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February 15, 2017

Mr. David Hayes
Unit Coordinator
Response and Remediation Program
Georgia Department of Natural Resources
Environmental Protection Division
2 Martin Luther King, Jr. Drive, SE, Suite 1054 East
Atlanta, Georgia 30334

Subject: **Response to EPD January 11, 2017 Comment Letter and Submittal of Revised Compliance Status Report Update**
Camak Quarry, HSI No. 10409
4236 Washington Highway NE, Thomson, Warren County, Georgia

Dear Mr. Hayes:

EarthCon Consultants, Inc. (EarthCon), on behalf of our client Martin Marietta Materials (MMM), has prepared this response to the Georgia Environmental Protection Division's (EPD) January 11, 2017 comment letter on MMM's *Compliance Status Report (CSR) Update*, dated January 29, 2016. Included with this response letter is a revised CSR Update.

EPD Comment 1: In the Table of Contents and in Section 5.1, Table 2 *Summary of 2014 Groundwater and Surface Water Analytical Results with Delineation Criteria* is referred to as Table 1 *April 2014 Groundwater Elevations*.

Response to Comment 1: The references to the tables have been corrected in the attached revised CSR Update.

EPD Comment 2: In the Table of Contents and in Section 5.2, Table 1 *April 2014 Groundwater Elevations* is referred to as Table 2 *Summary of 2014 Groundwater and Surface Water Analytical Results with Delineation Criteria*.

Response to Comment 2: The references to the tables have been corrected in the attached revised CSR Update.

EPD Comment 3: Table B1 *Historical Groundwater and Surface Water Data* does not include surface water data. Please revise the table to include this information.

Response to Comment 3: Table B1 been revised to include the surface water data.

EPD Comment 4: Please include a table with the monitoring well construction details and well depths to support the data shown in the cross-section figures.

Response to Comment 4: A table that summarizes well construction information has been added to the revised CSR Update as Table 2.

EPD Comment 5: Please include surface water elevation data in Table 1 to justify the surface water elevation shown on cross-section C-C' in Figure 9.

Response to Comment 5: Surface water elevation was last measured on April 22, 2012. Therefore, the surface water elevation during the last groundwater sampling event on April 21, 2014 is unknown. A footnote has been added to Figure 9 indicating that the surface water elevation is inferred.

EPD Comment 6: Please make the following changes to cross-section C-C' show in Figure 9. Add monitoring well MW-12 and shift the 0.00524 Type 4 RRS isoconcentration line for trichloroethylene (TCE) to the east away from the creek. If the surface water elevation and the depth of pond are unknown, please indicate that the surface water elevation and pond depth are inferred.

Response to Comment 6: Figure 9 has been revised as requested. The surface water elevation was last measured on April 22, 2012. A footnote has been added to Figure 9 indicating that the surface water elevation and depth of the pond are inferred.

EPD Comment 7: In Table 5 Input Coefficients for BIOSCREEN Model, please add units for the values, where applicable.

Response to Comment 7: Table 6 (former Table 5) has been revised to include units, where applicable.

EPD Comment 8: In the table located within Section 9.0, the hydraulic gradient and hydraulic conductivity percent of original value for >5,000 years should be >100 percent, not >100000 percent.

Response to Comment 8: The table within Section 9.0 has been revised as requested.

EPD Comment 9: Please evaluate the vapor intrusion pathway for any buildings that are located within the radius of the TCE plume.

Response to Comment 9: As shown on Figure 4 in the attached revised CSR Update, the only building located within the radius of the TCE plume is the former electrical warehouse. As shown in attached photographs 1, 2, and 3, the former electrical warehouse is an unused former storage structure constructed on a ventilated crawl space. The entrance to this structure is an open entryway with a door that no longer closes. Therefore, there is no enclosed area within the structure for vapors to accumulate and the vapor intrusion pathway is incomplete.

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If you have any questions regarding this submittal, please feel free to contact the undersigned at (770) 973-2100.

Sincerely,

R. Jessica Turner, P.G.
Project Geologist

Carol D. Northern, P.G.
Principal Geologist

Attachment: Photographs of the Former Electrical Warehouse
Revised Compliance Status Report – Update

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PHOTOGRAPHIC LOG

Photo No.	Date:
1	7/30/2015

Description:

Front (southeast facing) side of former electrical warehouse.

Photo No.	Date:
2	7/30/2015

Description:

Rear of former electrical warehouse with ventilated crawl space visible.

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PHOTOGRAPHIC LOG

Photo No.	**Date:**
3	7/30/2015

Description:

Monitoring well MW-11 and western corner of former electrical warehouse.

COMPLIANCE STATUS REPORT - UPDATE

CAMAK QUARRY
4236 WASHINGTON HIGHWAY NE
THOMSON, WARREN COUNTY, GEORGIA
HSI NUMBER 10409

PREPARED FOR:

MARTIN MARIETTA MATERIALS, INC.
3325 PADDOCKS PARKWAY
SUITE 350
SUWANEE, GEORGIA 30024

PREPARED BY:

EARTHCON CONSULTANTS, INC.
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770-973-2100

EarthCon Project No. 02.20140330.00

January 2016
Revised February 2017

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TABLES

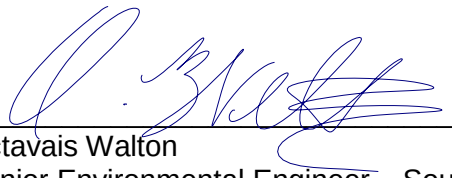
FIGURES

APPENDICES

COMPLIANCE CERTIFICATION

I certify under penalty of law that this report and all attachments were prepared under my direction in accordance with a system designed to assure that qualified personnel properly gathered and evaluated the information submitted. Based on my inquiry of the person or persons who manage the system, or those persons directly responsible for gathering the information, the information submitted is, to the best of my knowledge and belief, true, accurate, and complete. I am aware that there are significant penalties for submitting false information, including the possibility of fine and imprisonment for knowing violations.

Based on my review of the findings of this report with respect to the risk reduction standards of the Rules for Hazardous Site Response, Rule 391-3-19-.07, I have determined that this site/property complies with Type 1 risk reduction standards (RRS) for soil. I have also determined that groundwater at this site/property complies with the provisions, purposes, standards, and policies of the Georgia Voluntary Remediation Program Act (VRPA) and applicable voluntary remediation cleanup standards as referenced in OCGA 12-8-108(7).



February 10, 2017

Octavais Walton
Senior Environmental Engineer – Southeast Division
Martin Marietta Materials

Date

PG CERTIFICATION

"I certify under penalty of law that this report and all attachments were prepared by me or under my direct supervision in accordance with the Voluntary Remediation Program Act (O.C.G.A. Section 12-8-101, et seq.). I am a professional engineer/professional geologist who is registered with the Georgia State Board of Registration for Professional Engineers and Land Surveyors/Georgia State Board of Registration for Professional Geologists and I have the necessary experience and am in charge of the investigation and remediation of this release of regulated substances.

Furthermore, to document my direct oversight of the Voluntary Remediation Plan development, implementation of corrective action, and long term monitoring, I have attached a monthly summary of hours invoiced and description of services provided by me to the Voluntary Remediation Program participant since the previous submittal to the Georgia Environmental Protection Division.

The information submitted is, to the best of my knowledge and belief, true, accurate, and complete. I am aware that there are significant penalties for submitting false information, including the possibility of fine and imprisonment for knowing violations."

Carol D. Northern, P.G.
Principal Geologist

Registration No. 793
State of Georgia

Date: 2/15/17

1.0 INTRODUCTION

The Camak Quarry, located off Georgia Highway 80 near Thomson, Warren County, Georgia, is listed on the Hazardous Site Inventory (HSI) as the "Martin Marietta Aggregates Camak Quarry, HSI Site #10409" (Site). The Camak Quarry is owned by Martin Marietta Materials, Inc.

2.0 SITE SUMMARY

The Camak Quarry is located approximately 20 miles west of Augusta, approximately three-quarters of a mile north of Interstate 20 in Thomson, Warren County, Georgia (Figure 1). The Site consists of 767 acres, of which 349 acres are permitted for aggregate surface mining (Mine Permit No. 118-77). Active quarry operations are ongoing at the property. The facility layout is shown on Figure 2.

Weston and Brooker Company began crushed aggregate quarry operations at the property in 1929. Superior Stone, a division of Martin Marietta, purchased the assets of Weston and Brooker in 1970. In 1973, Superior Stone became Martin Marietta Aggregates (MMA). In 1996, Martin Marietta Materials (MMM) was spun off from the newly created Lockheed Martin and became an independent company. MMM, and/or its predecessor companies, have owned and operated the Camak Quarry since 1973.

The Georgia Department of Transportation (GDOT) conducted asphalt quality control testing in the laboratory at the former onsite asphalt plant. The asphalt plant was owned and operated by Knox Rivers Construction Company. The asphalt plant was in operation from 1965 to 1972 and then was relocated offsite. GDOT used trichloroethene (TCE) during asphalt quality control testing.

In 1994, MMA submitted a permit application to operate an existing onsite water supply well (PW-1) as a public water source for quarry personnel. The location of well PW-1 is shown on Figure 2. Analysis of groundwater samples collected from this well as part of the permitting process identified the presence of volatile organic compounds (VOCs) including TCE, cis-1,2-dichloroethene (cis-1,2-DCE), and toluene in groundwater. As a result, well PW-1 was deactivated and bottled water was supplied to facility workers. Based on the presence of TCE in well PW-1, a Hazardous Site Response Act (HSRA) release notification was submitted to the Georgia Environmental Protection Division (EPD) on July 21, 1995. The EPD listed the property on the Hazardous Site Inventory (HSI) on February 29, 1996, due to a known release of TCE to groundwater. The Site layout is shown on Figure 3.

From 1999 until 2003, numerous investigation activities were conducted at the Site. The results of these activities were submitted to EPD in the following documents:

- Compliance Status Report (CSR), dated June 1999;
- Addendum to CSR, dated November 2000;
- CSR Addendum No. 2, dated October 9, 2002;
- Revised CSR Addendum No. 2, dated September 2003;
- Corrective Action Plan (CAP), dated December 2002; and,
- Revised CAP, dated September 2003.

The September 2003 Revised CAP was approved by EPD on June 28, 2005. In accordance with the approved Revised CAP, quarterly groundwater monitoring began at the Site in December 2005. Groundwater monitoring transitioned to a semi-annual schedule beginning in March 2007. In emails dated November 2, 2009 and December 17, 2009, EPD approved a reduction in groundwater monitoring to an annual basis, which began in March 2011. Groundwater at the Site has been sampled annually since that time.

The Voluntary Investigation and Remediation Plan and Application (VIRP) for the Site was submitted to EPD on April 27, 2015. EPD approved the VIRP and enrolled the Site into the Voluntary Remediation Program (VRP) in a letter dated June 30, 2015, approving a Uniform Environmental Covenant (UEC) to restrict use of groundwater on the Property, groundwater modeling, and suspension of annual groundwater monitoring activities.

3.0 CONSTITUENTS/AREAS OF CONCERN

The 2002 CSR Addendum No. 2 demonstrated horizontal and vertical delineation of soil and groundwater contamination for the Site. A total of seventeen regulated substances were detected in soil samples collected at the Site. The CSR Addendum No. 2 documented that regulated substances detected in Site soils comply with Type 1 residential risk reduction standards (RRS). A table summarizing the historic soil analytical data and compliance with the applicable Type 1 RRS, along with figures showing the soil sample locations, is provided in Appendix A. Regulated substances documented in groundwater were at concentrations exceeding applicable RRS. A summary of regulated substances historically detected at the Site is provided in Appendix B.

The TCE detected in groundwater was limited to the area of the Site including the electrical warehouse, former rail spur area, and the former water supply well PW-1. Maintenance activities in the electrical warehouse and former rail spur area were performed through 1975. The depth to groundwater in this area is approximately three feet below ground surface (bgs). The former water supply well PW-1 was the primary water supply well for the quarry from 1985 until February 1995. It was constructed with steel casing from the ground surface to 37 feet bgs, which is approximately one to three feet above top of competent bedrock, and finished as a 600 foot open hole well with the pump set at 500 feet bgs. Inadequate well construction is suspected to have

allowed the well to act as a conduit for vertical migration of impacted shallow groundwater into the open borehole during pumping. These areas are on property that is solely owned by MMM and, based on delineation presented in the 2002 CSR Addendum No. 2, no offsite properties are impacted.

Fourteen regulated substances have been detected in groundwater at the Site at concentrations above laboratory detection limits (Appendix B). Historically, concentrations of ten of these regulated substances were below their respective Type 1 RRS for groundwater. Additionally, concentrations of two constituents that historically exceeded RRS are currently not present at concentrations above laboratory detection limits.

In accordance with the EPD-approved 2003 Revised CAP, groundwater samples were collected and analyzed for VOCs and MNA parameters per the following schedule:

- Quarterly from December 2005 through September 2006;
- Semi-annually from March 2007 through September 2008; and
- Annually from March 2009 through March 2011 and April 2012 through April 2014.

The TCE concentrations detected during the April 2014 sampling event in the overburden and bedrock are depicted on Figures 4 and 5, respectively. In a letter dated November 20, 2014, EPD approved removing monitoring wells MW-2D, MW-3, MW-4D, and MW-9 and former water supply well PW-1 from the monitoring plan. As shown in Table 1 and on Figures 4 and 5, the only regulated substance in groundwater not in compliance with the applicable RRS is TCE in monitoring wells MW-6, MW-11, MW-13 and MW-13D. Therefore, the area of concern is a low concentration TCE groundwater plume located in the immediate vicinity of monitoring wells MW-6, MW-11, MW-13 and MW-13D.

4.0 SUMMARY OF VRP ACTIVITIES

As described in the approved VIRP, soils at the property comply with Type 1 RRS; therefore, corrective action for soils is not required. Corrective action for groundwater consists of groundwater modeling and institutional controls. Activities conducted from July 2015 through December 2015 are described in the following sections.

4.1 Well Abandonment

In correspondence dated March 26, 2013, EPD approved the abandonment of monitoring wells MW-2D and MW-4D. In correspondence dated November 20, 2014, EPD approved the abandonment of wells MW-3 and MW-9 and restated their approval for abandonment of wells MW-2D and MW-4D. On July 30, 2015, monitoring wells MW-2D, MW-3, MW-4D, and MW-9 were abandoned. A Site reconnaissance to observe the well abandonment activities and Site conditions was conducted with EPD representatives on July 30, 2015.

The wells were abandoned in general accordance with the procedures provided in the United States Environmental Protection Agency (USEPA) Region 4 Science and Ecosystem Support Division (SESD) Guidance *Design and Installation of Monitoring Wells, SESDGUID-101-R1*, dated January 29, 2013. The wells were abandoned by pressure grouting the well with Type I Portland cement (with 5% powdered bentonite) using a tremie pipe from the bottom of the screened zone to the ground surface. Water was added to the cement/bentonite powder and blended with a mechanical mixer until the grout density was between 11.5 and 13 pounds/gallon. The grout was pumped through one-inch inner diameter tremie pipe, which was raised as the grout was pumped, until the water in the well was displaced and the density of the grout that returned to the surface was equal to the density of the grout pumped into the well. The volume of grout pumped into the wells was a minimum of 1.25 times the well volume. The monitoring well surface casings and well pads were removed and the ground surface was finished to match the surrounding area. A summary of well construction information is provided in Table 2.

4.2 Groundwater Modeling

Groundwater modeling was conducted using the maximum concentration of TCE documented since April 1999, which was the first groundwater sampling event at Camak Quarry. Model runs using Site data were conducted with both the BIOSCREEN and BIOCHLOR models. Due to the geographical layout of wells and small footprint of the groundwater plume, the analytical model BIOSCREEN appeared to be the most representative model to simulate subsurface transport and determine the length of time required for TCE to reach the downgradient point of exposure (POE) which, as described in Section 5.3, is Middle Creek. BIOSCREEN, an EPA supported software programmed in the Microsoft Excel spreadsheet environment, is based on the Domenico analytical solute transport model and is used to help simulate remediation through natural attenuation. A discharge calculation was also used to evaluate the effect of constituent migration into Middle Creek.

5.0 CONCEPTUAL SITE MODEL

A preliminary conceptual site model (CSM) was provided as Section 4.0 of the approved VIRP. Based on additional review of historical Site information as well as modeling results, the following sections of the CSM have been updated with additional information. Site stratigraphy is presented on cross sections A-A' through C-C'. The cross section locations are shown on Figure 6 while the cross sections are presented on Figures 7 through 9.

5.1 Groundwater Flow

Water level elevation measurements measured in April 2014 are provided in Table 3. The water level measurements collected on April 21, 2014, were used to develop a potentiometric surface map for the Site. As shown on Figure 10, groundwater appears to mimic surface topography and flows toward Middle Creek, which is ponded by an earthen dam. Groundwater north of Middle

Creek tends to flow southeasterly toward Middle Creek and the groundwater south of Middle Creek tends to flow northwesterly toward Middle Creek. Also, the ponded creek and the earthen dam seem to locally influence the direction and gradient of groundwater in the TCE release area by slowing the migration of groundwater and directing it toward the ponded creek. As shown on Figure 10, the groundwater elevation data suggest there is a groundwater ridge oriented along a northeast-southwest trending axis between wells MW-14 and MW-2. Groundwater elevations indicate the direction of groundwater flow at MW-2, approximately 100 feet south of the TCE release area, is southerly toward the quarry pit lake.

5.2 Groundwater Delineation and Extent of Groundwater Impacts

Horizontal and vertical delineation of constituents detected in groundwater were presented in Section 4.4 of the approved VIRP. The impacted groundwater at the Site is present primarily in the upper, unconfined surficial aquifer at a depth of no more than approximately 20 feet. The delineation criteria (Type 1 RRS) for regulated substances documented in groundwater are shown on Table 1. Based on the delineation criteria, the horizontal extent of surficial groundwater contamination is shown on Figure 4. TCE was detected at concentrations greater than RRS at monitoring well locations MW-6, MW-11, MW-13, and MW-13D. Groundwater at location MW-6 historically contained the highest TCE concentrations; therefore MW-6 is considered the source area. The TCE plume is observed to extend from MW-6 to MW-11, which is likely a result of the historic pumping from the former water supply well PW-1 that resulted in the release being pulled east-southeasterly.

Low levels of TCE have also been documented in two bedrock wells, MW-13D and PW-1 (Figure 5), which are located in close proximity to the impacted upper, unconfined aquifer wells. Monitoring well MW-13D is screened in the relatively shallow portion of the fractured bedrock from 33 to 38 feet bgs (Figure 8). The TCE detected in MW-13D is likely a result of downward migration from the upper, unconfined aquifer. Former water supply well PW-1 is an open hole well from 40 to 600 feet bgs. Monitoring well MW-1 is located between PW-1 and MW-13D and is screened at a depth of 33.5 to 43.5 feet bgs. There have been no detections of regulated substances above laboratory detection limits at MW-1 since the March 2011 sampling event. Therefore, monitoring well MW-1 defines the vertical extent of regulated substances in groundwater, as shown on cross section C-C' (Figure 9).

As discussed, the maintenance activities in the electrical warehouse and former rail spur area were performed through 1975 and the former water supply well PW-1 was the primary water source for the quarry from 1985 until February 1995 (Figures 4 and 7). Monitoring well MW-6, which has historically had the highest concentrations of TCE and is therefore considered the source area, is located along the rail spur adjacent to the electrical warehouse. In relation to the direction of groundwater flow, the source area appears to be located in the downgradient portion of the TCE plume. This can be attributed to pumping of former water supply well PW-1, which may have been inadequately constructed, pulling the TCE plume upgradient of the source area

toward PW-1 prior to its shut off in February 1995. The location and extent of the plume does not appear to have changed since that time due to the relatively flat hydraulic gradient present in this area. However, the concentrations observed in the TCE plume have decreased due to natural attenuation, which is evident by the presence of TCE daughter products cis-1,2-DCE and trans-1,2-DCE.

5.3 Point of Exposure

The VRP allows demonstration of compliance with site-specific cleanup standards based on fate and transport modeling as long as concentrations of site-specific constituents of concern in groundwater are shown to be protective of any established downgradient POE. The POE is defined as the nearest of the following:

1) closest existing downgradient drinking water supply well;
2) likely nearest future location of a downgradient drinking water supply well; or
3) hypothetical point of drinking water exposure located at a distance of 1,000 feet downgradient from the delineated site contamination.

As described in the approved VIRP, there are no documented water supply wells within a one-mile radius of the Site, with the exception of the "Old Camp Well" (OCW), which is the current water supply well for Camak Quarry. The OCW is located 1,600 feet west of well PW-1 and west of Middle Creek (Figure 2). TCE impacts have not been observed in groundwater west of Middle Creek or at the OCW due to the location of Middle Creek and the distance from the source area at well MW-6. The delineated groundwater contamination is located within the center of the Camak Quarry Property (Figure 4). MMM will submit a UEC to EPD which, when executed, will restrict the use of groundwater at the Site to non-potable uses only. Groundwater flow in the area of TCE impacts flows northwest toward Middle Creek (Figure 10). Therefore, the downgradient receptor/POE was determined to be Middle Creek.

6.0 BIOSCREEN MODEL

The BIOSCREEN Natural Attenuation software is a screening model based on the Domenico (1987) three dimensional analytical solute transport model. The solution to the Domenico model can actually be done by hand with a calculator. However, for this Site, BIOSCREEN was used as a "calculator" to replicate the Domenico model. For a differential equation that describes behavior over time (e.g., groundwater flow and solute transport equations), the numerical method starts with the initial values of the variables, and then uses the equations to approximate the changes in these variables over a very brief time period. This approximation is the calibration process (i.e., subtle changes in initial values until an adequate solution is achieved).

BIOSCREEN is a conservative screening model. It is typically used with unlikely high starting values (highest historical values) to determine the potential, using conservative assumptions, of the observed concentrations resulting in a "plume" that would reach a defined location (e.g., receptor). Analysis using a numerical model would be necessary only if the screening model showed potential for exceeding concentrations at the defined receptor location.

In BIOSCREEN, the Domenico solution has been adapted to provide three different model types representing i) transport with no decay, ii) transport with first-order decay, and iii) transport with "instantaneous" biodegradation. The second model type is applicable to chlorinated solvents. For this Site, transport with first-order decay was evaluated because it provides the most conservative results. The inputs for the BIOSCREEN model are provided in Appendix C.

6.1 Hydrogeology

As described in Section 4.3 of the VIRP, the calculated geometric mean for overburden hydraulic conductivity (K) is 5.51 x 10^{-4} centimeters per second (cm/s) or 1.56 feet/day. The estimated effective porosity of the Site soils is 20%. The hydraulic gradient was calculated based on depth to groundwater and was calculated using the April 2014 groundwater elevation data from monitoring wells MW-11 and MW-12. The hydraulic gradient for April 2014 was 0.001125 ft/ft. The seepage velocity, calculated by multiplying hydraulic conductivity by hydraulic gradient and dividing by effective porosity, is 9 feet/year.

6.2 Dispersion

Longitudinal, transverse, and vertical dispersivity are calculated as a relationship to plume length. The longitudinal dispersivity of 3.5 was determined by calculating 10% of the plume length (35 feet). As provided in the August 1996 BIOSCREEN User's Manual, the default values of 0.35 and 1.0 x 10^{-99} were used for transverse dispersivity and vertical dispersivity, respectively.

6.3 Adsorption

The soil retardation factor is calculated from the soil bulk density, partition coefficient (K_{oc}), and fraction organic carbon (foc). A value of 1.7 is frequently used as a default for soil bulk density (BIOSCREEN 1996). The K_{oc} value for TCE from the USEPA's Regional Screening Level (RSL) Chemical Specific Parameter table (Nov 2015) was used. A default value of 0.002 was used for the foc.

6.4 Biodegradation

The first order decay coefficient is related to the solvent's half-life. For this Site, the first-order decay degradation model was evaluated. First order decay constants for TCE were estimated from literature values and then refined during model calibration to achieve the best fit to the observed field data. A solute half-life of 1.32 was determined to best fit the field data and is within the range of published values for TCE.

6.5 General

As discussed in Section 3.0, the plume extends upgradient of the source area in the opposite direction of groundwater flow. The total length of the TCE plume is approximately 90 feet with the majority of the dissolved phase plume located upgradient of the source area (MW-6). However, the concentrations upgradient of MW-6 are lower than the concentrations observed at MW-6. Therefore, the length of the plume was modeled to be the distance from the source area (MW-6) to the POE (Middle Creek) along the primary axis of groundwater flow, which is approximately 35 feet. Area width was entered as an approximate width of the plume, which was estimated to be 120 feet. The simulation time for calibrating the model was 16 years based on the date of first available groundwater data (1998) to the most recent groundwater sampling event (2014). The source area is estimated to be 20 feet wide and 15 feet thick. Note that the source thickness has no bearing for this model situation because the Domenico (1987) model assumes a vertical plane (single layer). It should also be noted that area width has no bearing on the modeled centerline transport distance of a solvent in the Domenico (1987) model since BIOSCREEN expands the simple one source approach by allowing up to five source zones with different concentrations to account for spatial two-dimensional variations in the source area (BIOSCREEN 1996).

6.6 Source Data

TCE was the only constituent detected above the delineation criteria during the April 2014 sampling event. Therefore, the BIOSCREEN model was based on a TCE groundwater plume with the source area represented by well MW-6, migrating downgradient to well MW-12, and then to Middle Creek. The maximum concentration of TCE detected in well MW-6 was 4.6 milligrams per liter (mg/L) in August 2002. Downgradient well MW-12 was installed in December 2005. The maximum concentration of TCE detected in well MW-12 (0.58 mg/L) was used for the downgradient point in the BIOSCREEN model.

7.0 DISCHARGE CALCULATION

Discharge calculations were conducted for the constituents detected in April 2014 to verify that predicted constituent concentrations in Middle Creek would not exceed the Georgia Instream Water Quality Standards (ISWQS). Of the detected constituents, only TCE and trans-1,2-DCE have published ISWQS of 0.030 mg/L and 10 mg/L, respectively. There is no ISWQS for cis-1,2-DCE; therefore, the USEPA maximum contaminant level (MCL) of 0.07 mg/L was used.

The maximum concentrations of TCE, cis-1,2-DCE, and trans-1,2-DCE detected during the April 2014 sampling event were conservatively assumed to discharge directly into Middle Creek. A plume length of 35 feet was used based on the distance from the source area (MW-6) to Middle

Creek along the axis of groundwater flow. Darcy's velocity was calculated by multiplying the hydraulic conductivity and hydraulic gradient. The vertical thickness of the contaminated plume is estimated to be 15 feet. The USGS did not have flow data available for Middle Creek; however, the portion of Middle Creek that the plume would potentially discharge to is dammed with a small outflow to the downstream portion of Middle Creek. Therefore, to be conservative, a surface water flow velocity of 0.1 cubic feet per second (cfs) was used in the discharge calculations.

Results of the discharge calculations for TCE, cis-1,2-DCE, and trans-1,2-DCE, are summarized on Table 4 and discussed further in the following sections.

8.0 MODELING INPUTS AND RESULTS

Based on the degradation rate, the BIOSCREEN model predicts TCE would first reach Middle Creek at a detectable concentration of 0.001 mg/L in 7 years. The BIOSCREEN model, using conservative assumptions and simulation times of 5, 7, 10, 15, 25, 50, 75, 100, 200, 500, 1,000, 5,000, and 10,000 years, predicts that the maximum TCE concentration that will ever reach Middle Creek is 0.004 mg/L, which is below both the ISWQS and USEPA MCL established for TCE. Therefore, TCE will not adversely impact Middle Creek. The results from the BIOSCREEN modeling are summarized in Table 5. A list of BIOSCREEN model input coefficients are provided in Table 6. A selection of the model run outputs with various simulation times is included in Appendix C.

9.0 SENSITIVITY ANALYSIS

A sensitivity analysis was conducted to evaluate how changes to one parameter would affect the time until detectable levels of TCE reached the POE. TCE was used for the sensitivity model because it is the only constituent detected above the delineation criteria. The sensitivity tests were run the same way the previous models were run, by using time as a variable to achieve 0.001 mg/L concentration 35 feet downgradient of the plume, the distance from source well MW-6 to Middle Creek. A summary of the sensitivity analysis is provided below.

Sensitive Parameter	Original Parameter Value	New Parameter Value	Comment	Time when POE is reached (35 feet)	Percent of Original Value
Original Value	--	--	--	7 years	
Hydraulic Conductivity	0.000551	0.000413	25% lower	12 years	171%
Hydraulic Conductivity	0.000551	0.000689	25% higher	6 years	86%
Hydraulic Gradient	0.001125	0.000844	25% lower	12 years	171%
Hydraulic Gradient	0.001125	0.00141	25% higher	6 years	86%
Estimated Plume Length	35	17.5	50% lower	7 years	100%
Estimated Plume Length	35	52.5	50% higher	7 years	100%
Partition Coefficient	61	32.5	50% lower	5 years	71%
Partition Coefficient	61	91.5	50% higher	9 years	129%
Fraction Organic Carbon	0.002	0.001	50% lower	5 years	71%
Fraction Organic Carbon	0.002	0.003	50% higher	11 years	157%
Source Zone Width	120	60	50% lower	7 years	100%
Source Zone Width	120	180	50% higher	7 years	100%
Hydraulic Conductivity Hydraulic Gradient	0.000551 0.001125	0.000413 0.000844	25% lower 25% lower	> 5,000 years	> 100%

As previously stated, based on the degradation rate, the BIOSCREEN model predicts TCE would first reach Middle Creek at a detectable concentration of 0.001 mg/L in 7 years. The sensitivity analysis demonstrated that the parameters with the greatest impact on the model are the hydrogeology variables (gradient and conductivity) and adsorption criteria (partition coefficient and fraction organic carbon). As part of the sensitivity analysis, one test was run with extra conservative values from the parameters that were the most sensitive (gradient and conductivity) in the model. Those conservative parameters combined resulted in BIOSCREEN predicting that TCE would not reach the POE within 5,000 years. TCE degradation is occurring, as evidenced by the presence of daughter products cis-1,2-DCE and trans-1,2-DCE, and the hydraulic gradient is low; therefore, the low concentration TCE groundwater plume is not expected to adversely impact Middle Creek.

10.0 SUMMARY

As described in Section 5.2, the extent of constituents in groundwater above delineation criteria has been defined. Additionally, analytical results from the most recent annual sampling event demonstrate that TCE concentrations have continued to decline and that natural attenuation is occurring. Results of the BIOSCREEN groundwater model runs using conservative assumptions demonstrate that travel times for the detected constituents are extremely slow due to the flat hydraulic gradient in the plume area. Therefore, the existing groundwater concentrations are protective and will not adversely impact the downgradient POE (Middle Creek).

Based on the information provided in this report, the Site meets the requirements for compliance with site-specific cleanup standards set forth in the VRPA. MMM will submit a UEC to EPD which, when executed, will restrict the use of groundwater at the Site to non-potable uses only. A revised schedule reflecting this recommendation is provided in Table 7.

11.0 MONTHLY INVOICE SUMMARY

EPD requires that a professional geologist or engineer oversee the implementation of the VIRP in accordance with the provisions, purposes, standards and policies of the VRPA. During the seven month period from July 2015 to January 2016, Ms. Carol Northern, P.G. invoiced 13.75 hours on this project. A monthly summary of hours invoiced and a description of services provided is shown in Table 8.

12.0 REFERENCES

AquaFusion. 2002. Compliance Status Report Addendum No. 2. Camak Quarry Site, Thomson, Georgia, HIS Site No. 10409. October 9, 2002.

AquaFusion. 2014. April 2014 Annual Monitoring Report. Camak Quarry Site, Thomson, Georgia, HSI Site No. 10409. July 1, 2014.

Domenico, P.A. 1987. An analytical model for multidimensional transport of a decaying contaminant species. Journal of Hydrology, 91:49–58.

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Harding Lawson Associates, 1999. Compliance Status Report. Martin Marietta Aggregates, Camak Quarry, HIS Site No. 10409. July 30, 1999.

USEPA. 1996. BIOSCREEN, Natural Attenuation Decision Support System - User's Manual, Version 1.3.

USEPA. 2000. BIOCHLOR Natural Attenuation Decision Support System - User's Manual, Version 1.0.

USEPA. Nov 2015. Regional Screening Level, Chemical Specific Parameter Table.

TABLES

Table 1. Summary of 2014 Groundwater and Surface Water Analytical Results with Delineation Criteria

Groundwater		Regulated Substance (mg/L)				
		1,1-DCE	cis-1,2-DCE	trans-1,2-DCE	TCE	Vinyl chloride
Delineation Criteria (mg/L)		0.007	0.07	0.1	0.005	0.002
Type 4 RRS (mg/L)		0.524	0.204	0.161	0.00524	0.00327
Well ID	**Sample Date**					
PW-1 @ 110'	4/22/14	<0.001	<0.001	<0.001	**0.0018**	<0.001
MW-1	4/21/14	<0.001	<0.001	<0.001	<0.001	<0.001
MW-6	4/21/14	<0.001	**0.0029**	<0.001	**0.09**	<0.001
MW-11	4/21/14	<0.001	**0.0018**	<0.001	**0.061**	<0.001
MW-12	4/21/14	<0.001	**0.011**	**0.0016**	**0.0026**	<0.001
MW-13	4/21/14	<0.001	**0.028**	**0.0042**	**0.051**	<0.001
	6/12/14	<0.001	**0.032**	**0.0048**	**0.048**	<0.001
MW-13D	4/21/14	<0.001	**0.025**	**0.0042**	**0.022**	<0.001
MW-14	4/22/14	<0.001	**0.0022**	<0.001	<0.001	<0.001

Surface Water		Regulated Substance (mg/L)				
		1,1-DCE	cis-1,2-DCE	trans-1,2-DCE	TCE	Vinyl chloride
Sample Location	**Sample Date**					
SW-3/SW-6	4/22/14	<0.001	<0.001	<0.001	<0.001	<0.001

Prepared by: RJT 10/12/2015
Checked by: KRR 1/12/2016

Notes

Source: AquaFusion, July 2014

Bold indicates regulated substance concentration above laboratory detection limit.

Grey shading indicates regulated substance concentration above the Type 4 RRS.

Table 2. Summary of Well Construction Information

Well ID	Date Installed	Date Abandoned	TOC Elevation (ft msl)	Ground Surface Elevation (ft msl)	Well Diameter (inches)	Total Depth (ft bgs)	Screen/Open Hole Interval (ft bgs)	Depth to Rock (ft bgs)	Formation Screened
OCW	1955	--	478.67	477.37	6	273			open hole in bedrock
PW-01	9/27/84	--	417.31	414.22	6	605	40 - 600	39	open hole in bedrock
MW-1	4/5/99	--	415.74	411.28	2	44	33.5 - 43.5	36	Overburden/PWR/Bedrock
MW-2	4/1/99	--	424.27	420.14	2	51	38.5 - 48.5	46	Overburden/PWR
MW-2D	4/12/99	7/30/15	425.70	422.70	2	304	292.5 - 302.5	55.5	Bedrock
MW-3	4/6/99	7/30/15	421.73	419.63	2	30	18.5 - 28.5	2	Bedrock
MW-4	4/6/99	--	417.81	415.59	2	36	25.5 - 35.5	31	Overburden/PWR/Bedrock
MW-4D	4/20/99	7/30/15	418.91	415.77	2	202.5	192 - 202	25	Bedrock
MW-5	4/7/99	--	423.80	423.80	2	36	24.5 - 34.5	32	Overburden/PWR/Bedrock
MW-6	4/21/99	--	410.06	408.05	2	20.5	10 - 20	20	Overburden/PWR
MW-7	5/4/99	8/14/02	409.49	406.85	1	7.5	2.5 - 7.5	na	Overburden
MW-7R	8/14/02	--	410.42	407.31	2	11	6 - 11	11	Overburden
MW-8	5/4/99	8/14/02	411.87	409.67	1	13	3 - 13	na	Overburden
MW-8R	8/14/02	5/20/08	413.53	410.38	2	14	4 - 14	na	Overburden
MW-9	8/14/02	7/30/15	420.51	417.26	2	23	13 - 23	23	Overburden
MW-10	8/14/02	--	416.43	413.39	2	14	4 - 14	14	Overburden
MW-11*	2005	--	412.85	409.76	2	19	9 - 19	19	Overburden
MW-12*	2005	--	409.98	407.28	2	19	9 - 19	19	Overburden
MW-13*	2005	--	411.03	408.47	2	19	9 - 19	19	Overburden
MW-13D*	2005	--	412.79	408.03	2	38	33 - 38	19	Bedrock
MW-14*	2005	--	410.17	407.42	2	19	9 - 19	19	Overburden
Middle Ck Pier*	--	--	406.95	--	--	--	--	--	--

Created by: RJT 10/3/2016
Checked by: AGL 1/24/2017

Notes:
OCW = Old Camp Well, the current water supply well that replaced PW-01
MW-1 casing was repaired on 8/12/02 and resurveyed.
MW-7 was abandoned on 8/14/02; MW-8 was damaged by quarry equipment and removed.
MW-7R and MW-8R are 2-inch replacement wells, installed on 8/14/02.
MW-4D casing repaired in April 2006.
MW-2D, MW-3, MW-4D, and MW-9 were abandoned on July 30, 2015.

Table 3. April 2014 Groundwater Elevations

Well ID	Date	Ground Surface Elev. (ft-amsl)	TOC Elev. (ft-amsl)	DTW (ft bTOC)	Groundwater Elev. (ft-msl)
OCW	4/21/14	477.37	478.67	NM	NM
PW-01	4/21/14	414.22	417.31	19.67	397.64
MW-1	4/21/14	411.28	415.74	9.77	405.97
MW-2	4/21/14	420.14	424.27	19.01	405.26
MW-2D	4/21/14	422.70	425.70	29.20	396.50
MW-3	4/21/14	419.63	421.73	15.54	406.19
MW-4	4/21/14	415.59	417.81	8.99	408.82
MW-4D	4/21/14	415.77	418.91	23.70	395.21
MW-5	4/21/14	423.80	423.80	NM	NM
MW-6	4/21/14	408.05	410.06	NM	NM
MW-7R	4/21/14	407.31	410.42	4.43	405.99
MW-9	4/22/14	417.26	420.51	14.91	405.60
MW-10	4/22/14	413.39	416.43	11.87	404.56
MW-11	4/21/14	409.76	412.85	7.44	405.41
MW-12	4/21/14	407.28	409.98	4.66	405.32
MW-13	4/21/14	408.47	411.03	5.56	405.47
MW-13D	4/21/14	408.03	412.79	7.46	405.33
MW-14	4/21/14	407.42	410.17	4.81	405.36

Prepared by: RJT 10/12/2015
Checked by: AGL 1/24/2017

Notes

Source: AquaFusion, July 2014
OCW - Old Camp Well (active supply well)
NM - Not measured.

Table 4. Projected Maximum Constituent Concentrations in Middle Creek

Coefficient	Value		Source:
Hydraulic Conductivity, K	5.51E-04	cm/sec	Addendum to CSR, November 2000[1]
Hydraulic Gradient, i	0.001125	ft/ft	Calculated using April 2014 water levels
Effective porosity, n	0.2		VIRP, April 2015

ELECTRICAL WAREHOUSE AREA

Dilution Calculations

Darcy Velocity	2.03E-08	ft/sec
Aquifer depth	15	ft
Average River Flow	0.10	cfs

$$\text{Creek Concentration} = \frac{(\text{Darcy Velocity} * \text{Plume Width} * \text{Aquifer Depth})}{\text{Flow Rate}} * \text{GW Concentration}$$

Constituents	Maximum Plume Width (ft)	April 2014 Max Concentration[2] (mg/L)	Maximum Creek Concentration with Average Flow Rate (mg/L)	Instream Water Quality Standard[3] (mg/L)
TCE	120	0.090	0.00003	0.030
cis-1,2-DCE[4]	120	0.032	0.00001	0.07
trans-1,2-DCE[4]	120	0.0042	0.000002	10

Prepared by: RJT 12/11/2015
Checked by KRR: 1/12/2016

Notes

[1]K is the average of rising and falling head slug test at MW-1, MW-2, MW-4, and MW-5

[2]Maximum concentration in groundwater detected during the April 2014 sampling event

[3]Source: http://rules.sos.ga.gov/gac/391-3-6

[4]Maximum groundwater concentration detected was less than the Georgia Instream Water Quality Standard

Table 5. Summary of BIOSCREEN Model Results

Location	Regulated Substance	Point of Exposure (POE)	Historical Maximum Detected Concentration (mg/L) [1]	Distance from Maximum Concentration to POE (ft)	Time Until Constituent Reaches POE [2] (years)	Time Until Constituent Reaches POE above ISWQS [3] (years)
Electrical Warehouse	TCE	Middle Creek	4.6	35	7	> 5,000

Prepared by: RJT 12/10/15
Checked by: KRR 1/12/2016

Notes
[1]Maximum historical concentration detected at Site.
[2]Based on BIOSCREEN's "1st Order Decay" curve indicating the minimum detected concentration of 0.001 mg/L.
[3]Based on BIOSCREEN's "1st Order Decay" curve at the Instream Water Quality Standard (ISWQS) concentration of 0.030 mg/L.

Table 6. Input Coefficients for BIOSCREEN Model

Coefficient	Value	Source:
Hydraulic Conductivity, K (cm/sec)	5.51E-04	April 2015 VIRP
Hydraulic Gradient, I (feet/feet)	0.001125	Calculated using 2014 groundwater levels in MW-11 and MW-12
Effective porosity, n	0.2	April 2015 VIRP
Logitudinal Dispersivity, x (feet)	3.5	10% of length of plume (from source area to POE)
Transverse Dispersivity, alpha y : alpha x (feet)	0.35	BIOSCREEN default value
Vertical Dispersivity, alpha z : alpha x (feet)	1.00E-99	BIOSCREEN default value
Soil Bulk Density, rho (kg/L)	1.7	BIOSCREEN default value
Partition Coefficient, Koc (L/kg)	61	US EPA Risk-Based Screening Chemical Specific Parameters
Fractional Organic Carbon, foc	0.002	BIOSCREEN default value
Half-Life (years)	1.32	BIOCHLOR User's Manual, within typical range of values for TCE
Plume Length (feet)	35	Length from source area to POE along axis of groundwater flow
Plume Width (feet)	120	Measured width of plume, Figure 3
Simulation Time (years)	16	For model calibration: time of release (~1998) to last groundwater sampling event (~2014)
Source Thickness (feet)	15	Estimated from boring logs and cross sections

Prepared by: RJT 10/3/2016
Checked by:

References:

US EPA (1996) "BIOSCREEN, Natural Attenuation Decision Support System – User's Manual, Version 1.3" Publication No. EPA/600/R-96/087. August 1996

US EPA (2000) "BIOCHLOR, Natural Attenuation Decision Support System – User's Manual, Version 1.0." Publication No. EPA/600/R-00/008. January 2000

US EPA (2015) Risk-Based Screening Table - Generic Tables, Chemical Specific Parameters, November 2015

VIRP Report - Voluntary Investigation and Remediation Plan. EarthCon Consultants. April 2015.

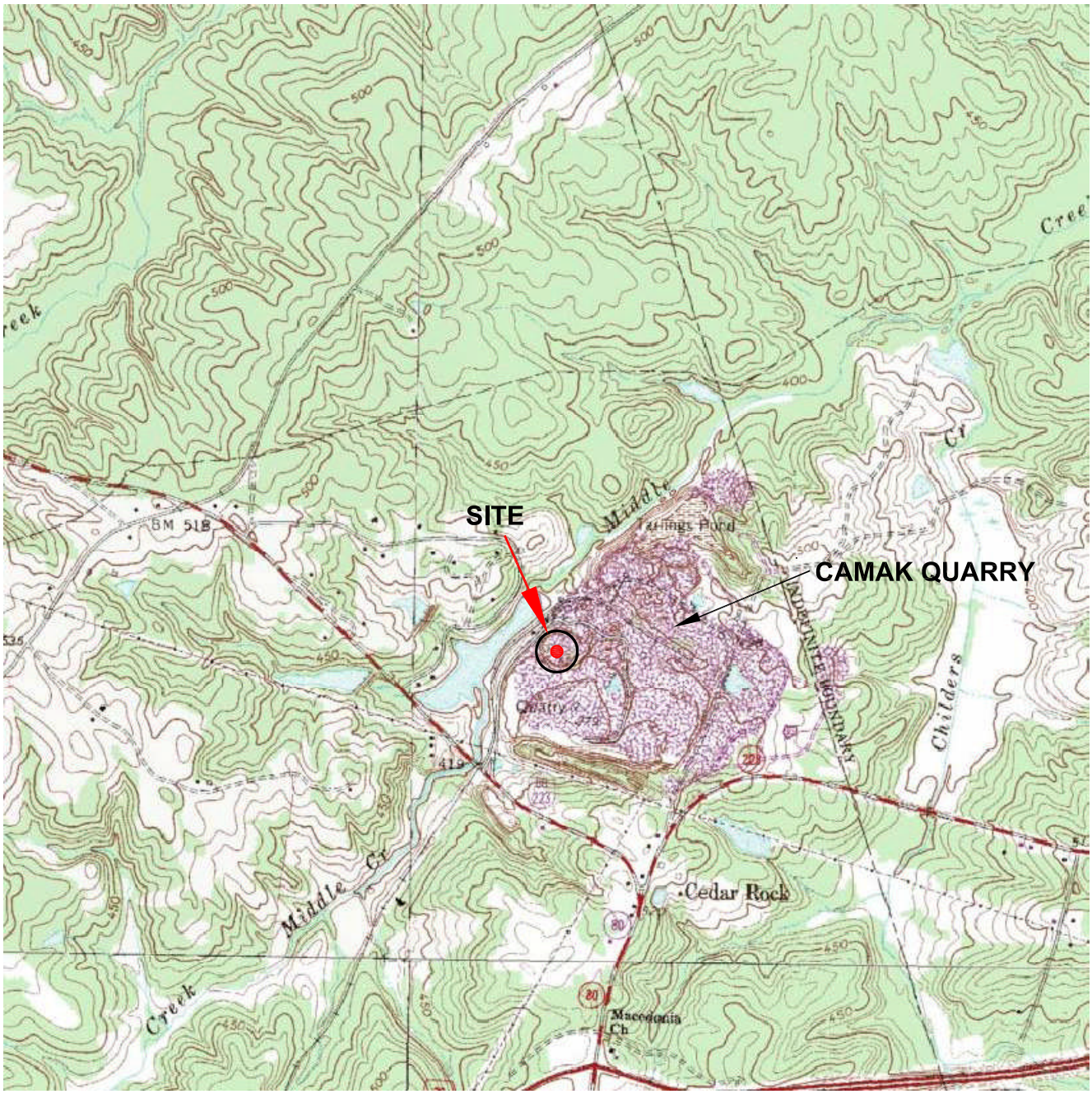
Table 7. Revised Milestone Schedule

Date	Activity
June 2015	*VIRP Approved*
September – December 2015	Groundwater Modeling
January 2016	Compliance Status Report Update
March 2016	UEC Submittal
June 2016	VIRP Progress Report Submittal
December 2016	VIRP Progress Report Submittal
February 2017	Compliance Status Report Update Revision 1 Submittal and Revised UEC Submittal

Table 8. Summary of Monthly Invoices

Month	Hours Billed by Carol Northern, P.G.	Description of Activities
July 2015	2	– Project management – Review plan for monitoring well abandonment/HASP
September 2015	1	– Discuss groundwater modeling methods/inputs
October 2015	0.75	– Review groundwater modeling inputs
November 2015	0.5	– Review groundwater modeling inputs
December 2015	1.5	– Review groundwater model – CSR Update
January 2016	8	– Review groundwater model – CSR Update

FIGURES



SOURCE: USGS 7.5 MINUTE QUAD. SERIES
WRIGHTSBORO, GEORGIA.
MAP SOURCE YEAR: 1987, PLSS TOWNSHIP: T.R

SCALE IN FEET

0 2000 4000

MARTIN
MARIETTA MATERIALS, INC.

CAMAK QUARRY, HSI #10409

PROJECT NO. 02.20140330

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SITE LOCATION

DRAWN:	CHECKED:	DATE:	FIGURE:
ED	RJT	1/29/2015	1

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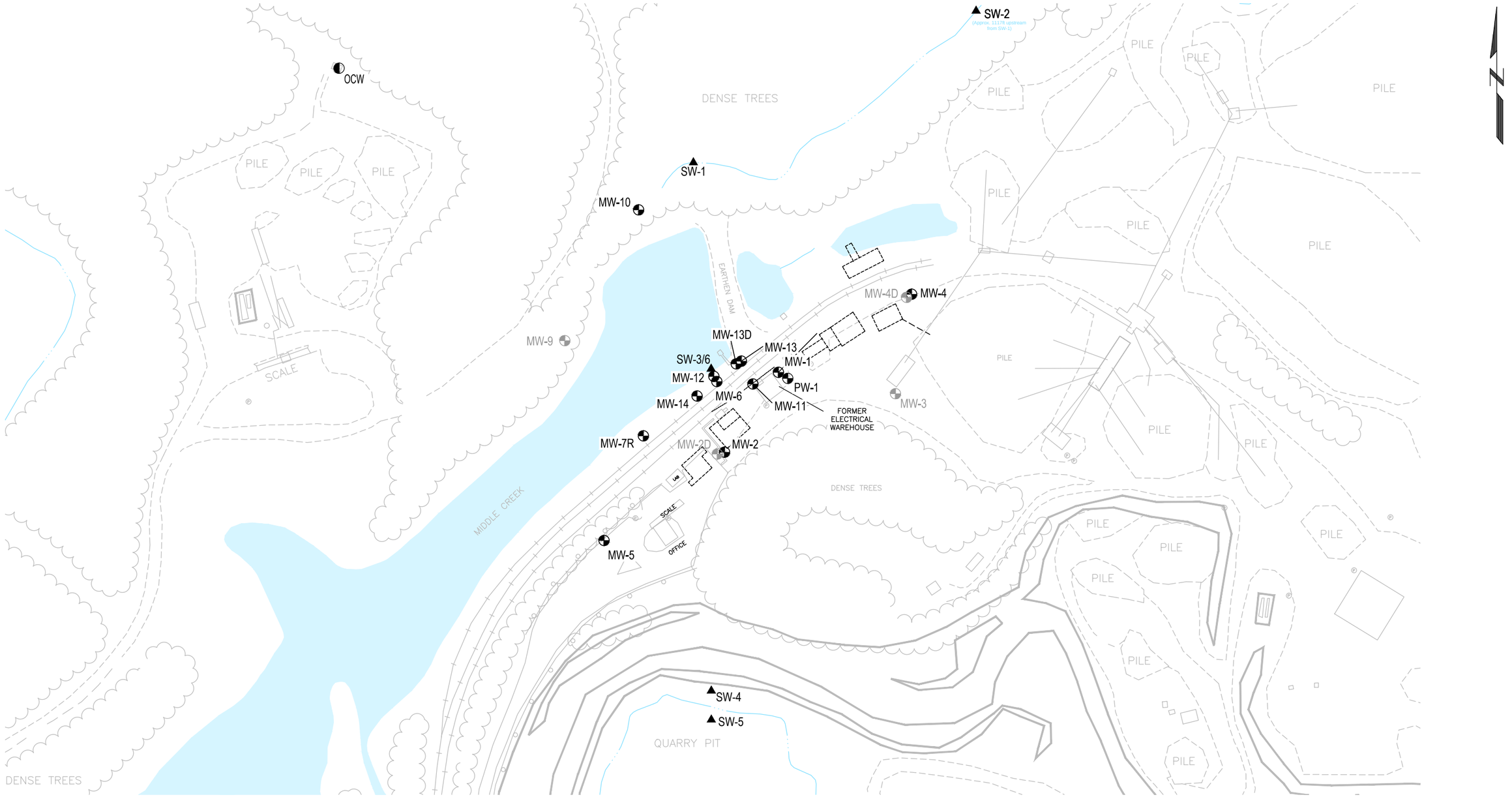

LEGEND

- MONITORING WELL LOCATION
- SURFACE WATER SAMPLE LOCATION
- WATER SUPPLY WELL
- BUILDING
- MATERIAL PILE
- MW-2D ABANDONED MONITORING WELL LOCATION
- CONTOUR LINE
- GUARD RAIL
- TRAIL
- DIRT ROAD
- PAVED ROAD
- RAILROAD TRACKS
- TREES
- WATER

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FACILITY LAYOUT MAP

DRAWN:	CHECKED:	DATE:	FIGURE:
SNW	RJT	1/23/2017	2

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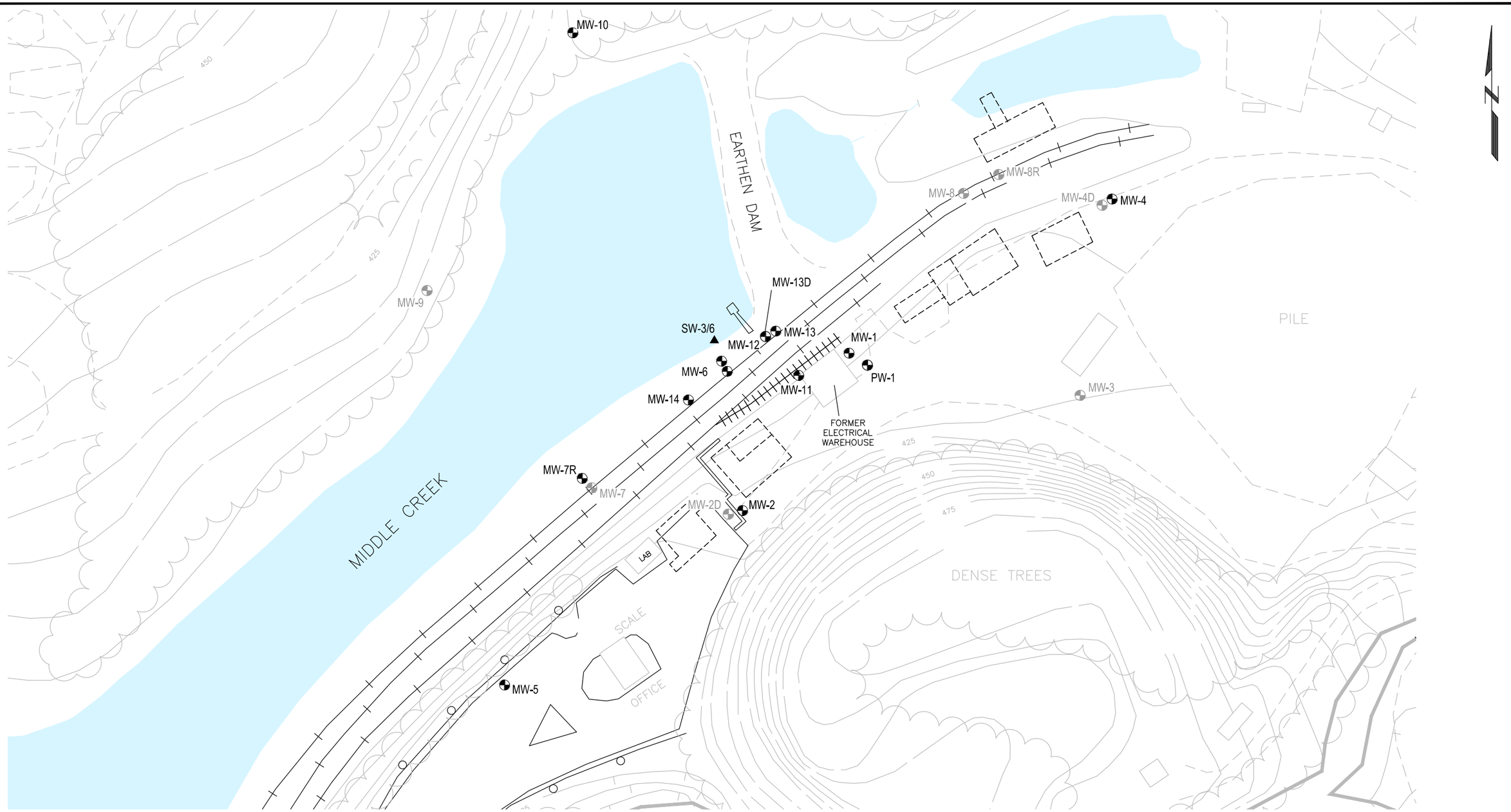

LEGEND

- MONITORING WELL LOCATION
- SURFACE WATER SAMPLE LOCATION
- WATER SUPPLY WELL
- BUILDING
- PILE — MATERIAL PILE
- MW-2D — ABANDONED MONITORING WELL LOCATION
- CONTOUR LINE
- RAILROAD TRACKS
- TREES

SCALE IN FEET

0 100 200

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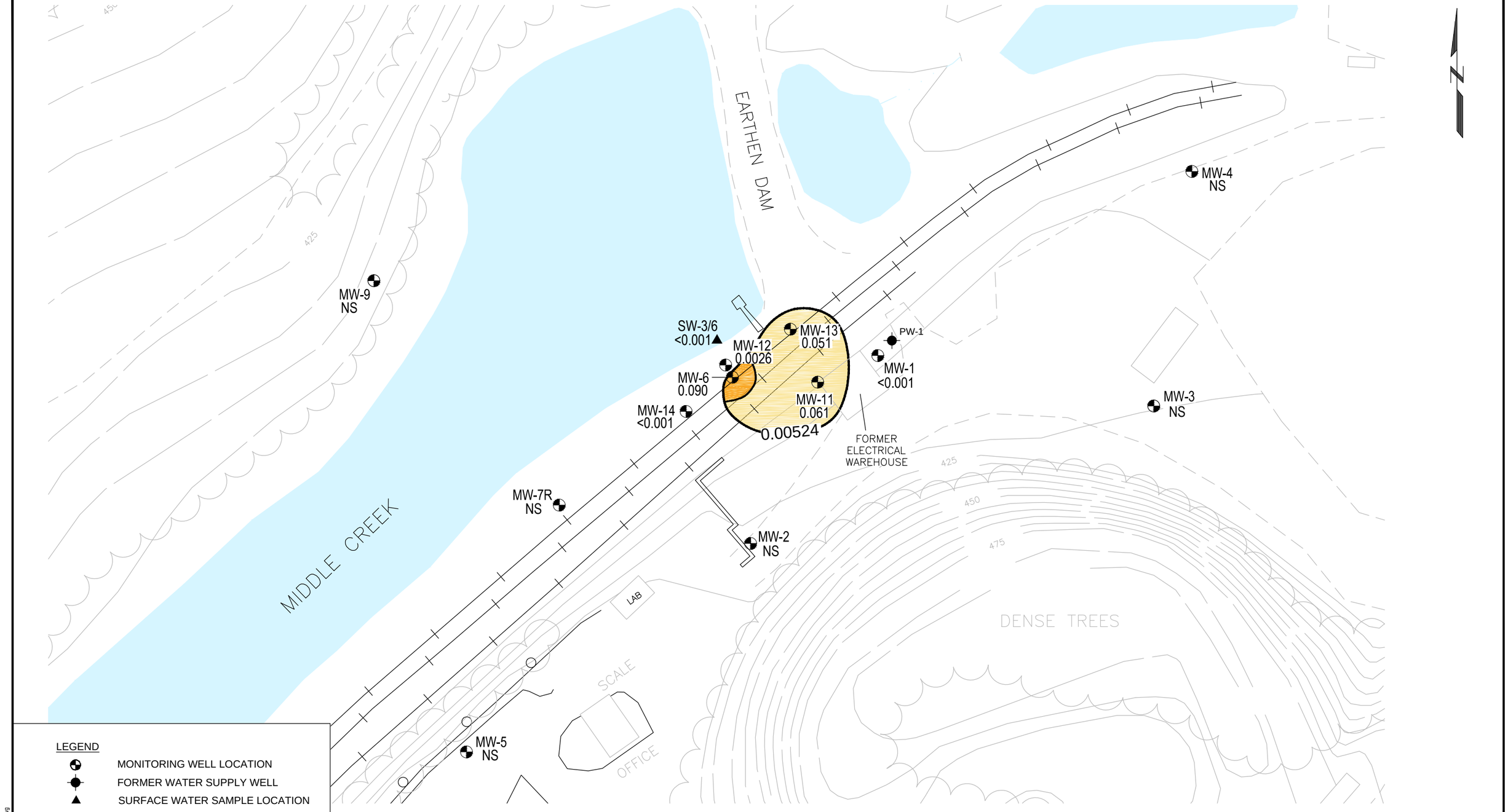
SITE LAYOUT

DRAWN:	CHECKED:	DATE:	FIGURE:
SNW	RJT	1/23/2017	3

FILENAME: 02.20140330 - layout-data figs.dwg



LEGEND

- MONITORING WELL LOCATION
- FORMER WATER SUPPLY WELL
- SURFACE WATER SAMPLE LOCATION
- mg/L — MILLIGRAMS PER LITER
- 0.051 — CONCENTRATION UNITS (mg/L)
- NS — NOT SAMPLED IN 2014
- TCE SOURCE AREA
- TCE CONCENTRATIONS ABOVE TYPE 4 RRS OF 0.00524 mg/L

SCALE IN FEET

0 80 160

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TCE CONCENTRATIONS IN OVERBURDEN APRIL 2014

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SNW	RJT	1/23/2017	4

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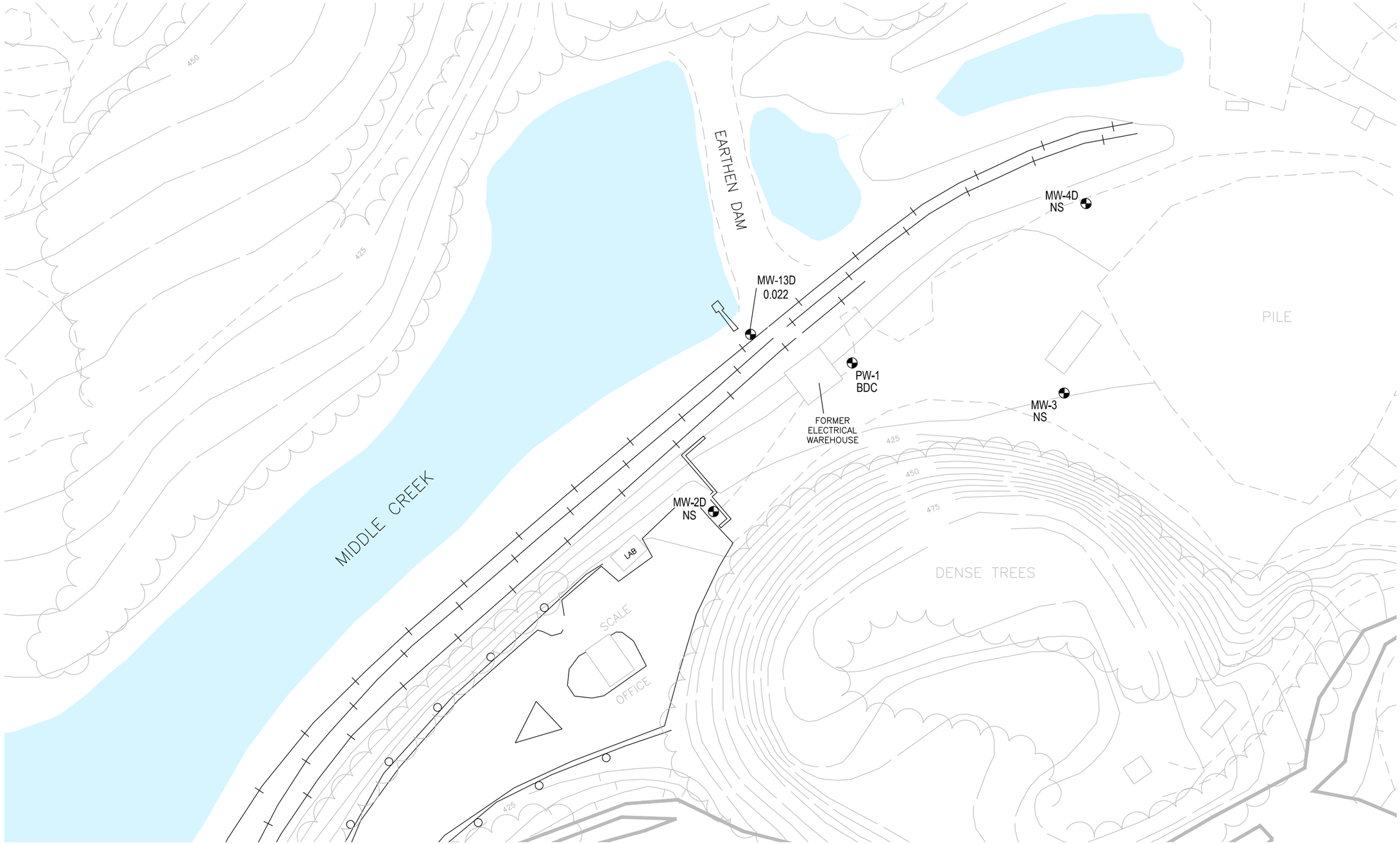

LEGEND

◓	MONITORING WELL LOCATION
▲	SURFACE WATER SAMPLE LOCATION
mg/L	MILLIGRAMS PER LITER
0.033	CONCENTRATION UNITS (mg/L)
NS	NOT SAMPLED IN 2014
BDC	BELOW DELINEATION CRITERIA

SCALE IN FEET

0 100 200

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TCE CONCENTRATIONS IN BEDROCK APRIL 2014

DRAWN:	CHECKED:	DATE:	FIGURE:
SNW	RJT	1/23/2017	5

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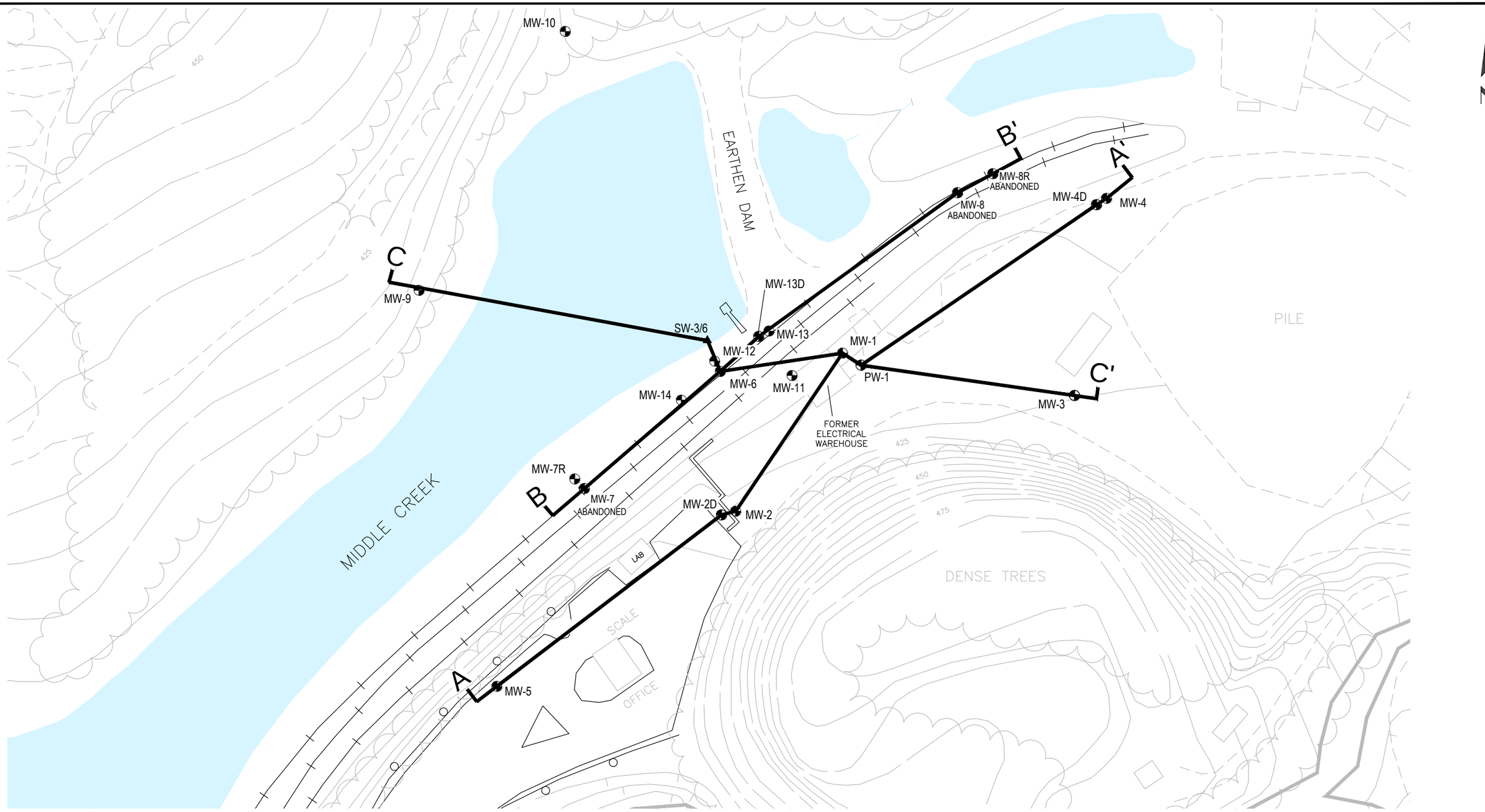

LEGEND

A A' CROSS-SECTION LOCATION

▲ SURFACE WATER SAMPLE LOCATION

MONITORING WELL LOCATION

SCALE IN FEET

0 100 200

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CROSS-SECTION LOCATION MAP

DRAWN:	CHECKED:	DATE:	FIGURE:
SNW	RJT	1/23/2017	6

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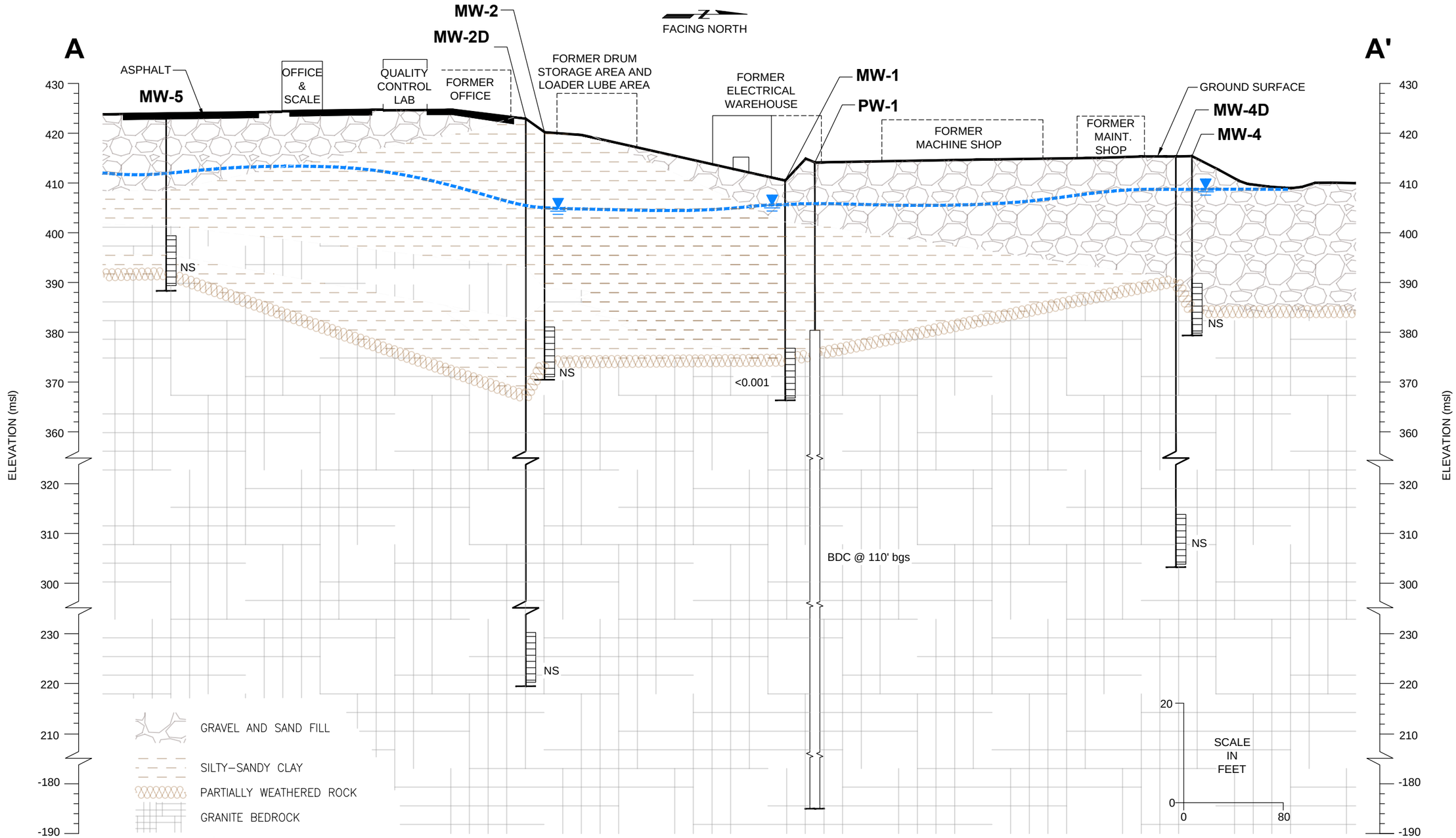

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CROSS-SECTION A-A'

DRAWN:	CHECKED:	DATE:	FIGURE:
SNW	RJT	1/23/2017	7

FILE NAME: U:\...\20140330 - XSEC B-B'.dwg

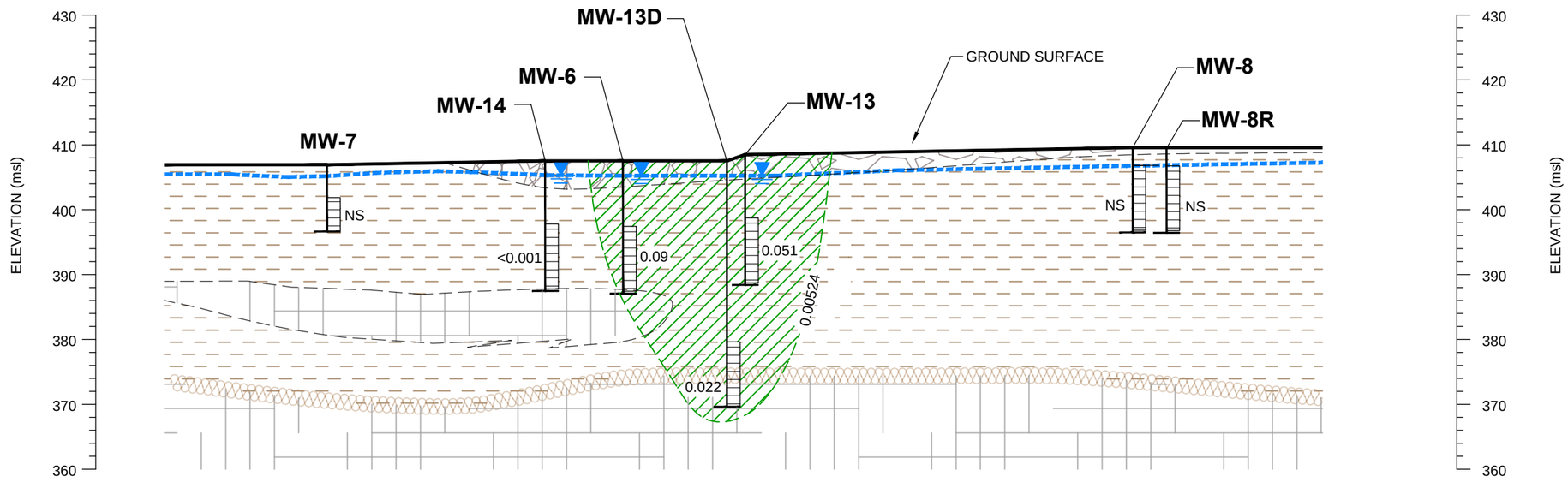
B

SOUTH

FACING NORTH

B'

NORTH



TCE CONCENTRATIONS > TYPE 4 RRS OF 0.00524 mg/L

GRAVEL AND SAND FILL

SILTY–SANDY CLAY

PARTIALLY WEATHERED ROCK

GRANITE BEDROCK

SCALE IN FEET

20

0

0

40

LEGEND

– SCREEN

mg/L – MILLIGRAMS PER LITER

<0.001 – TCE CONCENTRATION (mg/L) IN APRIL 2014

– GROUNDWATER LEVEL IN SURFICIAL AQUIFER

BDC – BELOW DELINEATION CRITERIA

msl – MEAN SEA LEVEL

NS – NOT SAMPLED IN APRIL 2014

MARTIN MARIETTA MATERIALS, INC.

CAMAK QUARRY, HSI# 10409

PROJECT NO. 02.20140330

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CROSS-SECTION B-B'

DRAWN:	CHECKED:	DATE:	FIGURE:
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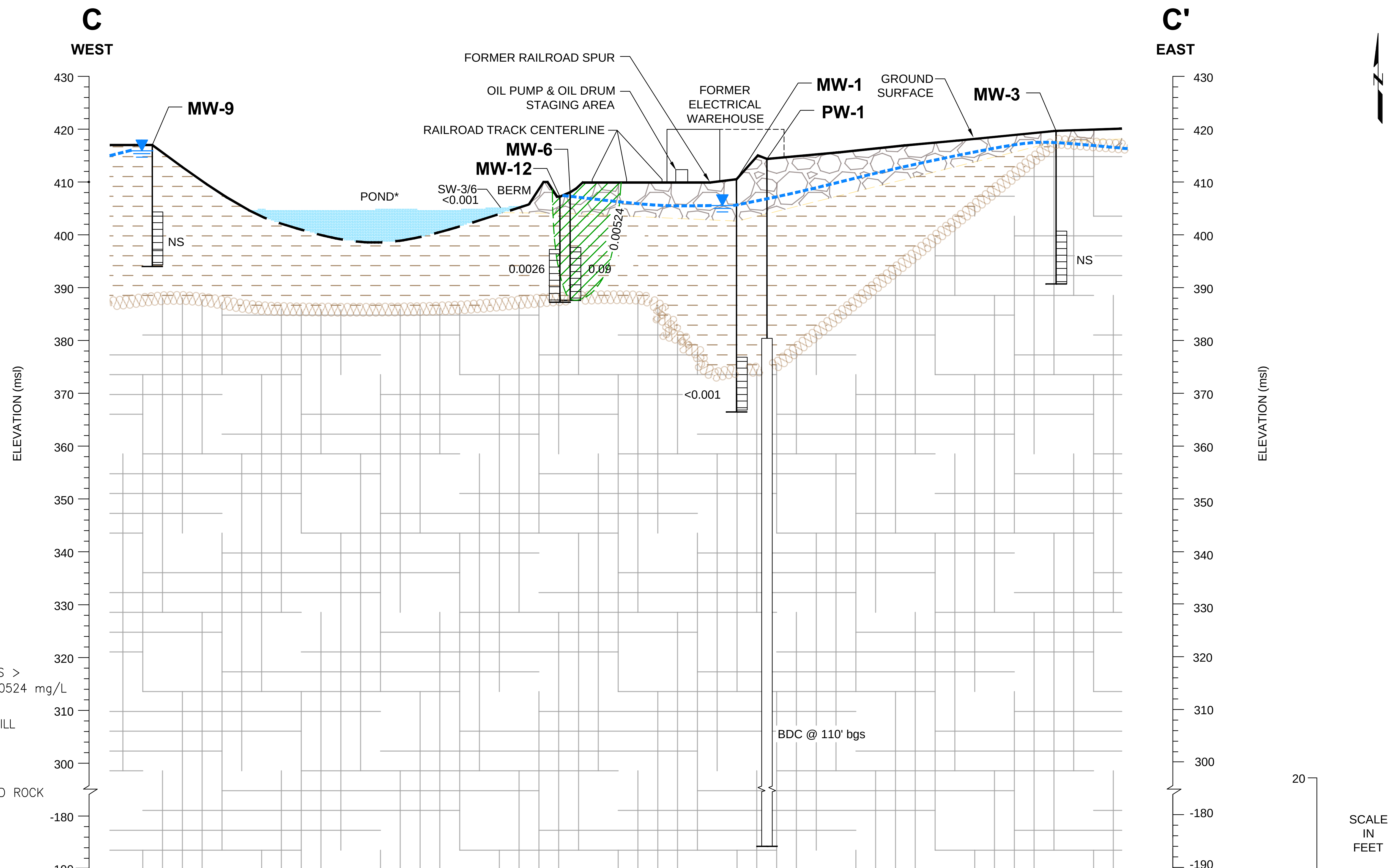

TCE CONCENTRATIONS > TYPE 4 RRS OF 0.00524 mg/L

GRAVEL AND SAND FILL

SILTY–SANDY CLAY

PARTIALLY WEATHERED ROCK

GRANITE BEDROCK

* – ELEVATION OF SURFACE WATER AND TOTAL DEPTH OF POND ARE INFERRED

mg/L – MILLIGRAMS PER LITER

<0.001 – TCE CONCENTRATION (mg/L) IN APRIL 2014

– GROUNDWATER LEVEL IN SURFICIAL AQUIFER

BDC – BELOW DELINEATION CRITERIA

msl – MEAN SEA LEVEL

NS – NOT SAMPLED IN APRIL 2014

LEGEND

– SCREEN

– OPEN HOLE CASING

SCALE IN FEET

0 80 (horizontal); 0 20 (vertical)

MARTIN MARIETTA MATERIALS, INC.

CAMAK QUARRY, HSI# 10409

PROJECT NO. 02.20140330

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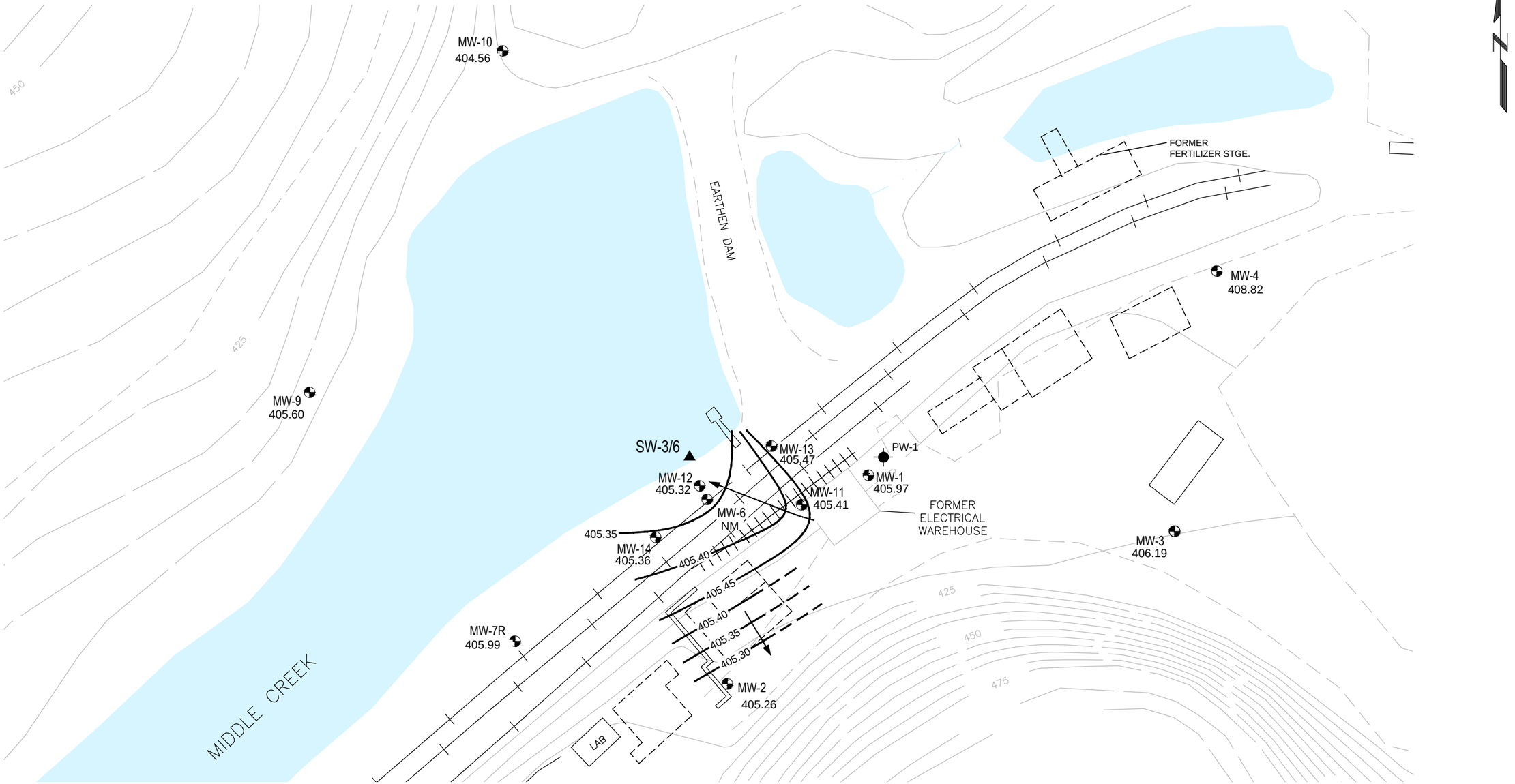
1880 WEST OAK PKWY, BLDG 100, STE 106, MARIETTA, GA, 30062

CROSS-SECTION C-C'

DRAWN:	CHECKED:	DATE:	FIGURE:
SNW	RJT	1/23/2017	9



LEGEND

- MONITORING WELL LOCATION
- FORMER WATER SUPPLY WELL
- SURFACE WATER SAMPLE LOCATION
- 405.2 — INFERRED GROUNDWATER ELEVATION CONTOUR (ft)
- 397.54 — GROUND WATER ELEVATION
- NM — NOT MEASURED
- APPROXIMATE DIRECTION OF FLOW

MARTIN MARIETTA MATERIALS, INC.

CAMAK QUARRY, HSI #10409

PROJECT NO. 02.20140330

EARTHCON®

EarthCon Consultants, Inc.

1880 WEST OAK PKWY, BLDG 100, STE 106, MARIETTA, GA, 30062

POTENTIOMETRIC SURFACE IN OVERBURDEN APRIL 2014

DRAWN:	CHECKED:	DATE:	FIGURE:
SNW	RJT	1/23/2017	10

FILENAME: 02.20140330 - potmap 2014.dwg

APPENDICES

Appendix A

Historical Soil Data

Table A1. Summary of Historical Soil Detections

			Regulated Substances															
			Acetone	2-Butanone (MEK)	N-Butylbenzene	Sec-Butylbenzene	Tert-Butlybenzene	Carbon disulfide	Dichlorodifluoromethane	Ethybenzene	Isopropylbenzene	4-Isopropyltoluene	Naphthalene	N-Propylbenzene	1,2,4-Trichlorobenzene	Trichloroethene	1,2,4-Trimethylbenzene	1,3,5-Trimethylbenzene	o-Xylene
Type 1 RRS (ug/kg)			2,740	790	500+	500+	500+	17,000+	1,490	20,000	21,880	500+	100,000	500+	10,830	130	500+	500+	20,000
Sample ID	**Sample Depth (feet bgs)**	**Sample Date**																	
Immediate Vacinity of Former Water Supply Well (PW-1)																			
SB-1	**4 - 6**	**4/6/1999**	< 63	< 32	**6.7**	**7.2**	< 6.3	< 6.3	< 6.3	< 6.3	**7.0**	< 6.3	**9.9**	**11.0**	< 6.3	< 6.3	< 6.3	< 6.3	< 6.3
SB-1	**9 - 11**	**4/6/1999**	< 70	< 35	< 7.0	< 7.0	< 7.0	< 7.0	< 7.0	< 7.0	< 7.0	< 7.0	< 7.0	**8.4**	< 7.0	< 7.0	< 7.0	< 7.0	< 7.0
SB-3	**4 - 6**	**4/5/1999**	< 64	< 32	< 6.4	< 6.4	< 6.4	< 6.4	< 6.4	< 6.4	< 6.4	< 6.4	< 6.4	**6.7**	< 6.4	< 6.4	< 6.4	< 6.4	< 6.4
SB-3	**9 - 11**	**4/5/1999**	< 64	< 32	< 6.4	< 6.4	< 6.4	< 6.4	< 6.4	< 6.4	< 6.4	< 6.4	< 6.4	**6.7**	< 6.4	< 6.4	< 6.4	< 6.4	< 6.4
SB-9	**4 - 6**	**4/6/1999**	< 58	< 29	< 5.8	< 5.8	< 5.8	< 5.8	< 5.8	< 5.8	< 5.8	< 5.8	< 5.8	< 5.8	< 5.8	**35.0**	< 5.8	< 5.8	< 5.8
Existing QA Lab																			
SB-23	**4 - 6**	**4/7/1999**	**84.0**	< 27	< 5.5	< 5.5	< 5.5	< 5.5	< 5.5	< 5.5	< 5.5	< 5.5	< 5.5	< 5.5	< 5.5	< 5.5	< 5.5	< 5.5	< 5.5
Within and Dowgradient of Former Machine and Maintenance Shops																			
SB-17*	**9 - 11**	**4/7/1999**	**150.0**	< 29	**15.0**	< 5.9	**8.3**	**6.8**	**6.4**	**6.7**	**7.9**	**9.7**	**8.7**	**21.0**	< 5.9	< 5.9	**29.0**	**15.0**	**21.0**
SB-31	**4 - 6**	**4/7/1999**	**64.0**	< 29	< 5.8	< 5.8	< 5.8	< 5.8	< 5.8	< 5.8	< 5.8	< 5.8	**9.6**	< 5.8	< 5.8	< 5.8	< 5.8	< 5.8	< 5.8
SB-31R	**4 - 6**	**4/7/1999**	**68.0**	< 30	< 5.9	< 5.9	< 5.9	< 5.9	< 5.9	< 5.9	< 5.9	< 5.9	**7.4**	< 5.9	< 5.9	< 5.9	< 5.9	< 5.9	< 5.9
SB-32	**1 - 3**	**4/7/1999**	**76.0**	< 27	< 5.4	< 5.4	< 5.4	< 5.4	< 5.4	< 5.4	< 5.4	< 5.4	**7.5**	< 5.4	< 5.4	< 5.4	< 5.4	< 5.4	< 5.4
B-1	**4 - 6**	**8/14/2002**	**61.0**	< 4.9	< 0.98	< 0.98	< 2.0	< 0.98	< 4.9	< 0.98	< 0.98	< 0.98	< 4.9	< 0.98	< 2.0	< 2.0	< 0.98	< 0.98	< 0.98
B-2	**4 - 6**	**8/14/2002**	**100.0**	< 3.8	< 0.76	< 0.76	< 1.5	< 0.76	< 3.8	< 0.76	< 0.76	< 0.76	< 3.8	< 0.76	< 1.5	< 1.5	< 0.76	< 0.76	< 0.76
B-3	**4 - 6**	**8/14/2002**	**160.0**	< 4.3	< 0.85	< 0.85	< 1.7	**4.3**	< 4.3	< 0.85	< 0.85	< 0.85	< 4.3	< 0.85	< 1.7	, 1.7	< 0.85	< 0.85	< 0.85
Former Asphalt Plant, Stockpiles, Testing Lab, and Plant Operations																			
SB-35	**4 - 6**	**4/7/1999**	< 54	< 27	< 5.4	< 5.4	< 5.4	< 5.4	< 5.4	< 5.4	< 5.4	< 5.4	**7.4**	< 5.4	< 5.4	< 5.4	< 5.4	< 5.4	< 5.4
Exisitng Electrical Warehouse and Former Rail Spur, Locomotive Oil Change, Oil Pump, and Oil Drum Staging Area																			
SB-37	**1 - 3**	**5/4/1999**	**60.0**	< 28	< 5.6	< 5.6	< 5.6	< 5.6	< 5.6	< 5.6	< 5.6	< 5.6	< 5.6	< 5.6	< 5.6	< 5.6	< 5.6	< 5.6	< 5.6
SB-39	**1 - 3**	**5/4/1999**	< 290	< 150	< 29	< 29	< 29	< 29	< 29	< 29	< 29	< 29	**990.0**	< 29	< 29	< 29	< 29	< 29	< 29
SB-40	**1 - 3**	**5/4/1999**	< 54	**28.0**	**40.0**	**21.0**	< 5.4	< 5.4	< 5.4	**9.0**	**6.2**	**34.0**	**170.0**	**10.0**	**200.0**	**26.0**	< 5.4	< 5.4	< 5.4
SB-41	**1 - 3**	**5/4/1999**	< 53	< 26	< 5.3	< 5.3	< 5.3	< 5.3	< 5.3	< 5.3	**18.0**	< 5.3	< 5.3	< 5.3	< 5.3	< 5.3	< 5.3	< 5.3	< 5.3
SB-43*	**1 - 3**	**5/4/1999**	**89.0**	< 34	< 6.8	< 6.8	< 6.8	< 6.8	< 6.8	< 6.8	< 6.9	< 6.8	< 6.8	< 6.8	< 6.8	< 6.8	< 6.8	< 6.8	< 6.8

Notes

Source: AquaFusion, 2002

ug/kg - micrograms per kilogram

RRS - risk reduction standards

BOLD - greater than detection limit

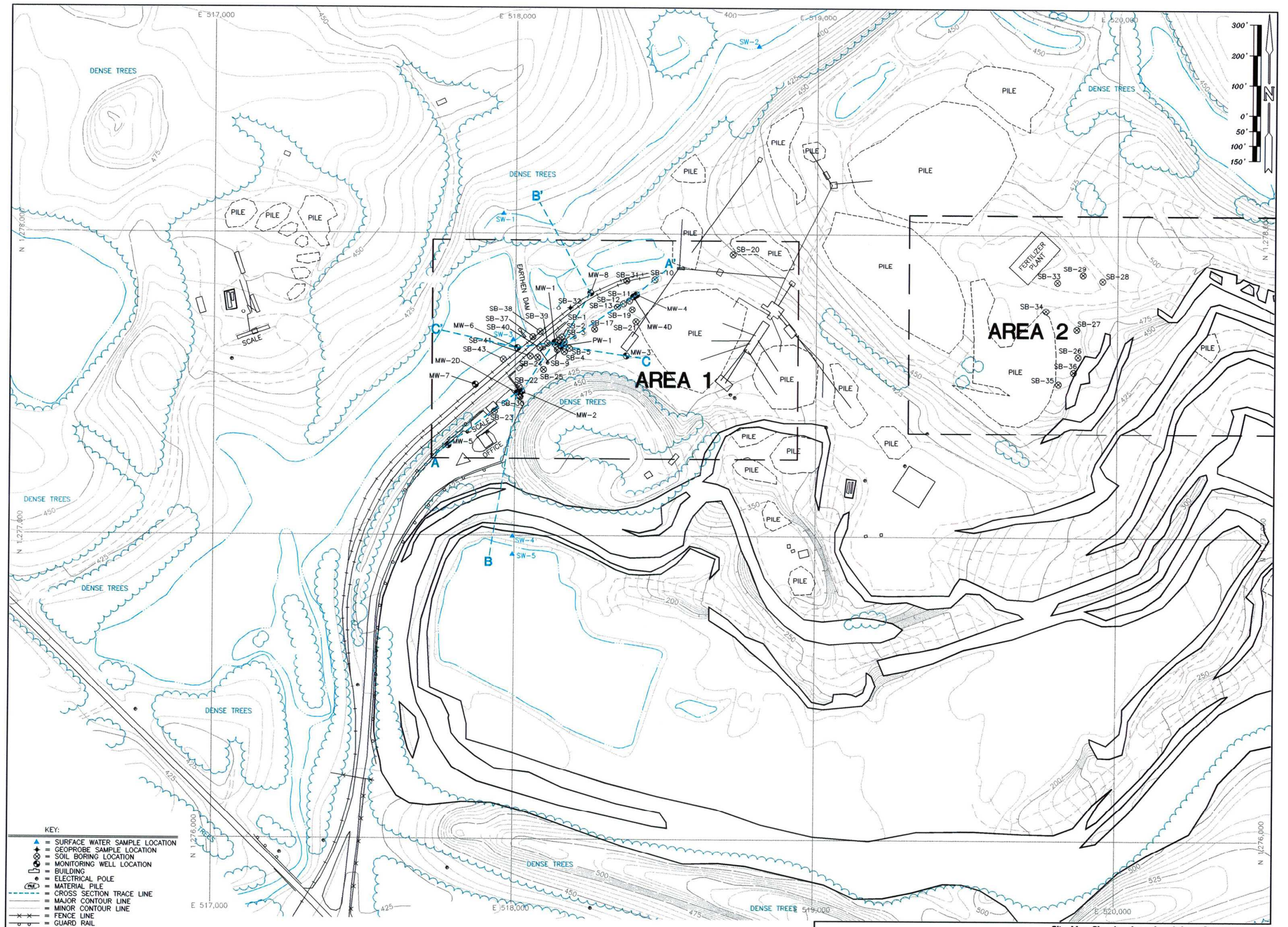
+ Approved Type 1 RRS in the 1999 CSR

* SB-17 - used in investigation of two potential source areas (Former Machine and Maintenance Shops and Former Office, Drum Storage, and Loader Lubrication Area)

* SB-43 - used in investigation of two potential source areas (Former Office, Drum Storage, and Loader Lubrication Area and Existing Electrical Warehouse and Former Rail Spur, Locomotive Oil Change, Oil Pump, and Oil Drum Staging Area)

Prepared By: KAH 1/5/2016

Prepared By: RJT 1/14/2016



KEY:

- ▲ = SURFACE WATER SAMPLE LOCATION
- ✦ = GEOPROBE SAMPLE LOCATION
- ⊗ = SOIL BORING LOCATION
- ◉ = MONITORING WELL LOCATION
- = BUILDING
- = ELECTRICAL POLE
- (PILE) = MATERIAL PILE
- = CROSS SECTION TRACE LINE
- = MAJOR CONTOUR LINE
- = MINOR CONTOUR LINE
- = FENCE LINE
- = GUARD RAIL
- = TRAIL
- = DIRT ROAD
- = PAVED ROAD
- = RAILROAD TRACKS
- = TREES
- = WATER

HORIZONTAL DATUM: NAD83
VERTICAL DATUM: NGVD27
CONTOUR INTERVAL: 5'

BASED ON A TOPOGRAPHIC MAP DATED FEBRUARY, 1998
PREPARED BY MARTIN MARIETTA AGGREGATES.

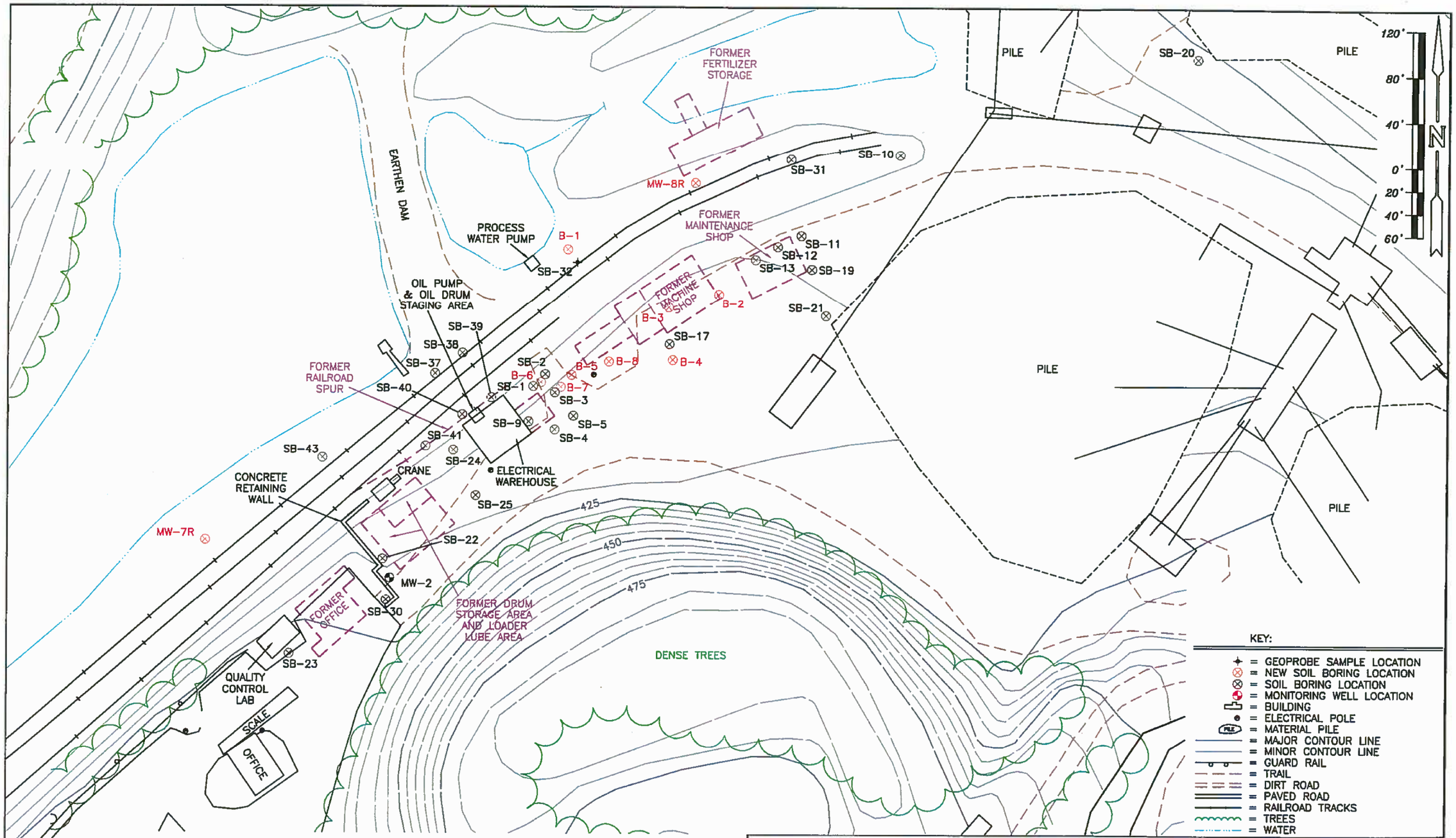
HLA

Harding Lawson Associates
Engineering and
Environmental Services

Site Map Showing Area 1 and Area 2
Martin Marietta Aggregates – Camak Quarry CSR
Warren and McDuffie Counties
Thomson, Georgia

PLATE **1**

DRAWN	PROJECT NUMBER	APPROVED	DATE	REVISED DATE
EWS	46654,6		06/29/99	



HORIZONTAL DATUM: NAD83
VERTICAL DATUM: NGVD27
CONTOUR INTERVAL: 5'

BASED ON A TOPOGRAPHIC MAP DATED FEBRUARY, 1998
PREPARED BY MARTIN MARIETTA AGGREGATES.

aquaFusion Inc
SCIENCE and ENGINEERING
P.O. BOX 2166 LEESBURG, VA 20177
(703) 737-2124

Soil Boring Locations
Martin Marietta Aggregates – Camak Quarry CSR
Warren and McDuffie Counties
Thomson, Georgia

FIGURE **2**

DRAWN	PROJECT NUMBER	APPROVED	DATE	REVISED DATE
EWS	46654,6		06/29/99	09/23/02

Appendix B

Historical Groundwater and Surface Water Data

Table B1. Historical Groundwater and Surface Water Data

Groundwater		Regulated Substance (mg/L)													
		1,1-DCE	2-butanone	4-methyl 2-pentanone	Acetone	Carbon disulfide	Chloro ethane	cis-1,2-DCE	Cyclo hexane	Methylene Chloride	Naphthalene	Toluene	trans-1,2-DCE	TCE	Vinyl chloride
Delineation Criteria (mg/L)		0.007	2	2	4	4	DL	0.07	DL	0.005	0.02	1	0.1	0.005	0.002
Type 4 RRS (mg/L)		0.524	NC	NC	45	1.7	NC	0.204	17.52	NC	0.00872	5.24	0.161	0.00524	0.00327
Sample Location	**Sample Date**														
PW-1	12/5/94	<0.001	NA	<0.001	NA	NA	<0.001	**0.0018**	NA	NA	NA	**0.0011**	<0.001	**0.179**	<0.001
	2/20/95	<0.001	NA	<0.001	NA	NA	<0.001	**0.0028**	NA	NA	NA	<0.001	<0.001	**0.137**	<0.001
	4/7/99	<0.001	<0.025	<0.002	<0.025	<0.001	<0.002	<0.001	NA	<0.001	<0.001	<0.001	<0.001	**0.013**	<0.001
	4/7/99	<0.001	<0.025	<0.002	<0.025	<0.001	<0.002	<0.001	NA	<0.001	<0.001	<0.001	<0.001	**0.015**	<0.001
	4/7/99	<0.001	<0.025	<0.002	<0.025	<0.001	<0.002	<0.001	NA	<0.001	<0.001	<0.001	<0.001	**0.008**	<0.001
	4/8/99	<0.001	<0.025	<0.002	<0.025	<0.001	<0.002	<0.001	NA	<0.001	<0.001	<0.001	<0.001	**0.011**	<0.001
	4/8/99	<0.001	<0.025	<0.002	<0.025	<0.001	<0.002	<0.001	NA	<0.001	<0.001	<0.001	<0.001	**0.012**	<0.001
	4/8/99	<0.001	<0.025	<0.002	<0.025	<0.001	<0.002	<0.001	NA	<0.001	<0.001	<0.001	<0.001	**0.013**	<0.001
	4/8/99	<0.001	<0.025	<0.002	<0.025	<0.001	<0.002	<0.001	NA	<0.001	<0.001	<0.001	<0.001	**0.016**	<0.001
	4/9/99	<0.001	<0.025	<0.002	<0.025	<0.001	<0.002	<0.001	NA	<0.001	<0.001	<0.001	<0.001	**0.012**	<0.001
@ 100'	10/21/00	<0.001	<0.025	<0.002	<0.025	<0.001	<0.002	<0.001	NA	<0.001	<0.001	<0.001	<0.001	**0.003**	<0.001
@ 300'	10/21/00	<0.002	<0.05	<0.004	<0.05	**0.03**	<0.004	<0.001	NA	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002
@ 100'	8/12/02	<0.001	<0.005	<0.001	<0.005	<0.001	<0.001	<0.001	NA	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
@ 300'	8/12/02	<0.001	<0.005	<0.001	<0.005	<0.001	<0.001	<0.001	NA	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
@ 100'	12/14/05	<0.005	<0.05	<0.01	<0.05	<0.005	<0.01	<0.005	<0.005	<0.005	NA	<0.005	<0.005	<0.005	<0.002
@ 100'	4/11/06	<0.005	**0.39**	**0.011**	**0.19**	<0.005	**0.052**	<0.005	<0.005	<0.005	NA	<0.005	<0.005	<0.005	<0.002
@ 100'	6/6/06	<0.005	<0.05	<0.01	<0.05	<0.005	<0.01	<0.005	<0.005	<0.005	NA	<0.005	<0.005	<0.005	<0.002
@ 100'	9/13/06	<0.005	<0.05	<0.01	<0.05	<0.005	<0.01	<0.005	<0.005	<0.005	NA	<0.005	<0.005	<0.005	<0.002
@ 100'	3/12/07	<0.005	<0.05	<0.01	<0.05	<0.005	<0.01	<0.005	<0.005	<0.005	NA	<0.005	<0.005	<0.005	<0.002
@ 100'	3/12/08	<0.005	<0.05	<0.01	<0.05	<0.005	<0.01	<0.005	<0.005	<0.005	NA	<0.005	<0.005	<0.005	<0.002
@ 100'	3/12/09	<0.005	<0.05	<0.01	<0.05	<0.005	<0.01	<0.005	<0.005	<0.005	NA	<0.005	<0.005	<0.005	<0.002
@ 100'	3/31/10	<0.005	<0.05	<0.01	<0.05	<0.005	<0.01	<0.005	<0.005	<0.005	NA	<0.005	<0.005	<0.005	<0.002
@ 100'	3/15/11	<0.001	<0.005	<0.002	<0.005	<0.001	<0.002	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
@ 120'	4/26/12	<0.001	<0.005	<0.002	**0.012**	<0.005	<0.002	<0.001	<0.001	<0.001	<0.001	**0.045**	<0.001	**0.0013**	<0.001
@ 110'	4/17/13	<0.001	<0.005	<0.002	<0.005	<0.005	<0.002	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
@ 110'	4/22/14	<0.001	<0.005	<0.002	<0.005	<0.005	<0.002	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	**0.0018**	<0.001
MW-1	4/12/99	<0.001	<0.025	<0.002	<0.025	<0.001	<0.002	<0.001	NA	<0.001	<0.001	<0.001	<0.001	**0.006**	<0.001
	8/12/02	<0.001	<0.005	<0.001	<0.005	<0.001	<0.001	<0.001	NA	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
	12/12/05	<0.005	<0.05	<0.01	<0.05	<0.005	<0.01	<0.005	<0.005	<0.005	NA	<0.005	<0.005	**0.018**	<0.002
	4/11/06	<0.005	<0.05	<0.01	<0.05	<0.005	<0.01	<0.005	<0.005	<0.005	NA	<0.005	<0.005	**0.008**	<0.002
	6/6/06	<0.005	<0.05	<0.01	<0.05	<0.005	<0.01	<0.005	<0.005	<0.005	NA	<0.005	<0.005	**0.0093**	<0.002
	9/14/06	<0.005	<0.05	<0.01	<0.05	<0.005	<0.01	<0.005	<0.005	<0.005	NA	<0.005	<0.005	<0.005	<0.002
	3/12/07	<0.005	<0.05	<0.01	<0.05	<0.005	<0.01	<0.005	<0.005	<0.005	NA	<0.005	<0.005	**0.0057**	<0.002
	3/11/08	<0.005	<0.05	<0.01	<0.05	<0.005	<0.01	<0.005	<0.005	<0.005	NA	<0.005	<0.005	<0.005	<0.002
	3/11/09	<0.005	<0.05	<0.01	<0.05	<0.005	<0.01	<0.005	<0.005	<0.005	NA	<0.005	<0.005	<0.005	<0.002
	3/30/10	<0.005	<0.05	<0.01	<0.05	<0.005	<0.01	<0.005	<0.005	<0.005	NA	<0.005	<0.005	<0.005	<0.002
	3/14/11	<0.001	<0.005	<0.002	<0.005	<0.001	<0.002	**0.017**	<0.001	<0.001	<0.001	<0.001	<0.001	**0.0016**	<0.001
	4/24/12	<0.001	<0.005	<0.002	<0.005	<0.005	<0.002	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
	4/22/13	<0.001	<0.005	<0.002	<0.005	<0.005	<0.002	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
	4/21/14	<0.001	<0.005	<0.002	<0.005	<0.001	<0.002	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001

Table B1. Historical Groundwater and Surface Water Data

Groundwater		Regulated Substance (mg/L)													
		1,1-DCE	2-butanone	4-methyl 2-pentanone	Acetone	Carbon disulfide	Chloro ethane	cis-1,2-DCE	Cyclo hexane	Methylene Chloride	Naphthalene	Toluene	trans-1,2-DCE	TCE	Vinyl chloride
Delineation Criteria (mg/L)		0.007	2	2	4	4	DL	0.07	DL	0.005	0.02	1	0.1	0.005	0.002
Type 4 RRS (mg/L)		0.524	NC	NC	45	1.7	NC	0.204	17.52	NC	0.00872	5.24	0.161	0.00524	0.00327
MW-2	4/12/99	<0.001	<0.025	<0.002	<0.025	<0.001	<0.002	<0.001	NA	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
MW-2D	4/21/99	<0.001	<0.025	<0.002	<0.025	**0.001**	<0.002	<0.001	NA	<0.001	<0.001	<0.001	<0.001	**0.018**	<0.001
	10/21/00	<0.001	<0.025	<0.002	<0.025	**0.072**	<0.002	<0.001	NA	<0.001	<0.001	<0.001	<0.001	**0.001**	<0.001
	8/13/02	<0.001	<0.005	<0.001	<0.005	<0.001	<0.001	<0.001	NA	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
	12/14/05	<0.005	<0.05	<0.01	<0.05	<0.005	<0.01	<0.005	<0.005	<0.005	NA	<0.005	<0.005	<0.005	<0.002
	4/12/06	<0.005	<0.05	<0.01	<0.05	<0.005	<0.01	<0.005	<0.005	<0.005	NA	<0.005	<0.005	<0.005	<0.002
	6/6/06	<0.005	<0.05	<0.01	<0.05	<0.005	<0.01	<0.005	<0.005	<0.005	NA	<0.005	<0.005	<0.005	<0.002
	9/13/06	<0.005	<0.05	<0.01	<0.05	<0.005	<0.01	<0.005	<0.005	<0.005	NA	<0.005	<0.005	<0.005	<0.002
	3/12/07	<0.005	<0.05	<0.01	<0.05	<0.005	<0.01	<0.005	<0.005	<0.005	NA	<0.005	<0.005	<0.005	<0.002
	3/11/08	<0.005	<0.05	<0.01	<0.05	<0.005	<0.01	<0.005	<0.005	<0.005	NA	<0.005	<0.005	<0.005	<0.002
	3/12/09	<0.005	<0.05	<0.01	<0.05	<0.005	<0.01	<0.005	<0.005	<0.005	NA	<0.005	<0.005	<0.005	<0.002
	3/31/10	<0.005	<0.05	<0.01	<0.05	<0.005	<0.01	<0.005	<0.005	<0.005	NA	<0.005	<0.005	<0.005	<0.002
	3/14/11	<0.001	<0.005	<0.002	<0.005	<0.001	<0.002	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
	4/25/12	<0.001	<0.005	<0.002	<0.005	<0.005	<0.002	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
MW-3	4/12/99	<0.001	<0.001	<0.002	<0.001	<0.001	<0.002	<0.001	NA	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
MW-4	4/12/99	<0.001	<0.025	<0.002	<0.025	<0.001	<0.002	<0.001	NA	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
MW-4D	4/21/99	<0.001	<0.025	<0.002	<0.025	<0.001	<0.002	<0.001	NA	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
	10/21/00	<0.002	<0.05	<0.004	<0.05	**0.034**	<0.004	<0.001	NA	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002
	8/13/02	<0.001	<0.005	<0.001	<0.005	<0.001	<0.001	<0.001	NA	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
	12/14/05	<0.005	<0.05	<0.01	<0.05	<0.005	<0.01	<0.005	<0.005	<0.005	NA	<0.005	<0.005	<0.005	<0.002
	4/12/06	<0.005	<0.05	<0.01	<0.05	<0.005	<0.01	<0.005	<0.005	<0.005	NA	<0.005	<0.005	<0.005	<0.002
	6/6/06	<0.005	<0.05	<0.01	<0.05	<0.005	<0.01	<0.005	<0.005	<0.005	NA	<0.005	<0.005	<0.005	<0.002
	9/13/06	<0.005	<0.05	<0.01	<0.05	<0.005	<0.01	<0.005	<0.005	<0.005	NA	<0.005	<0.005	<0.005	<0.002
	3/12/07	<0.005	<0.05	<0.01	<0.05	<0.005	<0.01	<0.005	<0.005	<0.005	NA	<0.005	<0.005	<0.005	<0.002
	3/11/08	<0.005	<0.05	<0.01	<0.05	<0.005	<0.01	<0.005	<0.005	<0.005	NA	<0.005	<0.005	<0.005	<0.002
	3/11/09	<0.005	<0.05	<0.01	<0.05	<0.005	<0.01	<0.005	<0.005	<0.005	NA	<0.005	<0.005	<0.005	<0.002
	3/31/10	<0.005	<0.05	<0.01	<0.05	<0.005	<0.01	<0.005	<0.005	<0.005	NA	<0.005	<0.005	<0.005	<0.002
	3/14/11	<0.001	<0.005	<0.002	<0.005	<0.001	<0.002	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
	4/25/12	<0.001	<0.005	<0.002	<0.005	<0.005	<0.002	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
MW-5	4/12/99	<0.001	<0.025	<0.002	<0.025	<0.001	<0.002	<0.001	NA	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001

Table B1. Historical Groundwater and Surface Water Data

Groundwater		Regulated Substance (mg/L)													
		1,1-DCE	**2-butanone**	**4-methyl 2-pentanone**	**Acetone**	**Carbon disulfide**	**Chloro ethane**	**cis-1,2-DCE**	**Cyclo hexane**	**Methylene Chloride**	**Naphthalene**	**Toluene**	**trans-1,2-DCE**	**TCE**	**Vinyl chloride**
Delineation Criteria (mg/L)		0.007	2	2	4	4	DL	0.07	DL	0.005	0.02	1	0.1	0.005	0.002
Type 4 RRS (mg/L)		0.524	NC	NC	45	1.7	NC	0.204	17.52	NC	0.00872	5.24	0.161	0.00524	0.00327
MW-6	4/21/99	<0.08	<2	<0.16	<2	<0.08	<0.16	<0.08	NA	<0.08	<0.08	<0.08	<0.08	**1.4**	<0.08
	10/21/00	<0.05	<1.2	<0.1	<1.2	<0.05	<0.1	<0.05	NA	<0.05	<0.05	<0.05	<0.05	**0.68**	<0.05
	8/12/02	**0.0021**	<0.005	<0.001	<0.005	<0.001	<0.001	**0.038**	NA	<0.001	<0.001	<0.001	<0.001	**4.6**	**0.0088**
	11/22/02	<0.01	NA	NA	NA	NA	NA	**0.0442**	NA	NA	NA	NA	<0.01	**1.26**	**0.0091**
	12/12/05	<0.005	<0.05	<0.01	<0.05	<0.005	<0.01	**0.01**	<0.005	<0.005	NA	<0.005	<0.005	**0.52**	<0.002
	4/11/06	<0.005	<0.05	<0.01	<0.05	<0.005	<0.01	**0.0066**	<0.005	<0.005	NA	<0.005	<0.005	**0.4**	<0.002
	6/6/06	<0.005	<0.05	<0.01	<0.05	<0.005	<0.01	**0.021**	<0.005	<0.005	NA	<0.005	<0.005	**0.72**	**0.004**
	9/13/06	<0.005	<0.05	<0.01	<0.05	<0.005	<0.01	**0.03**	<0.005	<0.005	NA	<0.005	<0.005	**0.79**	**0.0043**
	3/12/07	<0.005	<0.05	<0.01	<0.05	<0.005	<0.01	**0.011**	<0.005	<0.005	NA	<0.005	<0.005	**0.46**	<0.002
	9/6/07	<0.005	<0.05	<0.01	<0.05	<0.005	<0.01	**0.03**	<0.005	<0.005	NA	<0.005	<0.005	**0.64**	<0.002
	3/12/08	<0.005	<0.05	<0.01	<0.05	<0.005	<0.01	**0.0055**	<0.005	<0.005	NA	<0.005	<0.005	**0.28**	<0.002
	9/3/08	<0.005	<0.05	<0.01	<0.05	<0.005	<0.01	**0.0093**	<0.005	<0.005	NA	<0.005	<0.005	**0.4**	**0.0024**
	3/11/09	<0.005	<0.05	<0.01	<0.05	<0.005	<0.01	**0.0072**	**0.0052**	<0.005	NA	<0.005	<0.005	**0.18**	<0.002
	3/30/10	<0.005	<0.05	<0.01	<0.05	<0.005	<0.01	<0.005	<0.005	<0.005	NA	<0.005	<0.005	**0.098**	<0.002
	3/14/11	<0.001	<0.005	<0.002	<0.005	<0.001	<0.002	**0.012**	<0.001	<0.001	<0.001	<0.001	<0.001	**0.17**	<0.001
	4/24/12	<0.001	<0.005	<0.002	<0.005	<0.005	<0.002	**0.0053**	<0.001	<0.001	<0.001	<0.001	<0.001	**0.065**	<0.001
	4/22/13	<0.001	<0.005	<0.002	<0.005	<0.005	<0.002	**0.0048**	<0.001	<0.001	<0.001	<0.001	<0.001	**0.063**	<0.001
	4/21/14	<0.001	<0.005	<0.002	<0.005	<0.005	<0.002	**0.0029**	<0.001	<0.001	<0.001	<0.001	<0.001	**0.09**	<0.001
MW-7 **MW-7R**	4/26/99	**0.004**	<0.025	<0.002	<0.025	<0.001	<0.002	**0.002**	NA	<0.001	<0.001	<0.001	<0.001	<0.001	**0.002**
	5/4/99	<0.05	<1.2	<0.1	<1.2	<0.05	<0.1	<0.05	NA	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
	8/15/02	<0.001	<0.05	<0.001	<0.05	<0.001	<0.001	<0.001	NA	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
MW-8 **MW-8R**	5/4/99	<0.001	<0.025	<0.002	<0.025	<0.001	<0.002	<0.001	NA	<0.001	**0.002**	<0.001	<0.001	<0.001	<0.001
	8/15/02	<0.001	<0.025	<0.001	**0.05**	<0.001	<0.001	<0.001	NA	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
	9/5/02	<0.001	<0.005	<0.001	<0.005	<0.001	<0.001	<0.001	NA	**0.004**	<0.001	<0.001	<0.001	<0.001	<0.001
MW-9	8/15/02	<0.001	<0.05	<0.001	<0.05	<0.001	<0.001	<0.001	NA	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
	12/13/05	<0.005	<0.05	<0.01	<0.05	<0.005	<0.01	<0.005	<0.005	<0.005	NA	<0.005	<0.005	<0.005	<0.002
	4/11/06	<0.005	<0.05	<0.01	<0.05	<0.005	<0.01	<0.005	<0.005	<0.005	NA	<0.005	<0.005	<0.005	<0.002
	6/6/06	<0.005	<0.05	<0.01	<0.05	<0.005	<0.01	<0.005	<0.005	<0.005	NA	<0.005	<0.005	<0.005	<0.002
	9/13/06	<0.005	<0.05	<0.01	<0.05	<0.005	<0.01	<0.005	<0.005	<0.005	NA	<0.005	<0.005	<0.005	<0.002
	3/13/07	<0.005	<0.05	<0.01	<0.05	<0.005	<0.01	<0.005	<0.005	<0.005	NA	<0.005	<0.005	<0.005	<0.002
	3/11/08	<0.005	<0.05	<0.01	<0.05	<0.005	<0.01	<0.005	<0.005	<0.005	NA	<0.005	<0.005	<0.005	<0.002
	3/12/09	<0.005	<0.05	<0.01	<0.05	<0.005	<0.01	<0.005	<0.005	<0.005	NA	<0.005	<0.005	<0.005	<0.002
	3/30/10	<0.005	<0.05	<0.01	<0.05	<0.005	<0.01	<0.005	<0.005	<0.005	NA	<0.005	<0.005	<0.005	<0.002
	3/15/11	<0.001	<0.005	<0.002	<0.005	<0.001	<0.002	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
	4/26/12	<0.001	<0.005	<0.002	<0.005	<0.005	<0.002	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
	4/23/13	<0.001	<0.005	<0.002	<0.005	<0.005	<0.002	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
MW-10	8/15/02	<0.001	<0.05	<0.001	<0.05	<0.001	<0.001	<0.001	NA	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
	9/5/02	<0.001	<0.05	<0.001	0.02	<0.001	<0.001	<0.001	NA	0.0028	<0.001	<0.001	<0.001	<0.001	<0.001

Table B1. Historical Groundwater and Surface Water Data

Groundwater		Regulated Substance (mg/L)													
		1,1-DCE	2-butanone	4-methyl 2-pentanone	Acetone	Carbon disulfide	Chloro ethane	cis-1,2-DCE	Cyclo hexane	Methylene Chloride	Naphthalene	Toluene	trans-1,2-DCE	TCE	Vinyl chloride
Delineation Criteria (mg/L)		0.007	2	2	4	4	DL	0.07	DL	0.005	0.02	1	0.1	0.005	0.002
Type 4 RRS (mg/L)		0.524	NC	NC	45	1.7	NC	0.204	17.52	NC	0.00872	5.24	0.161	0.00524	0.00327
MW-11	12/12/05	<0.005	<0.05	<0.01	<0.05	<0.005	<0.01	**0.02**	<0.005	<0.005	NA	<0.005	<0.005	**0.94**	**0.004**
	4/11/06	<0.005	<0.05	<0.01	<0.05	<0.005	<0.01	**0.02**	<0.005	<0.005	NA	<0.005	<0.005	**1.4**	**0.0042**
	6/6/06	<0.005	<0.05	<0.01	<0.05	<0.005	<0.01	**0.015**	<0.005	<0.005	NA	<0.005	<0.005	**1.1**	**0.0023**
	9/14/06	<0.005	<0.05	<0.01	<0.05	<0.005	<0.01	**0.011**	<0.005	<0.005	NA	<0.005	<0.005	**0.64**	<0.002
	3/12/07	<0.005	<0.05	<0.01	<0.05	<0.005	<0.01	**0.018**	<0.005	<0.005	NA	<0.005	<0.005	**1.1**	<0.002
	9/6/07	<0.005	<0.05	<0.01	<0.05	<0.005	<0.01	**0.0077**	<0.005	<0.005	NA	<0.005	<0.005	**0.33**	<0.002
	3/11/08	<0.005	<0.05	<0.01	<0.05	<0.005	<0.01	**0.01**	<0.005	<0.005	NA	<0.005	<0.005	**0.63**	<0.002
	9/3/08	<0.005	<0.05	<0.01	<0.05	<0.005	<0.01	**0.013**	<0.005	<0.005	NA	<0.005	<0.005	**0.78**	**0.0028**
	3/11/09	<0.005	<0.05	<0.01	<0.05	<0.005	<0.01	**0.0064**	<0.005	<0.005	NA	<0.005	<0.005	**0.34**	<0.002
	3/30/10	<0.005	<0.05	<0.01	<0.05	<0.005	<0.01	<0.005	<0.005	<0.005	NA	<0.005	<0.005	**0.28**	<0.002
	3/14/11	<0.001	<0.005	<0.002	<0.005	<0.001	<0.002	**0.0025**	<0.001	<0.001	<0.001	<0.001	<0.001	**0.11**	<0.001
	4/24/12	<0.001	<0.005	<0.002	<0.005	<0.005	<0.002	**0.0034**	<0.001	<0.001	<0.001	<0.001	<0.001	**0.044**	<0.001
	4/22/13	<0.001	<0.005	<0.002	<0.005	<0.005	<0.002	**0.0096**	<0.001	<0.001	<0.001	<0.001	**0.0012**	**0.053**	<0.001
	4/21/14	<0.001	<0.005	<0.002	<0.005	<0.005	<0.002	**0.0018**	<0.001	<0.001	<0.001	<0.001	<0.001	**0.061**	<0.001
MW-12	12/13/05	<0.005	<0.05	<0.01	<0.05	<0.005	<0.01	**0.069**	<0.005	<0.005	NA	<0.005	<0.005	**0.58**	**0.0042**
	4/11/06	<0.005	<0.05	<0.01	<0.05	<0.005	<0.01	**0.056**	<0.005	<0.005	NA	<0.005	<0.005	**0.68**	**0.0029**
	6/6/06	<0.005	<0.05	<0.01	<0.05	<0.005	<0.01	**0.058**	<0.005	<0.005	NA	<0.005	<0.005	**0.67**	**0.0028**
	9/13/06	<0.005	<0.05	<0.01	<0.05	<0.005	<0.01	**0.037**	<0.005	<0.005	NA	<0.005	<0.005	**0.35**	<0.002
	3/12/07	<0.005	<0.05	<0.01	<0.05	<0.005	<0.01	**0.028**	<0.005	<0.005	NA	<0.005	<0.005	**0.6**	**0.0031**
	9/6/07	<0.005	<0.05	<0.01	<0.05	<0.005	<0.01	**0.015**	<0.005	<0.005	NA	<0.005	<0.005	**0.14**	<0.002
	3/12/08	<0.005	<0.05	<0.01	<0.05	<0.005	<0.01	**0.015**	<0.005	<0.005	NA	<0.005	<0.005	**0.2**	<0.002
	9/3/08	<0.005	<0.05	<0.01	<0.05	<0.005	<0.01	**0.02**	<0.005	<0.005	NA	<0.005	<0.005	**0.14**	**0.0025**
	3/11/09	<0.005	<0.05	<0.01	<0.05	<0.005	<0.01	**0.02**	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.002
	3/30/10	<0.005	<0.05	<0.01	<0.05	<0.005	<0.01	**0.016**	<0.005	<0.005	<0.005	<0.005	<0.005	**0.21**	<0.002
	3/14/11	<0.001	<0.005	<0.002	<0.005	<0.001	<0.002	**0.01**	<0.001	<0.001	<0.001	<0.001	**0.0012**	<0.001	<0.001
	4/24/12	<0.001	<0.005	<0.002	<0.005	<0.005	<0.002	**0.004**	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
	4/23/13	<0.001	<0.005	<0.002	<0.005	<0.005	<0.002	**0.0027**	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
	4/21/14	<0.001	<0.005	<0.002	<0.005	<0.005	<0.002	**0.011**	<0.001	<0.001	<0.001	<0.001	**0.0016**	**0.0026**	<0.001
MW-13	12/12/05	<0.005	<0.05	<0.01	<0.05	<0.005	<0.01	<0.005	<0.005	<0.005	NA	<0.005	<0.005	<0.005	<0.002
	4/11/06	<0.005	<0.05	<0.01	<0.05	<0.005	<0.01	<0.005	<0.005	<0.005	NA	<0.005	<0.005	<0.005	<0.002
	6/6/06	<0.005	<0.05	<0.01	<0.05	<0.005	<0.01	<0.005	<0.005	<0.005	NA	<0.005	<0.005	<0.005	<0.002
	9/13/06	<0.005	<0.05	<0.01	<0.05	<0.005	<0.01	<0.005	<0.005	<0.005	NA	<0.005	<0.005	<0.005	<0.002
	3/12/07	<0.005	<0.05	<0.01	<0.05	<0.005	<0.01	<0.005	<0.005	<0.005	NA	<0.005	<0.005	<0.005	<0.002
	3/12/08	<0.005	<0.05	<0.01	<0.05	<0.005	<0.01	<0.005	<0.005	<0.005	NA	<0.005	<0.005	<0.005	<0.002
	3/11/09	<0.005	<0.05	<0.01	<0.05	<0.005	<0.01	**0.022**	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.002
	3/30/10	<0.005	<0.05	<0.01	<0.05	<0.005	<0.01	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	**0.019**	<0.002
	3/15/11	<0.001	<0.005	<0.002	<0.005	<0.001	<0.002	**0.018**	<0.001	<0.001	<0.001	<0.001	<0.001	**0.0016**	<0.001
	4/25/12	<0.001	<0.005	<0.002	<0.005	<0.005	<0.002	**0.036**	<0.001	<0.001	<0.001	<0.001	**0.0017**	**0.0016**	<0.001
	4/22/13	<0.001	<0.005	<0.002	<0.005	<0.005	<0.002	**0.027**	<0.001	<0.001	<0.001	<0.001	**0.0022**	<0.001	<0.001
	4/21/14	<0.001	<0.005	<0.002	<0.005	<0.005	<0.002	**0.028**	<0.001	<0.001	<0.001	<0.001	**0.0042**	**0.051**	<0.001
	6/12/14	<0.001	<0.005	<0.002	<0.005	<0.005	<0.002	**0.032**	<0.001	<0.001	<0.001	<0.001	**0.0048**	**0.048**	<0.001

Table B1. Historical Groundwater and Surface Water Data

Groundwater		Regulated Substance (mg/L)													
		1,1-DCE	2-butanone	4-methyl 2-pentanone	Acetone	Carbon disulfide	Chloro ethane	cis-1,2-DCE	Cyclo hexane	Methylene Chloride	Naphthalene	Toluene	trans-1,2-DCE	TCE	Vinyl chloride
Delineation Criteria (mg/L)		0.007	2	2	4	4	DL	0.07	DL	0.005	0.02	1	0.1	0.005	0.002
Type 4 RRS (mg/L)		0.524	NC	NC	45	1.7	NC	0.204	17.52	NC	0.00872	5.24	0.161	0.00524	0.00327
MW-13D	12/13/05	<0.005	<0.05	<0.01	<0.05	<0.005	<0.01	<0.005	<0.005	<0.005	NA	<0.005	<0.005	**0.12**	<0.002
	4/11/06	<0.005	<0.05	<0.01	<0.05	<0.005	<0.01	<0.005	<0.005	<0.005	NA	<0.005	<0.005	**0.062**	<0.002
	6/6/06	<0.005	<0.05	<0.01	<0.05	<0.005	<0.01	<0.005	<0.005	<0.005	NA	<0.005	<0.005	**0.07**	<0.002
	9/13/06	<0.005	<0.05	<0.01	<0.05	<0.005	<0.01	<0.005	<0.005	<0.005	NA	<0.005	<0.005	**0.052**	<0.002
	3/12/07	<0.005	<0.05	<0.01	<0.05	<0.005	<0.01	<0.005	<0.005	<0.005	NA	<0.005	<0.005	**0.023**	<0.002
	3/12/08	<0.005	<0.05	<0.01	<0.05	<0.005	<0.01	<0.005	<0.005	<0.005	NA	<0.005	<0.005	**0.014**	<0.002
	9/3/08	<0.005	<0.05	<0.01	<0.05	<0.005	<0.01	<0.005	<0.005	<0.005	NA	<0.005	<0.005	**0.02**	<0.002
	3/12/09	<0.005	<0.05	<0.01	<0.05	<0.005	<0.01	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	**0.0089**	<0.002
	3/30/10	<0.005	<0.05	<0.01	<0.05	<0.005	<0.01	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	**0.0085**	<0.002
	3/15/11	<0.001	<0.005	<0.002	<0.005	<0.001	<0.002	**0.0022**	<0.001	<0.001	<0.001	<0.001	<0.001	**0.014**	<0.001
	4/25/12	<0.001	<0.005	<0.002	<0.005	<0.005	<0.002	**0.041**	<0.001	<0.001	<0.001	<0.001	**0.0076**	**0.04**	<0.001
	4/22/13	<0.001	<0.005	<0.002	<0.005	<0.005	<0.002	**0.056**	<0.001	<0.001	<0.001	<0.001	**0.0098**	**0.037**	<0.001
	4/21/14	<0.001	<0.005	<0.002	<0.005	<0.005	<0.002	**0.025**	<0.001	<0.001	<0.001	<0.001	**0.0042**	**0.022**	<0.001
MW-14	12/12/05	<0.005	<0.05	<0.01	<0.05	<0.005	<0.01	**0.009**	<0.005	<0.005	NA	<0.005	<0.005	**0.11**	<0.002
	4/11/06	<0.005	<0.05	<0.01	<0.05	<0.005	<0.01	**0.0052**	<0.005	<0.005	NA	<0.005	<0.005	**0.1**	<0.002
	6/6/06	<0.005	<0.05	<0.01	<0.05	<0.005	<0.01	**0.0072**	<0.005	<0.005	NA	<0.005	<0.005	**0.13**	<0.002
	9/13/06	<0.005	<0.05	<0.01	<0.05	<0.005	<0.01	**0.0058**	<0.005	<0.005	NA	<0.005	<0.005	**0.1**	<0.002
	3/13/07	<0.005	<0.05	<0.01	<0.05	<0.005	<0.01	<0.005	<0.005	<0.005	NA	<0.005	<0.005	**0.026**	<0.002
	3/12/08	<0.005	<0.05	<0.01	<0.05	<0.005	<0.01	<0.005	<0.005	<0.005	NA	<0.005	<0.005	**0.016**	<0.002
	3/11/09	<0.005	<0.05	<0.01	<0.05	<0.005	<0.01	**0.019**	<0.005	<0.005	<0.005	<0.005	**0.0069**	**0.032**	<0.002
	3/30/10	<0.005	<0.05	<0.01	<0.05	<0.005	<0.01	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.002
	3/15/11	<0.001	<0.005	<0.002	<0.005	<0.001	<0.002	**0.019**	<0.001	<0.001	<0.001	<0.001	**0.0016**	**0.0087**	<0.001
	4/25/12	<0.001	<0.005	<0.002	<0.005	<0.005	<0.002	**0.011**	<0.001	<0.001	<0.001	<0.001	**0.0015**	**0.0022**	<0.001
	4/23/13	<0.001	<0.005	<0.002	<0.005	<0.005	<0.002	**0.0035**	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
	4/22/14	<0.001	<0.005	<0.002	<0.005	<0.005	<0.002	**0.0022**	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
SW-1	4/13/99	<0.001	<0.025	<0.002	<0.025	<0.001	<0.002	<0.001	na	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
SW-2	4/13/99	<0.001	<0.025	<0.002	<0.025	<0.001	<0.002	<0.001	na	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
SW-3	5/4/99	<0.001	<0.025	<0.002	<0.025	<0.001	<0.002	<0.001	na	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
	10/21/00	<0.001	<0.025	<0.002	<0.025	**0.004**	<0.002	<0.001	na	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001

Table B1. Historical Groundwater and Surface Water Data

Groundwater		Regulated Substance (mg/L)													
		1,1-DCE	**2-butanone**	**4-methyl 2-pentanone**	**Acetone**	**Carbon disulfide**	**Chloro ethane**	**cis-1,2-DCE**	**Cyclo hexane**	**Methylene Chloride**	**Naphthalene**	**Toluene**	**trans-1,2-DCE**	**TCE**	**Vinyl chloride**
Delineation Criteria (mg/L)		0.007	2	2	4	4	DL	0.07	DL	0.005	0.02	1	0.1	0.005	0.002
Type 4 RRS (mg/L)		0.524	NC	NC	45	1.7	NC	0.204	17.52	NC	0.00872	5.24	0.161	0.00524	0.00327
SW-3/SW-6	11/22/02	<0.001	na	na	na	na	na	<0.001	na	na	na	na	<0.001	<0.001	<0.001
	12/13/05	<0.005	<0.05	<0.01	<0.05	<0.005	<0.01	<0.005	<0.005	<0.005	na	<0.005	<0.005	<0.005	<0.002
	4/11/06	<0.005	<0.05	<0.01	<0.05	<0.005	<0.01	<0.005	<0.005	<0.005	na	<0.005	<0.005	<0.005	<0.002
	6/6/06	<0.005	<0.05	<0.01	<0.05	<0.005	<0.01	<0.005	<0.005	<0.005	na	<0.005	<0.005	<0.005	<0.002
	9/13/06	<0.005	<0.05	<0.01	<0.05	<0.005	<0.01	<0.005	<0.005	<0.005	na	<0.005	<0.005	<0.005	<0.002
	3/13/07	<0.005	<0.05	<0.01	<0.05	<0.005	<0.01	<0.005	<0.005	<0.005	na	<0.005	<0.005	<0.005	<0.002
	9/6/07	<0.005	<0.05	<0.01	<0.05	<0.005	<0.01	<0.005	<0.005	<0.005	na	<0.005	<0.005	<0.005	<0.002
	3/11/08	<0.005	<0.05	<0.01	<0.05	<0.005	<0.01	<0.005	<0.005	<0.005	na	<0.005	<0.005	<0.005	<0.002
	9/3/08	<0.005	<0.05	<0.01	<0.05	<0.005	<0.01	<0.005	<0.005	<0.005	na	<0.005	<0.005	<0.005	<0.002
	3/11/09	<0.005	<0.05	<0.01	<0.05	<0.005	<0.01	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.002
	3/30/10	<0.005	<0.05	<0.01	<0.05	<0.005	<0.01	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.002
	3/14/11	<0.001	<0.005	<0.002	<0.005	<0.001	<0.002	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
	4/24/12	<0.001	<0.005	<0.002	<0.005	<0.005	<0.002	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
	4/17/13	<0.001	<0.005	<0.002	<0.005	<0.005	<0.002	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
	4/22/14	<0.001	<0.005	<0.002	<0.005	<0.005	<0.002	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
SW-4	5/5/99	<0.001	<0.025	<0.002	<0.025	<0.001	<0.002	<0.001	na	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
SW-5	5/5/99	<0.001	<0.025	<0.002	<0.025	<0.001	<0.002	<0.001	na	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
	12/14/05	<0.005	<0.05	<0.01	<0.05	<0.005	<0.01	<0.005	<0.005	<0.005	na	<0.005	<0.005	<0.005	<0.002
	4/12/06	<0.005	<0.05	<0.01	<0.05	<0.005	<0.01	<0.005	<0.005	<0.005	na	<0.005	<0.005	<0.005	<0.002
	6/6/06	<0.005	<0.05	<0.01	<0.05	<0.005	<0.01	<0.005	<0.005	<0.005	na	<0.005	<0.005	<0.005	<0.002
	9/13/06	<0.005	<0.05	<0.01	<0.05	<0.005	<0.01	<0.005	<0.005	<0.005	na	<0.005	<0.005	<0.005	<0.002
	3/13/07	<0.005	<0.05	<0.01	<0.05	<0.005	<0.01	<0.005	<0.005	<0.005	na	<0.005	<0.005	<0.005	<0.002
	3/12/08	<0.005	<0.05	<0.01	<0.05	<0.005	<0.01	<0.005	<0.005	<0.005	na	<0.005	<0.005	<0.005	<0.002
	3/11/09	<0.005	<0.05	<0.01	<0.05	<0.005	<0.01	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.002

Prepared By: KAH 1/5/2016
Checked By: RJT 10/3/2016

Notes
Delineation criteria equals Type 1 Risk Reduction Standards (RRS).
mg/L - milligrams per liter
For PW-1, the depth at which the sample was collected is noted for samples with available information. The depth of sample collection is unknown for those samples with no depth noted.
NC - Not calculated; meets delineation criteria (Type 1 RRS)
NA - Not analyzed
Bold indicates regulated substance concentration above laboratory detection limit.
Grey shading indicates regulated substance concentration above the Type 4 RRS.

Appendix C

BIOSCREEN Groundwater Modeling Results

Figure C1. Model Calibration Input

BIOSCREEN Natural Attenuation Decision Support System

Air Force Center for Environmental Excellence — *Version 1.4*

Camak Quarry
TCE Release
Run Name

Data Input Instructions:

115 — 1. Enter value directly....or
or — 2. Calculate by filling in grey
0.02 — cells below. (To restore formulas, hit button below).

Variable* → Data used directly in model.
20 → Value calculated by model. (Don't enter any data).

1. HYDROGEOLOGY

Seepage Velocity*	*Vs*	3.2	*(ft/yr)*
or		*or*	
Hydraulic Conductivity	*K*	5.5E-04	*(cm/sec)*
Hydraulic Gradient	*i*	0.001125	*(ft/ft)*
Porosity	*n*	0.2	*(-)*

2. DISPERSION

Longitudinal Dispersivity*	*alpha x*	3.5	*(ft)*
Transverse Dispersivity*	*alpha y*	0.35	*(ft)*
Vertical Dispersivity*	*alpha z*	1.00E-99	*(ft)*
or		*or*	
Estimated Plume Length	*Lp*	35	*(ft)*

3. ADSORPTION

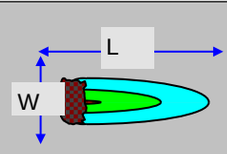
Retardation Factor*	*R*	2.0	*(-)*
or		*or*	
Soil Bulk Density	*rho*	1.7	*(kg/l)*
Partition Coefficient	*Koc*	61	*(L/kg)*
FractionOrganicCarbon	*foc*	2.0E-3	*(-)*

4. BIODEGRADATION

1st Order Decay Coeff*	*lambda*	5.3E-1	*(per yr)*
or		*or*	
Solute Half-Life	*t-half*	1.32	*(year)*
or Instantaneous Reaction Model			
Delta Oxygen*	*DO*		*(mg/L)*
Delta Nitrate*	*NO3*		*(mg/L)*
Observed Ferrous Iron*	*Fe2+*		*(mg/L)*
Delta Sulfate*	*SO4*		*(mg/L)*
Observed Methane*	*CH4*		*(mg/L)*

5. GENERAL

Modeled Area Length*	35	*(ft)*
Modeled Area Width*	120	*(ft)*
Simulation Time*	16	*(yr)*



6. SOURCE DATA

Source Thickness in Sat.Zone* 15 *(ft)*

Source Zones:

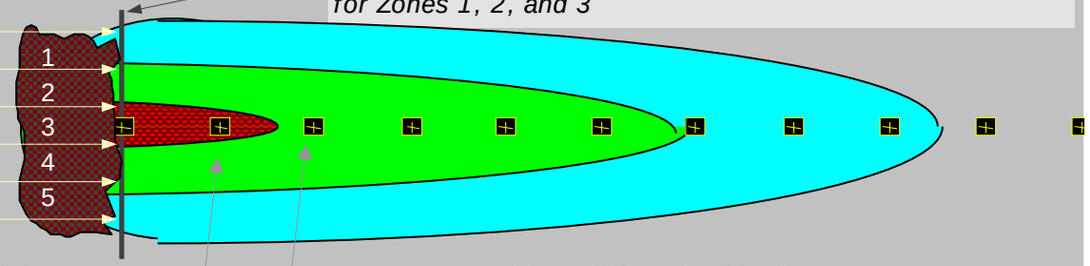
Width* (ft)	Conc. (mg/L)*
0	0
0	0
20	4.6
0	0
0	0

Source Halflife (see Help):

Infinite	Infinite	*(yr)*
Inst. React.	1st Order	
Soluble Mass	Infinite	*(Kg)*

In Source NAPL, Soil

Vertical Plane Source: Look at Plume Cross-Section and Input Concentrations & Widths for Zones 1, 2, and 3



View of Plume Looking Down

Observed Centerline Concentrations at Monitoring Wells
If No Data Leave Blank or Enter "0"

7. FIELD DATA FOR COMPARISON

Concentration (mg/L)	4.6			.58							.001
Dist. from Source (ft)	*0*	*4*	*7*	*11*	*14*	*18*	*21*	*25*	*28*	*32*	*35*

8. CHOOSE TYPE OF OUTPUT TO SEE:

RUN CENTERLINE — **View Output**

RUN ARRAY — **View Output**

Help

Recalculate This Sheet

Paste Example Dataset

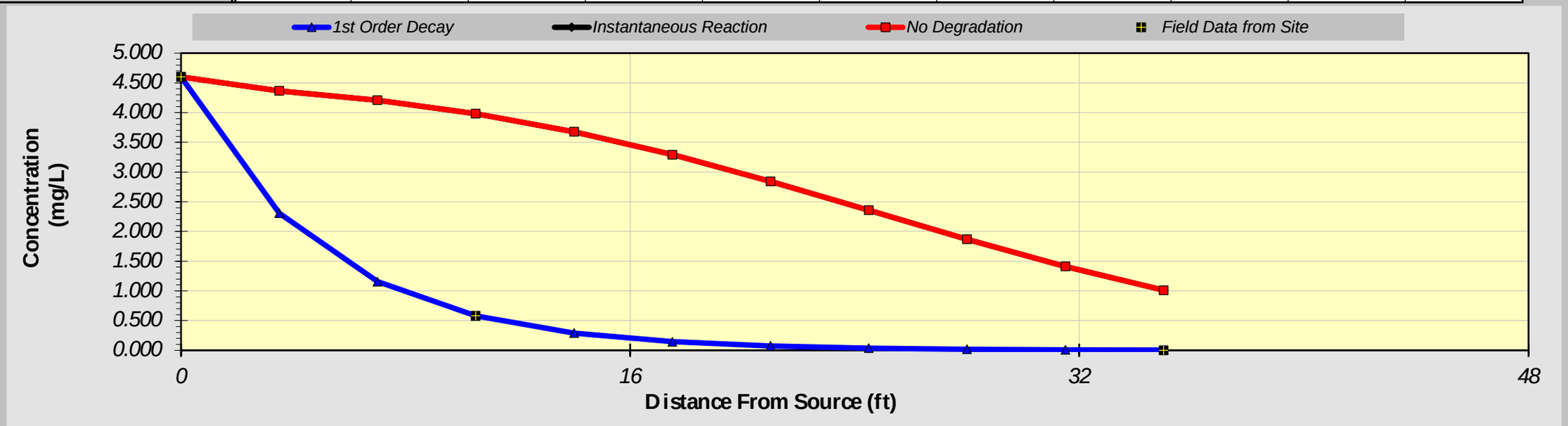
Restore Formulas for Vs, Dispersivities, R, lambda, other

Figure C2. Model Calibration Centerline Output

DISSOLVED TCE CONCENTRATION ALONG PLUME CENTERLINE (mg/L at Z=0)

Distance from Source (ft)

TYPE OF MODEL	0	4	7	11	14	18	21	25	28	32	35
No Degradation	4.600	4.364	4.207	3.981	3.676	3.292	2.843	2.357	1.869	1.411	1.012
1st Order Decay	4.600	2.306	1.156	0.579	0.290	0.145	0.072	0.036	0.018	0.009	0.004
Inst. Reaction	4.600	4.364	4.207	3.981	3.676	3.292	2.843	2.357	1.869	1.411	1.012
Field Data from Site	4.600			0.580							0.001



Calculate Animation

Time:
16 Years

Return to

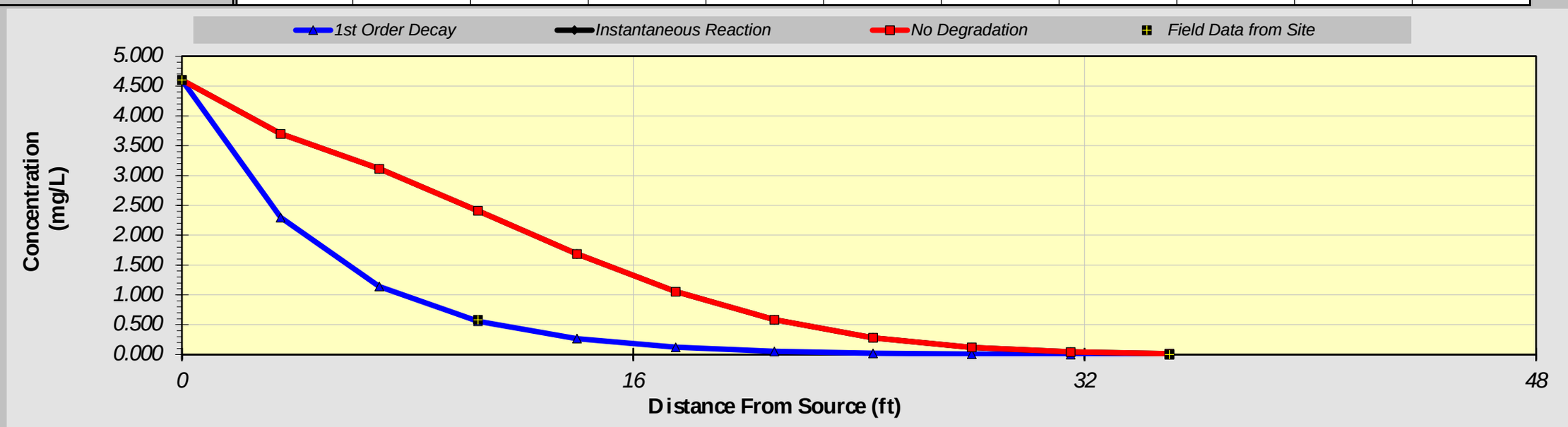
Recalculate This Sheet

Figure C3. 7-Year Simulation Time

DISSOLVED TCE CONCENTRATION ALONG PLUME CENTERLINE (mg/L at Z=0)

Distance from Source (ft)

TYPE OF MODEL	0	4	7	11	14	18	21	25	28	32	35
No Degradation	4.600	3.699	3.111	2.408	1.687	1.055	0.583	0.283	0.119	0.044	0.014
1st Order Decay	4.600	2.295	1.140	0.558	0.266	0.122	0.052	0.021	0.008	0.002	0.001
Inst. Reaction	4.600	3.699	3.111	2.408	1.687	1.055	0.583	0.283	0.119	0.044	0.014
Field Data from Site	4.600			0.580							0.001



Calculate Animation

Time: 7 Years

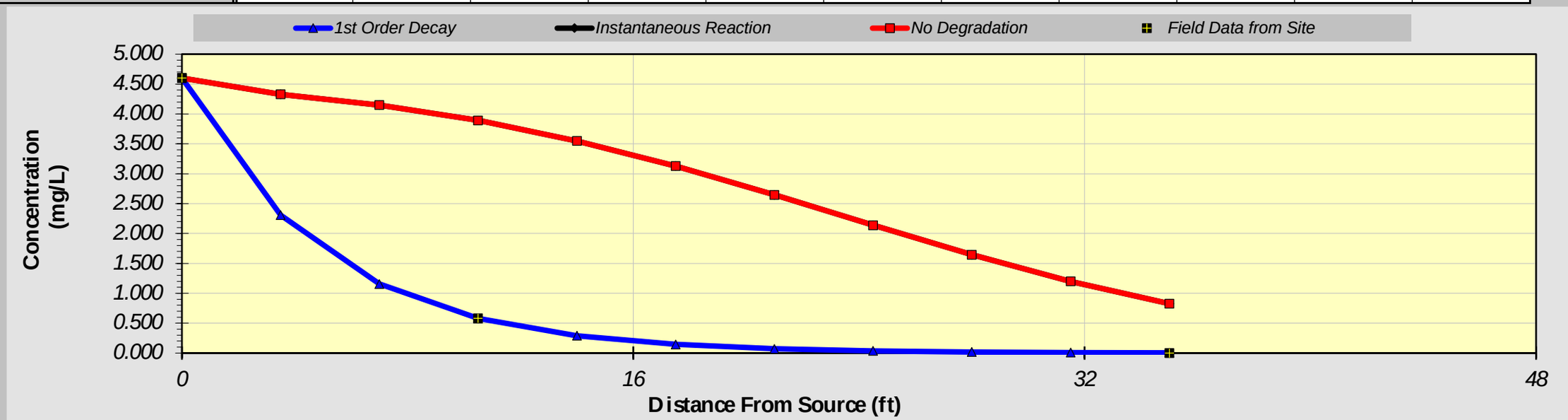
Return to

Recalculate This Sheet

Figure C4. 15-Year Simulation Time

DISSOLVED TCE CONCENTRATION ALONG PLUME CENTERLINE (mg/L at Z=0)

	Distance from Source (ft)										
TYPE OF MODEL	0	4	7	11	14	18	21	25	28	32	35
No Degradation	4.600	4.329	4.149	3.891	3.549	3.127	2.646	2.139	1.646	1.200	0.827
1st Order Decay	4.600	2.306	1.156	0.579	0.290	0.145	0.072	0.036	0.018	0.009	0.004
Inst. Reaction	4.600	4.329	4.149	3.891	3.549	3.127	2.646	2.139	1.646	1.200	0.827
Field Data from Site	4.600			0.580							0.001



Calculate Animation

Time:
15 Years

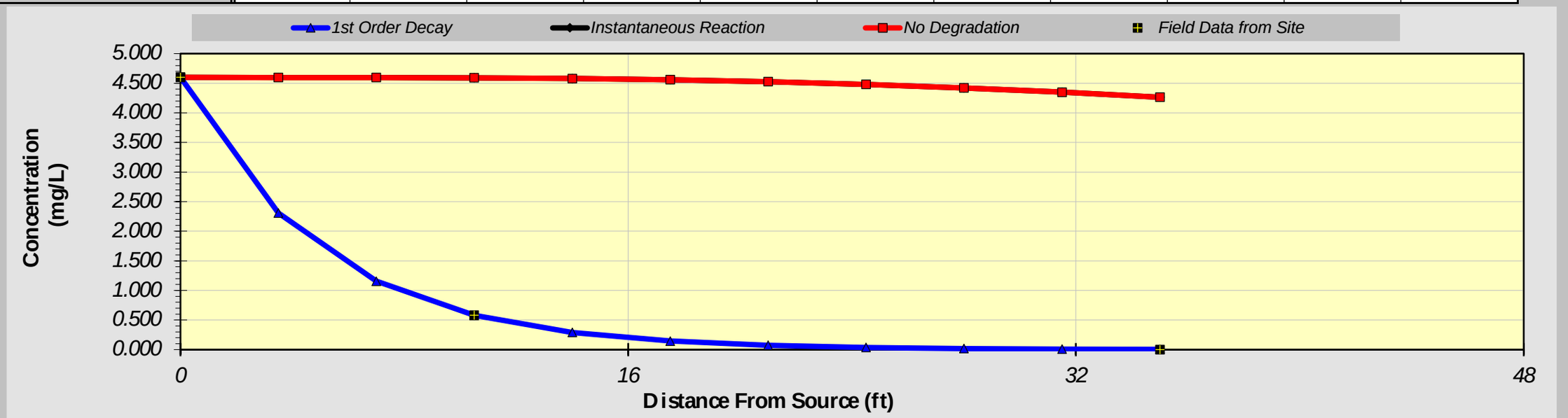
Return to

Recalculate This Sheet

Figure C5. 50-Year Simulation Time

DISSOLVED TCE CONCENTRATION ALONG PLUME CENTERLINE (mg/L at Z=0)

	Distance from Source (ft)										
TYPE OF MODEL	0	4	7	11	14	18	21	25	28	32	35
No Degradation	4.600	4.597	4.595	4.591	4.580	4.559	4.526	4.480	4.421	4.349	4.263
1st Order Decay	4.600	2.306	1.156	0.580	0.290	0.145	0.072	0.036	0.018	0.009	0.004
Inst. Reaction	4.600	4.597	4.595	4.591	4.580	4.559	4.526	4.480	4.421	4.349	4.263
Field Data from Site	4.600			0.580							0.001



Calculate Animation

Time:
50 Years

Return to

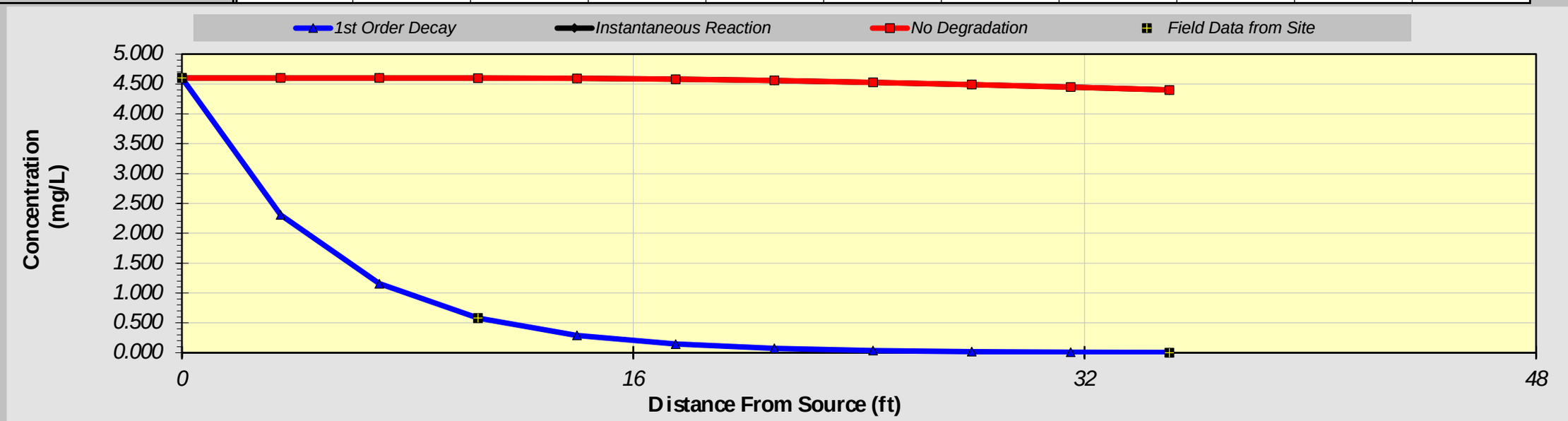
Recalculate This Sheet

Figure C6. 100-Year Simulation Time

DISSOLVED TCE CONCENTRATION ALONG PLUME CENTERLINE (mg/L at Z=0)

Distance from Source (ft)

TYPE OF MODEL	0	4	7	11	14	18	21	25	28	32	35
No Degradation	4.600	4.600	4.600	4.599	4.594	4.580	4.558	4.527	4.490	4.447	4.400
1st Order Decay	4.600	2.306	1.156	0.580	0.290	0.145	0.072	0.036	0.018	0.009	0.004
Inst. Reaction	4.600	4.600	4.600	4.599	4.594	4.580	4.558	4.527	4.490	4.447	4.400
Field Data from Site	4.600			0.580							0.001



Calculate Animation

Time: 100 Years

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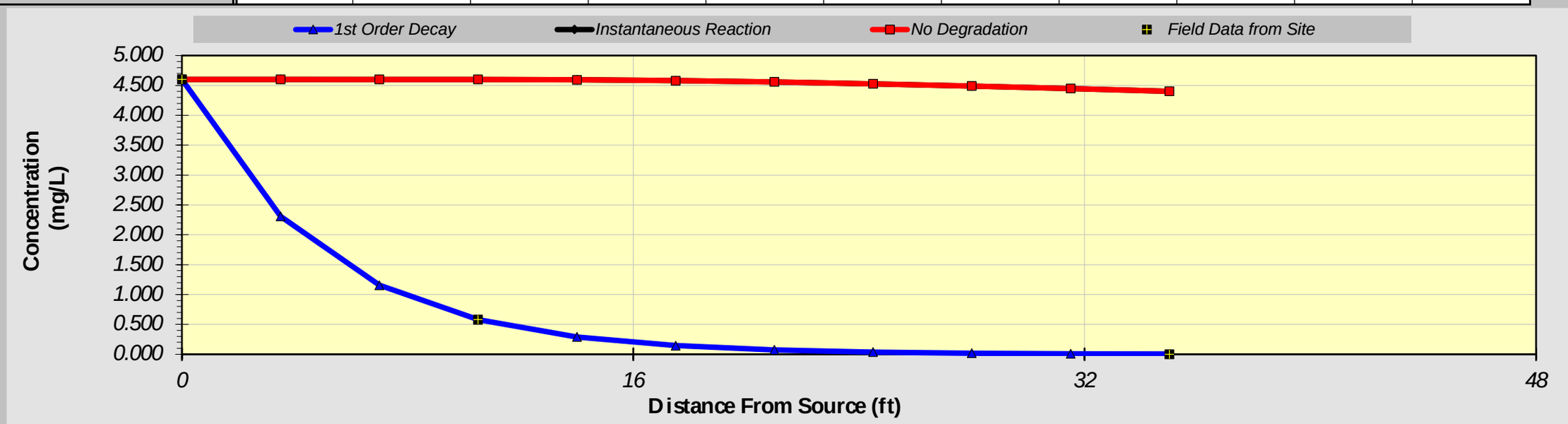
Recalculate This Sheet

Figure C7. 1000-Year Simulation Time

DISSOLVED TCE CONCENTRATION ALONG PLUME CENTERLINE (mg/L at Z=0)

Distance from Source (ft)

TYPE OF MODEL	0	4	7	11	14	18	21	25	28	32	35
No Degradation	4.600	4.600	4.600	4.599	4.594	4.580	4.558	4.528	4.490	4.447	4.401
1st Order Decay	4.600	2.306	1.156	0.580	0.290	0.145	0.072	0.036	0.018	0.009	0.004
Inst. Reaction	4.600	4.600	4.600	4.599	4.594	4.580	4.558	4.528	4.490	4.447	4.401
Field Data from Site	4.600			0.580							0.001



Calculate Animation

Time: 1,000 Years

Return to

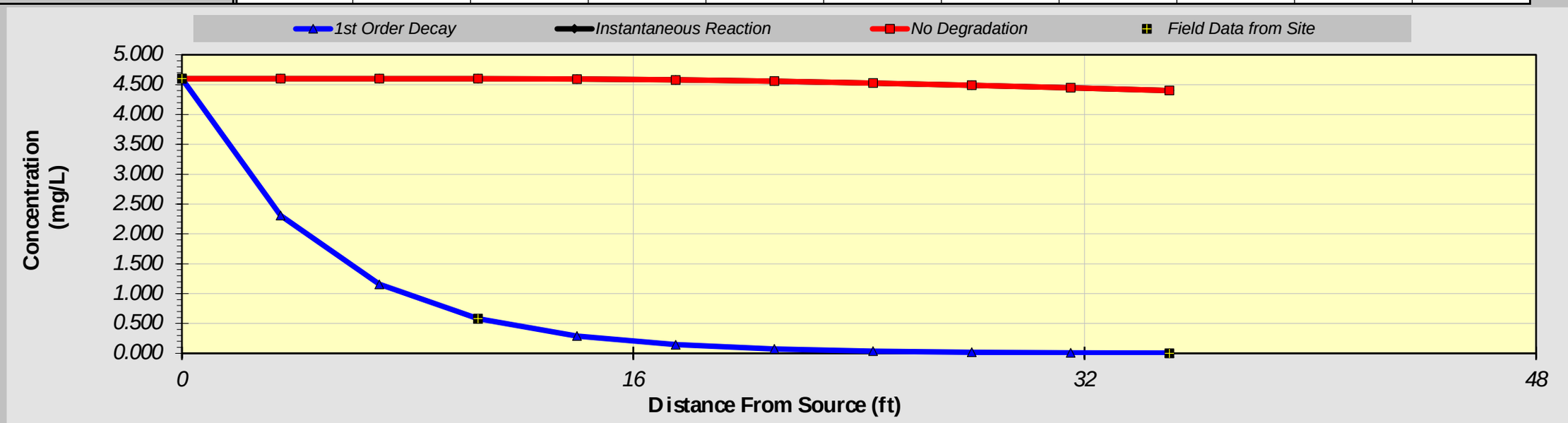
Recalculate This Sheet

Figure C8. 5000-Year Simulation Time

DISSOLVED TCE CONCENTRATION ALONG PLUME CENTERLINE (mg/L at Z=0)

Distance from Source (ft)

TYPE OF MODEL	0	4	7	11	14	18	21	25	28	32	35
No Degradation	4.600	4.600	4.600	4.599	4.594	4.580	4.558	4.528	4.490	4.447	4.401
1st Order Decay	4.600	2.306	1.156	0.580	0.290	0.145	0.072	0.036	0.018	0.009	0.004
Inst. Reaction	4.600	4.600	4.600	4.599	4.594	4.580	4.558	4.528	4.490	4.447	4.401
Field Data from Site	4.600			0.580							0.001



Calculate Animation

Time:
5,000 Years

Return to

Recalculate This Sheet