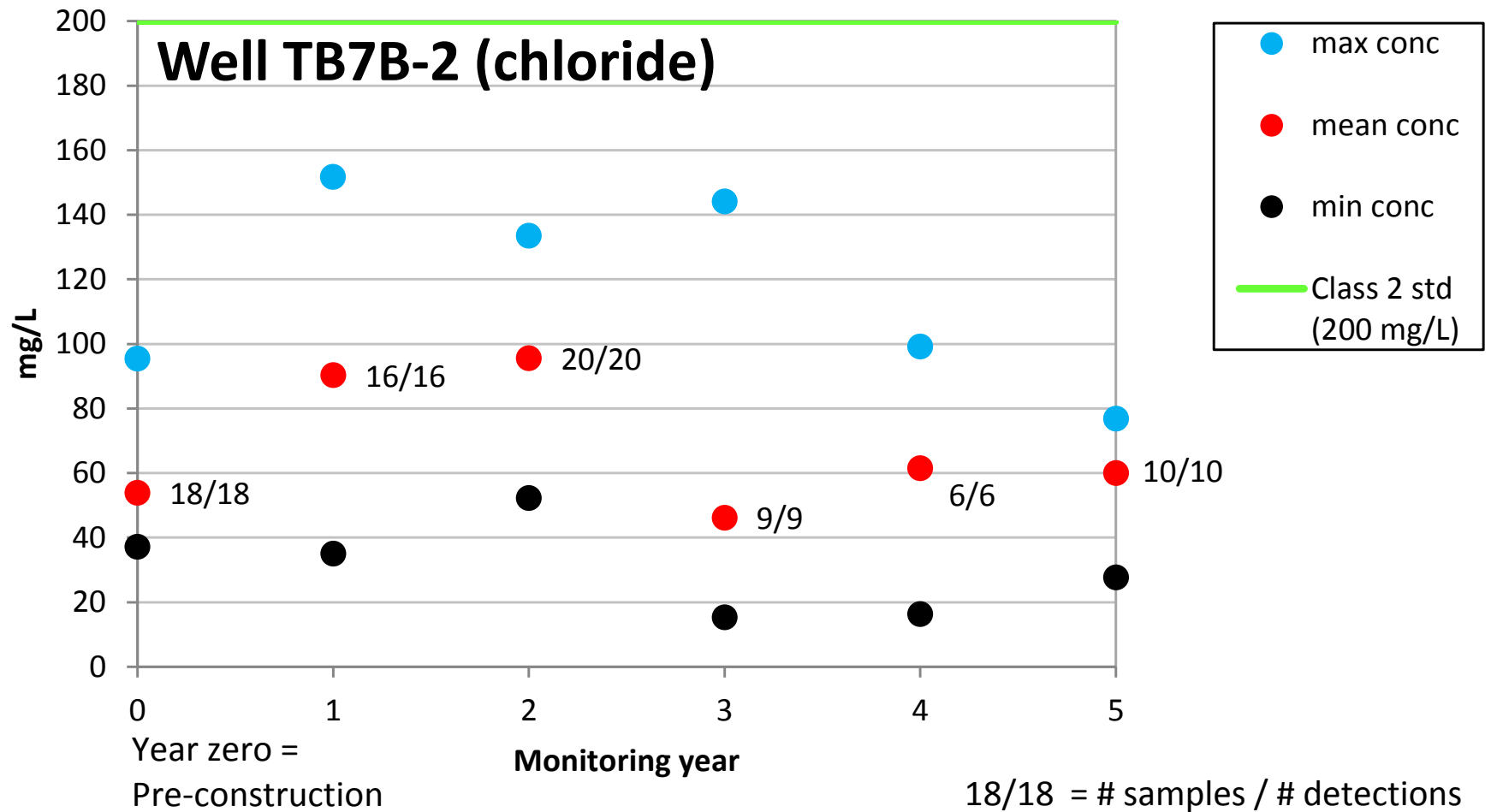


Figure 21. Evolution of chloride min-max-mean concentrations - Well TB7B-2

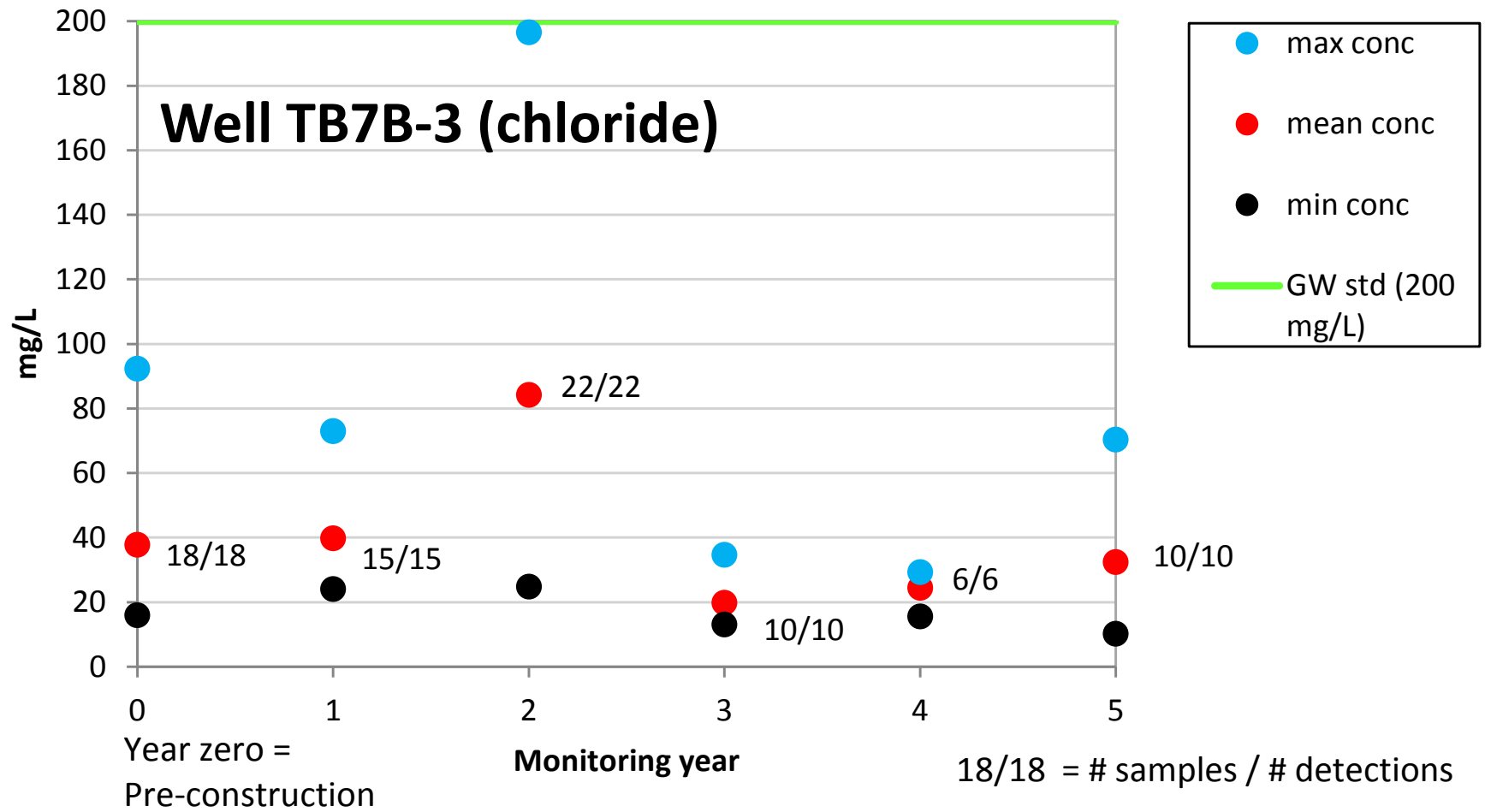


Figure 22. Evolution of chloride min-max-mean concentrations - Well TB7B-3

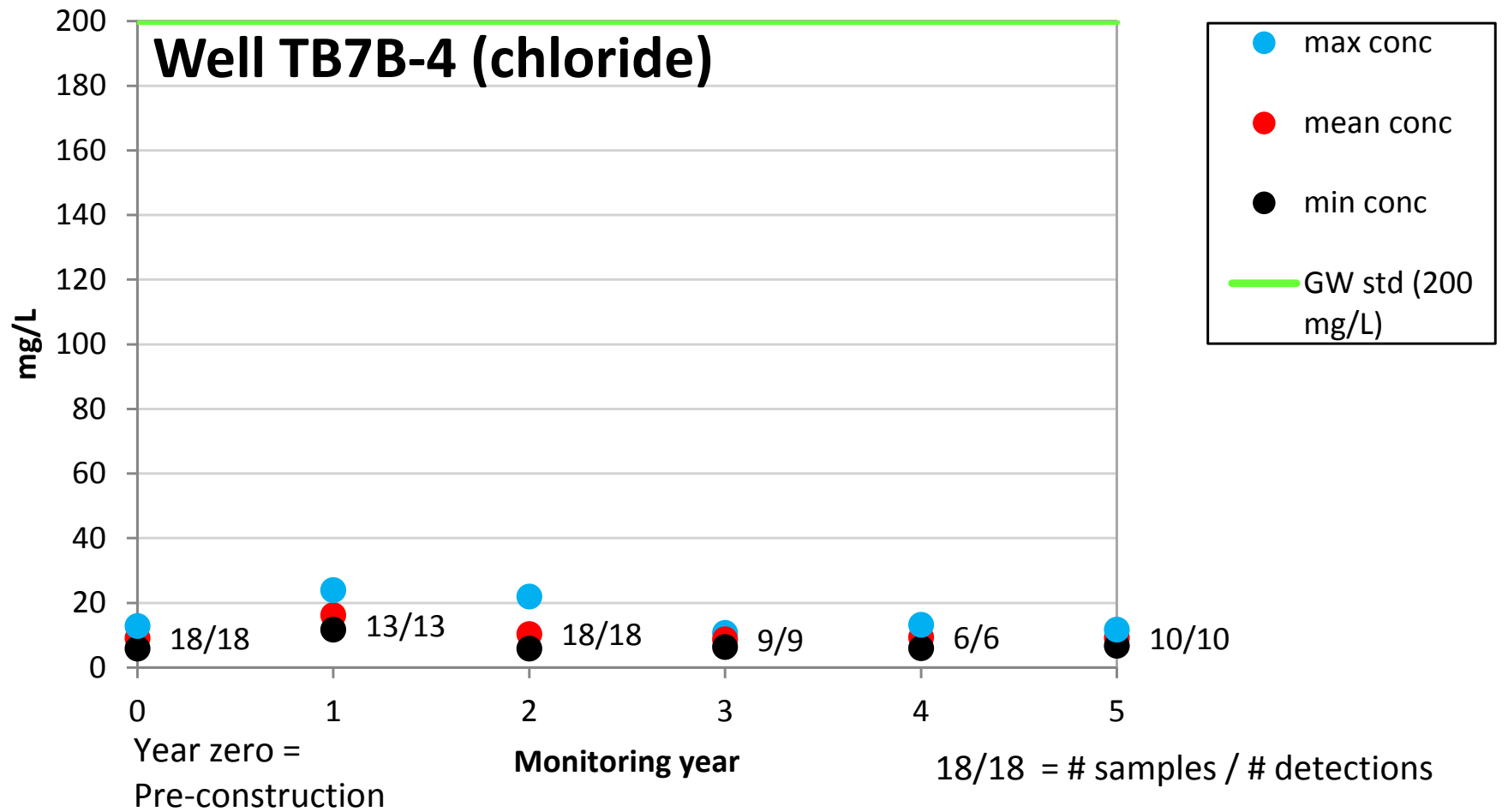


Figure 23. Evolution of chloride min-max-mean concentrations - Well TB7B-4

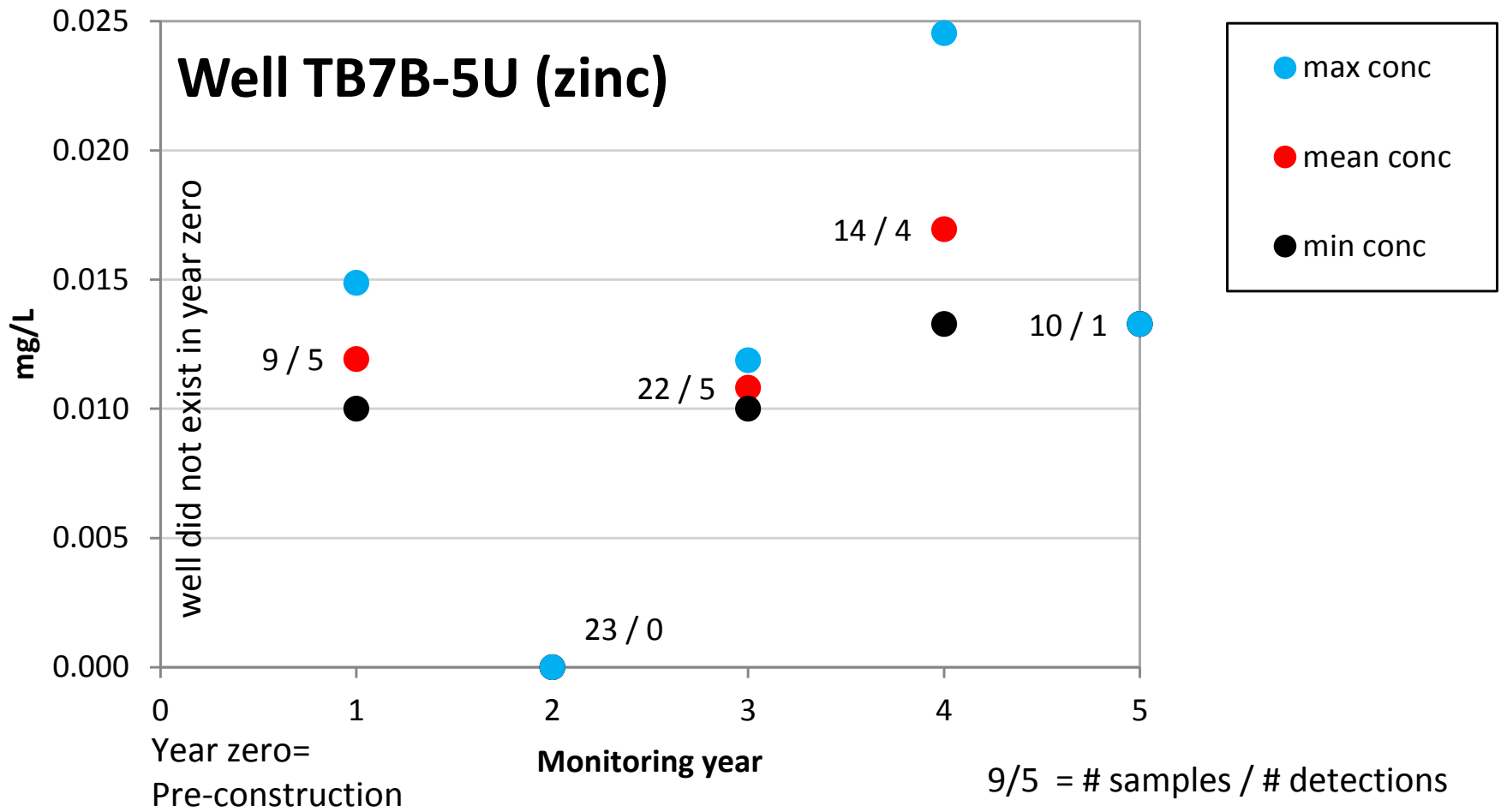


Figure 24. Evolution of zinc min-max-mean concentrations - Well TB7B-5U

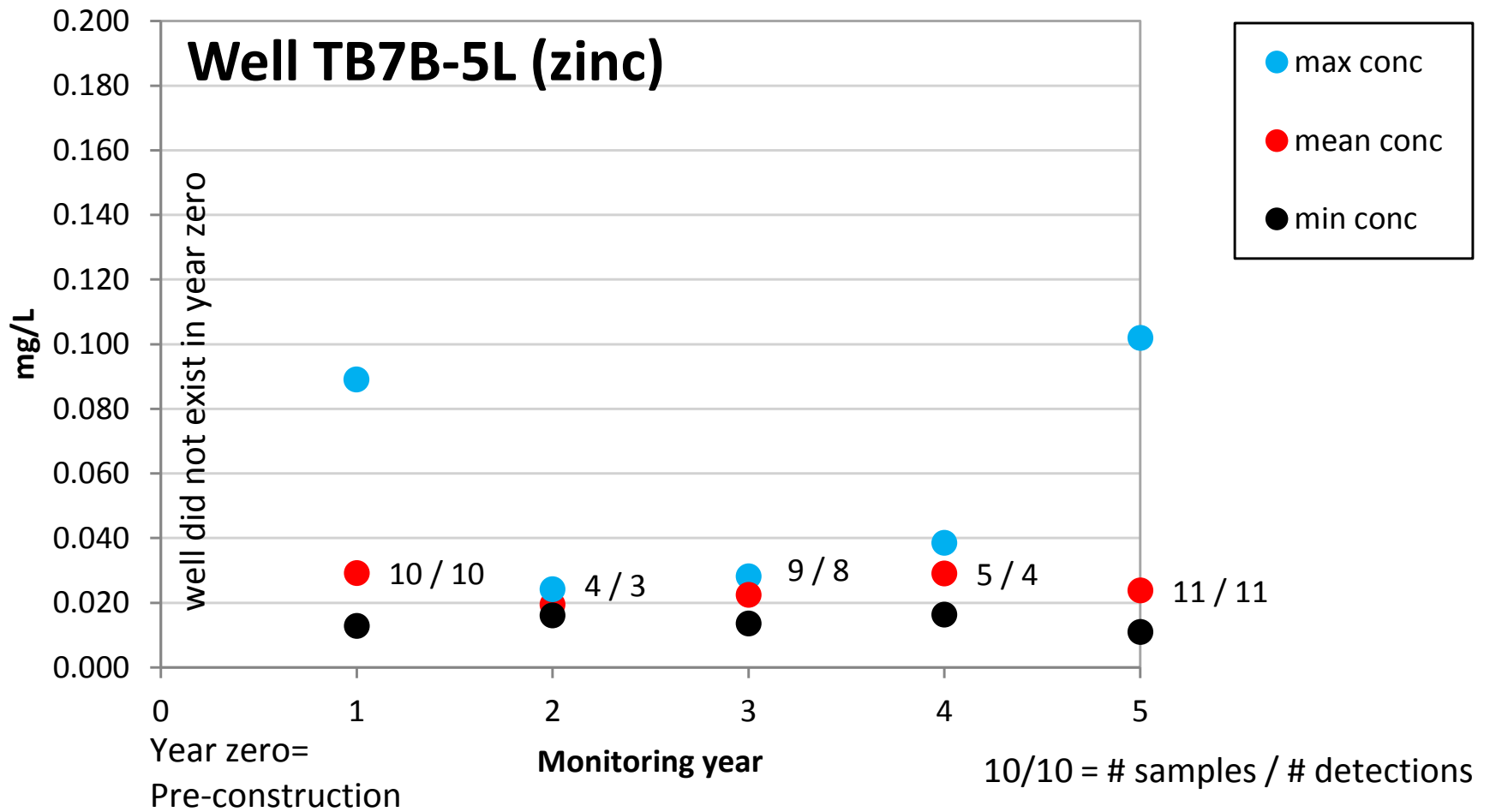


Figure 25. Evolution of zinc min-max-mean concentrations - Well TB7B-5L

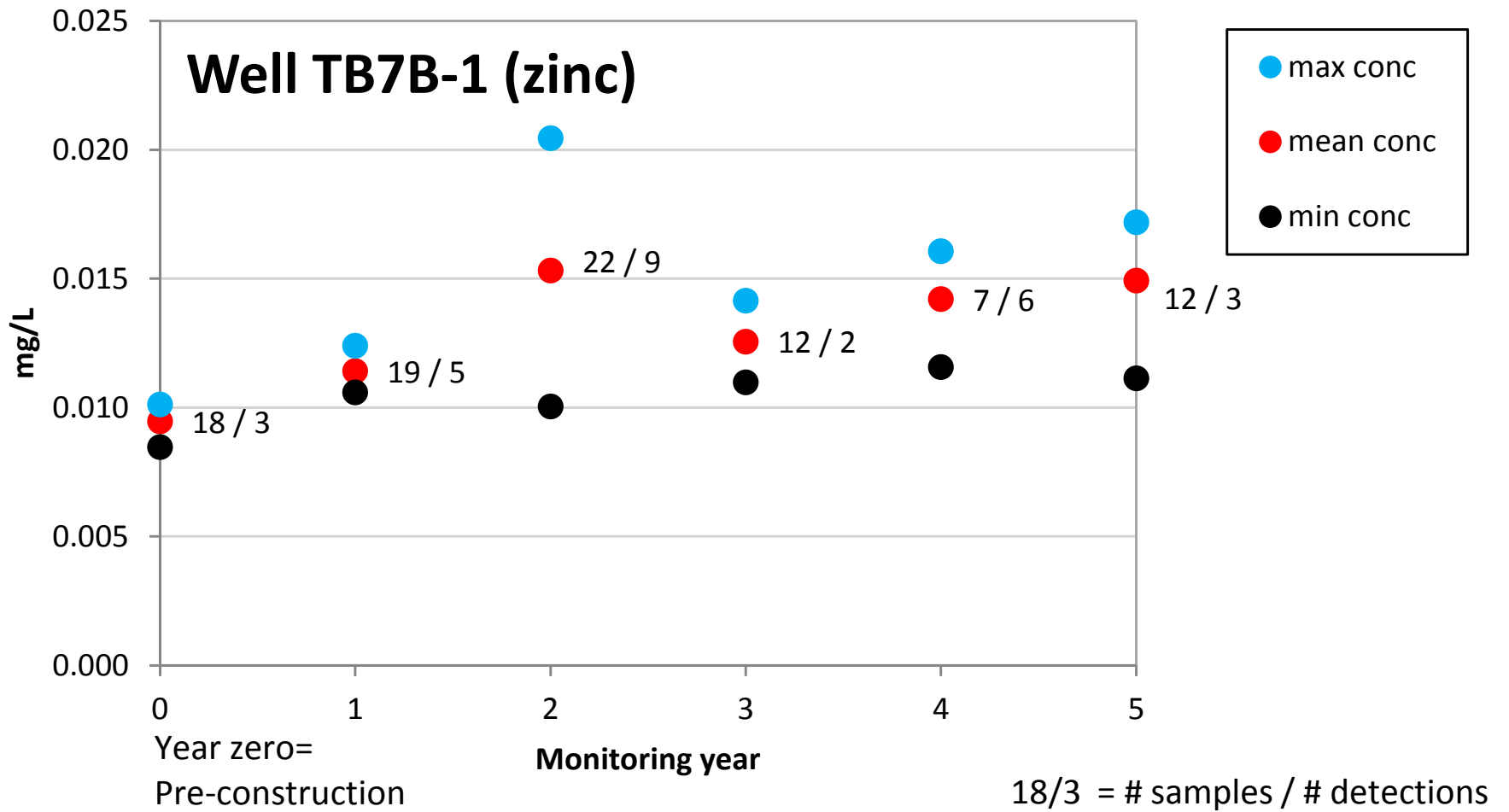


Figure 26. Evolution of zinc min-max-mean concentrations - Well TB7B-1

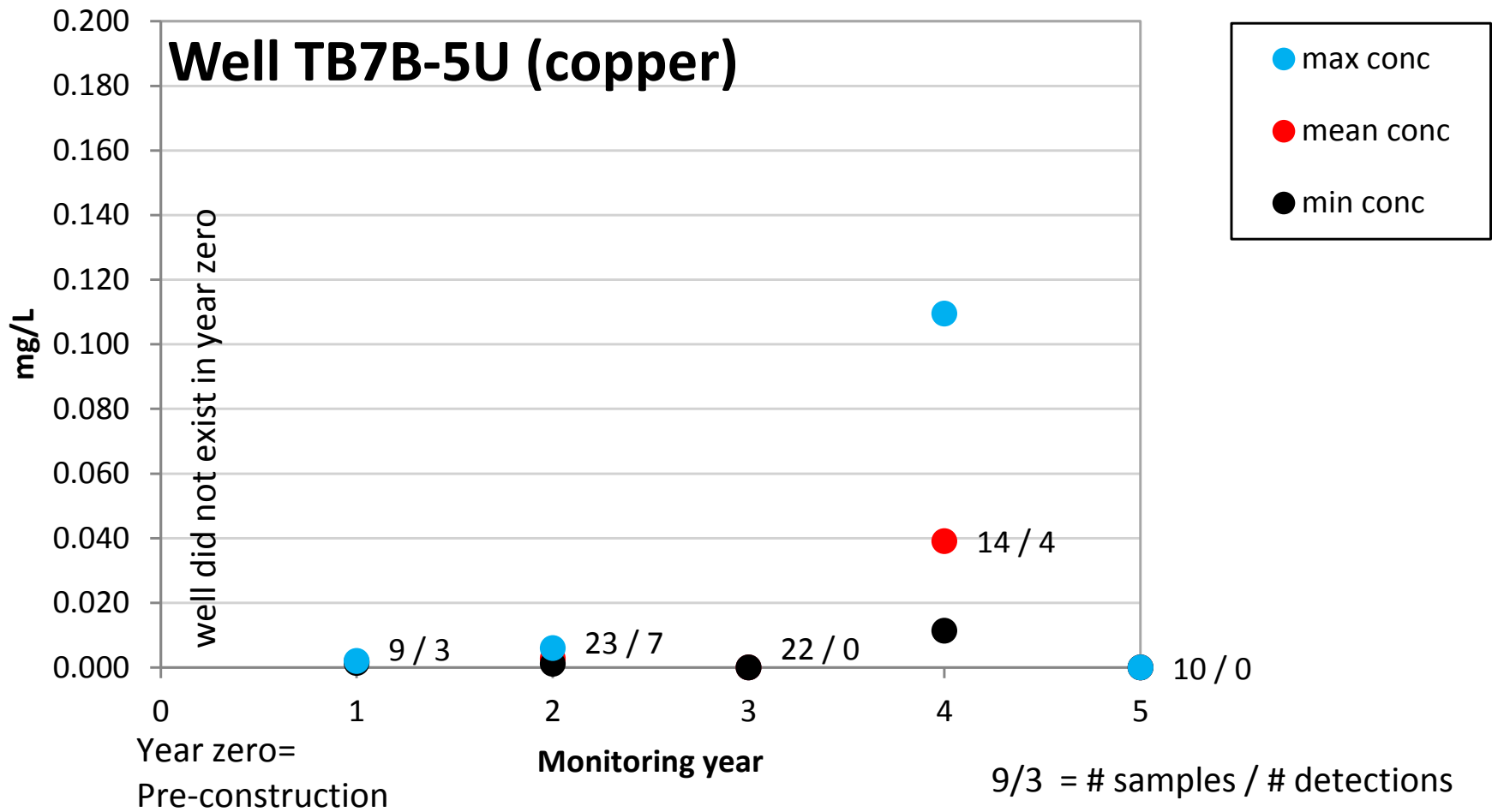


Figure 27. Evolution of copper min-max-mean concentrations - Well TB7B-5U



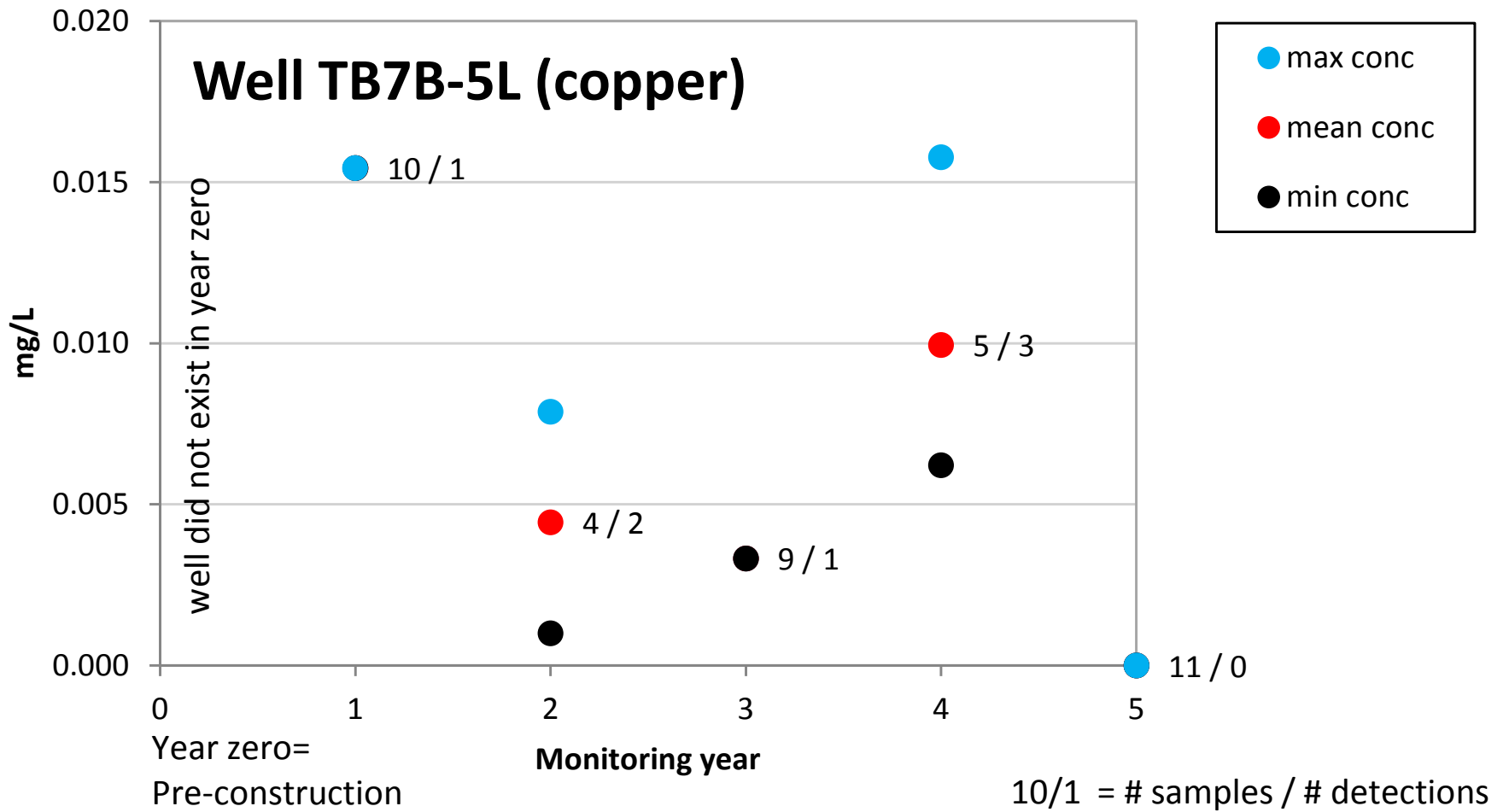


Figure 28. Evolution of copper min-max-mean concentrations - Well TB7B-5L

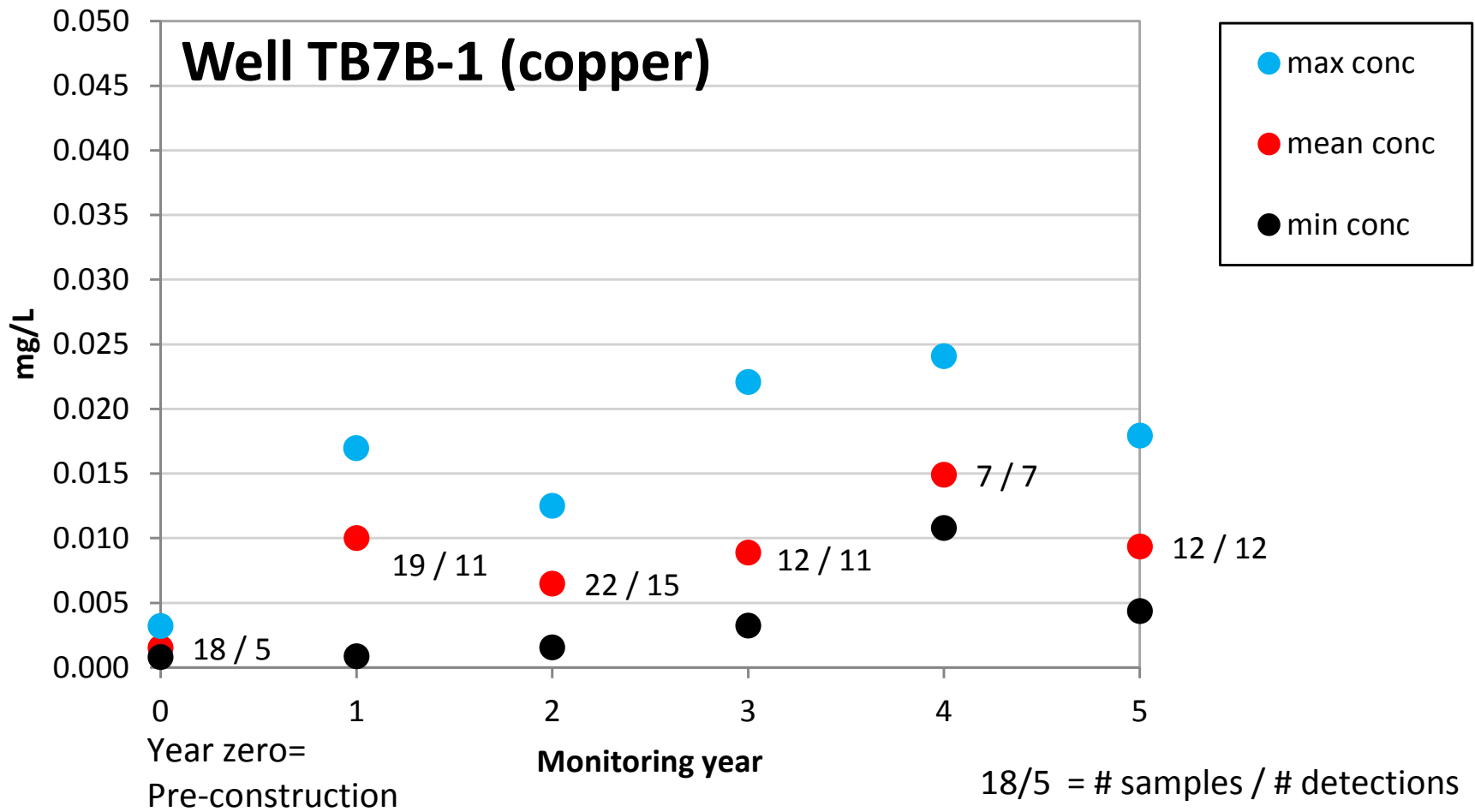


Figure 29. Evolution of copper min-max-mean concentrations - Well TB7B-1

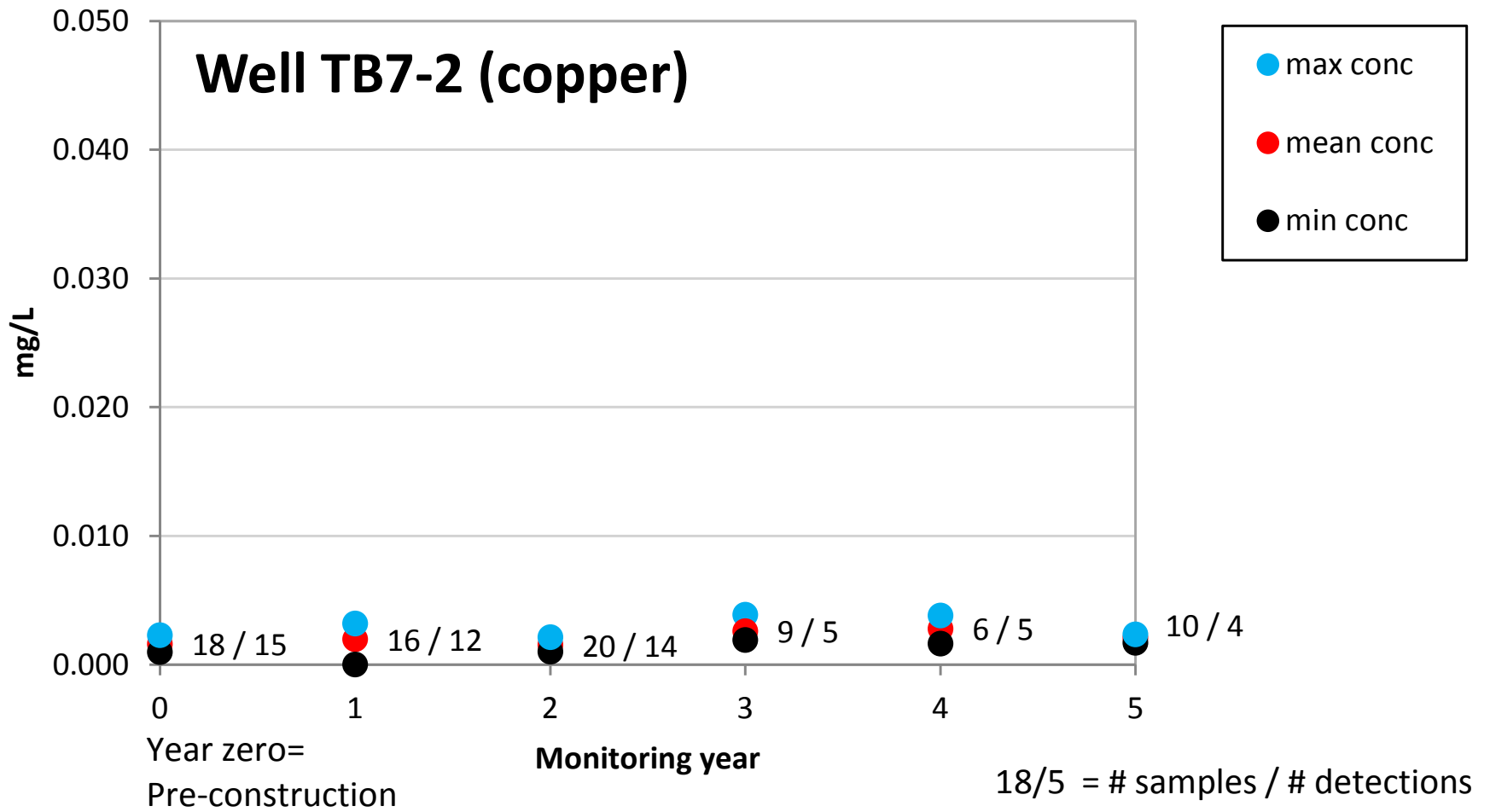


Figure 30. Evolution of copper min-max-mean concentrations - Well TB7B-2

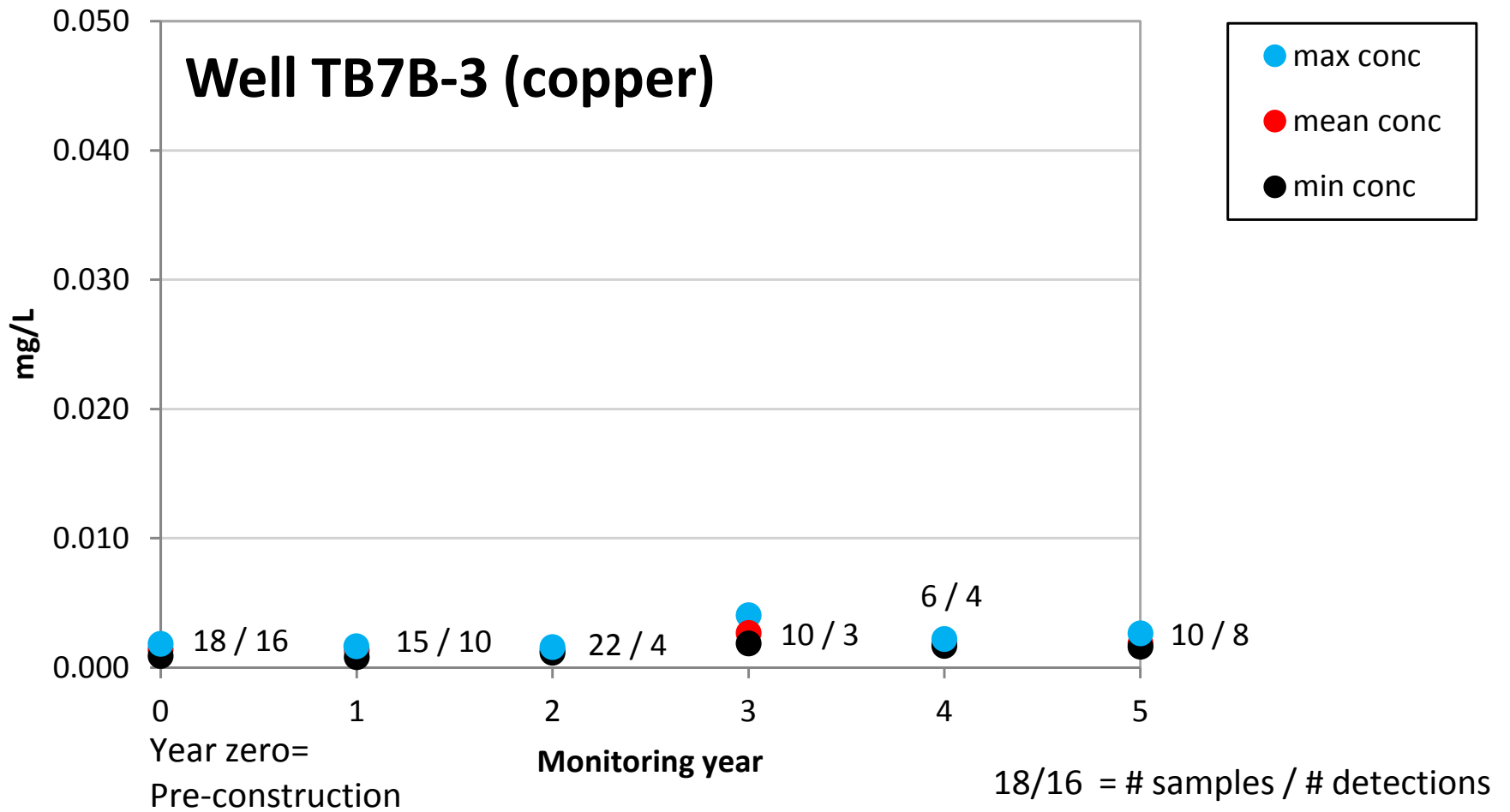


Figure 31. Evolution of copper min-max-mean concentrations - Well TB7B-3

## TB15B Groundwater Quality

### Specific conductivity

Specific conductivity measurements in wells at TB15B graphed with daily precipitation are shown in Figure 32, which shows the entire period of monitoring from pre-construction (from start of monitoring through August 2010) to post-construction Years 1 through 5. Annual graphs are included for increased resolution in Appendix C-31 to C-36. Annual snowfall totals are also plotted in Figure 33 alongside the conductivity record for the two wells within the bioswale.

Similar to TB7B, specific conductivity was elevated in groundwater within, below, and adjacent to the bioswale, generally decreasing westward away from the roadway. Specific conductivity measurements in well TB15B-4U (screened in the bioswale fill material) had winter and spring peaks as high as 18,000  $\mu\text{S}/\text{cm}$ , but more peaked more regularly in the 7,500 to 9,000  $\mu\text{S}/\text{cm}$  range (Figure 34). Measurements steadily increased over winter and spring, due to dissolved solids from road salt building up in the groundwater, followed by a slow decline through summer as salt application ended and increased precipitation diluted solute levels in the groundwater. Common measurements in summer and fall ranged between 1,000 and 3,000  $\mu\text{S}/\text{cm}$  after the winter/spring peaks subsided. Measurements were subject to large and frequent increases and decreases related both to dilution by precipitation events and rates of application of road salt. Well TB15B-4L (screened below the fill material) had constantly high specific conductivity levels, remaining around 8,000 to 9,000  $\mu\text{S}/\text{cm}$  throughout the year. Because there was no obvious response to specific dilution or salting events, and no seasonal patterns, infiltration is apparently slower or volumetrically smaller, or perhaps that the solute load was brought to the underlying sediments more indirectly through a longer groundwater flow path. No long-term increases or decreases were observed in the post-construction data for either TB15B-4U or TB15B-4L. Also, no pre-construction/post-construction comparison is possible as either well was present prior to construction.

Nested wells TB15B-1U (shallow) and TB15B-1L (deep), located just inside the forest preserve about 15 meters west of the bioswale, showed elevated specific conductivity levels. At TB15B-1U, levels typically peaked about 5,000-9,000  $\mu\text{S}/\text{cm}$  during winter, and fell throughout spring and summer to levels generally less than 3,000  $\mu\text{S}/\text{cm}$ , although sharp declines to below 1,000  $\mu\text{S}/\text{cm}$  were observed during heavy precipitation

Figure 32. Pre-construction to Year 5 specific conductivity of groundwater at bioswale TB15B

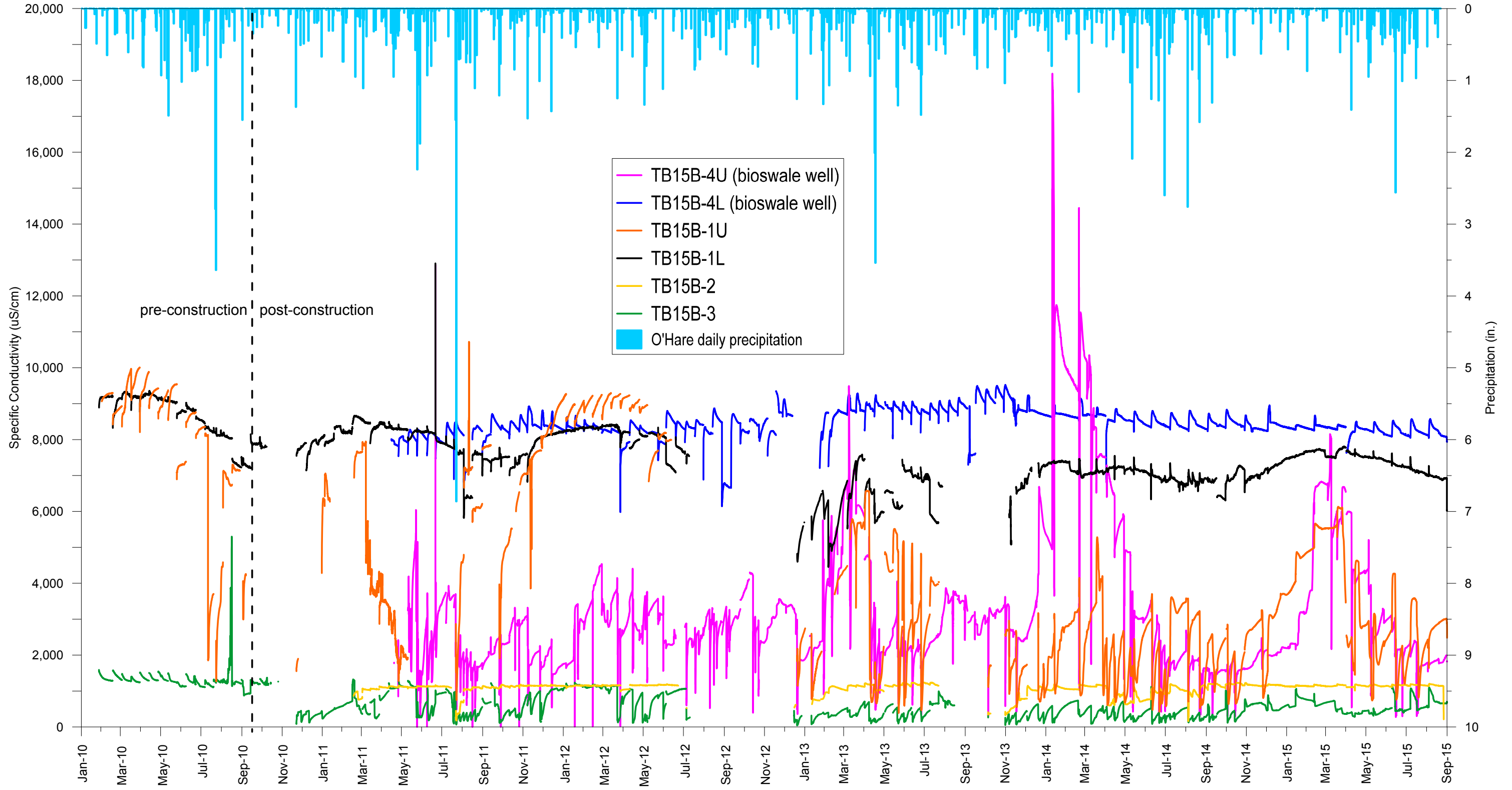
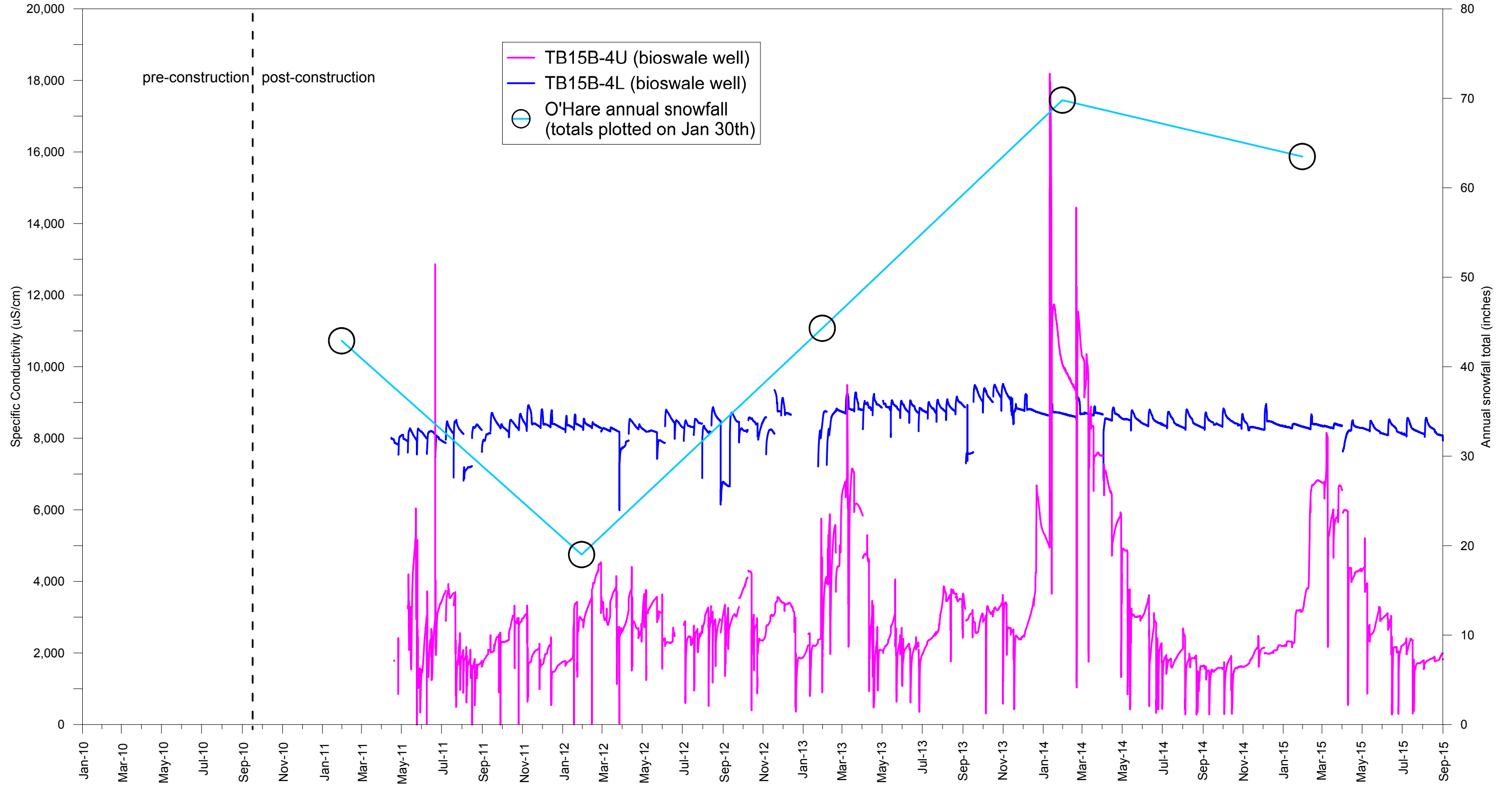


Figure 33. Pre-construction to Year 5 specific conductivity of groundwater in bioswale wells at TB15B with annual snowfall



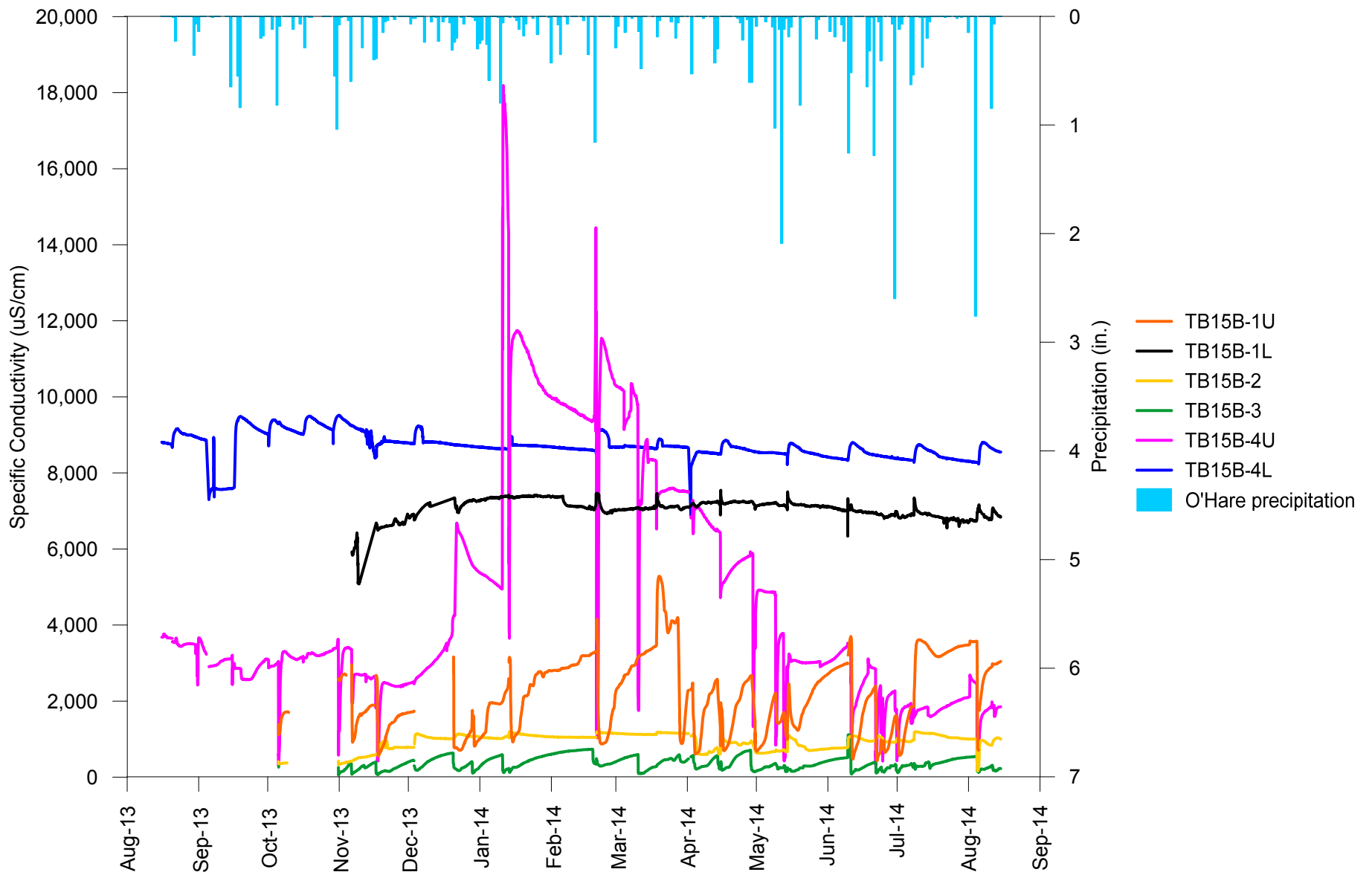


Figure 34. Year 4 specific conductivity of groundwater at bioswale TB15B



events due to dilution. Throughout the post-construction monitoring, peak levels and their duration declined dramatically, suggesting improvements in groundwater quality after bioswale installation. TB15B-1L maintained high specific conductivity levels throughout the year, ranging between about 6,000 and 8,000  $\mu\text{S}/\text{cm}$ ; there was also a less obvious response to precipitation events and a subdued seasonal response, suggesting less impact from infiltration events and a longer or slower flow path for groundwater supplying this well. During the monitoring period, peak levels and seasonally low levels both declined slightly at TB15B-1L, although to a lesser degree than TB15B-1U, suggesting possible water-quality improvements after bioswale installation. Groundwater-quality improvements at both TB15B-1U and TB15B-1L may have resulted from the installation of the underdrain, which as noted previously, likely received groundwater flow seasonally from deeper sediments and from the vicinity of wells TB15B-1U and TB15B-1L, reducing dissolved solids in groundwater in the periphery of the bioswale and possibly intercepting the supply of dissolved solids being transported in groundwater from the roadway.

Wells further west of the bioswale and the tollway (TB15B-2 and TB15B-3) had far lower specific conductivities, typically less than 1,000  $\mu\text{S}/\text{cm}$ , showing little or no seasonal variation. Well TB15B-2 seldom showed any response to precipitation events, while TB15B-3 showed responses to some but not others, likely due to antecedent moisture conditions in the soil profile. Neither well showed any trends through time over the course of the study, nor did they show any effects obviously attributable to roadway or bioswale operations.

Data indicate that the likelihood of deeper groundwater being further affected by current bioswale operations is minimal at this site, and it is possible that the underdrain may continue to induce groundwater discharge and remove legacy contaminants from surrounding areas, including adjacent parts of the forest preserve, so that future improvements in water quality may be expected. It should be noted that any dissolved solids removed from the groundwater system are discharged to the surface-water system, adding to the load already present in overland runoff.

## Groundwater samples

### *Chloride and TDS*

All wells at TB15B exceeded Class 2 Groundwater Standards for some constituents,

although wells within and adjacent to the bioswale exceeded standards more often and included constituents that are more characteristic of roadway runoff. TB15B-4L is screened in the native materials below the bioswale and exceeded the standard for chloride in 85 of 86 samples taken over the study period (Table 2). TB15B-4U is screened in the sand backfill of the bioswale itself, and despite being subject to occasional dilution by low-solute runoff from precipitation events, it still exceeded the chloride standard in 81 of 87 samples taken. Adjacent to the bioswale, TB15B-1U exceeded the chloride standard in 100% of samples taken from pre-construction through Year 3, but exceedances dropped to 88% and 83% in Years 4 and 5, respectively, possibly suggesting a slight decline in chloride. TB15B-1L showed no decline in chloride over the project duration, exceeding the chloride standard in 99 of 99 samples taken over all years.

The highest lab-measured concentration of chloride was 3,193 mg/L at TB15B-1U, collected in 2010 before construction (see Appendix B-0), although similarly high levels also were measured at different times at wells TB15B-4U, TB15B-4L, and TB15B-1L. Farther from the bioswale (Wells TB15B-2 and TB15B-3), maximum levels of chloride remained below the Class 2 standard of 200 mg/L for all samples in all years. The lowest levels were found at the west end of the transect at TB15B-3, with a mean chloride level near 30 to 40 mg/L, similar to unaffected wells at bioswale TB7B.

TDS levels and exceedances of water-quality standards were similar to those of chloride and specific conductivity. The well screened below the bioswale (TB15B-4L) exceeded the 1,200 mg/L groundwater standard in all samples collected in all seasons, and the shallower well, TB15B-4U, despite being affected by regular infiltration of low-solute waters, exceeded the standard in 67 out of 87 samples. In the wells adjacent to the bioswale (TB15B-1U and TB15B-1L), the deeper well exceeded the 1,200 mg/L standard at all times in all seasons, although mean levels declined slightly through time. However, the shallower well exceeded the standard in 100% of samples prior to construction through Year 2, but fell to 80% in Year 3 and 37% and 41% in Years 4 and 5, respectively. These declines were similar to that of chloride above, possibly related to underdrain installation and its interception of high-solute groundwaters from the roadway or bioswale.

In wells further from the bioswale (Wells TB15B-2 and TB15B-3, maximum levels of TDS remained below the groundwater standard of 1200 mg/L for all samples in all years except for one exceedance in the westernmost well during the pre-construction period.

Table 2. Exceedances of Class 2 Groundwater Standards - TB15B

Exceedance summary for Pre-con to Year 5 - groundwater

TB15B		Class 2 Std	5.0	10	0.024	0.05	0.02	0.1	1,200	200	400					
		mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L					
Monitoring	Well	total # of	Fe	Mn	Sb	Se	Ti	V	TDS, 180 C	Cl	SO4					
Year		samples	#	%	#	%	#	%	#	%	#	%	#	%	#	%
PRE-CON	TB15-4U	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Y1	TB15-4U	13	-	-	-	-	1	8	-	9	69	10	77	-	-	-
Y2	TB15-4U	22	-	-	-	1	5	1	5	-	16	73	21	95	-	-
Y3	TB15-4U	26	-	-	-	2	8	1	4	-	24	92	26	100	-	-
Y4	TB15-4U	14	-	-	-	2	14	1	7	-	12	86	13	93	-	-
Y5	TB15-4U	12	-	-	-	-	-	-	-	-	6	50	11	92	-	-
PRE-CON	TB15-4L	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Y1	TB15-4L	13	-	-	-	2	15	3	23	-	13	100	13	100	-	-
Y2	TB15-4L	21	-	-	-	11	52	14	67	-	21	100	21	100	-	-
Y3	TB15-4L	26	-	-	-	19	73	15	58	-	26	100	26	100	-	-
Y4	TB15-4L	14	-	-	-	12	86	8	57	-	14	100	14	100	-	-
Y5	TB15-4L	12	-	-	-	1	8	11	92	-	12	100	11	92	-	-
PRE-CON	TB15-1U	18	-	-	-	10	56	7	39	-	18	100	18	100	-	-
Y1	TB15-1U	12	-	-	-	5	42	6	50	1	8	12	100	12	100	-
Y2	TB15-1U	19	-	-	1	5	7	37	9	47	-	19	100	19	100	-
Y3	TB15-1U	10	1	10	-	-	2	20	2	20	-	8	80	10	100	-
Y4	TB15-1U	8	1	13	-	-	-	1	13	-	3	38	7	88	-	-
Y5	TB15-1U	12	-	-	-	-	-	1	8	-	5	42	10	83	-	-
PRE-CON	TB15-1L	18	1	6	-	-	8	44	12	67	-	18	100	18	100	-
Y1	TB15-1L	23	-	-	-	-	14	61	9	39	-	23	100	23	100	-
Y2	TB15-1L	23	-	-	-	-	12	52	12	52	-	23	100	23	100	-
Y3	TB15-1L	14	-	-	-	-	12	86	7	50	-	14	100	14	100	-
Y4	TB15-1L	9	-	-	1	11.1	6	67	4	44	-	9	100	9	100	-
Y5	TB15-1L	12	-	-	-	-	-	10	83	-	12	100	12	100	-	-
PRE-CON	TB15-2	18	1	6	-	-	-	2	11	-	-	-	-	-	-	-
Y1	TB15-2	13	1	8	-	-	-	-	-	-	-	-	-	-	-	-
Y2	TB15-2	20	1	5	-	-	1	5	-	-	-	-	-	-	-	-
Y3	TB15-2	14	-	-	-	-	-	1	7	-	-	-	-	-	-	-
Y4	TB15-2	9	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Y5	TB15-2	12	1	8	-	-	-	-	-	-	-	-	-	-	-	-
PRE-CON	TB15-3	18	2	11	-	-	-	2	11	-	1	6	-	-	-	-
Y1	TB15-3	18	1	6	-	-	-	1	6	-	-	-	-	-	-	-
Y2	TB15-3	21	2	10	-	-	-	-	-	-	-	-	-	-	-	-
Y3	TB15-3	12	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Y4	TB15-3	9	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Y5	TB15-3	12	1	8	-	-	-	1	8	-	-	-	-	-	-	-

Standards are Class II "general resource" groundwater (Section 620.420)

# is number of exceedances during the stated period

% is the percentage of samples taken that exceed during the stated period

100% of samples exceed standard

50-99% of samples exceed standard

well is in the area of the forest preserve boundary

well is within the forest preserve

NA well had not been constructed during this monitoring period

### *Roadway metals and other constituents*

Groundwater quality exceeded Class 2 groundwater standards for several constituents in wells in and adjacent to bioswale TB15B, with fewer exceedances in wells farther into the forest preserve.

The shallow well within the bioswale (TB15B-4U) exceeded the selenium standard in 5 of 87 samples, but the deeper well exceeded this standard more regularly (45 of 86 samples; Table 2). This pattern was mirrored in the two wells just outside the bioswale with TB15B-1U exceeding the selenium standard in 24 of 79 samples but the deeper well (TB15B-1L) exceeded this standard more regularly (52 of 99 samples). Of the remaining wells further westward into the forest preserve, TB15B-2 exceeded the selenium standard only once (out of 186 total samples).

Thallium showed a similar pattern as selenium, with the shallow well within the bioswale (TB15B-4U) exceeding the thallium standard in 4 of 87 samples but the deeper well exceeding this standard more regularly (51 of 86 samples). This pattern occurred again in the two wells just outside the bioswale with TB15B-1U exceeding the thallium standard in 26 of 79 samples but the deeper well exceeded the thallium standard more regularly (54 of 99 samples). Further westward, only 7 samples of 186 total taken at TB15B-2 and TB15B-3 exceeded the groundwater standard for thallium.

Wells within the forest preserve (TB15B-1U, TB15B-1L, TB15B-2 and TB15B-3) had a few isolated exceedances of the iron standard (13 of 527 samples) but there were no exceedances in the bioswale wells (TB15B-4U and 4L). There was also one exceedance of the standard for vanadium and one for antimony, both at TB15B-1U.

Given the differences between exceedances at the shallowly screened wells (TB15B-1U and TB15B-2) versus the deeper wells (TB15B-1L and TB15B-3), and given that the upper wells are screened in silty clay versus the deeper wells being at least partially screened in (or adjacent to) the lower sand body, it is possible that each group of wells is reflecting groundwater that has been impacted to differing degrees and may have had different flow paths or sources of contaminants. Also, the two units have greatly differing hydrogeologic characteristics, with flow paths and flow rates that may alter their potential impact on transport and fate of contaminants. Therefore, when possible, the two geologic units will be discussed separately. However, it should be noted that much less

information exists about the lower sand, including thickness and continuity, so that far less certainty can be attributed to any conclusions regarding the lower sand.

TB15B-4U (screened within coarse sand bioswale substrate) and TB15B-1U (screened in shallow native materials just outside the bioswale) had a large range of constituent concentrations and strong seasonal signatures, most notably with sodium, chloride, calcium, and sulfate. TB15B-4U clearly was responding to the influx of road salt and other constituents brought in from direct roadway runoff, as well as seasonal dilutions by low-solute runoff events. However, it is less clear that constituents found at TB15B-1U were transported solely by groundwater, which may flow slowly due to the tight character of the silty clay deposits in the area. While secondary porosity such as fractures and soil structure may have provided more rapid flow pathways, aerial deposition due to proximity to the roadway and lack of tree cover is a likely pathway for at least some of the contaminants, depositing at land surface and infiltrating with subsequent precipitation. However, since long-term trends over the monitoring period showed declines in TDS and chloride at the shallow well adjacent to the bioswale (TB15B-1U), and aerial deposition is not likely to have decreased given the expansion of the roadway, it seems most likely that discharge of groundwater to the underdrain is the main reason for the decline in contaminants in groundwater in the forest preserve adjacent to the bioswales, which further suggests groundwater is a major pathway for contaminant travel to well TB15B-1U, despite the fine-grained character of the silty clay.

In contrast to the shallowly screened wells, the sodium, chloride, calcium, and sulfate levels in wells TB15B-4L (screened within tighter native materials below the bioswale) and TB15B-1L (screened in deeper native materials just outside the bioswale) have a very narrow range of constituent concentrations and no strong seasonal signature. The ranges of concentrations of these constituents are also very similar between these two wells, suggesting they are part of the same deeper flow system or reservoir of affected waters that have a longer residence time. The movement of infiltrating groundwater through the overlying fine-grained materials may be slow, thus dampening any seasonal signature. These wells, despite their longer response times and higher attenuation of variability, are both affected by constituents of roadway origins, but their flow paths and modes of delivery are less understood.

It is also noteworthy that during the period of record, there were no exceedances at site TB15B of Class 2 groundwater standards for roadway metals chromium, copper, lead, nickel, and zinc

## Range and mean of solute levels

Annual minimum, maximum, and mean levels were compared for selected solutes, including chloride as the primary indicator of road salt impacts. Copper and zinc, two roadway metals commonly found in measurable quantities in groundwater at the study sites, were also compared.

### *Chloride*

At bioswale TB15B, the wells within the bioswale (TB15B-4U and 4L) showed no clear upward or downward trend in mean annual chloride concentration during the period from Year 1-5 (Figures 35 and 36). Well TB15B-4U, finished in the bioswale's sand backfill, showed much lower mean chloride concentrations and a wider range of concentrations than well TB15B-4L, which was finished in the native materials below the bioswale, suggesting that while the shallower zone is subject to more dilution due to infiltration; the deeper zone is more isolated and hence more consistent in chloride concentration. Analytes present in the deeper well either result from long-standing buildup from decades of roadway operations, or the well intercepts longer groundwater flow paths at depth. Chloride levels in well TB15B-1U, just outside the bioswale, showed a clear decline in mean chloride over the study period (from 2,674 mg/L to 683 mg/L), perhaps reflecting the aforementioned seasonal discharge of solute-affected groundwaters to the underdrain (Figure 37). A more subtle decline was also seen in the deeper well (TB15-1L; Figure 38), suggesting that discharge to the underdrain may impact deeper flow paths as well. Well TB15B-2, further from the roadway, showed no obvious downward or upward trend (Figure 39). Well TB15B-3, furthest from the roadway, mean chloride concentrations, although low as at TB15B-2, showed a decline over the study period (Figure 40), which may provide some evidence that the lower sand may transport contaminants more rapidly, but further work is required before making definitive conclusions.

### *Zinc and copper*

At bioswale TB15B, the wells within the bioswale (TB15B-4U and 4L) showed different results than at TB7B. The shallow zone, subject to aeration and flushing (TB15B-4U), showed only two detections of zinc in 87 samples and had too few samples to show any trends (Figure 41). The deeper zone (TB15B-4L) showed 85 detections of zinc in 86 samples (Figure 42) with the highest mean zinc concentration in Year 1 followed by a

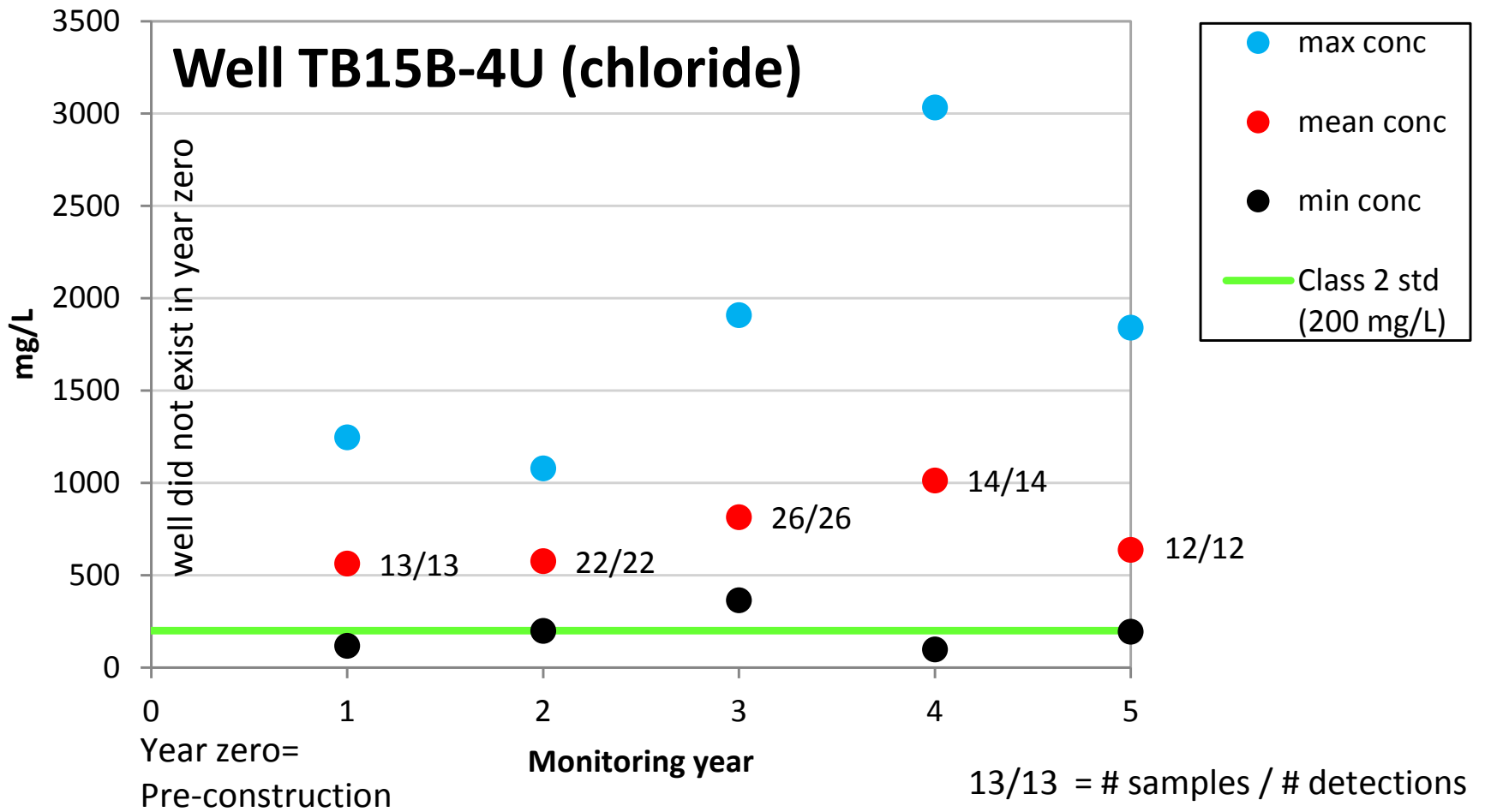


Figure 35. Evolution of chloride min-max-mean concentrations - Well TB15B-4U

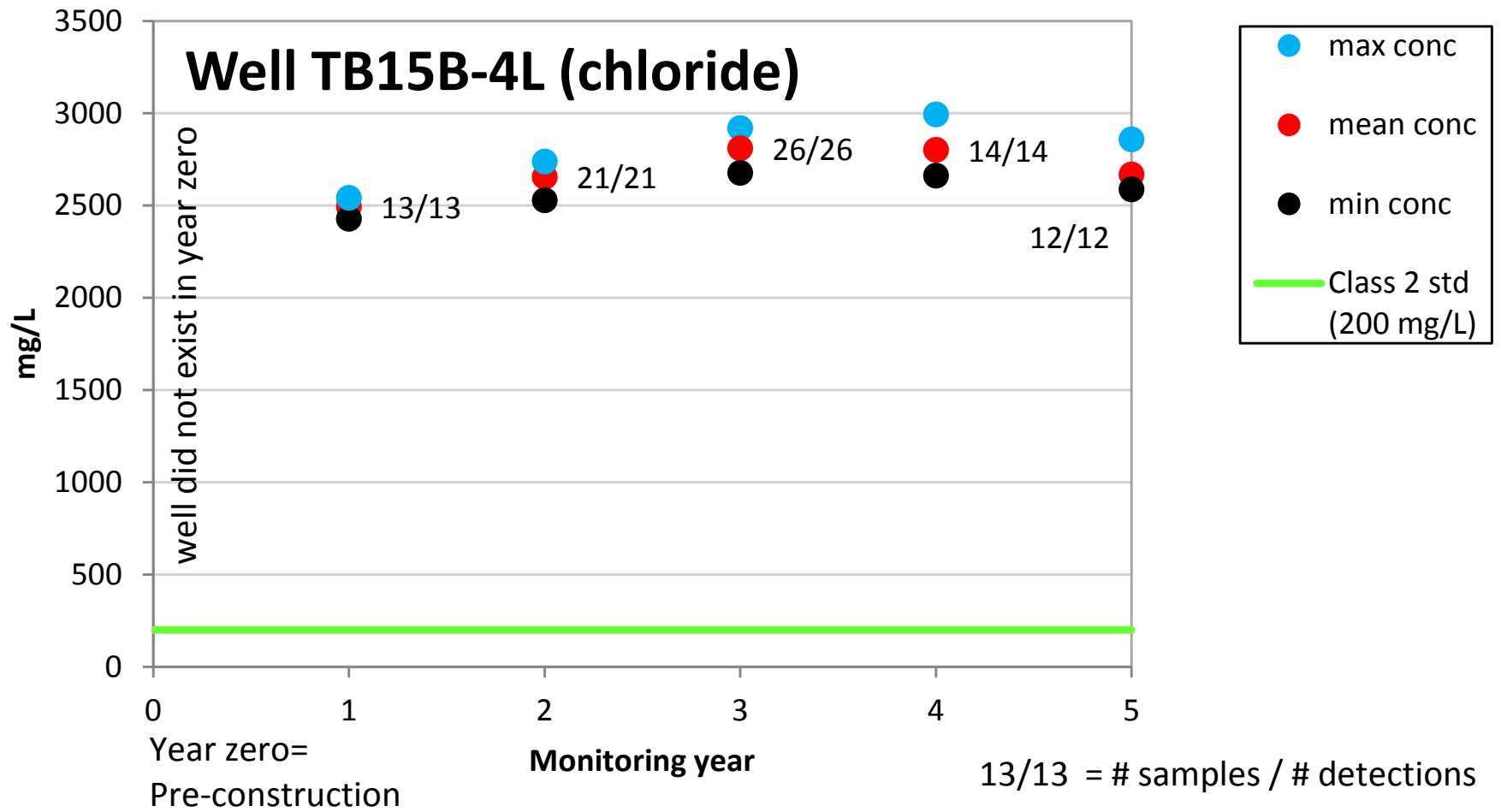


Figure 36. Evolution of chloride min-max-mean concentrations - Well TB15B-4L



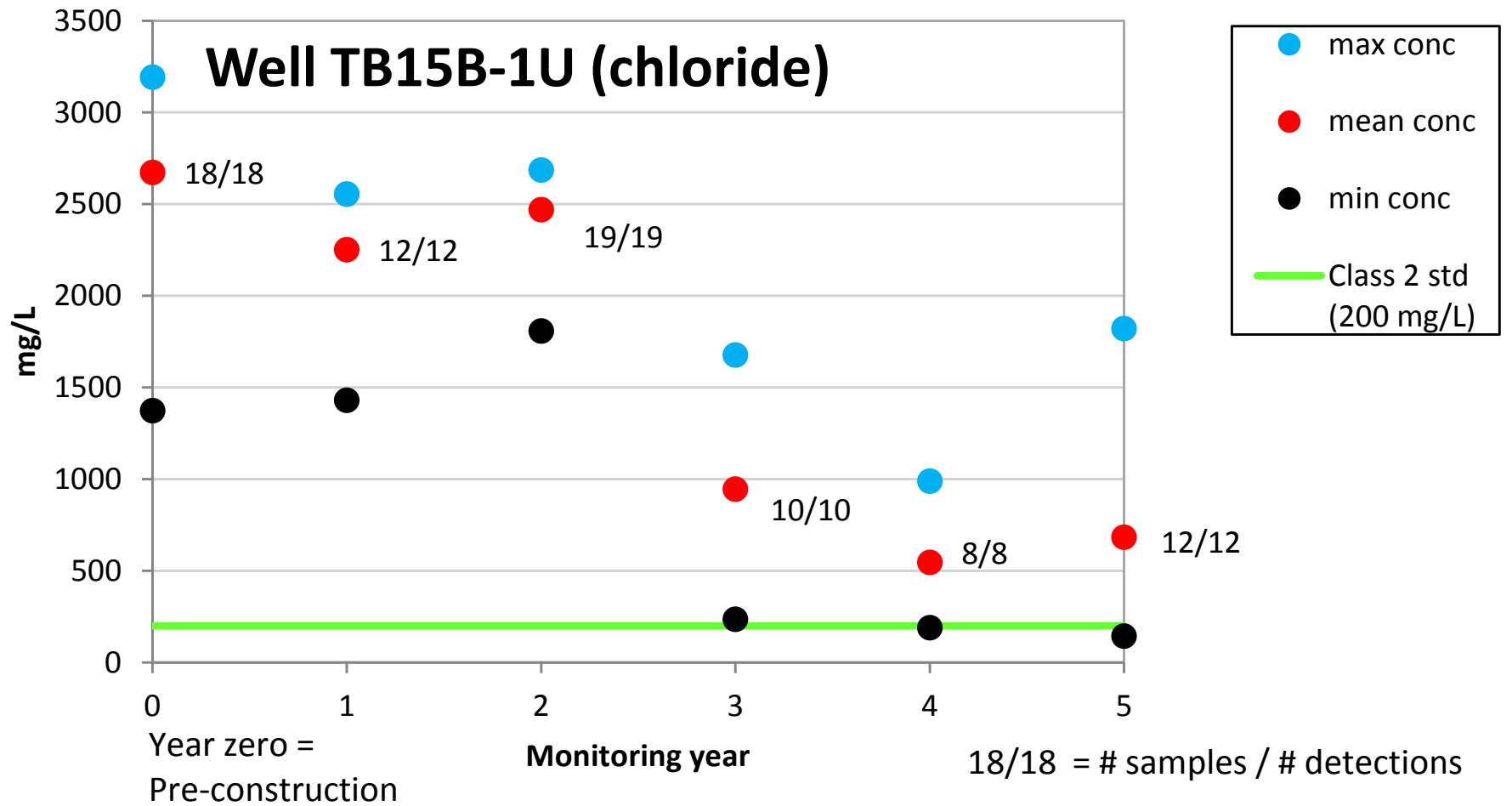


Figure 37. Evolution of chloride min-max-mean concentrations - Well TB15B-1U

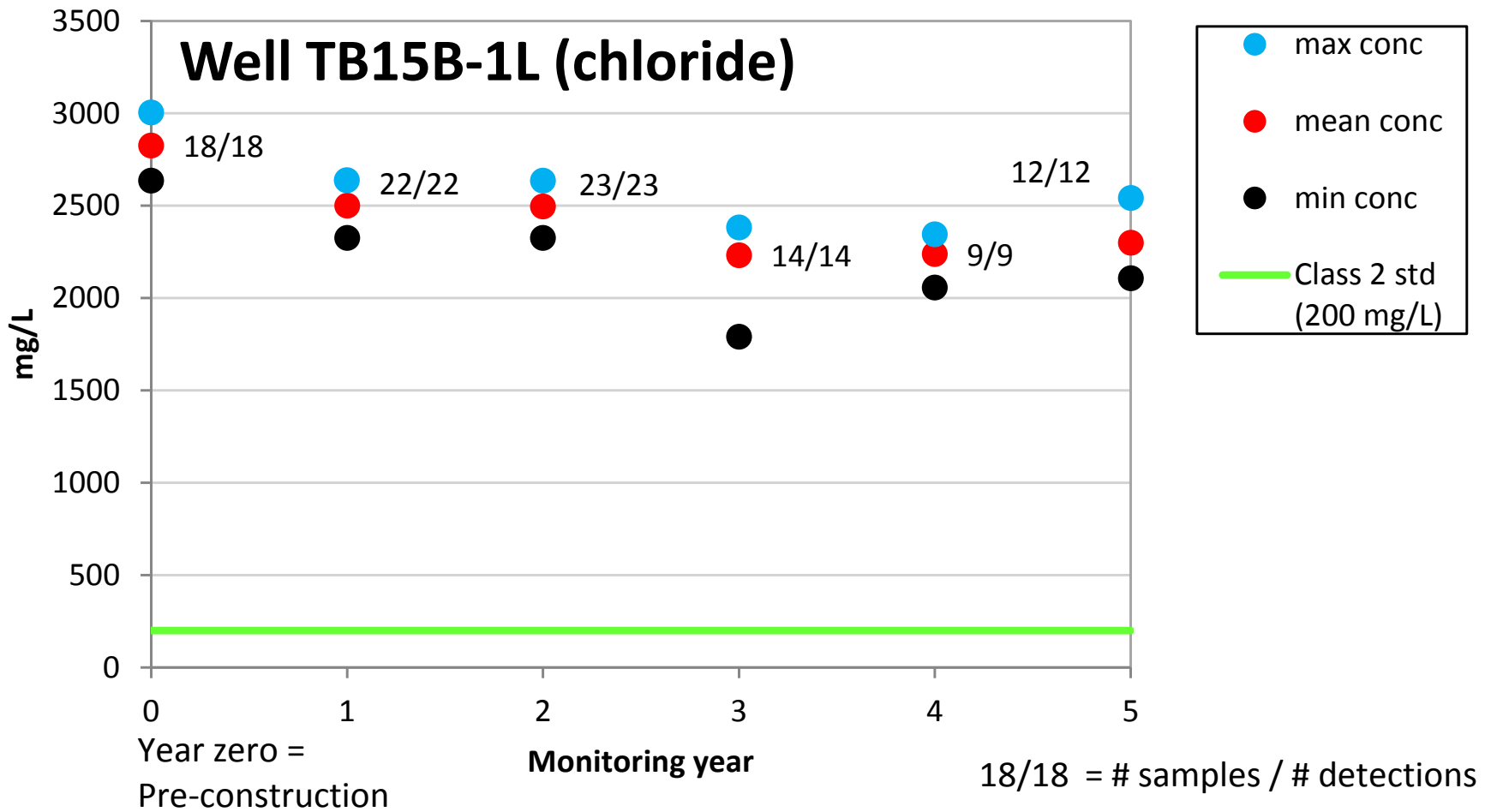


Figure 38. Evolution of chloride min-max-mean concentrations - Well TB15B-1L

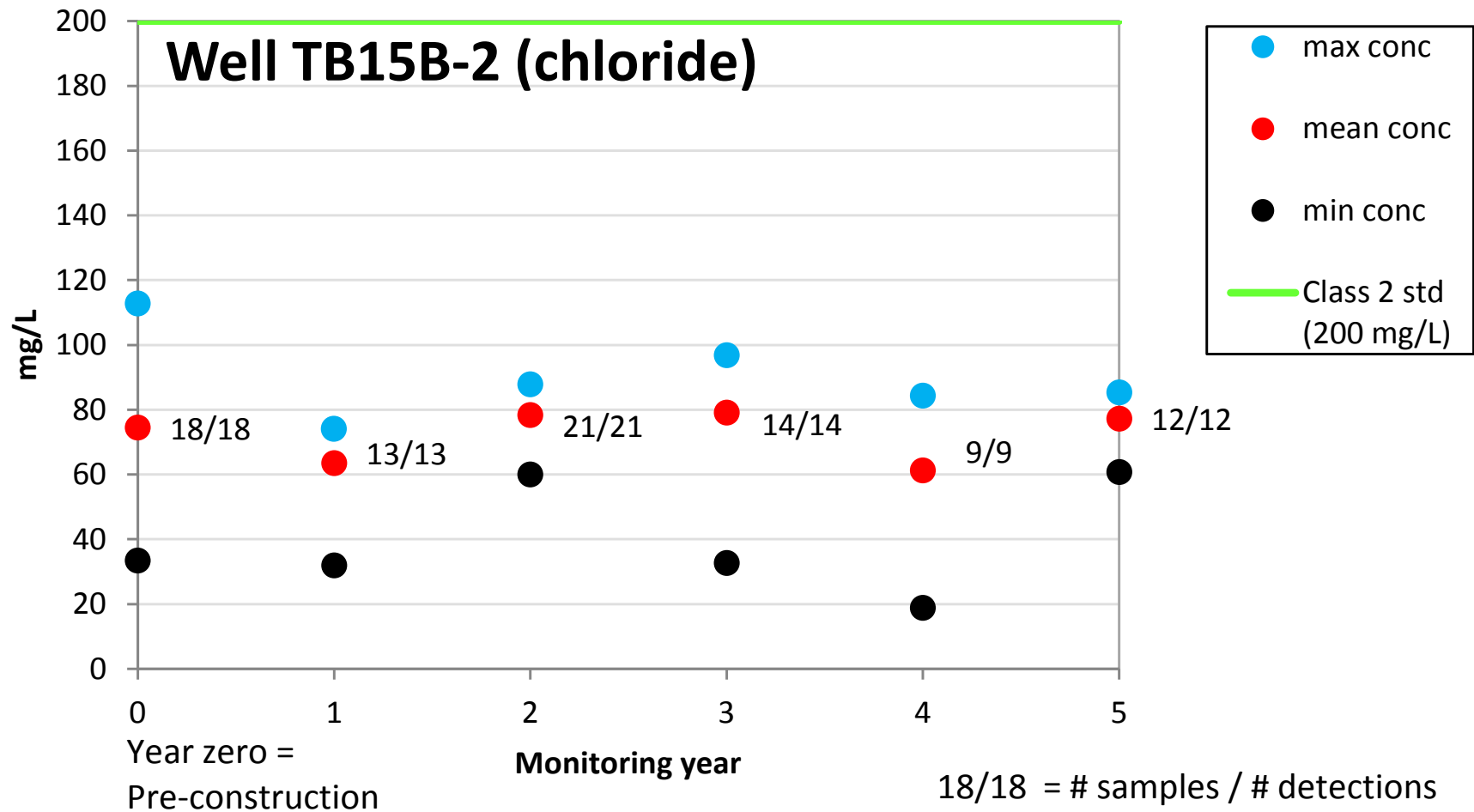


Figure 39. Evolution of chloride min-max-mean concentrations - Well TB15B-2

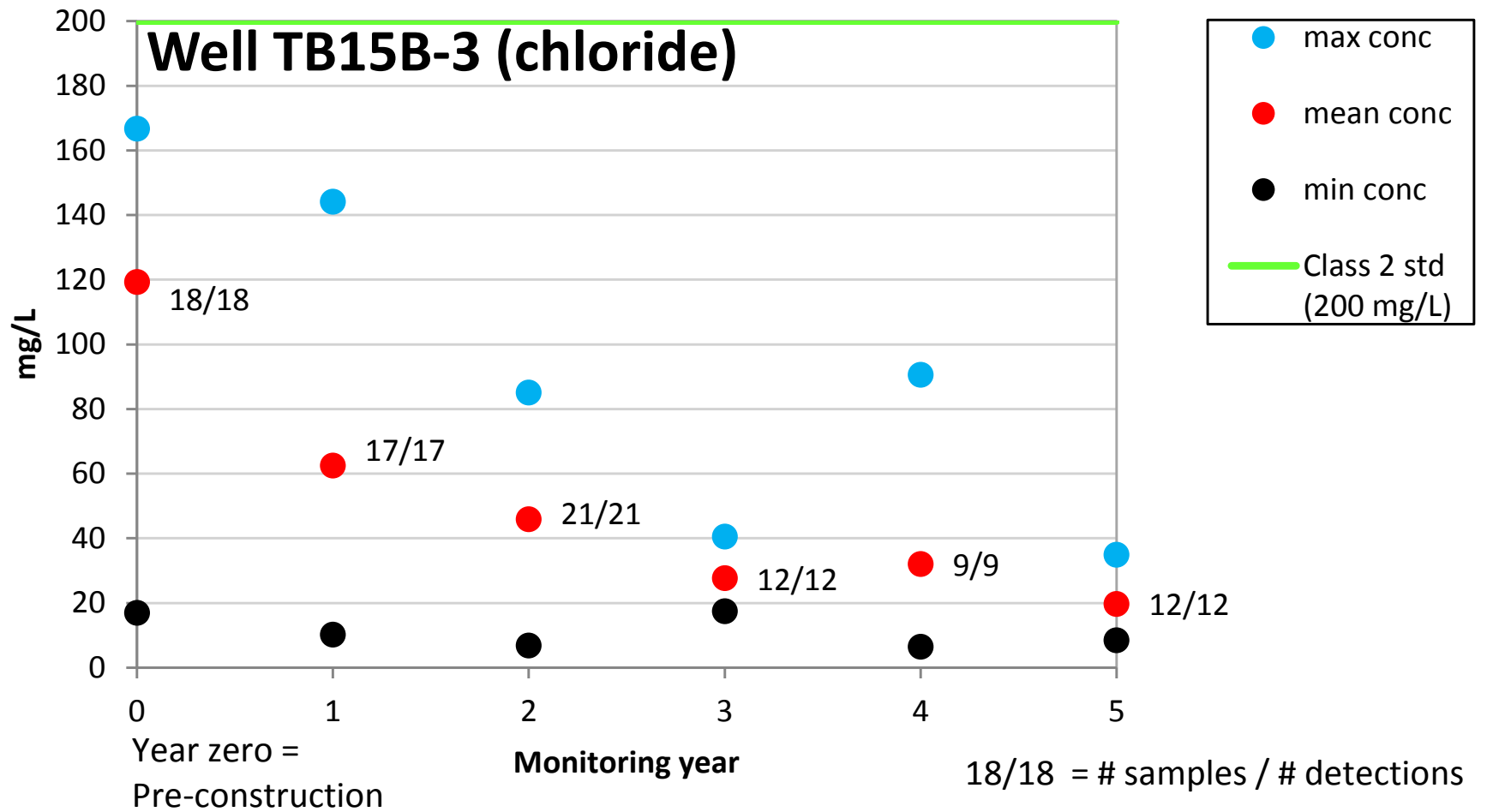


Figure 40. Evolution of chloride min-max-mean concentrations - Well TB15B-3

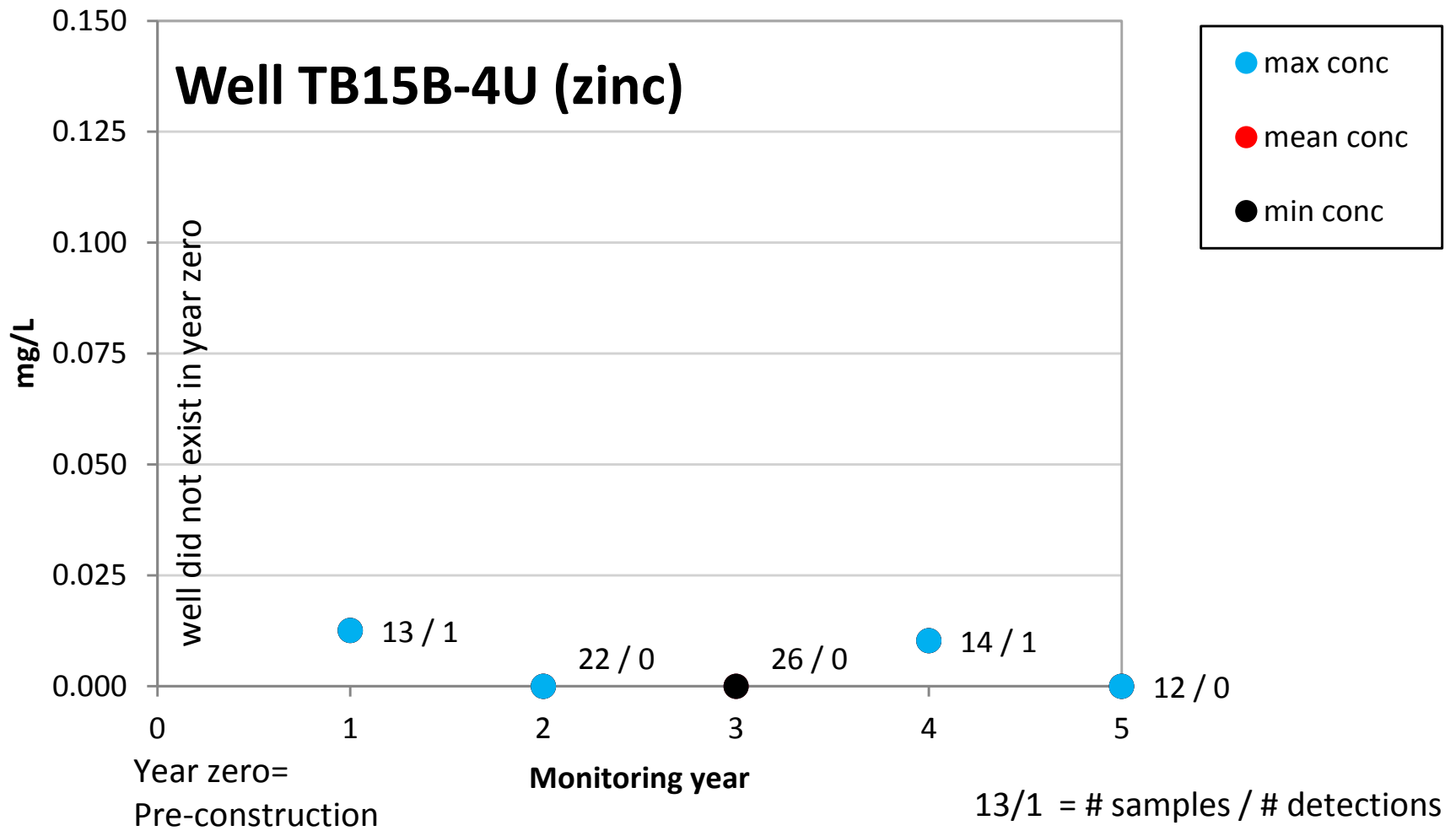


Figure 41. Evolution of zinc min-max-mean concentrations - Well TB15B-4U

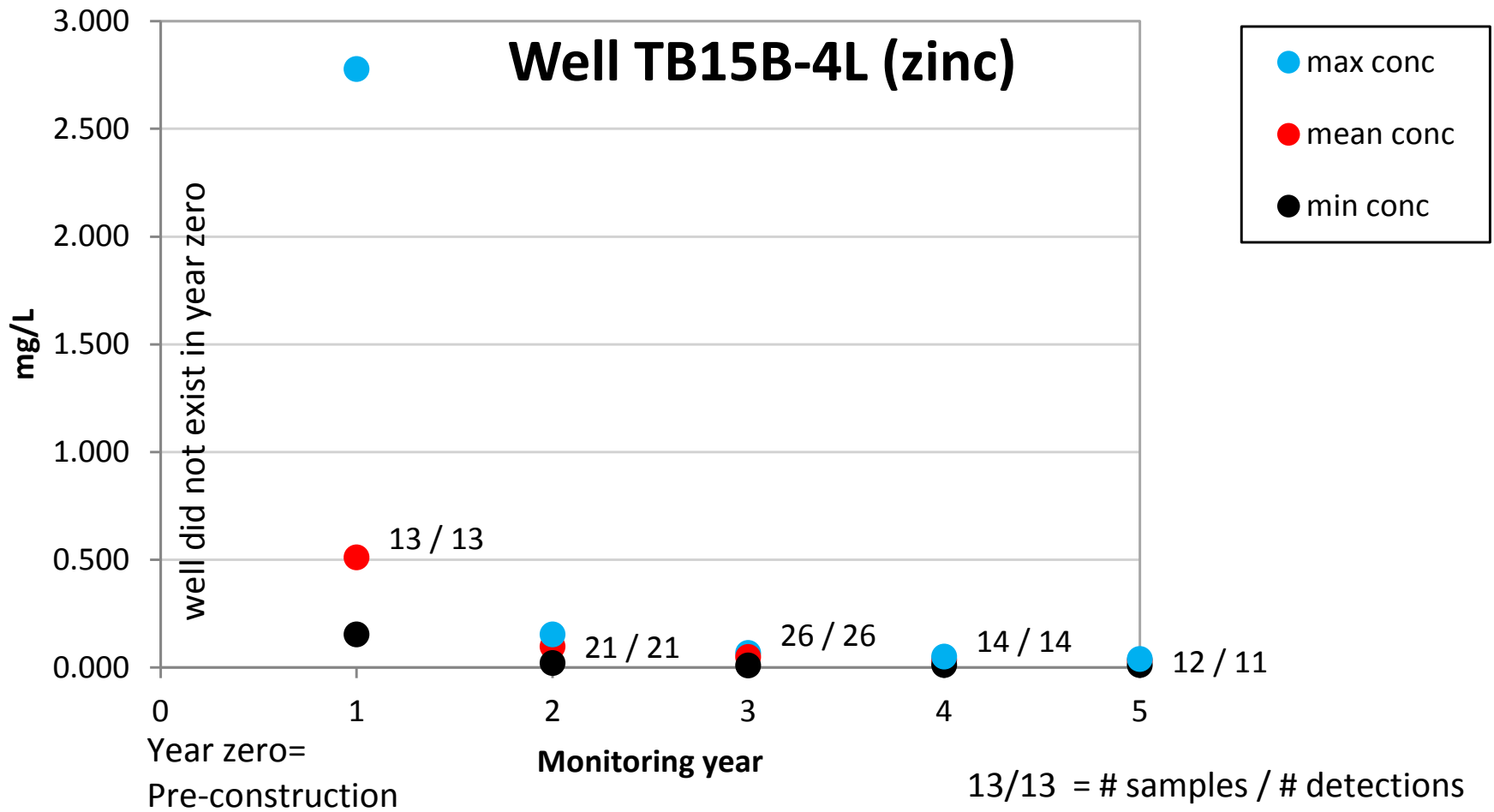


Figure 42. Evolution of zinc min-max-mean concentrations - Well TB15B-4L

rapid decline, possibly explained by disturbance during construction or by changes to groundwater flow directions or sources. All other wells in the transect, either shallow or deep, showed broadly similar annual mean zinc concentrations and a general lack of long-term trends (Figures 43-46). The well furthest from the roadway (TB15B-3) showed a slight increase in zinc in Years 1-2 but then it disappeared almost completely in Years 3-5 (Figure 46). This may also reflect metals mobilization during well construction.

In contrast, samples from well TB15B-4U showed the highest annual mean copper levels and regular detections, although there is no obvious trend (Figure 47). Other wells, including TB15B-4L, screened in the native materials below the bioswale, showed lower annual mean copper levels that were broadly similar, but had fewer detections and lack obvious long-term trends (Figures 48-51). The well furthest from the roadway (TB15B-3) showed mean copper concentrations only slightly below those of TB15B-4U (Figure 52), and had two copper levels (in the pre-construction period and Year 1) that were higher than maximum levels found at TB15B-4U. Given that well TB15B-1L also had occasional very high copper levels and both TB15B-1L and TB15B-3 are screened adjacent to the lower sand, perhaps transport of groundwater higher in copper occurred through the lower sand unit. Alternatively, there may be a non-roadway source of zinc or copper that is affecting well TB15B-3, perhaps due to its location in an old field, where anthropogenic activities like fly ash dumping or homesteading may have left sources of metals.

### Comparing Groundwater Quality Between TB7B and TB15B

Water-quality trends and behavior are similar at both sites, with some exceptions. The majority of groundwater samples collected at both sites exhibit elevated concentrations of roadway-related constituents within and below the bioswales, as well as at the nearest well (or well nest) in the forest preserve adjacent to the bioswale. Levels of constituents tend to decrease away from the bioswales at both sites, although the most distant wells at TB7B show no obvious roadway impacts. At TB15B, however, the most distant well shows some evidence of impacts (e.g., chloride, some roadway metals). Wells screened in the bioswale fill material showed obvious loading and dilution trends at both sites.

Bioswale TB7B has a more rapid and direct connection to groundwater due to the coarse-grained nature of the underlying native sediments, as shown by similar concentrations and seasonal trends of dissolved constituents, sometimes with a delay

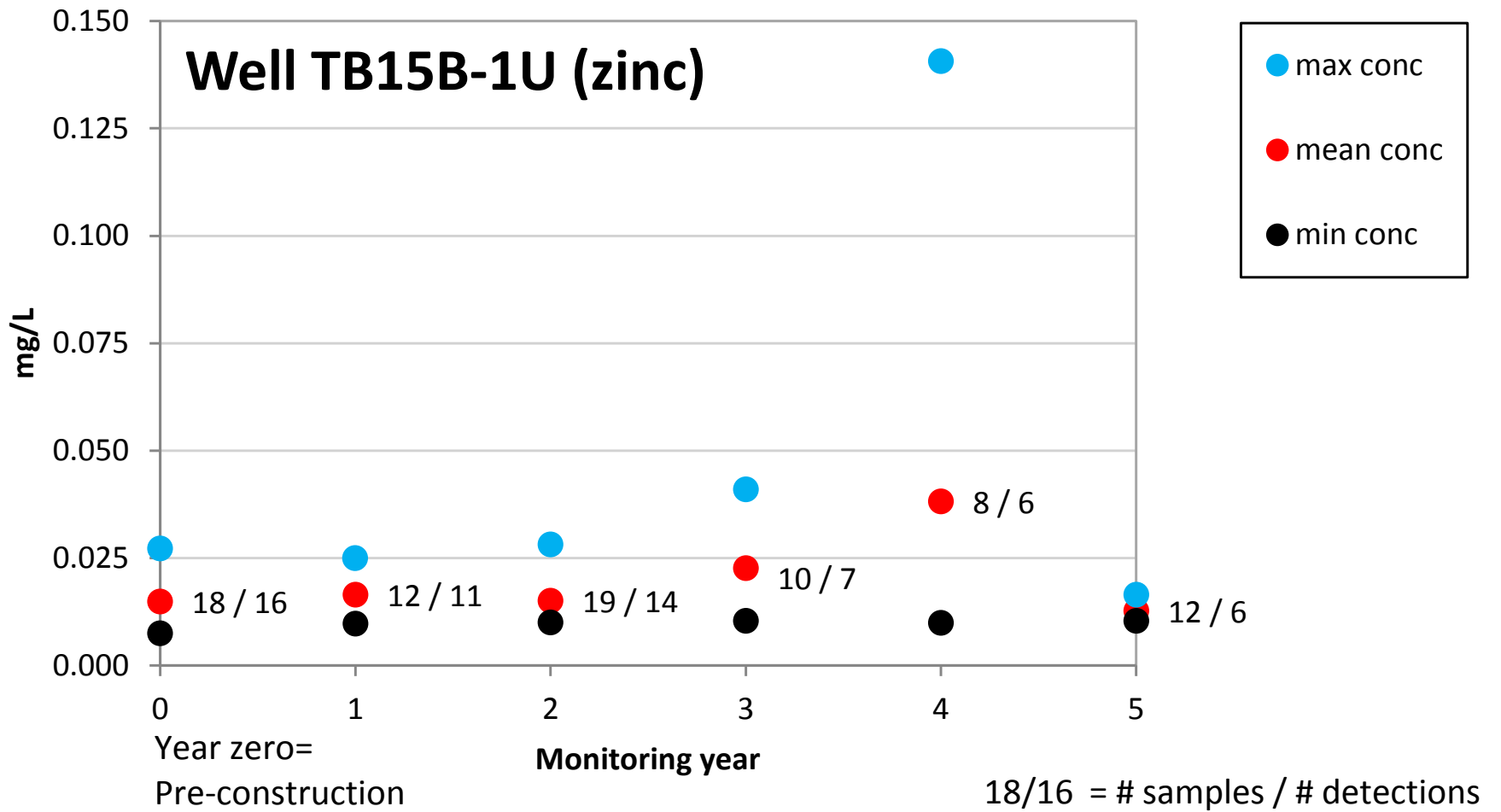


Figure 43. Evolution of zinc min-max-mean concentrations - Well TB15B-1U



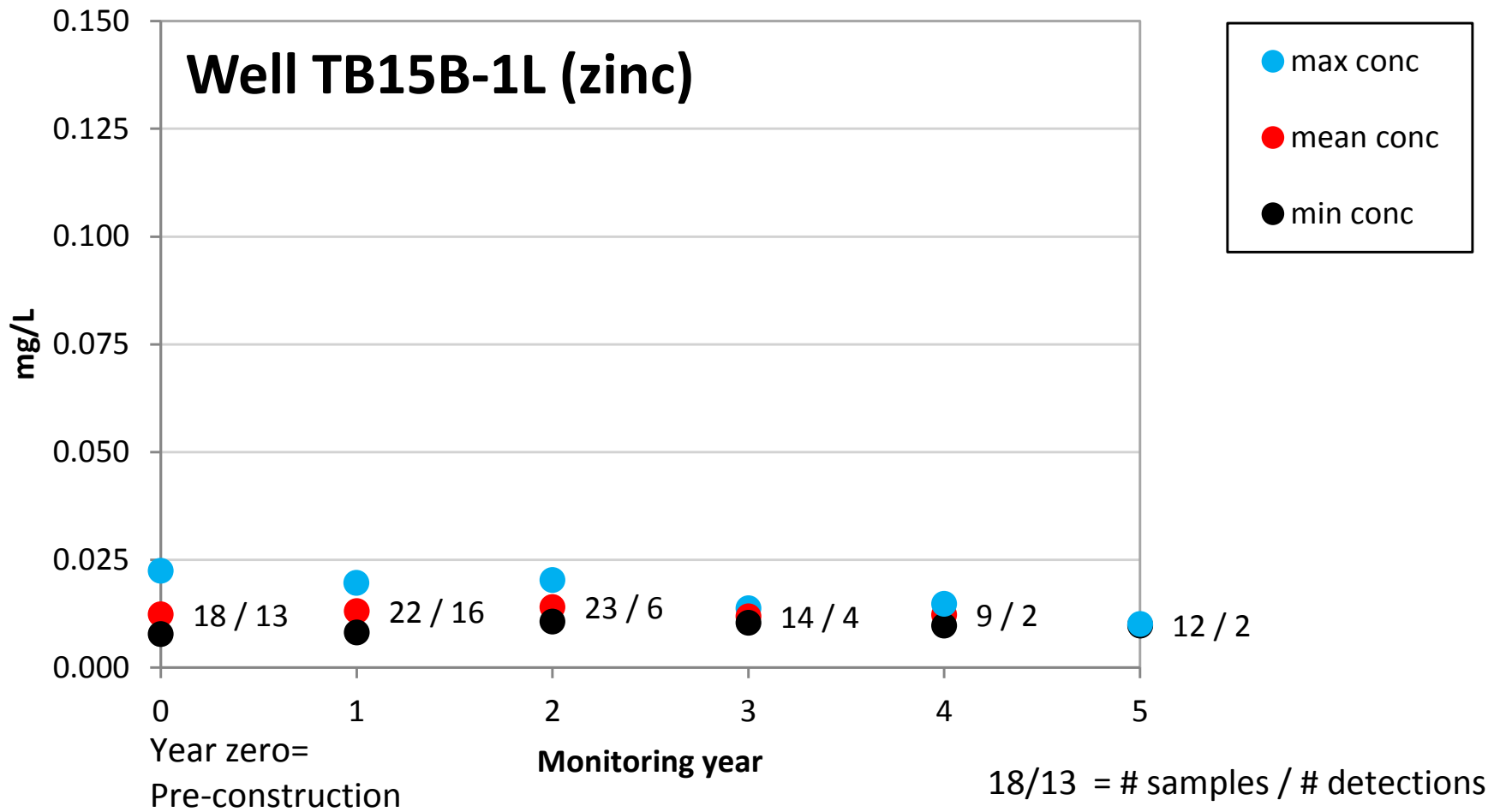


Figure 44. Evolution of zinc min-max-mean concentrations - Well TB15B-1L

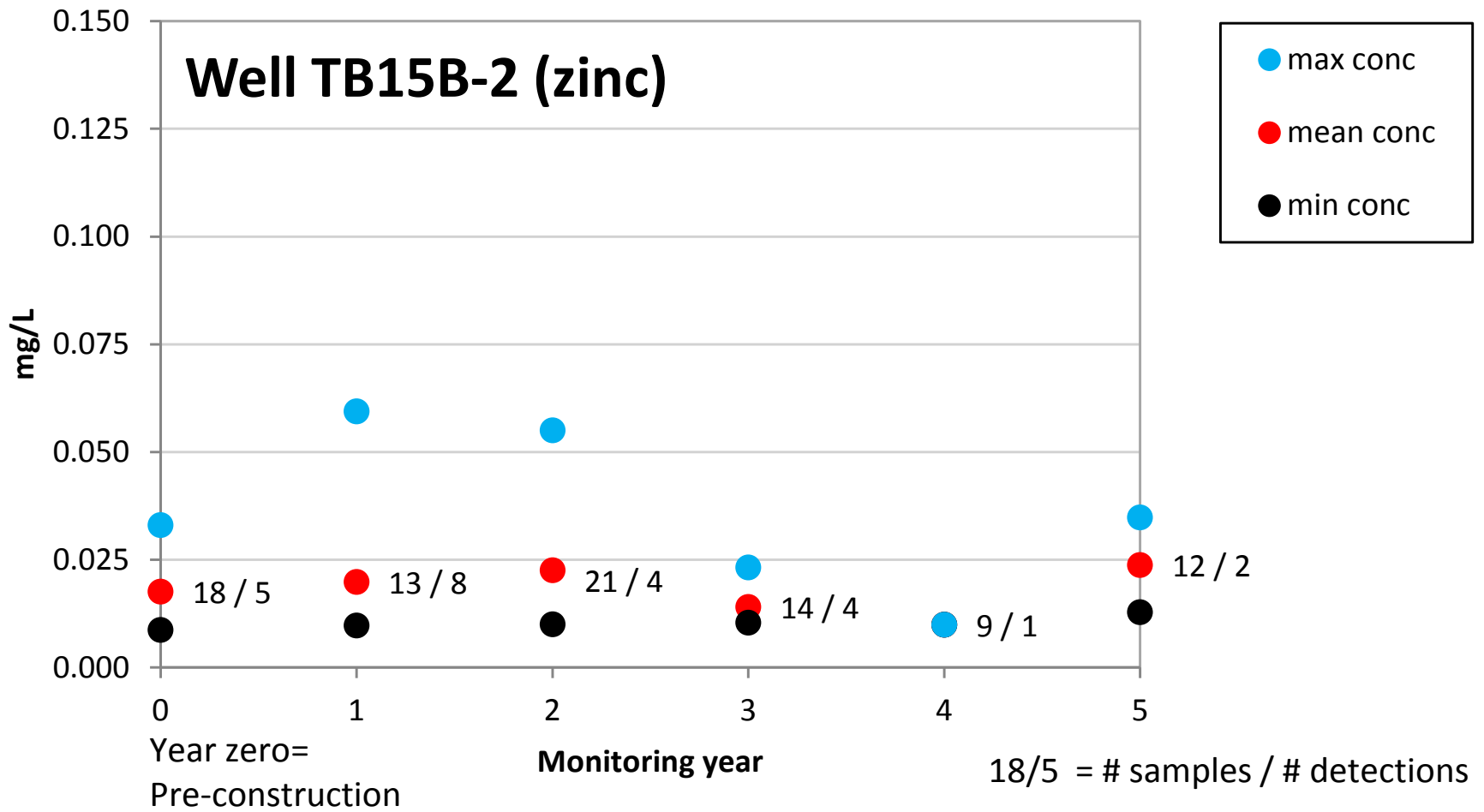


Figure 45. Evolution of zinc min-max-mean concentrations - Well TB15B-2

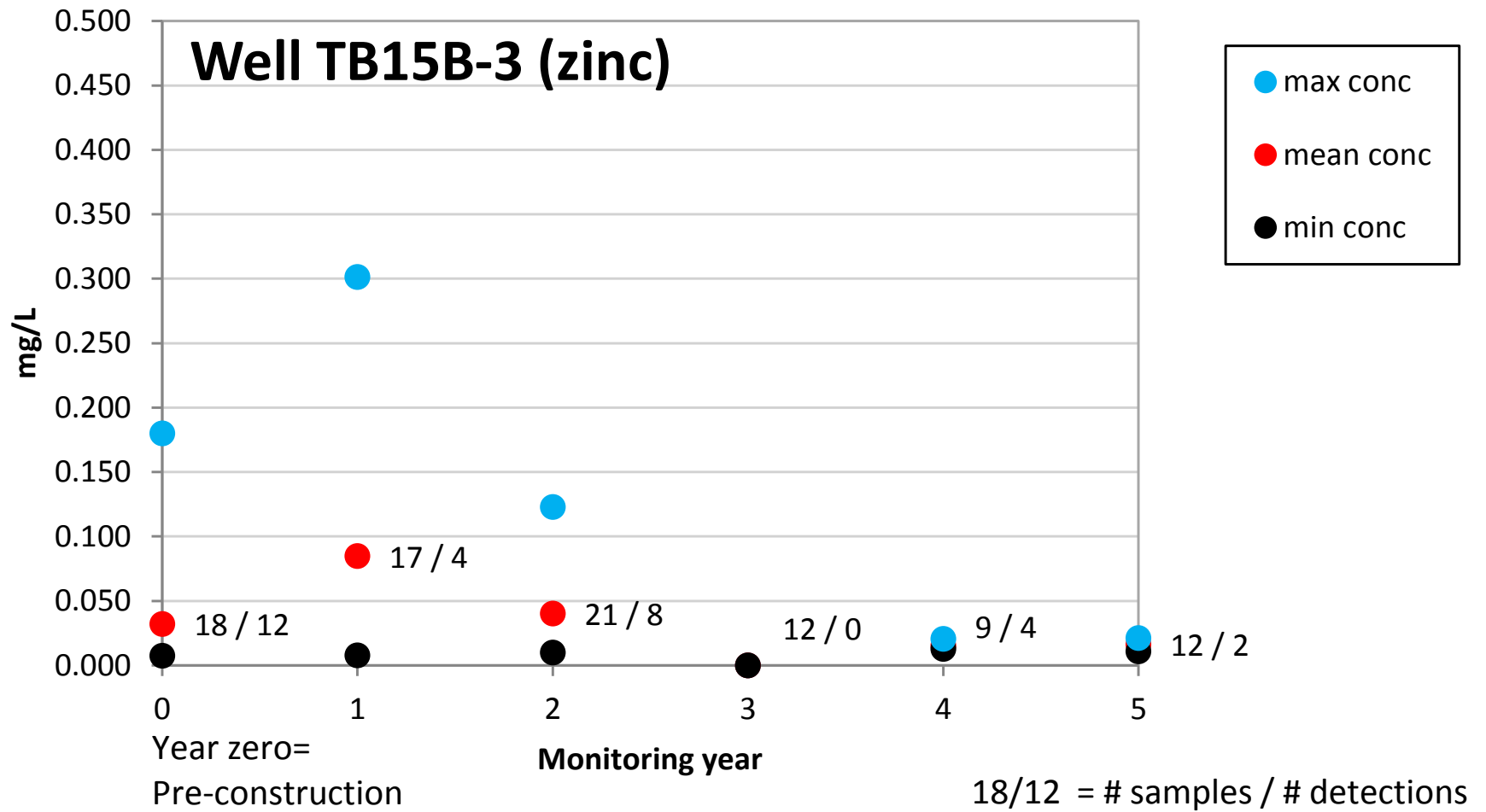


Figure 46. Evolution of zinc min-max-mean concentrations - Well TB15B-3

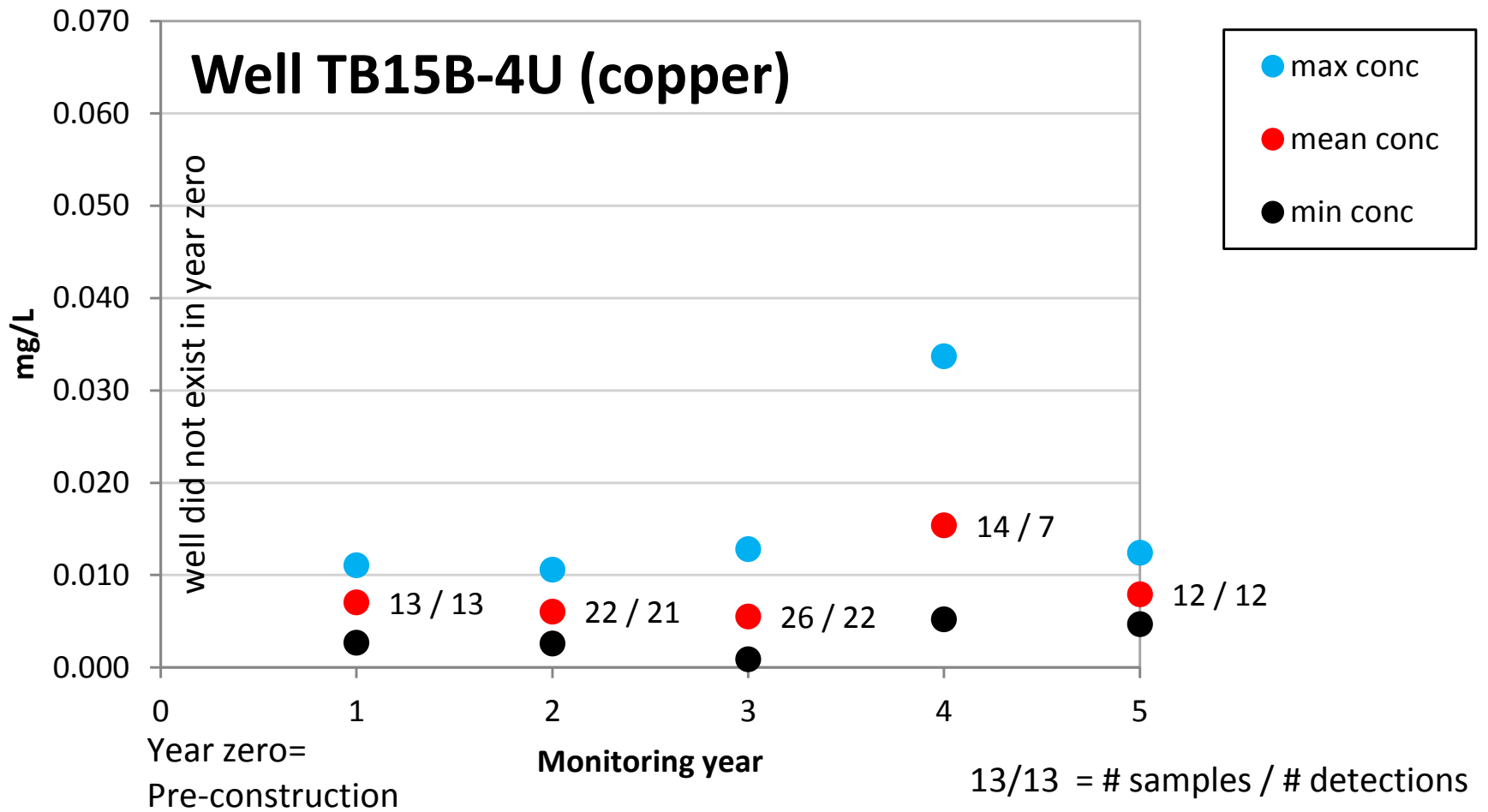


Figure 47. Evolution of copper min-max-mean concentrations - Well TB15B-4U

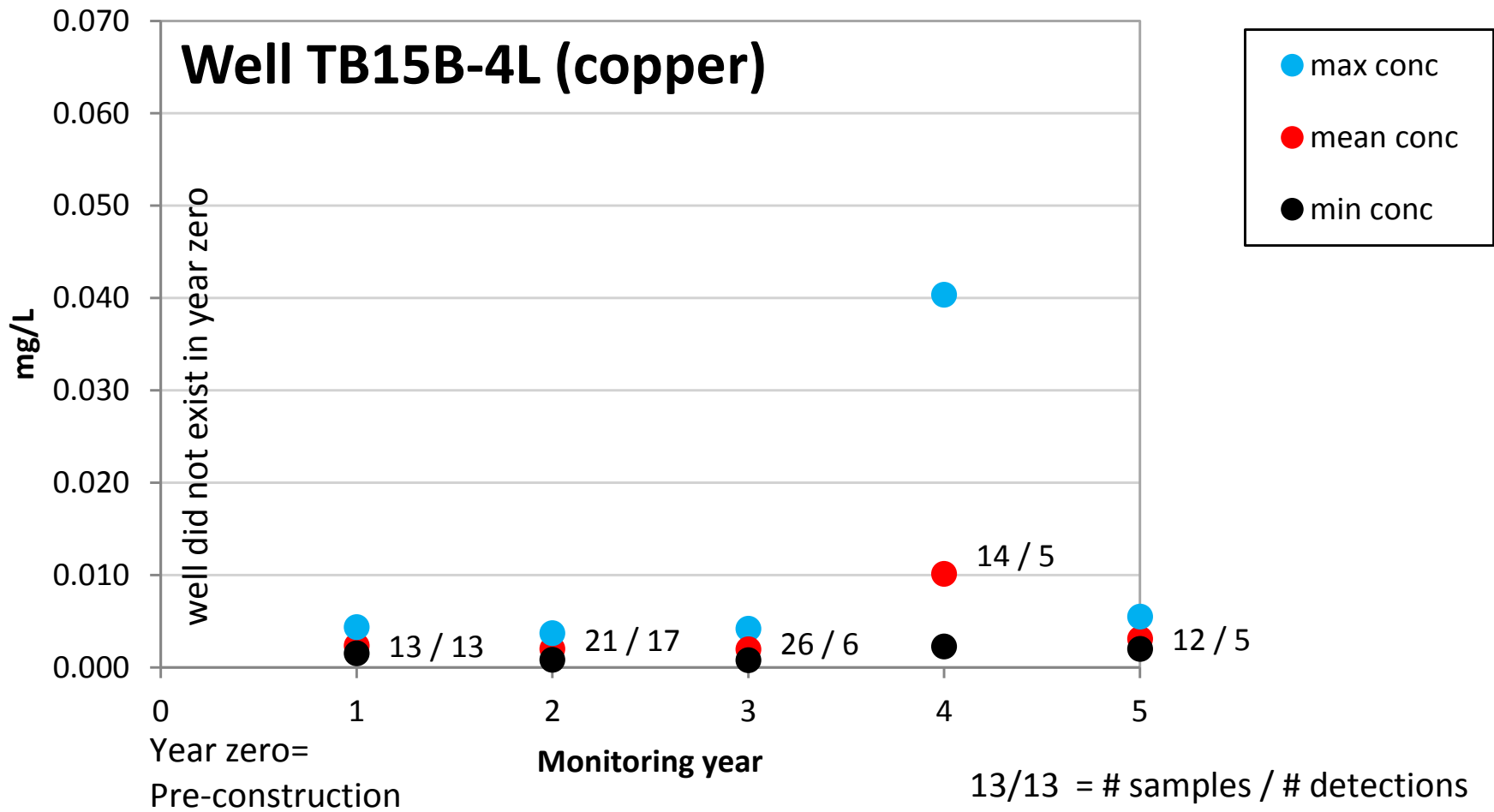


Figure 48. Evolution of copper min-max-mean concentrations - Well TB15B-4L

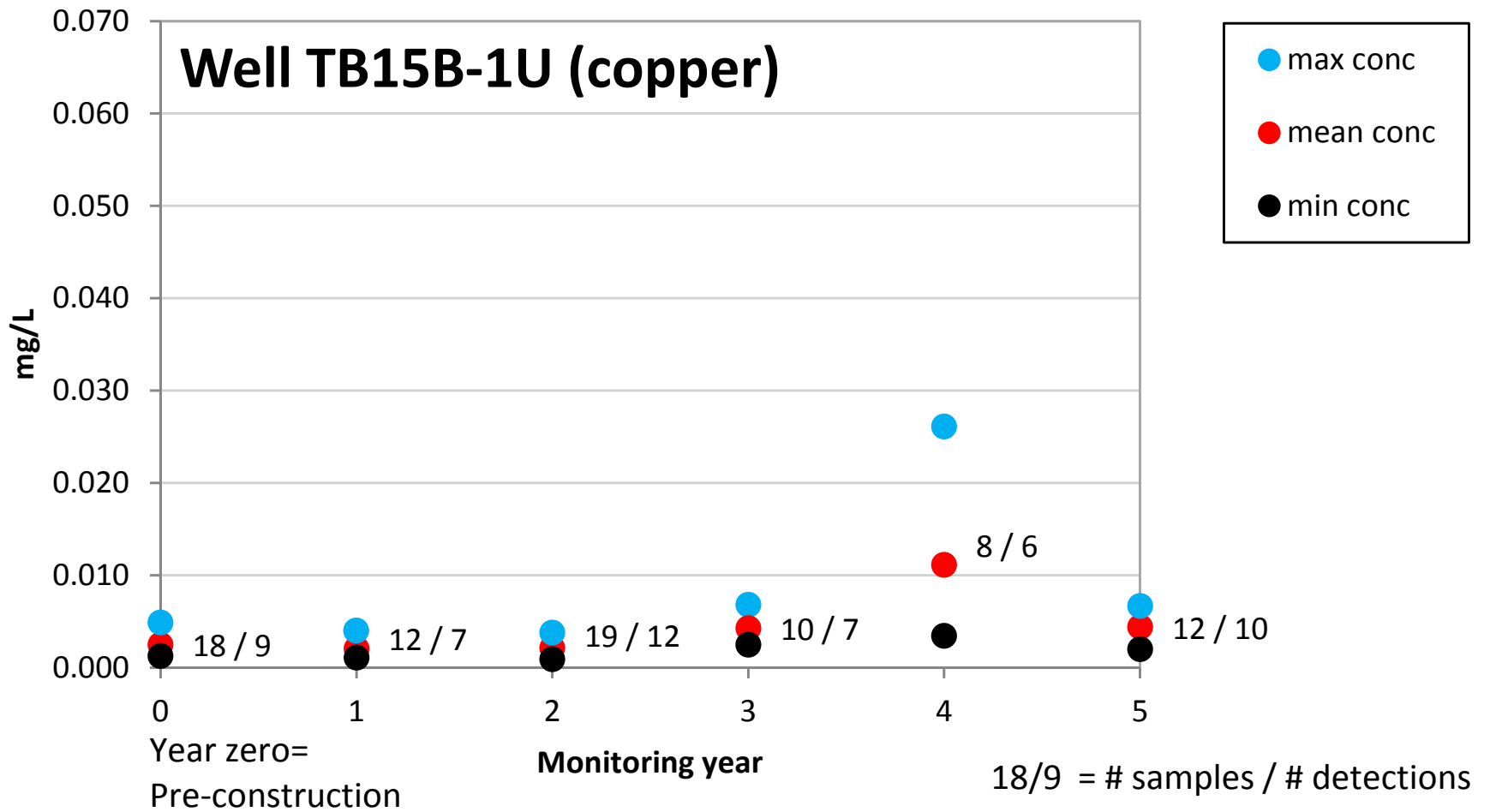


Figure 49. Evolution of copper min-max-mean concentrations - Well TB15B-1U

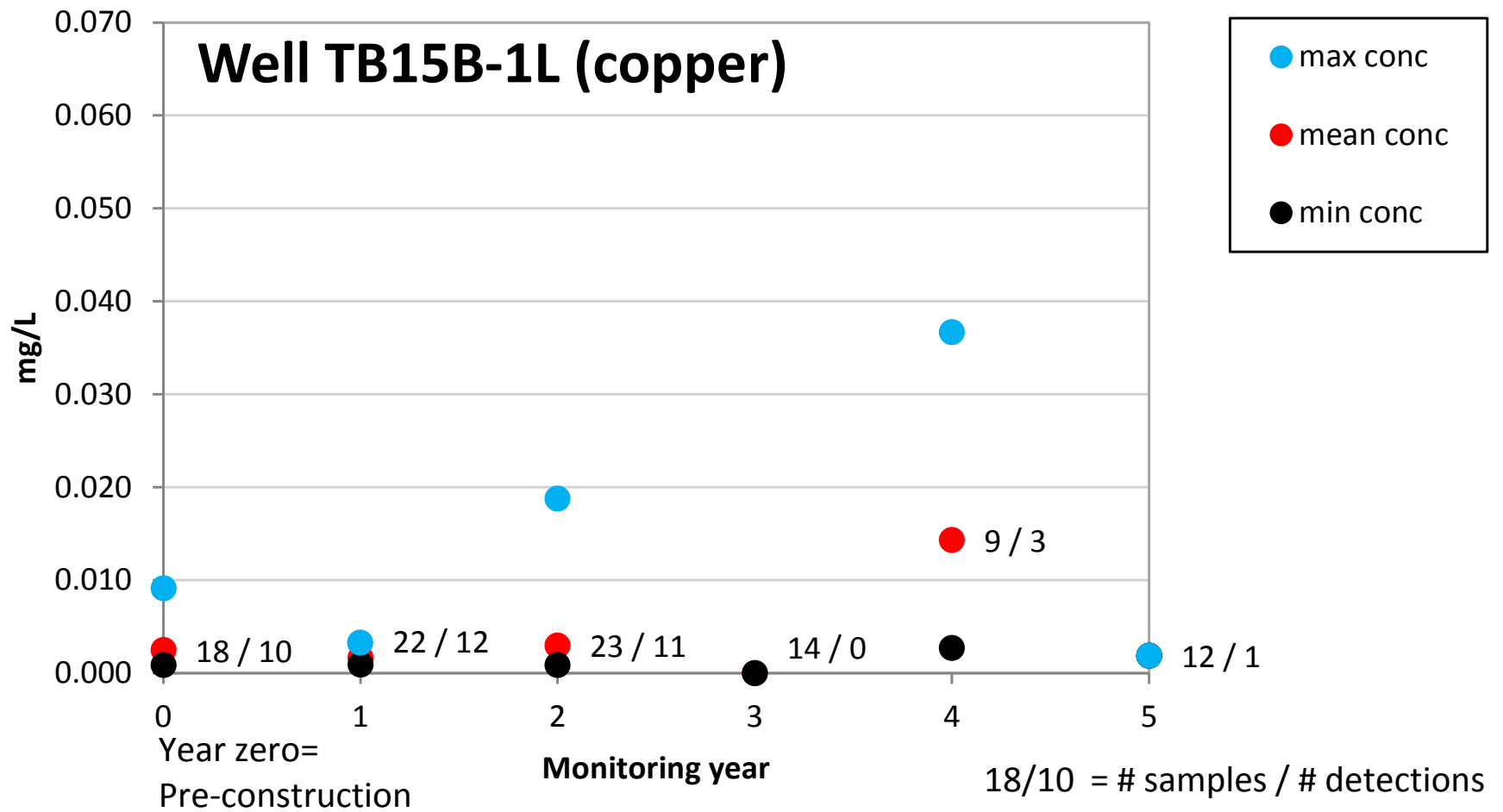


Figure 50. Evolution of copper min-max-mean concentrations - Well TB15B-1L

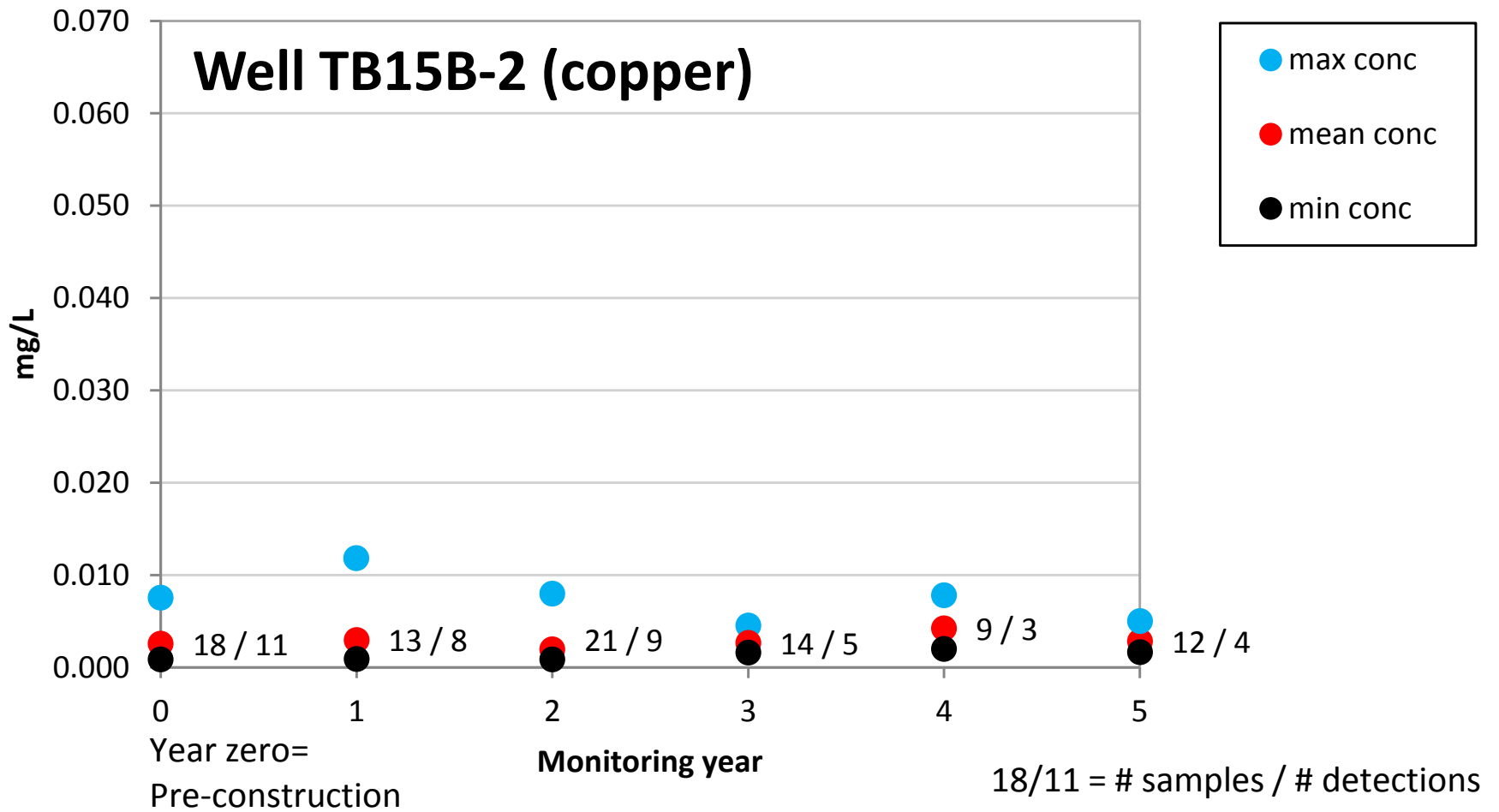


Figure 51. Evolution of copper min-max-mean concentrations - Well TB15B-2



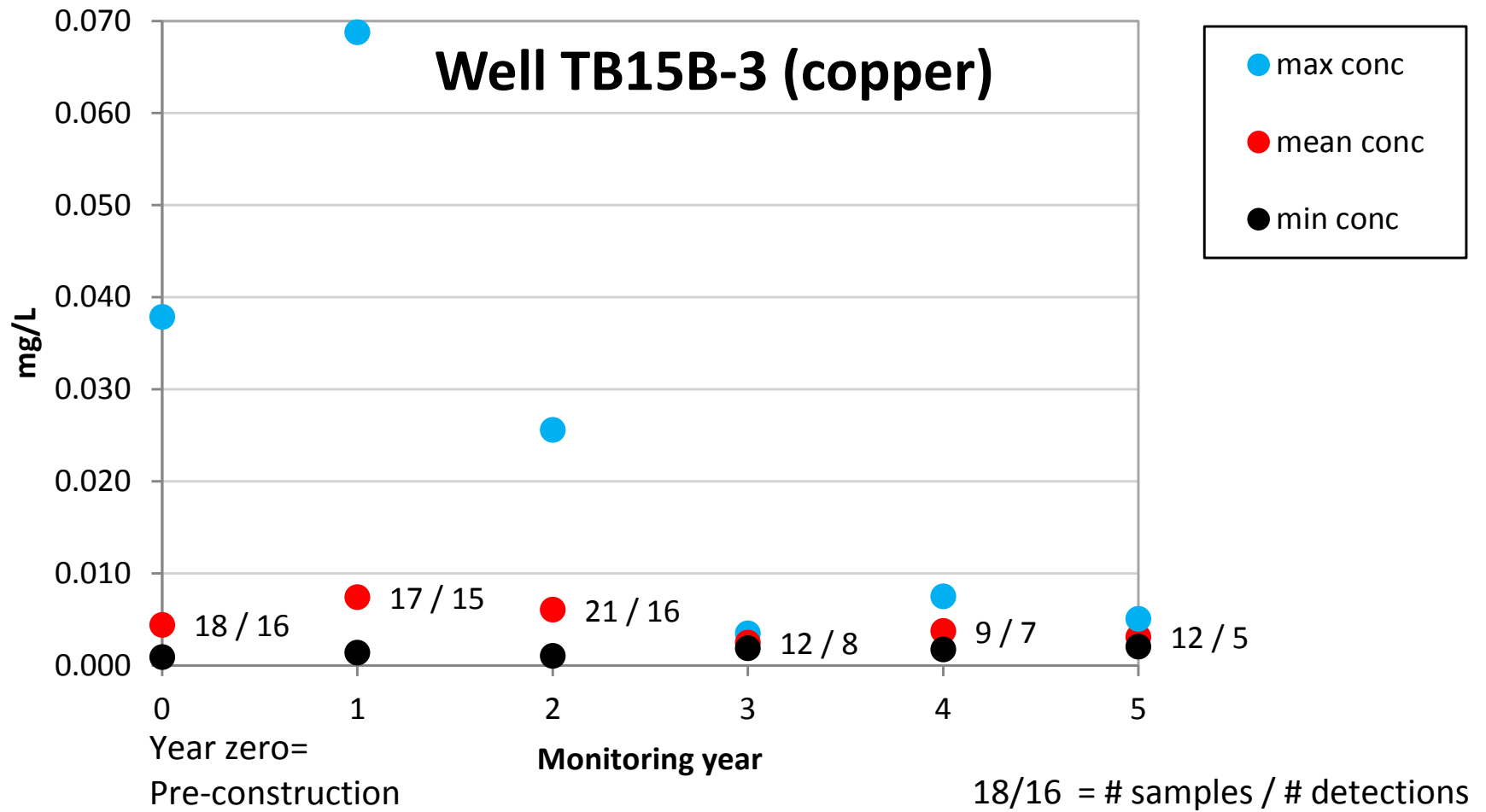


Figure 52. Evolution of copper min-max-mean concentrations - Well TB15B-3

on the order of a few weeks. This also means that conditions are conducive for roadway contaminants to move downward at TB7B and affect native groundwater, although groundwater flows eastward, which seems to be limiting translation of contaminants into the forest preserve. Groundwater quality below the tollway embankment and east of the roadway was not investigated, but impacts to groundwater may extend farther from the embankment east of the tollway.

At TB15B, although concentrations of dissolved constituents in native sediments underlying the bioswale are elevated, they do not correspond with concentrations in the bioswale backfill itself. Given that seasonal variations also are not apparent at depth, infiltration through the native silty clay sediments is likely to be slower and of less volume. Although the recharge rates apparently are slower at site TB15B, the deeper groundwaters are likely affected by roadway operations over decades or through longer or deeper flow paths. Because the groundwater-flow direction at TB15B is westward away from the tollway and towards Beck Lake, the migration of contaminants has extended further onto forest preserve lands. Wells TB15B-1L and TB15B-1U, adjacent to the tollway on forest preserve lands, are clearly affected, although it is possible that a portion of these contaminants were delivered by aerial deposition and subsequent infiltration rather than groundwater flow through the silty clay material. Also, sand was encountered at depth below the silty clay (intersected at the bottom of the borings for wells TB15B-1L and TB15B-3). This sand body, if contiguous, may transport roadway-related constituents more quickly, perhaps meters per year. There is some suggestion that metals or chloride may be delivered through the lower sand to the most distant well, but clear conclusions cannot be made, and additional analysis of the lower sand unit is prevented by the lack of information. It is also possible that these wells do not properly characterize the chemistry of waters in this deeper sand body because collapsing materials in both hand-augered borings precluded setting the screen more completely into the sand unit.

Significantly affected groundwater that routinely (and in some cases, chronically) exceeded water-quality standards was present within, beneath, and adjacent to the bioswales at both sites, with wider extent more so at TB15B due to westward groundwater flow from the roadway toward the forest preserve. Little impact is seen in the forest preserve at TB7B due to groundwater flow away from the forest preserve toward the tollway, although slightly elevated chloride levels are present at all wells except the most distant one (TB7B-4), so some aerial deposition may penetrate the forest for more than 100 meters (320 ft). It is not possible to assess definitively whether

bioswale design influenced the potential for impacts to groundwater quality, because the hydrogeology of each site differed so dramatically. However, the presence of the underdrain at TB15B may have altered groundwater flow in close proximity to the bioswale, causing groundwater flow toward the underdrain and subsequent discharge to downstream ditches, thus removing past contaminants from the groundwater near the roadway and in the forest preserve. The only improvement of groundwater quality seen at TB7B is more likely related to channelization of the bioswale that prevented overflow of surface water into the forest preserve. This effect was not directly attributable to the choice of a wet or dry bioswale design.

## **WATER SAMPLING QUALITY CONTROL**

Blank and duplicate samples were collected during all sampling runs as quality-control measures. Results are presented in Miner et al. (2016). In brief, no important QA/QC issues were identified, hence, no adjustment or sequestering of data was required.

## **FUTURE WORK**

Bioswale construction was completed by September 2010. This report details groundwater level and quality monitoring for the entire period from pre-construction through Year 5. Monitoring of surface water input at one wet and one dry bioswale site (TB7B and TB15B, respectively) will continue through 2019 in order to confirm and follow trends over a longer period of time. However, groundwater monitoring will be limited to water levels and specific conductivity at the TB15B well transect. No water sampling or analysis will be performed.

## **SUMMARY**

The ISGS sampled and monitored surface water at four locations both before and after bioswale installation along I-294 between Touhy Ave. and Lake-Cook Road (in Cook County, IL) over a 7-year period from 2008 through 2015. Of the four sites, two sites were selected for measurement of groundwater levels and quality within and adjacent to two bioswales to identify pre-existing impacts and any changes that occurred after bioswale construction. One “wet” bioswale (TB7B) and one “dry” bioswale (TB15B) were chosen for the groundwater study. The primary goal was to identify whether groundwater levels or quality were affected by bioswale operations. A secondary aim of the monitoring was to evaluate whether groundwater is a sink or transport mechanism for

runoff and any dissolved constituents. Also, differences between wet and dry bioswale designs were to be identified, if possible.

A transect of monitoring wells was installed at each of bioswales TB7B and TB15B beginning within the bioswales and extending roughly westward into adjacent forest preserves. Subsurface materials were identified during well installation. In general, subsurface materials at TB7B are coarser-grained silts and sands, while TB15B is dominated by thick silty clay overlying sand. No clear trends were identified in groundwater levels or the responses of groundwater to individual precipitation events or seasonal trends, suggesting that bioswale operations did not affect groundwater levels.

Groundwater in and adjacent to sites TB7B and TB15B showed impacts from roadway operations, both before and after bioswale construction. Specific conductivity data loggers showed highest TDS in wells within the bioswales or in native sediments directly beneath the bioswales, with affected groundwater also present adjacent to the bioswale in the forest preserves. After construction, specific conductivity decreased directly adjacent to bioswale TB7B, likely due to channelization of runoff that prevented overland flow into the forest preserve and subsequent infiltration; no other wells in the forest preserve were affected by roadway runoff before or after bioswale construction. Groundwater flow eastward away from the forest preserve and toward the roadway likely limited the westward movement of contaminants at TB7B, as did the extensive tree canopy cover to intercept materials moving aerially from the roadway. This flow direction limited lateral extent of impacts at TB7B despite the subsurface materials being generally coarser and more conducive to more significant infiltration and transport, although impacts may penetrate deeper vertically and travel under the tollway to the east. At TB15B, pre-construction impacts were seen farther into the forest preserve, likely due to lack of tree canopy and a westward groundwater flow direction towards the forest preserve. After construction, reductions in specific conductivity at TB15B were noted at the nest of wells in the forest preserve adjacent to the bioswale, likely due to seasonal discharge to the underdrain that caused dissolved solids to be drawn towards the bioswale and exported to surface water.

In general, constituents detected in runoff (Miner et al. 2016) were also detected in groundwater within or adjacent to the bioswales at levels higher than those found in wells more distant from the bioswales, including chloride, TDS, and metals. A number of constituents regularly exceeded Illinois Class 2 Groundwater Standards during the study period within or adjacent to the bioswales. At site TB7B, wells within the bioswales

exceeded the standards for both chloride and TDS nearly 100% of the time. At site TB15B, the groundwater standards for both chloride and TDS were exceeded nearly 100% of the time at wells both within (nest TB15B-4U/4L) and adjacent to the bioswale (nest TB15B-1U/1L). The latter nest is in the forest preserve. Groundwater in wells within and adjacent to the bioswales also regularly exceeded standards for thallium (both sites), selenium (both sites), iron (TB7B) and sulfate (TB7B). At wells more distant from the bioswales, some constituents occasionally exceeded the standards, but impacts to groundwater were sporadic and not likely related to the bioswales.

Comparing the well in the bioswale at TB7B (TB7B-5U) and a well in the native materials below the bioswale (TB7B5L), downward movement of roadway contaminants at this site was clear, with similar concentrations and seasonal variations, likely facilitated by the sandy silt sediments. At TB15B, the native materials underlying the bioswale at TB15B are more fine-grained (silty clay), likely inhibiting seasonal variations below the bioswale, and suggesting a lack of infiltration from the bioswale. While contaminants cannot move downward or laterally into the native groundwater as rapidly at this site as at TB7B, the deep groundwaters are highly affected by various dissolved solids, indicating that long-term loading from roadway operations has affected groundwater below the bioswale and at depth in the wells adjacent to the bioswale in the forest preserve. In addition to transport in groundwater, seasonal variations in constituents seen in wells nearby in the forest preserve indicate some more rapid and direct transfer of contaminants, such as by aerial transport and subsequent infiltration.

## **ACKNOWLEDGMENTS**

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APPENDIX A: Well Construction Information for sites TB7B and TB15B

Site ID Well ID	Installation date	Land surface elevation (m)	Well top elevation (m)	Screened interval (m)	Screen length (m)	Top of sand pack (m)	Bentonite seal extent (m)
<b>Site TB7B</b>							
TB7B-1	11/18/2009	192.825	194.042	0.415 to 1.728	1.313	0.365	0.365 to surface
TB7B-2	11/18/2009	192.965	194.123	0.448 to 1.755	1.307	0.300	0.300 to surface
TB7B-3	11/18/2009	192.955	194.135	0.444 to 1.750	1.306	0.300	0.300 to surface
TB7B-4	11/18/2009	193.161	194.290	0.547 to 1.855	1.308	0.300	0.300 to surface
TB7B-5U	4/12/2011	192.575	193.473	0.400 to 0.730	0.330	0.300	0.300 to surface
TB7B-5L	1/25/2011	192.575	193.691	1.220 to 1.720	0.500	0.300	0.300 to surface
<b>Site TB15B</b>							
TB15B-1U	11/19/2009	196.777	197.973	0.549 to 1.857	1.308	0.300	0.300 to surface
TB15B-1L	11/19/2009	196.777	197.930	1.589 to 2.896	1.307	1.740	1.740 to surface
TB15B-2	11/19/2009	196.435	197.525	0.564 to 1.869	1.305	0.300	0.300 to surface
TB15B-3	11/19/2009	196.105	197.105	0.714 to 2.021	1.307	0.300	0.300 to surface
TB15B-4U	1/25/2011	196.532	197.482	0.690 to 1.110	0.420	0.330	0.330 to surface
TB15B-4L	1/25/2011	196.532	197.265	2.055 to 2.905	0.850	1.745	1.745 to surface

APPENDIX B-0: Results of Geochemical Analysis of Groundwater Samples - Pre-construction period (Year 0)

				Al	As	B	Ba	Be	Ca	Cd	Co	Cr	Cu	Fe	K	Li	Mg	Mn	Mo	Na	Ni	P	Pb	S	
Sample ID				mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L
Date collected	Field conductivity	Field pH	Sample location	MDL:	0.037	0.108	0.023	0.00085	0.00055	0.012	0.012	0.013	0.0058	0.00079	0.0059	0.016	0.018	0.0025	0.0015	0.022	0.026	0.014	0.063	0.041	0.217
12/1/09	2629	7.10	TB7B-1	TOLLWAY 310			0.131	0.036		64.5				0.00322	0.846	3.97		22.1	0.733		531	0.021			39.9
12/15/09	2825	7.25	TB7B-1	TOLLWAY 332			0.119	0.0406		57.5					4.36	3.03		22.6	0.479		543	0.035			38.9
1/13/10	2488	6.96	TB7B-1	TOLLWAY 366			0.114	0.0348		48.3				0.00082	6.07	2.65		19.9	0.313		499	0.017			33.6
1/27/10	2482	7.04	TB7B-1	TOLLWAY 381	0.046		0.107	0.0380		50.0				0.00080	3.57	2.63		19.0	0.361		494	0.041			35.1
2/17/10	2292	7.46	TB7B-1	TOLLWAY 399			0.103	0.0353		57.6					4.31	2.27		21.5	0.395		496	0.018			35.6
3/2/10	2078	7.62	TB7B-1	TOLLWAY 415			0.107	0.0322		52.9					3.70	2.18		19.9	0.341		463	0.022			33.9
3/17/10	3101	7.40	TB7B-1	TOLLWAY 436	0.049		0.097	0.0488		74.0				0.00152	4.59	2.75		27.6	0.489		614	0.017			58.2
3/31/10	2871	7.66	TB7B-1	TOLLWAY 459			0.106	0.0407		64.4					4.72	2.32		26.1	0.400		573	0.025			48.5
4/13/10	2939	7.19	TB7B-1	TOLLWAY 474			0.113	0.0427		68.2				0.00123	5.78	2.86		25.2	0.415		545	0.020	0.064		48.2
4/27/10	2662	7.40	TB7B-1	TOLLWAY 496	0.038		0.103	0.0396		58.4					5.70	2.93		21.5	0.381		526				48.9
5/12/10	2665	7.53	TB7B-1	TOLLWAY 512	0.048		0.123	0.041		64.8					5.59	3.26		22.9	0.423		511	0.020			50.5
5/24/10	2530	6.99	TB7B-1	TOLLWAY 526			0.119	0.0362		59.4					6.35	3.08		22.1	0.363		476	0.021			40.5
6/8/10	3121	7.20	TB7B-1	TOLLWAY 552	0.038		0.122	0.0497		67.8					6.76	3.31		24.9	0.423		587	0.022			53.7
6/22/10	3009	6.83	TB7B-1	TOLLWAY 574	0.038		0.141	0.0475		67.8					6.55	4.64		24.7	0.401		575	0.032	0.081		46.4
7/7/10	2642	7.12	TB7B-1	TOLLWAY 597			0.155	0.0464		62.1					5.38	3.75		24.9	0.347		507		0.069		39.7
7/20/10	2584	6.97	TB7B-1	TOLLWAY 617			0.152	0.0453		49.1					4.94	3.40		19.4	0.302		516	0.014	0.078		42.4
8/2/10	2487	7.08	TB7B-1	TOLLWAY 630	0.041		0.170	0.040		58.9					4.60	3.52		21.1	0.324		462	0.014	0.121		39.2
8/17/10	3017	7.36	TB7B-1	TOLLWAY 657	0.040		0.162	0.052		60.8					5.85	3.36		22.0	0.376		581	0.028	0.097		47.8
			TB7B-1	min	0.038	NA	0.097	0.032	NA	48.266	NA	NA	0.00000	0.00080	0.8455	2.180	NA	18.9923	0.3018	NA	462.20	0.014	0.064	NA	33.61
			TB7B-1	max	0.049	NA	0.170	0.052	NA	73.984	NA	NA	0.00000	0.00322	6.7554	4.637	NA	27.6047	0.7331	NA	614.13	0.041	0.121	NA	58.17
			TB7B-1	mean	0.042	NA	0.125	0.042	NA	60.357	NA	NA	0.00000	0.00152	4.9812	3.106	NA	22.6272	0.4036	NA	527.70	0.023	0.085	NA	43.39
12/1/09	1296	7.17	TB7B-2	TOLLWAY 311			0.284	0.035		101				0.00129	1.04	0.702		93.4	0.647		82.5	0.053			23.7
12/15/09	1320	7.29	TB7B-2	TOLLWAY 333			0.285	0.0339		88.8					1.35	0.608		96.5	0.549		78.0	0.049			24.5
1/13/10	1249	7.09	TB7B-2	TOLLWAY 367	0.117		0.266	0.0342		85.5				0.00161	0.246	0.669		92.8	0.328		73.6	0.054			27.6
1/27/10	1232	7.44	TB7B-2	TOLLWAY 382	0.047		0.256	0.0330		83.1				0.00139	0.207	0.603		89.7	0.211		72.5	0.050			26.6
2/17/10	1252	7.54	TB7B-2	TOLLWAY 400	0.666		0.248	0.0350		101					0.884	0.906		104	0.434		79.1	0.054			31.2
3/2/10	1216	7.36	TB7B-2	TOLLWAY 416			0.234	0.0315		94.9				0.00143	0.237	0.509		110	0.342		74.7	0.042			27.6
3/17/10	1129	7.38	TB7B-2	TOLLWAY 437	0.457		0.229	0.0335		89.6				0.00214	0.512	0.723		97.7	0.170		65.1	0.028			25.7
3/31/10	1120	7.47	TB7B-2	TOLLWAY 460	0.334		0.225	0.0356		91.0				0.00179	0.481	0.620		99.7	0.198		59.2	0.034			24.5
4/13/10	1020	7.39	TB7B-2	TOLLWAY 475			0.189	0.0299		81.9				0.00149	0.0181	0.685		76.9	0.0823		46.3	0.033			24.3
4/27/10	1105	7.26	TB7B-2	TOLLWAY 497	0.050		0.217	0.0319		80.9				0.00231	0.0970	0.542		80.0	0.161		55.6	0.033			22.0
5/12/10	1083	7.49	TB7B-2	TOLLWAY 513			0.259	0.030		85.7				0.00175	0.0237	0.551		88.1	0.270		59.9	0.046			23.0
5/24/10	1030	7.14	TB7B-2	TOLLWAY 527			0.231	0.0306		81.6				0.00189	0.0070	0.525		75.0	0.102		51.9	0.035			20.1
6/8/10	1088	7.24	TB7B-2	TOLLWAY 553			0.261	0.0312		81.3				0.00162	0.0169	0.598		80.6	0.199		59.2	0.050			19.7
6/22/10	1102	7.10	TB7B-2	TOLLWAY 575			0.291	0.0317		86.1				0.00099	0.0271	0.629		84.3	0.264		57.7	0.044			18.8
7/7/10	1088	7.25	TB7B-2	TOLLWAY 599			0.318	0.0316		81.2				0.00182	0.0783	0.688		83.2	0.445		59.0	0.039			16.4
7/20/10	1082	7.13	TB7B-2	TOLLWAY 618			0.318	0.0307		78.8				0.00123	0.0603	0.657		79.1	0.505		55.6	0.048			13.1
8/2/10	1088	7.24	TB7B-2	TOLLWAY 632			0.297	0.032		94.3				0.001	0.196	0.750		79.0	0.228		53.2	0.048			15.2
8/17/10	1078	7.42	TB7B-2	TOLLWAY 658			0.270	0.029		79.5					0.169	0.708		74.4	0.431		65.1	0.041			13.4
			TB7B-2	min	0.047	NA	0.189	0.029	NA	78.805	NA	NA	NA	0.00099	0.0070	0.509	NA	74.4148	0.0823	NA	46.27	0.028	NA	NA	13.09
			TB7B-2	max	0.666	NA	0.318	0.036	NA	100.914	NA	NA	NA	0.00231	1.3489	0.906	NA	109.8040	0.6466	NA	82.51	0.054	NA	NA	31.20
			TB7B-2	mean	0.278	NA	0.260	0.032	NA	86.993	NA	NA	NA	0.00162	0.3139	0.649	NA	88.0357	0.3093	NA	63.80	0.043	NA	NA	22.08
12/1/09	1215	7.30	TB7B-3	TOLLWAY 312			0.125	0.025		114				0.00143	0.166	0.583		80.8	0.0348		70.0	0.038	0.071		12.9
12/15/09	1138	7.44	TB7B-3	TOLLWAY 334	0.217		0.122	0.0257		97.8				0.00163	0.403	0.633		75.5	0.0436		58.7	0.048			12.1
1/13/10	1034	7.23	TB7B-3	TOLLWAY 368			0.108	0.0191		87.2				0.00135	0.0228	0.403		69.8	0.0034		46.5	0.035			10.6
1/27/10	944	7.51	TB7B-3	TOLLWAY 383			0.114	0.0195		86.6				0.00139	0.0155	0.397		65.0			37.9	0.030			9.70
2/17/10	974	7.67	TB7B-3	TOLLWAY 401			0.113	0.0172		102					0.0363	0.381		72.3	0.0080		38.9	0.037			11.8
3/2/10	960	7.48	TB7B-3	TOLLWAY 417			0.085	0.0155		94.1				0.00121	0.0598	0.359		68.4	0.0038		36.1	0.026			12.3
3/17/10	870	7.53	TB7B-3	TOLLWAY 438			0.089	0.0160		91.4				0.00104		0.291		61.1			25.6	0.020			11.1
3/31/10	883	7.54	TB7B-3	TOLLWAY 461			0.104	0.0160		95.1						0.295		69.1	0.0018		23.5	0.031			12.0
4/13/10																									

APPENDIX B-0: Results of Geochemical Analysis of Groundwater Samples - Pre-construction period (Year 0)

Date collected	Field		Sample location	Sample ID	Sb	Se	Si	Sn	Sr	Ti	TI	V	Zn	pH	alkalinity	TDS, 180 C	TSS	oPO <sub>4</sub> -P	NH <sub>3</sub> -N	F	Cl	NO <sub>3</sub> -N	SO <sub>4</sub>	total NVOC	dissolved NVOC
	conductivity	Field pH		MDL:	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L as CaCO <sub>3</sub>	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L
					0.059	0.131	0.066	0.086	0.00037	0.00056	0.017	0.047	0.0073		4	12	3.0	0.01	0.06	0.08	0.09	0.07	0.31	0.31	0.31
12/1/09	2629	7.10	TB7B-1	TOLLWAY 310			4.89		0.131				0.0098	7.31	678	1520	no sample	0.004	0.44	0.21	405		104	14.4	9.88
12/15/09	2825	7.25	TB7B-1	TOLLWAY 332			5.16		0.133					7.60	681	1604	no sample	0.008	0.76	0.28	445		112	8.33	7.83
1/13/10	2488	6.96	TB7B-1	TOLLWAY 366			4.87		0.108				0.0101	7.53	699	1460	no sample	0.014	0.86	0.27	356		96.7	9.13	8.15
1/27/10	2482	7.04	TB7B-1	TOLLWAY 381			4.62		0.107	0.00153	0.026		0.0085	7.42	628	1411	no sample	0.011	0.80	0.24	368		99.4	9.06	7.75
2/17/10	2292	7.46	TB7B-1	TOLLWAY 399			7.18		0.106					7.40	644	1373	no sample	0.015	0.76	0.23	333		93.7	8.37	8.15
3/2/10	2078	7.62	TB7B-1	TOLLWAY 415			5.00		0.0955					7.44	627	1236	no sample	0.016	0.55	0.22	273	0.08	88.3	7.76	8.47
3/17/10	3101	7.40	TB7B-1	TOLLWAY 436			5.15		0.136	0.00190				7.31	734	1774	no sample	0.016	0.81	0.14	475		150	14.7	13.0
3/31/10	2871	7.66	TB7B-1	TOLLWAY 459			5.17		0.115		0.020			7.46	769	1615	no sample	0.023	0.78	0.18	383		126	10.7	9.94
4/13/10	2939	7.19	TB7B-1	TOLLWAY 474			5.43		0.123	0.00082				7.35	781	1690	no sample	0.008	1.17	0.27	1125		129	13.2	11.7
4/27/10	2662	7.40	TB7B-1	TOLLWAY 496			5.45		0.117	0.00103				7.39	674	1532	no sample	0.033	1.07	0.24	383		128	13.5	12.2
5/12/10	2665	7.53	TB7B-1	TOLLWAY 512			5.58		0.124	0.00117				7.48	677	1533	no sample	0.023	1.06	0.15	366		138	14.7	13.1
5/24/10	2530	6.99	TB7B-1	TOLLWAY 526			5.54		0.118					7.25	734	1478	no sample	0.040	1.15	0.37	318		118	11.1	9.94
6/8/10	3121	7.20	TB7B-1	TOLLWAY 552			6.19		0.137					7.18	733	1788	no sample	0.019	1.37	0.13	489		151	15.0	16.0
6/22/10	3009	6.83	TB7B-1	TOLLWAY 574			6.43		0.133					7.16	771	1669	no sample	0.018	1.52	0.25	417	0.07	131.2	13.8	15.5
7/7/10	2642	7.12	TB7B-1	TOLLWAY 597			6.00		0.125					7.33	776	1524	no sample	0.020	1.53	0.31	328		108	10.4	8.17
7/20/10	2584	6.97	TB7B-1	TOLLWAY 617			6.02		0.108					7.34	713	1457	no sample	0.024	1.44	0.33	326		118.7	14.3	10.5
8/2/10	2487	7.08	TB7B-1	TOLLWAY 630			6.05		0.106	0.001				7.31	724	1438	no sample	0.073	1.58	0.35	289		113	15.5	12.7
8/17/10	3017	7.36	TB7B-1	TOLLWAY 657			6.77		0.125	0.001				7.28	779	1642	no sample	0.045	1.49	0.31	387		131	14.8	14.2
			TB7B-1	min	NA	NA	4.62	NA	0.10	0.00059	0.020	NA	0.0085	7.16	627	1236	NA	0.00	0.44	0.13	272.56	0.07	88.33	7.76	7.75
			TB7B-1	max	NA	NA	7.18	NA	0.14	0.00190	0.026	NA	0.0101	7.60	781	1788	NA	0.07	1.58	0.37	1124.68	0.08	151.49	15.47	15.97
			TB7B-1	mean	NA	NA	5.64	NA	0.12	0.00111	0.023	NA	0.0095	7.36	712	1541	NA	0.02	1.06	0.25	414.67	0.08	118.74	12.15	10.95
12/1/09	1296	7.17	TB7B-2	TOLLWAY 311			6.59		0.126				0.0110	7.38	575	774	no sample	0.005	0.07	0.15	95.5		67.7	6.13	5.89
12/15/09	1320	7.29	TB7B-2	TOLLWAY 333			6.30		0.130				0.0078	7.68	586	781	no sample	0.008	0.11	0.21	89.0		74.8	6.03	5.30
1/13/10	1249	7.09	TB7B-2	TOLLWAY 367			5.67		0.118	0.00358			0.0086	7.56	605	760	no sample	0.007	0.07	0.19	68.1	0.64	81.5	20.2	4.07
1/27/10	1232	7.44	TB7B-2	TOLLWAY 382			5.28		0.114		0.024			7.51	587	762	no sample	0.008	0.20	0.20	63.5	0.81	79.6	6.14	3.97
2/17/10	1252	7.54	TB7B-2	TOLLWAY 400			8.31		0.115	0.0244				7.41	596	775	no sample	0.010	0.18	0.63	63.5	0.42	82.3	7.27	5.18
3/2/10	1216	7.36	TB7B-2	TOLLWAY 416			5.73		0.108				0.0075	7.45	589	751	no sample	0.010	0.17	0.63	63.9	0.68	78.3	5.19	5.15
3/17/10	1129	7.38	TB7B-2	TOLLWAY 437			6.25		0.105	0.0152			0.0075	7.51	541	714	no sample	0.014	0.17	0.17	51.2	2.68	74.1	5.16	5.06
3/31/10	1120	7.47	TB7B-2	TOLLWAY 460			5.96		0.100					7.52	550	759	no sample	0.021	0.17	0.47	47.9	3.68	79.6	5.70	4.23
4/13/10	1020	7.39	TB7B-2	TOLLWAY 475			4.94		0.0953					7.52	433	617	no sample	0.009	0.18	0.18	41.4	7.00	68.8	4.00	3.74
4/27/10	1105	7.26	TB7B-2	TOLLWAY 497			5.20		0.0994	0.00102				7.55	515	659	no sample	0.012	0.19	0.19	41.6	5.65	65.7	4.90	4.09
5/12/10	1083	7.49	TB7B-2	TOLLWAY 513			5.43		0.107					7.63	514	663	no sample	0.011	0.18	0.18	38.4	5.41	57.6	5.62	4.68
5/24/10	1030	7.14	TB7B-2	TOLLWAY 527			5.42		0.0973					7.40	485	643	no sample	0.008	0.17	0.17	37.7	4.62	62.6	3.68	3.82
6/8/10	1088	7.24	TB7B-2	TOLLWAY 553			5.55		0.101					7.41	528	648	no sample	0.008	0.16	0.16	38.5	2.47	58.9	5.40	4.41
6/22/10	1102	7.10	TB7B-2	TOLLWAY 575			5.90		0.103					7.43	546	647	no sample	0.010	0.22	0.22	37.2	0.80	53.7	4.32	4.88
7/7/10	1088	7.25	TB7B-2	TOLLWAY 599			6.09		0.105					7.48	544	631	no sample	0.010	0.22	0.22	37.7		46.6	4.17	3.50
7/20/10	1082	7.13	TB7B-2	TOLLWAY 618			6.13		0.102					7.40	516	626	no sample	0.010	0.23	0.23	50.1		37.5	5.73	4.16
8/2/10	1088	7.24	TB7B-2	TOLLWAY 632			6.57		0.102					7.48	511	625	no sample	0.012	0.00	0.21	48.0	0.17	43.3	6.23	5.12
8/17/10	1078	7.42	TB7B-2	TOLLWAY 658			6.09		0.097				0.009	7.39	495	628	no sample	0.008	0.26	0.26	57.5		41.2	4.35	3.94
			TB7B-2	min	NA	NA	4.94	NA	0.10	0.00102	0.024	NA	0.0075	7.38	433	617	NA	0.00	0.00	0.15	37.23	0.17	37.47	3.68	3.50
			TB7B-2	max	NA	NA	8.31	NA	0.13	0.02444	0.024	NA	0.0110	7.68	605	781	NA	0.02	0.11	0.26	95.46	7.00	82.34	20.19	5.89
			TB7B-2	mean	NA	NA	5.97	NA	0.11	0.01106	0.024	NA	0.0086	7.48	540	692	NA	0.01	0.06	0.19	53.94	2.69	64.11	6.12	4.51
12/1/09	1215	7.30	TB7B-3	TOLLWAY 312			9.76		0.0871					7.48	528	694	no sample	0.008		0.16	92.3	0.65	35.8	4.84	2.79
12/15/09	1138	7.44	TB7B-3	TOLLWAY 334			9.55		0.0848				0.0078	7.87	523	665	no sample	0.013	0.18	0.18	73.2	1.29	35.5	8.27	3.08
1/13/10	1034	7.23	TB7B-3	TOLLWAY 368			7.73		0.0670					7.66	507	606	no sample	0.009	0.16	0.16	52.9	1.24	31.5	3.12	2.50
1/27/10	944	7.51	TB7B-3	TOLLWAY 383			7.20		0.0651		0.025			7.61	473	561	no sample	0.008	0.17	0.17	33.1	8.18	28.3	3.23	3.00
2/17/10	974	7.67	TB7B-3	TOLLWAY 401			15.5		0.0662					7.58	476	572	no sample	0.010	0.16	0.16	47.3	2.61	31.2	4.10	3.04
3/2/10	960	7.48	TB7B-3	TOLLWAY 417			8.08		0.0615		0.030			7.55	459	571	no sample	0.012	0.16	0.16	44.1	4.55	35.0	3.62	3.36
3/17/10	870	7.53	TB7B-3	TOLLWAY 438			7.00		0.0587					7.62	414	506	no								

APPENDIX B-0: Results of Geochemical Analysis of Groundwater Samples - Pre-construction period (Year 0)

Date collected	Field conductivity	Field pH	Sample location	Sample ID	Al	As	B	Ba	Be	Ca	Cd	Co	Cr	Cu	Fe	K	Li	Mg	Mn	Mo	Na	Ni	P	Pb	S		
					mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L
				MDL:	0.037	0.108	0.023	0.00085	0.00055	0.012	0.012	0.013	0.0058	0.00079	0.0059	0.016	0.018	0.0025	0.0015	0.022	0.026	0.014	0.063	0.041	0.217		
12/1/09	750	7.50	TB7B-4	TOLLWAY 313			0.083	0.014		95.3				0.00110	0.0095	1.49		52.7			11.7	0.023			8.58		
12/15/09	814	7.71	TB7B-4	TOLLWAY 335			0.085	0.0134		81.8				0.00134	0.0257	1.49		52.0	0.0037		11.3	0.038			7.58		
1/13/10	696	7.45	TB7B-4	TOLLWAY 369			0.107	0.0123		72.4				0.00112	0.0367	0.851		49.4			7.95	0.026			3.88		
1/27/10	1071	7.74	TB7B-4	TOLLWAY 384			0.101	0.0114		70.8				0.00089	0.0259	0.731		46.3			7.97	0.025			3.74		
2/17/10	704	7.77	TB7B-4	TOLLWAY 402			0.094	0.00913		84.0					0.0063	0.795		54.3			7.73	0.027			5.01		
3/2/10	734	7.65	TB7B-4	TOLLWAY 418	0.048		0.084	0.0107		90.5					0.107	1.04		57.0	0.0033		9.43	0.020			6.04		
3/17/10	733	7.57	TB7B-4	TOLLWAY 439			0.079	0.0131		81.8					0.0757	0.622		47.6	0.0019		7.18				4.96		
3/31/10	704	7.51	TB7B-4	TOLLWAY 462	0.207		0.099	0.0102	0.00056	88.3				0.00125	0.603	0.749		55.1	0.0201		7.48	0.028			5.30		
4/13/10	690	7.41	TB7B-4	TOLLWAY 477			0.082	0.0176		78.5				0.00079	0.0201	0.610		47.6			6.50				5.76		
4/27/10	695	7.45	TB7B-4	TOLLWAY 499			0.108	0.00989		82.6				0.00121	0.0093	0.688		49.8			7.01	0.022			4.60		
5/12/10	734	7.56	TB7B-4	TOLLWAY 515			0.106	0.010		86.5					0.0062	0.711		52.8			7.38	0.021			5.02		
5/24/10	724	7.33	TB7B-4	TOLLWAY 529			0.099	0.0105		82.4				0.00082	0.0212	0.634		49.1			7.32	0.028			4.29		
6/8/10	749	7.38	TB7B-4	TOLLWAY 555			0.089	0.00905		85.1					0.0132	0.724		50.2			8.19	0.030			4.34		
6/22/10	742	7.24	TB7B-4	TOLLWAY 577			0.114	0.00866		87.0				0.00106	0.0087	0.747		49.7			7.42	0.024			4.34		
7/7/10	757	7.27	TB7B-4	TOLLWAY 601			0.113	0.00812		84.9				0.00124	0.0105	0.880		51.3			7.70	0.021			4.10		
7/20/10	783	7.29	TB7B-4	TOLLWAY 620			0.107	0.00981		81.7				0.00101	0.0116	1.17		50.2			8.97	0.033			4.46		
8/2/10	811	7.40	TB7B-4	TOLLWAY 634			0.136	0.011		101				0.001	0.009	0.895		53.7			8.33	0.021			4.25		
8/17/10	788	7.53	TB7B-4	TOLLWAY 660			0.121	0.010		89.1					0.023	1.06		51.3			8.49	0.018			4.21		
			TB7B-4	min	0.048	NA	0.079	0.008	NA	70.769	NA	NA	NA	0.00079	0.0062	0.610	NA	46.2956	0.0019	NA	6.50	0.018	NA	NA	3.74		
			TB7B-4	max	0.207	NA	0.136	0.018	NA	101.282	NA	NA	NA	0.00134	0.6031	1.493	NA	57.0283	0.0201	NA	11.67	0.038	NA	NA	8.58		
			TB7B-4	mean	0.127	NA	0.100	0.011	NA	84.661	NA	NA	NA	0.00108	0.0568	0.883	NA	51.1154	0.0072	NA	8.23	0.025	NA	NA	5.02		
12/2/09	8396	7.07	TB15B-1U	TOLLWAY 318			0.130	0.162		481				0.00154	0.0142	5.85	0.107	392	0.0210		702	0.148	0.083		82.1		
12/16/09	8648	7.05	TB15B-1U	TOLLWAY 336			0.112	0.151		448					0.0074	4.64	0.107	402	0.0098		735	0.150			82.7		
1/13/10	8985	7.16	TB15B-1U	TOLLWAY 364			0.105	0.138		503				0.00232	0.0256	4.19	0.100	400	0.0026		779	0.126	0.093		78.1		
1/27/10	8882	7.30	TB15B-1U	TOLLWAY 388			0.095	0.137		502					0.0084	3.25	0.094	417	0.0019		920	0.128			82.5		
2/17/10	8823	7.27	TB15B-1U	TOLLWAY 403	0.079		0.099	0.141		483					0.141	3.76	0.100	407	0.0074		760	0.159			89.2		
3/3/10	8558	6.97	TB15B-1U	TOLLWAY 419			0.100	0.134		520				0.00128	0.0244	4.26	0.119	442			735	0.128			85.3		
3/17/10	9573	7.19	TB15B-1U	TOLLWAY 440			0.085	0.134		490				0.00162		2.27	0.082	424	0.0017		969	0.111			92.4		
3/30/10	9517	7.80	TB15B-1U	TOLLWAY 454			0.089	0.139		514					0.0090	3.13	0.092	415	0.0031		908	0.114			95.9		
4/13/10	9590	8.16	TB15B-1U	TOLLWAY 470	0.062		0.100	0.135		504				0.00132	0.419	2.89	0.091	410	0.0051		941	0.132			96.9		
4/27/10	9245	7.10	TB15B-1U	TOLLWAY 495			0.087	0.132		497					0.0287	4.52	0.127	419	0.0021		785	0.146			86.2		
5/12/10	9361	7.10	TB15B-1U	TOLLWAY 518			0.102	0.141		515					0.0229	3.89	0.168	426			853	0.144	0.066		94.1		
5/25/10	9619	6.91	TB15B-1U	TOLLWAY 536			0.114	0.140		481					0.0238	4.56		397	0.0015		878	0.134	0.096		92.5		
6/8/10	8814	7.04	TB15B-1U	TOLLWAY 560			0.109	0.138		492					0.0145	4.88	0.138	405			775	0.147		0.041	86.7		
6/23/10	8670	7.88	TB15B-1U	TOLLWAY 581	0.043		0.120	0.136		463					0.0418	5.43		380	0.0043		691	0.138			79.0		
7/7/10	8771	7.50	TB15B-1U	TOLLWAY 593			0.149	0.145		495				0.00491	0.0093	6.04	0.156	400	0.0044		727	0.138			88.7		
7/20/10	NA*	NA*	TB15B-1U	TOLLWAY 614	4.61		0.127	0.170		285				0.00389	2.52	6.02	0.087	217	0.0991		482	0.103	0.081		52.1		
8/3/10	4044	8.26	TB15B-1U	TOLLWAY 639	2.39		0.126	0.166		215				0.004	1.42	3.67		164	0.017		484	0.067	0.072		37.9		
8/17/10	6368	7.49	TB15B-1U	TOLLWAY 653	1.71		0.151	0.202		371				0.002	1.01	4.61		286	0.017		641	0.117	0.083		67.2		
				NA*= not enough water for field parameters																							
			TB15B-1U	min	0.043	NA	0.085	0.132	NA	214.592	NA	NA	NA	0.00128	0.0074	2.268	0.08	164.4426	0.0015	NA	481.82	0.067	0.066	0.04	37.85		
			TB15B-1U	max	4.606	NA	0.151	0.202	NA	520.183	NA	NA	NA	0.00491	2.5247	6.043	0.17	441.8010	0.0991	NA	969.09	0.159	0.096	0.04	96.86		
			TB15B-1U	mean	1.482	NA	0.111	0.147	NA	458.890	NA	NA	NA	0.00251	0.3375	4.326	0.11	378.0193	0.0132	NA	764.74	0.130	0.082	0.04	81.63		
12/2/09	8332	6.93	TB15B-1L	TOLLWAY 319			0.121	0.113		498					0.0386	6.11	0.111	400	0.0275		713	0.151	0.073		89.6		
12/16/09	8762	6.98	TB15B-1L	TOLLWAY 337	0.073		0.115	0.115		483					0.0887	5.86	0.115	415	0.0144		725	0.145			91.1		
1/13/10	8786	7.04	TB15B-1L	TOLLWAY 365	0.981		0.108	0.113		537				0.00172	0.800	5.95	0.119	410	0.0206		730	0.139			83.0		
1/27/10	8493	7.05	TB15B-1L	TOLLWAY 387	0.129		0.108	0.111		545				0.00087	0.143	6.26	0.136	433	0.0118		802	0.121			85.6		
2/17/10	8789	7.18	TB15B-1L	TOLLWAY 404			0.090	0.108		526					4.99	0.105		445	0.0086		779	0.173			90.7		
3/3/10	8838	6.40	TB15B-1L	TOLLWAY 420	0.789		0.116	0.113		574			0.0059	0.00136	0.725	5.67	0.128	457	0.0162	0.028	823	0.125			95.9		
3/17/10	8776	6.92	TB15B-1L	TOLLWAY 441	2.06		0.089	0.124		542			0.0072	0.00437	1.99	5.94	0.115	451	0.0398		769	0.112			92.0		
3/30/10	8829	6.93	TB15B-1L	TOLLWAY 455	0.118		0.089	0.108																			

APPENDIX B-0: Results of Geochemical Analysis of Groundwater Samples - Pre-construction period (Year 0)

				Sb	Se	Si	Sn	Sr	Ti	Tl	V	Zn	pH	alkalinity	TDS, 180 C	TSS	oPO <sub>4</sub> -P	NH <sub>3</sub> -N	F	Cl	NO <sub>3</sub> -N	SO <sub>4</sub>	total NVOC	dissolved NVOC	
				mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L		mg/L as CaCO <sub>3</sub>	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L
Date collected	Field conductivity	Field pH	Sample location	MDL:	0.059	0.131	0.066	0.086	0.00037	0.00056	0.017	0.047	0.0073		4	12	3.0	0.01	0.06	0.08	0.09	0.07	0.31	0.31	0.31
12/1/09	750	7.50	TB7B-4	TOLLWAY 313			6.40		0.0603								0.004				12.9	2.15	22.8	5.04	1.96
12/15/09	814	7.71	TB7B-4	TOLLWAY 335			6.00		0.0609								0.007		0.10		12.0	2.11	21.6	2.36	2.15
1/13/10	696	7.45	TB7B-4	TOLLWAY 369			5.29		0.0505			0.0012					0.007		0.11		7.07	5.16	11.7	11.8	2.07
1/27/10	1071	7.74	TB7B-4	TOLLWAY 384			5.18		0.0471				0.018				0.007		0.11		5.84	10.3	10.9	2.06	1.79
2/17/10	704	7.77	TB7B-4	TOLLWAY 402			7.20		0.0467								0.007		0.11		7.53	7.95	13.8	4.28	2.47
3/2/10	734	7.65	TB7B-4	TOLLWAY 418			6.04		0.0496	0.00176							0.011		0.11		9.50	7.27	16.3	7.33	3.45
3/17/10	733	7.57	TB7B-4	TOLLWAY 439			5.37		0.0478								0.008		0.12		7.29	14.3	13.5	2.74	2.48
3/31/10	704	7.51	TB7B-4	TOLLWAY 462			5.94		0.0500	0.00720	0.023						0.016		0.10		7.37	14.4	13.6	1.86	2.21
4/13/10	690	7.41	TB7B-4	TOLLWAY 477			5.47		0.0490								0.009		0.12		9.00	15.1	15.7	1.74	1.88
4/27/10	695	7.45	TB7B-4	TOLLWAY 499			5.58		0.0545								0.011		0.14		9.00	14.4	13.4	2.37	2.91
5/12/10	734	7.56	TB7B-4	TOLLWAY 515			5.94		0.0575								0.010		0.12		9.27	15.6	14.8	3.07	2.35
5/24/10	724	7.33	TB7B-4	TOLLWAY 529			6.02		0.0554								0.009		0.12		9.79	16.1	13.0	2.38	2.18
6/8/10	749	7.38	TB7B-4	TOLLWAY 555			6.33		0.0577								0.009		0.11		9.02	16.0	12.6	2.13	2.01
6/22/10	742	7.24	TB7B-4	TOLLWAY 577			6.53		0.0573								0.010		0.13		8.78	14.9	12.3	1.60	1.95
7/7/10	757	7.27	TB7B-4	TOLLWAY 601			6.48		0.0580			0.0936					0.010		0.13		8.84	15.7	11.9	1.81	1.50
7/20/10	783	7.29	TB7B-4	TOLLWAY 620			6.54		0.0581								0.009		0.12		9.55	17.1	12.7	9.00	4.07
8/2/10	811	7.40	TB7B-4	TOLLWAY 634			7.47		0.064								0.012		0.14		10.4	12.6	11.9	2.19	2.65
8/17/10	788	7.53	TB7B-4	TOLLWAY 660			7.08		0.061								0.009		0.15		11.3	14.6	12.5	4.77	1.84
			TB7B-4	min	NA	NA	5.18	NA	0.05	0.00176	0.018	NA	0.0012	7.43	317	310	NA	0.00	NA	0.10	5.84	2.11	10.94	1.60	1.50
			TB7B-4	max	NA	NA	7.47	NA	0.06	0.00720	0.023	NA	0.0936	7.91	394	492	NA	0.02	NA	0.15	12.88	17.05	22.83	11.85	4.07
			TB7B-4	mean	NA	NA	6.16	NA	0.05	0.00448	0.020	NA	0.0474	7.61	355	431	NA	0.01	NA	0.12	9.13	11.98	14.17	3.81	2.33
12/2/09	8396	7.07	TB15B-1U	TOLLWAY 318			8.77		4.14		0.025		0.0272	7.30	352	5257	no sample	0.012			2691	0.14	224	4.15	3.07
12/16/09	8648	7.05	TB15B-1U	TOLLWAY 336			7.87		4.06				0.0143	7.67	327	5332	no sample	0.012		0.31	2745	0.16	225	3.56	3.51
1/13/10	8985	7.16	TB15B-1U	TOLLWAY 364			7.43		3.85		0.026		0.0217	7.44	313	5330	no sample	0.012		0.18	2788	0.14	221	3.78	3.43
1/27/10	8882	7.3	TB15B-1U	TOLLWAY 388			6.54		3.82		0.032		0.0140	7.52	316	5571	no sample	0.013			2994	0.14	235	2.33	2.66
2/17/10	8823	7.27	TB15B-1U	TOLLWAY 403			7.97		3.99				0.0103	7.53	331	4782	no sample	0.011			2751	0.14	222	4.98	3.14
3/3/10	8558	6.97	TB15B-1U	TOLLWAY 419			8.52		4.03		0.041		0.0121	7.45	342	4334	no sample	0.016			2438	0.11	206	3.38	2.96
3/17/10	9573	7.19	TB15B-1U	TOLLWAY 440			6.11		3.69		0.031		0.0091	7.44	309	5343	no sample	0.012			3130	0.11	245	3.67	3.32
3/30/10	9517	7.8	TB15B-1U	TOLLWAY 454			7.01		3.91		0.030		0.0076	7.40	330	5541	no sample	0.016			3193	0.08	252	3.52	3.11
4/13/10	9590	8.16	TB15B-1U	TOLLWAY 470			7.02		3.76				0.0103	7.26	342	5339	no sample	0.011			3185	0.09	256	3.30	3.52
4/27/10	9245	7.1	TB15B-1U	TOLLWAY 495			7.27		3.92					7.28	355	5157	no sample	0.015			3172	0.10	232	3.18	4.26
5/12/10	9361	7.1	TB15B-1U	TOLLWAY 518			7.44		4.02					7.41	342	5517	no sample	0.016		0.32	2884	0.13	239	3.92	3.33
5/25/10	9619	6.91	TB15B-1U	TOLLWAY 536			7.57		3.86		0.026		0.0074	7.33	347	6100	no sample	0.014		0.30	2967		255	3.54	3.18
6/8/10	8814	7.04	TB15B-1U	TOLLWAY 560			7.96		3.96				0.0188	7.28	357	4644	no sample	0.012		0.26	2764		223	4.64	5.94
6/23/10	8670	7.88	TB15B-1U	TOLLWAY 581			8.66		3.87				0.0122	7.24	360	5935	no sample	0.015		0.29	2576		218	2.96	2.93
7/7/10	8771	7.5	TB15B-1U	TOLLWAY 593			9.29		4.10				0.0228	7.14	365	5990	no sample	0.015		0.31	2712	0.07	223	3.20	4.94
7/20/10	NA*	NA*	TB15B-1U	TOLLWAY 614			18.4		2.30	0.156			0.0183	7.40	293	3546	no sample	0.099	0.39	0.42	1667	0.07	136	34.6	5.54
8/3/10	4044	8.26	TB15B-1U	TOLLWAY 639			12.4		1.60	0.080			0.015	7.45	244	2744	no sample	0.049		0.47	1375	0.08	117	10.8	7.11
8/17/10	6368	7.49	TB15B-1U	TOLLWAY 653			13.0		3.00	0.057			0.016	7.31	332	4267	no sample	0.287		0.34	2097	0.08	178	10.7	5.35
			TB15B-1U	min	NA	0.13	6.11	NA	1.60	0.05661	0.025	NA	0.0074	7.14	244	2744	NA	0.01	0.39	0.18	1374.73	0.07	117.01	2.33	2.66
			TB15B-1U	max	NA	0.16	18.40	NA	4.14	0.15550	0.041	NA	0.0272	7.67	365	6100	NA	0.29	0.39	0.47	3193.02	0.16	255.75	34.64	7.11
			TB15B-1U	mean	NA	0.15	8.85	NA	3.66	0.09723	0.030	NA	0.0148	7.38	331	5041	NA	0.04	0.39	0.32	2673.80	0.11	217.07	6.13	3.96
12/2/09	8332	6.93	TB15B-1L	TOLLWAY 319			8.96		4.04		0.022		0.0168	7.26	379	4673	no sample	0.010			2682		251	3.45	2.70
12/16/09	8762	6.98	TB15B-1L	TOLLWAY 337			8.70		4.18				0.0100	7.42	373	5433	no sample	0.014		0.31	2771	0.10	248	2.11	2.68
1/13/10	8786	7.040	TB15B-1L	TOLLWAY 365			10.3		3.94	0.0329	0.021		0.0147	7.23	373	4855	no sample	0.037		0.18	2860	0.08	240	4.08	2.97
1/27/10	8493	7.050	TB15B-1L	TOLLWAY 387			8.38		4.05	0.00072	0.027		0.0115	7.25	375	5448	no sample	0.016			2950	0.07	239	3.48	1.98
2/17/10	8789	7.180	TB15B-1L	TOLLWAY 404			8.32		3.90		0.042			7.25	373	5324	no sample	0.011			2869		237	4.62	2.69
3/3/10	8838	6.400	TB15B-1L	TOLLWAY 420			10.8		4.13	0.0227	0.046		0.0108	7.26	372	5465	no sample	0.021			2877		237	3.89	2.98
3/17/10	8776	6.920	TB15B-1L	TOLLWAY 441			12.8		4.00	0.0678	0.034		0.0128	7.26	370	5447	no sample	0.031			2855		239	5.17	4.13
3/30/10	8829	6.930	TB15B-1L	TOLLWAY 455			8.13		4.00		0.042			7.13	369	6042	no sample	0.017			2972		235	2.80	2.44
4/13/10	8841	7.360	TB15B-1L																						

APPENDIX B-0: Results of Geochemical Analysis of Groundwater Samples - Pre-construction period (Year 0)

Date collected	Field conductivity	Field pH	Sample location	Sample ID	Al	As	B	Ba	Be	Ca	Cd	Co	Cr	Cu	Fe	K	Li	Mg	Mn	Mo	Na	Ni	P	Pb	S
					mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L
				MDL:	0.037	0.108	0.023	0.00085	0.00055	0.012	0.012	0.013	0.0058	0.00079	0.0059	0.016	0.018	0.0025	0.0015	0.022	0.026	0.014	0.063	0.041	0.217
12/2/09	1143	7.37	TB15B-2	TOLLWAY 317			0.136	0.057		131				0.00099	0.0086	1.74		83.7	0.0035		31.0	0.036	0.069		62.9
12/16/09	1173	7.63	TB15B-2	TOLLWAY 338	0.041		0.130	0.0576		113				0.00110	0.0292	1.24		85.5	0.0023		29.2	0.053			62.3
1/13/10	1154	7.71	TB15B-2	TOLLWAY 363			0.123	0.0497		102						1.20		76.7			29.2	0.042			58.5
1/27/10	1128	7.68	TB15B-2	TOLLWAY 386			0.118	0.0505		105				0.00122	0.0259	1.02		81.8			33.2	0.051			59.3
2/17/10	1143	7.88	TB15B-2	TOLLWAY 405			0.105	0.0481		124					0.0465	1.26		88.0	0.0023		28.6	0.044	0.080		61.9
3/3/10	1149	7.46	TB15B-2	TOLLWAY 421			0.119	0.0488		121				0.00088	0.0107	1.47		87.2			30.7	0.043			65.6
3/17/10	1137	7.49	TB15B-2	TOLLWAY 442	0.038		0.095	0.0466		114				0.00097	0.0449	0.978		84.0			29.1	0.037			62.9
3/30/10	1133	7.35	TB15B-2	TOLLWAY 456			0.108	0.0468		121					0.0071	1.32		88.5		0.023	27.0	0.033			64.9
4/13/10	1144	7.61	TB15B-2	TOLLWAY 472	0.475		0.105	0.0494		116					0.530	1.34		87.7	0.0068		25.5	0.026			64.8
4/27/10	1143	7.47	TB15B-2	TOLLWAY 493	0.044		0.106	0.0521		116				0.00101	0.102	1.59		82.4	0.0056		25.4	0.037			62.7
5/12/10	1160	7.40	TB15B-2	TOLLWAY 517			0.123	0.053		123					0.0503	1.58		87.4	0.0224		25.7	0.035			64.9
5/25/10	1178	7.44	TB15B-2	TOLLWAY 537			0.128	0.0519		119				0.00090	0.0837	1.56		85.1	0.0186		27.4	0.045			63.5
6/8/10	1157	7.41	TB15B-2	TOLLWAY 558			0.117	0.0542		118					0.0766	1.65		84.7	0.0194		27.8	0.047			62.2
6/23/10	1128	7.47	TB15B-2	TOLLWAY 583	0.042		0.137	0.0535		120					0.0	1.65		84.0	0.0096		26.3	0.034			60.3
7/7/10	2762	7.60	TB15B-2	TOLLWAY 595			0.181	0.0538		117				0.00656	0.0093	1.29		87.6		0.024	28.4	0.039			62.8
7/20/10	978	7.45	TB15B-2	TOLLWAY 615	15.0		0.124	0.110		66.0			0.0140	0.00756	7.83	5.87		38.3	0.0613		28.3	0.037	0.083		22.6
8/3/10	285	7.94	TB15B-2	TOLLWAY 641	0.346		0.103	0.048		62.0					0.004	0.247	0.825	29.7	0.005		30.2				20.3
8/17/10	1956	7.48	TB15B-2	TOLLWAY 655	1.06		0.155	0.072		89.1					0.003	0.680	1.43	59.5	0.013		28.9	0.030	0.072		37.8
			TB15B-2	min	0.038	NA	0.095	0.047	NA	62.007	NA	NA	0.01397	0.00088	0.0071	0.825	NA	29.6703	0.0023	0.023	25.45	0.026	0.069	NA	20.33
			TB15B-2	max	14.999	NA	0.181	0.110	NA	131.139	NA	NA	0.01397	0.00756	7.8286	5.872	NA	88.4907	0.0613	0.024	33.22	0.053	0.083	NA	65.64
			TB15B-2	mean	2.131	NA	0.123	0.056	NA	109.764	NA	NA	0.01397	0.00256	0.5775	1.612	NA	77.8726	0.0142	0.023	28.44	0.040	0.076	NA	56.70
12/2/09	452	8.13	TB15B-3	TOLLWAY 316			0.030	0.021		35.7				0.00280	0.0351	0.874		16.6	0.0125	0.109	25.1				9.09
12/16/09	834	7.65	TB15B-3	TOLLWAY 339			0.078	0.0639		83.1				0.00206	0.0302	0.889		53.6	0.0053		28.9	0.029			17.5
1/13/10	1103	7.660	TB15B-3	TOLLWAY 362	0.040		0.133	0.0834		123				0.00135	0.0871	1.68		83.0	0.0087	0.022	48.2	0.044			40.9
1/27/10	1094	7.740	TB15B-3	TOLLWAY 385			0.102	0.0676		103				0.00117	0.0314	1.07		70.3	0.0017		37.0	0.028			25.7
2/17/10	1157	7.690	TB15B-3	TOLLWAY 406	7.62		0.122	0.119		168			0.0120	0.00979	15.1	4.71		105	0.154		42.5	0.059	0.160		37.5
3/3/10	1119	7.400	TB15B-3	TOLLWAY 422	0.126		0.095	0.0650		117				0.00153	0.157	0.891		76.0	0.0038		38.2	0.028			27.2
3/17/10	1061	7.360	TB15B-3	TOLLWAY 443	0.932		0.095	0.0742		121				0.00181	1.24	1.46		80.3	0.0147		39.4	0.031			31.7
3/30/10	1158	7.420	TB15B-3	TOLLWAY 457			0.111	0.0725		129					0.0165	1.38		85.6	0.0030		41.2	0.034			37.4
4/13/10	1112	7.440	TB15B-3	TOLLWAY 473			0.091	0.0667		113				0.00097	0.0506	0.930		75.2	0.0018	0.023	32.4	0.029			28.2
4/27/10	1165	7.770	TB15B-3	TOLLWAY 492	0.343		0.117	0.0761		129				0.00120	0.512	2.03		85.9	0.0146		38.7	0.042			44.9
5/12/10	1149	7.490	TB15B-3	TOLLWAY 516			0.129	0.068		128				0.00091	0.0509	1.77		85.8	0.0037		37.0	0.036			40.8
5/25/10	1079	7.390	TB15B-3	TOLLWAY 538			0.123	0.0751		119				0.00106	0.0400	1.47		80.0	0.0054		37.3	0.040			36.2
6/8/10	1109	7.790	TB15B-3	TOLLWAY 557			0.116	0.0748		123					0.0261	1.77		83.1	0.0022		37.4	0.041			37.1
6/23/10	1107	7.560	TB15B-3	TOLLWAY 584	15.2		0.165	0.143		238			0.0206	0.0378	31.6	6.80		136	0.583	0.028	38.0	0.076	0.271		39.6
7/7/10	1115	7.300	TB15B-3	TOLLWAY 596			0.159	0.0699		105				0.00181	0.0114	1.12		69.9	0.0023		35.0	0.029			23.1
7/20/10	1242	7.360	TB15B-3	TOLLWAY 616	0.937		0.163	0.0796		106				0.00332	1.44	1.86		69.5	0.0166		31.5	0.038			26.2
8/3/10	1285	8.130	TB15B-3	TOLLWAY 642			0.175	0.079		128				0.001		1.94		82.9	0.014		37.6	0.032			38.0
8/17/10	1188	7.780	TB15B-3	TOLLWAY 656	0.066		0.174	0.077		115				0.002	0.081	1.37		76.1	0.002		37.6	0.036	0.072		30.3
			TB15B-3	min	0.040	NA	0.030	0.021	NA	35.735	NA	NA	0.01200	0.00091	0.0114	0.874	NA	16.6075	0.0017	0.022	25.14	0.028	0.072	NA	9.09
			TB15B-3	max	15.203	NA	0.175	0.143	NA	238.351	NA	NA	0.02064	0.03785	31.5702	6.800	NA	136.2778	0.5825	0.109	48.18	0.076	0.271	NA	44.88
			TB15B-3	mean	3.159	NA	0.121	0.076	NA	121.241	NA	NA	0.01632	0.00441	2.9698	1.889	NA	78.5874	0.0472	0.046	36.83	0.038	0.167	NA	31.75

APPENDIX B-0: Results of Geochemical Analysis of Groundwater Samples - Pre-construction period (Year 0)

Date collected	Field		Sample location	Sample ID	Sb	Se	Si	Sn	Sr	Ti	Tl	V	Zn	pH	alkalinity	TDS, 180 C	TSS	oPO <sub>4</sub> -P	NH <sub>3</sub> -N	F	Cl	NO <sub>3</sub> -N	SO <sub>4</sub>	total NVOC	dissolved NVOC
	conductivity	Field pH		mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L as CaCO <sub>3</sub>	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L
				MDL:	0.059	0.131	0.066	0.086	0.00037	0.00056	0.017	0.047	0.0073		4	12	3.0	0.01	0.06	0.08	0.09	0.07	0.31	0.31	0.31
12/2/09	1143	7.37	TB15B-2	TOLLWAY 317			8.12		1.36				0.0087	7.62	375	747	no sample	0.008		0.45	73.9	0.12	187	4.89	3.19
12/16/09	1173	7.63	TB15B-2	TOLLWAY 338			7.56		1.29					7.86	388	746	no sample	0.016		0.47	75.9		177	2.62	2.22
1/13/10	1154	7.71	TB15B-2	TOLLWAY 363			6.72		1.22					7.76	386	740	no sample	0.012		0.45	81.0		181	3.48	2.01
1/27/10	1128	7.68	TB15B-2	TOLLWAY 386			6.68		1.20		0.030			7.77	384	729	no sample	0.013		0.43	78.4		175	2.46	1.59
2/17/10	1143	7.88	TB15B-2	TOLLWAY 405			7.07		1.18	0.00063				7.81	387	745	no sample	0.012		0.44	79.6		177	4.50	2.10
3/3/10	1149	7.46	TB15B-2	TOLLWAY 421			7.38		1.20					7.70	386	728	no sample	0.014		0.46	82.4	0.09	179	2.59	2.03
3/17/10	1137	7.49	TB15B-2	TOLLWAY 442			6.65		1.14	0.00065	0.028			7.71	372	728	no sample	0.012		0.39	81.1		178	3.21	2.79
3/30/10	1133	7.35	TB15B-2	TOLLWAY 456			7.02		1.23					7.71	385	818	no sample	0.016		0.43	79.3		176	2.21	1.65
4/13/10	1144	7.61	TB15B-2	TOLLWAY 472			8.44		1.20	0.0137				7.59	390	842	no sample	0.023		0.43	74.8		171	2.00	2.30
4/27/10	1143	7.47	TB15B-2	TOLLWAY 493			7.19		1.29					7.53	390	760	no sample	0.035		0.46	79.0		173	3.43	2.20
5/12/10	1160	7.40	TB15B-2	TOLLWAY 517			7.62		1.32					7.69	393	749	no sample	0.034	0.07	0.44	83.7		175	5.01	2.41
5/25/10	1178	7.44	TB15B-2	TOLLWAY 537			7.75		1.32					7.69	392	867	no sample	0.019		0.42	113		261	2.89	2.01
6/8/10	1157	7.41	TB15B-2	TOLLWAY 558			7.94		1.32					7.53	394	754	no sample	0.014		0.42	73.7		169	4.40	1.93
6/23/10	1128	7.47	TB15B-2	TOLLWAY 583			8.12		1.27					7.58	398	770	no sample	0.184		0.51	80.4		176	2.47	2.82
7/7/10	2762	7.60	TB15B-2	TOLLWAY 595			8.34		1.23				0.0186	7.48	395	770	no sample	0.016		0.52	75.0		173	2.47	1.67
7/20/10	978	7.45	TB15B-2	TOLLWAY 615			43.3		0.554	0.397			0.0331	7.61	224	761	no sample	0.009		0.57	43.7	0.11	82.2	8.10	6.32
8/3/10	285	7.94	TB15B-2	TOLLWAY 641			6.89		0.417	0.011			0.011	7.79	228	409	no sample	0.029		0.61	33.4		62.1	12.5	7.92
8/17/10	1956	7.48	TB15B-2	TOLLWAY 655			10.4		0.853	0.037			0.017	7.51	335	610	no sample	0.071		0.59	53.0	0.09	116	5.19	5.19
			TB15B-2	min	NA	NA	6.65	NA	0.42	0.00063	0.028	NA	0.0087	7.48	224	409	NA	0.01	0.07	0.39	33.40	0.09	62.11	2.00	1.59
			TB15B-2	max	NA	NA	43.29	NA	1.36	0.39745	0.030	NA	0.0331	7.86	398	867	NA	0.18	0.07	0.61	112.88	0.12	260.84	12.48	7.92
			TB15B-2	mean	NA	NA	9.62	NA	1.14	0.07675	0.029	NA	0.0176	7.66	367	737	NA	0.03	0.07	0.47	74.51	0.10	166.08	4.13	2.91
12/2/09	452	8.13	TB15B-3	TOLLWAY 316			5.40		0.303					7.96	152	221	no sample			0.72	17.0		24.7	24.1	4.75
12/16/09	834	7.65	TB15B-3	TOLLWAY 339			7.05		0.845				0.0126	7.92	334	507	no sample	0.010		0.44	93.0		60.0	6.31	2.45
1/13/10	1103	7.66	TB15B-3	TOLLWAY 362			8.22		1.38					7.63	440	924	no sample	0.009		0.37	167		108	16.2	2.37
1/27/10	1094	7.74	TB15B-3	TOLLWAY 385			7.05		1.08		0.038		0.0091	7.64	420	641	no sample	0.009		0.36	105		67.7	3.86	1.85
2/17/10	1157	7.69	TB15B-3	TOLLWAY 406					1.30	0.211			0.0830	7.61	470	1023	no sample	0.155		0.36	126	0.08	86.2	22.1	4.99
3/3/10	1119	7.40	TB15B-3	TOLLWAY 422			7.63		1.04	0.00371			0.0121	7.67	411	708	no sample	0.014		0.35	116		75.6	4.15	1.96
3/17/10	1061	7.36	TB15B-3	TOLLWAY 443			9.78		1.11	0.0301	0.021		0.0148	7.59	427	732	no sample	0.040		0.33	122		83.6	9.51	2.47
3/30/10	1158	7.42	TB15B-3	TOLLWAY 457			8.09		1.24					7.51	432	823	no sample	0.014		0.36	137		99.3	5.38	2.07
4/13/10	1112	7.44	TB15B-3	TOLLWAY 473			7.24		1.07				0.0074	7.49	428	726	no sample	0.011		0.37	126		90.5	2.98	2.03
4/27/10	1165	7.77	TB15B-3	TOLLWAY 492			9.44		1.41	0.0100			0.0077	7.55	399	853	no sample	0.018		0.35	155		120	3.68	1.65
5/12/10	1149	7.49	TB15B-3	TOLLWAY 516			8.97		1.36					7.63	412	770	no sample	0.013		0.39	143		114	4.47	2.26
5/25/10	1079	7.39	TB15B-3	TOLLWAY 538			8.48		1.26					7.51	410	822	no sample	0.011		0.37	135		109	4.54	1.78
6/8/10	1109	7.79	TB15B-3	TOLLWAY 557			9.11		1.34					7.52	406	893	no sample	0.012		0.35	143		116	5.76	1.76
6/23/10	1107	7.56	TB15B-3	TOLLWAY 584			40.2		1.35	0.523			0.180	7.51	402	1283	no sample	0.021		0.46	134		110	5.57	5.60
7/7/10	1115	7.30	TB15B-3	TOLLWAY 596			8.45		1.00				0.0139	7.44	407	674	no sample	0.011		0.48	90.9		66.9	2.61	1.90
7/20/10	1242	7.36	TB15B-3	TOLLWAY 616			11.4		1.12	0.0303			0.0186	7.47	407	772	no sample	0.035		0.45	97.8		70.7	3.65	3.38
8/3/10	1285	8.13	TB15B-3	TOLLWAY 642			9.88		1.31				0.011	7.60	392	813	no sample	0.016		0.50	128		105	2.52	2.23
8/17/10	1188	7.78	TB15B-3	TOLLWAY 656			9.64		1.16	0.001			0.015	7.56	414	881	no sample	0.019		0.51	114		90.1	3.60	3.06
			TB15B-3	min	NA	NA	5.40	NA	0.30	0.00073	0.021	NA	0.0074	7.44	152	221	NA	0.01	NA	0.33	17.00	0.08	24.73	2.52	1.65
			TB15B-3	max	NA	NA	40.22	NA	1.41	0.52306	0.038	NA	0.1801	7.96	470	1283	NA	0.15	NA	0.72	166.77	0.08	120.39	24.14	5.60
			TB15B-3	mean	NA	NA	10.36	NA	1.15	0.11553	0.030	NA	0.0322	7.60	398	781	NA	0.02	NA	0.42	119.30	0.08	88.83	7.28	2.70

APPENDIX B-1: Results of Geochemical Analysis of Groundwater Samples

Date collected	Field conductivity	Field pH	Sample location	Sample ID	Al	As	B	Ba	Be	Ca	Cd	Co	Cr	Cu	Fe	K	Li	Mg	Mn	Mo	Na	Ni	P	Pb	S		
					mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L
				MDL:	0.037	0.108	0.023	0.00085	0.00055	0.012	0.012	0.013	0.0058	0.00079	0.0059	0.016	0.018	0.0025	0.0015	0.022	0.026	0.014	0.063	0.041	0.217		
8/30/10	2598	6.85	TB7-1-GW	TOLLWAY 665	NA*	NA*	0.166	0.055	NA*	66.496	NA*	NA*	NA*	NA*	5.4002	3.154	NA*	23.8433	0.3778	NA*	479.01	0.019	NA*	NA*	48.29		
9/14/10	3505	7.25	TB7-1-GW	TOLLWAY 687	NA*	NA*	0.162	0.058	NA*	77.990	NA*	NA*	NA*	NA*	6.2700	3.836	NA*	27.8541	0.4479	NA*	548.16	0.028	NA*	NA*	56.32		
9/27/10	1235	7.24	TB7-1-GW	TOLLWAY 691	NA*	NA*	0.157	0.044	NA*	60.975	NA*	NA*	NA*	NA*	3.4651	3.026	NA*	25.0817	0.2657	NA*	386.63	0.023	0.135	NA*	41.28		
10/12/10	2000	7.92	TB7-1-GW	TOLLWAY 709	NA*	NA*	0.142	0.029	NA*	50.842	NA*	NA*	NA*	NA*	1.5212	1.664	NA*	21.9880	0.1809	NA*	320.60	0.028	0.109	NA*	25.86		
10/25/10	1837	7.13	TB7-1-GW	TOLLWAY 711	NA*	NA*	0.138	0.029	NA*	51.879	NA*	NA*	NA*	NA*	1.0895	1.567	NA*	22.6053	0.1810	NA*	322.55	0.025	0.105	NA*	25.14		
11/9/10	1792	7.30	TB7-1-GW	TOLLWAY 722	NA*	NA*	0.144	0.029	NA*	48.307	NA*	NA*	NA*	NA*	0.5888	1.575	NA*	22.8086	0.1743	NA*	305.93	0.033	0.134	NA*	21.70		
3/2/11	9491	8.59	TB7-1-GW	TOLLWAY 779	0.584		0.067	0.043		75.807				0.01695	0.8777	3.362		18.2294	0.1624		525.18				69.64		
3/15/11	2440	7.27	TB7-1-GW	TOLLWAY 792	0.405		0.072	0.043		78.825				0.01412	0.4727	4.055		16.5847	0.2186		513.32		0.193		63.99		
3/28/11	2409	7.82	TB7-1-GW	TOLLWAY 799	0.212		0.078	0.036		67.000				0.01513	0.2600	3.388		14.4672	0.2140		477.75		0.154		52.55		
4/12/11	2496	7.92	TB7-1-GW	TOLLWAY 828	0.080		0.080	0.036		62.852				0.01039	0.3731	3.569		14.8996	0.3186		486.87		0.145		50.29		
4/26/11	1617	7.45	TB7-1-GW	TOLLWAY 849	0.996		0.071	0.035		49.809				0.01558	1.0070	4.745		11.3452	0.2640		363.02		0.142		32.76		
5/10/11	2103	7.32	TB7-1-GW	TOLLWAY 870	0.395		0.091	0.039		62.738				0.01258	4.8629	4.034		13.9758	0.4451		459.37		0.347		45.14		
5/24/11	1979	7.02	TB7-1-GW	TOLLWAY 899	0.330		0.113	0.039		58.761				0.01509	0.8377	4.486		13.1496	0.4240		418.16		0.158		41.85		
6/6/11	1947	7.13	TB7-1-GW	TOLLWAY 914	0.059		0.103	0.038		59.188				0.00390	6.0826	4.545		11.0820	0.4843		397.72		0.422		40.48		
6/21/11	1831	7.23	TB7-1-GW	TOLLWAY 963	0.078		0.121	0.040		53.581				0.00343	8.3836	5.437		10.8274	0.4750		380.40		0.333		40.21		
7/5/11	2432	7.41	TB7-1-GW	TOLLWAY 974			0.122	0.044		62.400				0.00087	8.7700	4.550		14.8000	0.5450		456.00		0.453		47.00		
7/19/11	2598	7.36	TB7-1-GW	TOLLWAY 1002	0.121		0.126	0.046		67.309					7.6471	4.439		18.0587	0.4640		424.34		0.321		46.80		
8/1/11	1855	6.93	TB7-1-GW	TOLLWAY 1017	1.037		0.127	0.037		51.883				0.00207	17.2277	16.999		12.6430	0.4503	0.028	340.03		0.933		17.53		
8/16/11	2203	7.42	TB7-1-GW	TOLLWAY 1063	0.221		0.146	0.046		52.947					14.2641	8.817		15.6693	0.4007	0.036	410.08		0.520		21.72		
				NA*= not enough sample for analysis																							
				min	0.000	NA	0.067	0.029	NA	48.307	NA	NA	NA	0.00000	0.2600	1.567	NA	10.8274	0.1624	0.000	305.93	NA	0.000	NA	17.53		
				max	1.037	NA	0.166	0.058	NA	78.825	NA	NA	NA	0.01695	17.2277	16.999	NA	27.8541	0.5450	0.036	548.16	NA	0.933	NA	69.64		
				mean	0.348	NA	0.117	0.040	NA	61.031	NA	NA	NA	0.00847	4.7053	4.592	NA	17.3638	0.3418	0.005	421.85	NA	0.271	NA	41.50		
8/30/10	1702	7.33	TB7-2-GW	TOLLWAY 666	NA*	NA*	0.202	0.034	NA*	73.837	NA*	NA*	NA*	NA*	0.1764	0.921	NA*	66.6948	0.3114	NA*	86.56	0.042	NA*	NA*	11.76		
9/14/10	1421	7.46	TB7-2-GW	TOLLWAY 688	0.081	NA*	0.222	0.029	NA*	85.407	NA*	NA*	NA*	NA*	0.4623	0.813	NA*	79.9479	0.4506	NA*	80.43	0.050	NA*	NA*	11.79		
9/27/10	1342	7.48	TB7-2-GW	TOLLWAY 692	NA*	NA*	0.172	0.024	NA*	100.653	NA*	NA*	NA*	NA*	0.2766	0.948	NA*	88.4294	0.2945	NA*	42.89	0.047	NA*	NA*	13.34		
3/2/11	1368	8.27	TB7-2-GW	TOLLWAY 780			0.135	0.030		108.158				0.00196	0.0069	0.698		103.9555	0.0549		52.86				51.61		
3/15/11	1267	7.87	TB7-2-GW	TOLLWAY 791			0.153	0.034		102.977				0.00235		0.596		98.4540	0.0161		57.57		0.102		49.13		
3/28/11	1334	7.83	TB7-2-GW	TOLLWAY 800			0.173	0.035		102.795				0.00185		0.637		101.8598	0.0253		68.44		0.170		47.64		
4/12/11	1289	7.82	TB7-2-GW	TOLLWAY 829			0.165	0.035		96.284				0.00214		0.646		96.8285	0.0367		70.94		0.141		42.36		
4/26/11	1097	7.48	TB7-2-GW	TOLLWAY 844			0.090	0.060		93.911					0.0356	0.632		69.3713			37.60		0.124		56.55		
5/10/11	1177	7.35	TB7-2-GW	TOLLWAY 871			0.170	0.032		89.506				0.00221		0.561		82.6054	0.0207		58.52		0.131		32.75		
5/24/11	1212	7.21	TB7-2-GW	TOLLWAY 900			0.188	0.033		89.203				0.00297	0.0376	0.743		83.5873	0.0672		76.91		0.133		33.31		
6/6/11	752	7.23	TB7-2-GW	TOLLWAY 915			0.158	0.024		76.915				0.00275		0.504		52.0203	0.0058		35.39		0.160		15.60		
6/21/11	741	7.37	TB7-2-GW	TOLLWAY 964			0.219	0.029		91.601				0.00165		0.555		69.8885	0.0177		45.31		0.145		21.62		
7/5/11	1107	7.66	TB7-2-GW	TOLLWAY 975			0.244	0.031		87.300				0.00140		0.599		77.4000	0.0472		57.10		0.192		24.40		
7/19/11	988	7.59	TB7-2-GW	TOLLWAY 1003	0.910		0.237	0.032		73.855				0.00318	1.0000	1.035		68.0881	0.1512		50.12		0.192		18.57		
8/1/11	974	7.36	TB7-2-GW	TOLLWAY 1018			0.243	0.022		89.652					0.678			69.5436	0.0046		46.15		0.095		19.67		
8/16/11	1151	7.55	TB7-2-GW	TOLLWAY 1064			0.260	0.035		91.397				0.00126	0.0551	0.806		79.1786	0.2680		57.36		0.163		23.67		
				NA*= not enough sample for analysis																							
				min	0.000	NA	0.090	0.022	NA	73.837	NA	NA	NA	0.00000	0.0000	0.504	NA	52.0203	0.0000	NA	35.39	0.000	0.000	NA	11.76		
				max	0.910	NA	0.260	0.060	NA	108.158	NA	NA	NA	0.00318	1.0000	1.035	NA	103.9555	0.4506	NA	86.56	0.050	0.192	NA	56.55		
				mean	0.071	NA	0.189	0.033	NA	90.841	NA	NA	NA	0.00183	0.1282	0.711	NA	80.4908	0.1107	NA	57.76	0.009	0.134	NA	29.61		
8/30/10	1160	7.28	TB7-3-GW	TOLLWAY 667	0.039	NA*	0.111	0.036	NA*	104.471	NA*	NA*	NA*	0.00164	0.1387	0.766	NA*	73.5572	0.1808	NA*	54.15	0.036	NA*	NA*	14.96		
9/14/10	1142	7.42	TB7-3-GW	TOLLWAY 689	NA*	NA*	NA*	NA*	NA*	NA*	NA*	NA*	NA*	NA*	NA*	NA*	NA*	NA*	NA*	NA*	NA*	NA*	NA*	NA*	NA*		
9/27/10	1123	7.53	TB7-3-GW	TOLLWAY 693	NA*	NA*	0.106	0.029	NA*	89.558	NA*	NA*	NA*	0.00138	0.0168	0.944	NA*	62.1732	0.0763	NA*	89.61	0.038	NA*	NA*	16.29		
3/15/11	996	8.01	TB7-3-GW	TOLLWAY 790			0.074	0.016		91.115				0.00154	0.0297	0.328		63.4125			36.39		0.139		21.13		
3/28/11	907	7.85	TB7-3-GW	TOLLWAY 801			0.080	0.015		83.923				0.00092		0.358		59.1939			41.66		0.126		16.68		
4/12/11	933	7.87	TB7-3-GW	TOLLWAY 831			0.074	0.015		82.712				0.00143		0.372		59.9292			47.61		0.118		16.67		
4/26/11	8																										



APPENDIX B-1: Results of Geochemical Analysis of Groundwater Samples

Date collected	Field		Sample location	Sample ID	Sb	Se	Si	Sn	Sr	Ti	Tl	V	Zn	pH	alkalinity	TDS, 180 C	TSS	oPO <sub>4</sub> -P	NH <sub>3</sub> -N	F	Cl	NO <sub>3</sub> -N	SO <sub>4</sub>	total NVOC	dissolved NVOC		
	conductivity	Field pH			mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L as CaCO <sub>3</sub>	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	
				MDL:	0.059	0.131	0.066	0.086	0.00037	0.00056	0.017	0.047	0.0073		4	12	3.0	0.01	0.06	0.08	0.09	0.07	0.31	0.31	0.31		
8/30/10	2598	6.85	TB7-1-GW	TOLLWAY 665	NA*	NA*	6.60	NA*	0.12	NA*	NA*	NA*	NA*	7.23	719	1439	NA	0.03	1.35	0.29	292.95	NA*	124.92	22.10	10.89		
9/14/10	3505	7.25	TB7-1-GW	TOLLWAY 687	NA*	NA*	6.82	NA*	0.14	NA*	NA*	NA*	NA*	7.16	743	1660	NA	0.05	1.80	0.29	418.75	NA*	149.29	23.51	12.18		
9/27/10	1235	7.24	TB7-1-GW	TOLLWAY 691	NA*	NA*	5.40	NA*	0.10	NA*	NA*	NA*	NA*	7.19	693	1252	NA	0.03	1.55	0.30	221.10	NA*	126.29	19.29	10.18		
10/12/10	2000	7.92	TB7-1-GW	TOLLWAY 709	NA*	NA*	4.78	NA*	0.08	NA*	NA*	NA*	NA*	7.50	670	1138	NA	0.02	1.03	0.33	207.48	NA*	84.84	15.77	6.53		
10/25/10	1837	7.13	TB7-1-GW	TOLLWAY 711	NA*	NA*	4.63	NA*	0.08	NA*	NA*	NA*	NA*	7.22	660	1025	NA	0.01	0.34	0.35	139.41	NA*	73.25	19.79	6.23		
11/9/10	1792	7.30	TB7-1-GW	TOLLWAY 722	NA*	NA*	4.47	NA*	0.08	NA*	NA*	NA*	NA*	7.53	657	949	NA	0.01	0.67	0.32	109.93	NA*	58.84	11.96	5.85		
3/2/11	9491	8.59	TB7-1-GW	TOLLWAY 779			5.05		0.11	0.01706			0.0114	7.38	588	1664	NA	0.04	0.10	0.20	422.22	5.43	193.46	23.92	17.51		
3/15/11	2440	7.27	TB7-1-GW	TOLLWAY 792			4.65		0.12	0.01116			0.0124	7.27	632	1524	NA	0.04	0.41	0.17	335.33	2.48	171.06	20.23	14.38		
3/28/11	2409	7.82	TB7-1-GW	TOLLWAY 799			4.36		0.11	0.00584				7.32	584	1393	NA	0.04	0.36	0.26	304.50	2.35	148.48	19.03	15.62		
4/12/11	2496	7.92	TB7-1-GW	TOLLWAY 828			4.18		0.11	0.00299				7.33	592	1434	NA	0.04	0.57	0.23	325.22	1.74	137.99	20.18	16.24		
4/26/11	1617	7.45	TB7-1-GW	TOLLWAY 849			5.80		0.08	0.02529			0.0106	7.44	523	1148	NA	0.04	0.58	0.22	207.05	0.93	98.44	35.25	23.23		
5/10/11	2103	7.32	TB7-1-GW	TOLLWAY 870			5.29		0.10	0.01202			0.0113	7.50	620	1373	NA	0.19	1.00	0.28	279.05		116.80	23.33	21.77		
5/24/11	1979	7.02	TB7-1-GW	TOLLWAY 899			5.34		0.09	0.00540			0.0114	7.21	554	1242	NA	0.06	0.73	0.21	241.08	2.25	115.12	29.22	26.79		
6/6/11	1947	7.13	TB7-1-GW	TOLLWAY 914			4.82		0.10	0.00195				7.31	646	1203	NA	0.20	0.92	0.18	182.10	0.09	110.43	19.65	18.34		
6/21/11	1831	7.23	TB7-1-GW	TOLLWAY 963			5.85		0.10	0.00291				7.44	604	1151	NA	0.14	0.99	0.15	179.94		95.15	23.09	18.45		
7/5/11	2432	7.41	TB7-1-GW	TOLLWAY 974			6.39		0.11	0.00176				7.22	686	1417	NA	0.24	1.02	0.28	268.00		123.00	29.40	26.30		
7/19/11	2598	7.36	TB7-1-GW	TOLLWAY 1002			6.32		0.12	0.00429				7.37	693	1307	NA	0.06	0.78	0.29	215.20		129.13	19.72	13.97		
8/1/11	1855	6.93	TB7-1-GW	TOLLWAY 1017			11.42		0.11	0.01928				7.17	626	1116	NA	0.38	7.62	0.52	139.99		39.39	129.65	97.87		
8/16/11	2203	7.42	TB7-1-GW	TOLLWAY 1063			9.31		0.11	0.00849				7.53	755	1342	NA	0.25	4.46	0.52	256.64		60.64	46.07	39.17		
				NA*= not enough sample for analysis																							
	min				NA	NA	4.18	NA	0.08	0.00176	NA	NA	0.0000	7.16	523	949	NA	0.01	0.10	0.15	109.93	0.00	39.39	11.96	5.85		
	max				NA	NA	11.42	NA	0.14	0.02529	NA	NA	0.0124	7.53	755	1664	NA	0.38	7.62	0.52	422.22	5.43	193.46	129.65	97.87		
	mean				NA	NA	5.87	NA	0.10	0.00911	NA	NA	0.0044	7.33	645	1304	NA	0.10	1.38	0.28	249.79	1.18	113.50	29.01	21.13		
8/30/10	1702	7.33	TB7-2-GW	TOLLWAY 666	NA*	NA*	5.50	NA*	0.09	NA*	NA*	NA*	NA*	7.23	465	633	NA	0.01	NA*	0.25	93.26	NA*	34.10	3.69	3.02		
9/14/10	1421	7.46	TB7-2-GW	TOLLWAY 688	NA*	NA*	5.91	NA*	0.10	0.00150	NA*	NA*	0.0085	7.39	453	729	NA	0.01	0.13	0.23	146.20	NA*	33.98	4.81	2.69		
9/27/10	1342	7.48	TB7-2-GW	TOLLWAY 692	NA*	NA*	5.63	NA*	0.11	NA*	NA*	NA*	0.0091	7.13	430	728	NA	0.01	NA*	0.24	151.67	0.93	40.14	7.15	NA*		
3/2/11	1368	8.27	TB7-2-GW	TOLLWAY 780			4.17		0.12					7.65	433	865	NA	0.01		0.18	143.82	2.95	144.58	7.95	3.26		
3/15/11	1267	7.87	TB7-2-GW	TOLLWAY 791			4.22		0.12					7.47	407	842	NA	0.01		0.19	120.76	7.15	139.73	5.53	3.72		
3/28/11	1334	7.83	TB7-2-GW	TOLLWAY 800			4.48		0.13					7.54	432	813	NA	0.01		0.19	125.13	5.65	134.10	3.87	3.57		
4/12/11	1289	7.82	TB7-2-GW	TOLLWAY 829			4.44		0.12					7.55	436	800	NA	0.01	0.05	0.19	111.78	7.34	117.49	4.41	4.11		
4/26/11	1097	7.48	TB7-2-GW	TOLLWAY 844			5.89		0.99				0.0101	7.74	309	648	NA	0.01	0.05	0.47	70.35		157.97	4.78	2.39		
5/10/11	1177	7.35	TB7-2-GW	TOLLWAY 871			4.64		0.10					7.73	401	704	NA	0.01	0.11	0.20	84.70	9.66	93.34	3.67	3.09		
5/24/11	1212	7.21	TB7-2-GW	TOLLWAY 900			4.79		0.10					7.55	426	724	NA	0.01		0.20	85.56	8.04	92.62	3.69	3.33		
6/6/11	752	7.23	TB7-2-GW	TOLLWAY 915			5.73		0.07					7.41	324	487	NA	0.01	0.09	0.20	35.13	6.15	38.36	4.76	4.31		
6/21/11	741	7.37	TB7-2-GW	TOLLWAY 964			5.91		0.09					7.63	415	580	NA	0.00	0.03	0.10	48.25	4.13	55.29	5.25	4.34		
7/5/11	1107	7.66	TB7-2-GW	TOLLWAY 975			5.70		0.09					7.45	449	635	NA	0.01		0.15	63.60	1.26	67.50	5.55	5.50		
7/19/11	988	7.59	TB7-2-GW	TOLLWAY 1003			7.43		0.09	0.03013			0.0107	7.58	415	557	NA	0.02		0.23	51.28	0.07	52.35	3.92	3.95		
8/1/11	974	7.36	TB7-2-GW	TOLLWAY 1018			6.45		0.09					7.31	422	577	NA	0.02	0.05	0.22	47.31	1.76	51.70	6.60	5.57		
8/16/11	1151	7.55	TB7-2-GW	TOLLWAY 1064			6.23		0.10					7.70	471	647	NA	0.02	0.29	0.29	66.89		67.42	5.65	5.58		
				NA*= not enough sample for analysis																							
	min				NA	NA	4.17	NA	0.07	0.00000	NA	NA	0.0000	7.13	309	487	NA	0.00	0.00	0.10	35.13	0.00	33.98	3.67	2.39		
	max				NA	NA	7.43	NA	0.99	0.03013	NA	NA	0.0107	7.74	471	865	NA	0.02	0.13	0.47	151.67	9.66	157.97	7.95	5.58		
	mean				NA	NA	5.44	NA	0.16	0.00226	NA	NA	0.0026	7.50	418	686	NA	0.01	0.04	0.22	90.36	3.94	82.54	5.08	3.89		
8/30/10	1160	7.28	TB7-3-GW	TOLLWAY 667	NA*	NA*	9.56	NA*	0.08	NA*	NA*	NA*	0.0076	7.29	536	627	NA	0.01	NA*	0.20	55.42	0.72	42.71	13.86	3.89		
9/14/10	1142	7.42	TB7-3-GW	TOLLWAY 689	NA*	NA*	NA*	NA*	NA*	NA*	NA*	NA*	NA*	7.43	510	NA*	NA	0.02	NA*	0.19	65.66	0.30	45.22	8.43	NA*		
9/27/10	1123	7.53	TB7-3-GW	TOLLWAY 693	NA*	NA*	9.42	NA*	0.07	NA*	NA*	NA*	NA*	7.26	499	650	NA	0.01	NA*	0.24	60.09	0.23	47.94	NA*	NA*		
3/15/11	996	8.01	TB7-3-GW	TOLLWAY 790			6.09		0.07					7.63	346	621	NA	0.02		0.18	72.91	11.53	62.20	4.14	3.36		
3/28/11	907	7.85	TB7-3-GW	TOLLWAY 801			6.47		0.06					7.73	360	526	NA	0.01		0.24	49.93	9.43	49.36	3.26	3.06		
4/12/11	933	7.87	TB7-3-GW	TOLLWAY 831			6.57		0.06					7.74	372	571	NA	0.01		0.19	38.23	14.06	46.64	3.81	3.33		
4/26/11	878	7.68	TB7-3-GW	TOLLWAY 851			5.75		0.06					7.67													

APPENDIX B-1: Results of Geochemical Analysis of Groundwater Samples

Date collected	Field conductivity	Field pH	Sample location	Sample ID	Al	As	B	Ba	Be	Ca	Cd	Co	Cr	Cu	Fe	K	Li	Mg	Mn	Mo	Na	Ni	P	Pb	S		
					mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L
				MDL:	0.037	0.108	0.023	0.00085	0.00055	0.012	0.012	0.013	0.0058	0.00079	0.0059	0.016	0.018	0.0025	0.0015	0.022	0.026	0.014	0.063	0.041	0.217		
8/30/10	893	7.40	TB7-4-GW	TOLLWAY 668	NA*	NA*	0.102	0.024	NA*	91.969	NA*	NA*	NA*	0.00135	0.0200	1.422	NA*	53.1189	0.0064	NA*	9.55	0.026	NA*	NA*	5.05		
3/15/11	670	8.30	TB7-4-GW	TOLLWAY 789			0.073	0.005		71.590				0.00099	0.0445	0.581		43.3209			6.21		0.135	NA*	8.17		
3/28/11	620	7.95	TB7-4-GW	TOLLWAY 802			0.074	0.004		65.929				0.00089		0.617		41.8226			6.59		0.127		6.18		
4/12/11	632	7.97	TB7-4-GW	TOLLWAY 832			0.080	0.004		66.430					0.1340	0.634		41.6106			6.64		0.087		4.94		
4/26/11	677	7.77	TB7-4-GW	TOLLWAY 852			0.070	0.009		69.611						0.790		42.2764			8.12		0.102		13.54		
5/10/11	655	7.53	TB7-4-GW	TOLLWAY 873			0.080	0.007		69.909				0.00099		0.539		41.0241			6.58		0.116		5.45		
5/24/11	680	7.41	TB7-4-GW	TOLLWAY 902			0.087	0.006		76.273						0.571		44.8024			6.54		0.102		5.91		
6/6/11	624	7.48	TB7-4-GW	TOLLWAY 917			0.089	0.008		71.090				0.00095		0.615		37.9615			6.91		0.159		5.75		
6/21/11	676	7.47	TB7-4-GW	TOLLWAY 966			0.098	0.008		79.728						0.489		45.0355			6.84		0.152		5.51		
7/5/11	702	7.69	TB7-4-GW	TOLLWAY 977			0.098	0.007		82.000						0.580		47.7000			8.46		0.187		5.42		
7/19/11	648	7.74	TB7-4-GW	TOLLWAY 1005			0.086	0.007		87.145				0.00117		0.808		50.9631			8.04		0.144		4.94		
8/1/11	719	7.47	TB7-4-GW	TOLLWAY 1020			0.117	0.011		85.154				0.00137		0.585		48.2025			7.93		0.180		4.69		
8/16/11	753	7.57	TB7-4-GW	TOLLWAY 1066			0.121	0.008		84.474						0.788		48.5037			8.13		0.152		4.64		
				NA*= not enough sample for analysis																							
				min	NA	NA	0.070	0.004	NA	65.929	NA	NA	NA	0.00000	0.0000	0.489	NA	37.9615	0.0000	NA	6.21	0.000	0.087	NA	4.64		
				max	NA	NA	0.121	0.024	NA	91.969	NA	NA	NA	0.00137	0.1340	1.422	NA	53.1189	0.0064	NA	9.55	0.026	0.187	NA	13.54		
				mean	NA	NA	0.090	0.008	NA	77.023	NA	NA	NA	0.00059	0.0153	0.694	NA	45.1032	0.0005	NA	7.43	0.002	0.137	NA	6.17		
4/26/11	17607	7.47	TB7B-5U	TOLLWAY 848			0.171	0.164		396.962				0.00195	0.0409	66.945		115.0758	3.2450		3391.63		0.123		330.22		
5/10/11	14488	7.48	TB7B-5U	TOLLWAY 868			0.156	0.100		219.966				0.00200	0.0383	53.181		63.4167	1.5138		3058.57		0.124	0.04	307.44		
5/24/11	19137	7.40	TB7B-5U	TOLLWAY 898			0.166	0.153		288.688				0.00140	0.1295	76.368		82.8922	1.8228		4032.86		0.177		281.99		
6/6/11	13466	7.21	TB7B-5U	TOLLWAY 912			0.163	0.092		144.954					0.1128	47.638		45.3293	0.9204		2759.53		0.106		186.41		
6/21/11	13565	7.39	TB7B-5U	TOLLWAY 962			0.176	0.162		191.949					0.1530	70.615		59.7149	1.3268		2739.25		0.134		213.38		
7/5/11	11161	7.56	TB7B-5U	TOLLWAY 973			0.185	0.255		215.000					0.1580	55.600		64.3000	1.4800		3000.00		0.119		302.00		
7/19/11	13214	7.59	TB7B-5U	TOLLWAY 1001			0.172	0.302		256.298					0.2224	66.839		80.6132	1.6520	0.023	2761.36		0.242		239.81		
8/1/11	10100	7.76	TB7B-5U	TOLLWAY 1021			0.183	0.127		120.163					0.1147	40.552		38.1742	0.7301	0.026	1895.57		0.154		188.37		
8/16/11	7793	7.83	TB7B-5U	TOLLWAY 1060			0.178	0.137		131.881					0.1025	43.535		41.5630	0.8300	0.028	1435.09		0.162		169.85		
				min	NA	NA	0.156	0.092	NA	120.163	NA	NA	NA	0.00000	0.0383	40.552	NA	38.1742	0.7301	0.000	1435.09	NA	0.106	0.00	169.85		
				max	NA	NA	0.185	0.302	NA	396.962	NA	NA	NA	0.00200	0.2224	76.368	NA	115.0758	3.2450	0.028	4032.86	NA	0.242	0.04	330.22		
				mean	NA	NA	0.172	0.166	NA	218.429	NA	NA	NA	0.00060	0.1191	57.919	NA	65.6755	1.5023	0.009	2785.98	NA	0.149	0.00	246.61		
3/15/11	24463	7.09	TB7B-5L-GW	TOLLWAY 795	0.085		0.157	1.465		524.493		0.04	0.00837	0.01544	0.2284	133.529		307.3852	11.0881		4707.92		0.393	0.07	631.85		
3/28/11	23399	6.80	TB7B-5L-GW	TOLLWAY 803			0.104	0.740		541.313		0.02				64.028		159.6027	11.2307		4761.13				313.23		
4/12/11	26197	7.76	TB7B-5L-GW	TOLLWAY 827			0.109	0.729		506.560		0.02			0.0290	61.734		155.5188	9.7561		5376.17		0.203		358.49		
5/10/11	--	7.04	TB7B-5L-GW	TOLLWAY 867			0.110	0.454		446.043		0.02			0.5524	38.004		138.0781	6.2568		3475.74		0.169		224.33		
5/24/11	21211	7.19	TB7B-5L-GW	TOLLWAY 897			0.124	0.489		401.744		0.02			0.4049	45.340		125.7201	7.0281		4230.34		0.112		276.55		
6/6/11	8687	7.22	TB7B-5L-GW	TOLLWAY 913			0.119	0.250		250.914					9.2787	19.862		80.5934	3.0994		1990.37		0.395		151.50		
6/21/11	14549	7.07	TB7B-5L-GW	TOLLWAY 961			0.120	0.217		250.023					9.3408	15.174		82.8757	2.2890		1691.26		0.461		139.81		
7/5/11	12307	7.12	TB7B-5L-GW	TOLLWAY 972			0.141	0.305		340.000		0.02			0.0920	26.600		97.8000	4.2600		2841.00		0.142		171.00		
8/1/11	11210	7.60	TB7B-5L-GW	TOLLWAY 1022			0.152	0.272		299.120					4.8726	24.074		94.7933	3.0537		2318.63		0.193		140.40		
8/16/11	13295	7.52	TB7B-5L-GW	TOLLWAY 1061			0.153	0.252		349.213		0.02			0.0406	22.460		109.7464	2.5000		2161.58		0.250		145.33		
				min	0.000	NA	0.104	0.217	NA	250.023	NA	0.00	0.00000	0.00000	0.0000	15.174	NA	80.5934	2.2890	NA	1691.26	NA	0.000	0.00	139.81		
				max	0.085	NA	0.157	1.465	NA	541.313	NA	0.04	0.00837	0.01544	9.3408	133.529	NA	307.3852	11.2307	NA	5376.17	NA	0.461	0.07	631.85		
				mean	0.008	NA	0.129	0.517	NA	390.942	NA	0.02	0.00084	0.00154	2.4839	45.080	NA	135.2114	6.0562	NA	3355.41	NA	0.232	0.01	255.25		
8/31/10	6789	7.38	TB15-1U-GW	TOLLWAY 673	NA*	NA*	0.153	0.192	NA*	425.872	NA*	NA*	NA*	0.00400	NA*	5.144	NA*	334.7560	0.0750	NA*	615.74	0.123	NA*	NA*	74.92		
1/4/11	5993	6.68	TB15-1U-GW	TOLLWAY 746	0.070		0.062	0.152		308.915					0.0349	2.566		422.0195	0.0068		571.75				57.67		
3/14/11	7929	7.47	TB15-1U-GW	TOLLWAY 785			0.080	0.184		424.274						2.144		362.4572			765.41		0.193		79.04		
3/28/11	7275	7.14	TB15-1U-GW	TOLLWAY 797			0.086	0.168		418.277					0.00178	2.433		365.2701	0.0042		759.70		0.140		82.69		
4/11/11	8384	7.64	TB15-1U-GW	TOLLWAY 819	0.892		0.094	0.173		437.911				0.00114	0.6080	4.644		371.5569	0.0601		637.69		0.124		77.53		
4/26/11	8185	7.14	TB15-1U-GW	TOLLWAY 842			0.083	0.166		401.194						2.012		345.0180			828.10		0.246		88.87		
5/10/11	8395	7.82	TB15-1U-GW	TOLLWAY 877			0.090	0.153		449.790						3.505		368.7431	0.0511		676.04		0.147		79.75		
5/24/11	8222	6.9	TB15-1U-GW	TOLLWAY 905			0.097																				

APPENDIX B-1: Results of Geochemical Analysis of Groundwater Samples

Date collected	Field		Sample location	Sample ID	Sb	Se	Si	Sn	Sr	Ti	TI	V	Zn	pH	alkalinity	TDS, 180 C	TSS	oPO <sub>4</sub> -P	NH <sub>3</sub> -N	F	Cl	NO <sub>3</sub> -N	SO <sub>4</sub>	total NVOC	dissolved NVOC		
	conductivity	Field pH		MDL:	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L		mg/L as CaCO <sub>3</sub>	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L		
8/30/10	893	7.40	TB7-4-GW	TOLLWAY 668	NA*	NA*	7.02	NA*	0.06	NA*	NA*	NA*	NA*	7.36	361	468	NA	0.01	NA*	0.12	13.40	17.74	13.95	3.89	2.12		
3/15/11	670	8.30	TB7-4-GW	TOLLWAY 789			4.52		0.04					7.66	255	384	NA	0.02		0.11	16.92	14.19	25.02	2.37	1.64		
3/28/11	620	7.95	TB7-4-GW	TOLLWAY 802			4.63		0.04					7.76	254	342	NA	0.01		0.11	15.84	12.68	18.74	1.65	1.61		
4/12/11	632	7.97	TB7-4-GW	TOLLWAY 832			4.71		0.04					7.82	251	370	NA	0.01	0.08	0.11	15.29	13.26	14.38	2.00	1.66		
4/26/11	677	7.77	TB7-4-GW	TOLLWAY 852			4.79		0.04					7.66	233	415	NA	0.01		0.12	17.82	19.08	39.22	2.45	2.31		
5/10/11	655	7.53	TB7-4-GW	TOLLWAY 873			5.07		0.04					7.89	246	380	NA	0.01	0.05	0.12	20.04	15.01	15.38	1.70	1.56		
5/24/11	680	7.41	TB7-4-GW	TOLLWAY 902			5.44		0.04					7.70	247	393	NA	0.01		0.09	23.88	19.33	17.45	2.00	1.69		
6/6/11	624	7.48	TB7-4-GW	TOLLWAY 917			5.53		0.04					7.57	260	354	NA	0.01	0.12	0.18	16.41	12.97	14.94	2.07	2.27		
6/21/11	676	7.47	TB7-4-GW	TOLLWAY 966			6.17		0.04					7.73	279	389	NA		0.09	16.08	14.96	15.00	2.80	2.11			
7/5/11	702	7.69	TB7-4-GW	TOLLWAY 977			6.43		0.05					7.58	297	395	NA	0.01		0.09	14.60	14.60	15.10	2.60	2.83		
7/19/11	648	7.74	TB7-4-GW	TOLLWAY 1005			6.26		0.05					7.69	291	407	NA	0.02		0.09	15.68	16.49	13.65	2.69	1.65		
8/1/11	719	7.47	TB7-4-GW	TOLLWAY 1020			7.44		0.06					7.37	333	430	NA	0.02		0.13	12.54	9.23	13.13	2.25	2.12		
8/16/11	753	7.57	TB7-4-GW	TOLLWAY 1066			7.25		0.06					7.45	343	413	NA	0.02		0.27	11.74	10.64	13.03	2.21	2.72		
				NA*= not enough sample for analysis																							
				min	NA	NA	4.52	NA	0.04	NA	NA	NA	NA	7.36	233	342	NA	0.00	0.00	0.09	11.74	9.23	13.03	1.65	1.56		
				max	NA	NA	7.44	NA	0.06	NA	NA	NA	NA	7.89	361	468	NA	0.02	0.12	0.27	23.88	19.33	39.22	3.89	2.83		
				mean	NA	NA	5.79	NA	0.05	NA	NA	NA	NA	7.63	281	395	NA	0.01	0.02	0.12	16.17	14.63	17.61	2.36	2.02		
4/26/11	17607	7.47	TB7B-5U	TOLLWAY 848			4.82		3.09				0.0149	7.64	225	10652	NA	0.01	0.28		5472.05	0.36	823.69	13.40	12.77		
5/10/11	14488	7.48	TB7B-5U	TOLLWAY 868			4.87		1.69		0.022		0.0121	7.80	245	8862	NA	0.02	0.64		4416.82	0.30	869.79	12.48	10.91		
5/24/11	19137	7.40	TB7B-5U	TOLLWAY 898			5.39		2.43		0.027		0.0119	7.61	218	11656	NA	0.02	0.84		6728.89	0.50	655.70	13.45	13.70		
6/6/11	13466	7.21	TB7B-5U	TOLLWAY 912			5.20		1.39		0.017			7.71	265	7884	NA	0.02	0.56		4187.45	0.12	474.35	15.98	15.20		
6/21/11	13565	7.39	TB7B-5U	TOLLWAY 962			5.92		1.97		0.025		0.0100	7.80	239	7813	NA	0.01	0.81		4151.64	0.36	576.72	16.63	14.80		
7/5/11	11161	7.56	TB7B-5U	TOLLWAY 973			5.44		2.09		0.019			7.64	254	8632	NA	0.02	0.15		4256.00	0.21	707.00	15.20	15.10		
7/19/11	13214	7.59	TB7B-5U	TOLLWAY 1001			5.11		2.55		0.029		0.0108	7.77	213	7604	NA	0.03	0.39		3876.07		672.61	11.62	12.18		
8/1/11	10100	7.76	TB7B-5U	TOLLWAY 1021			4.83		1.23					7.78	252	5445	NA	0.02	0.37	0.48	2609.26		538.45	15.01	14.44		
8/16/11	7793	7.83	TB7B-5U	TOLLWAY 1060			4.49		1.38					7.89	218	4347	NA	0.02	0.90	0.37	2037.73		488.57	12.10	13.16		
				min	NA	NA	4.49	NA	1.23	NA	0.000	NA	0.0000	7.61	213	4347	NA	0.01	0.15	0.00	2037.73	0.00	474.35	11.62	10.91		
				max	NA	NA	5.92	NA	3.09	NA	0.029	NA	0.0149	7.89	265	11656	NA	0.03	0.90	0.48	6728.89	0.50	869.79	16.63	15.20		
				mean	NA	NA	5.12	NA	1.98	NA	0.015	NA	0.0066	7.74	237	8099	NA	0.02	0.55	0.09	4192.88	0.21	645.21	13.99	13.58		
3/15/11	24463	7.09	TB7B-5L-GW	TOLLWAY 795		0.35	9.21		6.65		0.019		0.0890	7.68	271	30004	NA	0.02	1.37		7383.18		809.62	35.69	22.76		
3/28/11	23399	6.80	TB7B-5L-GW	TOLLWAY 803		0.16	6.31		3.56				0.0253	7.63	265	15520	NA	0.02	1.43		8391.14	0.14	893.91	NA*	NA*		
4/12/11	26197	7.76	TB7B-5L-GW	TOLLWAY 827		0.18	6.61		3.67				0.0237	7.53	258	15984	NA	0.02	1.58		8779.31		844.62	25.45	20.01		
5/10/11	--	7.04	TB7B-5L-GW	TOLLWAY 867			7.29		2.56		0.036		0.0309	7.43	378	11270	NA	0.02	0.68		5947.35	0.08	598.23	14.83	14.21		
5/24/11	21211	7.19	TB7B-5L-GW	TOLLWAY 897			7.93		2.77		0.028		0.0249	7.23	379	13180	NA	0.01	0.94		6917.38		651.70	26.88	21.01		
6/6/11	8687	7.22	TB7B-5L-GW	TOLLWAY 913			8.37		1.41				0.0134	7.15	537	6381	NA	0.21	1.21		3112.89		383.26	17.88	20.00		
6/21/11	14549	7.07	TB7B-5L-GW	TOLLWAY 961			8.19		1.27		0.021		0.0326	7.59	553	8422	NA	0.01	0.78		4301.54		455.51	20.44	15.75		
7/5/11	12307	7.12	TB7B-5L-GW	TOLLWAY 972			8.74		1.90				0.0155	7.33	568	8978	NA	0.02	0.87		4502.00		447.00	33.50	28.40		
8/1/11	11210	7.60	TB7B-5L-GW	TOLLWAY 1022			10.05		1.64				0.0128	7.29	659	6808	NA	0.03	0.80	0.25	3327.00		378.27	32.63	29.16		
8/16/11	13295	7.52	TB7B-5L-GW	TOLLWAY 1061		0.14	9.79		1.71		0.023		0.0242	7.61	583	6836	NA	0.03	1.10		3380.59		388.20	22.16	21.41		
				NA*= not enough sample for analysis																							
				min	NA	0.00	6.31	NA	1.27	NA	0.000	NA	0.0128	7.15	258	6381	NA	0.01	0.68	0.00	3112.89	0.00	378.27	14.83	14.21		
				max	NA	0.35	10.05	NA	6.65	NA	0.036	NA	0.0890	7.68	659	30004	NA	0.21	1.58	0.25	8779.31	0.14	893.91	35.69	29.16		
				mean	NA	0.08	8.25	NA	2.71	NA	0.013	NA	0.0292	7.45	445	12338	NA	0.04	1.08	0.03	5604.24	0.02	585.03	25.50	21.41		
8/31/10	6789	7.38	TB15-1U-GW	TOLLWAY 673	NA*	0.15	9.33	NA*	3.35	NA*	NA*	NA*	0.0120	7.56	422	4072	NA	0.05	0.11	0.40	2027.48	0.12	184.38	55.41	NA*		
1/4/11	5993	6.68	TB15-1U-GW	TOLLWAY 746			4.94		2.41				0.0098	7.67	215	3302	NA	0.01		0.35	1756.35		150.99	6.38	5.24		
3/14/11	7929	7.47	TB15-1U-GW	TOLLWAY 785		0.14	6.32		3.43		0.020		0.0193	7.42	331	4965	NA	0.02		0.10	2479.84		214.53	4.84	3.63		
3/28/11	7275	7.14	TB15-1U-GW	TOLLWAY 797			6.82		3.59				0.0118	7.31	334	4797	NA	0.01		0.27	2472.36		212.72	3.65	3.27		
4/11/11	8384	7.64	TB15-1U-GW	TOLLWAY 819			10.06		3.89	0.02642			0.0098	7.35	398	4338	NA	0.01	0.06	0.30	2410.62		207.10	11.84	3.96		
4/26/11	8185	7.14	TB15-1U-GW	TOLLWAY 842			6.24		3.36				0.0140	7.42	310	4702	NA	0.01			2530.03		243.54	5.26	4.87		
5/10/11	8395	7.82	TB15-1U-GW	TOLLWAY 877			7.14		3.54		0.024		0.0250	7.80	350	4270	NA	0.01	0.10	0.47	2451.97		219.91	6.52	2.79		
5/24/11	8222	6.9	TB15-1U-GW	TOLLWAY 905		0.13	6.49		3.51		0.021		0.0151	7.35	332	4497	NA	0.01			2521.46		226.31	3.95	3.23		

APPENDIX B-1: Results of Geochemical Analysis of Groundwater Samples

Date collected	Field conductivity	Field pH	Sample location	Sample ID	Al	As	B	Ba	Be	Ca	Cd	Co	Cr	Cu	Fe	K	Li	Mg	Mn	Mo	Na	Ni	P	Pb	S			
					mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L
					MDL:	0.037	0.108	0.023	0.00085	0.00055	0.012	0.012	0.013	0.0058	0.00079	0.0059	0.016	0.018	0.0025	0.0015	0.022	0.026	0.014	0.063	0.041	0.217		
8/31/10	8230	7.01	TB15-1L-GW	TOLLWAY 674	NA*	NA*	0.155	0.114	NA*	499.835	NA*	NA*	NA*	NA*	0.0298	8.079	NA*	381.8680	0.0100	NA*	649.79	0.131	NA*	NA*	86.96			
9/14/10	8119	7.66	TB15-1L-GW	TOLLWAY 684	NA*	NA*	0.161	0.120	NA*	554.696	NA*	NA*	NA*	NA*	0.0203	8.254	NA*	394.2274	0.0140	NA*	700.92	0.158	NA*	NA*	83.84			
9/28/10	7556	7.12	TB15-1L-GW	TOLLWAY 698	NA*	NA*	0.156	0.114	NA*	521.718	NA*	NA*	NA*	NA*	0.0293	7.887	NA*	373.4105	0.0117	NA*	676.23	0.131	NA*	NA*	79.43			
10/12/10	7382	8.05	TB15-1L-GW	TOLLWAY 707	NA*	NA*	0.142	0.112	NA*	474.701	NA*	NA*	NA*	NA*	0.0338	7.682	NA*	367.4713	0.0234	NA*	648.26	0.163	0.155	NA*	84.26			
10/26/10	7371	6.89	TB15-1L-GW	TOLLWAY 717	NA*	NA*	0.143	0.113	NA*	473.298	NA*	NA*	NA*	0.00092	0.1219	7.807	NA*	364.6740	0.0324	NA*	623.71	0.172	0.149	NA*	84.31			
11/9/10	7577	7.54	TB15-1L-GW	TOLLWAY 723	NA*	NA*	0.155	0.112	NA*	443.708	NA*	NA*	NA*	NA*	0.2086	7.946	NA*	337.3284	0.0485	NA*	583.22	0.142	0.169	NA*	84.31			
12/7/10	8176	6.43	TB15-1L-GW	TOLLWAY 729			0.131	0.108		454.482				0.00145	0.0292	7.442		349.6137	0.0246		657.91	0.153	0.130		89.56			
1/4/11	7872	6.50	TB15-1L-GW	TOLLWAY 745			0.104	0.110		483.626					0.0277	7.623		384.4231	0.0172		682.58				84.33			
1/19/11	7801	7.20	TB15-1L-GW	TOLLWAY 754			0.099	0.106		495.456				0.00104		6.183		394.1012	0.0107		667.26		0.075		83.89			
2/15/11	8278	7.22	TB15-1L-GW	TOLLWAY 765			0.082	0.100		465.843				0.00101		5.592		382.0105	0.0052		687.92				76.54			
3/2/11	8316	7.60	TB15-1L-GW	TOLLWAY 776			0.089	0.105		522.087				0.00327		5.981		414.6259	0.0107		694.87				84.78			
3/14/11	8255	7.40	TB15-1L-GW	TOLLWAY 786			0.087	0.101		487.214				0.00232		5.247		403.7784	0.0076		690.49			0.193	83.20			
3/28/11	8213	6.83	TB15-1L-GW	TOLLWAY 796			0.093	0.100		472.998				0.00138	0.0297	5.617		385.9073	0.0097		683.50			0.141	85.88			
4/11/11	8173	7.32	TB15-1L-GW	TOLLWAY 820	0.040		0.094	0.102		466.282				0.00268	0.0430	5.821		385.0070	0.0111		679.51			0.134	86.39			
4/26/11	8166	6.86	TB15-1L-GW	TOLLWAY 843			0.090	0.104		467.672						5.518		387.3392	0.0078		684.19			0.134	82.04			
5/10/11	8161	7.86	TB15-1L-GW	TOLLWAY 878			0.096	0.105		504.046				0.00111	0.0381	5.670		400.6494	0.0125		681.86			0.138	0.05	83.25		
5/24/11	8178	6.75	TB15-1L-GW	TOLLWAY 906			0.105	0.107		483.902				0.00108	0.0341	5.909		390.8040	0.0081		682.17			0.131	86.03			
6/8/11	8088	6.82	TB15-1L-GW	TOLLWAY 932			0.109	0.107		471.966					0.0584	5.715		376.2010	0.0168		686.85			0.196	89.76			
6/21/11	8062	6.87	TB15-1L-GW	TOLLWAY 958			0.112	0.104		510.700					0.0430	5.600		399.7997	0.0131		671.73			0.170	88.54			
7/7/11	8519	7.14	TB15-1L-GW	TOLLWAY 988			0.111	0.105		538.000					0.0280	6.240		409.0000	0.0087		673.00			0.189	83.20			
7/19/11	8315	7.00	TB15-1L-GW	TOLLWAY 1000	0.320		0.131	0.113		512.796				0.00267	0.3863	7.174		396.9078	0.0205		678.58			0.226	75.11			
8/3/11	8200	7.05	TB15-1L-GW	TOLLWAY 1034			0.122	0.107		482.880				0.00112		7.118		368.7867	0.0150		675.52			0.225	77.23			
8/16/11	7065	7.09	TB15-1L-GW	TOLLWAY 1057			0.140	0.105		474.087					0.0290	7.799		367.4722	0.0126		639.57			0.136	0.04	78.69		
					NA*= not enough sample for analysis																							
				min	0.000	NA	0.082	0.100	NA	443.708	NA	NA	NA	0.00000	0.0000	5.247	NA	337.3284	0.0052	NA	583.22	0.000	0.000	0.00	0.00	75.11		
				max	0.320	NA	0.161	0.120	NA	554.696	NA	NA	NA	0.00327	0.3863	8.254	NA	414.6259	0.0485	NA	700.92	0.172	0.226	0.05	0.05	89.76		
				mean	0.021	NA	0.118	0.108	NA	489.652	NA	NA	NA	0.00111	0.0518	6.691	NA	383.2786	0.0153	NA	669.55	0.046	0.135	0.01	0.01	83.55		
8/31/10	1427	7.48	TB15-2-GW	TOLLWAY 675	31.457	NA*	0.199	0.157	NA*	114.235	NA*	NA*	0.02344	0.01183	15.4342	9.345	NA*	76.9501	0.1838	NA*	29.76	0.059	0.084	NA*	NA*	50.49		
9/14/10	626	8.17	TB15-2-GW	TOLLWAY 685	NA*	NA*	NA*	NA*	NA*	NA*	NA*	NA*	NA*	NA*	NA*	NA*	NA*	NA*	NA*	NA*	NA*	NA*	NA*	NA*	NA*	NA*		
9/28/10	1432	7.41	TB15-2-GW	TOLLWAY 699	NA*	NA*	0.145	0.047	NA*	86.824	NA*	NA*	NA*	0.00130	0.0179	1.955	NA*	54.9097	0.0533	NA*	31.01	0.035	NA*	NA*	NA*	33.67		
3/14/11	1178	7.96	TB15-2-GW	TOLLWAY 787			0.077	0.060		89.889				0.00192		0.737		62.8041	0.0030		43.61			0.132		54.78		
3/28/11	1011	7.42	TB15-2-GW	TOLLWAY 794	0.051		0.089	0.058		94.146				0.00091	0.0735	0.973		68.7669			33.30			0.121		52.71		
4/11/11	1068	7.96	TB15-2-GW	TOLLWAY 821			0.091	0.060		97.701						0.870		72.7504	0.0031		33.61			0.093		53.81		
4/26/11	1059	7.60	TB15-2-GW	TOLLWAY 844			0.090	0.060		93.911					0.0356	0.632		69.3713			37.60			0.124		56.55		
5/10/11	1072	8.60	TB15-2-GW	TOLLWAY 879	0.082		0.095	0.058		93.768				0.00154	0.0787	0.648		68.7010			37.41			0.121		55.74		
5/24/11	1120	7.40	TB15-2-GW	TOLLWAY 907			0.110	0.062		106.275				0.00093		0.782		77.8278			31.95			0.115		56.26		
6/8/11	1061	7.31	TB15-2-GW	TOLLWAY 933	0.461		0.123	0.062		96.114				0.00120	0.3372	0.742		72.0594	0.0055		50.30			0.202		67.05		
6/21/11	1112	7.36	TB15-2-GW	TOLLWAY 959			0.120	0.059		105.953					1.071			76.0448	0.0091		28.41			0.170		56.43		
8/3/11	637	7.77	TB15-2-GW	TOLLWAY 1037	5.137		0.086	0.081		74.988				0.00429	2.9362	2.904		47.9376	0.0276		28.19			0.175		28.75		
8/16/11	1037	7.90	TB15-2-GW	TOLLWAY 1058	0.515		0.149	0.069		97.504					0.3234	1.349		68.1557	0.0061		29.62			0.125		43.18		
					NA*= not enough sample for analysis																							
				min	0.000	NA	0.077	0.047	0.00	74.988	NA	NA	0.00000	0.00000	0.0000	0.632	NA	47.9376	0.0000	NA	28.19	0.000	0.084	NA	NA	28.75		
				max	31.457	NA	0.199	0.157	0.00	114.235	NA	NA	0.02344	0.01183	15.4342	9.345	NA	77.8278	0.1838	NA	50.30	0.059	0.202	NA	NA	67.05		
				mean	3.428	NA	0.115	0.069	0.00	95.942	NA	NA	0.00213	0.00199	1.6031	1.834	NA	68.0232	0.0243	NA	34.56	0.008	0.133	NA	NA	50.79		
8/31/10	1220	7.56	TB15-3-GW	TOLLWAY 676	0.264	NA*	0.168	0.079	NA*	118.800	NA*	NA*	NA*	0.00229	0.5855	2.126	NA*	76.3962	0.0182	NA*	35.51	0.032	NA*	NA*	NA*	32.63		
9/14/10	915	7.79	TB15-3-GW	TOLLWAY 686	NA*	NA*	0.144	0.058	NA*	90.992	NA*	NA*	NA*	0.00233	0.0264	1.702	NA*	57.6489	0.0061	NA*	32.85	0.035	NA*	NA*	NA*	25.32		
9/28/10	1118	7.41	TB15-3-GW	TOLLWAY 700	NA*	NA*	0.174	0.063	NA*	135.100	NA*	NA*	NA*	NA*	0.4256	2.756	NA*	83.3035	0.1319	NA*	37.05	0.035	NA*	NA*	NA*	46.19		
10/12/10	2021	8.30	TB15-3-GW	TOLLWAY 708	NA*	NA*	NA*	NA*	NA*	NA*	NA*	NA*	NA*	NA*	NA*	NA*	NA*	NA*	NA*	NA*	NA*	NA*	NA*	NA*	NA*	NA*		
12/7/10	868	4.03	TB15-3-GW																									

APPENDIX B-1: Results of Geochemical Analysis of Groundwater Samples

Date collected	Field		Sample location	Sample ID	Sb	Se	Si	Sn	Sr	Ti	Tl	V	Zn	pH	alkalinity	TDS, 180 C	TSS	oPO <sub>4</sub> -P	NH <sub>3</sub> -N	F	Cl	NO <sub>3</sub> -N	SO <sub>4</sub>	total NVOC	dissolved NVOC	
	conductivity	Field pH			mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L as CaCO <sub>3</sub>	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L
MDL:				0.059	0.131	0.066	0.086	0.00037	0.00056	0.017	0.047	0.0073			4	12	3.0	0.01	0.06	0.08	0.09	0.07	0.31	0.31	0.31	
8/31/10	8230	7.01	TB15-1L-GW	TOLLWAY 674	NA*	NA*	9.91	NA*	3.96	NA*	0.024	NA*	0.0154	7.26	366	4945	NA	0.01	NA*	0.31	2549.31	NA*	220.59	2.96	2.87	
9/14/10	8119	7.66	TB15-1L-GW	TOLLWAY 684	NA*	0.16	9.94	NA*	3.96	NA*	0.027	NA*	0.0108	7.13	362	4685	NA	0.02	NA*	0.28	2567.70	NA*	217.07	4.23	2.59	
9/28/10	7556	7.12	TB15-1L-GW	TOLLWAY 698	NA*	NA*	9.53	NA*	3.80	NA*	NA*	NA*	0.0135	7.20	366	4392	NA	0.02	NA*	0.36	2561.18	NA*	219.99	3.83	2.74	
10/12/10	7382	8.05	TB15-1L-GW	TOLLWAY 707	NA*	0.13	9.27	NA*	3.83	NA*	NA*	NA*	0.0087	7.39	361	5205	NA	0.01	0.03	0.11	2475.20	NA*	213.01	9.76	2.49	
10/26/10	7371	6.89	TB15-1L-GW	TOLLWAY 717	NA*	0.16	9.13	NA*	3.88	NA*	NA*	NA*	0.0095	7.37	345	4944	NA	0.01	NA*	0.16	2423.77	NA*	221.21	4.43	2.96	
11/9/10	7577	7.54	TB15-1L-GW	TOLLWAY 723	NA*	0.14	9.28	NA*	3.81	NA*	NA*	NA*	0.0081	7.44	350	4275	NA	0.02	NA*	0.27	2370.71	NA*	212.73	4.36	3.04	
12/7/10	8176	6.43	TB15-1L-GW	TOLLWAY 729		0.22	8.34		3.78		0.019		0.0166	7.22	342	4687	NA	0.02		0.18	2533.33		227.66	4.92	2.35	
1/4/11	7872	6.50	TB15-1L-GW	TOLLWAY 745			8.64		4.05				0.0086	7.22	351	4682	NA	0.01	0.03	0.14	2435.39		215.36	2.67	2.08	
1/19/11	7801	7.20	TB15-1L-GW	TOLLWAY 754			8.24		3.96		0.028			7.36	361	4929	NA	0.01		0.11	2638.03		233.59	2.87	1.91	
2/15/11	8278	7.22	TB15-1L-GW	TOLLWAY 765			7.50		3.73				0.0192	7.23	349	4979	NA	0.01		0.46	2618.12		210.48	4.01	2.87	
3/2/11	8316	7.60	TB15-1L-GW	TOLLWAY 776		0.15	7.86		3.93				0.0193	7.27	365	5235	NA	0.01		0.24	2619.37		233.18	4.31	2.78	
3/14/11	8255	7.40	TB15-1L-GW	TOLLWAY 786		0.20	7.89		3.89		0.029		0.0137	7.13	368	5033	NA	0.02		0.19	2557.62		220.52	11.03	2.58	
3/28/11	8213	6.83	TB15-1L-GW	TOLLWAY 796			8.09		3.92		0.035		0.0102	7.10	354	4845	NA	0.01		0.26	2555.18		223.81	2.72	2.64	
4/11/11	8173	7.32	TB15-1L-GW	TOLLWAY 820		0.20	8.21		4.00				0.0196	7.13	354	4941	NA	0.02	0.05	0.29	2517.55		225.24	5.37	2.47	
4/26/11	8166	6.86	TB15-1L-GW	TOLLWAY 843			7.68		3.79				0.0100	7.25	358	4933	NA	0.01	0.11		2514.44		223.53	5.23	2.43	
5/10/11	8161	7.86	TB15-1L-GW	TOLLWAY 878			8.21		3.84		0.028		0.0159	7.50	359	4675	NA	0.01	0.07	0.62	2527.25	0.08	221.21	3.55	1.91	
5/24/11	8178	6.75	TB15-1L-GW	TOLLWAY 906			8.64		3.96					7.27	355	4667	NA	0.01			2484.70		225.29	2.34	2.12	
6/8/11	8088	6.82	TB15-1L-GW	TOLLWAY 932		0.14	8.61		3.88		0.031			7.23	357	4640	NA	0.01	0.11		2500.50		198.53	3.24	2.53	
6/21/11	8062	6.87	TB15-1L-GW	TOLLWAY 958		0.15	8.89		3.83		0.042			7.22	356	4601	NA	0.01		0.11	2476.19		227.59	3.41	2.62	
7/7/11	8519	7.14	TB15-1L-GW	TOLLWAY 988		0.18	8.78		3.82					7.23	366	4971	NA	0.02			2439.00		210.00	7.56	2.86	
7/19/11	8315	7.00	TB15-1L-GW	TOLLWAY 1000		0.14	9.78		3.86	0.00786	0.026			7.30	363	4506	NA	0.04			2484.00		211.78	5.71	2.39	
8/3/11	8200	7.05	TB15-1L-GW	TOLLWAY 1034		0.22	9.68		3.69					7.22	357	4227	NA	0.02		0.31	2347.97		209.44	3.25	2.58	
8/16/11	7065	7.09	TB15-1L-GW	TOLLWAY 1057		0.15	9.78		3.76				0.0110	7.15	359	4402	NA	0.03		0.23	2326.80		213.15	3.41	2.65	
NA*= not enough sample for analysis																										
				min	NA	0.00	7.50	NA	3.69	0.00000	0.000	NA	0.0000	7.10	342	4227	NA	0.01	0.00	0.00	2326.80	0.00	198.53	2.34	1.91	
				max	NA	0.22	9.94	NA	4.05	0.00786	0.042	NA	0.0196	7.50	368	5235	NA	0.04	0.11	0.62	2638.03	0.08	233.59	11.03	3.04	
				mean	NA	0.11	8.78	NA	3.87	0.00046	0.015	NA	0.0091	7.25	358	4756	NA	0.02	0.02	0.20	2501.01	0.00	218.91	4.57	2.54	
8/31/10	1427	7.48	TB15-2-GW	TOLLWAY 675	NA*	NA*	85.69	NA*	1.10	0.54736	NA*	NA*	0.0594	7.55	377	1150	NA	0.01	0.09	0.60	61.32	0.08	139.21	15.63	7.16	
9/14/10	626	8.17	TB15-2-GW	TOLLWAY 685	NA*	NA*	NA*	NA*	NA*	NA*	NA*	NA*	NA*	7.59	267	NA*	NA	0.01	0.12	0.64	31.90	0.15	54.63	36.61	NA*	
9/28/10	1432	7.41	TB15-2-GW	TOLLWAY 699	NA*	NA*	8.10	NA*	0.82	NA*	NA*	NA*	NA*	7.90	319	597	NA	0.02	0.18	0.72	62.81	0.15	101.94	NA*	NA*	
3/14/11	1178	7.96	TB15-2-GW	TOLLWAY 787			5.47		0.89				0.0169	7.70	312	630	NA	0.01		0.47	70.87		158.61	7.82	3.65	
3/28/11	1011	7.42	TB15-2-GW	TOLLWAY 794			6.30		1.01	0.00148				7.70	322	633	NA	0.01		0.48	67.71		155.08	4.02	2.29	
4/11/11	1068	7.96	TB15-2-GW	TOLLWAY 821			6.47		1.06	0.00060				7.78	331	678	NA	0.03		0.44	69.55		153.54	4.63	2.95	
4/26/11	1059	7.60	TB15-2-GW	TOLLWAY 844			5.89		0.99				0.0101	7.74	309	648	NA	0.01	0.05	0.47	70.35		157.97	4.78	2.39	
5/10/11	1072	8.60	TB15-2-GW	TOLLWAY 879			6.18		0.97	0.00134			0.0164	7.92	320	656	NA	0.01	0.24	0.51	70.67		159.71	3.58	2.13	
5/24/11	1120	7.40	TB15-2-GW	TOLLWAY 907			7.03		1.10				0.0098	7.73	340	685	NA	0.01		0.50	74.05		160.65	3.92	2.09	
6/8/11	1061	7.31	TB15-2-GW	TOLLWAY 933			7.11		0.95	0.01547				7.68	284	725	NA	0.02	0.11	0.56	72.64		170.91	4.26	3.14	
6/21/11	1112	7.36	TB15-2-GW	TOLLWAY 959			7.42		1.10				0.0139	7.82	372	717	NA	0.01	0.40	0.30	73.93	0.09	152.29	7.28	NA*	
8/3/11	637	7.77	TB15-2-GW	TOLLWAY 1037			19.65		0.64	0.18511			0.0178	7.68	266	507	NA	0.06		0.59	40.29		79.29	15.54	6.10	
8/16/11	1037	7.90	TB15-2-GW	TOLLWAY 1058			9.46		0.98	0.01751			0.0141	7.58	345	617	NA	0.03		0.61	60.08		124.05	7.18	4.58	
NA*= not enough sample for analysis																										
				min	NA	NA	5.47	NA	0.64	0.00000	NA	NA	0.0000	7.55	266	507	NA	0.01	0.00	0.30	31.90	0.00	54.63	3.58	2.09	
				max	NA	NA	85.69	NA	1.10	0.54736	NA	NA	0.0594	7.92	377	1150	NA	0.06	0.40	0.72	74.05	0.15	170.91	36.61	7.16	
				mean	NA	NA	14.56	NA	0.97	0.06990	NA	NA	0.0144	7.72	320	687	NA	0.02	0.09	0.53	63.55	0.04	135.99	9.60	3.65	
8/31/10	1220	7.56	TB15-3-GW	TOLLWAY 676	NA*	NA*	10.66	NA*	1.23	0.00790	NA*	NA*	0.0187	7.61	399	923	NA	0.04	NA*	0.49	119.83	0.10	96.67	4.20	3.98	
9/14/10	915	7.79	TB15-3-GW	TOLLWAY 686	NA*	NA*	8.41	NA*	0.88	NA*	NA*	NA*	NA*	7.55	314	625	NA	0.01	NA*	0.52	101.77	NA*	90.36	4.97	2.66	
9/28/10	1118	7.41	TB15-3-GW	TOLLWAY 700	NA*	NA*	10.81	NA*	1.45	NA*	NA*	NA*	0.0077	7.34	376	751	NA	0.01	0.71	0.52	144.12	NA*	124.26	9.22	2.73	
10/12/10	2021	8.30	TB15-3-GW	TOLLWAY 708	NA*	NA*	NA*	NA*	NA*	NA*	NA*	NA*	NA*	7.70	381	NA*	NA	0.05	NA*	NA*	NA*	NA*	NA*	2.73	NA*	
12/7/10	868	4.03	TB15-3-GW	TOLLWAY 730			8.58		0.35																	

APPENDIX B-1: Results of Geochemical Analysis of Groundwater Samples

Date collected	Field conductivity	Field pH	Sample location	Sample ID	Al	As	B	Ba	Be	Ca	Cd	Co	Cr	Cu	Fe	K	Li	Mg	Mn	Mo	Na	Ni	P	Pb	S	
				MDL:	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L
3/2/11	4361	7.78	TB15-4U-GW	TOLLWAY 774			0.086	0.151		149.058				0.00552	0.0093	24.511		43.3753	0.1641		747.08					49.55
3/14/11	4493	7.01	TB15-4U-GW	TOLLWAY 781			0.146	0.174		149.486				0.00755		38.476		42.9094	0.1803		568.26		0.184			33.87
3/28/11	2980	7.51	TB15-4U-GW	TOLLWAY 798			0.179	0.147		129.820				0.00779		38.910		36.9415	0.1170		468.80		0.144			30.93
4/12/11	3074	8.27	TB15-4U-GW	TOLLWAY 823			0.202	0.160		131.380				0.00833		43.203		36.8266	0.1054		442.67		0.125			31.50
4/26/11	1028	7.60	TB15-4U-GW	TOLLWAY 841		0.975	0.105	0.045		37.384				0.01004	0.8574	16.772		9.1920	0.0075		143.00		0.147			10.04
5/10/11	3012	8.07	TB15-4U-GW	TOLLWAY 876		0.196	0.206	0.159		124.698				0.00877	0.1990	39.474		35.5291	0.6038		486.76		0.165	0.05		32.75
5/24/11	2310	7.04	TB15-4U-GW	TOLLWAY 904			0.194	0.135		112.062				0.01107	0.0337	30.884		28.4961	0.1468		370.24		0.112			23.57
6/8/11	1987	6.75	TB15-4U-GW	TOLLWAY 928			0.215	0.126		103.202				0.00774		32.241		24.3546	0.2369		299.08		0.211			22.39
6/21/11	2051	7.00	TB15-4U-GW	TOLLWAY 956			0.201	0.125		112.225				0.00603	0.0412	27.817		26.2698	0.4301		288.86		0.191			21.32
7/7/11	2889	7.24	TB15-4U-GW	TOLLWAY 987			0.258	0.179		141.000				0.00341	0.1180	37.800		36.0000	1.0300		449.00		0.172			27.50
7/19/11	3325	7.16	TB15-4U-GW	TOLLWAY 998			0.266	0.180		128.302				0.00488	0.1838	39.976		37.2088	1.3076		524.46		0.196			26.52
8/3/11	1309	7.22	TB15-4U-GW	TOLLWAY 1032			0.208	0.095		87.217				0.00789	0.0297	21.627		19.5482	0.3404		168.12		0.211			19.07
8/16/11	1456	7.26	TB15-4U-GW	TOLLWAY 1055			0.243	0.110		101.798				0.00269	0.0268	27.519		23.7550	0.7155		186.21		0.185			17.76
				min	0.000	NA	0.086	0.045	NA	37.384	NA	NA	NA	0.00269	0.0000	16.772	NA	9.1920	0.0075	NA	143.00	NA	0.000	0.00		10.04
				max	0.975	NA	0.266	0.180	NA	149.486	NA	NA	NA	0.01107	0.8574	43.203	NA	43.3753	1.3076	NA	747.08	NA	0.211	0.05		49.55
				mean	0.090	NA	0.193	0.137	NA	115.972	NA	NA	NA	0.00705	0.1153	32.247	NA	30.8005	0.4143	NA	395.58	NA	0.157	0.00		26.67
2/15/11	7443	7.23	TB15-4L-GW	TOLLWAY 764			0.133	0.394		587.508				0.00272		7.644		450.6813	0.2098		277.26		0.088			74.70
3/14/11	7855	6.89	TB15-4L-GW	TOLLWAY 783			0.138	0.353		629.370		0.01		0.00157		7.018	0.11	482.7272	0.1218		308.84		0.166			80.13
3/28/11	7955	7.22	TB15-4L-GW	TOLLWAY 734			0.147	0.356		616.232				0.00197		7.293		465.6494	0.1532		293.85		0.161			79.24
4/12/11	7962	7.78	TB15-4L-GW	TOLLWAY 824			0.149	0.361		606.199				0.00153	0.0996	7.308		479.5273	0.1872		299.40		0.160			80.38
4/26/11	7872	7.07	TB15-4L-GW	TOLLWAY 840			0.139	0.370		590.396		0.02		0.00159	0.2037	7.211	0.11	465.7651	0.2274		292.81		0.132			74.33
5/10/11	7955	8.02	TB15-4L-GW	TOLLWAY 875			0.142	0.346		635.820				0.00251	0.3625	7.059	0.11	471.9115	0.2299		290.68		0.151			75.29
5/24/11	8034	6.77	TB15-4L-GW	TOLLWAY 903			0.147	0.326		630.414				0.00253	0.0407	7.329	0.11	475.4913	0.1824		300.83		0.134			76.82
6/8/11	8088	6.70	TB15-4L-GW	TOLLWAY 929			0.157	0.349		615.843				0.00225		7.797	0.11	457.6402	0.1580		305.07		0.179			81.14
6/21/11	8231	6.71	TB15-4L-GW	TOLLWAY 955			0.162	0.328		708.540				0.00175		7.439	0.11	512.0508	0.1156		309.90		0.194			83.37
7/7/11	8391	7.34	TB15-4L-GW	TOLLWAY 986			0.161	0.327		707.000		0.01		0.00223		8.090		508.0000	0.1050		307.00		0.216			76.60
7/19/11	8378	7.08	TB15-4L-GW	TOLLWAY 999			0.174	0.325		667.449				0.00438		8.604	0.13	499.4884	0.0812		316.03		0.191			74.32
8/3/11	8494	7.04	TB15-4L-GW	TOLLWAY 1033			0.181	0.338		662.562				0.00342		8.958	0.13	487.5936	0.0866		330.02		0.189			75.98
8/16/11	8467	6.82	TB15-4L-GW	TOLLWAY 1054			0.191	0.344		664.058				0.00199		9.975	0.13	498.2143	0.0969		322.93		0.206			75.23
				min	NA	NA	0.133	0.325	NA	587.508	NA	0.00	NA	0.00153	0.0000	7.018	0.00	450.6813	0.0812	NA	277.26	NA	0.088	NA		74.32
				max	NA	NA	0.191	0.000	NA	708.540	NA	0.02	NA	0.00438	0.3625	9.975	0.13	512.0508	0.2299	NA	330.02	NA	0.216	NA		83.37
				mean	NA	NA	0.156	0.347	NA	640.107	NA	0.00	NA	0.00234	0.0543	7.825	0.08	481.1339	0.1504	NA	304.20	NA	0.167	NA		77.50

APPENDIX B-1: Results of Geochemical Analysis of Groundwater Samples

Date collected	Field conductivity	Field pH	Sample location	Sample ID	Sb mg/L	Se mg/L	Si mg/L	Sn mg/L	Sr mg/L	Ti mg/L	Tl mg/L	V mg/L	Zn mg/L	pH	alkalinity mg/L as CaCO <sub>3</sub>	TDS, 180 C mg/L	TSS mg/L	oPO <sub>4</sub> -P mg/L	NH <sub>3</sub> -N mg/L	F mg/L	Cl mg/L	NO <sub>3</sub> -N mg/L	SO <sub>4</sub> mg/L	total NVOC mg/L	dissolved NVOC mg/L	
				MDL:	0.059	0.131	0.066	0.086	0.00037	0.00056	0.017	0.047	0.0073		4	12	3.0	0.01	0.06	0.08	0.09	0.07	0.31	0.31	0.31	
3/2/11	4361	7.78	TB15-4U-GW	TOLLWAY 774			3.78		0.56					7.62	322	2595	NA	0.03	0.38	0.15	1246.16	1.16	134.75	15.91	14.93	
3/14/11	4493	7.01	TB15-4U-GW	TOLLWAY 781			4.37		0.49					7.42	342	2020	NA	0.03	1.30	0.11	872.40	0.73	90.87	20.31	21.22	
3/28/11	2980	7.51	TB15-4U-GW	TOLLWAY 798			4.36		0.42					7.43	345	1839	NA	0.02	1.14	0.21	799.68	2.08	89.57	17.70	19.11	
4/12/11	3074	8.27	TB15-4U-GW	TOLLWAY 823			5.07		0.43					7.37	371	1678	NA	0.03	0.74	0.20	671.86	6.18	87.08	17.93	18.11	
4/26/11	1028	7.60	TB15-4U-GW	TOLLWAY 841			5.07		0.10	0.02141				7.65	283	567	NA	0.04	0.12	0.34	118.16	0.60	30.07	22.32	14.84	
5/10/11	3012	8.07	TB15-4U-GW	TOLLWAY 876			6.30		0.38	0.00513	0.026		0.0125	7.67	462	1738	NA	0.03	1.96	0.25	661.56	0.32	86.89	25.37	26.14	
5/24/11	2310	7.04	TB15-4U-GW	TOLLWAY 904			5.91		0.33					7.42	396	1322	NA	0.03	0.56	0.18	480.81	1.27	64.49	17.35	16.05	
6/8/11	1987	6.75	TB15-4U-GW	TOLLWAY 928			6.12		0.30					7.53	435	1126	NA	0.03	0.61	0.23	342.98	0.35	60.21	18.09	18.00	
6/21/11	2051	7.00	TB15-4U-GW	TOLLWAY 956			6.60		0.30		0.020			7.40	429	1232	NA	0.03	0.54	0.19	388.41	0.47	57.78	19.46	14.58	
7/7/11	2889	7.24	TB15-4U-GW	TOLLWAY 987			8.48		0.41					7.36	470	1642	NA	0.03	0.72	0.14	599.00	0.10	69.60	25.70	24.70	
7/19/11	3325	7.16	TB15-4U-GW	TOLLWAY 998			9.08		0.40					7.35	441	1831	NA	0.04	0.88	0.39	750.37	0.14	70.90	20.97	19.92	
8/3/11	1309	7.22	TB15-4U-GW	TOLLWAY 1032			6.77		0.23					7.38	332	771	NA	0.03	0.25	0.35	188.49	0.09	53.77	21.66	22.36	
8/16/11	1456	7.26	TB15-4U-GW	TOLLWAY 1055			7.46		0.27					7.31	409	876	NA	0.03	0.28	0.46	199.03		48.67	24.03	23.07	
				min	NA	NA	3.78	NA	0.10	0.00000	0.000	NA	0.0000	7.31	283	567	NA	0.02	0.12	0.11	118.16	0.00	30.07	15.91	14.58	
				max	NA	NA	9.08	NA	0.56	0.02141	0.026	NA	0.0125	7.67	470	2595	NA	0.04	1.96	0.46	1246.16	6.18	134.75	25.70	26.14	
				mean	NA	NA	6.11	NA	0.36	0.00204	0.004	NA	0.0010	7.45	387	1480	NA	0.03	0.73	0.25	562.99	1.04	72.67	20.52	19.46	
2/15/11	7443	7.23	TB15-4L-GW	TOLLWAY 764			7.55		6.26				2.7772	7.57	288	5582	NA	0.01		0.33	2427.76		207.73	NA*	NA*	
3/14/11	7855	6.89	TB15-4L-GW	TOLLWAY 783			8.18		6.63		0.020		0.7294	7.18	302	5013	NA	0.02		0.23	2493.66		214.78	6.65	6.71	
3/28/11	7955	7.22	TB15-4L-GW	TOLLWAY 734			8.39		6.64		0.038		0.6810	7.18	302	4835	NA	0.02		0.29	2543.06		210.74	6.36	6.78	
4/12/11	7962	7.78	TB15-4L-GW	TOLLWAY 824			8.63		6.78				0.4675	7.11	299	4370	NA	0.01	0.03	0.30	2507.81		207.17	4.96	4.90	
4/26/11	7872	7.07	TB15-4L-GW	TOLLWAY 840			8.13		6.79				0.3398	7.21	300	4930	NA	0.01	0.04		2433.18		203.43	5.46	4.81	
5/10/11	7955	8.02	TB15-4L-GW	TOLLWAY 875			8.48		6.45		0.031		0.3532	7.38	297	4398	NA	0.01	0.08		2502.92		192.85	4.46	4.40	
5/24/11	8034	6.77	TB15-4L-GW	TOLLWAY 903			8.61		6.47		0.019		0.2347	7.22	296	4395	NA	0.01			2474.48		199.46	4.67	3.95	
6/8/11	8088	6.70	TB15-4L-GW	TOLLWAY 929		0.14	8.81		6.37		0.019		0.2021	7.27	295	4263	NA	0.02	0.14		2452.95		199.61	4.99	4.14	
6/21/11	8231	6.71	TB15-4L-GW	TOLLWAY 955			9.15		6.71		0.031		0.1876	7.18	300	4345	NA	0.01		0.11	2532.35		202.53	4.31	4.23	
7/7/11	8391	7.34	TB15-4L-GW	TOLLWAY 986			9.00		6.60		0.019		0.1780	7.21	296	4431	NA	0.02			2468.00		201.00	5.35	4.89	
7/19/11	8378	7.08	TB15-4L-GW	TOLLWAY 999			9.42		6.68				0.1647	7.17	298	4346	NA	0.02			2527.61		204.99	3.50	3.41	
8/3/11	8494	7.04	TB15-4L-GW	TOLLWAY 1033			10.00		6.61				0.1663	7.19	298	4271	NA	0.02		0.35	2518.97		200.80	3.77	4.42	
8/16/11	8467	6.82	TB15-4L-GW	TOLLWAY 1054			10.13		6.67				0.1527	7.16	301	4690	NA	0.03		0.35	2529.65		202.67	3.99	4.08	
				NA*= not enough sample for analysis																						
				min	NA	0.00	7.55	NA	6.26	NA	0.000	NA	0.1527	7.11	288	4263	NA	0.01	0.00	0.00	2427.76	NA	192.85	3.50	3.41	
				max	NA	0.23	10.13	NA	6.79	NA	0.038	NA	2.7772	7.57	302	5582	NA	0.03	0.14	0.35	2543.06	NA	214.78	6.65	6.78	
				mean	NA	0.03	8.81	NA	6.59	NA	0.014	NA	0.5103	7.23	298	4605	NA	0.02	0.02	0.15	2493.26	NA	203.67	4.87	4.73	

APPENDIX B-2: Results of Geochemical Analysis of Groundwater Samples

Date collected	Time collected (CST)	Field conductivity (uS/cm)	Field pH	Sample location	Sample ID	Al	As	B	Ba	Be	Ca	Cd	Co	Cr	Cu	Fe	K	Li	Mg	Mn	Mo	Na	Ni	P	Pb	S	
						mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L
						MDL:	0.037	0.108	0.023	0.00085	0.00055	0.012	0.012	0.013	0.0058	0.00079	0.0059	0.016	0.018	0.0025	0.0015	0.022	0.026	0.014	0.063	0.041	0.217
						Class 2 Groundwater Standards (mg/L)		0.2	2.0	2.0	0.5	0.05	1.0	1.0	0.65	5.0				10.0			2.0			0.1	
8/16/11	12:30:00 PM	2203	7.42	TB7B-1	TOLLWAY 1063	0.221		0.146	0.0462		52.95					14.264	8.82		15.669	0.4007	0.036	410.08		0.520		21.72	
8/31/11	14:02:00 PM	2038	7.12	TB7B-1	TOLLWAY 1099	0.606		0.140	0.0473		45.74					16.146	7.27		13.865	0.2849		323.66		0.222		24.72	
9/13/11	12:39:00 PM	2479	8.46	TB7B-1	TOLLWAY 1120	0.851		0.136	0.0587		58.60					15.325	7.76		16.821	0.3860	0.024	415.51		0.257		38.90	
9/28/11	16:54:00 PM	1866	7.95	TB7B-1	TOLLWAY 1142	0.305		0.125	0.0589		49.20			0.00156		11.567	6.36		12.401	0.2616	0.036	328.15		0.225		49.96	
10/11/11	13:25:00 PM	2592	8.23	TB7B-1	TOLLWAY 1177			0.131	0.0514		58.98					7.705	4.93		19.834	0.3134		379.36		0.272		39.37	
10/24/11	13:48:00 PM	2589	7.90	TB7B-1	TOLLWAY 1183	0.088		0.139	0.0691		69.99					10.177	5.33		20.503	0.3176	0.031	430.15		0.269		62.93	
11/8/11	13:51:00 PM	1651	9.27	TB7B-1	TOLLWAY 1242	0.345		0.115	0.0512		51.74			0.00545		2.149	6.04		15.925	0.2428		413.41		0.228		54.69	
11/30/11	10:50:00 AM	1766	8.34	TB7B-1	TOLLWAY 1270	0.442		0.095	0.0440		46.22			0.00888		15.956	10.39		10.595	0.5106	0.034	324.17		0.686		31.22	
12/13/11	14:57:00 PM	1989	7.59	TB7B-1	TOLLWAY 1304	0.152		0.107	0.0416		52.60			0.00575		4.075	6.53		16.208	0.3008		378.00		0.269		51.08	
1/5/12	13:29:00 PM	1283	7.90	TB7B-1	TOLLWAY 1325	0.160		0.081	0.0306		56.53					6.175	6.32		15.717	0.2965		228.31		0.261		25.25	
1/17/12	15:46:00 PM	1104	7.83	TB7B-1	TOLLWAY 1351	2.532		0.080	0.0350		31.12			0.01251		4.143	6.73		11.102	0.1456		231.50		0.284		25.38	
2/2/12	9:34:00 AM	1074	7.99	TB7B-1	TOLLWAY 1396	1.962		0.066	0.0304		37.27			0.01116		2.856	5.30		13.736	0.1442		178.39		0.214		22.40	
2/15/12	10:23:00 AM	1403	7.32	TB7B-1	TOLLWAY 1417	0.221		0.070	0.0308		52.26			0.00583		2.003	5.02		17.446	0.1614		261.94		0.168		32.46	
2/28/12	16:56:00 PM	1219	7.09	TB7B-1	TOLLWAY 1445	2.685		0.070	0.0424		48.63			0.01044		4.744	6.04		13.331	0.1911		238.76		0.209		25.25	
3/14/12	8:40:00 AM	1292	7.22	TB7B-1	TOLLWAY 1482	0.798		0.091	0.0304		49.89			0.00567		1.677	3.10		18.815	0.2256		228.53		0.210		24.84	
3/28/12	9:06:00 AM	965	6.90	TB7B-1	TOLLWAY 1508	0.339		0.094	0.0319		61.96			0.00350		1.261	5.03		20.848	0.2430		207.18		0.210		24.01	
4/10/12	9:09:00 AM	1330	7.21	TB7B-1	TOLLWAY 1516	0.088		0.094	0.0342		54.17			0.00502		4.181	6.15		14.788	0.2540		237.50		0.376		23.82	
4/25/12	8:21:00 AM	1298	7.31	TB7B-1	TOLLWAY 1557	0.540		0.104	0.0333		58.35			0.00489		3.681	4.87		21.775	0.3002		211.75		0.634		22.91	
5/8/12	13:06:00 PM	722	7.04	TB7B-1	TOLLWAY 1601	1.190		0.079	0.0308		40.93			0.00587		3.639	6.68		9.191	0.1739		118.59		0.317		7.56	
5/24/12	10:15:00 AM	1200	7.06	TB7B-1	TOLLWAY 1630	0.516		0.096	0.0349		73.24			0.00375		8.281	5.91		17.681	0.3388		201.27		0.477		17.51	
6/5/12	10:12:00 AM	1479	6.99	TB7B-1	TOLLWAY 1651	2.161		0.112	0.0435		62.41			0.00683		7.609	6.28		18.407	0.3155		240.47		0.771		16.15	
6/20/12	9:13:00 AM	1212	6.95	TB7B-1	TOLLWAY 1673	0.045		0.132	0.0316		61.72					1.650	2.90		23.003	0.3106		225.92		0.145		21.60	
						min	0.045	NA	0.066	0.0304	NA	31.12	NA	NA	NA	0.00156	1.261	2.90	NA	9.191	0.1442	0.024	118.59	NA	0.145	NA	7.56
						max	2.685	NA	0.146	0.0691	NA	73.24	NA	NA	NA	0.01251	16.146	10.39	NA	23.003	0.5106	0.036	430.15	NA	0.771	NA	62.93
						mean	0.774	NA	0.105	0.0413	NA	53.39	NA	NA	NA	0.00648	6.785	6.08	NA	16.257	0.2781	0.032	282.39	NA	0.328	NA	30.17
8/16/11	12:52:00 PM	1151	7.55	TB7B-2	TOLLWAY 1064			0.260	0.0348		91.40			0.00126		0.055	0.81		79.179	0.2680		57.36		0.163		23.67	
8/31/11	14:34:00 PM	1105	7.30	TB7B-2	TOLLWAY 1100			0.247	0.0334		75.83					0.049	0.79		69.084	0.3578		68.57		0.163		22.08	
9/13/11	13:17:00 PM	1124	8.44	TB7B-2	TOLLWAY 1121	0.694		0.216	0.0349		72.89			0.00108		0.776	1.08		65.117	0.3162		76.82				19.70	
9/28/11	17:05:00 PM	1087	8.17	TB7B-2	TOLLWAY 1143			0.194	0.0291		73.32			0.00143		0.051	0.67		66.944	0.1560		71.27		0.118		18.27	
10/11/11	14:00:00 PM	1049	8.45	TB7B-2	TOLLWAY 1178			0.177	0.0261		70.34			0.00125		0.080	0.68		65.634	0.4497		62.51		0.154		17.36	
10/24/11	14:03:00 PM	1014	8.31	TB7B-2	TOLLWAY 1189			0.160	0.0267		75.01			0.00203		0.072	0.61		70.387	0.3533		54.19		0.138		18.74	
11/8/11	14:09:00 PM	512	8.97	TB7B-2	TOLLWAY 1243			0.156	0.0284		77.96					0.120	0.72		72.917	0.1115		54.27		0.120		17.85	
11/30/11	11:01:00 AM	NA	8.28	TB7B-2	TOLLWAY 1271			0.193	0.0332		94.03						0.66		87.231	0.0298		65.36		0.183		23.16	
1/5/12	13:40:00 PM	1353	7.67	TB7B-2	TOLLWAY 1326			0.195	0.0385		105.57						0.53		99.736	0.2038		73.40		0.181		28.93	
1/17/12	15:45:00 PM	1335	8.04	TB7B-2	TOLLWAY 1350			0.178	0.0390		93.89			0.00147			0.58		93.796	0.1712		78.58		0.109		26.58	
2/2/12	9:52:00 AM	1421	7.40	TB7B-2	TOLLWAY 1397			0.190	0.0397		103.95			0.00178			0.46		103.295	0.1072		69.53		0.141		31.83	
2/15/12	10:45:00 AM	1796	7.43	TB7B-2	TOLLWAY 1418			0.188	0.0369		103.32			0.00140		0.037	0.53		103.746	0.0357		72.42		0.147		31.80	
2/28/12	17:04:00 PM	1417	7.14	TB7B-2	TOLLWAY 1446			0.191	0.0404		104.68			0.00140			0.49		106.406	0.1699		71.86		0.128		32.61	
3/14/12	9:01:00 AM	1366	7.13	TB7B-2	TOLLWAY 1483			0.195	0.0406		105.44			0.00155			0.51		103.475	0.2723		73.48		0.173		32.68	
3/28/12	9:30:00 AM	640	7.13	TB7B-2	TOLLWAY 1509			0.211	0.0381		106.55					0.026	0.47		100.157	0.2373		69.68		0.159		30.57	
4/10/12	9:36:00 AM	1435	7.22	TB7B-2	TOLLWAY 1517			0.230	0.0450		112.31			0.00101			0.55		117.822	0.3805		82.47		0.138		36.38	
4/25/12	8:28:00 AM	1596	7.03	TB7B-2	TOLLWAY 1558			0.209	0.0392		109.81						0.84		112.246	0.5645		99.16		0.133		37.44	
5/8/12	13:28:00 PM	1171	7.12	TB7B-2	TOLLWAY 1602			0.230	0.0377		97.39			0.00178			0.44		92.529	0.0716		54.01		0.178		22.16	
5/24/12	10:38:00 AM	1410	7.08	TB7B-2	TOLLWAY 1631			0.232	0.0438		115.16			0.00214		0.027	0.60		115.764	0.2590		75.32		0.170		30.52	
6/5/12	10:35:00 AM	1473	6.84	TB7B-2	TOLLWAY 1652			0.234	0.0426		113.97			0.00193			0.66		112.021	0.3155		84.70		0.151		30.02	
						min																					



APPENDIX B-2: Results of Geochemical Analysis of Groundwater Samples

Date collected	Time collected (CST)	Field conductivity (uS/cm)	Field pH	Sample location	Sample ID	Sb mg/L	Se mg/L	Si mg/L	Sn mg/L	Sr mg/L	Ti mg/L	Tl mg/L	V mg/L	Zn mg/L	pH	alkalinity mg/L as CaCO <sub>3</sub>	TDS, 180 C mg/L	TSS mg/L	oPO <sub>4</sub> -P mg/L	NH <sub>3</sub> -N mg/L	F mg/L	Cl mg/L	NO <sub>3</sub> -N mg/L	SO <sub>4</sub> mg/L	total NVOC mg/L	dissolved NVOC mg/L	
					MDL:	0.059	0.131	0.066	0.086	0.00037	0.00056	0.017	0.047	0.0073			4	12	3.0	0.01	0.06	0.08	0.09	0.07	0.31	0.31	0.31
					Class 2 Groundwater Standards (mg/L)	0.024	0.05					0.02	0.1	10.0			1,200				4.0	200	100	400			
8/16/11	12:30:00 PM	2203	7.42	TB7B-1	TOLLWAY 1063	0.221		9.315		0.1074	0.00849				7.53	755.4	1342		0.254	4.46	0.52	256.6		60.64	46.07	39.17	
8/31/11	14:02:00 PM	2038	7.12	TB7B-1	TOLLWAY 1099	0.606		9.317		0.0927	0.02188				7.29	620.4	1088		0.069	4.28	0.40	169.5	NA	71.97	28.44	21.42	
9/13/11	12:39:00 PM	2479	8.46	TB7B-1	TOLLWAY 1120	0.851		11.115		0.1147	0.03033		0.0144		7.33	676.8	1408		0.028	5.27	0.36	276.8		115.17	37.64	24.26	
9/28/11	16:54:00 PM	1866	7.95	TB7B-1	TOLLWAY 1142	0.305		7.634		0.0860	0.00861				7.38	513.9	1066		0.070	1.91	0.33	174.4	0.14	130.05	36.77	27.99	
10/11/11	13:25:00 PM	2592	8.23	TB7B-1	TOLLWAY 1177			7.069		0.1043	0.00105				7.41	637.1	1130		0.050	1.74	0.34	197.8		104.79	30.95	17.70	
10/24/11	13:48:00 PM	2589	7.90	TB7B-1	TOLLWAY 1183	0.088		6.846		0.1159	0.00209		0.0143		7.24	631.8	1309		0.021	1.32	0.31	244.9	0.29	164.25	25.12	16.31	
11/8/11	13:51:00 PM	1651	9.27	TB7B-1	TOLLWAY 1242	0.345		6.377		0.0978	0.01102				7.38	319.1	788		0.124	0.99	0.31	117.8	7.00	98.17	47.22	31.34	
11/30/11	10:50:00 AM	1766	8.34	TB7B-1	TOLLWAY 1270	0.442		5.699		0.0798	0.01759				7.56	568.9	1094		0.426	2.87	0.29	173.1		90.78	59.41	42.62	
12/13/11	14:57:00 PM	1989	7.59	TB7B-1	TOLLWAY 1304	0.152		4.886		0.0845	0.00483				7.50	601.7	1229		0.114	1.56	0.29	204.9	0.51	148.38	27.60	26.51	
1/5/12	13:29:00 PM	1283	7.90	TB7B-1	TOLLWAY 1325	0.160		5.283		0.0853	0.00538				7.43	471.1	818		0.073	1.92	0.31	110.8		70.96	27.26	22.04	
1/17/12	15:46:00 PM	1104	7.83	TB7B-1	TOLLWAY 1351	2.532		8.529		0.0511	0.06463		0.0203		7.26	426.3	839		0.059	0.72	0.26	94.6	2.44	80.18	27.80	27.90	
2/2/12	9:34:00 AM	1074	7.99	TB7B-1	TOLLWAY 1396	1.962		7.075		0.0610	0.05459		0.0175		7.58	354.0	642		0.049	0.21	0.29	59.9	2.48	61.38	30.54	19.42	
2/15/12	10:23:00 AM	1403	7.32	TB7B-1	TOLLWAY 1417	0.221		3.702		0.0777	0.00636		0.0100		7.50	514.7	922		0.051	0.16	0.24	121.4	1.50	95.12	24.35	21.43	
2/28/12	16:56:00 PM	1219	7.09	TB7B-1	TOLLWAY 1445	2.685		10.033		0.0706	0.09484		0.0204		7.48	469.1	821		0.047	0.63	0.28	79.9	0.49	71.95	15.62	12.06	
3/14/12	8:40:00 AM	1292	7.22	TB7B-1	TOLLWAY 1482	0.798	0.14	5.029		0.0715	0.02135				7.39	467.5	842		0.053	0.22	0.26	102.5	1.74	76.82	21.53	19.39	
3/28/12	9:06:00 AM	965	6.90	TB7B-1	TOLLWAY 1508	0.339		4.475		0.0989	0.01220				7.26	442.4	704		0.050	0.22	0.26	61.7	1.16	54.09	19.67	14.96	
4/10/12	9:09:00 AM	1330	7.21	TB7B-1	TOLLWAY 1516	0.088		4.148		0.1045	0.00345				7.30	505.8	982		0.144	1.09	0.29	82.7		62.86	19.15	15.12	
4/25/12	8:21:00 AM	1298	7.31	TB7B-1	TOLLWAY 1557	0.540		5.331		0.1074	0.01723		0.0103		7.34	453.2	821		0.318	0.96	0.28	86.5	0.33	63.65	25.12	31.89	
5/8/12	13:06:00 PM	722	7.04	TB7B-1	TOLLWAY 1601	1.190		6.269		0.1007	0.03864				7.32	348.0	488		0.114	0.36	0.29	19.4	0.08	20.63	36.12	30.32	
5/24/12	10:15:00 AM	1200	7.06	TB7B-1	TOLLWAY 1630	0.516		6.307		0.1280	0.01678		0.0112		7.30	490.8	767		0.251	1.36	0.33	81.5		43.36	33.27	23.19	
6/5/12	10:12:00 AM	1479	6.99	TB7B-1	TOLLWAY 1651	2.161		10.407		0.1010	0.07296		0.0193		7.38	569.7	902		0.441	1.14	0.32	96.3		67.96	39.64	39.80	
6/20/12	9:13:00 AM	1212	6.95	TB7B-1	TOLLWAY 1673	0.045		4.907		0.0969	0.00084				7.67	578.1	802		0.136	0.30	0.29	82.8		59.22	28.76	14.72	
					min	0.045	0.14	3.702	NA	0.0511	0.00084	NA	NA	0.0100	7.24	319.1	488	NA	0.021	0.16	0.24	19.4	0.08	20.63	15.62	12.06	
					max	2.685	0.14	11.115	NA	0.1280	0.09484	NA	NA	0.0204	7.67	755.4	1408	NA	0.441	5.27	0.52	276.8	7.00	164.25	59.41	42.62	
					mean	0.774	0.14	6.807	NA	0.0926	0.02342	NA	NA	0.0153	7.40	518.9	946	NA	0.134	1.53	0.31	131.6	1.51	82.38	31.27	24.53	
8/16/11	12:52:00 PM	1151	7.55	TB7B-2	TOLLWAY 1064			6.228		0.1045					7.70	470.6	647		0.020		0.29	66.9		67.42	5.65	5.58	
8/31/11	14:34:00 PM	1105	7.30	TB7B-2	TOLLWAY 1100			5.903		0.0973					7.43	470.1	626		0.016		0.27	56.0	NA	63.41	4.51	4.31	
9/13/11	13:17:00 PM	1124	8.44	TB7B-2	TOLLWAY 1121			7.294		0.0900	0.02506		0.0115		7.64	451.7	620		0.023		0.25	52.3		55.13	6.88	4.15	
9/28/11	17:05:00 PM	1087	8.17	TB7B-2	TOLLWAY 1143			5.373		0.0879					7.57	426.8	581		0.008		0.25	61.7		49.48	4.40	3.28	
10/11/11	14:00:00 PM	1049	8.45	TB7B-2	TOLLWAY 1178			5.344		0.0878					7.58	423.2	545		0.007		0.26	53.7		47.44	5.86	2.68	
10/24/11	14:03:00 PM	1014	8.31	TB7B-2	TOLLWAY 1189			5.390		0.0880			0.0101		7.47	425.7	565		0.006		0.27	59.6		49.48	3.81	2.87	
11/8/11	14:09:00 PM	512	8.97	TB7B-2	TOLLWAY 1243			5.069		0.0898					7.60	430.9	594		0.009		0.25	86.7		52.78	3.46	2.62	
11/30/11	11:01:00 AM	NA	8.28	TB7B-2	TOLLWAY 1271			5.369		0.1113					7.55	491.1	738		0.009		0.22	133.5	0.23	69.19	3.42	2.97	
1/5/12	13:40:00 PM	1353	7.67	TB7B-2	TOLLWAY 1326			5.409		0.1169					7.46	520.3	797		0.008		0.21	119.9	0.19	80.46	4.83	4.03	
1/17/12	15:45:00 PM	1335	8.04	TB7B-2	TOLLWAY 1350			5.031		0.1106					7.50	527.2	797		0.009		0.22	121.7	0.08	84.12	4.17	4.09	
2/2/12	9:52:00 AM	1421	7.40	TB7B-2	TOLLWAY 1397			5.216		0.1168					7.69	559.0	819		0.014		0.19	104.3	2.32	91.44	4.23	4.06	
2/15/12	10:45:00 AM	1796	7.43	TB7B-2	TOLLWAY 1418			5.108		0.1143			0.0107		7.43	556.5	845		0.017		0.16	117.2	1.70	93.79	4.84	4.16	
2/28/12	17:04:00 PM	1417	7.14	TB7B-2	TOLLWAY 1446			5.181		0.1236					7.56	571.1	853		0.015		0.18	111.5	1.80	94.15	3.29	3.27	
3/14/12	9:01:00 AM	1366	7.13	TB7B-2	TOLLWAY 1483		0.19	5.075		0.1195					7.40	568.2	873		0.016		0.17	116.5	1.76	94.44	3.95	3.87	
3/28/12	9:30:00 AM	640	7.13	TB7B-2	TOLLWAY 1509			5.450		0.1167					7.49	576.0	863		0.015		0.18	100.2	3.62	90.20	3.57	3.87	
4/10/12	9:36:00 AM	1435	7.22	TB7B-2	TOLLWAY 1517			5.775		0.1378					7.38	587.0	874		0.013		0.22	119.4	2.02	99.75	3.57	3.49	
4/25/12	8:28:00 AM	1596	7.03	TB7B-2	TOLLWAY 1558			5.485		0.1521					7.46	585.3	930		0.013		0.19	132.7	2.32	99.38	4.68	4.76	
5/8/12	13:28:00 PM	1171	7.12	TB7B-2	TOLLWAY 1602			5.923		0.1105					7.46	546.1	760		0.017		0.25	69.9	5.64	68.99	4.80	4.31	
5/24/12	10:38:00 AM	1410	7.08	TB7B-2	TOLLWAY 1631			5.892		0.1184		0.020			7.38	593.3	876		0.014		0.28	96.2	4.16	86.11	5.98	5.29	
6/5/12	10:35:00 AM	1473	6.84	TB7B-2																							

APPENDIX B-2: Results of Geochemical Analysis of Groundwater Samples

Date collected	Time collected (CST)	Field conductivity (uS/cm)	Field pH	Sample location	Sample ID	Al	As	B	Ba	Be	Ca	Cd	Co	Cr	Cu	Fe	K	Li	Mg	Mn	Mo	Na	Ni	P	Pb	S	
						mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L
						MDL:	0.037	0.108	0.023	0.00085	0.00055	0.012	0.012	0.013	0.0058	0.00079	0.0059	0.016	0.018	0.0025	0.0015	0.022	0.026	0.014	0.063	0.041	0.217
						Class 2 Groundwater Standards (mg/L)		0.2	2.0	2.0	0.5		0.05	1.0	1.0	0.65	5.0			10.0			2.0		0.1		
8/16/11	13:15:00 PM	1102	7.52	TB7B-3	TOLLWAY 1065			0.174	0.022		110.433					0.0255	0.460		75.8288			22.70		0.152		8.44	
8/31/11	14:55:00 PM	1196	7.27	TB7B-3	TOLLWAY 1101			0.157	0.024		111.527						0.526		79.0488			27.89		0.156		9.56	
9/13/11	13:37:00 PM	1172	8.32	TB7B-3	TOLLWAY 1122			0.119	0.023		111.221						0.613		75.3053			36.26				11.54	
9/28/11	17:24:00 PM	1142	8.00	TB7B-3	TOLLWAY 1144			0.120	0.045		115.567						3.294		78.7933			54.56		0.241		12.15	
10/11/11	14:30:00 PM	1157	8.03	TB7B-3	TOLLWAY 1179			0.086	0.026		87.820						0.670		62.3545	0.0096		69.05		0.166		10.54	
10/24/11	14:16:00 PM	1370	7.61	TB7B-3	TOLLWAY 1190			0.080	0.029		77.583						0.796		52.2575			116.79		0.128		10.87	
11/8/11	14:21:00 PM	494	8.46	TB7B-3	TOLLWAY 1244			0.072	0.033		82.602				0.00117		0.879		55.1384	0.0125		144.86		0.085		11.27	
11/30/11	11:13:00 AM	1267	8.30	TB7B-3	TOLLWAY 1272			0.124	0.025		108.269						0.587		79.2230			68.37		0.162		12.14	
12/13/11	14:30:00 PM	1315	8.12	TB7B-3	TOLLWAY 1303			0.086	0.025		99.110					0.0360	0.687		68.6247			112.27		0.147		11.78	
1/5/12	14:03:00 PM	1226	7.38	TB7B-3	TOLLWAY 1324			0.102	0.023		116.104						0.480		82.7603			74.83		0.121		12.80	
1/17/12	15:30:00 PM	1364	8.21	TB7B-3	TOLLWAY 1349			0.093	0.026		109.002						0.578		80.6500			86.17		0.115		11.60	
2/2/12	10:05:00 AM	1250	7.43	TB7B-3	TOLLWAY 1398			0.113	0.022		111.110						0.361		81.6664			49.26		0.099		11.80	
2/15/12	10:55:00 AM	1238	7.31	TB7B-3	TOLLWAY 1419			0.094	0.022		111.737						0.433		82.5940			61.12		0.157		12.55	
2/28/12	17:22:00 PM	1224	7.20	TB7B-3	TOLLWAY 1447			0.106	0.022		108.448						0.415		80.3143			46.83		0.087		12.04	
3/14/12	9:09:00 AM	1132	7.21	TB7B-3	TOLLWAY 1484			0.110	0.021		106.901						0.374		75.6315			45.56		0.185		12.47	
3/28/12	9:42:00 AM	958	7.17	TB7B-3	TOLLWAY 1510			0.120	0.022		114.679						0.342		80.0923			44.13		0.154		14.55	
4/10/12	9:58:00 AM	1238	7.26	TB7B-3	TOLLWAY 1518			0.117	0.023		116.734						0.426		88.8956			46.35		0.174		17.65	
4/25/12	8:55:00 AM	1311	7.01	TB7B-3	TOLLWAY 1559			0.103	0.024		119.250						0.497		90.1490			46.37		0.209		21.78	
5/8/12	13:37:00 PM	1151	7.18	TB7B-3	TOLLWAY 1603			0.134	0.024		117.901				0.00128		0.316		85.4464			30.21		0.150		20.27	
5/24/12	10:44:00 AM	1167	7.22	TB7B-3	TOLLWAY 1632			0.124	0.023		125.288				0.00160		0.401		90.6293			31.72		0.181		18.78	
6/5/12	10:42:00 AM	1193	7.02	TB7B-3	TOLLWAY 1653			0.088	0.021		113.474				0.00134	0.0275	0.434		81.8184	0.0058		35.34		0.102		16.65	
6/20/12	9:38:00 AM	1101	7.01	TB7B-3	TOLLWAY 1674			0.082	0.023		95.528						0.602		69.5888	0.0084		31.97				13.36	
						min	NA	NA	0.072	0.021	0.00	77.583	NA	NA	NA	0.00117	0.0255	0.316	NA	52.2575	0.0058	NA	22.70	NA	0.085	NA	8.44
						max	NA	NA	0.174	0.045	0.00	125.288	NA	NA	NA	0.00160	0.0360	3.294	NA	90.6293	0.0125	NA	144.86	NA	0.241	NA	21.78
						mean	NA	NA	0.109	0.025	0.00	107.740	NA	NA	NA	0.00135	0.0297	0.644	NA	77.1278	0.0091	NA	58.30	NA	0.148	NA	13.39
8/16/11	13:40:00 PM	753	7.57	TB7B-4	TOLLWAY 1066			0.121	0.008		84.474						0.788		48.5037			8.13		0.152		4.64	
8/31/11	15:19:00 PM	746	7.34	TB7B-4	TOLLWAY 1102			0.117	0.007		79.810						0.874		46.7724			8.23		0.154		4.99	
9/13/11	13:06:00 PM	765	8.20	TB7B-4	TOLLWAY 1123			0.102	0.010		81.658					0.0313	1.001		46.8722	0.0375		7.79		0.078		5.45	
9/28/11	17:39:00 PM	720	8.11	TB7B-4	TOLLWAY 1145			0.092	0.012		80.991				0.00428	0.0405	1.005		47.0961	0.0119		8.58		3.531		6.08	
11/30/11	11:35:00 AM	833	8.34	TB7B-4	TOLLWAY 1273			0.109	0.008		89.906						0.537		55.0994			8.85		0.097		4.19	
12/13/11	14:04:00 PM	939	8.60	TB7B-4	TOLLWAY 1302			0.094	0.011		87.116						0.856		51.8144			11.14		0.161		5.39	
1/5/12	14:13:00 PM	794	7.57	TB7B-4	TOLLWAY 1328			0.107	0.008		97.318					0.0599	0.613		59.5078	0.0017		7.91		0.155		4.16	
1/17/12	15:10:00 PM	844	9.27	TB7B-4	TOLLWAY 1348			0.094	0.009		88.126						0.880		55.2025			9.36		0.104		4.42	
2/2/12	10:20:00 AM	806	7.53	TB7B-4	TOLLWAY 1399			0.099	0.006		89.994						0.588		56.4491			6.86				3.86	
2/15/12	11:12:00 AM	800	7.41	TB7B-4	TOLLWAY 1420			0.093	0.006		87.047						0.617		55.8054			7.08		0.193		4.32	
2/28/12	17:38:00 PM	791	7.28	TB7B-4	TOLLWAY 1448			0.100	0.006		89.924					0.0296	0.631		57.3623			7.37		0.147		4.10	
3/14/12	9:28:00 AM	753	7.23	TB7B-4	TOLLWAY 1485			0.112	0.006		90.049						0.582		54.4910			7.54		0.201		4.39	
3/28/12	9:53:00 AM	625	7.23	TB7B-4	TOLLWAY 1511			0.104	0.006		93.163						0.567		54.1559			7.86		0.113		4.46	
4/10/12	10:24:00 AM	825	7.30	TB7B-4	TOLLWAY 1519			0.115	0.007		99.728						0.0389	0.817	64.2293			8.81		0.193		4.89	
4/25/12	8:56:00 AM	851	7.09	TB7B-4	TOLLWAY 1560			0.106	0.009		96.879					0.0977	0.935		62.5870	0.0043		9.09		0.197		5.37	
5/8/12	13:53:00 PM	817	7.23	TB7B-4	TOLLWAY 1604			0.111	0.009		93.489						0.742		57.9784			8.60		0.186		6.36	
5/24/12	11:04:00 AM	797	7.24	TB7B-4	TOLLWAY 1633			0.105	0.007		101.249				0.00116		0.791		63.2530			8.38		0.221		4.80	
6/5/12	10:50:00 AM	NA	NA	TB7B-4	TOLLWAY 1654	0.045		0.113	0.008		106.724						0.1481	0.664	66.7510	0.0038		8.72		0.131		4.64	
						min	0.045	NA	0.092	0.006	NA	79.810	NA	NA	NA	0.00116	0.0296	0.537	NA	46.7724	0.0017	NA	6.86	NA	0.078	NA	3.86
						max	0.045	NA	0.121	0.012	NA	106.724	NA	NA	NA	0.00428	0.1481	1.005	NA	66.7510	0.0375	NA	11.14	NA	3.531	NA	6.36
						mean	0.045	NA	0.105	0.008	NA	90.980	NA	NA	NA	0.00272	0.0637	0.749	NA	55.7739	0.0119	NA	8.35	NA	0.354	NA	4.81

APPENDIX B-2: Results of Geochemical Analysis of Groundwater Samples

Date collected	Time collected (CST)	Field conductivity (uS/cm)	Field pH	Sample location	Sample ID	Sb mg/L	Se mg/L	Si mg/L	Sn mg/L	Sr mg/L	Ti mg/L	Tl mg/L	V mg/L	Zn mg/L	pH	alkalinity mg/L as CaCO <sub>3</sub>	TDS, 180 C mg/L	TSS mg/L	oPO <sub>4</sub> -P mg/L	NH <sub>3</sub> -N mg/L	F mg/L	Cl mg/L	NO <sub>3</sub> -N mg/L	SO <sub>4</sub> mg/L	total NVOC mg/L	dissolved NVOC mg/L
					MDL:	0.059	0.131	0.066	0.086	0.00037	0.00056	0.017	0.047	0.0073		4	12	3.0	0.01	0.06	0.08	0.09	0.07	0.31	0.31	0.31
					Class 2 Groundwater Standards (mg/L)	0.024	0.05					0.02	0.1	10.0			1,200			4.0	200	100	400			
8/16/11	13:15:00 PM	1102	7.52	TB7B-3	TOLLWAY 1065			9.42		0.08					7.74	512	629		0.03		0.23	33.65	7.71	23.98	3.92	3.86
8/31/11	14:55:00 PM	1196	7.27	TB7B-3	TOLLWAY 1101			9.71		0.09					7.50	494	665		0.03		0.22	78.21	5.47	26.84	3.63	3.59
9/13/11	13:37:00 PM	1172	8.32	TB7B-3	TOLLWAY 1122			9.51		0.08					7.55	479	655		0.02		0.19	86.23	7.75	33.61	9.58	3.73
9/28/11	17:24:00 PM	1142	8.00	TB7B-3	TOLLWAY 1144			22.00		0.08					7.66	458	828		0.08		0.17	76.51	11.53	32.30	6.05	3.75
10/11/11	14:30:00 PM	1157	8.03	TB7B-3	TOLLWAY 1179			8.38		0.07					7.91	444	644		0.01		0.20	89.79	10.20	30.75	7.82	4.35
10/24/11	14:16:00 PM	1370	7.61	TB7B-3	TOLLWAY 1190			7.48		0.06					7.44	405	694		0.01		0.27	157.49	5.55	30.62	12.10	3.34
11/8/11	14:21:00 PM	494	8.46	TB7B-3	TOLLWAY 1244			7.79		0.06					7.77	394	760		0.02	0.04	0.19	196.58	3.72	32.30	NA	NA
11/30/11	11:13:00 AM	1267	8.30	TB7B-3	TOLLWAY 1272			8.84		0.07					7.69	536	748		0.01		0.18	96.45	6.22	36.70	5.55	3.43
12/13/11	14:30:00 PM	1315	8.12	TB7B-3	TOLLWAY 1303			8.29		0.07					7.75	539	763		0.01		0.17	144.84	4.90	32.92	7.96	4.25
1/5/12	14:03:00 PM	1226	7.38	TB7B-3	TOLLWAY 1324			8.65		0.07					7.63	576	752		0.01		0.17	83.75	5.38	35.78	4.59	4.11
1/17/12	15:30:00 PM	1364	8.21	TB7B-3	TOLLWAY 1349			8.26		0.07					7.62	565	786		0.01		0.19	107.92	5.12	35.94	3.96	3.73
2/2/12	10:05:00 AM	1250	7.43	TB7B-3	TOLLWAY 1398			7.67		0.07					7.78	542	718		0.02		0.16	64.51	11.41	34.77	3.94	3.68
2/15/12	10:55:00 AM	1238	7.31	TB7B-3	TOLLWAY 1419			7.88		0.07					7.49	536	737		0.02		0.13	91.20	7.85	36.53	3.87	3.74
2/28/12	17:22:00 PM	1224	7.20	TB7B-3	TOLLWAY 1447			7.64		0.07					7.60	516	714		0.02		0.14	71.40	12.35	35.24	2.84	2.85
3/14/12	9:09:00 AM	1132	7.21	TB7B-3	TOLLWAY 1484			7.41		0.07					7.49	499	616		0.02		0.16	69.57	11.70	37.03	3.62	3.40
3/28/12	9:42:00 AM	958	7.17	TB7B-3	TOLLWAY 1510			7.91		0.07					7.51	490	679		0.02		0.16	65.56	14.18	39.09	3.24	3.03
4/10/12	9:58:00 AM	1238	7.26	TB7B-3	TOLLWAY 1518			8.44		0.08					7.45	485	717		0.02		0.18	84.28	13.99	48.15	3.19	3.21
4/25/12	8:55:00 AM	1311	7.01	TB7B-3	TOLLWAY 1559			8.56		0.09					7.54	479	780		0.02		0.14	95.86	15.54	59.95	4.47	4.71
5/8/12	13:37:00 PM	1151	7.18	TB7B-3	TOLLWAY 1603			8.10		0.08					7.54	484	689		0.02		0.19	54.43	18.43	53.52	4.14	4.19
5/24/12	10:44:00 AM	1167	7.22	TB7B-3	TOLLWAY 1632			8.76		0.07					7.47	490	761		0.02		0.20	44.16	21.92	56.76	4.52	4.56
6/5/12	10:42:00 AM	1193	7.02	TB7B-3	TOLLWAY 1653			8.81		0.07					7.60	470	712		0.02		0.21	35.22	24.91	54.46	6.78	3.10
6/20/12	9:38:00 AM	1101	7.01	TB7B-3	TOLLWAY 1674			8.18		0.06					7.96	443	614		0.02		0.16	24.80	21.19	37.89	8.09	4.12
					min	NA	NA	7.41	NA	0.06	NA	NA	NA	NA	7.44	394	614	NA	0.01	0.04	0.13	24.80	3.72	23.98	2.84	2.85
					max	NA	NA	22.00	NA	0.09	NA	NA	NA	NA	7.96	576	828	NA	0.08	0.04	0.27	196.58	24.91	59.95	12.10	4.71
					mean	NA	NA	8.99	NA	0.07	NA	NA	NA	NA	7.62	492	712	NA	0.02	0.04	0.18	84.20	11.23	38.41	5.42	3.75
8/16/11	13:40:00 PM	753	7.57	TB7B-4	TOLLWAY 1066			7.25		0.06					7.45	343	413		0.02		0.27	11.74	10.64	13.03	2.21	2.72
8/31/11	15:19:00 PM	746	7.34	TB7B-4	TOLLWAY 1102			6.98		0.06					7.57	339	413		0.02		0.16	12.64	10.09	13.93	2.44	2.14
9/13/11	13:06:00 PM	765	8.20	TB7B-4	TOLLWAY 1123			6.69		0.05					7.56	351	399		0.02		0.16	13.90	8.92	15.84	7.04	2.61
9/28/11	17:39:00 PM	720	8.11	TB7B-4	TOLLWAY 1145			6.59		0.05			0.0247		7.91	319	396		3.05	0.13	0.13	14.96	8.47	16.37	3.25	2.54
11/30/11	11:35:00 AM	833	8.34	TB7B-4	TOLLWAY 1273			6.41		0.05					7.68	400	489		0.01		0.15	11.73	7.36	12.74	2.86	1.86
12/13/11	14:04:00 PM	939	8.60	TB7B-4	TOLLWAY 1302			6.03		0.05					7.62	369	465		0.01		0.11	22.02	8.27	15.20	2.61	2.01
1/5/12	14:13:00 PM	794	7.57	TB7B-4	TOLLWAY 1328			6.31		0.05					7.58	413	456		0.01		0.10	9.18	7.22	11.37	2.32	1.90
1/17/12	15:10:00 PM	844	9.27	TB7B-4	TOLLWAY 1348			5.85		0.05					7.71	402	457		0.01		0.14	14.14	9.13	13.67	2.07	1.79
2/2/12	10:20:00 AM	806	7.53	TB7B-4	TOLLWAY 1399			5.85		0.05					7.79	401	441		0.01		0.11	7.73	8.94	11.33	1.85	1.57
2/15/12	11:12:00 AM	800	7.41	TB7B-4	TOLLWAY 1420			5.69		0.05					7.61	413	471		0.02		0.09	9.21	8.56	12.47	2.54	2.02
2/28/12	17:38:00 PM	791	7.28	TB7B-4	TOLLWAY 1448			5.87		0.05					7.69	407	478		0.01		0.09	7.74	10.58	12.04	1.38	1.31
3/14/12	9:28:00 AM	753	7.23	TB7B-4	TOLLWAY 1485			5.71		0.05					7.53	398	488		0.02		0.10	6.53	12.57	12.78	1.65	1.60
3/28/12	9:53:00 AM	625	7.23	TB7B-4	TOLLWAY 1511			6.16		0.05					7.53	390	490		0.01		0.10	5.93	14.73	12.86	1.50	1.50
4/10/12	10:24:00 AM	825	7.30	TB7B-4	TOLLWAY 1519			6.65		0.06					7.52	414	479		0.01		0.10	8.11	12.68	13.19	1.84	1.78
4/25/12	8:56:00 AM	851	7.09	TB7B-4	TOLLWAY 1560			6.53		0.06					7.61	417	500		0.01		0.11	9.64	10.60	14.22	2.59	1.83
5/8/12	13:53:00 PM	817	7.23	TB7B-4	TOLLWAY 1604			6.54		0.06					7.54	395	516		0.01		0.11	6.66	16.84	21.39	2.41	1.99
5/24/12	11:04:00 AM	797	7.24	TB7B-4	TOLLWAY 1633			6.65		0.05					7.53	422	526		0.01		0.11	8.00	12.73	15.22	4.64	2.16
6/5/12	10:50:00 AM	NA	NA	TB7B-4	TOLLWAY 1654			7.04		0.05	0.00135				7.70	449	520		0.01		0.14	7.62	12.89	14.63	3.88	1.69
					min	NA	NA	5.69	NA	0.05	0.00135	NA	NA	0.0247	7.45	319	396	NA	0.01	NA	0.09	5.93	7.22	11.33	1.38	1.31
					max	NA	NA	7.25	NA	0.06	0.00135	NA	NA	0.0247	7.91	449	526	NA	3.05	NA	0.27	22.02	16.84	21.39	7.04	2.72
					mean	NA	NA	6.38	NA	0.05	0.00135	NA	NA	0.0247	7.62	391	467	NA	0.18	NA	0.13	10.41	10.62	14.02	2.73	1.94

APPENDIX B-2: Results of Geochemical Analysis of Groundwater Samples

Date collected	Time collected (CST)	Field conductivity (uS/cm)	Field pH	Sample location	Sample ID	Al mg/L	As mg/L	B mg/L	Ba mg/L	Be mg/L	Ca mg/L	Cd mg/L	Co mg/L	Cr mg/L	Cu mg/L	Fe mg/L	K mg/L	Li mg/L	Mg mg/L	Mn mg/L	Mo mg/L	Na mg/L	Ni mg/L	P mg/L	Pb mg/L	S mg/L	
						MDL:	0.037	0.108	0.023	0.00085	0.00055	0.012	0.012	0.013	0.0058	0.00079	0.0059	0.016	0.018	0.0025	0.0015	0.022	0.026	0.014	0.063	0.041	0.217
						Class 2 Groundwater Standards (mg/L)																					
8/16/11	11:21:00 AM	7793	7.83	TB7B-5U	TOLLWAY 1060			0.178	0.137		131.881					0.1025	43.535		41.5630	0.8300	0.028	1435.09		0.162			169.85
8/31/11	13:29:00 PM	10363	7.37	TB7B-5U	TOLLWAY 1098			0.239	0.219		159.900					0.3131	52.555		52.0610	1.2538		2030.35		0.111			275.71
9/13/11	12:20:00 PM	4572	8.28	TB7B-5U	TOLLWAY 1119			0.197	0.052		41.074					0.0902	21.914		13.0379	0.3703	0.047	911.22					108.19
9/28/11	16:15:00 PM	9410	7.88	TB7B-5U	TOLLWAY 1140			0.202	0.226		182.715					0.3602	38.171		55.9268	1.7493		1724.86		0.158			250.62
10/11/11	12:50:00 PM	10016	7.83	TB7B-5U	TOLLWAY 1176			0.231	0.232		189.911					0.3600	45.220		56.4106	1.9882		1960.59		0.175			315.24
10/24/11	12:26:00 PM	4256	7.57	TB7B-5U	TOLLWAY 1184			0.180	0.043		37.816					0.0728	17.157		11.9355	0.5692	0.050	816.98		0.118			113.63
11/8/11	13:27:00 PM	6354	8.68	TB7B-5U	TOLLWAY 1241			0.153	0.149		143.115				0.00225	0.2808	32.211		50.1899	1.7971		1146.48		0.074			190.97
11/30/11	10:02:00 AM	9430	7.35	TB7B-5U	TOLLWAY 1266			0.190	0.168		193.050				0.00597	0.4092	32.576		58.7912	1.9001		1791.48		0.162			316.70
12/13/11	15:17:00 PM	5101	7.71	TB7B-5U	TOLLWAY 1305			0.159	0.059		69.932				0.00338	0.1913	19.000		21.9062	0.8277		1022.50		0.106			167.67
1/17/12	14:14:00 PM	6468	7.47	TB7B-5U	TOLLWAY 1346			0.165	0.117		195.772				0.00351	0.3582	35.416		69.4037	2.2437		1230.69		0.168			295.16
2/2/12	8:24:00 AM	7366	7.17	TB7B-5U	TOLLWAY 1392			0.163	0.114		250.881		0.015			0.4800	41.709		85.3639	2.5703		1277.40	0.048	0.191			310.49
2/28/12	16:27:00 PM	7870	7.40	TB7B-5U	TOLLWAY 1444			0.147	0.108		288.003		0.019			0.4726	44.406		89.7690	2.7577		1488.89		0.223			338.83
3/14/12	8:15:00 AM	8215	7.32	TB7B-5U	TOLLWAY 1480			0.160	0.107		322.376		0.016			0.5889	42.306		95.3742	2.9680		1505.21		0.211			397.40
3/28/12	7:42:00 AM	7550	7.30	TB7B-5U	TOLLWAY 1504			0.191	0.098		365.281		0.016			0.5670	39.566		105.5186	3.2396		1334.74		0.189			476.52
4/10/12	8:47:00 AM	10642	7.44	TB7B-5U	TOLLWAY 1515			0.203	0.093		285.057					0.2481	35.947		90.4552	2.4535		2125.20		0.192			241.13
4/25/12	8:04:00 AM	12752	7.09	TB7B-5U	TOLLWAY 1556			0.187	0.117		304.061		0.015			0.2548	49.889		100.1837	3.0254		2672.19		0.194			261.81
5/8/12	12:43:00 PM	10746	7.24	TB7B-5U	TOLLWAY 1599			0.207	0.099		234.232					0.5157	34.758		77.1264	2.2673		2102.33		0.112			230.02
5/24/12	9:45:00 AM	9714	7.24	TB7B-5U	TOLLWAY 1629			0.218	0.099		232.471				0.00118	0.5712	36.153		76.2467	2.0001		1787.37		0.203			155.92
6/5/12	8:53:00 AM	NA	NA	TB7B-5U	TOLLWAY 1648			0.229	0.104		228.208				0.00150	0.3594	39.921		76.3998	1.9648		1934.76		0.232			159.13
6/20/12	8:36:00 AM	11726	6.90	TB7B-5U	TOLLWAY 1671			0.288	0.169		278.785		0.016			0.6723	51.016		96.8516	2.2362		2225.22					193.44
7/17/12	8:21:00 AM	10936	6.63	TB7B-5U	TOLLWAY 1687			0.262	0.195		216.514		0.017		0.00158	0.4567	67.168		85.4294	2.1737		2089.04					145.16
8/1/12	8:46:00 AM	9369	6.88	TB7B-5U	TOLLWAY 1717			0.265	0.177		166.991		0.013			1.1050	61.630		64.9912	1.7636		1823.08		0.104			138.04
8/13/12	12:22:00 PM	9431	6.79	TB7B-5U	TOLLWAY 1722			0.252	0.181		182.663					0.9454	58.411		67.3744	2.1020		1771.97					169.13
						min	NA	NA	0.147	0.043	NA	37.816	NA	0.013	NA	0.00118	0.0728	17.157	NA	11.9355	0.3703	0.028	816.98	0.048	0.074	NA	108.19
						max	NA	NA	0.288	0.232	NA	365.281	NA	0.019	NA	0.00597	1.1050	67.168	NA	105.5186	3.2396	0.050	2672.19	0.048	0.232	NA	476.52
						mean	NA	NA	0.203	0.133	NA	204.378	NA	0.016	NA	0.00277	0.4250	40.897	NA	67.0569	1.9588	0.042	1661.20	0.048	0.162	NA	235.68
8/16/11	11:40:00 AM	13295	7.52	TB7B-5L	TOLLWAY 1061			0.153	0.252		349.213		0.018			0.0406	22.460		109.75	2.50		2161.58		0.250			145.33
2/2/12	9:17:00 AM	9479	7.99	TB7B-5L	TOLLWAY 1395			0.107	0.167		211.787				0.00788	0.7954	10.652		70.09	2.66		1712.66		0.247			189.41
5/8/12	12:54:00 PM	9446	6.94	TB7B-5L	TOLLWAY 1600	0.079		0.123	0.242		273.351					1.3662	11.928		92.25	3.89		1855.12		0.162			248.09
7/3/12	11:42:00 AM	12405	6.70	TB7B-5L	TOLLWAY 1683			0.257	0.201		249.819		0.017		0.00100	0.6526	62.880		89.87	2.28		2400.94					188.75
						min	0.079	NA	0.107	0.167	NA	211.787	NA	0.017	NA	0.00100	0.0406	10.652	NA	70.09	2.28	NA	1712.66	NA	0.162	NA	145.33
						max	0.079	NA	0.257	0.252	NA	349.213	NA	0.018	NA	0.00788	1.3662	62.880	NA	109.75	3.89	NA	2400.94	NA	0.250	NA	248.09
						mean	0.079	NA	0.160	0.215	NA	271.043	NA	0.018	NA	0.00444	0.7137	26.980	NA	90.49	2.83	NA	2032.57	NA	0.220	NA	192.894

APPENDIX B-2: Results of Geochemical Analysis of Groundwater Samples

Date collected	Time collected (CST)	Field conductivity (uS/cm)	Field pH	Sample location	Sample ID	Sb mg/L	Se mg/L	Si mg/L	Sn mg/L	Sr mg/L	Ti mg/L	Tl mg/L	V mg/L	Zn mg/L	pH	alkalinity mg/L as CaCO <sub>3</sub>	TDS, 180 C mg/L	TSS mg/L	oPO <sub>4</sub> -P mg/L	NH <sub>3</sub> -N mg/L	F mg/L	Cl mg/L	NO <sub>3</sub> -N mg/L	SO <sub>4</sub> mg/L	total NVOC mg/L	dissolved NVOC mg/L
					MDL:	0.059	0.131	0.066	0.086	0.00037	0.00056	0.017	0.047	0.0073		4	12	3.0	0.01	0.06	0.08	0.09	0.07	0.31	0.31	0.31
					Class 2 Groundwater Standards (mg/L)	0.024	0.05					0.02	0.1	10.0			1,200			4.0	200	100	400			
8/16/11	11:21:00 AM	7793	7.83	TB7B-5U	TOLLWAY 1060			4.49		1.38					7.89	218	4347		0.02	0.90	0.37	2037.73	488.57	12.10	13.16	
8/31/11	13:29:00 PM	10363	7.37	TB7B-5U	TOLLWAY 1098			4.76		1.72					7.75	258	5991		0.02	0.34	0.51	2778.07	709.01	12.89	12.84	
9/13/11	12:20:00 PM	4572	8.28	TB7B-5U	TOLLWAY 1119			3.34		0.46		0.023			8.03	218	2574		0.01	0.22	2.10	1113.01	309.58	15.93	14.56	
9/28/11	16:15:00 PM	9410	7.88	TB7B-5U	TOLLWAY 1140			3.81		1.95					7.92	258	5298		0.01	1.23	1.35	2465.62	673.68	12.80	11.80	
10/11/11	12:50:00 PM	10016	7.83	TB7B-5U	TOLLWAY 1176			4.22		2.01					7.88	295	5958		0.01	0.46	0.93	2771.75	845.72	13.72	13.72	
10/24/11	12:26:00 PM	4256	7.57	TB7B-5U	TOLLWAY 1184			3.04		0.38					7.99	209	2353		0.01	0.11	1.25	1008.25	316.56	15.79	15.05	
11/8/11	13:27:00 PM	6354	8.68	TB7B-5U	TOLLWAY 1241			3.76		1.43					7.95	289	3522		0.01	0.51	0.80	1526.50	510.78	11.40	10.70	
11/30/11	10:02:00 AM	9430	7.35	TB7B-5U	TOLLWAY 1266			4.06		1.78					7.88	388	5518		0.01	0.61	0.70	2420.37	848.47	14.01	13.76	
12/13/11	15:17:00 PM	5101	7.71	TB7B-5U	TOLLWAY 1305			3.06		0.65					7.94	288	3197		0.01	0.30	0.75	1349.40	491.40	11.32	10.18	
1/17/12	14:14:00 PM	6468	7.47	TB7B-5U	TOLLWAY 1346			3.66		1.70					7.79	288	4039		0.01	0.33	0.49	1528.47	871.88	10.30	9.95	
2/2/12	8:24:00 AM	7366	7.17	TB7B-5U	TOLLWAY 1392			3.90		2.07					7.84	319	4524		0.01	0.43	0.33	1726.38	854.87	10.94	10.80	
2/28/12	16:27:00 PM	7870	7.40	TB7B-5U	TOLLWAY 1444		0.20	4.00		2.40					7.67	313	5214		0.01	0.59	0.42	2131.19	994.24	9.15	7.72	
3/14/12	8:15:00 AM	8215	7.32	TB7B-5U	TOLLWAY 1480			4.22		2.45					7.68	317	5693		0.02	0.67		2187.52	1160.33	10.77	10.54	
3/28/12	7:42:00 AM	7550	7.30	TB7B-5U	TOLLWAY 1504			5.10		2.78		0.025			7.64	283	5217		0.01	1.03	0.36	1854.53	1280.87	8.77	8.52	
4/10/12	8:47:00 AM	10642	7.44	TB7B-5U	TOLLWAY 1515			5.37		2.26		0.020			7.50	367	6503		0.01	1.76	0.39	3129.43	661.75	10.87	10.63	
4/25/12	8:04:00 AM	12752	7.09	TB7B-5U	TOLLWAY 1556			5.51		2.73					7.60	319	7831		0.01	1.86	1.33	3928.61	705.25	12.94	12.76	
5/8/12	12:43:00 PM	10746	7.24	TB7B-5U	TOLLWAY 1599			5.44		2.07					7.58	365	6620		0.01	1.78	1.20	3316.76	609.07	13.92	14.22	
5/24/12	9:45:00 AM	9714	7.24	TB7B-5U	TOLLWAY 1629			6.21		1.86					7.65	419	5601		0.02	2.44	1.06	2790.38	400.07	16.88	16.94	
6/5/12	8:53:00 AM	NA	NA	TB7B-5U	TOLLWAY 1648			6.46		1.90		0.022			7.80	474	6655		0.02	2.92	1.10	3321.87	522.19	13.96	13.84	
6/20/12	8:36:00 AM	11726	6.90	TB7B-5U	TOLLWAY 1671			8.14		2.95		0.030			7.55	533	7114		0.02	3.88	0.66	3563.21	477.41	20.54	20.77	
7/17/12	8:21:00 AM	10936	6.63	TB7B-5U	TOLLWAY 1687			9.64		2.33					7.29	624	6452		0.02	5.11	0.34	3236.00	380.81	24.37	24.29	
8/1/12	8:46:00 AM	9369	6.88	TB7B-5U	TOLLWAY 1717			9.15		1.93					7.71	554	5714		0.02	4.94	0.37	2806.42	389.34	19.24	19.32	
8/13/12	12:22:00 PM	9431	6.79	TB7B-5U	TOLLWAY 1722			9.14		1.86					7.42	488	5423		0.02	5.28	0.41	2683.76	456.87	18.81	18.47	
					min	NA	0.20	3.04	NA	0.38	NA	0.020	NA	NA	7.29	209	2353	NA	0.01	0.11	0.33	1008.25	NA	309.58	8.77	7.72
					max	NA	0.20	9.64	NA	2.95	NA	0.030	NA	NA	8.03	624	7831	NA	0.02	5.28	2.10	3928.61	NA	1280.87	24.37	24.29
					mean	NA	0.20	5.24	NA	1.87	NA	0.024	NA	NA	7.74	351	5276	NA	0.01	1.64	0.78	2420.66	NA	650.38	13.97	13.68
8/16/11	11:40:00 AM	13295	7.52	TB7B-5L	TOLLWAY 1061		0.14	9.79		1.71		0.023		0.0242	7.61	583	6836		0.03	1.10		3380.6	388.2	22.16	21.41	
2/2/12	9:17:00 AM	9479	7.99	TB7B-5L	TOLLWAY 1395			8.37		1.16				0.0161	NA	NA	5442		0.08	NA	0.62	2505.4	0.18	576.4	NA	NA
5/8/12	12:54:00 PM	9446	6.94	TB7B-5L	TOLLWAY 1600			8.57		1.76				0.0182	7.61	426	5600		0.02	0.31	0.87	2678.3	0.17	629.4	NA	NA
7/3/12	11:42:00 AM	12405	6.70	TB7B-5L	TOLLWAY 1683			8.67		2.76					7.53	537	7530		0.02	4.36	0.53	3760.8	520.8	26.19	25.04	
					min	NA	0.14	8.37	NA	1.16	NA	0.023	NA	0.0161	7.53	426	5442	NA	0.02	0.31	0.53	2505.4	0.17	388.2	22.16	21.41
					max	NA	0.14	9.79	NA	2.76	NA	0.023	NA	0.0242	7.61	583	7530	NA	0.08	4.36	0.87	3760.8	0.18	629.4	26.19	25.04
					mean	NA	0.14	8.85	NA	1.85	NA	0.023	NA	0.0195	7.58	515	6352	NA	0.04	1.92	0.67	3081.3	0.17	528.7	24.18	23.23

APPENDIX B-2: Results of Geochemical Analysis of Groundwater Samples

Date collected	Time collected (CST)	Field conductivity (uS/cm)	Field pH	Sample location	Sample ID	Al	As	B	Ba	Be	Ca	Cd	Co	Cr	Cu	Fe	K	Li	Mg	Mn	Mo	Na	Ni	P	Pb	S	
						mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L
						MDL:	0.037	0.108	0.023	0.00085	0.00055	0.012	0.012	0.013	0.0058	0.00079	0.0059	0.016	0.018	0.0025	0.0015	0.022	0.026	0.014	0.063	0.041	0.217
						Class 2 Groundwater Standards (mg/L)		0.2	2.0	2.0	0.5		0.05	1.0	1.0	0.65	5.0			10.0			2.0			0.1	
8/16/11	9:05:00 AM	5882	7.46	TB15-1U	TOLLWAY 1056			0.119	0.1576		345.87					0.075	2.41		272.053	0.0161		591.34		0.151		57.53	
8/31/11	9:12:00 AM	7430	6.85	TB15-1U	TOLLWAY 1093	0.830		0.144	0.1624		396.39				0.00180	0.849	3.73		319.640	0.0901		641.88		0.172		68.63	
9/13/11	8:31:00 AM	7599	7.00	TB15-1U	TOLLWAY 1114			0.133	0.1536		394.97						4.20		313.835	0.0878		572.90			59.48		
10/26/11	10:20:00 AM	6301	7.45	TB15-1U	TOLLWAY 1206	0.692		0.132	0.1179		314.70					0.657	3.09		246.026	0.1099		516.06		0.107	56.15		
11/28/11	13:54:00 PM	7621	7.20	TB15-1U	TOLLWAY 1250	0.054		0.110	0.1428		389.76				0.00254	0.068	2.48		323.520	0.0066		632.00		0.162	71.37		
12/13/11	10:57:00 AM	8065	7.20	TB15-1U	TOLLWAY 1297			0.114	0.1553		425.19				0.00093	0.058	2.49		352.981	0.0036		684.59		0.180	77.21		
1/5/12	8:52:00 AM	8773	6.79	TB15-1U	TOLLWAY 1319			0.098	0.1571		442.52				0.00321		2.07		364.873			902.74		0.180	92.62		
1/18/12	10:09:00 AM	8491	7.48	TB15-1U	TOLLWAY 1355			0.098	0.1504		421.26				0.00320		2.38		374.695	0.0019		811.15		0.178	84.50		
2/1/12	10:12:00 AM	8490	7.37	TB15-1U	TOLLWAY 1381	0.780		0.091	0.1570		427.66				0.00381	0.521	2.87		368.859	0.0071		856.45		0.214	88.10		
2/14/12	15:23:00 PM	8513	7.12	TB15-1U	TOLLWAY 1412	0.183		0.088	0.1440		444.04				0.00144	0.123	3.01		384.063	0.0081		764.31		0.159	93.12		
2/28/12	14:38:00 PM	8388	7.00	TB15-1U	TOLLWAY 1440	0.050		0.083	0.1453		436.23				0.00150	0.031	2.53		364.664	0.0034		850.11		0.155	101.14		
3/13/12	9:24:00 AM	8120	6.96	TB15-1U	TOLLWAY 1473	0.177		0.094	0.1439		450.46				0.00105	0.156	2.58		383.356	0.0050	0.039	810.53		0.184	96.24		
3/27/12	14:15:00 PM	7700	6.97	TB15-1U	TOLLWAY 1495			0.091	0.1441		436.08				0.00136		2.64		376.762	0.0042		794.59		3.949	92.34		
4/10/12	13:47:00 PM	8356	7.06	TB15-1U	TOLLWAY 1533	0.464		0.108	0.1550		462.61					0.328	3.16		404.078	0.0078		772.71		0.184	96.95		
4/25/12	10:59:00 AM	8109	6.92	TB15-1U	TOLLWAY 1562	0.215		0.111	0.1494		471.52					0.186	3.70		408.760	0.0850		727.89		0.226	86.05		
5/7/12	13:34:00 PM	8159	6.85	TB15-1U	TOLLWAY 1589	0.122		0.109	0.1459		452.86					0.121	2.96		396.090	0.0208		634.34		0.163	88.28		
5/23/12	16:23:00 PM	7755	7.10	TB15-1U	TOLLWAY 1623	0.060		0.114	0.1516		475.48				0.00162	0.059	3.17		404.239	0.0139		751.23		0.202	92.87		
6/4/12	16:06:00 PM	8082	6.62	TB15-1U	TOLLWAY 1639			0.101	0.1419		469.13				0.00320	0.071	3.00		390.552	0.0504		644.73		11.628	74.44		
6/19/12	8:52:00 AM	8120	6.36	TB15-1U	TOLLWAY 1665			0.126	0.1081		471.26						5.61		365.483	0.0076		692.76			83.09		
						min	0.050	NA	0.083	0.1081	NA	314.70	NA	NA	NA	0.00093	0.031	2.073	NA	246.026	0.0019	0.039	516.06	NA	0.107	NA	56.15
						max	0.830	NA	0.144	0.1624	NA	475.48	NA	NA	NA	0.00381	0.849	5.608	NA	408.760	0.1099	0.039	902.74	NA	11.628	NA	101.14
						mean	0.330	NA	0.109	0.1465	NA	427.79	NA	NA	NA	0.00214	0.236	3.057	NA	358.659	0.0294	0.039	718.54	NA	1.070	NA	82.11
8/16/11	9:11:00 AM	7065	7.09	TB15-1L	TOLLWAY 1057			0.140	0.1046		474.09					0.029	7.80		367.472	0.0126		639.57		0.136	0.041	78.69	
8/31/11	9:35:00 AM	7688	6.86	TB15-1L	TOLLWAY 1094			0.142	0.1080		449.48					0.052	7.98		340.639	0.0171		652.84		0.190	77.40		
9/13/11	8:55:00 AM	8000	7.00	TB15-1L	TOLLWAY 1115	0.483		0.144	0.1133		493.98					0.355	8.47		370.795	0.0137		659.45			74.57		
9/28/11	14:12:00 PM	8117	7.28	TB15-1L	TOLLWAY 1135	0.125		0.142	0.1069		497.93					0.259	8.07		380.312	0.0223		640.31		0.089	77.34		
10/11/11	9:46:00 AM	7804	7.22	TB15-1L	TOLLWAY 1172			0.145	0.1116		518.29				0.01880	0.045	7.51		397.365	0.0108		668.44		0.175	79.32		
10/26/11	10:32:00 AM	8085	7.27	TB15-1L	TOLLWAY 1207			0.101	0.1098		466.15						6.49		358.384	0.0057		625.23		0.189	83.06		
11/7/11	15:01:00 PM	8101	7.28	TB15-1L	TOLLWAY 1228			0.131	0.1001		441.65					0.092	6.35		340.277	0.0181		583.23		0.140	77.63		
11/28/11	13:38:00 PM	3574	7.01	TB15-1L	TOLLWAY 1249			0.132	0.1105		488.90				0.00355		6.00		386.705	0.0067		676.61		0.140	89.27		
12/13/11	11:07:00 AM	8486	7.18	TB15-1L	TOLLWAY 1298			0.123	0.1058		475.65				0.00091		5.83		380.841	0.0071		680.15		0.187	86.28		
1/5/12	9:04:00 AM	8370	6.85	TB15-1L	TOLLWAY 1320			0.119	0.1071		500.11				0.00113		5.57		402.748	0.0110		706.57		0.188	88.68		
1/18/12	10:20:00 AM	NA	7.37	TB15-1L	TOLLWAY 1356			0.109	0.1091		467.37				0.00184		5.99		386.120	0.0110		724.85		0.178	81.67		
2/14/12	15:28:00 PM	8355	6.94	TB15-1L	TOLLWAY 1413			0.094	0.1037		475.21				0.00099		5.65		392.276	0.0109		686.24		0.151	84.39		
2/28/12	14:49:00 PM	8340	6.71	TB15-1L	TOLLWAY 1441			0.096	0.1051		505.16		0.02		0.00090		5.64		410.946	0.0112		691.00		0.125	86.45		
3/13/12	16:10:00 PM	8029	6.76	TB15-1L	TOLLWAY 1474			0.098	0.1036		493.68		0.01		0.00101	0.033	5.60		407.539	0.0109		714.55		0.149	85.42		
3/27/12	14:22:00 PM	7596	6.77	TB15-1L	TOLLWAY 1496	0.105		0.097	0.1050		494.69					0.152	5.42		413.748	0.0140		715.71		0.213	84.23		
4/10/12	14:17:00 PM	8145	6.93	TB15-1L	TOLLWAY 1534			0.106	0.1040		480.26					0.033	5.51		402.382	0.0119		673.72		0.213	87.52		
4/25/12	11:05:00 AM	8154	6.67	TB15-1L	TOLLWAY 1563	0.233		0.119	0.1125		478.94					0.233	6.56		420.486	0.0112		717.56		0.219	0.045	84.02	
5/7/12	13:40:00 PM	7970	6.76	TB15-1L	TOLLWAY 1590	0.430		0.108	0.1128		482.19				0.00132	0.445	4.99		404.828	0.0142		665.83		0.173	88.94		
5/23/12	15:53:00 PM	8235	9.30	TB15-1L	TOLLWAY 1624			0.110	0.1077		495.68				0.00108	0.036	5.22		408.775	0.0063		696.56		0.182	84.48		
6/4/12	16:28:00 PM	8081	6.36	TB15-1L	TOLLWAY 1640			0.104	0.1050		543.10				0.00128	0.035	5.01		421.906	0.0061		655.32		0.157	74.07		
7/3/12	9:44:00 AM	7965	6.50	TB15-1L	TOLLWAY 1682	0.128		0.121	0.1008		452.65					0.118	5.92		363.427	0.0086		606.63			76.09		
7/18/12	12:45:00 PM	NA	NA	TB15-1L	TOLLWAY 1695			0.142	0.1110		455.48						6.75		369.159	0.0047		633.28		0.081	80.89		
7/31/12	11:02:00 AM	NA	NA	TB15-1L	TOLLWAY 1712			0.147	0.1126		446.62			0.0093		0.034	6.94	0.13	358.884	0.0142		634.49		0.087	76.96		
						min	0.105	NA	0.094	0.1001	NA	441.65	NA	0.01	0.0093	0.00090	0.029	4.99	0.13	340.277	0.0047	NA	583.23	NA	0.081		

APPENDIX B-2: Results of Geochemical Analysis of Groundwater Samples

Date collected	Time collected (CST)	Field conductivity (uS/cm)	Field pH	Sample location	Sample ID	Sb mg/L	Se mg/L	Si mg/L	Sn mg/L	Sr mg/L	Ti mg/L	Tl mg/L	V mg/L	Zn mg/L	pH	alkalinity mg/L as CaCO <sub>3</sub>	TDS, 180 C mg/L	TSS mg/L	oPO <sub>4</sub> -P mg/L	NH <sub>3</sub> -N mg/L	F mg/L	Cl mg/L	NO <sub>3</sub> -N mg/L	SO <sub>4</sub> mg/L	total NVOC mg/L	dissolved NVOC mg/L	
					MDL:	0.059	0.131	0.066	0.086	0.00037	0.00056	0.017	0.047	0.0073			4	12	3.0	0.01	0.06	0.08	0.09	0.07	0.31	0.31	0.31
					Class 2 Groundwater Standards (mg/L)	0.024	0.05					0.02	0.1	10.0			1,200				4.0	200	100	400			
8/16/11	9:05:00 AM	5882	7.46	TB15-1U	TOLLWAY 1056			7.389		2.6805				0.0243	7.31	324.0	3683		0.026		0.39		1914.5	163.99	6.94	4.58	
8/31/11	9:12:00 AM	7430	6.85	TB15-1U	TOLLWAY 1093	0.830	0.14	10.892		3.2042	0.01998			0.0162	7.30	336.8	3824		0.024		0.29		2152.7	183.97	8.04	4.65	
9/13/11	8:31:00 AM	7599	7.00	TB15-1U	TOLLWAY 1114			8.197		3.1944		0.024		0.0131	7.19	356.3	3942		0.018		0.30		2262.8	186.40	18.90	4.05	
10/26/11	10:20:00 AM	6301	7.45	TB15-1U	TOLLWAY 1206	0.692		9.676		2.4492	0.01754	0.033			7.94	300.4	3160		0.011	0.05	0.26		1809.1	140.43	7.01	4.39	
11/28/11	13:54:00 PM	7621	7.20	TB15-1U	TOLLWAY 1250	0.054		7.267		2.9841		0.019	0.0137		7.31	337.5	3818		0.011	0.07	0.37		2202.2	180.98	14.18	3.38	
12/13/11	10:57:00 AM	8065	7.20	TB15-1U	TOLLWAY 1297			6.983		3.2551		0.033	0.0107		7.46	323.9	4782		0.016		0.34		2426.6	203.34	15.75	3.08	
1/5/12	8:52:00 AM	8773	6.79	TB15-1U	TOLLWAY 1319			6.365		3.3674			0.0142		7.47	312.5	4565		0.013		0.21		2655.8	236.99	18.07	4.42	
1/18/12	10:09:00 AM	8491	7.48	TB15-1U	TOLLWAY 1355			6.411		3.3290			0.0127		7.46	327.1	5148		0.012		0.29		2612.0	236.29	4.70	3.88	
2/1/12	10:12:00 AM	8490	7.37	TB15-1U	TOLLWAY 1381	0.780		8.309		3.3568	0.01774			0.0282	7.54	314.6	4627		0.023		0.62		2682.9	253.93	5.58	4.30	
2/14/12	15:23:00 PM	8513	7.12	TB15-1U	TOLLWAY 1412	0.183	0.22	6.813		3.5766		0.049		0.0102	7.47	333.5	4410		0.017		0.64		2641.1	253.85	8.14	4.16	
2/28/12	14:38:00 PM	8388	7.00	TB15-1U	TOLLWAY 1440	0.050	0.15	6.158		3.3604				7.43	332.6	4686		0.029		0.24		2642.8	257.49	5.51	2.87		
3/13/12	9:24:00 AM	8120	6.96	TB15-1U	TOLLWAY 1473	0.177	0.31	6.860		3.4801	0.00115	0.018		0.0104	7.34	342.4	4801		0.023		0.60		2679.4	255.27	3.86	2.74	
3/27/12	14:15:00 PM	7700	6.97	TB15-1U	TOLLWAY 1495		0.17	6.735		3.4447		0.020		0.0133	7.50	356.1	4741		0.021		0.23		2613.0	244.06	3.96	4.14	
4/10/12	13:47:00 PM	8356	7.06	TB15-1U	TOLLWAY 1533	0.464		8.632		3.7926	0.01135		0.0100		7.40	352.2	4793		0.019		0.28		2606.2	245.99	5.77	2.78	
4/25/12	10:59:00 AM	8109	6.92	TB15-1U	TOLLWAY 1562	0.215	0.25	8.192		4.0198	0.00271	0.034			7.40	340.6	4894		0.018		0.79		2685.6	242.20	5.41	3.53	
5/7/12	13:34:00 PM	8159	6.85	TB15-1U	TOLLWAY 1589	0.122		7.938		3.9715		0.026			7.38	347.3	4525		0.018		0.81		2582.3	234.15	6.88	4.38	
5/23/12	16:23:00 PM	7755	7.10	TB15-1U	TOLLWAY 1623	0.060		7.350		3.6534		0.032		0.0145	7.33	346.5	4735		0.020		0.67		2617.7	240.23	5.45	4.20	
6/4/12	16:06:00 PM	8082	6.62	TB15-1U	TOLLWAY 1639			7.092		3.5704		0.028		0.0201	7.32	341.0	5242		0.019	0.05	0.48		2558.4	233.52	4.45	3.32	
6/19/12	8:52:00 AM	8120	6.36	TB15-1U	TOLLWAY 1665		0.14	9.222		3.9254		0.019			7.27	362.9	4612		0.018		0.20		2567.5	214.54	2.90	1.96	
					min	0.050	0.14	6.158	NA	2.4492	0.00115	0.018	NA	0.0100	7.19	300.4	3160	NA	0.011	0.05	0.20		1809.1	NA	140.43	2.90	1.96
					max	0.830	0.31	10.892	NA	4.0198	0.01998	0.049	NA	0.0282	7.94	362.9	5242	NA	0.029	0.07	0.81		2685.6	NA	257.49	18.90	4.65
					mean	0.330	0.20	7.710	NA	3.4008	0.01175	0.028	NA	0.0151	7.41	336.2	4473	NA	0.019	0.06	0.42		2469.1	NA	221.45	7.97	3.73
8/16/11	9:11:00 AM	7065	7.09	TB15-1L	TOLLWAY 1057		0.15	9.785		3.7595				0.0110	7.15	358.7	4402		0.026		0.23		2326.8	213.15	3.41	2.65	
8/31/11	9:35:00 AM	7688	6.86	TB15-1L	TOLLWAY 1094			9.903		3.7348					7.19	360.3	4108		0.023		0.22		2327.8	204.52	2.69	3.10	
9/13/11	8:55:00 AM	8000	7.00	TB15-1L	TOLLWAY 1115		0.14	11.379		3.8650	0.01368	0.028		0.0107	7.14	361.1	4826		0.023		0.22		2377.9	210.24	3.43	2.77	
9/28/11	14:12:00 PM	8117	7.28	TB15-1L	TOLLWAY 1135		0.13	10.205		3.7691	0.00239	0.033			7.31	356.1	4266		0.018		0.20		2376.9	202.90	4.32	2.38	
10/11/11	9:46:00 AM	7804	7.22	TB15-1L	TOLLWAY 1172			9.995		3.8527		0.025	0.0204		7.40	359.5	4477		0.013		0.14		2374.2	210.78	3.46	2.62	
10/26/11	10:32:00 AM	8085	7.27	TB15-1L	TOLLWAY 1207			9.720		3.6517		0.033			7.50	348.1	4152		0.011		0.29		2400.0	217.42	2.91	2.40	
11/7/11	15:01:00 PM	8101	7.28	TB15-1L	TOLLWAY 1228			9.020		3.2637					7.11	357.5	4031		0.013		0.45		2332.2	208.88	3.19	2.08	
11/28/11	13:38:00 PM	3574	7.01	TB15-1L	TOLLWAY 1249			9.367		3.7494			0.0114		7.16	363.8	4430		0.014		0.27		2535.7	227.21	2.89	2.24	
12/13/11	11:07:00 AM	8486	7.18	TB15-1L	TOLLWAY 1298			8.590		3.6579		0.034			7.11	366.6	4563		0.014		0.24		2577.1	232.29	3.23	2.23	
1/5/12	9:04:00 AM	8370	6.85	TB15-1L	TOLLWAY 1320			8.805		3.7756		0.025			7.29	365.6	4629		0.013		0.17		2607.5	227.77	3.30	2.55	
1/18/12	10:20:00 AM	NA	7.37	TB15-1L	TOLLWAY 1356		0.13	8.446		3.6951					7.30	366.1	4612		0.014		0.27		2572.9	224.40	2.70	2.36	
2/14/12	15:28:00 PM	8355	6.94	TB15-1L	TOLLWAY 1413		0.28	7.795		3.8373		0.049			7.13	364.8	4424		0.022		0.62		2634.6	223.86	3.66	2.64	
2/28/12	14:49:00 PM	8340	6.71	TB15-1L	TOLLWAY 1441		0.35	8.048		3.8594					7.22	363.6	4519		0.018		0.26		2631.3	227.55	4.57	1.62	
3/13/12	16:10:00 PM	8029	6.76	TB15-1L	TOLLWAY 1474		0.29	7.879		3.8245					7.19	361.5	4634		0.025		0.66		2636.1	223.71	4.21	2.01	
3/27/12	14:22:00 PM	7596	6.77	TB15-1L	TOLLWAY 1496		0.17	8.413		3.8279					7.12	362.7	5211		0.018		0.34		2593.3	221.53	2.53	1.76	
4/10/12	14:17:00 PM	8145	6.93	TB15-1L	TOLLWAY 1534			8.640		3.9236		0.022			7.18	358.4	4635		0.018		0.25		2583.0	224.41	3.34	2.00	
4/25/12	11:05:00 AM	8154	6.67	TB15-1L	TOLLWAY 1563		0.20	9.473		4.2478	0.00342	0.027			7.34	363.3	5002		0.019		0.65		2632.5	222.19	2.75	2.56	
5/7/12	13:40:00 PM	7970	6.76	TB15-1L	TOLLWAY 1590			9.609		4.1159	0.01066	0.019			7.25	355.7	4598		0.023		0.73		2571.3	222.40	3.29	2.96	
5/23/12	15:53:00 PM	8235	9.30	TB15-1L	TOLLWAY 1624		0.15	8.744		3.7083		0.027			7.22	361.4	5164		0.019		0.67		2588.7	222.21	2.89	2.25	
6/4/12	16:28:00 PM	8081	6.36	TB15-1L	TOLLWAY 1640			8.766		3.6796		0.029			7.33	361.2	4605		0.021		0.44		2556.7	220.47	2.55	1.69	
7/3/12	9:44:00 AM	7965	6.50	TB15-1L	TOLLWAY 1682		0.15	8.863		3.6858					7.51	355.7	4479		0.023		0.32		2464.7	211.41	4.83	2.41	
7/18/12	12:45:00 PM	NA	NA	TB15-1L	TOLLWAY 1695			9.550		4.0126		0.025		0.0161	7.19	346.7	4806		0.019		0.23		2388.9	208.70	5.67	2.12	
7/31/12	11:02:00 AM</																										

APPENDIX B-2: Results of Geochemical Analysis of Groundwater Samples

Date collected	Time collected (CST)	Field conductivity (uS/cm)	Field pH	Sample location	Sample ID	Al mg/L	As mg/L	B mg/L	Ba mg/L	Be mg/L	Ca mg/L	Cd mg/L	Co mg/L	Cr mg/L	Cu mg/L	Fe mg/L	K mg/L	Li mg/L	Mg mg/L	Mn mg/L	Mo mg/L	Na mg/L	Ni mg/L	P mg/L	Pb mg/L	S mg/L	
						MDL:	0.037	0.108	0.023	0.00085	0.00055	0.012	0.012	0.013	0.0058	0.00079	0.0059	0.016	0.018	0.0025	0.0015	0.022	0.026	0.014	0.063	0.041	0.217
						Class 2 Groundwater Standards (mg/L)		0.2	2.0	2.0	0.5		0.05	1.0	1.0	0.65	5.0			10.0			2.0		0.1		
8/16/11	9:39:00 AM	1037	7.90	TB15-2	TOLLWAY 1058	0.515		0.149	0.0687		97.50					0.323	1.35		68.156	0.0061		29.62		0.125		43.18	
8/31/11	9:57:00 AM	1104	7.63	TB15-2	TOLLWAY 1095			0.157	0.0674		101.38				0.00198		1.69		71.620	0.0584		27.49		0.174		51.45	
9/13/11	9:12:00 AM	2037	8.01	TB15-2	TOLLWAY 1116	1.639		0.164	0.0737		110.55					0.946	2.27		75.633	0.0328		27.79				49.06	
9/28/11	14:27:00 PM	2552	8.00	TB15-2	TOLLWAY 1136	0.180		0.160	0.0662		108.71				0.00152	0.127	1.38		76.564	0.0047	0.022	28.18		0.124		53.11	
10/11/11	10:13:00 AM	789	7.44	TB15-2	TOLLWAY 1173	0.461		0.158	0.0679		105.54					0.332	1.91		76.385	0.0364		27.99		0.152		50.59	
10/26/11	10:55:00 AM	1137	8.27	TB15-2	TOLLWAY 1208	0.212		0.155	0.0697		104.22				0.00099	0.320	1.75		76.871	0.0345		31.28		0.175		50.60	
11/7/11	15:15:00 PM	1534	8.31	TB15-2	TOLLWAY 1229			0.142	0.0659		108.54						1.36		78.759			29.14		0.120		55.78	
11/28/11	14:18:00 PM	1198	8.10	TB15-2	TOLLWAY 1251			0.135	0.0625		108.68					0.76			80.342			29.24		0.148		57.93	
12/13/11	11:26:00 AM	1147	8.22	TB15-2	TOLLWAY 1299			0.136	0.0600		107.94				0.00121		1.00		79.023			30.25		0.144		58.40	
1/5/12	9:22:00 AM	1119	7.66	TB15-2	TOLLWAY 1321	0.041		0.128	0.0614		108.23				0.00091	0.038	0.62		81.478			38.19		0.133		58.08	
1/18/12	10:38:00 AM	1113	8.27	TB15-2	TOLLWAY 1357	0.077		0.115	0.0574		108.50					0.034	0.64		81.380			32.93		0.124		56.44	
2/1/12	10:29:00 AM	1149	7.82	TB15-2	TOLLWAY 1382			0.119	0.0571		106.89				0.00116		0.68		83.199			30.96		0.176		52.08	
2/14/12	15:54:00 PM	1127	7.65	TB15-2	TOLLWAY 1414			0.103	0.0530		104.02						0.66		81.134			30.20		0.097		56.39	
2/28/12	15:08:00 PM	1121	7.36	TB15-2	TOLLWAY 1442	0.158		0.100	0.0552		110.13					0.107	0.78		83.552			30.15		0.108		57.90	
3/13/12	10:39:00 AM	1045	7.35	TB15-2	TOLLWAY 1475	0.165		0.104	0.0549		107.81				0.00090	0.149	0.74		82.908			31.01		0.131		57.49	
3/27/12	14:43:00 PM	981	7.35	TB15-2	TOLLWAY 1497			0.109	0.0573		108.12						0.71		83.995			32.05		0.187		55.94	
4/10/12	14:41:00 PM	1128	7.49	TB15-2	TOLLWAY 1535	18.880		0.150	0.1494		126.87			0.0185	0.00797	11.362	7.51		95.838	0.0911		31.10		0.295		58.81	
4/25/12	11:22:00 AM	1151	7.32	TB15-2	TOLLWAY 1564			0.120	0.0579		103.72					0.032	1.15		79.116	0.0020		27.91		0.176		50.85	
5/7/12	13:57:00 PM	1115	7.34	TB15-2	TOLLWAY 1591	0.074		0.124	0.0593		115.36				0.00087	0.066	0.75		88.378			26.97		0.144		58.65	
5/23/12	16:14:00 PM	1144	7.44	TB15-2	TOLLWAY 1626			0.125	0.0599		112.21					0.029	1.18		87.365	0.0028		27.52		0.189		56.49	
6/4/12	16:52:00 PM	1144	6.87	TB15-2	TOLLWAY 1641			0.124	0.0570		114.69						1.27		86.333	0.0193		26.50		0.191		51.37	
					min	0.041	NA	0.100	0.0530	NA	97.50	NA	NA	0.0185	0.00087	0.029	0.62	NA	68.156	0.0020	0.022	26.50	NA	0.097	NA	43.18	
					max	18.880	NA	0.164	0.1494	NA	126.87	NA	NA	0.0185	0.00797	11.362	7.51	NA	95.838	0.0911	0.022	38.19	NA	0.295	NA	58.81	
					mean	2.037	NA	0.132	0.0658	NA	108.55	NA	NA	0.0185	0.00195	1.066	1.44	NA	80.858	0.0288	0.022	29.83	NA	0.156	NA	54.31	
8/16/11	10:01:00 AM	366	7.70	TB15-3	TOLLWAY 1059	0.836		0.045	0.0362		36.63				0.00576	0.662	1.38		16.633	0.0055		15.97		0.087		2.50	
8/31/11	10:26:00 AM	685	7.73	TB15-3	TOLLWAY 1096	0.128		0.065	0.0459		48.14				0.00406	0.157	1.36		27.204	0.0017		20.96		0.159		5.36	
9/13/11	9:35:00 AM	729	8.24	TB15-3	TOLLWAY 1117	1.679		0.120	0.0894		106.28				0.00115	1.774	2.25		55.322	0.1671		26.64				25.61	
9/28/11	14:45:00 PM	1841	8.50	TB15-3	TOLLWAY 1137	3.573		0.034	0.0318		20.00				0.00627	2.477	1.81		10.457	0.0134		9.92		0.135		2.25	
10/11/11	10:52:00 AM	443	8.16	TB15-3	TOLLWAY 1174	3.859		0.039	0.0499		39.18				0.00662	3.181	2.31		19.877	0.0737		13.65		0.183		5.04	
10/26/11	11:14:00 AM	319	8.22	TB15-3	TOLLWAY 1209	2.784		0.037	0.0394		30.63				0.00491	1.874	1.70		16.918	0.0235		16.20		0.158		3.80	
11/7/11	15:38:00 PM	905	8.29	TB15-3	TOLLWAY 1230	0.110		0.097	0.0622		86.48				0.00160	0.082	0.92		56.361	0.0031		27.85		0.138		16.80	
11/28/11	14:30:00 PM	NA	8.18	TB15-3	TOLLWAY 1252	1.327		0.024	0.0248		23.92				0.00545	0.733	0.61		13.259	0.0034		11.74		0.124		3.78	
12/13/11	11:44:00 AM	981	7.98	TB15-3	TOLLWAY 1300	0.271		0.093	0.0681		101.09				0.00104	0.174	0.78		65.995			35.75		0.129		19.69	
1/5/12	9:49:00 AM	868	7.39	TB15-3	TOLLWAY 1322			0.079	0.0631		96.52						0.62		62.635			35.90		0.136		19.28	
1/18/12	10:56:00 AM	617	8.01	TB15-3	TOLLWAY 1358	0.349		0.097	0.0760		116.93					0.249	0.80		78.036	0.0025		34.13		0.094		27.09	
2/1/12	10:46:00 AM	837	7.75	TB15-3	TOLLWAY 1383	0.067		0.080	0.0644		98.46				0.00115	0.077	0.65		65.904	0.0015		33.44		0.162		18.64	
2/14/12	16:15:00 PM	1082	7.35	TB15-3	TOLLWAY 1415			0.076	0.0622		102.60					0.027	0.57		68.491			38.00			0.047	20.34	
2/28/12	15:19:00 PM	891	7.14	TB15-3	TOLLWAY 1443	25.498		0.104	0.1324		121.34			0.0202	0.02298	22.162	5.77		81.271	0.1445		35.09	0.08	0.279		20.79	
3/13/12	10:56:00 AM	912	7.17	TB15-3	TOLLWAY 1476	0.823		0.084	0.0647		100.90				0.00131	0.753	0.83		66.357	0.0046		32.97		0.112		24.86	
3/27/12	14:53:00 PM	366	7.24	TB15-3	TOLLWAY 1498	3.943		0.040	0.0497		41.00				0.00528	2.639	1.85		22.223	0.0163		15.27		0.171		4.90	
4/10/12	15:07:00 PM	762	7.27	TB15-3	TOLLWAY 1536	0.077		0.079	0.0596		89.58					0.702	0.72		58.922	0.0314		31.34		0.144		17.38	
4/25/12	11:34:00 AM	701	7.24	TB15-3	TOLLWAY 1565	0.098		0.061	0.0521		76.77					0.461	1.09		42.678	0.0477		21.30		0.170		15.38	
5/7/12	14:12:00 PM	250	7.39	TB15-3	TOLLWAY 1592	22.897		0.053	0.1446	0.00084	49.45			0.0241	0.02559	22.832	5.88		25.385	0.1599		9.85		0.369		2.74	
5/23/12	16:25:00 PM	748	7.32	TB15-3	TOLLWAY 1627	0.049		0.078	0.0622		84.74				0.00172	0.332	1.00		54.498	0.0284		25.61		0.179		14.13	
6/4/12	17:09:00 PM	567	6.91	TB15-3	TOLLWAY 1642	0.072		0.065	0.0463		67.06				0.00214	0.152	0.89		41.752	0.0085		21.78		0.147		11.38	
					min	0.049	NA	0.024	0.0248	0.00084	20.00	NA	NA	0.0202	0.00104	0.027	0.57	NA	10.457	0.0015	NA	9.85	0.08	0.087	0.047	2.25	
					max	25.498	NA	0.120	0.1446	0.00084	121.34	NA	NA	0.0241	0.02559	22.832	5.88	NA	81.271	0.1671	NA	38.00	0.08	0.369	0.047	27.09	
					mean	3.602	NA	0.069	0.0631	0.00084	73.22	NA	NA	0.0222	0.00606	3.075	1.61	NA	45.247	0.0409	NA	24.45	0.08	0.162	0.047	13.42	



APPENDIX B-2: Results of Geochemical Analysis of Groundwater Samples

Date collected	Time collected (CST)	Field conductivity (uS/cm)	Field pH	Sample location	Sample ID	Sb mg/L	Se mg/L	Si mg/L	Sn mg/L	Sr mg/L	Ti mg/L	Tl mg/L	V mg/L	Zn mg/L	pH	alkalinity mg/L as CaCO <sub>3</sub>	TDS, 180 C mg/L	TSS mg/L	oPO <sub>4</sub> -P mg/L	NH <sub>3</sub> -N mg/L	F mg/L	Cl mg/L	NO <sub>3</sub> -N mg/L	SO <sub>4</sub> mg/L	total NVOC mg/L	dissolved NVOC mg/L
					MDL:	0.059	0.131	0.066	0.086	0.00037	0.00056	0.017	0.047	0.0073		4	12	3.0	0.01	0.06	0.08	0.09	0.07	0.31	0.31	0.31
					Class 2 Groundwater Standards (mg/L)	0.024	0.05					0.02	0.1	10.0			1,200				4.0	200	100	400		
8/16/11	9:39:00 AM	1037	7.90	TB15-2	TOLLWAY 1058			9.455		0.9762	0.01751			0.0141	7.58	344.9	617		0.028		0.61	60.1		124.05	7.18	4.58
8/31/11	9:57:00 AM	1104	7.63	TB15-2	TOLLWAY 1095			8.617		1.1417					7.78	421.4	664		0.021	0.15	0.57	70.0		148.14	25.86	6.52
9/13/11	9:12:00 AM	2037	8.01	TB15-2	TOLLWAY 1116			12.872		1.1329	0.05977	0.018		0.0112	7.56	372.2	689		0.033		0.58	69.7		145.90	5.96	3.26
9/28/11	14:27:00 PM	2552	8.00	TB15-2	TOLLWAY 1136			8.826		1.0776	0.00618				7.65	371.1	703		0.014		0.53	78.2		145.64	4.02	2.61
10/11/11	10:13:00 AM	789	7.44	TB15-2	TOLLWAY 1173			9.714		1.1642	0.01462				7.79	377.9	681		0.015	0.03	0.52	75.6		141.16	3.30	3.28
10/26/11	10:55:00 AM	1137	8.27	TB15-2	TOLLWAY 1208			9.430		1.1628	0.00553				7.74	381.0	705		0.018	0.14	0.54	82.0		146.82	8.08	2.26
11/7/11	15:15:00 PM	1534	8.31	TB15-2	TOLLWAY 1229			7.915		1.0815					7.74	366.8	702		0.011		0.55	83.1		156.04	3.69	2.14
11/28/11	14:18:00 PM	1198	8.10	TB15-2	TOLLWAY 1251			7.747		1.0924					7.67	379.6	706		0.011		0.54	79.1		160.61	3.08	2.52
12/13/11	11:26:00 AM	1147	8.22	TB15-2	TOLLWAY 1299			7.226		1.1019					7.82	379.9	703		0.010		0.48	83.9		160.16	3.07	1.85
1/5/12	9:22:00 AM	1119	7.66	TB15-2	TOLLWAY 1321			6.451		1.0249					7.84	366.1	697		0.010		0.51	87.8		159.09	3.69	2.48
1/18/12	10:38:00 AM	1113	8.27	TB15-2	TOLLWAY 1357			6.526		1.0572	0.00089				7.83	369.5	713		0.011		0.49	82.7		160.36	3.59	2.28
2/1/12	10:29:00 AM	1149	7.82	TB15-2	TOLLWAY 1382			6.367		1.0225			0.0100		7.81	369.6	706		0.013		0.46	83.8		161.68	3.23	2.02
2/14/12	15:54:00 PM	1127	7.65	TB15-2	TOLLWAY 1414		0.14	6.118		0.9727					7.67	373.5	715		0.016		0.42	83.5		158.82	3.60	2.36
2/28/12	15:08:00 PM	1121	7.36	TB15-2	TOLLWAY 1442			6.856		1.0614	0.00482				7.72	377.6	701		0.023		0.42	78.6		156.68	2.27	1.80
3/13/12	10:39:00 AM	1045	7.35	TB15-2	TOLLWAY 1475			6.640		1.0453	0.00477				7.68	374.6	742		0.025		0.44	81.9		159.10	2.76	1.88
3/27/12	14:43:00 PM	981	7.35	TB15-2	TOLLWAY 1497			6.647		1.0659					7.61	383.5	738		0.016		0.46	77.4		159.91	2.43	1.42
4/10/12	14:41:00 PM	1128	7.49	TB15-2	TOLLWAY 1535			49.232		1.2464	0.58262		0.0550		7.60	394.9	983		0.176		0.48	76.0		161.05	3.99	2.73
4/25/12	11:22:00 AM	1151	7.32	TB15-2	TOLLWAY 1564			7.356		1.1978					7.69	389.3	750		0.015		0.50	74.2		157.76	3.53	2.12
5/7/12	13:57:00 PM	1115	7.34	TB15-2	TOLLWAY 1591			7.563		1.1857	0.00106				7.71	384.8	768		0.015		0.46	80.3		158.43	3.74	2.00
5/23/12	16:14:00 PM	1144	7.44	TB15-2	TOLLWAY 1626			7.642		1.1256					7.71	391.6	716		0.015		0.52	78.9		160.35	9.74	1.94
6/4/12	16:52:00 PM	1144	6.87	TB15-2	TOLLWAY 1641			7.988		1.1641					7.76	390.7	712		0.161		0.51	77.9		158.81	NA	NA
					min	NA	0.14	6.118	NA	0.9727	0.00089	0.018	NA	0.0100	7.56	344.9	617	NA	0.010	0.03	0.42	60.1	NA	124.05	2.27	1.42
					max	NA	0.14	49.232	NA	1.2464	0.58262	0.018	NA	0.0550	7.84	421.4	983	NA	0.176	0.15	0.61	87.8	NA	161.68	25.86	6.52
					mean	NA	0.14	9.866	NA	1.1000	0.06978	0.018	NA	0.0226	7.71	379.1	720	NA	0.031	0.11	0.50	78.3	NA	154.31	5.34	2.60
8/16/11	10:01:00 AM	366	7.70	TB15-3	TOLLWAY 1059	0.836		10.412		0.1928	0.02624				7.73	166.4	237		0.023		0.34	10.8		6.84	24.78	16.92
8/31/11	10:26:00 AM	685	7.73	TB15-3	TOLLWAY 1096	0.128		9.256		0.3729	0.00581			0.0099	7.65	227.3	311		0.021		0.40	23.2		16.35	14.99	13.55
9/13/11	9:35:00 AM	729	8.24	TB15-3	TOLLWAY 1117	1.679		14.934		0.6929	0.05388			0.0188	7.63	303.5	466		0.017	0.12	0.38	52.9	0.14	42.55	13.83	7.10
9/28/11	14:45:00 PM	1841	8.50	TB15-3	TOLLWAY 1137	3.573		13.781		0.1120	0.10453			0.0135	7.61	82.1	207		0.039		0.21	6.9		3.24	22.96	21.35
10/11/11	10:52:00 AM	443	8.16	TB15-3	TOLLWAY 1174	3.859		16.380		0.2164	0.10753			0.0161	7.75	237.0	350		0.038	0.23	0.28	20.1		15.68	19.79	13.89
10/26/11	11:14:00 AM	319	8.22	TB15-3	TOLLWAY 1209	2.784		12.779		0.2063	0.07891			0.0105	7.82	135.9	226		0.017		0.31	16.8		10.52	22.15	14.58
11/7/11	15:38:00 PM	905	8.29	TB15-3	TOLLWAY 1230	0.110		7.786		0.7220	0.00189				7.68	373.6	521		0.013		0.40	62.7		49.86	7.60	3.73
11/28/11	14:30:00 PM	NA	8.18	TB15-3	TOLLWAY 1252	1.327		7.623		0.1498	0.03236				7.32	101.1	181		0.012		0.25	13.8		10.14	16.86	10.09
12/13/11	11:44:00 AM	981	7.98	TB15-3	TOLLWAY 1300	0.271		7.406		0.8194	0.00623				7.62	409.6	611		0.023		0.31	70.0		56.31	4.81	3.11
1/5/12	9:49:00 AM	868	7.39	TB15-3	TOLLWAY 1322			6.283		0.7590					7.62	404.9	526		0.009		0.31	58.7		50.09	15.43	3.13
1/18/12	10:56:00 AM	617	8.01	TB15-3	TOLLWAY 1358	0.349		8.127		1.0223	0.00947				7.65	459.1	655		0.015		0.34	85.1		69.99	5.98	2.55
2/1/12	10:46:00 AM	837	7.75	TB15-3	TOLLWAY 1383	0.067		6.276		0.7802	0.00076				7.52	457.6	619		0.015		0.32	77.5		63.48	18.17	2.40
2/14/12	16:15:00 PM	1082	7.35	TB15-3	TOLLWAY 1415			5.931		0.7772					7.43	432.7	634		0.016		0.28	83.5		62.79	13.62	2.77
2/28/12	15:19:00 PM	891	7.14	TB15-3	TOLLWAY 1443	25.498		38.109		0.8952	0.36179		0.1231		7.57	390.9	813		0.111		0.30	75.0		59.62	8.04	3.93
3/13/12	10:56:00 AM	912	7.17	TB15-3	TOLLWAY 1476	0.823		8.166		0.7714	0.02585				7.59	376.6	679		0.030		0.30	81.5		80.27	4.14	2.46
3/27/12	14:53:00 PM	366	7.24	TB15-3	TOLLWAY 1498	3.943		14.838		0.2506	0.10835			0.0156	7.54	195.3	294		0.023		0.23	20.1		14.84	20.38	14.12
4/10/12	15:07:00 PM	762	7.27	TB15-3	TOLLWAY 1536	0.077		7.502		0.7191	0.00234				7.53	380.8	517		0.015	0.15	0.31	54.2		50.71	8.78	5.43
4/25/12	11:34:00 AM	701	7.24	TB15-3	TOLLWAY 1565	0.098		7.649		0.5630	0.00263				7.65	291.8	452		0.014	0.10	0.31	46.6		41.56	58.56	9.20
5/7/12	14:12:00 PM	250	7.39	TB15-3	TOLLWAY 1592	22.897		47.895		0.1919	0.30249			0.1141	7.52	133.8	657		0.189	0.08	0.22	11.4		7.94	54.67	41.49
5/23/12	16:25:00 PM	748	7.32	TB15-3	TOLLWAY 1627	0.049		8.131		0.6668	0.00105				7.61	349.4	470		0.015	0.07	0.31	52.0		43.56	40.16	12.34
6/4/12	17:09:00 PM	567	6.91	TB15-3	TOLLWAY 1642	0.072		6.698		0.5241	0.00369				7.63	252.5	378		0.016		0.41	40.7	0.23	32.69	11.34	5.82

APPENDIX B-2: Results of Geochemical Analysis of Groundwater Samples

Date collected	Time collected (CST)	Field conductivity (uS/cm)	Field pH	Sample location	Sample ID	Al	As	B	Ba	Be	Ca	Cd	Co	Cr	Cu	Fe	K	Li	Mg	Mn	Mo	Na	Ni	P	Pb	S	
						mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L
						MDL:	0.037	0.108	0.023	0.00085	0.00055	0.012	0.012	0.013	0.0058	0.00079	0.0059	0.016	0.018	0.0025	0.0015	0.022	0.026	0.014	0.063	0.041	0.217
						Class 2 Groundwater Standards (mg/L)		0.2	2.0	2.0	0.5		0.05	1.0	1.0	0.65	5.0			10.0			2.0		0.1		
8/16/11	8:30:00 AM	1456	7.26	TB15-4U	TOLLWAY 1055			0.243	0.1096		101.80				0.00269	0.027	27.52		23.755	0.7155		186.21		0.185		17.76	
8/31/11	8:25:00 AM	1713	7.01	TB15-4U	TOLLWAY 1091			0.300	0.1259		107.45				0.00278	0.209	33.26		26.149	0.8092		209.20		0.172		18.58	
9/13/11	7:47:00 AM	2042	7.37	TB15-4U	TOLLWAY 1112			0.328	0.1501		115.27					0.454	44.51		31.811	1.0918		267.13				20.24	
9/28/11	13:31:00 PM	2480	7.78	TB15-4U	TOLLWAY 1133			0.185	0.1591		128.11				0.00340	0.064	36.32		33.363	0.8472		327.69		0.076		25.35	
10/11/11	9:16:00 AM	2590	7.20	TB15-4U	TOLLWAY 1161			0.186	0.1643		131.56				0.00257	0.198	35.68		35.252	0.9290		354.83		0.207		30.80	
10/26/11	9:40:00 AM	2675	7.80	TB15-4U	TOLLWAY 1204			0.175	0.1748		142.55				0.00493		33.93		39.619	0.8428		360.70		0.106		37.05	
11/7/11	14:16:00 PM	2901	8.10	TB15-4U	TOLLWAY 1226			0.163	0.1550		116.47				0.00295	0.055	33.48		31.860	0.7835		448.90		0.146		30.81	
11/28/11	13:02:00 PM	1658	7.48	TB15-4U	TOLLWAY 1223			0.137	0.1008		91.89				0.01060	0.037	26.45		23.804	0.0437		220.53		0.157		26.71	
12/13/11	10:17:00 AM	2161	7.73	TB15-4U	TOLLWAY 1295			0.157	0.1260		108.83				0.01035		30.19		28.765	0.3328		296.86		0.171		27.12	
1/5/12	8:23:00 AM	1592	7.42	TB15-4U	TOLLWAY 1317			0.119	0.0930		87.70				0.01030		27.12		23.358	0.1101		227.19		0.172		22.23	
1/18/12	9:25:00 AM	2885	8.51	TB15-4U	TOLLWAY 1353			0.106	0.1599		141.82				0.00700		30.29		38.271	0.1270		398.59		0.117		23.85	
2/1/12	9:11:00 AM	2716	7.63	TB15-4U	TOLLWAY 1378			0.095	0.1466		133.76				0.00648		26.84		36.647	0.1108		364.49		0.167		21.63	
2/14/12	14:39:00 PM	3550	7.26	TB15-4U	TOLLWAY 1410			0.104	0.1831		160.78				0.00667		31.99		47.527	0.4894		495.97		0.100		23.97	
2/28/12	14:15:00 PM	3709	7.03	TB15-4U	TOLLWAY 1439			0.091	0.1980		176.38				0.00562		30.15		46.073	0.1719		558.76		0.198		26.09	
3/13/12	8:28:00 AM	3211	7.25	TB15-4U	TOLLWAY 1471			0.098	0.1640		137.37				0.00658		29.32		39.415	0.1904		532.44		0.160		26.23	
3/27/12	13:37:00 PM	2371	6.93	TB15-4U	TOLLWAY 1493			0.150	0.1329		101.39				0.00959		29.54		27.452	0.1669		389.97		0.179		21.75	
4/10/12	12:47:00 PM	3479	7.15	TB15-4U	TOLLWAY 1520			0.169	0.2057		156.20				0.00503	0.026	40.42		44.396	0.8807		520.09		0.192		23.19	
4/25/12	10:20:00 AM	2426	7.02	TB15-4U	TOLLWAY 1561			0.154	0.1210		91.19				0.00565		31.65		27.252	0.3589		376.82		0.155		20.40	
5/7/12	13:12:00 PM	1945	7.02	TB15-4U	TOLLWAY 1588		0.053	0.116	0.1192		105.69				0.00888	0.102	20.80		25.989	0.0905		286.10		0.169		14.63	
6/4/12	13:26:00 PM	2787	6.67	TB15-4U	TOLLWAY 1637			0.137	0.1460		120.90				0.00693		30.78		29.464	0.6387		417.30		0.179		18.85	
6/19/12	8:30:00 AM	2341	6.86	TB15-4U	TOLLWAY 1664			0.139	0.1102		87.38				0.00347	0.077	28.10		23.229	0.9956		370.71				20.21	
7/31/12	10:24:00 AM	2655	6.76	TB15-4U	TOLLWAY 1710			0.184	0.1474		113.09				0.00458		28.70		26.883	0.8516		410.95		0.099		23.29	
						min	0.053	NA	0.091	0.0930	NA	87.38	NA	NA	NA	0.00257	0.026	20.80	NA	23.229	0.0437	NA	186.21	NA	0.076	NA	14.63
						max	0.053	NA	0.328	0.2057	NA	176.38	NA	NA	NA	0.01060	0.454	44.51	NA	47.527	1.0918	NA	558.76	NA	0.207	NA	37.05
						mean	0.053	NA	0.161	0.1451	NA	120.80	NA	NA	NA	0.00605	0.125	31.23	NA	32.288	0.5263	NA	364.61	NA	0.155	NA	23.67
8/16/11	8:07:00 AM	8467	6.82	TB15-4L	TOLLWAY 1054			0.191	0.3442		664.06				0.00199		9.97	0.13	498.214	0.0969		322.93		0.206		75.23	
8/31/11	8:53:00 AM	8415	6.64	TB15-4L	TOLLWAY 1092			0.211	0.3557		666.31				0.00310	0.056	10.24	0.14	478.093	0.1085		331.30		0.175		79.36	
9/13/11	8:10:00 AM	8484	6.94	TB15-4L	TOLLWAY 1113			0.215	0.3876		677.01					0.548	10.05	0.14	478.883	0.1941		323.49				73.85	
10/11/11	8:53:00 AM	8404	7.16	TB15-4L	TOLLWAY 1160			0.217	0.3723		725.36		0.013		0.00122	0.048	8.65	0.13	534.984	0.1526		313.27		0.205		77.91	
10/26/11	9:56:00 AM	8499	7.40	TB15-4L	TOLLWAY 1205			0.199	0.3517		614.56				0.00372		7.85	0.13	449.963	0.0868		299.70		0.147		80.57	
11/7/11	14:36:00 PM	8611	7.45	TB15-4L	TOLLWAY 1227			0.199	0.3577		637.42				0.00110	0.408	8.14		494.456	0.1742		317.56		0.173		81.11	
11/28/11	13:21:00 PM	8866	7.05	TB15-4L	TOLLWAY 1248			0.195	0.3469		667.05				0.00226		8.11		512.457	0.1083		332.39		0.189		86.14	
12/13/11	10:33:00 AM	8685	7.28	TB15-4L	TOLLWAY 1296			0.181	0.3308		628.13				0.00185		7.59	0.11	471.296	0.1009		325.74		0.118		83.32	
1/5/12	8:32:00 AM	8450	6.96	TB15-4L	TOLLWAY 1318			0.170	0.3386		642.99				0.00239		7.97		500.827	0.1047		331.18		0.179		82.41	
1/18/12	9:44:00 AM	8737	7.65	TB15-4L	TOLLWAY 1354		0.051	0.163	0.3333		631.61				0.00181		7.92	0.12	493.210	0.0952		334.38		0.139		78.33	
2/1/12	9:29:00 AM	8594	7.24	TB15-4L	TOLLWAY 1379		0.045	0.151	0.3199		662.49		0.023		0.00209		7.86		510.287	0.0895		337.78		0.173		77.02	
2/14/12	14:54:00 PM	8429	7.05	TB15-4L	TOLLWAY 1411			0.144	0.2912		660.73		0.014		0.00214	0.027	7.37		486.989	0.0842		327.41		0.162	0.043	82.61	
3/13/12	8:42:00 AM	7825	6.94	TB15-4L	TOLLWAY 1472			0.146	0.3105		648.15		0.017		0.00227	0.030	7.60		498.753	0.0933		341.07		0.146		84.16	
3/27/12	13:54:00 PM	7707	6.74	TB15-4L	TOLLWAY 1494			0.141	0.2939		642.50				0.00224		7.19	0.12	496.951	0.0814		321.06		0.179		80.18	
4/10/12	13:09:00 PM	8087	6.99	TB15-4L	TOLLWAY 1521			0.159	0.3233		662.39					0.053	7.70	0.12	522.291	0.1008		326.54		0.182		83.63	
5/23/12	15:29:00 PM	8144	6.78	TB15-4L	TOLLWAY 1622		0.046	0.158	0.3193		663.20				0.00261		7.55	0.12	398.931	0.0844		310.04		0.185		76.80	
6/4/12	15:45:00 PM	8090	6.36	TB15-4L	TOLLWAY 1638			0.160	0.3021		695.84					0.00227	0.030	7.60		498.753	0.0933	341.07		0.146		84.16	
6/19/12	8:10:00 AM	8176	6.50	TB15-4L	TOLLWAY 1663			0.182	0.3069		619.35				0.00085		7.57	0.12	478.727	0.0512		328.21				81.68	
7/3/12	8:00:00 AM	8344	6.42	TB15-4L	TOLLWAY 1679			0.172	0.2777		614.05				0.00084		7.90	0.12	471.388	0.0226		322.46		0.126		77.98	
7/18/12	10:59:00 AM	8358	6.42	TB15-4L	TOLLWAY 1692			0.193	0.3070		614.22																

APPENDIX B-2: Results of Geochemical Analysis of Groundwater Samples

Date collected	Time collected (CST)	Field conductivity (uS/cm)	Field pH	Sample location	Sample ID	Sb mg/L	Se mg/L	Si mg/L	Sn mg/L	Sr mg/L	Ti mg/L	Tl mg/L	V mg/L	Zn mg/L	pH	alkalinity mg/L as CaCO <sub>3</sub>	TDS, 180 C mg/L	TSS mg/L	oPO <sub>4</sub> -P mg/L	NH <sub>3</sub> -N mg/L	F mg/L	Cl mg/L	NO <sub>3</sub> -N mg/L	SO <sub>4</sub> mg/L	total NVOC mg/L	dissolved NVOC mg/L	
					MDL:	0.059	0.131	0.066	0.086	0.00037	0.00056	0.017	0.047	0.0073			4	12	3.0	0.01	0.06	0.08	0.09	0.07	0.31	0.31	0.31
					Class 2 Groundwater Standards (mg/L)	0.024	0.05					0.02	0.1	10.0			1,200				4.0	200	100	400			
8/16/11	8:30:00 AM	1456	7.26	TB15-4U	TOLLWAY 1055			7.459		0.2707					7.31	409.1	876		0.032	0.28	0.46	199.0		48.67	24.03	23.07	
8/31/11	8:25:00 AM	1713	7.01	TB15-4U	TOLLWAY 1091			8.631		0.3026					7.35	467.9	948		0.032	0.37	0.30	208.8		49.84	25.51	24.82	
9/13/11	7:47:00 AM	2042	7.37	TB15-4U	TOLLWAY 1112			9.647		0.3390					7.28	480.2	1165		0.031	0.49	0.31	336.3		54.13	27.55	26.67	
9/28/11	13:31:00 PM	2480	7.78	TB15-4U	TOLLWAY 1133			7.260		0.3504	0.00080				7.43	365.8	1375		0.017	0.28	0.31	527.7	0.91	72.14	21.05	19.48	
10/11/11	9:16:00 AM	2590	7.20	TB15-4U	TOLLWAY 1161			7.808		0.3535					7.41	349.5	1458		0.017	0.25	0.30	590.0		79.40	20.75	21.26	
10/26/11	9:40:00 AM	2675	7.80	TB15-4U	TOLLWAY 1204			6.918		0.3385					7.56	405.6	1498		0.013	0.13	0.26	570.1	0.79	71.80	18.64	17.80	
11/7/11	14:16:00 PM	2901	8.10	TB15-4U	TOLLWAY 1226			6.102		0.3025					7.25	350.4	1652		0.014	0.18	0.38	707.5	0.09	85.40	19.41	17.41	
11/28/11	13:02:00 PM	1658	7.48	TB15-4U	TOLLWAY 1223			5.231		0.2229					7.24	359.0	939		0.012	0.08	0.29	264.8	1.20	81.86	17.44	19.64	
12/13/11	10:17:00 AM	2161	7.73	TB15-4U	TOLLWAY 1295			5.094		0.2846					7.34	384.8	1241		0.012	0.11	0.25	438.0	0.11				
1/5/12	8:23:00 AM	1592	7.42	TB15-4U	TOLLWAY 1317			4.694		0.2201					7.46	349.3	916		0.012	0.05	0.28	270.7	0.39	62.72	17.38	17.33	
1/18/12	9:25:00 AM	2885	8.51	TB15-4U	TOLLWAY 1353			4.293		0.3759					7.44	315.5	1670		0.010	0.16	0.26	723.6	1.23	72.73	15.61	15.56	
2/1/12	9:11:00 AM	2716	7.63	TB15-4U	TOLLWAY 1378			4.216		0.3744					7.42	309.2	1490		0.013	0.19	0.22	664.8	0.70	64.78	14.28	14.17	
2/14/12	14:39:00 PM	3550	7.26	TB15-4U	TOLLWAY 1410		0.19	4.285		0.4714		0.022			7.25	307.2	1984		0.017	0.19	0.39	969.9	0.20	69.92	15.53	14.99	
2/28/12	14:15:00 PM	3709	7.03	TB15-4U	TOLLWAY 1439			4.241	0.090	0.5108					7.36	280.2	2161		0.013	0.18	0.29	1078.8	1.87	72.03	10.05	9.81	
3/13/12	8:28:00 AM	3211	7.25	TB15-4U	TOLLWAY 1471			4.376		0.4518					7.41	294.0	1966		0.017	0.11	0.25	890.1	0.72	73.43	10.81	10.86	
3/27/12	13:37:00 PM	2371	6.93	TB15-4U	TOLLWAY 1493			5.391		0.3385					7.50	403.1	1432		0.021	0.06	0.30	558.3	0.93	63.45	13.73	13.59	
4/10/12	12:47:00 PM	3479	7.15	TB15-4U	TOLLWAY 1520			5.795		0.5550					7.32	343.4	1993		0.018	0.20	0.22	935.9	0.12	62.16	10.11	10.01	
4/25/12	10:20:00 AM	2426	7.02	TB15-4U	TOLLWAY 1561			5.458		0.3188					7.50	387.6	1356		0.022	0.28	0.28	532.2	0.09	57.26	16.14	15.89	
5/7/12	13:12:00 PM	1945	7.02	TB15-4U	TOLLWAY 1588			5.510		0.3198	0.00151				7.37	352.2	1148		0.019	0.05	0.34	435.1	0.67	38.05	14.84	14.39	
6/4/12	13:26:00 PM	2787	6.67	TB15-4U	TOLLWAY 1637			6.392		0.3648		0.017			7.38	386.4	1541		0.025	0.41	0.41	637.7	0.06	52.62	11.62	12.37	
6/19/12	8:30:00 AM	2341	6.86	TB15-4U	TOLLWAY 1664			6.619		0.2960					7.46	366.4	1306		0.023	0.04	0.43	514.3		53.93	15.63	15.53	
7/31/12	10:24:00 AM	2655	6.76	TB15-4U	TOLLWAY 1710			7.850		0.3591					7.57	372.2	1496		0.030	0.07	0.30	626.7	0.44	63.97	15.35	15.32	
					min	NA	0.19	4.216	0.090	0.2201	0.00080	0.017	NA	NA	7.24	280.2	876	NA	0.010	0.04	0.22	199.0	0.06	38.05	10.05	9.81	
					max	NA	0.19	9.647	0.090	0.5550	0.00151	0.022	NA	NA	7.57	480.2	2161	NA	0.032	0.49	0.46	1078.8	1.87	85.40	27.55	26.67	
					mean	NA	0.19	6.058	0.090	0.3510	0.00116	0.020	NA	NA	7.39	365.4	1437	NA	0.019	0.17	0.31	576.4	0.62	64.30	16.93	16.67	
8/16/11	8:07:00 AM	8467	6.82	TB15-4L	TOLLWAY 1054			10.134		6.6733			0.1527	7.16	301.0	4690		0.032		0.35	2529.7		202.67	3.99	4.08		
8/31/11	8:53:00 AM	8415	6.64	TB15-4L	TOLLWAY 1092		0.17	10.553		6.6916		0.021	0.1351	7.19	300.1	4270		0.028		0.24	2589.6		206.72	4.44	4.07		
9/13/11	8:10:00 AM	8484	6.94	TB15-4L	TOLLWAY 1113		0.18	10.576		6.8207		0.031	0.0697	7.11	298.1	4535		0.024	0.09	0.23	2649.8		211.14	3.78	3.46		
10/11/11	8:53:00 AM	8404	7.16	TB15-4L	TOLLWAY 1160		0.27	10.619		6.6282		0.030	0.1202	7.30	301.3	4878		0.019		0.09	2680.5		211.07	4.20	4.31		
10/26/11	9:56:00 AM	8499	7.40	TB15-4L	TOLLWAY 1205			10.318		6.3633		0.036	0.0886	7.56	303.3	4418		0.013		0.52	2621.1		205.83	3.84	2.89		
11/7/11	14:36:00 PM	8611	7.45	TB15-4L	TOLLWAY 1227			9.724		6.1076		0.049	0.0210	7.18	306.9	4375		0.017		0.46	2654.7		211.87	2.75	2.42		
11/28/11	13:21:00 PM	8866	7.05	TB15-4L	TOLLWAY 1248			9.754	0.111	6.6173		0.030	0.1015	7.20	305.8	4441		0.018		0.24	2721.2	0.08	219.74	3.02	2.62		
12/13/11	10:33:00 AM	8685	7.28	TB15-4L	TOLLWAY 1296			9.003		6.4219		0.029	0.1168	7.24	303.9	4595		0.022		0.25	2737.6	0.08	221.75	3.61	2.70		
1/5/12	8:32:00 AM	8450	6.96	TB15-4L	TOLLWAY 1318			8.789		6.3696		0.032	0.1300	7.40	295.5	4569		0.020		0.21	2695.0	0.10	220.95	2.98	2.77		
1/18/12	9:44:00 AM	8737	7.65	TB15-4L	TOLLWAY 1354		0.16	8.655		6.2945		0.041	0.1126	7.35	299.5	4518		0.020		0.27	2679.2	0.13	217.71	2.95	2.53		
2/1/12	9:29:00 AM	8594	7.24	TB15-4L	TOLLWAY 1379		0.28	8.537		6.2751		0.041	0.1204	7.28	301.6	4544		0.024		0.67	2713.0	0.10	219.17	3.34	2.56		
2/14/12	14:54:00 PM	8429	7.05	TB15-4L	TOLLWAY 1411		0.26	8.109		6.1848		0.033	0.1136	7.17	302.0	4298		0.027		0.60	2713.9	0.13	219.13	3.44	2.76		
3/13/12	8:42:00 AM	7825	6.94	TB15-4L	TOLLWAY 1472		0.40	8.329		6.3015			0.1086	7.29	297.5	5308		0.033		0.33	2639.4	0.14	219.90	2.30	2.26		
3/27/12	13:54:00 PM	7707	6.74	TB15-4L	TOLLWAY 1494		0.16	8.401		6.3001			0.0981	7.19	302.5	4676		0.026		0.33	2643.8	0.09	214.32	2.25	2.25		
4/10/12	13:09:00 PM	8087	6.99	TB15-4L	TOLLWAY 1521			9.188		6.8469		0.017	0.1009	7.21	292.4	5415		0.025		0.27	2609.0		210.80	2.18	2.54		
5/23/12	15:29:00 PM	8144	6.78	TB15-4L	TOLLWAY 1622		0.15	9.018		6.4261		0.028	0.0944	7.26	301.7	4547		0.031	0.24	0.62	2580.2	0.06	207.13	4.36	3.70		
6/4/12	15:45:00 PM	8090	6.36	TB15-4L	TOLLWAY 1638			9.562		6.2931		0.027	0.0405	7.20	303.0	4648		0.034		0.47	2628.4	0.06	215.39	1.83	1.63		
6/19/12	8:10:00 AM	8176	6.50	TB15-4L	TOLLWAY 1663		0.20	9.589		6.6746		0.025	0.0863	7.30	291.6	4806		0.027		0.30	2660.6	0.13	212.30	2.86	2.52		
7/3/12	8:00:00 AM	8344	6.42	TB15-4L	TOLLWAY 1679		0.17	9.233		6.6433			0.0730	7.35	299.1	4745		0.063	0.17	0.32	2672.9	0.12	213.26	4.18	3.77		
7/18/12	10:59:00 AM	8358	6.42	TB15-4L	TOLLWAY 1692			9.784		6.																	

APPENDIX B-3: Results of Geochemical Analysis of Groundwater Samples

Date collected	Time collected (CST)	Field conductivity (uS/cm)	Field pH	Sample location	Sample ID	Al mg/L	As mg/L	B mg/L	Ba mg/L	Be mg/L	Ca mg/L	Cd mg/L	Co mg/L	Cr mg/L	Cu mg/L	Fe mg/L	K mg/L	Li mg/L	Mg mg/L	Mn mg/L	Mo mg/L	Na mg/L	Ni mg/L	P mg/L	Pb mg/L	S mg/L
					MDL:	0.037	0.11	0.023	0.00085	0.00055	0.029	0.012	0.013	0.0058	0.00079	0.024	0.016	0.11	0.027	0.0015	0.022	0.026	0.043	0.073	0.041	0.22
Class 2 Groundwater Standards (mg/L)							0.2	2.0	2.0	0.5		0.05	1.0	1.0	0.65	5.0				10.0			2.0		0.1	
3/20/13	12:50:00 PM	3622	7.34	TB7B-1	TOLLWAY 2039	0.478		0.058	0.0514		73.1				0.00983	0.599	3.501		18.581	0.0108		571.6		0.105		97.708
4/2/13	14:47:00 PM	3187	7.38	TB7B-1	TOLLWAY 2054			0.060	0.0533		116				0.00323	0.238	3.128		34.567	0.2809		449.6		0.196		100.443
4/16/13	14:14:00 PM	1791	7.34	TB7B-1	TOLLWAY 2084	0.809		0.077	0.0384		67.4				0.01017	0.699	2.743		22.062	0.1809		295.9		0.113		56.726
4/29/13	13:21:00 PM	1135	7.19	TB7B-1	TOLLWAY 2099	1.077		0.097	0.0403		65.4				0.00922	1.861	5.193		21.163	0.3955		286.4		0.148		57.679
5/15/13	11:06:00 AM	1557	7.07	TB7B-1	TOLLWAY 2147	0.265		0.092	0.0384		64.4				0.00676	0.469	4.859		21.145	0.2708		308.5		0.198		52.956
5/29/13	15:07:00 PM	1221	6.75	TB7B-1	TOLLWAY 2171	2.190		0.125	0.0416		48.8				0.02210	7.129	6.774		9.981	0.4508		282.6		0.507		35.800
6/11/13	13:18:00 PM	1481	6.89	TB7B-1	TOLLWAY 2203	0.255		0.120	0.0293		43.8				0.01206	5.495	5.997		8.121	0.3715		307.9		0.399		33.886
6/25/13	15:27:00 PM	1155	6.92	TB7B-1	TOLLWAY 2235	0.333		0.127	0.0261		35.7				0.00789	4.405	4.461		7.412	0.2680		264.8		0.550		24.039
7/9/13	13:38:00 PM	1210	6.96	TB7B-1	TOLLWAY 2263	0.477		0.134	0.0247		33.1				0.00734	3.471	6.410		8.210	0.1821		277.3		0.625		14.422
7/23/13	14:09:00 PM	1004	6.92	TB7B-1	TOLLWAY 2285	0.351		0.125	0.0275		37.4				0.00571	3.726	6.179		7.516	0.2768		241.4		0.336		21.619
8/7/13	10:27:00 AM	1655	7.17	TB7B-1	TOLLWAY 2318	0.985		0.132	0.0325		42.4				0.00335	2.727	6.580		9.646	0.2708		273.8		0.621		20.094
8/19/13	12:25:00 PM	1430	6.96	TB7B-1	TOLLWAY 2325	0.150		0.129	0.0303		52.5					3.320	6.589		10.046	0.3355		266.4		0.416		24.424
					min	0.150	NA	0.058	0.0247	NA	33.054	NA	NA	NA	0.00323	0.238	2.743	NA	7.412	0.0108	NA	241.4	NA	0.105	NA	14.422
					max	2.190	NA	0.134	0.0533	NA	116.105	NA	NA	NA	0.02210	7.129	6.774	NA	34.567	0.4508	NA	571.6	NA	0.625	NA	100.443
					mean	0.670	NA	0.106	0.0362	NA	56.671	NA	NA	NA	0.00888	2.845	5.201	NA	14.871	0.2745	NA	318.8	NA	0.351	NA	44.983
4/16/13	14:16:00 PM	1533	7.59	TB7B-2	TOLLWAY 2085			0.224	0.0283		90.50				0.00276		0.37		118.03			148.3		0.101		74.95
4/29/13	13:44:00 PM	429	7.15	TB7B-2	TOLLWAY 2100			0.068	0.0095		47.14					0.045	0.28		26.63			17.6				6.10
5/15/13	11:29:00 AM	796	7.20	TB7B-2	TOLLWAY 2148			0.159	0.0200		68.07				0.00198		0.39		56.39			55.6		0.121		21.09
5/29/13	15:33:00 PM	596	6.97	TB7B-2	TOLLWAY 2172			0.154	0.0176		60.71				0.00387		0.45		42.62			36.2		0.131		11.61
6/11/13	13:38:00 PM	753	7.05	TB7B-2	TOLLWAY 2204			0.169	0.0211		81.34				0.00253		0.45		52.95	0.0243		41.1		0.101		13.61
6/25/13	15:52:00 PM	1040	7.03	TB7B-2	TOLLWAY 2236			0.231	0.0281		91.57					0.374	0.54		74.84	0.4302		64.6		0.133		17.48
7/9/13	13:58:00 PM	901	6.88	TB7B-2	TOLLWAY 2264			0.230	0.0281		92.02				0.00190	0.416	0.76		62.75	0.2706		56.9		0.095		10.00
7/23/13	14:17:00 PM	1147	6.95	TB7B-2	TOLLWAY 2286			0.283	0.0388		89.92					2.911	1.12		78.54	1.4321		89.1				11.05
8/7/13	10:49:00 AM	1102	6.84	TB7B-2	TOLLWAY 2319	0.050		0.268	0.0338		79.34					3.767	1.18		72.64	0.6654		92.0				18.46
					min	0.050	NA	0.068	0.0095	NA	47.14	NA	NA	NA	0.00190	0.045	0.28	NA	26.63	0.0243	NA	17.6	NA	0.095	NA	6.10
					max	0.050	NA	0.283	0.0388	NA	92.02	NA	NA	NA	0.00387	3.767	1.18	NA	118.03	1.4321	NA	148.3	NA	0.133	NA	74.95
					mean	0.050	NA	0.198	0.0250	NA	77.85	NA	NA	NA	0.00261	1.503	0.62	NA	65.04	0.5645	NA	66.8	NA	0.114	NA	20.48
3/20/13	13:13:00 PM	1279	7.17	TB7B-3	TOLLWAY 2040			0.094	0.0116		60.21							0.17	74.70			41.2				18.4
4/16/13	14:43:00 PM	810	7.70	TB7B-3	TOLLWAY 2086			0.098	0.0118		71.99							0.12	65.49			31.5		0.099		14.5
4/29/13	13:55:00 PM	566	7.39	TB7B-3	TOLLWAY 2101	0.054		0.124	0.0125		62.05				0.00208	0.045	0.19		35.84		0.025	21.7		0.080		8.49
5/15/13	11:35:00 AM	692	7.27	TB7B-3	TOLLWAY 2149			0.108	0.0118		71.10						0.19		45.93			13.8		0.129		8.76
5/29/13	16:31:00 PM	392	7.21	TB7B-3	TOLLWAY 2174			0.142	0.0131		75.85				0.00188	0.027	0.23		49.36			14.1		0.087		8.33
6/11/13	13:48:00 PM	697	7.21	TB7B-3	TOLLWAY 2205	0.039		0.136	0.0130		78.55					0.067	0.25		48.91			14.6		0.135		7.35
6/25/13	16:14:00 PM	764	7.23	TB7B-3	TOLLWAY 2237			0.154	0.0139		86.07				0.00407		0.26		56.89			15.2		0.130		6.88
7/9/13	14:15:00 PM	842	7.20	TB7B-3	TOLLWAY 2265			0.176	0.0157		87.41						0.34		57.96	0.0030		16.7				6.65
7/23/13	14:36:00 PM	914	7.18	TB7B-3	TOLLWAY 2287			0.177	0.0189		101.06					0.046	0.46		68.95	0.0321		17.2				7.70
8/7/13	10:58:00 AM	944	7.08	TB7B-3	TOLLWAY 2320	0.208		0.154	0.0212		102.95					0.159	0.82		76.73	0.0908		15.5				9.65
					min	0.039	NA	0.094	0.0116	NA	60.21	NA	NA	NA	0.00188	0.027	0.12	NA	35.84	0.0030	0.025	13.8	NA	0.080	NA	6.651
					max	0.208	NA	0.177	0.0212	NA	102.95	NA	NA	NA	0.00407	0.159	0.82	NA	76.73	0.0908	0.025	41.2	NA	0.135	NA	18.357
					mean	0.100	NA	0.136	0.0144	NA	79.72	NA	NA	NA	0.00267	0.069	0.30	NA	58.08	0.0420	0.025	20.1	NA	0.110	NA	9.670

APPENDIX B-3: Results of Geochemical Analysis of Groundwater Samples

Date collected	Time collected (CST)	Field conductivity (uS/cm)	Field pH	Sample location	Sample ID	Sb mg/L	Se mg/L	Si mg/L	Sn mg/L	Sr mg/L	Ti mg/L	Tl mg/L	V mg/L	Zn mg/L	pH	alkalinity mg/L as CaCO <sub>3</sub>	TDS, 180 C mg/L	TSS mg/L	oPO <sub>4</sub> -P mg/L	NH <sub>3</sub> -N mg/L	F mg/L	Cl mg/L	NO <sub>3</sub> -N mg/L	SO <sub>4</sub> mg/L	total NVOC mg/L	dissolved NVOC mg/L	
					MDL:	0.059	0.13	0.066	0.086	0.00037	0.00056	0.017	0.047	0.0097			4	12	3.0	0.003	0.03	0.07	0.16	0.04	0.21	0.31	0.31
					Class 2 Groundwater Standards (mg/L)	0.024	0.05					0.02	0.1	10.0			1,200			4.0	200	100	400				
3/20/13	12:50:00 PM	3622	7.34	TB7B-1	TOLLWAY 2039			4.056		0.1677	0.01427				7.813	606	1736		0.061	0.050	0.213	371	13.554	272.661	35.816	21.460	
4/2/13	14:47:00 PM	3187	7.38	TB7B-1	TOLLWAY 2054			3.835		0.2235				0.0110	7.716	675	1808		0.039		0.156	393	7.167	305.278	10.198	7.944	
4/16/13	14:14:00 PM	1791	7.34	TB7B-1	TOLLWAY 2084			4.633		0.1405	0.02266				7.511	517	1193		0.052	0.038	0.256	177	6.439	191.799	34.462	21.289	
4/29/13	13:21:00 PM	1135	7.19	TB7B-1	TOLLWAY 2099			5.501		0.1701	0.02239				7.611	428	1012		0.099	0.277	0.256	113	2.308	163.430	38.100	20.485	
5/15/13	11:06:00 AM	1557	7.07	TB7B-1	TOLLWAY 2147			4.086		0.1609	0.00897				7.671	519	1036		0.066	0.133	0.296	133	1.421	147.251	28.968	17.313	
5/29/13	15:07:00 PM	1221	6.75	TB7B-1	TOLLWAY 2171			8.510		0.1504	0.05231			0.0141	7.512	512	938		0.214	0.149	0.314	74	0.585	93.900	61.345	39.887	
6/11/13	13:18:00 PM	1481	6.89	TB7B-1	TOLLWAY 2203			4.758		0.1311	0.00928				7.337	575	949		0.243	0.333	0.342	98	0.123	94.480	41.276	31.209	
6/25/13	15:27:00 PM	1155	6.92	TB7B-1	TOLLWAY 2235			4.825		0.0966	0.00863				7.350	465	811		0.279	0.360	0.345	82		62.811	41.718	31.294	
7/9/13	13:38:00 PM	1210	6.96	TB7B-1	TOLLWAY 2263			5.314		0.1182	0.01235				7.523	534	833		0.400	1.036	0.347	73		36.046	45.745	35.836	
7/23/13	14:09:00 PM	1004	6.92	TB7B-1	TOLLWAY 2285			5.269		0.1132	0.00947				7.464	422	736		0.265	1.330	0.328	63		58.485	38.930	34.218	
8/7/13	10:27:00 AM	1655	7.17	TB7B-1	TOLLWAY 2318			6.908		0.1326	0.02608				7.309	527	857		0.554	5.039	0.301	87		51.621	25.057	25.229	
8/19/13	12:25:00 PM	1430	6.96	TB7B-1	TOLLWAY 2325			5.251		0.1490	0.00235				7.343	559	849		0.329	3.273	0.325	82		63.595	23.410	22.034	
					min	NA	NA	3.835	NA	0.0966	0.00235	NA	NA	0.0110	7.309	422	736	NA	0.039	0.038	0.156	63	0.123	36.046	10.198	7.944	
					max	NA	NA	8.510	NA	0.2235	0.05231	NA	NA	0.0141	7.813	675	1808	NA	0.554	5.039	0.347	393	13.554	305.278	61.345	39.887	
					mean	NA	NA	5.245	NA	0.1462	0.01716	NA	NA	0.0126	7.513	528	1063	NA	0.217	1.093	0.290	146	4.514	128.446	35.419	25.683	
4/16/13	14:16:00 PM	1533	7.59	TB7B-2	TOLLWAY 2085			4.999		0.1656					7.88	480	1081		0.026		0.23	144	12.90	218.58	6.02	6.01	
4/29/13	13:44:00 PM	429	7.15	TB7B-2	TOLLWAY 2100			5.057		0.0520	0.00114				7.67	173	271		0.016		0.18	15	8.31	17.18	5.30	4.87	
5/15/13	11:29:00 AM	796	7.20	TB7B-2	TOLLWAY 2148			5.317		0.1049					7.82	348	529		0.021		0.22	38	9.69	57.39	4.41	4.26	
5/29/13	15:33:00 PM	596	6.97	TB7B-2	TOLLWAY 2172			5.817		0.0878					7.70	281	415		0.025		0.21	22	6.09	33.52	6.53	5.76	
6/11/13	13:38:00 PM	753	7.05	TB7B-2	TOLLWAY 2204			6.498		0.1008					7.57	374	491		0.027	0.05	0.22	28	3.86	41.70	5.64	5.11	
6/25/13	15:52:00 PM	1040	7.03	TB7B-2	TOLLWAY 2236			7.497		0.1239					7.52	496	628		0.041		0.22	43	1.10	50.33	5.15	5.11	
7/9/13	13:58:00 PM	901	6.88	TB7B-2	TOLLWAY 2264			8.511		0.1236		0.018			7.54	467	614		0.033		0.22	36	0.25	31.40	6.74	6.32	
7/23/13	14:17:00 PM	1147	6.95	TB7B-2	TOLLWAY 2286			9.697		0.1434					7.50	579	700		0.029	0.10	0.20	48	0.36	31.65	7.27	7.45	
8/7/13	10:49:00 AM	1102	6.84	TB7B-2	TOLLWAY 2319			8.638		0.1320					7.37	538	666		0.026	0.17	0.29	40	0.75	50.36	6.94	5.93	
					min	NA	NA	4.999	NA	0.0520	0.00114	0.018	NA	NA	7.37	173	271	NA	0.016	0.05	0.18	15	0.25	17.18	4.41	4.26	
					max	NA	NA	9.697	NA	0.1656	0.00114	0.018	NA	NA	7.88	579	1081	NA	0.041	0.17	0.29	144	12.90	218.58	7.27	7.45	
					mean	NA	NA	6.892	NA	0.1149	0.00114	0.018	NA	NA	7.62	415	599	NA	0.027	0.11	0.22	46	4.81	59.13	6.00	5.65	
3/20/13	13:13:00 PM	1279	7.17	TB7B-3	TOLLWAY 2040			6.537		0.0833					8.07	383	498		0.016		0.25	35	13.98	52.39	4.01	3.90	
4/16/13	14:43:00 PM	810	7.70	TB7B-3	TOLLWAY 2086			6.670		0.0925					7.93	373	497		0.021		0.23	24	10.61	40.38	3.36	3.21	
4/29/13	13:55:00 PM	566	7.39	TB7B-3	TOLLWAY 2101			5.496		0.0682	0.00111				7.89	280	344		0.016		0.24	17	3.08	23.97	3.82	3.61	
5/15/13	11:35:00 AM	692	7.27	TB7B-3	TOLLWAY 2149			5.799		0.0870					7.85	294	422		0.016		0.24	15	15.58	25.05	3.22	3.05	
5/29/13	16:31:00 PM	392	7.21	TB7B-3	TOLLWAY 2174			6.446		0.0889					7.86	314	421		0.025		0.23	14	10.20	23.59	3.16	2.94	
6/11/13	13:48:00 PM	697	7.21	TB7B-3	TOLLWAY 2205			6.775		0.0863	0.00088	0.020			7.69	343	402		0.027		0.22	13	5.86	21.29	3.40	3.55	
6/25/13	16:14:00 PM	764	7.23	TB7B-3	TOLLWAY 2237			7.079		0.0940					7.68	381	455		0.035		0.23	15	4.63	19.66	3.51	3.29	
7/9/13	14:15:00 PM	842	7.20	TB7B-3	TOLLWAY 2265			7.640		0.1005					7.79	421	461		0.027		0.23	16	3.93	19.06	3.76	3.50	
7/23/13	14:36:00 PM	914	7.18	TB7B-3	TOLLWAY 2287			8.510		0.1164					7.68	460	521		0.020		0.22	23	4.22	22.49	3.54	3.46	
8/7/13	10:58:00 AM	944	7.08	TB7B-3	TOLLWAY 2320			8.681		0.1180					7.58	484	552		0.016	0.13	0.23	27	2.94	26.75	4.10	3.99	
					min	NA	NA	5.496	NA	0.0682	0.00088	0.020	NA	NA	7.58	280	344	NA	0.016	0.132	0.22	13	2.94	19.06	3.16	2.94	
					max	NA	NA	8.681	NA	0.1180	0.00111	0.020	NA	NA	8.07	484	552	NA	0.035	0.132	0.25	35	15.58	52.39	4.10	3.99	
					mean	NA	NA	6.963	NA	0.0935	0.00099	0.020	NA	NA	7.80	373	457	NA	0.022	0.132	0.23	20	7.50	27.46	3.59	3.45	

APPENDIX B-3: Results of Geochemical Analysis of Groundwater Samples

Date collected	Time collected (CST)	Field conductivity (uS/cm)	Field pH	Sample location	Sample ID	Al mg/L	As mg/L	B mg/L	Ba mg/L	Be mg/L	Ca mg/L	Cd mg/L	Co mg/L	Cr mg/L	Cu mg/L	Fe mg/L	K mg/L	Li mg/L	Mg mg/L	Mn mg/L	Mo mg/L	Na mg/L	Ni mg/L	P mg/L	Pb mg/L	S mg/L
					MDL:	0.037	0.11	0.023	0.00085	0.00055	0.029	0.012	0.013	0.0058	0.00079	0.024	0.016	0.11	0.027	0.0015	0.022	0.026	0.043	0.073	0.041	0.22
Class 2 Groundwater Standards (mg/L)							0.2	2.0	2.0	0.5		0.05	1.0	1.0	0.65	5.0				10.0		2.0			0.1	
4/16/13	15:03:00 PM	894	7.93	TB7B-4	TOLLWAY 2087			0.096	0.0029		46.8						0.23		64.14			12.0		0.108		8.71
4/29/13	14:05:00 PM	468	7.46	TB7B-4	TOLLWAY 2102	0.046		0.090	0.0068		52.7					0.032	0.35		29.64			8.9				3.98
5/15/13	11:58:00 AM	558	7.35	TB7B-4	TOLLWAY 2150			0.077	0.0055		66.3						0.38		35.82			6.6		0.117		4.75
5/29/13	16:02:00 PM	526	7.21	TB7B-4	TOLLWAY 2173			0.097	0.0068		61.9						0.43		34.44			7.3		0.096		3.92
6/11/13	13:30:00 PM	607	7.34	TB7B-4	TOLLWAY 2206			0.080	0.0056		77.2						0.50		40.28			7.2		0.127		4.37
6/25/13	16:35:00 PM	621	7.32	TB7B-4	TOLLWAY 2238			0.084	0.0053		78.0						0.44		43.93			7.7		0.163		4.25
7/9/13	14:35:00 PM	606	7.20	TB7B-4	TOLLWAY 2267			0.095	0.0060		75.4						0.40		37.65			7.8		0.084		3.80
7/23/13	14:56:00 PM	656	7.67	TB7B-4	TOLLWAY 2288			0.099	0.0054		81.4						0.33		41.44			7.6				4.30
8/7/13	11:12:00 AM	623	7.12	TB7B-4	TOLLWAY 2321	0.084		0.095	0.0047		77.5					0.054	0.29		42.69			7.8				4.78
					min	0.046	NA	0.077	0.0029	NA	46.809	NA	NA	NA	NA	0.032	0.23	NA	29.64	NA	NA	6.6	NA	0.084	NA	3.80
					max	0.084	NA	0.099	0.0068	NA	81.407	NA	NA	NA	NA	0.054	0.50	NA	64.14	NA	NA	12.0	NA	0.163	NA	8.71
					mean	0.065	NA	0.090	0.0055	NA	68.569	NA	NA	NA	NA	0.043	0.37	NA	41.12	NA	NA	8.1	NA	0.116	NA	4.76
8/29/12	9:10:00 AM	8934	6.92	TB7B-5U	TOLLWAY 1742			0.251	0.1626		166.23					1.246	51.90		61.59	1.9050		1688.6				154.27
9/11/12	11:54:00 AM	7991	6.91	TB7B-5U	TOLLWAY 1764			0.246	0.1402		151.07					1.425	43.14		55.93	1.7874		1507.3				159.68
9/26/12	8:28:00 AM	7986	6.90	TB7B-5U	TOLLWAY 1779			0.218	0.1370		156.92					1.379	39.07		57.66	1.8016		1498.5				152.07
10/9/12	14:35:00 PM	8370	6.79	TB7B-5U	TOLLWAY 1791			0.224	0.1599		182.56					0.785	35.00		63.73	2.2440		1546.4	0.094			209.34
10/22/12	13:25:00 PM	8876	6.63	TB7B-5U	TOLLWAY 1810			0.233	0.1638		177.74					1.776	37.42		67.85	2.1175		1628.7	0.079			140.50
11/6/12	11:16:00 AM	7060	6.77	TB7B-5U	TOLLWAY 1836			0.200	0.1086		127.49					0.940	28.95		46.80	1.4795		1260.1				152.50
11/19/12	13:15:00 PM	6272	6.84	TB7B-5U	TOLLWAY 1849			0.174	0.1154		159.76					0.689	28.10		56.21	1.6597		1183.7				184.81
12/4/12	13:54:00 PM	7638	6.98	TB7B-5U	TOLLWAY 1868			0.174	0.1337		190.51					0.824	29.78		62.23	1.7716		1441.2	0.113			248.93
12/18/12	13:58:00 PM	7538	6.81	TB7B-5U	TOLLWAY 1895			0.171	0.1460		233.03					1.424	31.49		69.29	1.9550		1587.4	0.151			252.77
1/7/13	13:48:00 PM	7069	6.97	TB7B-5U	TOLLWAY 1898			0.147	0.1021		172.24					0.677	24.43		54.73	1.3473		1395.5	0.113			253.69
3/20/13	12:13:00 PM	13908	6.05	TB7B-5U	TOLLWAY 2036			0.161	0.1944		384.60		0.016			1.222	45.49		138.19	3.8681		2774.1	0.138			376.19
4/2/13	14:39:00 PM	14822	6.74	TB7B-5U	TOLLWAY 2053			0.157	0.1247		412.05		0.016			0.899	44.76		139.80	3.9819		3113.5	0.05	0.152		398.33
4/16/13	13:35:00 PM	15865	7.10	TB7B-5U	TOLLWAY 2082			0.200	0.1353		448.76		0.022			1.095	48.23		146.49	4.2012		3330.5	0.119	0.050		325.27
4/29/13	12:44:00 PM	17055	6.89	TB7B-5U	TOLLWAY 2096			0.194	0.1387		457.63		0.018			1.702	34.35		144.58	4.2516		3561.2				310.79
5/15/13	10:01:00 AM	12662	7.02	TB7B-5U	TOLLWAY 2144			0.215	0.0830		215.84		0.015			0.459	31.40		67.51	2.2157		2555.0	0.117			253.48
5/29/13	13:57:00 PM	13668	6.97	TB7B-5U	TOLLWAY 2169			0.212	0.1089		245.73		0.014			1.109	43.55		76.65	2.4773		2751.2	0.102	0.043		219.63
6/11/13	12:19:00 PM	14188	6.96	TB7B-5U	TOLLWAY 2199			0.204	0.1177		266.84		0.015			1.284	44.32		78.65	2.4954		3053.2	0.130			221.42
6/25/13	14:12:00 PM	12020	6.99	TB7B-5U	TOLLWAY 2231			0.253	0.0979		192.91					1.085	38.27		68.51	1.8984		2597.5	0.107	0.042		170.72
7/9/13	12:50:00 PM	10423	7.08	TB7B-5U	TOLLWAY 2260			0.241	0.0999		154.18					0.887	46.49		53.21	1.7480		2152.9				197.28
7/23/13	13:20:00 PM	11242	7.02	TB7B-5U	TOLLWAY 2282			0.234	0.1373		204.32		0.013			1.058	48.23		70.45	1.8867		2262.2				196.12
8/7/13	9:54:00 AM	8287	7.19	TB7B-5U	TOLLWAY 2315			0.241	0.0999		132.60					0.586	31.86		44.89	1.3113		1650.9				129.84
8/19/13	12:23:00 PM	8937	6.88	TB7B-5U	TOLLWAY 2324			0.272	0.1157		146.93					0.613	26.70		45.19	1.1053		1928.3	0.05	0.081		133.92
					min	NA	NA	0.147	0.0830	NA	127.49	NA	0.013	NA	NA	0.459	24.428	NA	44.89	1.1053	NA	1183.7	0.05	0.079	0.042	129.84
					max	NA	NA	0.272	0.1944	NA	457.63	NA	0.022	NA	NA	1.776	51.896	NA	146.49	4.2516	NA	3561.2	0.05	0.152	0.050	398.33
					mean	NA	NA	0.210	0.1283	NA	226.36	NA	0.016	NA	NA	1.053	37.860	NA	75.92	2.2504	NA	2112.2	0.05	0.115	0.045	220.07
3/20/13	12:31:00 PM	11537	6.74	TB7B-5L	TOLLWAY 2037			0.100	0.2077		320.87						12.00		100.31	2.4064		2007.7	0.083			216.98
4/29/13	13:12:00 PM	10947	6.97	TB7B-5L	TOLLWAY 2098			0.108	0.2303		319.82					1.332	9.21		103.80	3.0524		2154.9				217.14
5/15/13	10:20:00 PM	9481	6.90	TB7B-5L	TOLLWAY 2145			0.113	0.2572		321.76		0.013			4.546	12.74		95.50	5.7942		2063.7	0.155			203.56
5/29/13	14:18:00 PM	8583	6.77	TB7B-5L	TOLLWAY 2170			0.124	0.2165		279.69		0.022			9.85			89.79	4.4595		1908.3	0.119			200.15
6/11/13	12:35:00 PM	7940	6.92	TB7B-5L	TOLLWAY 2200			0.111	0.1994		261.65					10.009	7.91		81.96	3.2600		1899.2	0.134			198.44
6/25/13	14:45:00 PM	10327	6.92	TB7B-5L	TOLLWAY 2233			0.116	0.1209		188.51						6.25		63.34	1.7612		1611.4	0.174	0.056		187.63
7/9/13	13:04:00 PM	9477	7.01	TB7B-5L	TOLLWAY 2261			0.124	0.1337		195.59				0.00332	1.542	7.40		68.94	1.5626		1610.7	0.108			187.35
7/23/13	13:18:00 PM	8856	7.05	TB7B-5L	TOLLWAY 2283			0.139	0.1418		165.89						10.78		65.34	0.1163		1862.9	0.082			170.68
8/7/13	10:09:00 AM	11104	7.35	TB7B-5L	TOLLWAY 2316			0.155	0.2021		245.80		0.015			0.037	12.46		78.32	2.5647		2068.0				181.26
					min	NA	NA	0.100	0.1209	NA	165.89	NA	0.013	NA	0.00332	0.037	6.25	NA	63.34	0.1163	NA	1610.7	NA	0.082	0.056	170.68
					max	NA	NA	0.155	0.2572	NA	321.76	NA	0.022													

APPENDIX B-3: Results of Geochemical Analysis of Groundwater Samples

Date collected	Time collected (CST)	Field conductivity (uS/cm)	Field pH	Sample location	Sample ID	Sb mg/L	Se mg/L	Si mg/L	Sn mg/L	Sr mg/L	Ti mg/L	Tl mg/L	V mg/L	Zn mg/L	pH	alkalinity mg/L as CaCO <sub>3</sub>	TDS, 180 C mg/L	TSS mg/L	oPO <sub>4</sub> -P mg/L	NH <sub>3</sub> -N mg/L	F mg/L	Cl mg/L	NO <sub>3</sub> -N mg/L	SO <sub>4</sub> mg/L	total NVOC mg/L	dissolved NVOC mg/L	
					MDL:	0.059	0.13	0.066	0.086	0.00037	0.00056	0.017	0.047	0.0097			4	12	3.0	0.003	0.03	0.07	0.16	0.04	0.21	0.31	0.31
					Class 2 Groundwater Standards (mg/L)	0.024	0.05					0.02	0.1	10.0			1,200				4.0	200	100	400			
4/16/13	15:03:00 PM	894	7.93	TB7B-4	TOLLWAY 2087			5.787		0.0639					8.11	316	373		0.021		0.18	11	8.05	24.88	2.60	2.46	
4/29/13	14:05:00 PM	468	7.46	TB7B-4	TOLLWAY 2102			5.020		0.0565	0.00067				7.95	233	284		0.019		0.17	6	4.21	11.77	2.56	2.45	
5/15/13	11:58:00 AM	558	7.35	TB7B-4	TOLLWAY 2150			5.296		0.0789					7.92	262	340		0.015		0.16	9	10.15	13.63	2.02	2.00	
5/29/13	16:02:00 PM	526	7.21	TB7B-4	TOLLWAY 2173			5.494		0.0742					7.89	259	312		0.022		0.14	8	5.98	11.26	2.23	1.90	
6/11/13	13:30:00 PM	607	7.34	TB7B-4	TOLLWAY 2206			5.619		0.0811					7.77	277	344		0.024		0.13	9	9.73	12.13	2.30	2.03	
6/25/13	16:35:00 PM	621	7.32	TB7B-4	TOLLWAY 2238			5.826		0.0822					7.76	280	359		0.029		0.14	9	12.59	12.10	2.01	2.05	
7/9/13	14:35:00 PM	606	7.20	TB7B-4	TOLLWAY 2267			6.070		0.0815					7.80	282	358		0.021		0.14	9	10.15	11.30	2.25	2.10	
7/23/13	14:56:00 PM	656	7.67	TB7B-4	TOLLWAY 2288			6.374		0.0886					7.74	298	380		0.017		0.14	9	7.24	12.72	2.00	1.79	
8/7/13	11:12:00 AM	623	7.12	TB7B-4	TOLLWAY 2321			6.381		0.0905					7.62	305	370		0.013		0.16	9	8.01	13.45	2.09	1.79	
					min	NA	NA	5.020	NA	0.0565	0.00067	NA	NA	NA	7.62	233	284	NA	0.013	NA	0.130	6	4.21	11.26	2.00	1.79	
					max	NA	NA	6.381	NA	0.0905	0.00067	NA	NA	NA	8.11	316	380	NA	0.029	NA	0.177	11	12.59	24.88	2.60	2.46	
					mean	NA	NA	5.763	NA	0.0775	0.00067	NA	NA	NA	7.84	279	347	NA	0.020	NA	0.151	9	8.46	13.69	2.23	2.06	
8/29/12	9:10:00 AM	8934	6.92	TB7B-5U	TOLLWAY 1742			9.071		1.7143					7.39	493	5086		0.021	5.79	0.35	2487		416.14	16.59	16.12	
9/11/12	11:54:00 AM	7991	6.91	TB7B-5U	TOLLWAY 1764			8.582		1.4771					7.54	434	4594		0.022	4.54	0.43	2229		438.37	15.56	14.73	
9/26/12	8:28:00 AM	7986	6.90	TB7B-5U	TOLLWAY 1779			8.231		1.5182					7.44	476	4609		0.023	4.62	0.32	2231		425.55	16.76	16.19	
10/9/12	14:35:00 PM	8370	6.79	TB7B-5U	TOLLWAY 1791			7.951		1.8166					7.60	403	4873		0.023	4.10	0.28	2265		563.30	12.11	12.13	
10/22/12	13:25:00 PM	8876	6.63	TB7B-5U	TOLLWAY 1810		0.153	8.476		1.8245					7.39	637	5051		0.025	5.12	0.54	2425		391.86	22.80	21.93	
11/6/12	11:16:00 AM	7060	6.77	TB7B-5U	TOLLWAY 1836			7.032		1.3285					7.65	436	3779		0.019	3.79	0.38	1680		430.15	16.07	14.79	
11/19/12	13:15:00 PM	6272	6.84	TB7B-5U	TOLLWAY 1849			6.268		1.5771					7.56	340	3783		0.016	2.40	0.32	1755		549.01	11.58	11.16	
12/4/12	13:54:00 PM	7638	6.98	TB7B-5U	TOLLWAY 1868			6.604		2.0646	0.017				7.58	369	4670		0.013	1.43	0.21	2021		694.02	12.50	12.75	
12/18/12	13:58:00 PM	7538	6.81	TB7B-5U	TOLLWAY 1895			6.208		2.1915					7.70	357	4997		0.019	2.31		2178		712.04	12.84	12.68	
1/7/13	13:48:00 PM	7069	6.97	TB7B-5U	TOLLWAY 1898			4.884		1.5313	0.017				7.49	308	4279		0.014	1.61		1885	0.44	723.42	11.32	11.72	
3/20/13	12:13:00 PM	13908	6.05	TB7B-5U	TOLLWAY 2036		0.330	6.440		3.2233			0.0105	7.65	345	8834		0.022	3.30		4430		903.75	19.87	19.25		
4/2/13	14:39:00 PM	14822	6.74	TB7B-5U	TOLLWAY 2053		0.137	6.101		3.1647			0.0111	7.48	249	9626		0.023	3.34		4930		1057.21	12.96	12.68		
4/16/13	13:35:00 PM	15865	7.10	TB7B-5U	TOLLWAY 2082		0.272	6.108		3.4942			0.0106	7.48	228	10285		0.027	3.55		5451		908.59	11.86	11.44		
4/29/13	12:44:00 PM	17055	6.89	TB7B-5U	TOLLWAY 2096		0.321	6.830		3.3822	0.020		0.0119	7.41	242	10818		0.030	3.25		5765		821.87	13.38	12.79		
5/15/13	10:01:00 AM	12662	7.02	TB7B-5U	TOLLWAY 2144			6.297		1.6588				7.66	287	7613		0.018	2.98	0.46	3882		695.91	15.95	16.19		
5/29/13	13:57:00 PM	13668	6.97	TB7B-5U	TOLLWAY 2169		0.241	7.251		1.9828				7.52	362	8196		0.032	3.19	0.43	4280		535.90	17.63	17.07		
6/11/13	12:19:00 PM	14188	6.96	TB7B-5U	TOLLWAY 2199		0.145	7.843		1.9193	0.026			7.53	344	8600		0.033	1.55	0.45	4518		584.94	18.75	18.43		
6/25/13	14:12:00 PM	12020	6.99	TB7B-5U	TOLLWAY 2231			8.963		1.5615			0.0100	7.39	467	6975		0.049	1.97	0.47	3660		438.06	19.72	19.39		
7/9/13	12:50:00 PM	10423	7.08	TB7B-5U	TOLLWAY 2260			8.634		1.3921	0.024			7.59	373	6095		0.032	2.45	0.62	3092		517.89	16.03	15.88		
7/23/13	13:20:00 PM	11242	7.02	TB7B-5U	TOLLWAY 2282		0.167	8.954		1.9869				7.39	347	6764		0.025	1.69	0.43	3421		533.70	15.00	15.24		
8/7/13	9:54:00 AM	8287	7.19	TB7B-5U	TOLLWAY 2315		0.138	8.570		1.3762				7.60	363	4776		0.018	0.99	0.44	2478		331.10	17.31	16.88		
8/19/13	12:23:00 PM	8937	6.88	TB7B-5U	TOLLWAY 2324		0.135	9.717		1.6096				7.48	539	5227		0.019	0.65	0.35	2698		340.28	19.99	19.79		
					min	NA	0.135	4.884	NA	1.3285	NA	0.017	NA	0.0100	7.39	228	3779	NA	0.013	0.65	0.21	1680	0.44	331.10	11.32	11.16	
					max	NA	0.330	9.717	NA	3.4942	NA	0.026	NA	0.0119	7.70	637	10818	NA	0.049	5.79	0.62	5765	0.44	1057.21	22.80	21.93	
					mean	NA	0.204	7.501	NA	1.9907	NA	0.021	NA	0.0108	7.52	382	6342	NA	0.024	2.94	0.40	3171	0.44	591.50	15.75	15.42	
3/20/13	12:31:00 PM	11537	6.74	TB7B-5L	TOLLWAY 2037		0.202	6.373		1.9462			0.0276	7.78	386	6644		0.025	0.17	0.32	3382	0.26	631.16				
4/29/13	13:12:00 PM	10947	6.97	TB7B-5L	TOLLWAY 2098		0.289	7.013		2.0355	0.020		0.0230	7.61	411	6926		0.027	0.25		3491		588.91	13.43	12.46		
5/15/13	10:20:00 PM	9481	6.90	TB7B-5L	TOLLWAY 2145		0.264	7.616		2.0344			0.0260	7.49	463	6645		0.038	0.40		3490		559.93	11.71	12.65		
5/29/13	14:18:00 PM	8583	6.77	TB7B-5L	TOLLWAY 2170		0.227	7.771		1.7722			0.0178	7.42	497	6019		0.046	0.68		2877		498.09	15.14	13.00		
6/11/13	12:35:00 PM	7940	6.92	TB7B-5L	TOLLWAY 2200		0.154	8.553		1.4810	0.017		0.0242	7.49	527	5756		0.096	0.74		2696		547.39	17.22	15.75		
6/25/13	14:45:00 PM	10327	6.92	TB7B-5L	TOLLWAY 2233			7.723		1.0957	0.025		0.0190	7.99	558	4264		0.062	0.92		2343		509.59	16.70	14.32		
7/9/13	13:04:00 PM	9477	7.01	TB7B-5L	TOLLWAY 2261		0.192	8.235		1.2068	0.019		0.0282	7.39	556	4941		0.049	0.56		2302	0.20	496.22	17.18	16.19		
7/23/13	13:18:00 PM	8856	7.05	TB7B-5L	TOLLWAY 2283			8.918		1.3442	0.026			7.31	563	5526		0.049	0.93		2660		452.17	16.25	16.25		
8/7/13	10:09:00 AM	11104	7.35	TB7B-5L	TOLLWAY 2316		0.209	9.432		1.7375			0.0136	7.95	537	6507		0.030	0.94		3268	0.08	482.49	20.02	19.36		

APPENDIX B-3: Results of Geochemical Analysis of Groundwater Samples

Date collected	Time collected (CST)	Field conductivity (uS/cm)	Field pH	Sample location	Sample ID	Al	As	B	Ba	Be	Ca	Cd	Co	Cr	Cu	Fe	K	Li	Mg	Mn	Mo	Na	Ni	P	Pb	S			
						mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L
						MDL:	0.037	0.11	0.023	0.00085	0.00055	0.029	0.012	0.013	0.0058	0.00079	0.024	0.016	0.11	0.027	0.0015	0.022	0.026	0.043	0.073	0.041	0.22		
						Class 2 Groundwater Standards (mg/L)		0.2	2.0	2.0	0.5	0.05	1.0	1.0	0.65	5.0					10.0		2.0		0.1				
3/6/13	10:04:00 AM	4869	6.68	TB15-1U	TOLLWAY 2001			0.073	0.0946		222.34																		
3/19/13	10:31:00 AM	5561	7.01	TB15-1U	TOLLWAY 2029	0.453			0.0511		86.51				0.00682	0.590	0.74			0.0015					0.112				34.62
4/1/13	14:29:00 PM	4468	7.34	TB15-1U	TOLLWAY 2047			0.027	0.1135		297.85				0.00252		2.32			0.0143					0.155				48.39
4/16/13	11:00:00 AM	958	8.06	TB15-1U	TOLLWAY 2079	0.437			0.0301		32.41				0.00629	0.351	0.47								0.095				11.00
4/30/13	15:58:00 PM	1866	7.45	TB15-1U	TOLLWAY 2115			0.048	0.0493		80.69				0.065	0.63									0.082				22.99
5/14/13	9:13:00 AM	3931	7.26	TB15-1U	TOLLWAY 2135	0.692		0.053	0.0961		214.31				0.396	1.83				0.0324						0.125			42.21
5/28/13	14:38:00 PM	2732	7.16	TB15-1U	TOLLWAY 2161	0.495		0.040	0.0502		78.72				0.00247	0.285	0.88				0.0023				0.113				14.84
6/11/13	9:12:00 AM	2263	7.28	TB15-1U	TOLLWAY 2192	0.167		0.047	0.0672		147.91				0.00414	0.096	1.23								0.125				24.73
6/25/13	9:38:00 AM	3209	7.37	TB15-1U	TOLLWAY 2224	11.011		0.085	0.1303		203.74			0.0085	0.00331	5.422	4.49								0.225				31.95
7/9/13	9:19:00 AM	2789	6.99	TB15-1U	TOLLWAY 2254			0.056	0.0583		112.73				0.00444	0.033	1.31				0.0100				0.460				18.92
						min	0.167	NA	0.027	0.0301	NA	32.41	NA	NA	0.0085	0.00247	0.033	0.47	NA	20.05	0.0015	NA	214.4	NA	0.082	NA	11.00		
						max	11.011	NA	0.085	0.1303	NA	297.85	NA	NA	0.0085	0.00682	5.422	4.49	NA	228.09	0.1494	NA	508.3	NA	0.460	NA	48.39		
						mean	2.209	NA	0.054	0.0741	NA	147.72	NA	NA	0.0085	0.00428	0.905	1.59	NA	111.22	0.0283	NA	378.3	NA	0.171	NA	28.34		
2/5/13	14:31:00 PM	6294	6.50	TB15B-1L	TOLLWAY 1953			0.115	0.0671		390.70					0.146	5.64			0.0138						0.044			84.23
3/6/13	10:00:00 AM	7126	6.23	TB15B-1L	TOLLWAY 2000	0.039		0.107	0.0770		383.80					0.048	4.43			0.0020					0.120				81.13
3/19/13	10:42:00 AM	7085	6.30	TB15B-1L	TOLLWAY 2030			0.096	0.0800		398.62						5.34								0.088				78.49
4/1/13	14:39:00 PM	7193	6.87	TB15B-1L	TOLLWAY 2048			0.072	0.0882		462.30						5.32			0.0103					0.149				79.13
4/16/13	10:41:00 AM	7032	6.91	TB15B-1L	TOLLWAY 2078			0.093	0.0910		462.03						5.56			0.0023					0.097				75.41
4/30/13	15:46:00 PM	7161	6.59	TB15B-1L	TOLLWAY 2114			0.113	0.0866		474.51						4.68			0.0022									76.48
5/14/13	9:15:00 AM	7129	6.70	TB15B-1L	TOLLWAY 2134			0.101	0.0915		466.49						5.15			0.0030					0.101				78.69
5/28/13	15:04:00 PM	7331	6.71	TB15B-1L	TOLLWAY 2162			0.103	0.0956		473.40						5.70			0.0088	0.023				0.168				73.74
6/11/13	9:12:00 AM	7054	6.65	TB15B-1L	TOLLWAY 2193			0.100	0.0904		472.67		0.01				5.01			0.0187					0.137				76.93
6/25/13	9:49:00 AM	7027	6.74	TB15B-1L	TOLLWAY 2225			0.104	0.0905		447.54						5.29								0.115				75.52
7/9/13	9:33:00 AM	7030	6.67	TB15B-1L	TOLLWAY 2255			0.117	0.0933		460.22						5.72												72.09
7/22/13	13:40:00 PM	7087	6.84	TB15B-1L	TOLLWAY 2275			0.127	0.0963		437.20					0.031	6.10			0.0034					0.076				70.56
8/6/13	8:59:00 AM	7110	6.71	TB15B-1L	TOLLWAY 2307	0.226		0.138	0.0931		453.39					0.878	5.94			0.0195					0.086				75.14
8/20/13	13:44:00 PM	7142	6.92	TB15B-1L	TOLLWAY 2332			0.135	0.0939		467.58					1.101	6.16			0.0099					0.097				78.91
						min	0.039	NA	0.072	0.0671	NA	383.80	NA	0.01	NA	NA	0.031	4.43	NA	302.82	0.0020	0.023	501.8	NA	0.076	0.044	70.56		
						max	0.226	NA	0.138	0.0963	NA	474.51	NA	0.01	NA	NA	1.101	6.16	NA	365.53	0.0195	0.023	619.4	NA	0.168	0.044	84.23		
						mean	0.133	NA	0.109	0.0882	NA	446.46	NA	0.01	NA	NA	0.441	5.43	NA	341.10	0.0086	0.023	575.8	NA	0.112	0.044	76.89		
1/8/13	15:56:00 PM	552	7.65	TB15B-2	TOLLWAY 1905	0.065		0.056	0.0289		43.76				0.00198	0.054	0.72				0.022				0.099				19.65
1/23/13	12:47:00 PM	984	7.73	TB15B-2	TOLLWAY 1932	7.257		0.078	0.0782		67.39			0.0087	0.00453	3.908	3.91			0.0288					0.101				32.14
2/5/13	14:54:00 PM	906	7.12	TB15B-2	TOLLWAY 1954	0.052		0.079	0.0521		84.28				0.00324	0.034	1.15			0.0028					0.111				40.43
3/6/13	10:16:00 AM	1294	7.37	TB15B-2	TOLLWAY 2002	0.432		0.100	0.0525		90.47					0.249	0.92												47.92
3/19/13	10:56:00 AM	1308	7.62	TB15B-2	TOLLWAY 2031	0.136		0.044	0.0376		61.82				0.00188	0.080	0.46								0.079				41.80
4/1/13	15:13:00 PM	818	7.85	TB15B-2	TOLLWAY 2049			0.054	0.0504		95.37				0.00161		0.71								0.167				50.67
4/16/13	11:13:00 AM	1103	7.67	TB15B-2	TOLLWAY 2080			0.082	0.0503		87.30						0.69								0.118				48.63
4/30/13	16:11:00 PM	777	7.50	TB15B-2	TOLLWAY 2116			0.119	0.0641		112.22						1.14												55.90
5/14/13	9:44:00 AM	1023	7.40	TB15B-2	TOLLWAY 2136			0.103	0.0597		110.60						1.33								0.097				55.08
5/28/13	15:36:00 PM	1075	7.45	TB15B-2	TOLLWAY 2163			0.116	0.0656		114.03						1.38								0.082				55.36
6/11/13	9:45:00 AM	871	7.43	TB15B-2	TOLLWAY 2194	0.345		0.106	0.0581		97.43					0.228	1.04			0.0026					0.114				50.40
6/25/13	10:06:00 AM	1081	7.47	TB15B-2	TOLLWAY 2226			0.127	0.0641		122.68					0.030	1.38			0.0074					0.128				57.85
7/9/13	9:48:00 AM	1106	7.34	TB15B-2	TOLLWAY 2256	0.098		0.143	0.0670		123.42					0.114	1.54			0.0051	0.026				0.087				57.85
7/22/13	13:49:00 PM	884	7.30	TB15B-2	TOLLWAY 2276			0.143	0.0566		84.91					1.58					0.025								54.23
						min	0.052	NA	0.044	0.0289	NA	43.76	NA	NA	0.0087	0.00161	0.030	0.46	NA	29.37	0.0026	0.022	24.5	NA	0.079	NA	19.65		
						max	7.257	NA	0.143	0.0782	NA	123.42	NA	NA	0.0087	0.00453	3.908	3.91	NA	85.31	0.0288	0.026	40.						



APPENDIX B-3: Results of Geochemical Analysis of Groundwater Samples

Date collected	Time collected (CST)	Field conductivity (uS/cm)	Field pH	Sample location	Sample ID	Sb mg/L	Se mg/L	Si mg/L	Sn mg/L	Sr mg/L	Ti mg/L	TI mg/L	V mg/L	Zn mg/L	pH	alkalinity mg/L as CaCO <sub>3</sub>	TDS, 180 C mg/L	TSS mg/L	oPO <sub>4</sub> -P mg/L	NH <sub>3</sub> -N mg/L	F mg/L	Cl mg/L	NO <sub>3</sub> -N mg/L	SO <sub>4</sub> mg/L	total NVOC mg/L	dissolved NVOC mg/L	
					MDL:	0.059	0.13	0.066	0.086	0.00037	0.00056	0.017	0.047	0.0097		4	12	3.0	0.003	0.03	0.07	0.16	0.04	0.21	0.31	0.31	
					Class 2 Groundwater Standards (mg/L)	0.024	0.05					0.02	0.1	10.0			1,200				4.0	200	100	400			
3/6/13	10:04:00 AM	4869	6.68	TB15-1U	TOLLWAY 2001			4.604		1.8360		0.020		0.0224	7.77	226	2425			0.016		0.56	1383	0.05	101.67	1.76	
3/19/13	10:31:00 AM	5561	7.01	TB15-1U	TOLLWAY 2029			3.449		0.6785	0.01680			0.0131	7.77	209	1936			0.015		0.78	1012		106.55	18.79	19.94
4/1/13	14:29:00 PM	4468	7.34	TB15-1U	TOLLWAY 2047			4.977		2.4035				0.0410	7.52	241	2996			0.014		0.46	1676		133.62	9.95	8.53
4/16/13	11:00:00 AM	958	8.06	TB15-1U	TOLLWAY 2079			4.836		0.2357	0.01362				8.14	208	649			0.028		0.48	236		28.89	25.09	18.97
4/30/13	15:58:00 PM	1866	7.45	TB15-1U	TOLLWAY 2115			3.959		0.5847	0.00119	0.021			8.06	208	1302			0.014		0.36	588		61.47	15.74	9.48
5/14/13	9:13:00 AM	3931	7.26	TB15-1U	TOLLWAY 2135		0.161	7.177		1.5910	0.01578			0.0104	7.50	267	2380			0.021	0.07	0.39	1298		113.08	10.41	7.14
5/28/13	14:38:00 PM	2732	7.16	TB15-1U	TOLLWAY 2161			5.053		0.6383	0.00829				7.72	167	933			0.017		0.41	450		35.73	19.16	7.03
6/11/13	9:12:00 AM	2263	7.28	TB15-1U	TOLLWAY 2192		0.160	5.795		1.0478	0.00379			0.0134	7.57	242	1762			0.026		0.40	874		68.71	14.67	9.46
6/25/13	9:38:00 AM	3209	7.37	TB15-1U	TOLLWAY 2224			42.246		1.5496	0.26779			0.0335	7.53	242	2354			0.087		0.37	1192		97.82	12.52	9.63
7/9/13	9:19:00 AM	2789	6.99	TB15-1U	TOLLWAY 2254			5.184		0.9163	0.00067			0.0250	7.60	238	1388			0.032	0.16	0.37	747	0.04	54.49	17.90	7.75
					min	NA	0.160	3.449	NA	0.2357	0.00067	0.020	NA	0.0104	7.50	167	649	NA	0.014	0.07	0.36	236	0.04	28.89	1.76	7.03	
					max	NA	0.161	42.246	NA	2.4035	0.26779	0.021	NA	0.0410	8.14	267	2996	NA	0.087	0.16	0.78	1676	0.05	133.62	25.09	19.94	
					mean	NA	0.160	8.728	NA	1.1481	0.04099	0.020	NA	0.0227	7.72	225	1813	NA	0.027	0.11	0.46	946	0.04	80.20	14.60	10.88	
2/5/13	14:31:00 PM	6294	6.50	TB15B-1L	TOLLWAY 1953			7.476		3.0140		0.019			7.53	284	3128			0.022		0.54	1792		230.73	2.90	2.22
3/6/13	10:00:00 AM	7126	6.23	TB15B-1L	TOLLWAY 2000			7.270		3.2988					7.29	316	3465			0.021		0.42	2068	0.05	220.20	2.48	1.95
3/19/13	10:42:00 AM	7085	6.30	TB15B-1L	TOLLWAY 2030		0.238	7.936		3.5189				0.0123	7.35	337	4129			0.018		0.40	2221	0.39	208.08	2.39	2.65
4/1/13	14:39:00 PM	7193	6.87	TB15B-1L	TOLLWAY 2048		0.173	7.891		3.7137				0.0138	7.35	326	4032			0.020		0.38	2264	0.09	220.08	2.49	2.26
4/16/13	10:41:00 AM	7032	6.91	TB15B-1L	TOLLWAY 2078		0.263	7.663		3.7721					7.23	338	4072			0.025		0.33	2344	0.30	210.24	2.61	2.15
4/30/13	15:46:00 PM	7161	6.59	TB15B-1L	TOLLWAY 2114		0.192	7.807		3.6053		0.037		0.0110	7.47	335	4467			0.023		0.17	2383	0.26	205.86	2.55	2.19
5/14/13	9:15:00 AM	7129	6.70	TB15B-1L	TOLLWAY 2134		0.381	8.202		3.3658		0.035			7.22	343	4245			0.020		0.24	2354	0.27	210.42	2.57	2.24
5/28/13	15:04:00 PM	7331	6.71	TB15B-1L	TOLLWAY 2162		0.199	8.130		3.7057					7.22	350	4228			0.033		0.21	2331	0.23	203.25	3.90	1.77
6/11/13	9:12:00 AM	7054	6.65	TB15B-1L	TOLLWAY 2193		0.274	8.638		3.5126		0.028			7.23	340	4046			0.033		0.23	2320	0.30	202.78	2.36	2.04
6/25/13	9:49:00 AM	7027	6.74	TB15B-1L	TOLLWAY 2225		0.288	8.759		3.4640		0.024			7.22	342	4728			0.042		0.24	2285	0.20	199.59	2.55	2.08
7/9/13	9:33:00 AM	7030	6.67	TB15B-1L	TOLLWAY 2255		0.259	9.092		3.4612		0.035		0.0104	7.76	343	3945			0.033		0.19	2279	0.18	195.61	2.49	2.15
7/22/13	13:40:00 PM	7087	6.84	TB15B-1L	TOLLWAY 2275		0.227	9.169		3.3318		0.032			7.10	348	4276			0.023		0.12	2245	0.24	194.25	2.63	2.17
8/6/13	8:59:00 AM	7110	6.71	TB15B-1L	TOLLWAY 2307		0.137	9.976		3.3959	0.00536				7.15	354	3955			0.021		0.21	2059	0.05	192.72	3.21	2.28
8/20/13	13:44:00 PM	7142	6.92	TB15B-1L	TOLLWAY 2332		0.373	9.468		3.4481		0.023			7.28	341	4100			0.017		0.20	2298	0.12	210.43	2.16	4.15
					min	NA	0.137	7.270	NA	3.0140	0.00536	0.019	NA	0.0104	7.10	284	3128	NA	0.017	NA	0.12	1792	0.05	192.72	2.16	1.77	
					max	NA	0.381	9.976	NA	3.7721	0.00536	0.037	NA	0.0138	7.76	354	4728	NA	0.042	NA	0.54	2383	0.39	230.73	3.90	4.15	
					mean	NA	0.250	8.391	NA	3.4720	0.00536	0.029	NA	0.0119	7.31	336	4058	NA	0.025	NA	0.28	2232	0.21	207.44	2.66	2.31	
1/8/13	15:56:00 PM	552	7.65	TB15B-2	TOLLWAY 1905			4.831		0.4369	0.00156			0.0104	7.76	158	301			0.015		0.68	33	0.08	53.98	9.01	7.36
1/23/13	12:47:00 PM	984	7.73	TB15B-2	TOLLWAY 1932			22.773		0.6915	0.27218			0.0232	7.99	218	465			0.061		0.70	58	0.04	92.67	6.20	6.18
2/5/13	14:54:00 PM	906	7.12	TB15B-2	TOLLWAY 1954			5.487		0.8734	0.00101			0.0119	7.87	286	562			0.020		0.56	77	0.19	123.85	5.17	4.70
3/6/13	10:16:00 AM	1294	7.37	TB15B-2	TOLLWAY 2002			6.491		0.9470	0.01412				7.82	278	562			0.021		0.55	80	0.06	133.09	3.38	2.84
3/19/13	10:56:00 AM	1308	7.62	TB15B-2	TOLLWAY 2031			4.079		0.5913	0.00456				7.84	334	506			0.014		0.67	81	0.04	132.51	2.52	3.95
4/1/13	15:13:00 PM	818	7.85	TB15B-2	TOLLWAY 2049			5.500		0.9610					7.94	261	677			0.018		0.54	84	0.09	148.03	3.19	1.88
4/16/13	11:13:00 AM	1103	7.67	TB15B-2	TOLLWAY 2080			5.483		0.9705					7.96	244	583			0.018		0.60	79		139.88	3.90	2.24
4/30/13	16:11:00 PM	777	7.50	TB15B-2	TOLLWAY 2116			6.698		1.2026		0.024		0.0108	8.09	265	642			0.016		0.55	76		140.31	3.39	1.74
5/14/13	9:44:00 AM	1023	7.40	TB15B-2	TOLLWAY 2136			6.878		1.0735		0.017			7.79	332	770			0.018		0.53	87	0.10	157.52	2.93	2.31
5/28/13	15:36:00 PM	1075	7.45	TB15B-2	TOLLWAY 2163			7.364		1.2945					7.80	337	779			0.031		0.48	90	0.11	162.59	2.22	1.58
6/11/13	9:45:00 AM	871	7.43	TB15B-2	TOLLWAY 2194			7.671		0.9310	0.01080				7.86	284	677			0.035		0.56	81		145.06	4.44	2.51
6/25/13	10:06:00 AM	1081	7.47	TB15B-2	TOLLWAY 2226			7.684		1.1884					7.70	318	782			0.037		0.52	92	0.08	158.74	3.36	1.85
7/9/13	9:48:00 AM	1106	7.34	TB15B-2	TOLLWAY 2256			8.454		1.2197	0.00275				7.24	343	739			0.036		0.52	97	0.10	161.11	3.17	4.47
7/22/13	13:49:00 PM	884	7.30	TB15B-2	TOLLWAY 2276			7.997		1.0805					7.56	370	784				0.13	0.56	92	0.12	156.48	6.14	3.43
					min	NA	NA	4.079	NA	0.4369	0.00101																

APPENDIX B-3: Results of Geochemical Analysis of Groundwater Samples

Date collected	Time collected (CST)	Field conductivity (uS/cm)	Field pH	Sample location	Sample ID	Al mg/L	As mg/L	B mg/L	Ba mg/L	Be mg/L	Ca mg/L	Cd mg/L	Co mg/L	Cr mg/L	Cu mg/L	Fe mg/L	K mg/L	Li mg/L	Mg mg/L	Mn mg/L	Mo mg/L	Na mg/L	Ni mg/L	P mg/L	Pb mg/L	S mg/L		
					MDL:	0.037	0.11	0.023	0.00085	0.00055	0.029	0.012	0.013	0.0058	0.00079	0.024	0.016	0.11	0.027	0.0015	0.022	0.026	0.043	0.073	0.041	0.22		
					Class 2 Groundwater Standards (mg/L)		0.2	2.0	2.0	0.5		0.05	1.0	1.0	0.65	5.0				10.0			2.0		0.1			
8/28/12	10:23:00 AM	2671	6.73	TB15B-4U	TOLLWAY 1736			0.146	0.1216		95.12				0.00449				27.88		24.59	0.6077				437.8		24.72
9/11/12	8:48:00 AM	2828	6.59	TB15B-4U	TOLLWAY 1760			0.156	0.1329		107.59				0.00533				27.34		25.53	0.6049				446.7		26.52
9/25/12	8:02:00 AM	3613	6.73	TB15B-4U	TOLLWAY 1770	0.168		0.121	0.1506		118.87				0.00144	0.155			28.57		31.32	0.7100				595.0		29.49
10/8/12	13:37:00 PM	4352	6.65	TB15B-4U	TOLLWAY 1785			0.096	0.1502		117.80				0.00089	0.049			22.77		31.42	0.7773				717.2	0.091	26.82
10/23/12	12:57:00 PM	1967	6.91	TB15B-4U	TOLLWAY 1821			0.083	0.0772		79.01				0.01014				14.01		18.09	0.0472				301.7		20.21
11/5/12	14:13:00 PM	3018	6.67	TB15B-4U	TOLLWAY 1830			0.101	0.1101		99.54				0.00268	0.025			22.25		24.45	0.4386				439.4		28.97
11/19/12	9:39:00 AM	3441	6.68	TB15B-4U	TOLLWAY 1845			0.087	0.1395		117.05				0.00143				24.93		29.16	0.4619				537.5	0.081	30.70
12/3/12	14:40:00 PM	3238	6.73	TB15B-4U	TOLLWAY 1862			0.078	0.1135		111.87				0.00088				21.02		27.48	0.4190				560.8		0.188
12/18/12	9:39:00 AM	2970	6.74	TB15B-4U	TOLLWAY 1889			0.076	0.0984		95.28								17.89		24.83	0.3052				492.7	0.103	34.25
1/8/13	15:05:00 PM	2410	6.81	TB15B-4U	TOLLWAY 1903			0.066	0.0924		104.40				0.00398	0.034			20.34		24.91	0.1987				368.9	0.094	33.06
1/23/13	12:29:00 PM	2341	6.66	TB15B-4U	TOLLWAY 1931			0.075	0.0992		105.08				0.00682				20.40		26.53	0.0515				356.0	0.122	39.46
2/5/13	15:27:00 PM	3370	6.53	TB15B-4U	TOLLWAY 1956			0.068	0.1692		173.93				0.00357	0.032			20.52		45.51	0.0751				595.0	0.116	39.68
2/19/13	16:45:00 PM	3903	6.71	TB15B-4U	TOLLWAY 1984	0.157		0.036	0.1540		169.83				0.00350	0.128			14.40		42.12	0.0069				626.3	0.152	29.42
3/6/13	9:36:00 AM	6307	6.40	TB15B-4U	TOLLWAY 1999			0.062	0.3085		262.38								28.53		62.02	0.0030				954.9	0.123	30.73
3/19/13	10:09:00 AM	5739	6.67	TB15B-4U	TOLLWAY 2028			0.053	0.2713		231.36				0.00512				27.36		57.90	0.0096				925.0	0.084	38.73
4/1/13	13:53:00 PM	5076	7.64	TB15B-4U	TOLLWAY 2045			0.054	0.2463		198.17				0.00409				26.04		52.66	0.0774				851.1	0.084	38.24
4/16/13	10:27:00 AM	2323	7.40	TB15B-4U	TOLLWAY 2077	0.139		0.066	0.1033		89.99				0.01279	0.119			15.49		24.11					425.4	0.104	23.99
4/30/13	15:09:00 PM	1909	7.03	TB15B-4U	TOLLWAY 2111	0.131		0.117	0.0844		70.67				0.01052	0.105			18.99		18.82	0.0071				329.9	0.094	20.79
5/14/13	8:18:00 AM	2613	7.19	TB15B-4U	TOLLWAY 2132			0.117	0.1266		101.03				0.00707	0.052			27.97		28.49	0.1429				446.5	0.083	25.83
5/28/13	13:44:00 PM	2194	7.21	TB15B-4U	TOLLWAY 2159	0.186		0.132	0.1076		87.86				0.01281	0.180			21.98		22.65	0.1076				360.0	0.190	21.80
6/11/13	8:25:00 AM	2089	6.99	TB15B-4U	TOLLWAY 2189	0.037		0.137	0.1012		82.68				0.01072	0.079			25.33		20.60	0.3680				347.9	0.155	20.96
6/25/13	8:49:00 AM	2132	7.01	TB15B-4U	TOLLWAY 2221	0.126		0.137	0.1063		96.52				0.00719	0.117			24.49		23.19	0.6257				342.2	0.174	20.73
7/9/13	8:52:00 AM	2310	6.94	TB15B-4U	TOLLWAY 2252			0.164	0.1216		93.19				0.00392	0.058			29.49		24.23	0.9210				385.9	0.111	21.83
7/22/13	13:14:00 PM	2525	6.66	TB15B-4U	TOLLWAY 2273			0.160	0.1258		101.67				0.00190	0.068			27.52		25.79	0.9686	0.033			412.9	0.135	20.69
8/6/13	8:18:00 AM	3386	7.02	TB15B-4U	TOLLWAY 2305			0.121	0.1654		144.57				0.137	0.1654			28.04		34.02	1.6567				534.0	0.100	24.69
8/20/13	13:01:00 PM	3531	6.74	TB15B-4U	TOLLWAY 2330			0.111	0.1638		130.86					0.178			27.35		35.21	1.5505				571.5	0.077	27.56
					min	0.037	NA	0.036	0.0772	NA	70.67	NA	NA	NA	0.00088	0.025	14.01	NA	18.09	0.0030	0.033	301.7	NA	0.077	NA	NA	20.21	
					max	0.186	NA	0.164	0.3085	NA	262.38	NA	NA	NA	0.01281	0.180	29.49	NA	62.02	1.6567	0.033	954.9	NA	0.190	NA	NA	39.68	
					mean	0.135	NA	0.101	0.1400	NA	122.55	NA	NA	NA	0.00551	0.095	23.50	NA	30.99	0.4457	0.033	513.9	NA	0.117	NA	NA	28.35	
8/28/12	10:48:00 AM	8291	6.34	TB15B-4L	TOLLWAY 1737			0.209	0.3258		662.41					0.461	9.56	0.13	497.02	0.2422		337.1				0.212		75.49
9/11/12	9:22:00 AM	8070	6.29	TB15B-4L	TOLLWAY 1761			0.215	0.3205		615.50					0.392	9.62	0.13	460.28	0.1047		334.4				0.233		72.23
9/25/12	8:22:00 AM	8295	6.34	TB15B-4L	TOLLWAY 1771			0.196	0.3119		626.65					0.150	8.78	0.12	482.12	0.0653		321.5				0.121		73.62
10/8/12	14:06:00 PM	8389	6.26	TB15B-4L	TOLLWAY 1786			0.219	0.3397		610.27				0.00088	0.269	8.37	0.13	476.67	0.0985		329.7				0.143		80.49
10/23/12	13:23:00 PM	8520	6.26	TB15B-4L	TOLLWAY 1822			0.208	0.3261		620.05					0.043	8.76	0.12	483.51	0.0702		341.8				0.110		79.71
11/5/12	14:33:00 PM	9606	6.14	TB15B-4L	TOLLWAY 1831			0.204	0.3159		622.93					0.032	8.49	0.12	489.24	0.0249		345.5				0.102		80.59
11/19/12	10:05:00 AM	8698	6.36	TB15B-4L	TOLLWAY 1846			0.213	0.3213		639.33					0.058	8.61	0.13	499.21	0.0366		365.0				0.090		79.79
12/3/12	15:04:00 PM	8632	6.44	TB15B-4L	TOLLWAY 1863			0.202	0.2813		609.59				0.00080		8.07	0.15	477.19	0.0576		388.3				0.139		92.58
12/18/12	10:03:00 AM	8832	6.35	TB15B-4L	TOLLWAY 1890			0.195	0.2849		660.03						8.38	0.15	510.22	0.0645	0.024	394.0				0.167		89.15
1/8/13	15:35:00 PM	8712	6.49	TB15B-4L	TOLLWAY 1904			0.176	0.2928		661.26						8.53	0.16	506.00	0.0715		358.0				0.153		91.44
1/23/13	12:02:00 PM	9050	6.06	TB15B-4L	TOLLWAY 1930			0.170	0.2968		701.10						8.31	0.14	516.66	0.0515		376.7				0.110		94.16
2/5/13	15:56:00 PM	8460	6.04	TB15B-4L	TOLLWAY 1959			0.162	0.2689		672.81				0.00114		7.71	0.12	532.86	0.0511		373.7				0.109		91.13
2/19/13	16:18:00 PM	8652	6.59	TB15B-4L	TOLLWAY 1983			0.147	0.2659		695.98						7.59	0.12	563.84	0.0511		377.2				0.142		90.09
3/6/13	9:28:00 AM	8918	6.25	TB15B-4L	TOLLWAY 1998			0.154	0.2801		670.15						6.83	0.12	512.82	0.0410		363.5					86.71	
3/19/13	9:59:00 AM	8678	6.37	TB15B-4L	TOLLWAY 2027			0.140	0.2684		668.15				0.00417		7.60	0.13	510.32	0.0477		388.6				0.135		85.24
4/1/13	14:1																											

APPENDIX B-3: Results of Geochemical Analysis of Groundwater Samples

Date collected	Time collected (CST)	Field conductivity (uS/cm)	Field pH	Sample location	Sample ID	Sb mg/L	Se mg/L	Si mg/L	Sn mg/L	Sr mg/L	Ti mg/L	Tl mg/L	V mg/L	Zn mg/L	pH	alkalinity mg/L as CaCO <sub>3</sub>	TDS, 180 C mg/L	TSS mg/L	oPO <sub>4</sub> -P mg/L	NH <sub>3</sub> -N mg/L	F mg/L	Cl mg/L	NO <sub>3</sub> -N mg/L	SO <sub>4</sub> mg/L	total NVOC mg/L	dissolved NVOC mg/L
					MDL:	0.059	0.13	0.066	0.086	0.00037	0.00056	0.017	0.047	0.0097		4	12	3.0	0.003	0.03	0.07	0.16	0.04	0.21	0.31	0.31
					Class 2 Groundwater Standards (mg/L)	0.024	0.05					0.02	0.1	10.0			1,200				4.0	200	100	400		
8/28/12	10:23:00 AM	2671	6.73	TB15B-4U	TOLLWAY 1736			7.126		0.2998					7.38	385	1516		0.026	0.06	0.38	614	0.04	68.93	16.70	16.89
9/11/12	8:48:00 AM	2828	6.59	TB15B-4U	TOLLWAY 1760			7.248		0.3097					7.36	398	1577		0.032	0.06	0.36	650	0.07	72.81	18.45	17.60
9/25/12	8:02:00 AM	3613	6.73	TB15B-4U	TOLLWAY 1770			7.164		0.3546	0.00364				7.37	338	2016		0.027	0.10	0.30	964		83.18	14.38	14.36
10/8/12	13:37:00 PM	4352	6.65	TB15B-4U	TOLLWAY 1785			6.226		0.3847					7.45	289	2409		0.021	0.23	0.32	1226		75.39	10.65	10.70
10/23/12	12:57:00 PM	1967	6.91	TB15B-4U	TOLLWAY 1821			4.848		0.2149					7.80	276	1113		0.019	0.06	0.39	446	0.55	58.89	18.59	18.68
11/5/12	14:13:00 PM	3018	6.67	TB15B-4U	TOLLWAY 1830			5.116		0.2758					7.47	316	1542		0.021	0.08	0.41	658		82.80	18.02	17.42
11/19/12	9:39:00 AM	3441	6.68	TB15B-4U	TOLLWAY 1845			4.974		0.3586					7.36	312	1927		0.019	0.14	0.31	889		88.14	16.58	16.61
12/3/12	14:40:00 PM	3238	6.73	TB15B-4U	TOLLWAY 1862			5.293		0.3949					7.46	324	1846		0.015	0.09	0.29	839		99.11	15.41	15.54
12/18/12	9:39:00 AM	2970	6.74	TB15B-4U	TOLLWAY 1889			4.919		0.3390		0.030			7.52	317	1619		0.017	0.09	0.30	706	0.29	93.12	15.15	15.64
1/8/13	15:05:00 PM	2410	6.81	TB15B-4U	TOLLWAY 1903			3.991		0.3237					7.47	310	1379		0.017	0.28	0.28	569	0.23	93.47	15.36	15.08
1/23/13	12:29:00 PM	2341	6.66	TB15B-4U	TOLLWAY 1931			4.095		0.3333					7.45	315	1318		0.013	0.25	0.25	522	0.99	103.87	16.34	16.17
2/5/13	15:27:00 PM	3370	6.53	TB15B-4U	TOLLWAY 1956			3.972		0.6231					7.57	265	2262		0.020	0.10	0.35	1100	1.54	106.65	15.55	14.84
2/19/13	16:45:00 PM	3903	6.71	TB15B-4U	TOLLWAY 1984			3.815		0.5562	0.00421				7.43	207	2224		0.020	0.04	0.34	1165	0.75	76.80	11.20	10.38
3/6/13	9:36:00 AM	6307	6.40	TB15B-4U	TOLLWAY 1999			3.441		0.7648					7.33	220	3451		0.017	0.31	0.31	1909	1.07	85.10	9.03	8.77
3/19/13	10:09:00 AM	5739	6.67	TB15B-4U	TOLLWAY 2028		0.163	3.685		0.7523					7.54	231	3178		0.023	0.34	0.34	1733	1.22	103.33	8.62	9.08
4/1/13	13:53:00 PM	5076	7.64	TB15B-4U	TOLLWAY 2045		0.156	3.883		0.7218					7.56	256	2958		0.021	0.30	0.30	1529	0.51	105.40	9.43	9.59
4/16/13	10:27:00 AM	2323	7.40	TB15B-4U	TOLLWAY 2077			4.160		0.3362	0.00289				7.69	304	1407		0.053	0.23	0.23	614	1.81	67.42	19.74	17.48
4/30/13	15:09:00 PM	1909	7.03	TB15B-4U	TOLLWAY 2111			4.413		0.2359	0.00278				7.87	357	1134		0.049	0.27	0.27	401	1.00	58.76	17.38	16.65
5/14/13	8:18:00 AM	2613	7.19	TB15B-4U	TOLLWAY 2132			4.681		0.3105					7.65	378	1514		0.041	0.36	0.36	627		73.01	18.24	17.95
5/28/13	13:44:00 PM	2194	7.21	TB15B-4U	TOLLWAY 2159			5.581		0.3007	0.00419				7.57	408	1253		0.074	0.34	0.34	445	0.13	60.23	19.44	19.38
6/11/13	8:25:00 AM	2089	6.99	TB15B-4U	TOLLWAY 2189			5.910		0.2573	0.00089				7.51	490	1218		0.059	0.35	0.35	364		58.84	19.94	19.87
6/25/13	8:49:00 AM	2132	7.01	TB15B-4U	TOLLWAY 2221			6.385		0.2815	0.00248				7.42	484	1232		0.061	0.33	0.33	383	0.11	56.74	19.87	19.40
7/9/13	8:52:00 AM	2310	6.94	TB15B-4U	TOLLWAY 2252			6.686		0.3191					7.43	482	1321		0.058	0.17	0.35	451		60.30	19.63	19.37
7/22/13	13:14:00 PM	2525	6.66	TB15B-4U	TOLLWAY 2273			6.869		0.3321		0.019			7.37	449	1440		0.050	0.23	0.32	546	0.04	58.39	18.26	18.72
8/6/13	8:18:00 AM	3386	7.02	TB15B-4U	TOLLWAY 2305			6.879		0.4798					7.40	352	1949		0.031	0.22	0.31	889		67.21	15.00	15.07
8/20/13	13:01:00 PM	3531	6.74	TB15B-4U	TOLLWAY 2330			6.924		0.4769					7.40	335	2173		0.031	0.24	0.28	931		72.32	15.04	14.69
					min	NA	0.156	3.441	NA	0.2149	0.00089	0.019	NA	NA	7.33	207	1113	NA	0.013	0.04	0.23	364	0.04	56.74	8.62	8.77
					max	NA	0.163	7.248	NA	0.7648	0.00421	0.030	NA	NA	7.87	490	3451	NA	0.074	0.24	0.41	1909	1.81	106.65	19.94	19.87
					mean	NA	0.159	5.319	NA	0.3976	0.00301	0.024	NA	NA	7.49	338	1807	NA	0.032	0.13	0.32	814	0.65	78.09	15.85	15.61
8/28/12	10:48:00 AM	8291	6.34	TB15B-4L	TOLLWAY 1737		0.211	10.617		6.6366		0.039	0.0146	7.24	368	4726		0.169	4.73	0.21	2687	0.10	190.48	5.51	4.27	
9/11/12	9:22:00 AM	8070	6.29	TB15B-4L	TOLLWAY 1761		0.185	10.499		6.6187		0.037	0.0102	7.37	352	4626		0.192	2.54	0.25	2679	0.11	180.62	7.11	4.06	
9/25/12	8:22:00 AM	8295	6.34	TB15B-4L	TOLLWAY 1771			10.020		6.3213		0.021	0.0110	7.17	322	4308		0.101	2.71	0.22	2678	0.13	189.04	4.83	2.98	
10/8/12	14:06:00 PM	8389	6.26	TB15B-4L	TOLLWAY 1786		0.166	10.246		6.5955		0.017	0.0548	7.30	293	4636		0.035	0.14	0.23	2726	0.10	202.54	2.25	2.06	
10/23/12	13:23:00 PM	8520	6.26	TB15B-4L	TOLLWAY 1822			9.790		6.8632		0.019	0.0680	7.42	301	4328		0.042	0.05	0.32	2733	0.40	214.60	3.46	2.96	
11/5/12	14:33:00 PM	9606	6.14	TB15B-4L	TOLLWAY 1831		0.251	9.436		6.8568			0.0628	7.29	284	4605		0.041	0.08	0.16	2746	0.43	213.16	3.47	2.74	
11/19/12	10:05:00 AM	8698	6.36	TB15B-4L	TOLLWAY 1846			9.758		6.9104		0.017	0.0608	7.29	294	4699		0.045			2826	0.33	222.66	2.84	2.66	
12/3/12	15:04:00 PM	8632	6.44	TB15B-4L	TOLLWAY 1863			10.652		6.9391		0.024	0.0522	7.26	309	4715		0.020		0.11	2921	0.40	236.23	2.87	2.67	
12/18/12	10:03:00 AM	8832	6.35	TB15B-4L	TOLLWAY 1890		0.231	10.290		7.1915		0.034	0.0610	7.34	308	4732		0.029			2900	0.26	232.28	3.28	2.85	
1/8/13	15:35:00 PM	8712	6.49	TB15B-4L	TOLLWAY 1904			9.012		7.6946		0.027	0.0624	7.31	301	4433		0.029			2868	0.13	235.34	2.62	3.17	
1/23/13	12:02:00 PM	9050	6.06	TB15B-4L	TOLLWAY 1930		0.271	9.197		7.3316			0.0622	7.27	302	4624		0.024		0.08	2855	0.12	233.48	2.77	2.43	
2/5/13	15:56:00 PM	8460	6.04	TB15B-4L	TOLLWAY 1959			8.581		7.1510		0.022	0.0589	7.32	300	4439		0.030		0.38	2848	0.19	231.89	3.17	2.67	
2/19/13	16:18:00 PM	8652	6.59	TB15B-4L	TOLLWAY 1983			8.513		7.5990		0.020	0.0594	7.25	303	4563		0.029		0.38	2912	0.16	233.78	3.50	2.75	
3/6/13	9:28:00 AM	8918	6.25	TB15B-4L	TOLLWAY 1998		0.152	8.041		6.8164			0.0535	7.27	303	4493		0.029		0.33	2847	0.18	346.15	2.13	1.84	
3/19/13	9:59:00 AM	8678	6.37	TB15B-4L	TOLLWAY 2027		0.224	8.540		6.8283			0.0584	7.31	304	4661		0.026		0.33	2819	0.15	233.14	3.41	3.29	
4/1/13	14:10:00 PM	8538	6.72	TB15B-4L	TOLLWAY 2046		0.269	8.554		7.2927			0.0545	7.27	304	4947		0.026		0.2						

APPENDIX B-4: Results of Geochemical Analysis of Groundwater Samples

Date collected	Time collected (CST)	Field conductivity (uS/cm)	Field pH	Sample location	Sample ID	Al mg/L	As mg/L	B mg/L	Ba mg/L	Be mg/L	Ca mg/L	Cd mg/L	Co mg/L	Cr mg/L	Cu mg/L	Fe mg/L	K mg/L	Li mg/L	Mg mg/L	Mn mg/L	Mo mg/L	Na mg/L	Ni mg/L	P mg/L	Pb mg/L	S mg/L
					MDL:	0.037	0.11	0.023	0.00085	0.00055	0.029	0.012	0.013	0.0058	0.0016	0.024	0.016	0.11	0.027	0.0015	0.022	0.026	0.043	0.073	0.041	0.22
					Class 2 Groundwater Standards (mg/L)		0.2	2.0	2.0	0.5		0.05	1.0	1.0	0.65	5.0				10.0			2.0		0.1	
1/15/14	10:22:00 AM	2230	7.72	TB7B-1	TOLLWAY 2528	1.430		0.078	0.0402		43.82				0.01437	1.494	3.91		11.24	0.0174		410.4		0.286		63.23
3/19/14	8:59:00 AM	536	7.66	TB7B-1	TOLLWAY 2617	2.258		0.057	0.0172		6.76				0.01125	1.583	2.85		2.27	0.0113		162.9				11.42
4/16/14	9:15:00 AM	1539	7.21	TB7B-1	TOLLWAY 2676	2.320		0.081	0.0361		38.69				0.02408	2.117	3.14		10.48	0.0403		319.9		0.108		38.52
5/13/14	12:57:00 PM	392	7.28	TB7B-1	TOLLWAY 2726	0.569		0.100	0.0144		12.86				0.01078	0.486	7.65		3.26	0.0108		81.2		0.151		4.56
6/10/14	9:42:00 AM	1531	7.17	TB7B-1	TOLLWAY 2782	0.118		0.116	0.0359		55.56				0.01506	0.753	5.16		14.06	0.1832		304.2		0.166		40.91
7/9/14	10:38:00 AM	858	7.06	TB7B-1	TOLLWAY 2849	1.855		0.146	0.0293		28.40				0.01760	1.764	6.24		6.40	0.1233		193.4		0.084		16.14
8/6/14	9:09:00 AM	761	7.28	TB7B-1	TOLLWAY 2896	3.034		0.125	0.0344		35.95				0.01131	2.761	4.37		9.98	0.1436		209.2		0.369		14.22
					min	0.118	NA	0.057	0.0144	NA	6.76	NA	NA	NA	0.01078	0.486	2.85	NA	2.27	0.0108	NA	81.2	NA	0.084	NA	4.56
					max	3.034	NA	0.146	0.0402	NA	55.56	NA	NA	NA	0.02408	2.761	7.65	NA	14.06	0.1832	NA	410.4	NA	0.369	NA	63.23
					mean	1.655	NA	0.100	0.0296	NA	31.72	NA	NA	NA	0.01492	1.565	4.76	NA	8.24	0.0757	NA	240.2	NA	0.194	NA	27.00
3/19/14	9:09:00 AM	11439	7.34	TB7B-2	TOLLWAY 2618			0.183	0.0335		95.87				0.00303	0.025	0.36		96.81	0.0220		108.7				55.07
4/16/14	9:41:00 AM	1344	7.21	TB7B-2	TOLLWAY 2677			0.174	0.0368		94.14				0.00204	0.113	0.53		98.94	0.0936		96.5				49.52
5/13/14	11:14:00 AM	413	7.06	TB7B-2	TOLLWAY 2727	0.063		0.102	0.0118		37.81				0.00349	0.074	0.37		23.44			23.9		0.114		4.63
6/10/14	9:55:00 AM	1119	7.09	TB7B-2	TOLLWAY 2784			0.224	0.0311		90.61				0.00163		0.66		78.80	0.0632		74.3		0.093		27.31
7/9/14	10:49:00 AM	926	6.86	TB7B-2	TOLLWAY 2846			0.220	0.0293		85.62				0.00383		0.60		66.20	0.0808		45.7				12.30
8/6/14	9:32:00 AM	1276	7.00	TB7B-2	TOLLWAY 2897			0.258	0.0374		94.02					2.283	0.78		85.50	0.7991		83.7				23.52
					min	0.063	NA	0.102	0.0118	NA	37.81	NA	NA	NA	0.00163	0.025	0.36	NA	23.44	0.0220	NA	23.9	NA	0.093	NA	4.63
					max	0.063	NA	0.258	0.0374	NA	95.87	NA	NA	NA	0.00383	2.283	0.78	NA	98.94	0.7991	NA	108.7	NA	0.114	NA	55.07
					mean	0.063	NA	0.194	0.0300	NA	83.01	NA	NA	NA	0.00280	0.624	0.55	NA	74.95	0.2118	NA	72.1	NA	0.103	NA	28.73
3/19/14	9:30:00 AM	850	7.42	TB7B-3	TOLLWAY 2619			0.120	0.0184		79.00						0.43		66.24			23.3				10.40
4/16/14	10:06:00 AM	850	7.34	TB7B-3	TOLLWAY 2678			0.114	0.0163		85.14				0.00168		0.30		69.44			17.1				9.04
5/13/14	11:24:00 AM	66	7.23	TB7B-3	TOLLWAY 2728			0.119	0.0136		55.90				0.00222		0.32		37.96			24.6		0.084		5.24
6/10/14	10:11:00 AM	1040	7.18	TB7B-3	TOLLWAY 2780			0.145	0.0203		95.37				0.00168		0.42		68.85			25.3		0.112		10.24
7/9/14	11:04:00 AM	1006	7.06	TB7B-3	TOLLWAY 2850			0.176	0.0212		96.36				0.00186		0.37		73.53			21.8				8.32
8/6/14	9:50:00 AM	1098	7.10	TB7B-3	TOLLWAY 2898			0.153	0.0241		112.01						0.41		87.37	0.0056		21.8				8.48
					min	NA	NA	0.114	0.0136	NA	55.90	NA	NA	NA	0.00168	NA	0.30	NA	37.96	0.0056	NA	17.1	NA	0.084	NA	5.239
					max	NA	NA	0.176	0.0241	NA	112.01	NA	NA	NA	0.00222	NA	0.43	NA	87.37	0.0056	NA	25.3	NA	0.112	NA	10.403
					mean	NA	NA	0.138	0.0190	NA	87.30	NA	NA	NA	0.00186	NA	0.38	NA	67.23	0.0056	NA	22.3	NA	0.098	NA	8.620

APPENDIX B-4: Results of Geochemical Analysis of Groundwater Samples

Date collected	Time collected (CST)	Field conductivity (uS/cm)	Field pH	Sample location	Sample ID	Sb mg/L	Se mg/L	Si mg/L	Sn mg/L	Sr mg/L	Ti mg/L	Tl mg/L	V mg/L	Zn mg/L	pH	alkalinity mg/L as CaCO <sub>3</sub>	TDS, 180 C mg/L	TSS mg/L	oPO <sub>4</sub> -P mg/L	NH <sub>3</sub> -N mg/L	F mg/L	Cl mg/L	NO <sub>3</sub> -N mg/L	SO <sub>4</sub> mg/L	total NVOC mg/L	dissolved NVOC mg/L	
					MDL:	0.059	0.13	0.066	0.086	0.00037	0.00056	0.017	0.047	0.0097			4	12	3.0	0.003	0.03	0.07	0.16	0.04	0.21	0.31	0.31
					Class 2 Groundwater Standards (mg/L)	0.024	0.05					0.02	0.1	10.0			1,200				4.0	200	100	400			
1/15/14	10:22:00 AM	2230	7.72	TB7B-1	TOLLWAY 2528			6.314		0.1114	0.03742			0.0151	7.75	530	1240	no sample	0.124	0.05	0.29	192	10.43	181.86	27.50	27.78	
3/19/14	8:59:00 AM	536	7.66	TB7B-1	TOLLWAY 2617			7.419		0.0137	0.05686			0.0119	7.45	188	466	no sample	0.056		0.33	50	7.73	31.84	17.90	16.55	
4/16/14	9:15:00 AM	1539	7.21	TB7B-1	TOLLWAY 2676			8.241		0.0408	0.04991			0.0161	7.60	567	1091	no sample	0.048	0.17	0.27	120	8.39	118.77	32.64	28.25	
5/13/14	12:57:00 PM	392	7.28	TB7B-1	TOLLWAY 2726			4.799		0.0429	0.01886			0.0116	7.36	170	288	no sample	0.077	0.11	0.25	11	4.70	12.41	29.81	19.48	
6/10/14	9:42:00 AM	1531	7.17	TB7B-1	TOLLWAY 2782			4.264		0.0690	0.00430				7.63	572	943	no sample	0.059	0.21	0.32	95	0.31	110.30	28.60	22.31	
7/9/14	10:38:00 AM	858	7.06	TB7B-1	TOLLWAY 2849			8.342		0.0676	0.04896			0.0145	7.48	385	625	no sample	0.088	0.15	0.30	40	0.70	42.26	27.89	24.49	
8/6/14	9:09:00 AM	761	7.28	TB7B-1	TOLLWAY 2896			10.804		0.0624	0.06473			0.0160	7.38	474	715	no sample	0.350	1.98	0.36	49	0.34	43.00	26.65	26.17	
					min	NA	NA	4.264	NA	0.0137	0.00430	NA	NA	0.0116	7.36	170	288	NA	0.048	0.05	0.25	11	0.31	12.41	17.90	16.55	
					max	NA	NA	10.804	NA	0.1114	0.06473	NA	NA	0.0161	7.75	572	1240	NA	0.350	1.98	0.36	192	10.43	181.86	32.64	28.25	
					mean	NA	NA	7.169	NA	0.0583	0.04015	NA	NA	0.0142	7.52	412	767	NA	0.115	0.44	0.30	80	4.66	77.20	27.28	23.57	
3/19/14	9:09:00 AM	11439	7.34	TB7B-2	TOLLWAY 2618			4.579		0.0625					7.60	566	923	no sample	0.018		0.21	99	4.50	164.01	4.63	4.32	
4/16/14	9:41:00 AM	1344	7.21	TB7B-2	TOLLWAY 2677			4.601		0.0498	0.00106				7.65	551	859	no sample	0.008		0.21	87	3.72	137.55	4.97	4.88	
5/13/14	11:14:00 AM	413	7.06	TB7B-2	TOLLWAY 2727			5.673		0.0018	0.00276				7.36	167	266	no sample	0.017		0.21	16	8.87	12.91	10.89	8.96	
6/10/14	9:55:00 AM	1119	7.09	TB7B-2	TOLLWAY 2784			5.721		0.0302					7.66	495	680	no sample	0.014		0.24	59	3.61	79.13	4.77	5.04	
7/9/14	10:49:00 AM	926	6.86	TB7B-2	TOLLWAY 2846			7.248		0.0698					7.34	473	554	no sample	0.018		0.18	30	1.45	31.54	4.37	4.43	
8/6/14	9:32:00 AM	1276	7.00	TB7B-2	TOLLWAY 2897			6.221		0.0929					7.31	561	742	no sample	0.025	0.04	0.25	77		67.18	4.50	4.41	
					min	NA	NA	4.579	NA	0.0018	0.00106	NA	NA	NA	7.31	167	266	NA	0.008	0.04	0.18	16	1.45	12.91	4.37	4.32	
					max	NA	NA	7.248	NA	0.0929	0.00276	NA	NA	NA	7.66	566	923	NA	0.025	0.04	0.25	99	8.87	164.01	10.89	8.96	
					mean	NA	NA	5.674	NA	0.0512	0.00191	NA	NA	NA	7.49	469	671	NA	0.017	0.04	0.22	62	4.43	82.05	5.69	5.34	
3/19/14	9:30:00 AM	850	7.42	TB7B-3	TOLLWAY 2619			6.154		0.0093					7.69	414	511	no sample	0.019		0.19	21	11.15	30.58	2.96	2.77	
4/16/14	10:06:00 AM	850	7.34	TB7B-3	TOLLWAY 2678			6.336							7.65	437	505	no sample	0.017		0.19	28	6.14	25.71	3.37	3.22	
5/13/14	11:24:00 AM	66	7.23	TB7B-3	TOLLWAY 2728			5.440		0.0007					7.75	274	329	no sample	0.014		0.26	16	4.75	15.10	6.23	4.90	
6/10/14	10:11:00 AM	1040	7.18	TB7B-3	TOLLWAY 2780			7.550		0.0009					7.64	471	554	no sample	0.014		0.23	26	13.49	29.58	3.94	3.92	
7/9/14	11:04:00 AM	1006	7.06	TB7B-3	TOLLWAY 2850			7.873		0.0573					7.59	486	584	no sample	0.017		0.19	27	8.41	24.16	3.03	2.92	
8/6/14	9:50:00 AM	1098	7.10	TB7B-3	TOLLWAY 2898			8.587		0.0647					7.45	546	647	no sample	0.021		0.21	29	8.93	23.93	3.22	3.08	
					min	NA	NA	5.440	NA	0.0007	NA	NA	NA	NA	7.45	274	329	NA	0.014	NA	0.19	16	4.75	15.10	2.96	2.77	
					max	NA	NA	8.587	NA	0.0647	NA	NA	NA	NA	7.75	546	647	NA	0.021	NA	0.26	29	13.49	30.58	6.23	4.90	
					mean	NA	NA	6.990	NA	0.0266	NA	NA	NA	NA	7.63	438	522	NA	0.017	NA	0.21	24	8.81	24.84	3.79	3.47	

APPENDIX B-4: Results of Geochemical Analysis of Groundwater Samples

Date collected	Time collected (CST)	Field conductivity (uS/cm)	Field pH	Sample location	Sample ID	Al mg/L	As mg/L	B mg/L	Ba mg/L	Be mg/L	Ca mg/L	Cd mg/L	Co mg/L	Cr mg/L	Cu mg/L	Fe mg/L	K mg/L	Li mg/L	Mg mg/L	Mn mg/L	Mo mg/L	Na mg/L	Ni mg/L	P mg/L	Pb mg/L	S mg/L
					MDL:	0.037	0.11	0.023	0.00085	0.00055	0.029	0.012	0.013	0.0058	0.0016	0.024	0.016	0.11	0.027	0.0015	0.022	0.026	0.043	0.073	0.041	0.22
					Class 2 Groundwater Standards (mg/L)		0.2	2.0	2.0	0.5		0.05	1.0	1.0	0.65	5.0				10.0			2.0		0.1	
3/19/14	9:39:00 AM	690	7.49	TB7B-4	TOLLWAY 2620			0.083	0.0041		64.97						0.17		59.09			12.9				4.67
4/16/14	10:28:00 AM	663	7.34	TB7B-4	TOLLWAY 2679			0.077	0.0042		78.67						0.13		50.12			7.2				3.61
5/13/14	11:48:00 AM	503	7.24	TB7B-4	TOLLWAY 2729			0.089	0.0091		57.42					0.037	0.49		33.40			15.8		0.100		4.10
6/10/14	10:26:00 AM	710	7.15	TB7B-4	TOLLWAY 2785			0.095	0.0067		86.29						0.30		48.94			6.9		0.098		4.03
7/9/14	11:15:00 AM	659	7.02	TB7B-4	TOLLWAY 2851			0.110	0.0102		80.23					0.116	0.61		44.57	0.06161		6.7				3.14
8/6/14	9:59:00 AM	738	7.11	TB7B-4	TOLLWAY 2899			0.111	0.0073		88.70						0.22		49.61	0.00183		7.4				3.74
					min	NA	NA	0.077	0.0041	NA	57.42	NA	NA	NA	NA	0.037	0.13	NA	33.40	0.0018	NA	6.7	NA	0.098	NA	3.14
					max	NA	NA	0.111	0.0102	NA	88.70	NA	NA	NA	NA	0.116	0.61	NA	59.09	0.0616	NA	15.8	NA	0.100	NA	4.67
					mean	NA	NA	0.094	0.0069	NA	76.04	NA	NA	NA	NA	0.076	0.32	NA	47.62	0.0317	NA	9.5	NA	0.099	NA	3.88
9/4/13	13:01:00 PM	9961	7.11	TB7B-5U	TOLLWAY 2356			0.295	0.1746		196.68					0.981	35.73		66.13	1.4498		2059.2		0.124		197.38
9/16/13	15:32:00 PM	9268	6.80	TB7B-5U	TOLLWAY 2363			0.284	0.2237		214.02					1.291	38.65		73.16	1.4613		1976.7				152.73
10/2/13	8:15:00 AM	6664	7.17	TB7B-5U	TOLLWAY 2391			0.215	0.1268		111.16					0.774	31.30		35.92	0.8505	0.022	1345.0		0.103		175.85
10/15/13	10:12:00 AM	7481	7.20	TB7B-5U	TOLLWAY 2403			0.228	0.1655		139.56					1.051	38.82		52.94	1.1880		1469.4				174.07
10/29/13	15:27:00 PM	6571	6.97	TB7B-5U	TOLLWAY 2434			0.199	0.1429		127.57					0.741	42.14		46.88	0.9698		1214.8		0.099		117.48
12/3/13	13:40:00 PM	6303	7.30	TB7B-5U	TOLLWAY 2481			0.136	0.1192		135.37					0.717	25.96		45.11	0.9431		1308.0		0.159		219.14
1/15/14	9:24:00 AM	13530	7.21	TB7B-5U	TOLLWAY 2526			0.153	0.2015		416.47		0.017			1.223	34.71		130.46	1.6116		2526.3		0.171		410.29
2/20/14	11:12:00 AM	31671	7.08	TB7B-5U	TOLLWAY 2569			0.129	0.2170		537.23		0.016			6.253	40.56		145.65	1.5212		7056.5		0.154		339.10
3/19/14	8:01:00 AM	35190	6.98	TB7B-5U	TOLLWAY 2613			0.174	0.2615		730.47		0.031		0.021924	3.566	61.38		179.47	1.7204		8006.7				400.80
4/16/14	8:10:00 AM	18529	7.29	TB7B-5U	TOLLWAY 2673			0.256	0.1084		452.95				0.109473	2.202	32.39		149.83	0.8112		3889.0				481.33
5/13/14	10:20:00 AM	17701	7.21	TB7B-5U	TOLLWAY 2724			0.228	0.1000		355.94				0.013679	1.213	30.30		101.10	0.6944		3714.7		0.292	0.053	376.44
6/10/14	8:22:00 AM	14661	7.06	TB7B-5U	TOLLWAY 2779			0.335	0.1010		395.37				0.011359	0.956	33.15		135.32	0.9036		2819.1		0.151		373.94
7/9/14	9:15:00 AM	14642	7.06	TB7B-5U	TOLLWAY 2843			0.351	0.1102		389.87					1.964	31.24		130.08	0.7465		2828.0				257.19
8/6/14	8:01:00 AM	11586	7.11	TB7B-5U	TOLLWAY 2892			0.350	0.1188		310.32					1.171	28.81		106.66	0.6552		2080.2				251.47
					min	NA	NA	0.129	0.1000	NA	111.16	NA	0.016	NA	0.0114	0.717	25.96	NA	35.92	0.6552	0.022	1214.8	NA	0.099	0.053	117.48
					max	NA	NA	0.351	0.2615	NA	730.47	NA	0.031	NA	0.1095	6.253	61.38	NA	179.47	1.7204	0.022	8006.7	NA	0.292	0.053	481.33
					mean	NA	NA	0.238	0.1551	NA	322.35	NA	0.022	NA	0.0391	1.722	36.08	NA	99.91	1.1091	0.022	3021.0	NA	0.157	0.053	280.51
3/19/14	8:26:00 AM	21736	7.06	TB7B-5L	TOLLWAY 2615			0.127	0.3628		526.07				0.0062		25.95		167.46	2.1301		3956.6				290.05
4/16/14	8:27:00 AM	23308	7.09	TB7B-5L	TOLLWAY 2674			0.118	0.4320		572.23		0.025		0.0158		37.67		174.78	9.2022		4870.9				299.11
5/13/14	9:36:00 AM	18039	6.80	TB7B-5L	TOLLWAY 2721			0.113	0.2889		498.89		0.020		0.0079	1.041	20.77		142.02	4.7107		3526.1		0.240		238.92
7/9/14	9:27:00 AM	15243	7.02	TB7B-5L	TOLLWAY 2844			0.118	0.1849		269.23					1.475	14.36		85.65	1.5080		2658.3				169.24
8/6/14	8:20:00 AM	16771	7.06	TB7B-5L	TOLLWAY 2894			0.151	0.2281		337.87					5.132	19.83		98.63	1.8323		3144.7				222.30
					min	NA	NA	0.113	0.1849	NA	269.23	NA	0.020	NA	0.0062	1.041	14.36	NA	85.65	1.5080	NA	2658.3	NA	0.240	NA	169.24
					max	NA	NA	0.151	0.4320	NA	572.23	NA	0.025	NA	0.0158	5.132	37.67	NA	174.78	9.2022	NA	4870.9	NA	0.240	NA	299.11
					mean	NA	NA	0.125	0.2993	NA	440.86	NA	0.023	NA	0.0099	2.549	23.72	NA	133.71	3.8767	NA	3631.3	NA	0.240	NA	243.92

APPENDIX B-4: Results of Geochemical Analysis of Groundwater Samples

Date collected	Time collected (CST)	Field conductivity (uS/cm)	Field pH	Sample location	Sample ID	Sb mg/L	Se mg/L	Si mg/L	Sn mg/L	Sr mg/L	Ti mg/L	Tl mg/L	V mg/L	Zn mg/L	pH	alkalinity mg/L as CaCO <sub>3</sub>	TDS, 180 C mg/L	TSS mg/L	oPO <sub>4</sub> -P mg/L	NH <sub>3</sub> -N mg/L	F mg/L	Cl mg/L	NO <sub>3</sub> -N mg/L	SO <sub>4</sub> mg/L	total NVOC mg/L	dissolved NVOC mg/L	
					MDL:	0.059	0.13	0.066	0.086	0.00037	0.00056	0.017	0.047	0.0097			4	12	3.0	0.003	0.03	0.07	0.16	0.04	0.21	0.31	0.31
					Class 2 Groundwater Standards (mg/L)	0.024	0.05					0.02	0.1	10.0			1,200			4.0	200	100	400				
3/19/14	9:39:00 AM	690	7.49	TB7B-4	TOLLWAY 2620			6.249		0.0066		0.027			7.75	383	405	no sample	0.020	0.07	0.16	6	6.01	13.01	2.64	2.11	
4/16/14	10:28:00 AM	663	7.34	TB7B-4	TOLLWAY 2679			5.996							7.64	324	387	no sample	0.011		0.13	7	12.88	10.08	1.91	1.79	
5/13/14	11:48:00 AM	503	7.24	TB7B-4	TOLLWAY 2729			5.666			0.00063				7.69	256	291	no sample	0.016		0.18	10	4.32	11.60	3.64	2.95	
6/10/14	10:26:00 AM	710	7.15	TB7B-4	TOLLWAY 2785			6.301							7.46	334	406	no sample	0.012		0.15	13	13.59	11.76	2.05	1.92	
7/9/14	11:15:00 AM	659	7.02	TB7B-4	TOLLWAY 2851			6.946		0.0408					7.53	350	380	no sample	0.016	0.08	0.12	8	3.34	8.57	3.66	3.76	
8/6/14	9:59:00 AM	738	7.11	TB7B-4	TOLLWAY 2899			7.098		0.0461					7.44	377	412	no sample	0.017		0.15	12	4.99	10.85	1.80	1.64	
					min	NA	NA	5.666	NA	0.0066	0.00063	0.027	NA	NA	7.44	256	291	NA	0.011	0.07	0.115	6	3.34	8.57	1.80	1.64	
					max	NA	NA	7.098	NA	0.0461	0.00063	0.027	NA	NA	7.75	383	412	NA	0.020	0.08	0.184	13	13.59	13.01	3.66	3.76	
					mean	NA	NA	6.376	NA	0.0312	0.00063	0.027	NA	NA	7.59	337	380	NA	0.015	0.08	0.147	9	7.52	10.98	2.62	2.36	
9/4/13	13:01:00 PM	9961	7.11	TB7B-5U	TOLLWAY 2356			11.036		2.1485		0.017			7.55	551	5904	no sample	0.025	1.51	0.39	2827		519.24	23.12	21.63	
9/16/13	15:32:00 PM	9268	6.8	TB7B-5U	TOLLWAY 2363		0.139	10.821		2.1625		0.030			7.36	566	5688	no sample	0.032	2.97	0.15	2822		365.97	24.11	23.78	
10/2/13	8:15:00 AM	6664	7.17	TB7B-5U	TOLLWAY 2391			9.813		0.9940					7.51	590	4096	no sample	0.035	1.23	0.23	1721		494.59	29.46	35.22	
10/15/13	10:12:00 AM	7481	7.20	TB7B-5U	TOLLWAY 2403			10.605		1.3317					7.53	503	4477	no sample	0.016	1.53	0.36	2081		452.36	22.45	22.34	
10/29/13	15:27:00 PM	6571	6.97	TB7B-5U	TOLLWAY 2434		0.131	9.817		1.2627					7.60	512	3771	no sample	0.011	1.68	0.39	1779		319.97	23.49	22.70	
12/3/13	13:40:00 PM	6303	7.30	TB7B-5U	TOLLWAY 2481			6.385		1.0424					7.68	315	3910	no sample	0.015	1.43	0.43	1587		634.02	12.08	11.81	
1/15/14	9:24:00 AM	13530	7.21	TB7B-5U	TOLLWAY 2526		0.143	5.641		3.4409					7.56	260	8442	no sample	0.019	0.36		4120	0.22	1189.08	10.11	10.21	
2/20/14	11:12:00 AM	31671	7.08	TB7B-5U	TOLLWAY 2569		0.222	4.633		4.6399				0.0150	7.32	162	19851	no sample	0.035	0.54		11529		1007.70	9.29	8.76	
3/19/14	8:01:00 AM	35190	6.98	TB7B-5U	TOLLWAY 2613		0.424	4.162		5.4202		0.102		0.0245	7.37	195	22066	no sample	0.024	1.13		12652		1031.90	9.19	9.92	
4/16/14	8:10:00 AM	18529	7.29	TB7B-5U	TOLLWAY 2673		0.195	5.010		2.9331		0.045		0.0150	7.52	235	11803	no sample	0.024	0.88		5974	0.63	1314.27	9.92	9.93	
5/13/14	10:20:00 AM	17701	7.21	TB7B-5U	TOLLWAY 2724		0.210	5.305		2.1033				0.0133	7.60	256	11074	no sample	0.015	0.19		5758		1033.38	13.99	13.89	
6/10/14	8:22:00 AM	14661	7.06	TB7B-5U	TOLLWAY 2779		0.196	6.540		2.4319					7.51	331	8924	no sample	0.021	0.24	0.92	4450		1010.41	13.28	12.96	
7/9/14	9:15:00 AM	14642	7.06	TB7B-5U	TOLLWAY 2843			6.900		2.4336					7.46	337	8821	no sample	0.024	0.57	0.75	4615		717.76	10.78	10.73	
8/6/14	8:01:00 AM	11586	7.11	TB7B-5U	TOLLWAY 2892			7.611		2.0372					7.53	501	6915	no sample	0.025	0.49	0.65	3365		677.42	13.65	12.60	
					min	NA	0.131	4.162	NA	0.9940	NA	0.017	NA	0.0133	7.32	162	3771	NA	0.011	0.19	0.15	1587	0.22	319.97	9.19	8.76	
					max	NA	0.424	11.036	NA	5.4202	NA	0.102	NA	0.0245	7.68	590	22066	NA	0.035	2.97	0.92	12652	0.63	1314.27	29.46	35.22	
					mean	NA	0.208	7.449	NA	2.4558	NA	0.049	NA	0.0169	7.51	380	8982	NA	0.023	1.05	0.48	4663	0.42	769.15	16.07	16.18	
3/19/14	8:26:00 AM	21736	7.06	TB7B-5L	TOLLWAY 2615		0.283	6.181		3.6962				0.0374	7.98	278	12483	no sample	0.027	0.14		6876	0.58	792.17	9.65	9.38	
4/16/14	8:27:00 AM	23308	7.09	TB7B-5L	TOLLWAY 2674		0.220	6.196		4.3681		0.055		0.0385	7.25	307	13828	no sample	0.026	1.08		7751	0.21	729.46	9.45	8.94	
5/13/14	9:36:00 AM	18039	6.80	TB7B-5L	TOLLWAY 2721		0.249	6.698		2.9902				0.0239	7.73	372	10592	no sample	0.016	0.73		5959		601.99	14.05	10.99	
7/9/14	9:27:00 AM	15243	7.02	TB7B-5L	TOLLWAY 2844			6.378		1.8115				0.0163	7.23	434	8038	no sample	0.019	0.79	0.59	4237	0.27	492.93	14.39	11.96	
8/6/14	8:20:00 AM	16771	7.06	TB7B-5L	TOLLWAY 2894			6.979		2.1275					7.30	388	9632	no sample	0.071	0.99	0.72	5258	0.06	633.74	14.70	14.51	
					min	NA	0.220	6.181	NA	1.8115	NA	0.055	NA	0.0163	7.23	278	8038	NA	0.016	0.14	0.59	4237	0.06	492.93	9.45	8.94	
					max	NA	0.283	6.979	NA	4.3681	NA	0.055	NA	0.0385	7.98	434	13828	NA	0.071	1.08	0.72	7751	0.58	792.17	14.70	14.51	
					mean	NA	0.251	6.486	NA	2.9987	NA	0.055	NA	0.0290	7.50	356	10915	NA	0.032	0.75	0.65	6016	0.28	650.06	12.45	11.15	

APPENDIX B-4: Results of Geochemical Analysis of Groundwater Samples

Date collected	Time collected (CST)	Field conductivity (uS/cm)	Field pH	Sample location	Sample ID	Al mg/L	As mg/L	B mg/L	Ba mg/L	Be mg/L	Ca mg/L	Cd mg/L	Co mg/L	Cr mg/L	Cu mg/L	Fe mg/L	K mg/L	Li mg/L	Mg mg/L	Mn mg/L	Mo mg/L	Na mg/L	Ni mg/L	P mg/L	Pb mg/L	S mg/L
					MDL:	0.037	0.11	0.023	0.00085	0.00055	0.029	0.012	0.013	0.0058	0.0016	0.024	0.016	0.11	0.027	0.0015	0.022	0.026	0.043	0.073	0.041	0.22
					Class 2 Groundwater Standards (mg/L)		0.2	2.0	2.0	0.5		0.05	1.0	1.0	0.65	5.0				10.0			2.0		0.1	
12/3/13	11:17:00 AM	16	7.62	TB15B-1U	TOLLWAY 2479	0.223			0.0423		63.35				0.0058	0.170	0.95		41.00			248.1		0.130		13.80
1/13/14	13:44:00 PM	2921	7.54	TB15B-1U	TOLLWAY 2510	0.242		0.036	0.0691		127.57					0.138	0.94		85.08			346.5		0.122		22.42
2/20/14	9:35:00 AM	3796	7.40	TB15B-1U	TOLLWAY 2566	0.046		0.032	0.0797		154.33					0.024	1.30		113.63	0.0041		354.8		0.149		25.65
3/18/14	14:38:00 PM	3088	7.42	TB15B-1U	TOLLWAY 2608	0.094		0.036	0.0774		150.50				0.0034	0.053	1.02		113.56			391.3				25.74
4/15/14	10:13:00 AM	690	7.51	TB15B-1U	TOLLWAY 2662	8.720		0.030	0.0590		34.13			0.0070	0.0184	4.095	3.15		18.44	0.0169		179.1		0.073		9.48
5/14/14	10:02:00 AM	554	7.70	TB15B-1U	TOLLWAY 2738	6.833		0.032	0.0490		31.19			0.0064	0.0082	3.165	2.44		17.48	0.0160		133.4				7.75
7/8/14	9:17:00 AM	1711	7.10	TB15B-1U	TOLLWAY 2829	1.569		0.050	0.0425		54.73				0.0048	0.799	1.02		33.41	0.0229		208.9				10.13
8/5/14	10:28:00 AM	1237	7.44	TB15B-1U	TOLLWAY 2882	51.598		0.105	0.1709	0.0015	65.38			0.0351	0.0261	32.785	8.32		49.62	0.1702		210.8		0.335		13.18
					min	0.046	NA	0.030	0.0423	0.0015	31.19	NA	NA	0.0064	0.0034	0.024	0.94	NA	17.48	0.0041	NA	133.4	NA	0.073	NA	7.75
					max	51.598	NA	0.105	0.1709	0.0015	154.33	NA	NA	0.0351	0.0261	32.785	8.32	NA	113.63	0.1702	NA	391.3	NA	0.335	NA	25.74
					mean	8.666	NA	0.046	0.0737	0.0015	85.15	NA	NA	0.0162	0.0111	5.154	2.39	NA	59.03	0.0460	NA	259.1	NA	0.162	NA	16.02
12/3/13	10:09:00 AM	7202	6.80	TB15B-1L	TOLLWAY 2476			0.103	0.0917		392.36						5.39		325.58			598.0		0.144		67.28
1/13/14	13:50:00 PM	7399	6.79	TB15B-1L	TOLLWAY 2511			0.117	0.0969		468.68					0.028	5.29	0.12	350.89	0.0022		642.3		0.203		75.74
2/20/14	9:31:00 AM	7278	6.95	TB15B-1L	TOLLWAY 2565	0.048		0.095	0.0985		429.74						4.80		349.32	0.0024		622.1		0.156		76.23
3/18/14	14:23:00 PM	7174	6.68	TB15B-1L	TOLLWAY 2607			0.097	0.0906		444.67				0.0036		4.31		343.23	0.0019		608.6				73.56
4/15/14	9:52:00 AM	7054	6.58	TB15B-1L	TOLLWAY 2661	0.231		0.093	0.0903		439.05				0.0367	0.210	5.38		357.43	0.0023		643.7				74.19
5/14/14	10:24:00 AM	6840	6.65	TB15B-1L	TOLLWAY 2739	0.099		0.097	0.0891		430.68			0.0027	0.031	4.93			341.91			622.6			0.049	76.84
6/9/14	14:43:00 PM	7232	7.01	TB15B-1L	TOLLWAY 2773			0.107	0.0925		446.03					5.56			356.24			582.2		0.134		72.28
7/8/14	9:32:00 AM	7062	6.49	TB15B-1L	TOLLWAY 2830	0.055		0.113	0.0855		398.36					0.045	5.65		318.96	0.0024		582.5		0.074		69.32
8/5/14	10:47:00 AM	6985	6.64	TB15B-1L	TOLLWAY 2883			0.122	0.0924		434.94					5.89			327.52	0.0074		569.8				70.16
					min	0.037	NA	0.093	0.0855	NA	392.36	NA	NA	NA	0.0027	0.028	4.31	0.12	318.96	0.0019	NA	569.8	NA	0.074	0.049	67.28
					max	0.231	NA	0.122	0.0985	NA	468.68	NA	NA	NA	0.0367	0.210	5.89	0.12	357.43	0.0074	NA	643.7	NA	0.203	0.049	76.84
					mean	0.094	NA	0.105	0.0919	NA	431.61	NA	NA	NA	0.0143	0.079	5.24	0.12	341.23	0.0031	NA	608.0	NA	0.142	0.049	72.84
12/3/13	10:33:00 AM	1071	7.95	TB15B-2	TOLLWAY 2477	0.354		0.078	0.0425		72.08					0.204	0.92		49.86			27.3		0.161		35.26
1/13/14	14:07:00 PM	946	7.84	TB15B-2	TOLLWAY 2512	0.084		0.109	0.0566		105.48					0.072	0.92		75.85			24.3		0.152		52.29
2/20/14	9:53:00 AM	1750	8.19	TB15B-2	TOLLWAY 2567			0.088	0.0528		100.32					0.95			71.80			28.9		0.166		52.64
3/18/14	14:46:00 PM	1045	7.39	TB15B-2	TOLLWAY 2609	0.038		0.093	0.0513		99.25						0.76		73.58			30.1				52.49
4/15/14	10:41:00 AM	587	7.70	TB15B-2	TOLLWAY 2663	0.185		0.047	0.0308		46.94				0.0078	0.118	0.46		31.28			62.1		0.076		19.85
5/14/14	10:44:00 AM	624	7.65	TB15B-2	TOLLWAY 2740			0.066	0.0343		49.33				0.0020	0.31			33.92			59.3				20.41
6/9/14	15:04:00 PM	NA	7.19	TB15B-2	TOLLWAY 2774			0.083	0.0398		61.41					0.57			39.92			54.5		0.141		24.83
7/8/14	9:57:00 AM	802	7.33	TB15B-2	TOLLWAY 2831	0.450		0.124	0.0572		92.39					0.276	1.37		65.74	0.0147		33.5				42.03
8/5/14	11:10:00 AM	435	7.80	TB15B-2	TOLLWAY 2885	1.565		0.071	0.0237		30.05				0.0030	0.886	0.84		17.20	0.0077		19.0				7.75
					min	0.038	NA	0.047	0.0237	NA	30.05	NA	NA	NA	0.0020	0.072	0.31	NA	17.20	0.0077	NA	19.0	NA	0.076	NA	7.75
					max	1.565	NA	0.124	0.0572	NA	105.48	NA	NA	NA	0.0078	0.886	1.37	NA	75.85	0.0147	NA	62.1	NA	0.166	NA	52.64
					mean	0.446	NA	0.084	0.0432	NA	73.03	NA	NA	NA	0.0043	0.311	0.79	NA	51.02	0.0112	NA	37.7	NA	0.139	NA	34.17
12/3/13	10:56:00 AM	423	7.76	TB15B-3	TOLLWAY 2478	0.417		0.024	0.0304		40.37				0.0022	0.374	1.12		23.31	0.0120		13.8		0.170		7.26
1/13/14	14:24:00 PM	180	7.71	TB15B-3	TOLLWAY 2513	1.259			0.0166		13.79				0.0018	0.849	1.47		7.06	0.0041		17.6		0.140		2.13
2/20/14	10:20:00 AM	321	8.17	TB15B-3	TOLLWAY 2568	0.188			0.0201		28.74					0.207	1.03		15.24			21.8		0.110		4.09
3/18/14	15:09:00 PM	274	7.49	TB15B-3	TOLLWAY 2612	0.206			0.0217		27.67				0.0019	0.245	1.18		13.92			17.6				3.86
4/15/14	11:10:00 AM	266	7.16	TB15B-3	TOLLWAY 2664	2.681			0.0316		28.41				0.0042	1.649	1.79		13.70	0.0076		14.0				4.27
5/14/14	11:07:00 AM	1466	7.25	TB15B-3	TOLLWAY 2741	3.497		0.029	0.0317		20.34				0.0053	1.998	2.04		9.54	0.0555		10.4				1.61
6/9/14	15:16:00 PM	495	7.17	TB15B-3	TOLLWAY 2775			0.039	0.0672		124.53					1.358	2.30		49.10	0.2813		26.2		0.166		31.90
7/8/14	10:19:00 AM	247	7.01	TB15B-3	TOLLWAY 2832	2.992		0.056	0.0411		35.42				0.0033	1.714	2.02		17.04	0.1178		11.1				2.30
8/5/14	11:27:00 AM	121	7.40	TB15B-3	TOLLWAY 2887	7.425		0.048	0.0486		20.34			0.0066	0.0075	3.805	2.75		10.13	0.0214		7.4				1.73
					min	0.188	NA	0.024	0.0166	NA	13.79	NA	NA	0.0066	0.0018	0.207	1.03	NA	7.06	0.0041	NA	7.4	NA	0.110	NA	1.61
					max	7.425	NA	0.056	0.0672	NA	124.53	NA	NA	0.0066	0.0075	3.805	2.75	NA	49.10	0.2813	NA	26.2	NA	0.170	NA	31.90
					mean	2.333	NA	0.039	0.0343	NA	37.73	NA	NA	0.0066	0.0037	1.355	1.75	NA	17.67	0.0714	NA	15.5	NA	0.146	NA	6.57



APPENDIX B-4: Results of Geochemical Analysis of Groundwater Samples

Date collected	Time collected (CST)	Field conductivity (uS/cm)	Field pH	Sample location	Sample ID	Sb mg/L	Se mg/L	Si mg/L	Sn mg/L	Sr mg/L	Ti mg/L	Tl mg/L	V mg/L	Zn mg/L	pH	alkalinity mg/L as CaCO <sub>3</sub>	TDS, 180 C mg/L	TSS mg/L	oPO <sub>4</sub> -P mg/L	NH <sub>3</sub> -N mg/L	F mg/L	Cl mg/L	NO <sub>3</sub> -N mg/L	SO <sub>4</sub> mg/L	total NVOC mg/L	dissolved NVOC mg/L	
					MDL:	0.059	0.13	0.066	0.086	0.00037	0.00056	0.017	0.047	0.0097			4	12	3.0	0.003	0.03	0.07	0.16	0.04	0.21	0.31	0.31
					Class 2 Groundwater Standards (mg/L)	0.024	0.05					0.02	0.1	10.0			1,200				4.0	200	100	400			
12/3/13	11:17:00 AM	16	7.62	TB15B-1U	TOLLWAY 2479			4.282		0.4245	0.00696			0.0122	7.80	165	964 no sample	0.014		0.54		462	0.04	39.16	no sample	no sample	
1/13/14	13:44:00 PM	2921	7.54	TB15B-1U	TOLLWAY 2510			4.168		0.9374	0.00506	0.018		0.0116	7.65	162	1480 no sample	0.013		0.46		816	0.10	65.07	11.26	7.43	
2/20/14	9:35:00 AM	3796	7.40	TB15B-1U	TOLLWAY 2566			4.198		1.2714				0.0099	8.04	200	1708 no sample	0.015		0.37		989		72.88	9.59	6.18	
3/18/14	14:38:00 PM	3088	7.42	TB15B-1U	TOLLWAY 2608			3.961		1.0686	0.00142	0.030			7.80	202	1733 no sample	0.013		0.33		972		71.93	4.77	4.77	
4/15/14	10:13:00 AM	690	7.51	TB15B-1U	TOLLWAY 2662			23.518		0.1636	0.15972			0.0275	7.95	167	573 no sample	0.022		0.39		189		23.93	23.44	22.15	
5/14/14	10:02:00 AM	554	7.70	TB15B-1U	TOLLWAY 2738			19.479		0.1630	0.17371			0.0269	7.90	165	628 no sample	0.062		0.36		207	0.07	24.52	24.84	19.55	
7/8/14	9:17:00 AM	1711	7.10	TB15B-1U	TOLLWAY 2829			8.973		0.3304	0.03498				7.35	209	774 no sample	0.015		0.37		310		26.54	21.94	11.09	
8/5/14	10:28:00 AM	1237	7.44	TB15B-1U	TOLLWAY 2882			118.462		0.4486	0.38444			0.1407	7.36	174	1172 no sample	0.262	0.03	0.77		427	0.08	39.39	44.51	13.13	
					min	NA	NA	3.961	NA	0.1630	0.00142	0.018	NA	0.0099	7.35	162	573 NA	0.013	0.03	0.33		189	0.04	23.93	4.77	4.77	
					max	NA	NA	118.462	NA	1.2714	0.38444	0.030	NA	0.1407	8.04	209	1733 NA	0.262	0.03	0.77		989	0.10	72.88	44.51	22.15	
					mean	NA	NA	23.380	NA	0.6009	0.10947	0.024	NA	0.0382	7.73	180	1129 NA	0.052	0.03	0.45		547	0.07	45.43	20.05	12.04	
12/3/13	10:09:00 AM	7202	6.80	TB15B-1L	TOLLWAY 2476			8.497		3.1286					7.21	310	3526 no sample	0.021	0.083	0.28		2058	0.06	175.15	2.77	2.70	
1/13/14	13:50:00 PM	7399	6.79	TB15B-1L	TOLLWAY 2511			8.923		3.7678	0.00087	0.031		0.0148	7.13	348	3973 no sample	0.020		0.29		2345	0.27	205.53	2.11	1.74	
2/20/14	9:31:00 AM	7278	6.95	TB15B-1L	TOLLWAY 2565	0.065154	0.266	8.058		3.8103					7.22	345	3848 no sample	0.017				2341	0.23	208.51	2.03	1.64	
3/18/14	14:23:00 PM	7174	6.68	TB15B-1L	TOLLWAY 2607		0.201	7.625		3.2989		0.029			7.27	346	3828 no sample	0.022		0.19		2280	0.22	203.87	1.77	1.68	
4/15/14	9:52:00 AM	7054	6.58	TB15B-1L	TOLLWAY 2661		0.233	8.488		3.2010	0.00834				7.17	340	3922 no sample	0.021		0.19		2230	0.22	197.67	2.86	2.70	
5/14/14	10:24:00 AM	6840	6.65	TB15B-1L	TOLLWAY 2739		0.163	7.561		3.3289	0.00063	0.019			7.25	341	4219 no sample	0.016		0.24		2267	0.14	196.77	2.75	2.41	
6/9/14	14:43:00 PM	7232	7.01	TB15B-1L	TOLLWAY 2773		0.202	8.363		3.2282					7.15	352	4015 no sample	0.015		0.30		2221	0.24	196.63	2.40	2.48	
7/8/14	9:32:00 AM	7062	6.49	TB15B-1L	TOLLWAY 2830			8.523		3.2081	0.00121	0.024		0.0097	7.15	336	3841 no sample	0.018		0.36		2150	0.09	192.66	2.72	2.25	
8/5/14	10:47:00 AM	6985	6.64	TB15B-1L	TOLLWAY 2883			8.207		3.2790		0.031			7.15	336	4082 no sample	0.023		0.52		2248		201.76	2.46	2.21	
					min	0.065	0.163	7.561	NA	3.1286	0.00063	0.019	NA	0.0097	7.13	310	3526 NA	0.015	0.083	0.19		2058	0.06	175.15	1.77	1.64	
					max	0.065	0.306	8.923	NA	3.8103	0.00834	0.031	NA	0.0148	7.27	352	4219 NA	0.023	0.083	0.52		2345	0.27	208.51	2.86	2.70	
					mean	0.065	0.229	8.249	NA	3.3612	0.00276	0.027	NA	0.0123	7.19	339	3917 NA	0.019	0.083	0.29		2238	0.18	197.62	2.43	2.20	
12/3/13	10:33:00 AM	1071	7.95	TB15B-2	TOLLWAY 2477			6.749		0.6829	0.01297				7.97	230	458 no sample	0.022		0.67		62		100.79	4.33	3.52	
1/13/14	14:07:00 PM	946	7.84	TB15B-2	TOLLWAY 2512			6.791		1.0975	0.00197			0.0099	7.80	324	639 no sample	0.023		0.54		84	0.10	151.29	2.49	2.18	
2/20/14	9:53:00 AM	1750	8.19	TB15B-2	TOLLWAY 2567			6.101		1.1052					8.02	303	614 no sample	0.018		0.52		83		146.59	2.54	1.57	
3/18/14	14:46:00 PM	1045	7.39	TB15B-2	TOLLWAY 2609			5.978		0.9798		0.019			7.95	312	628 no sample	0.019		0.52		84		150.45	1.88	1.54	
4/15/14	10:41:00 AM	587	7.70	TB15B-2	TOLLWAY 2663			4.039		0.3417	0.00642				8.12	221	393 no sample	0.014		0.70		50		58.72	6.37	5.94	
5/14/14	10:44:00 AM	624	7.65	TB15B-2	TOLLWAY 2740			3.829		0.3810					8.10	257	396 no sample	0.011		0.76		46		54.52	6.35	4.31	
6/9/14	15:04:00 PM	NA	7.19	TB15B-2	TOLLWAY 2774			5.113		0.4638					7.56	266	423 no sample	0.013		0.68		51	0.04	65.88	4.35	3.83	
7/8/14	9:57:00 AM	802	7.33	TB15B-2	TOLLWAY 2831			8.113		0.9285	0.01531				7.78	298	667 no sample	0.031		0.53		72	0.10	124.21	4.26	2.49	
8/5/14	11:10:00 AM	435	7.80	TB15B-2	TOLLWAY 2885			7.315		0.2140	0.06014				7.80	113	218 no sample	0.041	0.05	0.74		19	0.14	21.49	10.46	7.40	
					min	NA	NA	3.829	NA	0.2140	0.00197	0.019	NA	0.0099	7.56	113	218 NA	0.011	0.05	0.52		19	0.04	21.49	1.88	1.54	
					max	NA	NA	8.113	NA	1.1052	0.06014	0.019	NA	0.0099	8.12	324	667 NA	0.041	0.05	0.76		84	0.14	151.29	10.46	7.40	
					mean	NA	NA	6.003	NA	0.6883	0.01936	0.019	NA	0.0099	7.90	258	493 NA	0.021	0.05	0.63		61	0.10	97.10	4.78	3.64	
12/3/13	10:56:00 AM	423	7.76	TB15B-3	TOLLWAY 2478			6.381		0.2772	0.01590				7.90	174	201 no sample	0.013	0.03	0.23		16		14.59	10.01	6.59	
1/13/14	14:24:00 PM	180	7.71	TB15B-3	TOLLWAY 2513			5.235		0.0780	0.03327				6.85	34	124 no sample	0.014	0.10	0.13		43	0.11	5.80	8.39	5.77	
2/20/14	10:20:00 AM	321	8.17	TB15B-3	TOLLWAY 2568			3.375		0.2001	0.01080				7.81	77	199 no sample	0.007		0.21		55	0.19	11.18	4.65	2.94	
3/18/14	15:09:00 PM	274	7.49	TB15B-3	TOLLWAY 2612			3.547		0.1294	0.01828				7.48	101	160 no sample	0.010	0.13	0.19		29		11.01	4.08	3.36	
4/15/14	11:10:00 AM	266	7.16	TB15B-3	TOLLWAY 2664			10.790		0.1193	0.08346			0.01265	7.45	92	193 no sample	0.017		0.23		31		12.25	16.86	15.19	
5/14/14	11:07:00 AM	1466	7.25	TB15B-3	TOLLWAY 2741			12.556		0.0766	0.09246			0.01421	6.98	73	202 no sample	0.053		0.22		9	0.06	4.68	22.90	17.83	
6/9/14	15:16:00 PM	495	7.17	TB15B-3	TOLLWAY 2775			8.742		0.4318					7.70	355	712 no sample	0.016	0.14	0.16		91		99.20	15.08	7.46	
7/8/14	10:19:00 AM	247	7.01	TB15B-3	TOLLWAY 2832			13.450		0.1635	0.08492			0.01343	7.21	139	231 no sample	0.034	0.08	0.24		9		5.40	19.15	10.41	
8/5/14	11:27:00 AM	121	7.40	TB15B-3	TOLLWAY 2887			21.855		0.0920	0.19951			0.0206	7.23	70	177 no sample	0.063		0.24		6		3.99	26.31	17.62	
					min	NA	NA	3.375	NA	0.0766	0.01080	NA	NA	0.013	6.85	34	124 NA	0.007	0.03	0.13		6	0.06	3.99	4.08	2.94	

APPENDIX B-4: Results of Geochemical Analysis of Groundwater Samples

Date collected	Time collected (CST)	Field conductivity (uS/cm)	Field pH	Sample location	Sample ID	Al	As	B	Ba	Be	Ca	Cd	Co	Cr	Cu	Fe	K	Li	Mg	Mn	Mo	Na	Ni	P	Pb	S
					mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L
					MDL:	0.037	0.11	0.023	0.00085	0.00055	0.029	0.012	0.013	0.0058	0.0016	0.024	0.016	0.11	0.027	0.0015	0.022	0.026	0.043	0.073	0.041	0.22
Class 2 Groundwater Standards (mg/L)							0.2	2.0	2.0	0.5		0.05	1.0	1.0	0.65	5.0				10.0			2.0		0.1	
9/4/13	8:23:00 AM	2659	7.28	TB15B-4U	TOLLWAY 2351			0.101	0.1083		92.33				0.159	19.92			26.73	1.1620		453.8		0.093		23.23
9/16/13	12:34:00 PM	2551	6.68	TB15B-4U	TOLLWAY 2359			0.088	0.1045		96.13				0.114	19.35			24.77	0.9405		411.0		0.081		19.79
10/1/13	8:26:00 AM	2812	7.33	TB15B-4U	TOLLWAY 2384			0.080	0.1244		111.59				0.213	19.63			27.46	1.0582		437.8		0.139		20.67
10/16/13	8:56:00 AM	3036	7.27	TB15B-4U	TOLLWAY 2413			0.101	0.1471		121.72				0.045	21.33			30.26	1.0928		486.0		0.140		25.05
10/29/13	9:08:00 AM	3407	6.69	TB15B-4U	TOLLWAY 2427			0.088	0.1401		121.12				0.074	21.66			31.92	0.9303		507.1		0.112		28.41
12/3/13	9:27:00 AM	2430	7.17	TB15B-4U	TOLLWAY 2474	0.099		0.076	0.0976		97.99				0.0069	0.091	14.61		25.15	0.5200		394.6		0.164		32.41
1/13/14	13:03:00 PM	5995	7.05	TB15B-4U	TOLLWAY 2508	0.283		0.027	0.1738		183.03				0.208	8.51			33.01	0.0140		952.2		0.219		33.66
2/20/14	8:59:00 AM	9266	7.44	TB15B-4U	TOLLWAY 2563	0.038		0.026	0.3536		280.41				0.031	13.11			55.97	0.0713		1644.5		0.204		41.71
3/18/14	14:12:00 PM	6528	7.07	TB15B-4U	TOLLWAY 2606	0.041		0.049	0.2647		215.35				0.0052	14.45			46.44	0.0365		1174.2				34.35
4/15/14	9:16:00 AM	4785	7.00	TB15B-4U	TOLLWAY 2660	0.041		0.086	0.2085		173.96				0.0337	22.17			43.56	0.1680		832.5				34.35
5/14/14	9:03:00 AM	2467	7.21	TB15B-4U	TOLLWAY 2736	0.455		0.103	0.1116		102.07				0.0166	0.351	13.75		24.56	0.0067		421.1		0.127		21.63
6/9/14	13:49:00 PM	3504	6.99	TB15B-4U	TOLLWAY 2760			0.156	0.1602		125.03				0.0141	0.025	27.52		34.37	0.4453		587.0		0.125		29.16
7/8/14	8:40:00 AM	1600	7.00	TB15B-4U	TOLLWAY 2827	0.156		0.122	0.0691		65.66				0.0137	0.125	12.39		14.53	0.0766		269.4		0.096		13.12
8/5/14	9:22:00 AM	758	7.45	TB15B-4U	TOLLWAY 2886	3.408		0.066	0.0454		42.16				0.0176	2.126	5.44		8.62	0.0297		122.5		0.123		7.44
					min	0.038	NA	0.026	0.0454	NA	42.16	NA	NA	NA	0.0052	0.025	5.44	NA	8.62	0.0067	NA	122.5	NA	0.081	NA	7.44
					max	3.408	NA	0.156	0.3536	NA	280.41	NA	NA	NA	0.0337	2.126	27.52	NA	55.97	1.1620	NA	1644.5	NA	0.219	NA	41.71
					mean	0.565	NA	0.083	0.1506	NA	130.61	NA	NA	NA	0.0154	0.297	16.70	NA	30.52	0.4680	NA	621.0	NA	0.135	NA	26.07
9/4/13	8:45:00 AM	8565	6.76	TB15B-4L	TOLLWAY 1737			0.204	0.2711		690.87				0.126	9.10	0.17	481.88	0.0953		412.4		0.600		79.28	
9/16/13	12:55:00 PM	8963	6.4	TB15B-4L	TOLLWAY 1761			0.207	0.2682		696.76				1.793	8.43	0.16	505.69	0.1506		387.9		0.131		81.89	
10/1/13	8:46:00 AM	8919	6.77	TB15B-4L	TOLLWAY 1771			0.188	0.2642		657.18				0.139	7.87	0.16	480.88	0.0210		388.0		0.245		81.35	
10/16/13	9:19:00 AM	8640	6.78	TB15B-4L	TOLLWAY 1786			0.215	0.2829		691.98				0.776	8.05	0.15	494.32	0.1314		394.0		0.131		86.48	
10/29/13	8:49:00 AM	8389	6.27	TB15B-4L	TOLLWAY 1822			0.198	0.2726		667.44					8.92	0.16	406.20	0.0080		403.9		0.153		82.44	
12/3/13	9:44:00 AM	8761	6.70	TB15B-4L	TOLLWAY 1831	0.04693		0.181	0.2894		639.27					8.53	0.14	527.61	0.0383		390.1		0.183		83.71	
1/13/14	13:19:00 PM	8489	6.78	TB15B-4L	TOLLWAY 1846			0.186	0.2666		669.32					7.28	0.17	506.27	0.0293		380.1		0.236		82.38	
2/20/14	9:11:00 AM	8197	7.08	TB15B-4L	TOLLWAY 1863			0.158	0.2675		654.27					6.86	0.13	499.58	0.0236	0.025	368.2		0.197		85.30	
3/18/14	13:49:00 PM	8389	6.86	TB15B-4L	TOLLWAY 1890			0.137	0.2560		648.66				0.0023	6.19	0.13	501.96	0.0307		369.7				87.93	
4/15/14	8:56:00 AM	8346	6.68	TB15B-4L	TOLLWAY 1904			0.154	0.2444		691.25				0.0403	7.67	0.15	521.26	0.0290		381.9		0.083		82.62	
5/14/14	9:21:00 AM	8254	6.66	TB15B-4L	TOLLWAY 1930			0.151	0.2333		655.35				0.0026	6.93	0.12	507.91	0.0193		366.0		0.082		83.25	
6/9/14	14:14:00 PM	7971	6.59	TB15B-4L	TOLLWAY 1959			0.163	0.2491		660.60					8.15	0.14	507.86	0.0662		374.9		0.188		79.71	
7/8/14	8:55:00 AM	8336	6.50	TB15B-4L	TOLLWAY 1983			0.165	0.2301		655.03				0.0027	7.87	0.14	471.68	0.0093		361.9		0.114		76.31	
8/5/14	9:39:00 AM	8293	6.62	TB15B-4L	TOLLWAY 1998			0.176	0.2299		627.48				0.0027	7.94	0.11	479.31	0.0417		359.7				74.75	
					min	0.047	NA	0.137	0.2299	NA	627.48	NA	NA	NA	0.0023	0.126	6.19	0.11	406.20	0.0080	0.025	359.7	NA	0.082	NA	74.75
					max	0.047	NA	0.215	0.2894	NA	696.76	NA	NA	NA	0.0403	1.793	9.10	0.17	527.61	0.1506	0.025	412.4	NA	0.600	NA	87.93
					mean	0.047	NA	0.177	0.2590	NA	664.67	NA	NA	NA	0.0101	0.709	7.84	0.15	492.31	0.0495	0.025	381.3	NA	0.195	NA	81.96

APPENDIX B-4: Results of Geochemical Analysis of Groundwater Samples

Date collected	Time collected (CST)	Field conductivity (uS/cm)	Field pH	Sample location	Sample ID	Sb mg/L	Se mg/L	Si mg/L	Sn mg/L	Sr mg/L	Ti mg/L	Tl mg/L	V mg/L	Zn mg/L	pH	alkalinity mg/L as CaCO <sub>3</sub>	TDS, 180 C mg/L	TSS mg/L	oPO <sub>4</sub> -P mg/L	NH <sub>3</sub> -N mg/L	F mg/L	Cl mg/L	NO <sub>3</sub> -N mg/L	SO <sub>4</sub> mg/L	total NVOC mg/L	dissolved NVOC mg/L	
					MDL:	0.059	0.13	0.066	0.086	0.00037	0.00056	0.017	0.047	0.0097			4	12	3.0	0.003	0.03	0.07	0.16	0.04	0.21	0.31	0.31
					Class 2 Groundwater Standards (mg/L)	0.024	0.05					0.02	0.1	10.0			1,200				4.0	200	100	400			
9/4/13	8:23:00 AM	2659	7.28	TB15B-4U	TOLLWAY 2351			6.433		0.3419					7.57	311	1481	no sample	0.031	0.12	0.38	675		61.72	15.87	15.93	
9/16/13	12:34:00 PM	2551	6.68	TB15B-4U	TOLLWAY 2359			6.309		0.3400	0.00058	0.026			7.42	273	1407	no sample	0.030	0.15	0.37	654	0.09	53.75	15.32	15.22	
10/1/13	8:26:00 AM	2812	7.33	TB15B-4U	TOLLWAY 2384			5.898		0.3824		0.019			7.48	300	1589	no sample	0.034	0.10	0.31	771		56.68	15.37	15.24	
10/16/13	8:56:00 AM	3036	7.27	TB15B-4U	TOLLWAY 2413			6.326		0.4248					7.49	338	1698	no sample	0.027	0.05	0.24	782		67.39	16.12	15.91	
10/29/13	9:08:00 AM	3407	6.69	TB15B-4U	TOLLWAY 2427			5.750		0.4316					7.42	338	1900	no sample	0.023	0.09	0.23	913	0.05	82.23	16.02	15.50	
12/3/13	9:27:00 AM	2430	7.17	TB15B-4U	TOLLWAY 2474			5.265		0.2717	0.00249				7.46	408	1413	no sample	0.031		0.29	514		90.69	17.23	17.12	
1/13/14	13:03:00 PM	5995	7.05	TB15B-4U	TOLLWAY 2508			3.319		0.5346	0.00637				7.35	134	3097	no sample	0.025	0.05	0.23	1699	0.77	91.89	7.70	7.16	
2/20/14	8:59:00 AM	9266	7.44	TB15B-4U	TOLLWAY 2563		0.166	3.261		0.9869					7.56	178	5112	no sample	0.032	0.09		3034	2.37	107.87	7.83	7.81	
3/18/14	14:12:00 PM	6528	7.07	TB15B-4U	TOLLWAY 2606			3.944		0.6102					7.56	261	3707	no sample	0.040	0.14	0.14	2036	2.15	85.95	8.65	8.17	
4/15/14	9:16:00 AM	4785	7.00	TB15B-4U	TOLLWAY 2660		0.145	4.613		0.4291					7.44	309	2719	no sample	0.031		0.18	1371	2.60	92.18	13.59	13.00	
5/14/14	9:03:00 AM	2467	7.21	TB15B-4U	TOLLWAY 2736			6.080		0.2178	0.01118				7.53	354	1471	no sample	0.077		0.31	602	1.71	59.97	22.42	19.65	
6/9/14	13:49:00 PM	3504	6.99	TB15B-4U	TOLLWAY 2760			5.978		0.2931					7.40	462	1971	no sample	0.047	0.05	0.33	830	0.05	79.89	20.74	20.65	
7/8/14	8:40:00 AM	1600	7.00	TB15B-4U	TOLLWAY 2827			6.214		0.1745	0.00479				7.43	498	946	no sample	0.076	0.04	0.30	211	0.25	37.50	17.30	17.15	
8/5/14	9:22:00 AM	758	7.45	TB15B-4U	TOLLWAY 2886			11.226		0.0996	0.08583		0.01022		7.73	233	509	no sample	0.114		0.33	98	0.17	20.94	18.89	19.01	
					min	NA	0.145	3.261	NA	0.0996	0.00058	0.019	NA	0.0102	7.35	134	509	NA	0.023	0.04	0.14	98	0.05	20.94	7.70	7.16	
					max	NA	0.166	11.226	NA	0.9869	0.08583	0.026	NA	0.0102	7.73	498	5112	NA	0.114	0.15	0.38	3034	2.60	107.87	22.42	20.65	
					mean	NA	0.156	5.758	NA	0.3956	0.01854	0.022	NA	0.0102	7.49	314	2073	NA	0.044	0.09	0.28	1014	1.02	70.62	15.22	14.82	
9/4/13	8:45:00 AM	8565	6.76	TB15B-4L	TOLLWAY 2352		0.229	10.691		6.3737		0.041		0.0193	7.19	318	5010	no sample	0.391	0.95	0.17	2933	0.17	207.03	5.13	6.46	
9/16/13	12:55:00 PM	8963	6.4	TB15B-4L	TOLLWAY 2360		0.292	11.128		6.7243		0.025		0.0121	7.09	323	4748	no sample	0.077	1.35	0.15	2881	0.08	222.95	4.36	2.87	
10/1/13	8:46:00 AM	8919	6.77	TB15B-4L	TOLLWAY 2385		0.284	9.822		6.4942		0.026		0.0255	7.07	325	5318	no sample	0.062	0.55	0.15	2887	0.42	221.92	3.57	3.47	
10/16/13	9:19:00 AM	8640	6.78	TB15B-4L	TOLLWAY 2414		0.255	11.025		7.1532		0.024		0.0172	7.19	311	4990	no sample	0.065	0.13		2994		224.81	2.89	no sample	
10/29/13	8:49:00 AM	8389	6.27	TB15B-4L	TOLLWAY 2426		0.218	10.303		5.5810		0.029		0.0507	7.11	310	4928	no sample	0.024			2883	0.27	224.69	2.78	2.63	
12/3/13	9:44:00 AM	8761	6.70	TB15B-4L	TOLLWAY 2475		0.161	10.081		7.1276				0.0431	7.25	314	4552	no sample	0.032	0.16	0.30	2840	0.18	229.44	2.18	2.25	
1/13/14	13:19:00 PM	8489	6.78	TB15B-4L	TOLLWAY 2509		0.267	9.406		7.1064		0.038		0.0478	7.23	300	4365	no sample	0.033		0.29	2753	0.28	223.98	2.68	2.41	
2/20/14	9:11:00 AM	8197	7.08	TB15B-4L	TOLLWAY 2564		0.182	8.659		6.5547				0.0422	7.35	293	4426	no sample	0.029			2809	0.26	233.55	2.37	2.16	
3/18/14	13:49:00 PM	8389	6.86	TB15B-4L	TOLLWAY 2605		0.181	8.419		6.3606				0.0416	7.37	301	4492	no sample	0.031			2755	0.22	228.37	3.67	2.40	
4/15/14	8:56:00 AM	8346	6.68	TB15B-4L	TOLLWAY 2659		0.199	8.569		6.4336				0.0398	7.20	301	4597	no sample	0.028		0.15	2736	0.22	220.18	2.38	2.58	
5/14/14	9:21:00 AM	8254	6.66	TB15B-4L	TOLLWAY 2737		0.202	7.919		6.2884		0.020		0.0422	7.23	302	4991	no sample	0.022		0.21	2722	0.19	215.50	2.49	2.67	
6/9/14	14:14:00 PM	7971	6.59	TB15B-4L	TOLLWAY 2761		0.318	9.175		6.4335				0.0426	7.21	290	4539	no sample	0.022		0.24	2662	0.14	211.24	2.99	2.70	
7/8/14	8:55:00 AM	8336	6.50	TB15B-4L	TOLLWAY 2828			8.781		5.9810		0.025		0.0379	7.13	310	4781	no sample	0.026		0.29	2698	0.08	210.33	2.35	1.96	
8/5/14	9:39:00 AM	8293	6.62	TB15B-4L	TOLLWAY 2880			8.870		6.2097		0.027		0.0446	7.12	306	4606	no sample	0.050	0.07	0.43	2672	0.16	206.79	2.35	2.22	
					min	NA	0.161	7.919	NA	5.5810	NA	0.020	NA	0.0121	7.07	290	4365	NA	0.022	0.07	0.15	2662	0.08	206.79	2.18	1.96	
					max	NA	0.318	11.128	NA	7.1532	NA	0.041	NA	0.0507	7.37	325	5318	NA	0.391	1.35	0.43	2994	0.42	233.55	5.13	6.46	
					mean	NA	0.232	9.489	NA	6.4873	NA	0.028	NA	0.0362	7.20	307	4739	NA	0.064	0.53	0.24	2802	0.21	220.06	3.01	2.83	

APPENDIX B-5: Results of Geochemical Analysis of Groundwater Samples - Year 5

Date collected	Time collected (CST)	Field conductivity (uS/cm)	Field pH	Sample location	Sample ID	Al mg/L	As mg/L	B mg/L	Ba mg/L	Be mg/L	Ca mg/L	Cd mg/L	Co mg/L	Cr mg/L	Cu mg/L	Fe mg/L	K mg/L	Li mg/L	Mg mg/L	Mn mg/L	Mo mg/L	Na mg/L	Ni mg/L	P mg/L	Pb mg/L	S mg/L	
					MDL:	0.037	0.11	0.023	0.00085	0.00055	0.029	0.012	0.013	0.0058	0.0016	0.024	0.016	0.11	0.027	0.0015	0.022	0.026	0.043	0.073	0.041	0.22	
					Class 2 Groundwater Standards (mg/L)		0.2	2.0	2.0	0.5		0.05	1.0	1.0	0.65	5.0				10.0			2.0		0.1		
9/4/14	9:36:00 AM	1316	7.20	TB7B-1	TOLLWAY 2950	0.177		0.128	0.0250		45.20				0.00785	2.560	4.57		9.57	0.2229		237.7		0.138		27.26	
10/1/14	9:19:00 AM	1289	7.16	TB7B-1	TOLLWAY 3001	0.048		0.141	0.0282		51.43				0.00438	1.906	3.66		12.86	0.2389		248.4				28.71	
10/28/14	13:07:00 PM	1249	7.15	TB7B-1	TOLLWAY 3042	0.273		0.130	0.0271		47.16				0.00769	0.953	3.69		12.68	0.1688		260.4				28.63	
12/2/14	14:09:00 PM	3156	7.74	TB7B-1	TOLLWAY 3082	0.526		0.085	0.0264		39.57				0.01208	1.031	3.23		11.35	0.0923		255.6		0.100		31.37	
1/13/15	13:58:00 PM	1753	7.72	TB7B-1	TOLLWAY 3127	0.517		0.092	0.0285		47.18				0.01094	0.510	3.38		11.21	0.0451		294.9		0.123		41.33	
2/10/15	14:30:00 PM	NA	NA	TB7B-1	TOLLWAY 3170	0.098		0.090	0.0310		59.96			0.01	0.00764	0.299	3.49		16.65	0.0442		289.2		0.077		44.20	
3/17/15	9:52:00 AM	1184	7.20	TB7B-1	TOLLWAY 3216	1.185		0.065	0.0303		42.94				0.01081	1.578	3.57		14.93	0.0632		277.6				32.05	
4/13/15	14:23:00 PM	1383	7.39	TB7B-1	TOLLWAY 3264	1.067		0.065	0.0301		33.18				0.01217	0.954	5.42		8.27	0.0206		309.4		0.110		29.11	
5/12/15	13:46:00 PM	2864	7.35	TB7B-1	TOLLWAY 3331	2.861		0.100	0.0318		23.60			0.01	0.01794	2.073	5.62		6.30	0.0201		293.1		0.079		21.01	
6/10/15	9:29:00 AM	1405	7.37	TB7B-1	TOLLWAY 3389	2.424		0.115	0.0417		62.76				0.01166	6.163	4.28		20.31	0.2877		251.0		0.167		22.80	
7/8/15	9:16:00 AM	1825	7.12	TB7B-1	TOLLWAY 3440	0.228		0.134	0.0306		58.93				0.00464	3.750	4.25		19.75	0.2521		234.9		0.159		19.10	
8/5/15	8:53:00 AM	1604	7.18	TB7B-1	TOLLWAY 3495	0.561		0.111	0.0255		35.93			0.01	0.00437	3.220	4.06		10.52	0.1895		201.5		0.305		14.01	
					min	0.048	NA	0.065	0.0250	NA	23.60	NA	NA	0.01	0.00437	0.299	3.23	NA	6.30	0.0201	NA	201.5	NA	0.077	NA	14.01	
					max	2.861	NA	0.141	0.0417	NA	62.76	NA	NA	0.01	0.01794	6.163	5.62	NA	20.31	0.2877	NA	309.4	NA	0.305	NA	44.20	
					mean	0.830	NA	0.105	0.0297	NA	45.65	NA	NA	0.01	0.00935	2.083	4.10	NA	12.87	0.1371	NA	262.8	NA	0.140	NA	28.30	
9/4/14	9:53:00 AM	1212	7.02	TB7B-2	TOLLWAY 2951			0.255	0.0383		99.06					2.481	0.74		81.36	0.6691		69.7				19.08	
10/1/14	9:41:00 AM	1212	6.98	TB7B-2	TOLLWAY 3003	0.062		0.241	0.0361		85.89					2.825	0.72		81.73	0.5257		88.2				18.54	
10/28/14	13:34:00 PM	1278	6.91	TB7B-2	TOLLWAY 3043	0.042		0.252	0.0347		91.01					3.034	0.66		87.26	0.5502		98.6				19.14	
12/2/14	14:27:00 PM	1252	7.41	TB7B-2	TOLLWAY 3083			0.202	0.0348		90.31					2.084	0.65		88.45	0.3184		90.8				21.76	
3/17/15	9:35:00 AM	1297	6.97	TB7B-2	TOLLWAY 3215			0.193	0.0430		97.95				0.00237	0.148	0.63		99.62	0.1216		88.0				30.42	
4/13/15	14:37:00 PM	848	7.26	TB7B-2	TOLLWAY 3265			0.128	0.0255		75.30				0.00170		0.43		60.61	0.0271		45.3				11.10	
5/12/15	14:19:00 PM	1338	7.07	TB7B-2	TOLLWAY 3332			0.170	0.0286		78.08				0.00186		0.41		66.54	0.0310		51.3				11.05	
6/10/15	9:38:00 AM	1322	7.16	TB7B-2	TOLLWAY 3390			0.234	0.0450		101.32				0.00234	0.422	0.65		96.56	0.4267		79.1				24.71	
7/8/15	9:44:00 AM	1303	6.89	TB7B-2	TOLLWAY 3441			0.255	0.0438		102.51					0.243	0.61		90.99	0.3448		80.3				20.60	
8/5/15	9:08:00 AM	1409	7.19	TB7B-2	TOLLWAY 3496			0.251	0.0486		98.25					2.060	0.91		92.54	0.7125		95.5				18.26	
					min	0.042	NA	0.128	0.0255	NA	75.30	NA	NA	NA	0.00170	0.148	0.41	NA	60.61	0.0271	NA	45.3	NA	NA	NA	NA	11.05
					max	0.062	NA	0.255	0.0486	NA	102.51	NA	NA	NA	0.00237	3.034	0.91	NA	99.62	0.7125	NA	98.6	NA	NA	NA	NA	30.42
					mean	0.052	NA	0.218	0.0378	NA	91.97	NA	NA	NA	0.00207	1.662	0.64	NA	84.57	0.3727	NA	78.7	NA	NA	NA	NA	19.47
9/4/14	10:07:00 AM	1161	7.09	TB7B-3	TOLLWAY 2952	0.135		0.175	0.0264		116.42				0.00265	0.138	0.46		90.87	0.0109		21.8		0.074		7.78	
10/1/14	10:08:00 AM	1316	7.09	TB7B-3	TOLLWAY 3004			0.147	0.0278		121.29				0.00163	0.060	0.49		103.98	0.0261		37.3				7.10	
10/28/14	14:00:00 PM	1283	7.01	TB7B-3	TOLLWAY 3044	0.064		0.145	0.0275		118.63				0.00172	0.085	0.52		102.83	0.0187		49.7				8.08	
12/2/14	14:43:00 PM	1125	7.58	TB7B-3	TOLLWAY 3084			0.087	0.0221		100.66						0.46		90.77	0.0017		53.4				7.79	
3/17/15	9:13:00 AM	936	7.14	TB7B-3	TOLLWAY 3214			0.101	0.0178		92.62				0.00176		0.32		81.50			22.8				7.09	
4/13/15	14:56:00 PM	873	7.34	TB7B-3	TOLLWAY 3266			0.108	0.0167		88.28				0.00167		0.29		70.24			21.8				5.91	
5/12/15	14:33:00 PM	770	7.16	TB7B-3	TOLLWAY 3333			0.137	0.0173		83.96						0.27		65.70			18.0				4.52	
6/10/15	9:59:00 AM	851	7.25	TB7B-3	TOLLWAY 3391			0.128	0.0206		105.95				0.00199		0.33		92.21			19.5				10.89	
7/8/15	10:05:00 AM	1175	6.95	TB7B-3	TOLLWAY 3442			0.168	0.0226		113.38				0.00170		0.38		96.17			22.5				10.29	
8/5/15	9:20:00 AM	1270	7.33	TB7B-3	TOLLWAY 3497	0.042		0.102	0.0202		99.69				0.00197	0.075	0.52		91.36	0.0097		31.7				6.76	
					min	0.042	NA	0.087	0.0167	NA	83.96	NA	NA	NA	0.00163	0.060	0.27	NA	65.70	0.0017	NA	18.0	NA	0.074	NA	4.52	
					max	0.135	NA	0.175	0.0278	NA	121.29	NA	NA	NA	0.00265	0.138	0.52	NA	103.98	0.0261	NA	53.4	NA	0.074	NA	10.89	
					mean	0.080	NA	0.130	0.0219	NA	104.09	NA	NA	NA	0.00189	0.090	0.40	NA	88.56	0.0134	NA	29.9	NA	0.074	NA	7.62	

APPENDIX B-5: Results of Geochemical Analysis of Groundwater Samples - Year 5

Date collected	Time collected (CST)	Field conductivity (uS/cm)	Field pH	Sample location	Sample ID	Sb mg/L	Se mg/L	Si mg/L	Sn mg/L	Sr mg/L	Ti mg/L	Tl mg/L	V mg/L	Zn mg/L	pH	alkalinity mg/L as CaCO <sub>3</sub>	TDS, 180 C mg/L	TSS mg/L	oPO <sub>4</sub> -P mg/L	NH <sub>3</sub> -N mg/L	F mg/L	Cl mg/L	NO <sub>3</sub> -N mg/L	SO <sub>4</sub> mg/L	total NVOC mg/L	dissolved NVOC mg/L
					MDL:	0.059	0.13	0.066	0.086	0.00037	0.00056	0.017	0.047	0.0097		4	12	3.0	0.003	0.03	0.07	0.16	0.04	0.21	0.31	0.31
					Class 2 Groundwater Standards (mg/L)	0.024	0.05					0.02	0.1	10.0			1,200			4.0	200	100	400			
9/4/14	9:36:00 AM	1316	7.20	TB7B-1	TOLLWAY 2950			4.876		0.0929	0.00899				7.36	502	793		0.165	0.37	0.33	63		75.88	30.37	22.63
10/1/14	9:19:00 AM	1289	7.16	TB7B-1	TOLLWAY 3001			4.842		0.0925	0.00166				7.41	521	796		0.132	0.48	0.32	64		74.65	37.25	23.70
10/28/14	13:07:00 PM	1249	7.15	TB7B-1	TOLLWAY 3042			5.086		0.0828	0.00820				7.46	504	794		0.155	0.58	0.34	71	0.07	79.65	19.60	19.70
12/2/14	14:09:00 PM	3156	7.74	TB7B-1	TOLLWAY 3082			4.651		0.0653	0.01362				7.53	463	838		0.079		0.30	82	5.37	92.49	27.22	23.82
1/13/15	13:58:00 PM	1753	7.72	TB7B-1	TOLLWAY 3127			4.482		0.0770	0.01258		0.0111		7.92	514	922		0.084		0.30	97	1.13	113.44	21.64	19.13
2/10/15	14:30:00 PM	NA	NA	TB7B-1	TOLLWAY 3170			3.697		0.0946	0.00354				8.13	540	932		0.058		0.28	102	0.68	122.34	14.44	14.10
3/17/15	9:52:00 AM	1184	7.20	TB7B-1	TOLLWAY 3216			5.682		0.0861	0.03024				7.61	501	895		0.042	0.07	0.26	99	3.20	99.13	19.60	13.69
4/13/15	14:23:00 PM	1383	7.39	TB7B-1	TOLLWAY 3264			5.482		0.1108	0.02795				7.44	369	937		0.045		0.26	212	7.32	79.86	21.32	18.58
5/12/15	13:46:00 PM	2864	7.35	TB7B-1	TOLLWAY 3331			9.780		0.0852	0.07330		0.0165		7.46	501	857		0.097		0.28	75	1.52	55.07	35.96	32.58
6/10/15	9:29:00 AM	1405	7.37	TB7B-1	TOLLWAY 3389			10.238		0.1320	0.07698		0.0172		7.46	576	914		0.116	0.24	0.27	78		64.99	29.38	20.97
7/8/15	9:16:00 AM	1825	7.12	TB7B-1	TOLLWAY 3440			5.476		0.1270	0.00933				7.47	513	874		0.272	0.29	0.20	64	0.05	50.23	26.77	24.20
8/5/15	8:53:00 AM	1604	7.18	TB7B-1	TOLLWAY 3495			5.410		0.0801	0.01405				7.23	396	580		0.093	0.26	0.28	49		49.39	37.50	18.70
					min	NA	NA	3.697	NA	0.0653	0.00166	NA	NA	0.0111	7.23	369	580	NA	0.042	0.07	0.20	49	0.05	49.39	14.44	13.69
					max	NA	NA	10.238	NA	0.1320	0.07698	NA	NA	0.0172	8.13	576	937	NA	0.272	0.58	0.34	212	7.32	122.34	37.50	32.58
					mean	NA	NA	5.808	NA	0.0938	0.02337	NA	NA	0.0149	7.54	492	844	NA	0.111	0.33	0.28	88	2.42	79.76	26.75	20.98
9/4/14	9:53:00 AM	1212	7.02	TB7B-2	TOLLWAY 2951			7.911		0.0899					7.34	574	724		0.030	0.08	0.22	58		53.62	5.45	4.79
10/1/14	9:41:00 AM	1212	6.98	TB7B-2	TOLLWAY 3003			7.504		0.0961					7.37	569	725		0.024	0.08	0.24	60		52.43	4.94	4.53
10/28/14	13:34:00 PM	1278	6.91	TB7B-2	TOLLWAY 3043			7.236		0.1014					7.35	594	758		0.031	0.07	0.24	72		52.85	4.86	4.33
12/2/14	14:27:00 PM	1252	7.41	TB7B-2	TOLLWAY 3083			6.474		0.1008					7.46	598	802		0.028		0.22	77		65.11	3.60	3.51
3/17/15	9:35:00 AM	1297	6.97	TB7B-2	TOLLWAY 3215			4.987		0.1090					7.42	604	815		0.012		0.18	71	1.81	87.72	3.57	3.45
4/13/15	14:37:00 PM	848	7.26	TB7B-2	TOLLWAY 3265			4.789		0.0651					7.47	377	519		0.014		0.19	28	10.84	30.79	2.86	2.87
5/12/15	14:19:00 PM	1338	7.07	TB7B-2	TOLLWAY 3332			5.503		0.0754					7.56	426	578		0.016		0.18	32	9.26	32.87	3.12	3.00
6/10/15	9:38:00 AM	1322	7.16	TB7B-2	TOLLWAY 3390			5.608		0.1063					7.43	589	782		0.022	0.09	0.20	68	2.50	66.17	3.75	3.57
7/8/15	9:44:00 AM	1303	6.89	TB7B-2	TOLLWAY 3441			6.300		0.0995		0.018			7.39	613	786		0.019		0.20	63	0.70	58.78	3.94	3.77
8/5/15	9:08:00 AM	1409	7.19	TB7B-2	TOLLWAY 3496			6.571		0.1095	0.00065				7.36	604	758		0.045	0.27	0.21	71		49.25	3.51	3.45
					min	NA	NA	4.789	NA	0.0651	0.00065	0.018	NA	NA	7.34	377	519	NA	0.012	0.07	0.18	28	0.70	30.79	2.86	2.87
					max	NA	NA	7.911	NA	0.1095	0.00065	0.018	NA	NA	7.56	613	815	NA	0.045	0.27	0.24	77	10.84	87.72	5.45	4.79
					mean	NA	NA	6.288	NA	0.0953	0.00065	0.018	NA	NA	7.41	555	725	NA	0.024	0.12	0.21	60	5.02	54.96	3.96	3.73
9/4/14	10:07:00 AM	1161	7.09	TB7B-3	TOLLWAY 2952			9.740		0.0691	0.00322				7.36	617	679		0.028		0.21	33	0.70	22.16	3.64	3.74
10/1/14	10:08:00 AM	1316	7.09	TB7B-3	TOLLWAY 3004			9.640		0.0792		0.019			7.51	707	747		0.020		0.22	53	0.75	19.47	4.15	3.93
10/28/14	14:00:00 PM	1283	7.01	TB7B-3	TOLLWAY 3044			9.370		0.0795	0.00093				7.51	648	747		0.027		0.22	70	0.93	22.13	3.98	3.94
12/2/14	14:43:00 PM	1125	7.58	TB7B-3	TOLLWAY 3084			8.378		0.0648					7.53	618	680		0.024		0.20	40	0.40	22.55	3.00	2.91
3/17/15	9:13:00 AM	936	7.14	TB7B-3	TOLLWAY 3214			6.706		0.0576					7.60	535	557		0.013		0.17	13	3.67	19.89	2.60	2.64
4/13/15	14:56:00 PM	873	7.34	TB7B-3	TOLLWAY 3266			6.671		0.0526					7.60	482	502		0.016		0.20	11	3.40	16.65	2.26	2.41
5/12/15	14:33:00 PM	770	7.16	TB7B-3	TOLLWAY 3333			7.012		0.0540		0.018			7.67	415	487		0.017		0.19	10	7.64	12.61	2.72	2.55
6/10/15	9:59:00 AM	851	7.25	TB7B-3	TOLLWAY 3391			7.649		0.0641					7.60	510	678		0.024		0.18	47	15.35	31.42	3.33	3.39
7/8/15	10:05:00 AM	1175	6.95	TB7B-3	TOLLWAY 3442			8.445		0.0674		0.018			7.39	569	714		0.018		0.20	22	14.99	29.95	3.19	3.02
8/5/15	9:20:00 AM	1270	7.33	TB7B-3	TOLLWAY 3497			9.263		0.0636	0.00228				7.51	557	645		0.026		0.20	25	12.61	18.46	3.91	2.56
					min	NA	NA	6.671	NA	0.0526	0.00093	0.018	NA	NA	7.36	415	487	NA	0.013	NA	0.17	10	0.40	12.61	2.26	2.41
					max	NA	NA	9.740	NA	0.0795	0.00322	0.019	NA	NA	7.67	707	747	NA	0.028	NA	0.22	70	15.35	31.42	4.15	3.94
					mean	NA	NA	8.287	NA	0.0652	0.00214	0.018	NA	NA	7.53	566	644	NA	0.021	NA	0.20	32	6.05	21.53	3.28	3.11

APPENDIX B-5: Results of Geochemical Analysis of Groundwater Samples - Year 5

Date collected	Time collected (CST)	Field conductivity (uS/cm)	Field pH	Sample location	Sample ID	Al mg/L	As mg/L	B mg/L	Ba mg/L	Be mg/L	Ca mg/L	Cd mg/L	Co mg/L	Cr mg/L	Cu mg/L	Fe mg/L	K mg/L	Li mg/L	Mg mg/L	Mn mg/L	Mo mg/L	Na mg/L	Ni mg/L	P mg/L	Pb mg/L	S mg/L
					MDL:	0.037	0.11	0.023	0.00085	0.00055	0.029	0.012	0.013	0.0058	0.0016	0.024	0.016	0.11	0.027	0.0015	0.022	0.026	0.043	0.073	0.041	0.22
Class 2 Groundwater Standards (mg/L)							0.2	2.0	2.0	0.5		0.05	1.0	1.0	0.65	5.0				10.0			2.0		0.1	
9/4/14	10:21:00 AM	787	7.11	TB7B-4	TOLLWAY 2953			0.127	0.0114		98.51						0.35		52.87	0.0497		7.2				3.08
10/1/14	10:20:00 AM	844	7.11	TB7B-4	TOLLWAY 3005			0.130	0.0080		103.20						0.25		58.11	0.0355		9.0				3.94
10/28/14	14:24:00 PM	829	7.05	TB7B-4	TOLLWAY 3045			0.122	0.0078		104.24						0.40		57.48	0.0191		9.1				3.85
12/2/14	15:01:00 PM	852	7.53	TB7B-4	TOLLWAY 3085			0.084	0.0079		108.60						0.87		60.76	0.0038		9.8				4.33
3/17/15	8:47:00 AM	775	7.00	TB7B-4	TOLLWAY 3213			0.082	0.0085		101.51						0.81		59.78			7.8				3.42
4/13/15	15:11:00 PM	705	7.26	TB7B-4	TOLLWAY 3267			0.077	0.0100		85.60						0.70		49.71			13.2				2.78
5/12/15	14:46:00 PM	723	7.09	TB7B-4	TOLLWAY 3334			0.090	0.0117		88.55					0.039	0.73		50.22			15.0				3.16
6/10/15	10:17:00 AM	851	7.27	TB7B-4	TOLLWAY 3392			0.108	0.0091		105.02				0.00335		0.62		57.87			7.1				2.69
7/8/15	10:27:00 AM	874	7.00	TB7B-4	TOLLWAY 3443			0.125	0.0100		111.76						0.48		60.59			8.2				2.56
8/5/15	9:30:00 AM	1075	7.48	TB7B-4	TOLLWAY 3498	0.141		0.092	0.0140		120.70					0.296	1.07		70.30	0.0128		11.6				3.84
					min	0.141	NA	0.077	0.0078	NA	85.60	NA	NA	NA	0.00335	0.039	0.25	NA	49.71	0.0038	NA	7.1	NA	NA	NA	2.56
					max	0.141	NA	0.130	0.0140	NA	120.70	NA	NA	NA	0.00335	0.296	1.07	NA	70.30	0.0497	NA	15.0	NA	NA	NA	4.33
					mean	0.141	NA	0.104	0.0098	NA	102.77	NA	NA	NA	0.00335	0.168	0.63	NA	57.77	0.0242	NA	9.8	NA	NA	NA	3.37
9/4/14	8:42:00 AM	10150	7.31	TB7B-5U	TOLLWAY 2948			0.286	0.0908		210.47					1.119	22.66		65.28	0.4874		1988.6		0.124		231.98
10/1/14	8:45:00 AM	8693	7.39	TB7B-5U	TOLLWAY 2999			0.377	0.1223		424.60					0.863	25.86		147.63	0.9801		1493.3				393.79
10/28/14	12:28:00 PM	8937	7.11	TB7B-5U	TOLLWAY 3040			0.296	0.0800		246.67					1.141	17.70		86.93	0.6530		1662.0				336.59
12/2/14	13:19:00 PM	11211	7.37	TB7B-5U	TOLLWAY 3080			0.220	0.0888		321.06					2.119	19.79		109.56	1.0130		2076.5				311.48
3/17/15	10:04:00 AM	25259	6.64	TB7B-5U	TOLLWAY 3217			0.140	0.1588		531.11					6.226	45.22		147.80	0.9861		5406.9				343.03
4/13/15	13:19:00 PM	15466	7.16	TB7B-5U	TOLLWAY 3261			0.198	0.0968		453.90					3.353	32.69		148.48	1.1425		3127.9		0.085		401.08
5/12/15	13:14:00 PM	18383	7.09	TB7B-5U	TOLLWAY 3329			0.237	0.1287		335.30					3.348	34.69		93.81	0.8640		3964.2				179.77
6/10/15	8:53:00 AM	13948	7.22	TB7B-5U	TOLLWAY 3387			0.272	0.1098		317.00					3.183	33.22		94.34	1.1504		2785.6				178.42
7/8/15	8:53:00 AM	10857	6.89	TB7B-5U	TOLLWAY 3439			0.296	0.0716		229.82					1.748	19.44		74.15	0.7774		1830.6				339.04
8/5/15	8:28:00 AM	12396	6.97	TB7B-5U	TOLLWAY 3493			0.260	0.1030		296.94					2.378	24.19		92.09	0.8267		2421.0		0.077		218.93
					min	NA	NA	0.140	0.0716	NA	210.47	NA	NA	NA	NA	0.863	17.70	NA	65.28	0.4874	NA	1493.3	NA	0.077	NA	178.42
					max	NA	NA	0.377	0.1588	NA	531.11	NA	NA	NA	NA	6.226	45.22	NA	148.48	1.1504	NA	5406.9	NA	0.124	NA	401.08
					mean	NA	NA	0.258	0.1051	NA	336.69	NA	NA	NA	NA	2.548	27.55	NA	106.01	0.8880	NA	2675.7	NA	0.095	NA	293.41
9/4/14	8:56:00 AM	11459	7.29	TB7B-5L	TOLLWAY 2949			0.186	0.2065		293.05					10.307	18.26		84.97	1.7589		2759.5		0.093		219.23
10/1/14	9:04:00 AM	13350	7.26	TB7B-5L	TOLLWAY 3000			0.245	0.1406		267.96						23.18		83.76	1.3672		2362.7				260.79
10/28/14	12:40:00 PM	11955	7.15	TB7B-5L	TOLLWAY 3041			0.268	0.1290		347.86						23.49		109.80	2.1419		2263.5				314.43
12/2/14	13:33:00 PM	11676	7.46	TB7B-5L	TOLLWAY 3081			0.192	0.0988		326.23						18.87		112.12	0.1794		2222.9				327.95
1/17/15	13:48:00 PM	12985	7.36	TB7B-5L	TOLLWAY 3142			0.151	0.0818		264.09					0.130	17.00		94.64	0.0724		2285.7		0.088		316.40
3/17/15	10:20:00 AM	21153	7.10	TB7B-5L	TOLLWAY 3219			0.130	0.1851		514.41						34.21		152.01	0.6367		4054.5				305.57
4/13/15	13:36:00 PM	20101	7.15	TB7B-5L	TOLLWAY 3262			0.129	0.2159		518.36					0.271	27.56		145.14	4.3708		4358.4		0.081		286.58
5/12/15	13:25:00 PM	20669	7.12	TB7B-5L	TOLLWAY 3330			0.149	0.2368		481.85					1.426	23.18		135.32	5.7411		4250.7				256.58
6/10/15	9:07:00 AM	20285	7.34	TB7B-5L	TOLLWAY 3388			0.188	0.2009		434.66						28.54		122.06	3.1677		4278.9		0.083		226.64
7/8/15	8:36:00 AM	17000	6.32	TB7B-5L	TOLLWAY 3438			0.243	0.1399		328.26					3.109	27.44		99.05	1.9921		3412.2				256.68
8/5/15	8:41:00 AM	13640	7.09	TB7B-5L	TOLLWAY 3494			0.251	0.0992		306.52					1.391	26.38		94.62	0.7397		2648.7				225.94
					min	NA	NA	0.129	0.0818	NA	264.09	NA	NA	NA	NA	0.130	17.00	NA	83.76	0.0724	NA	2222.9	NA	0.081	NA	225.94
					max	NA	NA	0.268	0.2368	NA	518.36	NA	NA	NA	NA	3.109	34.21	NA	152.01	5.7411	NA	4358.4	NA	0.088	NA	327.95
					mean	NA	NA	0.195	0.1528	NA	379.02	NA	NA	NA	NA	1.265	24.99	NA	114.85	2.0409	NA	3213.8	NA	0.084	NA	277.76

APPENDIX B-5: Results of Geochemical Analysis of Groundwater Samples - Year 5

Date collected	Time collected (CST)	Field conductivity (uS/cm)	Field pH	Sample location	Sample ID	Sb mg/L	Se mg/L	Si mg/L	Sn mg/L	Sr mg/L	Ti mg/L	Tl mg/L	V mg/L	Zn mg/L	pH	alkalinity mg/L as CaCO <sub>3</sub>	TDS, 180 C mg/L	TSS mg/L	oPO <sub>4</sub> -P mg/L	NH <sub>3</sub> -N mg/L	F mg/L	Cl mg/L	NO <sub>3</sub> -N mg/L	SO <sub>4</sub> mg/L	total NVOC mg/L	dissolved NVOC mg/L	
					MDL:	0.059	0.13	0.066	0.086	0.00037	0.00056	0.017	0.047	0.0097			4	12	3.0	0.003	0.03	0.07	0.16	0.04	0.21	0.31	0.31
					Class 2 Groundwater Standards (mg/L)	0.024	0.05					0.02	0.1	10.0			1,200				4.0	200	100	400			
9/4/14	10:21:00 AM	787	7.11	TB7B-4	TOLLWAY 2953			7.933		0.0493					7.35	425	447		0.022		0.15	7	3.06	8.82	1.89	2.03	
10/1/14	10:20:00 AM	844	7.11	TB7B-4	TOLLWAY 3005			7.708		0.0581					7.56	455	467		0.016		0.15	11	5.12	10.70	1.89	1.81	
10/28/14	14:24:00 PM	829	7.05	TB7B-4	TOLLWAY 3045			7.243		0.0573		0.019			7.50	443	474		0.020		0.15	10	6.79	10.50	1.67	1.59	
12/2/14	15:01:00 PM	852	7.53	TB7B-4	TOLLWAY 3085			6.539		0.0565					7.51	444	502		0.019		0.13	12	9.39	11.98	1.42	1.52	
3/17/15	8:47:00 AM	775	7.00	TB7B-4	TOLLWAY 3213			5.869		0.0552					7.47	431	477		0.012		0.11	7	7.72	9.44	1.63	1.35	
4/13/15	15:11:00 PM	705	7.26	TB7B-4	TOLLWAY 3267			6.145		0.0466					7.44	359	417		0.017		0.11	8	8.31	7.81	1.39	1.43	
5/12/15	14:46:00 PM	723	7.09	TB7B-4	TOLLWAY 3334			6.709		0.0508					7.55	371	435		0.025		0.10	7	8.20	8.42	1.61	1.87	
6/10/15	10:17:00 AM	851	7.27	TB7B-4	TOLLWAY 3392			6.953		0.0570					7.57	432	484		0.021		0.13	9	7.26	7.78	1.40	1.68	
7/8/15	10:27:00 AM	874	7.00	TB7B-4	TOLLWAY 3443			7.575		0.0599					7.37	449	513		0.017		0.10	11	8.61	7.19	1.44	1.39	
8/5/15	9:30:00 AM	1075	7.48	TB7B-4	TOLLWAY 3498			7.773		0.0677	0.00632				7.48	484	579		0.025		0.10	11	20.04	10.88	3.22	1.51	
					min	NA	NA	5.869	NA	0.0466	0.00632	0.019	NA	NA	7.35	359	417	NA	0.012	NA	0.10	7	3.06	7.19	1.39	1.35	
					max	NA	NA	7.933	NA	0.0677	0.00632	0.019	NA	NA	7.57	484	579	NA	0.025	NA	0.15	12	20.04	11.98	3.22	2.03	
					mean	NA	NA	7.045	NA	0.0558	0.00632	0.019	NA	NA	7.48	429	480	NA	0.019	NA	0.12	9	8.45	9.35	1.76	1.62	
9/4/14	8:42:00 AM	10150	7.31	TB7B-5U	TOLLWAY 2948			7.571		1.3910		0.024			7.62	322	5888		0.023	0.83	0.43	2910		615.36	12.08	12.45	
10/1/14	8:45:00 AM	8693	7.39	TB7B-5U	TOLLWAY 2999			8.259		2.8404		0.029			7.45	436	5705		0.020	0.33	0.33	2353		1025.52	10.28	10.05	
10/28/14	12:28:00 PM	8937	7.11	TB7B-5U	TOLLWAY 3040			7.377		1.6537		0.019			7.49	381	5551		0.022	0.81	0.39	2323		945.65	11.16	11.37	
12/2/14	13:19:00 PM	11211	7.37	TB7B-5U	TOLLWAY 3080			6.030		2.0880		0.021			7.38	341	6942		0.023	0.50	0.27	3205		873.69	12.26	10.31	
3/17/15	10:04:00 AM	25259	6.64	TB7B-5U	TOLLWAY 3217			3.562		3.8345					7.25	199	15668		0.027	0.31		9160		973.76	8.47	8.49	
4/13/15	13:19:00 PM	15466	7.16	TB7B-5U	TOLLWAY 3261			4.664		3.1538					7.41	240	9759		0.033	0.45		5001		1112.62	6.73	6.95	
5/12/15	13:14:00 PM	18383	7.09	TB7B-5U	TOLLWAY 3329			5.597		2.4699					7.55	363	11146		0.022	1.57		6395		456.88	13.68	13.59	
6/10/15	8:53:00 AM	13948	7.22	TB7B-5U	TOLLWAY 3387			6.529		2.2511					7.31	255	8146		0.044	1.15		4478		461.85	9.79	9.81	
7/8/15	8:53:00 AM	10857	6.89	TB7B-5U	TOLLWAY 3439			7.040		1.4838		0.020			7.61	357	5513		0.020	0.68	0.52	2276		966.88	7.93	7.88	
8/5/15	8:28:00 AM	12396	6.97	TB7B-5U	TOLLWAY 3493			7.396		2.1082		0.018	0.0133		7.47	326	7458		0.030	0.53		3709		639.88	8.90	9.16	
					min	NA	NA	3.562	NA	1.3910	NA	0.018	NA	0.0133	7.25	199	5513	NA	0.020	0.31	0.27	2276	NA	456.88	6.73	6.95	
					max	NA	NA	8.259	NA	3.8345	NA	0.029	NA	0.0133	7.62	436	15668	NA	0.044	1.57	0.52	9160	NA	1112.62	13.68	13.59	
					mean	NA	NA	6.402	NA	2.3274	NA	0.022	NA	0.0133	7.45	322	8178	NA	0.026	0.72	0.39	4181	NA	807.21	10.13	10.01	
9/4/14	8:56:00 AM	11459	7.29	TB7B-5L	TOLLWAY 2949			8.701		1.8642			0.0109	7.51	404	7833		0.035	0.82		4178		530.10	16.37	14.55		
10/1/14	9:04:00 AM	13350	7.26	TB7B-5L	TOLLWAY 3000			7.300		1.8346		0.032	0.0133	7.87	372	7068		0.029	0.56		3462	0.10	841.79	16.18	13.37		
10/28/14	12:40:00 PM	11955	7.15	TB7B-5L	TOLLWAY 3041			7.762		2.3584		0.026	0.0131	7.31	353	7291		0.040	0.52		3455	0.08	887.65	13.27	13.95		
12/2/14	13:33:00 PM	11676	7.46	TB7B-5L	TOLLWAY 3081			6.157		2.1266			0.0172	7.87	307	7388		0.024	0.04	0.24	3509	0.27	931.04	10.52	9.82		
1/17/15	13:48:00 PM	12985	7.36	TB7B-5L	TOLLWAY 3142			4.880		1.7271		0.018	0.1020														
3/17/15	10:20:00 AM	21153	7.10	TB7B-5L	TOLLWAY 3219			4.372		3.5300			0.0162	7.93	219	12732		0.021	0.07		7229		906.82	no sample	no sample		
4/13/15	13:36:00 PM	20101	7.15	TB7B-5L	TOLLWAY 3262			5.571		3.5290		0.034	0.0134	7.42	325	12482		0.022	0.40		6910		726.08	8.50	8.43		
5/12/15	13:25:00 PM	20669	7.12	TB7B-5L	TOLLWAY 3330			6.074		3.2596			0.0220	7.38	342	12559		0.023	0.68		7111		659.67	10.91	11.21		
6/10/15	9:07:00 AM	20285	7.34	TB7B-5L	TOLLWAY 3388			6.397		2.8974			0.0109	7.39	356	12350		0.057	1.22		6916		593.23	no sample	no sample		
7/8/15	8:36:00 AM	17000	6.32	TB7B-5L	TOLLWAY 3438			6.553		2.2960			0.0123	7.76	311	9899		0.022	0.94		5495		665.93	10.91	10.05		
8/5/15	8:41:00 AM	13640	7.09	TB7B-5L	TOLLWAY 3494			6.811		2.0871		0.030	0.0175	8.20	292	7733		0.138	0.24		4042	0.36	660.72	9.49	8.79		
					min	NA	NA	4.372	NA	1.7271	NA	0.018	NA	0.0109	7.31	219	7068	NA	0.021	0.04	0.24	3455	0.08	593.23	8.50	8.43	
					max	NA	NA	7.762	NA	3.5300	NA	0.034	NA	0.1020	8.20	372	12732	NA	0.138	1.22	0.24	7229	0.36	931.04	16.18	13.95	
					mean	NA	NA	6.188	NA	2.5646	NA	0.028	NA	0.0238	7.68	320	9945	NA	0.042	0.52	0.24	5348	0.21	763.66	11.40	10.80	

APPENDIX B-5: Results of Geochemical Analysis of Groundwater Samples - Year 5

Date collected	Time collected (CST)	Field conductivity (uS/cm)	Field pH	Sample location	Sample ID	Al	As	B	Ba	Be	Ca	Cd	Co	Cr	Cu	Fe	K	Li	Mg	Mn	Mo	Na	Ni	P	Pb	S	
						mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L
						MDL:	0.037	0.11	0.023	0.00085	0.00055	0.029	0.012	0.013	0.0058	0.0016	0.024	0.016	0.11	0.027	0.0015	0.022	0.026	0.043	0.073	0.041	0.22
Class 2 Groundwater Standards (mg/L)								0.2	2.0	2.0	0.5		0.05	1.0	1.0	0.65	5.0				10.0			2.0		0.1	
9/3/14	11:09:00 AM	1966	7.27	TB15B-1U	TOLLWAY 2939	1.846		0.059	0.0464		66.43				0.00505	1.053	1.25		43.63	0.0522		244.4					11.52
9/30/14	10:03:00 AM	3158	7.30	TB15B-1U	TOLLWAY 2989	0.061		0.059	0.0551		113.48					0.762	1.56		77.52	0.1155		291.3					17.20
10/29/14	8:32:00 AM	2564	7.24	TB15B-1U	TOLLWAY 3049	0.615		0.044	0.0485		78.28				0.00423	0.381	0.89		49.65	0.0159		259.4					13.86
12/3/14	9:53:00 AM	1574	7.84	TB15B-1U	TOLLWAY 3090	0.298			0.0403		70.95				0.00613	0.291	0.79		48.18			225.4					14.46
1/14/15	12:21:00 AM	3834	7.62	TB15B-1U	TOLLWAY 3131	2.758		0.038	0.1131		190.61				0.00334	1.296	1.73		149.34	0.0070		471.6					42.04
2/11/15	11:30:00 AM	4870	7.43	TB15B-1U	TOLLWAY 3177			0.043	0.1293		250.78				0.00201	0.025	1.48		194.18			505.8	0.093				48.01
3/18/15	9:30:00 AM	5543	7.14	TB15B-1U	TOLLWAY 3231			0.043	0.1513		284.28						1.47		225.14			548.2					54.11
4/14/15	9:26:00 AM	820	7.94	TB15B-1U	TOLLWAY 3272	1.074			0.0271		33.60				0.00668	0.639	0.72		19.08	0.0037		184.4					9.76
5/12/15	9:23:00 AM	1069	7.51	TB15B-1U	TOLLWAY 3320	0.535			0.0257		35.44				0.00662	0.375	0.63		17.81	0.0046		156.4					6.82
6/9/15	9:06:00 AM	2882	7.33	TB15B-1U	TOLLWAY 3373	0.074		0.027	0.0628		98.26				0.00306	0.125	0.95		69.08	0.0812		360.8					20.11
7/7/15	9:49:00 AM	1675	7.41	TB15B-1U	TOLLWAY 3426	0.265		0.045	0.0402		61.53				0.00285	0.295	0.83		41.67	0.1613		247.6					10.74
8/4/15	8:27:00 AM	1858	7.25	TB15B-1U	TOLLWAY 3481	0.734		0.050	0.0396		57.69				0.00395	0.584	0.80		38.26	0.0500		239.2					12.58
					min	0.061	NA	0.027	0.0257	NA	33.60	NA	NA	NA	0.00201	0.025	0.63	NA	17.81	0.0037	NA	156.4	NA	0.093	NA	NA	6.82
					max	2.758	NA	0.059	0.1513	NA	284.28	NA	NA	NA	0.00668	1.296	1.73	NA	225.14	0.1613	NA	548.2	NA	0.093	NA	NA	54.11
					mean	0.826	NA	0.045	0.0649	NA	111.78	NA	NA	NA	0.00439	0.530	1.09	NA	81.13	0.0546	NA	311.2	NA	0.093	NA	NA	21.77
9/3/14	11:21:00 AM	7095	6.70	TB15B-1L	TOLLWAY 2940			0.144	0.0911		452.19					0.040	6.35		355.41	0.0073		564.0		0.095			77.79
9/30/14	10:25:00 AM	6901	6.65	TB15B-1L	TOLLWAY 2990			0.132	0.0890		439.37					0.353	6.14		345.15	0.0055		499.4					74.36
10/29/14	8:17:00 AM	7047	6.84	TB15B-1L	TOLLWAY 3048			0.145	0.0867		465.02					0.073	5.72		348.11	0.0042		557.8					81.50
12/3/14	9:50:00 AM	7169	7.03	TB15B-1L	TOLLWAY 3089			0.104	0.0872		431.48					0.047	5.37		335.84	0.0039		523.2					78.57
1/14/15	11:38:00 AM	7613	6.83	TB15B-1L	TOLLWAY 3132	0.295		0.098	0.0947		444.05					0.223	5.04		366.55	0.0070		613.4					77.52
2/11/15	11:26:00 AM	7600	6.83	TB15B-1L	TOLLWAY 3176			0.096	0.0939		473.17					0.032	5.32		367.35	0.0043		646.9	0.123				77.01
3/18/15	9:23:00 AM	7435	6.70	TB15B-1L	TOLLWAY 3230	0.182		0.088	0.0895		476.00				0.00190	0.147	4.65		373.43	0.0060		652.2					81.42
4/14/15	9:08:00 AM	7638	6.96	TB15B-1L	TOLLWAY 3271			0.083	0.0936		477.75						4.58		370.63	0.0055		658.4	0.075				78.27
5/12/15	9:31:00 AM	7437	6.72	TB15B-1L	TOLLWAY 3321			0.086	0.0940		469.24						4.58		365.95	0.0067		650.7					78.48
6/9/15	9:16:00 AM	7580	6.81	TB15B-1L	TOLLWAY 3374	0.054		0.082	0.0917		440.83					0.049	4.83		339.15	0.0074		640.2					73.84
7/7/15	10:09:00 AM	7328	6.63	TB15B-1L	TOLLWAY 3427			0.120	0.0972		462.27						5.10		360.15	0.0051		628.1					78.14
8/4/15	8:14:00 AM	7311	6.82	TB15B-1L	TOLLWAY 3480			0.127	0.0952		483.38						5.46		378.22	0.0061		528.0					77.62
					min	0.054	NA	0.082	0.0867	NA	431.48	NA	NA	NA	0.00190	0.032	4.58	NA	335.84	0.0039	NA	499.4	NA	0.075	NA	NA	73.84
					max	0.295	NA	0.145	0.0972	NA	483.38	NA	NA	NA	0.00190	0.353	6.35	NA	378.22	0.0074	NA	658.4	NA	0.123	NA	NA	81.50
					mean	0.177	NA	0.109	0.0920	NA	459.56	NA	NA	NA	0.00190	0.120	5.26	NA	358.83	0.0057	NA	596.9	NA	0.097	NA	NA	77.88
9/3/14	11:34:00 AM	1135	7.41	TB15B-2	TOLLWAY 2941			0.136	0.0485		81.95						0.83		57.64			30.2					34.47
9/30/14	10:35:00 AM	1128	7.34	TB15B-2	TOLLWAY 2991	2.384		0.146	0.0713		106.24					1.370	2.30		74.02	0.0329		26.7					47.32
10/29/14	8:51:00 AM	1148	7.30	TB15B-2	TOLLWAY 3050	0.132		0.154	0.0600		109.24					0.093	1.04		80.38	0.0024		33.6					53.57
12/3/14	10:15:00 AM	1151	7.80	TB15B-2	TOLLWAY 3091			0.117	0.0558		108.34						1.11		81.02			31.7					53.45
1/14/15	11:07:00 AM	1056	7.77	TB15B-2	TOLLWAY 3130	0.412		0.107	0.0565		110.05					0.238	0.97		80.22	0.0028		32.2					54.64
2/11/15	11:10:00 AM	1096	7.69	TB15B-2	TOLLWAY 3175			0.100	0.0527		105.77						0.86		79.75			29.1	0.080				53.96
3/18/15	9:54:00 AM	1082	7.26	TB15B-2	TOLLWAY 3233			0.092	0.0537		101.17						0.68		80.78			32.6					55.25
4/14/15	9:47:00 AM	738	7.75	TB15B-2	TOLLWAY 3273			0.072	0.0434		82.99					0.00164	0.60		62.72			34.2					38.20
5/12/15	10:00:00 AM	1285	7.28	TB15B-2	TOLLWAY 3322			0.094	0.0550		98.16					0.00171	0.59		72.41			39.4					45.26
6/9/15	9:31:00 AM	1220	7.52	TB15B-2	TOLLWAY 3375	0.129		0.103	0.0535		88.53					0.00292	0.62		67.46	0.0019		43.8					42.93
7/7/15	10:29:00 AM	1115	7.23	TB15B-2	TOLLWAY 3428	11.817		0.157	0.1185		122.42		0.01		0.00502	7.468	5.77		86.66	0.1229		28.6	0.097				53.93
8/4/15	8:36:00 AM	1152	7.54	TB15B-2	TOLLWAY 3482			0.142	0.0573		115.40					0.385	1.23		85.25	0.0384		30.9					50.91
					min	0.129	NA	0.072	0.0434	NA	81.95	NA	NA	0.01	0.00164	0.072	0.59	NA	57.64	0.0019	NA	26.7	NA	0.080	NA	NA	34.47
					max	11.817	NA	0.157	0.1185	NA	122.42	NA	NA	0.01	0.00502	7.468	5.77	NA	86.66	0.1229	NA	43.8	NA	0.097	NA	NA	55.25
					mean	2.975	NA	0.118	0.0605	NA	102.52	NA	NA	0.01	0.00282	1.604	1.38	NA	75.69	0.0336	NA	32.8	NA	0.088	NA	NA	48.66
9/3/14	11:45:00 AM	418	7.15	TB15B-3	TOLLWAY 2942	0.137		0.049	0.0257		45.30					2.003	1.37		20.39	0.1296		11.1					



APPENDIX B-5: Results of Geochemical Analysis of Groundwater Samples - Year 5

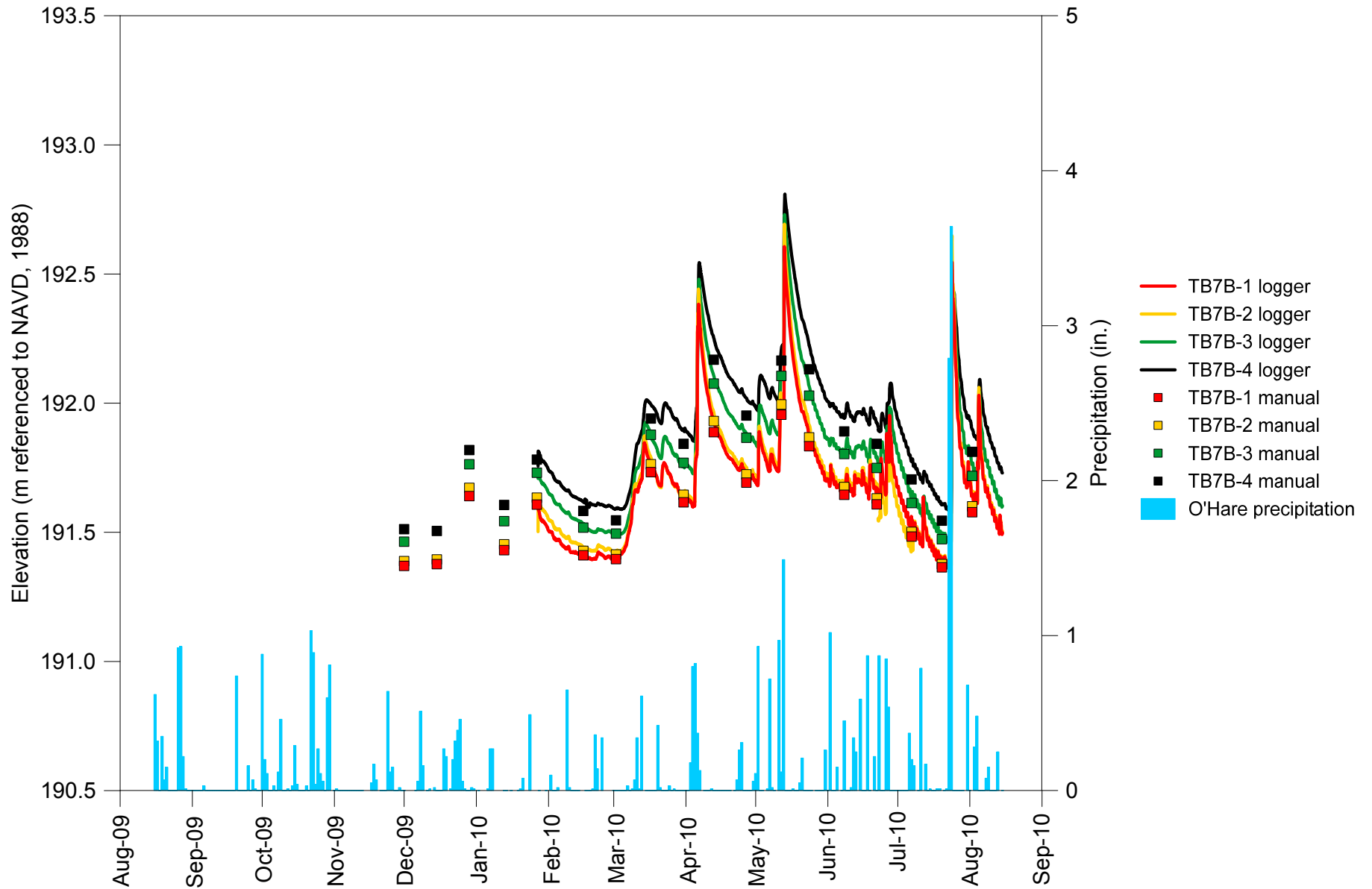
Date collected	Time collected (CST)	Field conductivity (uS/cm)	Field pH	Sample location	Sample ID	Sb mg/L	Se mg/L	Si mg/L	Sn mg/L	Sr mg/L	Ti mg/L	Tl mg/L	V mg/L	Zn mg/L	pH	alkalinity mg/L as CaCO <sub>3</sub>	TDS, 180 C mg/L	TSS mg/L	oPO <sub>4</sub> -P mg/L	NH <sub>3</sub> -N mg/L	F mg/L	Cl mg/L	NO <sub>3</sub> -N mg/L	SO <sub>4</sub> mg/L	total NVOC mg/L	dissolved NVOC mg/L	
					MDL:	0.059	0.13	0.066	0.086	0.00037	0.00056	0.017	0.047	0.0097			4	12	3.0	0.003	0.03	0.07	0.16	0.04	0.21	0.31	0.31
					Class 2 Groundwater Standards (mg/L)	0.024	0.05					0.02	0.1	10.0			1,200				4.0	200	100	400			
9/3/14	11:09:00 AM	1966	7.27	TB15B-1U	TOLLWAY 2939			11.174		0.4205	0.04694			0.0143	7.53	265	881		0.069		0.42	333		27.17	15.94	10.94	
9/30/14	10:03:00 AM	3158	7.30	TB15B-1U	TOLLWAY 2989			6.467		0.7594	0.00103				7.42	269	1267		0.015	0.07	0.44	618		46.63	17.74	8.84	
10/29/14	8:32:00 AM	2564	7.24	TB15B-1U	TOLLWAY 3049			7.039		0.5458	0.01665				7.53	240	953		0.022	0.05	0.37	427		34.12	14.54	9.21	
12/3/14	9:53:00 AM	1574	7.84	TB15B-1U	TOLLWAY 3090			4.853		0.5011	0.00884				7.72	177	929		0.016		0.39	443		40.81	12.32	8.60	
1/14/15	12:21:00 AM	3834	7.62	TB15B-1U	TOLLWAY 3131			11.551		1.3555	0.06851			0.0164	7.79	210	2256		0.038		0.27	1248		111.55	9.39	5.82	
2/11/15	11:30:00 AM	4870	7.43	TB15B-1U	TOLLWAY 3177			4.806		1.8568	0.00087	0.032		0.0113	7.81	220	2642		0.016		0.19	1556		132.84	4.62	3.84	
3/18/15	9:30:00 AM	5543	7.14	TB15B-1U	TOLLWAY 3231			5.010		2.1754					7.62	230	2979		0.011		0.27	1821		151.00	17.33	3.64	
4/14/15	9:26:00 AM	820	7.94	TB15B-1U	TOLLWAY 3272			6.515		0.1886	0.02958				7.83	230	614		0.028		0.32	191		25.82	13.88	10.67	
5/12/15	9:23:00 AM	1069	7.51	TB15B-1U	TOLLWAY 3320			6.123		0.1905	0.01632			0.0109	7.66	256	538		0.021		0.31	144		17.48	14.93	12.15	
6/9/15	9:06:00 AM	2882	7.33	TB15B-1U	TOLLWAY 3373			5.286		0.7012	0.00151			0.0131	7.68	338	1542		0.019		0.35	636		55.26	9.66	7.82	
7/7/15	9:49:00 AM	1675	7.41	TB15B-1U	TOLLWAY 3426			5.688		0.3869	0.01043			0.0104	7.41	280	921		0.015		0.33	362		30.17	10.51	7.67	
8/4/15	8:27:00 AM	1858	7.25	TB15B-1U	TOLLWAY 3481			5.771		0.3877	0.02295				7.28	184	951		0.041		0.47	418		36.40	12.20	7.76	
					min	NA	NA	4.806	NA	0.1886	0.00087	0.032	NA	0.0104	7.28	177	538	NA	0.011	0.05	0.19	144	NA	17.48	4.62	3.64	
					max	NA	NA	11.551	NA	2.1754	0.06851	0.032	NA	0.0164	7.83	338	2979	NA	0.069	0.07	0.47	1821	NA	151.00	17.74	12.15	
					mean	NA	NA	6.690	NA	0.7891	0.02033	0.032	NA	0.0128	7.61	242	1373	NA	0.026	0.06	0.35	683	NA	59.11	12.75	8.08	
9/3/14	11:21:00 AM	7095	6.70	TB15B-1L	TOLLWAY 2940			9.542		3.4147		0.025			7.17	336	4073		0.030		0.19	2135	0.04	205.07	6.05	2.07	
9/30/14	10:25:00 AM	6901	6.65	TB15B-1L	TOLLWAY 2990			9.103		3.2013		0.041			7.18	338	3683		0.020		0.27	2108	0.07	203.79	6.28	1.80	
10/29/14	8:17:00 AM	7047	6.84	TB15B-1L	TOLLWAY 3048			9.595		3.6746					7.19	339	3988		0.030	0.03	0.32	2188	0.07	213.32	1.47	1.48	
12/3/14	9:50:00 AM	7169	7.03	TB15B-1L	TOLLWAY 3089			8.737		3.6223		0.027			7.28	333	3872		0.026		0.24	2214		215.41	1.52	1.44	
1/14/15	11:38:00 AM	7613	6.83	TB15B-1L	TOLLWAY 3132			8.888		3.5909	0.00962	0.024			7.29	346	4116		0.026			2321		202.91	1.87	1.84	
2/11/15	11:26:00 AM	7600	6.83	TB15B-1L	TOLLWAY 3176			7.849		3.5479	0.00091	0.025		0.0098	7.35	347	4115		0.023		0.19	2359		208.14	2.12	1.69	
3/18/15	9:23:00 AM	7435	6.70	TB15B-1L	TOLLWAY 3230			8.211		3.4483	0.00538			0.0101	7.10	335	4067		0.019			2407		214.60	2.38	2.61	
4/14/15	9:08:00 AM	7638	6.96	TB15B-1L	TOLLWAY 3271			7.689		3.6028		0.023			7.12	337	4542		0.019		0.20	2418		210.05	1.82	1.48	
5/12/15	9:31:00 AM	7437	6.72	TB15B-1L	TOLLWAY 3321			7.807		3.5542		0.032			7.23	335	4397		0.024		0.26	2541		204.01	1.67	1.59	
6/9/15	9:16:00 AM	7580	6.81	TB15B-1L	TOLLWAY 3374			8.033		3.4050	0.00141	0.025			7.23	336	4446		0.028			2330		204.88	1.78	1.58	
7/7/15	10:09:00 AM	7328	6.63	TB15B-1L	TOLLWAY 3427			8.838		3.6573		0.021			7.19	328	4296		0.021			2299		205.25	2.09	1.50	
8/4/15	8:14:00 AM	7311	6.82	TB15B-1L	TOLLWAY 3480			8.993		3.7631		0.032			7.17	334	3948		0.136		0.23	2264		208.96	1.62	1.76	
					min	NA	NA	7.689	NA	3.2013	0.00091	0.021	NA	0.0098	7.10	328	3683	NA	0.019	0.03	0.19	2108	0.04	202.91	1.47	1.44	
					max	NA	NA	9.595	NA	3.7631	0.00962	0.041	NA	0.0101	7.35	347	4542	NA	0.136	0.03	0.32	2541	0.07	215.41	6.28	2.61	
					mean	NA	NA	8.607	NA	3.5402	0.00433	0.028	NA	0.0100	7.21	337	4129	NA	0.034	0.03	0.24	2299	0.06	208.03	2.56	1.74	
9/3/14	11:34:00 AM	1135	7.41	TB15B-2	TOLLWAY 2941			7.232		0.7468	0.00065				7.68	317	531		0.021		0.60	61		95.37	2.98	2.18	
9/30/14	10:35:00 AM	1128	7.34	TB15B-2	TOLLWAY 2991			14.392		0.9549	0.08866			0.0128	7.68	357	659		0.043		0.58	74	0.08	131.28	4.15	2.44	
10/29/14	8:51:00 AM	1148	7.30	TB15B-2	TOLLWAY 3050			8.221		1.1256	0.00362				7.78	375	678		0.025		0.56	82		145.28	2.74	1.85	
12/3/14	10:15:00 AM	1151	7.80	TB15B-2	TOLLWAY 3091			7.267		1.0941		0.018			7.97	369	676		0.022		0.54	80		150.53	1.83	1.49	
1/14/15	11:07:00 AM	1056	7.77	TB15B-2	TOLLWAY 3130			7.320		1.0069	0.01380				8.03	340	674		0.025		0.51	82		151.02	10.11	1.75	
2/11/15	11:10:00 AM	1096	7.69	TB15B-2	TOLLWAY 3175			6.205		1.0422					8.08	343	654		0.019		0.48	84		151.11	2.11	1.53	
3/18/15	9:54:00 AM	1082	7.26	TB15B-2	TOLLWAY 3233			6.086		1.0340					7.82	347	657		0.013		0.46	85		154.08	2.17	1.56	
4/14/15	9:47:00 AM	738	7.75	TB15B-2	TOLLWAY 3273			5.746		0.7669	0.00070				7.81	267	552		0.015		0.47	67		102.23	4.09	2.69	
5/12/15	10:00:00 AM	1285	7.28	TB15B-2	TOLLWAY 3322			6.049		0.8892					7.65	360	682		0.016		0.48	77		134.08	1.67	2.27	
6/9/15	9:31:00 AM	1220	7.52	TB15B-2	TOLLWAY 3375			6.367		0.8535	0.00386				7.77	355	613		0.021		0.51	76		121.15	2.29	2.01	
7/7/15	10:29:00 AM	1115	7.23	TB15B-2	TOLLWAY 3428			38.179		1.1835	0.44042			0.0348	7.60	369	889		0.184		0.52	78		146.32	2.65	1.92	
8/4/15	8:36:00 AM	1152	7.54	TB15B-2	TOLLWAY 3482			8.392		1.1029					7.58	362	719		0.045		0.52	81		137.54	5.93	1.72	
					min	NA	NA	5.746	NA	0.7468	0.00065	0.018	NA	0.0128	7.58	267	531	NA	0.013	NA	0.46	61	0.08	95.37	1.67	1.49	
					max	NA	NA	38.179	NA	1.1835	0.44042	0.018	NA	0.0348	8.08	375	889	NA	0.184	NA	0.60	85	0.08	154.08	10.11	2.69	
					mean	NA	NA	10.121	NA	0.9834	0.07881	0.018	NA	0.0238	7.79	347	665	NA	0.038	NA	0.52	77	0.08	135.00	3.56	1.95	
9/3/14	11:45:00 AM	418	7.15	TB15B-3	TOLLWAY 2942			9.070		0.2065	0.00619				7.52	205	238		0.021		0.24	9		4.15	14.11	10.73	

APPENDIX B-5: Results of Geochemical Analysis of Groundwater Samples - Year 5

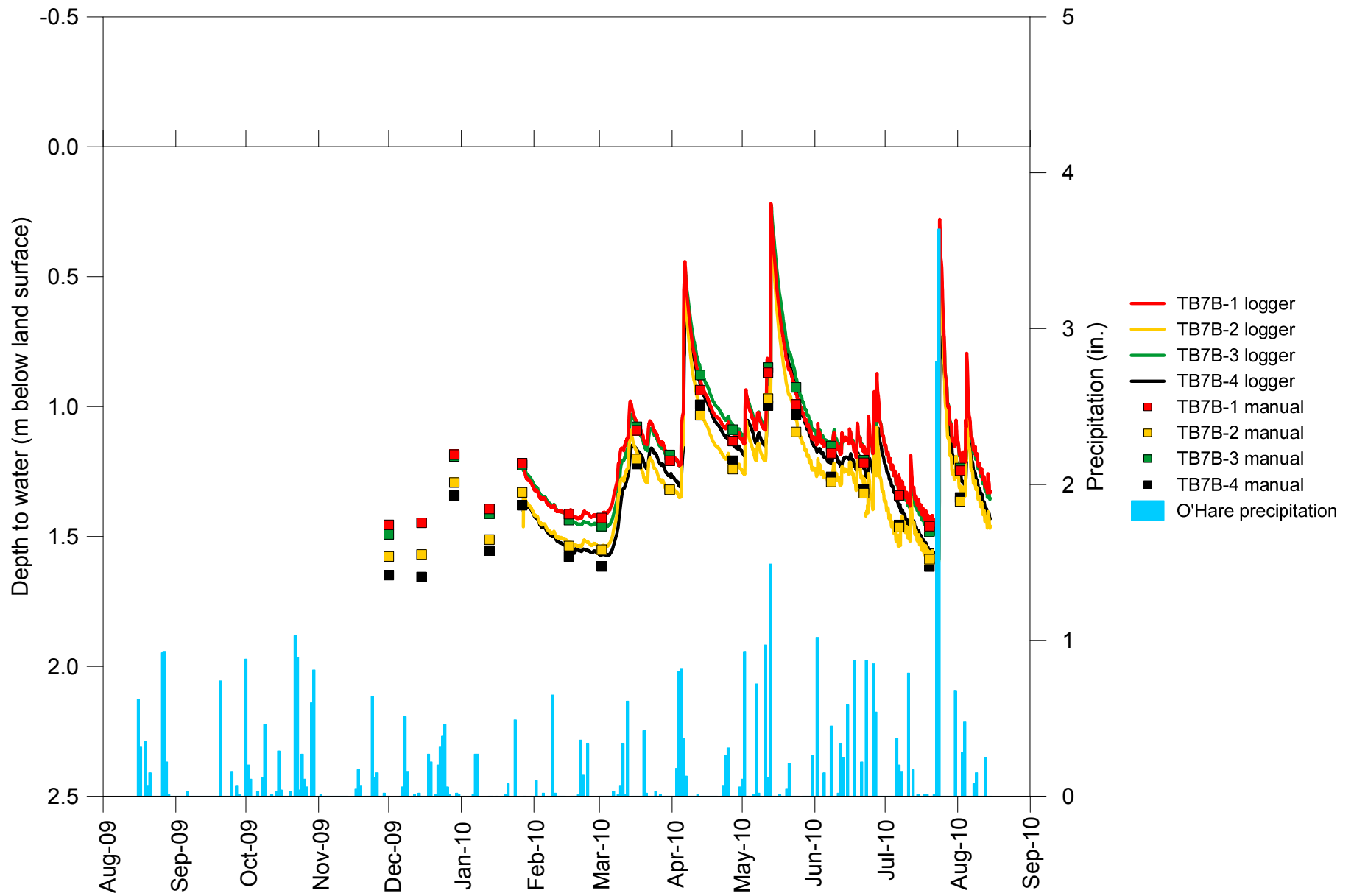
Date collected	Time collected (CST)	Field conductivity (uS/cm)	Field pH	Sample location	Sample ID	Al mg/L	As mg/L	B mg/L	Ba mg/L	Be mg/L	Ca mg/L	Cd mg/L	Co mg/L	Cr mg/L	Cu mg/L	Fe mg/L	K mg/L	Li mg/L	Mg mg/L	Mn mg/L	Mo mg/L	Na mg/L	Ni mg/L	P mg/L	Pb mg/L	S mg/L
					MDL:	0.037	0.11	0.023	0.00085	0.00055	0.029	0.012	0.013	0.0058	0.0016	0.024	0.016	0.11	0.027	0.0015	0.022	0.026	0.043	0.073	0.041	0.22
					Class 2 Groundwater Standards (mg/L)		0.2	2.0	2.0	0.5		0.05	1.0	1.0	0.65	5.0				10.0			2.0		0.1	
9/3/14	9:15:00 AM	1555	7.03	TB15B-4U	TOLLWAY 2933			0.178	0.0743		75.25				0.00809	0.031	15.16		17.22	0.6871		262.1		0.106		17.62
9/30/14	9:17:00 AM	1536	7.14	TB15B-4U	TOLLWAY 2987			0.147	0.0735		81.22				0.00572	0.035	14.67		17.77	1.0028		244.8				15.03
10/29/14	9:56:00 AM	1562	7.06	TB15B-4U	TOLLWAY 3052	0.081		0.126	0.0747		86.90				0.00765	0.049	14.20		19.87	0.5353		254.7				18.88
12/3/14	9:23:00 AM	1930	7.45	TB15B-4U	TOLLWAY 3088			0.062	0.0777		89.94				0.00693	0.024	13.90		20.09	0.2605		298.4				21.02
1/14/15	12:37:00 PM	2245	7.33	TB15B-4U	TOLLWAY 3133	0.093		0.067	0.0861		111.53				0.00636	0.074	11.47		27.06	0.1251		339.9				24.51
2/11/15	12:01:00 PM	5662	7.14	TB15B-4U	TOLLWAY 3179			0.045	0.2240		271.15				0.00481		12.37		57.46	0.0946		859.4		0.098		34.90
3/18/15	9:01:00 AM	4493	7.04	TB15B-4U	TOLLWAY 3228			0.048	0.1984		218.95				0.00488		11.96		51.93	0.0153		708.5				24.08
4/14/15	8:12:00 AM	3895	7.32	TB15B-4U	TOLLWAY 3269			0.058	0.1584		172.39				0.00470		12.68		38.91	0.0026		613.1		0.079		26.57
5/12/15	8:49:00 AM	2471	7.22	TB15B-4U	TOLLWAY 3319			0.075	0.0988		104.85				0.01101	0.046	11.60		23.09	0.0073		400.1				20.49
6/9/15	8:29:00 AM	5453	7.15	TB15B-4U	TOLLWAY 3372	0.204		0.057	0.0992		99.04				0.01086	0.198	12.53		23.09	0.0685		445.9				22.79
7/7/15	9:18:00 AM	3191	6.92	TB15B-4U	TOLLWAY 3425	0.224		0.094	0.0755		80.20				0.01170	0.168	11.42		17.74	0.2543		335.6				15.56
8/4/15	7:42:00 AM	1603	7.17	TB15B-4U	TOLLWAY 3479	0.091		0.104	0.0585		68.35				0.01242	0.071	10.95		14.83	0.1424		273.0				13.49
					min	0.081	NA	0.045	0.0585	NA	68.35	NA	NA	NA	0.00470	0.024	10.95	NA	14.83	0.0026	NA	244.8	NA	0.079	NA	13.49
					max	0.224	NA	0.178	0.2240	NA	271.15	NA	NA	NA	0.01242	0.198	15.16	NA	57.46	1.0028	NA	859.4	NA	0.106	NA	34.90
					mean	0.138	NA	0.088	0.1083	NA	121.65	NA	NA	NA	0.00793	0.077	12.74	NA	27.42	0.2663	NA	419.6	NA	0.094	NA	21.24
9/3/14	8:53:00 AM	8317	6.50	TB15B-4L	TOLLWAY 2932			0.203	0.2459		651.13						8.33	0.14	494.31	0.0381		370.2		0.117		78.60
9/30/14	9:40:00 AM	8181	6.58	TB15B-4L	TOLLWAY 2988	0.194		0.188	0.2314		635.81					0.423	9.02	0.13	472.92	0.2743		355.3		0.129		72.44
10/29/14	10:06:00 AM	8159	6.69	TB15B-4L	TOLLWAY 3053			0.207	0.2338		668.65					0.683	8.16	0.14	498.38	0.2680		369.1				77.00
12/3/14	8:54:00 AM	8233	7.11	TB15B-4L	TOLLWAY 3086			0.175	0.2303		675.13						7.86	0.16	492.09	0.1348		345.4				77.35
1/14/15	12:51:00 PM	8322	6.97	TB15B-4L	TOLLWAY 3134			0.168	0.2334		662.79						7.20	0.15	463.27	0.0405		356.1				80.92
2/11/15	11:51:00 AM	8179	6.98	TB15B-4L	TOLLWAY 3178			0.154	0.2291		671.58				0.00209		7.35	0.13	495.39	0.0298		355.0		0.165		78.73
3/18/15	9:08:00 AM	1555	7.03	TB15B-4L	TOLLWAY 3229			0.151	0.2302		687.00				0.00550		6.83	0.14	504.48	0.0189		369.0				81.91
4/14/15	9:15:00 AM	8068	6.84	TB15B-4L	TOLLWAY 3270			0.140	0.2222		663.89				0.00380		6.65	0.13	510.51	0.0239		349.0		0.089		79.44
5/12/15	8:36:00 AM	8153	6.81	TB15B-4L	TOLLWAY 3318			0.140	0.2182		660.23					0.049	6.43	0.13	468.55	0.0914		349.6				78.19
6/9/15	8:09:00 AM	8101	6.47	TB15B-4L	TOLLWAY 3371			0.138	0.2162		657.09				0.00206		6.71	0.14	479.56	0.0664		356.3				79.35
7/7/15	9:02:00 AM	8084	6.15	TB15B-4L	TOLLWAY 3424			0.165	0.2149		631.38				0.00199		6.79	0.12	460.30	0.0385		345.6				74.89
8/4/15	7:24:00 AM	8085	6.63	TB15B-4L	TOLLWAY 3477			0.176	0.2124		669.60						7.41	0.15	477.77	0.0167		364.6				78.52
					min	0.194	NA	0.138	0.2124	NA	631.38	NA	NA	NA	0.00199	0.049	6.43	0.12	460.30	0.0167	NA	345.4	NA	0.089	NA	72.44
					max	0.194	NA	0.207	0.2459	NA	687.00	NA	NA	NA	0.00550	0.683	9.02	0.16	510.51	0.2743	NA	370.2	NA	0.165	NA	81.91
					mean	0.194	NA	0.167	0.2265	NA	661.19	NA	NA	NA	0.00309	0.385	7.40	0.14	484.79	0.0868	NA	357.1	NA	0.125	NA	78.11

APPENDIX B-5: Results of Geochemical Analysis of Groundwater Samples - Year 5

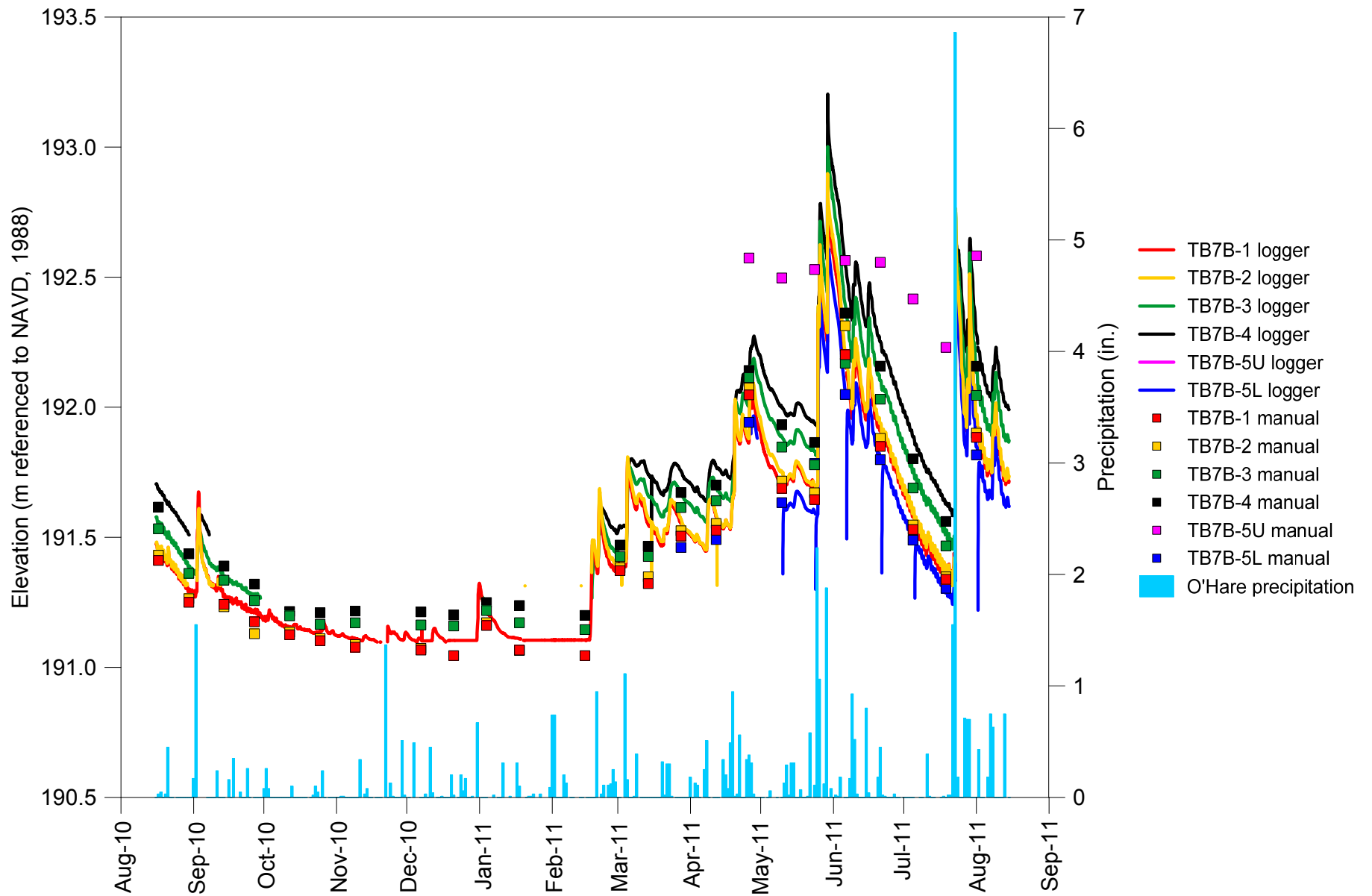
Date collected	Time collected (CST)	Field conductivity (uS/cm)	Field pH	Sample location	Sample ID	Sb mg/L	Se mg/L	Si mg/L	Sn mg/L	Sr mg/L	Ti mg/L	Tl mg/L	V mg/L	Zn mg/L	pH	alkalinity mg/L as CaCO <sub>3</sub>	TDS, 180 C mg/L	TSS mg/L	oPO <sub>4</sub> -P mg/L	NH <sub>3</sub> -N mg/L	F mg/L	Cl mg/L	NO <sub>3</sub> -N mg/L	SO <sub>4</sub> mg/L	total NVOC mg/L	dissolved NVOC mg/L
					MDL:	0.059	0.13	0.066	0.086	0.00037	0.00056	0.017	0.047	0.0097		4	12	3.0	0.003	0.03	0.07	0.16	0.04	0.21	0.31	0.31
					Class 2 Groundwater Standards (mg/L)	0.024	0.05					0.02	0.1	10.0			1,200				4.0	200	100	400		
9/3/14	9:15:00 AM	1555	7.03	TB15B-4U	TOLLWAY 2933			7.078		0.1897	0.00060				7.41	482	930		0.078	0.15	0.36	194		46.15	20.46	20.73
9/30/14	9:17:00 AM	1536	7.14	TB15B-4U	TOLLWAY 2987			6.607		0.1899					7.46	480	930		0.058	0.12	0.34	203		40.76	21.76	21.99
10/29/14	9:56:00 AM	1562	7.06	TB15B-4U	TOLLWAY 3052			6.042		0.2273	0.00105				7.53	416	932		0.057	0.03	0.31	245		52.62	14.72	14.82
12/3/14	9:23:00 AM	1930	7.45	TB15B-4U	TOLLWAY 3088			4.751		0.2239					7.56	365	1091		0.038		0.27	378	0.55	58.90	12.10	11.87
1/14/15	12:37:00 PM	2245	7.33	TB15B-4U	TOLLWAY 3133			4.661		0.2750	0.00295				7.56	326	1239		0.030		0.24	497	1.97	66.77	11.21	10.87
2/11/15	12:01:00 PM	5662	7.14	TB15B-4U	TOLLWAY 3179			4.007		0.7061		0.018			7.54	260	3255		0.021	0.03		1840	2.15	98.40	7.95	7.90
3/18/15	9:01:00 AM	4493	7.04	TB15B-4U	TOLLWAY 3228			4.252		0.6533					7.46	258	2523		0.025		0.16	1377	5.18	63.97	7.73	7.70
4/14/15	8:12:00 AM	3895	7.32	TB15B-4U	TOLLWAY 3269			4.224		0.4747					7.37	251	2261		0.025		0.21	1116	6.78	72.63	8.72	8.65
5/12/15	8:49:00 AM	2471	7.22	TB15B-4U	TOLLWAY 3319			5.170		0.2874	0.00096				7.54	346	1335		0.044		0.24	533	3.35	53.70	12.06	11.73
6/9/15	8:29:00 AM	5453	7.15	TB15B-4U	TOLLWAY 3372			5.832		0.2843	0.00502				7.45	376	1471		0.040		0.28	603	0.20	63.36	11.34	11.15
7/7/15	9:18:00 AM	3191	6.92	TB15B-4U	TOLLWAY 3425			6.335		0.2046	0.00687				7.36	363	1094		0.037		0.31	398		41.78	12.17	11.80
8/4/15	7:42:00 AM	1603	7.17	TB15B-4U	TOLLWAY 3479			6.438		0.1691	0.00210				7.43	398	908		0.069		0.36	263	0.31	36.71	14.69	14.77
					min	NA	NA	4.007	NA	0.1691	0.00060	0.018	NA	NA	7.36	251	908	NA	0.021	0.03	0.16	194	0.20	36.71	7.73	7.70
					max	NA	NA	7.078	NA	0.7061	0.00687	0.018	NA	NA	7.56	482	3255	NA	0.078	0.15	0.36	1840	6.78	98.40	21.76	21.99
					mean	NA	NA	5.450	NA	0.3238	0.00279	0.018	NA	NA	7.47	360	1497	NA	0.043	0.09	0.28	637	2.56	57.98	12.91	12.83
9/3/14	8:53:00 AM	8317	6.50	TB15B-4L	TOLLWAY 2932			9.803		6.2977		0.035	0.0348	7.03	318	4771		0.045		0.25	2624	0.16	206.20	2.10	2.46	
9/30/14	9:40:00 AM	8181	6.58	TB15B-4L	TOLLWAY 2988			9.658		6.2855		0.034	0.0117	7.11	326	4367		0.121	0.67		2675		201.74	2.88	3.63	
10/29/14	10:06:00 AM	8159	6.69	TB15B-4L	TOLLWAY 3053			10.207		5.9617		0.022		7.27	314	4360		0.087	1.11	0.27	2661		200.17	2.79	2.42	
12/3/14	8:54:00 AM	8233	7.11	TB15B-4L	TOLLWAY 3086			9.455		6.0948		0.034	0.0377	7.31	305	4852		0.027			2641	0.07	203.95	3.34	1.74	
1/14/15	12:51:00 PM	8322	6.97	TB15B-4L	TOLLWAY 3134			8.865		6.0191			0.0391	7.36	298	4463		0.038			2642	0.20	215.92	2.01	1.83	
2/11/15	11:51:00 AM	8179	6.98	TB15B-4L	TOLLWAY 3178			8.293		6.4260		0.027	0.0353	7.48	294	4469		0.033			2659	0.16	216.06	2.20	1.85	
3/18/15	9:08:00 AM	1555	7.03	TB15B-4L	TOLLWAY 3229			8.427		6.2184		0.022	0.0353	7.42	295	4307		0.028			2689	0.19	220.41	1.91	1.76	
4/14/15	9:15:00 AM	8068	6.84	TB15B-4L	TOLLWAY 3270			8.142		6.2618		0.024	0.0310	7.20	293	4710		0.028		0.12	2681	0.15	216.67	1.74	1.91	
5/12/15	8:36:00 AM	8153	6.81	TB15B-4L	TOLLWAY 3318			8.159		6.2048		0.022	0.0248	7.21	298	4897		0.036		0.22	2858	0.09	210.12	1.86	1.94	
6/9/15	8:09:00 AM	8101	6.47	TB15B-4L	TOLLWAY 3371			8.574		6.1536		0.019	0.0393	7.21	301	4519		0.040			2604	0.07	211.05	1.84	1.85	
7/7/15	9:02:00 AM	8084	6.15	TB15B-4L	TOLLWAY 3424		0.135	8.784		5.8542		0.039	0.0349	7.18	293	4737		0.028			2587	0.11	207.94	2.10	1.77	
8/4/15	7:24:00 AM	8085	6.63	TB15B-4L	TOLLWAY 3477			9.525		6.1486		0.034	0.0316	7.15	305	4722		0.045	0.06	0.23	2701	0.10	213.51	1.92	1.49	
					min	NA	0.135	8.142	NA	5.8542	NA	0.019	NA	0.0117	7.03	293	4307	NA	0.027	0.06	0.12	2587	0.07	200.17	1.74	1.49
					max	NA	0.135	10.207	NA	6.4260	NA	0.039	NA	0.0393	7.48	326	4897	NA	0.121	1.11	0.27	2858	0.20	220.41	3.34	3.63
					mean	NA	0.135	8.991	NA	6.1605	NA	0.028	NA	0.0323	7.24	303	4598	NA	0.046	0.61	0.22	2669	0.13	210.31	2.22	2.05



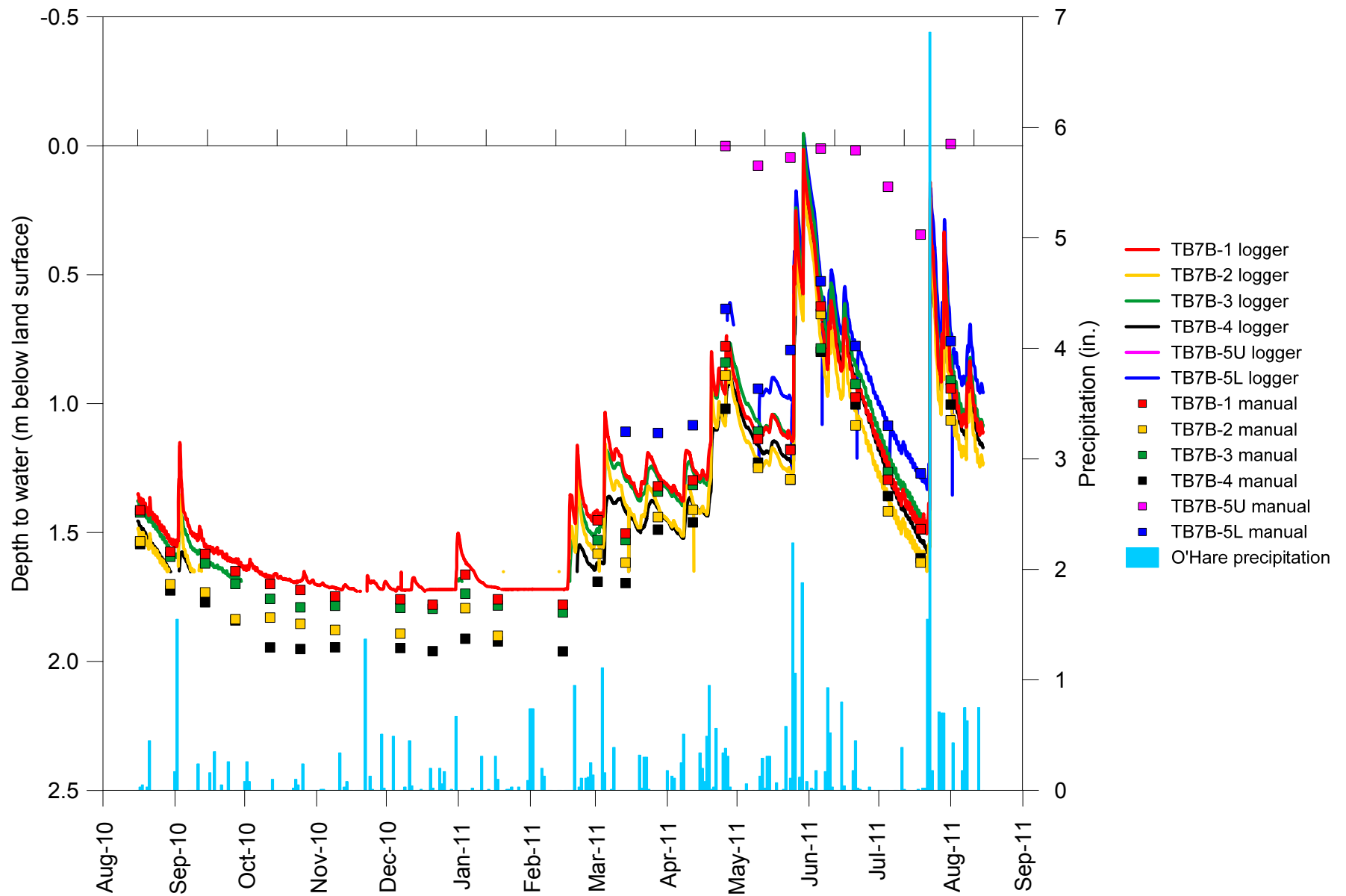
Appendix C-1. Pre-construction groundwater elevations at bioswale TB7B



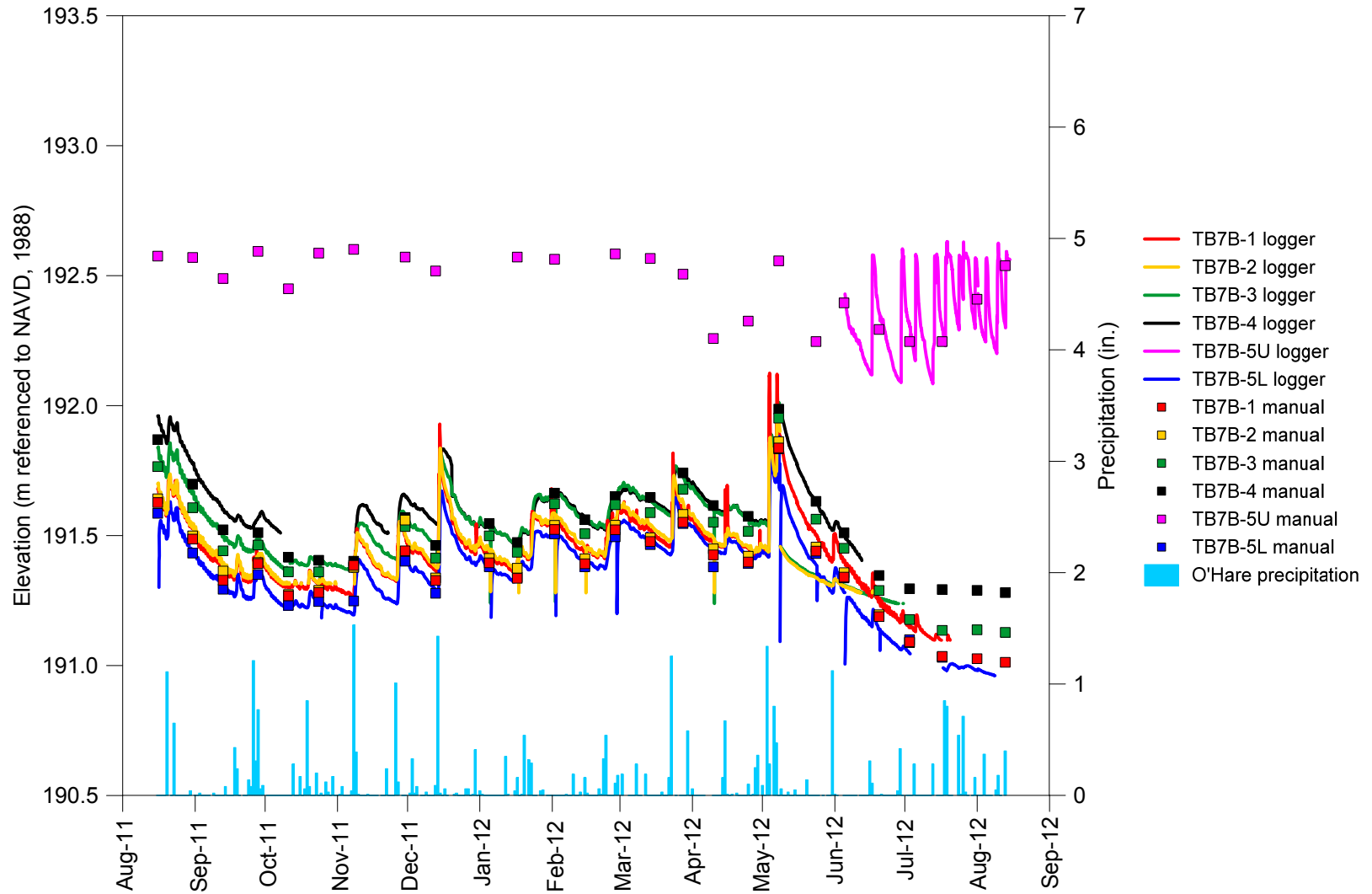
Appendix C-2. Pre-construction depths to groundwater at bioswale TB7B



Appendix C-3. Year 1 groundwater elevations at bioswale TB7B

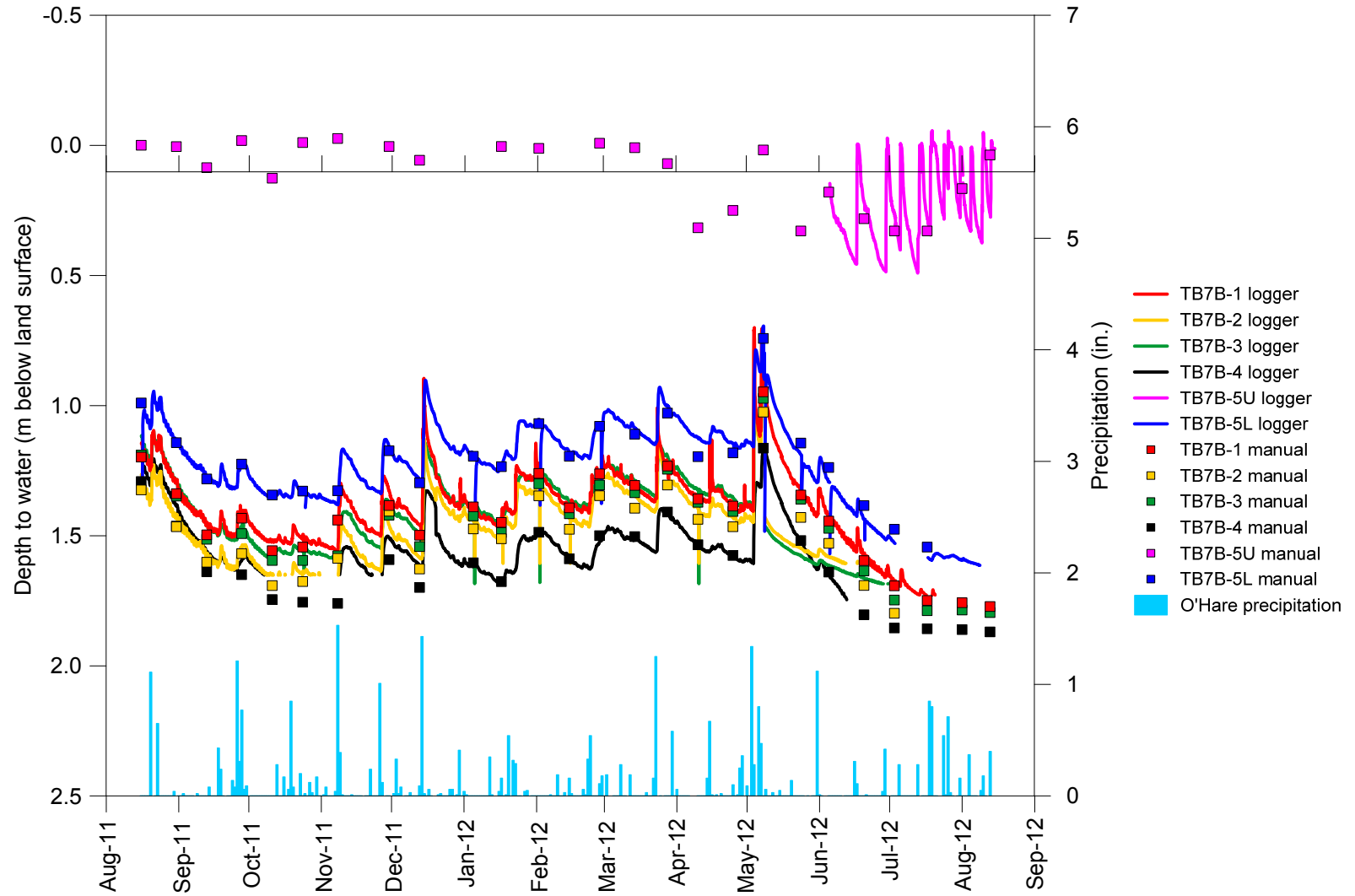


Appendix C-4. Year 1 depths to groundwater at bioswale TB7B

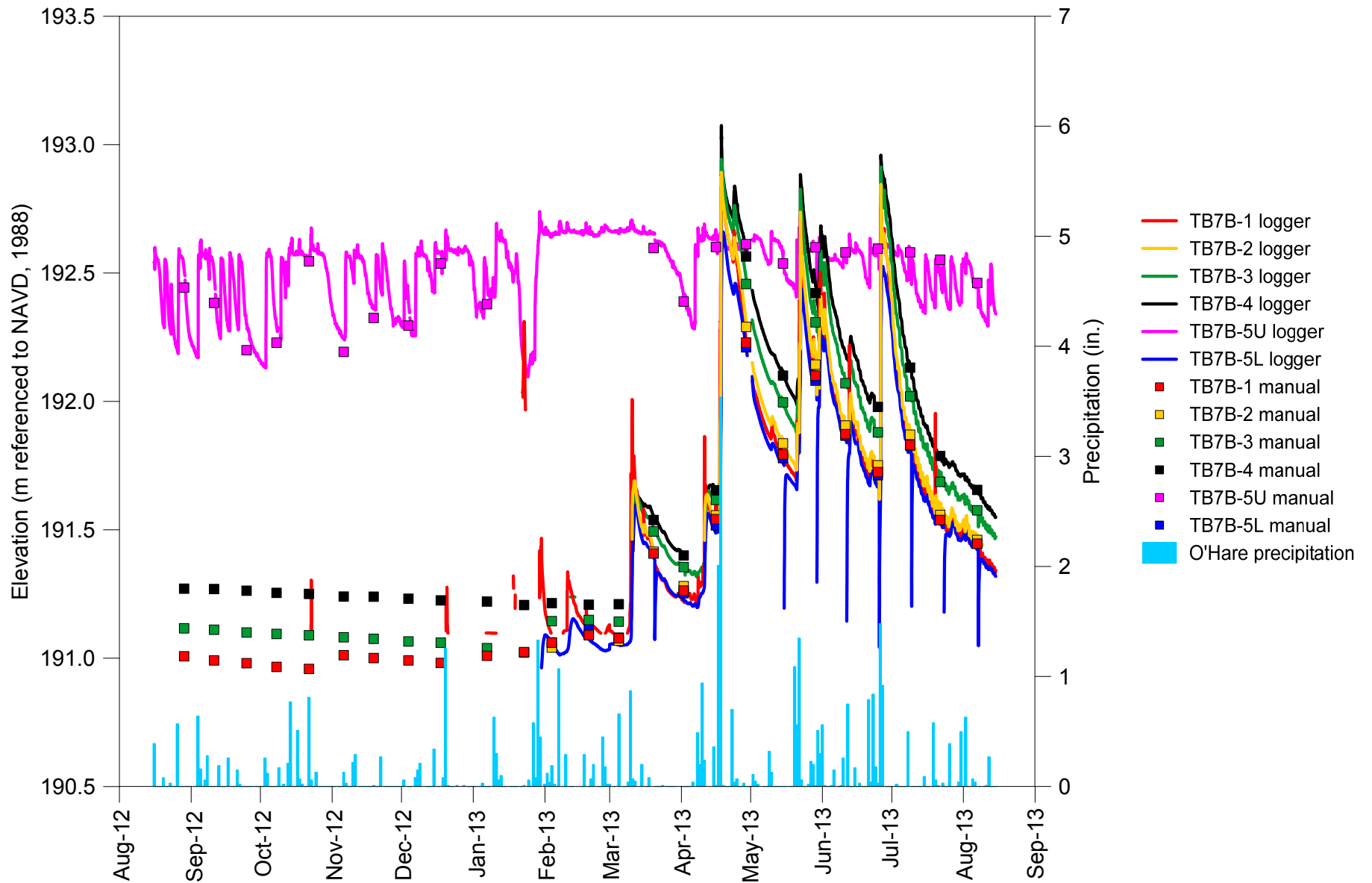


Appendix C-5. Year 2 groundwater elevations at bioswale TB7B

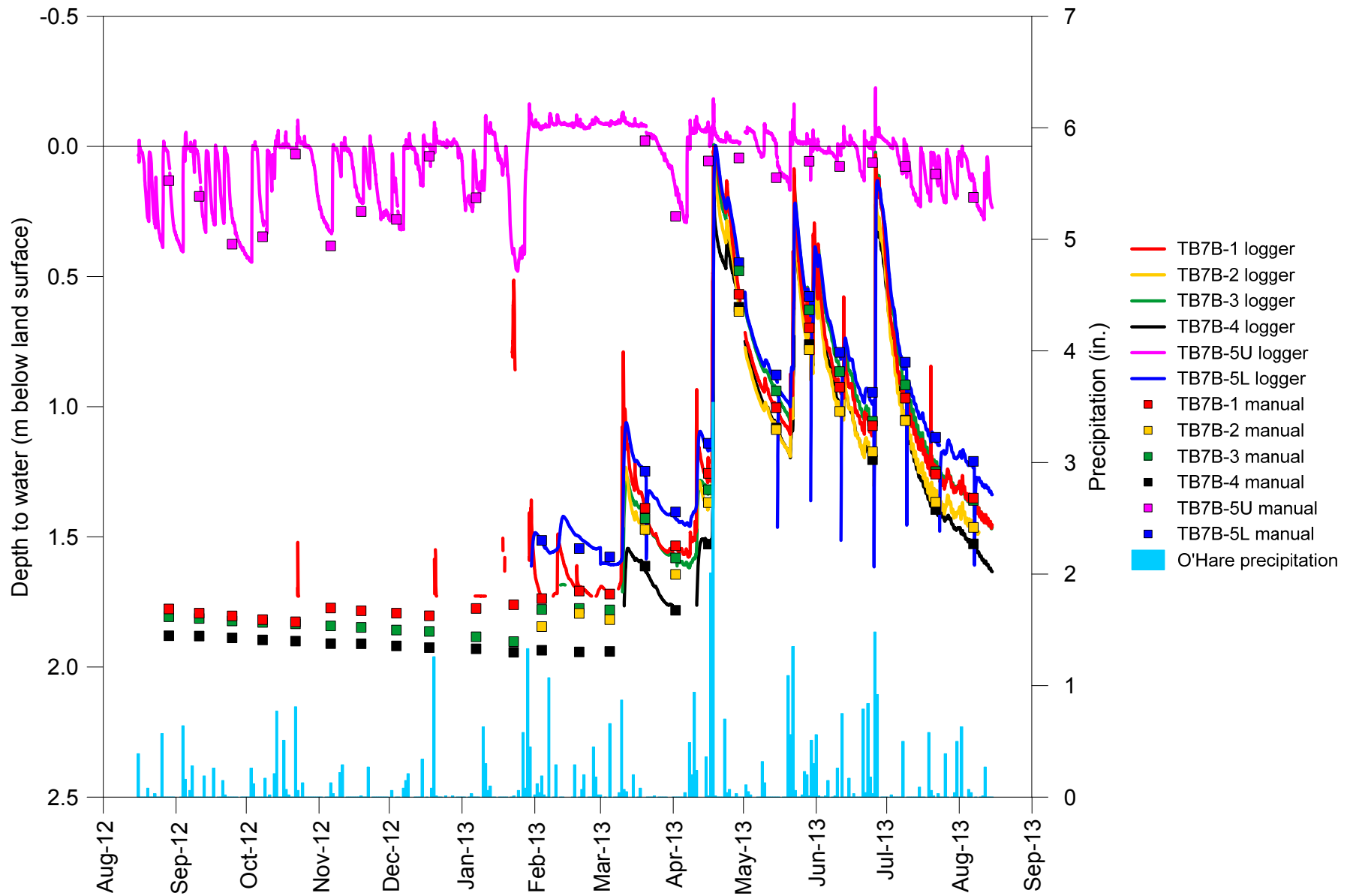




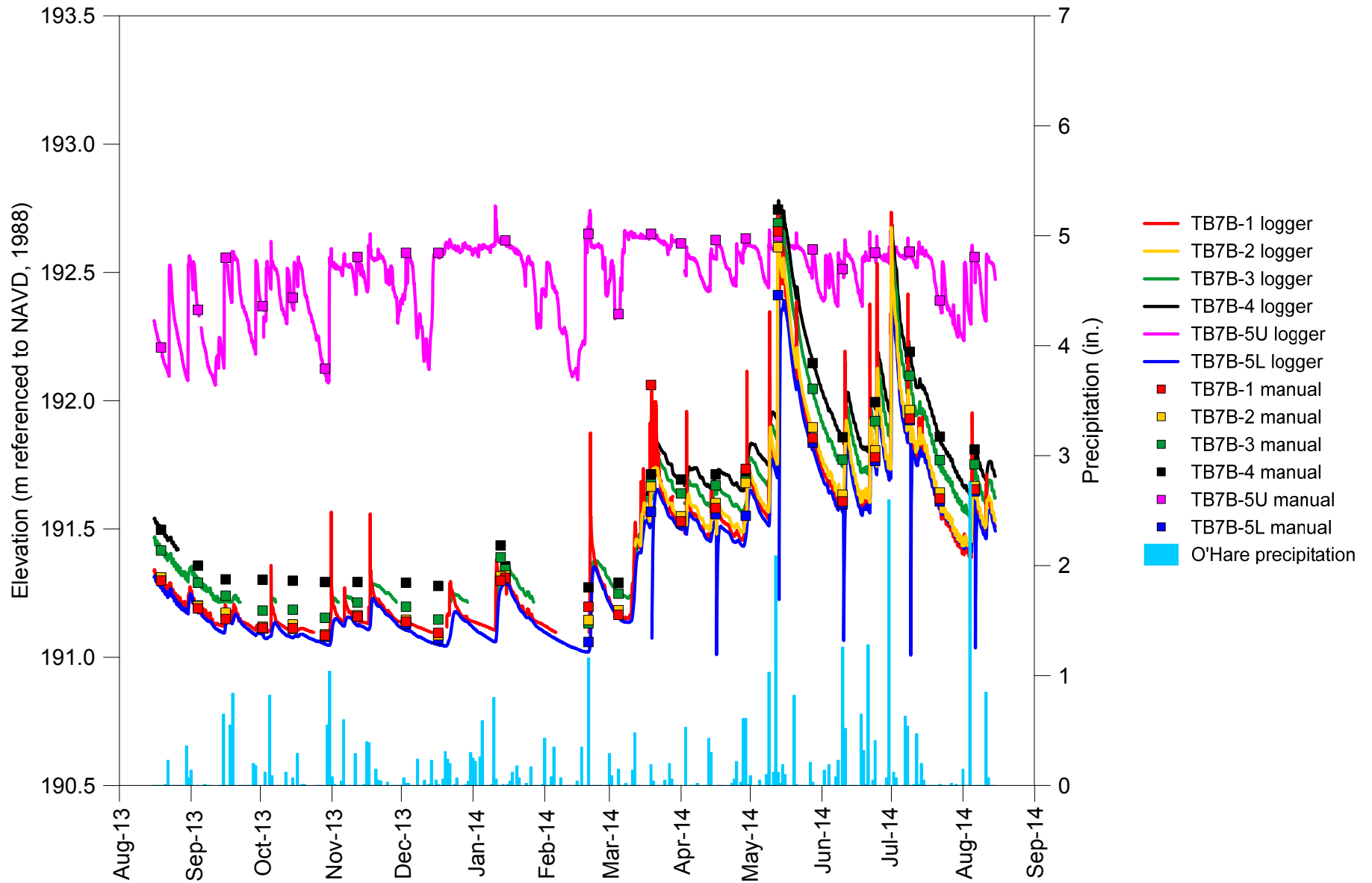
Appendix C-6. Year 2 depths to groundwater at bioswale TB7B



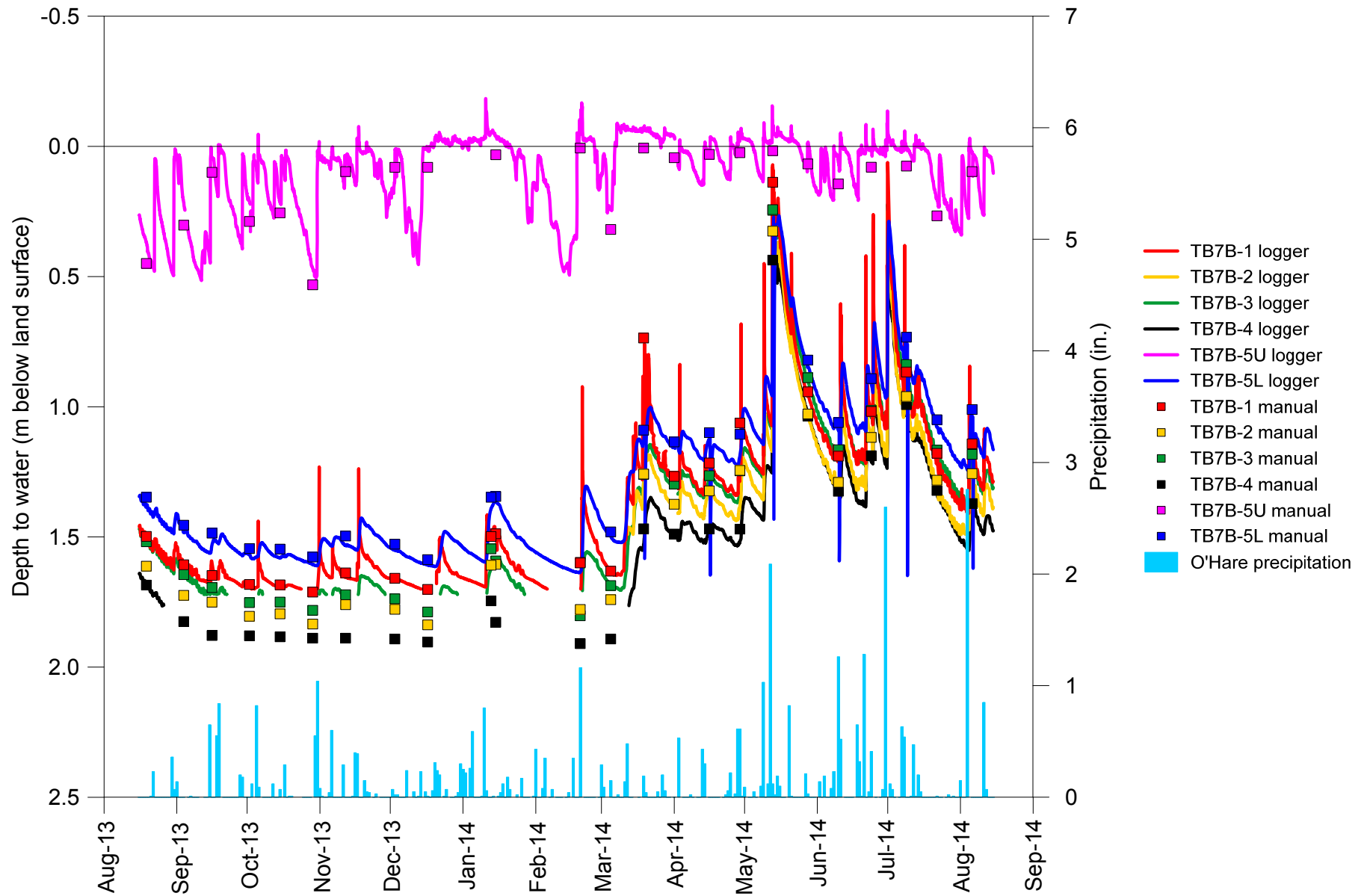
Appendix C-7. Year 3 groundwater elevations at bioswale TB7B



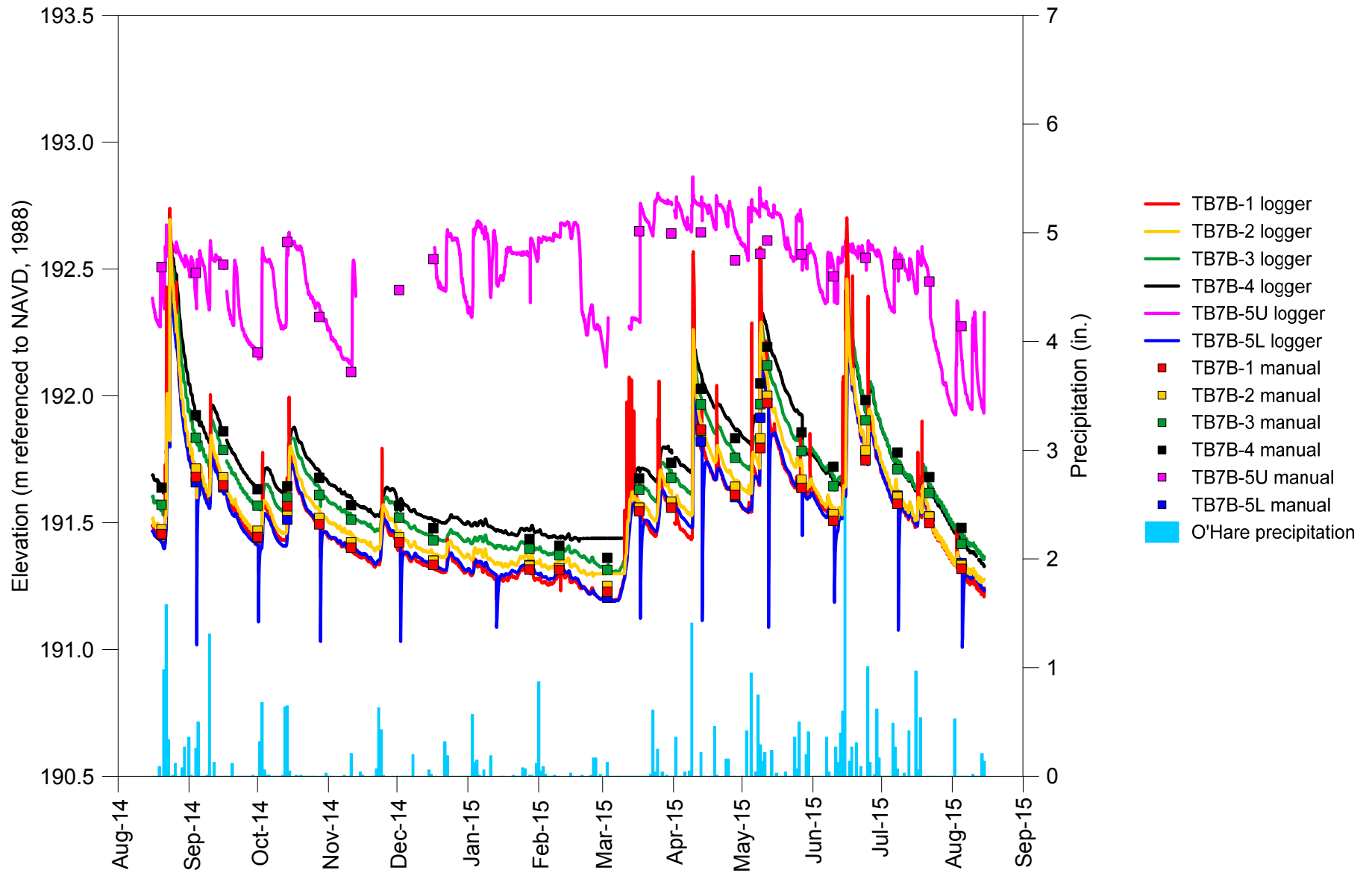
Appendix C-8. Year 3 depths to groundwater at bioswale TB7B



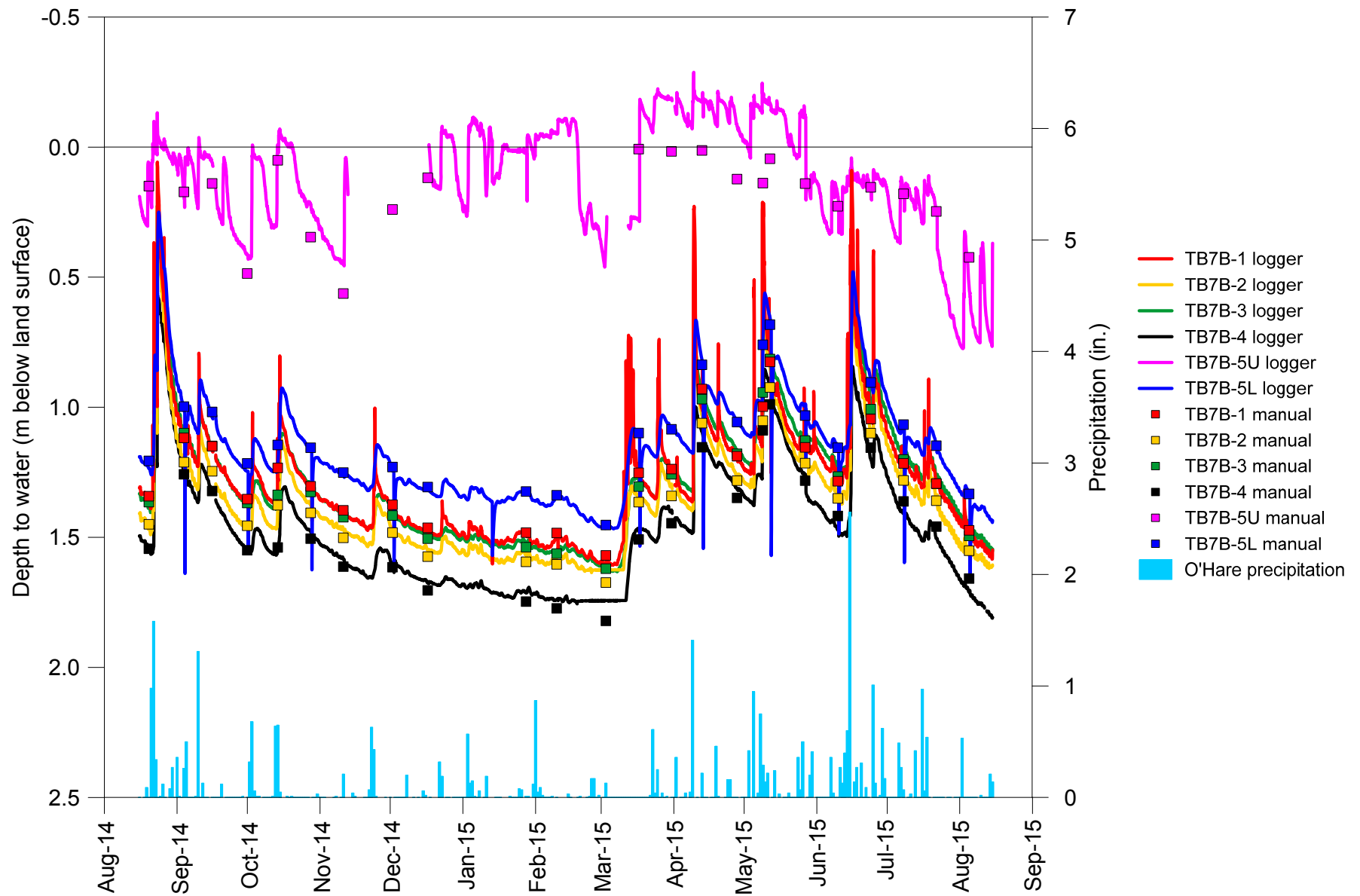
Appendix C-9. Year 4 groundwater elevations at bioswale TB7B



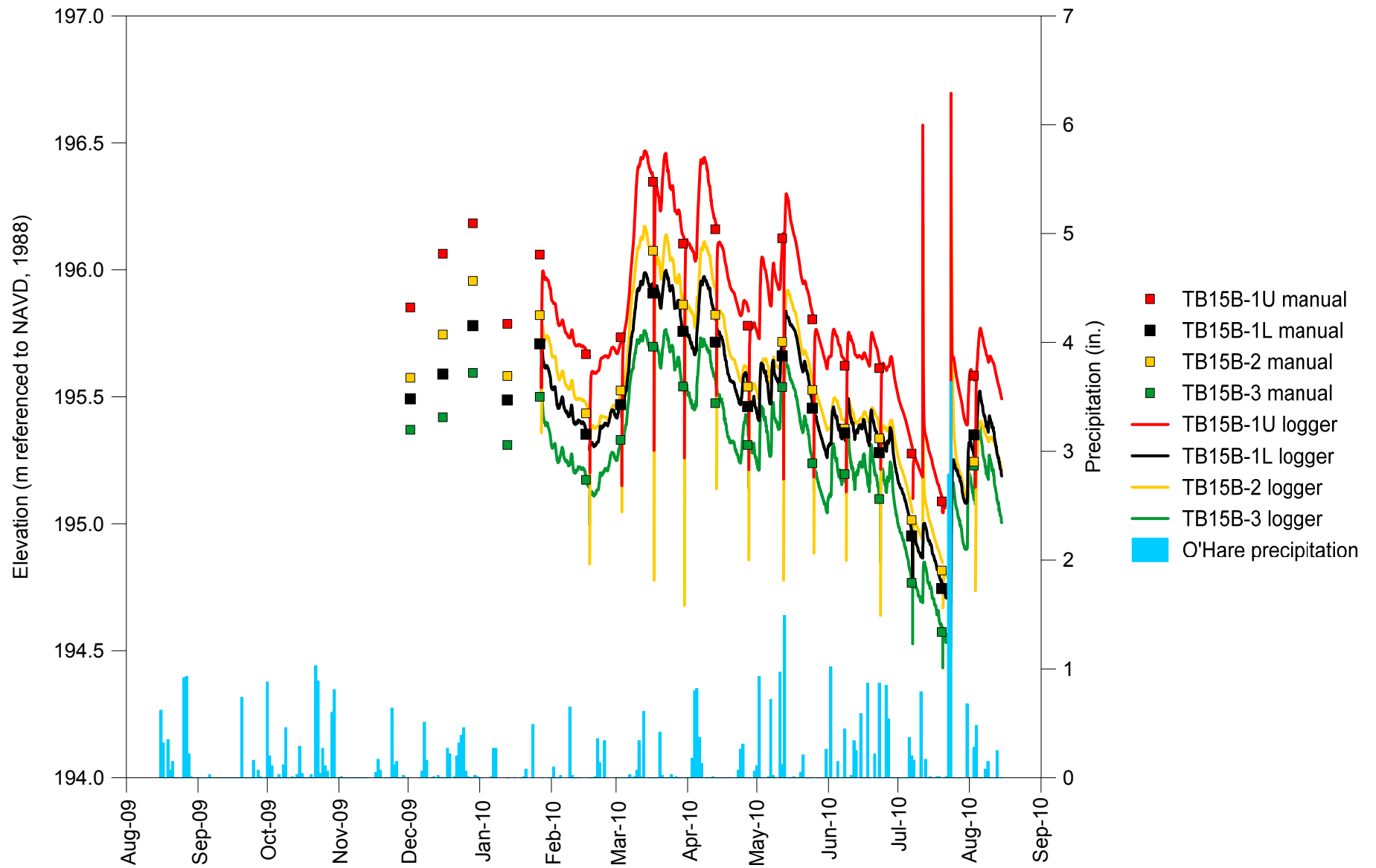
Appendix C-10. Year 4 depths to groundwater at bioswale TB7B



Appendix C-11. Year 5 groundwater elevations at bioswale TB7B

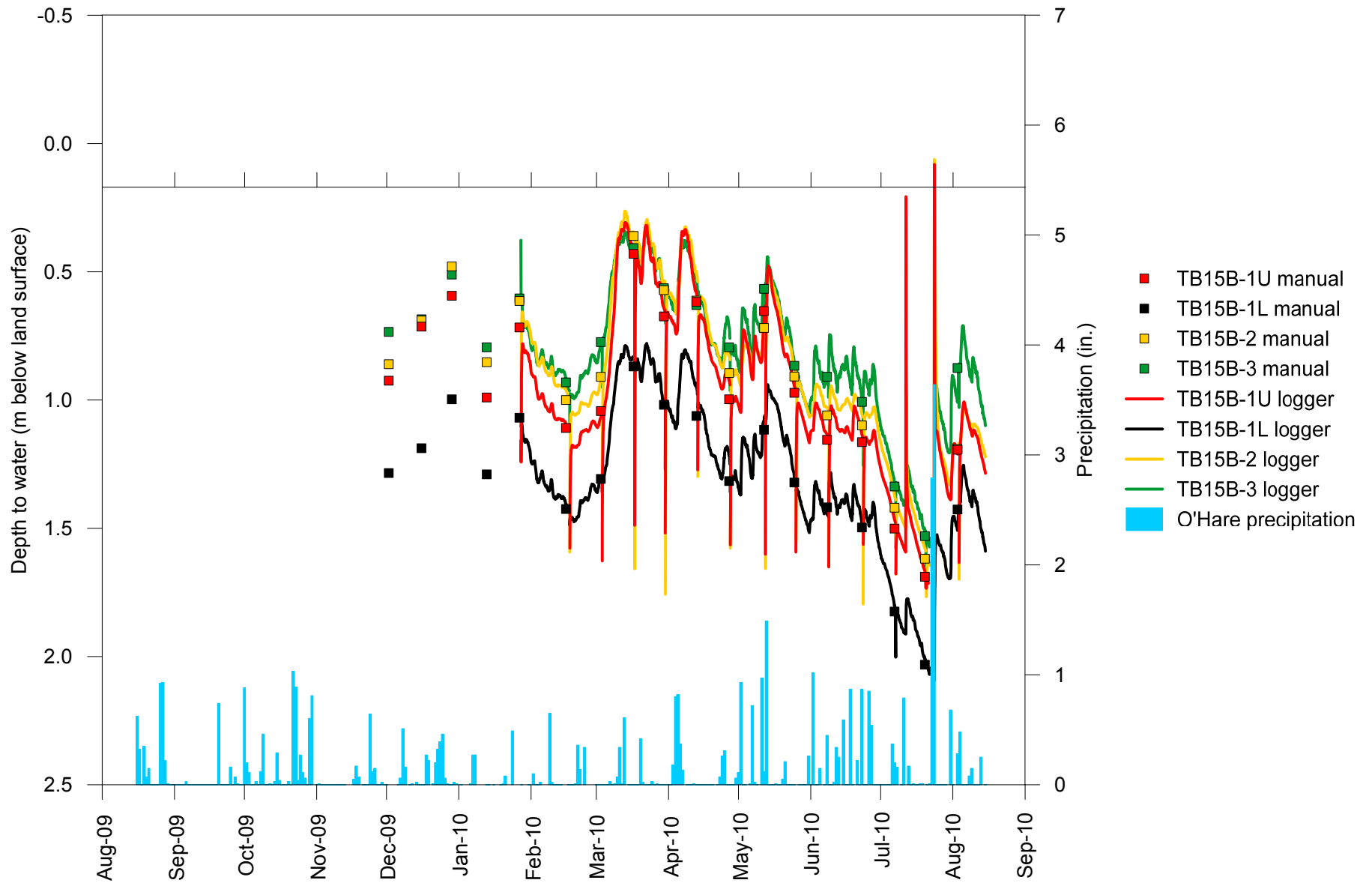


Appendix C-12. Year 5 depths to groundwater at bioswale TB7B

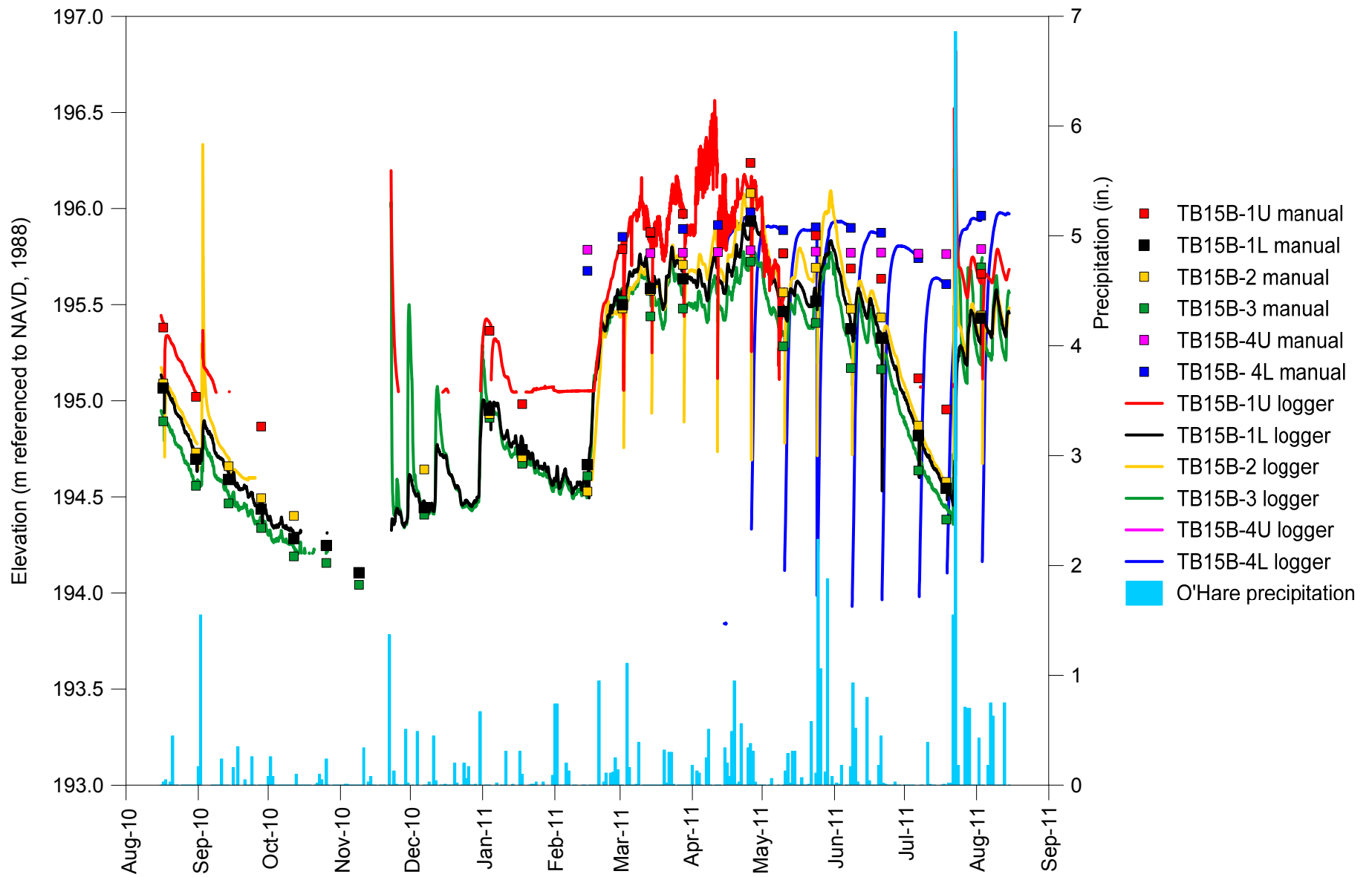


Appendix C-13. Pre-construction groundwater elevations at bioswale TB15B

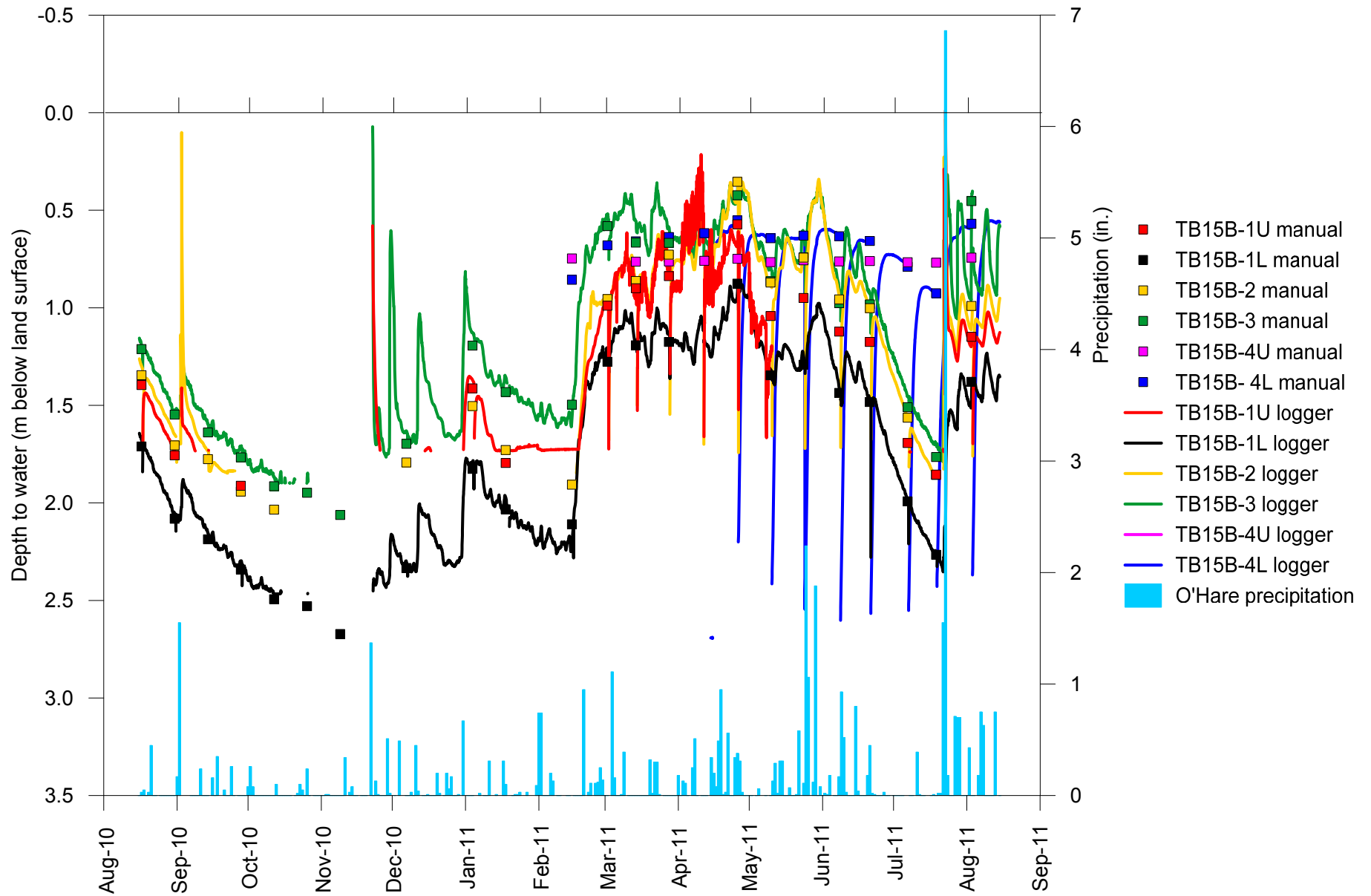




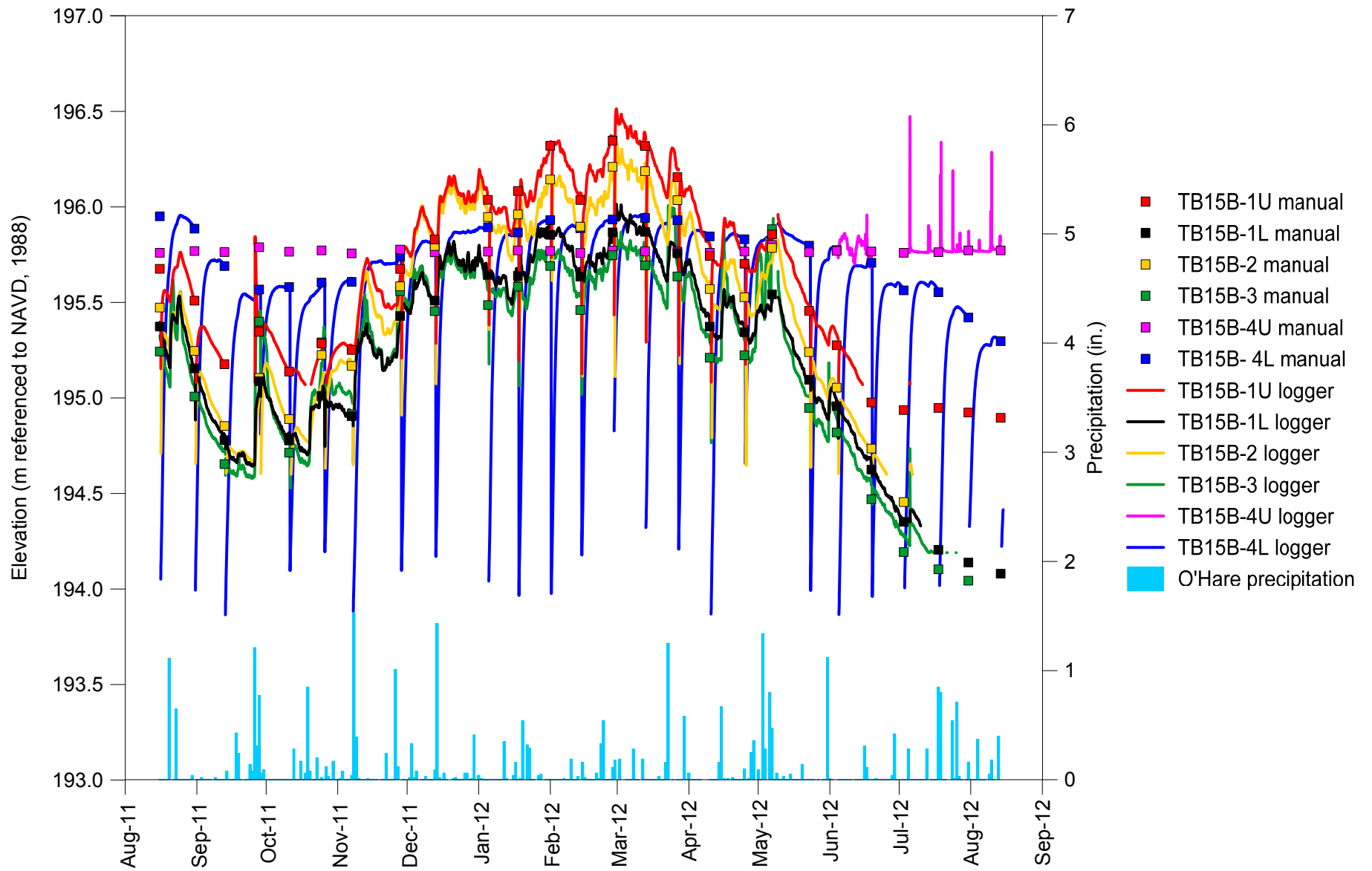
Appendix C-14. Pre-construction depths to groundwater at bioswale TB15B



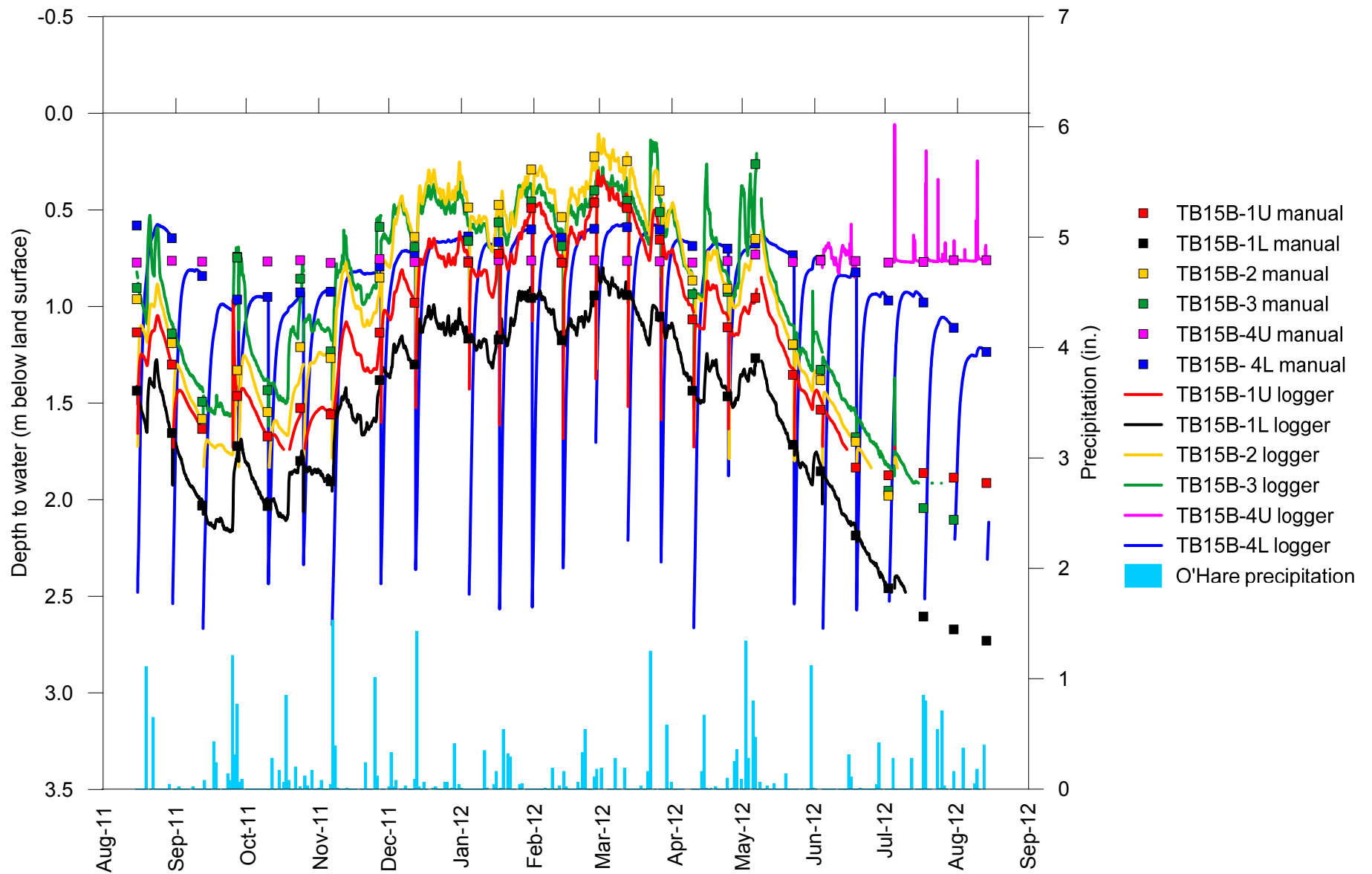
Appendix C-15. Year 1 groundwater elevations at bioswale TB15B



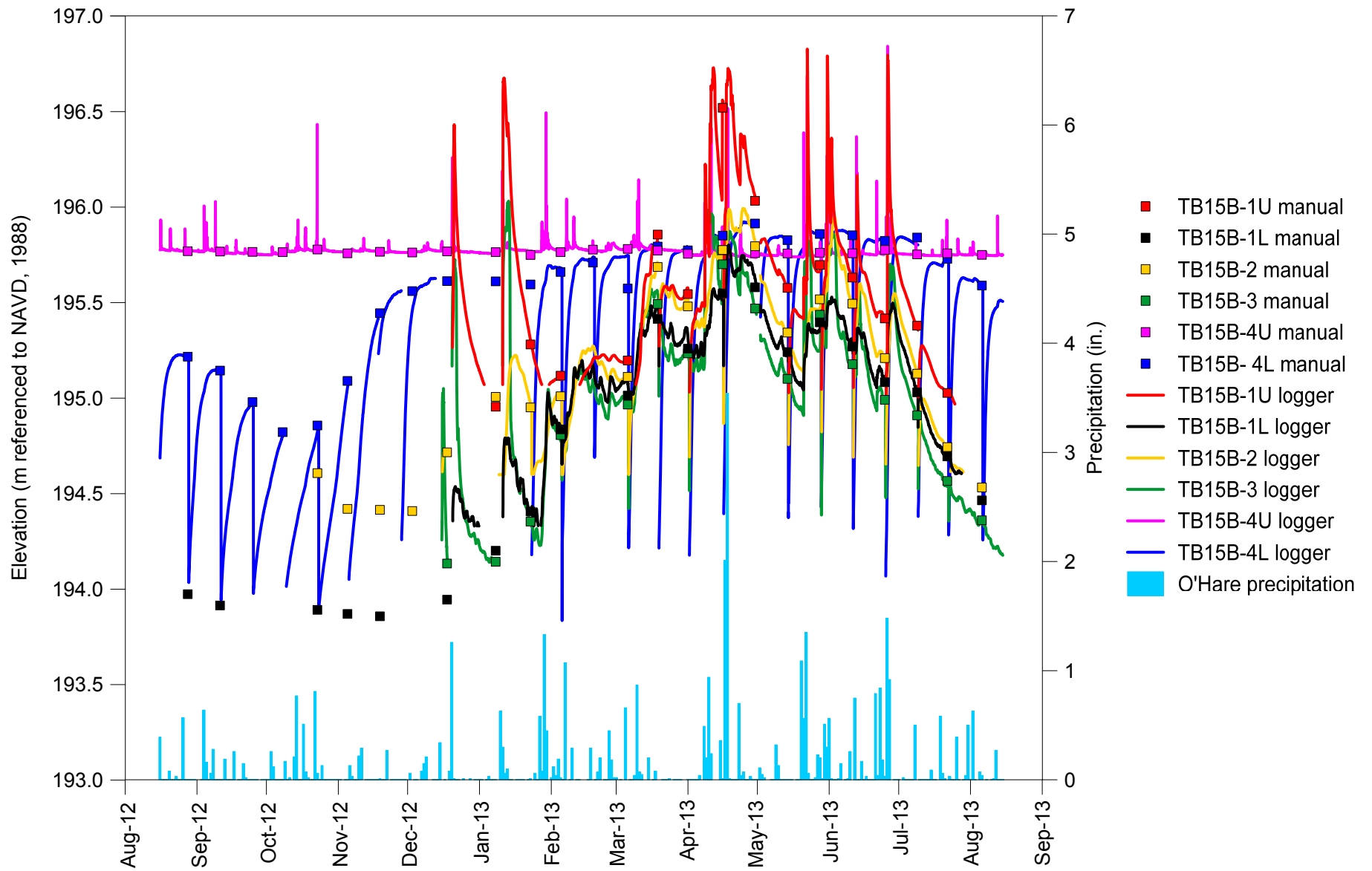
Appendix C-16. Year 1 depths to groundwater at bioswale TB15B



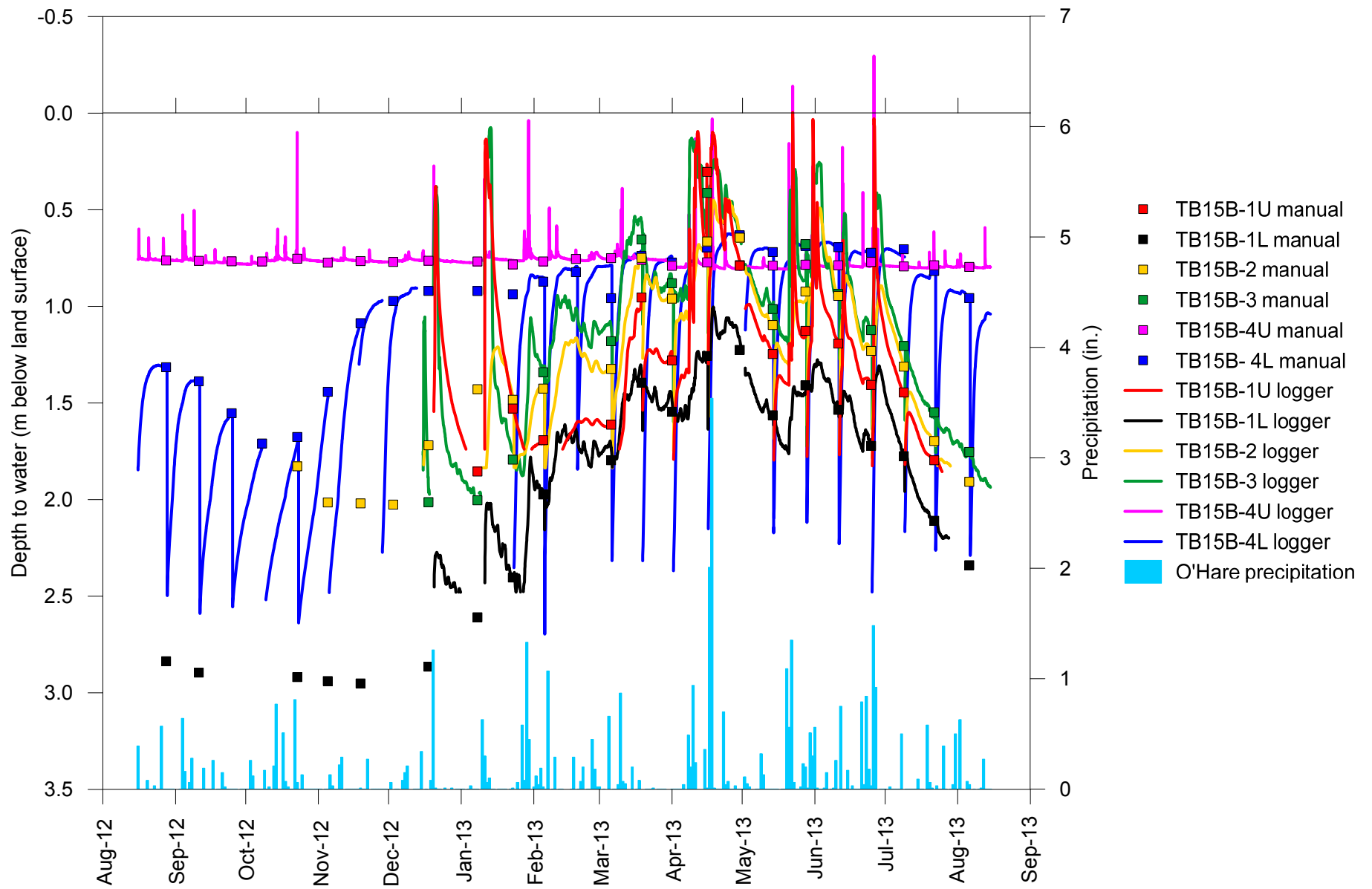
Appendix C-17. Year 2 groundwater elevations at bioswale TB15B



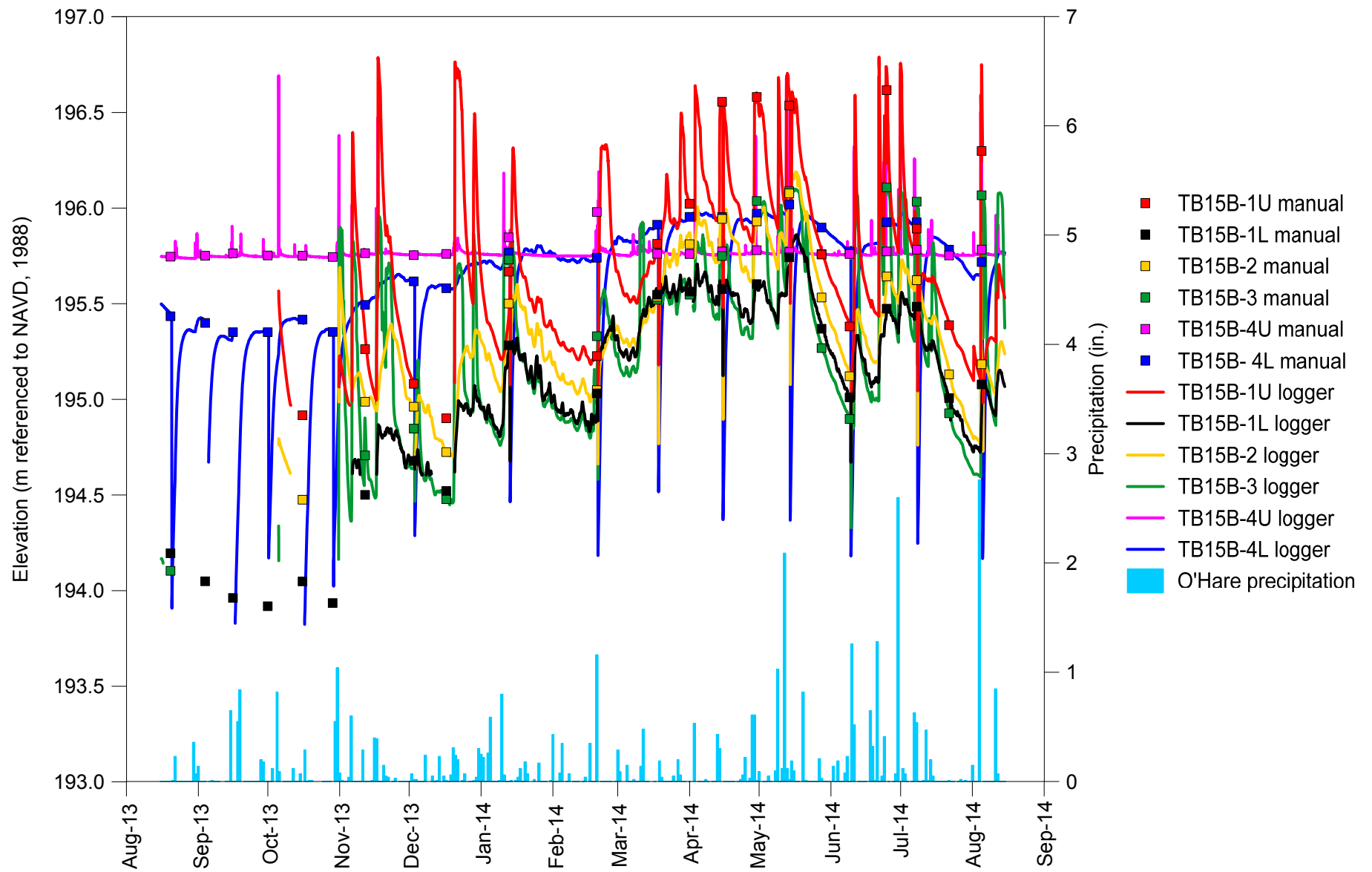
Appendix C-18. Year 2 depths to groundwater at bioswale TB15B



Appendix C-19. Year 3 groundwater elevations at bioswale TB15B

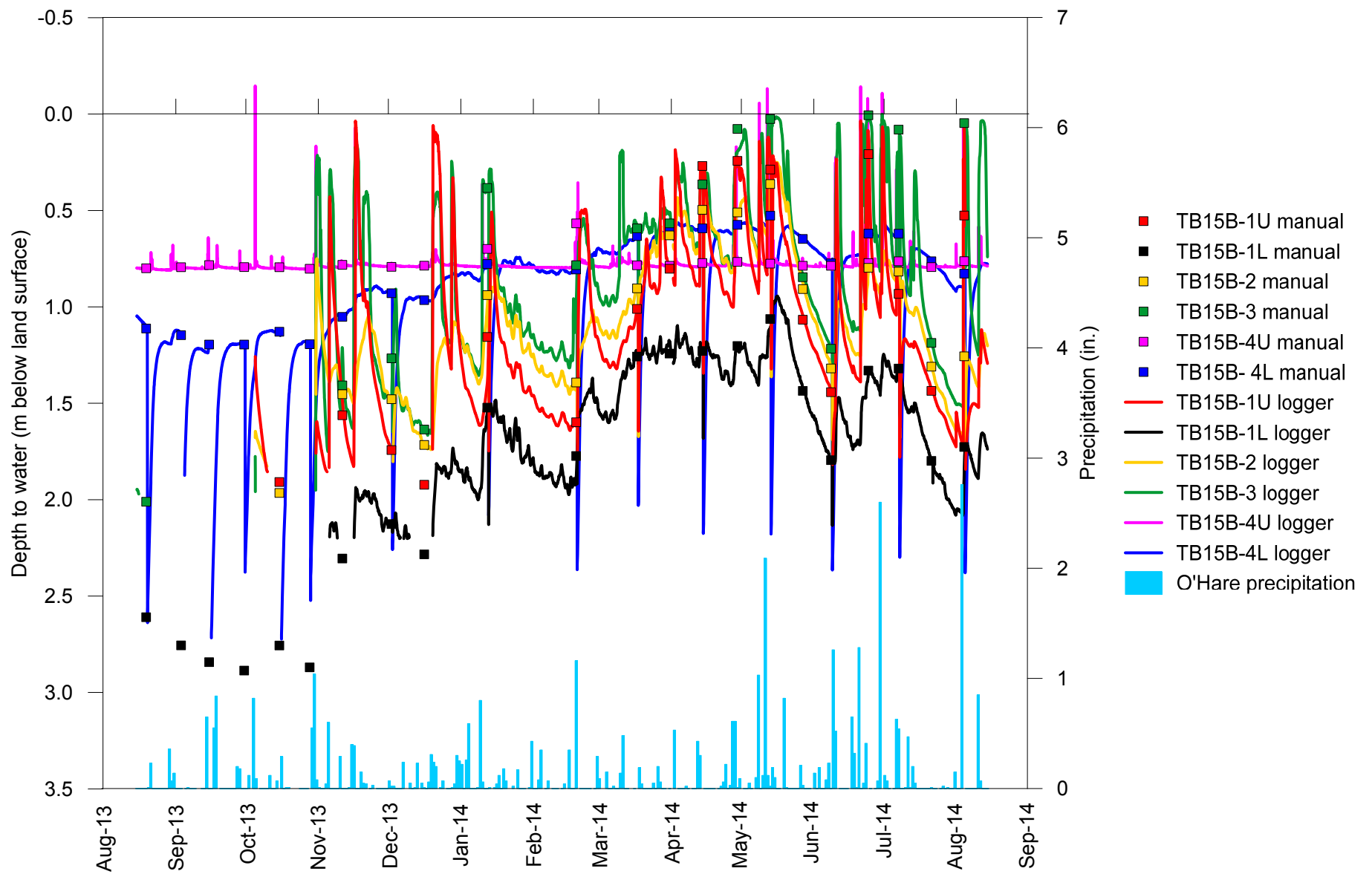


Appendix C-20. Year 3 depths to groundwater at bioswale TB15B

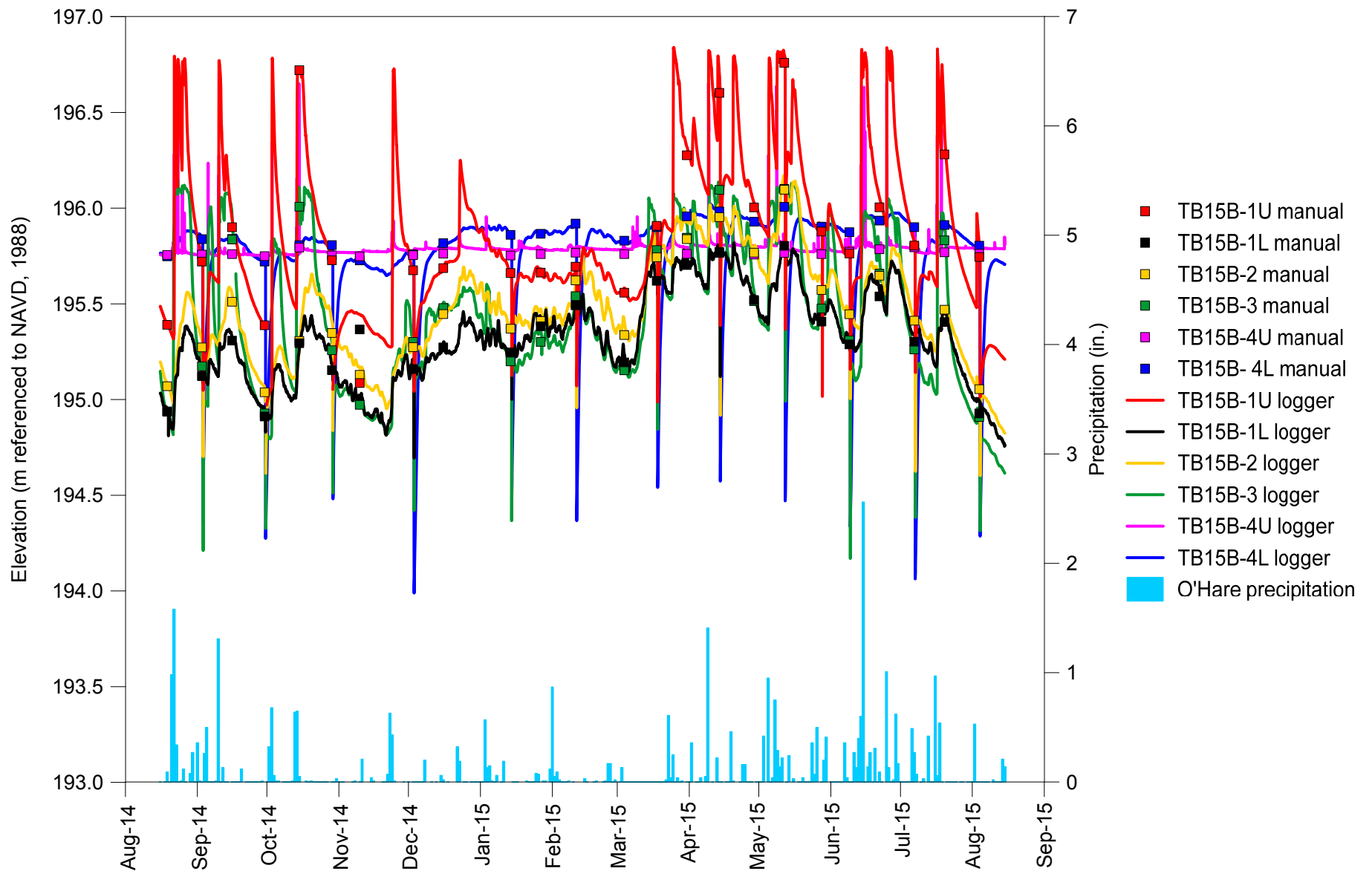


Appendix C-21. Year 4 groundwater elevations at bioswale TB15B

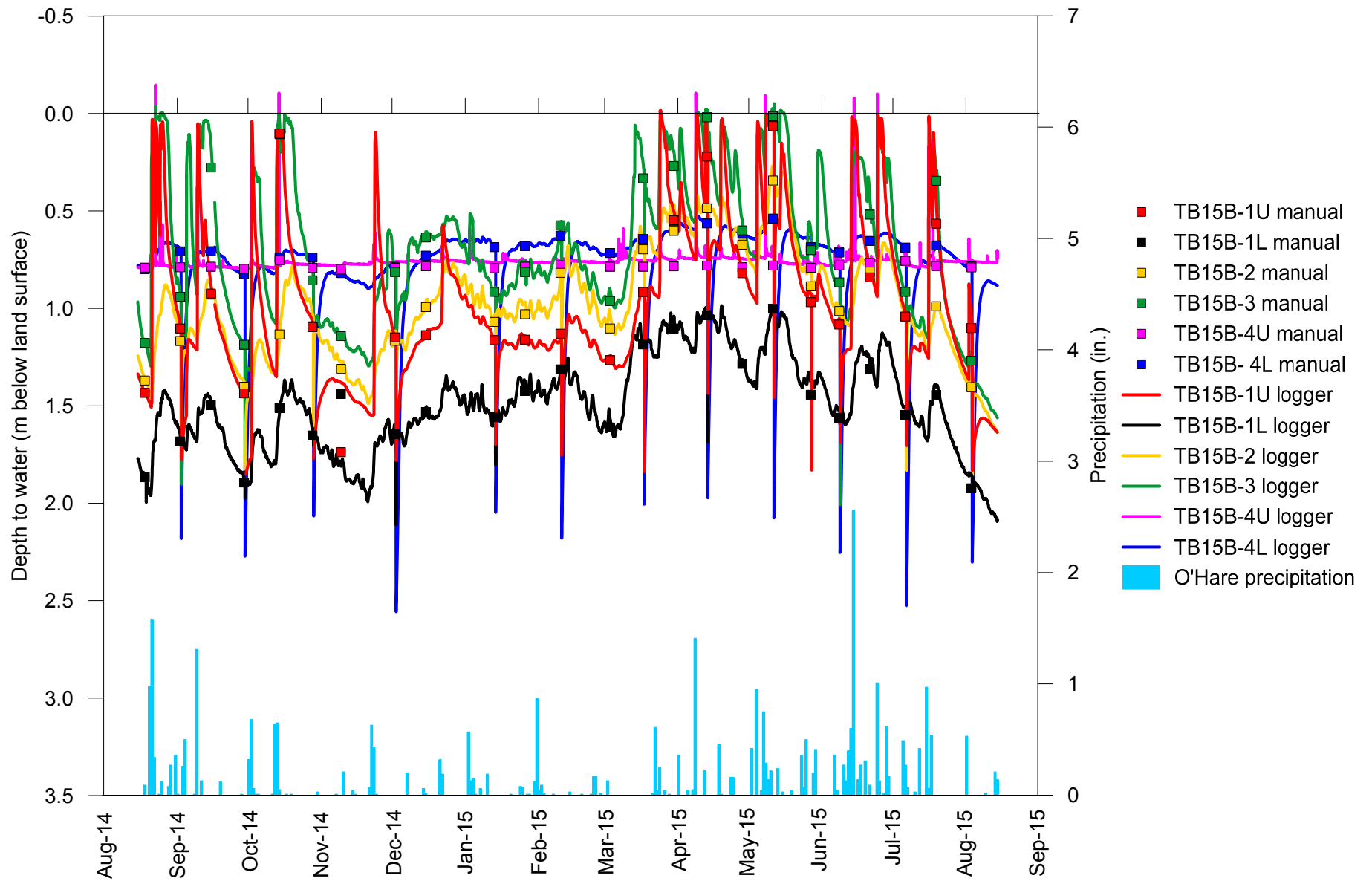




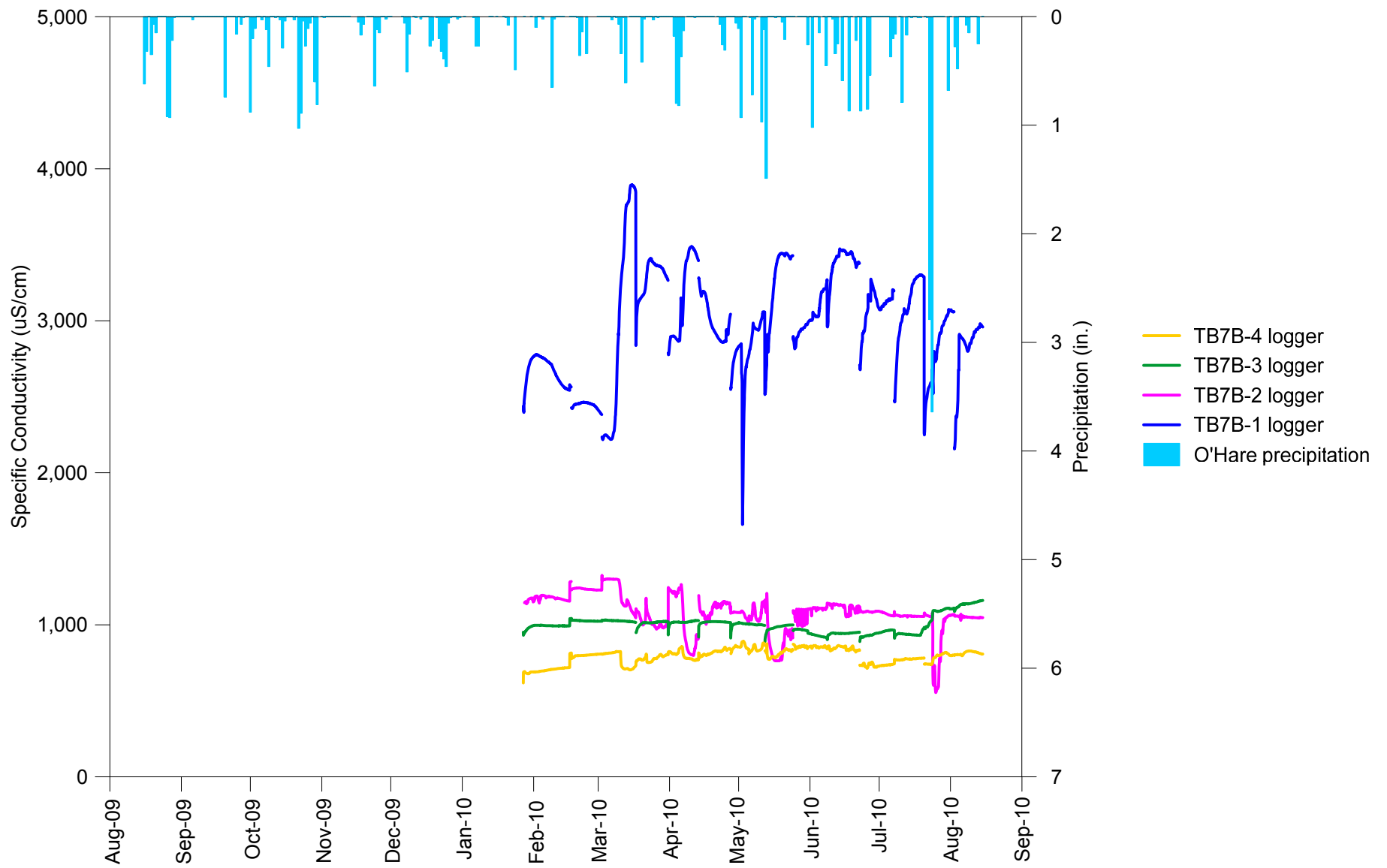
Appendix C-22. Year 4 depths to groundwater at bioswale TB15B



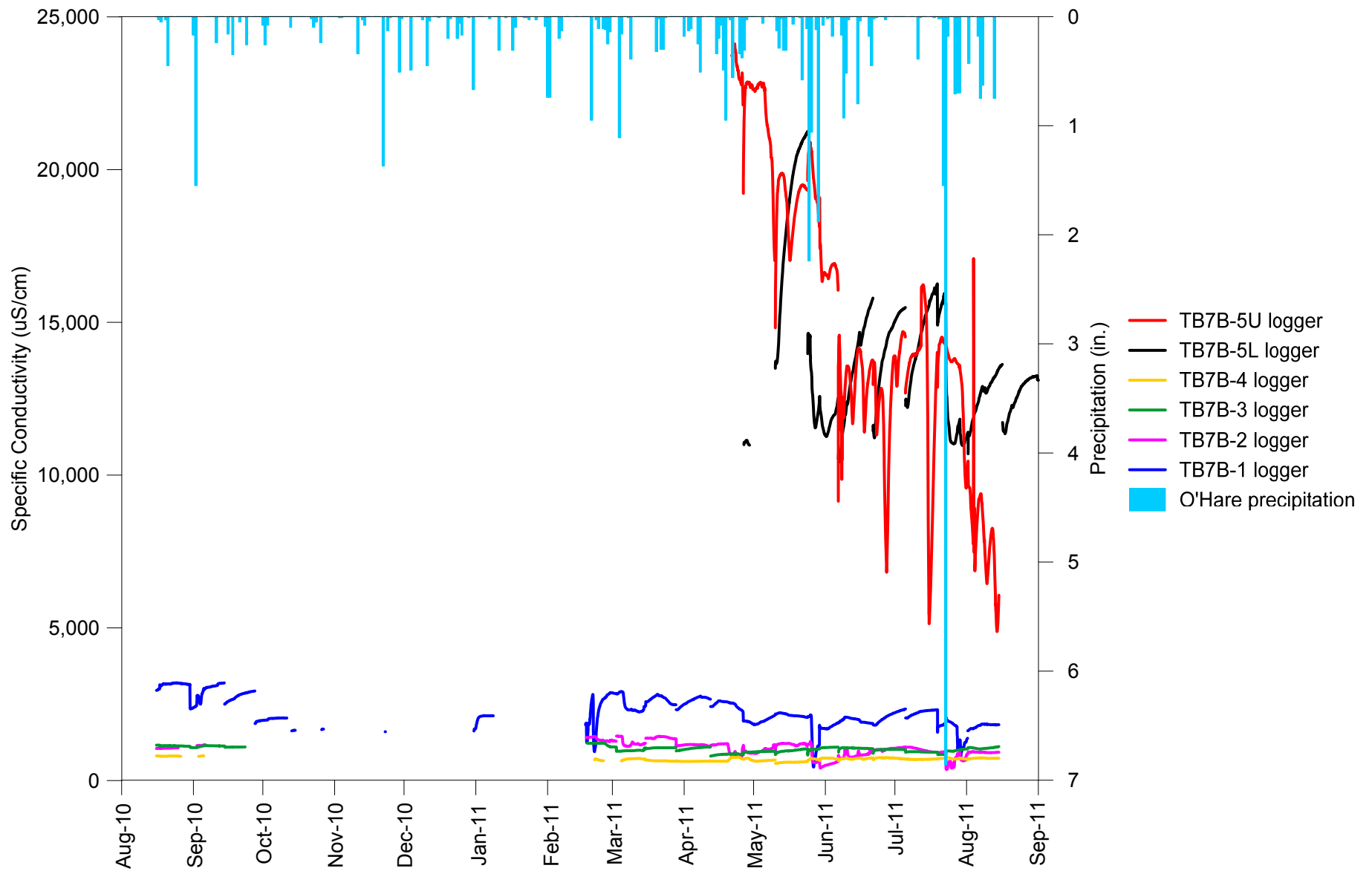
Appendix C-23. Year 5 groundwater elevations at bioswale TB15B



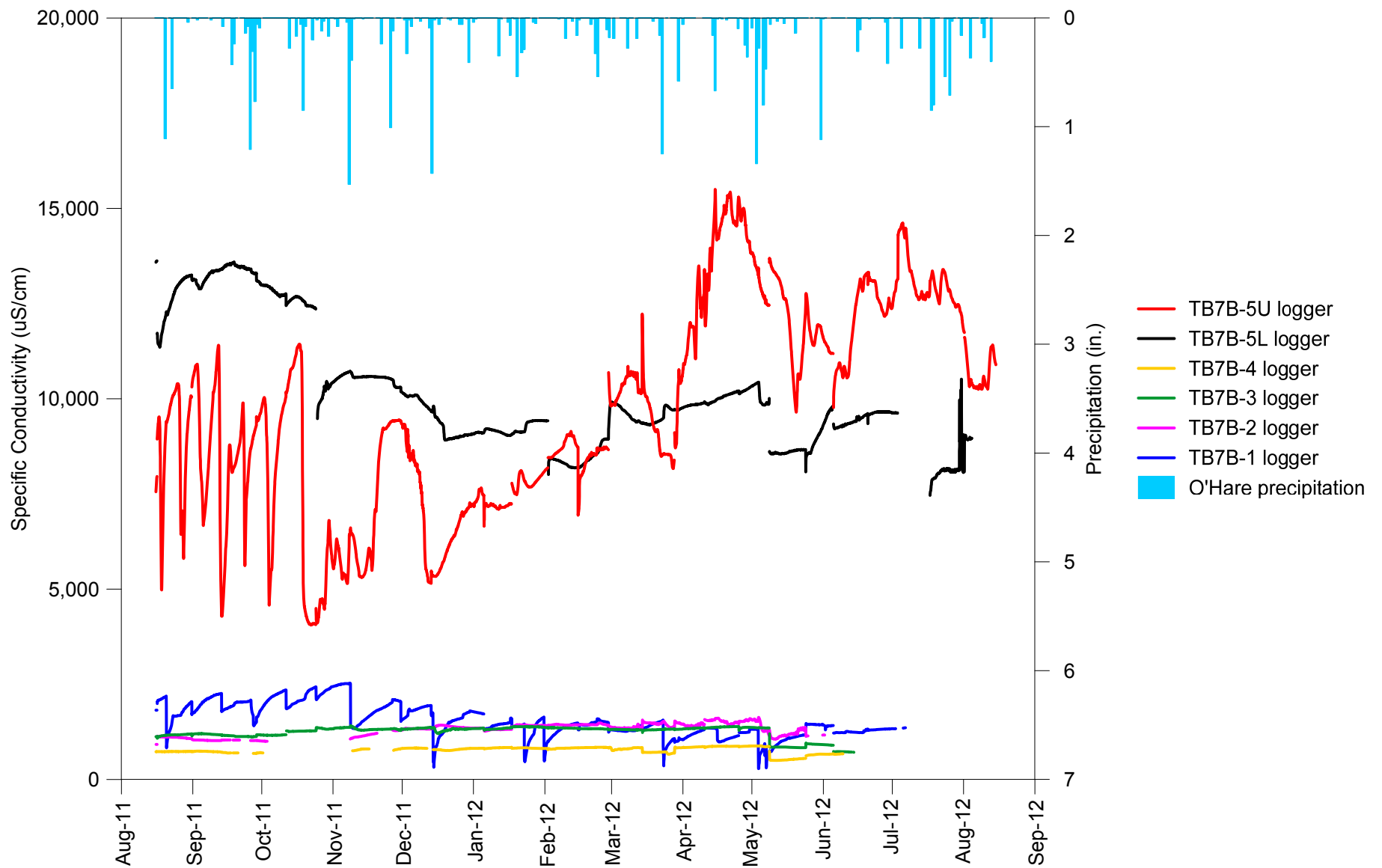
Appendix C-24. Year 5 depths to groundwater at bioswale TB15B



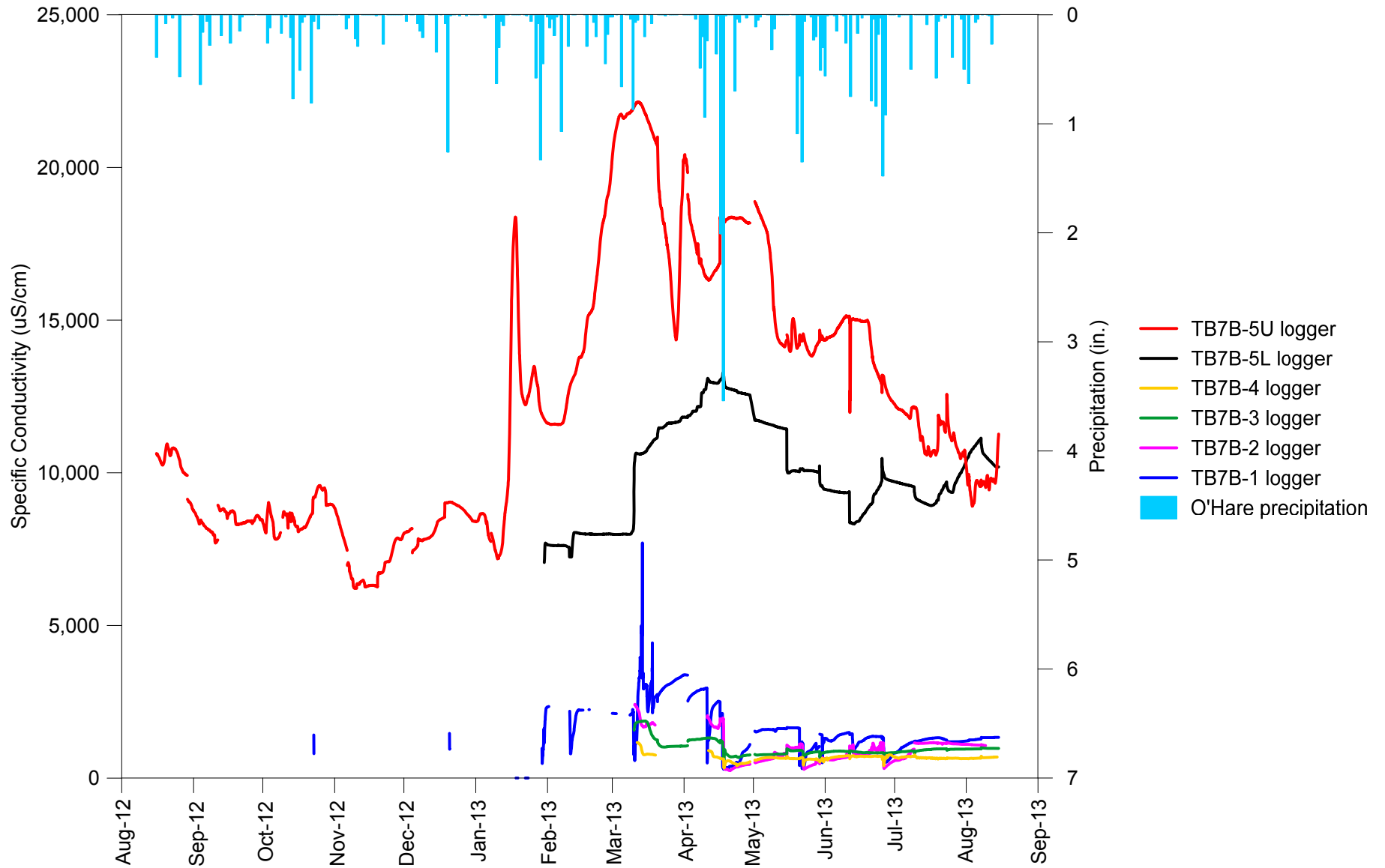
Appendix C-25. Pre-construction specific conductivity of groundwater at bioswale TB7B



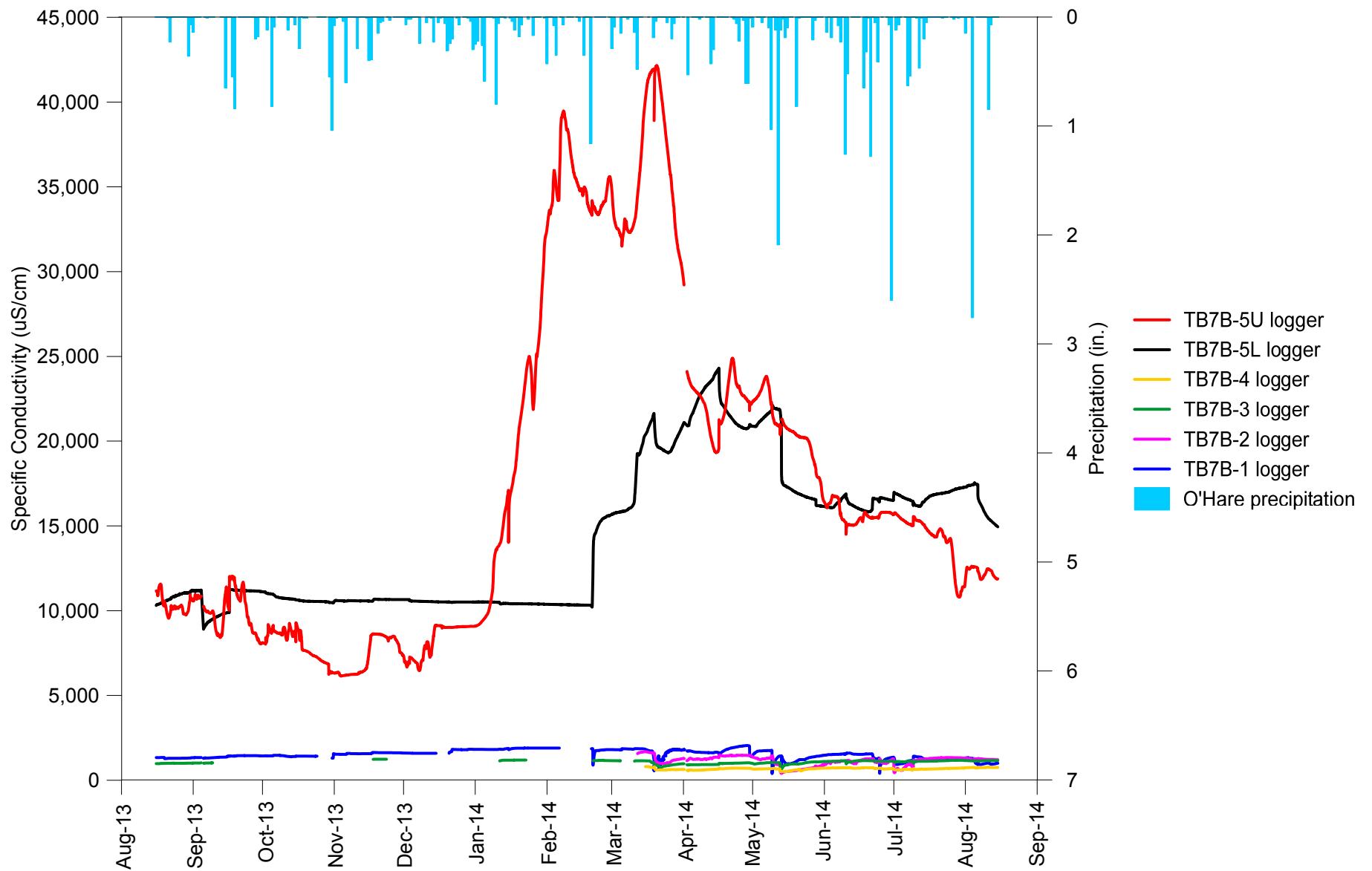
Appendix C-26. Year 1 specific conductivity of groundwater at bioswale TB7B



Appendix C-27. Year 2 specific conductivity of groundwater at bioswale TB7B

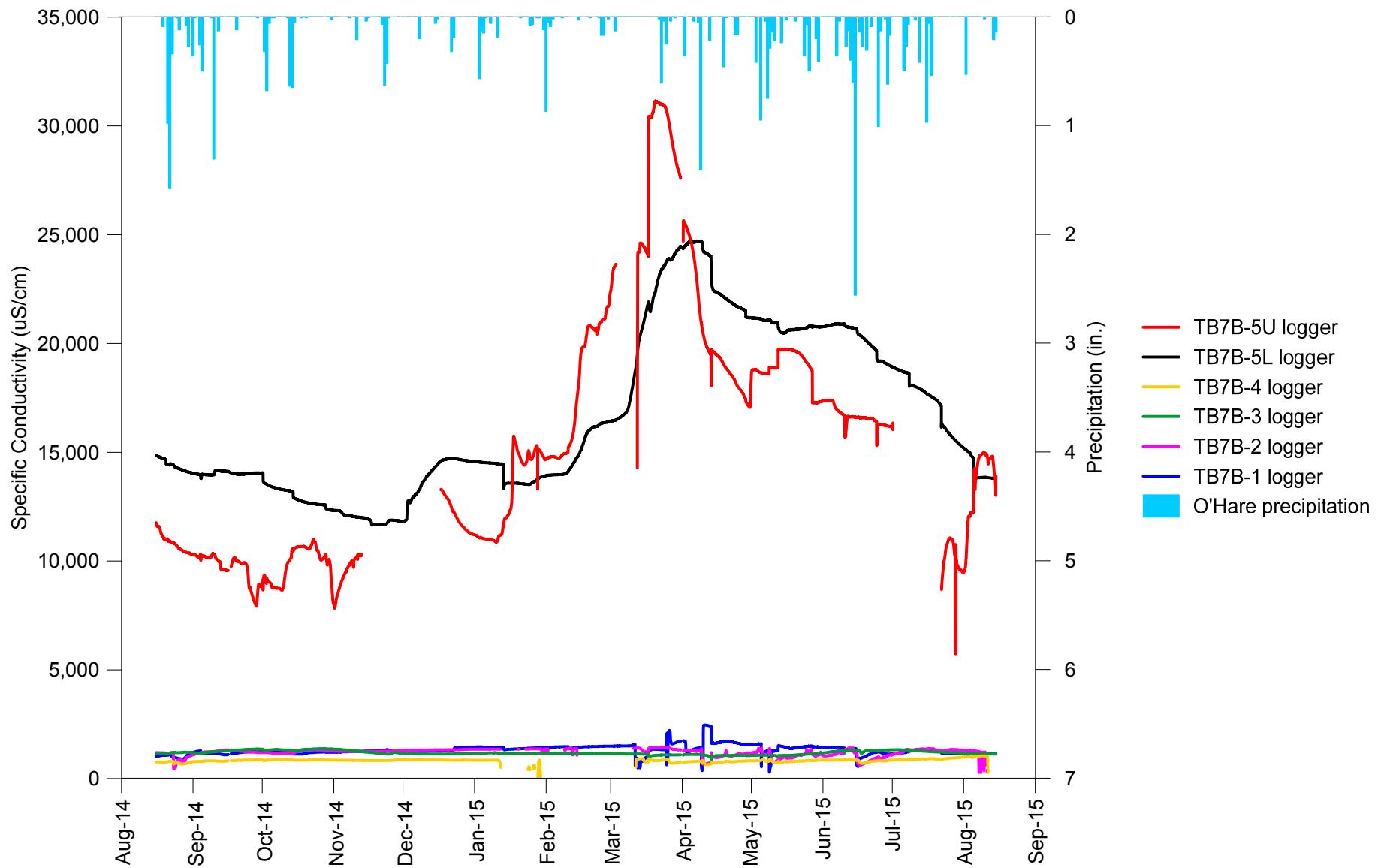


Appendix C-28. Year 3 specific conductivity of groundwater at bioswale TB7B

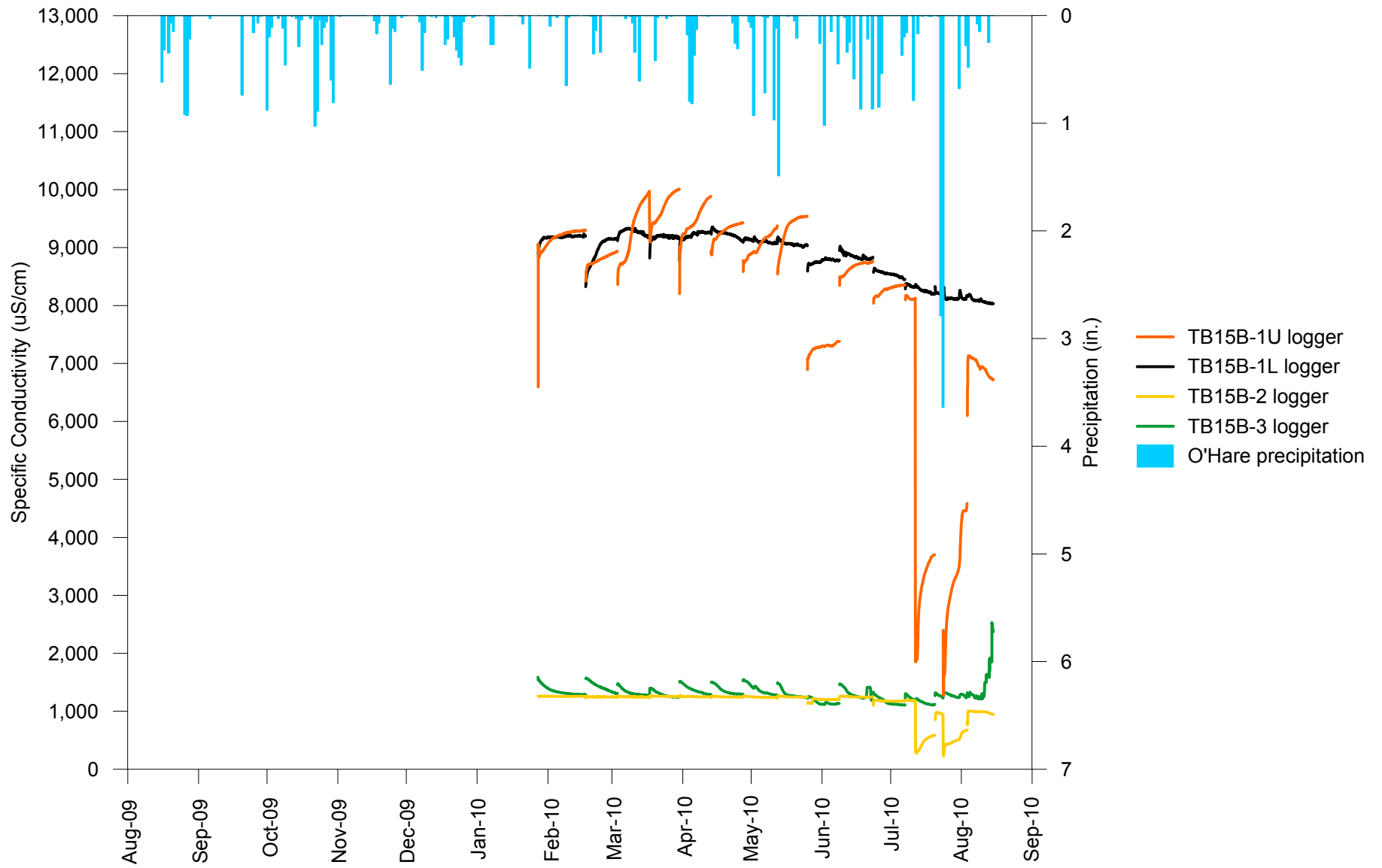


Appendix C-29. Year 4 specific conductivity of groundwater at bioswale TB7B

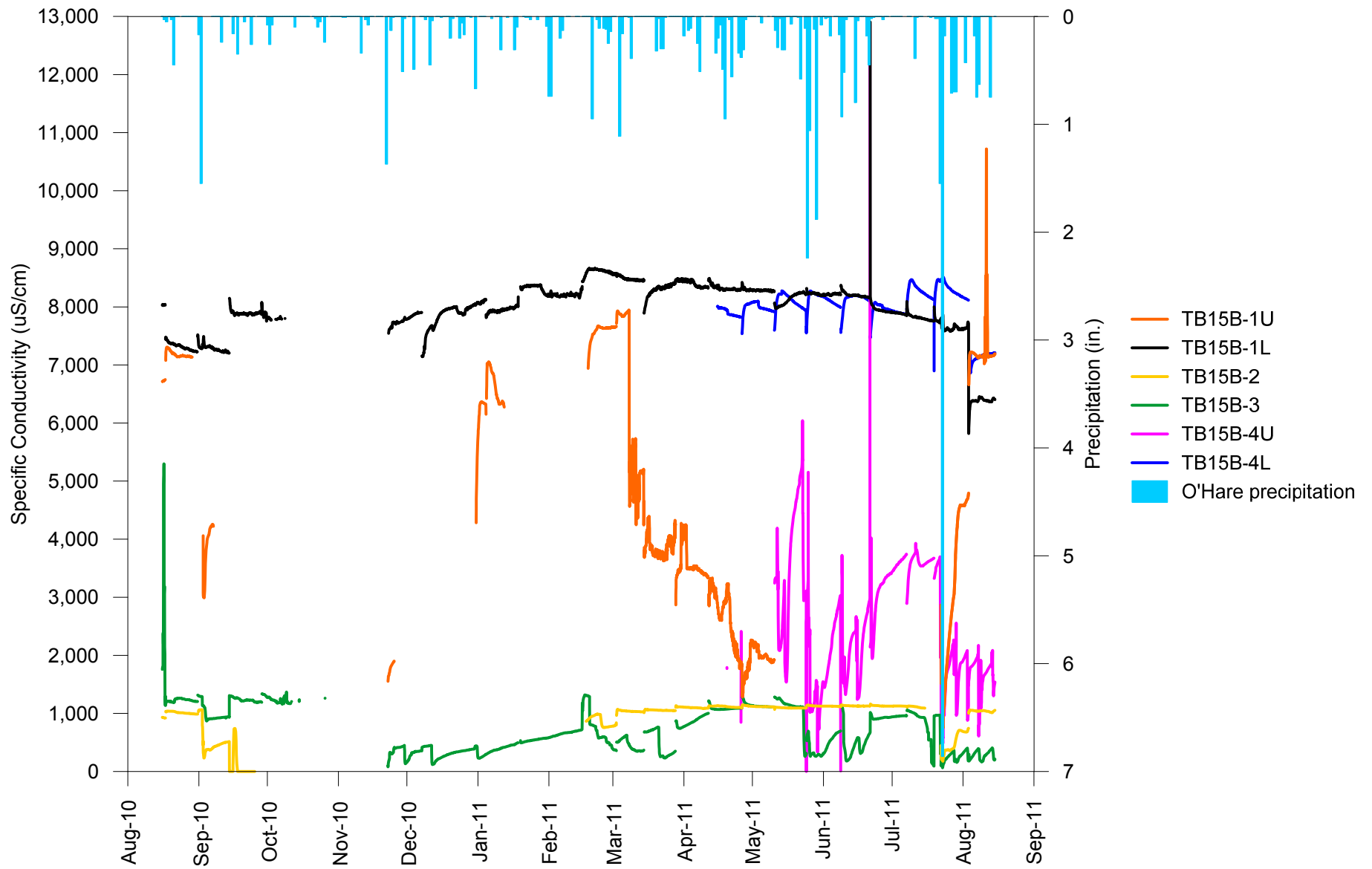




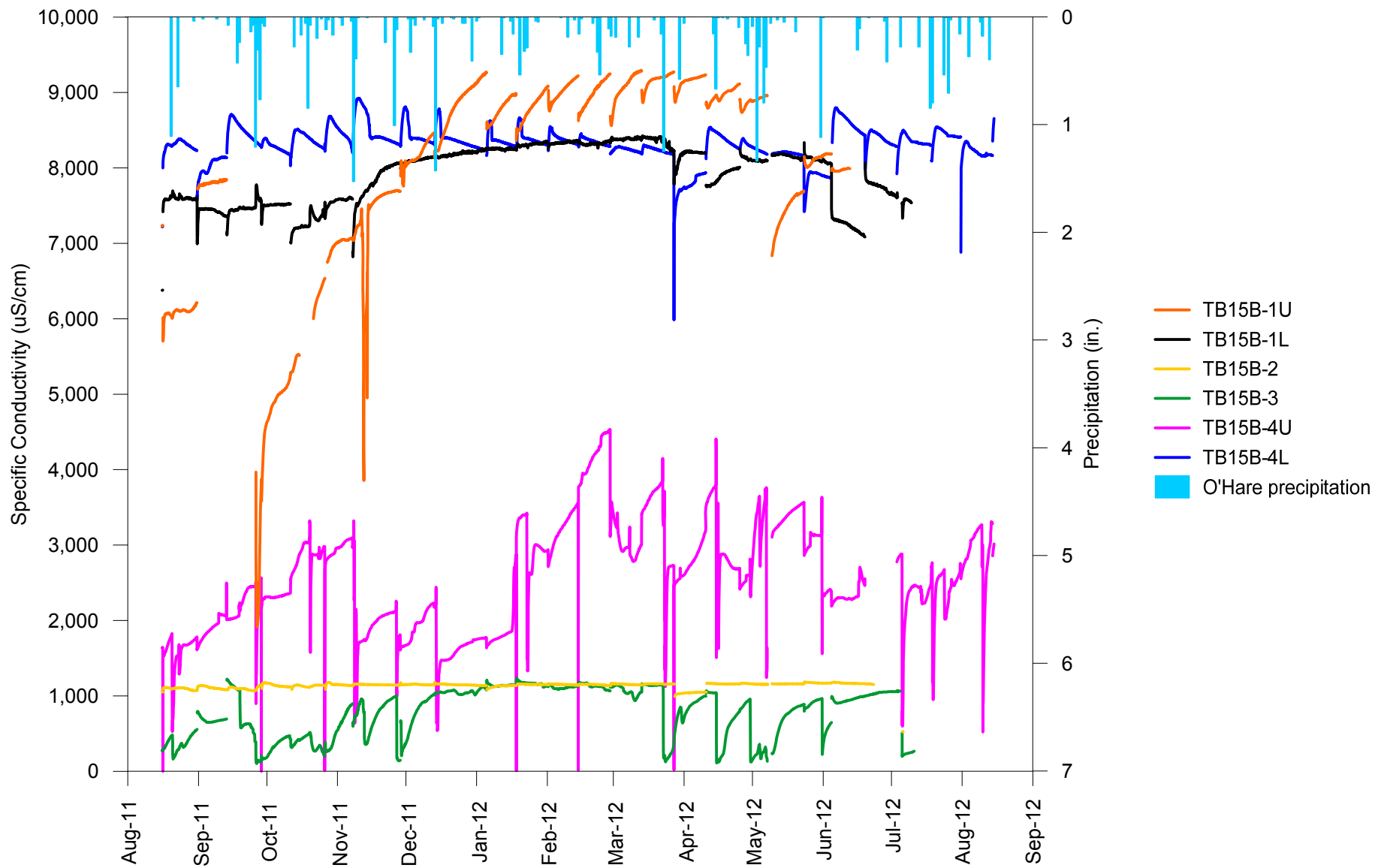
Appendix C-30. Year 5 specific conductivity of groundwater at bioswale TB7B



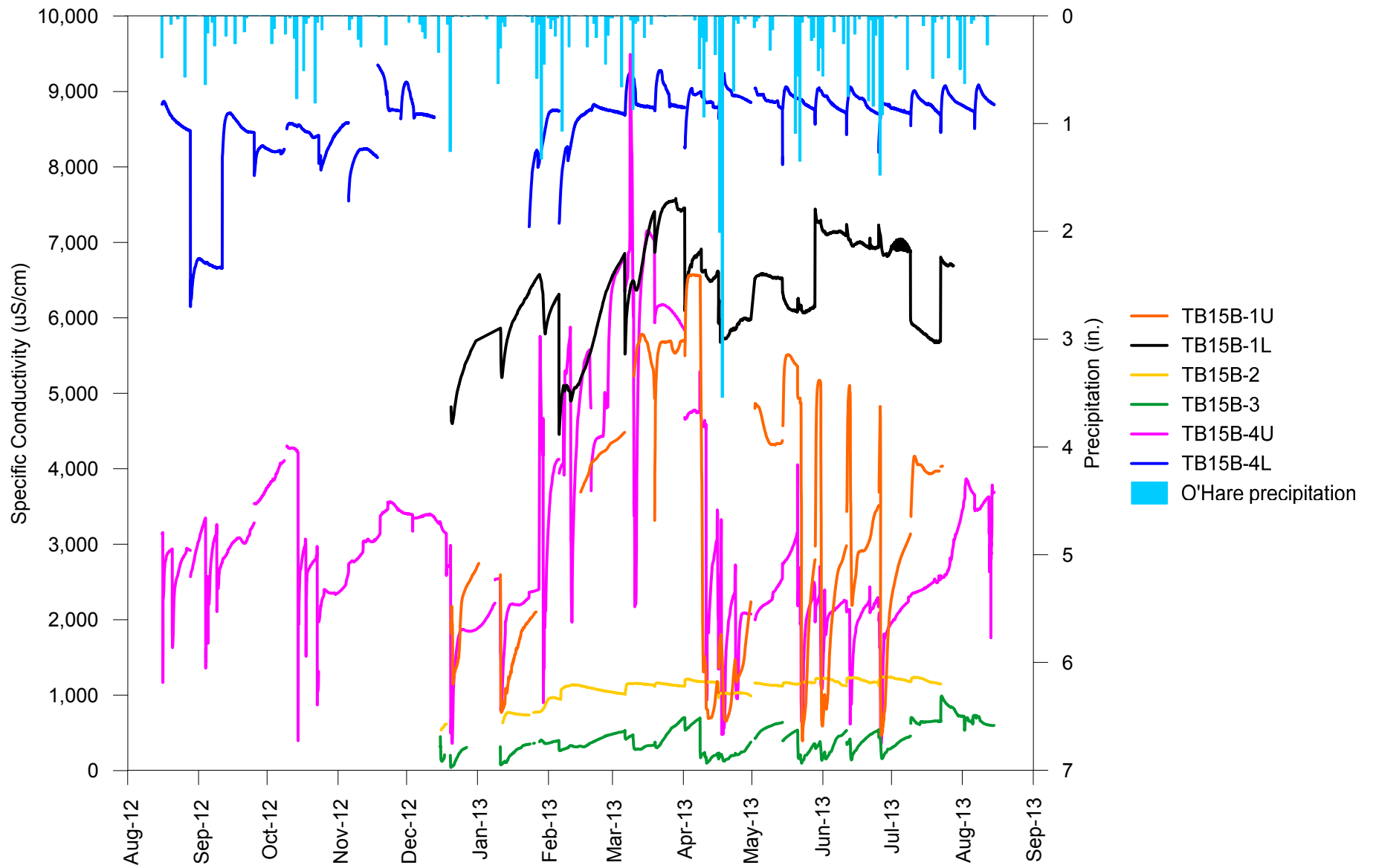
Appendix C-31. Pre-construction specific conductivity of groundwater at bioswale TB15B



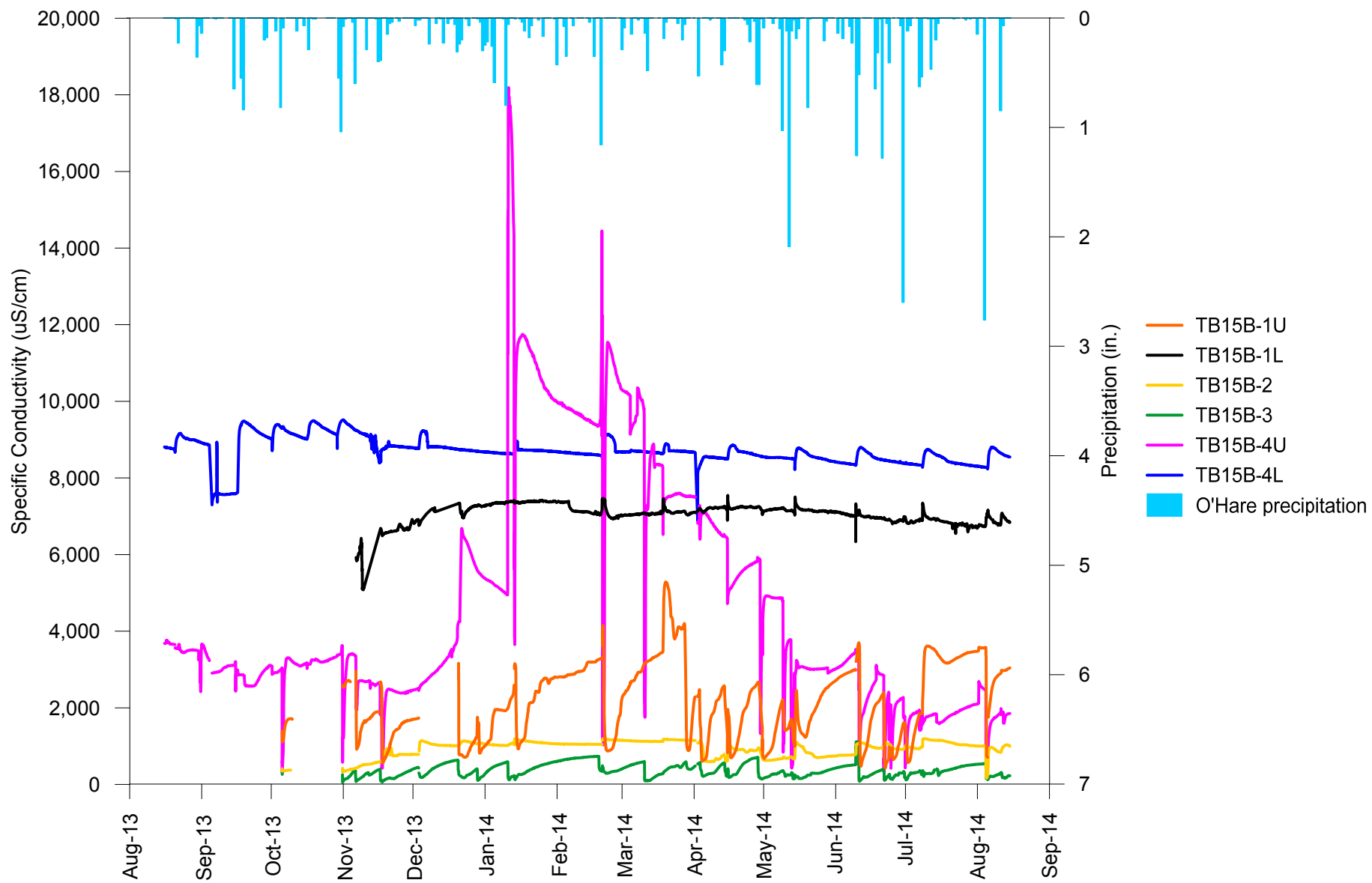
Appendix C-32. Year 1 specific conductivity of groundwater at bioswale TB15B



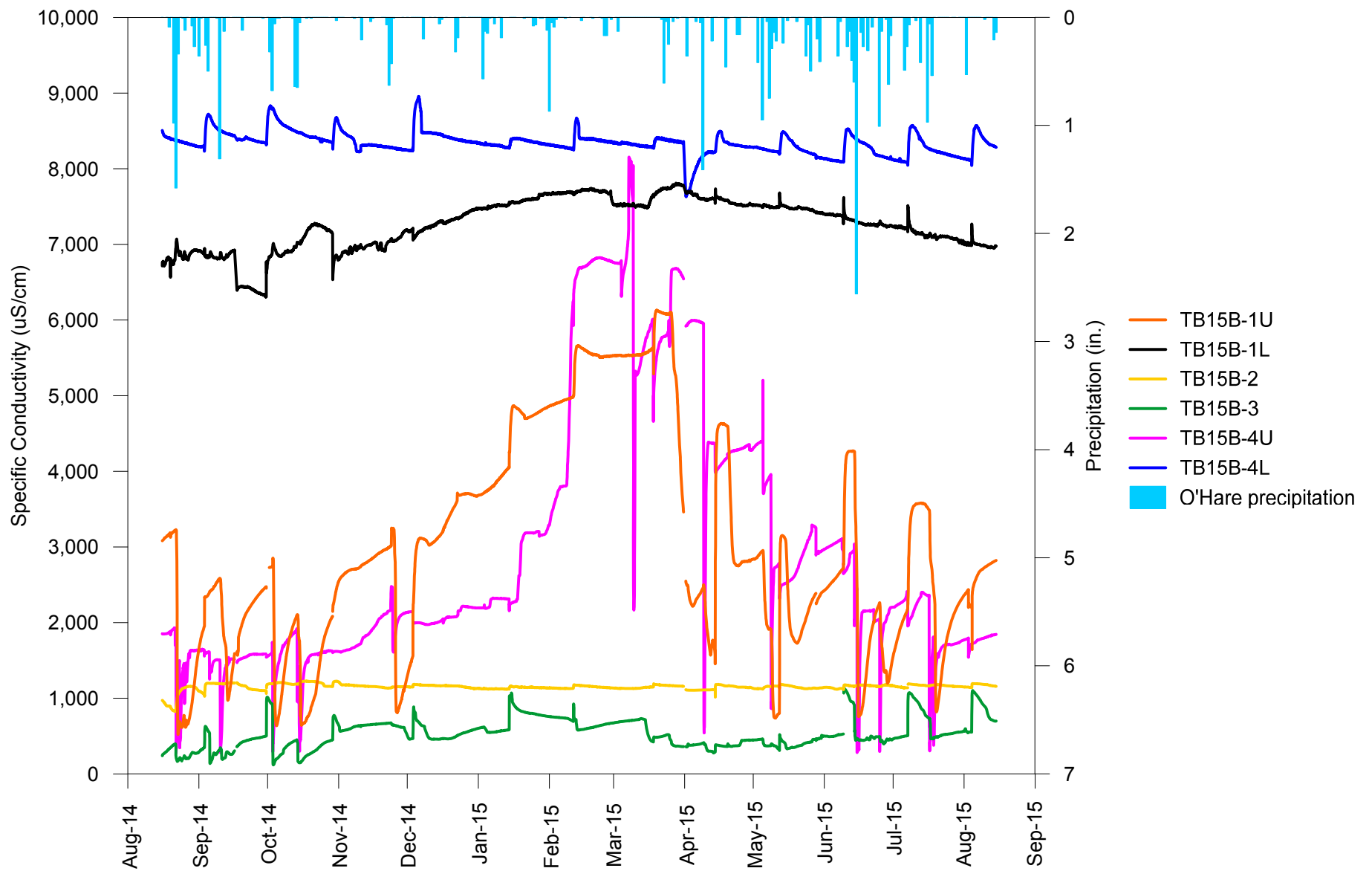
Appendix C-33. Year 2 specific conductivity of groundwater at bioswale TB15B



Appendix C-34. Year 3 specific conductivity of groundwater at bioswale TB15B



Appendix C-35. Year 4 specific conductivity of groundwater at bioswale TB15B



Appendix C-36. Year 5 specific conductivity of groundwater at bioswale TB15B