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(423) 336-4308 FAX: (423) 336-4166

January 15, 2010

Ms. Beth Walden
Remedial Project Manager
United States Environmental Protection Agency
Atlanta Federal Center
61 Forsyth Street
Atlanta, Georgia 30303-8960

Re: Revised Groundwater Investigation Report
Olin Chemicals/McIntosh Plant Site, Operable Unit 2
McIntosh, Alabama

Dear Ms. Walden,

Enclosed please find four copies of the *Revised Groundwater Investigation Report, Operable Unit (OU)-2, McIntosh, Alabama.* The report was revised to incorporate draft comments from the United States Environmental Protection Agency (USEPA). The revisions also addressed discussions from our meeting on July 17, 2009.

Olin requests approval from USEPA to decommission the temporary micro-wells and piezometers installed as part of the OU-2 groundwater investigation. The wells were installed to aid in determining the hydrogeologic characteristics of OU-2 and to answer the three principal study questions. Answers to the principal study questions are provided in the enclosed report and indicate that OU-2 sediment is not a source of mercury to groundwater and the Tombigbee River above the screening levels. Olin requests to decommission the temporary wells and piezometers in accordance with well decommissioning procedures outlined in the EPA Guidance Document Number SESDGUID-101-R0 entitled, *Design and installation of Monitoring Wells*.

Please let me know if you have any questions. I can be reached at (423) 336-4388 or via e-mail (kdroberts@olin.com).

Sincerely,

OLIN CORPORATION

Keith D Roberts

Keith D. Roberts
Manger, Environmental Sites

Enclosure
cc: S.B. Favors – ADEM
A.B. Carringer – Olin
R.A. Kennedy – Olin
C.E. Draper - MACTEC
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U.S. EPA REGION IV

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V. 2-040506

REVISED GROUNDWATER INVESTIGATION REPORT

OPERABLE UNIT 2
McINTOSH, ALABAMA

Prepared for:

OLIN CORPORATION

Prepared by:

MACTEC ENGINEERING AND CONSULTING, INC.
KENNESAW, GEORGIA

January 15, 2010

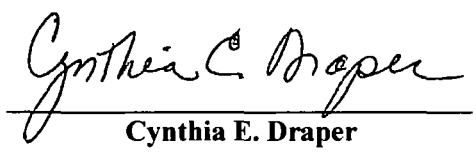
Project No. 6107-10-0036

REVISED GROUNDWATER INVESTIGATION REPORT
OPERABLE UNIT 2
McINTOSH, ALABAMA

Prepared for:

OLIN CORPORATION
Charleston, Tennessee

MACTEC Engineering and Consulting, Inc.
Kennesaw, Georgia



Cynthia E. Draper
Project Manager

James Wallace, Sc.D,
Senior Principal

January 15, 2010

MACTEC Project No. 6107-10-0036

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The undersigned have prepared or reviewed the tables and/or figures in this document as indicated in the table above.

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No Longer with MACTEC

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EJS: Erin J. Squires

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ABBREVIATIONS AND ACRONYMS

µg/L	microgram(s) per liter
AWQC	Ambient Water Quality Criteria/Criterion
Basin	Olin Basin
Battelle	Battelle Marine Sciences Laboratories
COC	constituent of concern
CSM	Conceptual Site Model
DDD	dichlorodiphenyldichloroethane
DDE	dichlorodiphenyldichloroethylene
DDT	dichlorodiphenyltrichloroethane
DDTR	total DDT, DDE, and DDD residues
DO	dissolved oxygen
DQO	Data Quality Objective
DPT	direct push technology
ESPP	Enhanced Sedimentation Pilot Project
HCB	hexachlorobenzene
HgII	inorganic mercury
Kd	partitioning coefficient
MACTEC	MACTEC Engineering and Consulting, Inc.
mL/g	milliliter(s) per gram
MS/MSD	matrix spike/matrix spike duplicate
NAVD88	North American Vertical Datum for 1988
NPDES	National Pollutant Discharge Elimination System
Olin	Olin Corporation
OU	Operable Unit
ORP	oxidation reduction potential
Pace	Pace Analytical Services, Inc.
Q_1	Upper Clay Unit of the Quaternary Alluvial Sediments
Q_2	Alluvial Aquifer of the Quaternary Alluvial Sediments
QA/QC	Quality Assurance/Quality Control
R	Riverine deposits
RCRA	Resource Conservation and Recovery Act

ABBREVIATIONS AND ACRONYMS (Continued)

RI/FS	Remedial Investigation/Feasibility Study
river	Tombigbee River
RPD	relative percent difference
SDG	sample delivery group
site	McIntosh Plant Site, McIntosh, Washington County, Alabama
Tm_l	Miocene Confining Unit
URS	URS Corporation
USEPA	U.S. Environmental Protection Agency
WCC	Woodward-Clyde Consultants
Work Plan	Groundwater Investigation Work Plan

1.0 INTRODUCTION

Olin Corporation (Olin) is conducting a Remedial Investigation/Feasibility Study (RI/FS) at its McIntosh, Washington County, Alabama Plant Site (site) under the oversight of the United States Environmental Protection Agency (USEPA). Olin signed an Administrative Order of Consent, effective May 9, 1990, to satisfy the National Contingency Plan (40 Code of Federal Regulations 300). The site is an active chemical production facility, located approximately 1 mile east-southeast of the town of McIntosh, Washington County, Alabama (Figure 1-1).

The site is listed on the National Priority List of Comprehensive Environmental Response, Compensation, and Liability Act and is composed of two operable units (OUs). Operable Unit-1 (OU-1) comprises the Olin property except for the Olin property within Operable Unit-2 (OU-2) and includes the manufacturing process areas. OU-2 comprises the Olin Basin (Basin), Round Pond, surrounding wetlands on the Olin property, and the former wastewater ditch that discharged to the Basin from 1952 to 1974 The area for OU-2 and the adjacent portion of OU-1 are depicted in Figure 1-1.

1.1 SITE BACKGROUND

Numerous studies have been conducted at the site. Reports on these studies include an RI report (Woodward-Clyde Consultants [WCC], 1993a), FS report (WCC, 1993b), additional ecological studies to supplement the RI (WCC, 1994a and b), an Ecological Risk Assessment report (WCC, 1995), a second FS report (WCC, 1996), OU-2 Remedial Goal Option Support Sampling Report (URS Corporation [URS], 2002), the Enhanced Sedimentation Pilot Project Baseline Sampling Report (MACTEC Engineering and Consulting, Inc. [MACTEC], 2007a), and the Enhanced Sedimentation Pilot Project Annual Report – Year One Results (MACTEC, 2009). The FS and implementation of the remedial action have been completed for OU-1 and the remedial action is being monitored under the Resource Conservation and Recovery Act (RCRA) program. Work at OU-2 is ongoing.

Previous OU-2 studies, as listed above, focused on surface water, floodplain soils, sediment, and biota. This report focuses on groundwater and potential mitigation of constituents of concern (COCs) to or from OU-2. This report is being prepared to fulfill the USEPA's requirements for finalizing an FS and Record of Decision for OU-2.

1.2 SITE DESCRIPTION

The Basin and Round Pond within OU-2 cover approximately 76 and 4 acres, respectively. The Basin is located between the bluff to the west and the Tombigbee River (river) to the east. The bluff is approximately 20 to 30 feet higher in elevation than the floodplain area near the Basin and approximates the western boundary between OU-1 and OU-2. The Basin and Round Pond are part of a natural oxbow lake lying within the floodplain of the Tombigbee River.

The primary COC at OU-2 is mercury, which best represents the extent of COCs in sediments and biota in the Basin and Round Pond. The primary release mechanism for mercury to OU-2 was the discharge through the former wastewater ditch (Figure 1-1) from 1952 to 1974 (WCC, 1993). Surface runoff and treated wastewater from the plant have not been discharged to the Basin since 1974. The plant effluent and stormwater discharge are permitted and monitored under the National Pollutant Discharge Elimination System (NPDES). The current discharge is acceptable within the NPDES limits.

With the conditional approval of the U.S. Environmental Protection Agency (USEPA, 2005), an enhanced sedimentation pilot project (ESPP) was initiated by Olin in June 2006. The ESPP includes a berm and gate system plus an improved inlet channel that provides a hydraulic connection between the Basin and the Tombigbee River. The purpose of this constructed system is to enhance movement of sediment-laden floodwater into the Basin and then hold the water and sediment to allow the sediment to be deposited within the Basin. This ESPP is a treatability study being performed under the FS.

During base flow conditions or non-flood conditions in the Tombigbee River, water levels in the river are typically near 3 feet North American Vertical Datum of 1988 (NAVD88), and there is little or no flow from the Basin to the Tombigbee River or vice versa. Under rising river water levels up to 12 feet NAVD88, river water flows from the south to north from the Tombigbee River to the Basin through the inlet channel. When floodwaters overtop the berm (flood level above 12 feet NAVD88), water enters the Basin from the north and east through the floodplain areas surrounding the Basin and exits the Basin to the south. Minor tidal influences have also been observed at the Basin when the Tombigbee River level is about 3 feet NAVD88. The tidal influences result in flow within the Basin from south to north and north to south during a rising and falling tidal cycle, respectively.

The ESPP enhances the natural process for sediment in floodwaters to settle out and cover the existing sediments by holding floodwater in the Basin over a longer duration and in a more quiescent condition

than would occur naturally, thus providing conditions that increase sedimentation. The floodwater held in the Basin is released approximately 48 hours after the water level in the river falls below flood stage. The 48-hour holding time will not alter the pattern of flooding in OU-2 above that of the natural variability associated with the flood events. Therefore, the action of the berm and gate system is not expected to significantly inhibit natural hydrologic or biological processes. The effectiveness of the ESPP is currently being monitored during a three-year demonstration period.

1.3 REGULATORY STATUS

Previous ecological studies in the OU-2 Basin (WCC, 1994b; 1995) have demonstrated potential ecological risk associated with mercury concentrations in sediments. The main COC in sediments and biota is mercury. Inorganic mercury may undergo some degree of methylation in sediments to form the more biologically active methylmercury. Other COCs include DDTR (total dichlorodiphenyl-trichloroethane [DDT], dichlorodiphenyldichloroethylene [DDE], and dichlorodiphenyldichloroethane [DDD] residues) and hexachlorobenzene (HCB). As part of the proposed remedial action to reduce potential ecological risk, Olin implemented the ESPP. The berm and gate system became operational in March 2007; physical features and components of OU-2 and the berm/gate system are depicted in Figure 1-1. Baseline physical and chemical data were collected to document conditions before implementation of this remediation strategy. In addition, annual samples will be collected and analyzed over the three-year ESPP evaluation period to assess the effectiveness of the enhanced sedimentation as a remediation alternative.

1.4 CONCEPTUAL SITE MODEL

The Conceptual Site Model (CSM) is summarized in the following paragraphs. A more detailed description of the OU-2 CSM is presented in the Groundwater Investigation Work Plan (Work Plan) (MACTEC, 2009) and Section 3.0 of this report.

1.4.1 Geologic Setting

The Basin and Round Pond lie within the floodplain of the Tombigbee River. Alluvial deposits of unspecified ages are present from the land surface of OU-2 to a depth of approximately 20 to 30 feet. These deposits consist of reworked and redeposited sediments along with river-transported sediment. The sediments consist of interlayered sands, silty or clayey sands, silts, and clays. These sediments represent numerous depositional environments including natural levees, bars, infilled channels, channel deposits,

flood-splays, and other deposits associated with meandering rivers. Generalized geologic conditions based on hydrogeologic investigations at OU-2 are presented in Figures 1-2 though 1-4. The lithology depicted in these figures is described in descending order as follows:

Riverine Deposits (R): Consists of reworked Q_1, Q_2, and Tm_l sediments along with river-transported sediment. These sediments consist of interlayered sands, silty or clayey sands, silts, and clays. This unit is predominantly clay and silt near the Basin and Round Pond.

Upper Clay Unit of the Quaternary Alluvial Sediments (Q_1): Variable, but primarily composed of silty/sandy clay (does not exist east of the Bluff at OU-2).

Alluvial Aquifer of the Alluvial Sediments (Q_2): The upper zone of this aquifer is composed primarily of very fine to fine-grained, silty sand. The lower zone is composed of fine to very coarse sands containing varying amounts of fine to large gravel.

Miocene Confining Unit (Tm_l): This unit is dominantly clay with various amounts of discontinuous sands, silt, or fine gravel.

1.4.2 Groundwater Flow

Review of potentiometric surface maps from OU-1 investigations and monitoring reports (WCC, 1995; URS, 2007) indicates groundwater flow in the Alluvial Aquifer west of OU-2 to be generally toward the southeast in the vicinity of OU-2. However, during elevated flow events when the water surface of the Tombigbee River is higher than the potentiometric surface in the Alluvial deposits, the groundwater flow direction near OU-2 is likely to be temporarily toward the west (WCC, 1993). During flood events, OU-2 and surrounding flooded areas would be a recharge area for Q_2, and groundwater flow is expected to be temporarily in a western direction immediately west of the flooded area. More discussion on groundwater flow is presented in Section 3.0.

1.4.3 Media of Concern

The media of concern at OU-2 with respect to the occurrence, concentration, distribution, and potential migration of mercury include surface water, sediment, and potentially groundwater. Surface water and sediment data at OU-2 have been collected in previous studies and as part of the ESPP. Groundwater data

at OU-1 and OU-2 were collected in accordance with the Work Plan and the Quality Assurance Project Plan (QAPP) (MACTEC, 2008) in September and November 2008 and are the focus of this report.

1.5 PURPOSE

The purpose of this groundwater report is to present the results of the groundwater investigation activities performed from July 2008 through November 2008 and to respond to the three Principal Study Questions. The three Principal Study Questions as identified in Step 2 of the Data Quality Objective (DQO) process presented in Section 4.0 of the Work Plan are:

- Are mercury and other COCs in the OU-2 sediments acting as a continuing source to groundwater?
- If COCs are detected in OU-2 groundwater, is there a plume that discharges to the Tombigbee River?
- Is mercury in the OU-1 groundwater plume migrating towards and beneath OU-2?

The responses to these questions are presented in Section 6.0.

This report is divided into the following sections: Section 1.0 presents the Introduction, Section 2.0 the Study Area Investigation Methods, and Section 3.0 the Hydrogeology and Geochemistry. The Groundwater Analytical Results are presented in Section 4.0, Fate and Transport are provided in Section 5.0, a response to the DQO Principal Study Questions is in Section 6.0, and the Summary and Conclusions are in Section 7.0.

2.0 STUDY AREA INVESTIGATION METHODS

This section summarizes the groundwater site investigation activities performed at OU-1 and OU-2 from July 2008 through November 2008. Several activities were performed to collect the data necessary to assess potential COC migration in groundwater in the study area. These activities included:

- Installation of piezometers and micro-wells
- Collection and analysis of groundwater samples and measurement of groundwater levels
- Description of site lithology from piezometer and micro-well borings
- Measurement of Basin and river levels

More detailed information is presented in the Work Plan (MACTEC, 2009). Coring within the Basin and Round Pond were also conducted in September 2009 as part of the ESPP studies. These activities are briefly described in the following paragraphs.

2.1 INSTALLATION OF MICRO-WELLS

Seventeen micro-wells were installed between July 31, 2008, and August 16, 2008, around the Basin at varying depths at eight locations (BA-MW1 through BA-MW8) to provide for the collection of groundwater samples. Micro-well BA-MW1 is located in OU-1 and serves as an upgradient well to the Basin during non-flood or baseline conditions. The remaining wells are located within OU-2. The OU-2 wells were spaced approximately 500 to 700 feet apart along the berm and located as depicted in Figure 2-1. In general, the micro-wells were positioned at locations thought to be potentially hydraulically downgradient and sidegradient from the largest area of higher mercury concentrations in the Basin sediments. The screens for the micro-wells were installed in the lithologic units R and Q_2. The micro-wells were installed in clusters of two or three, shallow and intermediate depths so that water quality parameters from R and Q_2 could be collected.

The micro-wells were installed with a direct push technology (DPT) rig by advancing 3.5-inch inner-diameter, hollow steel rods to total depth. On reaching the desired depth, the micro-wells were set within the rods by installing a 1-inch Schedule 40 PVC screen with a factory installed sand pack and a 1-inch Schedule 40 PVC casing (Figure 2-2). Additional sand pack (a 20/40 silica sand) was installed between the factory-installed sand pack and the drill rods. The sand pack was placed up to a depth of 4 feet above

the well screen. In some cases, due to bridging, small amounts of potable water were used to free bridging sand as the drill rods were being withdrawn from the borehole. Potable water was also used at some locations to keep sand from flowing into the borehole during well installation. After the sand pack was installed, the remaining annular space was tremie-grouted to land surface and the drill rods were extracted, leaving the micro-well in place. Additional details on well installation procedures are presented in the Work Plan. Well construction details are summarized in Table 2-1. Boring logs, including construction details and geologic cross sections, are presented in Appendix A.

2.2 INSTALLATION OF PIEZOMETERS

Ten piezometers were installed between August 17, 2008, and August 21, 2008, in clusters of two or three at four locations (BA-PZ1, BA-PZ2, BA-PZ3, and BA-PZ4) to provide permanent locations for water level measurements (Figure 2-1). Piezometers BA-PZ1 and BA-PZ2 are installed within OU-1 and are upgradient to the Basin during non-flood or baseline conditions. The remaining peizometers are located within OU-2. The screens for the piezometers were installed in R and Q_2 at varied depths.

The piezometers were installed using a DPT rig by advancing 3.5-inch inner-diameter steel rods to total depth. On reaching the desired depth, the piezometers were installed following the same procedure used in installing the micro-wells (Figure 2-3). The only difference between the installation method for micro-wells and piezometers was the grouting process. During piezometer installation, grout was not tremied but was slowly poured into the annular space between the casing and the rods. As the drill rods were slowly removed from the borehole, additional grout was poured into the annular space. This process continued until the annular space was filled to the land surface. Additional details on piezometer installation are presented in the Work Plan. Piezometer construction details are summarized in Table 2-1 and on Figure 2-3. Piezometer completion logs and geologic cross sections are presented in Appendix A.

2.3 SEDIMENT CORE SAMPLES

Sediment cores were collected during two sampling events (June 2009 and September 2009). A trial run for sediment coring was performed at one location during the week of June 1, 2009, to evaluate coring methods. During the week of September 21, 2009, sediment cores were collected from 12 additional sampling locations for a total of 13 core locations as depicted in Figure 2-4. Sediment cores were collected using vibracore techniques at depths ranging from 6.5 to 11 feet below the sediment surface.

Cores were kept in an upright position from the time they were retrieved until delivered to the shore for processing. A lithological description of the core was logged and sediment core and pore water samples were collected for analysis. Analytical results are pending and will be provided to EPA in a subsequent report. Core logs are included in Appendix B.

2.4 DESCRIPTION OF SITE LITHOLOGY

The lithologic characteristics of the subsurface formations at OU-2 (R, Q_1, Q_2, and Tm_1) were observed and noted during the advancement of the boreholes for micro-well and piezometer installation. Soil samples were collected using a 4-foot-long macro-core sampler. Continuous soil samples were collected from the existing land surface to the top of Tm_1. Soil descriptions were made by visual inspection using the Unified Soil Classification System. Sediments encountered included interlayered sands, silty or clayey sands, silts, clays, and gravels. Lithologic descriptions were recorded on boring log sheets to provide information on site-specific geology and the depth to the top of the Tm_1 near OU-2. Additional information is provided in Section 3.0. Boring logs including lithology are presented in Appendices A and B.

2.5 GROUNDWATER SAMPLING METHODOLOGY

The wells were purged and sampled in accordance with the USEPA standard operating procedures and USEPA Method 1669 *Sampling Ambient Water for Determination of Metals at EPA Water Quality Criteria Levels*. The groundwater depth was measured in each well and piezometer at OU-2 and the groundwater elevations were calculated. Field parameters were measured when the micro-wells were purged. Groundwater samples for chemical analysis were collected from the newly installed micro-well clusters (BA-MW1 through BA-MW8). Purging was not completed and a groundwater sample for chemical analysis was not collected from micro-well BA-MW1A due to an insufficient quantity of groundwater in the micro-well.

Two groundwater sampling events were conducted. The first event occurred from September 23, 2008, to September 30, 2008. During this event, groundwater samples were collected from micro-well clusters (BA-MW1 through BA-MW8). The second groundwater sampling event occurred between November 11, 2008, and November 12, 2008, and served as a confirmation sampling event. During this confirmation event, groundwater samples were collected from micro-wells BA-MW1B, BA-MW1C, BA-MW2C, BA-MW3B, BA-MW4C, and BA-MW5C.

The micro-wells were purged before sample collection using low-flow purging techniques with a peristaltic pump and new polyethylene tubing. Field parameters (including temperature, pH, specific conductance, turbidity, dissolved oxygen [DO], and oxygen reduction potential [ORP]) were measured during purging. A groundwater sample was collected from each micro-well, with the exception of monitoring well BA-MW1A (which had insufficient groundwater to purge), when the field parameters stabilized (i.e., three consecutive measurements were within a range of 5 percent) and the water turbidity was less than 10 nephelometric turbidity units. Groundwater elevation and field parameters are summarized in Tables 2-2 and 2-3, respectively. Groundwater field sampling logs are provided in Appendix C.

2.6 GROUNDWATER SAMPLE ANALYSIS

The groundwater and quality control samples collected during the two groundwater sampling events were placed in coolers with "wet" ice and transported under chain-of-custody protocol to Battelle Marine Sciences Laboratories (Battelle), Sequim, Washington, and Pace Analytical Services, Inc. (Pace), Green Bay, Wisconsin, for analysis.

2.6.1 Filtered and Unfiltered Mercury Analysis

Battelle analyzed each groundwater samples for mercury (filtered and unfiltered) by USEPA Method E1631. Confirmation samples were collected from monitoring wells BA-MW1B, BA-MW1C, and BA-MW2C in November 2008 and analyzed for mercury (filtered and unfiltered).

2.6.2 HCB

Pace analyzed the groundwater samples for HCB by USEPA Method SW8081. The groundwater samples collected in September 2008 from monitoring wells BA-MW2B, BA-MW2C, BA-MW3B, BA-MW3C, BA-MW4B, BA-MW4C, BA-MW5B, and BA-MW5C were analyzed for HCB. These micro-wells were selected for HCB analysis as agreed upon with the USEPA because they were nearest and likely downgradient/sidegradient from the southern portion of the Basin, which contained the highest HCB concentrations in sediment. Confirmation groundwater samples were collected from monitoring wells BA-MW3B, BA-MW4C, and BA-MW5C in November 2008 and analyzed for HCB.

2.6.3 DDTR

Pace analyzed the groundwater samples for DDTR by USEPA Method SW8081. Groundwater samples collected in September 2008 from monitoring wells BA-MW2B, BA-MW2C, BA-MW4B, and BA-MW4C were analyzed for 2,4'- and 4-4'-DDD, 2,4'- and 4-4'-DDE, and 2,4'- and 4,4'-DDT, collectively referred to as DDTR. These micro-wells were selected for DDTR analysis based on potential preferred flow paths within a potential historical river channel.

2.7 SURFACE WATER ELEVATION MEASUREMENTS OF THE RIVER AND BASIN

Surface water elevation measurements of the Tombigbee River and the Basin were measured by the two water elevation sensing transducers located on the north and south sides of the gate (river side and Basin side). The digital readings of the river and Basin can be obtained from a display panel at the control building. The display readings were confirmed by obtaining measurements from the staff gauges placed on either side of the gate when water level from the micro-wells and piezometers were measured.

3.0 HYDROGEOLOGY AND GEOCHEMISTRY

3.1 HYDROGEOLOGY

The Basin and Round Pond are part of a natural oxbow lake lying within the floodplain of the Tombigbee River. Alluvial deposits of unspecified ages are present from the land surface of OU-2 to a depth of approximately 20 to 30 feet. These deposits consist of reworked and re-deposited sediments along with river-transported sediment. The sediments consist of interlayered sands, silty or clayey sands, silts, clays, and gravels. These sediments represent numerous depositional environments including natural levees, bars, infilled channels, and channel deposits, flood-splays, and other deposits associated with meandering rivers.

Geologic cross sections (Figures 3-1 and 3-2) were prepared from the lithologic data collected during the August/September 2008 and June/September 2009 field investigations. Cross-section lines N-S,and W-E, (Figure 1-2 Basin only) were selected to depict the lithology encountered during these field investigations. A 3-dimensional diagram is also depicted in Figure 3-3 to conceptually display the lithology in relationship to the Basin and Round Pond. The lithology from the microwells around the Basin confirmed the absence of the upper clay unit of Q_1 in OU-2. Cores collected within the Basin and Round Pond, including the deepest portion of the Basin, indicate the presence of predominantly clay Riverine deposits continuously beneath the Basin and Round Pond.

A brief description of these alluvial deposits, from the most recent to the oldest, and a hydrogeologic description is provided in the following paragraphs.

3.1.1 Riverine Deposits (R)

Riverine deposits (R), accumulated beneath the Basin and Round Pond, are flood deposits from the Tombigbee River. These sediments are typically composed of tan, black, and dark gray silty clays and clayey silts that are interspersed with fine, medium, and coarse-grained sands (Figure 3-1 through 3-3). The 2009 core data collected within the Basin and Round Pond indicate that these deposits are at least 6.5 to 11 feet in thickness and are continuously present beneath the Basin and Round Pond. These sediments are underlain by greenish brown, brown, grey, and black clay; organic silty clay; and clayey sand deposits.. They vary in thickness from approximately 13 feet to 23 feet and are unconfined. Groundwater

flow appears to be to the southeast, based on a Basin surface elevation of 2.9 feet and the water levels shown on Figure 3-4.

3.1.2 Upper Clay Unit at the Alluvial Sediment (Q_1)

The bluff to the west of OU-2 is approximately 20 to 30 feet higher in elevation than the floodplain area. Previous investigations indicate that Q_1 west of OU-2 primarily consist of a silty/sandy plastic clay (Figure 3-1) (WCC, 1993). During this investigation, Q_1 sediments were observed immediately west of the bluff in OU-1 at a thickness ranging from 10 to 20 feet. These sediments were composed of sandy clay, low plasticity clay, and clayey sand.

3.1.3 Alluvial Aquifer System of the Quaternary Alluvial Sediment (Q_2)

Q_2 varies in thickness from approximately 37 feet in the west plant area to 60 feet in OU-1. East of the bluff, Q_2 averages about 40 feet thick and typically grades downward from fine sands to coarse-grained sands with some gravel in OU-2. Q_2 is divided into two zones, an upper zone and a lower zone, and is generally unconfined near the Basin. Groundwater flow is generally toward the southeast (Figure 3-4).

The upper zone of Q_2 is composed primarily of very fine to fine-grained, silty quartzose, subangular to subrounded sand. The lower zone of Q_2 is composed of fine to very coarse, orange-brown, quartzose, cherty, subangular to subrounded sands containing varying amounts of gravel. Although composed predominantly of sands, Q_2 also contains some thin beds of clay or silty, gravelly clay.

To the north, south, and east of the Basin it appears that Q_1 and the upper zone of Q_2 have been eroded by the Tombigbee River and are not present, but the lower zone of Q_2 is present.

Significant vertical gradients were not observed between R and Q_2 based on the September 22, 2008, groundwater measurements. It is likely that the variable lithology of the units as well as potential error in field measurement result in minor variations in the vertical gradients.

Bottom elevation of the Basin ranges from approximately 2 to -36 feet NAVD88. Shallow areas (2 to -4 feet NAVD88) are located in the southern portion of the Basin. The deepest part of the Basin is in the northwest. Floodplains are located to the north, northeast, and east of the Basin. The Basin is underlain by R followed by the alluvial sediments of the lower zone of Q_2. Therefore, the Basin is in direct hydraulic connection with R

3.1.4 Miocene Confining Unit (Tm_l)

The Tm_l underlies Q_2. This unit consists of clays, sandy clays, or clayey sands. Although the lithology may be complex, it is predominantly clay, with various amounts of discontinuous sand, silt, or, fine gravel. Boring logs from wells that penetrate Tm_l indicate that this unit is laterally continuous beneath OU-1 and approximately 80 to 100 feet thick in the plant areas west of OU-2. At OU-2, Tm_l consisting of a low-plasticity clay was found along the bluff at depths ranging from 55 to 65 feet below land surface. Just above the clay unit, a 10- to 15-foot layer of coarse sand and gravel was present and served as a marker for the approaching Tm_l unit. Along the southern berm, the top of Tm_l was not always encountered at the depths drilled. Drilling beyond these depths was not possible with the DPT rig. Where Tm_l was not encountered, a layer of well graded gravel underlain by poorly graded fine sand was used as a marker bed for approaching the top of Tm_l. This gravel layer was encountered at depths ranging from 39 feet to 42 feet below the top of the berm.

3.1.5 Miocene Aquifer

Tm_l is underlain by the Miocene Aquifer. The Miocene Aquifer is composed primarily of thick-bedded, coarse sand and gravel beds; however, sandy clay lenses occur within this unit. The attitude of the upper boundary of this aquifer is nearly horizontal in the main plant area; however, in the west plant area there is a pronounced southeastward dip, from -114 feet to -166 feet NAVD88 at OU-1. These differences are interpreted to be related to structural deformation of sediments associated with an underlying salt dome. The Miocene Aquifer was not encountered during the OU-2 investigation.

3.2 GEOCHEMISTRY

Field measurements pH, specific conductivity, ORP, DO, temperature, and turbidity were recorded during the two groundwater sampling events. In general, there was a distinct difference in the geochemistry of the Alluvial Aquifer groundwater between monitoring well clusters BA-MW1 and BA-MW2 and the clusters BA-MW3 through BA-MW8 located to the east along the berm.

The pH measured in micro-well cluster BA-MW1 and micro-well BA-MW2C ranged from 4.34 to 5.1, while the remainder of the Basin micro-wells had pH readings ranging from 6.33 to 6.95. Similarly, ORP measured in micro-well cluster BA-MW1 and micro-well BA-MW2C ranged from 151.1 to 278 compared to readings of -90 to -171 in the other Basin micro-wells. These results indicate that groundwater near micro-wells BA-MW1B/C and BA-MW2C are not similar in quality to the remaining

micro-well clusters. These micro-wells are not likely influenced by the Tombigbee River to the same extent as the micro-wells located between the Basin and the river and indicate a difference in water quality parameters. The difference in water quality parameters between micro-well cluster BA-MW-1/BA-MW2C and the remaining micro-wells likely represents an inherent difference in groundwater quality between OU-1 and OU-2. These data are included in Table 2-3.

4.0 GROUNDWATER ANALYTICAL RESULTS

This section presents the evaluation of the analytical results of groundwater samples collected for the OU-2 groundwater investigation. The analytical results are described in the following text and are presented in both tabular (Table 4-1) and graphical forms (Figure 4-1). Laboratory reports and chain of custody documentation for the groundwater samples collected for the groundwater investigation are provided in a CD in Appendix D. The data have been validated and are appropriate for use as qualified. A brief discussion of data validation is also presented below.

4.1 GROUNDWATER ANALYTICAL RESULTS

Groundwater samples were collected from 16 micro-wells, BA-MW1B/C through BA-MW-8B/C. Six micro-wells (BA-MW1B/C, BA-MW2C, BA-MW3B, BA-MW4C, and BA-MW-5C) were resampled on November 11 to confirm the September 2008 results. Analytical results for both sampling events are summarized in the following paragraphs. One micro-well (BA-MW1A) could not be sampled due to insufficient recharge during purging.

4.1.1 Mercury

Filtered mercury results indicate that the micro-wells had concentrations below the screening level of 0.012 microgram per liter (µg/L) for mercury with the exception of BA-MW1B/C, which is associated with OU-1. The 0.012 µg/L screening level is the Ambient Water Quality Criteria/Criterion (AWQC) for mercury. The mercury AWQC is compared to filtered mercury results from the groundwater micro-wells as a screening step as directed by the USEPA for this site. Filtered mercury concentrations in BA-MW1B/C ranged from 0.587 to 0.930 µg/L. Exceedance of this screening value does not necessarily indicate that an AWQC for surface water has been exceeded, but does indicate that additional evaluation such as modeling may be appropriate. Mercury in these wells may be the result of a historical remnant of the OU-1 plume near the bluff. Currently, the groundwater recovery system at OU-1 captures water above the OU-1 groundwater cleanup level. OU-1, including a closed sanitary landfill, is currently being addressed under RCRA.

The decision diagram (Figure 4-2) presented in the Work Plan was used to address the mercury detections in groundwater samples collected from micro-wells. Detections of mercury below the screening level do not require further evaluation or additional assessment based on the decision diagram. Detections of

mercury above the screening level in groundwater samples collected from micro-wells BA-MW1B, and BA-MW1C, require further evaluation for potential mercury transport from OU-1 to OU-2 and the Tombigbee River. An evaluation of the mercury transport from these micro-wells is provided in Section 5.1.

Statistical analysis of the OU-2 filtered mercury detections (excluding micro-well BA-MW1B/C) are listed below.

	Filtered Groundwater
Mean (µg/L)	0.00124
95% Upper confidence Limit (µg/L)	0.00254
Min (µg/L)	0.000236 JB
Max (µg/L)	0.00906

JB – Estimated value less than the reporting limit with blank concentration

Results from micro-well cluster BA-MW1 in OU-1were excluded from the statistical analysis so that the statistical analysis is representative of OU-2 only. The above values were calculated using the higher of the September and November 2008 analytical results. Both the mean and the 95% upper confidence limit are below the mercury screening levels. Mercury detected below the screening level in the micro-wells between the Basin the Tombigbee River may be related to mercury levels in the river rather than the Basin sediments. Studies of the Tombigbee River conducted by USEPA show mercury concentrations ranging from 0.001 to 0.004 ug/L upstream of the Basin and 0.005 ug/L near OU-2 (USEPA, 1995; USEPA1997). These concentrations (0.001 to 0.005 ug/L) likely represent background mercury concentrations in the river,

Core data collected from within the Basin during the RI further support that mercury concentrations in the micro-wells within OU-2 generally represent background mercury concentrations from the river and not a continuing source from the Basin sediment. Four cores were installed within the southern two-thirds of the Basin and extended from approximately 5.2 to 13.6 feet below the sediment surface during the RI. Mercury was detected in the upper portions of the sediment deposits beneath the Basin, but was not detected between 5 to 8 feet below the sediment surface. Reporting limits for the non-detect results ranged from 0.15 to 0.25 mg/kg. The RI core results indicate that mercury did not fully penetrate the

sediment deposits underlying the Basin (WCC, 1993a). The pathway for mercury transport between the Basin sediment and the underlying Alluvial Aquifer is not complete.

In summary, the micro-wells between the Basin and the Tombigbee River did not have detections above the screening criteria of 0.012 µg/L for filtered mercury. The only detection of filtered mercury exceeding the screening level was on the bluff in the BA-MW1 micro-well cluster in OU-1. These results indicate that sediments in the Basin are not a source of mercury above screening levels to groundwater in OU-2 or the Tombigbee River.

4.1.2 DDTR

DDTR was not detected above the reporting or method detection limit in the groundwater samples as shown on Figure 4-1 and Table 4-1.

4.1.3 HCB

Groundwater samples collected from eight micro-wells (BA-MW-2B/C, BA-MW3B/C, BA-MW4B/C, and BA-MW5B/C) were analyzed for HCB. HCB was detected above the reporting limit of 0.010 µg/L at concentrations of 0.011 to 0.0113 µg/L in one micro-well BA-MW3B. The screening level of HCB defaults to the reporting limit (0.010 µg/L) because the AWQC of HCB (0.0003 µg/L) is less than this limit. HCB was also detected in micro-wells BA-MW4C and BA-MW5C at an estimated concentration below the reporting limit and at concentrations similar to that detected in a laboratory blank sample. HCB was not detected in the November 2008 confirmation sample for BA-MW4C.

Since HCB was detected above the reporting limit in only one micro-well, its presence appears very isolated. An evaluation of the potential for HCB transport to the Tombigbee River is provided in Section 5.2.

4.1.4 Groundwater Data Quality Evaluation

Groundwater data were reported in seven sample delivery groups (SDGs). The quality of the groundwater data is discussed by SDG in Appendix D. The laboratory was able to meet the reporting limits presented in the Work Plan.

The following Quality Assurance/Quality Control (QA/QC) data were evaluated for each SDG:

- Sample receipt (chain of custody) and report completeness
- Holding times
- Field blanks, equipment blanks, and laboratory method blanks
- Field duplicates
- Surrogate recoveries (organics only)
- Matrix spike/matrix spike duplicates
- Relationship between total and dissolved fractions (mercury only)

The QA/QC data were within limits for the SDGs with the following exceptions. HCB detections from two SDGs were flagged "JB" due to possible laboratory method blank contamination. Laboratory blanks contained 0.0021 µg/L of HCB. Mercury (filtered and unfiltered) samples from both SDGs were flagged "JB" due to possible equipment blank contamination ranging from 0.000286 to 0.000554 µg/L for filtered samples and 0.000168 to 0.00814 µg/L for the unfiltered samples. The data are useable as qualified in Table 4-1.

5.0 FATE AND TRANSPORT

This section presents the fate and transport for COCs (mercury and HCB). These constituents were found above the screening level for groundwater in one or more wells. The screening level is based on the AWQCs. It should be noted that concentrations above the screening level in groundwater do not necessarily indicate a surface water exceedance of the AWQC, which is applicable only to in-stream measurements in surface water. This section will focus on filtered (or dissolved) mercury concentrations since dissolved mercury is subject to migration. The purpose of the following assessment is to evaluate the potential for COCs detected above the screening levels to migrate to the Basin and/or the Tombigbee River.

Mercury was detected at concentrations exceeding the screening level concentration (0.012 µg/L) in groundwater samples collected from micro-well cluster BA-MW1B/C installed in OU-1 near the bluff west of OU-2. Filtered mercury concentrations in this cluster ranged from 0.059 to 0.930 µg/L during two sampling events. Mercury was not detected above the screening level for filtered mercury in micro-wells in OU-2. These results indicate that sediment in the Basin is not a source of mercury above screening levels to groundwater or the Tombigbee River. The detection of mercury in micro-well cluster BA-MW1B/C may be the result of a historical remnant of a mercury plume at OU-1 near the bluff.

The 0.010 µg/L screening level for HCB represents the reporting limit for the analytical method because the method cannot detect down to the AWQC of 0.0003 µg/L with statistical confidence. HCB exceeded its screening level (0.010 µg/L) in the groundwater sample collected from micro-well BA-MW3B, which indicated an HCB concentration of 0.011 to 0.013 µg/L.

5.1 MERCURY TRANSPORT

The potential for mercury in groundwater to discharge from micro-well cluster BA-MW1into the Basin and/or migrate to the Tombigbee River was calculated using the one-dimensional fate and transport model BIOSCREEN-AT. BIOSCREEN-AT is an enhanced version of BIOSCREEN (Newell et al., 1996) with an exact analytical solution for the transport of a contaminant (Karanovic et al., 2007). This model is based on Microsoft Excel software that solves the widely-used analytical Domenico equation (Karanovic et al, 2007). This equation describes transport of solute in groundwater (inorganic or organic, decaying or non-decaying). Features within the model designed to account for processes specific to natural attenuation of organic constituents were not used. The model simulates advection, adsorption and three-

dimensional dispersion of any dissolved constituent (inorganic or organic), and has the ability to simulate constant or decaying sources, and contaminant degradation using degradation constants. The use of BIOSCREEN AT was limited for this site-specific application to model only advection, dispersion, and adsorption onto porous media since mercury and HCB are not known to degrade at notable rates naturally. Processes such as degradation or other chemical/biological processes were not included in this model. The use of this model as described above is consistent with USEPA guidance (Ford et al, 2007), where the USEPA's Center for Subsurface Modeling Support state that the Domenico-based models in their current forms are reasonable for screening level tools, such as BIOCHLOR, BIOSCREEN, FOOTPRINT, AND REMChlor. BIOSCREEN AT is available free of charge at: http://www.sspa.com/Software/bioscreen.shtml.

Mercury is modeled as flowing from micro-well cluster BA-MW1 into the Basin with the following assumptions.

- The modeled mercury flow path is from OU-1 near the bluff into the Basin, which may be different from the actual flow path. This assumption, that there is a direct pathway for migration to the Basin, provides for a very conservative or overestimation of mercury concentrations that may potentially reach the Basin. The model assumes that mercury is transported through the sandy aquifer (Q_2) near BA-MW1, through the clay sediment deposits beneath the Basin (R) and into the Basin. The modeled flow path is depicted in Appendix E.
- The highest detected filtered mercury concentration in mirco-well cluster BA-MW1 is representative of mercury concentrations in OU-1 west of the bluff and is constant in concentration until it reaches the clay sediment deposits beneath the Basin. No adsorption or dispersion of mercury occurs as it migrates through the sandy aquifer (Q_2) This assumption tends to overestimate the mercury concentration that could potentially reach the Basin.

The parameters selected for use in the model are presented in the following subsections.

5.1.1 Source Zone Width

The source zone is defined as the two-dimensional cross sectional area that is perpendicular to the direction of groundwater flow and of known constituent concentration. Downgradient of this zone, the groundwater concentration is calculated by the model based on the dispersion, decay, adsorption, etc. that would occur in the flow field based on the value of the parameters used in the model. The modeled source is the area along the bluff on the eastern edge of OU-1. The planar two-dimensional source is represented by the highest detected dissolved mercury concentration in the sandy alluvial aquifer around

BA-MW1. The cross section of the source is assumed to be approximately 1,000 feet long, or the combined length of half the distance between BA-MW1 and BA-PZ1, and half the distance between BA-MW1 and BA-MW2.

5.1.2 Source Zone Thickness

The source zone thickness was assumed to be 35 feet in Q_2 based on the boring logs of the BA-MW1 micro-well cluster.

5.1.3 Hydraulic Gradient

The hydraulic gradient was calculated as 0.011 based on the change in head between BA-MW1B and the Basin (approximately 200 feet from BA-MW1 to the Basin, Figures E-1 and E-2).

The driving force for the assumed transport of mercury toward the Basin is the observed drop of hydraulic head of about 3 feet between BA-MW-1 and the Basin. It should be noted, however, that this difference in the hydraulic heads does not necessarily mean that the discharge of mercury into the Basin is actually taking place. The presence of thick organic clays and clayey silts underlying the Basin may be effective in preventing the discharge of mercury into the Basin.

5.1.4 Effective porosity

The effective porosity for the clayey and silty sediments underlying the Basin was assumed to be approximately 5 percent based on the predominance of fine-grained materials. This porosity is based on published values for this material (Kresic, 2008; Johnson, 1967).

5.1.5 Hydraulic Conductivity

Based on the prevalence of fine-grained sediments underlying the Basin (clays, silty clays, and clayey silts), the hydraulic conductivity was assumed to be approximately 1×10^{-4} centimeters per second (cm/s). This value is conservative and represents the upper limit of the reported hydraulic conductivities of fine-grained sediments (USBR, 1977).

5.1.6 Dispersivity

The longitudinal dispersivity was assumed to be 20 feet, and the transverse and vertical dispersivity of 2 and 0.2 foot, respectively, based on an assumed plume length of 200 feet and published guidelines for dispersivity (Newell et al., 1996).

5.1.7 Partitioning Coefficient

Soil-water partition coefficients (Kd) for inorganic mercury (HgII) are reported to range between 24,000 and 270,000 milliliters per gram (mL/g) with a mean value of about 60,000 mL/g (USEPA, 1997). For methylmercury (MeHg), values range between 2,700 and 31,000 mL/g with a mean value of about 6,700 mL/g. Methylmercury constitutes less than 1 percent of the total analyzed mercury based on the results of the 2006 baseline sampling event (MACTEC, 2007). Consequently, the Kd value selected for the analytical calculations of fate and transport of mercury between BA-MW-1 and the Basin is conservatively assumed to be 24,000 mL/g, or the lowest reported for HgII.

As discussed by the Federal Remediation Technologies Roundtable (FRTR; 2009;http://www.frtr.gov/matrix2/section2/2_8_1.html), sorption in soils and sediments is one of the most important controlling factors for removal of mercury from solution. Mercury is also strongly sorbed to humic materials that constitute a significant portion of the sediments underlying the Basin; these materials have described as "tan," "dark," and containing "natural organics" (WCC, 1993). Inorganic mercury sorbed to soils and sediments is not readily desorbed; therefore, freshwater and marine sediments are important repositories for inorganic mercury.

The retardation factor (R) of 80,000 was calculated assuming the bulk density of 1.5 kilograms per liter and the total porosity of 45 percent:

$$R = 1 + \frac{1.5 \times 24{,}000}{0.45} = 80{,}000$$

The retardation factor is also conservative because it is based on the lowest reported literature value for Kd (24,000 mL/g) in a range of 24,000 to 270,000 mL/g.

5.1.8 Source Concentration and Strength

The dissolved mercury concentration in the entire assumed 1,000-foot-wide source zone at BA-MW1 was estimated to be 0.122 µg/L in the upper zone and 0.930 µg/L in the lower zone, based on the November 2008 sampling results. This source was assumed to be of constant strength in time.

5.1.9 Degradation and Chemical Transformations

Degradation of mercury or chemical reactions was not assumed in the model.

5.1.10 Mercury Model Results

The results of the analytical one-dimensional model of mercury fate and transport from BA-MW1 toward the Basin show that (for the modeled travel times of 5 to 100 years) the mercury concentration in the Riverine zone immediately next to the Basin would be less than 0.000001 µg/L (if this reporting limit were achievable). The input parameters and results of the model are provided in Appendix E. The calculated (modeled) concentration of mercury entering the Basin will be much greater than the concentration actually expected to enter the Basin because the model is based on the following conservative parameters:

- the highest reported literature value of the hydraulic conductivity for the fine-grained sediments
- a hydraulic gradient toward the Basin
- the highest detected dissolved mercury concentration in groundwater acting as a constant (non-decaying) source
- the lowest reported Kd value representing mercury sorption.

Based on this conservative evaluation, mercury above the AWQC would not enter the Basin from OU-1. Mercury concentrations from BA-MW1 entering the Tombigbee River would be orders of magnitude smaller than that entering the Basin, assuming groundwater from this location discharges to the Tombigbee River, a distance of approximately 1,900 feet from micro-well BA-MW1 to the river.

5.2 HCB TRANSPORT

A one-dimensional fate and transport model, BIOSCREEN AT, as described above, was used to determine whether the HCB represented by the November 2008 sampling results at BA-MW3B could be

transported to the Tombigbee River at concentrations above the AWQC of 0.0003 µg/L. The parameters selected for use in the model are presented in the following subsections.

5.2.1 Source Zone Width

The width of the planar two-dimensional source of HCB in the high plasticity clays noted in the screened interval of BA-MW3B was assumed to be approximately 500 feet, based on the approximate mid-distance to the adjacent micro-wells; these micro-wells indicated HCB concentrations less than the reporting limit.

5.2.2 Source Zone Thickness

The source zone thickness was assumed to be 10 feet based on the cross section in Appendix A, Figure A-2.

5.2.3 Hydraulic Gradient

The driving force for the calculated transport of HCB toward the river was based on an assumed 3-foot decrease in the hydraulic head between the Basin and the river. This head decrease was based on the groundwater elevation at the berm (BA-MW3B) being equal to the prevailing water elevation in the Basin during non-flooding periods (3 feet NAVD88) and an elevation of 0.0 feet at the river. The zero elevation in the river is below that historically observed and possibly lower than that physically achievable. This hydraulic gradient was used in the model to obtain a very conservative assessment. The distance between BA-MW3B and the river is approximately 880 feet. Based on these water elevations and this distance, a hydraulic gradient of 0.0034 was calculated.

5.2.4 Effective Porosity

The effective porosity for the clay underlying the berm was assumed to be approximately 5 percent based on the soil description (high plasticity clay) in the BA-MW3B boring log. This porosity is based on published values for this material (Kresic, 2008; Johnson, 1967).

5.2.5 Hydraulic Conductivity

The hydraulic conductivity reported for high plasticity clay ranges from 1.2×10^{-7} to 1.2×10^{-8} cm/s (USBR, 1977). For the purpose of modeling under a conservative scenario, a hydraulic conductivity of 1.2×10^{-7} was selected.

5.2.6 Dispersivity

Based on the assumed plume length of 880 feet and on published guidelines, the longitudinal dispersivity was assumed to be 80 feet, and the transverse and vertical dispersivities were assumed to be 8 feet and 0.8 foot, respectively (Newell et al., 1996).

5.2.7 Partitioning Coefficient with Respect to Organic Carbon (Koc)

Log Koc for HCB is reported to range between 2.56 and 4.54 (Weast and Astle, 1981). Based on this information, a conservatively low value of 363 mL/g for Koc was selected. The associated distribution coefficient, Kd, was calculated using two different methods to provide a range of inputs and outputs based on different assumptions for the percent organic carbon (foc). The first method assumes a conservative foc of 0.005 from the following equation (Newell et al., 1996):

$$K_d = f_{oc} \times K_{oc} = 0.005 \times 363 mL/g = 1.815 mL/g$$

A retardation factor (R) of 7.0 was calculated assuming a bulk density (ρ_b) of 1.5 g/mL and a total porosity of 45%:

$$R = 1 + \frac{\rho_b \times K_d}{n} = 1 + \frac{1.5 \times 1.815}{0.45} = 7.0$$

The second method is based on the assumption that foc is the lowest average foc of 0.0033 (3,300 mg/kg) in a sediment core collected from the 2009 coring activities.

$$K_d = f_{oc} \times K_{oc} = 0.0033 \times 363\, mL/g = 1.198\, mL/g$$

The resulting retardation factor for the second method is estimated as follows.

$$R = 1 + \frac{\rho_b \times K_d}{n} = 1 + \frac{1.5 \times 1.198}{0.45} = 4.993 = 5.0$$

The model outputs for both assumptions of foc are nearly equal as illustrated in the model output discussed below and provided in Appendix E.

5.2.8 Source Concentration and Strength

The HCB concentration in the entire assumed 500-foot-long source zone at BA-MW3B was estimated to be 0.013 µg/L based on the November 2008 sampling results. This source was assumed to be of constant strength in time.

5.2.9 Degradation and Chemical Transformations

No degradation of HCB or chemical reactions was assumed in the model.

5.2.10 HCB Model Results

The results of the analytical one-dimensional model of HCB fate and transport from BA-MW3B toward the river show that (for travel times 5 to 100 years) the most conservatively calculated concentration in the saturated zone immediately adjacent to the river would be less than 0.000001 µg/L (if this reporting limit were achievable) for both methods of estimating foc. The input parameters and outputs of the model are provided in Appendix E. Inputs are considered conservative (resulting in higher transported HCB concentrations) because of the following conservative assumptions:

- the highest reported literature value of the hydraulic conductivity for the sandy sediments
- a high hydraulic gradient assuming zero-elevation of the Tombigbee River
- the highest detected HCB concentration in groundwater acting as a constant (non-decaying) source

Thus, the actual concentration potentially entering the river would be far less than that calculated with these conservative parameters. HCB above the AWQC would not enter the Tombigbee River based on this model prediction.

6.0 DQO PRINCIPAL STUDY QUESTIONS

The CSM for OU-2 was developed and presented in the Work Plan to identify potential migration pathways and aid the planning of groundwater investigation activities. The CSM was refined by responding to the Principal Study Questions in Step 2 of the DQO process as presented in the Work Plan. The responses are provided below.

1. **Are mercury and other COCs in the OU-2 sediments acting as a continuing source to groundwater?**

   Micro-wells were placed at the most likely locations between the Basin and the Tombigbee River to detect the potential migration of mercury from sediments in groundwater. Mercury concentrations in micro-wells between the Basin and the river were not above the screening criterion of 0.012 µg/L (AWQC). The mean mercury concentration for filtered samples is 0.00124 µg/L, and the 95% UCL is 0.00254 µg/L for micro-wells within OU-2. Both the filtered mercury mean and 95% UCL are below the screening level. The only detection of mercury exceeding the screening level was west of the bluff in the upgradient micro-well cluster BA-MW1 in OU-1. (Results from BA-MW1 were not included in the mean and 95% UCL calculations for OU-2.) The screening level was agreed upon with USEPA prior to implementation of the Work Plan. Mercury in the OU-2 sediments does not act as a continuing source to groundwater or the Tombigbee River because mercury above the screening level was not detected in groundwater associated with OU-2.

   Mercury detected below the screening level in the micro-wells between the Basin the Tombigbee River may be related to mercury levels in the river rather than the Basin sediments. Studies of the Tombigbee River conducted by USEPA show mercury concentrations ranging from 0.001 to 0.004 ug/L upstream of the Basin and 0.005 ug/L near OU-2 (USEPA, 1995, USEPA, 1997). These concentrations (0.001 to 0.005 ug/L) likely represent background mercury concentrations in the river

   Core data collected from within the Basin during the RI further support that mercury concentrations in the micro-wells within OU-2 generally represent background mercury concentrations from the river and not a continuing source from the Basin sediment. The RI core results indicate that mercury did not fully penetrate the

sediment deposits underlying the Basin such that the pathway for mercury transport between the Basin sediment and the underlying Alluvial Aquifer is not complete (WCC, 1993a).

HCB was detected above the screening level (0.010 µg/L) in only one micro-well, BA-MW3B, along the southern portion of the berm. Since HCB was detected above the reporting limit in only one micro-well, its presence appears to be very isolated. The potential for HCB in groundwater to discharge to the Tombigbee River was calculated using the one-dimensional fate and transport model BIOSCREEN-AT. Very conservative inputs to the model were used and tend to overestimate the potential to transport HCB. Model results demonstrate that HCB concentrations at BA-MW3B would not result in an exceedance of the HCB AWQC in the Tombigbee River.

DDTR was not detected above the reporting limit in the groundwater samples and is not a continuing source to groundwater or the Tombigbee River.

The groundwater analytical data, RI core data, and the model results discussed above indicate that mercury and the other COCs in the OU-2 sediment do not act as a continuing source to groundwater or the Tombigbee River.

2. If COCs are detected in OU-2 groundwater, is there a plume that discharges to the Tombigbee River?

Mercury, HCB, and DDTR groundwater results are presented under Principal Study Question 1 above. Mercury concentrations in micro-wells between the Basin and the Tombigbee River were not detected above the screening criterion of 0.012 µg/L. Therefore, a mercury groundwater plume at concentrations above the screening level at OU-2 is not evident.

Model results for HCB, which was detected above the screening level in BA-MW3B, indicate that the detected level will not cause an exceedance of the AWQC in the Tombigbee River. Therefore, the detection of HCB in one micro-well would not result in an exceedance of the AWQC in the Tombigbee River.

DDTR was not detected above the reporting limits; therefore, a DDTR groundwater plume above reporting limits is not present.

3. Is mercury in the OU-1 groundwater plume migrating towards and beneath OU-2?

Mercury was detected above the screening level in micro-well cluster BA-MW1 as noted in Principal Study Question 1. Mercury in these wells may be the result of a historical remnant of the OU-1 plume near the bluff. Currently, the groundwater recovery system at OU-1 captures water above the OU-1 groundwater cleanup level of 2 ug/l. OU-1 groundwater monitoring and compliance is currently regulated under RCRA.

The potential for mercury at concentrations between the OU-2 screening level and the OU-1 clean up level, as detected in OU-1 groundwater west of the bluff, to discharge to the Basin and the Tombigbee River was calculated using the fate and transport model BIOSCREEN-AT. Very conservative model inputs to the model were used and tend to overestimate the potential to transport mercury. The model results demonstrate that mercury concentrations at BA-MW1 would not result in an exceedance of the screening level in the Basin or in the Tombigbee River. Micro-wells between the Basin and the Tombigbee River do not contain mercury concentrations above the screening level. Therefore, a groundwater plume of mercury exceeding the AWQC in the Basin or the Tombigbee River is not currently evident or predicted in the future.

The decision diagram (Figure 4-2) presented in the Work Plan indicates the path forward based on the resulting data and evaluations presented herein. No further groundwater assessment for OU-2 is recommended based on the logic in this diagram and the findings of this groundwater investigation.

7.0 SUMMARY AND CONCLUSIONS

The purpose of this groundwater report was to present the results of the groundwater investigation and respond to the three Principal Study Questions presented in the Work Plan. These Principal Study Questions are listed with a response below.

1. **Are mercury and other COCs in the OU-2 sediments acting as a continuing source to groundwater?**

   Micro-wells were placed at the most likely locations between the Basin and the Tombigbee River to detect the potential migration of mercury from sediments in groundwater. Mercury concentrations in micro-wells between the Basin and the river were not above the screening criterion of 0.012 µg/L (AWQC). The mean mercury concentration for filtered samples is 0.00124 µg/L, and the 95% UCL is 0.00254 µg/L for micro-wells within OU-2. Both the filtered mercury mean and 95% UCL are below the screening level. The only detection of mercury exceeding the screening level was west of the bluff in the upgradient micro-well cluster BA-MW1 in OU-1. Mercury in the OU-2 sediments does not act as a continuing source to groundwater or the Tombigbee River because mercury above the screening level was not detected in groundwater associated with OU-2.

   Core data collected from within the Basin during the RI further support that mercury in sediment in the Basin is not a continuing source to groundwater or the river. The RI core results indicate that mercury did not fully penetrate the sediment deposits underlying the Basin and, therefore, a pathway for mercury transport between the Basin sediment and the underlying Alluvial Aquifer (Q_2) is not complete (WCC, 1993a).

   HCB was detected above the screening level (0.010 µg/L) in only one micro-well, BA-MW3B, along the southern portion of the berm and the detection appears to be very isolated. The potential for HCB in groundwater to discharge to the Tombigbee River was calculated using a conservative, one-dimensional fate and transport model, BIOSCREEN-AT. Model results demonstrate that HCB concentrations at BA-MW3B would not result in an exceedance of the HCB AWQC in the Tombigbee River.

DDTR was not detected above the reporting limit in the groundwater samples. DDTR is not a continuing source to groundwater or the Tombigbee River.

The groundwater analytical data, RI core data, and the model results indicate that mercury and the other COCs in the OU-2 sediment do not act as a continuing source to groundwater or the Tombigbee River.

2. **If COCs are detected in OU-2 groundwater, is there a plume that discharges to the Tombigbee River?**

Mercury, HCB, and DDTR groundwater results are presented under Principal Study Question 1 above. Mercury concentrations in micro-wells between the Basin and the Tombigbee River were not above the screening criterion of 0.012 µg/L. Therefore, a mercury groundwater plume above the screening level at OU-2 is not evident.

Model results for HCB, which was detected above the screening level in BA-MW3B, indicate that the detected levels will not cause an exceedance of the AWQC in the Tombigbee River. Therefore, the detection of HCB in one micro-well would not result in an exceedance of the AWQC in the Tombigbee River.

DDTR was not detected above the reporting limits; therefore, a DDTR groundwater plume above reporting limits is not present.

3. **Is mercury in the OU-1 groundwater plume migrating towards and beneath OU-2?**

Mercury was detected above the screening level in micro-well cluster BA-MW1 as noted in Principal Study Question 1. Mercury in these wells may be the result of a historical remnant of the OU-1 plume near the bluff. Currently, the groundwater recovery system at OU-1 captures water above the OU-1 groundwater cleanup level of 2 ug/l. OU-1 groundwater monitoring and compliance is currently regulated under RCRA.

The potential for mercury at concentrations between the OU-2 screening level and the OU-1 clean up level, as detected in OU-1 groundwater west of the bluff, to discharge to the Basin and the Tombigbee River was calculated using the fate and

transport model BIOSCREEN-AT. The model results demonstrate that mercury concentrations at BA-MW1 would not result in an exceedance of the screening level in the Basin or in the Tombigbee River. Micro-wells between the Basin and the Tombigbee River do not contain mercury concentrations above the screening level. Therefore, a groundwater plume of mercury exceeding the AWQC in the Basin or the Tombigbee River is not currently evident or predicted in the future.

The overall goal of the OU-2 groundwater investigation was to determine whether the OU-2 sediments are acting as a continuing source to groundwater and impacting the Tombigbee River. Based on the evaluation of the analytical data collected and the model results, a groundwater plume above screening levels is not present at the Basin; nor will the AWQC in the Tombigbee River be exceeded. No further groundwater assessment for OU-2 is necessary based on the decision diagram (Figure 4-2) as previously presented in the Work Plan and the findings of this groundwater investigation.

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TABLES

Table 2-1
Micro-Well and Piezometer Construction Details
OU-2 Groundwater Investigation Report
McIntosh, Alabama

Well ID	TOC Elevation (ft)	Ground Elevation (ft)	Total Depth (ft)	Screen Interval (ft)	Well Material	Well Diameter (in)	Zone
BA-MW1A	34.39	32.60	30.61	20.61 - 30.61	PVC riser and Pre-packed screen	1	B
BA-MW1B	34.96	32.50	47.07	37.07 - 47.07	PVC riser and Pre-packed screen	1	B
BA-MW1C	34.26	32.00	67.09	57.09 - 67.09	PVC riser and Pre-packed screen	1	C
BA-MW2B	14.12	11.80	25.65	15.65 - 25.65	PVC riser and Pre-packed screen	1	A
BA-MW2C	14.25	11.80	46.37	36.37 - 46.37	PVC riser and Pre-packed screen	1	C
BA-MW3B	13.72	11.50	25.67	15.67 - 25.67	PVC riser and Pre-packed screen	1	A
BA-MW3C	13.86	11.40	44.10	34.10 - 44.10	PVC riser and Pre-packed screen	1	C
BA-MW4B	14.15	11.70	28.41	18.41 - 28.41	PVC riser and Pre-packed screen	1	A
BA-MW4C	14.01	11.40	42.13	32.13 - 42.13	PVC riser and Pre-packed screen	1	C
BA-MW5B	14.25	11.80	27.01	17.01 - 27.01	PVC riser and Pre-packed screen	1	A
BA-MW5C	13.88	11.60	38.20	28.20 - 38.20	PVC riser and Pre-packed screen	1	C
BA-MW6B	13.73	11.70	26.60	16.60 - 26.60	PVC riser and Pre-packed screen	1	A
BA-MW6C	13.91	11.70	46.13	36.13 - 46.13	PVC riser and Pre-packed screen	1	C
BA-MW7B	14.10	11.90	26.95	16.95 - 26.95	PVC riser and Pre-packed screen	1	A
BA-MW7C	14.20	11.80	46.38	36.38 - 46.38	PVC riser and Pre-packed screen	1	C
BA-MW8B	14.64	12.50	25.18	15.18 - 25.18	PVC riser and Pre-packed screen	1	A
BA-MW8C	14.76	12.40	45.84	35.84 - 45.84	PVC riser and Pre-packed screen	1	C
BA-PZ1A	43.29	41.00	38.88	28.88 - 38.88	PVC riser and screen	1	B
BA-PZ1B	43.29	40.90	49.20	39.20 - 49.20	PVC riser and screen	1	B
BA-PZ1C	42.98	40.80	68.21	58.21 - 68.21	PVC riser and screen	1	C
BA-PZ2A	42.23	39.80	39.13	29.13 - 39.13	PVC riser and screen	1	B
BA-PZ2B	41.82	39.50	49.41	39.41 - 49.41	PVC riser and screen	1	B
BA-PZ2C	42.00	39.60	59.09	49.09 - 59.09	PVC riser and screen	1	C
BA-PZ3B	14.42	12.20	24.86	14.86 - 24.86	PVC riser and screen	1	B
BA-PZ3C	14.46	12.10	45.00	35.00 - 45.00	PVC riser and screen	1	C
BA-PZ4B	14.21	11.90	25.99	15.99 - 25.99	PVC riser and screen	1	B
BA-PZ4C	14.28	11.90	42.89	32.89 - 42.89	PVC riser and screen	1	C

NOTE: Monitoring wells and piezometers installed between July 29, 2008 and August 21, 2008
All measurements referenced to NAVD88, NAD83
A - Riverine
B - Upper Alluvial
C - Lower Alluvial
TOC - Top of casing

Prepared by: LRP/01/29/09
Checked by: FKM/01/30/09

Table 2-2
Micro-Well and Piezometer Groundwater Elevations, September 22, 2008
OU 2 Groundwater Investigation Report
McIntosh, Alabama

Well ID	Northing	Easting	TOC Elevation (ft)	Depth to Water (ft)	Groundwater Elevation (ft)
BA-MW1A	460133.44	1815083.77	34.39	27.88	6.51
BA-MW1B	460138.27	1815082.66	34.96	28.76	6.20
BA-MW1C	460137.19	1815087.54	34.26	28.11	6.15
BA-MW2B	459476.43	1815489.95	14.12	11.30	2.82
BA-MW2C	459475.26	1815484.34	14.25	10.45	3.80
BA-MW3B	459556.17	1815966.06	13.72	11.21	2.51
BA-MW3C	459555.31	1815960.97	13.86	11.33	2.53
BA-MW4B	459525.37	1816529.17	14.15	11.56	2.59
BA-MW4C	459523.40	1816524.82	14.01	11.43	2.58
BA-MW5B	459770.88	1816967.14	14.25	11.71	2.54
BA-MW5C	459767.84	1816961.41	13.88	11.35	2.53
BA-MW6B	460088.58	1817342.52	13.73	11.28	2.45
BA-MW6C	460083.49	1817339.75	13.91	11.45	2.46
BA-MW7B	460539.29	1817461.30	14.10	11.61	2.49
BA-MW7C	460533.70	1817461.07	14.20	11.73	2.47
BA-MW8B	461140.47	1817463.95	14.64	12.07	2.57
BA-MW8C	461135.09	1817463.47	14.76	12.19	2.57
BA-PZ1A	461354.70	1814965.48	43.29	36.07	7.22
BA-PZ1B	461359.50	1814967.78	43.29	36.14	7.15
BA-PZ1C	461356.22	1814970.91	42.98	35.78	7.20
BA-PZ2A	461997.92	1815072.89	42.23	34.96	7.27
BA-PZ2B	462003.89	1815074.09	41.82	34.57	7.25
BA-PZ2C	462000.29	1815075.88	42.00	34.81	7.19
BA-PZ3B	462655.10	1815745.13	14.42	11.72	2.70
BA-PZ3C	462654.68	1815749.43	14.46	11.47	2.99
BA-PZ4B	462501.73	1816677.52	14.21	11.43	2.78
BA-PZ4C	462501.18	1816682.59	14.28	11.63	2.65

NOTE: All measurements referenced to NAVD88, NAD83
TOC = Top of casing

Prepared by: KPW 2/13/09
Checked by: EJS, LRP 11/7/2008

Table 2-3
Groundwater Field Parameters
OU 2 Groundwater Investigation Report
McIntosh, Alabama

Location:	Sample Date	Aquifer Monitored	Depth to Water (ft)	pH (std units)	Temperature °C	Specific Conductivity (mS/cm)	ORP (mV)	Turbidity (NTU)	Dissolved Oxygen (mg/L)	Purge Rate (mL/min)	Purge Volume (gal)
BA-MW1A*	09/30/2008	A	27.88	5.08	22.70	0.141	175	228	3 1	25	0.36
BA-MW1B	09/29/2008	A	28 76	4.34	20.85	0.302	179	1.1	1.58	220	2.2
BA-MW1C	09/30/2008	A	28.11	4.64	20.92	3.937	151.1	1.3	0 86	200	4.71
BA-MW1C	11/11/2008	A	28.50	4.49	19.73	3 51	278	0	0.34	500	4.7
BA-MW2B	09/23/2008	R	11.30	6.33	23.21	5.188	-110	5.15	0.9	150	1.8
BA-MW2C	09/23/2008	A	10.45	4.49	22.94	3 046	223	0.67	0.81	200	4.35
BA-MW2C	11/11/2008	A	11.24	4.53	20 27	2.74	224	1.08	0 3	500	4.3
BA-MW3B	09/25/2008	R	11 21	6 55	22.90	1 959	-89.9	6.71	0.75	150	1.8
BA-MW3B	11/12/2008	A	12.65	6 73	22 29	2.171	-140 1	2 07	0 22	280	1.6
BA-MW3C	09/24/2008	A	11 33	6.80	21 91	2.218	-145.4	1 35	0 38	260	4
BA-MW4B	09/25/2008	R	11.56	6.64	22.56	1 23	-133.2	4.24	0.48	240	2
BA-MW4C	09/24/2008	A	11 43	6.55	23.62	1.212	-110.3	3.54	0.38	230	3.72
BA-MW4C	11/12/2008	A	12.40	6.61	20.80	1 13	-142	0.15	0 2	600	3.6
BA-MW5B	09/25/2008	R	11.71	6.71	22.97	1.137	-142.6	3.53	0.5	240	1.86
BA-MW5C	09/26/2008	A	11 35	6.88	21.26	0.963	-151.4	6.19	0 24	230	3.3
BA-MW5C	11/12/2008	A	12.47	6.95	20.69	0.868	-171	2.82	0.15	600	3.12
BA-MW6B	09/26/2008	R	11.28	6.69	22.07	1.089	-118 5	3.83	0.5	200	1.9
BA-MW6C	09/26/2008	A	11.45	6.87	22.23	1.133	-154.3	3.2	0.25	220	4.2
BA-MW7B	09/26/2008	R	11.61	6.41	22.40	0.708	-112 2	4.34	0.52	210	1.9
BA-MW7C	09/29/2008	A	11.73	6.61	21.29	0 525	-132 4	3.35	0.31	220	4.2
BA-MW8B	09/29/2008	R	12.07	6.61	23 17	0.469	-127.1	4.3	0.26	180	1.6
BA-MW8C	09/29/2008	A	12.19	6.68	21.89	0.854	-122.8	2.53	0.43	260	4.1

Notes:
ft = feet
°C = Degrees Celsius
mS/cm = millisiemen per centimeter
mV = millivolts
NTU = nephelometric turbidity units
mg/L = milligrams per liter
mL/min = milliliter per minute
gal = gallons
A = Alluvial
R = Riverine
* BA - MW1A was not sampled due to insufficient water and recharge. Parameters did not stabilize during purging.

Prepared by: LRP 2/9/09
Checked by: KPW 02/13/09

Table 4-1
Summary of Groundwater Analytical Data
OU 2 Groundwater Investigation Report
McIntosh, Alabama

Location ID:	BA-MW1B				BA-MW1C				BA-MW2B		BA-MW2C			
Sample ID:	BA-MW1B092908		BA-MW1B111108		BA-MW1C0093008		BA-MW1C111108		BA-MW2B092308		BA-MW2C092308		BA-MW2C111108	
Sample Date:	09/29/2008		11/11/2008		09/30/2008		11/11/2008		09/23/2008		09/23/2008		11/11/2008	
Sample Type:	Sample		Sample		Sample		Sample		Sample		Sample		Sample	
Mercury, E1631, µg/L														
Mercury, Filtered	0.0587	JB	0.122	JB	0.395	JB	0.93	JB	0.00104	JB	0.00517	JB	0.00906	JB
Mercury, Unfiltered	0.0825	JB	0.119	JB	0.458	JB	0.965	JB	0.00186	JB	0.015	JB	0.0389	JB
Pesticides - SW846 8081, µg/L														
2,4'-DDD	NA		NA		NA		NA		< 0.050		< 0.052		NA	
2,4'-DDE	NA		NA		NA		NA		< 0.050		< 0.052		NA	
2,4'-DDT	NA		NA		NA		NA		< 0.050		< 0.052		NA	
4,4'-DDD	NA		NA		NA		NA		< 0.10		< 0.10		NA	
4,4'-DDE	NA		NA		NA		NA		< 0.10		< 0.10		NA	
4,4'-DDT	NA		NA		NA		NA		< 0.10		< 0.10		NA	
Hexachlorobenzene	NA		NA		NA		NA		< 0.010		< 0.010		NA	

Notes:
µg/L = micrograms per liter
< = Less than reporting limit (RL)
JQ = Estimated quantity. Detected below the reporting limit but above the method detection limit. Quantification cannot be reported with confidence.
JB = Estimated quantity; possibly biased high or false-positive based on blank contamination

Table 4-1
Summary of Groundwater Analytical Data
OU 2 Groundwater Investigation Report
McIntosh, Alabama

Location ID:	BA-MW3B		BA-MW3C	BA-MW4B	BA-MW4C	
Sample ID:	BA-MW3B092508	BA-MW3B111208	BA-MW3C092408	BA-MW4B092508	BA-MW4C092408	BA-MW4C111208
Sample Date:	09/25/2008	11/12/2008	09/24/2008	09/25/2008	09/24/2008	11/12/2008
Sample Type:	Sample	Sample	Sample	Sample	Sample	Sample
Mercury, E1631, µg/L						
Mercury, Filtered	0.00332 JB	NA	0.000236 JB	0.000394 JB	0.000389 JB	NA
Mercury, Unfiltered	0.00883 JB	NA	0.0004 JB	0.000534 JB	0.000265 JB	NA
Pesticides - SW846 8081, µg/L						
2,4'-DDD	NA	NA	NA	< 0.054	< 0.050	NA
2,4'-DDE	NA	NA	NA	< 0.054	< 0.050	NA
2,4'-DDT	NA	NA	NA	< 0.054	< 0.050	NA
4,4'-DDD	NA	NA	NA	< 0.11	< 0.099	NA
4,4'-DDE	NA	NA	NA	< 0.11	< 0.099	NA
4,4'-DDT	NA	NA	NA	< 0.11	< 0.099	NA
Hexachlorobenzene	0.011 JB	0.013	< 0.010	< 0.011	0.0018 JB	< 0.0096

Notes:
µg/L = micrograms per liter
< = Less than reporting limit (RL)
JQ = Estimated quantity. Detected below the reporting limit but above the method detection limit. Quantification cannot be reported with confidence.
JB = Estimated quantity; possibly biased high or false-positive based on blank contamination

Table 4-1
Summary of Groundwater Analytical Data
OU 2 Groundwater Investigation Report
McIntosh, Alabama

Location ID	BA-MW5B	BA-MW5C		BA-MW6B	BA-MW6C
Sample ID	BA-MW5B092508	BA-MW5C092608	BA-MW5C111208	BA-MW6B092608	BA-MW6C092608
Sample Date	09/25/2008	09/26/2008	11/12/2008	09/26/2008	09/26/2008
Sample Type	Sample	Sample	Sample	Sample	Sample
Mercury, E1631, µg/L					
Mercury, Filtered	0.000286 JB	0.000327 JB	NA	0.000375 JB	0.0003 JB
Mercury, Unfiltered	0.000298 JB	0.000475 JB	NA	0.000422 JB	0.00048 JB
Pesticides - SW846 8081, µg/L					
2,4'-DDD	NA	NA	NA	NA	NA
2,4'-DDE	NA	NA	NA	NA	NA
2,4'-DDT	NA	NA	NA	NA	NA
4,4'-DDD	NA	NA	NA	NA	NA
4,4'-DDE	NA	NA	NA	NA	NA
4,4'-DDT	NA	NA	NA	NA	NA
Hexachlorobenzene	< 0.010	0.0046 JB	0.0070 JQ	NA	NA

Notes:
µg/L = micrograms per liter
< = Less than reporting limit (RL)
JQ = Estimated quantity. Detected below the reporting limit but above the method detection limit Quantification cannot be reported with confidence.
JB = Estimated quantity; possibly biased high or false-positive based on blank contamination

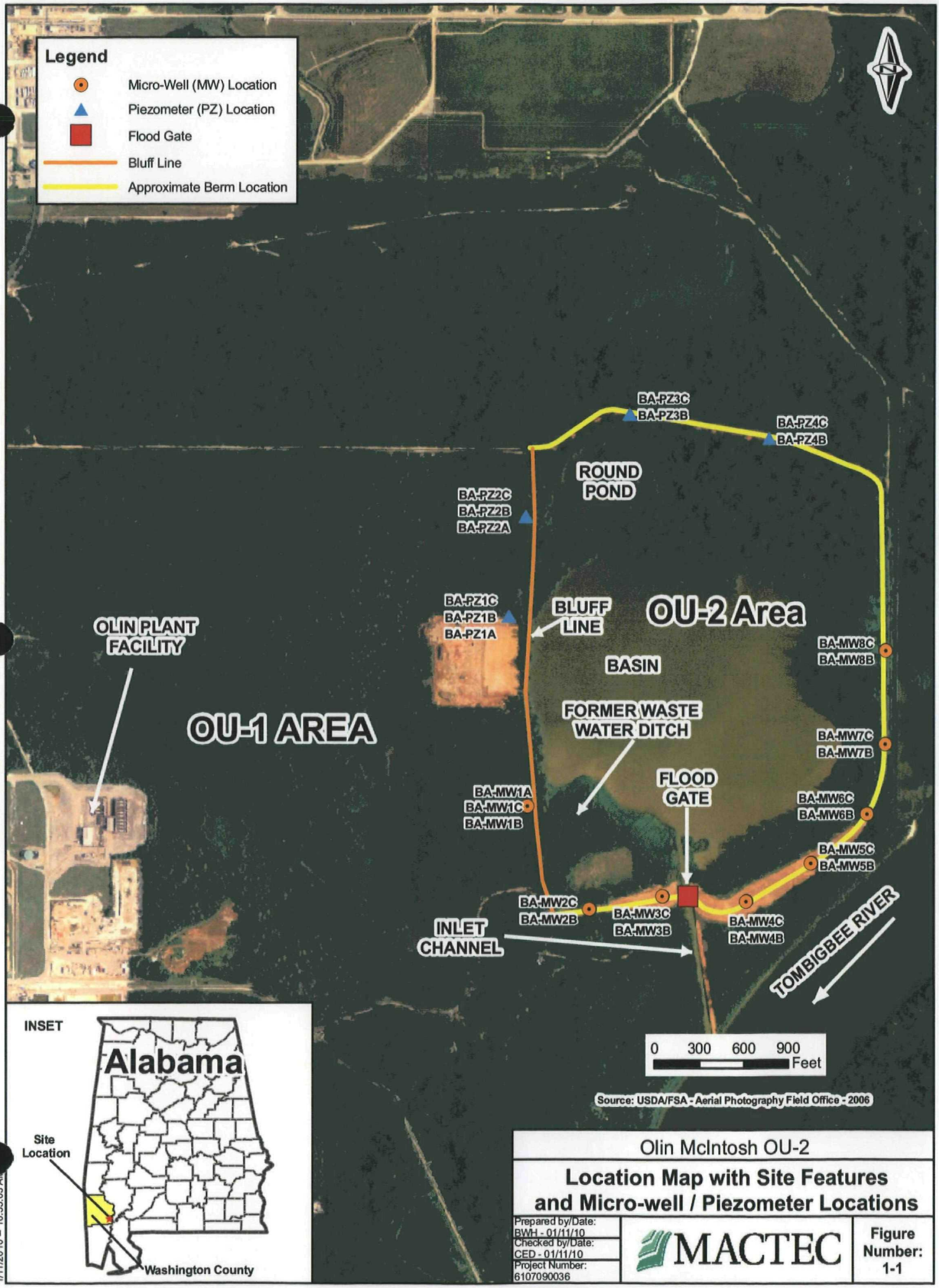
Table 4-1
Summary of Groundwater Analytical Data
OU 2 Groundwater Investigation Report
McIntosh, Alabama

Location ID:	BA-MW7B	BA-MW7C	BA-MW8B	BA-MW8C
Sample ID:	BA-MW7B092608	BA-MW7C092908	BA-MW8B092908	BA-MW8C092908
Sample Date:	09/26/2008	09/29/2008	09/29/2008	09/29/2008
Sample Type:	Sample	Sample	Sample	Sample
Mercury, E1631, µg/L				
Mercury, Filtered	0.000382 JB	0.000392 JB	0.00048 JB	0.000428 JB
Mercury, Unfiltered	0.000585 JB	0.00214 JB	0.00075 JB	0.000449 JB
Pesticides - SW846 8081, µg/L				
2,4'-DDD	NA	NA	NA	NA
2,4'-DDE	NA	NA	NA	NA
2,4'-DDT	NA	NA	NA	NA
4,4'-DDD	NA	NA	NA	NA
4,4'-DDE	NA	NA	NA	NA
4,4'-DDT	NA	NA	NA	NA
Hexachlorobenzene	NA	NA	NA	NA

Notes:
µg/L = micrograms per liter
< = Less than reporting limit (RL)
JQ = Estimated quantity. Detected below the reporting limit but above the method detection limit. Quantification cannot be reported with confidence.
JB = Estimated quantity; possibly biased high or false-positive based on blank contamination

Prepared by: KPW 02/13/2009
Checked by: FKM 02/13/2009

FIGURES



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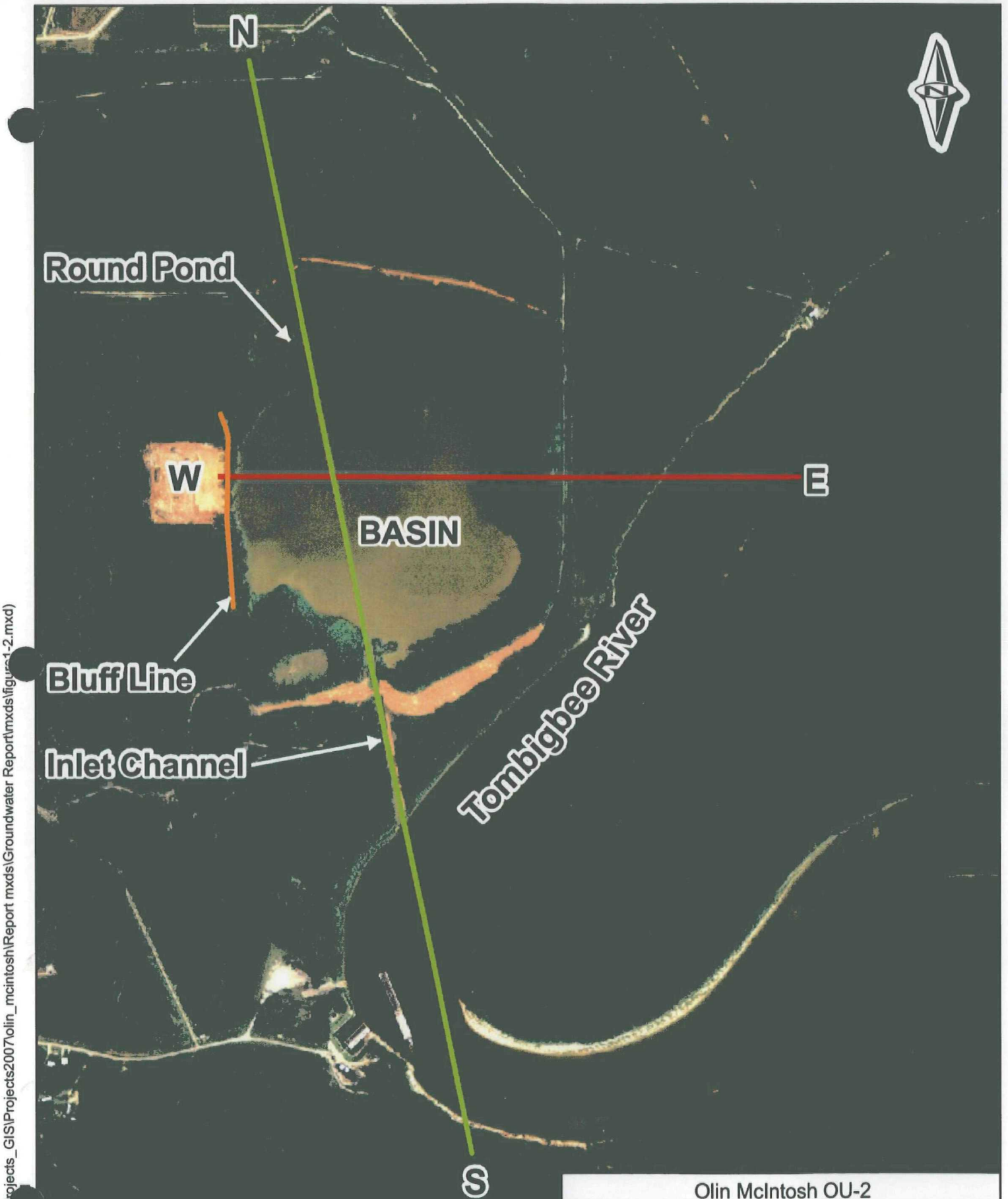
Olin McIntosh OU-2

Location Map with Site Features and Micro-well / Piezometer Locations

Prepared by/Date: BWH - 01/11/10 Checked by/Date: CED - 01/11/10 Project Number: 6107090036	MACTEC	Figure Number: 1-1



Olin McIntosh OU-2

Cross Section Locations

Prepared by/Date: APS - 2/13/09 Checked by/Date: CED - 2/13/09 Project Number: 6107090036	MACTEC	Figure Number: 1-2

Map Document: (G:\Projects_GIS\Projects2007\olin_mcintosh\Report mxds\Groundwater Report\mxds\figure1-2.mxd)
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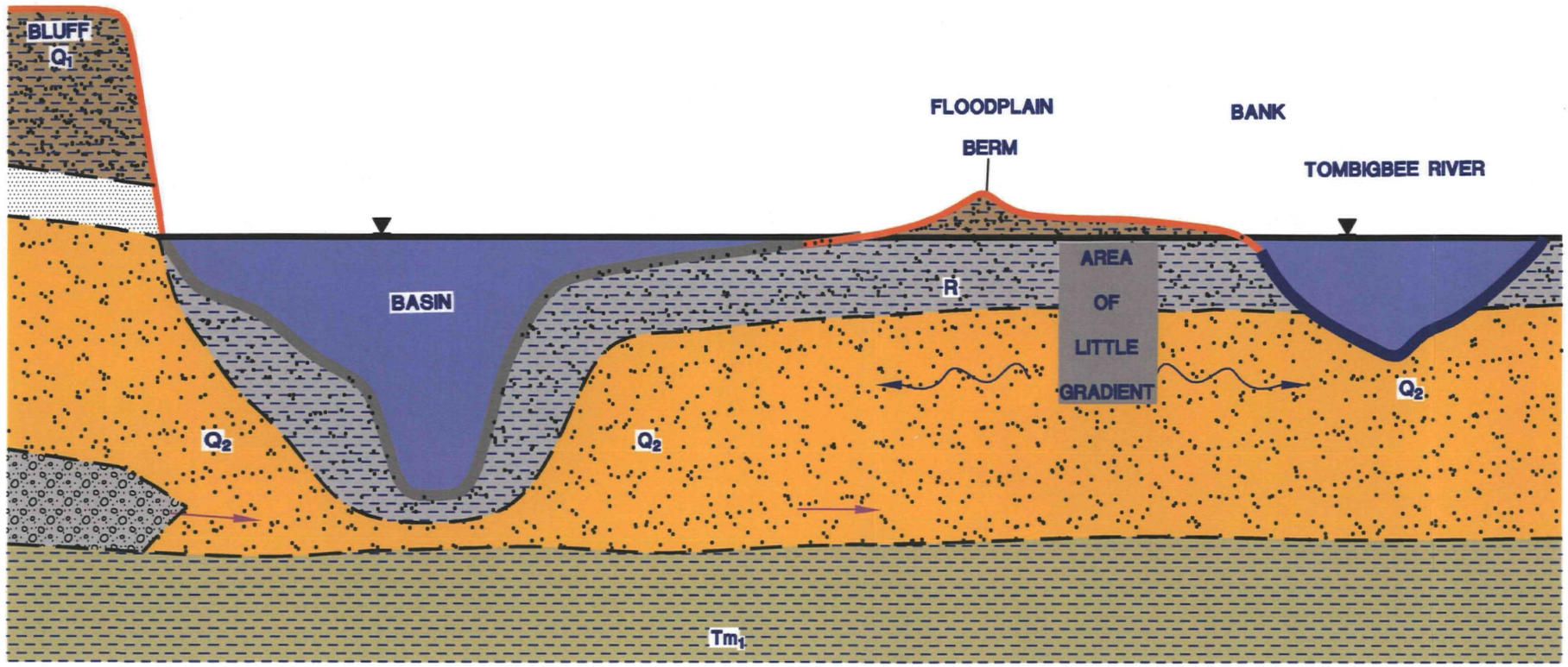


SCALE: NOT TO SCALE

LEGEND

PREDOMINANT GROUNDWATER FLOW DIRECTION

WATER LEVEL

R –Riverine Deposits: These deposits are of unspecified ages and consist of reworked Q1, Q2, and Tm1 sediments along with river–transported sediment. The sediments consist of predominately silty or clayey sands, silts, and clays.

Q_1 –The Upper Clay Unit of the Quaternary Alluvial Sediments: The lithology of this unit is variable, but is composed primarily of silty/sandy clay; the silt and sand content varies and generally increases with depth. (Does not exist throughtout all of OU–2).

Q_2 –The Alluvial Aquifer Unit of the Quaternary Alluvial Sediments: The upper zone of the Alluvial Aquifer is composed primarily of very fine to fine–grained, silty sand. The lower zone of the aquifer is composed of fine–to–very–coarse sands containing varying amounts of fine–to–large gravel.

Tm_1 –The Miocene Confining unit: This unit is dominantly clay, with various amounts of discontinuous sand, silt, or sometimes fine gravel.

CLAY/SILTY CLAY

SANDY CLAY

FINE SAND

FINE TO COARSE SAND

CLAY (MIOCENE)

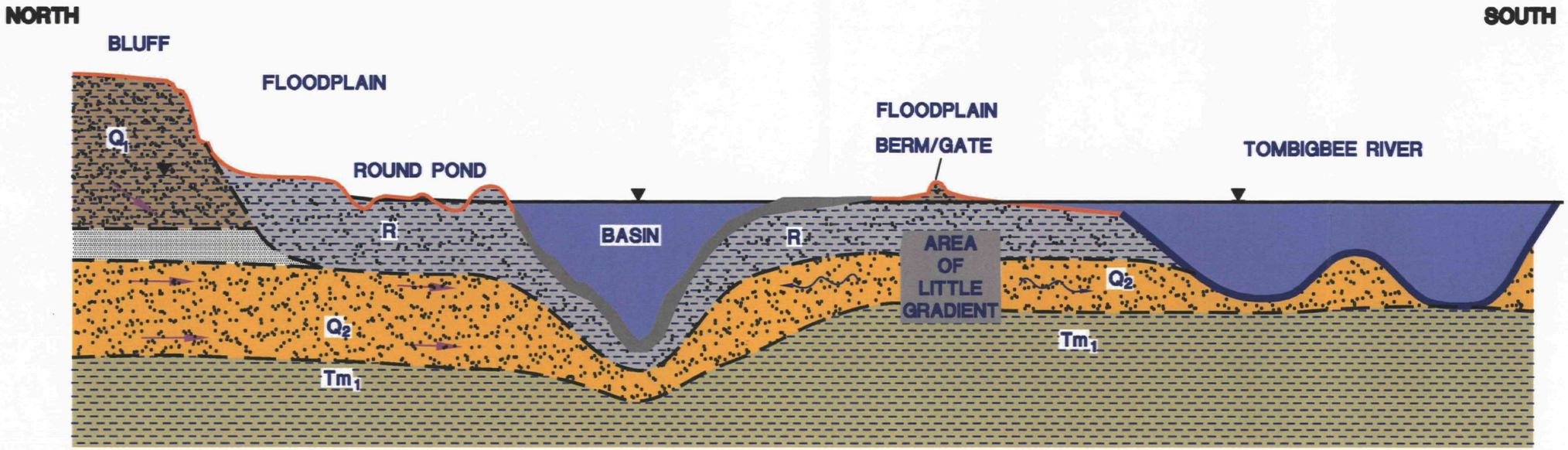
OLIN McINTOSH
McINTOSH, AL

MACTEC
MACTEC Engineering and Consulting, Inc.
3200 TOWN POINT DRIVE, SUITE 100
KENNESAW, GEORGIA 30144 (770) 421–3400

NON FLOOD CONDITIONS WITH RIVER AND BASIN AT 3' NAVD
CONCEPTUAL WEST–EAST CROSS SECTION

JOB NO. 6107090036 FIGURE 1–3

DRAWNED BY/DATE I.G. 1/13/2010
PREPARED BY/DATE F.K.M. 1/13/2010
CHECKED BY/DATE C.E.D. 1/13/2010



SCALE: NOT TO SCALE

LEGEND

PREDOMINANT GROUNDWATER FLOW DIRECTION

WATER LEVEL

R –Riverine Deposits: These deposits are of unspecified ages and consist of reworked Q1, Q2, and Tm1 sediments along with river–transported sediment. The sediments consist of predominately silty or clayey sands, silts, and clays.

Q_1 –The Upper Clay Unit of the Quaternary Alluvial Sediments: The lithology of this unit is variable, but is composed primarily of silty/sandy clay; the silt and sand content varies and generally increases with depth. (Does not exist throughtout all of OU–2).

Q_2 –The Alluvial Aquifer Unit of the Quaternary Alluvial Sediments: The upper zone of the Alluvial Aquifer is composed primarily of very fine to fine–grained, silty sand. The lower zone of the aquifer is composed of fine–to–very–coarse sands containing varying amounts of fine–to–large gravel.

Tm_1 –The Miocene Confining unit: This unit is dominantly clay, with various amounts of discontinuous sand, silt, or sometimes fine gravel.

CLAY/SILTY CLAY

SANDY CLAY

FINE SAND

FINE TO COARSE SAND

CLAY (MIOCENE)

OLIN McINTOSH
McINTOSH, AL

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MACTEC Engineering and Consulting, Inc.
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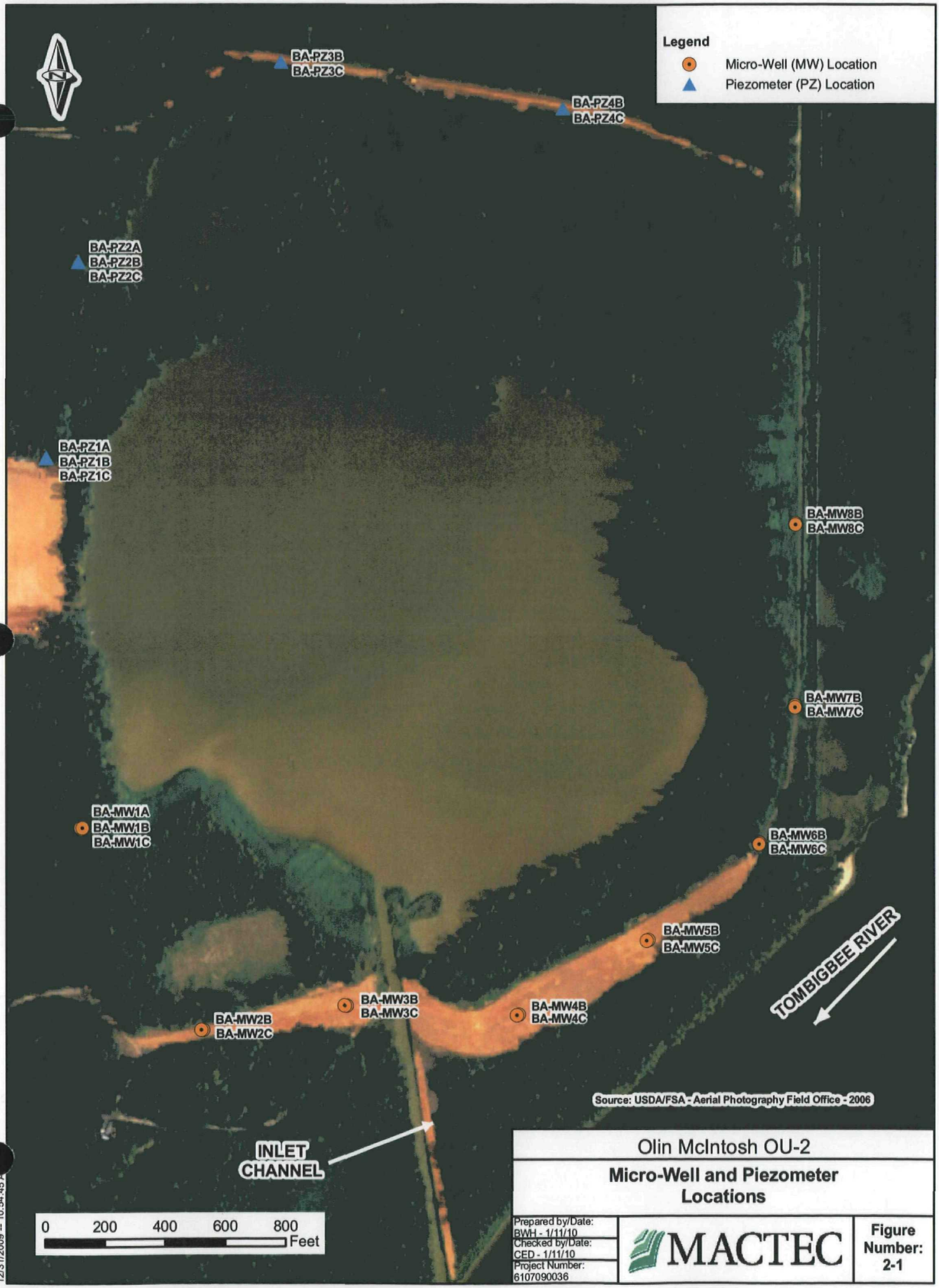
NON FLOOD CONDITIONS WITH RIVER AND BASIN AT 3 FEET NAVD
CONCEPTUAL NORTH–SOUTH CROSS–SECTION

JOB NO. 6107090036 FIGURE 1–4

DRAWNED BY/DATE T.G. 1/13/2010
PREPARED BY/DATE F.K.M. 1/13/2010
CHECKED BY/DATE C.E.D. 1/13/2010



Olin McIntosh OU-2

Micro-Well and Piezometer Locations

Prepared by/Date: BWH - 1/11/10 Checked by/Date: CED - 1/11/10 Project Number: 6107090036	MACTEC	Figure Number: 2-1

Map Document: (G:\Proj...\GIS\Projects2007\olin_mcintosh\Report mxds\Groundwater Report\mxds\figure2-1.mxd)
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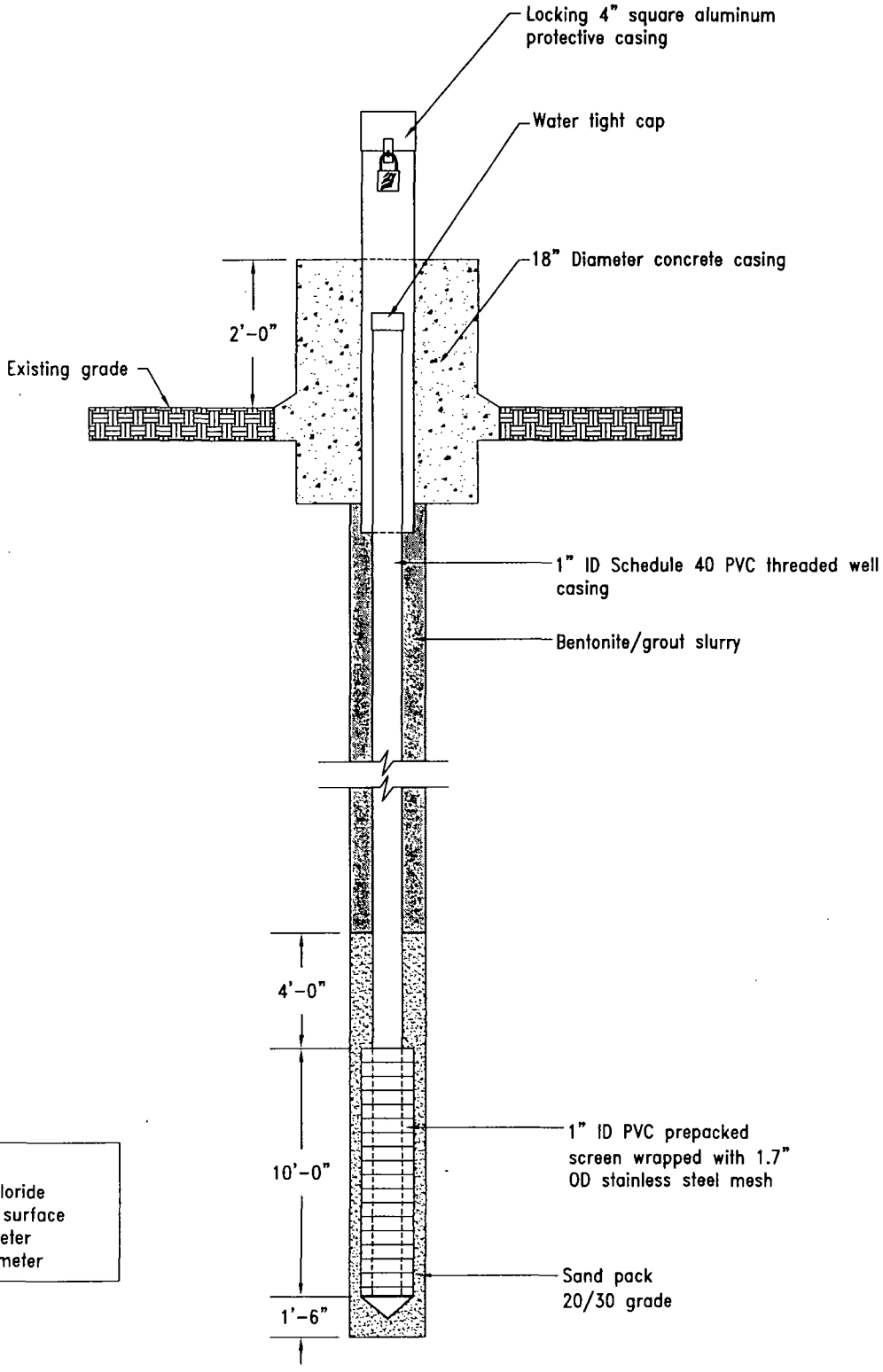
J:\OLIN_MCINTOSH\2009\FIG-2.dwg - Layout1 02/17/2009 4:50pm tgladsto



LEGEND

PVC	Polyvinyl chloride
bls	Below land surface
ID	Inside diameter
OD	Outside diameter

NOT TO SCALE

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McINTOSH, ALABAMA

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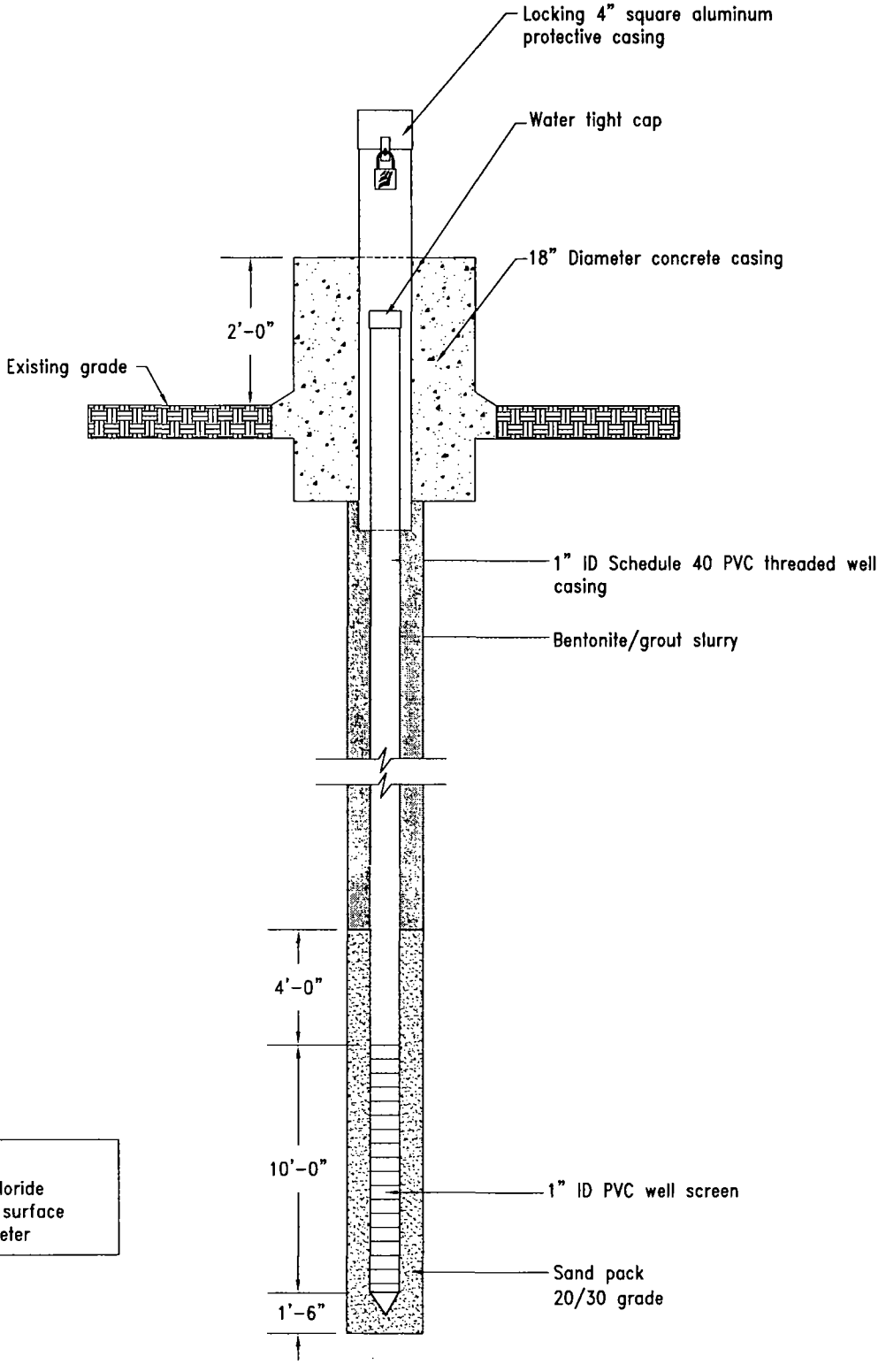
MICRO-WELL CONSTRUCTION DETAIL

JOB NO. 6107090036 FIGURE 2-2

PREPARED BY/DATE E.B. 2/13/09
CHECKED BY/DATE C.E.D. 2/16/09



LEGEND

PVC	Polyvinyl chloride
bls	Below land surface
ID	Inside diameter

NOT TO SCALE

OLIN-OU2
McINTOSH, ALABAMA

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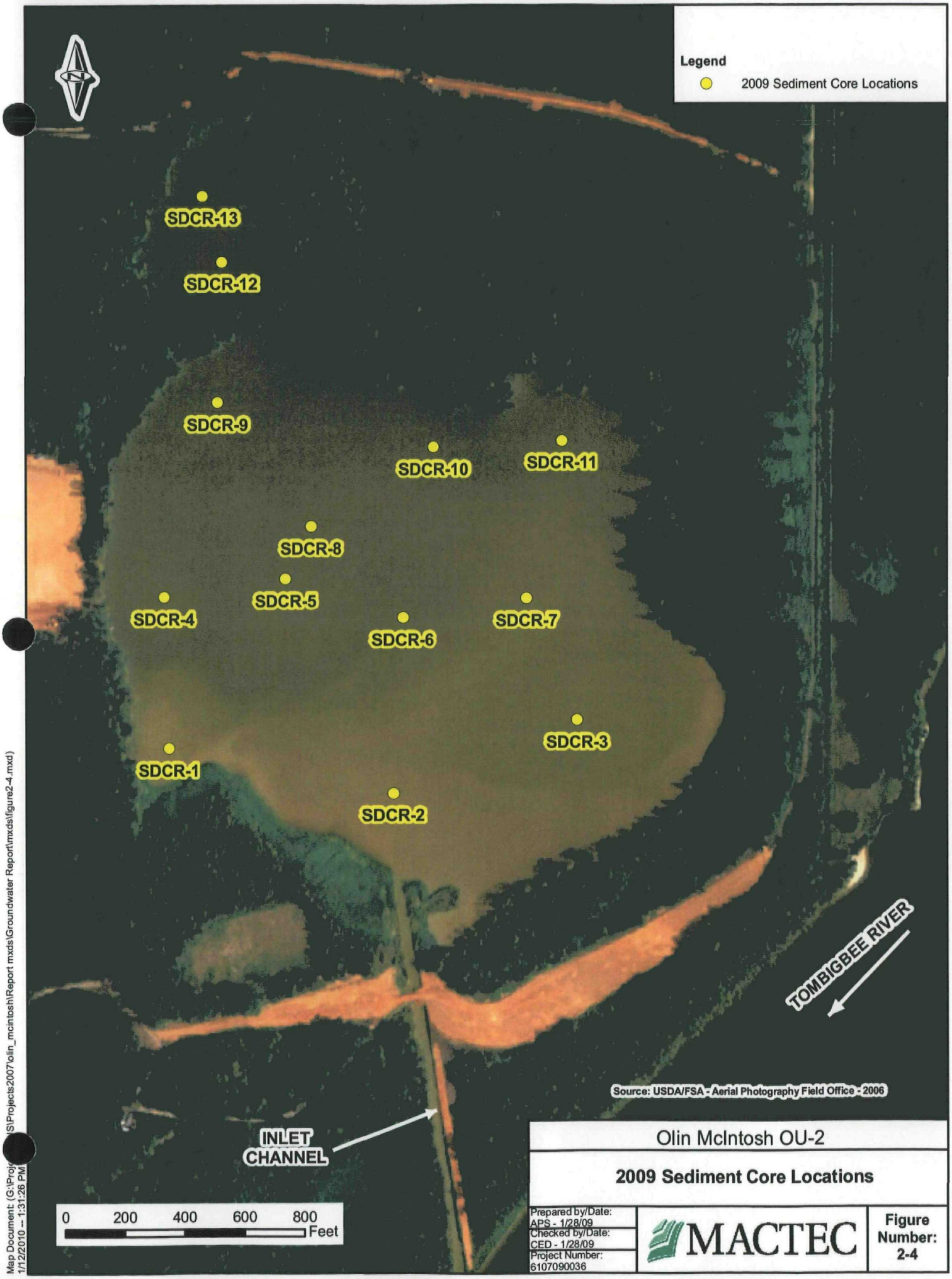
PIEZOMETER CONSTRUCTION DETAIL

JOB NO. **6107090036** FIGURE **2-3**

PREPARED BY/DATE E.B. 2/13/09
CHECKED BY/DATE C.E.D. 2/16/09



Olin McIntosh OU-2

2009 Sediment Core Locations

Prepared by/Date: APS - 1/28/09 Checked by/Date: CED - 1/28/09 Project Number: 6107090036	MACTEC	Figure Number: 2-4

Map Document: (G:\Proj...\GIS\Projects2007\olin_mcintosh\Report mxds\Groundwater Report\mxds\figure2-4.mxd)
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BA-MW1 (Projected)

WEST

EAST

BLUFF

BASIN

BERM

BA-MW8 (Projected)

SDCR-4

SDCR-10

SDCR-11

SDCR-8

LEGEND

- SANDY CLAY
- CLAY/ SILTY CLAY
- FINE SAND/ CLAYEY SAND
- MIOCENE CLAY
- FINE SAND
- FINE TO COARSE SAND
- SANDY GRAVEL/ COARSE SAND WITH GRAVEL

ELEVATION IN FEET (ABOVE MEAN SEA LEVEL)

30
20
10
0
-10
-20
-30
-40
-50

10 (FEET)

0 200 (FEET)

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McINSTOSH, AL

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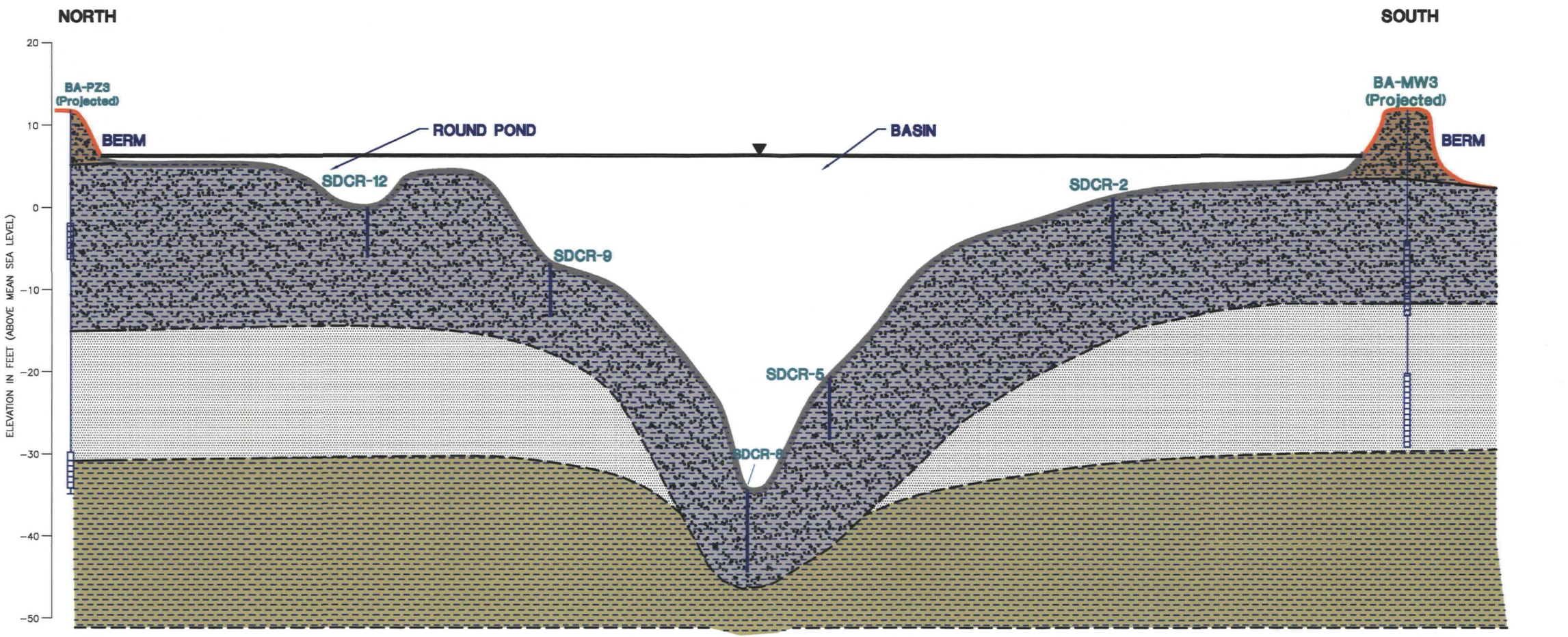
KENNESAW, GEORGIA 30144 (770) 421-3400

GEOLOGIC
CROSS SECTION
WEST-EAST

JOB NO. 6107-09-0036 FIGURE 3-1

DRAWNED BY/DATE T.G. 1/13/2010
PREPARED BY/DATE F.K.M. 1/13/2010
CHECKED BY/DATE C.E.D. 1/13/2010



LEGEND

- SANDY CLAY
- CLAY/ SILTY CLAY
- FINE SAND
- MIOCENE CLAY

10 (FEET)

0 260 (FEET)

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McINSTOSH, AL

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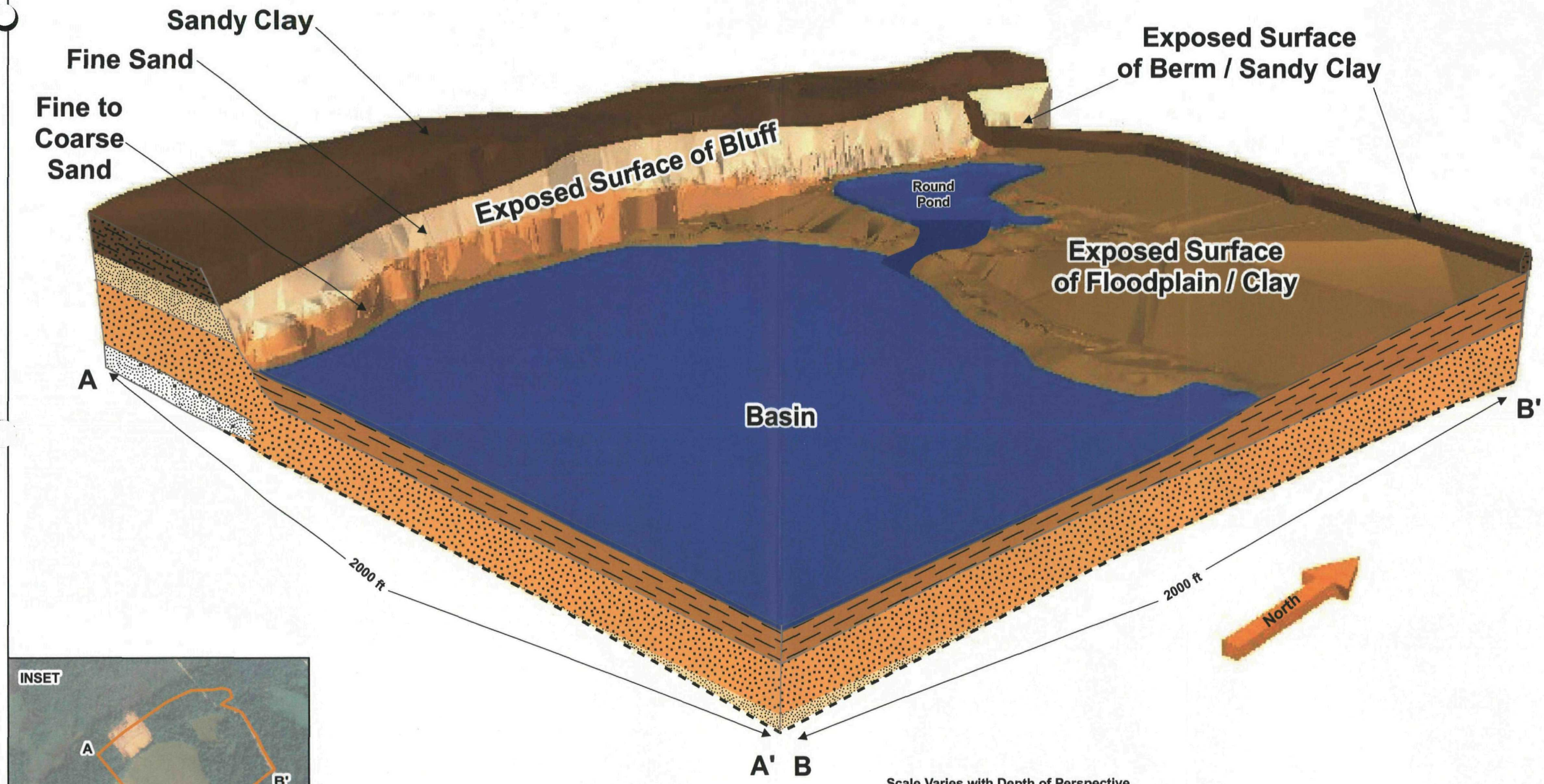
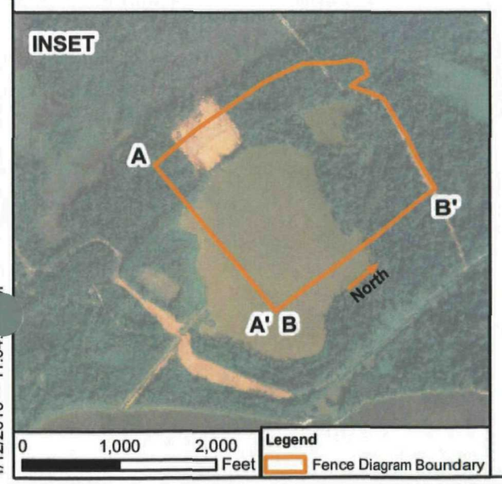
KENNESAW, GEORGIA 30144 (770) 421-3400

GEOLOGIC
CROSS SECTION
NORTH-SOUTH

JOB NO. 6107-09-0036 FIGURE 3-2

DRAWNED BY/DATE I.G. 1/13/2010
PREPARED BY/DATE F.K.M. 1/13/2010
CHECKED BY/DATE C.E.D. 1/13/2010





Scale Varies with Depth of Perspective
Vertical/Horizontal Scale is 5:1

Legend

- Clay
- Fine Sand
- Fine to Coarse Sand
- Gravel
- Sandy Clay
- Water

Olin McIntosh OU-2

3-Dimensional Perspective of the Lithology of OU-2 Basin

Prepared by/Date:	THP - 1/12/10
Checked by/Date:	FKM - 1/13/10
Project Number:	6107090036

MACTEC

Figure Number: 3-3

Map Document: (G:\Projects_GIS\Projects2007\olin_mcintosh\brownie\X_sect_1_layout_rev_12_12_10.mxd)
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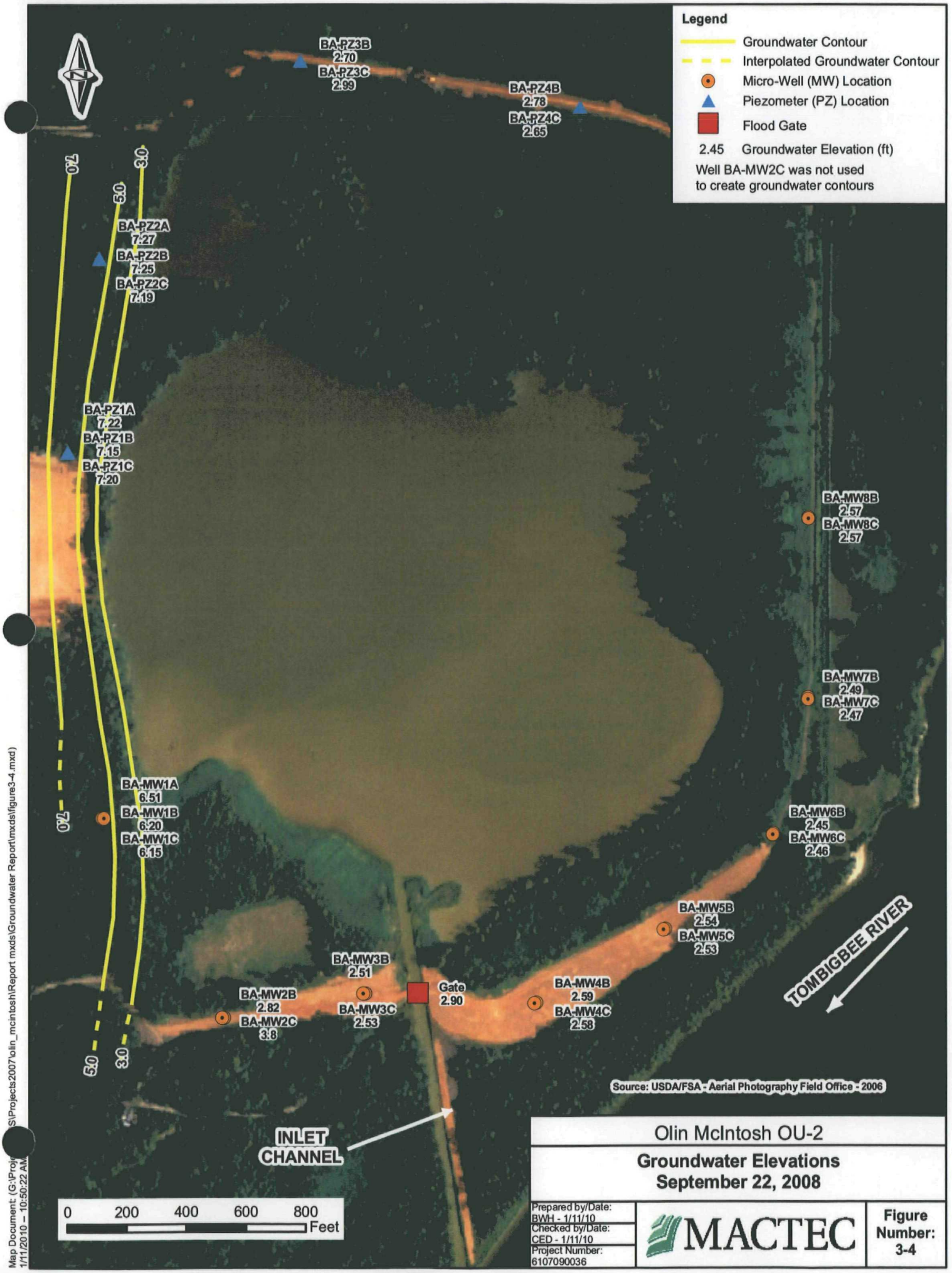

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1/11/2010 – 10:50:22 AM

Olin McIntosh OU-2

Groundwater Elevations
September 22, 2008

Prepared by/Date:	BWH - 1/11/10
Checked by/Date:	CED - 1/11/10
Project Number:	6107090036

MACTEC

Figure Number: 3-4

BA-MW8B		
Constituent	9/29/2008	
Mercury - Filtered (µg/L)	0.00048 JB	
Mercury - Unfiltered (µg/L)	0.00075 JB	

BA-MW8C		
Constituent	9/29/2008	
Mercury - Filtered (µg/L)	0.000428 JB	
Mercury - Unfiltered (µg/L)	0.000449 JB	

BA-MW7B		
Constituent	9/26/2008	
Mercury - Filtered (µg/L)	0.000382 JB	
Mercury - Unfiltered (µg/L)	0.000585 JB	

BA-MW7C		
Constituent	9/29/2008	
Mercury - Filtered (µg/L)	0.000392 JB	
Mercury - Unfiltered (µg/L)	0.00214 JB	

BA-MW1B		
Constituent	9/29/2008	11/11/2008
Mercury - Filtered (µg/L)	0.0587 JB	0.122 JB
Mercury - Unfiltered (µg/L)	0.0825 JB	0.119 JB

BA-MW1C		
Constituent	9/30/2008	11/11/2008
Mercury - Filtered (µg/L)	0.395 JB	0.930 JB
Mercury - Unfiltered (µg/L)	0.458 JB	0.965 JB

BA-MW3B		
Constituent	9/25/2008	11/12/2008
Mercury - Filtered (µg/L)	0.00332 JB	NA
Mercury - Unfiltered (µg/L)	0.00883 JB	NA
Hexachlorobenzene (µg/L)	0.011 JB	0.013

BA-MW3C		
Constituent	9/24/2008	
Mercury - Filtered (µg/L)	0.000236 JB	
Mercury - Unfiltered (µg/L)	0.0004 JB	
Hexachlorobenzene (µg/L)	<0.010	

BA-MW5B		
Constituent	9/25/2008	
Mercury - Filtered (µg/L)	0.000286 JB	
Mercury - Unfiltered (µg/L)	0.000298 JB	
Hexachlorobenzene (µg/L)	<0.010	

BA-MW5C		
Constituent	9/26/2008	11/12/2008
Mercury - Filtered (µg/L)	0.000327 JB	NA
Mercury - Unfiltered (µg/L)	0.000475 JB	NA
Hexachlorobenzene (µg/L)	0.0046 JB	0.007 JQ

BA-MW6B		
Constituent	9/26/2008	
Mercury - Filtered (µg/L)	0.000375 JB	
Mercury - Unfiltered (µg/L)	0.000422 JB	

BA-MW6C		
Constituent	9/26/2008	
Mercury - Filtered (µg/L)	0.00030 JB	
Mercury - Unfiltered (µg/L)	0.00048 JB	

BA-MW2B		
Constituent	9/23/2008	
Mercury - Filtered (µg/L)	0.00104 JB	
Mercury - Unfiltered (µg/L)	0.00186 JB	
2,4'-DDTr (µg/L)	<0.05	
4,4'-DDTr (µg/L)	<0.10	
Hexachlorobenzene (µg/L)	<0.010	

BA-MW2C		
Constituent	9/23/2008	11/12/2008
Mercury - Filtered (µg/L)	0.00517 JB	0.00906 JB
Mercury - Unfiltered (µg/L)	.015 JB	0.0389 JB
2,4'-DDTr (µg/L)	<0.052	NA
4,4'-DDTr (µg/L)	<0.10	NA
Hexachlorobenzene (µg/L)	<0.010	NA

BA-MW4B		
Constituent	9/25/2008	
Mercury - Filtered (µg/L)	0.000394 JB	
Mercury - Unfiltered (µg/L)	0.000534 JB	
2,4'-DDTr (µg/L)	<0.055	
4,4'-DDTr (µg/L)	<0.11	
Hexachlorobenzene (µg/L)	<0.011	

BA-MW4C		
Constituent	9/24/2008	11/12/2008
Mercury - Filtered (µg/L)	0.000389 JB	NA
Mercury - Unfiltered (µg/L)	0.000265 JB	NA
2,4'-DDTr (µg/L)	<0.050	NA
4,4'-DDTr (µg/L)	<0.099	NA
Hexachlorobenzene (µg/L)	0.0018 JB	<0.0096

Olin McIntosh OU-2

Groundwater Analytical Results

Prepared by/Date:	APS - 1/28/09
Checked by/Date:	CED - 1/28/09
Project Number:	6107090036

MACTEC

Figure Number: 4-1

Map Document: (G:\Projects2007\olin_mcintosh\Report mxds\Groundwater Report\mxds\figure4-1.mxd)
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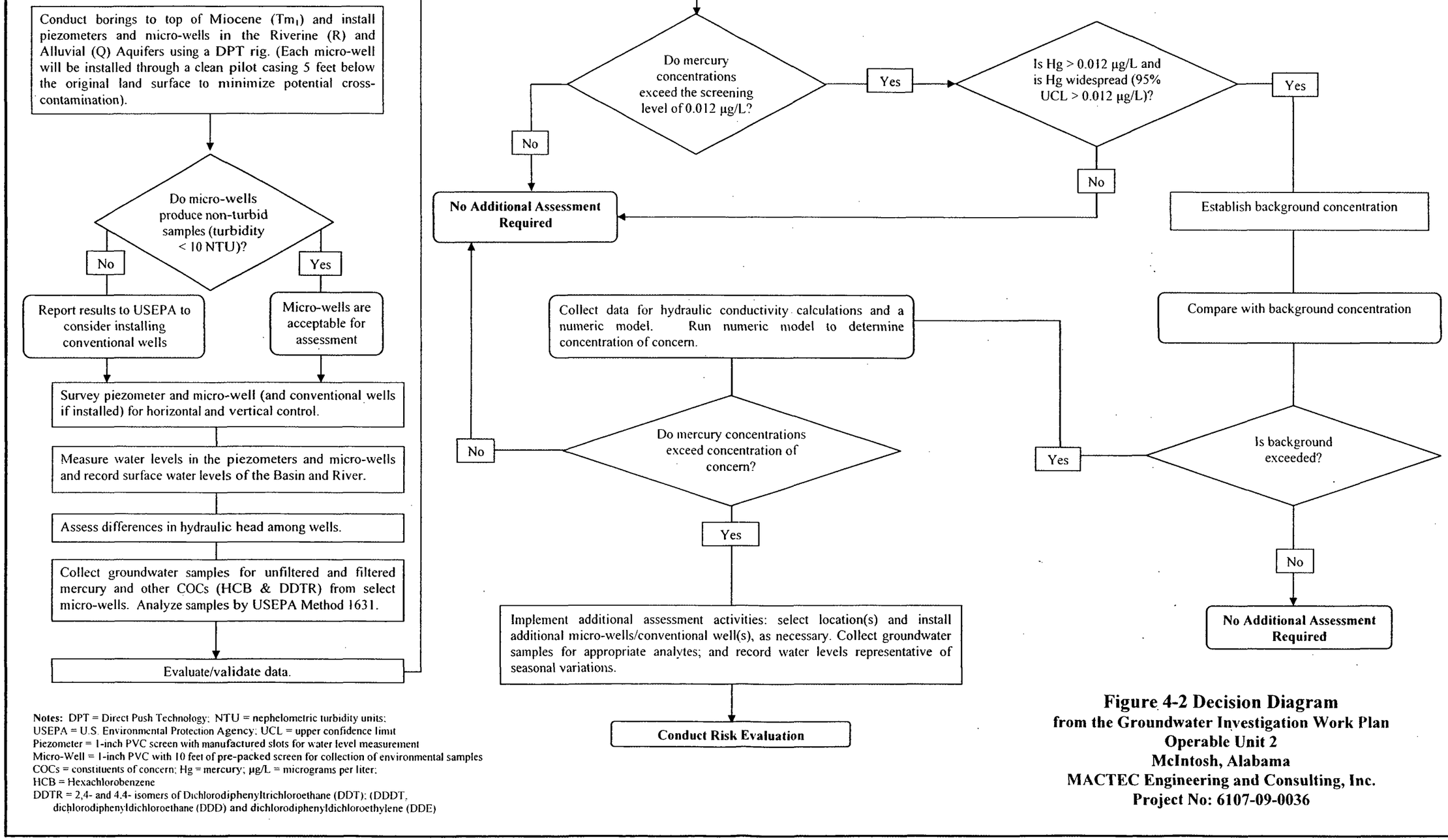


Notes: DPT = Direct Push Technology; NTU = nephelometric turbidity units;
USEPA = U.S. Environmental Protection Agency; UCL = upper confidence limit
Piezometer = 1-inch PVC screen with manufactured slots for water level measurement
Micro-Well = 1-inch PVC with 10 feet of pre-packed screen for collection of environmental samples
COCs = constituents of concern; Hg = mercury; µg/L = micrograms per liter;
HCB = Hexachlorobenzene
DDTR = 2,4- and 4,4- isomers of Dichlorodiphenyltrichloroethane (DDT); (DDDT, dichlorodiphenyldichloroethane (DDD) and dichlorodiphenyldichloroethylene (DDE)

Figure 4-2 Decision Diagram
from the Groundwater Investigation Work Plan
Operable Unit 2
McIntosh, Alabama
MACTEC Engineering and Consulting, Inc.
Project No: 6107-09-0036

Prepared by: EAB 10/28/08
Checked by: CED 10/28/08

APPENDIX A

WELL AND PIEZOMETER BORING LOGS

MACTEC

BORING LOG

Boring/Well Number : BA-PZ-1A

Site Name: OLIN-McIntosh, Alabama	Borehole Start Date: 08/19/08 End Date: 08/19/08	Borehole Start Time: 1600 ☐ AM ☑ PM End Time: 1640 ☐ AM ☑ PM	
Environmental Contractor: MACTEC Engineering and Consulting	Geologist's Name: FK MAYILA	Environmental Technician's Name: J MOORE	
Drilling Company: Walker-Hill Environmental	Pavement Thickness (inches):	Borehole Diameter (inches): 3.5"	Borehole Depth (feet): 37'
Drilling Method(s): Hollow-Stem Auger, Direct Push	Apparent Borehole DTW (in feet from soil moisture content):	Measured Well DTW (in feet after water recharges in well):	OVA (list model and check type): NA ☐ FID

Disposition of Drill Cuttings [check method(s)]: ☑ Drum ☐ Spread ☐ Backfill ☐ Stockpile ☐ Other

(describe if other or multiple items are checked):

Borehole Completion (check one): ☑ Well ☐ Grout ☐ Bentonite ☐ Backfill ☐ Other (describe)

Sample Type	Sample Depth Interval (feet)	Sample Recovery (inches)	SPT Blows (per six inches)	Depth (feet)	Sample Description (include grain size based on USCS, odors, staining, and other remarks)	USCS Symbol	Moisture Content	Comments
HA	0-5	60	N/A	5	Brown soil, red hard , clay	CL	M	
DP	5-9	48	N/A	9	red, hard clay	CL	M	
DP	9-13	48	N/A	13	red, light grey to tan, hard clay	CL	M	
DP	13-17	0	N/A	17	No Recovery	N/A	N/A	
DP	17-21	48	N/A	21	white, poorly graded fine sand, wet	SP	W	
DP	21-25	48	N/A	25	tan to white, fine sand	SP	W	
DP	25-29	48	N/A	29	tan to white, fine to medium sand, poorly graded	SP	W	
DP	29-33	48	N/A	33	tan to white, fine to medium sand, poorly graded, with interlayered with gravel	GP	W	
DP	33-37	48	N/A	37	white, poorly graded, meduim white sand	SP	W	Piezometer set at 37', screened from 27-37'

Sample Type Codes: **HA** = Hollow-Stem Auger; **DP** = Direct Push;
Moisture Content Codes: **D** = Dry; **M** = Moist; **W** = Wet; **S** = Saturated

MACTEC

BORING LOG

Boring/Well Number : BA-PZ-1B

Site Name: OLIN-McIntosh, Alabama	Borehole Start Date: 08/19/08 End Date: 08/19/08	Borehole Start Time: 1420 ☐ AM ☑ PM End Time: 1510 ☐ AM ☑ PM	
Environmental Contractor: MACTEC Engineering and Consulting	Geologist's Name: FK MAYILA	Environmental Technician's Name: J MOORE	
Drilling Company: Walker-Hill Environmental	Pavement Thickness (inches):	Borehole Diameter (inches): 3.5"	Borehole Depth (feet): 47'
Drilling Method(s): Hollow-Stem Auger, Direct Push	Apparent Borehole DTW (in feet from soil moisture content):	Measured Well DTW (in feet after water recharges in well):	OVA (list model and check type): NA ☐ FID

Disposition of Drill Cuttings [check method(s)]: ☑ Drum ☐ Spread ☐ Backfill ☐ Stockpile ☐ Other

(describe if other or multiple items are checked):

Borehole Completion (check one): ☑ Well ☐ Grout ☐ Bentonite ☐ Backfill ☐ Other (describe)

Sample Type	Sample Depth Interval (feet)	Sample Recovery (inches)	SPT Blows (per six inches)	Depth (feet)	Sample Description (include grain size based on USCS, odors, staining, and other remarks)	USCS Symbol	Moisture Content	Comments
HA	0-5	60	N/A	5	Brown soil, red hard , clay	CL	M	
DP	5-9	48	N/A	9	red, hard clay	CL	M	
DP	9-13	48	N/A	13	red, light grey to tan; hard clay	CL	M	
DP	13-17	0	N/A	17	No Recovery	N/A	N/A	
DP	17-21	48	N/A	21	white, poorly graded fine sand, wet	SP	W	
DP	21-25	48	N/A	25	tan to white, fine sand	SP	W	
DP	25-29	48	N/A	29	tan to white, fine to medium sand, poorly graded	SP	W	
DP	29-33	48	N/A	33	tan to white, fine to medium sand, poorly graded, with interlayered with gravel	GP	W	
DP	33-37	48	N/A	37	white, poorly graded, meduim white sand	SP	W	
DP	37-40	36	N/A	40	white, poorly graded, medium to coarse sand, wet	SP	W	
DP	40-43	36	N/A	43	tan to light brown poorly graded, coarsesand with some gravel (<5%) at 42', 2" later of clayey sand at bottom of sample	GP	W	
DP	43-47	48	N/A	47	light brown, orange, poorly graded, medium sand , increasing grain size with depth, mixing with gravel	GP	W	Piezometer set at 47', screened from 37-47'

Sample Type Codes: **HA** = Hollow-Stem Auger; **DP** = Direct Push;
Moisture Content Codes: **D** = Dry; **M** = Moist; **W** = Wet; **S** = Saturated

MACTEC

BORING LOG

Boring/Well Number : BA-PZ-1C

Site Name: OLIN-McIntosh, Alabama	Borehole Start Date: 08/18/08 End Date: 08/19/08	Borehole Start Time: 1355 ☐ AM ☑ PM End Time: 1025 ☑ AM ☐ PM	
Environmental Contractor: MACTEC Engineering and Consulting	Geologist's Name: FK MAYILA	Environmental Technician's Name: J MOORE	
Drilling Company: Walker-Hill Environmental	Pavement Thickness (inches):	Borehole Diameter (inches): 3.5"	Borehole Depth (feet): 75'
Drilling Method(s): Hollow-Stem Auger, Direct Push	Apparent Borehole DTW (in feet from soil moisture content):	Measured Well DTW (in feet after water recharges in well):	OVA (list model and check type): NA ☐ FID

Disposition of Drill Cuttings [check method(s)]: ☑ Drum ☐ Spread ☐ Backfill ☐ Stockpile ☐ Other

(describe if other or multiple items are checked):

Borehole Completion (check one): ☐ Well ☐ Grout ☐ Bentonite ☐ Backfill ☐ Other (describe)

Sample Type	Sample Depth Interval (feet)	Sample Recovery (inches)	SPT Blows (per six inches)	Depth (feet)	Sample Description (include grain size based on USCS, odors, staining, and other remarks)	USCS Symbol	Moisture Content	Comments
HA	0-5	60	N/A	5	Brown soil, red hard , clay	CL	M	
DP	5-9	48	N/A	9	red, hard clay	CL	M	
DP	9-13	48	N/A	13	red, light grey to tan, hard clay	CL	M	
DP	13-17	0	N/A	17	No Recovery	N/A	N/A	
DP	17-21	48	N/A	21	white, poorly graded fine sand, wet	SP	W	
DP	21-25	48	N/A	25	tan to white, fine sand	SP	W	
DP	25-29	48	N/A	29	tan to white, fine to medium sand, poorly graded	SP	W	
DP	29-33	48	N/A	33	tan to white, fine to medium sand, poorly graded, with interlayered with gravel	GP	W	
DP	33-37	48	N/A	37	white, poorly graded, meduim white sand	SP	W	
DP	37-40	36	N/A	40	white, poorly graded, medium to coarse sand, wet	SP	W	
DP	40-43	36	N/A	43	tan to light brown poorly graded, coarsesand with some gravel (<5%) at 42', 2" later of clayey sand at bottom of sample	GP	W	
DP	43-47	48	N/A	47	light brown, orange, poorly graded, medium sand , increasing grain size with depth, mixing with gravel	GP	W	
DP	47-51	48	N/A	51	light tan to white, poorly graded medium sand, wet	SP	W	
DP	51-55	48	N/A	55	light tan, pooryl graded medium sand, increasing grain size, with depth to coarse grained mix with gravel	GP	W	
DP	55-59	48	N/A	59	55-57' poorly graded medium sand with some gravel, 57-59' well graded gravel with sand, gravel size up to 1.4" diameter	GP	W	
DP	59-63	48	N/A	63	white to medium coarse sand with some gravel, wet	GP	W	
DP	63-67	48	N/A	67	tan coarse sand with some gravel <5% 1.5 " layer of well graded gravel with some sand	GP	W	
DP	67-71	48	N/A	71	light brown, coarse sand with some gravel interlayered with a 1' layer of gravel and 4" later of hard grey clay	GP	W	
DP	71-75	48	N/A	75	grey hard clay, miocene clay	CL	W	Piezometer set at 68', screened from 58-68'

Sample Type Codes: HA = Hollow-Stem Auger; DP = Direct Push;

Moisture Content Codes: D = Dry; M = Moist; W = Wet; S = Saturated

MACTEC

BORING LOG

Boring/Well Number : BA-PZ-2A

Site Name: OLIN-McIntosh, Alabama	Borehole Start Date: 08/21/08 End Date: 08/21/08	Borehole Start Time: 1030 ☑ AM ☐ PM End Time: 1130 ☑ AM ☐ PM	
Environmental Contractor: MACTEC Engineering and Consulting	Geologist's Name: FK MAYILA	Environmental Technician's Name: J MOORE	
Drilling Company: Walker-Hill Environmental	Pavement Thickness (inches):	Borehole Diameter (inches): 3.5"	Borehole Depth (feet): 37'
Drilling Method(s): Hollow-Stem Auger, Direct Push	Apparent Borehole DTW (in feet from soil moisture content):	Measured Well DTW (in feet after water recharges in well):	OVA (list model and check type): NA ☐ FID

Disposition of Drill Cuttings [check method(s)]: ☑ Drum ☐ Spread ☐ Backfill ☐ Stockpile ☐ Other

(describe if other or multiple items are checked):

Borehole Completion (check one): ☑ Well ☐ Grout ☐ Bentonite ☐ Backfill ☐ Other (describe)

Sample Type	Sample Depth Interval (feet)	Sample Recovery (inches)	SPT Blows (per six inches)	Depth (feet)	Sample Description (include grain size based on USCS, odors, staining, and other remarks)	USCS Symbol	Moisture Content	Comments
HA	0-4	48	N/A	4	Brown soil , graded into clay	SC	M	
DP	4-8	48	N/A	8	red with shades of grey, hard and brittle, clay, (8-11')	CL	M	
DP	8-12	48	N/A	12	grey to light brown, moist, sandy clay, clay layers changing within sandy clay	SC	M	
DP	12-16	48	N/A	16	grey to light brown , moist sandy clay	SC	M	
DP	16-20	48	N/A	20	red with shades of grey, hard and brittle, clay, moist	CL	M	
DP	20-24	48	N/A	24	brownish to tan moist fine sand with interlayers of clay (6")	SC	M	
DP	24-27	36	N/A	27	brown to tan moist fine sand with layers of clay through sample	SC	M	
DP	27-31	48	N/A	31	tan and red, fine sand interlayered with clay, wet	SC	W	
DP	31-35	48	N/A	35	grey, wet, fine sand interlatered with clay	SC	W	
DP	35-37	48	N/A	37	tan and grey, wet, medium sand interlayered with clay	SC	W	Piezometer set at 37', screen 27-37'

Sample Type Codes: **HA** = Hollow-Stem Auger; **DP** = Direct Push;
Moisture Content Codes: **D** = Dry; **M** = Moist; **W** = Wet; **S** = Saturated

MACTEC

BORING LOG

Boring/Well Number : BA-PZ-2B

Site Name: OLIN-McIntosh, Alabama	Borehole Start Date: 08/21/08 End Date: 08/21/08	Borehole Start Time: 0830 ☑ AM ☐ PM End Time: 0930 ☑ AM ☐ PM	
Environmental Contractor: MACTEC Engineering and Consulting	Geologist's Name: FK MAYILA	Environmental Technician's Name: J MOORE	
Drilling Company: Walker-Hill Environmental	Pavement Thickness (inches):	Borehole Diameter (inches): 3.5"	Borehole Depth (feet): 47'
Drilling Method(s): Hollow-Stem Auger, Direct Push	Apparent Borehole DTW (in feet from soil moisture content):	Measured Well DTW (in feet after water recharges in well):	OVA (list model and check type): NA ☐ FID

Disposition of Drill Cuttings [check method(s)]: ☑ Drum ☐ Spread ☐ Backfill ☐ Stockpile ☐ Other

(describe if other or multiple items are checked):

Borehole Completion (check one): ☑ Well ☐ Grout ☐ Bentonite ☐ Backfill ☐ Other (describe)

Sample Type	Sample Depth Interval (feet)	Sample Recovery (inches)	SPT Blows (per six inches)	Depth (feet)	Sample Description (include grain size based on USCS, odors, staining, and other remarks)	USCS Symbol	Moisture Content	Comments
HA	0-4	48	N/A	4	Brown soil , graded into clay	SC	M	
DP	4-8	48	N/A	8	red with shades of grey, hard and brittle, clay, (8-11')	CL	M	
DP	8-12	48	N/A	12	grey to light brown, moist, sandy clay, clay layers changing within sandy clay	SC	M	
DP	12-16	48	N/A	16	grey to light brown , moist sandy clay	SC	M	
DP	16-20	48	N/A	20	red with shades of grey, hard and brittle, clay, moist	CL	M	
DP	20-24	48	N/A	24	brownish to tan moist fine sand with interlayers of clay (6")	SC	M	
DP	24-27	36	N/A	27	brown to tan moist fine sand with layers of clay through sample	SC	M	
DP	27-31	48	N/A	31	tan and red, fine sand interlayered with clay, wet	SC	W	
DP	31-35	48	N/A	35	grey, wet, fine sand interlatered with clay	SC	W	
DP	35-39	48	N/A	39	tan and grey, wet, medium sand interlayered with clay	SC	W	
DP	39-43	48	N/A	43	tan to white fine to medium sand, interlayered with clay, wet	SC	W	
DP	43-47	48	N/A	47	Red and tan, wet, medium to coarse sand with some gravel	GM	W	Piezometer set at 47', screened 37-47'

Sample Type Codes: **HA** = Hollow-Stem Auger; **DP** = Direct Push;
Moisture Content Codes: **D** = Dry: **M** = Moist; **W** = Wet; **S** = Saturated

MACTEC

BORING LOG

Boring/Well Number : BA-PZ-2C

Site Name: OLIN-McIntosh, Alabama	Borehole Start Date: 08/20/08 End Date: 08/20/08	Borehole Start Time: 1005 ☑ AM ☐ PM End Time: 1435 ☐ AM ☑ PM	
Environmental Contractor: MACTEC Engineering and Consulting	Geologist's Name: FK MAYILA	Environmental Technician's Name: J MOORE	
Drilling Company: Walker-Hill Environmental	Pavement Thickness (inches):	Borehole Diameter (inches): 3.5"	Borehole Depth (feet): 60'
Drilling Method(s): Hollow-Stem Auger, Direct Push	Apparent Borehole DTW (in feet from soil moisture content):	Measured Well DTW (in feet after water recharges in well):	OVA (list model and check type): NA ☐ FID

Disposition of Drill Cuttings [check method(s)]: ☑ Drum ☐ Spread ☐ Backfill ☐ Stockpile ☐ Other

(describe if other or multiple items are checked):

Borehole Completion (check one): ☑ Well ☐ Grout ☐ Bentonite ☐ Backfill ☐ Other (describe)

Sample Type	Sample Depth Interval (feet)	Sample Recovery (inches)	SPT Blows (per six inches)	Depth (feet)	Sample Description (include grain size based on USCS, odors, staining, and other remarks)	USCS Symbol	Moisture Content	Comments
HA	0-4	48	N/A	4	Brown soil , graded into clay	SC	M	
DP	4-8	48	N/A	8	red with shades of grey, hard and brittle, clay, (8-11')	CL	M	
DP	8-12	48	N/A	12	grey to light brown, moist, sandy clay, clay layers changing within sandy clay	SC	M	
DP	12-16	48	N/A	16	grey to light brown , moist sandy clay	SC	M	
DP	16-20	48	N/A	20	red with shades of grey, hard and brittle, clay, moist	CL	M	
DP	20-24	48	N/A	24	brownish to tan moist fine sand with interlayers of clay (6")	SC	M	
DP	24-27	36	N/A	27	brown to tan moist fine sand with layers of clay through sample	SC	M	
DP	27-31	48	N/A	31	tan and red, fine sand interlayered with clay, wet	SC	W	
DP	31-35	48	N/A	35	*grey, wet, fine sand interlatered with clay*	SC	W	
DP	35-39	48	N/A	39	tan and grey, wet, medium sand interlayered with clay	SC	W	
DP	39-43	48	N/A	43	tan to white fine to medium sand, interlayered with clay, wet	SC	W	
DP	43-47	48	N/A	47	Red and tan, wet, medium to coarse sand with some gravel	GM	W	
DP	47-51	48	N/A	51	tan to white fine to medium sand, interlayered with clay, wet	SC	W	
DP	51-55	48	N/A	55	No Sample recovered	N/A	N/A	
DP	55-60	60	N/A	60	grey, hard well compacted clay, miocene clay	CL	W	Piezometer set at 57', screened from 47-57'

Sample Type Codes: **HA** = Hollow-Stem Auger; **DP** = Direct Push;
Moisture Content Codes: **D** = Dry; **M** = Moist; **W** = Wet; **S** = Saturated

MACTEC

BORING LOG

Boring/Well Number : BA-PZ-3B

Site Name: OLIN-McIntosh, Alabama	Borehole Start Date: 08/18/08 End Date: 08/18/08	Borehole Start Time: 0935 ☑ AM ☐ PM End Time: 1015 ☑ AM ☐ PM	
Environmental Contractor: MACTEC Engineering and Consulting	Geologist's Name: FK MAYILA	Environmental Technician's Name: J MOORE	
Drilling Company: Walker-Hill Environmental	Pavement Thickness (inches):	Borehole Diameter (inches): 3.5"	Borehole Depth (feet): 24'
Drilling Method(s): Hollow-Stem Auger, Direct Push	Apparent Borehole DTW (in feet from soil moisture content):	Measured Well DTW (in feet after water recharges in well):	OVA (list model and check type): NA ☐ FID

Disposition of Drill Cuttings [check method(s)]: ☑ Drum ☐ Spread ☐ Backfill ☐ Stockpile ☐ Other

(describe if other or multiple items are checked):

Borehole Completion (check one): ☑ Well ☐ Grout ☐ Bentonite ☐ Backfill ☐ Other (describe)

Sample Type	Sample Depth Interval (feet)	Sample Recovery (inches)	SPT Blows (per six inches)	Depth (feet)	Sample Description (include grain size based on USCS, odors, staining, and other remarks)	USCS Symbol	Moisture Content	Comments
HA	0-5	60	N/A	5	Fill Material, from borrow pit	SM	M	
DP	5-10	60	N/A	10	sand silt mix, backfill material from borrow pit	SM	M	
DP	10-15	60	N/A	15	greenish- grey soft, moist clay	CL	M	
DP	15-19	48	N/A	19	greenish-grey, wet soft clay, plastic, some fine sand present	SC	M	
DP	19-23	48	N/A	23	greenish-grey, wet, soft clay with interlayered poorly graded fine sand	SC	M	
DP	23-24	48	N/A	24	greenish, wet, soft clay, interlayered with poorly graded fine sand, bottom 6" sandy clay	SC	M	Piezometer set at 23', screened from 13-23'

Sample Type Codes: **HA** = Hollow-Stem Auger; **DP** = Direct Push;
Moisture Content Codes: **D** = Dry; **M** = Moist; **W** = Wet; **S** = Saturated

MACTEC

BORING LOG

Boring/Well Number : BA-PZ-3C

Site Name: OLIN-McIntosh, Alabama	Borehole Start Date: 08/17/08	End Date: 08/18/08	Borehole Start Time: 1510 ☐ AM ☑ PM	End Time: 0935 ☑ AM ☐ PM	
Environmental Contractor: MACTEC Engineering and Consulting	Geologist's Name: FK MAYILA		Environmental Technician's Name: J MOORE		
Drilling Company: Walker-Hill Environmental	Pavement Thickness (inches):	Borehole Diameter (inches): 3.5"	Borehole Depth (feet): 47'		
Drilling Method(s): Hollow-Stem Auger, Direct Push	Apparent Borehole DTW (in feet from soil moisture content):	Measured Well DTW (in feet after water recharges in well):	OVA (list model and check type): NA ☐ FID		

Disposition of Drill Cuttings [check method(s)]: ☑ Drum ☐ Spread ☐ Backfill ☐ Stockpile ☐ Other

(describe if other or multiple items are checked):

Borehole Completion (check one): ☑ Well ☐ Grout ☐ Bentonite ☐ Backfill ☐ Other (describe)

Sample Type	Sample Depth Interval (feet)	Sample Recovery (inches)	SPT Blows (per six inches)	Depth (feet)	Sample Description (include grain size based on USCS, odors, staining, and other remarks)	USCS Symbol	Moisture Content	Comments
HA	0-5	60	N/A	5	Fill Material, from borrow pit	SM	M	
DP	5-10	60	N/A	10	sand silt mix, backfill material from borrow pit	SM	M	
DP	10-15	60	N/A	15	greenish- grey soft, moist clay	CL	M	
DP	15-19	48	N/A	19	greenish-grey, wet soft clay, plastic, some fine sand present	SC	M	
DP	19-23	48	N/A	23	greenish-grey, wet, soft clay with interlayered poorly graded fine sand	SC	M	
DP	23-27	48	N/A	27	greenish, wet, soft clay, interlayered with poorly graded fine sand, bottom 6" sandy clay	SC	M	
DP	27-31	36	N/A	31	greenish-grey wet, poorly graded fine sand	SC	M	
DP	31-35	48	N/A	35	greenish -grey, wet, poorly grafrf fine sanf with layers of clay present in sample	SC	W	
DP	35-39	48	N/A	39	wet greenish grey fine sand	SC	W	
DP	39-43	48	N/A	43	light grey, wet, poorly graded fine sand	SP	W	
DP	43-47	48	N/A	47	Light grey, hard clay, miocene clay	CL	W	Piezometer set at 43', screen 33-43'

Sample Type Codes: **HA** = Hollow-Stem Auger; **DP** = Direct Push;
Moisture Content Codes: **D** = Dry; **M** = Moist; **W** = Wet; **S** = Saturated

MACTEC

BORING LOG

Boring/Well Number : BA-PZ-4B

Site Name: OLIN-McIntosh, Alabama	Borehole Start Date: 08/17/08 End Date: 08/17/08	Borehole Start Time: 1330 ☐ AM ☑ PM End Time: 1415 ☐ AM ☑ PM	
Environmental Contractor: MACTEC Engineering and Consulting	Geologist's Name: FK MAYILA	Environmental Technician's Name: J MOORE	
Drilling Company: Walker-Hill Environmental	Pavement Thickness (inches):	Borehole Diameter (inches): 3.5"	Borehole Depth (feet): 24'
Drilling Method(s): Hollow-Stem Auger, Direct Push	Apparent Borehole DTW (in feet from soil moisture content):	Measured Well DTW (in feet after water recharges in well):	OVA (list model and check type): NA ☐ FID

Disposition of Drill Cuttings [check method(s)]: ☑ Drum ☐ Spread ☐ Backfill ☐ Stockpile ☐ Other

(describe if other or multiple items are checked):

Borehole Completion (check one): ☑ Well ☐ Grout ☐ Bentonite ☐ Backfill ☐ Other (describe)

Sample Type	Sample Depth Interval (feet)	Sample Recovery (inches)	SPT Blows (per six inches)	Depth (feet)	Sample Description (include grain size based on USCS, odors, staining, and other remarks)	USCS Symbol	Moisture Content	Comments
HA	0-5	60	N/A	5	Fill Material, from borrow pit	SM	M	
DP	5-10	60	N/A	10	sand silt mix, backfill material from borrow pit TO 8', dark grey clay, soft, very plastic	SM	M	
DP	10-14	48	N/A	14	Dark grey, soft clay, very plastic	CL	M	
DP	14-19	60	N/A	19	same as above	CL	M	
DP	19-23	48	N/A	23	greenish, soft clay, interlayered with poorly graded fine sand	SC	M	
DP	23-24'	48	N/A	24'	greenish-light grey, wet, poorly graded fine sand	SP	W	Piezometer set at 24', screened from 14-24'

Sample Type Codes: **HA** = Hollow-Stem Auger; **DP** = Direct Push;
Moisture Content Codes: **D** = Dry; **M** = Moist; **W** = Wet; **S** = Saturated

MACTEC

BORING LOG

Boring/Well Number : BA-PZ-4C

Site Name: OLIN-McIntosh, Alabama	Borehole Start Date: 08/17/08 End Date: 08/17/08	Borehole Start Time: 0905 ☑ AM ☐ PM End Time: 1205 ☐ AM ☑ PM	
Environmental Contractor: MACTEC Engineering and Consulting	Geologist's Name: FK MAYILA	Environmental Technician's Name: J MOORE	
Drilling Company: Walker-Hill Environmental	Pavement Thickness (inches):	Borehole Diameter (inches): 3.5"	Borehole Depth (feet): 43'
Drilling Method(s): Hollow-Stem Auger, Direct Push	Apparent Borehole DTW (in feet from soil moisture content):	Measured Well DTW (in feet after water recharges in well):	OVA (list model and check type): NA ☐ FID

Disposition of Drill Cuttings [check method(s)]: ☑ Drum ☐ Spread ☐ Backfill ☐ Stockpile ☐ Other

(describe if other or multiple items are checked):

Borehole Completion (check one): ☑ Well ☐ Grout ☐ Bentonite ☐ Backfill ☐ Other (describe)

Sample Type	Sample Depth Interval (feet)	Sample Recovery (inches)	SPT Blows (per six inches)	Depth (feet)	Sample Description (include grain size based on USCS, odors, staining, and other remarks)	USCS Symbol	Moisture Content	Comments
HA	0-5	60	N/A	5	Fill Material, from borrow pit	SM	M	
DP	5-10	60	N/A	10	sand silt mix, backfill material from borrow pit TO 8', dark grey clay, soft, very plastic	SM	M	
DP	10-14	48	N/A	14	Dark grey, soft clay, very plastic	CL	M	
DP	14-19	60	N/A	19	same as above	CL	M	
DP	19-23	48	N/A	23	greenish, soft clay, interlayered with poorly graded fine sand	SC	M	
DP	23-27	48	N/A	27	greenish-light grey, wet, poorly graded fine sand	SP	W	
DP	27-31	48	N/A	31	greenish, wet, poorly graded fine sand grading into medium sand at bottom of sample	SP	W	
DP	31-35	48	N/A	35	greenish, wet, poorly graded fine sand, grading into medium sand	SP	W	
DP	35-39	48	N/A	39	light grey- tan , wet, poorly graded , medium size to coarse particles, at the bottom of sample 39', coarse sand with gravel	SP	W	
DP	39-43	48	N/A	43	light grey, hard clay, interlayered with some fine sand, and a moderate composition of gravel, miocene clay.	SC	W	Piezometer set at 41' , screened from 31-41'

Sample Type Codes: **HA** = Hollow-Stem Auger; **DP** = Direct Push;

Moisture Content Codes: **D** = Dry; **M** = Moist; **W** = Wet; **S** = Saturated

MACTEC

BORING LOG

Boring/Well Number : BA-MW-1A

Site Name: OLIN-McIntosh, Alabama	Borehole Start Date: 08/16/08 End Date: 08/16/08	Borehole Start Time: 1520 ☐ AM ☑ PM End Time: 1800 ☐ AM ☑ PM	
Environmental Contractor: MACTEC Engineering and Consulting	Geologist's Name: FK MAYILA	Environmental Technician's Name:	
Drilling Company: Walker-Hill Environmental	Pavement Thickness (inches):	Borehole Diameter (inches): 3.5"	Borehole Depth (feet): 29
Drilling Method(s): Hollow-Stem Auger, Direct Push	Apparent Borehole DTW (in feet from soil moisture content):	Measured Well DTW (in feet after water recharges in well):	OVA (list model and check type): NA ☐ FID

Disposition of Drill Cuttings [check method(s)]: ☑ Drum ☐ Spread ☐ Backfill ☐ Stockpile ☐ Other

(describe if other or multiple items are checked):

Borehole Completion (check one): ☑ Well ☐ Grout ☐ Bentonite ☐ Backfill ☐ Other (describe)

Sample Type	Sample Depth Interval (feet)	Sample Recovery (inches)	SPT Blows (per six inches)	Depth (feet)	Sample Description (include grain size based on USCS, odors, staining, and other remarks)	USCS Symbol	Moisture Content	Comments
HA	0-5	60	N/A	5	Light brown, sandy clay	SC	D	
DP	5-9	48	N/A	9	light brown- reddish, sandy clay	SC	D	
DP	9-11	24	N/A	11	reddish, stiff and dry clay	CL	D	
DP	11-15	48	N/A	15	grey stiff silty clay, with orange streaks bottom turns red	CL	M	
DP	15-19	48	N/A	19	grey stiff clay grading into clayey silt	ML	M	
DP	19-23	48	N/A	23	poorly graded grey fine sand interlayered with clay	SC	M	
DP	23-27	48	N/A	27	poorly graded grey fine sand grading into clay, bottom foot contained silty clay	SC	M	
DP	27-29	24	N/A	29	grey, moist, soft clay, pieces of decomposed wood at approximately 29 ft BLS.	OH	M	Well set at 29' screened from 19-29'

Sample Type Codes: **HA** = Hollow-Stem Auger; **DP** = Direct Push;
Moisture Content Codes: **D** = Dry; **M** = Moist; **W** = Wet; **S** = Saturated

MACTEC

BORING LOG

Boring/Well Number : BA-MW-1B

Site Name: OLIN-McIntosh, Alabama	Borehole Start Date: 08/16/08 End Date: 08/16/08	Borehole Start Time: 1230 ☐ AM ☑ PM End Time: 1500 ☐ AM ☑ PM	
Environmental Contractor: MACTEC Engineering and Consulting	Geologist's Name: FK MAYILA	Environmental Technician's Name:	
Drilling Company: Walker-Hill Environmental	Pavement Thickness (inches):	Borehole Diameter (inches): 3.5"	Borehole Depth (feet): 44'
Drilling Method(s): Hollow-Stem Auger, Direct Push	Apparent Borehole DTW (in feet from soil moisture content):	Measured Well DTW (in feet after water recharges in well):	OVA (list model and check type): NA ☐ FID

Disposition of Drill Cuttings [check method(s)]: ☑ Drum ☐ Spread ☐ Backfill ☐ Stockpile ☐ Other

(describe if other or multiple items are checked):

Borehole Completion (check one): ☑ Well ☐ Grout ☐ Bentonite ☐ Backfill ☐ Other (describe)

Sample Type	Sample Depth Interval (feet)	Sample Recovery (inches)	SPT Blows (per six inches)	Depth (feet)	Sample Description (include grain size based on USCS, odors, staining, and other remarks)	USCS Symbol	Moisture Content	Comments
HA	0-5	60	N/A	5	Light brown, sandy clay	SC	D	
DP	5-9	48	N/A	9	light brown- reddish, sandy clay	SC	D	
DP	9-11	24	N/A	11	reddish, stiff and dry clay	CL	D	
DP	11-15	48	N/A	15	grey stiff silty clay, with orange streaks bottom turns red	CL	M	
DP	15-19	48	N/A	19	grey stiff clay grading into clayey silt	ML	M	
DP	19-23	48	N/A	23	poorly graded grey fine sand interlayered with clay	SC	M	
DP	23-27	48	N/A	27	poorly graded grey fine sand grading into clay, bottom foot contained silty clay	SC	M	
DP	27-29	24	N/A	29	grey, moist, soft clay, pieces of decomposed wood at approximately 29 ft BLS.	OH	M	
DP	29-31	24	N/A	31	grey, moist, soft clay, pieces of decomposed wood graded in soil sample, wet	OH	W	
DP	31-35	48	N/A	35	poorly graded, light brown, fine to medium sand, wet	SW	W	
DP	35-39	48	N/A	39	poorly graded, tan to light orange, medium grade sand, wet	SP	W	
DP	39-43	48	N/A	43	poorly graded, light orange medium grade sand, wet	SP	W	
DP	43-44	0	N/A	44	No sample, sample fell to the ground while retrieving the poly tube from the SS core, light orange wet coarse sand with gravel.	GP	W	Well set at 44', screened 34-44'

Sample Type Codes: **HA** = Hollow-Stem Auger; **DP** = Direct Push; Screened 2004

Moisture Content Codes: **D** = Dry; **M** = Moist; **W** = Wet; **S** = Saturated

MACTEC

BORING LOG

Boring/Well Number : BA-MW-1C

Site Name: OLIN-McIntosh, Alabama	Borehole Start Date: 08/13/08 End Date: 08/13/08	Borehole Start Time: 1400 ☐ AM ☑ PM End Time: 1815 ☐ AM ☑ PM	
Environmental Contractor: MACTEC Engineering and Consulting	Geologist's Name: FK MAYILA	Environmental Technician's Name:	
Drilling Company: Walker-Hill Environmental	Pavement Thickness (inches):	Borehole Diameter (inches): 3.5"	Borehole Depth (feet): 67
Drilling Method(s): Hollow-Stem Auger, Direct Push	Apparent Borehole DTW (in feet from soil moisture content):	Measured Well DTW (in feet after water recharges in well):	OVA (list model and check type): NA ☐ FID

Disposition of Drill Cuttings [check method(s)]: ☑ Drum ☐ Spread ☐ Backfill ☐ Stockpile ☐ Other

(describe if other or multiple items are checked):

Borehole Completion (check one): ☑ Well ☐ Grout ☐ Bentonite ☐ Backfill ☐ Other (describe)

Sample Type	Sample Depth Interval (feet)	Sample Recovery (inches)	SPT Blows (per six inches)	Depth (feet)	Sample Description (include grain size based on USCS, odors, staining, and other remarks)	USCS Symbol	Moisture Content	Comments
HA	0-5	60	N/A	5	Light brown, sandy clay	SC	D	
DP	5-9	48	N/A	9	light brown- reddish, sandy clay	SC	D	
DP	9-11	24	N/A	11	reddish, stiff and dry clay	CL	D	
DP	11-15	48	N/A	15	grey stiff silty clay, with orange streaks bottom turns red	CL	M	
DP	15-19	48	N/A	19	grey stiff clay grading into clayey silt	ML	M	
DP	19-23	48	N/A	23	poorly graded grey fine sand interlayered with clay	SC	M	
DP	23-27	48	N/A	27	poorly graded grey fine sand grading into clay, bottom foot contained silty clay	SC	M	
DP	27-29	24	N/A	29	grey, moist, soft clay, pieces of decomposed wood at approximately 29 ft BLS.	OH	M	
DP	29-31	24	N/A	31	grey, moist, soft clay, pieces of decomposed wood graded in soil sample, wet	OH	W	
DP	31-35	48	N/A	35	poorly graded, light brown, fine to medium sand, wet	SW	W	
DP	35-39	48	N/A	39	poorly graded, tan to light orange, medium grade sand, wet	SP	W	
DP	39-43	48	N/A	43	poorly graded, light orange medium grade sand, wet	SP	W	
DP	43-47	0	N/A	47	No sample, sample fell to the ground while retrieving the poly tube from the SS core, light orange wet coarse sand with gravel.	GP	W	
	47-51	48	N/A	51	Light tan, wet medium to coarse sand with gravel, gravel only from 47 ' to 47.5'	GP	W	
	51-55	48	N/A	55	light tan to white medium coarse sand with gravel < 5%	GW	W	
	55-59	48	N/A	59	wet, well graded gravel with sand, gravel up to 1.4" in diameter	GW	W	
	59-63	48	N/A	63	wet, well graded gravel with sand, pea gravel, large pieces up to 1.2 "	GW	W	
	63-67	48	N/A	67	soft grey clay, with some organic matter	OH	W	well installed at 64', screened 54-64'

Sample Type Codes: HA = Hollow-Stem Auger; DP = Direct Push;

Moisture Content Codes: D = Dry; M = Moist; W = Wet; S = Saturated

MACTEC

BORING LOG

Boring/Well Number : BA-MW-2B

Site Name: OLIN-McIntosh, Alabama	Borehole Start Date: 07/31/08 End Date: 07/31/08	Borehole Start Time: 09:45 ☑ AM ☐ PM End Time: 13:00 ☐ AM ☑ PM	
Environmental Contractor: MACTEC Engineering and Consulting	Geologist's Name: FK MAYILA	Environmental Technician's Name: Jeff Moore	
Drilling Company: Walker-Hill Environmental	Pavement Thickness (inches):	Borehole Diameter (inches): 3.5"	Borehole Depth (feet): 24.3'
Drilling Method(s): Hollow-Stem Auger, Direct Push	Apparent Borehole DTW (in feet from soil moisture content):	Measured Well DTW (in feet after water recharges in well):	OVA (list model and check type): NA ☐ FID

Disposition of Drill Cuttings [check method(s)]: ☑ Drum ☐ Spread ☐ Backfill ☐ Stockpile ☐ Other

(describe if other or multiple items are checked):

Borehole Completion (check one): ☑ Well ☐ Grout ☐ Bentonite ☐ Backfill ☐ Other (describe)

Sample Type	Sample Depth Interval (feet)	Sample Recovery (inches)	SPT Blows (per six inches)	Depth (feet)	Sample Description (include grain size based on USCS, odors, staining, and other remarks)	USCS Symbol	Moisture Content	Comments
HA	0-5	60	N/A	5	Berm fill material, Clay, Cl, red brwon to 4' then brownish grey to 5' , moist, medium plasticity, soft, fine	CL	M	
DP	5-9.5	54	N/A	9.5	Clay, greenish brown, soft, moist, medium plasticity, soft fne as above	CL	M	
DP	9.5-14.5	60	N/A	14.5	Clay, greenish brown, soft, moist, medium plasticity, soft fne as above	CL	M	
DP	14.5-18.5	48	N/A	18.5	Fat Clay, CH, dark grey, moist to wet, fine 100 % fines	CH	W	
DP	18.5-22.5	48	N/A	22.5	as above to 17' , then a layer of organics, black to 17.5' then clay with silt ,CL, greenish grey, wet 20% sand	CL	W	
DP	22.5-24.3	48	N/A	24.3	Poorly graded sand, with thin zones of fat clay CH, clay layers are thicker toward bottom of sample,	CH	W	Set well at 24' screened from14-24'

Sample Type Codes: **HA** = Hollow-Stem Auger; **DP** = Direct Push;
Moisture Content Codes: **D** = Dry; **M** = Moist; **W** = Wet; **S** = Saturated

MACTEC

BORING LOG

Boring/Well Number : BA-MW-2C

Site Name: OLIN-McIntosh, Alabama	Borehole Start Date: 07/29/08 End Date: 07/30/08	Borehole Start Time: 12:22 ☐ AM ☑ PM End Time: 16:00 ☐ AM ☑ PM	
Environmental Contractor: MACTEC Engineering and Consulting	Geologist's Name: FK MAYILA	Environmental Technician's Name: Jeff Moore	
Drilling Company: Walker-Hill Environmental	Pavement Thickness (inches):	Borehole Diameter (inches): 3.5"	Borehole Depth (feet): 44.7'
Drilling Method(s): Hollow-Stem Auger, Direct Push	Apparent Borehole DTW (in feet from soil moisture content):	Measured Well DTW (in feet after water recharges in well):	OVA (list model and check type): NA ☐ FID

Disposition of Drill Cuttings [check method(s)]: ☑ Drum ☐ Spread ☐ Backfill ☐ Stockpile ☐ Other

(describe if other or multiple items are checked):

Borehole Completion (check one): ☑ Well ☐ Grout ☐ Bentonite ☐ Backfill ☐ Other (describe)

Sample Type	Sample Depth Interval (feet)	Sample Recovery (inches)	SPT Blows (per six inches)	Depth (feet)	Sample Description (include grain size based on USCS, odors, staining, and other remarks)	USCS Symbol	Moisture Content	Comments
HA	0-5	60	N/A	5	Berm fill material, Clay, CL, red brwon to 4' then brownish grey to 5', moist, medium plasticity, soft, fine	CL	M	
DP	5-9.5	54	N/A	9.5	Clay, greenish brown, soft, moist, medium plasticity, soft fne as above	CL	M	
DP	9.5-14.5	60	N/A	14.5	Clay, greenish brown, soft, moist, medium plasticity, soft fne as above	CL	M	
DP	14.5-18.5	48	N/A	18.5	Fat Clay, CH, dark grey, moist to wet, fine 100 % fines	CH	W	
DP	18.5-22.5	48	N/A	22.5	as above to 17', then a layer of organics, black to 17.5' then clay with silt ,CL, greenish grey, wet 20% sand	CL	W	
DP	22.5-26.5	48	N/A	26.5	Poorly graded sand, with thin zones of fat clay CH, clay layers are thicker toward bottom of sample,	CH	W	
DP	26.5-30.5	48	N/A	30.5	As above, alternating to poorly graded sand (SP) and Fat Clay, CH with sand, saturated.	SP,CH	S	
DP	30.5-34.5	48	N/A	34.5	Poorly graded sand with greenish grey saturated fines, thin layers of Fat Clay, mixed with sand	SP,CH	W	
DP	34.5-38.5	0	N/A	38.5	No Recovery	N/A	N/A	
DP	38.5-42.5	0	N/A	42.5	No Recovery	N/A	N/A	
DP	42.5-44.7	0	N/A	44.7	No Recovery	N/A	N/A	well set at 44', screened 34-44'

Sample Type Codes: **HA** = Hollow-Stem Auger; **DP** = Direct Push;
Moisture Content Codes: **D** = Dry; **M** = Moist; **W** = Wet; **S** = Saturated

MACTEC

BORING LOG

Boring/Well Number : BA-MW-3B

Site Name: OLIN-McIntosh, Alabama	Borehole Start Date: 08/04/08 End Date: 08/04/08	Borehole Start Time: 07:20 ☑ AM ☐ PM End Time: 09:15 ☑ AM ☐ PM	
Environmental Contractor: MACTEC Engineering and Consulting	Geologist's Name: FK MAYILA	Environmental Technician's Name: Jeff Moore	
Drilling Company: Walker-Hill Environmental	Pavement Thickness (inches):	Borehole Diameter (inches): 3.5"	Borehole Depth (feet): 24.2'
Drilling Method(s): Hollow-Stem Auger, Direct Push	Apparent Borehole DTW (in feet from soil moisture content):	Measured Well DTW (in feet after water recharges in well):	OVA (list model and check type): NA ☐ FID

Disposition of Drill Cuttings [check method(s)]: ☑ Drum ☐ Spread ☐ Backfill ☐ Stockpile ☐ Other

(describe if other or multiple items are checked):

Borehole Completion (check one): ☑ Well ☐ Grout ☑ Bentonite ☐ Backfill ☐ Other (describe)

Sample Type	Sample Depth Interval (feet)	Sample Recovery (inches)	SPT Blows (per six inches)	Depth (feet)	Sample Description (include grain size based on USCS, odors, staining, and other remarks)	USCS Symbol	Moisture Content	Comments
HA	0-5	60	N/A	5	Red Brown Berm Fill, Clay, high plasticity	CH	M	
DP	5-9.5	54	N/A	9.5	Red Brown Berm Fill, Clay, high plasticity, moist fine fat clay, (CH)	CH	M	
DP	9.5-14.5	60	N/A	14.5	Same as above, dark grey	CH	M	
DP	14.5-15	48	N/A	15	Fat Clay, CH, dark grey, wet, fine, 5% fine sand, 95% fines	CH	W	
DP	15-19	48	N/A	19	Same as Above, soil content exhibiting slight mica content	CH	W	
DP	19-23	48	N/A	23	Fat Clay with sand, CH, dark geenish grey, wet, fine, 25% fine sand, slight mica content	CH	W	
DP	23-24.2	0	N/A	24.2	No Recovery	N/A	N/A	well installed 24', screened 14-24

Sample Type Codes: **HA** = Hollow-Stem Auger; **DP** = Direct Push;
Moisture Content Codes: **D** = Dry; **M** = Moist; **W** = Wet; **S** = Saturated

MACTEC

BORING LOG

Boring/Well Number : BA-MW-3C

Site Name: OLIN-McIntosh, Alabama	Borehole Start Date: 08/01/08 End Date: 08/01/08	Borehole Start Time: 07:30 ☑ AM ☐ PM End Time: 12:15 ☐ AM ☑ PM	
Environmental Contractor: MACTEC Engineering and Consulting	Geologist's Name: FK MAYILA	Environmental Technician's Name: Jeff Moore	
Drilling Company: Walker-Hill Environmental	Pavement Thickness (inches):	Borehole Diameter (inches): 3.5"	Borehole Depth (feet): 43'
Drilling Method(s): Hollow-Stem Auger, Direct Push	Apparent Borehole DTW (in feet from soil moisture content):	Measured Well DTW (in feet after water recharges in well):	OVA (list model and check type): NA ☐ FID

Disposition of Drill Cuttings [check method(s)]: ☑ Drum ☐ Spread ☐ Backfill ☐ Stockpile ☐ Other

(describe if other or multiple items are checked):

Borehole Completion (check one): ☑ Well ☐ Grout ☐ Bentonite ☐ Backfill ☐ Other (describe)

Sample Type	Sample Depth Interval (feet)	Sample Recovery (inches)	SPT Blows (per six inches)	Depth (feet)	Sample Description (include grain size based on USCS, odors, staining, and other remarks)	USCS Symbol	Moisture Content	Comments
HA	0-5	60	N/A	5	Red Brown Berm Fill, Clay, high plasticity	CH	M	
DP	5-9.5	54	N/A	9.5	Red Brown Berm Fill, Clay, high plasticity, moist fine fat clay, (CH)	CH	M	
DP	9.5-14.5	60	N/A	14.5	Same as above, dark grey	CH	M	
DP	14.5-15	48	N/A	15	Fat Clay, CH, dark grey, wet, fine, 5% fine sand, 95% fines	CH	W	
DP	15-19	48	N/A	19	Same as Above, soil content exhibiting slight mica content	CH	W	
DP	19-23	48	N/A	23	Fat Clay with sand, CH, dark geenish grey, wet, fine, 25% fine sand, slight mica content	CH	W	
DP	23-27	0	N/A	27	No Recovery	N/A	N/A	
DP	27-31	48	N/A	31	Poortly graded sand, SP, dark greenish grey, wet, fine soil with slight mica content	SP	W	
DP	31-35	48	N/A	35	Same as Above, SP	SP	W	
DP	35-39	48	N/A	39	Same as Above, with increased mica content	SP	W	
DP	39-43	48	N/A	43	poortly graded sand (SP) , pale brown, wet, >95% fine sand, <5% fines, with a 2" layer of compact fat clay mixed with gravel	SP,CL	W	Well set at 42', screened from 32-42'

Sample Type Codes: **HA** = Hollow-Stem Auger; **DP** = Direct Push;
Moisture Content Codes: **D** = Dry; **M** = Moist; **W** = Wet; **S** = Saturated

MACTEC

BORING LOG

Boring/Well Number : BA-MW-4B

Site Name: OLIN-McIntosh, Alabama	Borehole Start Date: 08/05/08 End Date: 08/05/08	Borehole Start Time: 7:30 ☑ AM ☐ PM End Time: 11:30 ☑ AM ☐ PM	
Environmental Contractor: MACTEC Engineering and Consulting	Geologist's Name: FK MAYILA	Environmental Technician's Name: J MOORE	
Drilling Company: Walker-Hill Environmental	Pavement Thickness (inches):	Borehole Diameter (inches): 3.5"	Borehole Depth (feet): 26.4'
Drilling Method(s): Hollow-Stem Auger, Direct Push	Apparent Borehole DTW (in feet from soil moisture content):	Measured Well DTW (in feet after water recharges in well):	OVA (list model and check type): NA ☐ FID

Disposition of Drill Cuttings [check method(s)]: ☑ Drum ☐ Spread ☐ Backfill ☐ Stockpile ☐ Other

(describe if other or multiple items are checked):

Borehole Completion (check one): ☑ Well ☐ Grout ☐ Bentonite ☐ Backfill ☐ Other (describe)

Sample Type	Sample Depth Interval (feet)	Sample Recovery (inches)	SPT Blows (per six inches)	Depth (feet)	Sample Description (include grain size based on USCS, odors, staining, and other remarks)	USCS Symbol	Moisture Content	Comments
HA	0-5	60	N/A	5	Fill material from borrow pit	SM	M	
DP	5-9.5	54	N/A	9.5	Fill material encountered natural ground at 9.5'	SM	M	
DP	9.5-14.5	60	N/A	14.5	Dark grey- greenish grey, clay with fine sand	SC	M	
DP	14.5-15.5	0	N/A	15.5	No Recovery	N/A	N/A	
DP	15.5-19.5	48	N/A	19.5	Dark grey- greenish grey, clay with fine sand	SC	M	
DP	19.5-23.5	48	N/A	23.5	light grey,poorly graded fines to medium size soil, wet, sand with some organic material	SM	W	
DP	23.5-26.4	35	N/A	26.4	light grey- brownish wet poorly gradedsand, medium size with some organic material and <5% gravel ,(tan)	SM	W	Well set at 26', screened from 16-26'

Sample Type Codes: **HA** = Hollow-Stem Auger; **DP** = Direct Push;

Moisture Content Codes: **D** = Dry; **M** = Moist; **W** = Wet; **S** = Saturated

MACTEC

BORING LOG

Boring/Well Number : BA-MW-4C

Site Name: OLIN-McIntosh, Alabama	Borehole Start Date: 08/04/08 End Date: 08/04/08	Borehole Start Time: 1220 ☐ AM ☑ PM End Time: 1530 ☐ AM ☑ PM	
Environmental Contractor: MACTEC Engineering and Consulting	Geologist's Name: FK MAYILA	Environmental Technician's Name: J MOORE	
Drilling Company: Walker-Hill Environmental	Pavement Thickness (inches):	Borehole Diameter (inches): 3.5"	Borehole Depth (feet): 43.5'
Drilling Method(s): Hollow-Stem Auger, Direct Push	Apparent Borehole DTW (in feet from soil moisture content):	Measured Well DTW (in feet after water recharges in well):	OVA (list model and check type): NA ☐ FID

Disposition of Drill Cuttings [check method(s)]: ☑ Drum ☐ Spread ☐ Backfill ☐ Stockpile ☐ Other

(describe if other or multiple items are checked):

Borehole Completion (check one): ☑ Well ☐ Grout ☐ Bentonite ☐ Backfill ☐ Other (describe)

Sample Type	Sample Depth Interval (feet)	Sample Recovery (inches)	SPT Blows (per six inches)	Depth (feet)	Sample Description (include grain size based on USCS, odors, staining, and other remarks)	USCS Symbol	Moisture Content	Comments
HA	0-5	60	N/A	5	Fill material from borrow pit	SM	M	
DP	5-9.5	54	N/A	9.5	Fill material encountered natural ground at 9.5'	SM	M	
DP	9.5-14.5	60	N/A	14.5	Dark grey- greenish grey, clay with fine sand	SC	M	
DP	14.5-15.5	0	N/A	15.5	No Recovery	N/A	N/A	
DP	15.5-19.5	48	N/A	19.5	Dark grey- greenish grey, clay with fine sand	SC	M	
DP	19.5-23.5	48	N/A	23.5	light grey,poorly graded fines to medium size soil, wet, sand with some organic material	SM	W	
DP	23.5-27.5	48	N/A	27.5	light grey- brownish wet poorly gradedsand, medium size with some organic material and <5% gravel ,(tan)	SM	W	
DP	27.5-31.5	48	N/A	31.5	light tan, wet, medium- coarse sand, <5% gravel no fines	SP	W	
DP	31.5-35.5	48	N/A	35.5	light tan wet, poorly graded coarse sand <15% gravel, no fines, a piece of clay at bottom of sample	SP	W	
DP	35.5-38.5	36	N/A	38.5	No Recovery	N/A	N/A	
DP	38.5-40.5	24	N/A	40.5	Light tan, wet, poorly graded coarse sand, .5 foot of gravel layer, at 40-40.5'	SP	W	
DP	40.5-43.5	36	N/A	43.5	light grey- tan, clay, hard clay, very stiff	CH	W	well set at 40', screened 30-40'

Sample Type Codes: **HA** = Hollow-Stem Auger; **DP** = Direct Push;
Moisture Content Codes: **D** = Dry; **M** = Moist; **W** = Wet; **S** = Saturated

MACTEC

BORING LOG

Boring/Well Number : BA-MW-5B

Site Name: OLIN-McIntosh, Alabama	Borehole Start Date: 08/07/08 End Date: 08/07/08	Borehole Start Time: 1420 ☐ AM ☑ PM End Time: 1500 ☐ AM ☑ PM	
Environmental Contractor: MACTEC Engineering and Consulting	Geologist's Name: FK MAYILA	Environmental Technician's Name: J MOORE	
Drilling Company: Walker-Hill Environmental	Pavement Thickness (inches):	Borehole Diameter (inches): 3.5"	Borehole Depth (feet): 25
Drilling Method(s): Hollow-Stem Auger, Direct Push	Apparent Borehole DTW (in feet from soil moisture content):	Measured Well DTW (in feet after water recharges in well):	OVA (list model and check type): NA ☐ FID

Disposition of Drill Cuttings [check method(s)]: ☑ Drum ☐ Spread ☐ Backfill ☐ Stockpile ☐ Other

(describe if other or multiple items are checked):

Borehole Completion (check one): ☑ Well ☐ Grout ☐ Bentonite ☐ Backfill ☐ Other (describe)

Sample Type	Sample Depth Interval (feet)	Sample Recovery (inches)	SPT Blows (per six inches)	Depth (feet)	Sample Description (include grain size based on USCS, odors, staining, and other remarks)	USCS Symbol	Moisture Content	Comments
HA	0-5	60	N/A	5	Fill material from borrow pit	SM	M	
DP	5-10	60	N/A	10	Fill material from borrow pit	SM	M	
DP	10-14.5	54	N/A	14.5	dark greenish grey clay cuttings	CL	M	
DP	14.5-19	54	N/A	19	Dark grey- greenish clayey sand, interlayered with zones of clay and fine sand, poorly graded fine sand	SC	M	
DP	19-23	48	N/A	23	light grey -tan, wet, medium to coarse sand no fines, poorly graded sand	SP	W	
DP	23-25	48	N/A	25	light tan, wet, medium poorly graded sand	SP	W	Well set at 24', screened 14-24'

Sample Type Codes: **HA** = Hollow-Stem Auger; **DP** = Direct Push;
Moisture Content Codes: **D** = Dry; **M** = Moist; **W** = Wet; **S** = Saturated

MACTEC

BORING LOG

Boring/Well Number : BA-MW-5C

Site Name: OLIN-McIntosh, Alabama	Borehole Start Date: 08/05/08 End Date: 08/06/08	Borehole Start Time: 1430 ☐ AM ☑ PM End Time: 1015 ☑ AM ☐ PM	
Environmental Contractor: MACTEC Engineering and Consulting	Geologist's Name: FK MAYILA	Environmental Technician's Name: J MOORE	
Drilling Company: Walker-Hill Environmental	Pavement Thickness (inches):	Borehole Diameter (inches): 3.5"	Borehole Depth (feet): 37.5
Drilling Method(s): Hollow-Stem Auger, Direct Push	Apparent Borehole DTW (in feet from soil moisture content):	Measured Well DTW (in feet after water recharges in well):	OVA (list model and check type): NA ☐ FID

Disposition of Drill Cuttings [check method(s)]: ☑ Drum ☐ Spread ☐ Backfill ☐ Stockpile ☐ Other

(describe if other or multiple items are checked):

Borehole Completion (check one): ☑ Well ☐ Grout ☐ Bentonite ☐ Backfill ☐ Other (describe)

Sample Type	Sample Depth Interval (feet)	Sample Recovery (inches)	SPT Blows (per six inches)	Depth (feet)	Sample Description (include grain size based on USCS, odors, staining, and other remarks)	USCS Symbol	Moisture Content	Comments
HA	0-5	60	N/A	5	Fill material from borrow pit	SM	M	
DP	5-10	60	N/A	10	Fill material from borrow pit	SM	M	
DP	10-14.5	54	N/A	14.5	dark greenish grey clay cuttings	CL	M	
DP	14.5-19	54	N/A	19	Dark grey- greenish clayey sand, interlayered with zones of clay and fine sand, poorly graded fine sand	SC	M	
DP	19-23	48	N/A	23	light grey -tan, wet, medium to coarse sand no fines, poorly graded sand	SP	W	
DP	23-27	48	N/A	27	light tan, wet, medium poorly graded sand	SP	W	
DP	27-31	48	N/A	31	light tan wet medium poorly graded sand	SP	W	
DP	31-35	48	N/A	35	31-32.5' tan medium coarse poorly graded sand 32.5'-35' white, poorly graded fine sand, compact	SP	W	
DP	35-38	36	N/A	38	white poorly graded very fine sand, compact, hard to penetrate	SP	W	WELL SET AT 37', SCREENED FROM 27-37'
DP	38-41	36	N/A	41	white poorly graded very fine sand interlayed with some clay at bottom of sample	SC	W	

Sample Type Codes: **HA** = Hollow-Stem Auger; **DP** = Direct Push;
Moisture Content Codes: **D** = Dry; **M** = Moist; **W** = Wet; **S** = Saturated

MACTEC

BORING LOG

Boring/Well Number : BA-MW-6B

Site Name: OLIN-McIntosh, Alabama	Borehole Start Date: 08/14/08 End Date: 08/14/08	Borehole Start Time: 1130 ☑ AM ☐ PM End Time: 1400 ☐ AM ☑ PM	
Environmental Contractor: MACTEC Engineering and Consulting	Geologist's Name: FK MAYILA	Environmental Technician's Name: J MOORE	
Drilling Company: Walker-Hill Environmental	Pavement Thickness (inches):	Borehole Diameter (inches): 3.5"	Borehole Depth (feet): 25
Drilling Method(s): Hollow-Stem Auger, Direct Push	Apparent Borehole DTW (in feet from soil moisture content):	Measured Well DTW (in feet after water recharges in well):	OVA (list model and check type): NA ☐ FID

Disposition of Drill Cuttings [check method(s)]: ☑ Drum ☐ Spread ☐ Backfill ☐ Stockpile ☐ Other

(describe if other or multiple items are checked):

Borehole Completion (check one): ☑ Well ☐ Grout ☐ Bentonite ☐ Backfill ☐ Other (describe)

Sample Type	Sample Depth Interval (feet)	Sample Recovery (inches)	SPT Blows (per six inches)	Depth (feet)	Sample Description (include grain size based on USCS, odors, staining, and other remarks)	USCS Symbol	Moisture Content	Comments
HA	0-5	60	N/A	5	Fill material from borrow pit	SM	M	
DP	5-8	60	N/A	8	Fill material from borrow pit	SM	M	
DP	8-10	54	N/A	10	Dark brown moist clay, light plasticity	CL	M	
DP	10-14	54	N/A	14	dark brown moist clay, high plasticity	CL	M	
DP	14-19	48	N/A	19	same as above	CL	M	
DP	19-23	0	N/A	23	No recovery	N/A	N/A	
DP	23-25	24	N/A	25	dark grey to greenish medium sand, wet, interlayed with poorly graded fine sand	SP	W	Well set at 25', screened from 15-25'

Sample Type Codes: **HA** = Hollow-Stem Auger; **DP** = Direct Push;
Moisture Content Codes: **D** = Dry; **M** = Moist; **W** = Wet; **S** = Saturated

MACTEC

BORING LOG

Boring/Well Number : BA-MW-6C

Site Name: OLIN-McIntosh, Alabama	Borehole Start Date: 08/14/08 End Date: 08/14/08	Borehole Start Time: 0805 ☑ AM ☐ PM End Time: 1045 ☑ AM ☐ PM	
Environmental Contractor: MACTEC Engineering and Consulting	Geologist's Name: FK MAYILA	Environmental Technician's Name: J MOORE	
Drilling Company: Walker-Hill Environmental	Pavement Thickness (inches):	Borehole Diameter (inches): 3.5"	Borehole Depth (feet): 51'
Drilling Method(s): Hollow-Stem Auger, Direct Push	Apparent Borehole DTW (in feet from soil moisture content):	Measured Well DTW (in feet after water recharges in well):	OVA (list model and check type): NA ☐ FID

Disposition of Drill Cuttings [check method(s)]: ☑ Drum ☐ Spread ☐ Backfill ☐ Stockpile ☐ Other

(describe if other or multiple items are checked):

Borehole Completion (check one): ☑ Well ☐ Grout ☐ Bentonite ☐ Backfill ☐ Other (describe)

Sample Type	Sample Depth Interval (feet)	Sample Recovery (inches)	SPT Blows (per six inches)	Depth (feet)	Sample Description (include grain size based on USCS, odors, staining, and other remarks)	USCS Symbol	Moisture Content	Comments
HA	0-5	60	N/A	5	Fill material from borrow pit	SM	M	
DP	5-8	60	N/A	8	Fill material from borrow pit	SM	M	
DP	8-10	54	N/A	10	Dark brown moist clay, light plasticity	CL	M	
DP	10-14	54	N/A	14	dark brown moist clay, high plasticity	CL	M	
DP	14-19	48	N/A	19	same as above	CL	M	
DP	19-23	0	N/A	23	No recovery	N/A	N/A	
DP	23-27	48	N/A	27	dark grey to greenish medium sand, wet, interlayed with poorly graded fine sand	SP	W	
DP	27-31	48	N/A	31	grey poorly graded medium- coarse sand, wet	SP	W	
DP	31-35	48	N/A	35	light brown, greyish poorly graded medium coarse sand, wet	SP	W	
DP	35-39	48	N/A	39	same as above	SP	W	
DP	39-43	48	N/A	43	well graded gravel with <5% sand, 42-43' grey poorly graded fine sand	GW	W	
DP	43-47	48	N/A	47	Poorly graded white fine sand	SP	W	Well set at 44' screened from 34-44'
DP	47-51	48	N/A	51	Poorly graded white fine sand	SP	W	

Sample Type Codes: **HA** = Hollow-Stem Auger; **DP** = Direct Push;
Moisture Content Codes: **D** = Dry; **M** = Moist; **W** = Wet; **S** = Saturated

MACTEC

BORING LOG

Boring/Well Number : BA-MW-7B

Site Name: OLIN-McIntosh, Alabama	Borehole Start Date: 08/15/08 End Date: 08/15/08	Borehole Start Time: 1350 ☐ AM ☑ PM End Time: 1510 ☐ AM ☑ PM	
Environmental Contractor: MACTEC Engineering and Consulting	Geologist's Name: FK MAYILA	Environmental Technician's Name: J MOORE	
Drilling Company: Walker-Hill Environmental	Pavement Thickness (inches):	Borehole Diameter (inches): 3.5"	Borehole Depth (feet): 25'
Drilling Method(s): Hollow-Stem Auger, Direct Push	Apparent Borehole DTW (in feet from soil moisture content):	Measured Well DTW (in feet after water recharges in well):	OVA (list model and check type): NA ☐ FID

Disposition of Drill Cuttings [check method(s)]: ☑ Drum ☐ Spread ☐ Backfill ☐ Stockpile ☐ Other

(describe if other or multiple items are checked):

Borehole Completion (check one): ☑ Well ☐ Grout ☐ Bentonite ☐ Backfill ☐ Other (describe)

Sample Type	Sample Depth Interval (feet)	Sample Recovery (inches)	SPT Blows (per six inches)	Depth (feet)	Sample Description (include grain size based on USCS, odors, staining, and other remarks)	USCS Symbol	Moisture Content	Comments
HA	0-5	60	N/A	5	Fill material from borrow pit	SM	M	
DP	5-9	48	N/A	9	Dark grey- greenish, moist, soft clay, highly plastic	SM	M	
DP	9-11	24	N/A	11	greenish, moist, soft clay, highly plastic	CL	M	
DP	11-15	48	N/A	15	greenish, wet, poorly graded, fine sand interlayed with 6" later of clay	CL	W	
DP	15-19	48	N/A	19	grey, wet, poorly graded medium sand	SP	W	
DP	19-23	48	N/A	23	same as above	SP	W	
DP	23-25	24	N/A	25	light grey ,wet, poorly graded medium sand	SP	W	Well installed at 25', screened 15-25'

Sample Type Codes: **HA** = Hollow-Stem Auger; **DP** = Direct Push;
Moisture Content Codes: **D** = Dry; **M** = Moist; **W** = Wet; **S** = Saturated

MACTEC

BORING LOG

Boring/Well Number : BA-MW-7C

Site Name: OLIN-McIntosh, Alabama	Borehole Start Date: 08/15/08 End Date: 08/15/08	Borehole Start Time: 0750 ☑ AM ☐ PM End Time: 1055 ☑ AM ☐ PM	
Environmental Contractor: MACTEC Engineering and Consulting	Geologist's Name: FK MAYILA	Environmental Technician's Name: J MOORE	
Drilling Company: Walker-Hill Environmental	Pavement Thickness (inches):	Borehole Diameter (inches): 3.5"	Borehole Depth (feet): 55
Drilling Method(s): Hollow-Stem Auger, Direct Push	Apparent Borehole DTW (in feet from soil moisture content):	Measured Well DTW (in feet after water recharges in well):	OVA (list model and check type): NA ☐ FID

Disposition of Drill Cuttings [check method(s)]: ☑ Drum ☐ Spread ☐ Backfill ☐ Stockpile ☐ Other

(describe if other or multiple items are checked):

Borehole Completion (check one): ☑ Well ☐ Grout ☐ Bentonite ☐ Backfill ☐ Other (describe)

Sample Type	Sample Depth Interval (feet)	Sample Recovery (inches)	SPT Blows (per six inches)	Depth (feet)	Sample Description (include grain size based on USCS, odors, staining, and other remarks)	USCS Symbol	Moisture Content	Comments
HA	0-5	60	N/A	5	Fill material from borrow pit	SM	M	
DP	5-9	48	N/A	9	Dark grey- greenish, moist, soft clay, highly plastic	SM	M	
DP	9-11	24	N/A	11	greenish, moist, soft clay, highly plastic	CL	M	
DP	11-15	48	N/A	15	greenish, wet, poorly graded, fine sand interlayed with 6" later of clay	CL	W	
DP	15-19	48	N/A	19	grey, wet, poorly graded medium sand	SP	W	
DP	19-23	48	N/A	23	same as above	SP	W	
DP	23-27	48	N/A	27	light grey ,wet, poorly graded medium sand	SP	W	
DP	27-31	48	N/A	31	light tan- grey mix, wet, poorly graded medium sand	SP	W	
DP	31-35	48	N/A	35	light tan, wet, poorly graded medium sand	SP	W	
DP	35-39	48	N/A	39	light grey- tan, wet, poorly graded sand with coarse sand mix to fine gravel content (<5%)	SP	W	
DP	39-43	48	N/A	43	light grey- tan, wet, poorly graded medium- coarse sand with some gravel (<5%)	SP	W	
DP	43-47	48	N/A	47	dark grey, coarse sand, poorly graded with some gravel (>15%)	SP	W	Well installed at 45', screened from 35'-45'
DP	47-51	48	N/A	51	poorly graded , fine white sand	SM	W	
DP	51-55	48	N/A	55	same as above	SM	W	

ıple Type Codes: **HA** = Hollow-Stem Auger; **DP** = Direct Push;
.oisture Content Codes: **D** = Dry; **M** = Moist; **W** = Wet; **S** = Saturated

MACTEC

BORING LOG

Boring/Well Number : BA-MW-8B

Site Name: OLIN-McIntosh, Alabama	Borehole Start Date: 08/08/08	End Date: 08/08/08	Borehole Start Time: 1030 ☑ AM ☐ PM	End Time: 1100 ☑ AM ☐ PM	
Environmental Contractor: MACTEC Engineering and Consulting	Geologist's Name: FK MAYILA		Environmental Technician's Name: J MOORE		
Drilling Company: Walker-Hill Environmental	Pavement Thickness (inches):	Borehole Diameter (inches): 3.5"	Borehole Depth (feet): 24		
Drilling Method(s): Hollow-Stem Auger, Direct Push	Apparent Borehole DTW (in feet from soil moisture content):	Measured Well DTW (in feet after water recharges in well):	OVA (list model and check type): NA ☐ FID		
Disposition of Drill Cuttings [check method(s)]: ☑ Drum ☐ Spread ☐ Backfill ☐ Stockpile ☐ Other					
(describe if other or multiple items are checked):					
Borehole Completion (check one): ☑ Well ☐ Grout ☐ Bentonite ☐ Backfill ☐ Other (describe)					

Sample Type	Sample Depth Interval (feet)	Sample Recovery (inches)	SPT Blows (per six inches)	Depth (feet)	Sample Description (include grain size based on USCS, odors, staining, and other remarks)	USCS Symbol	Moisture Content	Comments
HA	0-5	60	N/A	5	Fill material to 4', clay from 4-5'	SM, CL	M	
DP	5-9	48	N/A	9	brown soft clay soil material	CL	M	
DP	9-12	24	N/A	12	same as above	CL	M	
DP	12-16	48	N/A	16	brown soft clay with interlaters of silty sand, color changed to dark greyish green clayey sand	CL	M	
DP	16-20	48	N/A	20	dark grey-greenish, wet clayey sand	CL	W	
DP	20-24	48	N/A	24	grey-tan medium sand- coarse sand <10% fines,	SP	W	Well set at 24', screened from 12-24'

Sample Type Codes: **HA** = Hollow-Stem Auger; **DP** = Direct Push;
Moisture Content Codes: **D** = Dry; **M** = Moist; **W** = Wet; **S** = Saturated

MACTEC

BORING LOG

Boring/Well Number : BA-MW-8C

Site Name: OLIN-McIntosh, Alabama	Borehole Start Date: 08/06/08 End Date: 08/07/08	Borehole Start Time: 1350 ☐ AM ☑ PM End Time: 0840 ☑ AM ☐ PM	
Environmental Contractor: MACTEC Engineering and Consulting	Geologist's Name: FK MAYILA	Environmental Technician's Name: J MOORE	
Drilling Company: Walker-Hill Environmental	Pavement Thickness (inches):	Borehole Diameter (inches): 3.5"	Borehole Depth (feet): 64'
Drilling Method(s): Hollow-Stem Auger, Direct Push	Apparent Borehole DTW (in feet from soil moisture content):	Measured Well DTW (in feet after water recharges in well):	OVA (list model and check type): NA ☐ FID

Disposition of Drill Cuttings [check method(s)]: ☑ Drum ☐ Spread ☐ Backfill ☐ Stockpile ☐ Other

(describe if other or multiple items are checked):

Borehole Completion (check one): ☑ Well ☐ Grout ☐ Bentonite ☐ Backfill ☐ Other (describe)

Sample Type	Sample Depth Interval (feet)	Sample Recovery (inches)	SPT Blows (per six inches)	Depth (feet)	Sample Description (include grain size based on USCS, odors, staining, and other remarks)	USCS Symbol	Moisture Content	Comments
HA	0-5	60	N/A	5	Fill material to 4', clay from 4-5'	SM, CL	M	
DP	5-9	48	N/A	9	brown soft clay soil material	CL	M	
DP	9-12	24	N/A	12	same as above	CL	M	
DP	12-16	48	N/A	16	brown soft clay with interlaters of silty sand, color changed to dark greyish green clayey sand	CL	M	
DP	16-20	48	N/A	20	dark grey-greenish, wet clayey sand	CL	W	
DP	20-24	48	N/A	24	grey-tan medium sand- coarse sand <10% fines,	SP	W	
DP	24-28	48	N/A	28	grey, wet, medium sand - coarse sand	SP	W	
DP	28-32	48	N/A	32	grey medium- coarse sand, <10% fines, wet	SP	W	
DP	32-36	48	N/A	36	light grey medium- coarse sand, <10% fines, some gravel at the bottom of the sample	SP	W	
DP	36-40	48	N/A	40	light grey -tan medium-coarse sand, with some gravel at 37.5' to 38', <5% gravel	SP	W	
DP	40-44	48	N/A	44	silty gravel with sand, poorly graded, wet	GP	W	
DP	44-48	48	N/A	48	well graded gravel with <15% sand,	GW	W	Well set at 44', screened from 34-44'
DP	48-52	48	N/A	52	poorly graded gravel with sand, >15% sand , interlayered with some clay- greenish color	GP	W	
DP	52-56	48	N/A	56	white poorly graded fine sand	SP	W	
DP	56-60	48	N/A	60	same as above, dense	SP	W	
DP	60-64	48	N/A	64	same as above	SP	W	

Sample Type Codes: HA = Hollow-Stem Auger; DP = Direct Push;
Moisture Content Codes: D = Dry; M = Moist; W = Wet; S = Saturated

APPENDIX B

CORE LOGS

Site Name: OLIN-McIntosh, Alabama											
Location ID	SDCR-1	Date:	6/3/2009	Start Time:	10:40	☑	AM	☐	PM		
				Finish Time:	11:00	☑	AM	☐	PM		
Field Personnel:	F. Mayila/R. Hicks/A. Carringer	Drillers:	Pro-Diving Crew								
Core Tube Diameter:	3-in	Core Tube Length:	10.0 ft.	Recovered Core:	6.0 ft						
Encountered refusal at approximately 7.0 ft.											

Sample Depth Interval (in)	Blow Counts	Sample Collection Time	Sample Description (grain size, color, and other remarks)	USCS Symbol	Comments
0 - 14"			Dark grey CLAY	CL	
14 - 28"			Dark grey CLAY mixed with some sand at approximately 2 ft.	CL	
28 - 42"			Dark grey CLAY with some fine sand	CL	
42 - 56"			Dark grey CLAY	CL	
56 - 70"			Dark grey to black CLAY	OH	
70 - 84"			Dark grey CLAY mixed with some fine sand.	CL	

Sample Type: W = Water; S = Soil

Site Name: OLIN-McIntosh, Alabama									
Location ID	SDCR-2	Date:	9/24/2009	Start Time:	10:15	☑ AM	☐ PM		
				Finish Time:	11:00	☑ AM	☐ PM		
Field Personnel:	F. Maylia/E. Guillen	Drillers:	Kevin Sondag/Jeff Clemens-Aqua Survey (ASI)						
Core Tube Diameter:	4-in	Core Tube Length:	11.5 ft	Recovered Core:	9.5 ft				

Sample Depth Interval (in)	Blow Counts	Sample Collection Time	Sample Description (grain size, color, and other remarks)	USCS Symbol	Comments
0-10"			very soft, dark grey clayey silt	CL	
10-20"			very soft, light brown silty CLAY, relic shells of corbicula	CL	
20-30"			soft and firm, dark grey-greenish, CLAY, corbicula shelll	CL	
30-40"			"same"	CL	
40-50"			"same" with some wood chips/debris	OH	
50-60"			firm, Dark grey, CLAY, color grades into greenish	CL	
60-70"			firm, dark grey-greenish CLAY	CL	
70-80"			firm, dark grey CLAY	CL	
80-90"			firm, dark grey CLAY	CL	
90-100"			firm, dark grey CLAY, interlayered w/ wood chips	OH	
100-110"			Firm, dark grey CLAY	CL	
110-114"			Firm, dary grey CLAY	CL	

Sample Type: W = Water; S = Soil

Site Name: OLIN-McIntosh, Alabama										
Location ID	SDCR-3	Date:	9/27/2009	Start Time:		☑	AM	☐	PM
				Finish Time:	10:25	☑	AM	☐	PM
Field Personnel:	F. Maylia/E. Guillen	Drillers:	Kevin Sondag/Jeff Clemens-Aqua Survey (ASI)						
Core Tube Diameter:	4-in	Core Tube Length:	11 ft	Recovered Core:	9 ft				

Sample Depth Interval (in)	Blow Counts	Sample Collection Time	Sample Description (grain size, color, and other remarks)	USCS Symbol	Comments
0-11"					
11-22"			very soft, dark grey-black, CLAY, plant matter	CL	
22-33"			soft, dark grey-black, CLAY, organic/plant matter	CL	
33-44"			soft, dark grey-dark greenish, CLAY	CL	
44-55"			soft, dark grey-black, CLAY, plant matter	CL	
55-66"			soft, dark grey, CLAY	CL	
66-77"			soft, dark grey, CLAY	CL	
77-88"			soft, dark grey, CLAY	CL	
88-99"			Firm/soft, dark grey, CLAY	CL	
99-108"			Firm, dark grey, CLAYEY SILT	CL	

Sample Type: W = Water; S = Soil

Site Name: OLIN-McIntosh, Alabama									
Location ID	SDCR-4	Date:	9/26/2009	Start Time:		☑	AM	☐	PM
				Finish Time:	11:30	☑	AM	☐	PM
Field Personnel:	F. Maylia/E. Guillen	Drillers:	Kevin Sondag/Jeff Clemens-Aqua Survey (ASI)						
Core Tube Diameter:	4-in	Core Tube Length:	9.5 ft	Recovered Core:	8.25 ft				

Sample Depth Interval (in)	Blow Counts	Sample Collection Time	Sample Description (grain size, color, and other remarks)	USCS Symbol	Comments
0-11"			very soft, dark grey, black, CLAY	CL	
11-22"			very soft, dark grey-black, CLAY	CL	
22-33"			soft, dark to light grey, CLAY	CL	
33-44"			soft, dark to light grey, CLAY, wood chip	CL	
44-55"			soft, dark grey to black, CLAY	CL	
55-66"			soft, dark grey to black, CLAY	CL	
66-77"			soft/firm, dark grey, CLAY	CL	
77-88"			soft/firm, dark grey, CLAY, plant matter	CL	
88-99"			soft/firm, dark grey, CLAY	CL	

Sample Type: W = Water; S = Soil

Site Name: OLIN-McIntosh, Alabama									
Location ID	SDCR-5	Date:	9/26/2009	Start Time:		☐ AM	☐ PM		
				Finish Time:	13:20	☐ AM	☐ PM		
Field Personnel:	F. Maylia/E. Guillen	Drillers:	Kevin Sondag/Jeff Clemens-Aqua Survey (ASI)						
Core Tube Diameter:	4-in	Core Tube Length:	9.5 ft	Recovered Core:	8.0 ft				

Sample Depth Interval (in)	Blow Counts	Sample Collection Time	Sample Description (grain size, color, and other remarks)	USCS Symbol	Comments
0-11"			very soft, black, CLAY, over 50% organic matter. layered	CL	
11-22"			very soft, black, CLAY, over 50% organic matter. interlayered	CL	
22-33"			soft, black, CLAY, over 50% organic matter. interlayered	CL	
33-44"			soft, black, CLAY	CL	
44-55"			soft, grey, CLAY	CL	
55-66"			soft, grey, CLAY, some organic matter, leaves-decomposed	CL	
66-77"			soft, grey, CLAY	CL	
7-88"			firm, grey, CLAY	CL	
88-99"			firm, grey, CLAY	CL	

Sample Type: W = Water; S = Soil

Site Name: OLIN-McIntosh, Alabama									
Location ID	SDCR-6	Date:	9/26/2009	Start Time:		☐	AM	☐	PM
				Finish Time:	14:10	☐	AM	☐	PM
Field Personnel:	F. Maylia/E. Guillen	Drillers:	Kevin Sondag/Jeff Clemens-Aqua Survey (ASI)						
Core Tube Diameter:	4-in	Core Tube Length:	9.5 ft	Recovered Core:	8.2 ft				

Sample Depth Interval (in)	Blow Counts	Sample Collection Time	Sample Description (grain size, color, and other remarks)	USCS Symbol	Comments
0-11"			very soft, black, CLAY, some plant matter-ocassional	CL	
11-22"			very soft, black, CLAY, with some plant matter-ocassional	CL	
22-33"			soft, dark grey, CLAY	CL	
33-44"			soft, dark grey, CLAY	CL	
44-55"			soft, dark grey, CLAY, some plant matter	CL	
55-66"			firm, dark grey-greenish, CLAY	CL	
66-77"			firm, dark grey-greenish, CLAY	CL	
77-88"			firm, dark grey-greenish, CLAY	CL	
88-98"			firm, dark grey-greenish, CLAY	CL	

Sample Type: W = Water; S = Soil

Site Name: OLIN-McIntosh, Alabama									
Location ID	SDCR-7	Date:	9/26/2009	Start Time:		☐ AM	☐ PM		
				Finish Time:	14:55	☐ AM	☐ PM		
Field Personnel:	F. Maylia/E. Guillen	Drillers:	Kevin Sondag/Jeff Clemens-Aqua Survey (ASI)						
Core Tube Diameter:	4-in	Core Tube Length:	9.5 ft	Recovered Core:	8.25 ft				

Sample Depth Interval (in)	Blow Counts	Sample Collection Time	Sample Description (grain size, color, and other remarks)	USCS Symbol	Comments
0-11"			very soft, dark + black, CLAY	CL	
11-22"			soft, dark grey , CLAY, w/ some plant matter	CL	
22-33"			soft, dark grey-greenish, CLAY	CL	
33-44"			soft, dark grey, CLAY	CL	
44-55"			soft, dark grey, CLAY	CL	
55-66"			soft, dark grey, CLAY, brownish spots	CL	
66-77"			soft, dark grey, CLAY	CL	
77-88"			soft, dark grey-greenish, CLAY	CL	
88-99"			soft, dark grey-greenish, CLAY	CL	

Sample Type: W = Water; S = Soil

Site Name: OLIN-McIntosh, Alabama							
ocation ID	SDCR-8	Date:	9/27/2009	Start Time:		☐ AM	☐ PM
				Finish Time:	14:35	☐ AM	☐ PM
Field Personnel:	F. Maylia/E. Guillen	Drillers:	Kevin Sondag/Jeff Clemens-Aqua Survey (ASI)				
Core Tube Diameter:	4-in	Core Tube Length:	11 ft	Recovered Core:	10.2 ft		

Sample Depth Interval (in)	Blow Counts	Sample Collection Time	Sample Description (grain size, color, and other remarks)	USCS Symbol	Comments
0-10"			very soft,black, CLAY	CL	
10-20"			very soft,black, CLAY, organic matter	CL	
20-30"			very soft,black, CLAY, organic matter	CL	
30-40"			very soft,black, CLAY, interlayered with organic matter	CL	
40-50"			very soft,black, CLAY, interlayered with organic matter	CL	
50-60"			very soft,grey, CLAY, some organic matter	CL	
60-70"			very soft,grey, CLAY	CL	
-80"			very soft,grey, CLAY	CL	
80-90"			very soft,grey, CLAY	CL	
90-100"			very soft,grey, CLAY	CL	
100-110"			very soft,grey, CLAY	CL	
110-120"			very soft,grey, CLAY	CL	

TE: Organic matter (black matter) is from the surface to approx. 5.5 ft.
Sample Type: W = Water; S = Soil

Site Name: OLIN-McIntosh, Alabama					
Location ID	SDCR-9	Date:	9/25/2009	Start Time:	☐ AM ☐ PM
				Finish Time: 15:30	☐ AM ☐ PM
Field Personnel:	F. Maylia/E. Guillen	Drillers:	Kevin Sondag/Jeff Clemens-Aqua Survey (ASI)		
Core Tube Diameter:	4-in	Core Tube Length:	6.5 ft	Recovered Core:	5.8 ft

Sample Depth Interval (in)	Blow Counts	Sample Collection Time	Sample Description (grain size, color, and other remarks)	USCS Symbol	Comments
0-11"			very soft, dark grey-black, CLAY, plant matter	CL	
11-22"			very soft, dark grey-black, CLAY, plant matter	CL	
22-33"			very soft, black, CLAY	CL	
33-44"			soft, black, CLAY	CL	
44-55"			soft, dark grey, CLAY	CL	
55-66"			soft, grey, CLAY	CL	
66-72"			soft, grey, CLAY	CL	

Sample Type: W = Water: S = Soil

Site Name: OLIN-McIntosh, Alabama									
Location ID	SDCR-10	Date:	9/26/2009	Start Time:	8:00	☐ AM	☐ PM		
				Finish Time:	9:30	☐ AM	☐ PM		
Field Personnel:	F. Maylia/E. Guillen	Drillers:	Kevin Sondag/Jeff Clemens-Aqua Survey (ASI)						
Core Tube Diameter:	4-in	Core Tube Length:	6.5 ft	Recovered Core:	5.7 ft				

Sample Depth Interval (in)	Blow Counts	Sample Collection Time	Sample Description (grain size, color, and other remarks)	USCS Symbol	Comments
0-11"			4" of mostly water (60%) and 40% silty clay	CL	
11-22"			soft, dark grey to black, CLAY, high organic matter	CL	
22-33"			soft, dark grey to black, CLAY, organic matter	CL	
33-44"			soft, dark grey + black, light brown spots, CLAY	CL	
44-55"			soft, dark grey, CLAY	CL	
55-66"			soft, grey, CLAY	CL	
66-72"			soft, grey, CLAY	CL	
			NOTE: smells like H_2S - Hydrogen Sulfide	CL	

Sample Type: W = Water; S = Soil

Site Name: OLIN-McIntosh, Alabama									
Location ID	SDCR-11	Date:	9/26/2009	Start Time:	9:40	☐	AM	☐	PM
				Finish Time:	10:10	☐	AM	☐	PM
Field Personnel:	F. Maylia/E. Guillen	Drillers:	Kevin Sondag/Jeff Clemens-Aqua Survey (ASI)						
Core Tube Diameter:	4-in	Core Tube Length:	6.5 ft	Recovered Core:	5.8 ft				

Sample Depth Interval (in)	Blow Counts	Sample Collection Time	Sample Description (grain size, color, and other remarks)	USCS Symbol	Comments
0-11"			soft, dark grey-black, CLAY, organic matter	CL	
11-22"			soft, dark grey-black, CLAY, organic matter	CL	
22-33"			soft, grey, CLAY, organic matter	CL	
33-44"			soft, dark grey, CLAY, organic matter, leaves	CL	
44-55"			soft, dark grey, CLAY, organic matter	CL	
55-66"			soft, dark grey, CLAY, organic matter	CL	
66-72"			soft, dark grey, CLAY, organic matter	CL	

Sample Type: W = Water; S = Soil

Site Name: OLIN-McIntosh, Alabama									
Location ID	SDCR-12	Date:	9/25/2009	Start Time:	13:25	☐ AM	☐ PM		
				Finish Time:	14:15	☐ AM	☐ PM		
Field Personnel:	F. Maylia/E. Guillen	Drillers:	Kevin Sondag/Jeff Clemens-Aqua Survey (ASI)						
Core Tube Diameter:	4-in	Core Tube Length:	6.5 ft	Recovered Core:	5.75 ft				

Sample Depth Interval (in)	Blow Counts	Sample Collection Time	Sample Description (grain size, color, and other remarks)	USCS Symbol	Comments
0-11"			very soft, dark grey, CLAY, w/ some wood debris	CL	
11-22"			very soft, dark black, CLAY, plant matter, wood chips	CL	
22-33"			very soft, dark grey-black CLAY	CL	
33-44"			very soft, dark grey to black CLAY, plant matter	CL	
44-55"			soft, dark grey CLAY	CL	
55-66"			very soft, dark grey CLAY	CL	
66-72"			very soft, dark grey CLAY	CL	

Sample Type: W = Water; S = Soil

Site Name: OLIN-McIntosh, Alabama									
Location ID	SDCR-13	Date:	9/25/2009	Start Time:	14:25	☐ AM	☐ PM		
				Finish Time:	14:45	☐ AM	☐ PM		
Field Personnel:	F. Maylia/E. Guillen	Drillers:	Kevin Sondag/Jeff Clemens-Aqua Survey (ASI)						
Core Tube Diameter:	4-in	Core Tube Length:	6.5 ft	Recovered Core:	6 ft				

Sample Depth Interval (in)	Blow Counts	Sample Collection Time	Sample Description (grain size, color, and other remarks)	USCS Symbol	Comments
0-11"			very soft, dark grey, CLAY, some plant matter	CL	
11-22"			soft, dark grey, CLAY, some plant matter	CL	
22-33"			soft, dark grey, CLAY	CL	
33-44"			soft, dark grey-black, CLAY, some plant matter	CL	
44-55"			soft, dark grey-black, CLAY, some plant matter	CL	
55-66"			soft, dark grey-black, CLAY	CL	
66-72"			soft, dark grey, CLAY	CL	

NOTE: Organic matter (black matter) is from the surface to approx. 5.5 ft.
Sample Type: W = Water; S = Soil

APPENDIX C

GROUNDWATER FIELD SAMPLING LOG

FIELD SAMPLING REPORT

PROJECT NO: 6100080536

MACTEC ENGINEERING AND CONSULTING, INC.
3200 TOWN POINT DRIVE, SUITE 100 KENNESAW GA 30144
PHONE: (770) 421-3400 / FAX: (770) 421-3486

WELL ID: BAMW1A DEPTH TO PRODUCT: NA DATE: 9/30/08

SAMPLE METHOD: peristaltic pump TIME: 0906

DUP./REP. OF: _____ DEPTH TO WATER: 27.88 GRAB (X) COMPOSITE ( )

TOTAL DEPTH: 30.88 3.00

PURGE VOLUME: 0.12 x 3 = 0.36 gal.

[0.163 x water column height (ft) x 3 (well volumes) for 2" wells]

1" = 0.04 gal/ft

TIME	VOL. PURGED (gal)	pH	TEMP (°C)	SPEC. COND. (ms/cm)	ORP (mV)	TURB. (NTU)	DO (mg/L)	Pump Rate ml/min. (& pump setting)	New Water Level
Initial: 0922		4.96	21.19	0.122	220.0	—	1.93	25. (rpd)	[illegible]
0932	0.25	4.98	21.48	0.127	207.7	out of range	1.79		
0944	0.3	5.02	21.93	0.132	194.2	—	1.97	empty chamber	
1008	0.35	5.08	22.70	0.141	174.5	228	3.10	20	30.48
1014	Turned pump off to let well recharge								
1045	decision from Mgmt (C. Drago & K Roberts) not to sample								
	because well yield was too low to meet quality								
	purging & sampling standards.								

Low Flow Stability Criteria: pH = ± 0.1 ORP = ± 10mV Sp. Cond = ± 3% DO = ± 10% Turb. < 10 NTU

COMMENTS: * Very slow recharge rate pump is 0.4ft from bottom of well
Due to poor recharge + 3ft initial water column

YSI: 12614 Lamotte 2020: 04168

CONTAINER SIZE/TYPE	NO.	PRESERVATIVE	ANALYTICAL METHOD	ANALYSIS
2-500mL	glass	None	1631	LL Hg (total & dissolved)

GENERAL INFORMATION	
WEATHER:	Sunny, Clear, ~70°
SHIPPED VIA:	FedEx
SHIPPED TO:	Battelle
SAMPLER: DHoward MRottenberg	OBSERVER: ~~MRottenberg~~ EBlomberg

FIELD SAMPLING REPORT

PROJECT NO: 6100080086

MACTEC ENGINEERING AND CONSULTING, INC.
3200 TOWN POINT DRIVE, SUITE 100 KENNESAW GA 30144
PHONE: (770) 421-3400 / FAX: (770) 421-3486

WELL ID: BAMW2B DEPTH TO PRODUCT: NA DATE: 9/29/08

SAMPLE METHOD: peristaltic pump TIME: 1539

DUP./REP. OF: _____ DEPTH TO WATER: 28.76 GRAB (X) COMPOSITE ( )

TOTAL DEPTH: 47.34 18.58

PURGE VOLUME: 0.74 x 3 = 2.2 gal

[0.163 x water column height (ft) x 3 (well volumes) for 2" wells]

1" = 0.04 gal/ft

TIME	VOL. PURGED (gal)	pH	TEMP (°C)	SPEC. COND. (ms/cm)c	ORP (mV)	TURB. (NTU)	DO (mg/L)	ml/min Pump Rate ml/min. (& pump setting)	ft New Water Level
Initial: 1545		4.56	22.17	0.271	155.7	40	2.01	250 (NL)	28.90
1555	0.75	4.28	21.03	0.287	178.0	4.9	1.70	250	28.89
1605	1.5	4.30	20.97	0.295	178.6	2.6	1.58	210	28.88
1615	2.0 gal mb	4.32	20.88	0.300	180.0	1.1	1.61	210	28.88
1625	2.5	4.34	20.85	0.302	178.5	1.1	1.58	220	28.89

Low Flow Stability Critera: pH = ± 0.1 ORP = ± 10mV Sp. Cond = ± 3% DO = ± 10% Turb. < 10 NTU

COMMENTS: Sample time 1632

CONTAINER SIZE/TYPE	NO.	PRESERVATIVE	ANALYTICAL METHOD	ANALYSIS
2-500mL		—	1631	LL Hg

GENERAL INFORMATION			
WEATHER:	partly cloudy upper 80's		
SHIPPED VIA:	FedEx		
SHIPPED TO:	Battelle		
SAMPLER:	MRottenberg	OBSERVER:	D. Howard, EBlomberg, AKennedy

FIELD SAMPLING REPORT

PROJECT NO: 6100080036

MACTEC ENGINEERING AND CONSULTING, INC.
3200 TOWN POINT DRIVE, SUITE 100 KENNESAW GA 30144
PHONE: (770) 421-3400 / FAX: (770) 421-3486

WELL ID: BAMW1C DEPTH TO PRODUCT: NA DATE: 9/30/08

SAMPLE METHOD: peristaltic pump TIME: 0919

DUP./REP. OF: _____ DEPTH TO WATER: 28.11 GRAB (X) COMPOSITE ( )

TOTAL DEPTH: 67.36 39.25

PURGE VOLUME: 1.57 x 3 = 4.71 gal

[0.163 x water column height (ft) x 3 (well volumes) for 2" wells]

1" = 0.04 gal / ft

TIME	VOL. PURGED (gal)	pH	TEMP (°C)	SPEC. COND. (ms/cm)	ORP (mV)	TURB. (NTU)	DO (mg/L)	Pump Rate ml/min. (& pump setting)	New Water Level
Initial: 0927		4.48	20.52	3.603	242.6	18	1.25	220 (ml)	
0937	0.5	4.56	20.28	3.805	223.7	2.9	0.95	220	28.25
0950	1.5	4.51	20.30	3.886	211.0	0.56	1.02	220	28.25
1000	2.25	4.54	20.43	3.909	199.8	1.5	0.88	210	28.25
1010	3.00	4.68	20.48	3.920	190.0	1.3	0.88	200	28.25
1020	3.5	4.70	20.61	3.928	166.8	1.4	1.05	200	28.25
1030	4.0	4.65	20.54	3.931	169.2	1.6	0.92	200	28.26
1040	4.5	4.93	20.76	3.934	143.9	1.1	0.88	200	28.25
1050	5.0	4.61	20.80	3.937	151.9	1.0	0.85	200	28.26
1055	5.25	4.61	20.82	3.937	153.2	1.1	0.85	200	28.27
1100	5.50	4.64	20.92	3.937	151.1	1.3	0.86	200	28.26

Low Flow Stability Critera: pH = ± 0.1 ORP = ± 10mV Sp. Cond = ± 3% DO = ± 10%. Turb. < 10 NTU

COMMENTS: Sample time 1115

YSI ID: 12642 Lamotte ID: 03166

CONTAINER SIZE/TYPE	NO.	PRESERVATIVE	ANALYTICAL METHOD	ANALYSIS
2-500 ml	glass	—	1631	LL Hg (total + dissolved)

GENERAL INFORMATION			
WEATHER:	sunny, clear mid-60's		
SHIPPED VIA:	FedEx		
SHIPPED TO:	Battelle		
SAMPLER: D Howard, M Rothberg		OBSERVER: E Blomberg	

FIELD SAMPLING REPORT

PROJECT NO: _____

MACTEC ENGINEERING AND CONSULTING, INC.
3200 TOWN POINT DRIVE, SUITE 100 KENNESAW GA 30144
PHONE: (770) 421-3400 / FAX: (770) 421-3486

WELL ID: BAMW2B DEPTH TO PRODUCT: NA DATE: 9/22/08

SAMPLE METHOD: Peristaltic TIME: 1020

DUP./REP. OF: _____ DEPTH TO WATER: ~~14.6~~ 11.3 GRAB (X) COMPOSITE ( )

TOTAL DEPTH: 25.92 = 14.62

PURGE VOLUME: 0.6 x 3 = 1.8

[0.163 x water column height (ft) x 3 (well volumes) for 2" wells]

1 inch ~~1FT~~ pipe 0.04 gallons for 1" well

TIME	VOL. PURGED (gal)	pH	TEMP (°C)	SPEC. COND. (ms/cm)	ORP (mV)	TURB. (NTU)	DO (mg/L)	Pump Rate ml/min. (& pump setting)	New Water Level
Initial: 1028		6.37	24.40	4.261	-117.5	24.1	1.14	200 ( )	
1038	0.75	6.35	23.28	5.142	-120.0	8.56	~~10~~ 0.87	150	12.62
1047	1.5	6.33	23.38	5.313	-117.1	5.27	0.82	180	12.75
1055	2.0	6.34	23.56	5.109	-117.4	5.52	0.88	150	12.60
1103	2.25	6.34	23.23	5.244	-120.4	6.28	0.98	150	12.63
1109	2.50	6.34	23.44	5.221	-114.1	8.28	0.96	150	12.54
1117	2.75	6.35	24.08	5.177	-113.0	4.63	0.76	150	12.64
1126	3.00	6.33	24.21	5.202	-107.0	5.64	~~1.7~~ 0.94	150	12.50
1135	3.25	6.33	24.00	5.242	-109.2	7.83	~~8.9~~ 0.84	150	12.64
1144	3.50	6.33	23.21	5.188	-110.0	5.15	0.90	150	12.60

Low Flow Stability Critera: pH = ± 0.1 ORP = ± 10mV Sp. Cond = ± 3% DO = ± 10% Turb. < 10 NTU

COMMENTS: YSI ID: 12644 Water level meter 145781
LaMotte 2020 ID: 01468
Sample time 1210

CONTAINER SIZE/TYPE	NO.	PRESERVATIVE	ANALYTICAL METHOD	ANALYSIS
500ml glass	2	None	1631	LL Hg (total + dissolved)
1L Amber	2	none	8081, 8270	DDT_s, HCB

GENERAL INFORMATION	
WEATHER:	Clear + Sunny
SHIPPED VIA:	Fed Ex
SHIPPED TO:	
SAMPLER: D Howard	OBSERVER: M Rothenberg, A Kennedy (OWA), L. George (EPA)

FIELD SAMPLING REPORT

PROJECT NO: _____

MACTEC ENGINEERING AND CONSULTING, INC.
3200 TOWN POINT DRIVE, SUITE 100 KENNESAW GA 30144
PHONE: (770) 421-3400 / FAX: (770) 421-3486

WELL ID: BAMW2C DEPTH TO PRODUCT: NA DATE: 9/23/08

SAMPLE METHOD: Peristaltic Pump TIME: 1445

DUP./REP. OF: _____ DEPTH TO WATER: 10.45 = GRAB (X) COMPOSITE ( )

TOTAL DEPTH: 46.64 = 36.19

PURGE VOLUME: 1.45 gal x 3 = ~~3.35~~ 4.35 gal

[0.163 x water column height (ft) x 3 (well volumes) for 2" wells]

1 inch pipe 0.04 gal per 1 Ft

TIME	VOL. PURGED (gal)	pH	TEMP (°C)	SPEC. COND. (ms/cm)	ORP (mV)	TURB. (NTU)	DO (mg/L)	Pump Rate ml/min. (& pump setting)	New Water Level
Initial: 1453		4.74	23.92	2.996	178.4	13.2	0.75	240 ( )	
1503	0.5	4.47	23.98	3.174	206.1	3.11	0.76	200	10.80
1513	1.0	4.48	23.62	3.197	206.8	1.46	0.79	200	10.85
1523	1.5	4.51	23.48	3.190	209.5	0.77	0.99	200	10.84
1533	2.0	4.49	23.76	3.181	202.6	0.81	0.87	200	10.85
1543	2.5	4.49	23.18	3.158	201.6	0.73	0.79	200	10.85
1553	3.0	4.48	23.88	3.131	207.0	0.50	0.76	200	10.80
1603	3.5	4.52	23.70	3.111	216.7	0.65	1.03	200	10.80
1613	4.0	4.51	22.82	3.088	214.6	0.69	0.89	200	10.88
1623	4.5	4.50	23.24	3.050	220.5	0.39	0.83	200	10.80
1628	4.75	4.49	22.94	3.046	223.3	0.67	0.81	200	10.80

Low Flow Stability Critera: pH = ± 0.1 ORP = ± 10mV Sp. Cond = ± 3% DO = ± 10% Turb. < 10 NTU

COMMENTS: YSI ID: 12644 Water level meter ID: 49882
LaMotte 2020 ID: 01468
Sample time 1700. Duplicate sample collected

CONTAINER SIZE/TYPE	NO.	PRESERVATIVE	ANALYTICAL METHOD	ANALYSIS
1 L Amber		none	8081	PCB's
1 L Amber		"	8270	PAH
2-500ml Plas		none	1631	1L Hg total + dissolved

GENERAL INFORMATION

WEATHER:	clear + sunny
SHIPPED VIA:	Fed Ex
SHIPPED TO:	
SAMPLER: D Howard	OBSERVER:

FIELD SAMPLING REPORT

PROJECT NO: 60000800361208.FW

P. 1 of 2

MACTEC ENGINEERING AND CONSULTING, INC.
3200 TOWN POINT DRIVE, SUITE 100 KENNESAW GA 30144
PHONE: (770) 421-3400 / FAX: (770) 421-3486

WELL ID: BAMW3B DEPTH TO PRODUCT: _____ DATE: 9/24/08 & 9/25/08

SAMPLE METHOD: Peristaltic Pump TIME: 0930

DUP./REP. OF: _____ DEPTH TO WATER: 11.21 GRAB (X) COMPOSITE ( )

TOTAL DEPTH: 25.94 = 14.73

PURGE VOLUME: 0.6 gal x 3 = 1.8 gal

[0.163 x water column height (ft) x 3 (well volumes) for 2" wells]

1 inch pipe = 0.04 gal per 1Ft

TIME	VOL. PURGED (gal)	pH	TEMP (°C)	SPEC. COND.[c] (ms/cm)	ORP (mV)	TURB. (NTU)	DO (mg/L)	Pump Rate ml/min. (& pump setting)	New Water Level
Initial: 0936		6.58	23.53	2.093	-120.0	28.2	0.98	200 ( )	
0947	0.5	6.60	23.54	2.171	-121.4	2.97	0.98	200	16.39
0957	1.0	6.69	23.43	2.145	-111.8	1.68	1.12	200	16.48
1007	1.5	6.70	23.83	2.047	-114.2	1.75	0.98	200	16.56
1017	2.0	6.69	23.64	2.074	-118.1	—	0.88	—	20.98
1028	2.25	6.69	24.70	2.121	-115.0	33.5	1.06	—	22.8
1225	2.50	6.56	24.35	1.927	-107.1	23.9	1.13	140	22.0
Crew to allow well to recharge over night & commence 9/25/08									
0915 9/25/08	Initial water level							→	13.17
0933	0.25	6.53	22.27	1.850	-128.4	15.9	1.02	150.0	15.70
0943	~~0.5~~ 0.5	6.55	22.67	1.877	-113.3	~~10:52~~ 10:47	0.74	150.0	16.52
0953	0.75	6.56	22.84	1.845	-97.0	4.58	0.75	150.0	18.55
1004	1.0	6.55	22.90	1.959	-89.9	6.71	0.75	150.0	21.36
1012	Ceased purging - crew to allow well to recharge →								22.25
1215	water level check							→	17.4

Low Flow Stability Critera: pH = ± 0.1 ORP = ± 10mV Sp. Cond = ± 3% DO = ± 10% Turb. < 10 NTU

COMMENTS: YSI ID: 12644 Water meter ID: 49882
Lamotte 2020: 04168
Stopped pump at 1028 due to low water level
1215 restarted purging water level 17.8
1230 Stopped pump due to low water level
9/25/08 restart purge (1.5 gal) then sample per Ugut team.

CONTAINER SIZE/TYPE	NO.	PRESERVATIVE	ANALYTICAL METHOD	ANALYSIS
~~1 L glass Amber~~		NONE	8081A	DDTs (2,4'+4,4' DDD, DDE, DDT) ~~water~~
1 L glas Amber		NONE	8081A	HCB Method 8270
500 mL glass		NONE	1631	LL Hg total
500 mL glass		NONE	1631	LL Hg dissolved - not field filtered

GENERAL INFORMATION			
WEATHER:	clear + sunny temp ~ 50°F		
SHIPPED VIA:	Fed Ex		
SHIPPED TO:	Battelle + Parc		
SAMPLER: D Howard		OBSERVER: MRottenberg	

P. 2 of 2

FIELD SAMPLING REPORT

PROJECT NO: 60000D00361 2008, GW

MACTEC ENGINEERING AND CONSULTING, INC.
3200 TOWN POINT DRIVE, SUITE 100 KENNESAW GA 30144
PHONE: (770) 421-3400 / FAX: (770) 421-3486

WELL ID: BAMW 3B DEPTH TO PRODUCT: N/A DATE: 9/25/08

SAMPLE METHOD: Peristaltic Pump TIME: 1625

DUP./REP. OF: _____ DEPTH TO WATER: 11.21 GRAB ( ) COMPOSITE ( )

TOTAL DEPTH: 25.94 - 14.73

PURGE VOLUME: 0.6 gal x 3 = 1.8 gal

~~[0.163 x water column height (ft) x 3 (well volumes) for 2" wells]~~

1 inch pipe = 0.04 gal/ft

TIME	VOL. PURGED (gal)	pH	TEMP (°C)	SPEC. COND. (ms/cm)	ORP (mV)	TURB. (NTU)	DO (mg/L)	Pump Rate ml/min. (& pump setting)	New Water Level
Initial:								( )	
1330	water level check							→	16.8
1615	water level check							→	16.4
crew sample & read turbidity									
1627						13.1			
1629						9.98			
1648	end of sampling					19.9			23.47

Low Flow Stability Critera: pH = ± 0.1 ORP = ± 10mV Sp. Cond = ± 3% DO = ± 10% Turb. < 10 NTU

COMMENTS: Sample time 1630

CONTAINER SIZE/TYPE	NO.	PRESERVATIVE	ANALYTICAL METHOD	ANALYSIS
		See p.1		

GENERAL INFORMATION	
WEATHER:	
SHIPPED VIA:	See p.1
SHIPPED TO:	
SAMPLER:	OBSERVER:

FIELD SAMPLING REPORT

PROJECT NO: 6100080036/2008 GW

MACTEC ENGINEERING AND CONSULTING, INC.
3200 TOWN POINT DRIVE, SUITE 100 KENNESAW GA 30144
PHONE: (770) 421-3400 / FAX: (770) 421-3486

WELL ID: BAMW3C DEPTH TO PRODUCT: _____ DATE: 9/24/08

SAMPLE METHOD: Peristaltic Pump TIME: 0935

DUP./REP. OF: _____ DEPTH TO WATER: 11.33 GRAB (X) COMPOSITE ( )

TOTAL DEPTH: 44.37 - 33.04

PURGE VOLUME: 1.32 gal x 3 = 4 gal

[0.163 x water column height (ft) x 3 (well volumes) for 2" wells]

1 inch pipe = 0.04 gal per 1 Ft.

TIME	VOL. PURGED (gal)	pH	TEMP (°C)	SPEC. COND. (ms/cm)	ORP (mV)	TURB. (NTU)	DO (mg/L)	Pump Rate ml/min. (& pump setting)	New Water Level
Initial: 0940		6.84	21.87	1.927	-142.2	41.6	0.65	250 ( )	
0950	0.5	6.81	21.80	2.174	-131.9	5.70	0.40	280	12.02
1000	1.25	6.77	21.61	2.219	-139.8	3.74	0.36	260	12.01
1010	2.25	6.82	21.78	2.212	-156.6	3.59	0.51	260	12.00
1030	3.0	6.81	21.86	2.218	-140.2	7.57	0.41	280	~~12.00~~ 11.99
1033	4.0	6.79	21.87	2.221	-134.2	5.47	0.37	260	11.99
1040	4.25	6.80	21.81	2.222	-144.2	1.30	0.37	280	11.99
1045	4.5	6.81	21.74	2.224	-142.0	1.15	0.36	260	11.98
1050	4.75	6.80	21.83	2.219	-136.0	1.40	0.32	260	11.98
1055	5.0	6.80	21.86	2.217	-139.0	1.74	0.40	260	11.97
1100	5.25	6.80	21.91	2.218	-145.4	1.35	0.38	260	11.96

Low Flow Stability Critera: pH = ± 0.1 ORP = ± 10mV Sp. Cond = ± 3% DO = ± 10% Turb. < 10 NTU

COMMENTS: YSI ID: 12642 Water meter ID: 45781
Lamotte 2020i: 05678
Sample time 1125

CONTAINER SIZE/TYPE	NO.	PRESERVATIVE	ANALYTICAL METHOD	ANALYSIS
500ml glass	2	none	1631	Lt Hg (total + dissolved)
1L Amber	1	none	8081	DDTr
1L Amber	1	none	8270	HCB

GENERAL INFORMATION	
WEATHER:	clear & sunny ~75°F
SHIPPED VIA:	FedEx
SHIPPED TO:	
SAMPLER: D Howard	OBSERVER: MRottenberg

FIELD SAMPLING REPORT

PROJECT NO: 6010008OO36/2008.GW

MACTEC ENGINEERING AND CONSULTING, INC.
3200 TOWN POINT DRIVE, SUITE 100 KENNESAW GA 30144
PHONE: (770) 421-3400 / FAX: (770) 421-3486

WELL ID: BAMW4B DEPTH TO PRODUCT: NA DATE: 9/25/08

SAMPLE METHOD: peristaltic pump TIME: 0953

DUP./REP. OF: _____ DEPTH TO WATER: 11.56 GRAB (X) COMPOSITE ( )

TOTAL DEPTH: 28.68 17.12

PURGE VOLUME: 0.68 x 3 = 2.0

~~[0.163 x water column height (ft) x 3 (well volumes) for 2" wells]~~

1 inch well = 0.04 gal / foot

TIME	VOL. PURGED (gal)	pH	TEMP (°C)	SPEC. COND. (ms/cm)	ORP (mV)	TURB. (NTU)	DO (mg/L)	Pump Rate ml/min. (& pump setting)	New Water Level
Initial: 1058		6.61	22.97	1.331	-133.9	20.6	0.76	220 ( )	12.25
1108	0.5	6.64	22.69	1.307	-140.3	18.9	0.31	240	12.24
1118	1.0	6.64	22.61	1.286	-152.7	9.38	0.34	240	12.23
1033	1.5	6.67	22.69	1.255	-127.3	4.14	0.54	220	12.21
1143	2.0	6.66	22.69	1.253	-151.1	8.31	0.48	240	12.20
1148	2.25	6.66	22.65	1.249	-146.1	7.99	0.46	240	12.19
1158	3.0	6.67	22.68	1.232	-130.6	7.80	0.53	240	12.17
1204	3.25	6.65	22.67	1.230	-130.8	5.50	0.51	240	12.16
1209	3.50	6.64	22.56	1.230	-133.2	4.24	0.48	240	12.16

Low Flow Stability Critera: pH = ± 0.1 ORP = ± 10mV Sp. Cond = ± 3% DO = ± 10% Turb. < 10 NTU

COMMENTS: Sample time 1215

CONTAINER SIZE/TYPE	NO.	PRESERVATIVE	ANALYTICAL METHOD	ANALYSIS
1 L glass Amber		None	8270	HCB
1 L glass Amber		None	8081	DDT,
500 ml glass		none	1631	LL Hg (total)
500 ml glass		none	1631	LL Hg (dissolved)

GENERAL INFORMATION		
WEATHER:	Clear Sunny ~73°F	
SHIPPED VIA:	FedEx	
SHIPPED TO:		
SAMPLER: MBR/DLH	OBSERVER:	

FIELD SAMPLING REPORT

PROJECT NO: _____

MACTEC ENGINEERING AND CONSULTING, INC.
3200 TOWN POINT DRIVE, SUITE 100 KENNESAW GA 30144
PHONE: (770) 421-3400 / FAX: (770) 421-3486

WELL ID: BAMW4C DEPTH TO PRODUCT: NA DATE: 9/24/08

SAMPLE METHOD: Peristaltic Pump TIME: 1340

DUP./REP. OF: _____ DEPTH TO WATER: 11.43 GRAB (X) COMPOSITE ( )

TOTAL DEPTH: ~~43.16~~ 42.40 = 30.97

PURGE VOLUME: 1.24 gal X 3 = 3.72 gal

[0.163 x water column height (ft) x 3 (well volumes) for 2" wells]

1" pipe = 0.04 gal per 1Ft

TIME	VOL. PURGED (gal)	pH	TEMP (°C)	SPEC. COND. (ms/cm)	ORP (mV)	TURB. (NTU)	DO (mg/L)	Pump Rate ml/min. (& pump setting)	New Water Level
Initial: 1346		6.62	23.99	1.258	-136.3	9.85	0.66	230 (ml)	
1356	0.5	6.60	23.65	1.222	-136.6	4.30	0.25	230	11.86
1406	1.0	6.51	23.72	1.217	-130.3	3.24	0.27	250	11.85
1416	1.5	6.60	23.69	1.203	-125.8	2.99	0.39	250	11.86
1426	2.0	6.51	23.66	1.212	-128.1	3.17	0.37	250	11.85
1436	2.5	6.54	23.51	1.208	-119.3	3.27	0.35	230	11.85
1446	3.0	6.55	23.45	1.207	-115.0	3.27	0.50	250	11.85
1456	3.5	6.50	23.68	1.222	-118.4	3.34	0.39	250	11.84
1502	3.75	6.51	23.39	1.224	-115.9	4.05	0.37	250	11.84
1507	4.0	6.55	23.62	1.212	-110.3	3.54	0.38	230	11.83

Low Flow Stability Critera: pH = ± 0.1 ORP = ± 10mV Sp. Cond = ± 3% DO = ± 10% Turb. < 10 NTU

COMMENTS: collected MS/MSD
Sample time 1600

CONTAINER SIZE/TYPE	NO.	PRESERVATIVE	ANALYTICAL METHOD	ANALYSIS
500 ml glass	4	none	1631	LL Hg (total & dissolved)
1L amber	2	none	8081	DDTr
1L amber	2	none	8270	HCB

GENERAL INFORMATION	
WEATHER:	Sunny temp ~ 85°F
SHIPPED VIA:	Fed Ex
SHIPPED TO:	
SAMPLER: D Howard	OBSERVER:

FIELD SAMPLING REPORT

PROJECT NO: _____

MACTEC ENGINEERING AND CONSULTING, INC.
3200 TOWN POINT DRIVE, SUITE 100 KENNESAW GA 30144
PHONE: (770) 421-3400 / FAX: (770) 421-3486

WELL ID: BAMW5B DEPTH TO PRODUCT: NA DATE: 9/25/08

SAMPLE METHOD: Peristaltic Pump TIME: 1424

DUP./REP. OF: _____ DEPTH TO WATER: 11.71 GRAB (X) COMPOSITE ( )

TOTAL DEPTH: 27.28 = 15.57

PURGE VOLUME: 0.62 gal x 3 = 1.86

[0.163 x water column height (ft) x 3 (well volumes) for 2" wells]

1" well = 0.04 gal/Ft

TIME	VOL. PURGED (gal)	pH	TEMP (°C)	SPEC. COND. (ms/cm)	ORP (mV)	TURB. (NTU)	DO (mg/L)	Pump Rate ml/min. (& pump setting)	New Water Level
Initial: 1430	[illegible]	6.69	23.01	1.235	-144.9	11.4	0.48	240 (ml)	[illegible]
1440 ~~1430~~	0.5	6.69	22.57	1.221	-138.9	4.0	0.48	240	12.11
1450	1.0	6.68	23.65	1.199	-144.2	3.77	0.52	240	12.11
1500	1.5	6.68	22.49	1.188	-146.5	4.42	0.48	240	12.13
1510	2.0	6.69	22.44	1.167	-144.2	3.27	0.45	240	12.12
1520	2.5	6.70	22.56	1.154	-147.2	3.45	0.46	240	12.12
1525	2.75	6.70	22.82	1.147	-144.1	3.56	0.52	240	12.13
1530	3.00	6.71	23.02	1.140	-150.9	3.37	0.50	240	12.14
1535	3.25	6.71	22.97	1.137	-142.6	3.53	0.50	240	12.15

12.1 ~~12.7~~ DW

Low Flow Stability Critera: pH = ± 0.1 ORP = ± 10mV Sp. Cond = ± 3% DO = ± 10% Turb. < 10 NTU

COMMENTS: Sample time 1540

CONTAINER SIZE/TYPE	NO.	PRESERVATIVE	ANALYTICAL METHOD	ANALYSIS
500 mL glass	2	none	1631	LL Hg
1L glass	1	none	8270	HLR

GENERAL INFORMATION			
WEATHER:	clear & sunny		
SHIPPED VIA:	FedEx		
SHIPPED TO:			
SAMPLER: DHoward		OBSERVER: MRothenberg	

FIELD SAMPLING REPORT

PROJECT NO: _____

MACTEC ENGINEERING AND CONSULTING, INC.
3200 TOWN POINT DRIVE, SUITE 100 KENNESAW GA 30144
PHONE: (770) 421-3400 / FAX: (770) 421-3486

WELL ID: BAMW5C DEPTH TO PRODUCT: _____ DATE: 9/26/08

SAMPLE METHOD: Peristaltic Pump TIME: 0937

DUP./REP. OF: _____ DEPTH TO WATER: 11.35 GRAB (X) COMPOSITE ( )

TOTAL DEPTH: 38.47 = 27.12

PURGE VOLUME: 1.1 x 3 = 3.3

[0.163 x water column height (ft) x 3 (well volumes) for 2" wells]

1" well = 0.04 gal/Ft

TIME	VOL. PURGED (gal)	pH	TEMP (°C)	SPEC. COND. (ms/cm)	ORP (mV)	TURB. (NTU)	DO (mg/L)	Pump Rate ml/min. (& pump setting)	New Water Level
Initial: 0942		6.87	21.29	0.947	-146.4	111	0.68	200 (ml)	12.3
0952	0.5	6.91	21.00	0.953	-155.0	20.5	0.36	220	12.29
1002	1.0	6.89	20.97	0.957	-165.9	12.8	0.36	220	12.28
1012	1.5	6.89	20.98	0.957	-166.4	6.69	0.26	220	12.26
1022	2.0	6.89	21.08	0.961	-155.0	7.27	0.25	230	12.24
1032	2.5	6.88	21.18	0.962	-148.6	6.30	0.27	230	12.22
1042	3.0	6.89	21.22	0.964	-150.7	5.21	0.24	230	12.21
1052	3.5	6.88	21.26	0.963	-151.4	6.19	0.24	230	12.19

Low Flow Stability Critera: pH = ± 0.1 ORP = ± 10mV Sp. Cond = ± 3% DO = ± 10% Turb. < 10 NTU

COMMENTS: Sample time 1105

CONTAINER SIZE/TYPE	NO.	PRESERVATIVE	ANALYTICAL METHOD	ANALYSIS
2-500ML Glass		—	8081	LLHS
1L Amber			8270	HCB

GENERAL INFORMATION			
WEATHER:	Clear & Sunny Temp ~ 70°F		
SHIPPED VIA:	Fed Ex		
SHIPPED TO:			
SAMPLER: D Howard		OBSERVER:	M Rottenberg

FIELD SAMPLING REPORT

PROJECT NO: _____

MACTEC ENGINEERING AND CONSULTING, INC.
3200 TOWN POINT DRIVE, SUITE 100 KENNESAW GA 30144
PHONE: (770) 421-3400 / FAX: (770) 421-3486

WELL ID: BAMWGB DEPTH TO PRODUCT: _____ DATE: 9/26/08

SAMPLE METHOD: Peristaltic Pump TIME: 1244

DUP./REP. OF: _____ DEPTH TO WATER: 11.28 GRAB (X) COMPOSITE ( )

TOTAL DEPTH: 26.87 = 15.59

PURGE VOLUME: 0.62 x 3 = 1.9

[0.163 x water column height (ft) x 3 (well volumes) for 2" wells]

1" well = 0.04 gal/Ft

TIME	VOL. PURGED (gal)	pH	TEMP (°C)	SPEC. COND. (ms/cm)	ORP (mV)	TURB. (NTU)	DO (mg/L)	Pump Rate ml/min. (& pump setting)	11.79 New Water Level
Initial: 1250		6.59	22.00	1.088	-79.9	13.5	0.74	180 (ml)	
1300	0.5	6.63	22.27	1.083	-104.9	6.84	0.68	200	11.77
1310	1.0	6.65	22.13	1.081	-109.5	4.92	0.61	200	11.77
1320	1.5	6.66	22.06	1.081	-113.2	4.27	0.49	200	11.76
1330	2.0	6.68	22.17	1.085	-116.7	4.24	0.47	200	11.75
1335	2.25	6.69	22.07	1.089	-118.5	3.83	0.50	200	11.74

Low Flow Stability Critera: pH = ± 0.1 ORP = ± 10mV Sp. Cond = ± 3% DO = ± 10% Turb. < 10 NTU

COMMENTS: Sample Time 1352

CONTAINER SIZE/TYPE	NO.	PRESERVATIVE	ANALYTICAL METHOD	ANALYSIS
250 ml	—			Hg

GENERAL INFORMATION	
WEATHER:	
SHIPPED VIA:	
SHIPPED TO:	
SAMPLER: DHoward	OBSERVER: MRottenberg

FIELD SAMPLING REPORT

PROJECT NO: 1619080036

MACTEC ENGINEERING AND CONSULTING, INC.
3200 TOWN POINT DRIVE, SUITE 100 KENNESAW GA 30144
PHONE: (770) 421-3400 / FAX: (770) 421-3486

WELL ID: BAMW6C DEPTH TO PRODUCT: NA DATE: ~~6/7~~ mb. 9/26/08

SAMPLE METHOD: peristaltic pump TIME: 1233

DUP./REP. OF: _____ DEPTH TO WATER: 11.45 GRAB (X) COMPOSITE ( )

TOTAL DEPTH: 46.40 - 34.95

PURGE VOLUME: 1.4 x 3 = 4.2 gal.

~~[0.163 x water column height (ft) x 3 (well volumes) for 2" wells]~~

1" well 0.04 gal/ft

TIME	VOL. PURGED (gal)	pH	TEMP (°C)	SPEC. COND. (ms/cm)	ORP (mV)	TURB. (NTU)	DO (mg/L)	Pump Rate ml/min. (& pump setting)	New Water Level
Initial: 1249		6.85	22.19	1.127	-145.6	20.4	0.37	200 ( )	1498
1300	1.0	6.84	22.35	1.129	-151.2	16.0	0.29	200	11.94
1310	2.0	6.85	22.64	1.134	-154.3	7.99	0.30	230	11.94
1320	2.75	6.85	22.18	1.135	-155.7	6.74	0.28	230	11.91
1330	3.25	6.86	22.64	1.128	-151.6	5.2	0.25	200	11.91
1340	3.75	6.85	22.72	1.130	-152.1	4.2	0.27	210	11.90
1357	4.75	6.87	22.23	1.133	-154.3	3.2	0.25	220	11.88

Low Flow Stability Critera: pH = ± 0.1 ORP = ± 10mV Sp. Cond = ± 3% DO = ± 10% Turb. < 10 NTU

COMMENTS: Sample time = 1412

CONTAINER SIZE/TYPE	NO.	PRESERVATIVE	ANALYTICAL METHOD	ANALYSIS
2-500 mL glass		none	1631	LL Hg - total + dissolved

GENERAL INFORMATION			
WEATHER:	Sunny, clear upper 80's		
SHIPPED VIA:	Fedex		
SHIPPED TO:	Battelle		
SAMPLER:	M Bottenberg	OBSERVER:	D Howard

FIELD SAMPLING REPORT

PROJECT NO: _____

MACTEC ENGINEERING AND CONSULTING, INC.
3200 TOWN POINT DRIVE, SUITE 100 KENNESAW GA 30144
PHONE: (770) 421-3400 / FAX: (770) 421-3486

WELL ID: RAMW7B DEPTH TO PRODUCT: _____ DATE: 9/26/08

SAMPLE METHOD: Peristaltic TIME: 1456

DUP./REP. OF: _____ DEPTH TO WATER: 11.61 GRAB ( ) COMPOSITE ( )

TOTAL DEPTH: 27.22 - 15.61

PURGE VOLUME: 0.62 x 3 = 1.9

[0.163 x water column height (ft) x 3 (well volumes) for 2" wells]

1" well = 0.04 gal/ft

TIME	VOL. PURGED (gal)	pH	TEMP (°C)	SPEC. COND. (ms/cm)	ORP (mV)	TURB. (NTU)	DO (mg/L)	Pump Rate ml/min. (& pump setting)	12.03 New Water Level
Initial: 1500		6.46	22.88	0.712	-107.6	51.2	0.94	200 (hi)	
1510	0.5	6.40	23.18	0.714	-116.1	19.8	0.76	180	12.02
1520	1.0	6.41	22.42	0.710	-111.4	8.56	0.59	200	12.03
1530	1.5	6.41	22.22	0.710	-112.1	6.25	0.54	210	12.02
1540	2.0	6.41	22.26	0.710	-111.7	4.50	0.53	210	12.00
1545	2.25	6.41	22.40	0.708	-112.2	4.34	0.52	210	12.01

Low Flow Stability Critera: pH = ± 0.1 ORP = ± 10mV Sp. Cond = ± 3% DO = ± 10% Turb. < 10 NTU

COMMENTS: sample time 1555

CONTAINER SIZE/TYPE	NO.	PRESERVATIVE	ANALYTICAL METHOD	ANALYSIS
2-500 mL				LL Hg

GENERAL INFORMATION	
WEATHER:	Sunny + clear temp ~ 85°F
SHIPPED VIA:	Fed Ex
SHIPPED TO:	
SAMPLER: D Howard	OBSERVER: MRottenberg

FIELD SAMPLING REPORT

PROJECT NO: ~~BAMW7C~~ 6600080036

MACTEC ENGINEERING AND CONSULTING, INC.
3200 TOWN POINT DRIVE, SUITE 100 KENNESAW GA 30144
PHONE: (770) 421-3400 / FAX: (770) 421-3486

WELL ID: BAMW7C DEPTH TO PRODUCT: NA DATE: 9/29/08

SAMPLE METHOD: Peristaltic pump TIME: 0921

DUP./REP. OF: _____ DEPTH TO WATER: 11.73 GRAB (X) COMPOSITE ( )

TOTAL DEPTH: 46.65 - 34.92

PURGE VOLUME: 1.4 X 3 = 4.2

[0.163 x water column height (ft) x 3 (well volumes) for 2" wells]

1" well = 0.04 gal/Ft

TIME	VOL. PURGED (gal)	pH	TEMP (°C)	SPEC. COND. (ms/cm) C	ORP (mV)	TURB. (NTU)	DO (mg/L)	mL/min Pump Rate ml/min. (& pump setting)	ft New Water Level
Initial: 0929		6.55	21.60	0.538	-98.6	358	0.91	200 (ML)	TD 46.65 13.36
0939	0.5	6.61	20.70	0.542	-120.5	9.02	0.45	240	12.40
0949	1.25	6.62	20.87	0.540	-125.3	6.09	0.40	220	12.41
0959	1.75	6.62	20.78	0.535	-131.8	4.82	0.40	220	12.42
1014	2.50	6.61	20.96	0.530	-132.2	4.10	0.33	220	12.43
1024	3.0	6.61	20.00	0.528	-130.5	4.05	0.31	220	12.45
1034	3.5	6.60	20.90	0.526	-131.8	3.67	0.31	220	12.47
1044	4.0	6.60	21.17	0.525	-131.8	3.55	0.32	220	12.48
1049	4.25	6.61	21.29	0.525	-132.4	3.35	0.31	220	12.49

Low Flow Stability Critera: pH = ± 0.1 ORP = ± 10mV Sp. Cond = ± 3% DO = ± 10% Turb. < 10 NTU

COMMENTS: Duplicate collected - BAMWDUP0209290B sample time 1200
sample time 1055

CONTAINER SIZE/TYPE	NO.	PRESERVATIVE	ANALYTICAL METHOD	ANALYSIS
2-500mL			1631	LL Hg sample
2-500mL			1631	LL Hg duplicate

GENERAL INFORMATION			
WEATHER:	clear sunny ~68°F		
SHIPPED VIA:	FedEx		
SHIPPED TO:	Battelle		
SAMPLER:	M Rottenberg	OBSERVER:	D. Howard

FIELD SAMPLING REPORT

PROJECT NO: 6100080036

MACTEC ENGINEERING AND CONSULTING, INC.
3200 TOWN POINT DRIVE, SUITE 100 KENNESAW GA 30144
PHONE: (770) 421-3400 / FAX: (770) 421-3486

WELL ID: BAMW8B DEPTH TO PRODUCT: NA DATE: 9/29/08

SAMPLE METHOD: peristaltic pump TIME: 1250

DUP./REP. OF: _____ DEPTH TO WATER: 12.07 GRAB (X) COMPOSITE ( )

TOTAL DEPTH: 25.45 13.38

PURGE VOLUME: 0.53 x 3 = 1.6 gal

[0.163 x water column height (ft) x 3 (well volumes) for 2" wells]

1" well = 0.04 gal/ft

TIME	VOL. PURGED (gal)	pH	TEMP (°C)	SPEC. COND. (ms/cm)	ORP (mV)	TURB. (NTU)	DO (mg/L)	Pump Rate ml/min. (& pump setting)	New Water Level
Initial: 1255		6.49	23.77	0.470	-93.8	110	0.66	150 (ml)	12.96
1305	0.25	6.53	23.54	0.471	-113.3	40	0.38	170	12.96
1315	0.5	6.56	23.76	0.468	-112.5	8.17	0.31	160	12.97
1325	1.0	6.58	24.01	0.470	-120.0	7.9	0.36	160	12.99
1335	1.5	6.60	23.11	0.469	-125.1	6.7	0.28	180	12.99
1340	1.75	6.61	23.49	0.467	-128.8	4.9	0.27	180	12.99
1345	2.0	6.61	23.17	0.469	-127.1	4.3	0.26	180	12.99

Low Flow Stability Critera: pH = ± 0.1 ORP = ± 10mV Sp. Cond = ± 3% DO = ± 10% Turb. < 10 NTU

COMMENTS: Sample time 1354

YSI 12644 Turbidity meter 03166

CONTAINER SIZE/TYPE	NO.	PRESERVATIVE	ANALYTICAL METHOD	ANALYSIS
500 ml	2	-	1631	LL Hg

GENERAL INFORMATION			
WEATHER:	Clear, Sunny		
SHIPPED VIA:	Fed Ex		
SHIPPED TO:	Battelle		
SAMPLER: D Howard		OBSERVER: M Rottenberg	

FIELD SAMPLING REPORT

PROJECT NO: 6100080036

MACTEC ENGINEERING AND CONSULTING, INC.
3200 TOWN POINT DRIVE, SUITE 100 KENNESAW GA 30144
PHONE: (770) 421-3400 / FAX: (770) 421-3486

WELL ID: BAMWBC DEPTH TO PRODUCT: NA DATE: 9/29/08

SAMPLE METHOD: Peristaltic pump TIME: 1250

DUP./REP. OF: DEPTH TO WATER: 12.19 GRAB (X) COMPOSITE ( )

TOTAL DEPTH: 46.11 = 33.92

PURGE VOLUME: 1.36 x 3 = 4.1

[0.163 x water column height (ft) x 3 (well volumes) for 2" wells]

1" well = 0.04 gal/Ft

TIME	VOL. PURGED (gal)	pH	TEMP (°C)	SPEC. COND. (ms/cm)C	ORP (mV)	TURB. (NTU)	DO (mg/L)	mL/min Pump Rate ml/min. (& pump setting)	Ft New Water Level
Initial: 1254		6.61	22.75	0.825	23.6	C434	0.69	210 (mL)	[illegible]
1304	0.5	6.67	22.59	0.874	-107.3	27.9	0.39	220	13.07
1315	1.0	6.68	23.27	0.873	-123.0	16.1	0.35	200	13.07
1325	1.50	6.70	23.07	0.886	-128.1	8.14	0.44	200	13.07
1335	2.0 NW	6.69	22.90	0.865	-127.1	6.70	0.41	210	13.10
1345	2.5	6.68	22.12	0.863	-129.9	5.14	0.42	200	13.08
1402	3.5	6.68	21.92	0.860	-126.5	3.47	0.38	210	13.10
1410	4.0	6.69	21.40	0.856	-125.4	3.11	0.38	240	13.09
1415	4.25	6.69	21.49	0.850	-123.9	3.21	0.43	260	13.11
1420	4.50	6.68	22.02	0.851	-123.9	2.74	0.43	260	13.10
1425	4.75	6.68	21.89	0.854	-122.8	2.53	0.43	260	13.10

Low Flow Stability Critera: pH = ± 0.1 ORP = ± 10mV Sp. Cond = ± 3% DO = ± 10% Turb. < 10 NTU

COMMENTS: Sample time 1432

CONTAINER SIZE/TYPE	NO.	PRESERVATIVE	ANALYTICAL METHOD	ANALYSIS
500 mL	2		1631	LL Hg

GENERAL INFORMATION

WEATHER:	Clear, sunny ~~~68°F mbs~~		
SHIPPED VIA:	Fed Ex		
SHIPPED TO:	Battelle		
SAMPLER:	MRottenberg	OBSERVER:	O. Howard

FIELD SAMPLING REPORT

PROJECT NO: 6100080036/2008.GW

MACTEC ENGINEERING AND CONSULTING, INC.
3200 TOWN POINT DRIVE, SUITE 100 KENNESAW GA 30144
PHONE: (770) 421-3400 / FAX: (770) 421-3486

WELL ID: BAMW1B DEPTH TO PRODUCT: NA DATE: 11/11/08

SAMPLE METHOD: peristaltic pump TIME: 9:41 Start

DUP./REP. OF: - DEPTH TO WATER: 29.13 GRAB (X) COMPOSITE ( )

TOTAL DEPTH: 47.34
difference = 18.21

PURGE VOLUME: 0.73 x 3 = 2.2gal. Actually started Pumping at 9:49

[0.163 x water column height (ft) x 3 (well volumes) for 2" wells]

1" = 0.04 gal / ft

TIME	VOL. PURGED (gal)	pH	TEMP (°C)	SPEC. COND. (ms/cm)	ORP (mV)	TURB. (NTU)	DO (mg/L)	Pump Rate ml/min. (& pump setting)	New Water Level
Initial: JAm								( )	
9:51	Just filled YSI	4.53	18.97	0.241	217	0.63	2.67	130 ml/min	29.15
10:11	0.5 Gal	4.31	19.63	0.247	260.4	0.28	1.46	100 ml/min	29.15
10:21	0.7 Gal	4.30	19.83	0.257	274.8	0.25	1.31	100 ml/min	29.15
10:31	1 Gal	4.30	19.95	0.260	274.6	0.27	1.19	100 ml/min	29.15
10:41	1.4 Gal	4.31	20.49	0.265	276.9	0.25	1.19	100 ml/min	29.15
10:51	1.7 Gal	4.31	20.91	0.270	280	0.24	1.13	100 ml/min	29.15
11:01	2 Gal	4.33	20.96	0.272	281	0.23	1.14	100 ml/min	29.16
11:11	2.3 Gal	4.33	20.98	0.275	280	0.23	1.14	100 ml/min	29.15
11:14 - Parameters Stable - Sample									

Low Flow Stability Critera: pH = ± 0.1 ORP = ± 10mV Sp. Cond = ± 3% DO = ± 10% Turb. < 10 NTU

COMMENTS:
YSI 10:08H00816
LaMotte ID: 05600
Sample time: 11:14
Water level meter ID: 07620

CONTAINER SIZE/TYPE	NO.	PRESERVATIVE	ANALYTICAL METHOD	ANALYSIS
500 ml	2	none	1631	LL Hg (total + dissolved)

GENERAL INFORMATION			
WEATHER:			
SHIPPED VIA:	FedEx		
SHIPPED TO:	Battelle		
SAMPLER:	MR / JM	OBSERVER:	

FIELD SAMPLING REPORT

PROJECT NO: 6010080036/2008.GW

MACTEC ENGINEERING AND CONSULTING, INC.
3200 TOWN POINT DRIVE, SUITE 100 KENNESAW GA 30144
PHONE: (770) 421-3400 / FAX: (770) 421-3486

WELL ID: BAMW 1C DEPTH TO PRODUCT: NA DATE: 11/11/08

SAMPLE METHOD: peristaltic pump TIME: 1012 start

DUP./REP. OF: - DEPTH TO WATER: 28.50 GRAB (X) COMPOSITE ( )

TOTAL DEPTH: 67.36
difference: 38.86
PURGE VOLUME: 1.55 x 3 = 4.7 gal
[0.163 x water column height (ft) x 3 (well volumes) for 2" wells]
1" = 0.04 gal/ft

TIME	VOL. PURGED (gal)	pH	TEMP (°C)	SPEC. COND. (ms/cm)	ORP (mV)	TURB. (NTU)	DO (mg/L)	Pump Rate ml/min. (& pump setting)	New Water Level
Initial: JMM								( )	
10:22	0.75	4.69	19.52	3.22	192	2.41	2.49	500 ml/min	28.55
10:27	1.50	4.51	19.69	3.46	257	0	0.56	500 ml/min	28.55
10:37	3	4.49	19.70	3.49	272	0	0.40	500 ml/min	28.56
10:47	4.5	4.49	19.73	3.51	278	0	0.34	500ml/min	28.56
10:50 - Parameters Stable - Sample									

Low Flow Stability Critera: pH = ± 0.1 ORP = ± 10mV Sp. Cond = ± 3% DO = ± 10% Turb. < 10 NTU

COMMENTS:
YSI ID: 07E100591
Lamotte I.D: 4430
Sample time: 10:50
Water level meter ID: 03431

CONTAINER SIZE/TYPE	NO.	PRESERVATIVE	ANALYTICAL METHOD	ANALYSIS
500 mL	2	none	1631	LL Hg (total + dissolved)

GENERAL INFORMATION			
WEATHER:			
SHIPPED VIA:	FedEx		
SHIPPED TO:	Battelle		
SAMPLER: MR / JM		OBSERVER:	

FIELD SAMPLING REPORT

PROJECT NO: 6100080036/2008,GW

MACTEC ENGINEERING AND CONSULTING, INC.
3200 TOWN POINT DRIVE, SUITE 100 KENNESAW GA 30144
PHONE: (770) 421-3400 / FAX: (770) 421-3486

WELL ID: BA MW2C DEPTH TO PRODUCT: NA DATE: 11-11-08

SAMPLE METHOD: peristaltic pump TIME: 12:25 Start

DUP./REP. OF: — DEPTH TO WATER: 11.24 GRAB (X) COMPOSITE ( )

TOTAL DEPTH: 46.64

Could Not Get water levels due to joints in sample tubing & small diameter well

difference =

PURGE VOLUME: 1.46 x 3 = 4.3

[0.163 x water column height (ft) x 3 (well volumes) for 2" wells]

1" pipe 0.04 gal/ft

TIME	VOL. PURGED (gal)	pH	TEMP (°C)	SPEC. COND. (ms/cm)	ORP (mV)	TURB. (NTU)	DO (mg/L)	Pump Rate ml/min. (& pump setting)	New Water Level
Initial: JAM		4.66	20.72	3.172	195	29.6	2.27	500 ml/min (41)	
12:30	1 Gal	4.54	20.39	2.923	211.7	14.2	0.84	600 ml/min	NA
12:40	2.5 Gal	4.53	20.27	2.852	219.5	8.33	0.43	500 ml/min	NA
12:50	4 Gal	4.53	20.26	2.808	220	3.41	0.37	500 ml/min	NA
1:00	5.5	4.53	20.27	2.74	224	1.08	0.30	" "	NA
Sample at 1:05 - Parameters Stable									

Low Flow Stability Critera: pH = ± 0.1 ORP = ± 10mV Sp. Cond = ± 3% DO = ± 10% Turb. < 10 NTU

COMMENTS: YSI ID: 07E100591 Water level meter ID: NA
Lamotte ID: 4430
Sample time: 1305
Water level meter would not fit in well with tubing due to multiple (4) connections/joints.

CONTAINER SIZE/TYPE	NO.	PRESERVATIVE	ANALYTICAL METHOD	ANALYSIS
500 mL	2	none	1631	LL Hg - (total + dissolved)

GENERAL INFORMATION

WEATHER:	
SHIPPED VIA:	FedEx
SHIPPED TO:	Battelle
SAMPLER: MR/JM	OBSERVER:

FIELD SAMPLING REPORT

PROJECT NO: 6100080036 / 2008, GW

MACTEC ENGINEERING AND CONSULTING, INC.
3200 TOWN POINT DRIVE, SUITE 100 KENNESAW GA 30144
PHONE: (770) 421-3400 / FAX: (770) 421-3486

WELL ID: BAMW3B DEPTH TO PRODUCT: — DATE: 11/12/08

SAMPLE METHOD: peristaltic pump TIME: 1040 start

DUP./REP. OF: — DEPTH TO WATER: 12.65 GRAB (X) COMPOSITE ( )

TOTAL DEPTH: 25.94 13.29

PURGE VOLUME: 0.53 x 3 = 1.6 gal

[0.163 x water column height (ft) x 3 (well volumes) for 2" wells]

0.04 gal / ft

TIME	VOL. PURGED (gal)	pH	TEMP (°C)	SPEC. COND. (ms/cm)	ORP (mV)	TURB. (NTU)	DO (mg/L)	Pump Rate ml/min. (& pump setting)	New Water Level
Initial: MK								ml/min)	
1045	0.7 gal	6.60	21.83	2.153	-135.3	5.50	0.58	210	16.5
1050	1.0	6.66	22.21	2.200	-135.9	8.28	0.36	300	16.52
1055	1.5	6.71	22.26	2.192	-143.8	2.19	0.22	300	16.53
1100	2.0	6.73	22.29	2.171	-140.1	2.07	0.22	280	16.83
1105		Stopped purge - allow to recharge							19.7
1108								→	17.05
1111								→	16.84
1112 re	start pump to collect sample								
1113	sample time								

Low Flow Stability Critera: pH = ± 0.1 ORP = ± 10mV Sp. Cond = ± 3% DO = ± 10% Turb. < 10 NTU

COMMENTS:
- YSI ID - 08H100816
- Lamotte ID - 05600
- Water level meter ID - 03431
- Sample time -

CONTAINER SIZE/TYPE	NO.	PRESERVATIVE	ANALYTICAL METHOD	ANALYSIS
amber glass	1L	—	HCB	~~8270~~ Method 8081A

GENERAL INFORMATION

WEATHER:	100% cloud cover - rain expected
SHIPPED VIA:	FedEx
SHIPPED TO:	PACE
SAMPLER: MK/JM	OBSERVER:

FIELD SAMPLING REPORT

PROJECT NO: 6100080836 / 2008-BGW

MACTEC ENGINEERING AND CONSULTING, INC.
3200 TOWN POINT DRIVE, SUITE 100 KENNESAW GA 30144
PHONE: (770) 421-3400 / FAX: (770) 421-3486

WELL ID: BAMW 4C DEPTH TO PRODUCT: NA DATE: 11/12/08

SAMPLE METHOD: peristaltic pump TIME: 11:08

DUP/REP. OF: _____ DEPTH TO WATER: 12.40 GRAB (X) COMPOSITE ( )

TOTAL DEPTH: 42.40

PURGE VOLUME: 1.2 x3 = 3.6

[0.163 x water column height (ft) x 3 (well volumes) for 2" wells]

0.04 gal/ft

TIME	VOL. PURGED (gal)	pH	TEMP (°C)	SPEC. COND. (ms/cm)	ORP (mV)	TURB. (NTU)	DO (mg/L)	Pump Rate ml/min. (& pump setting)	New Water Level
Initial: 11:09		6.49	20.85	1.067	-117.4	3.48	6.05	600ml/min (37)	12.46
11:13	1	6.60	20.79	1.123	-137	1.19	0.39	600 ml/min	12.46
11:18	2	6.61	20.81	1.128	-140	0.21	0.25	" "	12.46
11:23	3	6.61	20.80	1.129	-141	0.19	0.21	" "	12.46
11:28	4	6.61	20.80	1.130	-142	0.15	0.20	" "	12.46

Parameters Stable - Sample 11:30 & Table (Duplicate)

Low Flow Stability Critera: pH = ± 0.1 ORP = ± 10mV Sp. Cond = ± 3% DO = ± 10% Turb. < 10 NTU

COMMENTS:
YSI ID: 07E100591
LaMotte ID: 4430
Water Level ID: 7620
DUP sample here - 1200 sample time
Sample time = ~~MR~~ 1130

CONTAINER SIZE/TYPE	NO.	PRESERVATIVE	ANALYTICAL METHOD	ANALYSIS
glass-amber	1L	NA	8081A	HCB

GENERAL INFORMATION

WEATHER:	100% cloud cover rain expected		
SHIPPED VIA:	FedEx		
SHIPPED TO:	PACE		
SAMPLER: JM/MR		OBSERVER:	

FIELD SAMPLING REPORT

PROJECT NO: 6100080036139008.GWW

MACTEC ENGINEERING AND CONSULTING, INC.
3200 TOWN POINT DRIVE, SUITE 100 KENNESAW GA 30144
PHONE: (770) 421-3400 / FAX: (770) 421-3486

WELL ID: BAMW5C DEPTH TO PRODUCT: — DATE: 11/12/08

SAMPLE METHOD: peristaltic pump TIME: 11:54 start

DUP./REP. OF: — DEPTH TO WATER: 12.47 GRAB (X) COMPOSITE ( )

TOTAL DEPTH: 38.47

PURGE VOLUME: 1.04 x 3 = 3.12

[0.163 x water column height (ft) x 3 (well volumes) for 2" wells]

0.04 gal / ft

TIME	VOL. PURGED (gal)	pH	TEMP (°C)	SPEC. COND. (ms/cm)	ORP (mV)	TURB. (NTU)	DO (mg/L)	Pump Rate ml/min. (& pump setting)	New Water Level
Initial:		6.75	21.41	0.874	-66	18.4	5.0	600 ml/min (33)	12.51
11:59	1	6.94	20.75	0.867	-160.4	12.7	0.36	600 ml/min	12.51
12:04	2	6.96	20.72	0.867	-167	7.54	0.22	" "	12.51
12:09	3	6.95	20.69	0.868	-171	2.82	0.15	" "	12.51
12:12 - Parameters Stable - Sample									

Low Flow Stability Critera: pH = ± 0.1 ORP = ± 10mV Sp. Cond = ± 3% DO = ± 10% Turb. < 10 NTU

COMMENTS:
YSI ID - 07E100591
LaMotte ID: 4430
water level meter ID = 7620
Sample time = 12:12

CONTAINER SIZE/TYPE	NO.	PRESERVATIVE	ANALYTICAL METHOD	ANALYSIS
1L glass	1	NA	8081A	HCB

GENERAL INFORMATION	
WEATHER:	100% cloud cover - rain expected
SHIPPED VIA:	Fed Ex
SHIPPED TO:	PACE
SAMPLER: JM / MR	OBSERVER:

APPENDIX D

DATA VALIDATION AND CD FOR LABORATORY ANALYTICAL RESULTS REPORTS

APPENDIX D

DATA VALIDATION

The groundwater sample laboratory analytical data packages consisted of seven sample delivery groups (SDGs). Each SDG was evaluated to determine compliance with the Quality Assurance/Quality Control (QA/QC) protocols established in the Groundwater Investigation Work Plan (Work Plan) (MACTEC, 2009) listed below:

- Sample receipt (chain of custody) and report completeness
- Holding times
- Field blanks, equipment blanks, and laboratory method blanks
- Field duplicates
- Surrogate recoveries (organics only)
- Matrix spike/matrix spike duplicates (MS/MSDs)
- Relationship between total and dissolved fractions (mercury only)

The laboratory met the reporting limit for the constituents of concern (COCs) as specified in the Work Plan. The COCs include mercury; hexachlorobenzene (HCB); and 2,2- and 2,4- isomers of dichlorodiphenyldichloroethane (DDD), dichlorodiphenyldichloroethylene (DDE), and dichlorodiphenyltrichloroethane (DDT), collectively referred to as DDTR. Data from the seven SDGs are useable with the qualifications discussed below.

EVALUATION OF SDGS ANALYZED FOR HCB AND DDTR

SDG 4011410 consisted of five samples, including one equipment blank and one field duplicate, which were analyzed by Pace Analytical Services, Inc. in Green Bay, Wisconsin, by U.S. Environmental Protection Agency (USEPA) Method 8081 for HCB. The samples were received by the laboratory in good condition, and anomalies were not reported on the chain of custody. The samples were analyzed within the applicable holding time. The equipment blank and laboratory method blank were free of contamination. Samples BAMW4C111208 and BAMWDUP01111208 were collected as field duplicates. HCB was not detected in either field duplicate, so precision could not be calculated. Surrogate recoveries for the HCB analysis were within laboratory recovery acceptance ranges. Volume was insufficient to prepare an MS/MSD sample for this SDG. The data from SDG 4011410 are useable without qualification.

SDG 409490 consisted of four samples, including one field blank and one field duplicate, which were analyzed by Pace Analytical Services, Inc. in Green Bay, Wisconsin, by USEPA Method 8081 for HCB, DDD, DDE, and DDT. The samples were received by the laboratory in good condition, and anomalies were not reported on the chain of custody. The samples were analyzed within the applicable holding time. The field blank was free of contamination. The laboratory method blank had a detection of HCB of 0.0021J micrograms per liter (µg/L); however, the environmental samples were non-detect for HCB, and qualification was not necessary. Samples BAMW2C092308 and BAMWDUP01092308 were collected as field duplicates. HCB was not detected in either field duplicate, so precision could not be calculated. Surrogate recoveries for the analyses were within laboratory recovery acceptance ranges. The MS/MSD was performed on a sample from another SDG. The data from SDG 409490 are useable without qualification.

SDG 409500 consisted of three samples, including a field blank, that were analyzed by Pace Analytical Services, Inc. in Green Bay, Wisconsin, by USEPA Method 8081 for HCB, DDD, DDE, and DDT. The samples were received by the laboratory in good condition, and anomalies were not reported on the chain of custody. The samples were analyzed within the applicable holding time. The field blank was free of contamination. The laboratory method blank had a detection of HCB of 0.0021J µg/L. Environmental sample BAMW4C092408 was flagged "JB" as estimated with possible blank contamination. The other samples were non-detect for HCB and did not require qualification. Surrogate recoveries for the analyses were within laboratory recovery acceptance ranges. The MS/MSD was performed on sample BAMW4C092408, and recoveries were within laboratory limits. The data from SDG 409500 are useable with the qualifications discussed above.

SDG 409501 consisted of five samples, including a field blank and equipment blank, which were analyzed by Pace Analytical Services, Inc. in Green Bay, Wisconsin, by USEPA Method 8081 for HCB, DDD, DDE, and DDT. The samples were received by the laboratory in good condition, and anomalies were not reported on the chain of custody. The samples were analyzed within the applicable holding time. The field blank and equipment blank were free of contamination. The laboratory method blank had a detection of HCB of 0.0021J µg/L. All samples with detections of HCB were flagged "JB" as estimated with possible blank contamination. Surrogate recoveries for the analyses were within laboratory recovery acceptance ranges. The MS/MSD was performed on a sample from another SDG. The data from SDG 409501 are useable with the qualifications discussed above.

SDG 409570 consisted of two samples, including a field blank, that were analyzed by Pace Analytical Services, Inc. in Green Bay, Wisconsin, by USEPA Method 8081 for HCB, DDD, DDE, and DDT. The samples were received by the laboratory in good condition, and anomalies were not reported on the chain of custody. The samples were analyzed within the applicable holding time. The field blank was free of contamination. The laboratory method blank had a detection of HCB of 0.0021J µg/L. Environmental sample BAMW5C092608 was flagged "JB" as estimated with possible blank contamination. The other sample was non-detect for HCB and did not require qualification. Surrogate recoveries for the analyses were within laboratory recovery acceptance ranges. The MS/MSD was performed on a sample from another SDG. The data from SDG 409570 are useable with the qualifications discussed above.

EVALUATION OF SDGS ANALYZED FOR MERCURY

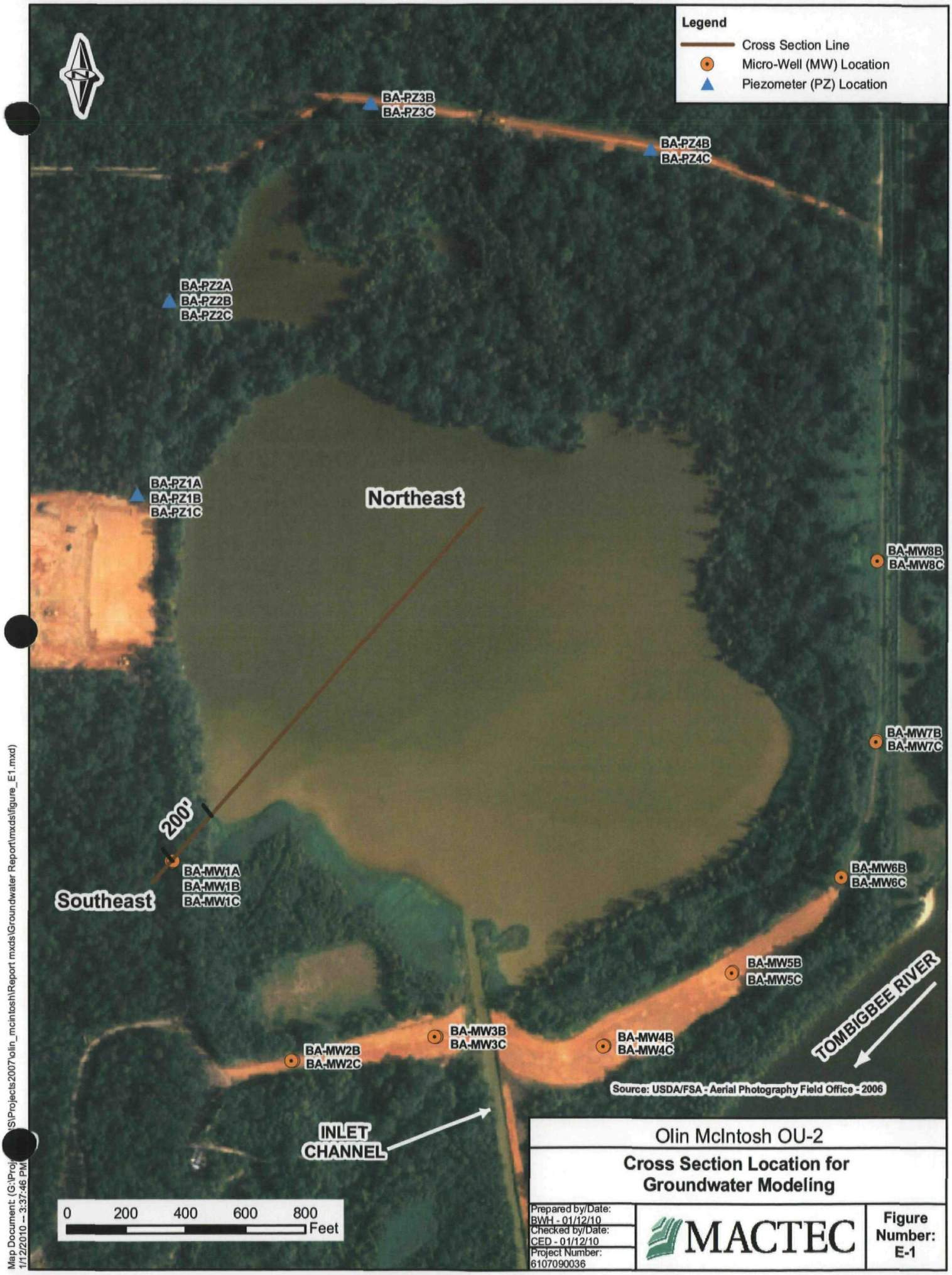
SDG 2950_1-50 consisted of 25 samples, including 2 field duplicate pairs, one equipment blank, and 6 field blanks. SDG 2950_1-50 was analyzed via Battelle Marine Sciences Laboratory in Sequim, WA Washington, for filtered and unfiltered mercury by USEPA Method 1631. The samples were received by the laboratory in good condition, and anomalies were not reported on the chain of custody. The samples were analyzed within the applicable holding time. Field blanks were free of contamination as were the laboratory method blanks. The equipment blank had a filtered mercury result of 0.000554 µg/L and unfiltered mercury result of 0.00814 µg/L. The samples with mercury results (dissolved or total) greater than the detection limit were flagged "JB" for estimated with possible blank contamination. MS/MSDs were performed on seven samples from this SDG and recoveries were within laboratory method limits. Two field duplicate pairs were collected: BAMW7C092908 is a duplicate of BAMWDUP02092908, and BAM2C092308 is a duplicate of BAMWDUP01092308. The relative percent differences (RPD) between the duplicates were less than 20 percent except for the total mercury for BAMW7C092908/BAMWDUP02092908, which was 141 percent. A "J" flag would be applied to these two samples; however, they are already flagged "JB," which is higher than "J" in the evaluation hierarchy. The filtered mercury results were less than 110 percent of the corresponding unfiltered mercury results. The data from SDG2950_1-50 are useable with the qualifications discussed above.

SDG 2950_51-62 consisted of 6 samples, including one field duplicate pair, one equipment blank, and one field blank. SDG 2950_51-62 was analyzed by Battelle Marine Sciences Laboratory in Sequim, Washington, for filtered and unfiltered mercury via USEPA Method 1631. The samples were received by the laboratory in good condition, and anomalies were not reported on the chain of custody. The samples were analyzed within the applicable holding time. The field blank and laboratory method blanks were

free of contamination. The equipment blank had a filtered mercury result of 0.000286 JQ µg/L and an unfiltered mercury result of 0.000168 JQ µg/L. Samples with total or dissolved mercury results above the detection limit were flagged "JB" for estimated with possible blank contamination. An MS/MSD was performed on sample BAMW2C111108, and the recoveries were within laboratory method limits. The field duplicate pair (BAMW2C11108 and BAMWDUP01111108) had RPDs within 20 percent. The filtered mercury results were less than 110 percent of the corresponding unfiltered mercury results. The data from SDG2950_51-620 are useable with the qualifications discussed above.

APPENDIX E

BIOSCREEN-AT MODEL INPUTS AND OUTPUTS



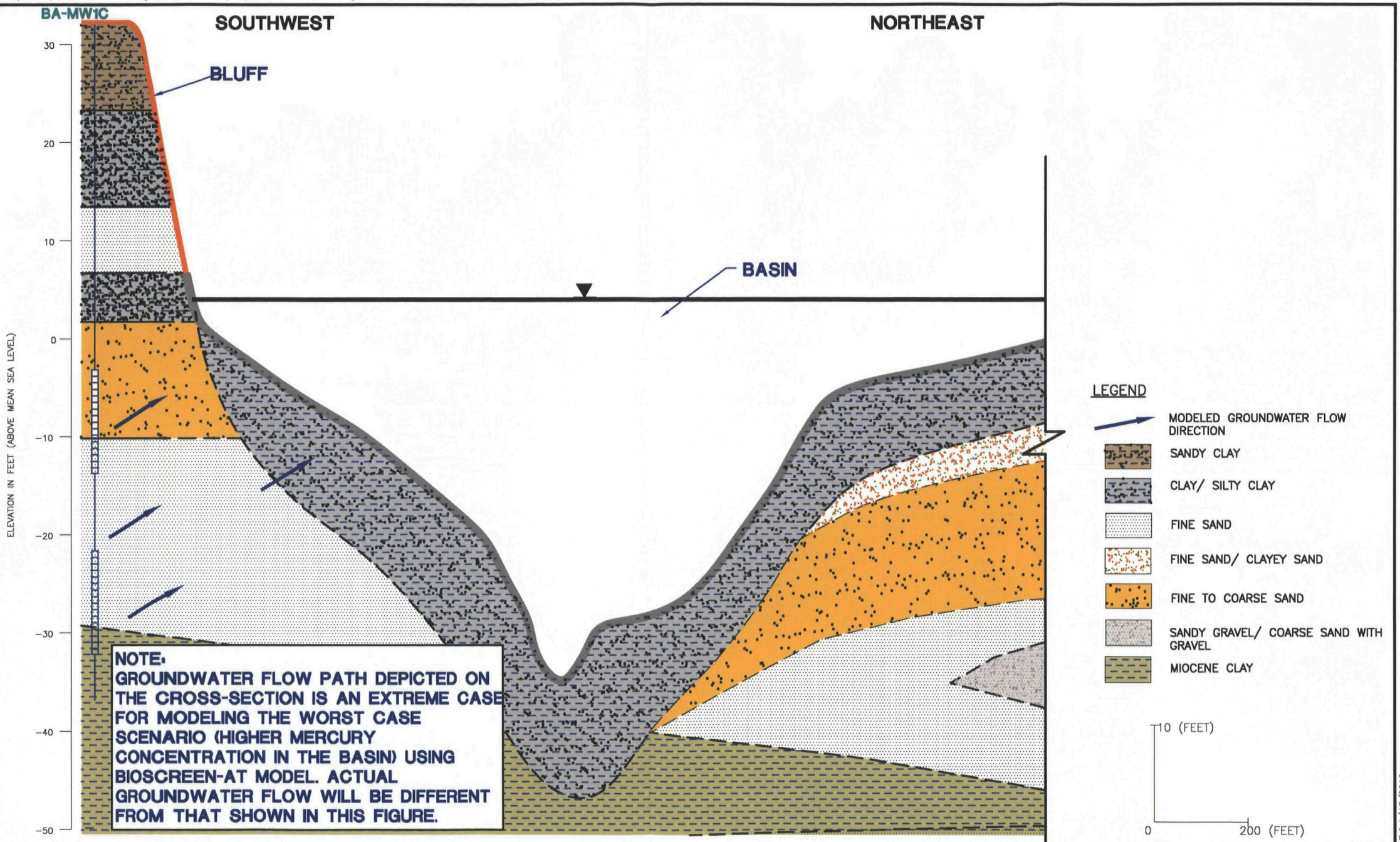
Map Document: (G:\Proj...S\Projects2007\olin_mcintosh\Report mxds\Groundwater Report\mxds\figure_E1.mxd)
1/12/2010 -- 3:37:46 PM

Olin McIntosh OU-2

Cross Section Location for Groundwater Modeling

Prepared by/Date: BWH - 01/12/10 Checked by/Date: CED - 01/12/10 Project Number: 6107090036	MACTEC	Figure Number: E-1

J:\OLIN_MCINTOSH\2009\XSECT-102009.dwg — C-C 01/15/2010 10:48am tgladsto



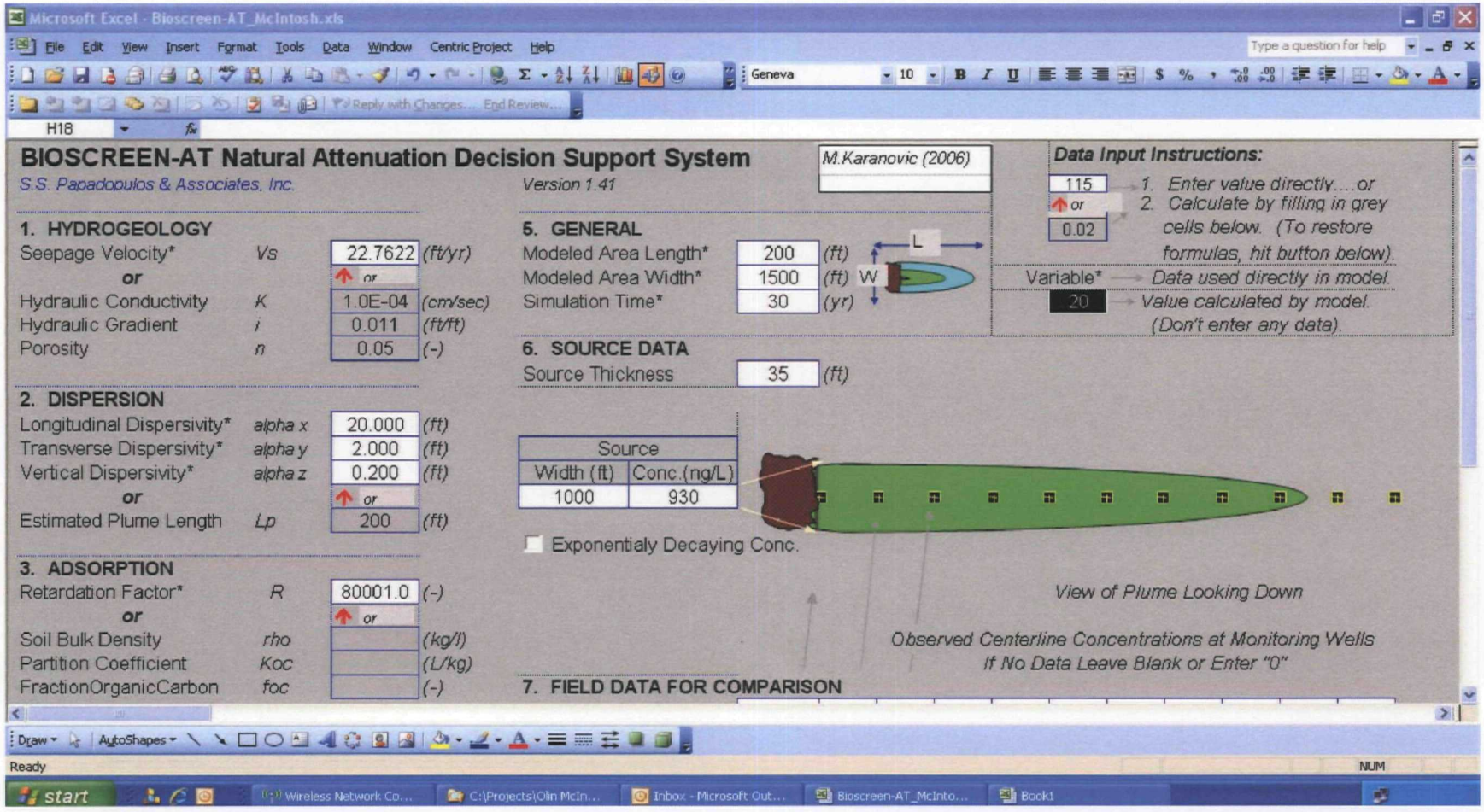
OLIN McINTOSH OU-2
McINSTOSH, AL

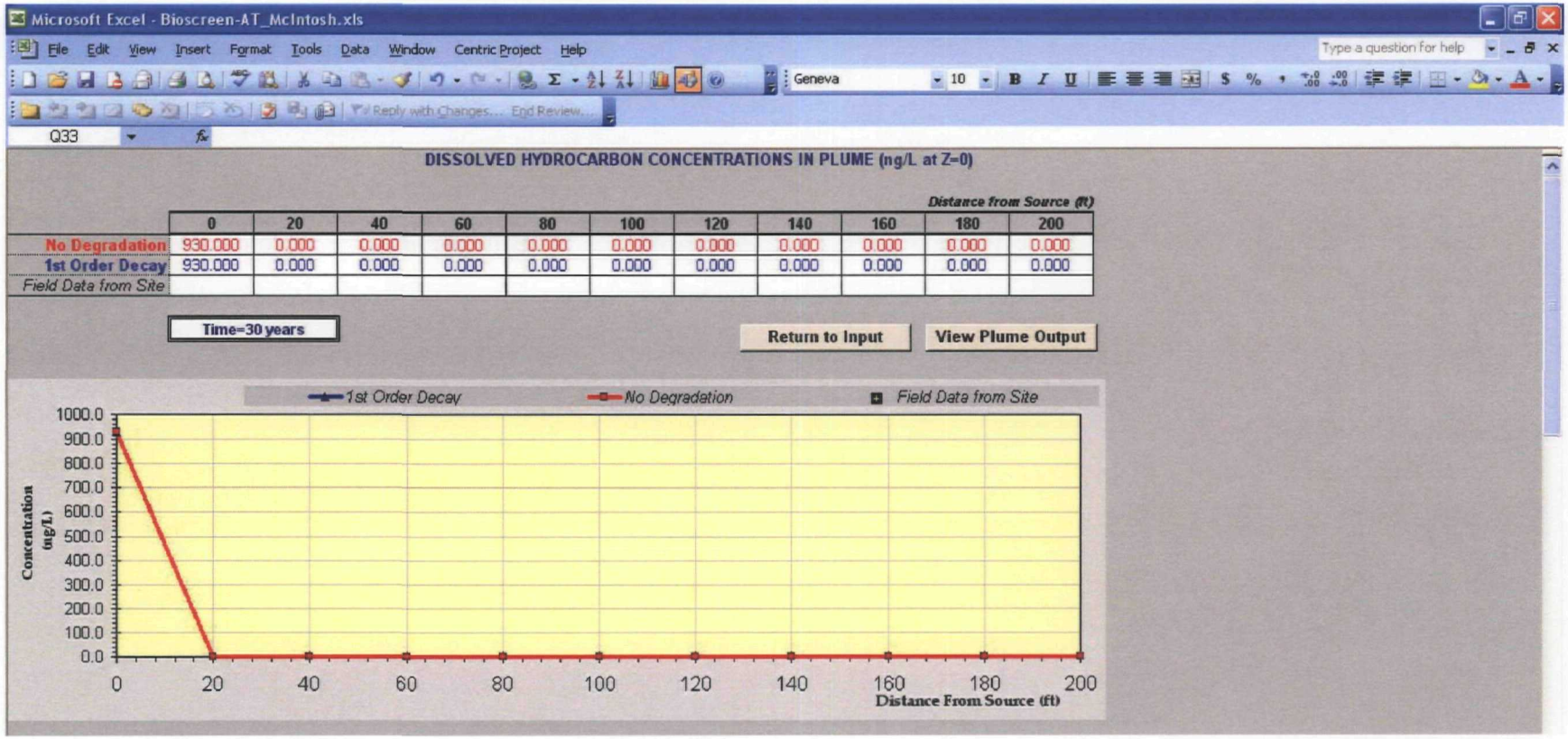
MACTEC
MACTEC Engineering and Consulting, Inc.
3200 TOWN POINT DRIVE, SUITE 100
KENNESAW, GEORGIA 30144 (770) 421-3400

GEOLOGIC
CROSS SECTION SHOWING
ASSUMED FLOW PATH FOR
BIOSCREEN-AT MODEL

JOB NO. 6107-09-0036 FIGURE E-2

DRAWNED BY/DATE T.G. 1/13/2010
PREPARED BY/DATE F.M. 1/13/2010
CHECKED BY/DATE C.D. 1/13/2010


Microsoft Excel - Bioscreen-AT_McIntosh.xls
File Edit View Insert Format Tools Data Window Centric Project Help
Type a question for help
Geneva 10
Reply with Changes... End Review...
H18
BIOSCREEN-AT Natural Attenuation Decision Support System
S.S. Papadopulos & Associates, Inc.
Version 1.41
M.Karanovic (2006)
Data Input Instructions:
115
or
0.02
1. Enter value directly....or
2. Calculate by filling in grey 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 22.7622 (ft/yr)
or
Hydraulic Conductivity K 1.0E-04 (cm/sec)
Hydraulic Gradient i 0.011 (ft/ft)
Porosity n 0.05 (-)
5. GENERAL
Modeled Area Length* 200 (ft)
Modeled Area Width* 1500 (ft)
Simulation Time* 30 (yr)
L
W
6. SOURCE DATA
Source Thickness 35 (ft)
2. DISPERSION
Longitudinal Dispersivity* alpha x 20.000 (ft)
Transverse Dispersivity* alpha y 2.000 (ft)
Vertical Dispersivity* alpha z 0.200 (ft)
or
Estimated Plume Length Lp 200 (ft)
Source
Width (ft) Conc.(ng/L)
1000 930
Exponentially Decaying Conc.
3. ADSORPTION
Retardation Factor* R 80001.0 (-)
or
Soil Bulk Density rho (kg/l)
Partition Coefficient Koc (L/kg)
FractionOrganicCarbon foc (-)
View of Plume Looking Down
Observed Centerline Concentrations at Monitoring Wells
If No Data Leave Blank or Enter "0"
7. FIELD DATA FOR COMPARISON
Draw AutoShapes
Ready
NUM
start
Wireless Network Co...
C:\Projects\Olin McIn...
Inbox - Microsoft Out...
Bioscreen-AT_McInto...
Book1

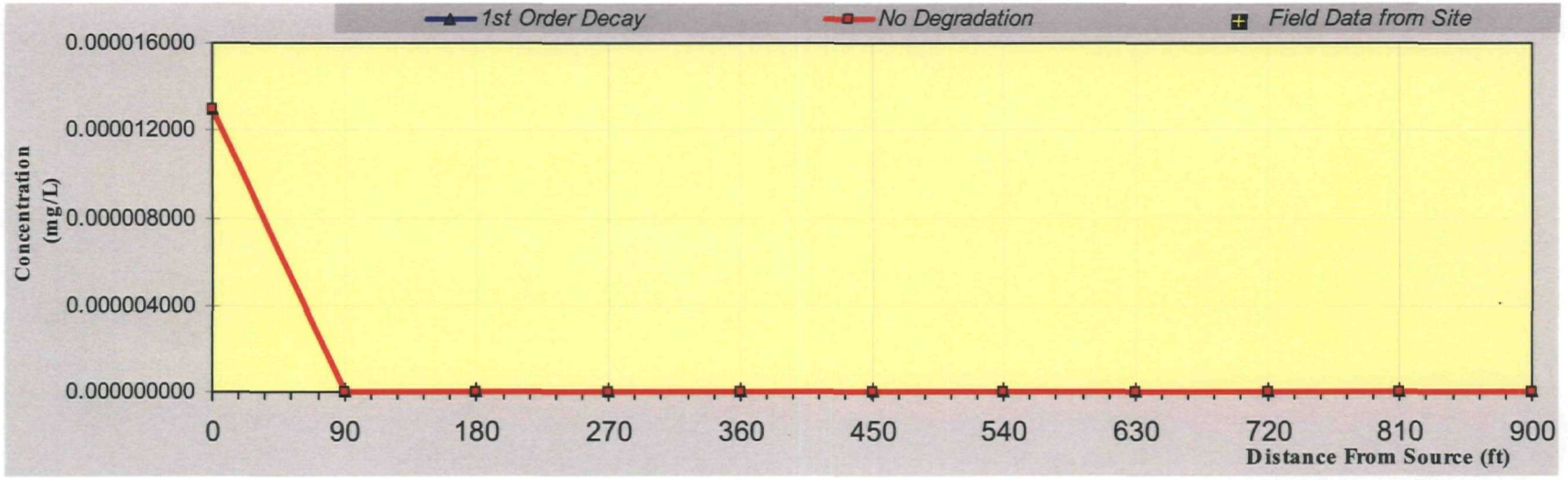


Distance (ft)	0	20	40	60	80	100	120	140	160	180	200
Conc (ng/L)	930.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000

Source thickness: 35 ft
Hydraulic gradient: 0.011

0	90	180	270	360	450	540	630	720	
0.0000130000	0.0000000000	0.0000000000	0.0000000000	0.0000000000	0.0000000000	0.0000000000	0.0000000000	0.0000000000	0.00000

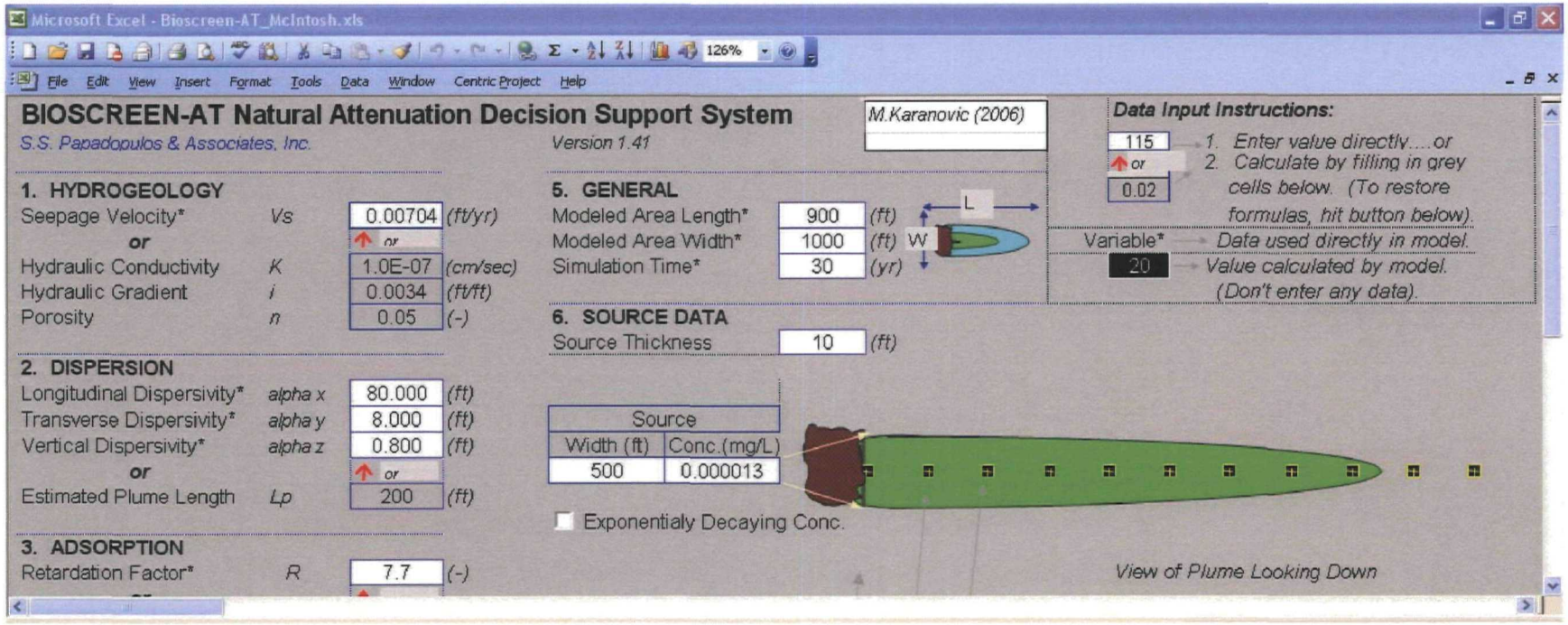
all conc. are in mg/L (e.g., at zero distance, at the well, it is 0.000013 mg/L or 0.013 micrograms per liter) and distances are in feet

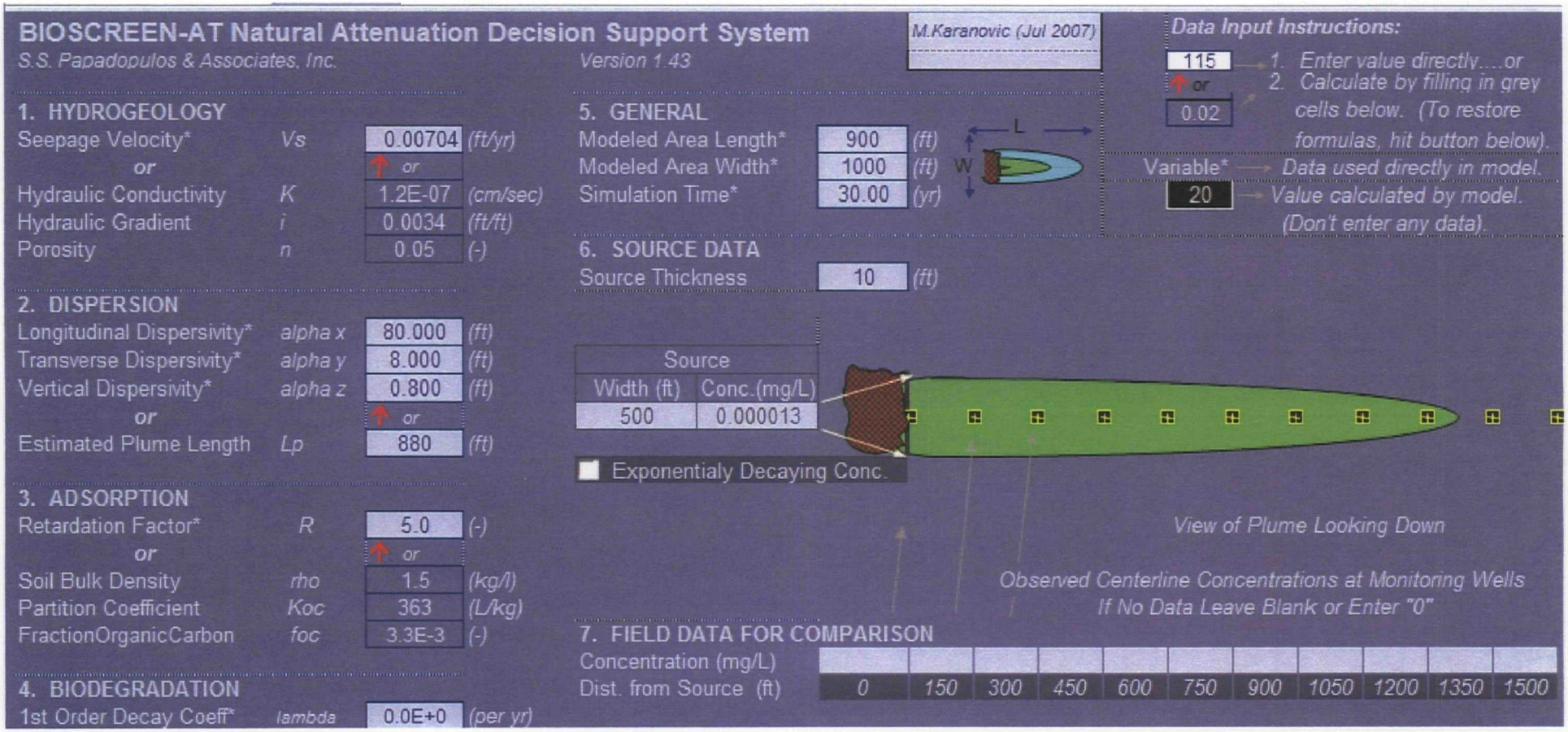


Hydraulic conductivity is $1x10^{-7}$ cm/s ($1x10^{-4}$ m/d; USBR reference)

Zone thickness is 10 feet

Effective porosity is 0.05


Microsoft Excel - Bioscreen-AT_McIntosh.xls
File Edit View Insert Format Tools Data Window Centric Project Help
BIOSCREEN-AT Natural Attenuation Decision Support System
S.S. Papadopulos & Associates, Inc.
Version 1.41
M.Karanovic (2006)
Data Input Instructions:
1. Enter value directly....or
2. Calculate by filling in grey cells below. (To restore formulas, hit button below).
Variable* Data used directly in model.
Value calculated by model. (Don't enter any data).
1. HYDROGEOLOGY
Seepage Velocity* Vs 0.00704 (ft/yr)
or
Hydraulic Conductivity K 1.0E-07 (cm/sec)
Hydraulic Gradient i 0.0034 (ft/ft)
Porosity n 0.05 (-)
2. DISPERSION
Longitudinal Dispersivity* alpha x 80.000 (ft)
Transverse Dispersivity* alpha y 8.000 (ft)
Vertical Dispersivity* alpha z 0.800 (ft)
or
Estimated Plume Length Lp 200 (ft)
3. ADSORPTION
Retardation Factor* R 7.7 (-)
5. GENERAL
Modeled Area Length* 900 (ft)
Modeled Area Width* 1000 (ft)
Simulation Time* 30 (yr)
L
W
6. SOURCE DATA
Source Thickness 10 (ft)
Source
Width (ft) Conc.(mg/L)
500 0.000013
Exponentially Decaying Conc.
View of Plume Looking Down



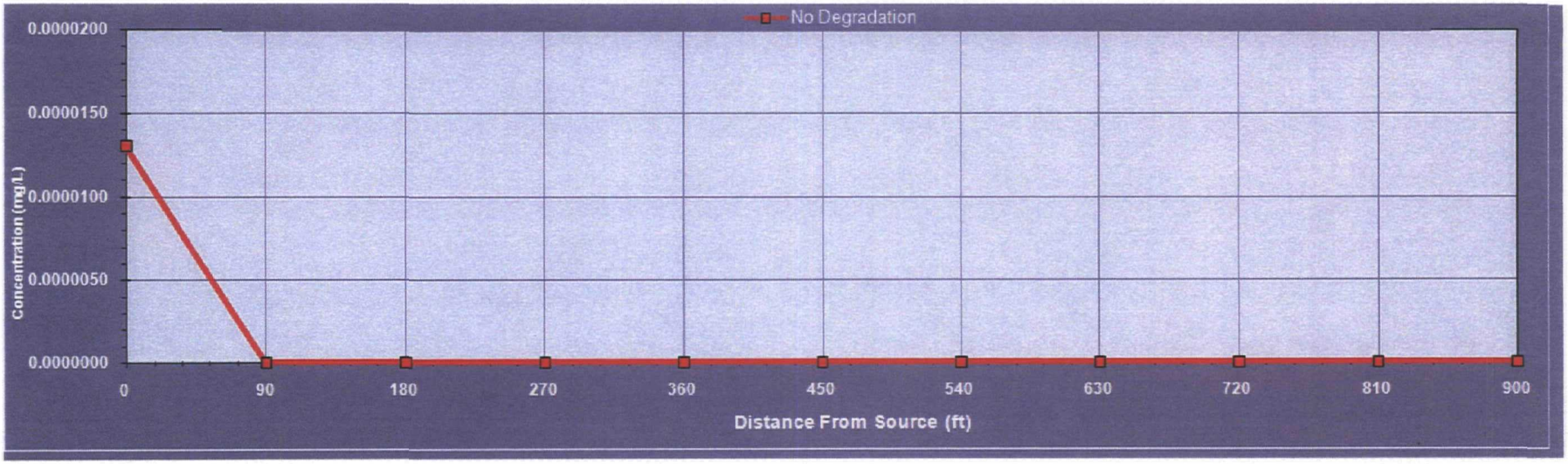
Input for total porosity of 45% and fraction organic carbon of 0.0033 (R ~ 5.0)

DISSOLVED HCB CONCENTRATIONS IN PLUME (mg/L at Z=0)

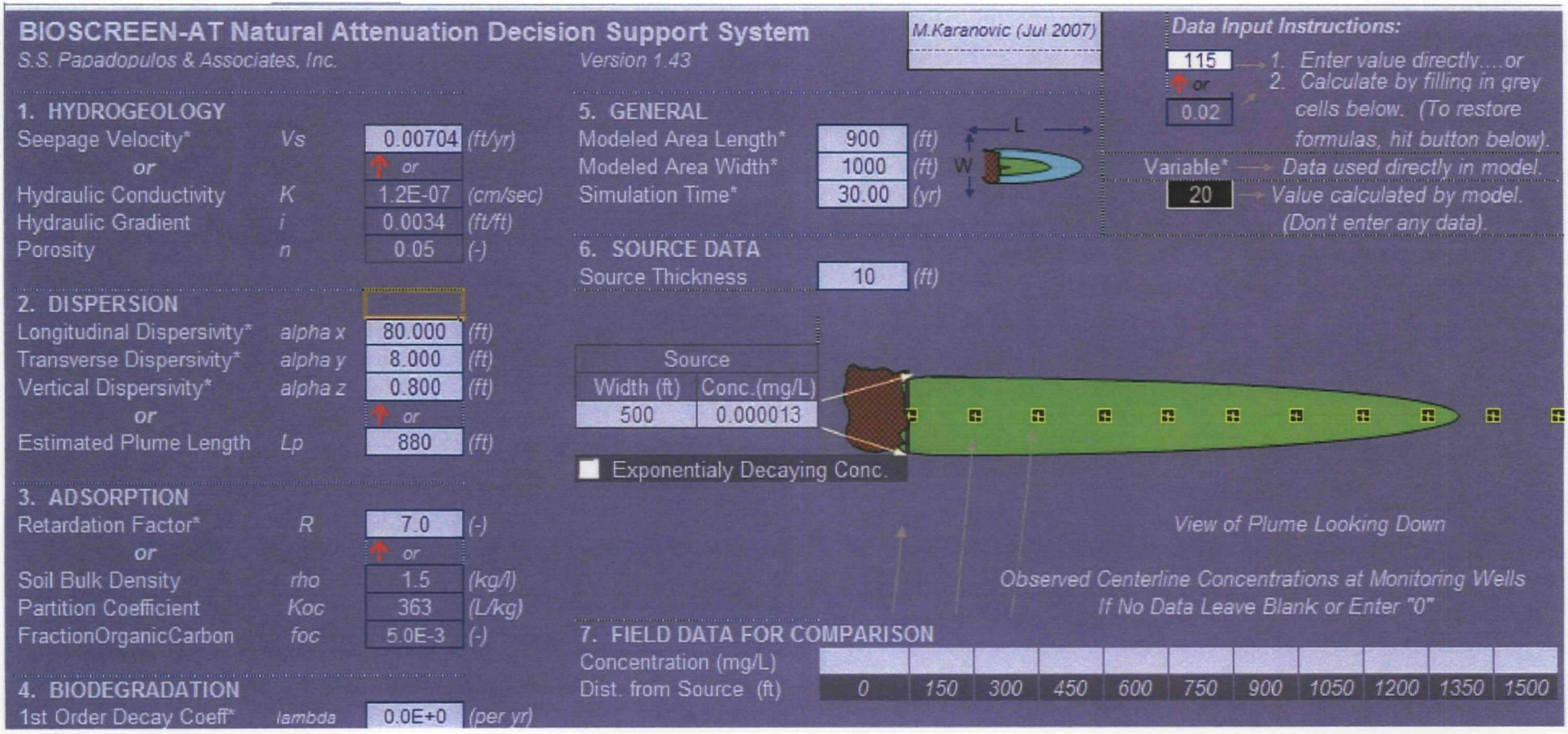
Distance from Source (ft)

	0	90	180	270	360	450	540	630	720	810	900
No Degradation	0.000013000	0.000000000	0.000000000	0.000000000	0.000000000	0.000000000	0.000000000	0.000000000	0.000000000	0.000000000	0.000000000

# of TimeSteps 20 | Displayed Time=30.00 years | Return to Input | View Plume Output



Output for total porosity of 45% and fraction organic carbon of 0.0033 (R ~ 5.0)



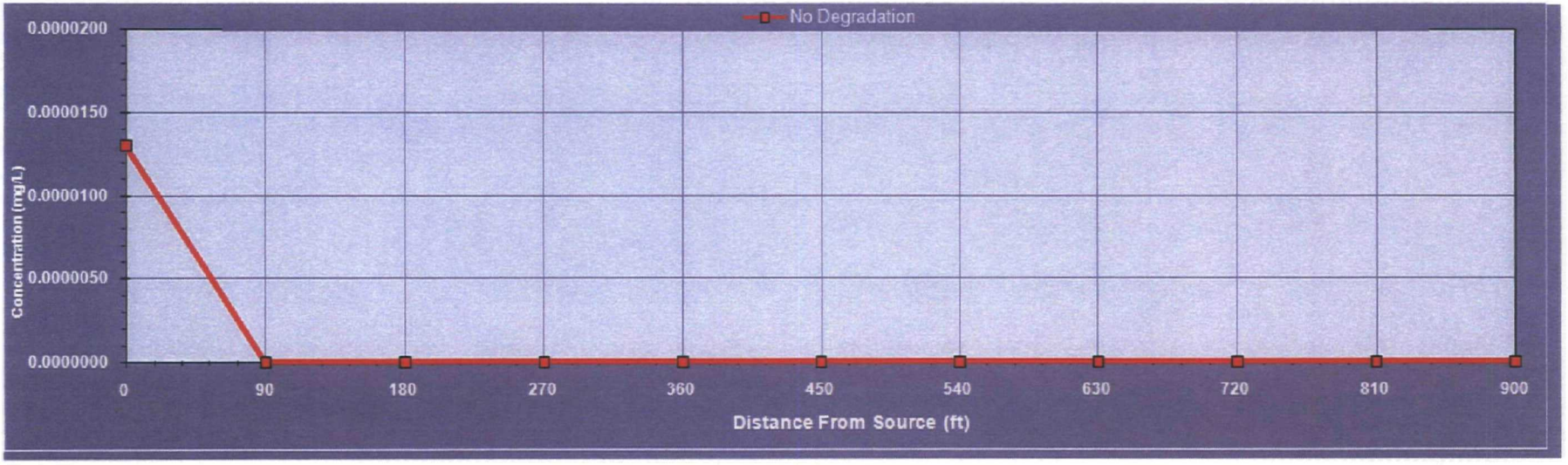
Input for total porosity of 45% and fraction organic carbon of 0.005 (R ~ 7.0)

DISSOLVED HCB CONCENTRATIONS IN PLUME (mg/L at Z=0)

Distance from Source (ft)

	0	90	180	270	360	450	540	630	720	810	900
No Degradation	0.000013000	0.000000000	0.000000000	0.000000000	0.000000000	0.000000000	0.000000000	0.000000000	0.000000000	0.000000000	0.000000000

# of TimeSteps 20 | Displayed Time=30.00 years | Return to Input | View Plume Output



Output for total porosity of 45% and fraction organic carbon of 0.005 (R ~ 7.0)