SUPPLEMENTAL UPPER FLORIDAN AQUIFER MONITORING WELL INSTALLATION -- ADDENDUM TO THE FLORIDAN AQUIFER MONITORING PLAN

KOPPERS INC. SITE
GAINESVILLE, FLORIDA

FINAL REPORT

July 26, 2006

GeoTrans, Inc.

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July 26, 2006

Ms. Amy McLaughlin
Remedial Project Manager
U.S. Environmental Protection Agency
Region IV, Superfund North Florida Section
61 Forsyth Street, SW
Atlanta, GA 30303-3104

Subject: Transmittal of the "Supplemental Upper Floridan Aquifer Monitoring Well Installation -- Addendum to the Floridan Aquifer Monitoring Plan, Koppers Inc. Site, Gainesville, Florida"

Dear Ms. McLaughlin:

On behalf of Beazer East, Inc., attached is a copy of the report entitled "*Supplemental Upper Floridan Aquifer Monitoring Well Installation, Addendum to the Floridan Aquifer Monitoring Plan, Koppers Inc. Site, Gainesville, Florida*". We welcome your comments on the enclosed report. Should you require additional information, please feel free to contact me at (303) 665-4390.

Sincerely,

James R. Erickson, P.G.
Principal Hydrogeologist

James W. Mercer, Ph.D., P.G.
Executive Vice President
Professional Geologist FL #275
Principal Hydrogeologist

Enclosure

Cc: Kelsey Helton, FDEP
John Mousa, ACEPD
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FINAL REPORT

Prepared For:

Beazer East, Inc.

Prepared by:

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July 26, 2006

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ACRONYMS

ACEPD	Alachua County Environmental Protection Division
ASTM	American Society of Testing and Materials
Beazer	Beazer East, Inc.
bgs	Below Ground Surface
DNAPL	Dense Non-Aqueous Phase Liquid
EPA	Environmental Protection Agency
FDEP	Florida Department of Environmental Protection
GC/MS	gas chromatograph/mass spectrometer
GCTL	Groundwater Cleanup Target Level
GRU	Gainesville Regional Utility
GS/MS	gas chromatograph/mass spectrometer field unit
HG	Hawthorn Group
HASP	Health and Safety Plan
IDW	investigational derived wastes
KI	Koppers Inc.
LDR	land-disposal restriction
LTZ	Lower Transmissive Zone
MAGI	MOSDAX Automated Groundwater Interface
MCL	Maximum Concentration Limit
OSHA	Occupational Safety and Health Administration
PID	Photoionization Detector
QA	Quality Assurance
QAPP	Quality Assurance Project Plan
QC	Quality Control
RCRA	Resource Recovery and Conservation Act
RFAMPA	Revised Floridan Aquifer Monitoring Plan Addendum
SAP	Sampling and Analysis Plan
SCM	Site Conceptual Model
SOP	Standard Operating Procedure
SJRWMD	St John's River Water Management District
Site	Koppers portion of the Cabot Carbon/Koppers Superfund Site
TCLP	Toxicity Characteristic Leaching Procedure
UAO	Unilateral Administrative Order
UF	Upper Floridan
UTZ	Upper Transmissive Zone
VOCs	Volatile Organic Compounds

1.0 INTRODUCTION

This report documents the installation of new Upper Floridan (UF) monitoring wells to augment the existing UF Aquifer monitoring program for the Koppers, Inc. (KI) portion of the Cabot Carbon/Koppers Superfund Site in Gainesville, Florida (the Site). The Site location is shown on Figure 1-1. A total of 14 UF monitoring wells were installed as part of the current drilling program, with 12 of the monitoring well locations specified by the U. S. Environmental Protection Agency (EPA) and two additional monitoring wells voluntarily installed by Beazer, East Inc. (Beazer).

This report is presented as an Addendum to the Floridan Aquifer Monitoring Plan (TRC, June 2004b). The EPA prepared the Revised Floridan Aquifer Monitoring Plan Addendum (RFAMPA), as detailed in their letters to Beazer dated July 12, 2005 and July 20, 2005. The EPA's RFAMPA was in response to Beazer's proposed workplan (June 24, 2005) for the implementation of the Floridan Aquifer Monitoring Plan.

In general, the monitoring well installation activities were performed as required by the RFAMPA, pursuant to the Unilateral Administrative Order (UAO) issued by EPA to Beazer and KI (previously known as Koppers Industries, Inc), on March 22, 1991, and amended on April 28, 1994. The monitoring well design and approach were modified as detailed in GeoTrans' October 17, 2005 letter to the EPA.

1.1 OBJECTIVES AND APPROACH

Objectives

The primary objective of the Floridan Aquifer monitoring program is to develop a comprehensive monitoring well network for the Upper Transmissive Zone (UTZ) of the UF Aquifer. Previously, a total of 11 monitoring wells were installed into the upper 30 feet of the UTZ. Only one Site monitoring well (FW-1) was completed to the base of the UTZ prior to the current drilling program (monitoring well FW-1 was subsequently backfilled so that it only monitors the upper portion of the UTZ). The current program addresses installation of 14 additional UTZ monitoring wells to augment the existing monitoring network.

A second objective of the Floridan Aquifer monitoring program was to investigate the potential for groundwater impacts in the UF Aquifer downgradient of monitoring well FW-6 and beneath the four former source areas. Monitoring well FW-6 was installed into the UF Aquifer using mud-rotary drilling methods in July 2004. Monitoring well FW-6 has contained elevated concentrations of Site related constituents since its installation; however, the constituent concentrations have declined since the first sample collected in 2004. Four potential conceptual models for the presence of these organic constituents are: 1) Residual NAPLs, mixed with drilling fluids, were dragged-down during well installation; 2) On-going dissolved-phase transport of constituents through the Hawthorn Group (HG) lower clay unit; 3) Vertical leakage from Hawthorn Group deposits along the well casing; 4) NAPL migration through the HG lower clay unit into the UF Aquifer, acting as an on-going source to a dissolved-phase plume; and 5) A combination of conceptual models 1 through 4. Hence, this supplement to the Floridan Aquifer monitoring program will help to resolve the conceptual model for FW-6 impacts and to determine if UF Aquifer impacts are present beneath the four source area at the Site.

A third objective of this supplement to the Floridan Aquifer monitoring program was to utilize new information to confirm or update the Site Conceptual Model (SCM).

Approach

One concern associated with the installation of wells into the UF Aquifer is the potential for compromising the integrity of the HG middle and lower clay units. Because of this concern, all on-Site monitoring wells were completed with telescoping isolation casings in an attempt to minimize the potential introduction of Site constituents from overlying strata into the Lower Hawthorn deposits and the underlying UF Aquifer. The UF monitoring well design consisted of four telescoping casings (three isolation casings and one well casing) to minimize potential impacts in overlying zones from the final UF Aquifer completion. The two large-diameter telescoping isolation casings (18-inch and 12-inch ID) were installed with a cable-tool drill rig. The third telescoping isolation casing (8-inch ID) and final well casing (4-inch ID) were installed with a rotasonic drill rig. Each of the successive isolation casings is grouted in place prior to proceeding with the next casing installation. Although extensive precautions were taken to help ensure isolation of impacted areas from the UF Aquifer, the potential for inducing Site constituent migration pathways via these wells still exists. The technical challenge to the implementation of this program was to limit the possibility for the new monitoring wells and boreholes from inadvertently providing vertical conduits for the downward migration of Site constituents.

One of the lessons learned from the installation of FW-6 is that even with extraordinary precautions to prevent “drag down” of constituents from overlying HG deposits; it is difficult to completely eliminate the potential for “drag down”. With approximately 120 feet of hydraulic-head differential across the HG deposits, high permeability secondary dissolution features, and the relatively high permeability of the UF Aquifer matrix material, it is difficult to install a monitoring well without some “drag down” of impacts from overlying deposits.

In addition to limiting the potential for introduction of Site constituents during the installation of the well, it is difficult to ensure long-term integrity of the annulus grout seals, which seat the isolation casings. The approximately 120-foot hydraulic-head difference from the Surficial Aquifer to the UF Aquifer may induce flow along small pathways adjacent to a well casing. This flow would eventually result in transmission of detectable quantities of impacted groundwater over periods of months and years.

Figure 1-2 shows the location of the 14 UF Aquifer monitoring wells installed under this program. Because of the concern for the long-term introduction of Site constituents into the UF Aquifer via imperfections in the annulus grout seal, the procedure for installation of the four source area monitoring wells (FW-18B through FW-21B) was the following: 1) If NAPL was detected in core samples collected from below the lowermost isolation casing (8-inch ID), the borehole was to be stopped and the well completed as a Lower Hawthorn monitoring well; 2) If no NAPL was detected in the core samples collected from below the lowermost isolation casing, the borehole was advanced and completed as an UF monitoring well; and 3) In the event that NAPL was detected at the first location, a second borehole was to be installed approximately 100 feet downgradient of the first borehole. NAPL was not observed in any of the boreholes advanced below the 8-inch ID casing during this program.

1.2 SITE LOCATION AND DESCRIPTION

The Site encompasses approximately 90 acres and is located within the Gainesville City limits in Alachua County, Florida (Figure 1-1). It has been used as an active wood-treating facility for 89 years. The Site is located in an area of the city that is zoned for industrial, commercial, and residential use. The adjacent property to the east of the Site is the former Cabot Carbon Superfund site. This property was redeveloped for commercial use in the1990s. The adjacent property to the north is the Alachua County vehicle/equipment maintenance facility. The adjacent properties to the west are private residences, and the adjacent properties to the south are a mixture of commercial and residential properties.

The Koppers Site is located on a gently sloping plain at an elevation of approximately 180 feet above mean sea level (msl). The ground surface immediately around the Site has very low relief and slopes gently to the northeast. A central drainage ditch bisects the Site in a north to northeasterly direction. The ground surface elevation declines over a distance of about 3,000 feet, from approximately 190 feet above msl on the southern property boundary to 170 feet above msl on the northern property boundary.

1.3 REGIONAL HYDROGEOLOGY

The Site is located in the Northern Highlands of Alachua County, where the HG deposits confine the UF Aquifer. Four principal hydrostratigraphic units are present in this area: 1) Surficial Aquifer, 2) HG deposits, 3) UF Aquifer, and 4) Lower Floridan Aquifer. For purposes of this discussion, the Surficial, UF and Lower Floridan deposits are classified as aquifers beneath the Site. Conversely, the hydrogeologic and water-yielding properties of the HG deposits more closely approximate that of an aquitard, which is defined as: "..*less permeable beds in a stratigraphic sequence. These beds may be permeable enough to transmit water in quantities that are significant in the study of regional groundwater flow, but their permeability is not sufficient to allow the completion of production wells within them.*" (Freeze and Cherry, 1979, page 47).

Surficial Aquifer

The Surficial Aquifer consists of approximately 20- to 30-feet of Pliocene to Pleistocene marine terrace deposits (Figure 1-3). These deposits primarily consist of unconsolidated, fine- to medium-grained sand, with thin layers of interbedded silt and clay deposits. The Surficial Aquifer groundwater flow is primarily controlled by land surface topography and localized discharge points such as wetlands, creeks and drainage ditches. The Surficial Aquifer is not a major source of potable groundwater; however, some wells have been installed in this unit for residential irrigation.

Hawthorn Group Deposits

The HG deposits underlie the Surficial Aquifer and consist of a thick sequence of interbedded low- and moderate-permeability, unconsolidated sedimentary deposits. These deposits are approximately 120 to 125 feet thick beneath the Site and separate the overlying Surficial Aquifer from the underlying UF Aquifer. The HG deposits consist of a complex sequence of interbedded clays, silts, sands and carbonates, with three predominantly clay deposits located at the top, middle and bottom of this unit. Deposits separating the three major clay units are clayey sands, sands, silts, silty-sand and isolated carbonate deposits. As indicated above, the HG is not a major source of groundwater for this area. Hydraulic heads in the Hawthorn are primarily controlled by the three low-permeability clay units. The ratio of horizontal to vertical groundwater flow within this formation is about 2:1. The ratio of horizontal to vertical flow in a typical interbedded sedimentary deposit similar to the HG is usually greater than 10:1. Although the vertical groundwater flow component is relatively low as a result of the three clay units, it is only slightly less than the horizontal groundwater flow component. Hence, horizontal groundwater flow is relatively insignificant in comparison to the Surficial and UF Aquifer systems.

Upper Floridan Aquifer

The UF Aquifer underlies the Hawthorn Group deposits. The two primary formations that comprise the UF Aquifer are the Ocala Limestone and the Avon Park (Figure 1-3). The UTZ is a secondary water-producing interval for the UF Aquifer and is located in the uppermost portion of the Ocala Limestone. The thickness of the UTZ is also highly variable, ranging from 50- to 100-feet in thickness. The Lower Transmissive Zone (LTZ) is the major water-producing interval for the Murphree Wellfield in Alachua County. The LTZ is located at the contact of the Ocala Limestone and Avon Park and is highly variable in thickness ranging from 20 to 100 feet (GeoSys, Inc., 2000). Approximately 85 percent of the Murphree Wellfield production is obtained from the LTZ and 15 percent is obtained from the UTZ (GeoTrans, 2004b). The UTZ and LTZ are separated by approximately 100 feet of dense, low-permeability carbonate deposits that produce limited quantities of water. The regional groundwater flow direction in the UF Aquifer is to the west and northwest; however, groundwater withdrawals from the Murphree Wellfield have changed groundwater flow directions across a large area of the county. Because of Murphree Wellfield withdrawals, the UF Aquifer average groundwater flow direction at the Site is to the northeast. A more thorough discussion of the hydrogeologic SCM is provided under separate cover in the report entitled: *Addendum 7: Groundwater Flow and Transport Model* (GeoTrans, 2004b).

Lower Floridan Aquifer

The Lower Floridan Aquifer is separated from the UF Aquifer by approximately 200 feet of low-permeability carbonate deposits, in addition to numerous intra-aquifer low-permeability zones. The Lower Floridan Aquifer is effectively isolated from the UF Aquifer, with limited potential for groundwater flow between them. No water-supply wells are known to be completed in the Lower Floridan Aquifer within Alachua County (CH2M HILL, 1993).

1.4 DNAPL SOURCE AREAS

There are four potential dense nonaqueous phase liquid (DNAPL) source areas at the Site identified in the 1987 RI (IT Corp., 1987): 1) The Former North Lagoon; 2) The Former South Lagoon; 3) The Former Cooling Pond (including the Former Tank Containment and Process Areas); and 4) The Former Drip Track Area. The locations of these four potential source areas are shown in Figure 1-2.

1.5 EXISTING FLORIDAN MONITORING WELLS

Prior to the installation of Floridan monitoring wells under this current program, there were 11 UF Aquifer monitoring wells (Figure 1-2) completed at or near the Site. Two of these wells were installed by GRU as sentinel monitoring wells, with monitoring well MWTP-MW-1 located approximately 1,400 feet to the northeast of the northern Site property boundary and monitoring well MWTP-MW-2 located approximately 4,500 feet to the east-northeast of the Site. The location of monitoring well MWTP-MW-1 is shown in Figure 1-2; however, the location of monitoring well MWTP-MW-2 is too far east of the Site to be shown on this figure. Nine of these monitoring wells (FW-2 through FW-9, and GRU well MWTP-MW-1) are part of the current Floridan Aquifer Monitoring Plan (TRC, 2004b). GRU monitoring well MWTP-MW2 is completed in the UTZ and is included in the GRU/County monitoring program; however, it is located too far east to intercept groundwater flow from beneath the Site. Monitoring well FW-1 was installed in 1992 to a depth of 310 feet (above the LTZ), with an uncased hole from 151 to 310 feet. Although this monitoring well was always clean, because of concerns that it could provide a conduit for Site constituents to the LTZ, this monitoring well was recently backfilled to a depth of approximately 166 feet and now monitors only the upper 20 feet of the UTZ (TRC, April 2004a).

2.0 DRILLING AND MONITORING WELL CONSTRUCTION

Monitoring well installation was performed in accordance with the *Addendum to the Floridan Aquifer Monitoring Plan Supplemental Upper Floridan Aquifer Monitoring Well Installation*, dated June 24, 2005 with modifications to the plan in accordance with the following letters: 1) EPA, July 12, 2005; 2) EPA, July 20, 2005; 3) GeoTrans, October 17, 2005, and 4) GeoTrans, October 31, 2005. The 14 monitoring wells were installed in the UF Aquifer using a combination of cable-tool and rotasonic drilling methods, with work beginning in July 2005. Well construction, development, and installation of the Westbay Multi-Port System (Westbay System) were completed in May 2006. The monitoring well as-builts, and the well construction logs are provided in Appendix A.

2.1 MONITORING WELL LOCATIONS AND DEPTHS

The final UF Aquifer locations for monitoring wells FW-10B through FW-21B were prescribed by the EPA in their letter to Beazer dated July 12, 2005. Minor modifications to the original monitoring well locations were required due to Site operations and were approved by the EPA prior to implementing the change. The well locations were divided into transect monitoring wells (FW-10B through FW-17B) and source monitoring wells (FW-18B through FW-21B). The transect monitoring wells form an east-west line that crosses the northern half of the Site; where as the source monitoring wells are located downgradient of potential source areas. Prior to the July 12, 2005 EPA letter, potential monitoring well locations were discussed in the following meetings and correspondence:

1) Discussions with the EPA, Florida Department of Environmental Protection (FDEP), Alachua County Environmental Protection Division (ACEPD) and Gainesville Regional Utility (GRU) at a meeting in Gainesville, Florida on January 19, 2005;
2) Discussions with the EPA, FDEP, ACEPD and GRU at a meeting in Gainesville, Florida on March 8, 2005;
3) Response to comments from the EPA (April 14, 2005), FDEP (E-mail dated March 30, 2005), ACEPD (April 5, 2005) and GRU (April 1, 2005) on the draft Addendum workplan, submitted to the Stakeholders on February 28, 2005; and
4) Discussions with the EPA, FDEP, ACEPD and GRU at a meeting in Gainesville, Florida on June 15, 2005.

The target zone for completion of the monitoring wells was the upper 100 feet of the Ocala Limestone, which corresponds to the maximum thickness reported for the UTZ in the county. Because the actual thickness of the UTZ is unknown and may vary across the Site, all UF Aquifer monitoring wells installed under this program were prescribed to be completed in the upper 100 feet of the UF Aquifer.

In addition to the 12 monitoring wells prescribed by the EPA, two additional UF monitoring wells (FW-22B and FW-23B) were voluntarily installed by Beazer to monitor groundwater quality along the northern Site property boundary and downgradient of Site constituent impacts observed in monitoring well FW-12B.

2.2 DRILLING APPROACH

The UF monitoring well design consisted of four telescoping casings (three isolation casings and one well casing) to minimize potential impacts in overlying zones from the final UF Aquifer completion (Figure 2-1). The two large-diameter telescoping isolation casings required for the UF Aquifer monitoring wells exceeded the maximum casing size for rotasonic drilling; therefore, the two largest telescoping casings (18-inch and 12-inch ID) were installed using a cable-tool drill rig. The rotasonic drilling method was used to install the 8-inch ID telescoping casing and the 4-inch ID well casing. One of the primary advantages to the cable-tool drilling method is that it minimized the volume of investigative derived waste (IDW) relative to the anticipated volume that would have been generated by other drilling methods, such as mud rotary.

2.2.1 Cable-Tool Drilling

The cable-tool rig and associated tools were decontaminated prior to setting up and drilling at each new well location. The general cable-tool rig drilling procedure described below was repeated for the installation of the 18-inch and 12-inch telescoping isolation casings for the 14 UF Aquifer monitoring wells.

The telescoping isolation casing installation for each of the borings was initiated by first manually digging a pilot hole to a depth of approximately 4 feet for the start of the temporary outer drill casing. In addition to acting as a guide for the temporary drill casing, the 4-foot deep pilot hole provided secondary verification that no subsurface utilities were present at the location. Before drilling with the cable tool, a Geoprobe was used to identify the depth to the top of the HG upper clay unit at the locations for monitoring wells FW-10B through FW-17B. The Geoprobe holes were immediately abandoned by grouting.

The cable-tool rig was used to drill a nominal 24-inch diameter borehole to an average depth of approximately 26 feet below ground surface (bgs), penetrating approximately 1 foot into the HG upper clay unit. To prevent caving, a temporary, reusable, 24-inch ID steel casing was driven into the boring ahead of the drill bit. When it was necessary to add additional casing, the joints were beveled and triple welded.

A permanent 18-inch ID black steel isolation casing was then set in the HG upper clay unit, within the 24-inch temporary casing and tremie grouted to ground surface. Centralizers were welded to the top and bottom of the 18-inch casing to help ensure a complete and uniform grout seal and to minimize grout channeling. The temporary 24-

inch ID casing was removed from the boring as grout was added, taking care to keep at least 5 feet of grout in the annular space above the bottom of the temporary 24-inch ID casing. The grout was allowed to cure a minimum of 12 hours prior to performing the next phase of drilling.

Once the grout had cured, a nominal 16-inch ID borehole was advanced through the center of the 18-in casing from approximately 26 feet bgs to an average depth of approximately 67 feet bgs, penetrating approximately 3 feet into the HG middle clay unit. Borehole stability was maintained using a temporary 16-inch ID steel casing. The casing was beveled and triple-welded at each joint. A permanent nominal 12-inch ID black steel isolation casing was then placed inside of the 16-inch temporary casing at approximately 3 feet into the top of the HG middle clay unit. The 12-inch ID casing was tremie-grouted to ground surface, contemporaneously with the removal of the temporary 16-inch ID casing. Approximately 5 feet of grout was maintained in the annular space above the bottom of the temporary 16-inch ID casing during the removal of this casing. A protective steel plate was tack welded to the top of the 12-inch ID casing to prevent materials/equipment from falling downhole prior to the rotasonic rig being mobilized to the well. The grout seal was allowed to cure a minimum of 12 hours before additional work was performed.

2.2.2 Rotasonic Drilling

A rotasonic-drill rig was mobilized to the each of the well locations to complete the installation of the third isolation casing (8-inch ID) and the stainless steel well (4-inch ID). The rotasonic drilling method is commonly used in Florida and employs the use of high-frequency, resonant energy to advance a core barrel or casing into subsurface formations. The resonant energy is transferred down the drill string to the bit face at various sonic frequencies, while simultaneously rotating the drill string. This method advances both an inner and outer casing as the borehole is drilled. The inner casing is typically a core barrel for the collection of samples and the outer casing prevents borehole collapse. The maximum standard-size permanent casing that can be installed by local rotasonic drilling contractors is an 8-inch ID casing inside of a 12-inch ID retractable override casing.

Rotasonic drilling continued from the base of the 12-inch ID isolation casing to an average depth of 120 feet using a 10-inch OD override casing. The 8-inch ID isolation casing was set approximately 6 to 10 feet into the HG lower clay unit. The completion depth of the 8-inch isolation casing was chosen based on the presence of massive low-permeability clay deposits that are typically encountered at these depths. Continuous 6-inch diameter core samples were collected and logged from the base of the 12-inch isolation casing (at an approximate average depth of 67 feet bgs) to the base of the borehole at an average depth of approximately 120 feet bgs. Prior to setting the 8-inch ID isolation casing, the core barrel was advanced an additional 10 to 15 feet below this proposed completion depth to visually check for the presence of NAPLs. The cores were also scanned using a photoionization detector (PID) for evidence of volatilize organic compounds. If NAPLs had been encountered below the proposed completion depth, the UF Aquifer monitoring well workplan required that the borehole not extend into the UF Aquifer and that it be completed in the lower clay unit as a HG monitoring well. This well completion contingency was not required because NAPLs were never observed below the completion depth of the 8-inch isolation casing in any of the 14 UF monitoring well locations.

To ensure that the borehole did not collapse during the installation and grouting of the casing, the 8-inch isolation casing was completed inside of the temporary 10-inch override casing prior to removing the override casing. Before lowering the 8-inch ID casing into the borehole, approximately 180 gallons of cement grout were pumped via a tremie pipe inside the 10-inch override casing, creating a reservoir of cement grout in the base of the 10-inch override casing. This exceeds the volume required to fill the void space between the 8-inch and 10-inch ID casings and ensured that the grout seal around the casing would be continuous. Prior to installing the 8-inch casing, a PVC end cap was slipped on the lower end of the 8-inch casing to preclude cement grout from entering the inside of the casing. The 8-inch ID casing was then lowered inside of the 10-inch override casing displacing the grout and filling the annular space between the 10-inch and 8-inch casing. The 8-inch ID casing was centralized at the base of the 10-inch override casing, by setting it into the 4-inch pilot hole remaining from the core and it was locked into the drill-rig jaws to centralized at land surface for overnight curing of the grout. Potable water was added to the inside of the 8-inch casing to add weight for displacing the cement grout while the grout cured. Displaced annular fluid was collected into the mud tub as it was discharged during casing installation. It was then containerized for IDW disposal. After the 8-inch casing was lowered to its completion depth, the 10-inch override casing was removed by lifting and vibrating the casing causing the grout to flow into void spaces between the 8-casing and formation material. Typically, the grout level dropped about 30 feet inside of the 12-inch isolation casing after the 10-inch override casing was removed. Additional cement grout was added the following day to ensure a complete grout seal to land surface.

After the grout had cured a minimum of 12-hours, a nominal 7-inch boring was advanced from the base of the 8-inch ID casing (approximate 120 feet bgs) to the completion depth of the well (at an approximate average of 245 feet bgs). The borehole was first advanced to within 5 feet of the Ocala Limestone contact, using standard rotasonic drilling methods. Continuous 3 ½ - inch diameter core was collected in 5-foot intervals in front of the 7-inch OD override casing to help ensure that the borehole was not inadvertently advanced into the UF Aquifer. Once the borehole was within approximately 5 feet of the Ocala Limestone contact, the override casing was flushed with approximately 300 gallons of clean tracer-tagged water to help minimize the potential introduction of impacted drilling fluids into the UF Aquifer. The borehole was flushed until the majority of the drill cuttings were removed from the borehole, based on visual inspection of the return fluid. In addition, the flushed water and cuttings were examined for evidence of NAPL impacts. Once flushing was complete, the borehole was advanced to the completion depth of approximately 245 feet in the Ocala Limestone. Loss of drilling fluid circulation was routinely encountered within the upper 10 to 20 feet of the Ocala Limestone. Continuous core was collected from the Ocala Limestone, logged, and scanned with a PID to the completion depth of the borehole.

2.2.3 Geologic Core Collection

Approximately 2,000 feet of geologic core were collected from the 14 boreholes starting at the HG middle clay unit and extending to the base of the boreholes in the Ocala Limestone. Geologic core section log field forms are provided in Appendix B and a photographic summary of the cores are provided in Appendix C. Core was not collected from land surface to the top of the middle clay unit because the cable-tool drill rig did not have sample collection capabilities. To better identify the top of the HG upper clay unit and to prevent penetration of this unit with the cable tool, a Geoprobe rig was utilized to define the top of the HG upper clay unit for monitoring wells locations FW-10B through FW-17B. Samples from these borings were not formally logged and the Geoprobe holes were immediately abandoned by grouting. In addition, drill cuttings from the cable-tool drilling operation were logged to establish geologic contacts and lithologies. Geologic contacts established from the geoprobe samples, in conjunction with geologic contact depths established from drill cuttings were used to help guide depths chosen for the isolation casings.

Continuous core samples from the HG middle clay unit to approximately 100 feet below the Ocala Limestone contact were described by the on-Site field hydrogeologist, photographed, and screened for Volatile Organic Compounds (VOCs) with the PID. All Ocala Limestone cores were stored on Site and retained for future use in core boxes. Geologic cores obtained from the Lower HG deposit were also described by the on-Site field hydrogeologist, photographed, and screened for Volatile Organic Compounds (VOCs) with the PID. Approximately half of these lower HG deposit cores were retained for confirmation of previous geologic contact. All of the lower HG deposits cores were retained for the four source area monitoring wells. Lower HG cores that were not retained were containerized for disposal. Monitoring well construction as-built drawings with geologic descriptions, soil core log forms, and photographs of the cores are provided in Appendices A, B, and C, respectively. A summary of the well as-built data and depths to major stratigraphic contacts for the 14 monitoring wells is provided in Figure 2-2.

Continuous 6-inch diameter cores were collected from the HG middle clay unit to the upper 10 feet of the HG lower clay unit. Continuous 3 ½ -inch diameter cores were collected from the HG lower clay unit to the base of the boring at about 245 feet. The core sample diameter was a function of the rotasonic override casing ID. The larger diameter override casing used to install the permanent 8-inch isolation casing required the use of a larger core barrel, whereas a smaller override casing diameter for the 120 feet of the borehole allowed the use of a smaller 3 ½ -inch diameter core barrel. Select core intervals from the Ocala Limestone and the Lower HG deposit were analyzed for arsenic-containing minerals as part of the on-going arsenic evaluation of the UF Aquifer. Results of this evaluation are not included in this document and will be presented in a separate report.

2.2.4 Drilling Fluids

The cable-tool and rotasonic drilling methods required the use of water (drilling fluids) for drilling and well construction. A summary of drilling fluids lost to the UF Aquifer during drilling and well construction is provided in Table 2-1. All fluids used during the drilling and well construction in the UF Aquifer were “tagged” with a bromide tracer. The bromide tracer was used to help guide well development. Initially, the bromide target concentration for the drilling fluids was established at approximately 4,000 mg/L. Based on the well development activities in the first few monitoring wells installed (FW-10B through FW-14B), it was determined that a lower bromide target concentration of approximately 1,000 mg/L would meet the objectives of the program. Drilling fluid bromide concentrations and the daily field bromide concentrations during well development are provided in Table 2-2.

2.2.5 Equipment and Materials Decontamination Procedures

Drilling Equipment and Materials Decontamination

Drilling equipment, tools and associated materials used in well construction were decontaminated prior to first use on Site, after the installation of each telescoping isolation casing, and prior to drilling at a new well location (i.e., before and after all operations). Decontamination was performed at the existing on-Site decontamination pad. Decontamination fluids were containerized for characterization, testing and disposal. The following decontamination procedures were used:

1) The external and internal surfaces of equipment were washed with a high-pressure steam cleaner. If necessary, all visible dirt, grime, grease, oil, loose paint, rust flakes, etc., was scrubbed with brushes for removal.
2) After cleaning, the equipment/material was rinsed with potable water.
3) All decontaminated drilling equipment, casings and override casing was stored above ground on racks prior to being used in the drilling and well construction process.

Groundwater Sampling Equipment Decontamination

Decontamination of sampling equipment followed the standard protocol established for the Floridan Aquifer Monitoring Plan (TRC, 2004b) for this Site. New tubing, supplies and equipment were used whenever possible to minimize the potential for cross contamination. In general, new tubing was used for each well during Wattera pump development and purging operations. When new equipment and/or supplies were not available, the equipment and supplies were decontaminated by cleaning exterior surfaces and flushing all pumps and hoses with potable water, Alconox, or an equivalent detergent. After washing, the equipment was thoroughly rinsed with potable water.

2.2.6 Investigative Derived Waste

All investigative derived waste (IDW) originating from designated Superfund Sites must be treated as hazardous waste, unless laboratory analyses establish that it can be treated as nonhazardous waste. To make this determination Beazer utilized the material handling and waste characterization process described below.

The material (drill and auger cuttings, drilling mud, development water, etc) generated from the drilling activities for the installation of 14 quadruple-cased UF Aquifer monitoring wells conducted by GeoTrans and Prosonic were placed in DOT- approved open-top drums. The material produced from each well installation was segregated into three categories (Surficial zone material, Upper/Middle Hawthorn zone material and Lower Hawthorn/transmissive zone material) for material handling and disposal characterization purposes.

All material generated from the Surficial, Upper/Middle Hawthorn, Lower Hawthorn/transmissive zones was contained in drums, labeled accordingly, and moved from the drilling location to the confines of Beazer's on-Site wastewater treatment plant area. The drums were then opened and all water was removed and treated at the Beazer wastewater treatment plant for subsequent discharge to GRU. In order to properly characterize the solid material remaining in the drums, a sample was obtained from each drum produced from the Surficial zone, the Upper/Middle Hawthorn zone, and the Lower Hawthorn/transmissive zone to form three composite samples (i.e., one composite sample representing each zone). The above material handling procedures and sampling criteria was performed for each of the 14 monitoring well installations.

The composite samples were shipped to STL laboratories for analysis of Volatile Organic Compounds (VOCs) by gas chromatograph/mass spectrometer field unit (GS/MS), Semi-Volatile Organic Compounds (SVOCs), by gas chromatograph/mass spectrometer (GC/MS) total arsenic, total chromium, and Toxicity Characteristic Leaching Procedure (TCLP) analysis for arsenic and chromium. The purpose of performing VOC, SVOC, total arsenic and total chromium analysis was to determine if the material met the definition of a potentially applicable "listed" hazardous waste (i.e., F032, F034, and F035). Additionally, the purpose of performing TCLP analysis was to determine if the material was a characteristic hazardous waste (i.e., D004, D007). These analyses also identified whether the material complied with the Resource Recovery and Conservation Act (RCRA) land-disposal restriction (LDR's) regulations that are applicable for each potentially applicable listed hazardous waste code.

A total of 954 drums were generated during the monitoring well installation process. The drummed material, representing all of the above three zones for all 14 monitoring wells, was managed for off-site transport and disposal in accordance with the results of the analytical data and regulatory guidelines as follows:

- The analytical data revealed that no organic constituents were identified with the material contained within 653 drums. The data did identify the presence of some inorganic constituents (arsenic and chromium), and consequently the material was protectively characterized as an F035 listed hazardous waste. However, the TCLP analysis revealed that the material was not a characteristic hazardous waste; these materials also met LDR treatment standards for F035 listed hazardous waste. Consequently, these 653 drums were transported for off-Site disposal to Envirosafe Services' Subtitle "C" landfill located in Oregon, Ohio.

- The analytical data showed that the material in 253 drums contained low levels of organic constituents and arsenic and chromium concentrations. Therefore, these 253 drums were protectively characterized as an F034 and F035 listed hazardous waste. However, the TCLP analysis revealed that the material was not a characteristic hazardous waste; these materials also met LDR treatment standards for F034 and F035 wastes. Thus, these 253 drums were transported for off-Site disposal to Envirosafe Services Subtitle "C" landfill located in Oregon, Ohio.

- In the remaining 48 drums, analytical data again revealed concentrations of organic constituents, and arsenic and chromium. Therefore, these 48 drums were protectively characterized as an F034 and F035 listed hazardous waste. The TCLP analysis revealed that the material was not a characteristic hazardous waste, and also met LDR treatment standards for F035 waste. However, organic constituents were identified that exceeded the treatment standard for the waste code F034. Therefore, these 48 drums were transported for off-Site disposal to American Environmental Services, Inc. for subsequent incineration. The 48 drums managed in this fashion were generated from only one of the 14 monitoring well locations, FW-21 in the drip-track area, and only from the Surficial and Upper Hawthorn zones.

It should also be noted that pentachlorophenol was not identified in any of the analyses performed on the 954 drums of IDW. This is consistent with groundwater monitoring data for the Site and underscores the fact that pentachlorophenol is not a major constituent at this Site.

2.2.7 Geophysical Logging and Aquifer Testing

The original open borehole monitoring well design for the UF Aquifer necessitated geophysical logging for design and installation of the Westbay System (see EPA July 12, 2005 letter). The primary purpose of the geophysical logging was to quantify potential flow zones within the borehole and to optimize packer locations. The alternative monitoring well design (see Section 2.3.1 below) eliminated the open borehole completion and stipulated the use of a multiple-screen design, thereby eliminating the need for geophysical logging. The GeoTrans letter to the EPA dated October 14, 2005 that discussed the alternative monitoring well design and the elimination of geophysical logs was approved by the EPA in an email to Beazer dated October 19, 2005. These documents are provided in Appendix D.

The July 12, 2005 EPA letter specified that rising-head test (slug tests) be performed for each of the Westbay System multi-port zones to estimate the hydraulic conductivity value for the zones. A slug test involves the temporal measurement of the water-level recovery in the well as a result of the injection into or withdrawal from the formation. Under ideal conditions, slug tests can provide an estimate of formation permeability in the immediate vicinity of the well; however, the accuracy of the measurements are reduced because of interferences from the well screen openings, filter pack permeability and increases/decreases to the permeability due to drilling effects in the immediate vicinity of the wellbore. In addition, the analysis of slug test data is based on the assumption that the aquifer is confined and that the well screen interval fully penetrates the entire thickness of the aquifer. This assumption is not valid for the UTZ where individual zones for the Westbay System are completed within a small interval of the UTZ.

The Westbay Systems have the capability of performing slug tests; however, data obtained from slug tests in the Westbay System would not provide useful information at this Site. The following procedure is used to conduct a rising-head slug test in a Westbay System:

1) With the purge port closed, a fixed volume of water is removed from the inside of the Westbay System casing;
2) The purge port is then opened and groundwater flows into the Westbay System casing;
3) The temporal water-level rise inside of the Westbay System casing is recorded until the water level inside of the casing is approximately equal to the formation water-level; and
4) These data are analyzed with standard analytical methods to obtain a hydraulic-conductivity value.

One of the biggest problems with a rising-head slug test is that it only tests a small volume of material within a few feet of the well. As a result the data collected from these tests are more reflective of the well screen and the material used to construct the well than the aquifer material. This is especially true for tests conducted in a Westbay System that is installed inside a screened well.

As indicated above, the slug test is performed by allowing groundwater to flow through the Westbay System purge port. The Westbay System purge port has a small screen that is 1.8 inches in length (oral communication, Westbay, July 2006). In and of itself, this is a fairly small screen interval for attempting to measure formation permeabilities. One of the primary assumptions in the analysis of these data is that the well is screened over the entire UTZ and not just 1.8 inches. In reality, the slug test would essentially measure the permeability of the Westbay System 1.8 inch long purge port and not the aquifer. Complicating the analysis of the data is the fact that groundwater entering the purge port has to flow from the aquifer through the well screen filter pack and a 10-foot long well screen. Hence, data obtained from these tests would not be representative of formation permeabilities and would be of questionable value. Because of the issue discussed above with the performance and analysis of rising-head slug tests in the Westbay System, Beazer did not perform these tests.

2.2.8 Field Documents

Health and Safety Plan

A project-specific Health and Safety Plan (HASP) (TRC 2002a) was previously prepared to define the health and safety requirements for this project. This HASP establishes the procedures and requirements used to minimize health and safety risks to persons working on the project. The HASP meets the requirements of the Occupational Safety and Health Administration (OSHA) Standard, 29 CFR 1910.120 and 29 CFR 1926.65, "Hazardous Waste Operations and Emergency Response". The HASP includes a discussion of the following:

- Health and safety responsibilities;
- Hazard analysis;
- Personnel training requirements;
- Medical surveillance program;
- Site control procedures;
- Decontamination requirements; and
- Safety procedures and emergency procedures.

Quality Assurance Project Plan

Quality assurance procedures were performed as specified in TRC (2002c) Quality Assurance Project Plan (QAPP). The QAPP plan includes procedures and discussions of the following topics:

- Quality Assurance (QA) objectives;
- Sampling procedures;
- Sampling custody;
- Analytical procedures;
- Calibration and controls and frequency;
- Data reduction validation and reporting;
- Quality Control (QC) procedures;
- Performance and system audits;
- Assessment procedures for data acceptability;
- Preventive maintenance;
- Corrective action;
- QA reports to management;
- Standard Operating Procedures (SOPs) for laboratory sampling control and custody;
- Data validation in analytical reports; and
- Analysis for pentachlorophenol.

Sampling and Analysis Plan (SAP)

The SAP was amended to accommodate new procedures for the following: 1) Well development and purging of Westbay System; 2) Sampling procedures for the Westbay System; and 3) Decontamination procedures for the Westbay System equipment. The amendments to the SAP describing the new procedures above are contained in Appendix E.

2.3 MONITORING WELL DESIGN, INSTALLATION AND COMPLETION

2.3.1 Monitoring Well Design

The original monitoring well design consisted of three telescoping isolation casings through the HG deposits and a 4-inch ID well casing completed approximately 5 to 10 feet into the top of the Ocala Limestone. All UF Aquifer monitoring wells were initially planned to be completed as open boreholes from the base of the 4-inch well casing and extending approximately 100 feet into the Ocala Limestone Formation. The open borehole was to be instrumented with a Westbay System for the collection vertically discrete groundwater samples.

The initial geologic core samples for the upper 100 feet of the Ocala Limestone were obtained at monitoring well location FW-12B. Approximately 70 percent of the 100 feet of Ocala Limestone core at this location was poorly indurated, unconsolidated and not suitable for an open borehole completion in the UF Aquifer. The physical properties of the Ocala Limestone at this location were unexpected and inconsistent with the proposed monitoring well design. To investigate whether unconsolidated Ocala Limestone was unique to this location or laterally continuous across the Site, geologic core samples were collected from two additional monitoring well locations across the Site (FW-10B and FW-14B). The predominantly unconsolidated nature of the Ocala Limestone was also observed at these locations, indicating that the Ocala Limestone consisted of primarily unconsolidated material beneath the entire Site. To accommodate well installation in the unconsolidated material of the UTZ of the UF Aquifer, an alternative monitoring well design was proposed to the EPA (see letter dated October 17, 2005 included in Appendix D).

The alternative monitoring well design consisted of a 4-inch ID, stainless-steel well completion for the UF Aquifer with four 10-foot long, stainless-steel screens, separated by 10-foot long blank stainless-steel casing. A 15-foot long stainless-steel sump was placed at the bottom of the well to facilitate installation of the Westbay System and approximately 40 feet of stainless-steel casing extended from the top of the upper screen to the base of the 8-inch isolation casing. Four-inch ID black carbon steel casing extended from the top of the stainless-steel casing to land surface. The conceptual alternative monitoring well design is shown in Figure 2-1. The only exception to this design is that the 4-inch ID black-carbon steel was replaced with 4-inch ID stainless-steel casing in monitoring wells FW-20B, FW-22B and FW-23B because of casing material availability.

The open boreholes resulting from the collection of cores from monitoring well locations FW-12B, FW-10B and FW-14B were temporarily backfilled until an alternative monitoring well design could be developed and approved by the EPA. The purpose of the backfilling was to minimize potential vertical migration of Site constituents from the overlying HG deposits and to address the Stakeholders' concern for vertically mixing groundwater within the UF Aquifer prior to well construction. The backfill material used at these locations consisted of alternating layers of fine and coarse sand. The fine sand helped to prevent vertical mixing of UF Aquifer groundwater and the coarse sand approximated the natural formation permeability thereby minimizing the potential for adversely impacting the natural formation permeability at these locations. After the backfill sand material was placed in the open borehole portion of the Ocala Limestone, cement grout was tremied into the borehole to seal the open borehole portion within the HG lower clay unit. Cement grout was placed from the top of Ocala Limestone to the base of the 8-inch diameter (third) isolation casing to help minimize the potential for vertical migration of impacted groundwater from the HG lower clay unit into the UF Aquifer. The conceptual design of the temporary backfill is shown in Figure 2-3. The temporary backfilling of these open boreholes was consistent with abandonment criteria and specifications of the Saint Johns River Water Management District (SJRWMD) (Chapter 40C-3, F.A.C.). Correspondence concerning the alternative monitoring well design is included in Appendix D.

2.3.2 Monitoring Well Installation

The complexity of the UF monitoring well installation increased considerably with the alternative monitoring well design that required precise placement of annular backfill material opposite the screened intervals and the blank casing. Because of the restricted annular space between the 4.5-inch OD (4-inch ID) well casing and the 6.23 ID (7-inch OD) override casing, a tremie pipe could not be used for placement of the backfill material. Considerable time and effort was spent installing each monitoring well, placing the backfill materials, removing fine sand from the inside of the wells, and developing wells to remove the larger volume of drilling fluids required to drill and construct each well.

The alternative monitoring well design required the drilling of a 7-inch diameter borehole from the base of the 8-inch ID isolation casing (approximately 120 feet bgs) to the total depth of the well (approximately 245 feet bgs). This is a change from the original design where a 7-inch diameter borehole was to be drilled from the base of the 8-inch ID isolation casing to the top of the Ocala Limestone (approximately 145 feet bgs), where a 4-inch diameter open borehole was to be drilled to the total well depth. The larger 7-inch diameter borehole was needed in the Ocala Limestone to allow a sufficient borehole diameter for construction of the 4-inch ID well.

The alternative monitoring well design consists of four, 4-inch ID by 10-foot long stainless-steel, 0.020-inch slot wire wrapped well screens separated by 10-feet of blank stainless-steel casing. The multiple-screened intervals are intended to provide vertically discrete water quality data over the entire UTZ interval. The screen opening size was based on grain-size analyses of formation material, which indicated a maximum slot size of approximately 0.030-inch was appropriate for the Ocala Limestone. To minimize the potential for fines entering the well during development and sampling, a conservative screen-slot size of 0.020-inch was selected.

Stainless-steel blank casing was installed below the lowermost screen interval and above the uppermost screen interval. A 15-foot long stainless-steel sump was installed at the bottom of each well and approximately 40 feet of stainless-steel casing was installed above the upper screen. The 15-foot sump is required to accommodate sampling equipment. The 40-foot stainless-steel casing installed above the screen was the length required to extend above the UF Aquifer potentiometric surface elevation and into the 8-inch ID isolation casing. The remaining well casing consists of approximately 110 feet of black-carbon-steel casing extending to land surface.

The monitoring wells were constructed inside the 6.23-inch ID (7-inch OD) rotasonic override casing to ensure borehole integrity during well construction. The 4-inch ID well was constructed by assembling the flush-joint, threaded casing and screen together as it was lowered inside of the override casing.

The minimal annular space between the override casing (6.23-inch ID) and well casing (4.5-inch OD) prevented the use of a tremie pipe for placing the backfill material. Therefore, the backfill material was placed by slowly pouring the material in the annular space between the override and well casings. The backfill material consisted of filter sand opposite the screen intervals and fine sand opposite the blank casing. Alternating layers of fine sand and filter sand were installed in the approximately 100-foot interval of annular space in the UF Aquifer.

The filter pack was sized to match the 20-slot screen opening and consisted of 12/20 silica sand. It was impractical to accurately place a bentonite seal because of annular space limitations. The installation of the fine sand isolation material required that it cascade past the upper well screens before reaching its final placement depth. The isolation material chosen for the wells consisted of fine (30/65) silica sand. The use of fine sand for isolation material is consistent with well construction requirements of the SJRWMD.

Backfilling of the annular space started with placement of about 13 feet of fine sand opposite the 15-foot sump. Once the isolation sand had been placed opposite the sump, approximately 14 feet of filter sand was placed in the annular space to extend from approximately 2 feet below to 2 feet above the10-foot well screen. Alternating layers of fine sand and coarse filter sand progressed upwards in the borehole until the upper screen filter pack was placed. Approximately 5 feet of isolation sand was then placed above the uppermost filter pack sand to help minimize the potential for cement grout infiltration into the upper screen interval. The remainder of the borehole annulus from the top of the fine sand to land surface was backfilled with a cement grout.

The override casing was systematically withdrawn during placement of the backfill material; however, a minimum of 5 feet of backfill material was maintained inside of the override casing at all times during well construction. During placement of the backfill material the override casing was vibrated to pack the backfill material and to minimize post-well construction settling. In addition, vibration of the override casing and well casing help to prevent bridging of backfill during placement. After the final 5 feet of isolation material had been placed, the override casing was completely removed from the borehole prior to grouting the remainder of the annular space.

A portion of the isolation 30/65 sand flowed into the well as it cascaded past the upper screen intervals. Attempts were made to minimize the amount of sand entering the well screen during installation, but these methods were either ineffective or resulted in sand-locking of equipment down hole. As a result, approximately 12 to 20 feet of fine sand accumulated in the well sumps and lower screen interval during the placement of the backfill. This sand was subsequently removed as part of the well development activities discussed in Section 2.3.4.

Table 2-3 provides as-built specifications for screen intervals and backfill materials for the 14 UF Aquifer monitoring wells installed under this program.

2.3.3 Borehole and Casing Grouting

The cement grout mixture and preparation used in all components of the casing installation and well construction was in accordance with American Society of Testing and Materials (ASTM) 5092 and consisted of ASTM Type I Portland cement, powdered bentonite, and potable city water. The cement was mixed into a smooth slurry using 6.5 gallons of water, 3 pounds of bentonite, and 94-pounds of cement. Powdered bentonite was added to the cement grout mixture to minimize shrinkage during the curing process, as required by SJRWMD (Chapter 40C-3, F.A.C.). All grout used in casing installation and well construction was placed downhole using a tremie pipe. Grouting over each interval was continuous unless otherwise noted and continued until grout returns were confirmed at ground surface. The grout was allowed to cure a minimum of 12 hours prior to additional work being performed inside of the casing.

A complete and uniform cement grout seal for the casings cannot be guaranteed. Casing centralizers help reduce grout channeling; however, channeling cannot be completely eliminated. Centralizers were used to set the 18-inch, 12-inch and 4-inch ID casings. No centralizers were used to set the 8-inch ID isolation casing because of annular-space limitations between the 8.65-inch OD casing and the 9.65-inch ID override casing. The annular space between the 8-inch and override casing is only about 0.5 inches, preventing the use of centralizers. With the removal of the override casing the annular space increases to about 1.7 to 2 inches between the casing and borehole. Hence, the override casing served as the centralizer in the open borehole for the 8-inch ID casing.

Similarly, the 4-inch ID well casing was set with a centralizer at the bottom of the well opposite the 15-foot sump. The 6.23-inch ID rotasonic override casing served as the centralizer for the upper portion of the 4-inch ID well casing. External casing centralizers could not be utilized in the upper portion of the 4-inch well casing because of concerns that they would promote bridging of backfill materials during placement. In addition, centralizers would interfere with the numerous required tag-tape measurements during backfill placement. In summary, external casing centralizers were utilized where technically practical and the rotasonic override casing served as an effective centralizer when physical limitations prevented the use of external casing centralizers. With the combination of the external casing centralizers and the override casing, all well casings were approximately centered within the borehole.

2.3.4 Sediment Removal and Well Development

Removal of Sediment from Well Sump

A portion of the fine isolation sand used to backfill the annular space between well screens accumulated inside each of the 15-foot well sumps. Well development activities could not begin until the fine isolation sand inside of the well sump was removed. A number of different methods were attempted for removal of the fine sand from the sumps including: 1) Sand bailers; 2) Groundwater pumps; and 3) Jetting in combination with pumps. None of these techniques were completely successful in removal of all the sand. The method that was most successful consisted of a dual-string pipe where tracer-tagged potable water was injected down the center pipe and the sand/water slurry flowed up the annular space between the inner and outer pipes. External K-packers were installed on the outer pipe to prevent the slurry from flowing up the well casing. In a few cases, the fine sand accumulation extended up into the lower screen interval, where the dual-pipe system would not work. As a result, a sand bailer was used to remove sand from the screen interval prior to using the dual-pipe system to remove the remainder of the sand in the sumps. Fine sand accumulated in all wells during construction and was subsequently removed prior to well development (with the exception of monitoring well FW-22B, which is described below and in Section 3.1.1).

Well Development

Well development is a standard practice performed at the completion of well construction. The procedure removes fine-grained materials opposite the screened interval to improve the hydraulic connection between the aquifer and well. In addition, well development is used to recover a significant portion of the water injected during drilling and well completion operations.

The EPA July 12, 2005 letter required that all drilling fluids contain a tracer to quantify drilling fluids impacts on future groundwater samples collected from the well. A bromide tracer was added to all drilling and well-completion water used in the UF Aquifer. The bromide tracer was also used as qualitative indicator of drilling fluid impacts to the UF Aquifer.

A bromide tracer was added to the drill rig external water supply tanks prior to water usage. Table 2-2 contains the target bromide concentration used in the drilling and construction of the 14 UF monitoring wells.

Well development was performed prior to the installation of the Westbay System because the Westbay System pumping port design limits the rate at which groundwater can be removed. After the Westbay Systems were installed, a limited amount of secondary well development was performed through the pumping ports.

Primary well development was performed by targeting each of the individual screen intervals. Individual intervals were isolated by positioning external K-packers above and below each screen, then pumping from the center of the screen interval. A K-packer consist of an approximately 6-inch long pipe, with flexible rubber seals (approximately 4-inch ID) on the outside of the pipe. The K-packer is attached to 2-inch galvanized pipe for lowering and installing the K-packer in a well. The rubber seals on the outside of the K-packer fits tightly inside of the 4-inch ID wells casing and effectively isolate the inside of the well casing above and below the K-packer. Groundwater was pumped using a 2- or 3-inch submersible Grundfos pump connected to 1-inch discharge line. At some well locations the permeability of the well was too low to pump from one screen interval. These wells were developed by simultaneously pumping from all four screen intervals. In these few cases, a limited amount of development was then performed by isolating each individual screen interval, prior to installing the Westbay System. The daily and total volume of development water removed from each well is provided in Table 2-4.

Well development cessation criteria were primarily based on the total volume of groundwater removed in relation to the volume of water injected during the drilling at each of the monitoring wells. In addition, bromide concentrations and turbidity were monitored from each of the four screen intervals during the development as a secondary indication of well development completion. A minimum of four times the volume of water injected during drilling was removed from each of the wells and in over half the wells more than 10 times the volume injected was removed. Development water bromide concentrations were periodically measured using a Oakton Ion 5 – Acorn Series meter equipped with a bromide ion-specific probe (Table 2-2), and turbidity was measured using a LaMotte 2020 turbidity meter. Field measurements were recorded on field-data sheets, which are provided in Appendix F. An attempt was made to develop wells until the average bromide concentrations dropped below 30 mg/L, and turbidity readings dropped below 10 NTUs. In a few monitoring well locations, well development stopped before bromide concentrations and/or turbidity readings reached the target values because of limited water production rates from the wells or schedule limitations associated with the Westbay System installation.

The first two Westbay Systems were installed in monitoring wells FW-10B and FW-16B prior to completing the initial well development. Monitoring well FW-10B had a total of approximately 2,700 gallons withdrawn and monitoring well FW-16B had 250 gallons withdrawn prior to installing the Westbay Systems. As a result, development was performed using a Waterra® inertia pump equipped with ¾-inch HDPE tubing and a foot valve connected to the end. The Westbay System was opened to the formation by lowering a Westbay open/close tool to the desired purge port depth, and the tool was engaged to open the sliding sleeve on the purge port. Each purge port was closed prior to opening a different port in the Westbay System. Due to the low flow rates encountered in monitoring well FW-16B, the well was initially developed by simultaneously opening all 4 Westbay System purge ports. Monitoring well FW-10B produced water at a higher rate, and development was performed at each purge port, individually. Similar to the initial development with the submersible Grundfos pumps, bromide, turbidity, and total purge volumes were used to determine when development was complete.

All development water was contained in portable poly storage tanks, and transported to the Beazer on-Site water treatment facility. Water was temporarily stored in a 30,000 frac tank until treated and discharged to the POTW. Figure 2-4 shows a timeline of well development and purging activities.

After the completion of each monitoring well installation and development, external K-packers were installed to isolate individual screen intervals. The K-packers minimize the potential for vertical mixing between screen intervals, prior to the installation of the Westbay System in individual wells. A series of three K-packers on 2-inch galvanized pipe were lowered into the well and position between each of the screen intervals. K-packers were installed immediately following sediment removal and they were removed and re-installed immediately following well development. In a few wells, development immediately preceded the installation of the Westbay System, eliminating the need for re-installing the K-packer system.

Development Issues For Well FW-22B

The development of monitoring well FW-22B was performed in two phases resulting in the removal of over 55,000 gallons of water. Water quality field parameter criteria had been achieved upon completion of this development on April 21, 2006. A final measurement of well depth after development revealed that approximately 15 feet of formation silt had accumulated in the sump. This silt originated from one or more of the screen intervals based on the fact that it was a carbonate material and the backfill material used in the well construction was silica sand. The drill rig was not available at the time to remove the silt; therefore, K-packers were installed and removal of the silt was scheduled for a few days prior to Westbay System installation in May 2006.

It was not feasible to utilize the dual-pipe injection system for sediment removal because it would require injection of tracer-tagged water, necessitating a redevelopment of this well, with the potential for causing additional silt to flow into the well.

The first approach attempted for silt removal was a combination of jetting and groundwater withdrawal. A 2-inch Grundfos pump was equipped with a "T" connection on the discharge line that diverted a portion of the discharge water downward in an attempt to suspend the silt and remove it through pumping. This attempt failed because the pump's plastic impellers were damaged by the suspended silt after less than a few hours of pumping.

The second attempt to remove the silt utilized a modified sand bailer. Modifications were made to prevent potential damage to the well screens when the bailer was lowered into the well. About 2.2 feet of silt was removed before the bailer became sand-locked in the bottom of the well. Successful retrieval of the bailer was accomplished by jetting a small volume of compressed air around the bailer while pulling on the bailer cable. Measurements inside the well casing after retrieval of the bailer indicated that approximately 12.8 feet of silt remained in the 15.3-foot long sump. The top of silt was approximately 2.5 feet below the bottom of lowermost well screen.

A third approach to remove the silt was with the use of an airlift groundwater withdrawal system. The airlift system was also unsuccessful in removing silt from the sump.

2.3.5 Surface Completion and Survey

The above ground completions of the monitoring wells consisted of: 1) Cutting the 4-inch steel casing; 2) Constructing a concrete apron around the well; and 3) Installing protective bollards. All isolation and well casings extending above ground surface were cut to their final height. The 18-inch, 12-inch and 8-inch isolation casings were cut to extend less than 1.0-foot above ground surface and the 4-inch casing was cut to an approximate height of 30-inches above the ground surface. The State Plane coordinates and elevation of the 4-inch steel casings were surveyed on April 25, 2006 and are provided in Table 2-6.

Following installation of the Westbay System, the protective surface completions were installed at the well heads. The surface completions consisted of a 2-foot by 2-foot by 4-inch thick concrete pad, and a 6-inch by 6-inch protective aluminum stickup casing. The protective aluminum stickup casing was installed over the 4-inch steel casing and set in place in the concrete pad. The stickup was set at a height that provided room for sampling the Westbay System and to securely lock the well.

Protective bollards were installed around all monitoring wells to help protect them from on-going Site activities. The bollards consisted of four 4-inch diameter steel casing installed approximately 2-feet out from the well casing. In addition to the 4-inch diameter bollards, 20-foot long by 6-inch diameter bollards were installed around four monitoring wells to provide additional protection in high-traffic areas. The 20-foot long bollards were installed with the rotasonic rig by vibrating the bollards to a depth of about 15 feet. The portion of the bollards that extended above land surface was filled with cement grout.

2.3.6 Well Construction Issues

In general, there were very few significant well construction issues during construction of the 14 monitoring wells. The well installation and development procedures described above were successfully implemented for the majority of the wells at the Site. However, problems were encountered in monitoring well FW-21B during the removal of sand from the sump and in monitoring well FW-22B, as described above in Section 2.3.4.

The dual-string tube used for sand removal became sand locked preventing routine removal of this pipe from the well. Attempts by the drillers to remove this pipe, by pulling and pushing on the drill rods, resulted in damage to two of the well screen intervals. A down-hole camera was utilized to inspect the well and to document the extent of damage. The damage consisted of deformation to the upper 1.2 and 2 feet of the third and second screen intervals, respectively. The upper portions of these screens were compressed, with a corresponding reduction in the ID of the upper screen intervals. The compression reduced the ID of the damaged screen intervals from 4.0 to 3.5 inches. With the exception of the compression to the upper portions of the screens and the reduction in screen ID, no other damage was sustained in the well. The slight damage to the screens did not impact the installation of the Westbay System nor will it impact future data collected from this well.

2.3.7 Monitoring Well Timelines

The well drilling installation commenced on July 2005. The well drilling started with the cable-tool rig for installation of the two upper isolation casing at each well. The rotasonic rig followed behind the cable-tool rig for the installation of the third isolation casing and the final well casing. Well development was performed prior to the installation of the Westbay System, with the exception of monitoring well FW-10B and FW-16B. Installation of all 14 monitoring wells was completed in May 2006. Groundwater sampling was performed in three separate phases in January, March and May 2006. A timeline showing the schedule for individual monitoring wells is provided in Figure 2-4.

3.0 WESTBAY SYSTEM

A Westbay System was installed in each of the 14 UF monitoring wells following completion of the well development. The Westbay System is a multi-level sampling system that allows groundwater samples to be collected from multiple discrete intervals within an open borehole or multi-screened well.

3.1 WESTBAY SYSTEM INSTALLATION

The Westbay System consists of the following: 1) Inflatable packers that isolate the well-screen intervals; 2) Purge ports to facilitate well development; and 3) Sampling/measurement ports for collecting groundwater samples and formation pressures. The following sections describe the procedures for the Westbay System installation.

In general, the Westbay System design is approximately the same for each UF monitoring well, with the exception of a modification to the design for monitoring well FW-22B discussed in Section 3.1.1. The basic design of the Westbay System consists of the following:

1) Packer elements set above and below each of the four screen intervals to isolate each of the intervals;
2) A 4-inch long screened port for purging individual monitoring zones;
3) A sample port for collecting water samples and formation pressure readings;
4) A 5-foot sump at the bottom of the system; and
5) Blank casing that extends to land surface.

The purge ports for the Westbay System are located in the lower half of each screen interval and the sample port is located approximately 5 feet above the purge port, in the upper half of the screen interval. The 5-foot sump at the base of the well is required for equipment used in the collection of groundwater samples. Westbay developed a system design for each well and the designs were approved by GeoTrans prior to installing the Westbay Systems. The Westbay System diagrams for each well are provided in Appendix G.

Installation of the Westbay System was supervised by Westbay's technical representative with assistance from GeoTrans and drill-rig personnel. Westbay System components were laid out sequentially on an above-ground support stand near the wellhead. Each section consisted of a 2-inch OD PVC section of casing and the appropriate coupling component. Couplings were attached to the casing section using a nylon shear wire. The purge and measurement ports also act as couplings to connect sections of the Westbay System. Magnetic collars were placed between the purge port and measurement port to verify sample tool depths. Packer sections were pre-assembled and pre-tested by Westbay at their shop, and only required attachment to the Westbay

System. Serial numbers of purge ports, measurement ports and packers are recorded on the installation log.

Installation of the Westbay System began with the removal of the K-packer system. Once the K-packers were removed the Westbay System was assembled and lowered into the monitoring well. Each of the Westbay System components was manually assembled, starting with the bottom components. After securing each connection, the coupling was pressure tested before being lowered into the well to ensure that the various system components did not leak and that the coupling was properly sealed and mechanically competent. A hoist, attached to a smeal rig, was used to hold the system in place above the well while component testing was performed. A final hydraulic-integrity test was conducted after the assembled Westbay System was lowered into the well. The final integrity test included water-level measurements inside of the Westbay System to check for leaks and to verify that each sample/purge port was opening and closing properly.

After performing the Westbay System integrity and quality assurance checks, the packer elements were inflated, beginning with the lowest packer element. Potable water was pumped into the packer element until the specified pressure was attained indicating proper inflation of the packer elements. The pressure inside of the packer was monitored for a period of minutes to ensure that no leaks were present in the system and that the packer was properly set in the well casing. The volume of water and final pressure for each inflated packer was recorded and is provided in Appendix G.

The final groundwater purge of the Westbay System monitoring zones was conducted by GeoTrans personnel. Each of the monitoring zones were purged to help ensure representative groundwater samples and to remove groundwater that may have been mixed vertically in the well and formation during the Westbay System installation. A minimum of three well casing volumes for the packed-off intervals were removed during the final purge. In addition to the groundwater purge volume measurements, water quality field parameters were monitored during the purging operation to ensure stabilization of these parameters prior to completing the well purging (Table 2-5).

The approach to the final purge of the Westbay System monitoring zones consisted of opening the Westbay System purge ports to the formation by lowering a Westbay open/close tool to the desired purge port depth, and engaging the tool to open the purge port sliding sleeve. Each purge port was sequentially closed prior to opening a different port in the Westbay System for development. Once an individual purge port was opened, formation water flowed into the Westbay System where a Waterra® pump was utilized to pump groundwater. The flow rates varied, but typical rates for final purging ranged between 1.0 and 1.5 gallons per minute. Field parameters monitored during the final purge of the zones including pH, specific conductance, oxidation reduction potential, temperature, turbidity, and bromide concentrations. These parameters were recorded during the final purge of the Westbay System by using a Horiba U-22. The only wells that did not have these field parameters monitored were monitoring wells FW-10B and FW-16B (zone 4), which were the first wells to undergo development prior to the equipment arriving on Site. Development included: 1) Purging a minimum of three casing volumes; and 2) Stabilization of field parameters to within ±10 percent of the previous reading. Development continued beyond the three casing volumes if the field parameters had not stabilized. Purge/development water was contained in portable poly storage tanks, and was transported to the on-Site water-treatment facility for treatment and discharge to the POTW. Figure 2-4 shows a timeline of development activities for the wells.

3.1.1 Westbay System Modifications for Monitoring Well FW-22B

Westbay System installation for the last two monitoring wells (FW-22B and FW-23B) commenced on May 16, 2006. The first task prior to the installation of the Westbay System was to remove the residual silt from monitoring well FW-22B. It was not feasible to utilize the dual-pipe injection system for sediment removal because it would require injection of tracer-tagged water, necessitating a redevelopment of this well, with the potential for causing additional silt to flow into the well (see Section 2.3.4). Therefore, it was decided that a slightly modified Westbay System design for this well would: 1) Allow the system to be installed immediately; 2) Meet the objectives of the program, without compromising the data; and 3) Meet the sampling and reporting schedule.

The alternative design for the FW-22B Westbay System only affected the lowermost zone (Zone 4). The design for the upper three monitoring zones (Zones 1 through 3) remained the same as all previous Westbay System installations. The primary design change in the lowermost zone was to shift the sampling and purge ports to the upper portion of the screen interval to allow sufficient space below the sample port for the sample bottle train. In order to accommodate a shift of the sampling/purge ports, the bottom packer element and a 5-foot section of blank casing below this packer were removed. Removal of the 5-foot section of blank casing has no affect on the Westbay System performance and was only there to allow additional space for the sampling equipment. The lowermost packer element is not required for the Westbay System, but was installed to minimize the potential of sump water mixing with formation water during sampling. Because the sump is currently filled with a low-permeability silt, the lowermost packer unit was not needed. Hence, groundwater samples collected from this lower zone will not be impacted by the alternative design of the Westbay System.

<u>FW-22B Westbay System Final Purge</u>

Similar to the approach used to purge the previous wells, the Westbay System monitoring zones were developed using a Waterra pump. The final purge of the Westbay System zones started at the lowermost zone and progressed upward in the well. A total of 110 and 82 gallons were pumped from Zones 4 and 3, respectively before field parameter measurements stabilized. The turbidity reading for these two lower zones dropped to less than 10 NTU within about 1 hour for each of the zones.

Zone 2 required more than double the volume of groundwater removal before field parameter values stabilized. However, after 2 ½ hours of pumping and withdrawal of approximately 210 gallons of water, the turbidity in this zone stabilized at approximately 24 NTU, but would not decrease below this value. Therefore, purging of this zone was stopped.

The total volume of water withdrawn form Zone 1 was 182 gallons over a period of approximately 2 ¾ hours. All of the field parameters, with the exception of turbidity, stabilized after approximately 2 hours. The turbidity value decreased to 48.7 NTU after approximately 2 hours of pumping. In an effort to reduce the turbidity value further, pumping continued for another ¾ of an hour. After the initial 2 hours of pumping, the turbidity value increased to 550 NTUs, with no visible sediment in the discharge water. To minimize the potential introduction of sediment into this Westbay System zone, groundwater purging was stopped.

Based on turbidity measurements recorded during development, it appears that source of the accumulated silt in the sump was likely the upper two zones of this well. The elevated turbidity values for Zone 1 are a good indication that the formation outside of the screen interval contains a high percentage of fine-grained material. This fine-grained material is apparently migrating through the filter pack and entering the well. The small volume of water removed during sampling should not induce additional formation silt to flow into this well.

3.2 HYDRAULIC-HEAD MEASUREMENTS AND SAMPLING

3.2.1 Potentiometric Measurements

A Westbay System pressure monitoring port was installed in each of the four monitoring zones for all UF Aquifer monitoring wells installed under this program. The Westbay System pressure monitoring port can be used to obtain formation pressure readings at the discrete depth of the sample port. These pressure readings can be converted to formation hydraulic-head values by converting the pressure readings to feet of water and subtracting this value from the elevation of the sample port. Pressure readings were obtained from all wells with the Westbay System.

The pressure measurement port consists of a valve in the wall of the Westbay System coupling, with an associated alignment notch for the pressure transducer tool. The Westbay System measurement tool contains a calibrated pressure transducer, and is lowered inside of the Westbay System casing to the depth of the measurement port to collect a reading. The following equipment is required for the collection of pressure measurement:

- Tripod
- Westbay wire-line cable reel, with counter
- Westbay MOSDAX Sampler Probe Model 2531

- Westbay MOSDAX Automated Groundwater Interface (MAGI)
- Field pressure measurement form
- Distilled water
- Liquinox
- Squirt bottles
- As-built well diagrams for the Westbay System

The tripod, wire-line cable reel, and reel counter are centered above the well head and are needed to lower the measurement tool into the well. The sampler probe is used for both the collection of groundwater samples and for obtaining pressure readings. When the probe is utilized solely for collecting pressure readings, the bottom of the sampler probe is fitted with a threaded-end cap to eliminate the potential for hydraulic communication between the formation and water inside the Westbay System casing. The MAGI controls the down-hole operation of the sampler probe for connecting to the measurement port and displays the pressure readings.

The pressure transducer is a sealed unit and measures total pressure, which includes both water and atmospheric pressures. As such, downhole pressure readings need to be corrected for atmospheric pressure. Therefore, before the sampler probe is lowered into the well for the first formation pressure reading, the ambient air pressure reading is taken. The ambient air pressure reading is recorded once per well prior to collecting the formation pressure readings for each zone. The sampler probe is then lowered into the well to the desired measurement port depth, and seated into the alignment notch. The depth indicated on the wire-line reel counter is recorded to verify the sampler probe was seated at the correct measurement port. Prior to taking the formation pressure measurement, a pressure measurement is taken inside of the Westbay System casing. The pressure measurement inside of the Westbay System casing is a QA check to make sure the tool is properly seated during the formation pressure reading. The Westbay sampler probe contains a mechanical lever, termed “the shoe”, which pushes the probe against the wall of the coupler, to engage the sampling port. Once the shoe is fully extended, a connection with the formation is verified by a pressure change. The formation pressure measurement should be different than the pressure measurement taken inside the Westbay System casing. The formation pressure, temperature and time of the measurement are recorded as displayed on the MAGI. Once the pressure reading stabilizes, the shoe is retracted and a pressure reading inside the casing is obtained again for a second QA check. The pressure measurement taken inside of the Westbay System casing both before and after the formation pressure measurement are compared to verify the shoe is fully retracted, and that the pressure measurement port was properly resealed.

The sampling probe is extracted from the well and decontaminated after each pressure port reading and before proceeding to the next measurement port. The sampler probe port is opened and the end cap is removed prior to decontamination of the tool. Decontamination procedures consisted of an exterior wash with a solution of Liquinox and store-bought distilled water, followed by a rinse with store-bought distilled water. Cleaning of the probe’s interior consisted of a squirt bottle wash and rinse through the inside of the tool from the port to the bottom of the probe. In addition, the probe is visually inspected during cleaning for damage or wear.

Pressure measurements were taken in all measurement ports following the installation and purging of the Westbay Systems. These pressure measurements are discussed in Section 4.3.

3.2.2 Westbay System Water Quality Sampling

Collection of groundwater samples in the Westbay System is similar to the procedure used to collect pressure measurements. The Westbay equipment used in the collection of the groundwater samples is also the same, with the addition of the sample-bottle train. The groundwater sampling port is the same port used to obtain pressure measurements.

The tripod and wireline cable reel are assembled above the well, and an evacuation port coupling is attached to the top of the Westbay System. A 10-foot long by 4-inch ID PVC pipe, split longitudinally to form a curved tray, is utilized to hold the sample-bottle train while it is being assembled at the well head. The Westbay sample bottles are assembled in the 4-inch PVC pipe tray, with up to four bottles connected to the sampler probe. Atmospheric air inside of the sample bottles is removed with either a hand operated or a battery operated vacuum pump to place the bottles under a negative pressure. The removal of air is necessary to allow for the sample bottle to be completely filled. When the desired vacuum pressure has been reached, the valve between the sampler probe and the bottles is closed. The sampler probe and bottle train are then placed in the well and lowered to the desired monitoring-zone depth. Once the sampler probe is at the monitoring-zone depth, the location arm on the sampler probe is activated, the probe is seated into the alignment notch of the sampling port, and groundwater flows into the sample bottles. After the sample bottles are filled, the lever is released and the sample-bottle train is removed from the well and sample is poured into appropriate bottles for analysis. The limited volume of water collected in each of the four sample bottles requires that the sample-bottle train system be lowered into the well and retrieved a total of four times to obtain the required volume of water for the SVOCs, VOCs and metal analyses for each sample port in a well. Hence, in order to sample all four Westbay System zones, the sample bottle train has to be lowered into the well and retrieved a total of 16 times, along with decontamination of the sample-bottle train between sampling each of the four zones.

Field water quality data for the groundwater sampling events were only collected during the purging of the individual sample ports, prior to the collection of the groundwater sample (Table 2-5). Some of the field parameters (DO, ORP, pH) collected during purging are affected by the agitation of the discharge water by the Waterra pump and therefore, are not representative of aquifer conditions. In addition, the Westbay equipment collects groundwater samples in four individual bottles (about 250 ml each). A total of four sample runs are required for each Westbay System sampling port to obtain sufficient volume for analysis. The collection of field parameters during the collection of these samples is not feasible, given the procedures and limited volume of groundwater collected with the Westbay System. Hence, field parameters are not routinely measured during sampling using the Westbay System.

The sample probe is decontaminated after the sampling of each monitoring port. Standard decontamination procedures are followed for cleaning of the sample probe, similar to the procedures described above for the pressure measurements.

4.0 HYDROGEOLOGIC DATA ANALYSIS

The data collected as part of this program support the hydrogeologic SCM previously presented for the Site in the report entitled: *Addendum 7: Groundwater Flow and Transport Model* (GeoTrans, 2004b). The predominantly unconsolidated physical property of the UF Aquifer supports prior assumptions regarding appropriate effective-porosity values for the UTZ, as presented in the GeoTrans (2004b) model report. Approximately 70 percent of the geologic core collected at the Site was unconsolidated, with the remainder of the core being moderately consolidated. The geologic core collected from these wells also supports the SCM of secondary dissolution features predominantly located in the upper 20 feet of the Ocala Limestone.

Additionally, visual inspection and PID measurements from over 1,400 feet of UF Aquifer core collected under this drilling program supports the conceptual model of no free-phase or residual DNAPL impacts to the UF Aquifer at the Site. Limited dissolved-phase impacts were detected at only a few select monitoring well locations.

Finally, water quality data collected as part of this program further supports the hypothesis that previously detected elevated arsenic concentrations in the UF Aquifer are likely due to the introduction of oxygenated drilling fluids, which mobilized naturally occurring arsenic minerals in this aquifer. Elevated dissolved-phase arsenic concentrations were not detected in the new UF monitoring wells after extensive well development, supporting the conceptual model of a natural source of arsenic in the UF Aquifer being mobilized by the introduction of drilling fluids.

4.1 SITE GEOLOGY

The wells recently installed under the Floridan Aquifer Monitoring Program provide the most comprehensive geologic core data to date at the Site and within this area of Alachua County. Attempts were made to collect continuous core from the top of the HG middle clay unit to the total depth of the borehole. With the exception of a few instances where the core barrel became blocked during a core run, continuous cores were collected at all well locations.

The geologic core from this program supports the SCM previously developed for the Surficial Aquifer, HG deposits and UF Aquifer systems, as presented in the GeoTrans (2004b) model report. The thickness of the Surficial Aquifer deposits and depth to the top of the HG deposits are consistent with the previous SCM and prior Site data. The depth to the top of the Ocala Limestone is also fairly consistent with the previously presented SCM and with prior Site data. In general, the thickness of the HG lower clay unit is in agreement with the SCM. The thickness of the HG lower clay unit in the new UF monitoring wells varied from about 22 to 38 feet, whereas previous thickness data for this unit from earlier monitoring well installations at the Site indicated it ranged from about 32 to 38 feet. For this report it was assumed that the previously reported thickness for the lower clay unit represents spatial variability in this unit; however, some of the variations in thickness may result from different interpretations for the tops and bottoms of the lower clay unit by different geologists logging the core.

The UTZ thickness cannot be established from geologic core samples because the UTZ is qualitatively defined based on flow-meter surveys in groundwater production wells. Groundwater flow to a well is directly related to the interconnectivity of the matrix porosity and secondary dissolution channels. Geologic core does not provide insight into aquifer interconnectivity and potential production rates. In general, the number of secondary dissolution features appeared to be more prevalent in the upper 20 feet of this formation based on drilling rates, fluid loses and well development. Well development records for the monitoring wells are provided in Table 2-4.

Geologic sections that are oriented north-south and east-west across the Site are provided in Figure 4-1. These geologic sections support the SCM of HG deposits and Ocala Limestone dipping to the northeast. The contact of the HG deposit and Ocala Limestone are about 10 feet higher on the southern end of the Site than on the northern end. Similarly, the geologic contact depths for the HG deposits and Ocala Limestone dip from west to east, with the elevation of the HG deposits about 20 feet higher in monitoring well FW-9, near the western Site boundary, than on the eastern Site property boundary.

Monitoring wells FW-5 and FW-1 were incorporated into the geologic sections shown in Figure 4-1; however contact depths and thicknesses for these wells vary slightly from what would be projected based on data from new monitoring wells surrounding these older monitoring wells. The top of the HG middle clay unit in monitoring well FW-5 is higher than would be projected from the recently installed UF monitoring wells. In addition, the thickness of this middle clay unit is less than monitoring wells surrounding it. It is unknown if this discrepancy is real or a result of different data quality or geologic interpretations. Similarly, geologic contacts and thicknesses for the HG clay units and top of Ocala Limestone for monitoring well FW-1 vary slightly from newer monitoring wells in the vicinity of this well. Given that this monitoring well was installed at the Site in 1992, with rotary drilling methods, the geologic data would not be as accurate as geologic core data obtained from the present program. Hence, contact depths for monitoring well FW-1 may reflect different drilling methods, lower quality geologic samples, potentially resulting in different interpretations of contact depths by the geologist supervising the installation of this well in 1992. The contact depths and geologic interpretations from FW-1 are likely not as reliable as the hydrogeologic data obtained from this recent monitoring well installation and should be given less weight in establishing the geologic conceptual model for unit thicknesses across the Site.

4.2 EFFECTIVE POROSITY

The effective porosity of the UF Aquifer was qualitatively evaluated based on geologic cores collected as part of this Floridan Aquifer Monitoring Program. Attempts were made to collect continuous geologic core from the base of the 12-inch ID isolation casing completed in the HG middle clay unit to the total depth of the borehole approximately 100 feet into the Ocala Limestone. Visual inspection of the core shows that the majority of the UTZ beneath the Site is unconsolidated. Approximately 70 percent of the 100 feet of core collected at each of the monitoring well locations are poorly indurated and highly unconsolidated. Physical descriptions of the core indicate that the carbonate cementation of the matrix material has been dissolved, leaving behind the individual carbonate sand grains and shells. The matrix material for the majority of the UTZ beneath the Site is equivalent to an unconsolidated silty-sand deposit. Approximately 30 percent of the UTZ was moderately indurated, with partial consolidation of the deposits. These moderately indurated layers tended to be thin (< 1 to 12 inches thick) limestone deposits.

The essentially unconsolidated nature of the UTZ deposits was unexpected, given previous descriptions of this deposit by investigators in other parts of the county; however, this is consistent with descriptions of “soft” drilling for the previous UF monitoring wells installed at this Site. Additionally, it is recognized that the areal extent and degree of dissolution of the matrix cement material in the Ocala Limestone is likely to vary across the county.

One hypothesis considered for the significant amount of unconsolidated material encountered in these cores was that the sonic vibrations and down pressure from the rotasonic drilling were breaking the carbonate matrix cement that binds the individual grains together. It is acknowledged that the sonic vibrations can break apart previously consolidated cores. Two different approaches were taken to investigate the hypothesis that the core collection procedure was physically breaking the bonds. One line of evidence that indicated sonic vibrations were not responsible for the unconsolidated nature of the core was the physical appearance of the core. The 30 percent of the core that was moderately consolidated carbonate deposits rarely were preserved in one homogeneous section. The moderately consolidated core was typically broken into gravel size pieces with fresh angular breaks. This type of mechanical disaggregation of the core was clearly visible and easily identifiable as a result of the rotasonic drilling method. Conversely, the approximately 70 percent of the core samples did not have gravel-sized pieces, with fresh angular breaks. There was no evidence of a carbonate cementation material between the individual grains or that the matrix cementation, if present, was freshly broken. The carbonate cementation material was predominately absent from the core samples indicating that it had been historically removed by dissolution of the matrix cementation by groundwater. This is not entirely surprising given the abundance of vugs and secondary dissolution features present in this formation.

A second approach to evaluate the potential of mechanical disaggregation of the core was to modify the drilling and core collection technique to observe the physical affects of the drilling method on the core samples. Typical rotasonic drilling and core collection involves applying a high resonance sonic vibration at the leading edge of the core barrel and override casing, which partially liquefies deposits at this leading edge. A small amount of rotation and down pressure also is applied to the core barrel and override casing as they are advanced into the formation. The rotasonic method for collecting a core sample is to advance the core barrel approximately 10 feet in front of the override casing to obtain relatively undisturbed core. Once the core barrel is at its sample depth, the override casing is advanced to the depth of the core barrel to maintain the integrity of the borehole while the core barrel is removed. The effort required to advance the core barrel at this Site using the technique described above has been described by the drilling crew as a “hot knife going through butter”. It typically took less than 30 seconds for the core barrel to advance 10 feet with some of the lowest sonic vibration setting allowable for the rig, and with little to no rotation or down pressure on the core barrel. This observation is consistent with the description of the well log for FW-1, which describes the limestone as “soft”. This drilling observation in itself is an indication that the UTZ is weakly consolidated to unconsolidated.

To evaluate the potential for disaggregation of the core as a result of the mechanical processes described above, the typical core collection technique was modified to eliminate the sonic vibrations and to further reduce the already minimal amount of down pressure. The modified core-collection technique was attempted in four of the monitoring well locations at various depths within the Ocala Limestone. The attempts to collect core with the modified technique were successful in a number of locations; however, at some of these locations, thin beds of moderately consolidated limestone prevented advancement of the core barrel. At locations where no sonic vibrations were applied, the in-situ physical property of the Ocala Limestone deposits was verified, with approximately 70 percent of the core collected with this modified technique being unconsolidated. At a few monitoring well locations, thin beds of moderately consolidated limestone prevented the advancement of the core barrel without sonic vibrations. When thin beds of moderately consolidated limestone were encountered, a small amount of vibration was applied to the core barrel to penetrate the thin beds before coring deeper with no vibration. Again, the cores collected without vibration confirmed that the majority of the UTZ is unconsolidated beneath the Site. However, numerous small refusals encountered during the attempts to collect core without the use of sonic vibration demonstrate that thin moderately consolidated deposits are interbedded with the predominantly unconsolidated deposits in the UTZ. These thin beds of moderately consolidated limestone likely provide enough structure to prevent wells with open borehole completions from completely collapsing. This is consistent with the large diameter open borehole of the previous Site production well, where sections of the borehole in the UF Aquifer exceeded the measurement capacity of the downhole caliper tool of a 20-inch diameter borehole (Layne-Atlantic, 1992).

Geologic core samples from the UTZ demonstrate that the total porosity for this formation is high and approaching that of an unconsolidated alluvial silty-sand deposit.

GeoTrans' original effective-porosity estimate was based on the scale of the model and the REV concept, but given the unconsolidated nature of the Upper Floridan beneath the Site, even at smaller scales, the effective porosity estimate is valid Given the high matrix porosity, in conjunction with the secondary dissolution features, it would be reasonable to assume that the average effective porosity for this formation is in the range of 10 to 15 percent, consistent with the GeoTrans fate and transport model analysis (GeoTrans 2004b). The largely unconsolidated nature of the UTZ causes it to behave more like a porous media than a fractured media; thus, preferential pathways, although still potentially present, are less of a concern than previously suggested.

4.3 UPPER FLORIDAN AQUIFER HYDRAULIC HEADS

UF Aquifer Potentiometric Surface

A comprehensive water-level measurement program was initiated to collect hydraulic-head data from all UF Aquifer monitoring wells on-Site and in the immediate vicinity. Water level and/or formation pressures were obtained on May 16-21, 2006 for all 24 UF monitoring wells at the Site. Water levels in monitoring wells FW-1 through FW-9 and MWTP MW-1 were obtained with a water-level meter probe and water levels for the 64 Westbay System zones in monitoring wells FW-10B through FW-23B were calculated from formation pressures measured with the sample-probe transducer. Formation pressures were converted to hydraulic-head elevations by converting the pressure measurements to feet of water and adding the feet of water measured by the sample-probe transducer to the elevation of the measurement port. The results of the water-level measurements and hydraulic-head calculations are presented in Table 4-1.

The potentiometric surface resulting from the hydraulic-head data obtained in May 2006 is shown in Figure 4-2. The potentiometric surface elevation contours for hydraulic heads in the upper 20 feet of the UF Aquifer indicate a predominantly northeastern groundwater flow direction across the Site. Along the western Site property boundary the groundwater flow direction is more northerly. Within the central portion and along the eastern boundary of the Site the flow direction is more to the northeast.

The horizontal hydraulic gradient across the Site is approximately 7.3×10^{-4} ft/ft, resulting in a total hydraulic-head change of approximately 2 feet from the southern to the northern Site property boundary (approximately 3,100 feet). This relatively small hydraulic-head gradient is an indication that the transmissivity (product of hydraulic conductivity times aquifer thickness) value of the UF Aquifer is moderately high and consistent with the value used in the GeoTrans numerical model. This would be expected given the significant loss of drilling fluids upon penetrating into the upper 20 feet of this formation. This loss of drilling fluid has been hypothesized to be a direct indication of higher permeability deposits most likely due to vugs and solution cavities in the upper 20 feet of this formation. In general, the higher the transmissivity value of the aquifer, the smaller the hydraulic gradient.

The small hydraulic gradient magnifies the difficulty of correlating water levels obtained with a water-level meter probe in the original monitoring wells (FW-1 through FW-9 and MWTP-MW-1), with hydraulic heads calculated from pressure measurements in vertically discrete zones in the Westbay Systems for new monitoring wells (FW-10B through FW-23B). As indicated above, hydraulic heads are calculated based on the pressure reading and the elevation of the Westbay System measurement ports. The elevation of the Westbay System measurement port is based on the surveyed elevation of the 4-inch ID steel casing and construction as-builts of the Westbay System. Small errors in the elevation of the port based on the construction as-builts are reflected directly in the calculated hydraulic head. Another potential error in the Westbay System port measurements is the fact that the wells may not be perfectly vertical. Therefore, establishing the elevation of the measurement ports from construction as-builts does not account for changes in the measurement port elevation because of borehole deviations. A few tenths of feet difference in the measurement port elevation results in a similar error in the calculated hydraulic head. In addition, even with accurate measurements on the Westbay System casing and coupling lengths, it is difficult to quantify the effects of casing/coupling stretch in the downhole location of the ports. A few tenths of foot stretch in the casing will result in the calculated hydraulic-head values to be off by a corresponding amount. Therefore, some of the potentiometric elevations obtained from pressure measurements in the Westbay System ports do not correlate with water-levels measurements in the previous UF monitoring wells at the Site.

The potentiometric-surface elevation in FW-6 has historically been lower than what would be projected for this area of the Site based on elevations in surrounding monitoring wells. Monitoring well FW-20B was installed approximately 100 feet downgradient from monitoring well FW-6. The potentiometric-surface elevation in monitoring well FW-20B is more consistent with the projected elevations based on other UF monitoring wells in this area of the Site. Conversely, monitoring well FW-12B has an anomalously high calculated hydraulic head in relation to wells around it. GeoTrans is working with Westbay representatives in an effort to better quantify measurement port elevations for this well.

UTZ Vertical Hydraulic Gradients

Vertical hydraulic gradients were calculated from pressure readings in the four discrete Westbay System zones in the new UF Aquifer monitoring wells. The vertical hydraulic gradient within the upper 90 feet of the UF Aquifer appear to be fairly small, consistent with the SCM. Vertical hydraulic-head differences from the upper Westbay System zone (Zone 1) to the lower zone (Zone 4) are on average less than 0.1 foot/foot and are fairly uniform across the Site. These low vertical hydraulic gradients are consistent with the relatively low horizontal hydraulic gradients across the Site, which indicates good hydraulic connection.

The majority of the UTZ beneath the Site is unconsolidated, with secondary dissolution features that provide vertical hydraulic connection. Given this fact, it would logically follow that the vertical hydraulic gradients are low within this deposit. In addition, given that the Site is within the cone of depression for the Murphree Wellfield, groundwater withdrawals from this wellfield would tend to equilibrate vertical hydraulic gradients within the area of influence for this wellfield. Hence, the combination of the physical properties of the UTZ and the hydraulic effects of groundwater withdrawals from the Murphree Wellfield, would tend to minimize vertical hydraulic gradients within this unit.

4.4 PERMEABILITY OF ANNULAR BACKFILL MATERIAL

Laboratory permeability measurements of the backfill materials used in the construction of the UF monitoring wells was performed to evaluate the potential for preferential flow within the annular backfill material of these wells. Samples of the 12/20 filter pack sand and 30/65 fine sand were submitted to a materials testing lab for permeability measurements. The sand was submitted to the lab in 2-inch ID Shelby tubes. Three subsamples were taken from each of the Shelby tubes for permeability testing. The sub-samples were placed in standard permeability testing sleeves and vibrated in an attempt to pack the samples similar to the procedure used to install and place the backfill material in the borehole annulus. Individual permeability tests were performed on all three samples and then averaged to obtain an approximation of the average subsurface permeability of the backfill material.

Constant head column tests of the 12/20 filter pack sand and the 30/65 fine sand indicate that the filter pack sand is approximately one order of magnitude higher permeability than the fine sand used to backfill annular space between screen intervals (Table 4-2). The average hydraulic-conductivity value of the filter sand is 1.0×10^{-1} cm/sec and the average hydraulic-conductivity value of the fine sand is 1.0×10^{-2} cm/sec. This is in comparison to the GeoTrans (2004b) model average horizontal hydraulic-conductivity value of 2.0×10^{-2} cm/sec for the UTZ. Hence, the hydraulic-conductivity value of the fine sand is approximately a factor of two less than the average horizontal hydraulic-conductivity value of the formation. The vertical permeability of the UTZ is unknown, but given the physical properties of the UTZ and potential low vertical gradient, it would be expected that the vertical hydraulic-conductivity value closely approximates the horizontal hydraulic-conductivity value for this formation. Similarly, the factor of two difference between the vertical and horizontal permeability of the formation is an indication that the backfill material does not provide a significant vertical preferential pathway for groundwater flow within the UTZ.

Analytical equations used to quantify groundwater flow are dependent on both the hydraulic gradient and the hydraulic conductivity of the aquifer material. Therefore, the measured hydraulic gradient is directly dependent on the hydraulic conductivity of the material. In general, the higher the hydraulic conductivity of the material the lower the hydraulic gradient. Therefore, a measured low hydraulic gradient within the new UF monitoring wells could be due to the moderately high hydraulic conductivity of the aquifer material or similarly a reflection of hydraulic connection through the backfill material. There is no way to indisputability separate the hydraulic gradient from the permeability of backfill material without a separate measure of the vertical hydraulic gradient in the UTZ.

However, the Darcy equation can be used to help qualify the relative significance of the vertical groundwater flow through the fine sand backfill material in relation to horizontal groundwater flow. Given an average horizontal hydraulic gradient for the UF Aquifer of 7.3×10^{-4} ft/ft, an annular cross-sectional area of 8.17 ft^2 and an average permeability of 46 ft/day, the horizontal groundwater flux across a single screen interval of a 7-inch diameter wellbore is conservatively estimated to be about 2 gal/day. In actuality, this flux would be larger due to convergence of groundwater flow and the approximately doubling of flux through a well (analytical solution for groundwater flow in a uniform flow field containing a circular feature with infinite permeability). The groundwater flux in the vertical direction through the fine sand can be estimated based on 1) The hydraulic conductivity of the fine sand backfill material (1.0×10^{-2} cm/sec); 2) The vertical hydraulic gradient (less than 0.1ft/100 ft); and 3) The cross-sectional area of the annular space (0.16 ft^2). Results of this calculation show that vertical flux through the fine sand is approximately 0.03 gal/day. This means that the potential vertical flux through the sand is about a factor of approximately 70 times less than the estimated horizontal flux of groundwater across the approximately 14 feet of filter sand used to backfill each screen interval. Hence, the potential vertical flux of groundwater through the fine sand annular backfill material is small compared to the natural horizontal groundwater flow in the aquifer. Therefore, measurable water quality impacts potentially resulting from vertical groundwater flow through the annular backfill material are expected to be small and insignificant

The potential hydraulic flux and gradients are consistent with the water quality data observed in the Westbay System zones. As discussed in Section 4.5 below, relatively low levels of organic constituent impacts were detected in two source area monitoring wells (FW-20B and FW-21B). Water quality results from these wells show low levels of impacts in the upper two zones and no impacts in the lower zones. If vertical groundwater flux was a significant issue within the backfill material of these wells, it is likely that impacts would have been distributed vertically across all four zones. Conversely, monitoring well FW-12B shows the greatest impacts in the deepest monitoring zone (Zone 4) and less impacts in the zones above with non-detect concentrations in uppermost zone (Zone 1). Therefore, the initial water quality data support the conceptual model of minimal vertical flux through the annular backfill material.

In summary, although there is no single set of indisputable data to confirm that potential vertical flow through the fine-sand annular backfill material is small, the combination of multiple sets of data support the conclusion that the fine-sand backfill is not adversely impacting hydrogeologic and water quality data obtained from the new UF monitoring wells. The measured relatively low horizontal and vertical hydraulic gradients fit the SCM of a hydraulically connected UTZ, but it cannot be established that the low hydraulic gradients are not due to the annular backfill material. The vertical gradients within the UTZ are in part low because of hydraulic effects from the Murphree

Wellfield. The hydraulic conductivity of the fine-sand material is approximately a factor of two less than the average horizontal hydraulic conductivity of the UTZ and the horizontal groundwater flux is estimated to be approximately a factor of 70 greater than the potential vertical flux. Water quality results from the new UF monitoring wells also support the conclusion that the fine-sand annular backfill does not provide a preferential pathway along the borehole. No annular backfill material is impermeable. A bentonite annular backfill material also allows vertical groundwater flow within a borehole annulus; however, the volume of flow through bentonite is typically small in comparison to the horizontal flow in the aquifer. Similarly, the potential volume of groundwater migrating through the fine sand is small in comparison to horizontal flow and is expected to be readily dispersed horizontally within the aquifer resulting in non-measurable hydraulic head impacts within the well-screen interval. All of the various sets of data support the conclusion that the UF monitoring well design and construction provide representative UTZ data for the individual zones. In addition, water quality data, discussed below, indicate vertical segregation that supports the conclusion of a low vertical hydraulic gradient and minimal vertical mixing.

4.5 GROUNDWATER SAMPLE ANALYSES

Groundwater samples were collected from the UF monitoring wells during three separate sampling episodes corresponding to when individual wells were constructed. The first set of groundwater samples were collected from transect monitoring wells FW-10B through FW-16B in January 2006 (Table 4-3a). The second set of groundwater samples was collected in March 2006 from source area monitoring wells FW-18B through FW-21B and transect monitoring well FW-17B (Table 4-3b). The second sampling event also included confirmation sampling of transect monitoring wells FW-11B, FW-12B and FW-16B. The third and final sampling event was performed in May 2006 and consisted of sampling the two Site boundary monitoring wells FW-22B and FW-23B (Table 4-3c).

Results of the groundwater samples are discussed below. The discussion is subdivided into organic constituent analyses and metals.

4.5.1 Volatile and Semi-Volatile Organic Analyses

A summary of the organic sample analyses for all wells with laboratory detections are provided in Tables 4-3a, 4-3b and 4-3c. The 2006 water quality sample results for Zones 1 through 4 are shown in Figures 4-3a through 4-3d. In addition, water quality results for previous UF monitoring wells FW-1 through FW-9 and MWTP-MW-1 are also provided in Figure 4-3a. The laboratory analytical reports and the data validation report for all sampling events are included in Appendix H.

The results of the groundwater sampling for the new UF transect and source monitoring wells are consistent with the conceptual model for the Site. No significant impacts to the UF Aquifer were identified, with organic constituents from the 64 samples (four sample intervals in each of the 14 monitoring wells) reported as either non-detect or below the Federal Maximum Concentration Limit (MCL) drinking water standards. The only exception to this was low levels of benzene that exceeded Federal MCLs in one monitoring zone of two wells. In addition, 59 of the 64 monitoring zones were either non-detect or below the Florida Groundwater Cleanup Target Levels (GCTLs) concentration limits. The following wells exceeded GCTL concentration limits: 1) Two sample zones in monitoring well FW-12B; 2) Two sample zones in monitoring well FW-20B; and 3) One sample zone in monitoring well FW-21B.

<u>Source Area Monitoring Wells</u>

The source area monitoring wells demonstrate no impacts in two of the source areas and limited impacts in the remaining two Site source areas. Monitoring wells completed in the Process Area (FW-18B) and former South Lagoon (FW-19B) were non-detect for all organic constituents, with the exception of extremely low levels of one constituent in one zone of each monitoring well. These results are consistent with the results discussed in the report entitled: *Data Report for Additional Investigation of Hawthorn Group DNAPL Source Evaluation for the Koppers Industries Property* (GeoTrans, 2004a) that indicated that creosote DNAPL was not present in the Lower Hawthorn Group deposits in these former source areas. Monitoring well FW-20B was completed in the former North Lagoon Area and had two zones with select organic constituents above Florida GCTL standards. Monitoring well FW-21B was completed in the former Drip Track Area and contained one zone with one organic constituent that exceeded Florida GCTL standards.

Monitoring well FW-20B was installed immediately downgradient of the former North Lagoon and in the vicinity of UF Aquifer monitoring well FW-6. Monitoring well FW-6 is completed in the upper 20 feet of the Ocala Limestone and contains elevated concentrations of organic constituents. The presence of elevated organic constituents in this well is hypothesized to be a result of “dragdown” of NAPL-impacted sediments and drilling fluids. Monitoring well FW-20B was installed to evaluate whether constituents detected in FW-6 are localized or an indication of wide-spread impacts beneath the former North Lagoon. The relatively low organic-constituent concentrations detected in two of the four monitoring zones in FW-20B indicate that wide-spread impacts are not present beneath the former North Lagoon. The naphthalene concentration in FW-6 in March 2006 was 960 µg/L and the March 2006 naphthalene concentration in the uppermost monitoring zone (Zone 1) for FW-20B was non-detect. Zone 2 in FW-20B is located approximately 30 to 40 feet below the Ocala Limestone contact and contained a slightly elevated naphthalene concentration of 53 µg/L. The relatively low naphthalene concentrations detected in this well, in relation to FW-6, is an indication that wide-spread impacts are not present beneath the former North Lagoon and that the elevated concentrations in FW-6 are consistent with the drilling-induced impacts as previously discussed. None of these concentrations are indicative of the presence of DNAPL creosote.

The former Drip Track area does not contain wide-spread organic constituent impacts. No constituents exceeded Federal standards and naphthalene was the only constituent that exceeded State GCTL standards (14 µg/L), with a concentration of 140 µg/L in the uppermost zone (Zone 1) of monitoring well FW-21B. Although low levels of select organic constituents were detected in deeper zones within this well, these constituent concentrations are all below Federal and State standards. Furthermore, downgradient monitoring wells FW-15B, FW-14B and FW-13B had no organics detected.

Therefore, initial groundwater samples from the four source area monitoring wells demonstrate that dissolved-phase impacts, although present in the UTZ beneath two of the source areas, are not wide-spread. In addition, the relatively low concentrations indicate that free-phase DNAPL has not migrated through the Hawthorn Group lower clay unit into the UF Aquifer.

Transect Monitoring Wells

Groundwater samples from the eight transect monitoring wells are consistent with the findings of limited dissolved-phase impacts beneath two of the four potential source areas, as discussed above. Seven of the eight transect monitoring wells were non-detect for all organic constituents, with the exception of a few low organic constituent concentrations detected in two monitoring wells. Consequently, the constituent mass flux across this transect is low. A few select organic constituents were detected in a couple of monitoring zones, but these constituents do not indicate a pattern consistent with the presence of a dissolved-phase organic groundwater plume. The only transect well that contained elevated organic concentrations was monitoring well FW-12B. The location of organic constituents in monitoring well FW-12B is not consistent with the two source area monitoring wells where impacts were isolated to the upper two monitoring zones for the well. Impacts in monitoring well FW-12B were restricted to the lower monitoring zones, with no impacts in the uppermost monitoring zone. In addition, the highest concentrations detected in this well were in the deepest zone (Zones 4), with concentrations declining in the upper monitoring zones. This apparent reversal in concentration trends will be further investigated in subsequent sampling events and with additional investigations downgradient of this well, as discussed in Section 5.

The closely spaced transect monitoring wells (approximately 300 feet apart) along the western, northern and easterly Site boundaries provide a tight network of wells for detection and monitoring of constituent plumes in the UTZ. These transect monitoring wells demonstrate that a large-scale groundwater plume is not present in the UF Aquifer. Constituents detected in the vicinity of the former North Lagoon and Drip Track source areas are not present in the downgradient transect monitoring wells. The absence of constituents in the downgradient transect monitoring wells supports the conceptual model of limited dissolved-phase impacts to the UTZ in the immediate vicinity of two source areas. These dissolved-phase impacts appear to be contained on-Site and have not migrated significant distances downgradient of the source areas.

Site Property Boundary Monitoring Wells

Two monitoring wells (FW-22B and FW-23B) were installed along the northern Site property boundary, downgradient of monitoring well FW-12B to investigate the lateral extent of impacts observed in this well. The sample results for these two monitoring wells were below the Federal MCLs and State GCTL water standards. Similarly, monitoring wells FW-11B and FW-13B are located side gradient of monitoring well FW-12B. Monitoring well FW-13B is non-detect for organic constituents and monitoring well FW-11B contained low levels for two organic constituents, with non-detect concentrations for all other constituents. Therefore, the areal extent of impacts detected in monitoring well FW-12B appear to be limited both side gradient and downgradient of this well. The data for monitoring wells FW-22B and FW-23B installed along the northern Site property boundary further demonstrates that extensive impacts are not present in the UF Aquifer and that there is likely no off-site migration of Site constituents in the UF Aquifer that exceed Federal and State groundwater standards.

UF monitoring wells with constituent detections for Zones 1 through 4 are shown in Figures 4-3a through 4-3d. These plots provide the most recent data for the groundwater samples collected at the Site. In addition, the most recent sample results from the previous UF monitoring wells are more appropriately grouped with sample results from Zone 1 and are provided in Figure 4-3a. Results of these plots show that in the upper 10-20 feet of the UTZ there are no wells that exceed Federal MCLs and three monitoring wells (FW-3, FW-20B and FW-21B) that exceed Florida GCTLs, excluding monitoring well FW-6. The three monitoring wells that exceed GCTLs contain only one to two constituents above GCTLs.

Figure 4-3b shows constituent concentrations for Zone 2, approximately 30-40 feet below the top of the UTZ. There are no monitoring wells that exceed Federal MCLs and only one monitoring well (FW-20B) that exceeds Florida GCTLs for two constituents. Figure 4-3c shows constituent concentrations for Zone 3, approximately 50-60 feet below the top of the UTZ. There are no monitoring wells that exceed Federal MCLs and only one monitoring well (FW-12B) that exceeds Florida GCTLs for four constituents. Figure 4-3d shows constituent concentrations for Zone 4, approximately 70-80 feet below the top of the UTZ. There are no monitoring wells that exceed Federal MCLs and only one monitoring well (FW-12B) that exceeds Florida GCTLs for four constituents. Water quality results for the four zones further support the conclusion that wide-spread impacts are not present beneath the Site.

The groundwater sample results from the 64 samples zones in the 14 new transect, source, and property boundary monitoring wells are consistent with over 2 years of monitoring data from the 11 UF monitoring wells previously installed at and in the immediate vicinity of the Site. The relatively low concentrations detected in a few wells indicate that free-phase DNAPL has not migrated through the Hawthorn Group lower clay unit into the UF Aquifer. All UF Aquifer monitoring wells at the Site support the GeoTrans' numerical model results indicating that the Murphree Wellfield is not currently impacted and will not be impacted from Site constituents in the future.

As was previously discussed in Beazer's February 10, 2006, April 3, 2006 and June 13, 2006 data transmittal letters, the sample results are reassuring in that they confirm significant impacts are not present in the UF Aquifer. Concentrations are well below those utilized in the EPA's hypothetical calculation (1,700 µg/L) included in its July 12, 2005 letter to Beazer. Additionally, there is no plume present beneath the Site that would begin to approach the lateral and vertical extent assumed in this calculation. The EPA's hypothetical calculation was based on an extremely conservative assumption that natural processes of biodegradation and adsorption were not active in the UF Aquifer. The relatively low concentrations detected in a few discrete zones in the UF Aquifer demonstrate that extensive impacts are not present in the UF Aquifer and that there is no significant off-Site migration of Site constituents.

4.5.2 Metals Analyses

Metals analyses were performed on groundwater samples collected from the 64 Westbay System zones. Samples were analyzed for arsenic, bromide, copper, chromium, and zinc. Samples collected in January 2006 from transect monitoring wells FW-10B through FW-16B were analyzed for total metals and samples from sampling events in February and May were analyzed for dissolved metals. Samples were initially analyzed for total metals to help guide future core samples for further assessment as part of the arsenic evaluation.

Total arsenic concentrations for monitoring wells FW-10B through FW-16B ranged from 1 to 47 µg/L. Monitoring wells FW-12B, -13B and 16B were resampled in March 2006 for confirmation samples of transect monitoring wells with constituent organic detections as specified in the EPA July 12, 2005 letter. The confirmation samples and all subsequent samples were analyzed for dissolved arsenic. The dissolved arsenic concentrations for monitoring wells FW-12B, FW-13B, FW-16B and monitoring wells FW-17B through FW-23B ranged from non-detect to 13 µg/L. These data support the hypothesis that previously elevated arsenic concentrations in the UF Aquifer are likely due to the introduction of oxygenated drilling fluids, which mobilized naturally occurring arsenic. The low to non-detect dissolved arsenic concentrations in the new UF monitoring wells are likely due to the significant well development performed for the new UF Aquifer monitoring wells. The results of the metals analyses are included in summary Tables 4-3a, 4-3b and 4-3c are.

Bromide concentrations for monitoring wells FW-10B through FW-16B ranged from 1.3 to 180 mg/L in monitoring wells FW-13B (zone 4) and FW-10B (zone 1), respectively. Because of elevated bromide concentrations in select sampling zones, additional development was performed in some of these wells. Bromide concentrations in these wells dropped as a result of this redevelopment. Monitoring well FW-10B was not resampled in March, 2006; however, monitoring well FW-12B (zone 1) saw bromide concentrations drop from 110 mg/L in January 2006 to 23 mg/L in March 2006 as a result of the redevelopment of this well. Similar bromide declines were observed in other wells that were redeveloped. The bromide concentrations for monitoring wells FW-17B through FW-23B ranged from non-detect to 62 mg/L in monitoring well FW-20B (zone 1). In general, bromide concentrations were below 25 mg/L for sample zones in these wells, indicating that the significant development performed in these wells removed the majority of the drilling fluids introduced to the UTZ during well drilling and completion.

Dissolved copper was only detected in one sampling zone of three separate monitoring wells (Zone 3 in FW-19B, Zone 4 in FW-20B and Zone 4 in FW-22B). All other samples were non-detect for dissolved copper. Similarly, dissolved chromium was only detected in one sampling zone of four monitoring wells (Zone 1 in FW-11B, Zone 1 in FW-12B, Zone 4 in FW-17B and Zone 4 in FW-19B). All other samples were non-detect for chromium. Low concentrations of dissolved zinc were detected in virtually all monitoring wells.

Results of the metals analyses indicate that dissolved metals have not migrated into the UF Aquifer, consistent with the SCM and numerical simulations.

5.0 CONCLUSIONS AND RECOMMENDATIONS

5.1 CONCLUSIONS

Hydrogeologic data obtained from the 14 new monitoring wells installed under this Supplemental UF Aquifer Monitoring Well Installation Program are the most comprehensive data ever collected of the UF Aquifer at this Site. These data in combination with hydrogeologic data from the previous 11 UF monitoring wells installed at or in the vicinity of the Site provide a comprehensive database for the SCM and provide an effective monitoring well network for the UTZ of the UF Aquifer system.

The over 2,000 feet of geologic core collected under this program support the SCM previously presented in the report entitled: *Addendum 7: Groundwater Flow and Transport Model* (GeoTrans, 2004b). The following conclusions can be established from these data:

1) The HG upper, middle and lower clay units are continuous and laterally extensive over the Site;
2) No free-phase or residual DNAPL impacts were detected below the upper few feet of the HG lower clay unit;
3) No free-phase or residual DNAPL impacts were detected in the UF Aquifer;
4) The UTZ is approximately 70 percent unconsolidated, with 30 percent of the formation classified as moderately consolidated;
5) The estimated total porosity of the UTZ is approaching that of an alluvial silty-sand deposits) and the effective porosity for this formation is estimated to be in the range of 10 to 15 percent; and
6) The largely unconsolidated nature of the UTZ causes it to behave more like a porous media than a fractured media; thus, preferential pathways are less of a concern than previously suggested.

The hydraulic-head data obtained in May 2006 also support the groundwater flow conceptual model for the Site. The following conclusions can be established from these data:

1) Horizontal and vertical hydraulic gradients at the Site are low indicating that the UTZ is well connected both horizontally and vertically;
2) The potential inaccuracies of up to a few tenths of feet in the Westbay System pressure measurement port elevations are approximately equal to change in hydraulic head between wells;
3) The moderately high permeability of the UTZ and the extensive cone of depression resulting from active pumping at the Murphree Wellfield minimize vertical hydraulic gradients in the UTZ; and

4) The UF Aquifer potentiometric surface elevation contours indicate a predominantly northeastern groundwater flow direction across the Site and a predominantly northerly direction to the west of the Site.

The laboratory permeability measurements were performed on the annular backfill material to evaluate the potential for vertical migration through the fine sand annular backfill material. The following conclusions can be established from these measurements:

1) The estimated potential vertical flux of groundwater through the fine sand annular backfill material (0.03 gal/day) is small in comparison to the estimated horizontal groundwater flow through the screen interval for the UTZ (2 gal/day); and
2) Measurable water quality impacts as a result of vertical groundwater flow through the annular backfill material are expected to be small and insignificant.

Groundwater samples were collected from 14 monitoring well locations at 4 discrete sample zones resulting in a total of 64 samples. The analytical results are consistent with the conceptual model for the Site and previously collected water quality data. The following conclusions can be established from these water quality data:

1) No wide-spread Site constituent impacts to the UF Aquifer were identified:
    a. Organic constituents were either non-detect or below the Federal MCL drinking water standards, with the exception of low levels of benzene in two monitoring zones; and
    b. Organic constituents were either non-detect or below the Florida GCTLs concentration limits in 59 of the 64 monitoring zones.
2) No wide-spread constituent impacts were encountered beneath the four potential source areas; water quality results from two of the source areas were non-detect for organic constituents, with the exception of low concentrations of one organic constituent; one source area contained elevated concentrations of only one organic constituent in one sample zone and the other source area contained four organic constituents that exceeded State standards in two zones;
3) Previous detections of elevated organic constituent concentrations in FW-6 appear to be restricted to the immediate vicinity of this well, supporting the hypothesis that constituent “drag down” likely occurred during construction of the well;
4) The only transect well with elevated constituent concentrations was monitoring well FW-12B; concentrations in this well are anomalous with other results in that the highest concentrations are in the lowermost sample zone and non-detect in the uppermost sample zone; two monitoring wells (FW-22B and FW-23B) installed downgradient of monitoring well FW-12B demonstrate that impacts have not migrated off Site; and

5) The new UF monitoring well data support the hypothesis that previously elevated arsenic concentrations in the UF Aquifer are likely due to the introduction of oxygenated drilling fluids, which mobilized naturally occurring arsenic; dissolved arsenic concentrations are below the Federal and State standards in all but one sample zone in two monitoring wells.

In conclusion, the results of the Floridan Aquifer Monitoring Program and data obtained through the installation and sampling of 14 new multi-level UF monitoring wells, indicate that Site constituents will not impact the Murphree Wellfield. These data are consistent with the previously presented fate and transport analyses for Site constituents. Low concentrations of naphthalene, detected immediately downgradient of two source areas, were not detectable at the downgradient transect monitoring well locations. Further, monitoring wells installed on the Site boundary, downgradient of monitoring well FW-12B, indicate that impacts at the FW-12B location are contained on Site.

5.2 RECOMMENDATIONS

Recommendations have been developed to address the following three technical issues at the Site: 1) Water quality impacts in UF monitoring well FW-12B; 2) Data quality issues with UF monitoring well FW-6; and 3) Hydraulic gradient issues for the UF Aquifer.

<u>Recommendation #1</u>

The 14 recently installed monitoring wells, in addition to the 11 existing UF monitoring wells, provide a comprehensive monitoring network for the UTZ. Conversely, constituent impacts detected in transect monitoring well FW-12B require additional investigation. The impacts detected in this well appear to be limited in areal extent based on UF monitoring wells located both side-gradient and downgradient of monitoring well FW-12B. Constituent concentrations increased with depth, with the deepest sampling zone having the highest concentrations.

Beazer proposes to install monitoring wells into the UF Aquifer LTZ to further define the vertical extent of impacts. Beazer previously had proposed to install a LTZ monitoring well adjacent to FW-12B to investigate impacts in this area (Beazer letter to EPA, dated February 10, 2006). However, because of concerns with opening up potential future pathways to the LTZ in a known area of impacts, an alternative to this proposed location is being considered. Beazer believes that an appropriate and more robust alternative is the installation of a transect of LTZ monitoring wells along the northern Site boundary. This proposed transect will consist of four LTZ monitoring wells nested with three existing UTZ monitoring wells. One additional UTZ monitoring well will be installed in the northwestern corner of the Site to complete the nested pair transect. Locations of the four proposed LTZ monitoring wells and the one UTZ monitoring well are shown in Figure 5-1.

The conceptual design under consideration is an open borehole completion across the LTZ interval. The open borehole will be instrumented with a Westbay System, similar to the recently completed UTZ monitoring wells. Telescoping isolation casing will be installed to isolate shallow impacts, if present, from deeper zones. Telescoping isolation casing will extend into the semi-confining unit, which separates the UTZ from the LTZ. A detail design for these monitoring wells will be submitted under separate cover, as an addendum to the current Floridan Monitoring Program (TRC, 2004b). This submittal will also outline a proposed revised monitoring program (sample frequency, parameters, etc.), incorporating the 14 newly installed multi-level monitoring wells with the monitoring wells currently in the Floridan Monitoring Program.

Recommendation #2

Results of this extensive UF Aquifer investigation program support the hypothesis that elevated constituent detections at monitoring well FW-6 are likely the result of drilling induced impacts. The recently installed UF monitoring wells demonstrate that wide-spread impacts are not present in the UF Aquifer. Only one of the eight closely-spaced transect monitoring wells show impacts that exceed Federal or State standards and only two of the four source area monitoring wells have elevated organic impacts for constituents in two zones. In addition, the location of monitoring well FW-6 within the former North Lagoon source area is undesirable in that it provides a potential pathway for Site constituents to the UF Aquifer. Therefore, Beazer proposes that the use of monitoring well FW-6 be discontinued and that the well be abandoned. Water-quality data from this monitoring well are potentially compromised and are of limited technical value. Additionally, monitoring well FW-20B is located within 100 feet of this well and is an effective substitute for monitoring well FW-6. Beazer strongly recommends that this well be abandoned as soon as practical.

Recommendation #3

Water-level data collected from the 14 recently installed UF monitoring wells and from the existing 10 UF monitoring wells at the Site indicate that hydraulic gradients in the UF Aquifer are extremely low. Water-levels in UF monitoring well FW-6 from August 2004 to March 2006 have risen approximately 10 feet. In addition, changes in groundwater withdrawals at the Murphree Wellfield are expected to have a corresponding impact on water levels within the wellfield's cone of depression. As a result of natural hydrologic processes and wellfield pumping effects, water-levels at the Site can potentially fluctuate more than a few tenths of foot in a day. Given the extremely low hydraulic gradients at the Site, these daily water-level fluctuations will impact water levels collected over one or more days and the corresponding potentiomtric surface maps developed from these water-level measurements.

Beazer proposes to install data loggers and pressure transducers in three UF monitoring wells to address the issue of daily water-level fluctuations. The data logger/pressure transducer systems will monitor hourly water-levels in three wells to better characterize temporal water-level fluctuations in the UF Aquifer at the Site. These data will also be used to adjust Site-wide water levels collected over a 1 to 2 day period, if needed. These semi-continuous water-level measurements will provide hydraulic-head data with which to better define future horizontal and vertical hydraulic gradients at the Site.

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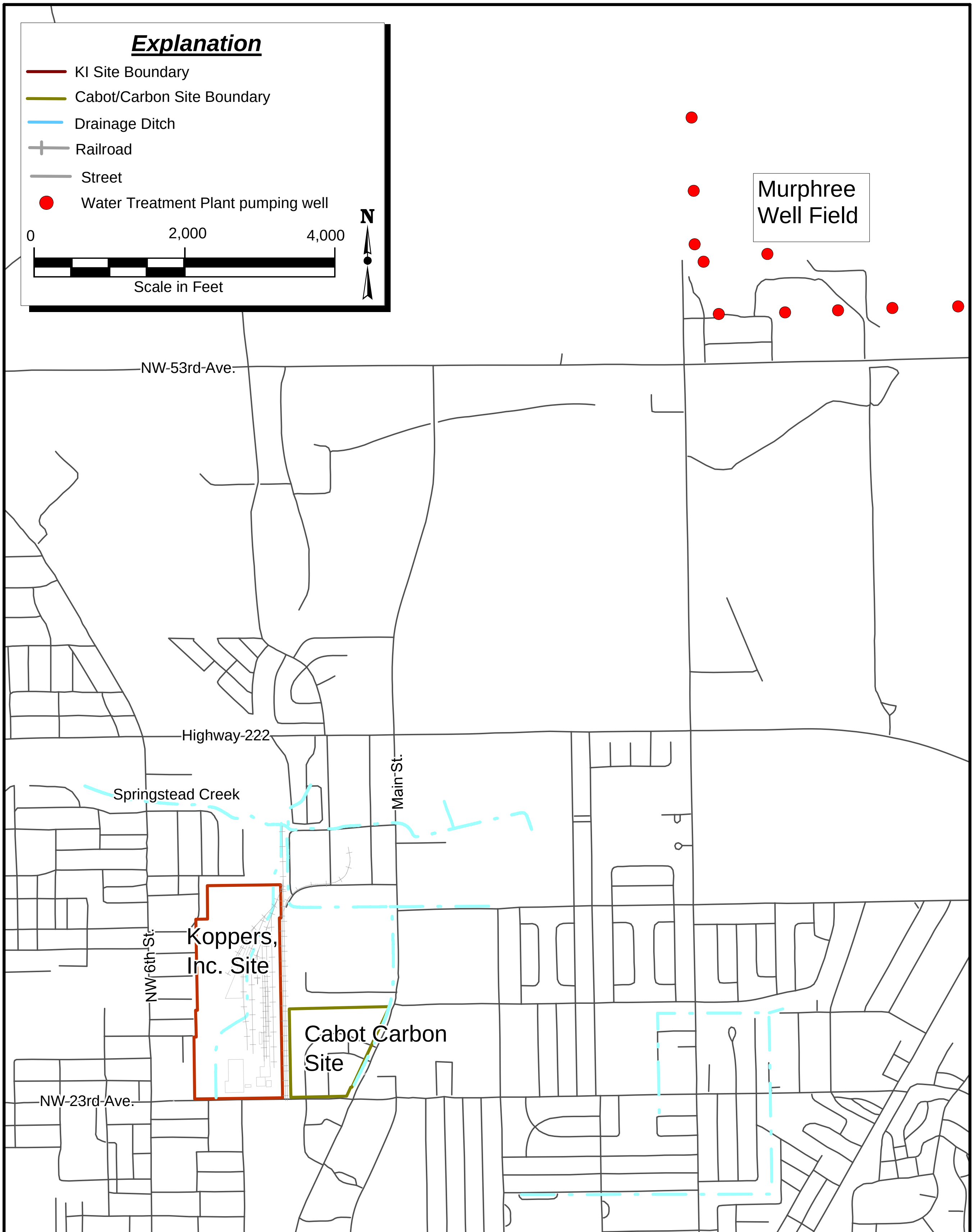

TITLE: SITE LOCATION MAP

LOCATION: Cabot Carbon/Koppers Superfund Site, Gainesville, Florida

GeoTrans, Inc. A TETRA TECH COMPANY

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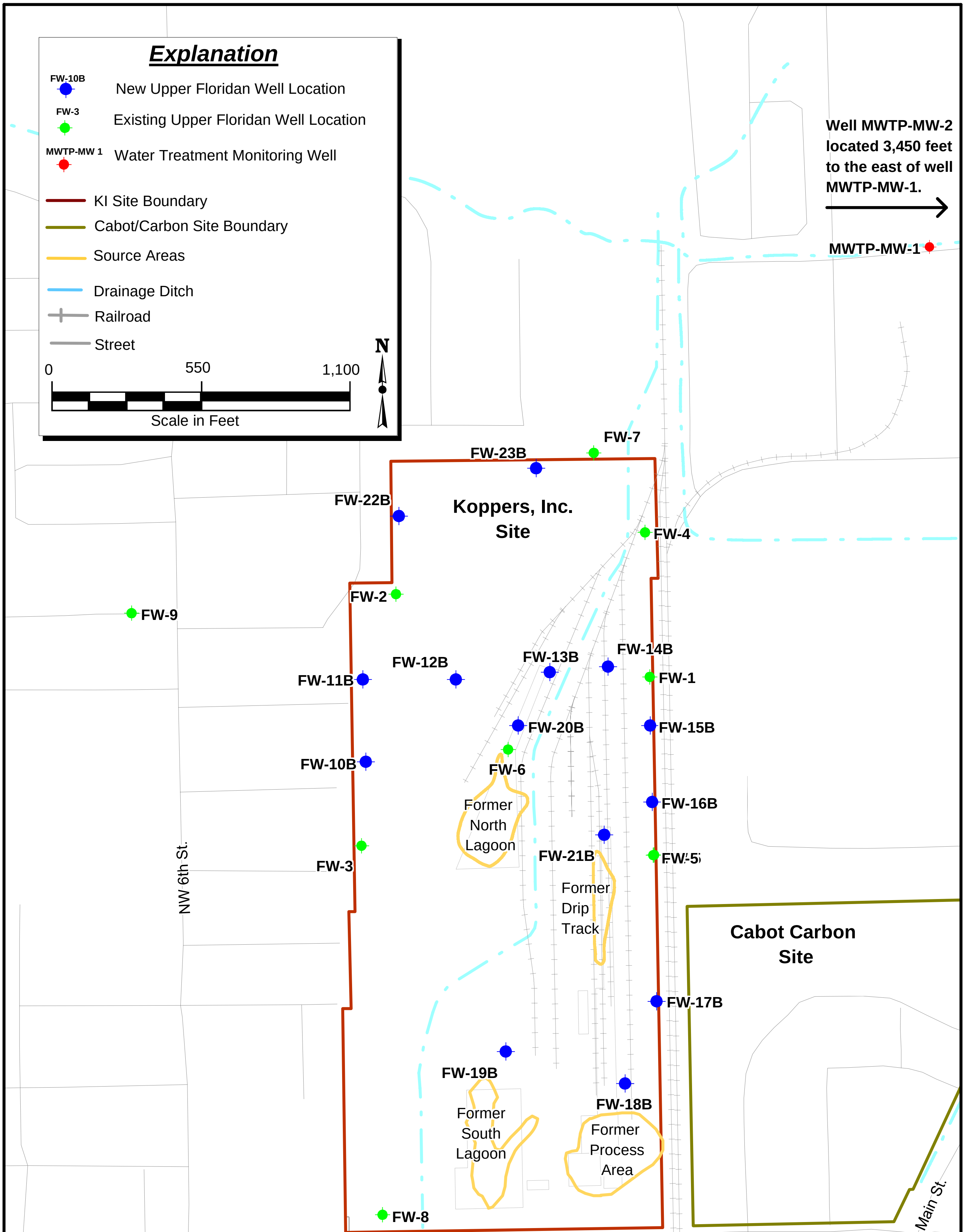

TITLE: LOCATIONS OF UPPER FLORIDAN AQUIFER WELLS

LOCATION: Cabot Carbon/Koppers Superfund Site, Gainesville, Florida

GeoTrans, Inc. A TETRA TECH COMPANY

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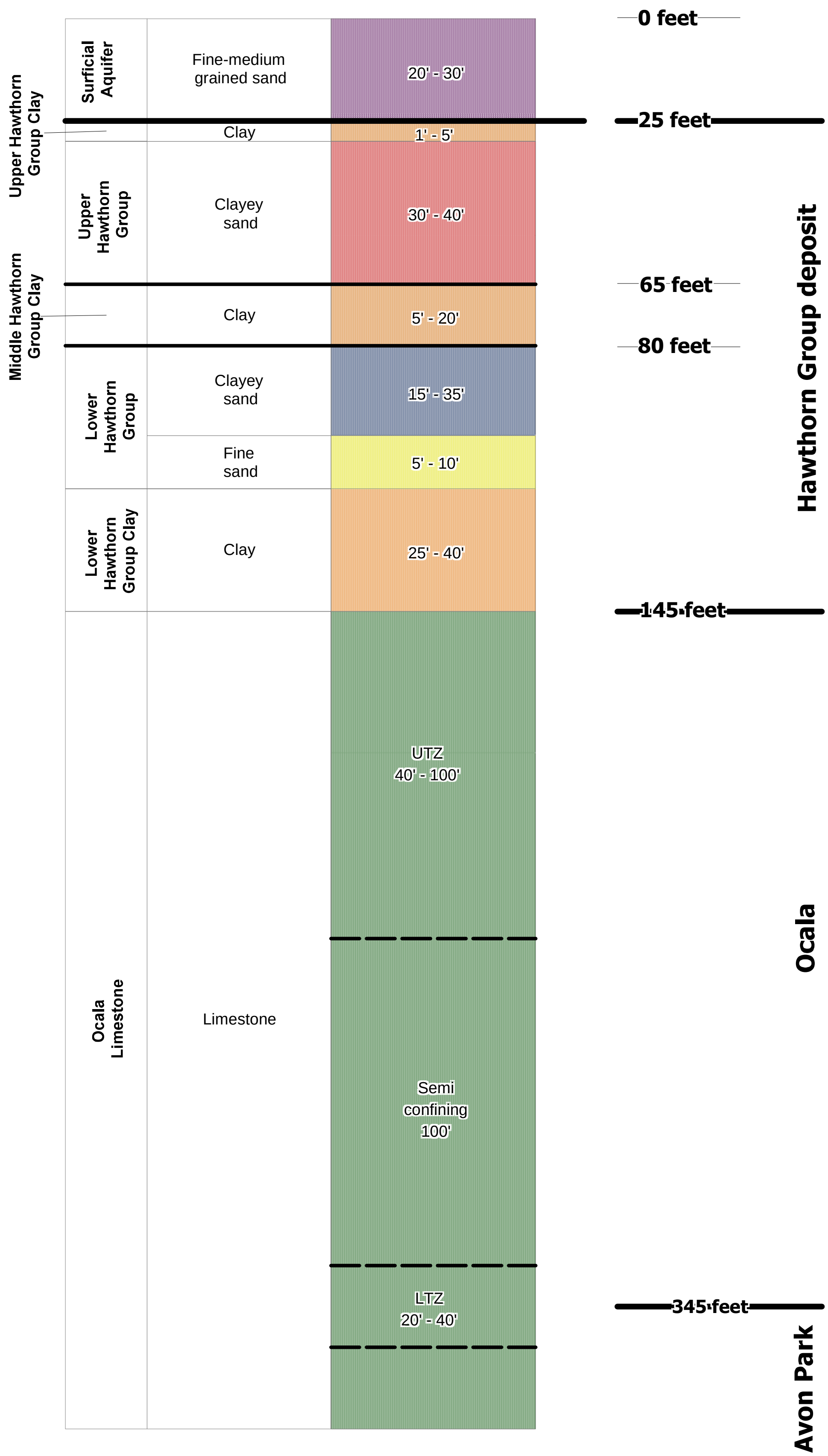

TITLE:	HYDROSTRATIGRAPHY OF DEPOSITS BENEATH SITE
LOCATION:	Cabot Carbon/Koppers Superfund Site, Gainesville, Florida

GeoTrans, Inc. A TETRA TECH COMPANY

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DATE	07/14/06	

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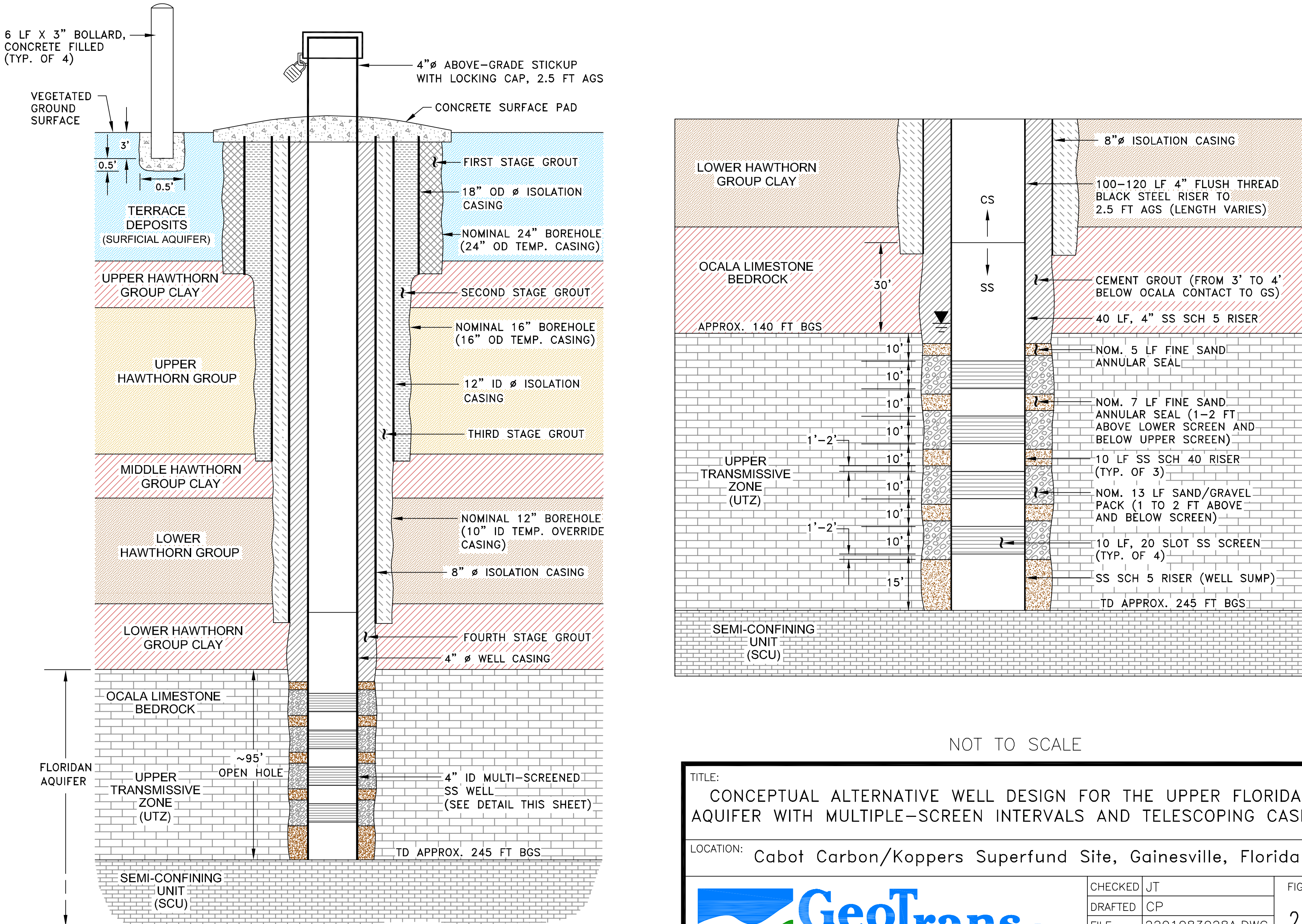


NOT TO SCALE

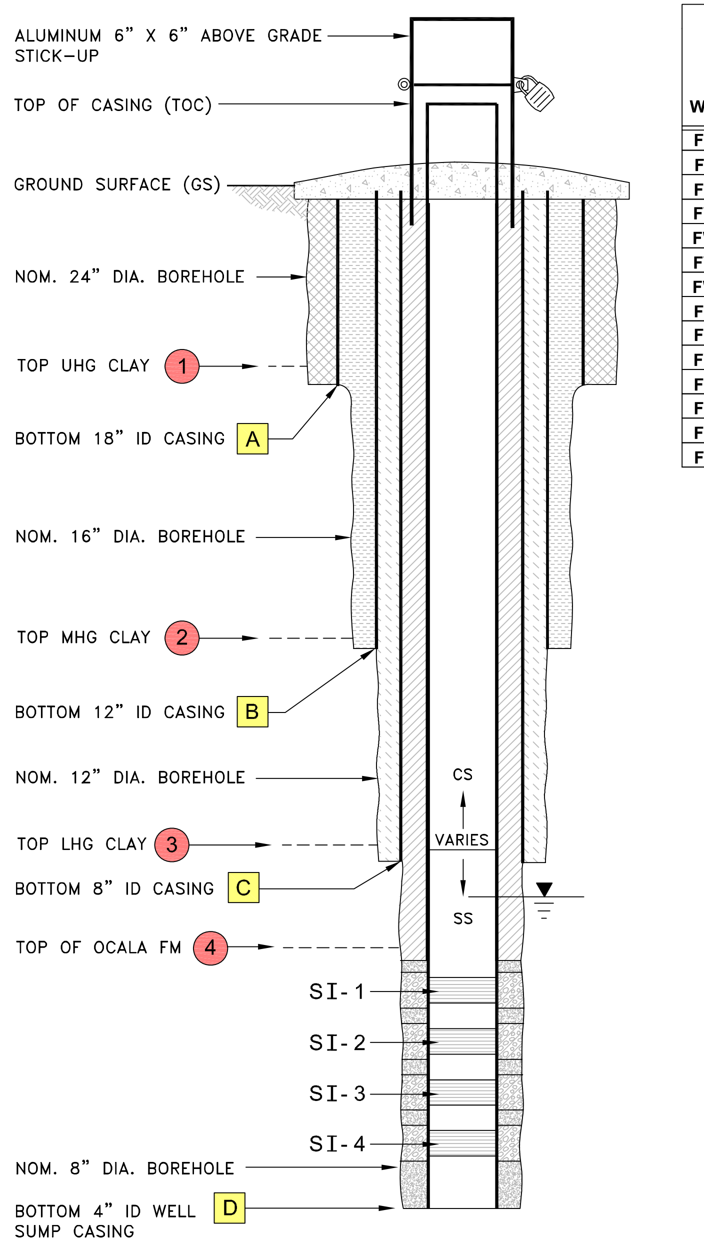
TITLE:
CONCEPTUAL ALTERNATIVE WELL DESIGN FOR THE UPPER FLORIDAN AQUIFER WITH MULTIPLE-SCREEN INTERVALS AND TELESCOPING CASING

LOCATION: Cabot Carbon/Koppers Superfund Site, Gainesville, Florida

GeoTrans, Inc. A TETRA TECH COMPANY

CHECKED	JT
DRAFTED	CP
FILE	2201083028A.DWG
DATE	7-18-06

FIGURE: 2-1



TYPICAL UPPER FLORIDAN MULTI-SCREEN WELL SCHEMATIC

(N.T.S.)

WELL ID	TOC (ft AGS)	Formation Depths (ft BGS)				Casing Depths (ft BGS)				Screen Interval Depths (ft TOC)							
		1 UHG CL	2 MHG CL	3 LHG CL	4 Ocala	A 18"	B 12"	C 8"	D 4"	SI-1 Top	SI-1 Bottom	SI-2 Top	SI-2 Bottom	SI-3 Top	SI-3 Bottom	SI-4 Top	SI-4 Bottom
FW-10B	2.60	25.0	60	110.8	141.8	26.0	63.0	122.0	237.9	154.8	164.5	175.0	184.7	195.1	204.7	215.2	225.0
FW-11B	2.63	19.0	60	107.5	141.9	25.8	63.5	123.0	237.1	154.7	164.3	174.7	184.3	194.7	204.3	214.7	224.3
FW-12B	2.48	24.7	62	108.5	143.6	25.9	64.0	118.5	239.7	157.0	166.6	177.1	186.7	197.1	206.7	217.1	226.7
FW-13B	2.55	24.1	60	110.3	143.7	26.0	64.0	120.0	239.3	156.8	166.4	176.8	186.4	196.9	206.5	216.9	226.5
FW-14B	2.73	24.7	63	106.7	140.9	26.0	66.0	118.0	240.7	158.3	168.0	178.4	188.0	198.4	208.0	218.4	228.0
FW-15B	2.78	21.4	63	114.3	143.5	23.1	68.0	120.5	238.7	156.4	166.0	176.4	186.0	196.4	206.0	216.5	226.1
FW-16B	2.56	20.0	65	111.5	142.4	22.2	69.6	118.0	250.9	163.4	173.0	183.4	193.0	203.5	213.1	223.5	233.1
FW-17B	2.73	24.3	64	115.0	144.6	26.3	67.8	124.2	240.9	158.6	168.2	178.6	188.2	198.6	208.2	218.6	228.2
FW-18B	2.44	23.5	69	115.0	143.7	24.0	72.5	122.5	238.2	155.5	165.1	175.5	185.1	195.5	205.1	215.6	225.2
FW-19B	2.65	22.5	63	115.6	142.9	24.0	66.0	117.2	237.2	154.8	164.4	174.8	184.4	194.8	204.4	214.8	224.4
FW-20B	2.75	23.5	63	108.5	142.9	25.1	65.5	124.8	238.1	155.7	165.3	175.7	185.4	195.8	205.4	215.8	225.4
FW-21B	2.56	23.0	62	111.8	140.0	26.6	65.3	125.6	237.0	154.5	164.1	174.5	184.1	194.5	204.1	214.5	224.1
FW-22B	2.56	23.0	60	108.6	142.7	24.0	63.6	116.9	237.6	155.3	164.9	175.3	184.9	195.3	204.8	215.2	224.8
FW-23B	2.51	22.0	60	108.7	137.6	22.8	64.6	117.0	232.4	149.9	159.5	169.9	179.5	189.9	199.5	209.9	219.5

NOTES:

BGS	BELOW GROUND SURFACE
AGS	ABOVE GROUND SURFACE
TOC	TOP OF 4" CASING (ABOVE GRADE)
SI	SCREEEN INTERVAL (DEPTHS SHOWN ARE TO THE ACTUAL SCREEN SLOTS, NOT THE PIPE JOINTS)
CS	CARBON (BLACK) STEEL
SS	STAINLESS STEEL
UHG CL	UPPER HAWTHORN GROUP CLAY
MHG CL	MIDDLE HAWTHORN GROUP CLAY
LHG CL	LOWER HAWTHORN GROUP CLAY

FORMATION DEPTHS ARE SHOWN TO THE TOP OF THE TRANSITION SEQUENCE, IF ANY.
TOP OF 18", 12" AND 8" CASINGS ARE AT GROUND SURFACE, WITHIN THE CONCRETE PAD.
TOP OF 4" CASING IS WITHIN THE ABOVE GRADE PROTECTION.

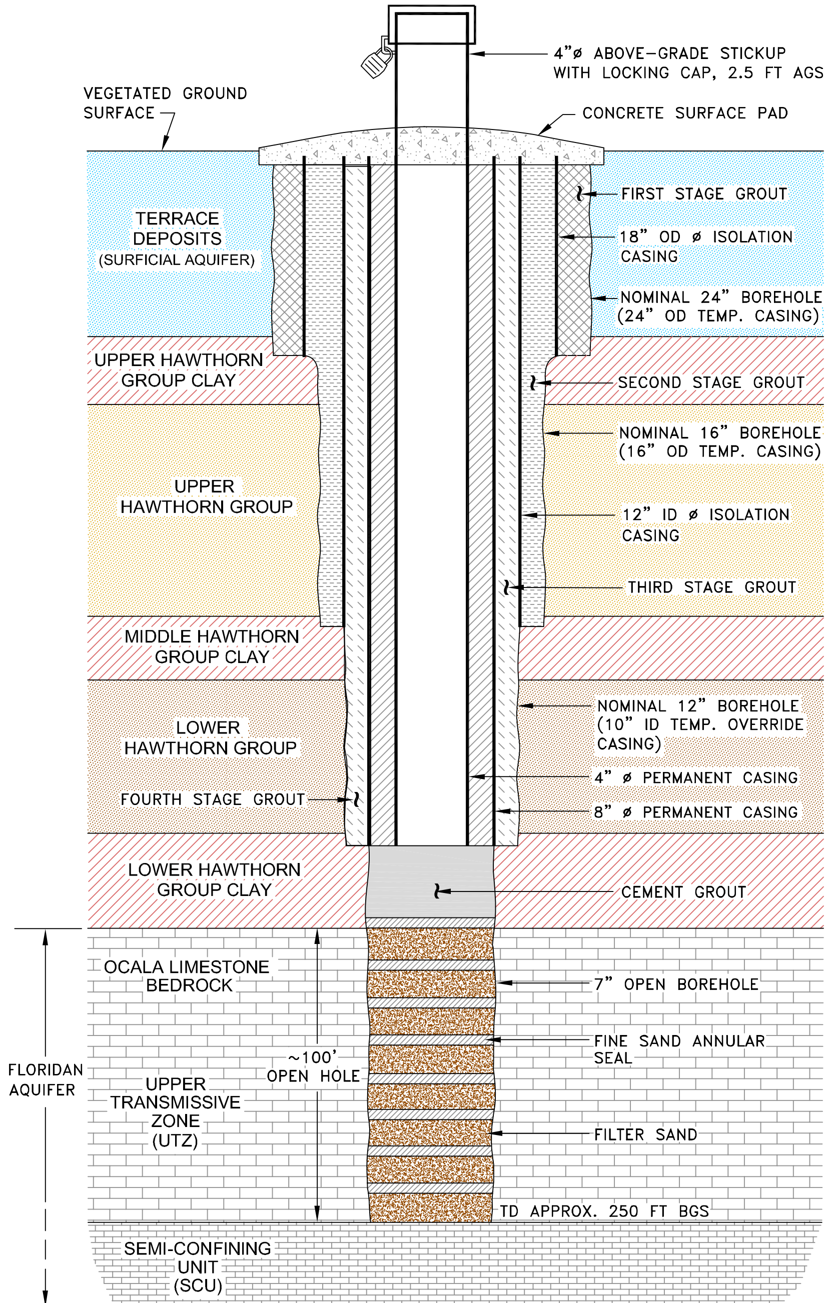
TITLE: UPPER FLORIDAN WELL CONSTRUCTION SUMMARY

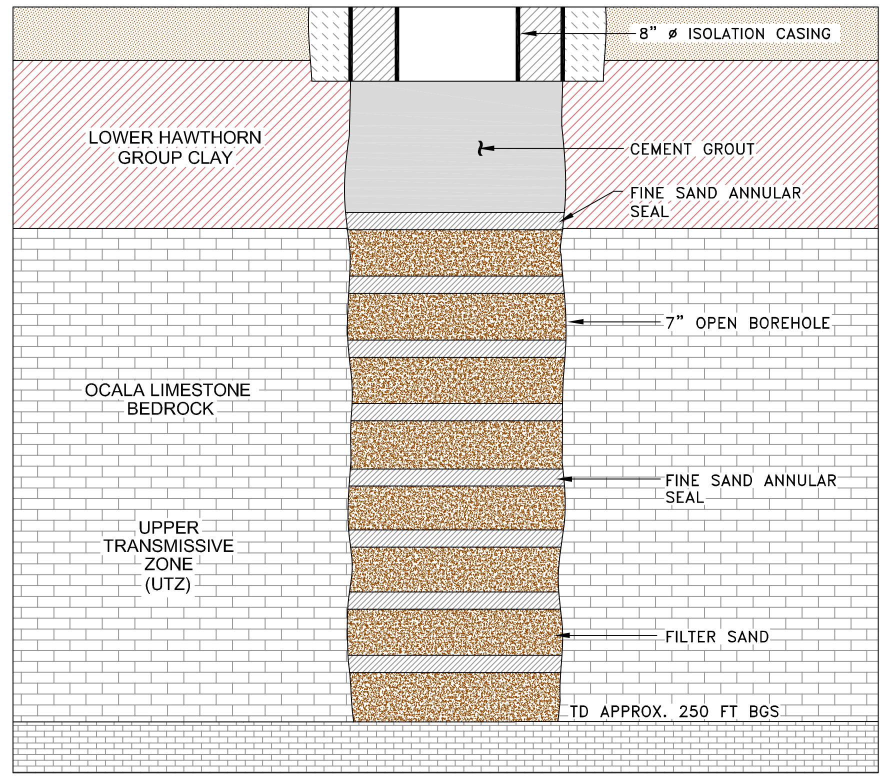
LOCATION: Beazer/KI Site, Gainesville, Florida

GeoTrans, Inc. A TETRA TECH COMPANY

CHECKED	JT	FIGURE:
DRAFTED	CP	2-2
FILE	2201083023A.DWG	
DATE	6–28–06	

2201083026A.DWG





NOT TO SCALE

TITLE: TEMPORARY ABANDONMENT DESIGN FOR BOREHOLES EXTENDING INTO THE UPPER FLORIDAN AQUIFER			
LOCATION: Cabot Carbon/Koppers Superfund Site, Gainesville, Florida			
GeoTrans, Inc. A TETRA TECH COMPANY	CHECKED	JT	FIGURE: 2-3
	DRAFTED	CP	
	FILE	2201083029A.DWG	
	DATE	7-18-06	

Figure 2-4. Well completion, development, Westbay installation, and sample collection timeline.

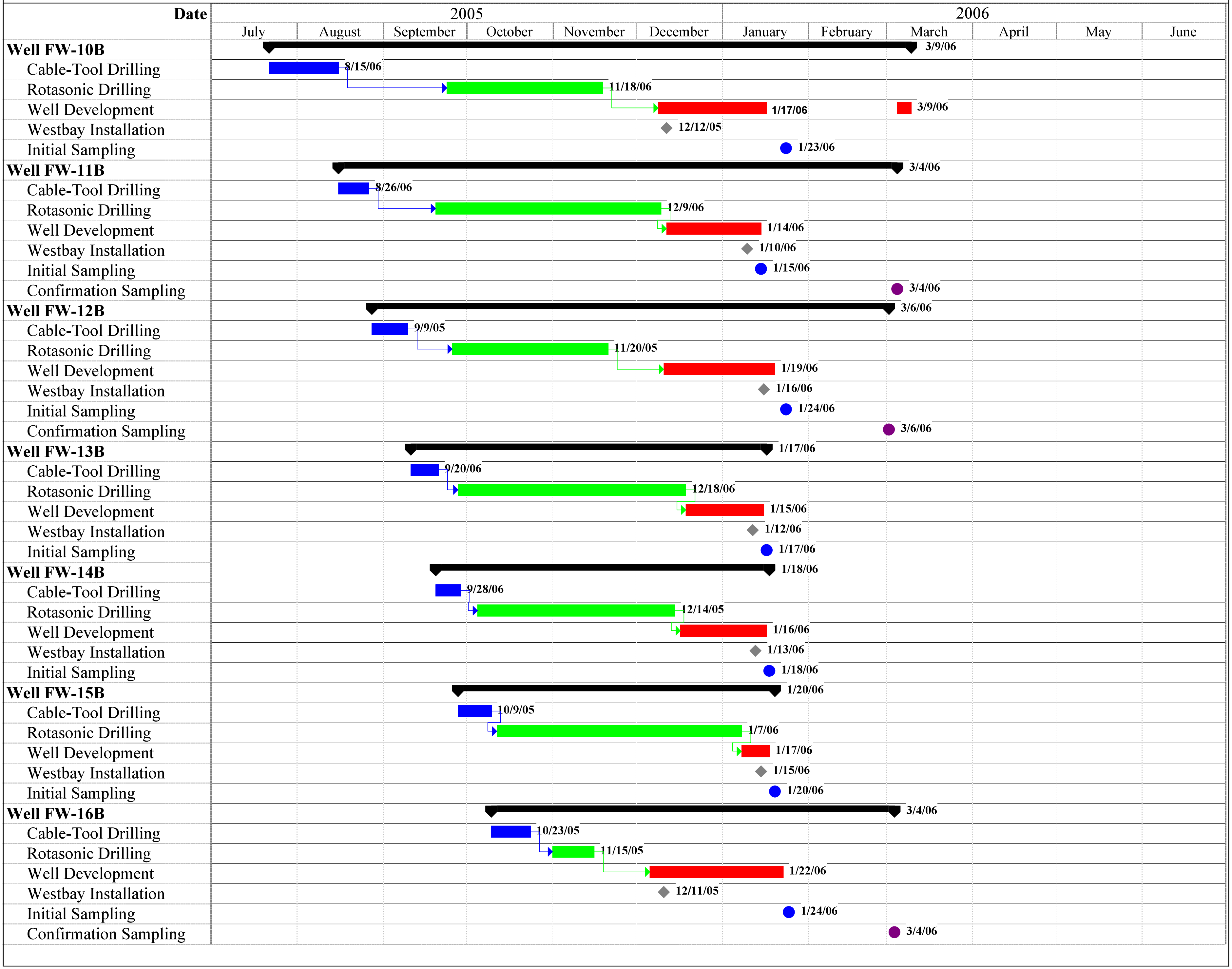
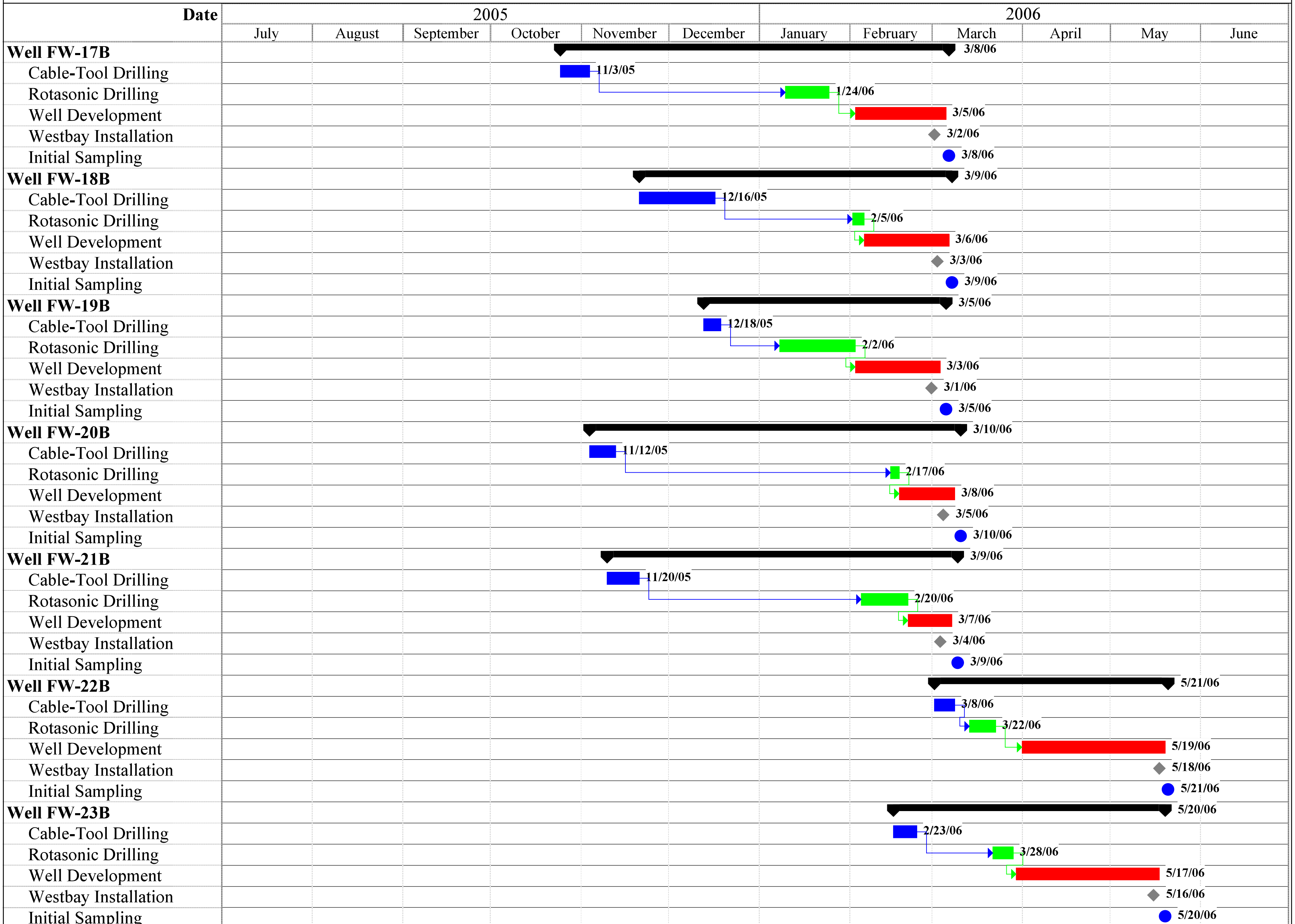
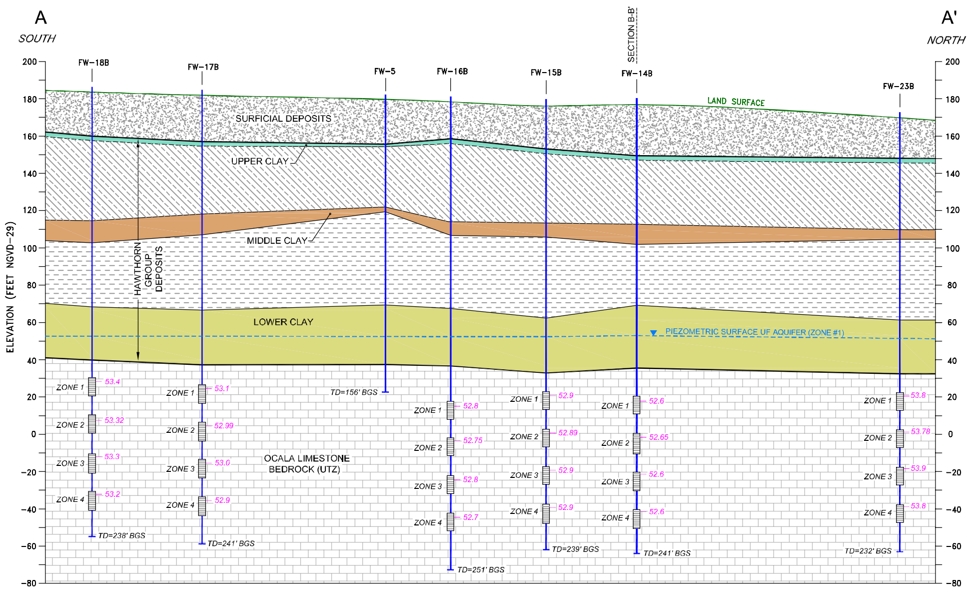
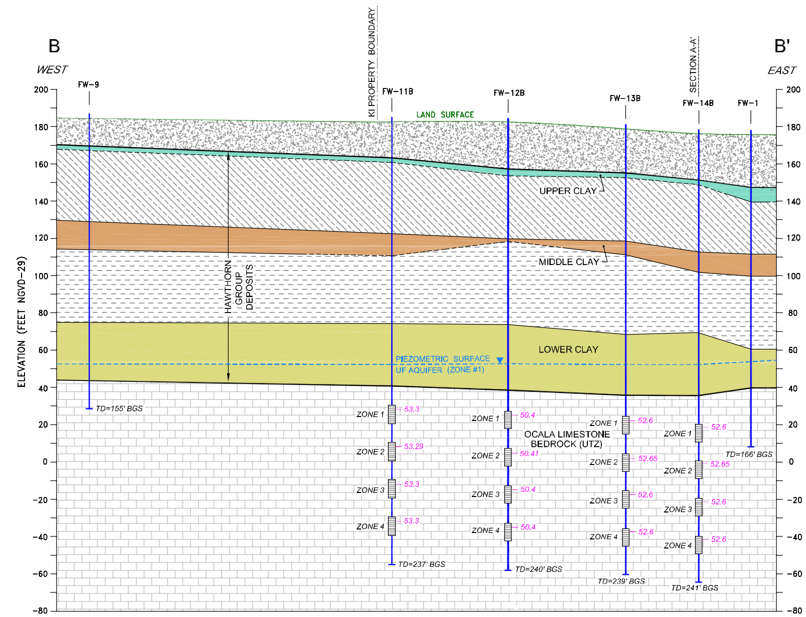
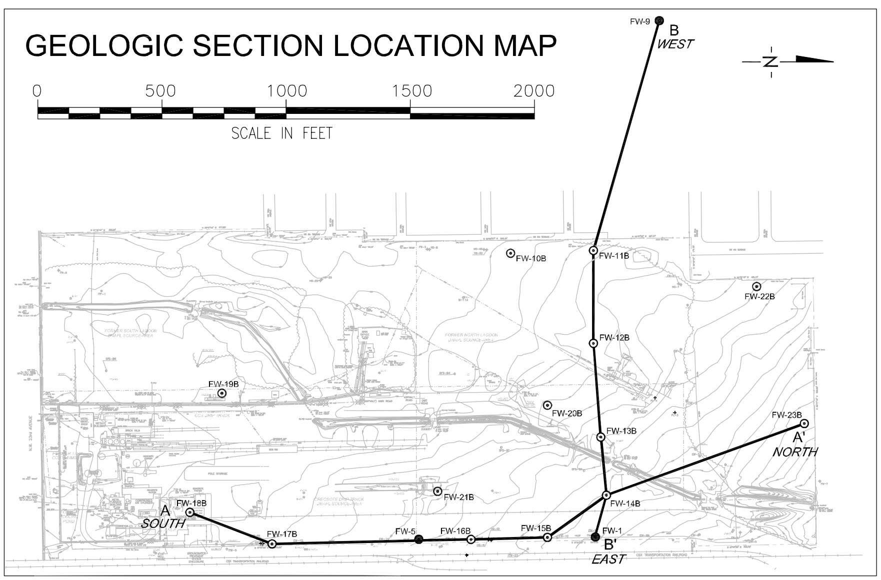


Figure 2-4 (cont). Well completion, development, Westbay installation, and sample collection timeline.









NOTES:

1. THE POTENTIOMETRIC SURFACE AT THE ZONE 1 WATER-BEARING STRATA IS SHOWN FROM THE MAY 16–21, 2006 GAUGING EVENT. THE POTENTIOMETRIC SURFACES FOR ZONES 2, 3, AND 4 ARE SIMILAR, AND ARE NOT SHOWN ON THE SECTIONS FOR CLARITY.
2. THE CALCULATED POTENTIOMETRIC ELEVATIONS FOR FW-12B ARE NOT IN LINE WITH SURROUNDING WELLS. THE DEPTHS OF THE MEASUREMENT PORTS WILL BE VERIFIED DURING THE NEXT SAMPLING EVENT.

HYDROGEOLOGIC SECTION

SURFICIAL AQUIFER SYSTEM	SURFICIAL DEPOSITS	SURFICIAL DEPOSITS
AQUICLUDE	HAWTHORN GROUP	UPPER CLAY UNIT
		UPPER HAWTHORN
		MIDDLE CLAY UNIT
		LOWER HAWTHORN
		LOWER CLAY UNIT
UPPER FLORIDAN AQUIFER	OCALA FM	OCALA LIMESTONE BEDROCK (UPPER TRANSMISSIVE ZONE)

LEGEND

(dashed line)	POTENTIOMETRIC SURFACE IN SCREEN INTERVAL NO. 1
BGS	BELOW GROUND SURFACE
NGVD-29	NATIONAL GEODETIC VERTICAL DATUM, 1929
GCTL	GROUNDWATER CLEANUP TARGET LEVEL (FDEP)

WELL SCREEN (ZONE 1 AT TOP; ZONE 4 AT BOTTOM)
53.2 — PIEZOMETRIC HEAD MEASUREMENT AT WESTBAY SAMPLING PORT
TOTAL DEPTH (FT BGS)

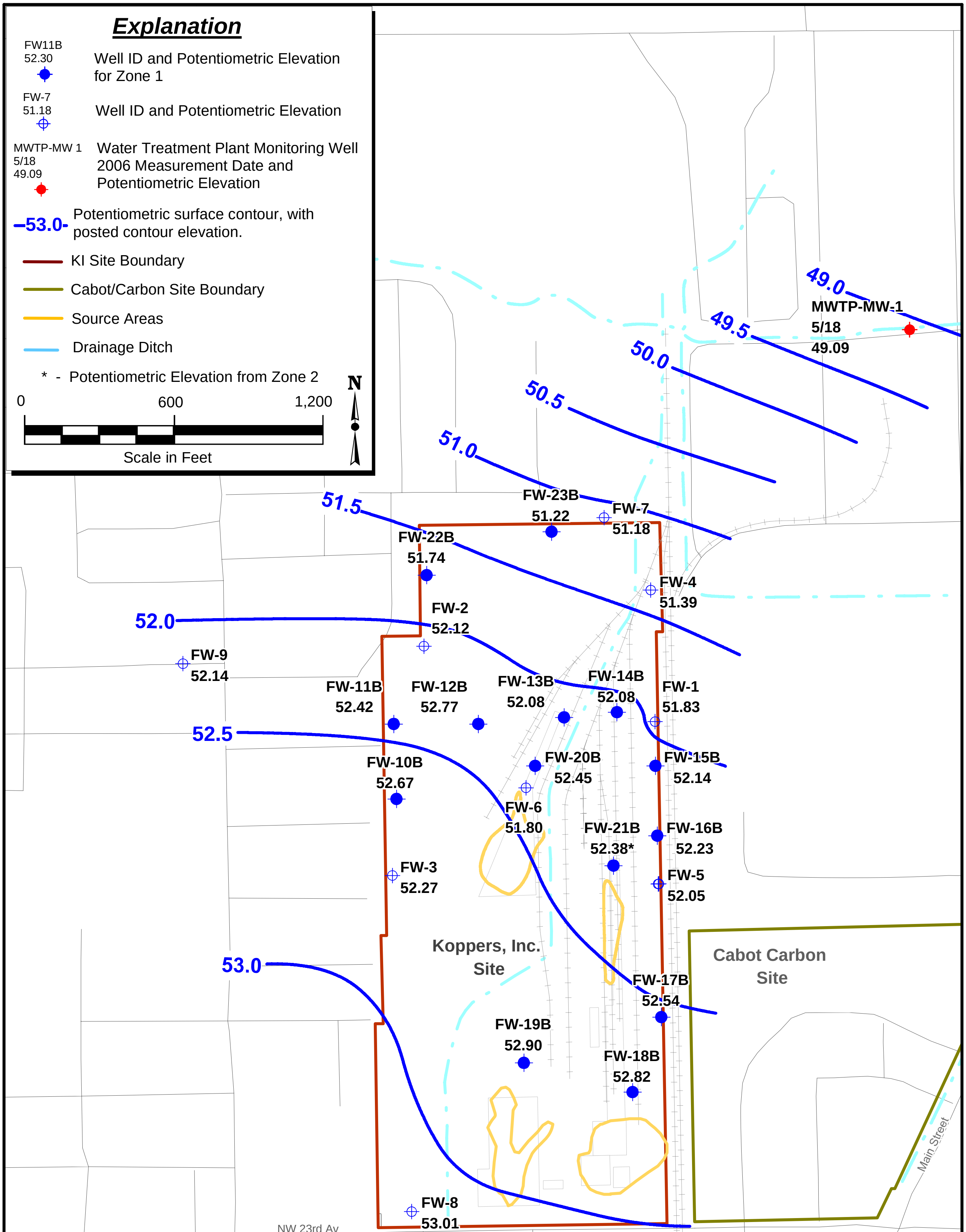
0 400 800
HORONZONTAL SCALE IN FEET
VERTICAL EXAGGERATION 6X

TITLE: GEOLOGIC SECTIONS A–A' AND B–B'

LOCATION: Cabot Carbon/Koppers Superfund Site, Gainesville, Florida

GeoTrans, Inc. A TETRA TECH COMPANY

CHECKED	JE	FIGURE:
DRAFTED	CP	4–1
FILE	2201083024A.DWG	
DATE	7–5–06	

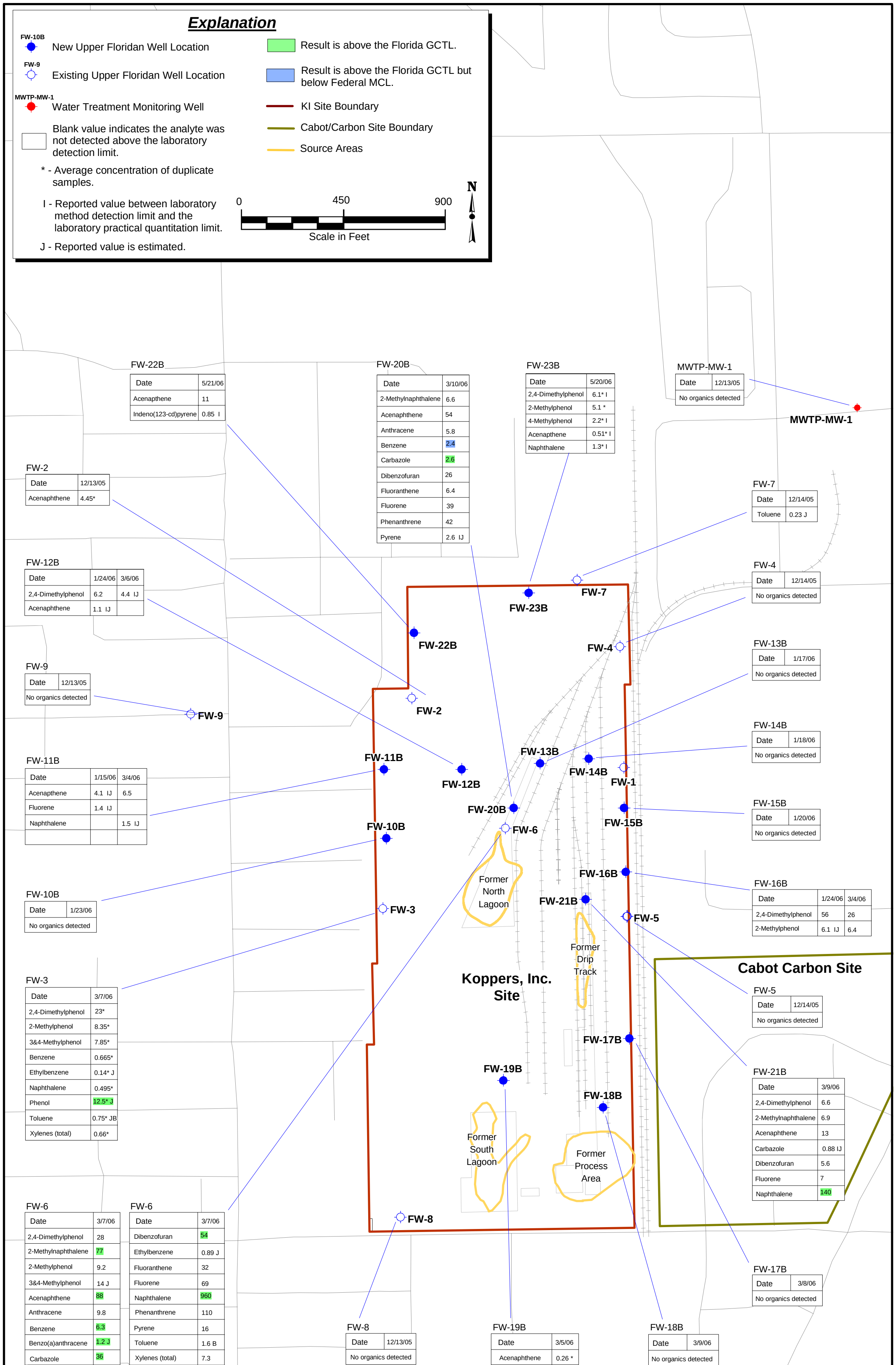


TITLE: UPPER FLORIDAN AQUIFER POTENTIOMETRIC SURFACE CONTOURS FOR MAY 2006

LOCATION: Cabot Carbon/Koppers Superfund Site, Gainesville, Florida

GeoTrans, Inc. A TETRA TECH COMPANY

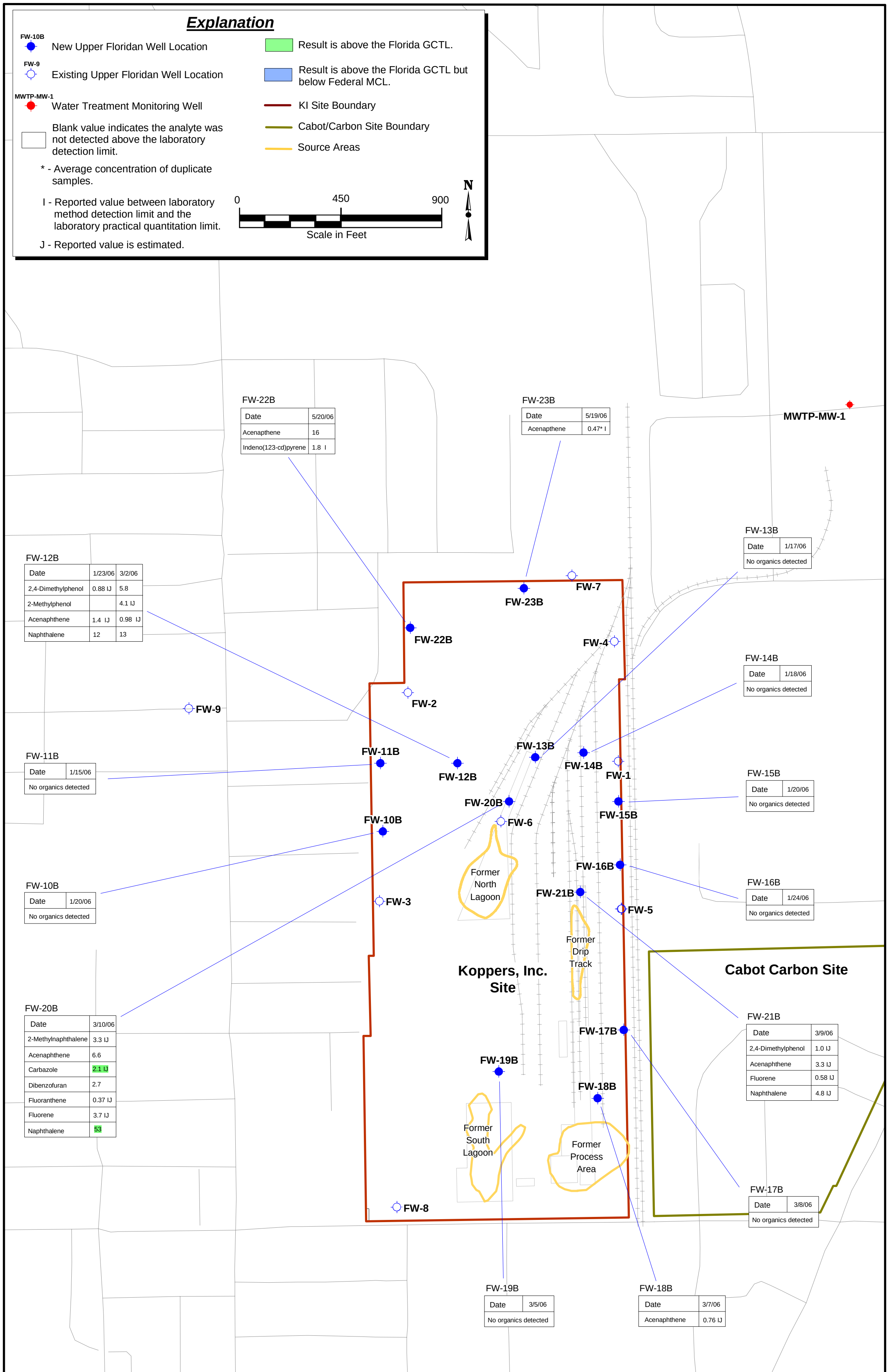
CHECKED	JRE	FIGURE:
DRAFTED	SKU	4-2
FILE	WatLev_May06.WOR	
DATE	07-24-06	



TITLE:	UPPER FLORIDAN 2006 WATER QUALITY RESULT FOR ZONE 1 WELLS FW-10B THROUGH FW-23B AND MOST RECENT SAMPLE RESULTS FOR WELLS FW-1 THROUGH FW-9
LOCATION:	Cabot Carbon/Koppers Superfund Site, Gainesville, Florida

GeoTrans, Inc.
A TETRA TECH COMPANY

CHECKED	JRE	FIGURE:
DRAFTED	SKU	4.3a
FILE	MPwell_contaminant_map	
DATE	07-21-06	



FW-22B

Date	5/20/06
Acenapthene	16
Indeno(123-cd)pyrene	1.8 I

FW-23B

Date	5/19/06
Acenapthene	0.47* I

FW-13B

Date	1/17/06
No organics detected	

FW-12B

Date	1/23/06	3/2/06
2,4-Dimethylphenol	0.88 IJ	5.8
2-Methylphenol		4.1 IJ
Acenapthene	1.4 IJ	0.98 IJ
Naphthalene	12	13

FW-14B

Date	1/18/06
No organics detected	

FW-11B

Date	1/15/06
No organics detected	

FW-15B

Date	1/20/06
No organics detected	

FW-10B

Date	1/20/06
No organics detected	

FW-16B

Date	1/24/06
No organics detected	

FW-20B

Date	3/10/06
2-Methylnaphthalene	3.3 IJ
Acenapthene	6.6
Carbazole	2.1 IJ
Dibenzofuran	2.7
Fluoranthene	0.37 IJ
Fluorene	3.7 IJ
Naphthalene	53

FW-21B

Date	3/9/06
2,4-Dimethylphenol	1.0 IJ
Acenaphthene	3.3 IJ
Fluorene	0.58 IJ
Naphthalene	4.8 IJ

FW-17B

Date	3/8/06
No organics detected	

FW-19B

Date	3/5/06
No organics detected	

FW-18B

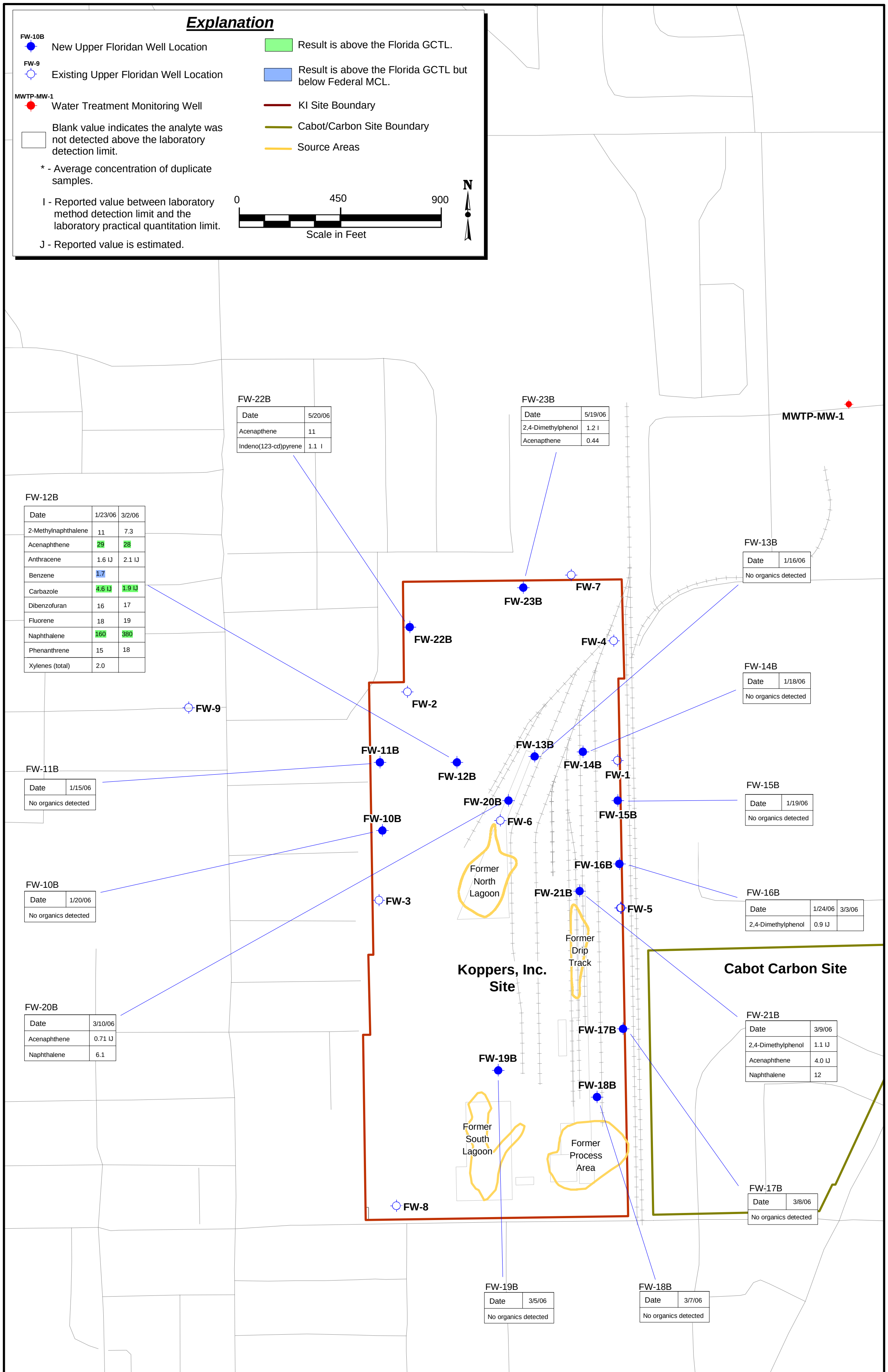
Date	3/7/06
Acenaphthene	0.76 IJ

TITLE: UPPER FLORIDAN 2006 WATER QUALITY RESULTS FOR ZONE 2 WELLS FW-10B THROUGH FW-23B

LOCATION: Cabot Carbon/Koppers Superfund Site, Gainesville, Florida

GeoTrans, Inc. A TETRA TECH COMPANY

CHECKED	JRE	FIGURE:
DRAFTED	SKU	4.3b
FILE	MPwell_contaminant_map	
DATE	07-21-06	



FW-22B

Date	5/20/06
Acenapthene	11
Indeno(123-cd)pyrene	1.1 I

FW-23B

Date	5/19/06
2,4-Dimethylphenol	1.2 I
Acenapthene	0.44

FW-12B

Date	1/23/06	3/2/06
2-Methylnaphthalene	11	7.3
Acenaphthene	29	28
Anthracene	1.6 IJ	2.1 IJ
Benzene	1.7	
Carbazole	4.6 IJ	1.9 IJ
Dibenzofuran	16	17
Fluorene	18	19
Naphthalene	160	380
Phenanthrene	15	18
Xylenes (total)	2.0	

FW-13B

Date	1/16/06
No organics detected	

FW-14B

Date	1/18/06
No organics detected	

FW-11B

Date	1/15/06
No organics detected	

FW-15B

Date	1/19/06
No organics detected	

FW-10B

Date	1/20/06
No organics detected	

FW-16B

Date	1/24/06	3/3/06
2,4-Dimethylphenol	0.9 IJ	

FW-20B

Date	3/10/06
Acenaphthene	0.71 IJ
Naphthalene	6.1

FW-21B

Date	3/9/06
2,4-Dimethylphenol	1.1 IJ
Acenaphthene	4.0 IJ
Naphthalene	12

FW-17B

Date	3/8/06
No organics detected	

FW-19B

Date	3/5/06
No organics detected	

FW-18B

Date	3/7/06
No organics detected	

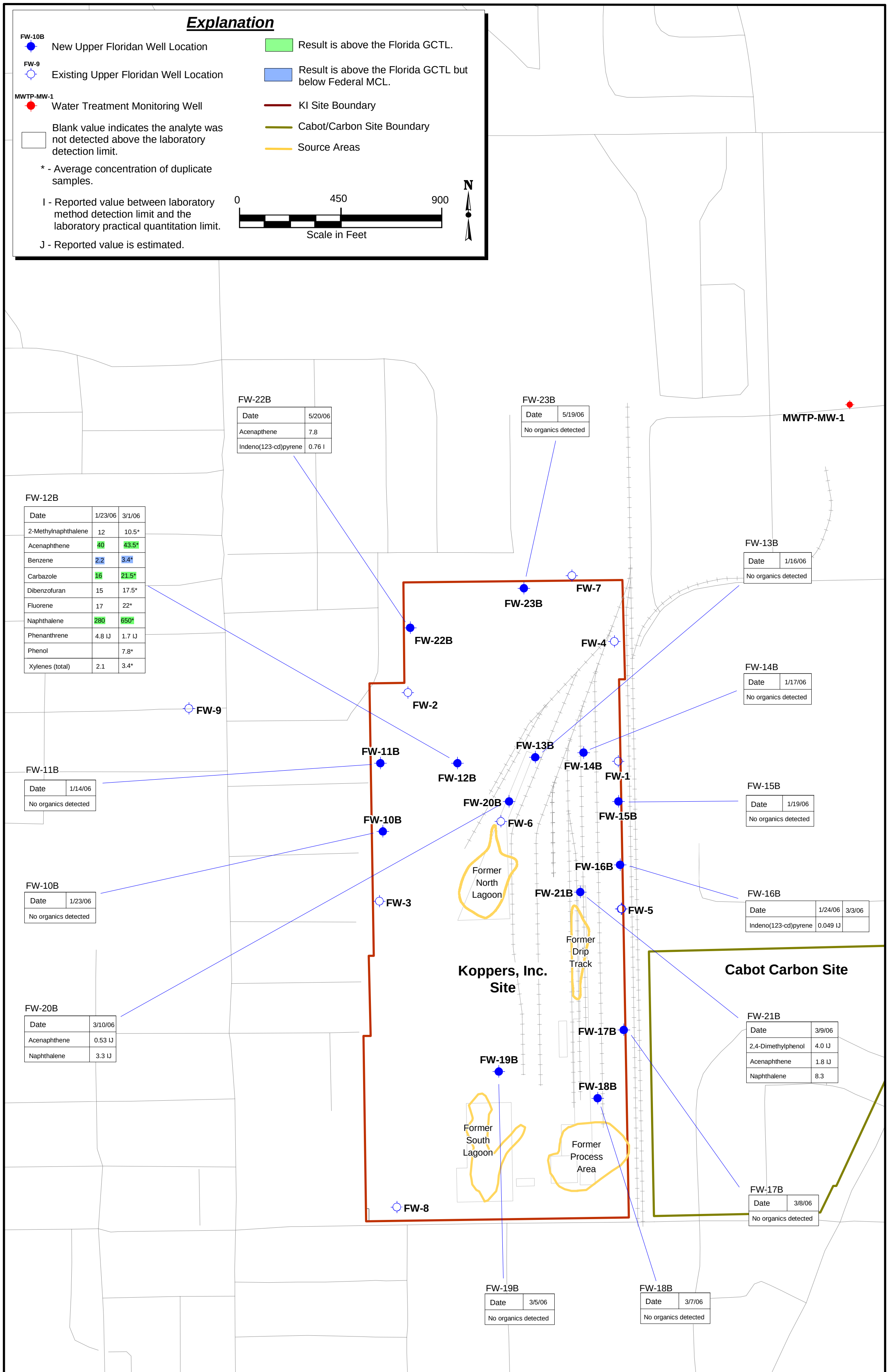
TITLE: UPPER FLORIDAN 2006 WATER QUALITY RESULTS FOR ZONE 3 WELLS FW-10B THROUGH FW-23B

LOCATION: Cabot Carbon/Koppers Superfund Site, Gainesville, Florida

GeoTrans, Inc. A TETRA TECH COMPANY

CHECKED	JRE
DRAFTED	SKU
FILE	MPwell_contaminant_map
DATE	07-21-06

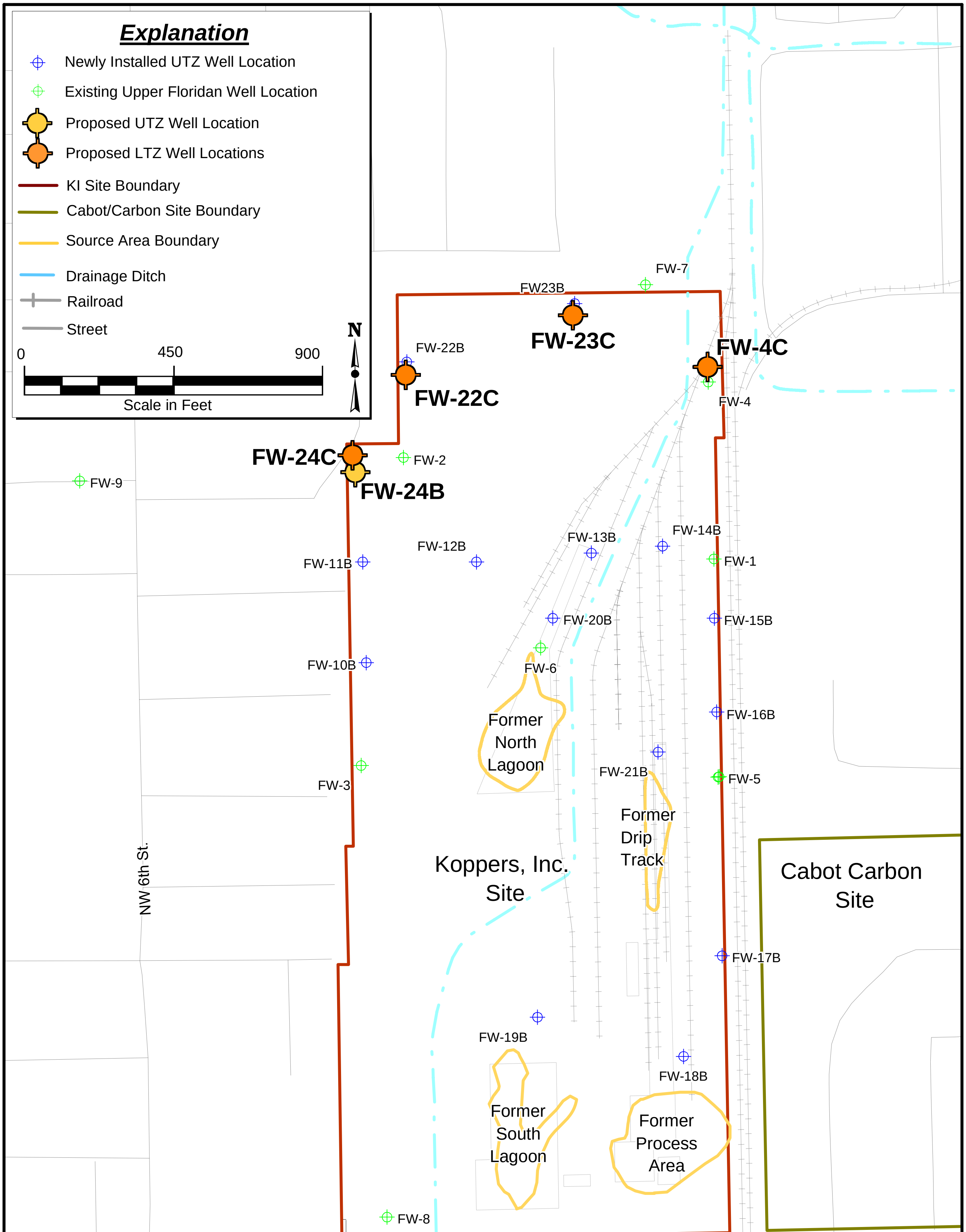
FIGURE: 4.3c



TITLE:	UPPER FLORIDAN 2006 WATER QUALITY RESULTS FOR ZONE 4 WELLS FW-10B THROUGH FW-23B
LOCATION:	Cabot Carbon/Koppers Superfund Site, Gainesville, Florida

GeoTrans, Inc. A TETRA TECH COMPANY

CHECKED	JRE	FIGURE:
DRAFTED	SKU	4.3d
FILE	MPwell_contaminant_map	
DATE	07-21-06	



TITLE: PROPOSED LOCATIONS OF NEW FLORIDAN AQUIFER UTZ AND LTZ WELLS AT KI SITE

LOCATION: Cabot Carbon/Koppers Superfund Site, Gainesville, Florida

GeoTrans, Inc. A TETRA TECH COMPANY

CHECKED	JRE	FIGURE:
DRAFTED	SKU	5-1
FILE	Figure 5-1.WOR	
DATE	07-17-06	

Table 2-1. Volume of drilling fluids lost to Upper Floridan Aquifer versus volume of water removed during well development.

Well I.D.	Volume of Water Lost During Drilling (gal)	Volume of Water Removed During Development (gal)	Percent of Water Removed vs. Water Lost
FW-10B	4,710	24,870	528%
FW-11B	2,400	13,455	561%
FW-12B	2,100	21,550	1,026%
FW-13B	2,100	11,271	537%
FW-14B	1,580	18,606	1,177%
FW-15B	2,090	13,105	627%
FW-16B	1,900	8,238	434%
FW-17B	1,420	24,598	1,732%
FW-18B	1,570	54,299	3,458%
FW-19B	1,475	9,824	666%
FW-20B	2,460	25,211	1,024%
FW-21B	5,300	57,227	1,079%
FW-22B	3,625	55,704	1,536%
FW-23B	2,680	51,811	1,933%
TOTALS	**35,410**	**389,769**	**Avg = 1,100%**

Table 2-2. Drilling fluid bromide concentrations and daily field bromide concentrations during well development.

Purge Date	Interval	Daily Volume Removed (gal)	Field Bromide Concentration at Start of Day (mg/L)	Field Bromide Concentration at End of Day (mg/L)
FW-10B (Drilling fluid Br conc 3,800 mg/L)				
12/10/05	1	635	560	NM
03/04/06	1	145	126.3	154.4
03/05/06	1	735	109.9	114.9
03/06/06	1	595	82.8	95.7
03/07/06	1	795	110.3	106.8
03/08/06	1	720	56.2	NM
03/09/06	1	955	88.5	89.3
12/10/05	2	1,250	1593	1,290
01/09/06	2	1,450	40.5	114.8
01/10/06	2	1,525	148.8	87.7
01/11/06	2	1,100	123.2	121.1
01/12/06	2	625	169.5	147.0
01/13/06	2	1,535	103.4	89.4
01/14/06	2	575	NM	117.9
01/15/06	2	690	67.8	65.5
01/16/06	2	1,365	73.0	55.3
01/17/06	2	325	87.0	59.9
12/09/05	3	330	1030	922
12/15/05	3	120	232	181.5
12/19/05	3	120	NM	NM
12/20/05	3	425	162.5	64.7
12/21/05	3	480	60.4	77.0
12/27/05	3	500	58.2	68.2
12/28/05	3	850	56.7	49.6
12/29/05	3	1,000	66.8	28.0
12/30/05	3	500	28.0	42.6
12/09/05	4	475	694	530
01/05/06	4	650	208	86.0
01/06/06	4	1,250	166.2	48.8
01/07/06	4	1,350	47.9	35.2
01/08/06	4	1,550	39.8	36.6
01/09/06	4	250	35.8	39.7

Purge Date	Interval	Daily Volume Removed (gal)	Field Bromide Concentration at Start of Day (mg/L)	Field Bromide Concentration at End of Day (mg/L)
FW-11B (Drilling fluid Br conc 2,100 mg/L)				
12/14/05	1	1,300	NM	NM
12/15/05	1	250	NM	50.0
12/16/05	1	540	NM	15-25
01/14/06	1	93	NM	NM
12/14/05	2	520	NM	NM
12/15/05	2	2,580	NM	50.0
12/16/05	2	480	NM	15-25
01/14/06	2	82	NM	NM
12/13/05	3	1,000	NM	NM
12/14/05	3	500	NM	NM
12/15/05	3	520	NM	50.0
12/16/05	3	1,115	NM	NM
12/16/05	3	525	NM	15-25
01/14/06	3	75	NM	12.9
12/12/05	4	700	NM	NM
12/13/05	4	1,330	NM	NM
12/16/05	4	1,740	NM	15-25
01/13/06	4	80	NM	6.3
01/14/06	4	25	NM	NM

Table 2-2 (cont). Drilling fluid bromide concentrations and daily field bromide concentrations during well development.

Purge Date	Interval	Daily Volume Removed (gal)	Field Bromide Concentration at Start of Day (mg/L)	Field Bromide Concentration at End of Day (mg/L)
FW-12B (Drilling fluid Br conc 3,700 mg/L)				
12/15/05	All	600	NM	270
12/16/05	All	500	NM	190.0
12/17/05	All	400	NM	360
12/18/05	All	720	NM	232
12/19/05	All	700	NM	220
12/20/05	All	1,000	NM	208
12/21/05	All	500	NM	175.0
12/27/05	All	250	NM	126.0
12/28/05	All	1,125	NM	68.0
12/29/05	All	1,200	NM	119.0
12/30/05	All	300	NM	96.0
01/06/06	All	800	NM	NM
01/07/06	All	2,250	NM	NM
01/08/06	All	1,350	NM	NM
01/09/06	All	1,300	66.2	41.3
01/10/06	All	700	62.4	35.1
01/11/06	All	850	45.4	50.9
01/12/06	All	855	51.0	127.0
01/13/06	All	780	40.1	53.8
01/14/06	All	1,045	55.5	72.8
01/15/06	All	965	40.5	38.8
01/16/06	All	810	41.1	29.0
12/12/05	1	105	NM	500
01/22/06	1	90	69.4	56.3
03/03/06	1	165	52.5	30.2
03/04/06	1	510	37.1	37.6
03/05/06	1	505	23.2	25.5
12/11/05	2	267	NM	1000
12/12/05	2	195	NM	NM
01/21/06	2	60	16.6	43.4
12/11/05	3	266	NM	800
01/21/06	3	60	15.0	39.4
12/11/05	4	267	NM	1000
01/19/06	4	10	0.75	NM
01/20/06	4	50	24.0	25.5

Purge Date	Interval	Daily Volume Removed (gal)	Field Bromide Concentration at Start of Day (mg/L)	Field Bromide Concentration at End of Day (mg/L)
FW-13B (Drilling fluid Br conc 300 mg/L)				
12/28/05	1	934	NM	12.4
12/30/05	1	1,050	NM	2.6
01/16/06	1	60	NM	NM
12/28/05	2	933	NM	12.4
12/29/05	2	1,667	NM	2.6
01/16/06	2	87	3.3	18.9
12/28/05	3	933	NM	12.4
12/29/05	3	1,666	NM	1.9
01/15/06	3	60	3.7	4.7
12/19/05	4	1,100	NM	147.3
12/20/05	4	1,000	NM	140.0
12/29/05	4	1,666	NM	9.3
01/15/06	4	115	8.3	7.6
FW-14B (Drilling fluid Br conc 4,000 mg/L)				
12/20/05	1	1,250	NM	20.0
01/17/06	1	30	37.3	22.5
12/19/05	2	4,670	NM	48.4
12/20/05	2	1,250	NM	21.0
01/17/06	2	60	23.0	16.2
12/19/05	3	3,300	NM	120.0
12/20/05	3	1,250	NM	28.0
01/17/06	3	60	14.4	13.6
12/17/05	4	3,780	NM	360
12/18/05	4	1,636	NM	NM
12/20/05	4	1,250	NM	35.0
01/16/06	4	70	30.7	47.4

Table 2-2 (cont). Drilling fluid bromide concentrations and daily field bromide concentrations during well development.

Purge Date	Interval	Daily Volume Removed (gal)	Field Bromide Concentration at Start of Day (mg/L)	Field Bromide Concentration at End of Day (mg/L)
FW-15B (Drilling fluid Br conc 1,000 mg/L)				
01/13/06	1	310	22.8	NM
01/14/06	1	760	21.0	15.4
01/18/06	1	60	8.5	28.5
01/13/06	2	1,030	12.9	16.6
01/18/06	2	60	13.5	13.5
01/11/06	3	1,875	47.7	26.0
01/12/06	3	2,490	30.5	29.3
01/13/06	3	650	16.9	NM
01/18/06	3	60	12.2	14.4
01/08/06	4	1,900	158.3	139.8
01/09/06	4	1,950	97.1	70.2
01/10/06	4	1,900	111.2	50.7
01/17/06	4	60	0.36	10.6
FW-16B (Drilling fluid Br conc 2,500 mg/L)				
12/07/05	All	250	NM	NM
01/07/06	All	20	71.3	217
01/08/06	All	530	250	131.1
01/09/06	All	925	114.1	71.1
01/10/06	All	840	106.2	68.3
01/11/06	All	400	77.7	46.2
01/12/06	All	995	89.5	107.0
01/13/06	All	420	77.1	92.9
01/14/06	All	980	73.9	92.7
01/15/06	All	860	57.8	44.9
01/16/06	All	770	73.0	57.3
01/22/06	1	75	172.8	116.4
03/01/06	1	20	16.0	NM
03/02/06	1	505	39.9	54.2
03/03/06	1	495	55.5	61.8
01/22/06	2	75	51.6	61.6
01/22/06	3	78	42.2	53.5

Purge Date	Interval	Daily Volume Removed (gal)	Field Bromide Concentration at Start of Day (mg/L)	Field Bromide Concentration at End of Day (mg/L)
FW-17B (Drilling fluid Br conc 1,000 mg/L)				
02/03/06	All	1,223	83.0	120.0
02/04/06	All	4,245	130.0	34.0
02/05/06	All	5,005	32.0	14.0
02/06/06	All	4,760	16.2	13.9
02/07/06	All	1,365	23.0	7.2
02/08/06	1	836	NM	15.0
02/09/06	1	175	NM	0.8
03/06/06	1	115	0.33	0.3
03/07/06	1	450	0.79	0.43
02/08/06	2	1,085	NM	9.6
02/09/06	2	300	NM	0.4
03/05/06	2	95	2.0	0.32
03/06/06	2	390	0.4	0.06
02/08/06	3	945	NM	2.9
02/09/06	3	270	NM	1.6
03/05/06	3	70	0.5	0.8
02/07/06	4	1,540	15.0	2.4
02/08/06	4	140	2.4	2.4
02/09/06	4	1,424	NM	6.6
03/05/06	4	165	1.4	2.1

Table 2-2 (cont). Drilling fluid bromide concentrations and daily field bromide concentrations during well development.

Purge Date	Interval	Daily Volume Removed (gal)	Field Bromide Concentration at Start of Day (mg/L)	Field Bromide Concentration at End of Day (mg/L)
FW-18B (Drilling fluid Br conc 1,000 mg/L)				
02/05/06	All	20	94.4	NM
02/06/06	All	3,037	191.0	102.3
02/07/06	All	2,825	108.0	50.0
02/08/06	All	6,540	8.5	56.0
02/18/06	1	842	NM	NM
02/19/06	1	446	39.0	45.0
03/07/06	1	175	18.6	1.8
03/08/06	1	135	3.7	13.4
02/17/06	2	6,595	45.9	104.4
02/18/06	2	5,850	49.4	67.8
03/06/06	2	245	1.5	21.8
03/07/06	2	80	32.1	25.1
02/16/06	3	5,910	44.0	46.0
02/17/06	3	540	47.4	52.5
02/19/06	3	3,081	75.0	50.0
02/20/06	3	4,680	1.1	29.5
03/06/06	3	103	0.1	0.26
02/14/06	4	4,002	0.38	45.0
02/15/06	4	6,250	22.3	58.0
02/19/06	4	2,860	54.0	57.0
03/06/06	4	85	4.7	1.3

Purge Date	Interval	Daily Volume Removed (gal)	Field Bromide Concentration at Start of Day (mg/L)	Field Bromide Concentration at End of Day (mg/L)
FW-19B (Drilling fluid Br conc 1,000 mg/L)				
02/03/06	All	340	139.0	114.0
02/04/06	All	525	123.0	159.0
02/05/06	All	494	211.0	140.0
02/06/06	All	907	211.0	111.8
02/07/06	All	512	143.0	107.0
02/08/06	All	1,024	69.4	91.0
02/14/06	All	294	130.0	60.0
02/15/06	All	554	63.0	52.0
02/16/06	All	798	61.0	40.0
02/17/06	All	663	44.0	55.0
02/18/06	All	914	72.0	27.0
02/19/06	All	807	25.0	22.0
02/20/06	All	825	25.0	16.0
02/21/06	All	644	24.0	20.0
03/04/06	1	75	29.7	34.5
03/04/06	2	75	20.8	28.1
03/04/06	3	80	41.5	52.8
03/03/06	4	293	26.1	28.5

Table 2-2 (cont). Drilling fluid bromide concentrations and daily field bromide concentrations during well development.

Purge Date	Interval	Daily Volume Removed (gal)	Field Bromide Concentration at Start of Day (mg/L)	Field Bromide Concentration at End of Day (mg/L)
FW-20B (Drilling fluid Br conc 1,000 mg/L)				
02/22/06	1	1,550	15.8	12.9
03/09/06	1	72	35.0	45.0
02/22/06	2	3,100	37.2	19.4
03/09/06	2	111	12.7	16.0
02/21/06	3	4,875	239	30.0
02/23/06	3	3,100	16.0	31.6
03/08/06	3	85	NM	NM
03/09/06	3	70	4.2	4.0
02/18/06	4	2,900	NM	NM
02/19/06	4	4,650	95.0	49.0
02/20/06	4	4,500	48.0	21.0
03/08/06	4	198	0.32	3.0
FW-21B (Drilling fluid Br conc 1,000 mg/L)				
02/20/06	All	800	52.0	46.0
02/21/06	All	4,200	21.0	98.0
02/22/06	All	4,320	NM	NM
02/23/06	All	3,656	NM	NM
02/24/06	All	4,559	NM	17.1
02/25/06	All	4,726	NM	14.0
02/26/06	All	4,374	NM	13.4
02/27/06	All	4,860	NM	21.1
02/28/06	All	8,640	NM	52.5
03/01/06	All	11,520	NM	55.4
03/02/06	All	4,160	NM	45.4
03/09/06	1	346	12.9	35.9
03/08/06	2	260	22.5	31.6
03/09/06	2	156	37.6	48.6
03/08/06	3	300	22.5	31.6
03/07/06	4	250	47.4	39.9
03/08/06	4	100	26.9	53.8

Purge Date	Interval	Daily Volume Removed (gal)	Field Bromide Concentration at Start of Day (mg/L)	Field Bromide Concentration at End of Day (mg/L)
FW-22B (Drilling fluid Br conc 1,000 mg/L)				
04/01/06	All	4,850	830	133.0
04/02/06	All	6,350	55.0	29.4
04/03/06	All	9,450	12.9	23.9
04/04/06	All	6,450	13.1	16.2
04/21/06	1	2,750	0.85	15.9
05/20/06	1	182	12.7	27.8
04/20/06	2	4,225	35.9	34.8
04/21/06	2	450	11.2	22.7
05/19/16	2	195	0.35	32.0
04/19/06	3	4,800	25.7	34.1
04/20/06	3	3,575	5.7	32.7
05/19/06	3	82	5.2	0.65
04/18/06	4	8,100	4.7	23.6
04/19/06	4	4,120	2.5	33.5
05/19/06	4	110	82.2	9.72

Table 2-2 (cont). Drilling fluid bromide concentrations and daily field bromide concentrations during well development.

Purge Date	Interval	Daily Volume Removed (gal)	Field Bromide Concentration at Start of Day (mg/L)	Field Bromide Concentration at End of Day (mg/L)
FW-23B (Drilling fluid Br conc 1,000 mg/L)				
03/30/06	All	6,110	1,530	28.0
03/31/06	All	11,410	39.0	9.9
04/01/06	All	7,350	14.9	13.8
04/02/06	All	9,200	2.8	7.7
04/21/06	1	2,850	0.13	2.0
05/18/06	1	102	0.72	0.65
04/20/06	2	1,585	11.7	18.8
04/21/06	2	1,925	8.1	3.9
05/18/06	2	88	0.7	0.39
04/19/06	3	950	8.4	19.9
04/20/06	3	4,115	4.6	18.8
05/18/06	3	114	2.3	6.2
04/18/06	4	1,900	2.3	13.5
04/19/06	4	3,950	4.5	18.9
05/1706	4	162	12.5	10.2

NOTES:
NM = Not measured.

Table 2-3. Well as-builts for the 14 Upper Floridan wells.

Well ID	Well Type	Surveyed 4-in Black Steel TOC (FT AGS)	Surveyed 4-in Well TOC Elevation (NGVD-29)	Ground Surface Elev (NGVD-29)	Total Depth 4-in Well (TOC)	Total Depth 4-in Well (NGVD)	Total Depth 4-in Well (BGS)	4-in Sump Depth (LF below bottom slot)	Top Fine Sand Seal	Screen 1							
										Top Filter Pack	Top Joint	Top Slot	Top Slot (NGVD-29)	Bottom Slot	Bottom Slot (NGVD-29)	Bottom Joint	Bottom Filter Pack
FW-10B	Transect	2.60	187.16	184.56	240.45	-53.29	237.85	15.32	146.4	151.20	154.46	154.77	32.39	164.46	22.70	164.56	166.9
FW-11B	Transect	2.63	184.93	182.30	239.76	-54.83	237.13	15.33	145.9	151.53	154.37	154.68	30.25	164.28	20.65	164.38	166.0
FW-12B	Transect	2.48	184.26	181.78	242.14	-57.88	239.66	15.34	148.6	153.68	156.70	157.01	27.25	166.62	17.64	166.72	168.0
FW-13B	Transect	2.55	181.37	178.82	241.88	-60.51	239.33	15.32	148.8	153.45	156.52	156.83	24.54	166.43	14.94	166.53	168.1
FW-14B	Transect	2.73	178.73	176.00	243.41	-64.68	240.68	15.32	148.6	154.63	158.03	158.34	20.39	167.95	10.78	168.05	169.1
FW-15B	Transect	2.78	179.20	176.42	241.49	-62.29	238.71	15.34	148.3	152.08	156.09	156.40	22.80	166.00	13.20	166.10	167.3
FW-16B	Transect	2.56	181.19	178.63	253.46	-72.27	250.90	20.32	153.0	160.9	163.1	163.37	17.82	173.0	8.23	173.1	174.9
FW-17B	Transect	2.73	184.69	181.96	243.59	-58.90	240.86	15.32	149.3	155.23	158.32	158.63	26.06	168.20	16.49	168.30	169.3
FW-18B	Source -Area	2.44	185.97	183.53	240.59	-54.62	238.15	15.33	148.1	152.44	155.22	155.53	30.44	165.11	20.86	165.21	166.7
FW-19B	Source -Area	2.65	186.09	183.44	239.83	-53.74	237.18	15.34	148.0	151.95	154.53	154.84	31.25	164.42	21.67	164.52	166.0
FW-20B	Source -Area	2.75	183.60	180.85	240.84	-57.24	238.09	15.33	147.6	151.15	155.40	155.71	27.89	165.31	18.29	165.41	166.5
FW-21B	Source -Area	2.56	182.38	179.82	239.54	-57.16	236.98	15.35	144.6	151.16	154.20	154.51	27.87	164.09	18.29	164.19	165.6
FW-22B	Down Gradient	2.56	181.37	178.81	240.14	-58.77	237.58	15.29	147.5	152.06	154.95	155.26	26.11	164.86	16.51	164.96	166.0
FW-23B	Down Gradient	2.51	172.46	169.95	234.86	-62.40	232.35	15.28	142.1	146.71	149.62	149.93	22.53	159.49	12.97	159.59	160.6

Well ID	Screen 2								Screen 3							
	Top Filter Pack	Top Joint	Top Slot	Top Slot (NGVD-29)	Bottom Slot	Bottom Slot (NGVD-29)	Bottom Joint	Bottom Filter Pack	Top Filter Pack	Top Joint	Top Slot	Top Slot (NGVD-29)	Bottom Slot	Bottom Slot (NGVD-29)	Bottom Joint	Bottom Filter Pack
FW-10B	170.8	174.66	174.97	12.19	184.68	2.48	184.78	186.1	192.3	194.83	195.14	-7.98	204.73	-17.57	204.83	205.8
FW-11B	171.5	174.39	174.70	10.23	184.30	0.63	184.40	185.6	191.7	194.41	194.72	-9.79	204.32	-19.39	204.42	205.7
FW-12B	173.9	176.74	177.05	7.21	186.66	-2.40	186.76	187.9	193.8	196.77	197.08	-12.82	206.68	-22.42	206.78	207.6
FW-13B	173.8	176.53	176.84	4.53	186.44	-5.07	186.54	186.7	193.6	196.54	196.85	-15.48	206.45	-25.08	206.55	207.7
FW-14B	175.2	178.06	178.37	0.36	187.97	-9.24	188.07	189.5	195.7	198.08	198.39	-19.66	207.98	-29.25	208.08	209.7
FW-15B	173.3	176.10	176.41	2.79	186.02	-6.82	186.12	187.5	193.5	196.12	196.43	-17.23	206.04	-26.84	206.14	207.3
FW-16B	179.2	183.1	183.37	-2.18	193.0	-11.77	193.1	195.1	201.4	203.2	203.5	-22.28	213.1	-31.87	213.2	215.4
FW-17B	175.8	178.30	178.61	6.08	188.18	-3.49	188.28	189.9	195.8	198.28	198.59	-13.90	208.18	-23.49	208.28	209.7
FW-18B	172.7	175.23	175.54	10.43	185.12	0.85	185.22	186.3	192.6	195.23	195.54	-9.57	205.12	-19.15	205.22	206.2
FW-19B	171.7	174.52	174.83	11.26	184.42	1.67	184.52	186.0	192.0	194.52	194.83	-8.74	204.40	-18.31	204.50	206.3
FW-20B	172.9	175.43	175.74	7.86	185.35	-1.75	185.45	186.7	193.0	195.47	195.78	-12.18	205.38	-21.78	205.48	206.9
FW-21B	171.2	174.20	174.51	7.87	184.08	-1.70	184.18	185.5	191.6	194.20	194.51	-12.13	204.09	-21.71	204.19	205.7
FW-22B	171.7	174.99	175.30	6.07	184.86	-3.49	184.96	186.5	192.7	194.97	195.28	-13.91	204.84	-23.47	204.94	206.0
FW-23B	167.1	169.61	169.92	2.54	179.52	-7.06	179.62	180.6	187.3	189.58	189.89	-17.43	199.45	-26.99	199.55	200.7

Well ID	Screen 4								Formation Depths (ft BGS)					Formation Depths (ft NGVD-29)				
	Top Filter Pack	Top Joint	Top Slot	Top Slot (NGVD-29)	Bottom Slot	Bottom Slot (NGVD-29)	Bottom Joint	Bottom Filter Pack	Top UHG Clay	Top MHG (Upper Clay)	Bot MHG Upper Clay	Top LHG Clay	Ocala Fm	Top UHG Clay	Top MHG (Upper Clay)	Bot MHG Upper Clay	Top LHG Clay	Ocala Fm
FW-10B	213.5	214.93	215.24	-28.08	225.03	-37.87	225.13	226.1	25.0	60	70.1	110.8	141.8	159.6	124.6	114.5	73.8	42.8
FW-11B	212.1	214.43	214.74	-29.81	224.33	-39.40	224.43	226.6	19.0	60	71.5	107.5	141.9	163.3	122.3	110.8	74.8	40.4
FW-12B	214.6	216.79	217.10	-32.84	226.70	-42.44	226.80	229.0	24.7	62	~63.8	108.5	143.6	157.1	119.8	~118.0	73.3	38.2
FW-13B	214.1	216.55	216.86	-35.49	226.46	-45.09	226.56	228.7	24.1	60	68.5	110.3	143.7	154.7	118.8	110.3	68.5	35.1
FW-14B	216.1	218.08	218.39	-39.66	227.99	-49.26	228.09	229.8	24.7	63	74.2	106.7	140.9	151.3	113.0	101.8	69.3	35.1
FW-15B	213.8	216.14	216.45	-37.25	226.05	-46.85	226.15	228.6	21.4	63	70.5	114.3	143.5	155.0	113.4	105.9	62.1	32.9
FW-16B	221.6	223.2	223.5	-42.28	233.1	-51.87	233.2	234.5	20.0	65	72.2	111.5	142.4	158.6	113.6	106.4	67.1	36.2
FW-17B	215.7	218.28	218.59	-33.90	228.17	-43.48	228.27	231.6	24.3	64	75.0	115.0	144.6	157.7	118.0	107.0	67.0	37.4
FW-18B	212.3	215.24	215.55	-29.58	225.16	-39.19	225.26	226.9	23.5	69	81.3	115.0	143.7	160.0	114.5	102.2	68.5	39.8
FW-19B	212.4	214.50	214.81	-28.72	224.39	-38.30	224.49	229.4	22.5	63	72.7	115.6	142.9	160.9	120.4	110.7	67.8	40.5
FW-20B	213.3	215.50	215.81	-32.21	225.41	-41.81	225.51	230.8	23.5	63	66.8	108.5	142.9	157.4	117.9	114.1	72.4	38.0
FW-21B	211.6	214.20	214.51	-32.13	224.09	-41.71	224.19	226.4	23.0	62	70.0	111.8	140.0	156.8	117.8	109.8	68.0	39.8
FW-22B	212.2	214.89	215.20	-33.83	224.75	-43.38	224.85	229.8	23.0	60	77.8	108.6	142.7	155.8	118.8	101.0	70.2	36.1
FW-23B	207.0	209.57	209.88	-37.42	219.48	-47.02	219.58	218.0	22.0	60	65.0	108.7	137.6	148.0	110.0	105.0	61.3	32.4

Notes: DeGrove Surveyors conducted an elevation survey on 4/25/06, which provided the above grade lengths.

All wells FW-10B through FW-19B and FW-21B have a nominal 15 or 20 LF Sch 40 SS casing sump with four (4) 10-LF SS screens, each separated by a 10 LF Sch 40 SS casing, topped with 40 LF Sch 5 SS casing, completed with 117 to 126 LF black steel casing to above grade, all within three telescopic 8-in, 12-in, and 18-in CS conductor casings.

Wells FW-20B, FW-22B, and FW-23B are constructed similar to above, but are completed with 14 to 15 pieces of 10 LF lengths of Sch 5 SS from above the top screen to just below ground surface, topped with one 10-LF length of black steel cut to approximatley 2.5 ft above grade.

Filter pack media is silica sand grade 12/20. Grade 30/65 silica seal sand was placed within the annulus above and below each filter pack.

Table 2-4. Well development daily total water volumes removed for Upper Floridan wells FW-10B through FW-23B.

Date	Daily Volume (gal)	Interval	Total Water Volume (gal)
FW-10B*			
12/10/2005	635	1	
3/4/2006	145	1	
3/5/2006	735	1	
3/6/2006	595	1	4,580
3/7/2006	795	1	
3/8/2006	720	1	
3/9/2006	955	1	
12/10/2005	1,250	2	
1/9/2006	1,450	2	
1/10/2006	1,525	2	
1/11/2006	1,100	2	
1/12/2006	625	2	10,440
1/13/2006	1,535	2	
1/14/2006	575	2	
1/15/2006	690	2	
1/16/2006	1,365	2	
1/17/2006	325	2	
12/9/2005	330	3	
12/15/2005	120	3	
12/19/2005	120	3	
12/20/2005	425	3	
12/21/2005	480	3	4,325
12/27/2005	500	3	
12/28/2005	850	3	
12/29/2005	1,000	3	
12/30/2005	500	3	
12/9/2005	475	4	
1/5/2006	650	4	
1/6/2006	1,250	4	5,525
1/7/2006	1,350	4	
1/8/2006	1,550	4	
1/9/2006	250	4	
	Cummulative Total =		24,870

Date	Daily Volume (gal)	Interval	Total Water Volume (gal)
FW-11B			
12/14/2005	1,300	1	
12/15/2005	250	1	
12/16/2005	540	1	
1/14/2006	93	1	2,183
12/14/2005	520	2	
12/15/2005	2,580	2	
12/16/2005	480	2	
1/14/2006	82	2	3,662
12/13/2005	1,000	3	
12/14/2005	500	3	
12/15/2005	520	3	
12/16/2005	1,115	3	
12/16/2005	525	3	
1/14/2006	75	3	3,735
12/12/2005	700	4	
12/13/2005	1,330	4	
12/16/2005	1,740	4	
1/13/2006	80	4	
1/14/2006	25	4	3,875
	Cumulative Total =		13,455

Table 2-4 (cont). Well development daily total water volumes removed for Upper Floridan wells FW-10B through FW-23B.

Date	Daily Volume (gal)	Interval	Total Water Volume (gal)
FW-12B			
12/15/2005	600	All	19,000
12/16/2005	500	All	
12/17/2005	400	All	
12/18/2005	720	All	
12/19/2005	700	All	
12/20/2005	1,000	All	
12/21/2005	500	All	
12/27/2005	250	All	
12/28/2005	1,125	All	
12/29/2005	1,200	All	
12/30/2005	300	All	
1/6/2006	800	All	
1/7/2006	2,250	All	
1/8/2006	1,350	All	
1/9/2006	1,300	All	
1/10/2006	700	All	
1/11/2006	850	All	
1/12/2006	855	All	
1/13/2006	780	All	
1/14/2006	1,045	All	
1/15/2006	965	All	
1/16/2006	810	All	
12/12/2005	105	1	1,375
1/22/2006	90	1	
3/3/2006	165	1	
3/4/2006	510	1	
3/5/2006	505	1	
12/11/2005	267	2	522
12/12/2005	195	2	
1/21/2006	60	2	
12/11/2005	266	3	326
1/21/2006	60	3	
12/11/2005	267	4	327
1/19/2006	10	4	
1/20/2006	50	4	
	Cummulative Total =		21,550

Date	Daily Volume (gal)	Interval	Total Water Volume (gal)
FW-13B			
12/28/2005	934	1	2,044
12/30/2005	1,050	1	
1/16/2006	60	1	
12/28/2005	933	2	2,687
12/29/2005	1,667	2	
1/16/2006	87	2	
12/28/2005	933	3	2,659
12/29/2005	1,666	3	
1/15/2006	60	3	
12/19/2005	1,100	4	3,881
12/20/2005	1,000	4	
12/29/2005	1,666	4	
1/15/2006	115	4	
	Cumulative Total =		11,271
FW-14B			
12/20/2005	1,250	1	1,280
1/17/2006	30	1	
12/19/2005	4,670	2	5,980
12/20/2005	1,250	2	
1/17/2006	60	2	
12/19/2005	3,300	3	4,610
12/20/2005	1,250	3	
1/17/2006	60	3	
12/17/2005	3,780	4	6,736
12/18/2005	1,636	4	
12/20/2005	1,250	4	
1/16/2006	70	4	
	Cummulative Total =		18,606

Table 2-4 (cont). Well development daily total water volumes removed for Upper Floridan wells FW-10B through FW-23B.

Date	Daily Volume (gal)	Interval	Total Water Volume (gal)
FW-15B			
1/13/2006	310	1	
1/14/2006	760	1	
1/18/2006	60	1	1,130
1/13/2006	1,030	2	
1/18/2006	60	2	1,090
1/11/2006	1,875	3	
1/12/2006	2,490	3	
1/13/2006	650	3	
1/18/2006	60	3	5,075
1/8/2006	1,900	4	
1/9/2006	1,950	4	
1/10/2006	1,900	4	
1/17/2006	60	4	5,810
	Cummulative Total =		13,105
FW-16B*			
12/7/2005	250	All	
1/7/2006	20	All	
1/8/2006	530	All	
1/9/2006	925	All	
1/10/2006	840	All	
1/11/2006	400	All	6,990
1/12/2006	995	All	
1/13/2006	420	All	
1/14/2006	980	All	
1/15/2006	860	All	
1/16/2006	770	All	
1/22/2006	75	1	
3/1/2006	20	1	1,095
3/2/2006	505	1	
3/3/2006	495	1	
1/22/2006	75	2	75
1/22/2006	78	3	78
	Cummulative Total =		8,238

Date	Daily Volume (gal)	Interval	Total Water Volume (gal)
FW-17B			
2/3/2006	1,223	All	
2/4/2006	4,245	All	
2/5/2006	5,005	All	16,598
2/6/2006	4,760	All	
2/7/2006	1,365	All	
2/8/2006	836	1	
2/9/2006	175	1	1,576
3/6/2006	115	1	
3/7/2006	450	1	
2/8/2006	1,085	2	
2/9/2006	300	2	1,870
3/5/2006	95	2	
3/6/2006	390	2	
2/8/2006	945	3	
2/9/2006	270	3	1,285
3/5/2006	70	3	
2/7/2006	1,540	4	
2/8/2006	140	4	3,269
2/9/2006	1,424	4	
3/5/2006	165	4	
	Cummulative Total =		24,598

Table 2-4 (cont). Well development daily total water volumes removed for Upper Floridan wells FW-10B through FW-23B.

Date	Daily Volume (gal)	Interval	Total Water Volume (gal)
FW-18B			
2/5/2006	20	All	12,422
2/6/2006	3,037	All	
2/7/2006	2,825	All	
2/8/2006	6,540	All	
2/18/2006	842	1	1,598
2/19/2006	446	1	
3/7/2006	175	1	
3/8/2006	135	1	
2/17/2006	6,595	2	12,770
2/18/2006	5,850	2	
3/6/2006	245	2	
3/7/2006	80	2	
2/16/2006	5,910	3	14,314
2/17/2006	540	3	
2/19/2006	3,081	3	
2/20/2006	4,680	3	
3/6/2006	103	3	
2/14/2006	4,000	4	13,195
2/15/2006	6,250	4	
2/19/2006	2,860	4	
3/6/2006	85	4	
	Cummulative Total =		54,299

Date	Daily Volume (gal)	Interval	Total Water Volume (gal)
FW-19B			
2/3/2006	340	All	9,301
2/4/2006	525	All	
2/5/2006	494	All	
2/6/2006	907	All	
2/7/2006	512	All	
2/8/2006	1,024	All	
2/14/2006	294	All	
2/15/2006	554	All	
2/16/2006	798	All	
2/17/2006	663	All	
2/18/2006	914	All	
2/19/2006	807	All	
2/20/2006	825	All	
2/21/2006	644	All	
3/4/2006	75	1	75
3/4/2006	75	2	75
3/4/2006	80	3	80
3/3/2006	293	4	293
	Cummulative Total =		9,824

Table 2-4 (cont). Well development daily total water volumes removed for Upper Floridan wells FW-10B through FW-23B.

Date	Daily Volume (gal)	Interval	Total Water Volume (gal)
FW-20B			
2/22/2006	1,550	1	1,622
3/9/2006	72	1	
2/22/2006	3,100	2	3,211
3/9/2006	111	2	
2/21/2006	4,875	3	8,130
2/23/2006	3,100	3	
3/8/2006	85	3	
3/9/2006	70	3	
2/18/2006	2,900	4	12,248
2/19/2006	4,650	4	
2/20/2006	4,500	4	
3/8/2006	198	4	
	Cummulative Total =		25,211

Date	Daily Volume (gal)	Interval	Total Water Volume (gal)
FW-21B			
2/20/2006	800	All	55,815
2/21/2006	4,200	All	
2/22/2006	4,320	All	
2/23/2006	3,656	All	
2/24/2006	4,559	All	
2/25/2006	4,726	All	
2/26/2006	4,374	All	
2/27/2006	4,860	All	
2/28/2006	8,640	All	
3/1/2006	11,520	All	
3/2/2006	4,160	All	
3/9/2006	346	1	346
3/8/2006	260	2	416
3/9/2006	156	2	
3/8/2006	300	3	300
3/7/2006	250	4	350
3/8/2006	100	4	
	Cummulative Total =		57,227

Table 2-4 (cont). Well development daily total water volumes removed for Upper Floridan wells FW-10B through FW-23B.

Date	Daily Volume (gal)	Interval	Total Water Volume (gal)
FW-22B			
4/1/2006	4,850	All	27,100
4/2/2006	6,350	All	
4/3/2006	9,450	All	
4/4/2006	6,450	All	
4/21/2006	2,750	1	2,932
5/20/2006	182	1	
4/20/2006	4,225	2	4,885
4/21/2006	450	2	
5/19/2006	210	2	
4/19/2006	4,800	3	8,457
4/20/2006	3,575	3	
5/19/2006	82	3	
4/18/2006	8,100	4	12,330
4/19/2006	4,120	4	
5/19/2006	110	4	
	Cummulative Total =		55,704

Date	Daily Volume (gal)	Interval	Total Water Volume (gal)
FW-23B			
3/30/2006	6,110	All	34,070
3/31/2006	11,410	All	
4/1/2006	7,350	All	
4/2/2006	9,200	All	
4/21/2006	2,850	1	2,952
5/17/2006	102	1	
4/20/2006	1,585	2	3,598
4/21/2006	1,925	2	
5/17/2006	88	2	
4/19/2006	950	3	5,179
4/20/2006	4,115	3	
5/17/2006	114	3	
4/18/2006	1,900	4	6,012
4/19/2006	3,950	4	
5/17/2006	162	4	
	Cummulative Total =		51,811

* - All development performed with Wattera pump inside of Westbay MP System
Shaded cells indicated development using Wattera pump

Table 2-5. Water quality field parameter measurement values for wells FW-10B through FW-23B at completion of well zone purging.

Well Designation	MP System Zone	Date	Purge Volume (gal)	Conductivity (umhos/cm)	Dissolved Oxygen (mg/l)	Oxidation Red. Potential (mV)	pH	Temperature (°C)	Turbidity (NTU)
FW-10B	1	3/9/2006	955	NM	NM	NM	NM	NM	12.9
	2	1/17/2006	325	NM	NM	NM	NM	NM	111
	3	12/30/2005	500	NM	NM	NM	NM	NM	7.51
	4	1/9/2006	250	NM	NM	NM	NM	NM	2.7
FW-11B	1	1/14/2006	93	38.2	1.24	-196	8.14	23.71	273
	2	1/14/2006	82	45.2	2.05	-125	7.84	23.68	165
	3	1/14/2006	75	44.6	3.89	-135	7.86	21.44	64.1
	4	1/14/2006	105	43.5	1.55	-118	7.94	21.90	46.3
FW-12B	1	1/22/2006	90	41.9	5.15	-165	7.72	24.48	999
	2	1/21/2006	60	41.5	5.00	-189	7.64	25.09	514
	3	1/21/2006	60	47.2	4.00	-167	7.70	25.17	999
	4	1/19/2006	60	44.8	1.29	-127	8.27	24.68	133
FW-13B	1	1/16/2006	60	50.6	0.88	-168	7.60	24.84	841
	2	1/16/2006	87	48.9	1.35	-166	7.81	21.38	>999
	3	1/15/2006	60	46.3	1.35	-192	7.37	21.44	596
	4	1/15/2006	115	45.9	0.67	-163	7.32	23.24	47.8
FW-14B	1	1/17/2006	30	40.7	4.47	-79	8.17	25.12	447
	2	1/17/2006	60	41.6	4.12	-123	7.81	23.81	213
	3	1/17/2006	60	43.7	3.60	-160	7.69	24.00	207
	4	1/16/2006	70	54.1	1.75	-154	7.77	23.11	114
FW-15B	1	1/18/2006	60	47.0	3.66	-131	7.67	21.63	169
	2	1/18/2006	60	48.4	2.63	-148	7.67	21.34	121
	3	1/18/2006	60	48.0	1.82	-156	7.64	21.68	962
	4	1/17/2006	60	48.6	4.49	-137	7.78	23.79	462
FW-16B	1	1/22/2006	75	57.1	4.38	-220	8.68	23.76	137
	2	1/22/2006	75	52.4	0.92	-230	7.50	25.05	776
	3	1/22/2006	78	51.6	1.52	-224	7.59	25.34	316
	4		NM	NM	NM	NM	NM	NM	NM
FW-17B	1	3/7/2006	565	54.0	0.93	-188	6.63	23.10	220
	2	3/6/2006	485	50.0	1.75	-165	7.03	23.00	110
	3	3/5/2006	70	48.0	0.10	-150	7.01	23.50	10
	4	3/5/2006	165	50.0	1.18	-126	6.81	23.40	40

Table 2-5 (cont). Water quality field parameter measurement values for wells FW-10B through FW-23B at completion of well zone purging.

Well Designation	MP System Zone	Date	Purge Volume (gal)	Conductivity (umhos/cm)	Dissolved Oxygen (mg/l)	Oxidation Red. Potential (mV)	pH	Temperature (oC)	Turbidity (NTU)
FW-18B	1	3/8/2006	310	47.0	1.45	-203	6.67	22.50	27
	2	3/7/2006	325	51.0	3.63	-218	6.58	20.60	27
	3	3/6/2006	103	42.0	0.79	-174	7.00	23.20	5
	4	3/6/2006	85	45.0	0.49	-172	6.86	23.00	10
FW-19B	1	3/4/2006	75	51.0	4.35	-20	7.29	20.50	6.25
	2	3/4/2006	75	50.0	1.44	-175	7.20	22.70	5.57
	3	3/4/2006	80	50.0	1.27	-201	7.08	21.10	5.48
	4	3/3/2006	293	49.0	3.56	-205	7.57	22.50	280
FW-20B	1	3/9/2006	72	55.0	0.43	-217	6.75	23.10	2.5
	2	3/9/2006	111	51.0	0.00	-189	6.71	23.00	12
	3	3/9/2006	155	55.0	1.65	-179	6.41	21.70	20
	4	3/8/2006	198	52.0	3.44	-187	6.65	23.50	18
FW-21B	1	3/9/2006	346	60.0	1.49	-265	6.65	23.40	2.2
	2	3/9/2006	416	63.0	2.63	-267	6.69	22.50	2.3
	3	3/8/2006	300	61.0	3.24	-265	6.68	23.20	1.5
	4	3/7/2006	350	64.0	3.88	-250	6.59	21.30	1.7
FW-22B	1	5/20/2006	182	182.0	2.91	-195	7.98	22.90	55
	2	5/19/2006	210	195.0	3.20	-175	7.88	23.47	23.2
	3	5/19/2006	82	420.0	2.94	-153	7.74	23.73	7.37
	4	5/19/2006	110	411.0	4.29	-79	7.38	23.01	9.72
FW-23B	1	5/18/2006	102	304.0	3.19	-136	7.85	23.48	4.52
	2	5/18/2006	88	308.0	3.31	-139	7.67	22.69	8.11
	3	5/18/2006	114	305.0	2.14	-169	7.68	21.89	9.87
	4	5/17/2006	162	304.0	3.03	-144	7.95	23.06	17.7

Table 2-6. Well survey coordinates and elevations.

Well ID	Northing (ft)	Easting (ft)	Elevation (ft)		Measurement Port Elevations (ft)			
			Ground	4" Well Casing	Zone 1	Zone 2	Zone 3	Zone 4
FW-10B	253577	2658068	184.56	187.16	29.19	9.19	-10.82	-30.82
FW-11B	253908	2658056	182.30	184.93	27.46	7.46	-12.55	-32.55
FW-12B	253908	2658430	181.78	184.26	26.79	6.79	-13.22	-33.22
FW-13B	253937	2658808	178.82	181.37	21.90	1.90	-18.11	-38.11
FW-14B	253960	2659042	176.00	178.73	18.16	-1.85	-21.85	-41.85
FW-15B	253723	2659212	176.42	179.20	20.23	0.22	-19.78	-39.78
FW-16B	253415	2659220	178.63	181.19	15.16	-4.85	-24.85	-44.85
FW-17B	252614	2659238	181.96	184.69	24.32	4.32	-15.69	-35.69
FW-18B	252283	2659111	183.53	185.97	27.60	7.60	-12.41	-32.41
FW-19B	252412	2658631	183.44	186.09	28.72	8.72	-11.29	-31.29
FW-20B	253723	2658681	180.85	183.60	25.23	5.22	-14.78	-34.78
FW-21B	253283	2659027	179.82	182.38	26.01	6.01	-14.00	-34.00
FW-22B	254565	2658201	178.81	181.37	25.00	5.00	-15.01	-35.01
FW-23B	254757	2658753	169.95	172.46	19.05	-0.96	-20.96	-40.96

Notes:

1) Horizontal datum (northing/easting) is NAD 83 State Plane Coordinate System, zone Florida North.

2) Horizontal accuracy is ± 1m (3.28 ft).

3) Elevation datum is NGVD 1929.

Table 4-1. Hydraulic-head measurements for Upper Floridan wells (January, March and May 2006).

Well I.D.	MP System Zone	Measurement Event: January 2006 Date	January 2006 Piezometric Elevation (ft ngvd-29)	March 2006 Date	March 2006 Piezometric Elevation (ft ngvd-29)	May 2006 Date	May 2006 Piezometric Elevation (ft ngvd-29)
FW-1	NA					05/16/06	51.83
FW-2	NA					05/16/06	52.12
FW-3	NA					05/16/06	52.27
FW-4	NA					05/16/06	51.39
FW-5	NA					08/16/06	52.05
FW-6	NA					05/16/06	51.80
FW-7	NA					05/16/06	51.18
FW-8	NA					05/16/06	53.01
FW-9	NA					05/16/06	52.14
FW-10B	1	01/23/06	53.46			05/16/06	52.67
	2	01/20/06	53.51			05/16/06	52.68
	3	01/20/06	53.49			05/16/06	52.66
	4	01/23/06	53.45			05/16/06	52.64
FW-11B	1	01/15/06	53.02	03/04/06	53.58	05/16/06	52.42
	2	01/15/06	53.00			05/16/06	52.45
	3	01/15/06	53.01			05/16/06	52.43
	4	01/14/06	53.01			05/16/06	52.43
FW-12B	1	01/24/06	52.79	03/06/06	53.25	05/16/06	52.09
	2	01/23/06	52.80	03/02/06	53.28	05/16/06	52.07
	3	01/23/06	52.82	03/02/06	53.28	05/16/06	52.07
	4	01/23/06	52.80	03/01/06	53.24	05/16/06	52.05
FW-13B	1	01/17/06	52.73			05/16/06	52.08
	2	01/17/06	52.76			05/16/06	52.11
	3	01/16/06	52.78			05/16/06	52.09
	4	01/16/06	52.74			05/16/06	52.07
FW-14B	1	01/17/06	52.78			05/16/06	52.08
	2	01/17/06	52.80			05/16/06	52.11
	3	01/17/06	52.76			05/16/06	52.07
	4	01/17/06	52.65			05/16/06	52.05
FW-15B	1	01/20/06	52.98			05/16/06	52.14
	2	01/20/06	52.98			05/16/06	52.15
	3	01/19/06	52.94			05/16/06	52.15
	4	01/19/06	52.90			05/16/06	52.11
FW-16B	1	01/24/06	52.90	03/04/06	53.38	05/16/06	52.23
	2	01/24/06	52.92			05/16/06	52.21
	3	01/24/06	52.97	03/03/06	53.37	05/16/06	52.23
	4	01/24/06	52.91	03/03/06	53.35	05/16/06	52.19

Table 4-1 (cont). Hydraulic-head measurements for Upper Floridan wells (January, March and May 2006).

Well I.D.	MP System Zone	January 2006 Date	January 2006 Piezometric Elevation (ft ngvd-29)	March 2006 Date	March 2006 Piezometric Elevation (ft ngvd-29)	May 2006 Date	May 2006 Piezometric Elevation (ft ngvd-29)
FW-17B	1			03/08/06	53.79	05/17/06	52.54
	2			03/08/06	53.74	05/17/06	52.45
	3			03/08/06	53.70	05/17/06	52.41
	4			03/08/06	53.68	05/17/06	52.37
FW-18B	1			03/09/06	54.02	05/17/06	52.82
	2			03/07/06	53.91	05/17/06	52.77
	3			03/07/06	53.89	05/17/06	52.73
	4			03/07/06	53.87	05/17/06	52.69
FW-19B	1			03/05/06	53.98	05/17/06	52.90
	2			03/05/06	53.99	05/17/06	52.88
	3			03/05/06	53.99	05/17/06	52.88
	4			03/05/06	53.97	05/17/06	86.59*
FW-20B	1			03/10/06	53.47	05/17/06	52.45
	2			03/10/06	53.48	05/17/06	52.41
	3			03/10/06	53.43	05/17/06	52.37
	4			03/10/06	53.42	05/17/06	52.35
FW-21B	1			03/09/06	53.56	05/17/06	82.06*
	2			03/09/06	53.54	05/17/06	52.38
	3			03/09/06	53.52	05/17/06	52.37
	4			03/09/06	53.48	05/17/06	52.35
FW-22B	1					05/21/06	51.74
	2					05/20/06	51.91
	3					05/20/06	51.68
	4					05/20/06	51.69
FW-23B	1					05/19/06	51.22
	2					05/19/06	51.20
	3					05/19/06	51.27
	4					05/19/06	51.26

* - Questionable measurement due to discrepancy with other data.

Table 4-2. Laboratory-permeability test results for Upper Floridan well backfill material.

TESTING PARAMETER	TEST METHOD	UNIT	RESULTS							
			Sample # 30-65				Sample # 12-20			
			Tube #1	Tube #2	Tube #3	Average	Tube #1	Tube #2	Tube #3	Average
PHYSICAL PROPERTIES										
Moisture Content	ASTM D2216	%	9.12	22.13	22.89	**18.05**	4.76	22.13	5.74	**10.88**
Density Determination	ASTM D2937									
- Bulk Density		lb/ft^3	110.5	132.9	129.9	**124.4**	108.9	126.4	108	**114.4**
- Dry Density Sand		lb/ft^3	101.3	108.8	105.7	**105.4**	104.0	103.5	102.1	**103.2**
Constant-Head Permeability	ASTM D2434		Composite		Composite Duplicate		Composite Sample			
- Initial Moisture Content		%	**19.8**		**19.1**		**8.2**			
- Initial Bulk Density		lb/ft^3	**121.3**		**120.6**		**106.7**			
- Initial Dry Density		lb/ft^3	**101.3**		**101.3**		**98.6**			
- Coefficient of Permeability (k)		cm/sec	**1.6E-02**		**1.3E-02**		**2.5E-01**			

Test performed by:

Applied Technologies Group

Kemron Environmental Services, Inc.

Atlanta, GA

Table 4-3a. Upper Floridan transect wells water quality results for January 2006.

Constituent	Federal MCL (µg/L)	Florida GCTL (µg/L)	Well ID				Well ID			
			FW-10B				FW-11B			
			Zone 1	Zone 2	Zone 3	Zone 4	Zone 1	Zone 2	Zone 3	Zone 4
Metals										
Sanple Date			1/23/2006	1/20/2006	1/20/2006	1/23/2006	1/15/2006	1/15/2006	1/15/2006	1/14/2006
Arsenic (total)	-	-	25	2.1	1.0	6.6	6.8	47	34	14
Chromium (total)	-	-	2.4	10	12	3.8				
Copper (total)	-	-	2.0	2.7	5.6	8.1		3.0	14	2.0
Zinc (total)	-	-	110	170	170	360	710	1,200	1,100	790
Organic Chemicals										
Sanple Date			1/23/2006	1/20/2006	1/20/2006	1/23/2006	1/15/2006	1/15/2006	1/15/2006	1/14/2006
2,4-Dimethylphenol	-	140								
2-Methylnaphthalene	-	28								
2-Methylphenol	-	35								
4-Methylphenol †	-	-								
Acenaphthene	-	20								
Acenaphthylene	-	-					4.1 I,J			
Anthracene	-	2,100								
Benzene	5.0	1.0								
Benz(a)anthracene	-	-								
Benzo(a)pyrene	0.2	-								
Benzo(b)fluoranthene	-	-								
Benzo(g,h,i)perylene	-	-								
Benzo(k)fluoranthene	-	-								
Carbazole	-	1.8								
Chrysene	-	-								
Dibenz(a,h)anthracene	-	-								
Dibenzofuran	-	28								
Ethylbenzene	700	700								
Fluoranthene	-	280								
Flourene	-	280					1.4 I,J			
Indeno(1,2,3-cd)pyrene	-	0.05								
Naphthalene	-	14								
Pentachlorophenol	1	-								
Phenanthrene	-	210								
Phenol	-	10								
Pyrene	-	10								
Toluene	1,000	1,000								
Xylenes (total)	10,000	10,000								

Table 4-3a (cont.). Upper Floridan transect wells water quality results for January 2006.

Constituent	Federal MCL (µg/L)	Florida GCTL (µg/L)	Well ID FW-12B				Well ID FW-13B			
			Zone 1	Zone 2	Zone 3	Zone 4	Zone 1	Zone 2	Zone 3	Zone 4
Metals										
Sample Date			1/24/2006	1/23/2006	1/23/2006	1/23/2006	1/17/2006	1/17/2006	1/16/2006	1/16/2006
Arsenic (total)	-	-	11	7.6	2.2	2.2	6.8 *	12	3.5	4.2
Chromium (total)	-	-	2.8	3.6	2.6	2.7	4.2 *	2.2		
Copper (total)	-	-	3.0			3.9		2.9		6.3
Zinc (total)	-	-	95	230	280	250	690 *	610	980	670
Organic Chemicals										
Sample Date			1/24/2006	1/23/2006	1/23/2006	1/23/2006	1/17/2006	1/17/2006	1/16/2006	1/16/2006
2,4-Dimethylphenol	-	140	6.2	0.82 I,J						
2-Methylnaphthalene	-	28			11	12				
2-Methylphenol	-	35								
4-Methylphenol †	-	-								
Acenaphthene	-	20	1.1 I,J	1.4 I,J	29	40				
Acenaphthylene	-	-								
Anthracene	-	2,100			1.6 I,J					
Benzene	5.0	1.0			1.7	2.2				
Benz(a)anthracene	-	-								
Benzo(a)pyrene	0.2	-								
Benzo(b)fluoranthene	-	-								
Benzo(g,h,i)perylene	-	-								
Benzo(k)fluoranthene	-	-								
Carbazole	-	1.8			4.6 I,J	16				
Chrysene	-	-								
Dibenz(a,h)anthracene	-	-								
Dibenzofuran	-	28			16	15				
Ethylbenzene	700	700								
Fluoranthene	-	280								
Flourene	-	280			18	17				
Indeno(1,2,3-cd)pyrene	-	0.05								
Naphthalene	-	14		12	160	280				
Pentachlorophenol	1	-								
Phenanthrene	-	210			15	4.8 I,J				
Phenol	-	10								
Pyrene	-	10								
Toluene	1,000	1,000								
Xylenes (total)	10,000	10,000			2.0	2.1				

Table 4-3a (cont.). Upper Floridan transect wells water quality results for January 2006.

Constituent	Federal MCL (µg/L)	Florida GCTL (µg/L)	Well ID FW-14B Zone 1	Well ID FW-14B Zone 2	Well ID FW-14B Zone 3	Well ID FW-14B Zone 4	Well ID FW-15B Zone 1	Well ID FW-15B Zone 2	Well ID FW-15B Zone 3	Well ID FW-15B Zone 4
Metals										
Sanple Date			1/18/2006	1/18/2006	1/18/2006	1/17/2006	1/20/2006	1/20/2006	1/19/2006	1/19/2006
Arsenic (total)	-	-	3.9	8.5	1.3	3.3	8.9	2.3	2.8	11
Chromium (total)	-	-			4.3	2.3		4.3	4.3	4.5
Copper (total)	-	-	4.4		10	5.2		7.8	4.4	13
Zinc (total)	-	-	410	680	940	1,400	20	39	76	49
Organic Chemicals										
Sanple Date			1/18/2006	1/18/2006	1/18/2006	1/17/2006	1/20/2006	1/20/2006	1/19/2006	1/19/2006
2,4-Dimethylphenol	-	140								
2-Methylnaphthalene	-	28								
2-Methylphenol	-	35								
4-Methylphenol †	-	-								
Acenaphthene	-	20								
Acenaphthylene	-	-								
Anthracene	-	2,100								
Benzene	5.0	1.0								
Benz(a)anthracene	-	-								
Benzo(a)pyrene	0.2	-								
Benzo(b)fluoranthene	-	-								
Benzo(g,h,i)perylene	-	-								
Benzo(k)fluoranthene	-	-								
Carbazole	-	1.8								
Chrysene	-	-								
Dibenz(a,h)anthracene	-	-								
Dibenzofuran	-	28								
Ethylbenzene	700	700								
Fluoranthene	-	280								
Flourene	-	280								
Indeno(1,2,3-cd)pyrene	-	0.05								
Naphthalene	-	14								
Pentachlorophenol	1	-								
Phenanthrene	-	210								
Phenol	-	10								
Pyrene	-	10								
Toluene	1,000	1,000								
Xylenes (total)	10,000	10,000								

Table 4-3a (cont.). Upper Floridan transect wells water quality results for January 2006.

Constituent	Federal MCL (µg/L)	Florida GCTL (µg/L)	Well ID FW-16B Zone 1	Zone 2	Zone 3	Zone 4
Metals						
Sample Date			1/24/2006	1/24/2006	1/24/2006	1/24/2006
Arsenic (total)	-	-	19	4.0	1.7	2.4
Chromium (total)	-	-		5.0	5.2	6.9
Copper (total)	-	-				2.5
Zinc (total)	-	-	34	13	210	460
Organic Chemicals						
Sanple Date			1/24/2006	1/24/2006	1/24/2006	1/24/2006
2,4-Dimethylphenol	-	140	56		0.9 I,J	
2-Methylnaphthalene	-	28				
2-Methylphenol	-	35	6.1 I,J			
4-Methylphenol †	-	-				
Acenaphthene	-	20				
Acenaphthylene	-	-				
Anthracene	-	2,100				
Benzene	5.0	1.0				
Benz(a)anthracene	-	-				
Benzo(a)pyrene	0.2	-				
Benzo(b)fluoranthene	-	-				
Benzo(g,h,i)perylene	-	-				
Benzo(k)fluoranthene	-	-				
Carbazole	-	1.8				
Chrysene	-	-				
Dibenz(a,h)anthracene	-	-				
Dibenzofuran	-	28				
Ethylbenzene	700	700				
Fluoranthene	-	280				
Flourene	-	280				
Indeno(1,2,3-cd)pyrene	-	0.05				0.049 I,J
Naphthalene	-	14				
Pentachlorophenol	1	-				
Phenanthrene	-	210				
Phenol	-	10				
Pyrene	-	10				
Toluene	1,000	1,000				
Xylenes (total)	10,000	10,000				

Notes:

* Average concentration of sample and duplicate.
† Analyte cannot be separated from 3-Methylphenol.
\- No published standard.
I Reported value between the laboratory method detection limit and the laboratory practical quantitation limit.
J Reported value is estimated.
Blank value indicates the analyte was not detected above the laboratory detection limit.
Result is above the Florida GCTL.
Result is above the Florida GCTL, but below the Federal MCL.

Table 4-3b. Upper Floridan Aquifer source area and transect wells water quality results for March 2006.

Constituent	Federal MCL (µg/L)	Florida GCTL (µg/L)	Well ID FW-11B Zone 1	Well ID FW-12B Zone 1	Zone 2	Zone 3	Zone 4	Well ID FW-13B Zone 1
Metals								
Sample Date			3/4/2006	3/6/2006	3/2/2006	3/2/2006	3/1/2006	3/9/2006
Arsenic (dissolved)	10	10	6.3		2.0	0.55		0.8
Chromium (dissolved)	100	100	11	2.2				
Copper (dissolved)	1,300	-						
Zinc (dissolved)	-	-	1,300	17	58	14	19 *	
Organic Chemicals								
Sample Date			3/4/2006	3/6/2006	3/2/2006	3/2/2006	3/1/2006	3/9/2006
2,4-Dimethylphenol	-	140		4.4 I,J	5.8			
2-Methylnaphthalene	-	28				7.3	10.5 *	
2-Methylphenol	-	35			4.1 I,J			
4-Methylphenol †	-	-						
Acenaphthene	-	20	6.5		0.98 I,J	28	43.5 *	
Acenaphthylene	-	-						
Anthracene	-	2,100				2.1 I,J		
Benzene	5.0	1.0					3.4 *	
Benz(a)anthracene	-	-						
Benzo(a)pyrene	0.2	-						
Benzo(b)fluoranthene	-	-						
Benzo(g,h,i)perylene	-	-						
Benzo(k)fluoranthene	-	-						
Carbazole	-	1.8				1.9 I,J	21.5 *	
Chrysene	-	-						
Dibenz(a,h)anthracene	-	-						
Dibenzofuran	-	28				17	17.5 *	
Ethylbenzene	700	700						
Fluoranthene	-	280						
Flourene	-	280				19	22 *	
Indeno(1,2,3-cd)pyrene	-	0.05						
Naphthalene	-	14	1.5 I,J		13	380	650 *	
Pentachlorophenol	1	-						
Phenanthrene	-	210				18	1.7 *I,J	
Phenol	-	10					7.8 *	
Pyrene	-	10						
Toluene	1,000	1,000						
Xylenes (total)	10,000	10,000					3.4 *	

Table 4-3b (cont.). Upper Floridan Aquifer source area and transect wells water quality results for March 2006.

Constituent	Federal MCL (µg/L)	Florida GCTL (µg/L)	Well ID FW-16B Zone 1	Zone 2	Zone 3	Zone 4	Well ID FW-17B Zone 1	Zone 2	Zone 3	Zone 4
Metals										
Sample Date			3/4/2006	3/4/2006	3/3/2006	3/3/2006	3/8/2006	3/8/2006	3/8/2006	3/8/2006
Arsenic (dissolved)	10	10			0.71			1.4	1.4	1.7
Chromium (dissolved)	100	100								2.1
Copper (dissolved)	1,300	-								
Zinc (dissolved)	-	-	27		15			680	1,000	570
Organic Chemicals										
Sample Date			3/4/2006	3/4/2006	3/3/2006	3/3/2006	3/8/2006	3/8/2006	3/8/2006	3/8/2006
2,4-Dimethylphenol	-	140	26							
2-Methylnaphthalene	-	28								
2-Methylphenol	-	35								
4-Methylphenol †	-	-								
Acenaphthene	-	20								
Acenaphthylene	-	-								
Anthracene	-	2,100								
Benzene	5.0	1.0								
Benz(a)anthracene	-	-								
Benzo(a)pyrene	0.2	-								
Benzo(b)fluoranthene	-	-								
Benzo(g,h,i)perylene	-	-								
Benzo(k)fluoranthene	-	-								
Carbazole	-	1.8								
Chrysene	-	-								
Dibenz(a,h)anthracene	-	-								
Dibenzofuran	-	28								
Ethylbenzene	700	700								
Fluoranthene	-	280								
Flourene	-	280								
Indeno(1,2,3-cd)pyrene	-	0.05								
Naphthalene	-	14	6.4							
Pentachlorophenol	1	-								
Phenanthrene	-	210								
Phenol	-	10								
Pyrene	-	10								
Toluene	1,000	1,000								
Xylenes (total)	10,000	10,000								

Table 4-3b (cont.). Upper Floridan Aquifer source area and transect wells water quality results for March 2006.

Constituent	Federal MCL (µg/L)	Florida GCTL (µg/L)	Well ID FW-18B Zone 1	Well ID FW-18B Zone 2	Well ID FW-18B Zone 3	Well ID FW-18B Zone 4	Well ID FW-19B Zone 1	Well ID FW-19B Zone 2	Well ID FW-19B Zone 3	Well ID FW-19B Zone 4
Metals										
Sample Date			3/9/2006	3/7/2006	3/7/2006	3/7/2006	3/5/2006	3/5/2006	3/5/2006	3/5/2006
Arsenic (dissolved)	10	10	0.77			1.0	3.1 *	2.2	13	4.8
Chromium (dissolved)	100	100								4.6
Copper (dissolved)	1,300	-							4.1	
Zinc (dissolved)	-	-					551 *	56	51	24
Organic Chemicals										
Sample Date			3/9/2006	3/7/2006	3/7/2006	3/7/2006	3/5/2006	3/5/2006	3/5/2006	3/5/2006
2,4-Dimethylphenol	-	140								
2-Methylnaphthalene	-	28								
2-Methylphenol	-	35								
4-Methylphenol †	-	-								
Acenaphthene	-	20		0.76 I,J			0.26 *			
Acenaphthylene	-	-								
Anthracene	-	2,100								
Benzene	5.0	1.0								
Benz(a)anthracene	-	-								
Benzo(a)pyrene	0.2	-								
Benzo(b)fluoranthene	-	-								
Benzo(g,h,i)perylene	-	-								
Benzo(k)fluoranthene	-	-								
Carbazole	-	1.8								
Chrysene	-	-								
Dibenz(a,h)anthracene	-	-								
Dibenzofuran	-	28								
Ethylbenzene	700	700								
Fluoranthene	-	280								
Flourene	-	280								
Indeno(1,2,3-cd)pyrene	-	0.05								
Naphthalene	-	14								
Pentachlorophenol	1	-								
Phenanthrene	-	210								
Phenol	-	10								
Pyrene	-	10								
Toluene	1,000	1,000								
Xylenes (total)	10,000	10,000								

Table 4-3b (cont.). Upper Floridan Aquifer source area and transect wells water quality results for March 2006.

Constituent	Federal MCL (µg/L)	Florida GCTL (µg/L)	Well ID FW-20B Zone 1	Well ID FW-20B Zone 2	Well ID FW-20B Zone 3	Well ID FW-20B Zone 4	Well ID FW-21B Zone 1	Well ID FW-21B Zone 2	Well ID FW-21B Zone 3	Well ID FW-21B Zone 4
Metals										
Sample Date			3/10/2006	3/10/2006	3/10/2006	3/10/2006	3/9/2006	3/9/2006	3/9/2006	3/9/2006
Arsenic (dissolved)	10	10	4.4	11	1.5	0.6				0.54
Chromium (dissolved)	100	100								
Copper (dissolved)	1,300	-				3.7				
Zinc (dissolved)	-	-	20	320	43	11		13		
Organic Chemicals										
Sample Date			3/10/2006	3/10/2006	3/10/2006	3/10/2006	3/9/2006	3/9/2006	3/9/2006	3/9/2006
2,4-Dimethylphenol	-	140					6.6	1.0 I,J	1.1 I,J	4.0 I,J
2-Methylnaphthalene	-	28	6.6	3.3 I,J			6.9			
2-Methylphenol	-	35								
4-Methylphenol †	-	-								
Acenaphthene	-	20	54	6.6	0.71 I,J	0.53 I,J	13	3.3 I,J	4.0 I,J	1.8 I,J
Acenaphthylene	-	-								
Anthracene	-	2,100	5.8							
Benzene	5.0	1.0	2.4							
Benz(a)anthracene	-	-								
Benzo(a)pyrene	0.2	-								
Benzo(b)fluoranthene	-	-								
Benzo(g,h,i)perylene	-	-								
Benzo(k)fluoranthene	-	-								
Carbazole	-	1.8	26	2.1 I,J			0.88 I,J			
Chrysene	-	-								
Dibenz(a,h)anthracene	-	-								
Dibenzofuran	-	28	26	2.7 I,J			5.6			
Ethylbenzene	700	700								
Fluoranthene	-	280	6.4	0.37 I,J						
Flourene	-	280	39	3.7 I,J			7.0	0.58 I,J		
Indeno(1,2,3-cd)pyrene	-	0.05								
Naphthalene	-	14		53	6.1	3.3 I,J	140	4.8 I,J	12	8.3
Pentachlorophenol	1	-								
Phenanthrene	-	210	42							
Phenol	-	10								
Pyrene	-	10	2.6 I,J							
Toluene	1,000	1,000								
Xylenes (total)	10,000	10,000								

Notes:

* Average concentration of sample and duplicate.

† Analyte cannot be separated from 3-Methylphenol.

\- No published standard.

I Reported value between the laboratory method detection limit and the laboratory practical quantitation limit.

J Reported value is estimated.

Blank value indicates the analyte was not detected above the laboratory detection limit.

(green) Result is above the Florida GCTL.

(blue) Result is above the Florida GCTL, but below the Federal MCL.

Table 4-3c. Upper Floridan Aquifer property boundary wells water quality results for May 2006.

Constituent	Federal MCL (µg/L)	Florida GCTL (µg/L)	Well ID FW-22B				Well ID FW-23B			
			Zone 1	Zone 2	Zone 3	Zone 4	Zone 1	Zone 2	Zone 3	Zone 4
Metals										
Sample Date			5/21/2006	5/20/2006	5/20/2006	5/20/2006	5/20/2006	5/19/2006	5/19/2006	5/19/2006
Arsenic (dissolved)	10	10	1.4	3.4	6.1	5.3				
Chromium (dissolved)	100	100								
Copper (dissolved)	1,300	-				3.2				
Zinc (dissolved)	-	-			15	26				
Organic Chemicals										
Sample Date			5/21/2006	5/20/2006	5/20/2006	5/20/2006	5/20/2006	5/19/2006	5/19/2006	5/19/2006
2,4-Dimethylphenol	-	140					6.05 *		1.2 I,J	
2-Methylnaphthalene	-	28								
2-Methylphenol	-	35					5.05 *I,J			
4-Methylphenol †	-	-					2.2 *I,J			
Acenaphthene	-	20	11	16	11	7.8	0.505 *I,J	0.47 I,J	0.44 I,J	
Acenaphthylene	-	-								
Anthracene	-	2,100								
Benzene	5.0	1.0								
Benz(a)anthracene	-	-								
Benzo(a)pyrene	0.2	-								
Benzo(b)fluoranthene	-	-								
Benzo(g,h,i)perylene	-	-								
Benzo(k)fluoranthene	-	-								
Carbazole	-	1.8								
Chrysene	-	-								
Dibenz(a,h)anthracene	-	-								
Dibenzofuran	-	28								
Ethylbenzene	700	700								
Fluoranthene	-	280								
Flourene	-	280	0.85 I,J	1.8 I,J	1.1 I,J	0.76 I,J				
Indeno(1,2,3-cd)pyrene	-	0.05								
Naphthalene	-	14					1.3 *I,J			
Pentachlorophenol	1	-								
Phenanthrene	-	210								
Phenol	-	10								
Pyrene	-	210								
Toluene	1,000	1,000								
Xylenes (total)	10,000	10,000								

Notes:

* Average concentration of sample and duplicate.

† Analyte cannot be separated from 3-Methylphenol.

\- No published standard.

I Reported value between the laboratory method detection limit and the laboratory practical quantitation limit.

J Reported value is estimated.

Blank value indicates the analyte was not detected above the laboratory detection limit.

Result is above the Florida GCTL.

Result is above the Florida GCTL, but below the Federal MCL.