Appendix A
Groundwater Investigation Methodology

A.1 Introduction

Appendix C describes the methodology for the groundwater investigation tasks that were completed at the Dundalk Marine Terminal (DMT) in support of the Chromium Transport Study (CTS). In addition to explaining the field methodology for each investigation task, Appendix C also discusses the laboratory analytical methods and validation procedures for soil and groundwater samples and describes the methods used to analyze hydraulic data collected during the investigation. Where applicable, Appendix C also provides test results that are extraneous to the focused discussion presented in the CTS.

A.2 Investigation Events

The tasks described herein were completed during four investigation events (Table A-1).

TABLE A-1
Groundwater Investigation Events

Event ID	Timeframe
Voluntary Investigation	November 2005–June 2006
Phase 1 Groundwater Investigation	Fall 2006–Spring 2007
Phase 2 COPR and Groundwater Investigation	June 2007–February 2008
Phase 3 Groundwater Investigation	September 2008–March 20009
Interim Groundwater Sampling Event	June 2009

A.3 Sample Locations

Over 300 new investigation locations were established during the groundwater and COPR investigations at DMT (Figure A-1). Data was also collected from a number of the monitoring wells that existed at DMT prior to initiation of the groundwater investigation. The groundwater investigation mainly utilized data from the monitoring wells and temporary piezometers so these sample locations are discussed herein. Details regarding the installation of inclinometers, soil borings, and cone penetration test (CPT) borings are provided in the Final COPR Investigation Report (CH2M HILL, 2009a).

Prior to each investigation event, the proposed sample locations were marked using global positioning system (GPS) equipment. Each location was then cleared with the Maryland Port Administration (MPA), Miss Utility, and ERT (a private utility location firm) for utility and other potential conflicts with existing port operations, such as storage for large box containers, pallets, and loose materials; equipment movement; dedicated haul routes; or general access.

A.3.1 Monitoring Well Surveying

After establishment, each sample location was surveyed in accordance with the MPA local survey datum (NAVD 88 vertical datum and NAD 83/91 horizontal datum). In order to remain consistent with previous site information, the NAVD88 vertical datum was converted to the Baltimore City elevation datum. The Baltimore City datum was used exclusively in the calculation of elevation information in the CTS. At a minimum, the survey data for each monitoring well includes northing and easting data in US State Plane Coordinates and a ground surface and top of casing. Elevations were surveyed to the nearest 0.01 foot and horizontal coordinates were surveyed to the nearest 0.1 foot. The monitoring well survey data is provided in Table 3-2-1 of the CTS.

A.4 Air Monitoring

Perimeter air monitoring and sampling was conducted during intrusive activities in accordance with the health and safety plan that was prepared for the groundwater investigation. During the voluntary and Phase 1 groundwater investigation events, samples were collected from personal air monitors and analyzed in accordance with the Occupational Safety and Health Administration Method ID-215 (Hexavalent Chromium in Workplace Atmospheres) and the National Institute for Occupational Safety and Health Method 500 for total particulates. Results of the sample analysis and real-time air monitoring results from the voluntary investigation are provided in Attachment A. During all investigation events, real-time dust monitoring was performed continuously during intrusive activities using MIE Data RAM 4000 dust monitors. The monitors were placed in upwind and downwind positions with respect to the work area and the results were evaluated on a daily basis to ensure that the action limits specified in the health and safety plan were not exceeded.

A.5 Expansion of the DMT Monitoring Well Network

The network of monitoring wells that existed at DMT prior to the voluntary investigation consisted of 35 shallow wells and 16 M-series wells (labeled EA-, EAC-, EAS-, and P-). That network is nearly 20 years old and it was determined that it would not provide a level of detail adequate for purposes of the CTS. Therefore, an additional 50 shallow monitoring wells, 15 upper sand monitoring wells, 12 additional M-series monitoring wells, three D-series monitoring wells, and 49 temporary piezometers were added to the DMT monitoring network during the groundwater investigation (Figure A-1). Table 3-2-1 in the CTS summarizes the well construction data and detailed well construction diagrams are provided in the Final COPR Investigation Report (CH2M HILL, 2009a).

A.5.1 Shallow Well Installation Methods

Monitoring wells were installed in the shallow fill unit during each phase of investigation. Boreholes for all but one shallow well were advanced using hollow-stem augers and continuous split-spoon or direct-push technology (DPT) soil samples were collected during borehole installation. The borehole for DMT-63S was drilled using rotosonic methods with continuous core sampling. Soil samples were logged in the field in accordance with the procedures described in Section A.8 and select samples were retained for analysis. Borings for shallow fill unit wells were typically terminated when the bottom of the shallow fill unit was encountered.

The shallow wells were constructed with threaded, flush-joint, Schedule 40 polyvinyl chloride (PVC) riser and 0.010-inch machine-slotted PVC well screen. The shallow well screens typically extend across most of the saturated shallow unit. The annular space around the well screen was filled with a filter pack of #1 silica sand to a level 2–3 feet above the top of the screen. The filter pack was then capped with a hydrated bentonite pellet seal at least 2 feet thick. The remaining annular space (to ground surface) was grouted with Portland cement–bentonite mix (20:1), which was emplaced through a tremmie pipe.

A.5.2 Upper Sand Well Installation Methods

Upper sand monitoring wells were installed during the Phase 2 and Phase 3 groundwater investigation events. The upper sand wells were installed and screened within the first water-bearing sand interval encountered beneath the shallow fill unit. Continuous samples of subsurface material were collected during borehole advancement at each location. Soil samples were logged in the field in accordance with the procedures described in Section A.8 and select samples were retained for future analysis. Borings for the upper sand wells were typically terminated when the bottom of the sand unit was encountered.

These upper sand wells located within the COPR boundary were installed by a combination of HSA, mud-rotary, or rotosonic drilling methods and were double-cased through the COPR fill and through at least 3 feet of the silt and clay alluvial deposits that underlie the COPR. The 6-inch diameter outer steel casing was tremmie-grouted from the bottom to land surface using a Portland cement–bentonite mix. The grout was then allowed to set for at least 24 hours, after which a nominal 4-inch-diameter mud rotary or rotosonic drill bit was advanced through the outer casing to the bottom of the underlying sand unit. The upper sand wells located outside of the COPR fill were installed by advancing a nominal 8-inch diameter borehole to the bottom of the upper sand unit using HSA drilling methods.

The upper sand monitoring wells were constructed with a 2-inch-diameter, threaded, flush-joint, Schedule 40 PVC riser and machine-slotted PVC well screen (0.010-inch slot size). Screen intervals for the upper sand wells range from five to ten feet depending on the thickness of the sand interval. The annular space around the screen interval was filled with a sand-size filter pack, typically #1 silica sand to a level 2–3 feet above the top of the slotted screen. The filter pack was then capped with a hydrated bentonite pellet seal at least 2 feet thick. The remaining annular space up to ground surface was grouted with Portland cement–bentonite mix (20:1) which was emplaced through a tremmie pipe.

A.5.3 M-Series Well Installation Methods

M-series wells were installed during each investigation phase. The M-series wells are screened in a portion of the Potomac Group sediments that is believed to be representative of the Patapsco Aquifer. Boreholes for the M-series wells were advanced by mud rotary or rotosonic drilling methods and each well was double-cased through the shallow fill and through at least 5 feet of the fine sediments that separate the shallow fill unit from the Patapsco Aquifer. The 6-inch steel outer casing at each location was tremmie-grouted from the bottom to land surface using a Portland cement–bentonite mix. The grout was allowed to set for at least 24 hours, after which a nominal 4-inch-diameter mud rotary or rotosonic drill bit (6-inch-diameter drill bit for DMT-01M) was advanced through the outer casing to complete the borehole.

The M-series monitoring wells are constructed with, threaded, flush-joint, Schedule 40 PVC riser and a 10-foot length of machine-slotted PVC well screen (0.010-inch slot size). DMT-01M (aquifer test well) was constructed with a 4-inch-diameter, threaded, flush-joint, Schedule 40 PVC riser and a 10-foot length of machine-slotted PVC well screen (0.010-inch slot size). The annular space around the screen interval was filled with a sand-size filter pack, typically #1 silica sand, to a level 2-3 feet above the top of the slotted screen. The filter pack was then capped with a bentonite seal at least 2 feet thick. The remaining annular space (to ground surface) was filled with a Portland cement–bentonite mix (20:1) and both the bentonite seal and grout were placed through a side-discharge tremmie pipe.

A.5.4 D-Series Well Installation Methods

The D-Series wells were installed during the Phase 3 investigation. As specified in the Phase 3 work plan, each of the D-series wells were installed outside the COPR boundary, and each was triple cased to protect the deep water-bearing units. A 10-inch-diameter shallow surface casing was installed at each location using either mud rotary or HSA drilling techniques. The 10-inch casings were set at least 5 feet into a clay or silt layer at the base of the shallow fill unit and tremie grouted into place. Six-inch diameter casings were then installed and tremie grouted at each location. Boreholes for the 6-inch casings were drilled using rotosonic techniques to depths greater than 100 feet below grade until a competent clay unit with a thickness greater than 10 feet was encountered. The 6-inch casings were then set at least 10 feet into the clay and tremie grouted in place. The 4-inch borehole for the monitoring well was then advanced to completion using rotosonic techniques.

Screen intervals for the D-series wells were selected based on subsurface conditions encountered in each boring and to be consistent with the lithologic unit being monitored by DMT-81D, which was the first of these wells to be installed. MDE observed subsurface conditions at DMT-81D and agreed to set the well screen interval at 217–227 feet below grade. The other well screens were set in the same lithologic unit as DMT-81D, which based on regional geologic data, is interpreted to represent the upper portion of the Patuxent Formation.

A.5.5 Temporary Piezometer Installation

Forty-nine temporary piezometers were added to the DMT monitoring well network during the groundwater investigation. During each investigation phase, the piezometers were installed at various locations and depths with slightly different construction materials or methods depending on the investigation objective as described below.

Voluntary Investigation Piezometers

The primary purpose of the three piezometers that were installed during the voluntary investigation was to characterize vertical flow in the semi-confining unit that separates the shallow fill unit and Patapsco Aquifer. The Neumann-Witherspoon aquifer test cluster at well DMT-1M required the installation of three small-diameter temporary piezometers, TPZ-1, -2, and -3, which were positioned a specified distance from the aquifer test well. The piezometer boreholes were installed in January 2006 using a combination of hollow-stem auger and DPT drilling methods. The piezometers were completed in the lower silt unit above the Patapsco Aquifer at depths corresponding to approximately one quarter, one half, and three quarters of the unit thickness (Figure A-2).

The temporary piezometers were constructed with a 1-inch-inner-diameter (ID) threaded, flush-joint, Schedule 40 PVC riser and a 1-inch-ID, 3-foot length of machine-slotted, prepacked Schedule 40 PVC well screen (0.010-inch slot size) with a prefabricated 1.4-inch-outer-diameter (OD) sand pack. After drilling through the COPR layer by hollow-stem auger, a direct-push hole was advanced with a 3.25-inch-OD probe rod to the desired depth within the semiconfining unit. The prepacked well screen and riser assembly were then lowered to the bottom of the rod as the Geoprobe™ rod was retracted, leaving the piezometer assembly in place, a 1-foot sand barrier was installed directly above the screen, and the remainder of the annulus above the sand barrier was sealed with granular bentonite.

Phase 1 Piezometers

The primary purpose of the Phase 1 piezometers was to provide additional water level data that would aid in the characterization of groundwater flow in the shallow fill unit, especially in the vicinity of the storm drains. Accordingly, five piezometer arrays were installed along linear transects that ran perpendicular to the 12th, 12.5th, 13th, and 13.5th Street storm drains. Each array consisted of four piezometers that were spaced at 10, 30, 50, and 100 feet from the storm drain. The bases of the piezometers were set at approximately 10 feet below the bottom of the storm drain pipe for the associated array. Therefore, the piezometer depth is specific to each array and varies between 16 and 19 feet below grade.

The Phase 1 piezometers were installed using an Ingersoll Rand A-300 drill rig with 4-inch-OD hollow-stem augers. The augers were advanced to a depth of approximately 10 feet below grade for the purpose of drilling through any fill material that could possibly cause refusal with the direct-push equipment. Once the augers were advanced to 10 feet, they were removed from the borehole and direct push techniques were then used to advance 3-inch-diameter flush joint casing with a disposable point to the target depth.

The piezometers were constructed with a 1.5-inch-ID threaded, flush-joint Schedule 40 PVC riser and a 1.5-inch-ID, 5-foot length of machine-slotted prepacked Schedule 40 PVC well screen (0.010-inch slot size) with a prefabricated nominal 3-inch-OD sand pack. The prepacked well screen and riser assembly were lowered to the bottom of the bore hole as the direct push casing was retracted, leaving the piezometer assembly in place, a 1-foot sand barrier was installed directly above the screen. The remainder of the annulus above the sand barrier was sealed with granular bentonite, which was hydrated with water following emplacement.

In addition to the storm drain arrays, temporary piezometers TPZ-27A/B, -28, -29, and -30A/B were installed along the eastern site boundary to monitor groundwater elevations and chemical concentrations. TPZ-27A/B and TPZ-30A/B are nested piezometer pairs. The nested pairs were constructed such that the shallow piezometer (TPZ-27B or -30B) is screened across the water table above a shallow silt layer (located between 11 and 18 feet bgs) and the deep piezometer (TPZ-27B or -30B) is screened immediately below the silt layer.

Phase 2 Piezometers

Fifteen temporary piezometers were installed during the Phase 2 investigation for the purpose of characterizing groundwater flow in the shallow fill unit north of the COPR fill area near the former airport bulkhead (now buried) and along the 15th Street storm drain. Six of the piezometers were installed along the northern COPR fill area along both sides of the buried wooden bulkhead that bounds the fill area to the north and nine piezometers were installed along the 15th Street storm drain. Three of the nine piezometers were installed along drain segments that lie outside the Areas 1501 and 1602 COPR cell to characterize the groundwater flow regime in the vicinity of the drain. The other six piezometers were completed within the COPR cell for the purpose of characterizing the interaction between groundwater and storm water inside the cell. The Phase 2 piezometers were constructed in the same manner as the Phase 1 piezometers.

Phase 3 Piezometers

Per MDE request, two temporary piezometers (TPZ-48 and TPZ-49) were installed along the south margin of the Area 1501/1602 COPR cell during the Phase 3 investigation. The boreholes were drilled using rotosonic techniques to produce a 4-inch diameter borehole and to temporarily case off the COPR encountered of the borehole while the well was being constructed. The screen intervals were selected to coincide with the depth intervals yielding the highest estimated flow rate based on limited duration yield tests that were performed during installation (CH2M HILL, 2009b). These piezometers are 2-inches in diameter and were constructed in a manner consistent with the upper sand monitoring wells.

A.5.6 Concrete Pad and Flush-Mounted Covers

All permanent wellheads were finished at grade with a minimum 6-inch-diameter, flush-mounted steel protective cover, typically installed in a 2-foot by 2-foot by 1-foot concrete pad or a circular area that was cored (drill cut). The pads were constructed by first removing a minimum of 1 foot of material below the existing ground surface and then setting the bottom of the pad at least 1 foot below the ground surface. The well heads were constructed to match MES well installation standards for heavy-traffic loading and cement mortar of 5,000 pounds per square inch minimum compressive strength.

A.5.7 Well Development

The level of effort for well development met and more often exceeded the requirements proposed in the groundwater investigation work plan. The well development procedures for the newly installed monitoring wells are summarized below:

1. Each new well was surged with a surge block throughout the saturated well screen interval.
2. Water was removed from each well using a submersible pump. Flow rates were generally sustained in the range of 0.5 to approximately 3 gallons per minute (gpm). Higher flow rates, ranging up to approximately 15 gpm, were used if the well could sustain the higher flow rate.
3. A minimum of five well volumes of water was pumped from the saturated interval of each well, more if so directed by CH2M HILL personnel. Quantities of water removed during development ranged from 50 to 330 gallons.

4. Pumps used for well development were decontaminated between uses at each well. A solution of Alconox–tap water solution was pumped through the pump, followed by a tap water and deionized water rinse.
5. Development water was contained within a double-walled tank during development and was handled by MES for disposal at the onsite groundwater treatment facility.

A.6 Existing Well Repair, Redevelopment, and Replacement

As part of the groundwater investigation a number of existing wells were inspected, redeveloped, and repaired, as appropriate. Most of the wells were rehabilitated by simply surging and redeveloping. Two older wells, EA-9M and EAC-01S, were abandoned and replaced with new wells identified as EA-9M and DMT-80M, respectively. During a tidal study conducted during the voluntary investigation, it was determined that monitoring wells EAC-4M, EA-3M, and EA-5M had limited to no connectivity with any aquifer system at DMT because these wells filled with rain water that remained in the well casing for periods of up to several days. Therefore, during the Phase 1 investigation, DMT-34M, -35M, and -36M were installed near these existing M-series wells.

A.7 Decontamination Procedures

All downhole equipment was decontaminated with a high-pressure steam cleaner prior to the equipment's being advanced at each boring location. The equipment was cleaned on a temporary decontamination pad that was constructed of wood and had a disposable plastic liner that was removed and replaced at the end of each day.

All nondisposable sampling equipment was decontaminated on arrival at the site and prior to each use. Decontamination followed these general procedures:

1. Potable water rinse
2. Wash in laboratory-grade detergent solution
3. Potable water rinse
4. Methanol rinse
5. Deionized water rinse
6. Air drying or drying with clean paper towels
7. Storage until further use on clean, plastic-covered surface or wrapped in aluminum foil

Water generated during the decontamination procedures was collected and treated at the onsite treatment plant.

A.8 Soil Sampling, Laboratory Analysis, and Data Validation

Soil samples were collected during each phase of subsurface investigation and the sampling methodology remained consistent throughout the investigation. Samples were collected from boreholes, which were installed using HSAs, DPT, mud-rotary, or rotosonic techniques as outlined in Section A.5. The samples were collected ahead of the auger flights using either DPT or split-spoon sampling techniques. DPT sampling uses a 3-inch-diameter, 4-foot-long macrocore sampler with a nonreactive acetate liner. Soil samples obtained via split spoon were collected in accordance with ASTM D-1586 (Standard Penetration Test Method for Penetration Test and Split-Barrel Sampling of Soil). Soil samples obtained with rotosonic methods were collected inside a 3-inch diameter core barrel.

The soil samples were classified in accordance with the USCS classification system as outlined in ASTM D 2488 (Visual-Manual Procedure for Description and Identification of Soils). The USCS descriptors were accompanied by a brief description of the soil, including soil group name, color (using a Munsell Rock-Color Chart™), moisture content, relative density or consistency inferred from the drilling effort or blow counts at select locations, soil structure, mineralogy, or other descriptors (such as odor, angularity, or presence of organic debris).

COPR samples were described in accordance with the procedures and nomenclature defined in the Phase I COPR Investigation Work Plan (CH2M HILL, 2006b). The description and identification of COPR materials is based on grain size, hardness, color, Diphenylcarbazide (DPC) reactivity, and the degree of lithification (strongly indurated, moderately indurated, weakly indurated, or particulate).

All soil samples were field screened with DPC liquid, which is used as a qualitative field screening tool that indicates the presence or absence of Cr(VI). DPC is a liquid chemical that reacts on contact with Cr(VI) by changing to various hues of purple depending on the quantity of Cr(VI) present. The screening process involved applying one to three drops of DPC plastic directly to a small (1–2 g) aliquot of soil. If the soil had no reaction to the DPC, it was concluded that Cr(VI) was not present and indicated by a "–" on the soil boring log. If the soil turned a light purple upon contact with DPC, it was determined that some Cr(VI) was present. A light colorimetric reaction was indicated by a "+" on the soil boring log. If the soil turned dark purple upon contact with the DPC, it was determined that a significant amount of Cr(VI) was present in the soil. A strong colorimetric reaction was indicated by a "++" on the soil boring log.

The soil samples were labeled, preserved, and transported to the laboratory in accordance with the DMT Quality Assurance Project Plan (QAPP) (CH2M HILL, 2007). At a minimum, most soil samples collected for the groundwater investigation were analyzed for total solids, Cr (SW-846 Method 6010B), and Cr(VI) (SW 846 Method 7199).

The soil analytical results received Level IV validation for Cr and Cr(VI) by a third-party validator (Validata, LLC), in accordance with the USEPA Region 3 guidelines for data validation procedures. Additionally, 10 percent of the remaining analytical fractions also received Level IV validation. Additional information on data validation is provided in the QAPP (CH2M HILL, 2007).

A.9 Groundwater Sampling and Analysis

Two sampling methodologies, low-flow and conventional purging, were used to collect representative groundwater samples. The technique used depended primarily on the depth of the well being sampled. The following subsections briefly describe both methods.

A.9.1 Low-Flow Method

The low-flow purge and sample technique has been used frequently to sample all types of wells at DMT. The technique uses a submersible or peristaltic pump to extract groundwater from the well at a rate of approximately 0.2 to 0.5 L/min. Probes mounted inside an inline flow-through cell were used to monitor the conductivity, pH, temperature, dissolved oxygen, turbidity, and oxidation-reduction potential (ORP) of the groundwater. In accordance with standard operating procedures (SOPs), samples were collected only after the parameters stabilized within specified limits. A table of water quality parameters is provided in Attachment B.

A.9.2 Conventional Method

The conventional purging method was used in the M-series wells during the Phase 1 and 2 investigation events. This technique was initially used to determine if stagnation or small-scale leakage within the M-series wells was causing the elevated pH results observed during previous low-flow sampling events. Through this assessment it was discovered that the most representative samples from the M-series wells were collected by conventional purging and sampling.

The method involves using a submersible pump to purge the wells at sustainable flow rates generally in the range of 5 to 10 gpm. Field parameters are monitored and recorded as the well is purged. Purging is considered complete after three to five well volumes of water have been extracted and the field parameters have stabilized. The pumping rate is then reduced to facilitate sample collection as discussed in the next section.

A.9.3 Sample Collection

At the completion of low-flow or conventional purging, the groundwater samples were collected in laboratory-supplied containers that were pre-preserved as required by the analytical method. Samples for analysis of dissolved constituents were field-filtered with a 0.45-μm filter during collection. The samples were then packaged on ice and transferred to the laboratory under industry-standard chain-of-custody procedures presented in the site-specific QAPP.

A.9.4 Laboratory Analysis

A number of methods have been used to analyze groundwater for various COPR-related constituents (Table A-2). At a minimum, all characterization samples were analyzed for total and dissolved Cr and Cr(VI). Per the request of MDE, a number of the characterization samples were also analyzed for the "COPR constituents," which included aluminum, calcium, iron, magnesium, manganese, silicon, and vanadium. Aquifer characterization and pH assessment samples were analyzed for a series of constituents which may have included total and dissolved metals, total dissolved solids (TDS), total suspended solids (TSS), alkalinity, bicarbonate, sulfate, chloride, fluoride, bromide, nitrate, nitrite, nitrogen, silica, and carbon dioxide.

A.9.5 Sampling Events

Groundwater samples were collected from DMT monitoring wells during each phase of investigation. The sampling events were focused primarily on new monitoring wells that were installed during the investigation, but a limited number of samples were also collected from the pre-existing monitoring well network. The following subsections provide a list of specific wells that were sampled during each investigation event, outline the general purpose of each sample, and briefly discuss any additions to or deviations from the methodology described above.

Voluntary Investigation

Twenty-five shallow wells and two M-series wells were sampled during the voluntary investigation sampling event, which took place from May 21 to May 25, 2006 (Table A-3). All of these monitoring wells were sampled using low-flow purge and sample techniques.

Two additional groundwater samples were collected from DMT-24S and DMT-1M on June 7 and June 21, 2006, respectively. The additional samples were collected in conjunction with aquifer tests at these locations to better understand the geochemical conditions in the shallow and deep aquifers and to determine the cause of pump fouling that was encountered at DMT-24S. The aquifer test well samples were collected with a slightly different methodology than that outlined above. DMT-24S was pumped at 10–15 gpm for approximately 1 hour prior to sample collection. The sample from DMT-1M was collected near the end of a 48-hour pump test during which DMT-1M was pumped at a rate of 26–30 gpm.

The additional samples from shallow aquifer test well DMT-24S were collected after three initial attempts had been made to conduct a constant rate aquifer test at this location. During the shallow aquifer tests at DMT-24S a fine precipitant was observed in the extracted groundwater and the amount of this precipitant appeared to increase as the test progressed. The precipitant appeared to rapidly accumulate as a scale buildup on pump fittings, barbs, valves, and hoses. The scaling caused a substantial reduction in flow rate and consequently all tests were abandoned shortly after startup.

The samples from DMT-24S included a “sludge” sample and a groundwater sample. The sludge sample was composed of the precipitant and was collected by letting the precipitant settle out from extracted groundwater. The water on top of the settled precipitant was then decanted and the sludge sample was collected. A precipitant scale sample was also collected at the end of the initial pump test attempts at DMT-24S. The scale sample was a composite of dry material scraped from scaled pump equipment. The precipitant scale sample was submitted to Battelle Laboratories, Inc., for mineralogical analyses by X-ray diffraction.

Phase I Groundwater Investigation

Additional samples were collected during the Phase I investigation (Table A-4). The monitoring wells and temporary piezometers that were installed during the Phase I investigation were initially sampled February 26 through March 2, 2007.

The aquifer characterization samples were collected with low-flow techniques from four shallow wells on October 4, 2006. The purpose of these samples was to characterize conditions in the shallow fill unit aquifer in order to properly design the proposed Phase I aquifer tests.

From November 28 through December 5, 2006, groundwater samples were collected from seven monitoring well pairs during a pH assessment (Table A-4). The purpose of the pH assessment was to compare pH trends and chemical concentrations in the M-series and shallow monitoring well pairs to address MDE concern that "COPR leachate" was migrating to the Patapsco Aquifer. During this work, the shallow wells were sampled using low-flow techniques, and the M-series wells were sampled at the beginning and end of conventional purging.

On January 8, 2007, well DMT-2M was resampled due to the elevated pH and Cr concentrations detected in this well during the May 2006 event. The sample results were attributed to incomplete well development after installation, and the well was subsequently redeveloped. DMT-2M was resampled using low-flow techniques. The methodology was kept consistent so that differences in concentration would be indicative of the benefits of development rather than a change in methodology. A limited number of shallow and M-series wells were also resampled during Phase I to verify site boundary conditions and/or to confirm/negate Cr(VI) detections from previous sampling rounds.

Phase 2 Groundwater Investigation

The monitoring wells and piezometers that were installed during the Phase 2 Investigation event were sampled from September through November 2007 (Table A-5). The shallow wells, Upper Sand wells, and EAC-4M were sampled using low-flow techniques. The M-series wells were sampled using conventional purge and sample techniques.

Phase 3 Groundwater Investigation

The monitoring wells that were sampled during the Phase 3 investigation were sampled in November 2008 (Table A-6). Samples were collected from TPZ-48 and TPZ-49 after they were installed in March 2009. All of the Phase 3 wells were sampled using low-flow purge and sampling techniques.

Interim Groundwater Sampling Event

A total of 38 monitoring wells were sampled during the first interim groundwater sampling event in June 2009. The thirty-five wells that were sampled are identified, along with a detailed sample rationale, in the Interim Groundwater Sampling Plan (CH2M HILL, 2009c). The 35 wells listed in the plan included shallow, upper sand, and M-Series wells. At the request of MDE, the three D-series wells were also sampled during the event. All of the wells were sampled using low-flow purge and sample techniques.

TABLE A-2
Laboratory Analytical Methods for Groundwater

Constituent	Analytical Method
Cr (total and dissolved)	SW-846 Method 6010B
Cr(VI)	SW-846 Method 7199
Aluminum, iron, magnesium, manganese, silicon, vanadium and calcium (total and dissolved)	SW-846 Method 6010B
Total dissolved solids (TDS)	E160.1
Total suspended solids (TSS)	E160.2
Alkalinity to pH 4.5, alkalinity to pH 8.3, bicarbonate, carbonate	E310.1
Nitrate, nitrite, and nitrogen	E353.2
Silica (total and dissolved)	E370.1
Sulfide	E376.1
Bromide, chloride, fluoride, sulfate	E300.0
Carbon dioxide	A4500B

TABLE A-3
Monitoring Wells Sampled During the Voluntary Investigation

Well Type	Well ID	Sample Purpose
Shallow monitoring well	DMT-1S through DMT-25S	Site characterization
M-series well	DMT-1M, DMT-2M	Site characterization
Shallow aquifer test well	DMT-24S	Aquifer geochemistry characterization
M-series aquifer test well	DMT-1M	Aquifer geochemistry characterization

TABLE A-4
Monitoring Wells Sampled During the Phase 1 Investigation

Well Type	Well ID	Sample Purpose
Phase 1 shallow monitoring well	DMT-26S through DMT-33S, DMT-39S	Site characterization
Phase 1 shallow piezometer	TPZ-27A, TPZ-27B, TPZ-28, TPZ-29, TPZ-30A, TPZ-30B	Site characterization
Phase 1 M-series well	DMT-34M through DMT-38M	Site characterization
Shallow monitoring/aquifer test well	DMT-21S, DMT-23S, DMT-24S, DMT-25S	Aquifer geochemistry characterization

TABLE A-4
Monitoring Wells Sampled During the Phase 1 Investigation

Well Type	Well ID	Sample Purpose
Shallow M-series well pairs	EAC-1S/EAC-1M, EAC-4S/EAC-4M, DMT-25S/EA-5M, EA-6S/EA-6M, EA-11S/EA-11M, P-4/EA-13M, EA-15S/EA-15M	pH assessment
Shallow monitoring well	DMT-12S, DMT-14S through DMT-20S, EA-8S, EA-10S, EAC-2S, EAC-3S	Resample
M-series well	DMT-2M, EA-7M, EA-8M, EA-10M, EAC-2M, EAC-3M	Resample

TABLE A-5
Monitoring Wells Sampled During Phase 2 CTS Investigation

Well Type	Well ID	Sample Purpose
Phase 2 shallow monitoring well	DMT-40S through DMT-48S, DMT-56S through DMT-58S	Site characterization
Phase 2 shallow piezometer	TPZ-33, TPZ-36, TPZ-38, TPZ-44, TPZ-45, TPZ-46	Site characterization
Phase 2 Upper Sand well	DMT-49US through DMT-54US	Site characterization
Phase 2 M-series well	DMT-60M	Site characterization
Shallow monitoring well	EA-8S	Resample
M-series well	DMT-35M, EA-38M, EA-8M, EAC-4M	Characterization and/or resample

TABLE A-6
Monitoring Wells Sampled During Phase 3 CTS Investigation

Well Type	Well ID	Sample Purpose
Phase 3 shallow monitoring well	DMT-63S	Site characterization
Phase 3 Upper Sand well	DMT-64US, DMT-65US, DMT-67US, DMT-70US through DMT-75US	Site characterization
Phase 3 M-series well	DMT-77M through DMT-80M	Site characterization
Phase 3 D-series well	DMT-81D, DMT-82D, DMT-83D	Site characterization
Phase 3 Piezometers	TPZ-48 and TPZ-49	Site characterization

A.10 Tidal Studies

Tidal studies have been completed in a total of 75 monitoring wells including shallow wells, upper sand wells, M-Series wells and D-Series wells (Table A-7). The purpose of these studies was to identify the tidally influenced areas and to quantify the tidal response parameters for each affected well. During each tidal study, digital data loggers were used to automatically measure and record the groundwater elevation once every 6 minutes for a period of 6 to 7 days. The two types of data loggers used were the In-Situ Level-Troll 500™ and the In-Situ MiniTroll Pro™. During the initial tidal studies of April and May 2006, one additional data logger was installed as a local tide gauge in the Patapsco River to provide a record of the surface water tidal fluctuations. The tide gauge was installed in a temporary stilling well attached to the vertical bulkhead on the southeast boundary of Area 1400. Evaluation of the data from the local tide gauge showed a very close correlation with the publicly available data from the permanent gauging station operated by the National Oceanographic and Atmospheric Administration (NOAA) at Fort McHenry (Station 8574680), in Baltimore harbor. A local tide gauge was not installed for subsequent 2007 tide studies; rather the tide data was downloaded from the NOAA Web site. In February 2008, a permanent stilling well was attached to the vertical bulkhead just west of the 14th Street outfall and a data logger was installed in this permanent stilling well for each subsequent tidal study.

A.10.1 Analysis of Tidal Response

Linear analysis of groundwater levels in a tidally influenced aquifer assumes that the groundwater, if affected, will fluctuate at the same frequency as the driving tides in the adjacent surface water body. However, the fluctuations will have smaller amplitudes and longer time lags at locations more distant from the source of the tidal signal. These response characteristics are quantified by a tidal efficiency and a time lag, which are assumed to be constants for each well. Identifying these constants is necessary where water levels measured in the well are to be used for aquifer test analysis or for plotting the potentiometric surface to characterize flow patterns and hydraulic gradients.

For aquifer test analysis, the tidal influences must be removed from the time-drawdown data record before the aquifer response to pumping can be quantified. When groundwater levels from several tidally influenced wells are used to plot the potentiometric surface, the measured levels must first be adjusted to a common tidal stage (typically mean tide) so all of the results are relative to the same tidal stage, resulting in a meaningful representation of groundwater flow patterns in the aquifer.

In the case of a time-drawdown data record from an aquifer test, which consists of a sequence of water-level measurements more or less closely spaced in time, the equation for removing the tidal component from each term of the record is

$$h'(t) = h(t) - E_T\,[T(t - t_{lag}) - T_0] \qquad \text{(Eq. 1)}$$

where

$h'(t)$ = the adjusted groundwater level at time t, with tidal influence removed
$h(t)$ = the measure groundwater level at time t
E_T = the tidal efficiency of the well

$T(t)$ = the tide level at time t in the surface water body
t_{lag} = the tidal lag time of the well
T_0 = a reference tide level for comparison with $T(t)$

When Equation 1 is used to remove tidal influence from a sequential record of water levels (i.e., a time-drawdown record), the reference tidal level, T_0, is arbitrary and is taken as the first measurement of the tide record. To adjust a single water level measurement, as in a groundwater-monitoring event, the reference tidal level should be the mean tide. Thus, when groundwater levels from multiple wells are corrected by reference to the mean tidal level, the potentiometric surface map plotted from them will be a representation of the time mean potentiometric surface.

For each of the monitoring wells listed in Table A-7, the groundwater level records collected by the data loggers during the tidal studies were compared with either the tide record obtained from the Patapsco River stilling well or tide data from the Ft. McHenry gauge to identify the tidal efficiency, E_T, and the tide lag, t_{lag}. This was done by trial-and-error application of Equation 1, using different values of efficiency and lag until the tidal influence remaining in the corrected groundwater level record was minimized.

For the tide studies conducted during the voluntary, Phase 1 and Phase 2 events, the calculation procedure was facilitated using an Excel spreadsheet that applied Equation 1 to each measurement in the data record while interactively displaying a graphical representation of the groundwater and tide records and a linear regression of the corrected groundwater record versus the tide. Adjustment of the efficiency parameter, E_T, was guided by the objective of minimizing the linear regression coefficient so that the corrected groundwater elevations were statistically no longer affected by tidal fluctuations. Adjustment of the lag time, t_{lag}, was guided by the objective of minimizing the standard deviation of the corrected groundwater record, thus minimizing the departure of the groundwater levels from their time-mean value. For some of the data sets, non-periodic trends were identified. In these cases, the trends were removed from both the well hydrograph and the tide record by filtering with a 25-hour running average before initiating the linear regression analysis. Hydrographs presented in Attachment C illustrate the results of this process as a graphical comparison of the raw and corrected groundwater level records for each of the tidal study wells.

The tidal record from each Phase 3 well was analyzed using a program published by the U.S. Geological Survey (Halford, 2006). The program is designed primarily for removing extraneous water level changes (e.g., changes due to barometric pressure, earth tides, or regional water level trends) from observation wells during aquifer tests, but the time series function of the program allows for the determination of the barometric efficiency, tidal efficiency, and lag time for influenced wells.

A.10.2 Analysis of Barometric Response

Comparison of the shallow tidal hydrographs with the barometric record for the period of April 26 to May 1, 2006, shows that water levels in many of the shallow wells appear to be affected by barometric pressure changes. In some wells, such as DMT-14S, the water level record is a near mirror image of the barometric record, while in other wells the barometric effects are more subtle. The general pattern of higher water levels recorded at lowest barometric pressure and vice versa was observed in most, if not all, of the shallow monitoring wells. Because of the magnitude of the barometric response in many of the shallow wells, it was thought that the barometric effects may overprint and mask the tidal influence, if present, in the monitoring well. Therefore, it was necessary to remove barometric effects from the shallow groundwater records before analyzing them for tidal influences. This was done by applying a barometric correction equation of the form

$$h''(t) = h(t) - E_B\,[B(t) - B_0] \qquad \text{(Eq. 2)}$$

where

$h''(t)$ = groundwater level at time t, with barometric influence removed
$h(t)$ = the measured groundwater level at time t
E_B = barometric efficiency of the well
$B(t)$ = barometric pressure at time t, measure in feet of water
B_0 = reference barometric pressure for comparison with $B(t)$

TABLE A-7
Monitoring Wells Included in Tidal Studies

	Hydrogeologic Unit			
Date Range	**Shallow Fill Unit**	**Patapsco Aquifer**	**Alluvial Sand Unit**	**Patuxent Aquifer**
April 26–May 1, 2006	DMT-1S, DMT-3S, DMT-12S, DMT-13S, DMT-14S, DMT-15S, DMT-16S, DMT-17S, DMT-18S, EAC-3S, EAC-4S, EA-6S, EA-7S, EA-10S, EA-11S, EA-14S, EA-17S, P-10	–	–	–
May 11–16, 2006	–	DMT-1M, DMT-2M, EAC-1M, EAC-2M, EAC-3M, EAC-4M, EA-2M, EA-3M, EA-5M, EA-6M, EA-7M, EA-8M, EA-9M, EA-10M, EA-11M, EA-13M, EA-14M, EA-15M,	–	–
Feb. 5–12, 2007	–	DMT-34M, DMT-35M, DMT-36M, DMT-37M, DMT-38M	–	–
Nov. 11–18, 2007	DMT-45S, DMT-46S, DMT-56S, DMT-57S, DMT-58S, EA-11S*	–	DMT-50US	–

TABLE A-7
Monitoring Wells Included in Tidal Studies

	Hydrogeologic Unit			
Date Range	**Shallow Fill Unit**	**Patapsco Aquifer**	**Alluvial Sand Unit**	**Patuxent Aquifer**
Dec. 18–24, 2007	–	DMT-60M	DMT-49US, DMT-50US,* DMT-51US, DMT-52US, DMT-54US	–
Nov. 24-Dec 1, 2008	DMT-63S	DMT-77M, DMT-78M, DPT-79M, DMT-80M	DMT-64US, DMT-65US, DMT-67US, DMT-70US, DMT-71US, DMT-72US, DMT-73US, DMT-74US, DMT-75US	DMT-81D, DMT-82D, DMT-83D
March 19-26, 2009	—	—	TPZ-48, TPZ-49	—

* Repeated tidal study for this well.

Equation 2 is very similar to the equation for tidal correction, except that there is no time lag associated with the barometric correction. Also, the barometric efficiency coefficient, E_B, has a negative value, because the groundwater level in a barometrically affected monitoring well is depressed by increasing atmospheric pressure. The barometric efficiency for each well was obtained using a trial-and-error procedure similar to that used in the tidal analysis. The result of the barometric efficiency calculation in Table A-8 shows, for example, that DMT-01S, which had a low efficiency percentage of -3.5 showed a fluctuation in groundwater elevation of only 0.06 feet. In contrast, DMT-08S, which had a barometric efficiency percentage of -90.9, showed a much greater fluctuation in groundwater elevation—1.07 feet—during the tidal study. As a result, it can be noted that the greater the barometric efficiency, the greater the fluctuation in the groundwater elevation.

TABLE A-8
Barometric Efficiency

Well ID	Barometric Efficiency (%)	Well ID	Barometric Efficiency (%)
DMT-1S	-3.5	DMT-10S	-53
DMT-3S	-8.1	DMT-20S	-50.9
DMT-12S	-60.5	DMT-25S	-28.6
DMT-13S	-48.2	P-3	-29
DMT-14S	-67.5	TPZ-B	-33.7
DMT-15S	-68.5	TPZ-24	-40
DMT-16S	-6.25	DMT-63S	-39.8
DMT-17S	-11.5	DMT-49US	-58
DMT-18S	-21.65	DMT-50US (Nov. 2007)	-22
EAC-3S	-44	DMT-50US (Dec. 2007)	—
EAC-4S	-13.1	DMT-51US	-34

TABLE A-8
Barometric Efficiency

Well ID	Barometric Efficiency (%)	Well ID	Barometric Efficiency (%)
EA-6S	-4.3	DMT-52US	-81
EA-7S	-80	DMT-54US	-27
EA-10S	-10.2	DMT-64US	-39.2
EA-11S	-9.74	DMT-65US	-40.1
EA-14S	-5.37	DMT-67US	-63.3
EA-17S	-49	DMT-70US	-1.3
P-10	-70	DMT-71US	-99.9
DMT-45S	-83.7	DMT-72US	-1.0
DMT-46S	-29.6	DMT-73US	-53.8
DMT-56S	-54.2	DMT-74US	-62.7
DMT-57S	-24.5	DMT-75US	-63.5
DMT-58S	-10.8	TPZ-48	-96.0
DMT-2S	-7.8	TPZ-49	—
DMT-7S	-83.3	DMT-81D	-46.8
DMT-8S	-90.9	DMT-82D	-58.1
DMT-9S	-71.67	DMT-83D	-70.0

Summary of Barometric Response

Barometric effects were widespread in the shallow wells, upper sand wells, and D-Series wells, but these effects are generally negligible for the M-Series wells (Table A-8). The barometric efficiency values are distributed in a non-uniform manner across the site, with the highest efficiencies generally between 12th and 14th Streets and lower values in the southwest corner of DMT. A clear barometric response is somewhat unusual for wells in shallow unconfined aquifers, where atmospheric pressure changes are expected to act with almost equal effectiveness on both the free water surfaces in open wells and on the water table outside the wells. The shallow fill unit at DMT, however, is covered almost entirely with pavement, which may inhibit the downward propagation of atmospheric pressure changes to the water table. Also, in some parts of the site the aquifer materials at the water table consist of COPR fill, which may be more or less lithified and may have relatively low permeability to both air and water. This could also inhibit equalization of atmospheric pressure between the water table and the water surfaces in open wells, thus causing barometric response in the monitoring wells.

The barometric response has no overall effect on groundwater flow at the site, but since the water levels at individual wells are affected differently, the barometric response may affect the interpretation of potentiometric surface maps or comparisons of water levels in individual wells over time. Under normal conditions barometric pressure tends not to vary at extreme levels that would require the correction of measured water levels. To minimize the effects of atmospheric pressure change, synoptic water levels in a series of wells should be collected over the shortest span of time possible and the barometric changes during the measurement period should be evaluated after the results have been obtained.

A.11 Synoptic Water Level Monitoring

The methodology for the nine synoptic water level measurement rounds was consistent for each of the events. Prior to obtaining the measurement, the well caps at each location were removed and the water level was allowed to equilibrate with atmospheric pressure for a period of time. After equilibration, water level measurements were collected manually using an electronic water-level probe. The times of the measurements for each well were recorded to the nearest minute so that any necessary tidal corrections could be made. All groundwater elevations calculated from the manual groundwater depth measurements are referenced to the BCD. The measurement times and calculated groundwater elevations for the nine synoptic rounds are presented in Attachment D. Potentiometric maps for April 28, 2006; May 15, 2006; January 18, 2007; April 23, 2007; September 24, 2007; November 19, 2007; and March 14, 2008, are presented in Figures C-3 through C-14. Potentiometric maps for November 24, 2008, and June 2, 2009, are presented in the main body of the CTS.

A.12 Aquifer Test Methods and Analysis

A.12.1 Slug Tests

In January 2006, slug tests were conducted in monitoring wells DMT-1S, -2S, and -4S through -10S to quantify spatial variations in the hydraulic properties of the shallow fill unit and plan for the placement of aquifer test wells. Two rising-head slug tests were performed in each of these monitoring wells.

Methodology

Before each slug test, a digital data logger (Solinst Levelogger™) was installed in the well to a depth of several feet below the static water level. After equilibration, the static depth to water was measured and recorded. The data logger was securely fastened in the well and programmed to record the depth of water above the sensor at half-second intervals. For each rising-head test, a displacement slug was lowered into the well and held steady for 2 to 3 minutes while the water level stabilized. The slug was then rapidly removed from the well to conduct a rising-head test by monitoring the recovery of the water level to its pretest position. Recovery was usually complete in less than 1 minute. At least two tests were run in each well. All equipment that entered the well was decontaminated before testing was started and before the equipment was moved to test a new well. After each test, the data logger was downloaded and the test results were examined.

Slug Test Analysis and Results

The slug test data sets were analyzed by AQTESOLV™ using the Bouwer-Rice solution method. The graphical AQTESOLV™ analysis sheets are presented in Attachment E. The tests run in well DMT-3S produced oscillating water levels that could not be analyzed. The oscillations are believed to have been the result of contact between the test slug and the data-logger cable as the slug was being withdrawn. In the remaining wells, the duplicate tests generally produced consistent estimates of hydraulic conductivity.

The Bouwer-Rice solution was developed to accommodate the analysis of slug tests in unconfined aquifers and is theoretically appropriate for these slug tests. Additional complications are encountered when the well is screened in a gravel pack that intersects the water table, as was the case in all of the slug test wells. In such cases, the change in water level caused by inserting or removing the test slug causes movement of the water surface in both the well casing and the gravel pack. If the gravel pack has significantly higher hydraulic conductivity than the aquifer, this often produces a time-displacement curve that is concave upward and segmented, instead of being straight in the semilog plot, as required by the analytical procedure. The tests in wells DMT-5S, -6S, -7S, and -8S yielded responses of this type. For these cases, the preferred method is to ignore the initial straight-line segment (which is attributed to the gravel pack) and use the slope of the second straight segment of the response for the analysis. In some of the test results that showed this type of behavior, the second straight segment was difficult to identify. This is true of the results for wells DMT-6S and DMT-7S, the two wells that produced the lowest hydraulic conductivity estimates (7.91 to 10.15 feet/day). These wells are located between 12th and 13th Streets, an area of relatively thick COPR fill. The low estimated hydraulic conductivity values may be due to the high proportion of COPR in the aquifer, but they could also be a product of the interpretation used in the analysis.

The highest hydraulic conductivity estimates, ranging from 39.45 to 57.02 feet/day, were obtained from the tests in wells DMT-1S and DMT-2S, at the western end of the site. This is an area where the aquifer is composed of non-COPR fill. The time-displacement curves from these wells were relatively straight, suggesting that the assumptions underlying the Bouwer-Rice method were valid for these wells.

The test results for wells DMT-5S and DMT-8S through DMT-10S yielded hydraulic conductivity estimates in the range of 13 to 20 feet/day. Although these wells are located in areas of COPR fill, the boring logs show that all the screens penetrate a layer of silty sand beneath the COPR that is 10 to 15 feet thick.

A.12.2 Pumping Test Procedures and Analysis

Aquifer-pumping tests have been conducted at five locations at DMT, one in the Patapsco Aquifer and four in the shallow fill unit. Because of challenging site conditions, several attempts were required at some locations to obtain useful test data. The testing activities for each location are described below, and test results are summarized in the CTS report. Graphical presentations of the test data and the analysis of the time-drawdown records are provided in Attachment F.

Pumping Tests at Patapsco Aquifer Well DMT-1M

Well DMT-1M was installed in December 2005 and January 2006 as the pumping well of an aquifer test cluster. The other wells in the test cluster were three small-diameter temporary piezometers—TPZ-1, -2, and -3—and monitoring well EA-9M, which was a recently constructed replacement for an existing well of the same name that was found to be damaged. Figure A-2 shows a stratigraphic column based on the lithologic log collected during installation of DMT-1M. The figure also shows the relative locations and screen elevations of the wells in the test cluster.

Wells DMT-1M and EA-09M are both screened in the Patapsco Aquifer, which corresponds to the sand and gravel layers shown in Figure A-2 at elevations between -82.87 and -100.87 feet (BCD). These two wells were used to test the hydraulic properties of the Patapsco Aquifer in two constant-rate aquifer tests performed in June and November 2006. In these tests, DMT-01M was the pumping well, and EA-09M was used as the primary drawdown observation well.

The three temporary piezometers were installed in clay and silt layers between elevations -34.87 and -79.87 feet (BCD). These silt units, together with the clays between -57.87 and -73.87 feet (BCD), make up the Patapsco confining unit, which separates the Patapsco Aquifer from the upper sand unit (-27.87 to -34.87 at DMT-1M) and overlying shallow fill unit. The temporary piezometers were designed for observation of drawdown in the confining unit during the Patapsco Aquifer test. It was intended that the drawdown records from the temporary piezometers would be analyzed by the ratio method of Neuman and Witherspoon (1972). However, for reasons explained below, the data records obtained from them were not suitable for analysis by that method.

Step-Drawdown Test. A step-drawdown test was conducted on June 8, 2006, to establish a suitable flow rate for the constant rate test. The pumping well, DMT-01M, and one observation well, EA-09M, were used for the test, and groundwater elevations were recorded by data loggers (In-Situ Level-Troll 700™) installed in both wells. The pumping well was equipped with a 230-volt Grundfos Redi-Flow III™ pump rated for 22 gpm at 240 feet of total dynamic head. Flow rate was regulated though the use of a gate valve mounted on the discharge line, and the flow rate was obtained by routing extracted groundwater through a totalizing flowmeter.

The step-drawdown test was conducted in increments of 10, 12.5, and 15 gpm because development logs suggested that the maximum yield in the well would be approximately 15 gpm. The 10-gpm step was maintained for 1 hour and 21 minutes; the 12.5-gpm step was maintained for 1 hour and 4 minutes; and at a flow rate of 15 gpm, the water level in the well was immediately drawn down to the pump intake. The final (15-gpm) step in the test was terminated after 14 minutes because of excessive drawdown in the test well.

A preliminary analysis of data collected in observation well EA-9M suggested that the aquifer should support a higher yield than was demonstrated by well DMT-1M during the step test. Therefore, prior to the constant rate test, both the observation well and pumping well were redeveloped. Observations during the redevelopment indicated that well production was restricted because the formation immediately surrounding the well screen was clogged with drilling mud. The redevelopment program was extended to include the four pump-test wells that had been installed in the shallow fill unit.

Although a second step-drawdown test was not formally conducted after redevelopment of DMT-1M, short yield tests conducted after drilling mud was removed did show that the redeveloped well would produce higher flow rates than had been observed in the step-drawdown test. Consequently, it was decided that a flow rate of 25 gpm would be used in the constant-rate pumping test to adequately stress the aquifer.

First Constant-Rate Test. The first constant-rate pumping test at DMT-1M was conducted over a period of 48 hours, starting June 19, 2006, and ending June 21, 2006. The pumping well was DMT-01M, and the observation wells were EA-09M, -06M, and -13M; EAC-02M and -03M; and the three small-diameter temporary piezometers (TPZ-1, -2, and -3). The piezometers and wells were equipped with data loggers (In-Situ Level-Troll 700™) that continuously recorded groundwater elevations during the constant rate test. The pump-and-flow measurement setup used in the step drawdown test was used for the constant-rate test. Within the first few hours after startup, it was observed that routing water through the totalizer led to brief increments of flow loss. For the remainder of the test, flow rates were obtained by recording the time to fill a graduated 5-gallon container.

Hydrographs of the raw and tidal corrected data collected during the constant rate aquifer test are presented in Attachment F. Tidal effects were removed from the observation well data sets using the tidal correction equation. The tidal data used in the correction were obtained from the Ft. McHenry tide station.

Tidal-corrected data from the constant-rate pumping test were analyzed to generate estimates of the transmissivity and storage coefficient of the Patapsco Aquifer. The data from each of the observation wells were analyzed using the AQTESOLV™ software package. Corrected time-drawdown and recovery records from each observation well were matched by the software to the Theis (1935) drawdown equation for radial flow in a confined aquifer. The drawdown portions of the record were analyzed for a constant flow rate of 28 gpm. A complete description of the analysis procedure and the derivation of results are provided in Attachment F.

Temporary piezometers TPZ-1, -2, and -3 were monitored during the constant-rate pumping test with the intention of using the time-drawdown records collected from them to analyze the vertical flow properties in the Patapsco semi-confining unit by the Newman-Witherspoon ratio method. These piezometers were installed using small-diameter (1-inch) casings to minimize the volumetric storage associated with changes in water levels in the piezometers, thus increasing their sensitivity to pressure changes in the low-permeability soils of the semi-confining unit. It was found, however, that the two deeper piezometers, TPZ-2 and TPZ-3, were still not sensitive enough to record pressure changes in the semi-confining unit during the test. However, the declining water levels in TPZ-2 and TPZ-3 after the data loggers were installed were analyzed as slug tests.

In piezometer TPZ-1, the initial displacement caused by installation of the data logger dissipated in less than 1 hour, and the subsequent measurements appeared to be representative of the potentiometric head in the confining unit. In this sense, the piezometer functioned as intended; however, the water-level record did not show any detectable drawdown signal resulting from the drawdown produced in the Patapsco Aquifer by pumping at well DMT-01M.

Second Constant-Rate Test. To overcome the insensitivity of temporary piezometers TPZ-1, -2, and -3, a set of packers was constructed so that the piezometer casings could be sealed above the data logger after it was installed. The packers isolated the data loggers from the atmosphere and prevented any movement of the water surfaces in the piezometers so that pressure variations in the porous matrix outside the piezometer screens would be registered directly by the data loggers. Because the piezometers were isolated from changes in atmospheric pressure by the packers, it was not considered necessary to use vented differential pressure transducers. Instead, non-vented transducers were used in these three piezometers.

Using these packers to seal the piezometers, a second aquifer test was run in well DMT-01M. Pumping started at 9:45 a.m. on October 31, and continued at 28 gpm until 10:03 a.m. on November 2. The only observation wells monitored during this test were the three packered piezometers in the semiconfining unit and well EA-9M in the Patapsco Aquifer.

The water-level record for observation well EA-09M during the 48 hours of the second DMT-1M pumping test is presented in Attachment F. Also shown are the tide record for that period and the tide-corrected water level record, which was analyzed for drawdown. A notable feature of the raw water-level record is the sudden rise that occurred about 1:30 a.m. on November 2. Although the graph is truncated at elevation -0.5 feet (BCD) in the figure, the actual water level rose rapidly to the elevation of the ground surface and stayed there for approximately 5 hours before rapidly declining to the previous level of drawdown just before termination of pumping. This disturbance evidently corresponds to a rainfall event in which runoff ponded on the ground surface and filled the well for the duration of the storm. The tide-corrected record shown in the figure for the period before the storm event reveals a maximum drawdown of approximately 2.3 feet, which is consistent with the results observed in the first aquifer test at DMT-1M.

The pressure records collected in the packered piezometers during the second DMT-1M pumping test showed that the TPZ-1 and TPZ-3 were very sensitive to pressure changes in the semi-confining unit. The packer in TPZ-2, however, provided only a partial seal, so that the record from that piezometer was not useful for interpretation. In spite of its sensitivity, piezometer TPZ-3 did not show a detectable drawdown resulting from the pumping in well DMT-1M. This lack of response was attributed to the relatively low hydraulic conductivity of the soils in the lower part of the semi-confining unit. While this lack of hydraulic response precluded the planned application of the Neuman-Witherspoon analysis procedure, an alternative analysis estimated an upper bound of 6×10^{-4} ft/day (2.1×10^{-7} cm/s) for the vertical component of hydraulic conductivity of the soils between the screen of TPZ-3 and the transmissive sand and gravel aquifer of the lower Patapsco Formation. The details of the alternative analysis and the hydrographs obtained from the piezometers are given in Attachment F.

Shallow Fill Unit Tests. Aquifer-pumping tests were run in each of the four test wells in the shallow fill unit: DMT-21S, -23S, -24S, and -25S. The four test locations were chosen with the objective of evaluating the hydraulic properties of the aquifer in areas that were representative of different fill characteristics. At each test site, a 4-inch test well was installed approximately 20 feet from a shallow monitoring well that was designated as the primary observation well for aquifer testing. Additional wells at greater distances were also monitored during each of the tests, but these did not always provide useful data.

Aquifer Testing at DMT-24S

Step-Drawdown Test. On June 2, 2006, a step drawdown test was conducted to determine a suitable flow rate for constant rate aquifer testing. The pumping well, DMT-24S, and one observation well, DMT-08S, were outfitted with data loggers (Level-Troll 700™) to continuously record groundwater elevations during the test. A 230-volt submersible pump, rated at approximately 20 gpm at 20 feet of head pressure, was installed in DMT-24S, and the flow rate was controlled with a gate valve mounted on the discharge line. Flow rates were monitored by routing the discharged water through a totalizing flowmeter. The step test was conducted at increments of 5.6, 10, and 15 gpm. The 5-gpm step duration was 1 hour and 44 minutes; the 10-gpm step duration was 1 hour and 36 minutes; and the 15-gpm-step duration was 1 hour and 3 minutes. The 15-gpm step was terminated early because the pump would not maintain a 15-gpm flow rate. Based on these results, a target pumping rate of 12.5 gpm was chosen for the planned constant rate pumping test.

The step-drawdown test produced a drawdown response of approximately 1.5 feet in observation well DMT-8S. The time-drawdown record from this well was analyzed using a variable-rate application of the Theis equation, which was implemented using the AQTESOLV™ software package. This resulted in a transmissivity estimate of 520.9 ft^2/day and a storage coefficient estimate of 0.0085. The graphical curve match is shown in Attachment F.

Variable-Rate Aquifer Tests. Based on the results of the step-drawdown test, it was expected that a 24-hour aquifer test pumping at 12.5 gpm could produce drawdown response at a considerable distance from the test well. Therefore, data loggers were installed in seven observation wells at distances ranging from 18 feet (DMT-08S) to 682 feet (P-9) from test well DMT-24. Five attempts were required before a full 24-hour pumping test could be completed in well DMT-24S. The difficulty in running the test was caused by the high dissolved calcium content of the groundwater at this test well, which fouled the pump and discharge lines. In none of the tests could a constant pumping rate be maintained. However, enough hydraulic response was generated at the nearest observation well (DMT-08S) in two tests to permit an evaluation of aquifer flow parameters.

First Aquifer Test. The first attempt at a sustained pumping test took place on June 5, 2006. As in the step draw-down test, the submersible pump was used to pump the well, and a totalizing meter was used to determine flow rate. The test ran at 12.5 gpm for 3 hours and 20 minutes before the pumping rate began to decline, with a resultant decrease in drawdown in the test well. After it was shut down, it was observed that the inlet screen of the totalizing flowmeter was clogged and was restricting water discharge.

Second Aquifer Test. A second attempt was made on June 6, 2006. The same pumping equipment was used, but a diversion system was constructed so that water could be periodically routed through the totalizer to determine the flow rate. The test ran for 1 hour before the target 12.5-gpm flow rate could no longer be maintained, and the test well began to recover. Within 3 hours and 30 minutes after startup, the flow rate was reduced to less than 5 gpm and the test was terminated.

Third Aquifer Test. A third aquifer test was conducted at DMT-24S on June 28, 2006. A 1.5-horsepower jet pump (Dayton Model 4TB24), equipped with a deep well ejector package rated at 24.5 gpm at 20 feet of total dynamic head, was used. A 12.5-gpm flow was maintained for approximately 30 minutes, but within 2 hours and 20 minutes the flow was reduced to less than 5 gpm. When the pump ejector was removed from the well, it was observed that the ejector nozzles and piping were encrusted and scaled with precipitant.

Fourth Aquifer Test. A fourth test was run on June 29, 2006. The jet pump was again used, but to minimize flow restrictions and clogging problems, the ejector package was removed from the pump. Flow was maintained above 20 gpm for approximately 30 minutes. Within 3 hours and 20 minutes after startup the flow rate was reduced to 7 gpm and the test was terminated. It was later observed that the hose barbs, piping, and the swing check valve used in the pump test were completely encrusted and scaled with precipitant. Although this test experienced a continuously declining flow rate, the total volume of groundwater extracted was greater than in any of the previous tests. It produced a clearly defined time-drawdown curve in observation well DMT-08S, with a maximum drawdown of approximately 3.2 feet. This drawdown response was analyzed as a variable-rate aquifer test using the Theis equation. The estimated aquifer parameters were a transmissivity value of 393.7 ft^2/day and a storage coefficient of 0.0027.

Fifth Aquifer Test. The fifth aquifer test at DMT-24S was run January 2 through January 4, 2007. For this test, a constant-displacement double-diaphragm pump was used (Graco Husky Model 1590). This pump was chosen for its corrosion resistance and its minimization of submerged moving parts, which was expected to reduce susceptibility to precipitation and clogging. The pump was driven by compressed air, and was located aboveground with a suction line inserted into the test well. The pumping rate was measured periodically by routing the pump discharge into a graduated 250-gallon poly tank. This tank drained into a larger frac tank, where the extracted groundwater was stored for later transport to the groundwater treatment plant.

The test started at 3:55 p.m. on January 2, 2007, with a pumping rate of 15 gpm. This rate was maintained for approximately 7 hours until the air compressor supplying power to the pump failed. The test was restarted at 10:20 a.m. on January 3 at a pumping rate of 13 gpm, and pumping continued at a declining rate until pump failure at 10:20 a.m. on January 4. The pumping rate just before failure was 5 gpm. The test produced more than 3 feet of drawdown in observation well DMT-8S. The more-distant observation wells did not yield time-drawdown records that were clear enough to analyze.

The time-drawdown record from observation well DMT-8S covered a period of 70 hours, 35 minutes, including 11½ hours of down time after the compressor failure and 28 hours of recovery after cessation of pumping. After barometric correction of the data, the record was analyzed in three different ways. Drawdown during the first 7 hours of pumping, prior to compressor failure, was analyzed as a separate test, yielding a transmissivity estimate of 546.6 ft^2/day and a storage coefficient of 0.00045. This transmissivity estimate is similar to that obtained from the step-drawdown test. Next, the entire 70-hour record was analyzed as a variable-rate test with multiple recovery periods. This resulted in a transmissivity estimate of 316 ft^2/day and a storage coefficient of 0.0033. Finally, the restart portion of the test after the compressor failure was analyzed as a separate 24-hour aquifer test with a 28-hour recovery period. This yielded a transmissivity estimate of 296 ft^2/day with a storage coefficient of 0.0023. The graphical matches produced during analysis of these test segments are presented in Attachment F.

Aquifer Testing at DMT-23S

Preliminary Pumping Test. A preliminary pumping test was run in well DMT-23S on November 3, 2006, to select an appropriate pumping rate for a constant-rate aquifer test. The preliminary test was intended to be run as a step-drawdown test, and was started at 12:00 p.m. with a pumping rate of 5 gpm. After 3½ hours of pumping, excessive drawdown in the test well necessitated a reduction in pumping rate to 4.3 gpm. Pumping continued at 3.4 gpm until 5:00 p.m., and, since the drawdown appeared to stabilize at approximately 9 feet, the preliminary test was terminated.

53-Hour Aquifer Test. Digital data loggers (In-Situ MiniTroll Pro™) were installed in four observation wells in addition to the test well to monitor the DMT-23S aquifer test. The observation wells and their distances from the test wells were the following: DMT-2S at 24.6 feet, DMT-3S at 218 feet, EA-14S at 303 feet, and DMT-1S at 455 feet.

The aquifer test was started at 7:03 a.m. on November 4, 2006, with a pumping rate of 4.3 gpm. This rate was maintained until 8:00 a.m. the following day, when it was lowered to 3.5 gpm because drawdown in the test well was approaching 15 feet. With this flow reduction, the water level in DMT-23S recovered appreciably, and the rate was increased to 3.75 gpm at 9:00 a.m. and increased again to 4 gpm at 9:45 a.m. The rate was again reduced to 3.5 gpm at 12:30 p.m. on November 5, and that rate was maintained until the end of the test, at 12:00 p.m. on November 6, 2006.

Pumping at DMT-23S produced a maximum drawdown of approximately 0.3 feet in the closest observation well, DMT-2S. This drawdown record, while small in magnitude was a clear and distinct response to the test. After barometric correction of the time-drawdown record, it was analyzed, using AQTESOLV™, as a variable-rate pumping and recovery test based on the Theis equation. This produced a transmissivity estimate of 1,052.5 ft^2/day and a storage coefficient of 0.027. The 53-hour aquifer test at DMT-23S did not produce a detectable hydraulic response in any of the more-distant observation wells beyond DMT-2S.

Aquifer Testing at DMT-21S

Two aquifer tests were run at DMT-21S. The first was conducted in November 2006 but was not successful because of monitoring problems caused by inclement weather. The second test was run in January 2007. Although the second test was cut short by equipment problems, it yielded data that could be analyzed to estimate the flow properties in the former airport area of DMT. Both aquifer tests at DMT-21S used wells DMT-20S and TPZ-24 as observation wells.

Preliminary Pumping Tests. Two preliminary pumping tests were run at well DMT-21S on November 7, 2006, to test the pumping equipment and select an appropriate pumping rate for a planned 48-hour constant-rate aquifer test. The first pretest was started at 10:24 a.m. on November 7, 2006, with a pumping rate of 0.55 gpm. This rate was maintained for 5 hours and 20 minutes, resulting in a drawdown of approximately 12 feet in the test well. The rate was then increased to 2.5 gpm for 15 minutes before the test was terminated with a drawdown of approximately 26 feet in the test well.

A second preliminary test was run on November 13, 2006. It started at 1:10 p.m. with a pumping rate of 2 gpm. The pumping rate was reduced to 1.2 gpm after 5 minutes, and reduced again to 1 gpm after 2 more minutes. The pumping rate of 1 gpm was then maintained for 3 hours and 13 minutes with a stable drawdown of approximately 20 feet in well DMT-21S.

First Aquifer Test. The 48-hour aquifer test was started at 7:20 a.m. on November 14, 2006, at a pumping rate of 1 gpm. This flow rate was not intentionally reduced throughout the duration of the test. However, several checks of the flowmeter showed that the rate had dropped off to 0.5 gpm and had to be increased. Pumping was terminated at 7:30 a.m. on November 16.

This test did not produce satisfactory drawdown data from the observation wells. The data loggers had been installed in the test well and two observation wells on November 7. On November 8, the two observation wells appear to have been flooded by storm runoff, and it is likely that some rainwater entered the transducer vent tubes during those events.

Second Aquifer Test. The second aquifer test was run on January 9, 2007, with pumping in well DMT-21S and with wells DMT-20S and TPZ-24 instrumented as observation wells. All three wells were provided with temporary 2-foot risers to prevent the entry of ponded storm runoff in case of rain. Pumping started at 8:55 a.m. at a rate of 1gpm, and the pump was readjusted every few minutes to maintain that rate as the water level went down in the test well. By 10:23 a.m., the drawdown in the test well was more than 32 feet and had reached the submersible pump. Therefore, the pumping rate was reduced to 0.6 gpm. Thereafter, the pumping rate was adjusted approximately every 5 minutes to maintain a water level just above the top of the pump. This resulted in a pumping rate that declined gradually until 1:45 p.m., when it stabilized at 0.57 gpm. At about 4:36 p.m., the pump failed, and the test was terminated after a total of 7 hours and 41 minutes of pumping.

Although this aquifer test did not achieve the planned 24-hour duration, it did result in measurable hydraulic responses in the observations wells. The barometrically corrected time-drawdown curves and graphical analysis by the Theis method are shown in Attachment F.

Observation well DMT-20S, 19.6 feet east of the test well, experienced maximum barometrically corrected drawdown of approximately 0.26 feet. The time-drawdown record was analyzed using AQTESOLVE™ to perform a variable-rate Theis analysis resulting in a transmissivity estimate of 65 ft^2/day with a storage coefficient of 0.024.

Observation well TPZ-24, 20.4 feet northeast of the test well, showed a maximum barometrically corrected drawdown of 0.29 feet. Analysis by the variable-rate Theis method produced estimates of approximately 108 ft^2/day for transmissivity and 0.009 for storage coefficient.

Aquifer Testing at DMT-25S

A preliminary pumping test was run in well DMT-25S on November 21, 2006, to select an appropriate pumping rate for constant-rate aquifer testing. It was determined that a pumping rate of 0.5 gpm should be satisfactory for a 48-hour constant-rate test. Two aquifer test attempts were subsequently made at DMT-25S, with wells DMT-10S and TPZ-B instrumented as observation wells. However, neither of these tests resulted in detectable hydraulic responses in the observation wells.

First Aquifer Test. The first aquifer test was run from 4:00 p.m. on November 27 to approximately 3:30 a.m. on November 30, 2006. The test duration was approximately 57 hours and 30 minutes. The initial pumping rate was 0.5 gpm, but the rate declined as the drawdown in DMT-21S increased, and at 7:45 a.m. on November 28, it was only 0.25 gpm. The pumping rate was reset to 0.5 gpm, but the drawdown in the test well continued to increase, necessitating continued reductions in the pumping rate to avoid dewatering the submersible pump. By the morning of November 29, the pumping rate had been reduced to 0.25 gpm, and sometime between 3:00 a.m. and 4:00 a.m. on November 30, the pump stopped.

Data-logger records from observation wells DMT-10S and TPZ-B (19 feet and 89 feet from the test well, respectively) showed no responses that could be attributed to the pumping of well DMT-25S. Instead, both records were inversely correlated to variations in air temperature at the site. This suggests that the transducer vent tubes were clogged throughout the test.

Second Aquifer Test. The second aquifer test at DMT-25S was run on January 10 and 11, 2007. New data loggers (In-Situ MiniTroll Pro™) were tested and installed in the test well and observation wells prior to the start of the test. Pumping in well DMT-25S started at 10:10 a.m. on January 10, with an initial pumping rate of 0.5 gpm. The pumping rate was carefully monitored and readjusted to maintain a constant rate every 5 minutes for the first 97 minutes of the test. By 11:47 a.m., the drawdown in the test well had increased to within 1 foot of the submersible pump, and the pumping rate had to be reduced to 0.375 gpm. This rate was maintained, with a few minor variations, until the test was terminated, at 10:15 a.m. on January 11. The total test duration was 24 hours and 5 minutes.

The water-level records obtained from observation wells DMT-10S and TPZ-B were compared with manual measurements that were taken throughout the test and appeared to be accurate. However, after the records were corrected for barometric variations, no hydraulic responses to the pumping in well DMT-25S could be discerned. Consequently, no analysis of the observation well data was possible.

Analysis of the recovery data obtained from the test well after the cessation of pumping was attempted. The recovery records were examined using the Theis recovery and Papadopulos-Cooper recovery methods. The recovery data did not fulfill the requirements of the Theis recovery method (did not plot on a straight line) well enough to permit analysis. Although the data also matched poorly to the Papadopulos-Cooper recovery curve, an analysis was completed using a best least-squares fit (Attachment F). This resulted in a transmissivity estimate of approximately 4.8 ft^2/day. The accuracy of this estimate is highly uncertain. However, it was clear from the well and aquifer behavior observed during the test that a relatively low transmissivity is realistic.

A.13 References

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CH2M HILL. 2009b. Phase 3 Groundwater Investigation Data Report, Dundalk Marine Terminal, Baltimore, Md.

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Halford, K. J. 2006. Documentation of a Spreadsheet for Time-Series Analysis and Drawdown Estimation. *Scientific Investigations Report 2006-5024*. U.S. Geological Survey. Reston, Va.

Theis, C. V. 1935. The Relation between Lowering of the Piezometric Surface and Rate and Duration of Discharge of a Well Using Groundwater Storage. *Transactions of the American Geophysical Union*. Vol. 16. pp. 519–524.

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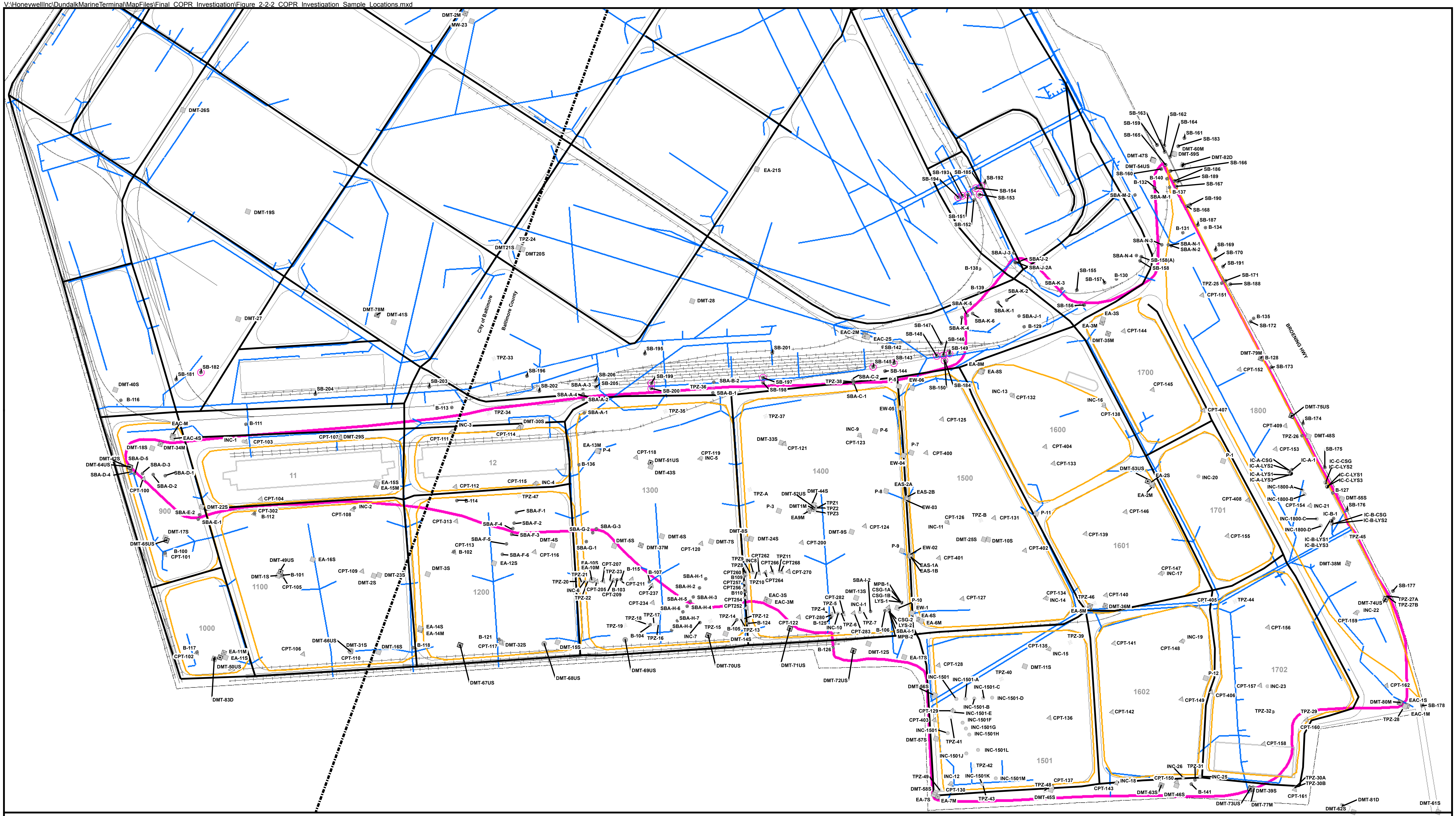

Legend

▪	Shallow Well	○	Shallow COPR Present
◆	D-Series Well	▬ ▪ ▪ ▬	County/City Boundary
▣	Upper Sand Well	—	Curb
⊠	M-Series Well	┼─┼	Railroad Centerline
✛	Piezometer	—	Storm Sewer Line
◑	Lysymeter	▭	Areas
●	Inclinometer	▭	Buildings
▲	CPT Boring	▬	COPR Extent (CH2M Hill, 2009)
●	Soil Boring	⬚	DMT Boundary

N
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0 100 200 400
Feet

FIGURE A-1

Sample Locations

Chromium Transport Study

Dundalk Marine Terminal, Baltimore, Maryland

CH2MHILL

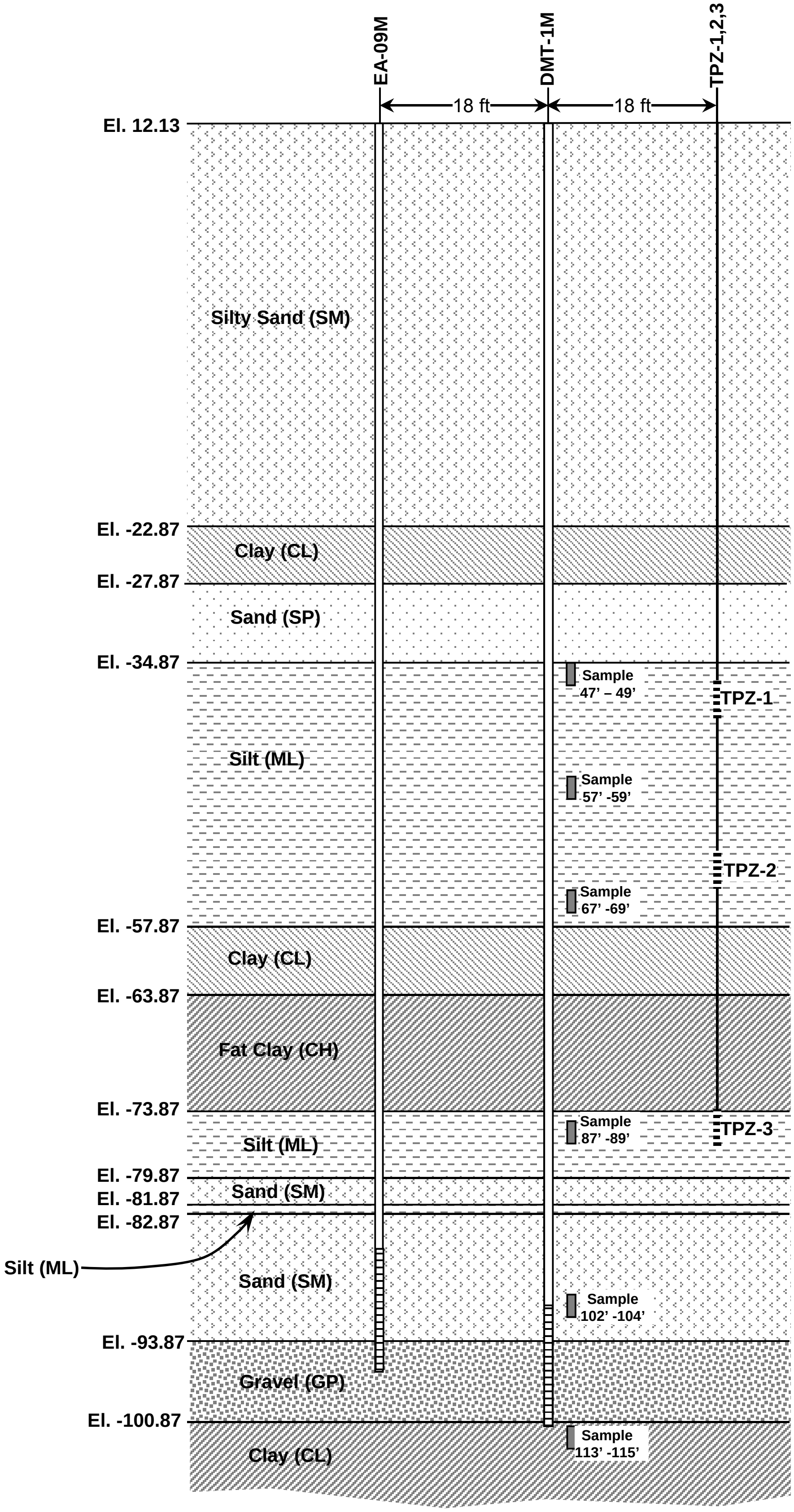
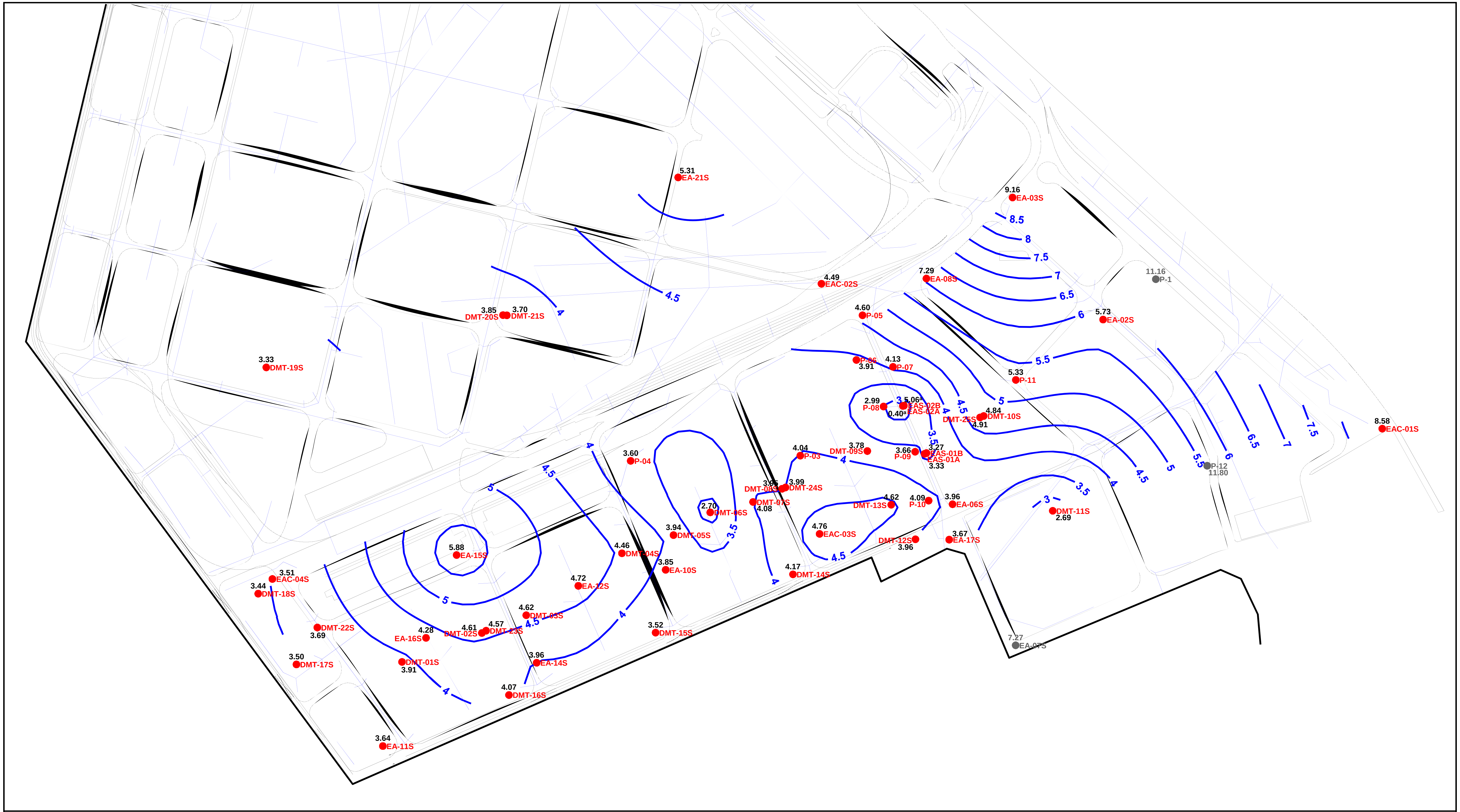


Figure A-2
Stratigraphic Column and Well Configurations at the DMT-01M Aquifer Test Cluster



Legend

3.36 ● EA-17S	Shallow Well and Water Level
7.27 ● EA-07S	Non-Aquifer Well and Water Level
—4—	Shallow Aquifer Potentiometric Contour
0.40ª 5.06ª	Water Levels Averaged for Contouring

(All Levels in Feet, Baltimore City Datum)

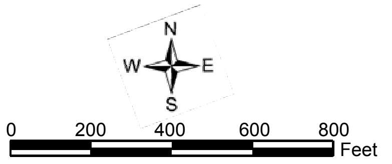
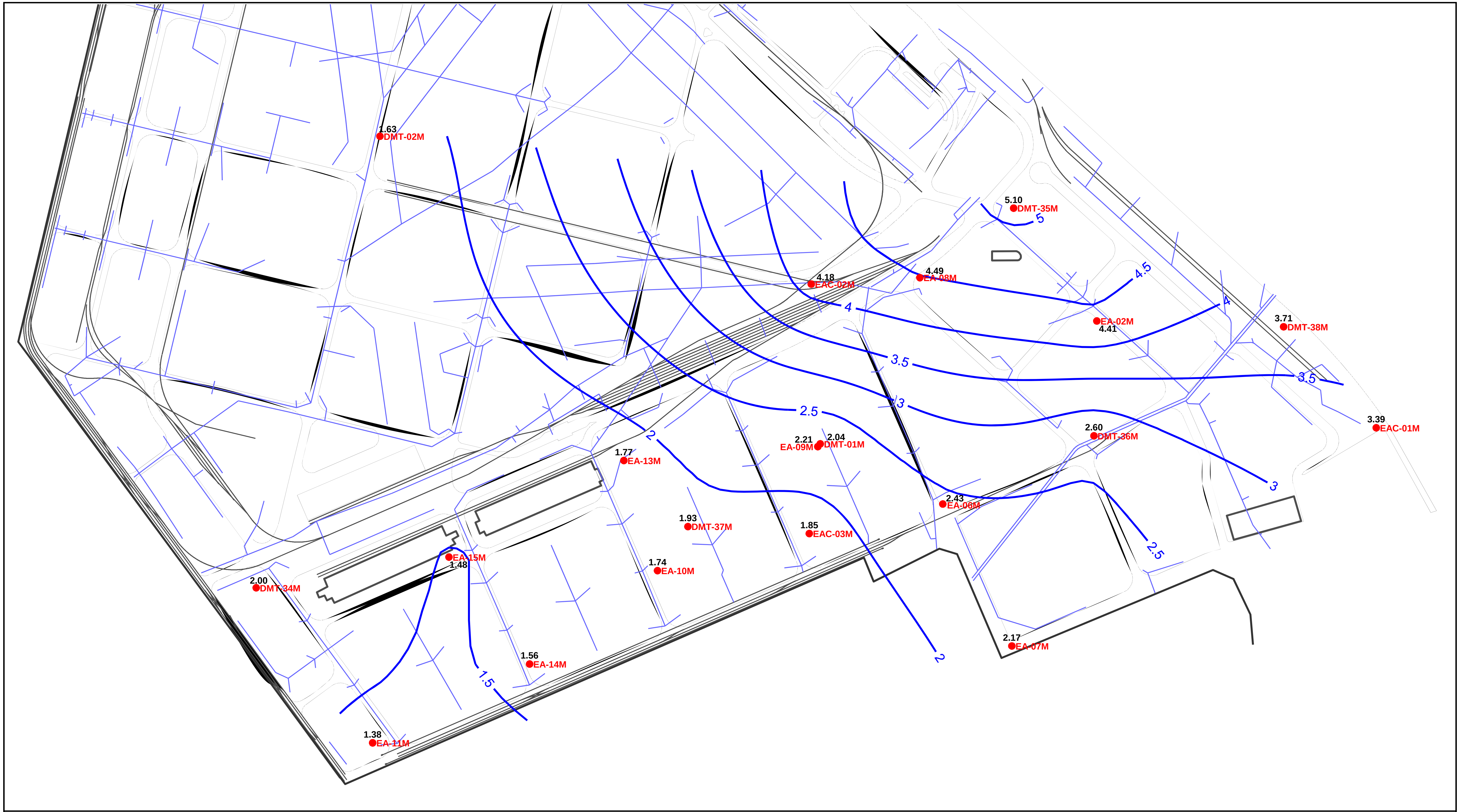


Figure A-3
Water Levels Measured in the Shallow Fill Unit
April 28, 2006

Dundalk Marine Terminal
Baltimore, Maryland

CH2M HILL



Legend

1.23 ● EA-11M	Patapsco Well and Water Level
—4—	Patapsco Aquifer Potentiometric Contour

(All Levels in Feet, Baltimore City Datum, adjusted to mean tide)

N
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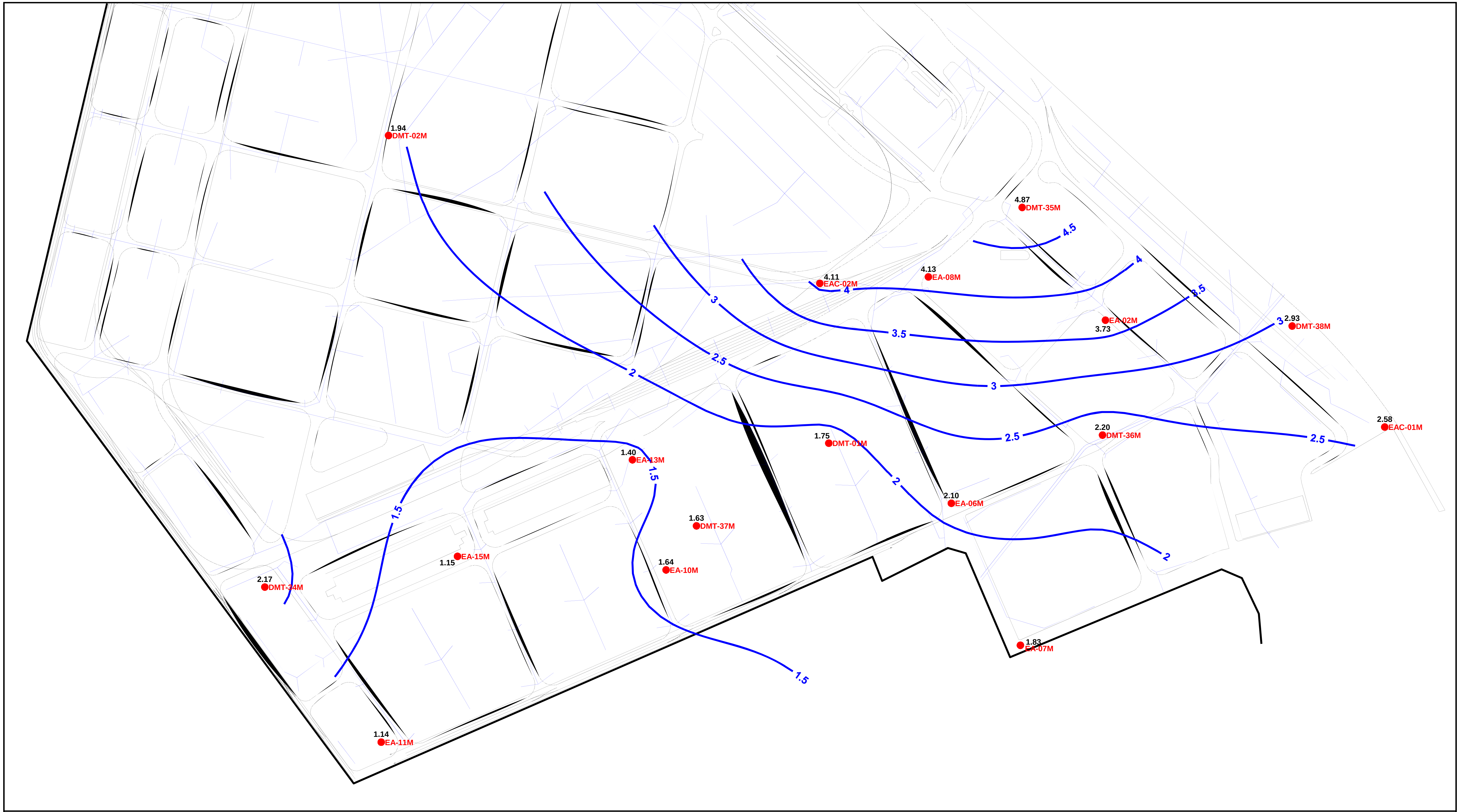
0 200 400 600 800 Feet

Figure A-4
Water Levels Measured in the Patapsco Aquifer
April 23, 2007

Dundalk Marine Terminal
Baltimore, Maryland

CH2M HILL



Legend

1.23 ● EA-11M Patapsco Well and Water Level

—4— Patapsco Aquifer Potentiometric Contour

(All Levels in Feet, Baltimore City Datum,
adjusted to mean tide)

N
W E
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0 200 400 600 800
Feet

Figure A-5
Water Levels Measured in the Patapsco Aquifer
September 24, 2007

Dundalk Marine Terminal
Baltimore, Maryland

CH2M HILL

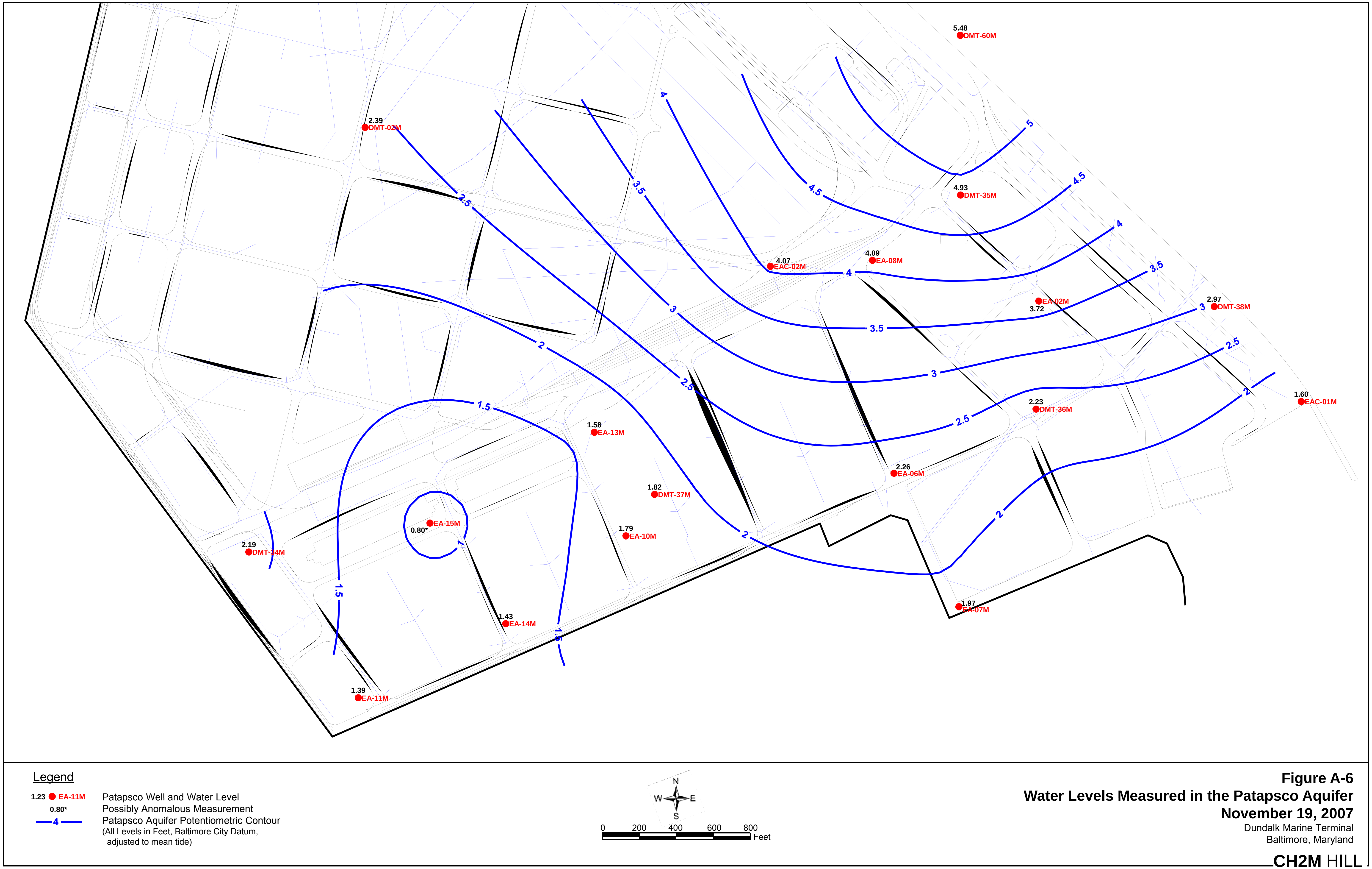
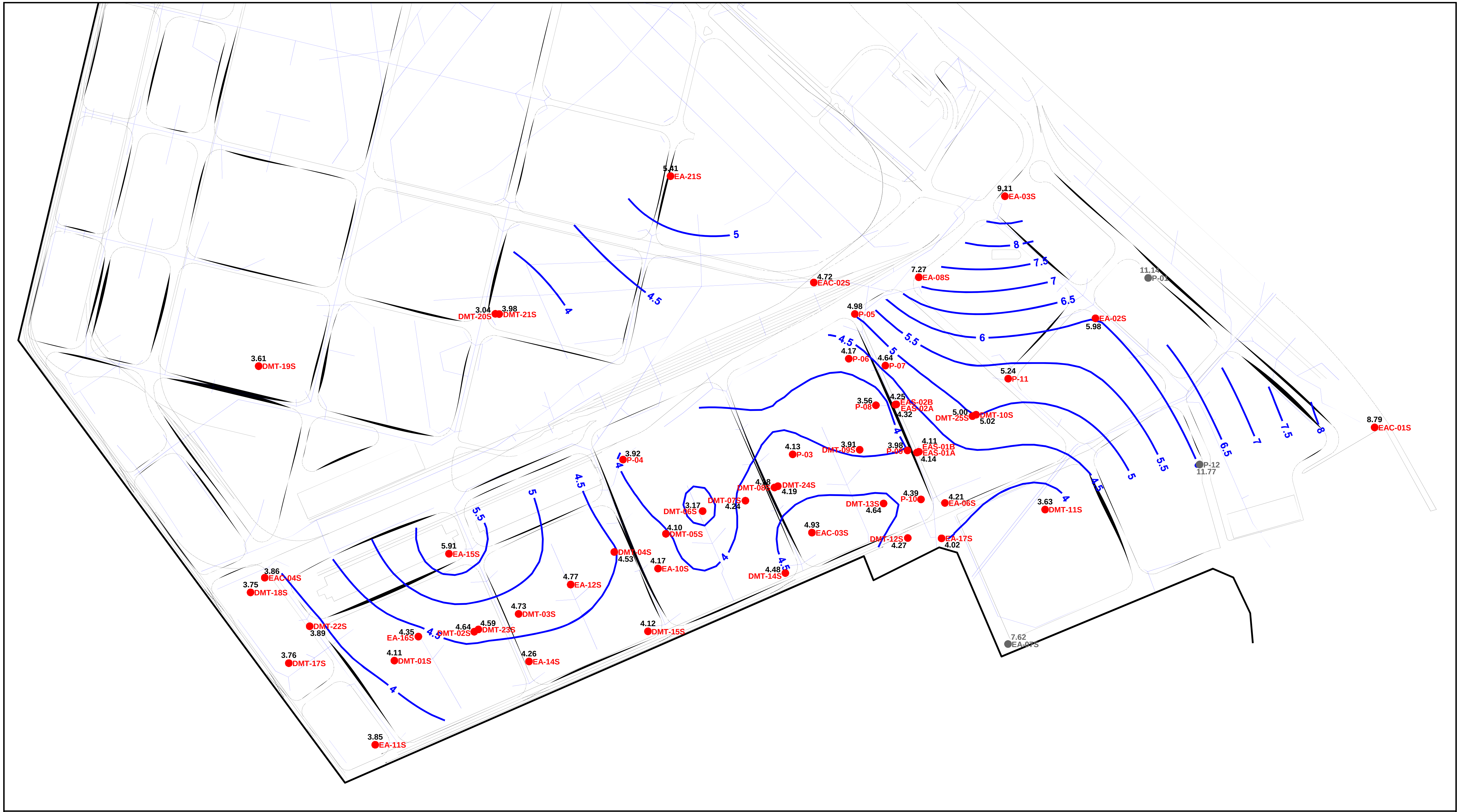


Figure A-6
Water Levels Measured in the Patapsco Aquifer
November 19, 2007

Dundalk Marine Terminal
Baltimore, Maryland

CH2M HILL



Legend

3.36 ● EA-17S	Shallow Well and Water Level
7.27 ● EA-07S	Non-Aquifer Well and Water Level
—4—	Shallow Aquifer Potentiometric Contour
6.61*	Water Level Not Contoured (Damaged Well)

(All Levels in Feet, Baltimore City Datum)

N
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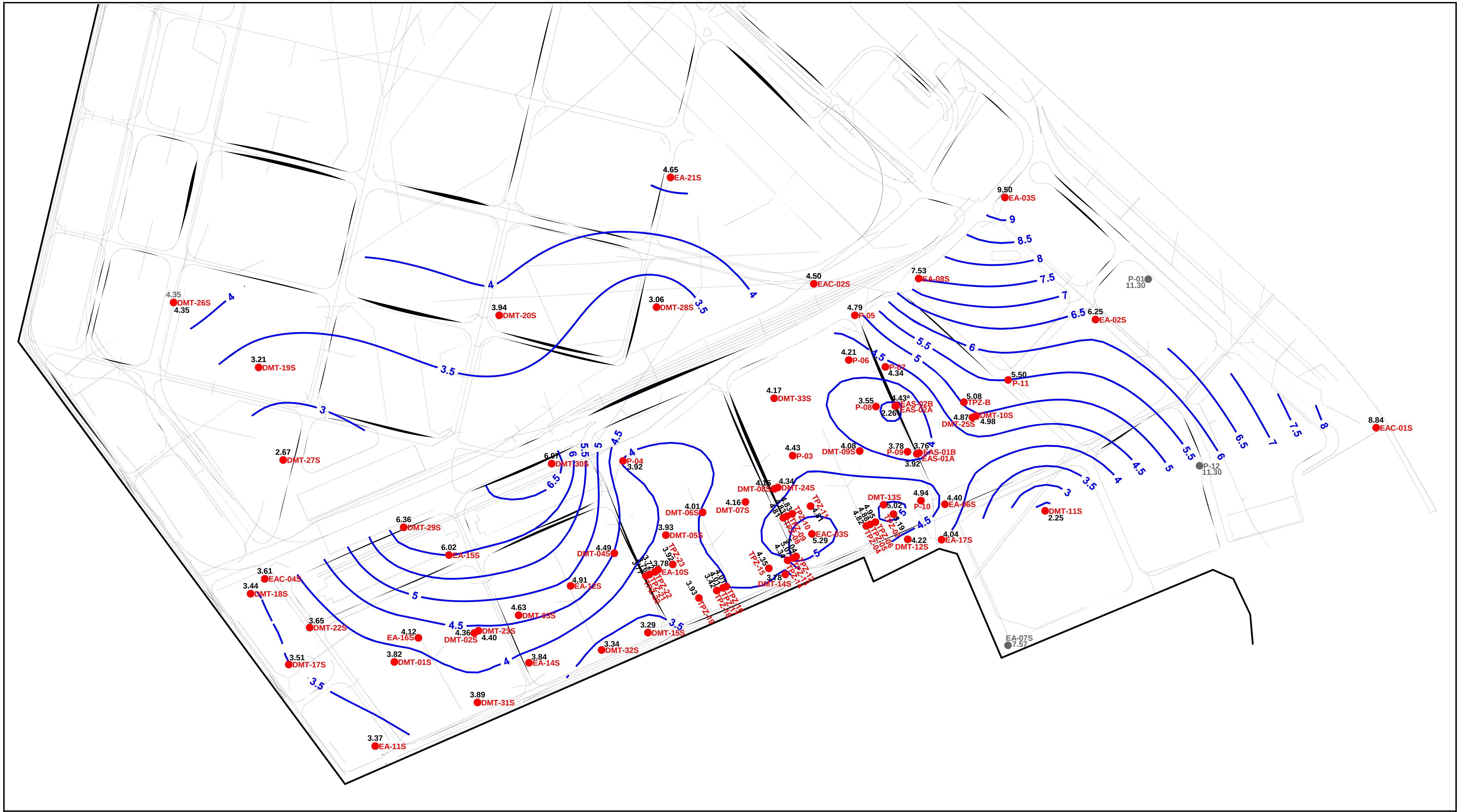
0 200 400 600 800 Feet

Figure A-7
Water Levels Measured in the Shallow Aquifer
May15, 2006
Dundalk Marine Terminal
Baltimore, Maryland

CH2M HILL



Legend

3.36 ● EA-17S Shallow Well and Water Level
7.27 ● EA-07S Non-Aquifer Well and Water Level
—4— Shallow Aquifer Potentiometric Contour
4.43ᴬ 2.26ᴬ Water Levels Averaged for Contouring
(All Levels in Feet, Baltimore City Datum)

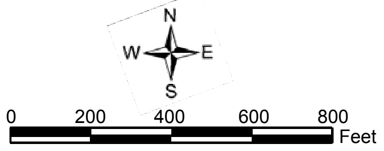
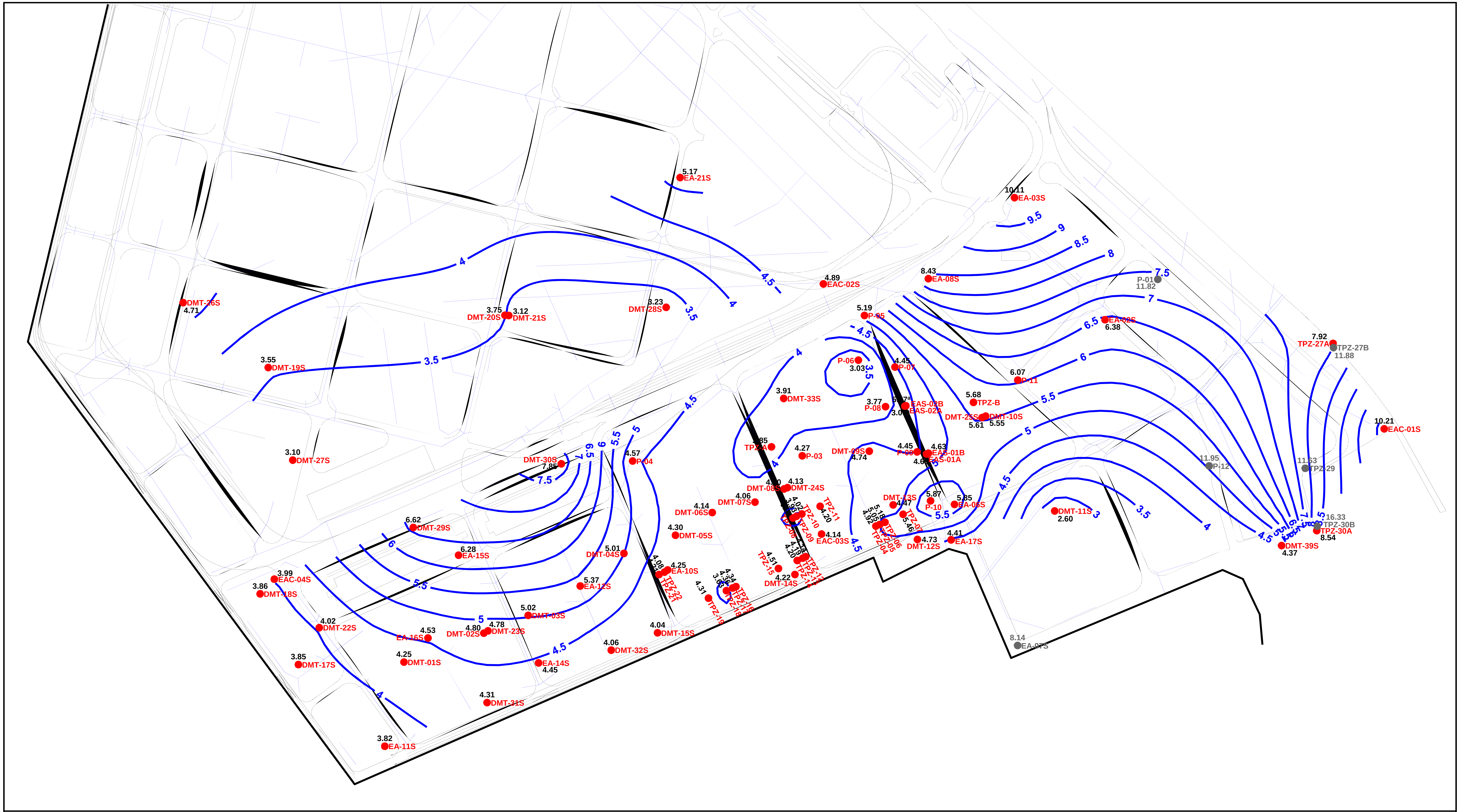


Figure A-8
Water Levels Measured in the Shallow Aquifer
January 18, 2007

Dundalk Marine Terminal
Baltimore, Maryland

CH2M HILL



Legend

3.36 ● EA-17S	Shallow Well and Water Level
7.27 ● EA-07S	Non-Aquifer Well and Water Level
—4—	Shallow Aquifer Potentiometric Contour
4.43ᴬ 2.26ᴬ	Water Levels Averaged for Contouring
	(All Levels in Feet, Baltimore City Datum)

N
W E
S

0 200 400 600 800 Feet

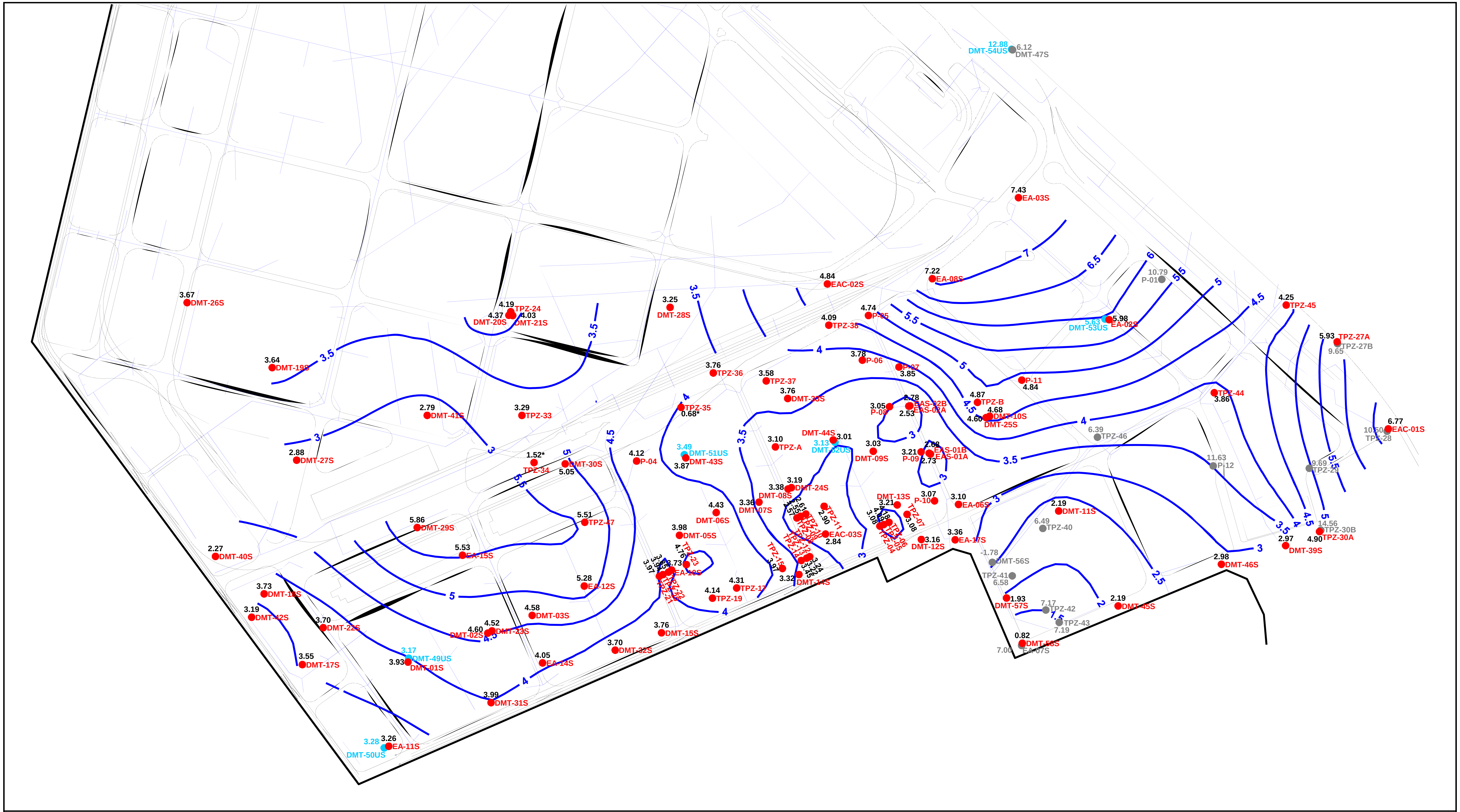
Figure A-9

Water Levels Measured in the Shallow Aquifer

April 23, 2007

Dundalk Marine Terminal
Baltimore, Maryland

CH2M HILL



Legend	
3.36 ● EA-17S	Shallow Well and Water Level
6.58 ● TPZ-41	Non-Aquifer Well and Water Level
3.49 ● DMT-51US	Upper Sand Well and Water Level
—4—	Shallow Aquifer Potentiometric Contour
1.46*	Water Level Not Used for Contouring
	(All Levels in Feet, Baltimore City Datum)

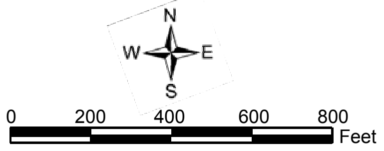
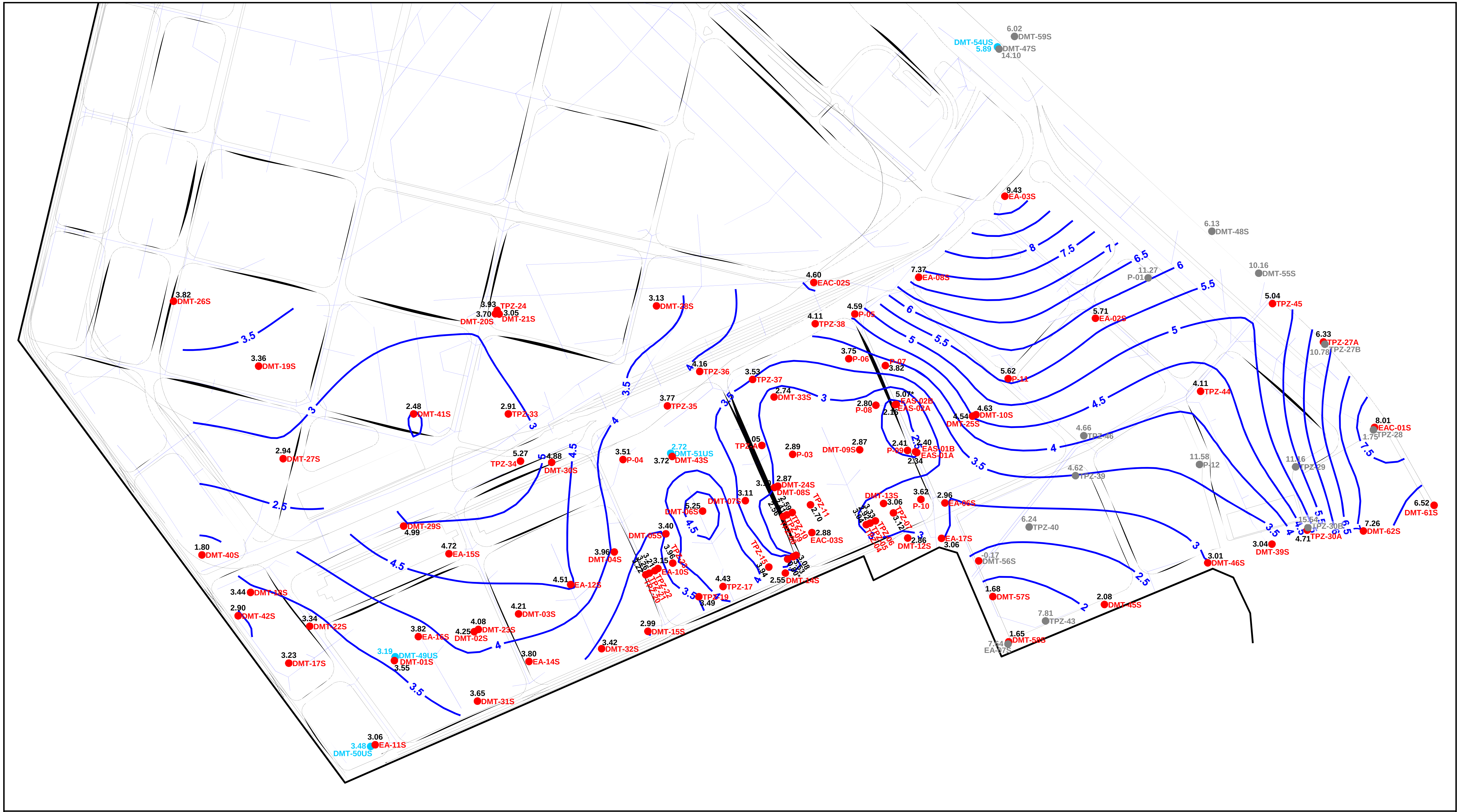


Figure A-10
Water Levels Measured in the Shallow Aquifer
September 24, 2007

Dundalk Marine Terminal
Baltimore, Maryland

CH2M HILL



Legend

3.36 ● EA-17S Shallow Well and Water Level
6.58 ● TPZ-41 Non-Aquifer Well and Water Level
3.49 ● DMT-51US Upper Sand Well and Water Level
—4— Shallow Aquifer Potentiometric Contour
1.46* Water Level Not Used for Contouring
(All Levels in Feet, Baltimore City Datum)

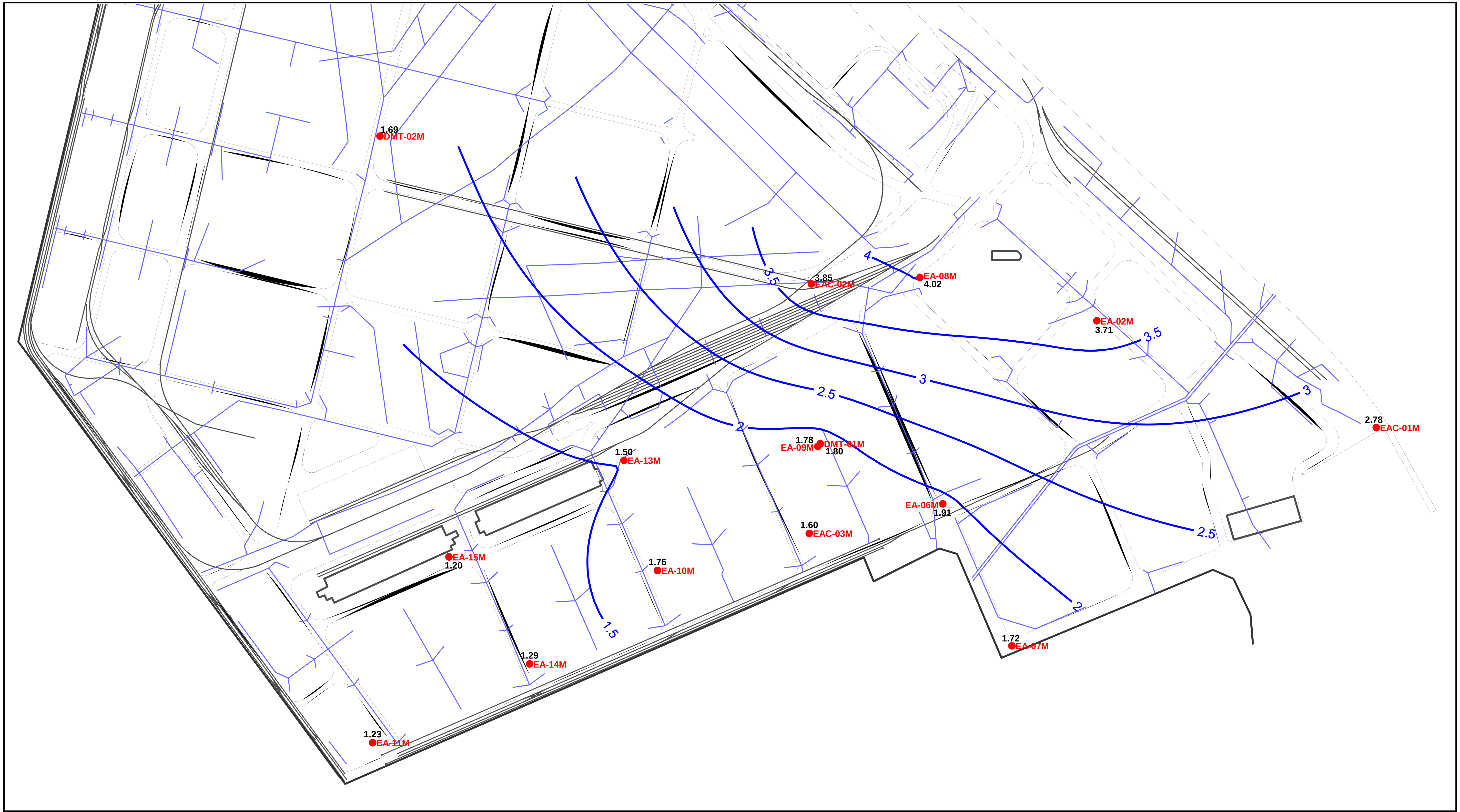
N
W E
S

0 200 400 600 800 Feet

Figure A-11
Water Levels Measured in the Shallow Aquifer
November 19, 2007

Dundalk Marine Terminal
Baltimore, Maryland

CH2M HILL



Legend

1.23 ● EA-11M Patapsco Well and Water Level

—4— Patapsco Aquifer Potentiometric Contour

(All Levels in Feet, Baltimore City Datum,
adjusted to mean tide)

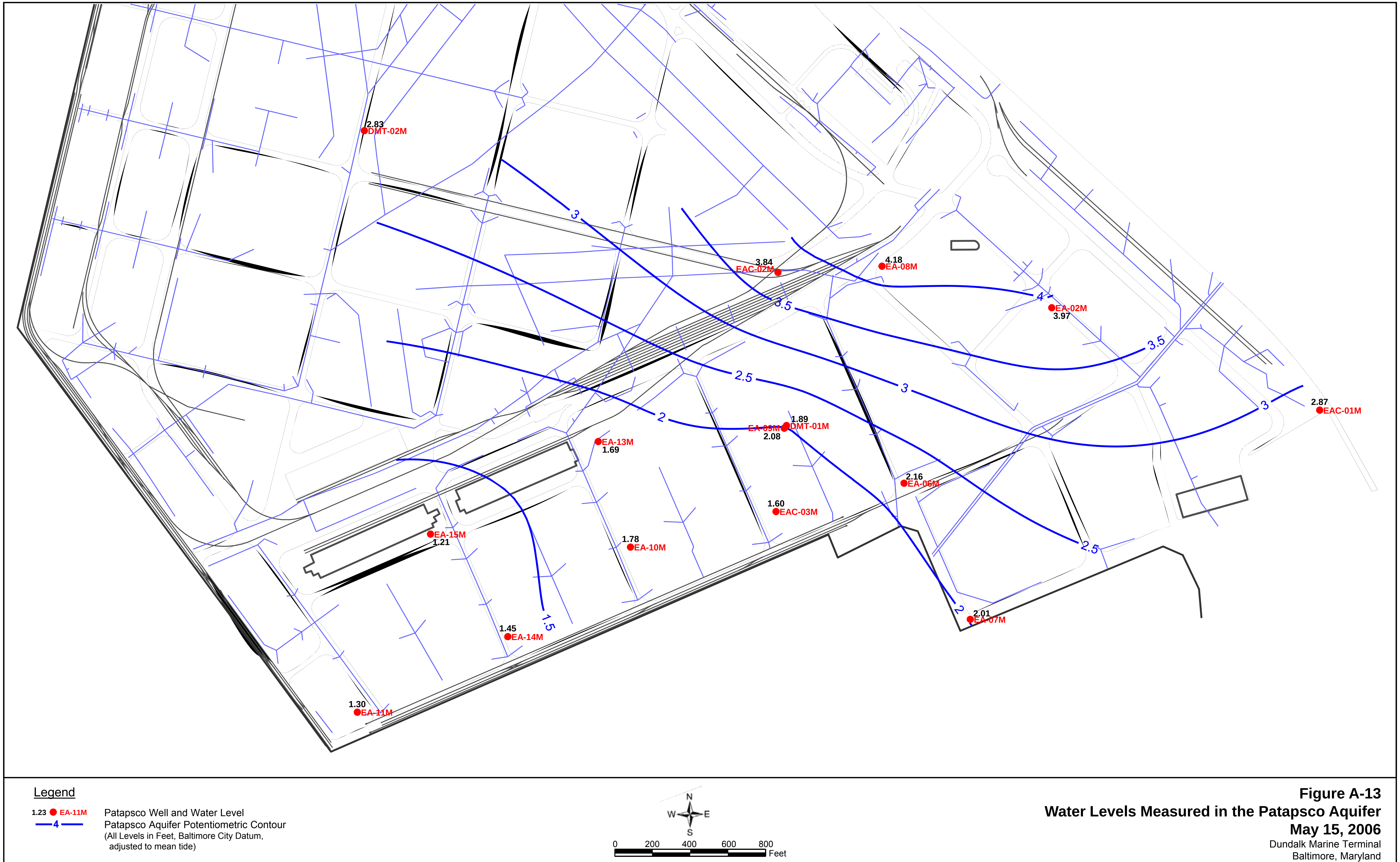
N
W E
S

0 200 400 600 800 Feet

Figure A-12
Water Levels Measured in the Patapsco Aquifer
April 28, 2006

Dundalk Marine Terminal
Baltimore, Maryland

CH2M HILL



Legend

1.23 ● EA-11M Patapsco Well and Water Level

—4— Patapsco Aquifer Potentiometric Contour

(All Levels in Feet, Baltimore City Datum, adjusted to mean tide)

Figure A-13

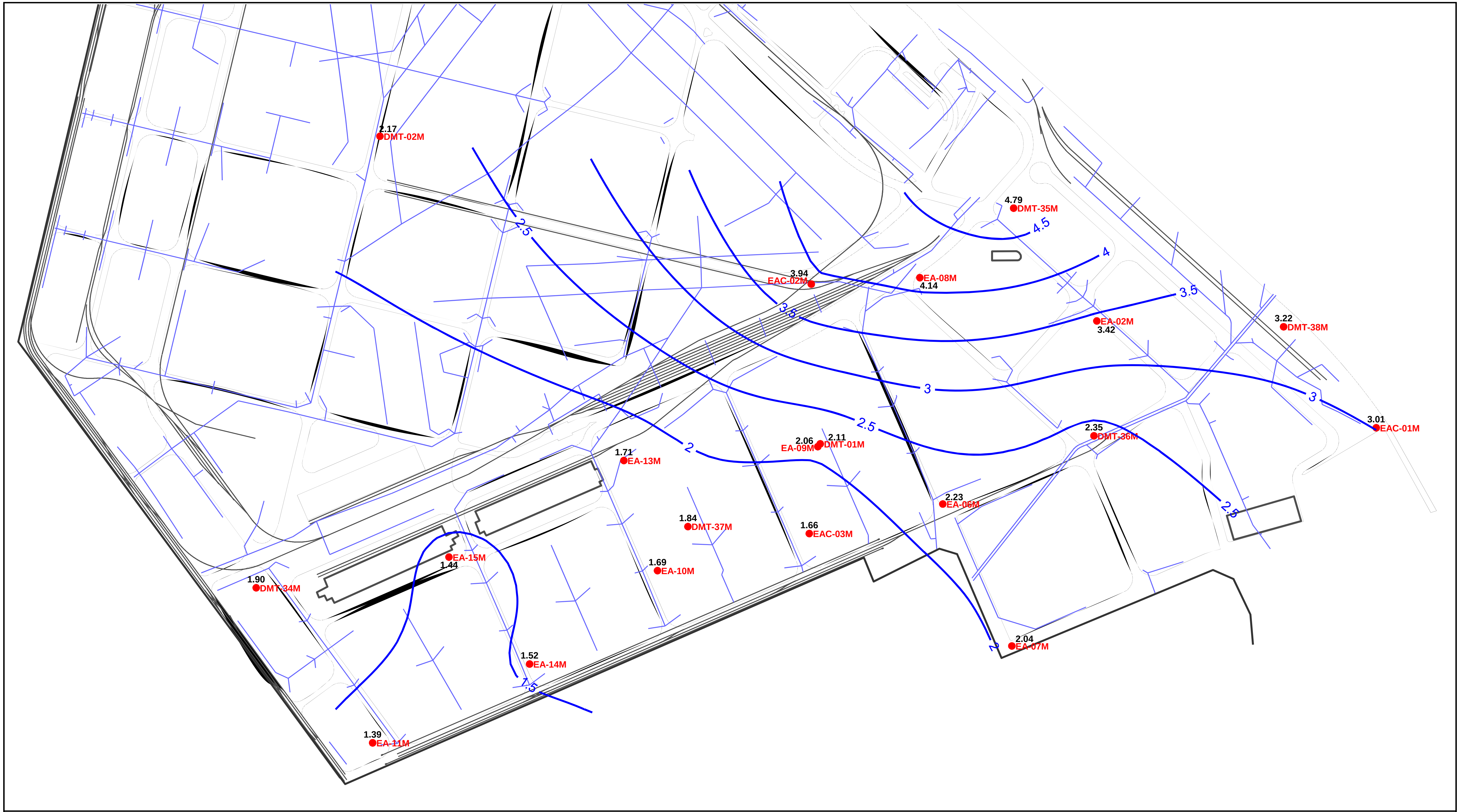
Water Levels Measured in the Patapsco Aquifer

May 15, 2006

Dundalk Marine Terminal

Baltimore, Maryland

CH2M HILL



Legend

1.23 ● EA-11M Patapsco Well and Water Level

—4— Patapsco Aquifer Potentiometric Contour

(All Levels in Feet, Baltimore City Datum, adjusted to mean tide)

N W E S

0 200 400 600 800 Feet

Figure A-14
Water Levels Measured in the Patapsco Aquifer
January 18, 2007

Dundalk Marine Terminal
Baltimore, Maryland

CH2M HILL

Attachment A

Dundalk Marine Terminal Perimeter Air Monitoring (Hollow Stem Drilling)

December 6 thru December 12, 2005

Date	Direction	Location	Upwind/ Downwind	Particulates by RAM Average μg/m^3	Particulates by Ram (μg/m^3) Maximum	OSHA 215 Hexavalent Chromium Average (μg/m^3)	Comments
6-Dec	North	Bore Hole 10S				<0.013	
	East	Bore Hole 10S	Down	33.5	46.5	<0.013	
	West	Bore Hole 10S	Up	69.3	113.9	<0.012	
	South	Bore Hole 10 S				<0.012	
7-Dec	North	Bore Hole 9S				<0.01	Wind between 10 & 20 mph
	East	Bore Hole 9S	Down	34.3	42.8	<0.027	Wind between 10 & 20 mph
	West	Bore Hole 9S	Up	56.2	82.1	0.016	Wind between 10 & 20 mph
	South	Bore Hole 9S				<0.00098	Wind between 10 & 20 mph
8-Dec	North	Bore Hole 8S				<0.011	Wind between 10 & 20 mph
	East	Bore Hole 8S	Down	25.9	50	<0.011	
	West	Bore Hole 8S	Up	36.7	76.8	<0.012	
	South	Bore Hole 8S				<0.011	
9-Dec	North	Bore Hole 7S				<0.018	Wind between 10 & 20 mph
	East	Bore Hole 7S	Down	30	41	<0.018	Wind between 10 & 20 mph
	West	Bore Hole 7S	Up	63.5	85.2	<0.017	Wind between 10 & 20 mph
	South	Bore Hole 7S				<0017	Wind between 10 & 20 mph
10-Dec	North	Bore Hole 2S	Down	49.7	73.6	<0.010	
	East	Bore Hole 2S				<0.010	
	West	Bore Hole 2S				<0.0098	

Dundalk Marine Terminal Perimeter Air Monitoring (Hollow Stem Drilling)

December 6 thru December 12, 2005

Date	Direction	Location	Upwind/ Downwind	Particulates by RAM Average $\mu g/m^3$	Particulates by Ram ($\mu g/m^3$) Maximum	OSHA 215 Hexavalent Chromium Average ($\mu g/m^3$)	Comments
	South	Bore Hole 2S	Up	33.2	45.4	<0.0094	
11-Dec	North	Bore Hole 4S				<0.0095	
	East	Bore Hole 4S	Down	68.2	150	<0.0095	
	West	Bore Hole 4S	Up	33.2	45	<0.0095	
	South	Bore Hole 4S				<0.011	
12-Dec	North	Bore Hole 12S				<0.015	
	East	Bore Hole 12S	Down	38.9	74.7	<0.015	
	West	Bore Hole 12S	Up	16	22.4	<0.0014	
	South	Bore Hole 12S				<0.0016	

Notes:

Total particulate (NIOSH 500) results are not shown because they were generally <160 $\mu g/m^3$

At the time of this report, April 17, 2006, the Chromium VI results had not been validated and are considered preliminary.

Dundalk Marine Terminal Perimeter Air Monitoring (Hollow Stem Drilling)

December 6 thru December 12, 2005

Date	Direction	Location	Upwind/ Downwind	Particulates by RAM Average µg/m^3	Particulates by Ram (µg/m^3) Maximum	OSHA 215 Hexavalent Chromium Average (µg/m^3)	Comments
6-Dec	North	Bore Hole 10S				<0.013	
	East	Bore Hole 10S	Down	33.5	46.5	<0.013	
	West	Bore Hole 10S	Up	69.3	113.9	<0.012	
	South	Bore Hole 10 S				<0.012	
7-Dec	North	Bore Hole 9S				<0.01	Wind between 10 & 20 mph
	East	Bore Hole 9S	Down	34.3	42.8	<0.027	Wind between 10 & 20 mph
	West	Bore Hole 9S	Up	56.2	82.1	0.016	Wind between 10 & 20 mph
	South	Bore Hole 9S				<0.00098	Wind between 10 & 20 mph
8-Dec	North	Bore Hole 8S				<0.011	Wind between 10 & 20 mph
	East	Bore Hole 8S	Down	25.9	50	<0.011	
	West	Bore Hole 8S	Up	36.7	76.8	<0.012	
	South	Bore Hole 8S				<0.011	
9-Dec	North	Bore Hole 7S				<0.018	Wind between 10 & 20 mph
	East	Bore Hole 7S	Down	30	41	<0.018	Wind between 10 & 20 mph
	West	Bore Hole 7S	Up	63.5	85.2	<0.017	Wind between 10 & 20 mph
	South	Bore Hole 7S				<0017	Wind between 10 & 20 mph
10-Dec	North	Bore Hole 2S	Down	49.7	73.6	<0.010	
	East	Bore Hole 2S				<0.010	
	West	Bore Hole 2S				<0.0098	

Dundalk Marine Terminal Perimeter Air Monitoring (Hollow Stem Drilling)

December 6 thru December 12, 2005

Date	Direction	Location	Upwind/ Downwind	Particulates by RAM Average $\mu g/m^3$	Particulates by Ram ($\mu g/m^3$) Maximum	OSHA 215 Hexavalent Chromium Average ($\mu g/m^3$)	Comments
	South	Bore Hole 2S	Up	33.2	45.4	<0.0094	
11-Dec	North	Bore Hole 4S				<0.0095	
	East	Bore Hole 4S	Down	68.2	150	<0.0095	
	West	Bore Hole 4S	Up	33.2	45	<0.0095	
	South	Bore Hole 4S				<0.011	
12-Dec	North	Bore Hole 12S				<0.015	
	East	Bore Hole 12S	Down	38.9	74.7	<0.015	
	West	Bore Hole 12S	Up	16	22.4	<0.0014	
	South	Bore Hole 12S				<0.0016	

Notes:
Total particulate (NIOSH 500) results are not shown because they were generally <160 $\mu g/m^3$
At the time of this report, April 17, 2006, the Chromium VI results had not been validated and are considered preliminary.

Submitter Sample ID	Collect Date	Air Volume	Test Method	Compound Name	Receive Date	Analysis Date	Report Date	Micrograms	Log Units	Result Qualifier	Loq	Loq Units	Work Order Numbe	Sample Code
101306-01PAS	10/13/06	895.23	MODIFIED OSHA ID 215	Chromium (VI) Compounds, as Cr (OSHA)	10/16/06	10/17/06	10/17/06	0.01014199	ug	LT	0.01	ug	2006100515	1
101306-02PAS	10/13/06	921.69	MODIFIED OSHA ID 215	Chromium (VI) Compounds, as Cr (OSHA)	10/16/06	10/17/06	10/17/06	0.01014199	ug	LT	0.01	ug	2006100515	2
101306-03AAS	10/13/06	906.88	MODIFIED OSHA ID 215	Chromium (VI) Compounds, as Cr (OSHA)	10/16/06	10/17/06	10/17/06	0.01014199	ug	LT	0.01	ug	2006100515	3
101306-04AAS	10/13/06	917.85	MODIFIED OSHA ID 215	Chromium (VI) Compounds, as Cr (OSHA)	10/16/06	10/17/06	10/17/06	0.01014199	ug	LT	0.01	ug	2006100515	4
101306-05AAS	10/13/06	883.32	MODIFIED OSHA ID 215	Chromium (VI) Compounds, as Cr (OSHA)	10/16/06	10/17/06	10/17/06	0.01014199	ug	LT	0.01	ug	2006100515	5
101306-TB	10/13/06	0	MODIFIED OSHA ID 215	Chromium (VI) Compounds, as Cr (OSHA)	10/16/06	10/17/06	10/17/06	0.01014199	ug	LT	0.01	ug	2006100515	6
101306-01PAS	10/13/06	895.23	NIOSH 0500	Total Particulates	10/16/06	10/16/06	10/17/06	100	µg	LT	100	µg	2006100515	1
101306-02PAS	10/13/06	921.69	NIOSH 0500	Total Particulates	10/16/06	10/16/06	10/17/06	101	µg		100	µg	2006100515	2
101306-03AAS	10/13/06	906.88	NIOSH 0500	Total Particulates	10/16/06	10/16/06	10/17/06	100	µg	LT	100	µg	2006100515	3
101306-04AAS	10/13/06	917.85	NIOSH 0500	Total Particulates	10/16/06	10/16/06	10/17/06	100	µg	LT	100	µg	2006100515	4
101306-05AAS	10/13/06	883.32	NIOSH 0500	Total Particulates	10/16/06	10/16/06	10/17/06	100	µg	LT	100	µg	2006100515	5
101306-TB	10/13/06	0	NIOSH 0500	Total Particulates	10/16/06	10/16/06	10/17/06	100	µg	LT	100	µg	2006100515	6

Submitter Sample ID	Collect Date	Air Volume	Test Method	Compound Name	Receive Date	Analysis Date	Report Date	Micrograms	Log Units	Result Qualifier	Loq	Loq Units	Work Order Numbe	Sample Code
101906-01-PA	10/19/06	658.84	MODIFIED OSHA ID 215	Chromium (VI) Compounds, as Cr (OSHA)	10/20/06	10/20/06	10/23/06	0.01012146	ug	LT	0.01	ug	2006100703	1
101906-02-PA	10/19/06	684.814	MODIFIED OSHA ID 215	Chromium (VI) Compounds, as Cr (OSHA)	10/20/06	10/20/06	10/23/06	0.02476721	ug		0.01	ug	2006100703	2
101906-03-PA	10/19/06	664.668	MODIFIED OSHA ID 215	Chromium (VI) Compounds, as Cr (OSHA)	10/20/06	10/20/06	10/23/06	0.09571862	ug		0.01	ug	2006100703	3
101906-04-AA	10/19/06	715.34	MODIFIED OSHA ID 215	Chromium (VI) Compounds, as Cr (OSHA)	10/20/06	10/20/06	10/23/06	0.01012146	ug	LT	0.01	ug	2006100703	4
101906-05-AA	10/19/06	700.556	MODIFIED OSHA ID 215	Chromium (VI) Compounds, as Cr (OSHA)	10/20/06	10/20/06	10/23/06	0.01012146	ug	LT	0.01	ug	2006100703	5
101906-06-AA	10/19/06	665.763	MODIFIED OSHA ID 215	Chromium (VI) Compounds, as Cr (OSHA)	10/20/06	10/20/06	10/23/06	0.01012146	ug	LT	0.01	ug	2006100703	6
101906-07-AA	10/19/06	719.316	MODIFIED OSHA ID 215	Chromium (VI) Compounds, as Cr (OSHA)	10/20/06	10/20/06	10/23/06	0.01012146	ug	LT	0.01	ug	2006100703	7
101906-TB	10/19/06	0	MODIFIED OSHA ID 215	Chromium (VI) Compounds, as Cr (OSHA)	10/20/06	10/20/06	10/23/06	0.01012146	ug	LT	0.01	ug	2006100703	8
101906-01-PA	10/19/06	658.84	NIOSH 0500	Total Particulates	10/20/06	10/20/06	10/23/06	100	µg	LT	100	µg	2006100703	1
101906-02-PA	10/19/06	684.814	NIOSH 0500	Total Particulates	10/20/06	10/20/06	10/23/06	548	µg		100	µg	2006100703	2
101906-03-PA	10/19/06	664.668	NIOSH 0500	Total Particulates	10/20/06	10/20/06	10/23/06	358	µg		100	µg	2006100703	3
101906-04-AA	10/19/06	715.34	NIOSH 0500	Total Particulates	10/20/06	10/20/06	10/23/06	100	µg	LT	100	µg	2006100703	4
101906-05-AA	10/19/06	700.556	NIOSH 0500	Total Particulates	10/20/06	10/20/06	10/23/06	100	µg	LT	100	µg	2006100703	5
101906-06-AA	10/19/06	665.763	NIOSH 0500	Total Particulates	10/20/06	10/20/06	10/23/06	100	µg	LT	100	µg	2006100703	6
101906-07-AA	10/19/06	719.316	NIOSH 0500	Total Particulates	10/20/06	10/20/06	10/23/06	100	µg	LT	100	µg	2006100703	7
101906-TB	10/19/06	0	NIOSH 0500	Total Particulates	10/20/06	10/20/06	10/23/06	100	µg	LT	100	µg	2006100703	8

Submitter Sample ID	Collect Date	Air Volume	Test Method	Compound Name	Receive Date	Analysis Date	Report Date	Micrograms	Log Units	Result Qualifier	Loq	Loq Units	Work Order Numbe	Sample Code
102106-05-AA	10/21/06	1014.291	MODIFIED OSHA ID 215	Chromium (VI) Compounds, as Cr (OSHA)	10/24/06	10/26/06	10/26/06	0.01009082	ug	LT	0.01	ug	2006100820	1
102106-06-AA	10/21/06	1005.757	MODIFIED OSHA ID 215	Chromium (VI) Compounds, as Cr (OSHA)	10/24/06	10/26/06	10/26/06	0.01009082	ug	LT	0.01	ug	2006100820	2
102106-07-AA	10/21/06	1013.538	MODIFIED OSHA ID 215	Chromium (VI) Compounds, as Cr (OSHA)	10/24/06	10/26/06	10/26/06	0.01009082	ug	LT	0.01	ug	2006100820	3
102106-08-AA	10/21/06	622.857	MODIFIED OSHA ID 215	Chromium (VI) Compounds, as Cr (OSHA)	10/24/06	10/26/06	10/26/06	0.01009082	ug	LT	0.01	ug	2006100820	4
102106-TB	10/21/06	0	MODIFIED OSHA ID 215	Chromium (VI) Compounds, as Cr (OSHA)	10/24/06	10/26/06	10/26/06	0.01009082	ug	LT	0.01	ug	2006100820	5
102206-04-AA	10/22/06	630.198	MODIFIED OSHA ID 215	Chromium (VI) Compounds, as Cr (OSHA)	10/24/06	10/26/06	10/26/06	0.01009082	ug	LT	0.01	ug	2006100820	6
102206-05-AA	10/22/06	638.364	MODIFIED OSHA ID 215	Chromium (VI) Compounds, as Cr (OSHA)	10/24/06	10/26/06	10/26/06	0.01009082	ug	LT	0.01	ug	2006100820	7
102206-06-AA	10/22/06	627.432	MODIFIED OSHA ID 215	Chromium (VI) Compounds, as Cr (OSHA)	10/24/06	10/26/06	10/26/06	0.01009082	ug	LT	0.01	ug	2006100820	8
102206-07-AA	10/22/06	611.115	MODIFIED OSHA ID 215	Chromium (VI) Compounds, as Cr (OSHA)	10/24/06	10/26/06	10/26/06	0.01009082	ug	LT	0.01	ug	2006100820	9
102206-TB	10/22/06	0	MODIFIED OSHA ID 215	Chromium (VI) Compounds, as Cr (OSHA)	10/24/06	10/26/06	10/26/06	0.01009082	ug	LT	0.01	ug	2006100820	10
102306-04-AA	10/23/06	1070.916	MODIFIED OSHA ID 215	Chromium (VI) Compounds, as Cr (OSHA)	10/24/06	10/26/06	10/26/06	0.01009082	ug	LT	0.01	ug	2006100820	11
102306-05-AA	10/23/06	1058.792	MODIFIED OSHA ID 215	Chromium (VI) Compounds, as Cr (OSHA)	10/24/06	10/26/06	10/26/06	0.01009082	ug	LT	0.01	ug	2006100820	12
102306-06-AA	10/23/06	1034.12	MODIFIED OSHA ID 215	Chromium (VI) Compounds, as Cr (OSHA)	10/24/06	10/26/06	10/26/06	0.01009082	ug	LT	0.01	ug	2006100820	13
102306-07-AA	10/23/06	1027.072	MODIFIED OSHA ID 215	Chromium (VI) Compounds, as Cr (OSHA)	10/24/06	10/26/06	10/26/06	0.01009082	ug	LT	0.01	ug	2006100820	14
102306-TB	10/23/06	0	MODIFIED OSHA ID 215	Chromium (VI) Compounds, as Cr (OSHA)	10/24/06	10/26/06	10/26/06	0.01009082	ug	LT	0.01	ug	2006100820	15
102106-01-PA	10/21/06	955.306	MODIFIED OSHA ID 215	Chromium (VI) Compounds, as Cr (OSHA)	10/24/06	10/26/06	10/26/06	0.01009082	ug	LT	0.01	ug	2006100820	16
102106-02-PA	10/21/06	1022.04	MODIFIED OSHA ID 215	Chromium (VI) Compounds, as Cr (OSHA)	10/24/06	10/26/06	10/26/06	0.01009082	ug	LT	0.01	ug	2006100820	17
102106-03-PA	10/21/06	985.52	MODIFIED OSHA ID 215	Chromium (VI) Compounds, as Cr (OSHA)	10/24/06	10/26/06	10/26/06	0.1051362	ug		0.01	ug	2006100820	18
102106-04-PA	10/21/06	1027.182	MODIFIED OSHA ID 215	Chromium (VI) Compounds, as Cr (OSHA)	10/24/06	10/26/06	10/26/06	0.3505449	ug		0.01	ug	2006100820	19
102206-01-PA	10/22/06	895.492	MODIFIED OSHA ID 215	Chromium (VI) Compounds, as Cr (OSHA)	10/24/06	10/26/06	10/26/06	0.01009082	ug	LT	0.01	ug	2006100820	20
102206-03-PA	10/22/06	922.07	MODIFIED OSHA ID 215	Chromium (VI) Compounds, as Cr (OSHA)	10/24/06	10/26/06	10/26/06	0.2872755	ug		0.01	ug	2006100820	21
102306-01-PA	10/23/06	1172.137	MODIFIED OSHA ID 215	Chromium (VI) Compounds, as Cr (OSHA)	10/24/06	10/26/06	10/26/06	0.02517659	ug		0.01	ug	2006100820	22
102306-02-PA	10/23/06	1185.53	MODIFIED OSHA ID 215	Chromium (VI) Compounds, as Cr (OSHA)	10/24/06	10/26/06	10/26/06	0.04529768	ug		0.01	ug	2006100820	23
102306-03-PA	10/23/06	1224.213	MODIFIED OSHA ID 215	Chromium (VI) Compounds, as Cr (OSHA)	10/24/06	10/26/06	10/26/06	0.06260343	ug		0.01	ug	2006100820	24
102106-05-AA	10/21/06	1014.291	NIOSH 0500	Total Particulates	10/24/06	10/25/06	10/26/06	100	µg	LT	100	µg	2006100820	1
102106-06-AA	10/21/06	1005.757	NIOSH 0500	Total Particulates	10/24/06	10/25/06	10/26/06	100	µg	LT	100	µg	2006100820	2
102106-07-AA	10/21/06	1013.538	NIOSH 0500	Total Particulates	10/24/06	10/25/06	10/26/06	100	µg	LT	100	µg	2006100820	3
102106-08-AA	10/21/06	622.857	NIOSH 0500	Total Particulates	10/24/06	10/25/06	10/26/06	100	µg	LT	100	µg	2006100820	4
102106-TB	10/21/06	0	NIOSH 0500	Total Particulates	10/24/06	10/25/06	10/26/06	100	µg	LT	100	µg	2006100820	5
102206-04-AA	10/22/06	630.198	NIOSH 0500	Total Particulates	10/24/06	10/25/06	10/26/06	100	µg	LT	100	µg	2006100820	6
102206-05-AA	10/22/06	638.364	NIOSH 0500	Total Particulates	10/24/06	10/25/06	10/26/06	100	µg	LT	100	µg	2006100820	7
102206-06-AA	10/22/06	627.432	NIOSH 0500	Total Particulates	10/24/06	10/25/06	10/26/06	100	µg	LT	100	µg	2006100820	8
102206-07-AA	10/22/06	611.115	NIOSH 0500	Total Particulates	10/24/06	10/25/06	10/26/06	100	µg	LT	100	µg	2006100820	9
102206-TB	10/22/06	0	NIOSH 0500	Total Particulates	10/24/06	10/25/06	10/26/06	100	µg	LT	100	µg	2006100820	10
102306-04-AA	10/23/06	1070.916	NIOSH 0500	Total Particulates	10/24/06	10/25/06	10/26/06	100	µg	LT	100	µg	2006100820	11
102306-05-AA	10/23/06	1058.792	NIOSH 0500	Total Particulates	10/24/06	10/25/06	10/26/06	100	µg	LT	100	µg	2006100820	12
102306-06-AA	10/23/06	1034.12	NIOSH 0500	Total Particulates	10/24/06	10/25/06	10/26/06	100	µg	LT	100	µg	2006100820	13

Submitter Sample ID	Collect Date	Air Volume	Test Method	Compound Name	Receive Date	Analysis Date	Report Date	Micrograms	Log Units	Result Qualifier	Loq	Loq Units	Work Order Numbe	Sample Code
102306-07-AA	10/23/06	1027.072	NIOSH 0500	Total Particulates	10/24/06	10/25/06	10/26/06	100	µg	LT	100	µg	2006100820	14
102306-TB	10/23/06	0	NIOSH 0500	Total Particulates	10/24/06	10/25/06	10/26/06	100	µg	LT	100	µg	2006100820	15
102106-01-PA	10/21/06	955.306	NIOSH 0500	Total Particulates	10/24/06	10/25/06	10/26/06	126	µg		100	µg	2006100820	16
102106-02-PA	10/21/06	1022.04	NIOSH 0500	Total Particulates	10/24/06	10/25/06	10/26/06	119	µg		100	µg	2006100820	17
102106-03-PA	10/21/06	985.52	NIOSH 0500	Total Particulates	10/24/06	10/25/06	10/26/06	519	µg		100	µg	2006100820	18
102106-04-PA	10/21/06	1027.182	NIOSH 0500	Total Particulates	10/24/06	10/25/06	10/26/06	865	µg		100	µg	2006100820	19
102206-01-PA	10/22/06	895.492	NIOSH 0500	Total Particulates	10/24/06	10/25/06	10/26/06	100	µg	LT	100	µg	2006100820	20
102206-03-PA	10/22/06	922.07	NIOSH 0500	Total Particulates	10/24/06	10/25/06	10/26/06	989	µg		100	µg	2006100820	21
102306-01-PA	10/23/06	1172.137	NIOSH 0500	Total Particulates	10/24/06	10/25/06	10/26/06	161	µg		100	µg	2006100820	22
102306-02-PA	10/23/06	1185.53	NIOSH 0500	Total Particulates	10/24/06	10/25/06	10/26/06	539	µg		100	µg	2006100820	23
102306-03-PA	10/23/06	1224.213	NIOSH 0500	Total Particulates	10/24/06	10/25/06	10/26/06	633	µg		100	µg	2006100820	24

Submitter Sample ID	Collect Date	Air Volume	Test Method	Compound Name	Receive Date	Analysis Date	Report Date	Micrograms	Log Units	Result Qualifier	Loq	Loq Units	Work Order Numbe	Sample Code
102406-01-PA	10/24/06	691.22	MODIFIED OSHA ID 215	Chromium (VI) Compounds, as Cr (OSHA)	10/26/06	10/27/06	10/30/06	0.01006036	ug	LT	0.01	ug	2006100890	1
102406-02-PA	10/24/06	668.136	MODIFIED OSHA ID 215	Chromium (VI) Compounds, as Cr (OSHA)	10/26/06	10/27/06	10/30/06	0.2751207	ug		0.01	ug	2006100890	2
102406-03-PA	10/24/06	671.496	MODIFIED OSHA ID 215	Chromium (VI) Compounds, as Cr (OSHA)	10/26/06	10/27/06	10/30/06	0.01438632	ug		0.01	ug	2006100890	3
102506-01-PA	10/25/06	359.832	MODIFIED OSHA ID 215	Chromium (VI) Compounds, as Cr (OSHA)	10/26/06	10/27/06	10/30/06	0.01006036	ug	LT	0.01	ug	2006100890	4
102506-02-PA	10/25/06	357.894	MODIFIED OSHA ID 215	Chromium (VI) Compounds, as Cr (OSHA)	10/26/06	10/27/06	10/30/06	0.02962777	ug		0.01	ug	2006100890	5
102506-03-PA	10/25/06	358.071	MODIFIED OSHA ID 215	Chromium (VI) Compounds, as Cr (OSHA)	10/26/06	10/27/06	10/30/06	0.01006036	ug	LT	0.01	ug	2006100890	6
102506-04-AA	10/25/06	285.854	MODIFIED OSHA ID 215	Chromium (VI) Compounds, as Cr (OSHA)	10/26/06	10/27/06	10/30/06	0.01006036	ug	LT	0.01	ug	2006100890	7
102506-05-AA	10/25/06	287.105	MODIFIED OSHA ID 215	Chromium (VI) Compounds, as Cr (OSHA)	10/26/06	10/27/06	10/30/06	0.01006036	ug	LT	0.01	ug	2006100890	8
102506-06-AA	10/25/06	287.243	MODIFIED OSHA ID 215	Chromium (VI) Compounds, as Cr (OSHA)	10/26/06	10/27/06	10/30/06	0.01006036	ug	LT	0.01	ug	2006100890	9
102506-07-AA	10/25/06	289.12	MODIFIED OSHA ID 215	Chromium (VI) Compounds, as Cr (OSHA)	10/26/06	10/27/06	10/30/06	0.01006036	ug	LT	0.01	ug	2006100890	10
102506-TB	10/25/06	0	MODIFIED OSHA ID 215	Chromium (VI) Compounds, as Cr (OSHA)	10/26/06	10/27/06	10/30/06	0.01006036	ug	LT	0.01	ug	2006100890	11
102406-01-PA	10/24/06	691.22	NIOSH 0500	Total Particulates	10/26/06	10/26/06	10/30/06	100	µg	LT	100	µg	2006100890	1
102406-02-PA	10/24/06	668.136	NIOSH 0500	Total Particulates	10/26/06	10/26/06	10/30/06	748	µg		100	µg	2006100890	2
102406-03-PA	10/24/06	671.496	NIOSH 0500	Total Particulates	10/26/06	10/26/06	10/30/06	129	µg		100	µg	2006100890	3
102506-01-PA	10/25/06	359.832	NIOSH 0500	Total Particulates	10/26/06	10/26/06	10/30/06	100	µg	LT	100	µg	2006100890	4
102506-02-PA	10/25/06	357.894	NIOSH 0500	Total Particulates	10/26/06	10/26/06	10/30/06	342	µg		100	µg	2006100890	5
102506-03-PA	10/25/06	358.071	NIOSH 0500	Total Particulates	10/26/06	10/26/06	10/30/06	192	µg		100	µg	2006100890	6
102506-04-AA	10/25/06	285.854	NIOSH 0500	Total Particulates	10/26/06	10/26/06	10/30/06	100	µg	LT	100	µg	2006100890	7
102506-05-AA	10/25/06	287.105	NIOSH 0500	Total Particulates	10/26/06	10/26/06	10/30/06	100	µg	LT	100	µg	2006100890	8
102506-06-AA	10/25/06	287.243	NIOSH 0500	Total Particulates	10/26/06	10/26/06	10/30/06	100	µg	LT	100	µg	2006100890	9
102506-07-AA	10/25/06	289.12	NIOSH 0500	Total Particulates	10/26/06	10/26/06	10/30/06	100	µg	LT	100	µg	2006100890	10
102506-TB	10/25/06	0	NIOSH 0500	Total Particulates	10/26/06	10/26/06	10/30/06	100	µg	LT	100	µg	2006100890	11

Submitter Sample ID	Collect Date	Air Volume	Test Method	Compound Name	Receive Date	Analysis Date	Report Date	Micrograms	Log Units	Result Qualifier	Loq	Loq Units	Work Order Numbe	Sample Code
103106-01-PA	10/31/06	1051.115	MODIFIED OSHA ID 215	Chromium (VI) Compounds, as Cr (OSHA)	11/01/06	11/06/06	11/06/06	0.01002004	ug	LT	0.01	ug	2006110001	1
103106-02-PA	10/31/06	1056.524	MODIFIED OSHA ID 215	Chromium (VI) Compounds, as Cr (OSHA)	11/01/06	11/06/06	11/06/06	0.01721443	ug		0.01	ug	2006110001	2
103106-03-PA	10/31/06	1031.198	MODIFIED OSHA ID 215	Chromium (VI) Compounds, as Cr (OSHA)	11/01/06	11/06/06	11/06/06	0.1169339	ug		0.01	ug	2006110001	3
103106-04-PA	10/31/06	1006.802	MODIFIED OSHA ID 215	Chromium (VI) Compounds, as Cr (OSHA)	11/01/06	11/06/06	11/06/06	0.2490982	ug		0.01	ug	2006110001	4
103106-05-AA	10/31/06	940.688	MODIFIED OSHA ID 215	Chromium (VI) Compounds, as Cr (OSHA)	11/01/06	11/06/06	11/06/06	0.01002004	ug	LT	0.01	ug	2006110001	5
103106-06-AA	10/31/06	874.489	MODIFIED OSHA ID 215	Chromium (VI) Compounds, as Cr (OSHA)	11/01/06	11/06/06	11/06/06	0.01002004	ug	LT	0.01	ug	2006110001	6
103106-07-AA	10/31/06	909.44	MODIFIED OSHA ID 215	Chromium (VI) Compounds, as Cr (OSHA)	11/01/06	11/06/06	11/06/06	0.01002004	ug	LT	0.01	ug	2006110001	7
103106-08-AA	10/31/06	869.753	MODIFIED OSHA ID 215	Chromium (VI) Compounds, as Cr (OSHA)	11/01/06	11/06/06	11/06/06	0.01002004	ug	LT	0.01	ug	2006110001	8
103106-TB	10/31/06	0	MODIFIED OSHA ID 215	Chromium (VI) Compounds, as Cr (OSHA)	11/01/06	11/06/06	11/06/06	0.01002004	ug	LT	0.01	ug	2006110001	9
103106-01-PA	10/31/06	1051.115	NIOSH 0500	Total Particulates	11/01/06	11/01/06	11/06/06	140	µg		100	µg	2006110001	1
103106-02-PA	10/31/06	1056.524	NIOSH 0500	Total Particulates	11/01/06	11/01/06	11/06/06	178	µg		100	µg	2006110001	2
103106-03-PA	10/31/06	1031.198	NIOSH 0500	Total Particulates	11/01/06	11/01/06	11/06/06	566	µg		100	µg	2006110001	3
103106-04-PA	10/31/06	1006.802	NIOSH 0500	Total Particulates	11/01/06	11/01/06	11/06/06	1103	µg		100	µg	2006110001	4
103106-05-AA	10/31/06	940.688	NIOSH 0500	Total Particulates	11/01/06	11/01/06	11/06/06	100	µg	LT	100	µg	2006110001	5
103106-06-AA	10/31/06	874.489	NIOSH 0500	Total Particulates	11/01/06	11/01/06	11/06/06	100	µg	LT	100	µg	2006110001	6
103106-07-AA	10/31/06	909.44	NIOSH 0500	Total Particulates	11/01/06	11/01/06	11/06/06	100	µg	LT	100	µg	2006110001	7
103106-08-AA	10/31/06	869.753	NIOSH 0500	Total Particulates	11/01/06	11/01/06	11/06/06	100	µg	LT	100	µg	2006110001	8
103106-TB	10/31/06	0	NIOSH 0500	Total Particulates	11/01/06	11/01/06	11/06/06	100	µg	LT	100	µg	2006110001	9

Submitter Sample ID	Collect Date	Air Volume	Test Method	Compound Name	Receive Date	Analysis Date	Report Date	Micrograms	Log Units	Result Qualifier	Loq	Loq Units	Work Order Numbe	Sample Code
110206-01-PA	11/02/06	1146.103	MODIFIED OSHA ID 215	Chromium (VI) Compounds, as Cr (OSHA)	11/06/06	11/08/06	11/08/06	0.01007049	ug	LT	0.01	ug	2006110107	1
110306-01-PA	11/03/06	1109.35	MODIFIED OSHA ID 215	Chromium (VI) Compounds, as Cr (OSHA)	11/06/06	11/08/06	11/08/06	0.01007049	ug	LT	0.01	ug	2006110107	2
110306-02-PA	11/03/06	1062.923	MODIFIED OSHA ID 215	Chromium (VI) Compounds, as Cr (OSHA)	11/06/06	11/08/06	11/08/06	0.01007049	ug	LT	0.01	ug	2006110107	3
110306-03-PA	11/03/06	1026.129	MODIFIED OSHA ID 215	Chromium (VI) Compounds, as Cr (OSHA)	11/06/06	11/08/06	11/08/06	0.1389225	ug		0.01	ug	2006110107	4
110306-04-PA	11/03/06	1018.659	MODIFIED OSHA ID 215	Chromium (VI) Compounds, as Cr (OSHA)	11/06/06	11/08/06	11/08/06	0.04407855	ug		0.01	ug	2006110107	5
110306-05-AA	11/03/06	964.925	MODIFIED OSHA ID 215	Chromium (VI) Compounds, as Cr (OSHA)	11/06/06	11/08/06	11/08/06	0.01007049	ug	LT	0.01	ug	2006110107	6
110306-07-AA	11/03/06	1019.528	MODIFIED OSHA ID 215	Chromium (VI) Compounds, as Cr (OSHA)	11/06/06	11/08/06	11/08/06	0.01007049	ug	LT	0.01	ug	2006110107	7
110306-08-AA	11/03/06	1031.085	MODIFIED OSHA ID 215	Chromium (VI) Compounds, as Cr (OSHA)	11/06/06	11/08/06	11/08/06	0.01007049	ug	LT	0.01	ug	2006110107	8
110306-TB	11/03/06	0	MODIFIED OSHA ID 215	Chromium (VI) Compounds, as Cr (OSHA)	11/06/06	11/08/06	11/08/06	0.01007049	ug	LT	0.01	ug	2006110107	9
110306-06-AA	11/03/06	1015.808	MODIFIED OSHA ID 215	Chromium (VI) Compounds, as Cr (OSHA)	11/06/06	11/08/06	11/08/06	0.01007049	ug	LT	0.01	ug	2006110107	10
110206-01-PA	11/02/06	1146.103	NIOSH 0500	Total Particulates	11/06/06	11/07/06	11/08/06	100	µg	LT	100	µg	2006110107	1
110306-01-PA	11/03/06	1109.35	NIOSH 0500	Total Particulates	11/06/06	11/07/06	11/08/06	100	µg	LT	100	µg	2006110107	2
110306-02-PA	11/03/06	1062.923	NIOSH 0500	Total Particulates	11/06/06	11/07/06	11/08/06	100	µg	LT	100	µg	2006110107	3
110306-03-PA	11/03/06	1026.129	NIOSH 0500	Total Particulates	11/06/06	11/07/06	11/08/06	965	µg		100	µg	2006110107	4
110306-04-PA	11/03/06	1018.659	NIOSH 0500	Total Particulates	11/06/06	11/07/06	11/08/06	292	µg		100	µg	2006110107	5
110306-05-AA	11/03/06	964.925	NIOSH 0500	Total Particulates	11/06/06	11/07/06	11/08/06	100	µg	LT	100	µg	2006110107	6
110306-07-AA	11/03/06	1019.528	NIOSH 0500	Total Particulates	11/06/06	11/07/06	11/08/06	100	µg	LT	100	µg	2006110107	7
110306-08-AA	11/03/06	1031.085	NIOSH 0500	Total Particulates	11/06/06	11/07/06	11/08/06	100	µg	LT	100	µg	2006110107	8
110306-TB	11/03/06	0	NIOSH 0500	Total Particulates	11/06/06	11/07/06	11/08/06	100	µg	LT	100	µg	2006110107	9
110306-06-AA	11/03/06	1015.808	NIOSH 0500	Total Particulates	11/06/06	11/07/06	11/08/06	100	µg	LT	100	µg	2006110107	10

Submitter Sample ID	Collect Date	Air Volume	Test Method	Compound Name	Receive Date	Analysis Date	Report Date	Micrograms	Log Units	Result Qualifier	Loq	Loq Units	Work Order Numbe	Sample Code
110606-01-PA	11/06/06	1227.76	MODIFIED OSHA ID 215	Chromium (VI) Compounds, as Cr (OSHA)	11/07/06	11/09/06	11/09/06	0.01081653	ug		0.01	ug	2006110128	1
110606-02-PA	11/06/06	1240.872	MODIFIED OSHA ID 215	Chromium (VI) Compounds, as Cr (OSHA)	11/07/06	11/09/06	11/09/06	0.01865928	ug		0.01	ug	2006110128	2
110606-03-PA	11/06/06	1186.636	MODIFIED OSHA ID 215	Chromium (VI) Compounds, as Cr (OSHA)	11/07/06	11/09/06	11/09/06	1.842369	ug		0.01	ug	2006110128	3
110606-04-PA	11/06/06	1180.378	MODIFIED OSHA ID 215	Chromium (VI) Compounds, as Cr (OSHA)	11/07/06	11/09/06	11/09/06	0.174627	ug		0.01	ug	2006110128	4
110606-05-AA	11/06/06	917.29	MODIFIED OSHA ID 215	Chromium (VI) Compounds, as Cr (OSHA)	11/07/06	11/09/06	11/09/06	0.01008064	ug	LT	0.01	ug	2006110128	5
110606-06-AA	11/06/06	874.927	MODIFIED OSHA ID 215	Chromium (VI) Compounds, as Cr (OSHA)	11/07/06	11/09/06	11/09/06	0.01008064	ug	LT	0.01	ug	2006110128	6
110606-07-AA	11/06/06	919.046	MODIFIED OSHA ID 215	Chromium (VI) Compounds, as Cr (OSHA)	11/07/06	11/09/06	11/09/06	0.01008064	ug	LT	0.01	ug	2006110128	7
110606-08-AA	11/06/06	915.534	MODIFIED OSHA ID 215	Chromium (VI) Compounds, as Cr (OSHA)	11/07/06	11/09/06	11/09/06	0.01008064	ug	LT	0.01	ug	2006110128	8
110606-TB	11/06/06	0	MODIFIED OSHA ID 215	Chromium (VI) Compounds, as Cr (OSHA)	11/07/06	11/09/06	11/09/06	0.01008064	ug	LT	0.01	ug	2006110128	9
110606-01-PA	11/06/06	1227.76	NIOSH 0500	Total Particulates	11/07/06	11/07/06	11/09/06	155	µg		100	µg	2006110128	1
110606-02-PA	11/06/06	1240.872	NIOSH 0500	Total Particulates	11/07/06	11/07/06	11/09/06	117	µg		100	µg	2006110128	2
110606-03-PA	11/06/06	1186.636	NIOSH 0500	Total Particulates	11/07/06	11/07/06	11/09/06	1325	µg		100	µg	2006110128	3
110606-04-PA	11/06/06	1180.378	NIOSH 0500	Total Particulates	11/07/06	11/07/06	11/09/06	594	µg		100	µg	2006110128	4
110606-05-AA	11/06/06	917.29	NIOSH 0500	Total Particulates	11/07/06	11/07/06	11/09/06	100	µg	LT	100	µg	2006110128	5
110606-06-AA	11/06/06	874.927	NIOSH 0500	Total Particulates	11/07/06	11/07/06	11/09/06	100	µg	LT	100	µg	2006110128	6
110606-07-AA	11/06/06	919.046	NIOSH 0500	Total Particulates	11/07/06	11/07/06	11/09/06	100	µg	LT	100	µg	2006110128	7
110606-08-AA	11/06/06	915.534	NIOSH 0500	Total Particulates	11/07/06	11/07/06	11/09/06	100	µg	LT	100	µg	2006110128	8
110606-TB	11/06/06	0	NIOSH 0500	Total Particulates	11/07/06	11/07/06	11/09/06	100	µg	LT	100	µg	2006110128	9

Submitter Sample ID	Collect Date	Air Volume	Test Method	Compound Name	Receive Date	Analysis Date	Report Date	Micrograms	Log Units	Result Qualifier	Loq	Loq Units	Work Order Numbe	Sample Code
111406-01-PA	11/14/06	1162.367	MODIFIED OSHA ID 215	Chromium (VI) Compounds, as Cr (OSHA)	11/15/06	11/20/06	11/20/06	0.01012146	ug	LT	0.01	ug	2006110375	1
111406-02-PA	11/14/06	965.246	MODIFIED OSHA ID 215	Chromium (VI) Compounds, as Cr (OSHA)	11/15/06	11/20/06	11/20/06	0.01012146	ug	LT	0.01	ug	2006110375	2
111406-03-PA	11/14/06	933.878	MODIFIED OSHA ID 215	Chromium (VI) Compounds, as Cr (OSHA)	11/15/06	11/20/06	11/20/06	0.3381478	ug		0.01	ug	2006110375	3
111406-04-PA	11/14/06	950.222	MODIFIED OSHA ID 215	Chromium (VI) Compounds, as Cr (OSHA)	11/15/06	11/20/06	11/20/06	2.208897	ug		0.01	ug	2006110375	4
111406-05-AA	11/14/06	1007.056	MODIFIED OSHA ID 215	Chromium (VI) Compounds, as Cr (OSHA)	11/15/06	11/20/06	11/20/06	0.01012146	ug	LT	0.01	ug	2006110375	5
111406-06-AA	11/14/06	1047.19	MODIFIED OSHA ID 215	Chromium (VI) Compounds, as Cr (OSHA)	11/15/06	11/20/06	11/20/06	0.01012146	ug	LT	0.01	ug	2006110375	6
111406-07-AA	11/14/06	1008.371	MODIFIED OSHA ID 215	Chromium (VI) Compounds, as Cr (OSHA)	11/15/06	11/20/06	11/20/06	0.01012146	ug	LT	0.01	ug	2006110375	7
111406-08-AA	11/14/06	1019.608	MODIFIED OSHA ID 215	Chromium (VI) Compounds, as Cr (OSHA)	11/15/06	11/20/06	11/20/06	0.01012146	ug	LT	0.01	ug	2006110375	8
111406-TB	11/14/06	0	MODIFIED OSHA ID 215	Chromium (VI) Compounds, as Cr (OSHA)	11/15/06	11/20/06	11/20/06	0.01012146	ug	LT	0.01	ug	2006110375	9
111406-01-PA	11/14/06	1162.367	NIOSH 0500	Total Particulates	11/15/06	11/16/06	11/20/06	100	µg	LT	100	µg	2006110375	1
111406-02-PA	11/14/06	965.246	NIOSH 0500	Total Particulates	11/15/06	11/16/06	11/20/06	100	µg	LT	100	µg	2006110375	2
111406-03-PA	11/14/06	933.878	NIOSH 0500	Total Particulates	11/15/06	11/16/06	11/20/06	1384	µg		100	µg	2006110375	3
111406-04-PA	11/14/06	950.222	NIOSH 0500	Total Particulates	11/15/06	11/16/06	11/20/06	2132	µg		100	µg	2006110375	4
111406-05-AA	11/14/06	1007.056	NIOSH 0500	Total Particulates	11/15/06	11/16/06	11/20/06	100	µg	LT	100	µg	2006110375	5
111406-06-AA	11/14/06	1047.19	NIOSH 0500	Total Particulates	11/15/06	11/16/06	11/20/06	100	µg	LT	100	µg	2006110375	6
111406-07-AA	11/14/06	1008.371	NIOSH 0500	Total Particulates	11/15/06	11/16/06	11/20/06	100	µg	LT	100	µg	2006110375	7
111406-08-AA	11/14/06	1019.608	NIOSH 0500	Total Particulates	11/15/06	11/16/06	11/20/06	100	µg	LT	100	µg	2006110375	8
111406-TB	11/14/06	0	NIOSH 0500	Total Particulates	11/15/06	11/16/06	11/20/06	100	µg	LT	100	µg	2006110375	9

Attachment B

Attachment B - Water Quality Data

Location ID	Sample ID	Sample Date	Turbidity (NTU)	Temperature (°C)	pH (Std. Units)	Conductivity (mS/cm)	ORP (mV)	Dissolved Oxygen (mg/L)
DMT-01S	DMT01S-052306	5/23/06	67.1	19.6	10.31	4.45	-400	3.41
DMT-02S	DMT02S-052306	5/23/06	99.8	19.3	10.39	1.27	-314	3.21
DMT-03S	DMT03S-052306	5/23/06	119	21.1	10.06	13.6	-309	1.84
DMT-04S	DMT04S-052306	5/23/06	43.2	20.4	11.04	3.24	-382	1.35
DMT-05S	DMT05S-052306	5/23/06	17.7	20.4	11.9	8.3	-431	1.09
DMT-06S	DMT06S-052306	5/23/06	29.6	20.7	12.75	29	-458	0.87
DMT-07S	DMT07S-052406	5/24/06	91.9	18.8	12.61	35.6	-92	0.76
DMT-08S	DMT08S-052406	5/24/06	52.2	18.4	11.77	8.38	-283	0.87
DMT-09S	DMT09S-052406	5/24/06	44.8	21.3	12.39	24.2	-485	0.49
DMT-10S	DMT10S-052406	5/24/06	40.5	20.1	12.01	12	-485	0
DMT-11S	DMT11S-052406	5/24/06	384	19.9	8.52	11.1	-365	0.08
DMT-12S	DMT12S-052206	5/22/06	99.7	19.3	11.36	1.79	-291	3.97
DMT-12S	DMT-12S-GRW-022607	2/26/07	20.1	15.9	12.17	1.54	-393	0
DMT-12S	DMT-12S-GRW-060509-F	6/5/09	31	16.41	11.89	2.31	-369	0.32
DMT-13S	DMT13S-052406	5/24/06	46.6	18.6	12.24	12.7	-282	0
DMT-14S	DMT14S-052206	5/22/06	31.5	18.9	6.17	12.4	-254	3.65
DMT-14S	DMT-14S-GRW-022607	2/26/07	79.3	14.2	6.49	10.6	-93	0
DMT-14S	DMT-14S-GRW-060809-F	6/8/09	109	20.18	8.19	0.209	-116	0
DMT-15S	DMT15S-052206	5/22/06	122	20.4	5.36	11	-133	3.56
DMT-15S	DMT-15S-GRW-022807	2/28/07	28.2	19.3	5.32	12.5	72	0
DMT-15S	DMT-15S-GRW-060809-F	6/8/09	407	21.26	5.9	13.3	11	0
DMT-16S	DMT16S-052206	5/22/06	24.2	19.4	7.97	8	-216	4.06
DMT-16S	DMT-16S-GRW-030107	3/1/07	0	10.9	8.62	5.93	-114	0.05
DMT-17S	DMT17S-052306	5/23/06	108	18.5	10.7	3.79	-374	3.08
DMT-17S	DMT-17S-GRW-022707	2/27/07	4.41	15.7	10.11	2.9	-321	0
DMT-17S	DMT-17S-GRW-060409-F	6/4/09	27.9	20.89	10.1	2.75	-345	0.26
DMT-18S	DMT18S-052306	5/23/06	25.8	20.3	11.72	5.49	-440	3.15
DMT-18S	DMT-18S-GRW-022807	2/28/07	80.3	14.2	10.4	6.98	-431	0
DMT-19S	DMT19S-052406	5/24/06	88.7	19.6	6.24	3.26	-293	0.06
DMT-19S	DMT-19S-GRW-022807	2/28/07	0	12.6	6.64	3.62	-89	1.09
DMT-20S	DMT20S-052406	5/24/06	31.1	19.5	6.69	13.4	-247	0.09
DMT-20S	DMT-20S-GRW-030207	3/2/07	0	15.4	6.95	4.97	-151	0
DMT-21S	DMT21S-052506	5/24/06	76.9	18.5	6.33	11.3	-109	1.41

Attachment B - Water Quality Data

Location ID	Sample ID	Sample Date	Turbidity (NTU)	Temperature (°C)	pH (Std. Units)	Conductivity (mS/cm)	ORP (mV)	Dissolved Oxygen (mg/L)
DMT-22S	DMT22S-052306	5/23/06	88.2	19.5	12.69	22.9	-220	3.97
DMT-23S	DMT23S-052306	5/23/06	18.5	19.6	9.74	4.11	-316	3.11
DMT-24S	DMT24S-052406	5/24/06	4.3	19.4	12.06	10	-307	0.43
DMT-25S	DMT25S-052406	5/24/06	19	18.5	12.07	9.57	-467	0
DMT-25S	DMT-25S-GRW-120406	12/4/06	0	22.25	12.63	9.8	-330	0
DMT-26S	DMT-26S-GRW-022807	2/28/07	121	18.1	7.03	11.7	-209	2.43
DMT-27S	DMT-27S-GRW-022707	2/27/07	108	16.8	7.41	13.6	-232	0
DMT-27S	DMT-27S-GRW-060409-F	6/4/09	900	18.82	7.66	23.4	-244	0.26
DMT-28S	DMT-28S-GRW-030207	3/2/07	0	20.1	6.9	9.79	-193	0.1
DMT-29S	DMT-29S-GRW-022707	2/27/07	12.8	13.6	12.47	10.9	-274	0
DMT-30S	DMT-30S-GRW-022807	2/28/07	922	13.7	13.18	25.4	-197	0
DMT-30S	DMT-30S-GRW-100807-F	10/8/07	504	21.3	12.41	26.1	-266	4.02
DMT-31S	DMT-31S-GRW-030107	3/1/07	279	17.8	7.28	4.07	-199	0
DMT-32S	DMT-32S-GRW-030107	3/1/07	112	16.2	6.65	11.1	-172	0
DMT-33S	DMT-33S-GRW-022707	2/27/07	43.7	19.7	13.02	19.8	-168	0.11
DMT-39S	DMT-39S-GRW-022707	2/27/07	88.1	19.4	5.26	0.93	106	0.1
DMT-39S	DMT-39S-GRW-061009-F	6/10/09	90	21.59	6.16	28.5	171	0.83
DMT-40S	DMT-40S-GRW-092507-F	9/25/07	--	23.8	6.73	5.23	-196	1.23
DMT-41S	DMT-41S-GRW-092607-F	9/26/07	322	25.4	7.04	3.19	-219	0.37
DMT-41S	DMT-41S-GRW-060509-F	6/5/09	39.7	22.8	9.43	2.6	-122	0
DMT-42S	DMT-42S-GRW-092607-F	9/26/07	992	26.3	7.63	0	-88	6.57
DMT-42S	DMT-42S-GRW-060409-F	6/4/09	301	19.9	13.07	1.32	-274	0
DMT-43S	DMT-43S-GRW-092507-F	9/25/07	--	23.4	12.14	8.95	-462	1.72
DMT-44S	DMT-44S-GRW-092507-F	9/25/07	613	24	12.45	23.6	-203	0.27
DMT-44S	DMT-44S-GRW-060809-F	6/8/09	111	19.4	13.23	33.7	-245	0.3
DMT-45S	DMT-45S-GRW-092607-F	9/26/07	419	19.8	11.76	6.28	-502	0.47
DMT-45S	DMT-45S-GRW-061109-F	6/11/09	30.4	18.7	8.08	0.223	123	1.94
DMT-46S	DMT-46S-GRW-100107-F	10/1/07	44.7	20.64	13.58	20.2	-151	0
DMT-47S	DMT-47S-GRW-100207-F	10/2/07	160.7	23.5	7.79	0.476	112	4.08
DMT-48S	DMT-48S-GRW-112707-F	11/27/07	--	19.36	6.41	1.39	-45	2.14
DMT-55S	DMT-55S-GRW-112707-F	11/27/07	0	17.52	6.96	0.632	-126	2
DMT-56S	DMT-56S-GRW-092707-F	9/27/07	--	18.2	6.63	15.6	-174	0.72
DMT-57S	DMT-57S-GRW-092707-F	9/27/07	--	20.4	7.35	14.5	-218	0.7

Attachment B - Water Quality Data

Location ID	Sample ID	Sample Date	Turbidity (NTU)	Temperature (°C)	pH (Std. Units)	Conductivity (mS/cm)	ORP (mV)	Dissolved Oxygen (mg/L)
DMT-57S	DMT-57S-GRW-060909-F	6/9/09	73.4	20.8	8.83	18.1	-569	0
DMT-58S	DMT-58S-GRW-092707-F	9/27/07	253	19.9	7.76	12.5	-228	1.03
DMT-58S	DMT-58S-061109-F	6/11/09	19.4	17.1	12.8	8.6	-153	0
DMT-59S	DMT-59S-GRW-112907-F	11/29/07	790	15.95	3.96	1.47	287	2.32
DMT-59S	DMT-59S-GRW-061009-F	6/10/09	89.3	21.1	3.99	1.27	353	0.84
DMT-61S	DMT-61S-GRW-112607-F	11/26/07	164	19.88	5.15	0.266	101	2.12
DMT-62S	DMT-62S-GRW-112607-F	11/26/07	140	20.67	5.34	0.411	-13	1.69
DMT-63S	DMT-63US-GRW-112008F	11/20/08	17.4	19.8	10.94	5.98	-356	0.69
DMT-63S	DMT-63S-GRW-060909-F	6/9/09	81.4	21.6	11.93	4.95	-411	-411
EA-6S	EA-6S-GRW-112906	11/29/06	2.5	23.69	12.66	5.53	-312	0
EA-8S	EA-8S-GRW-022807	2/28/07	0	15.1	12.89	13.2	-95	6.53
EA-8S	EA-8S-GRW-092807-F	9/28/07	0	24	11.97	13.4	-144	1.5
EA-10S	EA-10S-GRW-030107	3/1/07	0	15	10.14	6.43	-274	0
EA-11S	EA-11S-GRW-120106	12/1/06	111	21.92	7.4	0.838	-138	0
EA-11S	EA-11S-GRW-060809-F	6/8/09	91.3	19.5	8.45	0.9	-167	0.38
EA-15S	EA-15S-GRW-113006	11/30/06	263	23.67	12.96	19.8	-178	0.2
EAC-01S	EAC-1S-GRW-112806	11/28/06	0	19.63	7.69	0.945	-143	0
EAC-01S	EAC-01S-GRW-060409-F	6/4/09	32.1	17.75	7.28	0.427	15	0.59
EAC-02S	EAC-2S-GRW-030207	3/2/07	0	17	7.46	4.59	-182	0
EAC-03S	EAC-3S-GRW-022707	2/27/07	29	15.2	12.8	9.29	-71	2.44
EAC-04S	EAC-4S-GRW-113006	11/30/06	0	22.71	12.76	12	-235	0
P-4	P-4-GRW-120506	12/5/06	0	20.22	12.91	16.8	-228	0
TPZ-27A	TPZ-27A-GRW-022607	2/26/07	69.5	13.9	6.71	0.71	-78	9.54
TPZ-27B	TPZ-27B-GRW-022607	2/26/07	35.2	12.4	11.64	1.23	-27	4.51
TPZ-28	TPZ-28-GRW-022707	2/27/07	115	7	7.35	0.361	-112	0.63
TPZ-29	TPZ-29-GRW-022707	2/27/07	33.9	15.5	5.81	0.544	-13	4.48
TPZ-30A	TPZ-30A-GRW-022607	2/26/07	89	13.9	6.18	0.288	-35	8.49
TPZ-30B	TPZ-30B-GRW-022607	2/26/07	41.8	10.5	12.8	10.1	-174	0
TPZ-33	TPZ-33-GRW-092607-F	9/26/07	207	29.2	6.08	50.1	-68	3.01
TPZ-36	TPZ-36-GRW-092607-F	9/26/07	21	29.4	7.01	0.87	-151	0.03
TPZ-38	TPZ-38-GRW-092607-F	9/26/07	222	25.7	7.6	6.07	-203	0
TPZ-44	TPZ-44-GRW-092807-F	9/28/07	13.1	23	13.44	12.9	-277	0
TPZ-45	TPZ-45-GRW-092807-F	9/28/07	43.2	21.8	6.42	0.86	38	0.02

Attachment B - Water Quality Data

Location ID	Sample ID	Sample Date	Turbidity (NTU)	Temperature (°C)	pH (Std. Units)	Conductivity (mS/cm)	ORP (mV)	Dissolved Oxygen (mg/L)
TPZ-46	TPZ-46-GRW-092807-F	9/28/07	216	25.7	13.02	8.17	-334	0.37
DMT-49US	DMT-49US-GRW-100807-F	10/8/07	336	20.1	7.35	13.6	-202	--
DMT-50US	DMT-50US-GRW-092507-F	9/25/07	284	19.51	7.65	0.992	-135	0
DMT-50US	DMT-50US-GRW-060809-F	6/8/09	229	20.1	8.31	3.19	-104	0.36
DMT-51US	DMT-51US-GRW-092507-F	9/25/07	7.5	19.61	7.03	1.86	-148	2.94
DMT-52US	DMT-52US-GRW-092507-F	9/25/07	0	20.63	8.33	0.884	-4	1.62
DMT-52US	DMT-52US-GRW-060809-F	6/8/09	60.2	21.3	11.43	15.1	-246	0
DMT-53US	DMT-53US-GRW-092807-F	9/28/07	0	22	5.97	4.47	-14	2.14
DMT-54US	DMT-54US-GRW-100107-F	10/1/07	--	18.01	4.41	0.818	229	0.6
DMT-54US	DMT-54US-GRW-060509-F	6/5/09	36.1	17.65	4.04	1.05	396	0.95
DMT-64US	DMT-64US-GRW-111808F	11/18/08	3	17.81	6.46	9.99	-245	0.75
DMT-64US	DMT-64US-GRW-060409-F	6/4/09	121	18.3	11.63	9.03	-244	0
DMT-65US	DMT-65US-GRW-111808F	11/18/08	48.4	18.7	7.81	12.3	-202	0.35
DMT-65US	DMT-65US-GRW-060409-F	6/4/09	65.1	19.79	7.92	15.9	-209	0
DMT-67US	DMT-67US-GRW-111908F	11/19/08	3.7	18.07	6.04	15.8	-150	0.94
DMT-67US	DMT-67US-GRW-060809-F	6/8/09	63.1	20.81	7.05	15.2	-156	0
DMT-70US	DMT-70US-GRW-111908F	11/19/08	208	15.53	5.58	14.1	-114	0.69
DMT-70US	DMT-70US-GRW-060809-F	6/8/09	191	20.22	6.46	19.1	-99	0
DMT-71US	DMT-71US-GRW-111908F	11/19/08	0	17.44	5.67	20.7	-119	0.73
DMT-72US	DMT-72US-GRW-111908F	11/19/08	0	17.66	6.03	10.7	-136	0.68
DMT-72US	DMT-72US-GRW-060509-F	6/5/09	28.3	17.2	10.25	19.6	-156	0
DMT-73US	DMT-73US-GRW-111808F	11/18/08	15	18.06	5.02	0.9	13	1.26
DMT-73US	DMT-73US-GRW-061009-F	6/10/09	44.4	19.6	5.6	0.94	172	0.2
DMT-74US	DMT-74US-GRW-111708F	11/17/08	25.7	16.8	6.63	1.2	-161	0.32
DMT-75US	DMT-75US-GRW-111708F	11/17/08	14.5	17	6.68	1.81	-102	0.63
TPZ-48	TPZ-48-GRW-031909F	3/19/09	25.2	12.99	7.22	4.88	-128	0.43
TPZ-48	TPZ-48-GRW-060909-F	6/9/09	25	22.5	6.69	6.88	-148	0.8
TPZ-49	TPZ-49-GRW-031909F	3/19/09	17.6	17.77	7.38	3.41	-124	0.36
TPZ-49	TPZ-49-GRW-060909-F	6/9/09	117	26.2	6.55	17.28	-114	1.52
DMT-01M	DMT-1M-GRW-022807	2/28/07	0.6	17.3	5.54	0.7	93	0
DMT-01M	DMT-01M-GRW-060809-F	6/8/09	85.5	19	7.05	0.826	88	0
DMT-02M	DMT-2M-GRW-010807	1/8/07	200	19.21	6.75	6.34	-125	1.95
DMT-34M	DMT-34M-GRW-022807	2/28/07	3.7	17	6.52	7.5	-147	0

Attachment B - Water Quality Data

Location ID	Sample ID	Sample Date	Turbidity (NTU)	Temperature (°C)	pH (Std. Units)	Conductivity (mS/cm)	ORP (mV)	Dissolved Oxygen (mg/L)
DMT-34M	DMT-34M-GRW-060409-F	6/4/09	277	18	9.45	6.64	-137	0
DMT-35M	DMT-35M-GRW-030207	3/2/07	77	17.1	5.77	0.378	161	4.4
DMT-35M	DMT-35M-GRW-061907-L	6/19/07	10.5	18.24	5.24	0.332	215	4.93
DMT-35M	DMT-35M-GRW-100107-F	10/1/07	529	23.8	5.98	0.24	180	5.44
DMT-36M	DMT-36M-GRW-022607	2/26/07	25.7	16.1	6.43	0.698	4	0
DMT-37M	DMT-37M-GRW-022707	2/27/07	0	16.8	5.65	0.749	57	0
DMT-38M	DMT-38M-GRW-030107	3/1/07	2.6	16.2	6.99	0.095	85	2.76
DMT-38M	DMT-38M-GRW-061807-L	6/18/07	21.4	17.38	5.73	0.106	209	3.24
DMT-60M	DMT-60M-GRW-112707-F	11/27/07	147	15.12	6.1	0.388	163	5.46
DMT-60M	DMT-60M-GRW-061009-F	6/10/09	85.7	16.81	5.28	2.08	210	6.68
DMT-77M	DMT-77M-GRW-111808F	11/18/08	222	16.3	5.09	0.9	-24	0.59
DMT-77M	DMT-77M-GRW-060809-F	6/8/09	--	17.8	7.93	0.774	-46	0
DMT-78M	DMT-78M-GRW-111808F	11/18/08	54.7	17.83	6.05	5.6	-165	0.89
DMT-79M	DMT-79M-GRW-111708F	11/17/08	7.2	17.16	5.19	0.509	39	2.19
DMT-80M	DMT-80M-GRW-111708F	11/17/08	20.2	16.69	5.63	0.91	-29	0.56
EA-05M	EA-5M-GRW-120406-02	12/4/06	463	17.86	6.85	1.84	-80	2.04
EA-06M	EA-6M-GRW-112906-02	11/29/06	88.3	19.67	6.17	1.22	-126	6.77
EA-06M	EA-06M-GRW-060409-F	6/4/09	58	17.2	8.55	1.56	-77	0
EA-07M	EA-7M-GRW-030107	3/1/07	140	17.3	6.98	0.809	-86	0
EA-07M	EA-07M-GRW-060909-F	6/9/09	0	18.7	8.81	0.514	-119	0
EA-08M	EA-8M-GRW-022807	2/28/07	0	17.2	5.43	1.32	42	0
EA-08M	EA-8M-GRW-100107-F	10/1/07	88.1	15	5.9	--	--	--
EA-10M	EA-10M-GRW-030107	3/1/07	76.3	18.1	7.48	7.48	-343	0
EA-11M	EA-11M-GRW-120106-02	12/1/06	208	22.78	6.55	1.57	-128	0
EA-11M	EA-11M-GRW-060809-F	6/8/09	65	22.3	9.56	0.91	-151	0.09
EA-13M	EA-13M-GRW-120506-2	12/5/06	0	19.72	6.17	2.2	-90	0
EA-15M	EA-15M-GRW-120106-02	12/1/06	1.1	20	6.39	4.24	-112	0
EAC-01M	EAC-1M-GRW-112806-02	11/28/06	0	22.42	5.23	0.249	165	4.17
EAC-02M	EAC-2M-GRW-030207	3/2/07	0	16.8	5.1	2.93	224	0
EAC-03M	EAC-3M-GRW-022707	2/27/07	0	16.6	6.57	0.977	-178	0
EAC-04M	EAC-4M-GRW-113006-02	11/30/06	10.2	20.65	8.03	12.2	-225	0
EAC-04M	EAC-4M-GRW-100207-F	10/2/07	203	18.8	7.99	12.6	-212	1.07
DMT-81D	DMT-81D-GRW-111908F	11/19/08	0	17	5.74	0.096	117	1.75

Attachment B - Water Quality Data

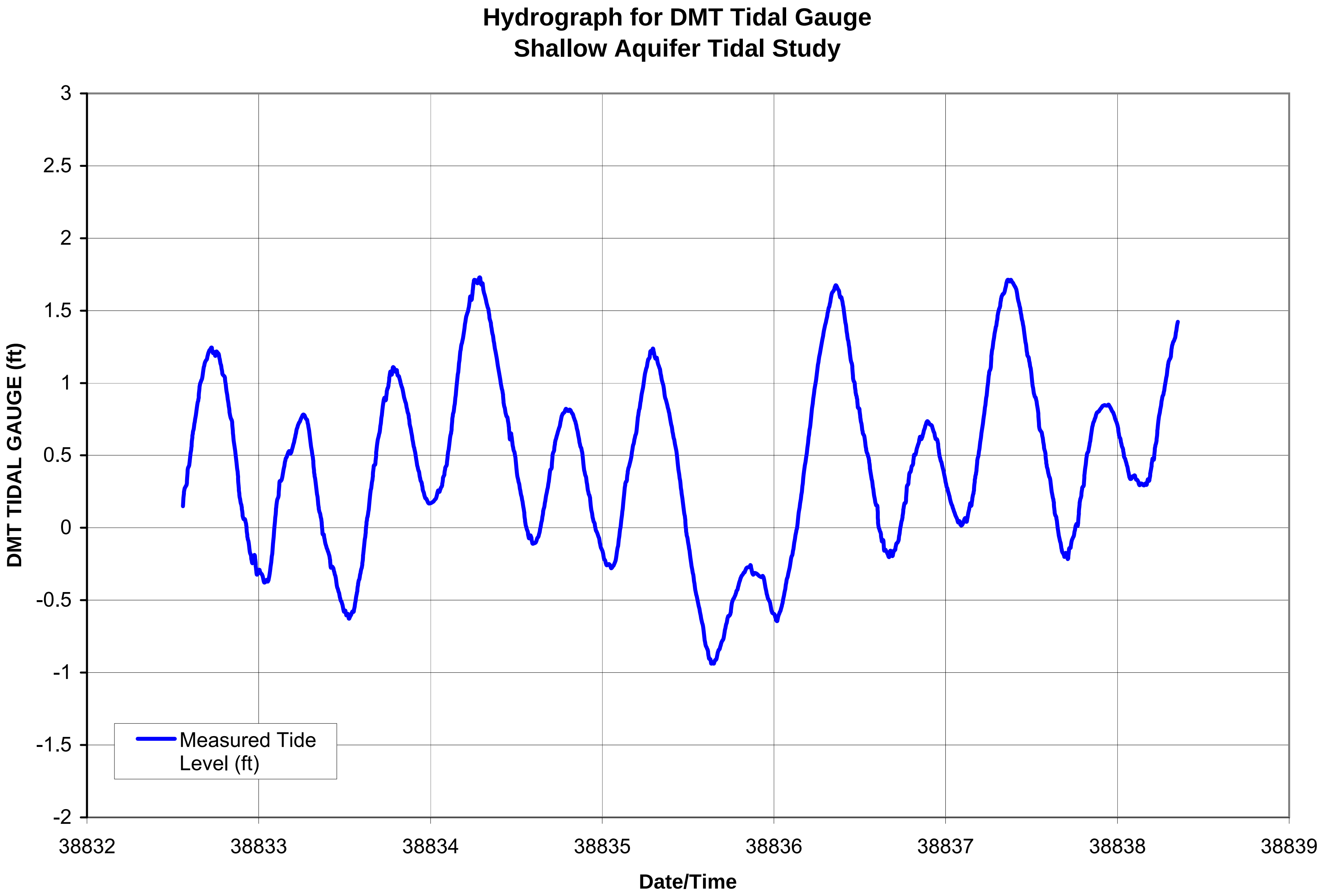
Location ID	Sample ID	Sample Date	Turbidity (NTU)	Temperature (°C)	pH (Std. Units)	Conductivity (mS/cm)	ORP (mV)	Dissolved Oxygen (mg/L)
DMT-81D	DMT-81D-061109-F	6/11/09	103	18.2	6.59	0.086	89	0.62
DMT-82D	DMT-82D-GRW-111908F	11/19/08	367	14.5	7.1	0.262	-94	1.03
DMT-82D	DMT-82D-GRW-061009-F	6/10/09	258	17	6.08	0.135	139	3.79
DMT-83D	DMT-83D-GRW-111808F	11/18/08	31.9	16.4	6.71	0.175	-82	0.59
DMT-83D	DMT-83D-GRW-061009-F	6/10/09	115	17.6	7.71	0.121	-16	0.14

Notes:

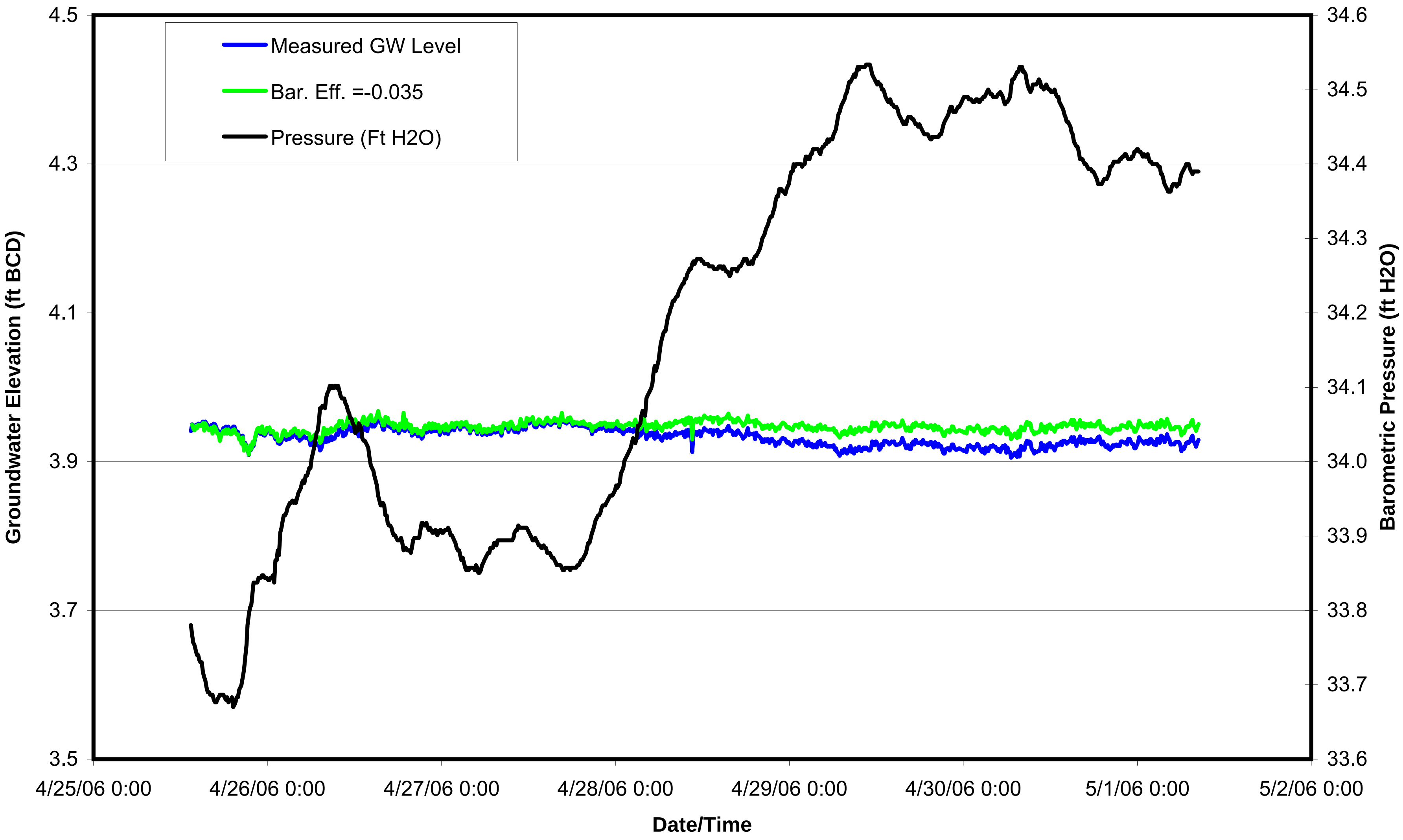
Values in table represent water quality measurements collected immediately prior to sample collection.

-- = Not Quantified

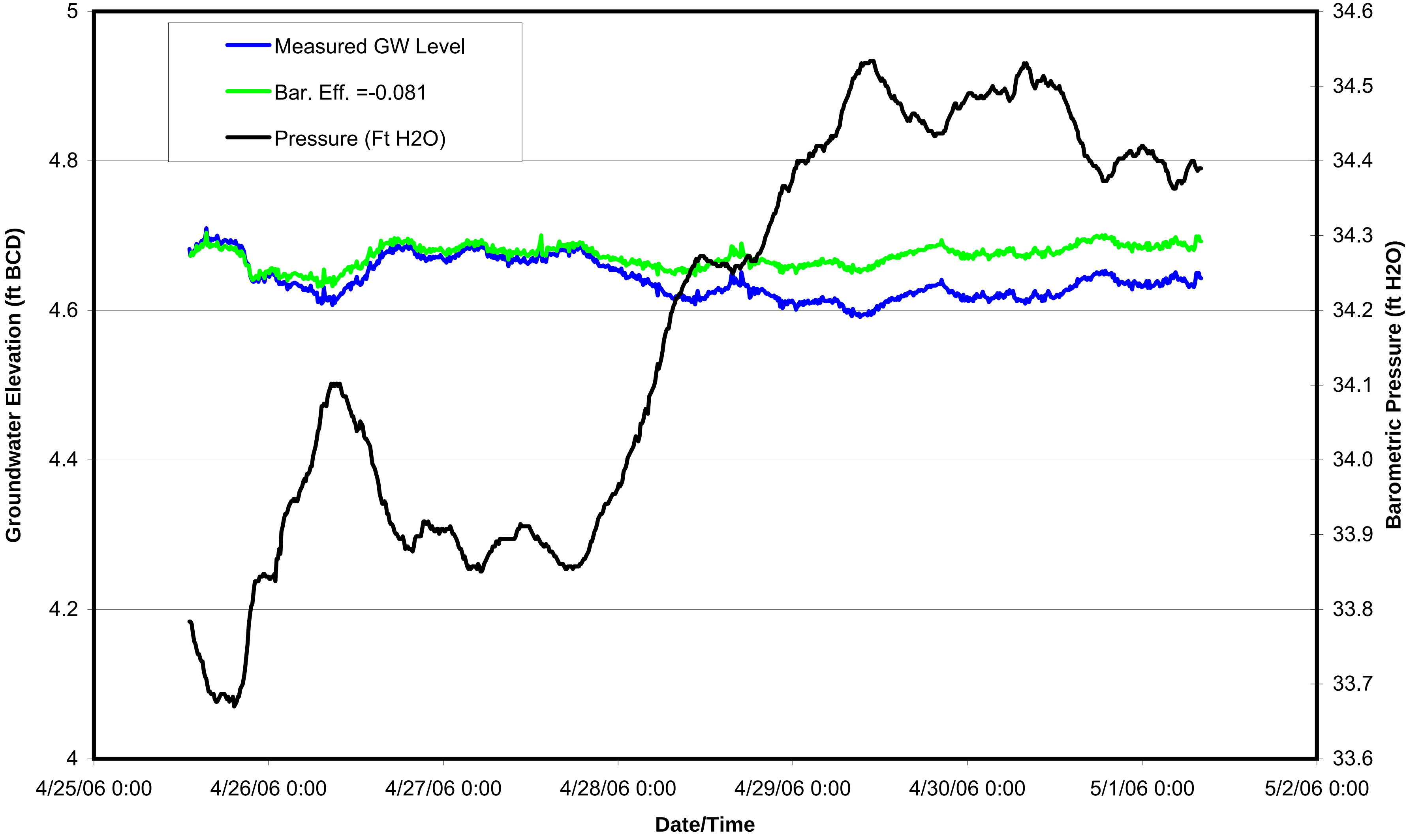
Attachment C


Hydrograph for DMT Tidal Gauge
Shallow Aquifer Tidal Study
DMT TIDAL GAUGE (ft)
3
2.5
2
1.5
1
0.5
0
-0.5
-1
-1.5
-2
38832
38833
38834
38835
38836
38837
38838
38839
Date/Time
Measured Tide Level (ft)

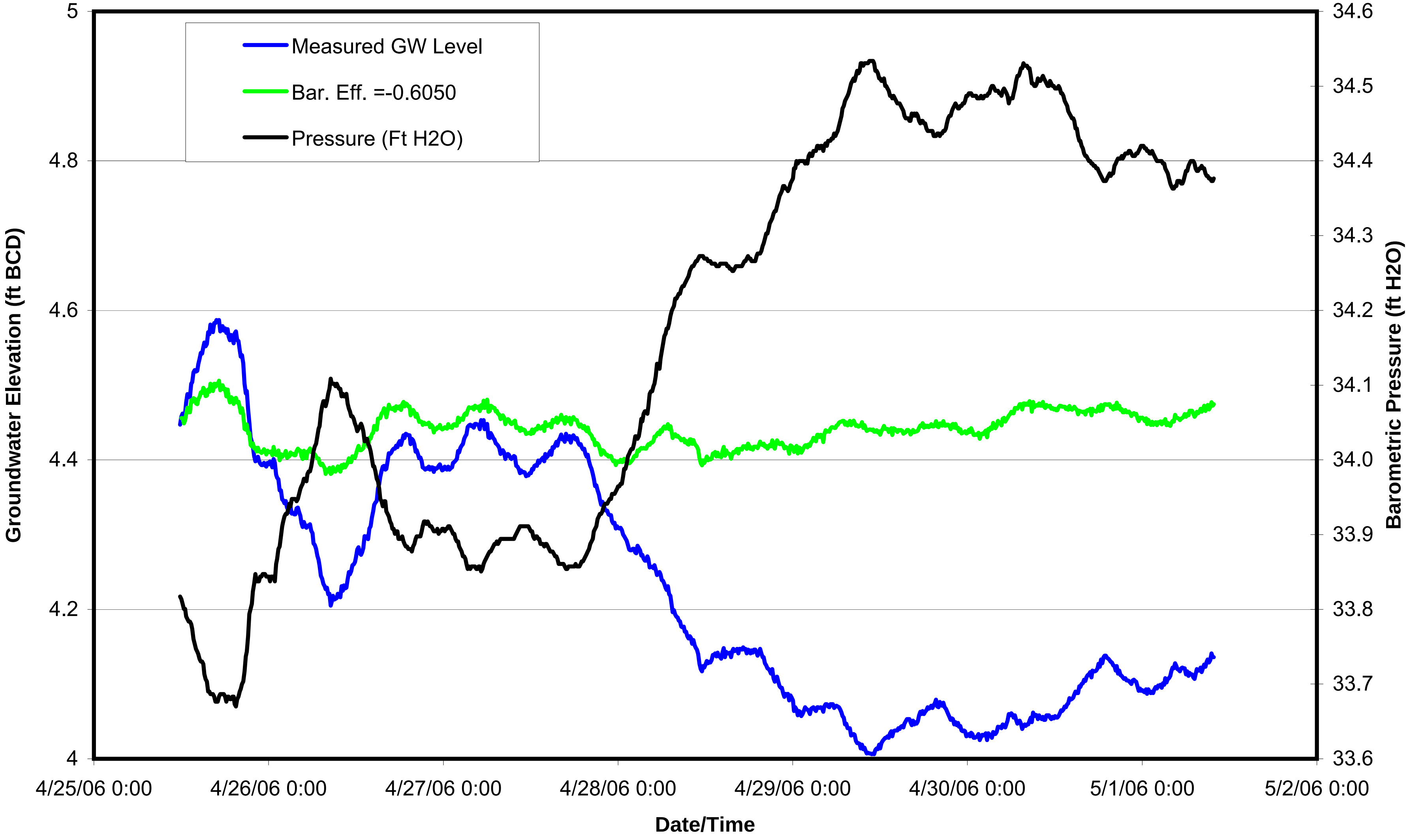
Hydrograph for Well DMT-01S
Shallow Aquifer Tidal Study



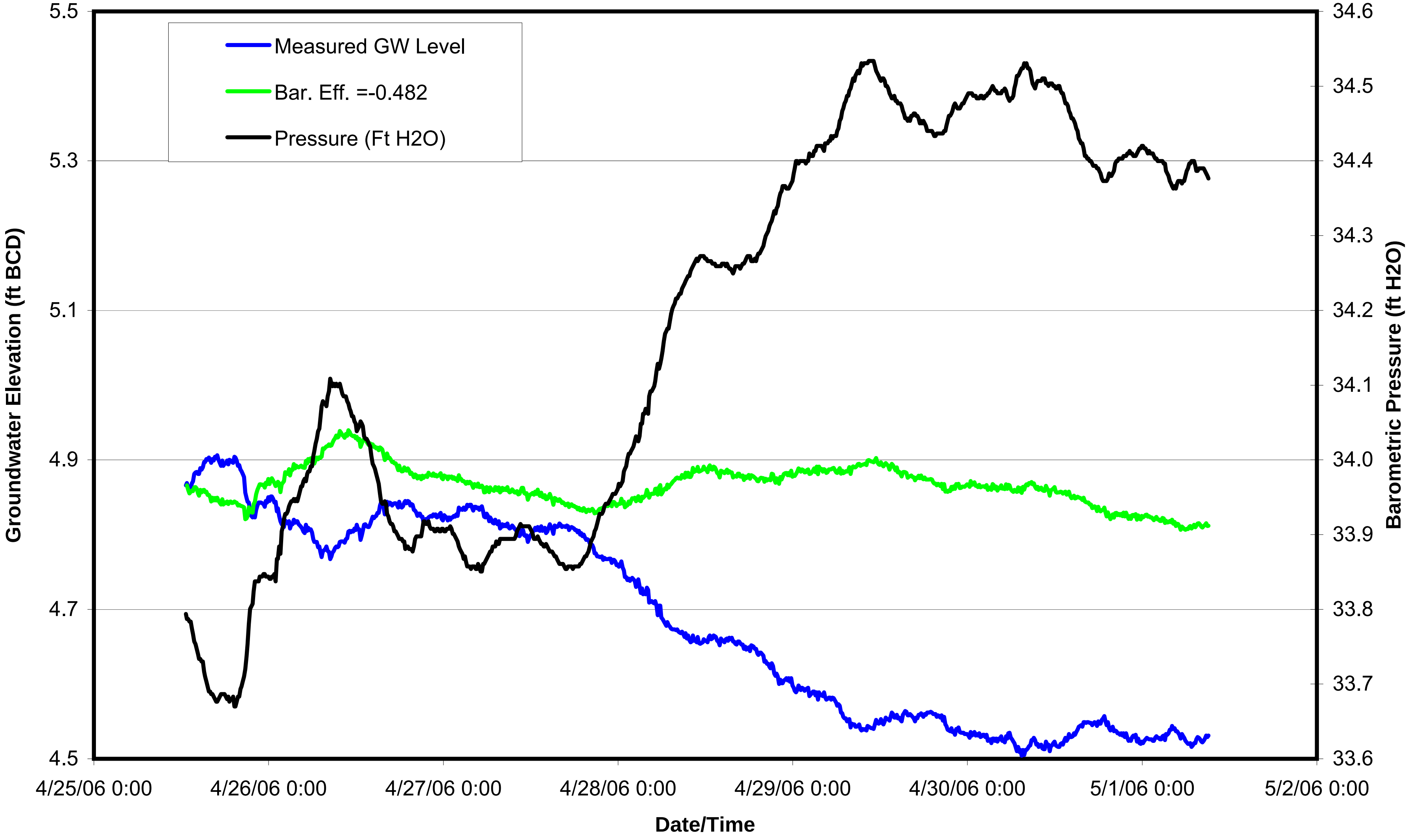
Hydrograph for Well DMT-03S
Shallow Aquifer Tidal Study



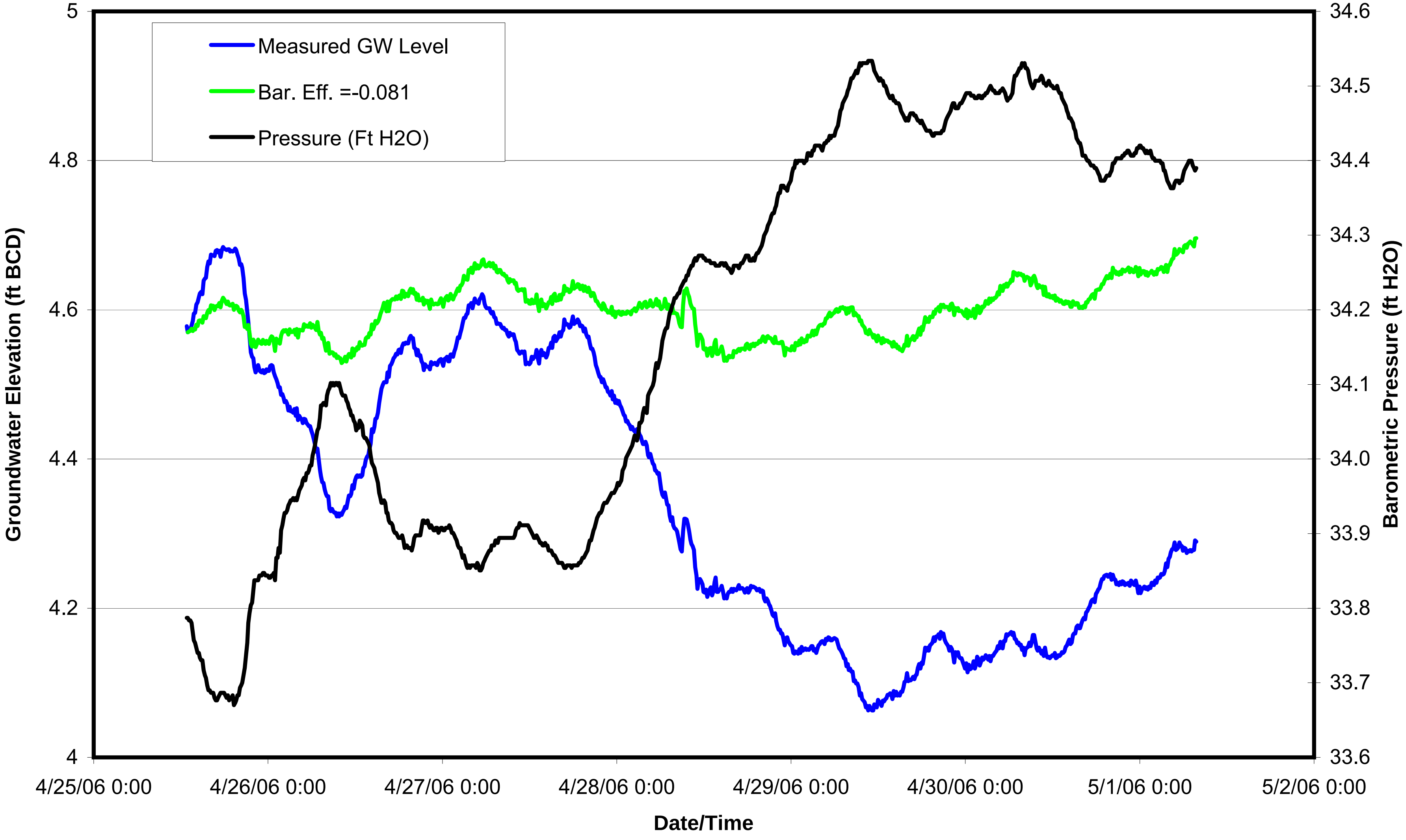
Hydrograph for Well DMT-12S
Shallow Aquifer Tidal Study

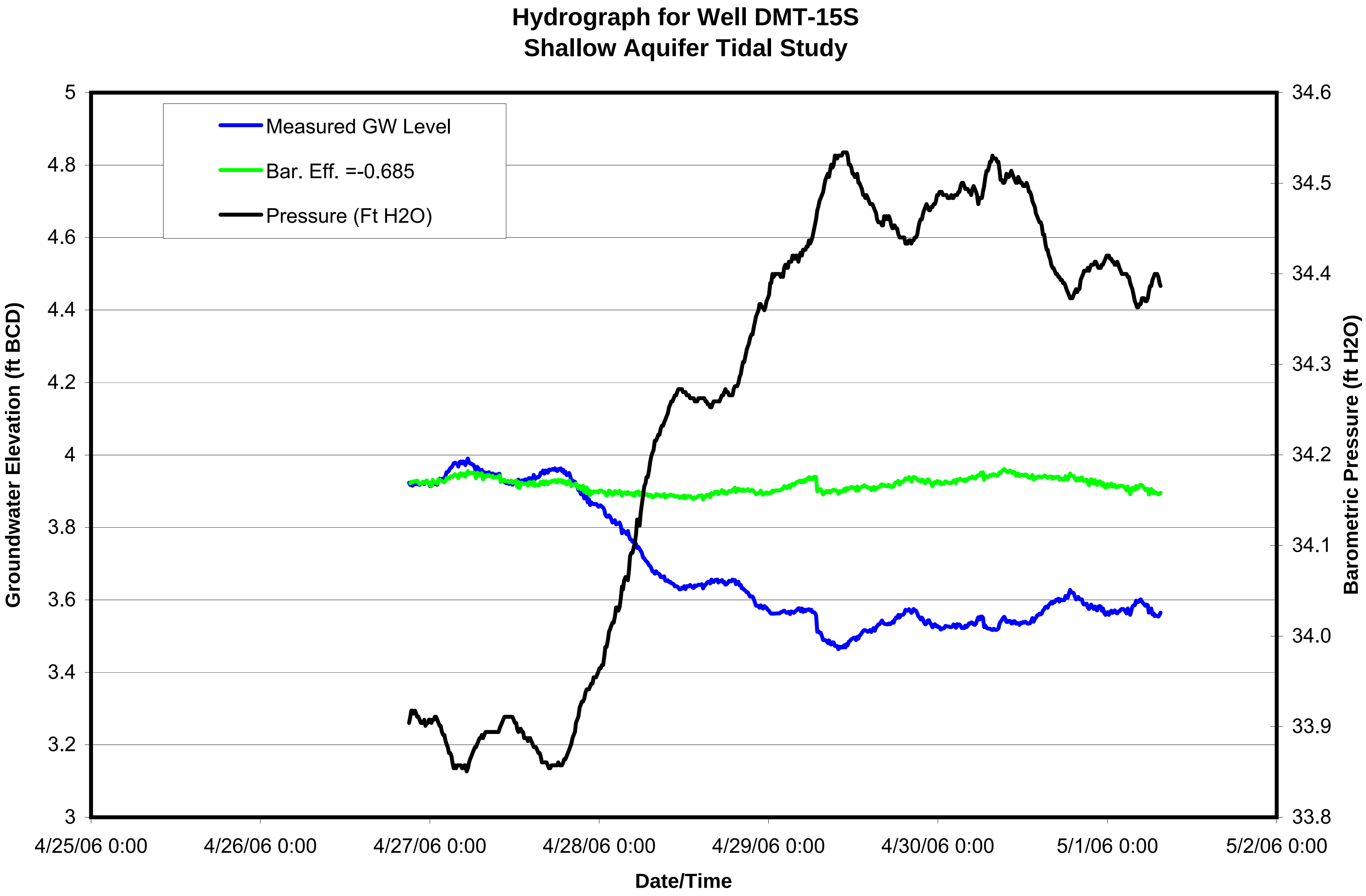


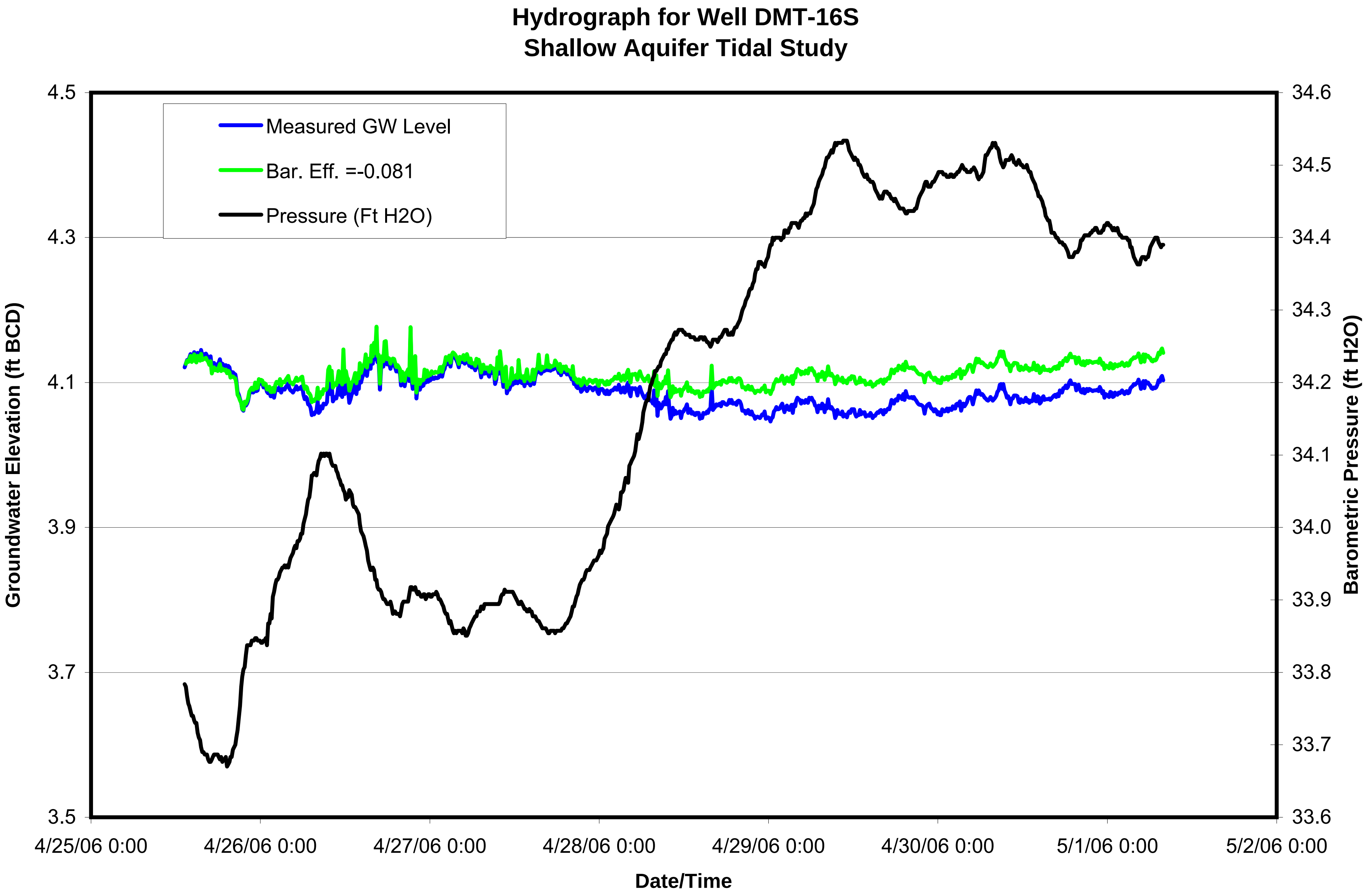
Hydrograph for Well DMT-13S
Shallow Aquifer Tidal Study



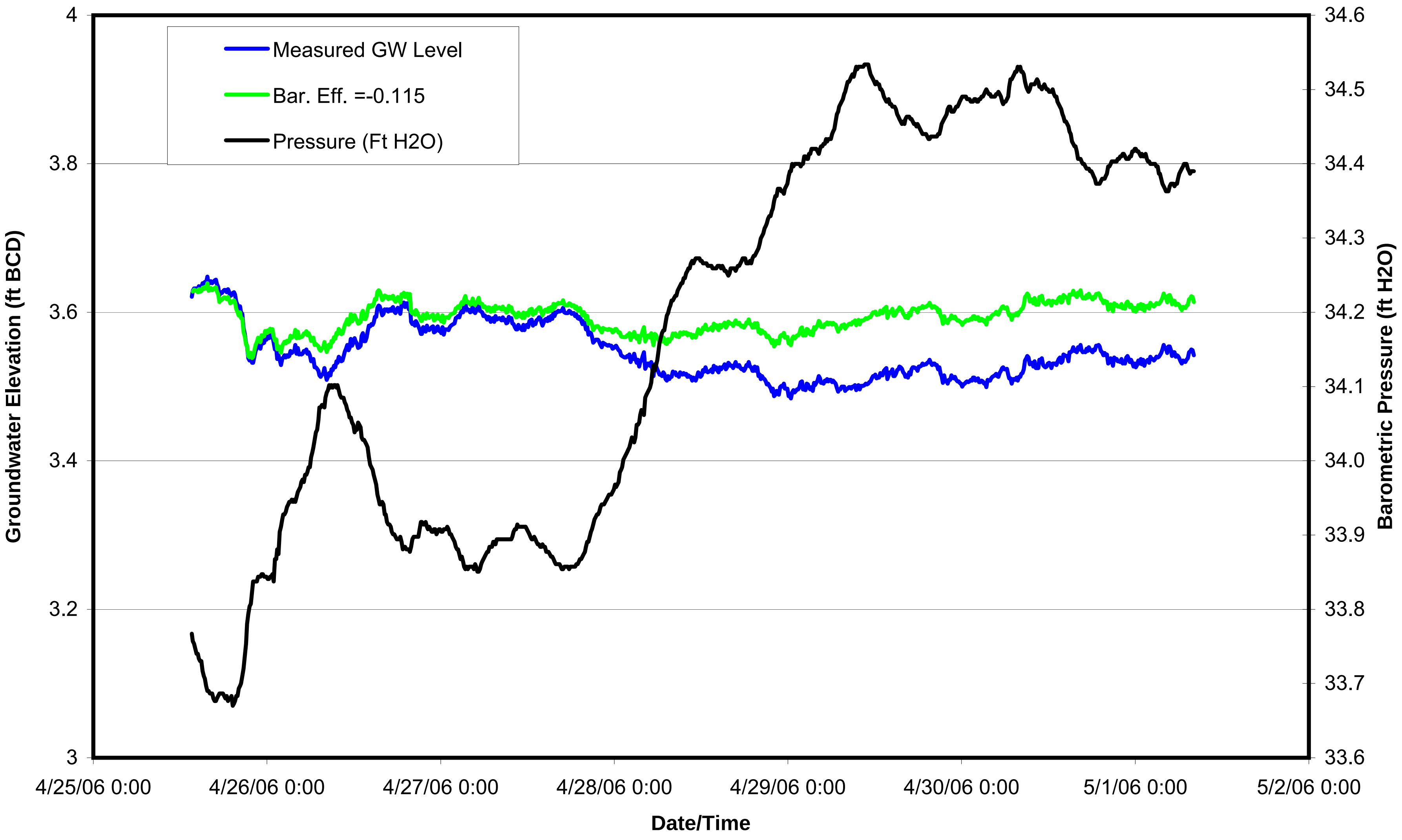
Hydrograph for Well DMT-14S
Shallow Aquifer Tidal Study



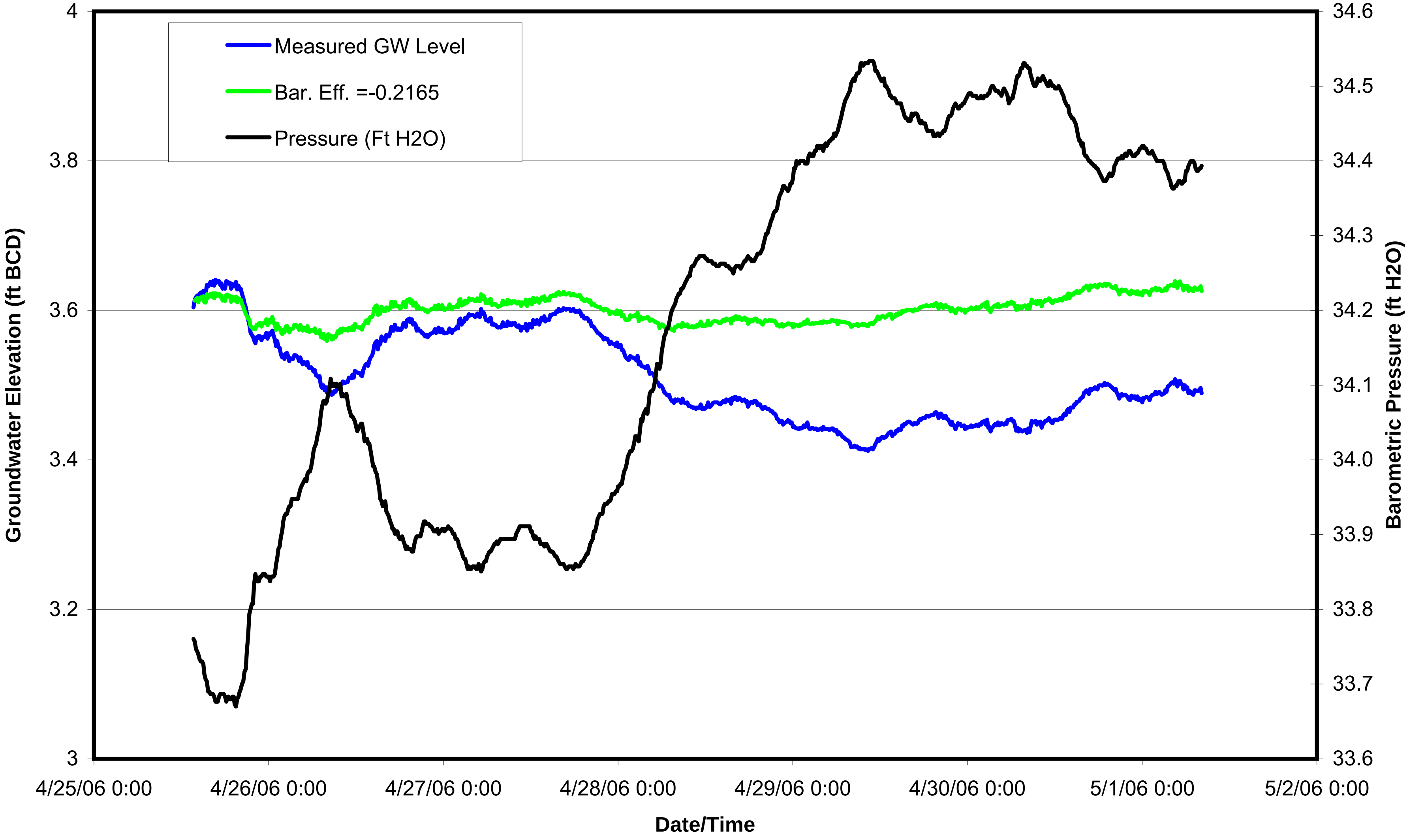

Hydrograph for Well DMT-15S
Shallow Aquifer Tidal Study
Measured GW Level
Bar. Eff. =-0.685
Pressure (Ft H2O)
Groundwater Elevation (ft BCD)
Barometric Pressure (ft H2O)
Date/Time
5
4.8
4.6
4.4
4.2
4
3.8
3.6
3.4
3.2
3
34.6
34.5
34.4
34.3
34.2
34.1
34.0
33.9
33.8
4/25/06 0:00
4/26/06 0:00
4/27/06 0:00
4/28/06 0:00
4/29/06 0:00
4/30/06 0:00
5/1/06 0:00
5/2/06 0:00


Hydrograph for Well DMT-16S
Shallow Aquifer Tidal Study
Measured GW Level
Bar. Eff. =-0.081
Pressure (Ft H2O)
Groundwater Elevation (ft BCD)
Barometric Pressure (ft H2O)
Date/Time
4.5
4.3
4.1
3.9
3.7
3.5
34.6
34.5
34.4
34.3
34.2
34.1
34.0
33.9
33.8
33.7
33.6
4/25/06 0:00
4/26/06 0:00
4/27/06 0:00
4/28/06 0:00
4/29/06 0:00
4/30/06 0:00
5/1/06 0:00
5/2/06 0:00

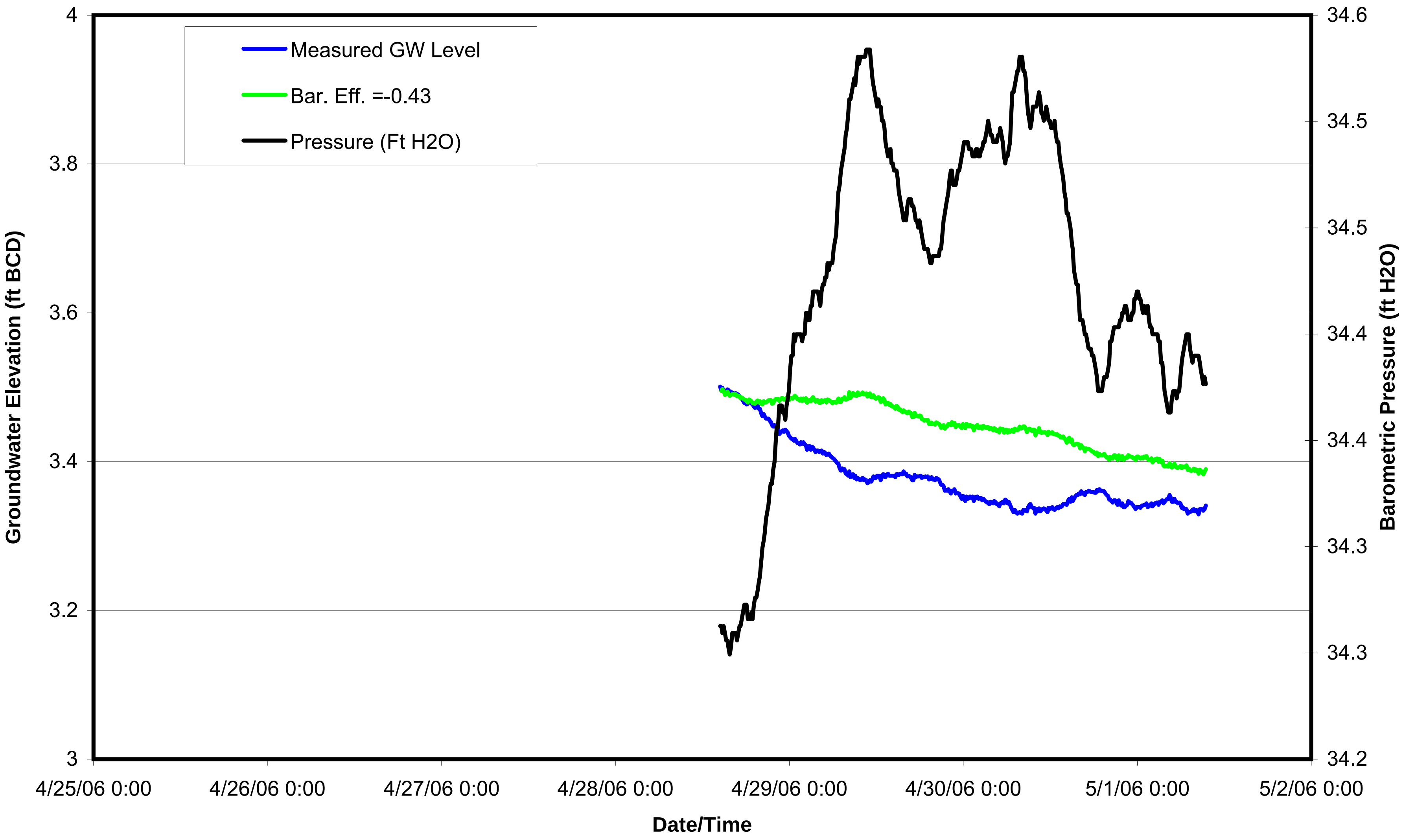
Hydrograph for Well DMT-17S
Shallow Aquifer Tidal Study



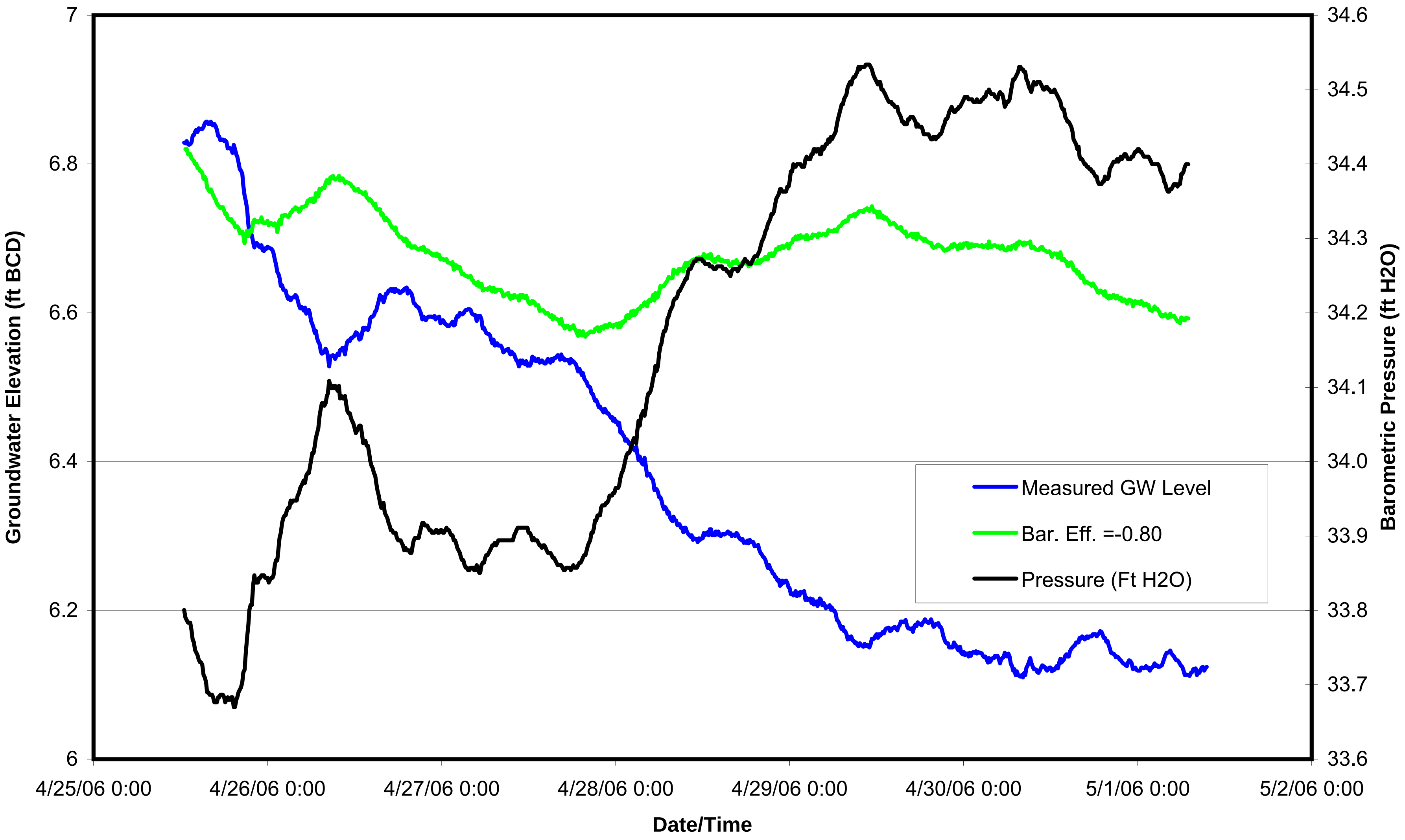
Hydrograph for Well DMT-18S
Shallow Aquifer Tidal Study



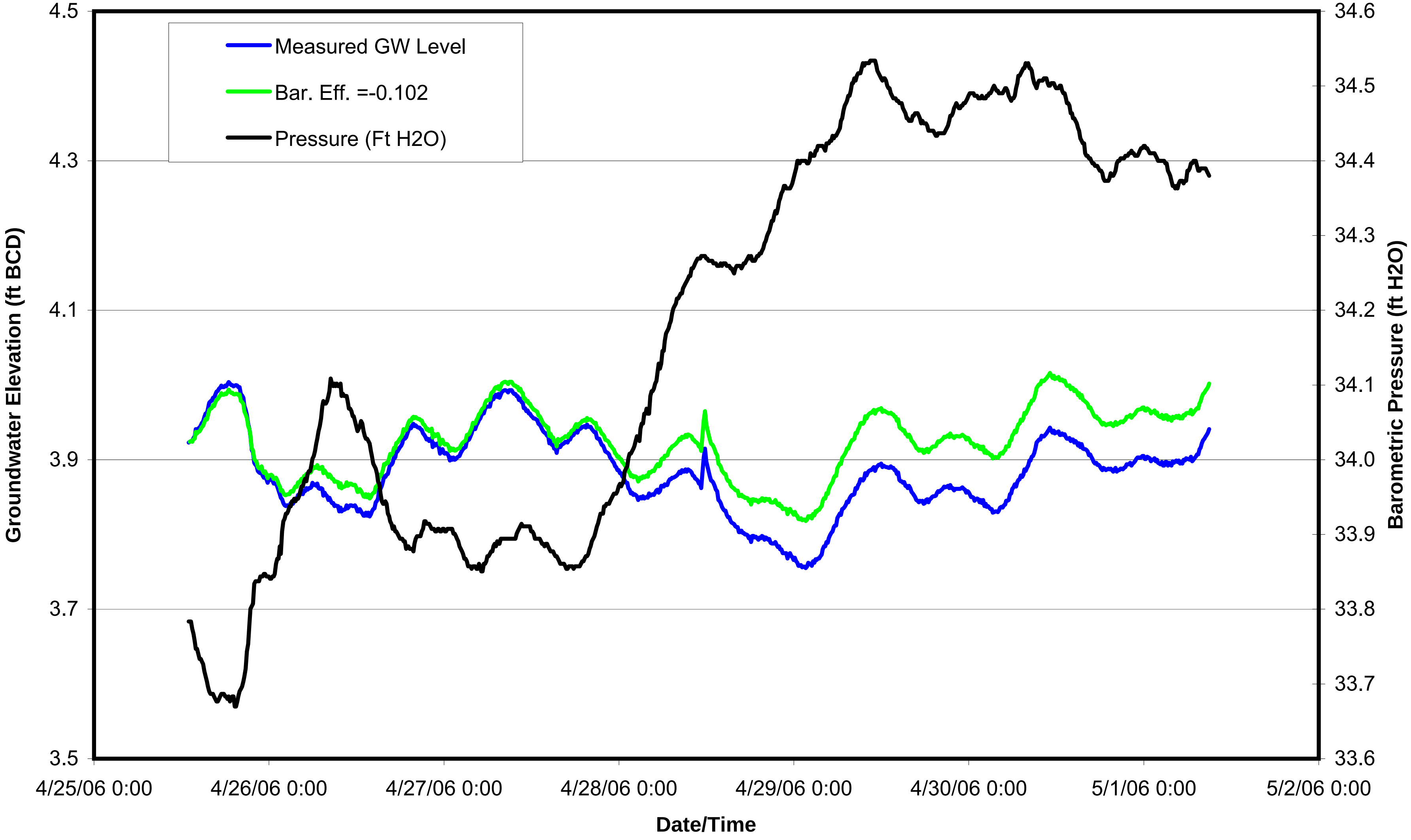
Hydrograph for Well EA-6S
Shallow Aquifer Tidal Study



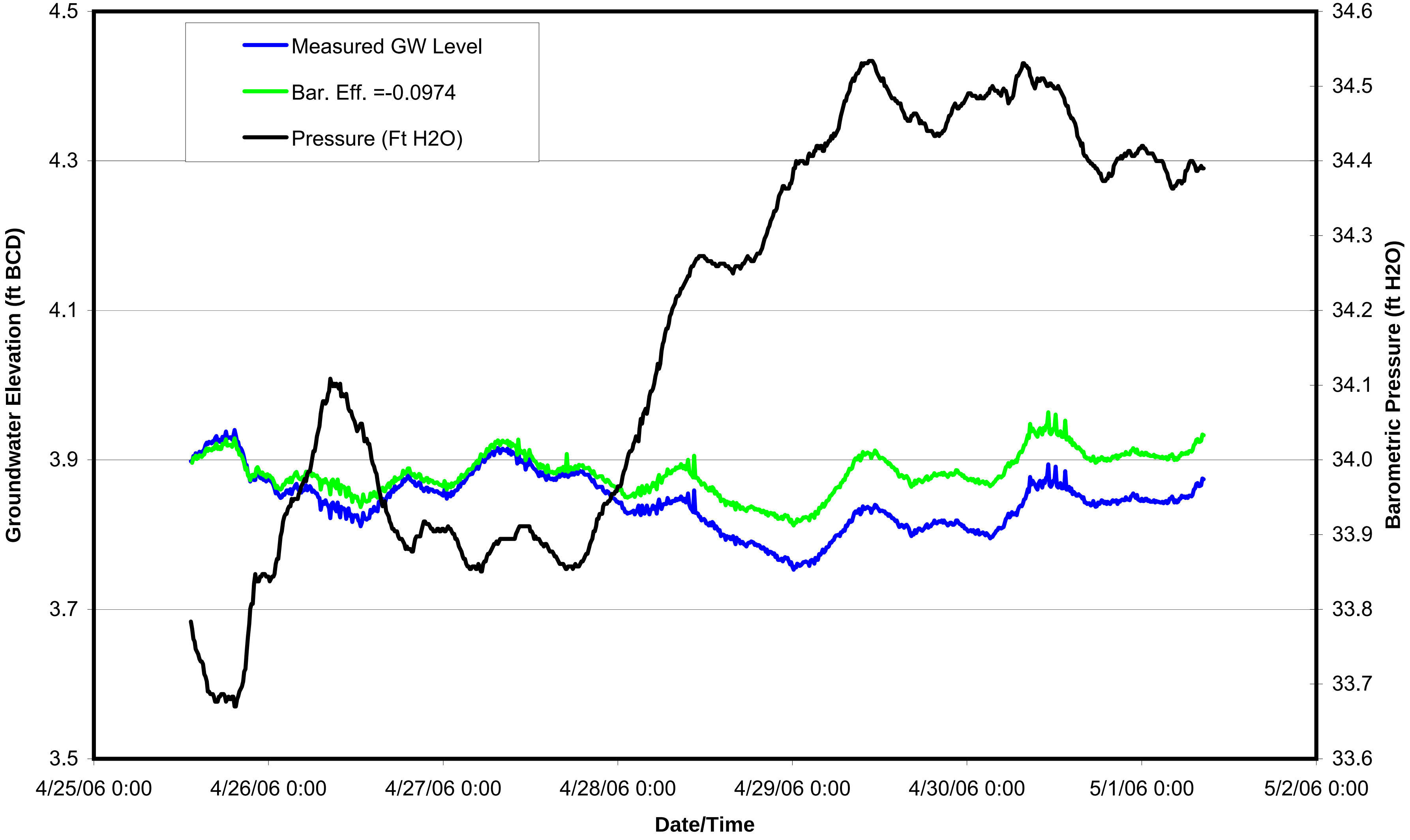
Hydrograph for Well EA-7S
Shallow Aquifer Tidal Study



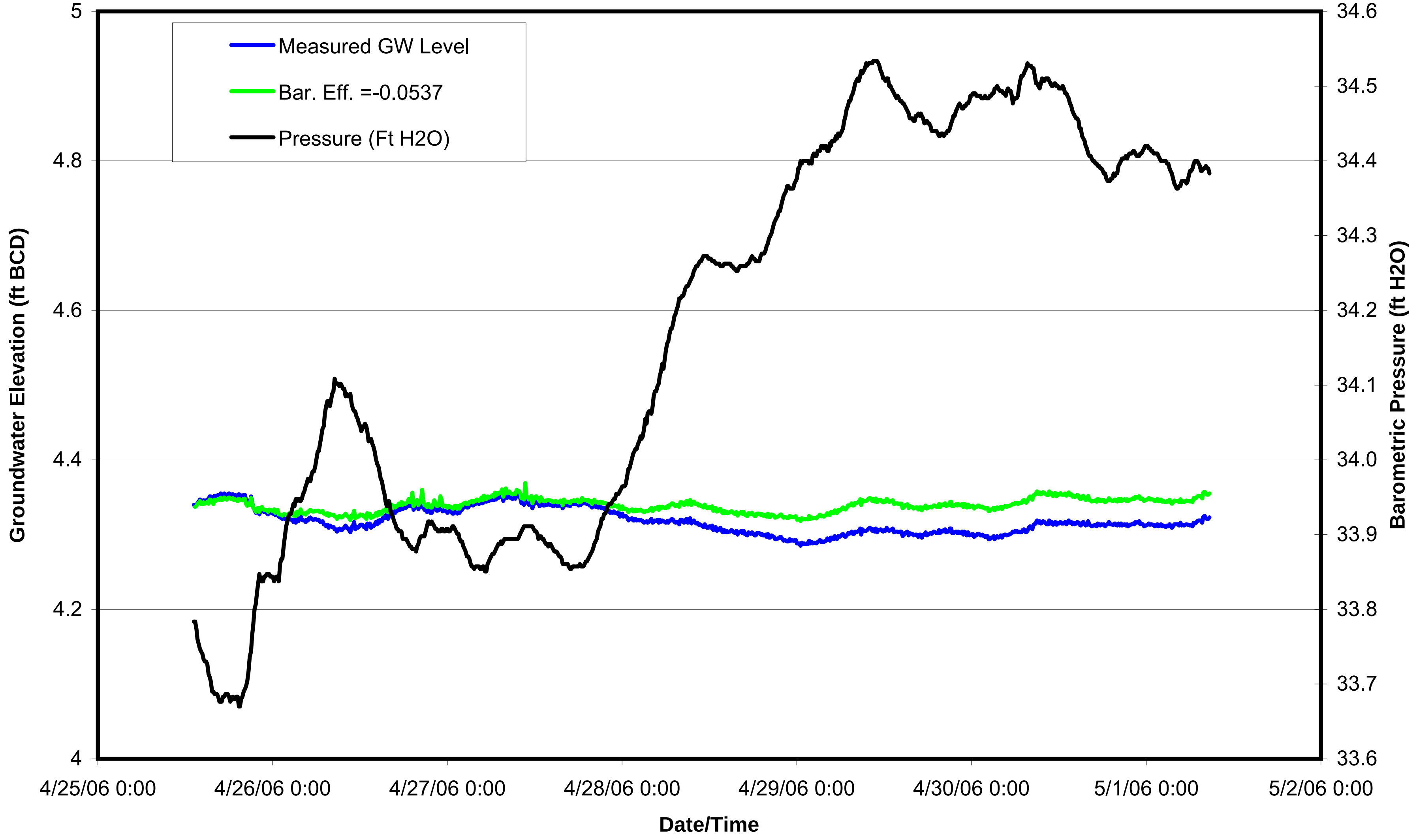
Hydrograph for Well EA-10S
Shallow Aquifer Tidal Study



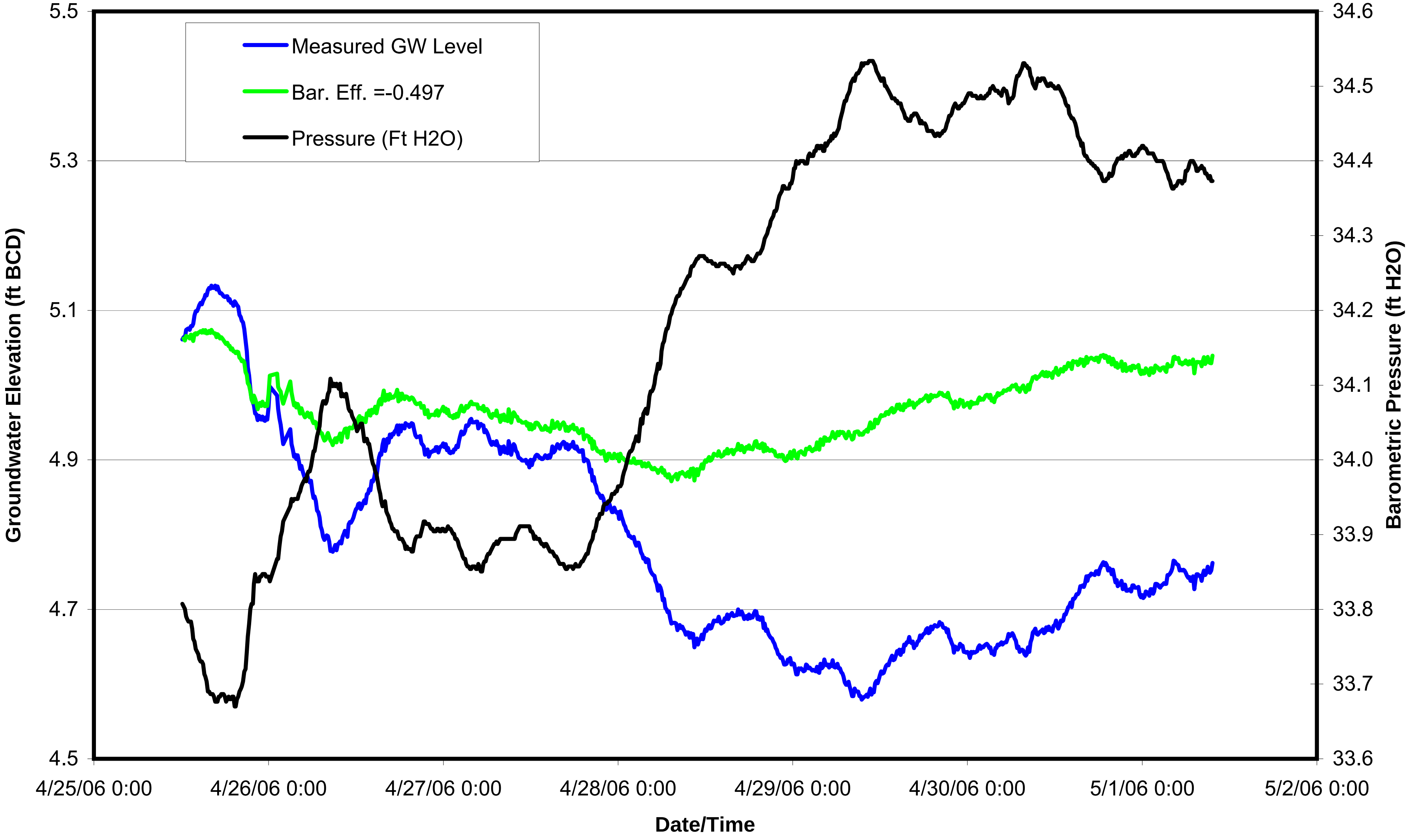
Hydrograph for Well EA-11S
Shallow Aquifer Tidal Study



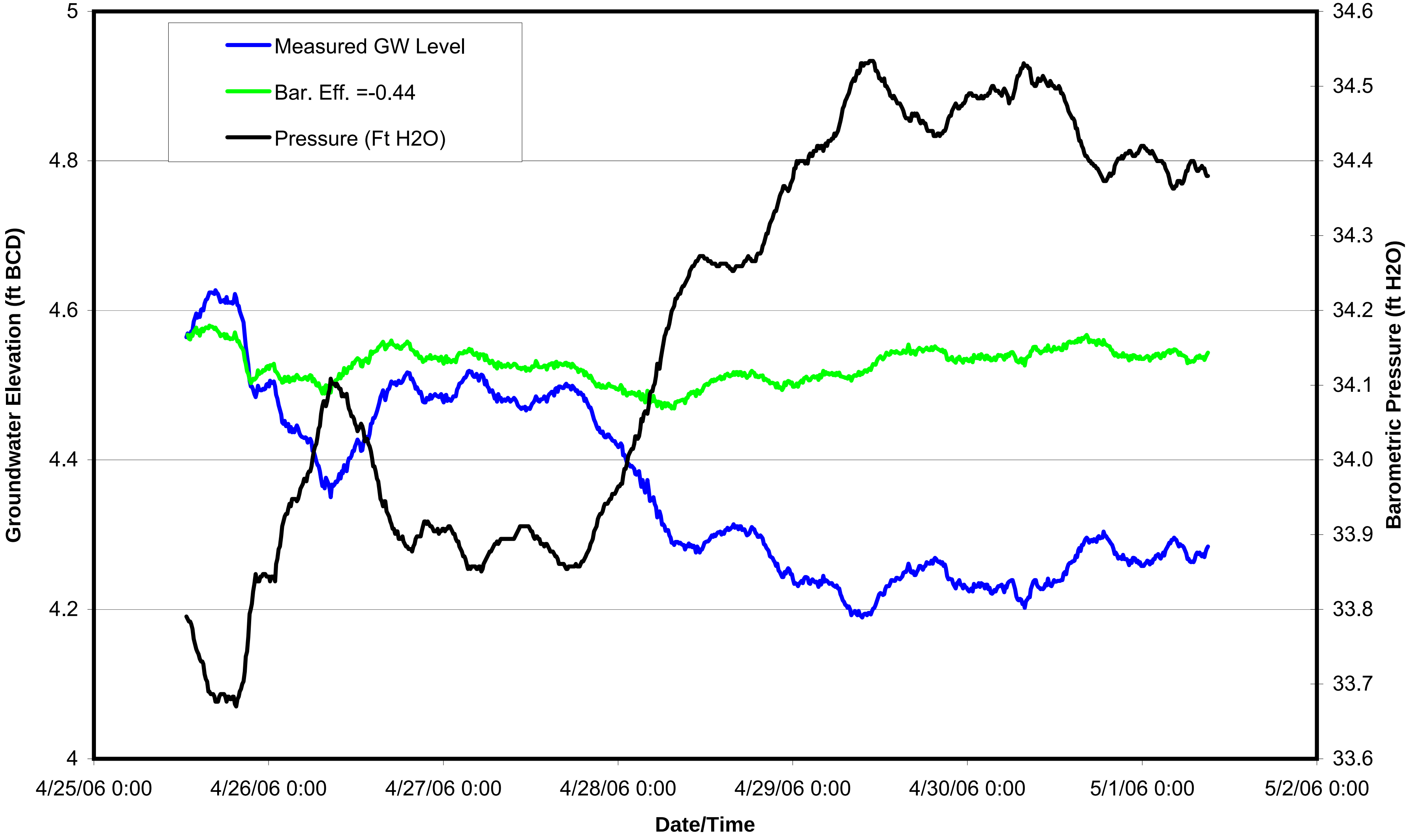
Hydrograph for Well EA-14S
Shallow Aquifer Tidal Study



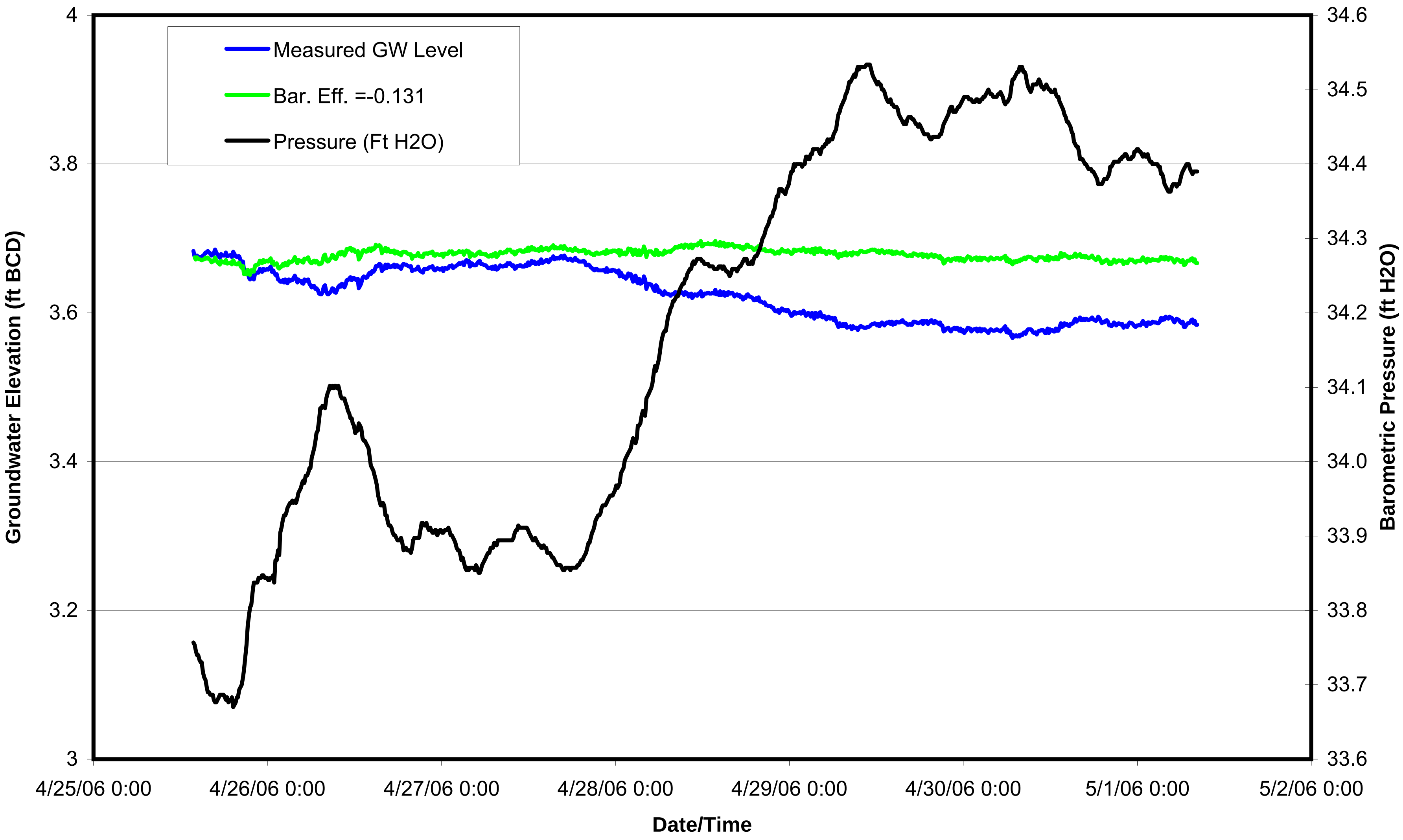
Hydrograph for Well EA-17S
Shallow Aquifer Tidal Study

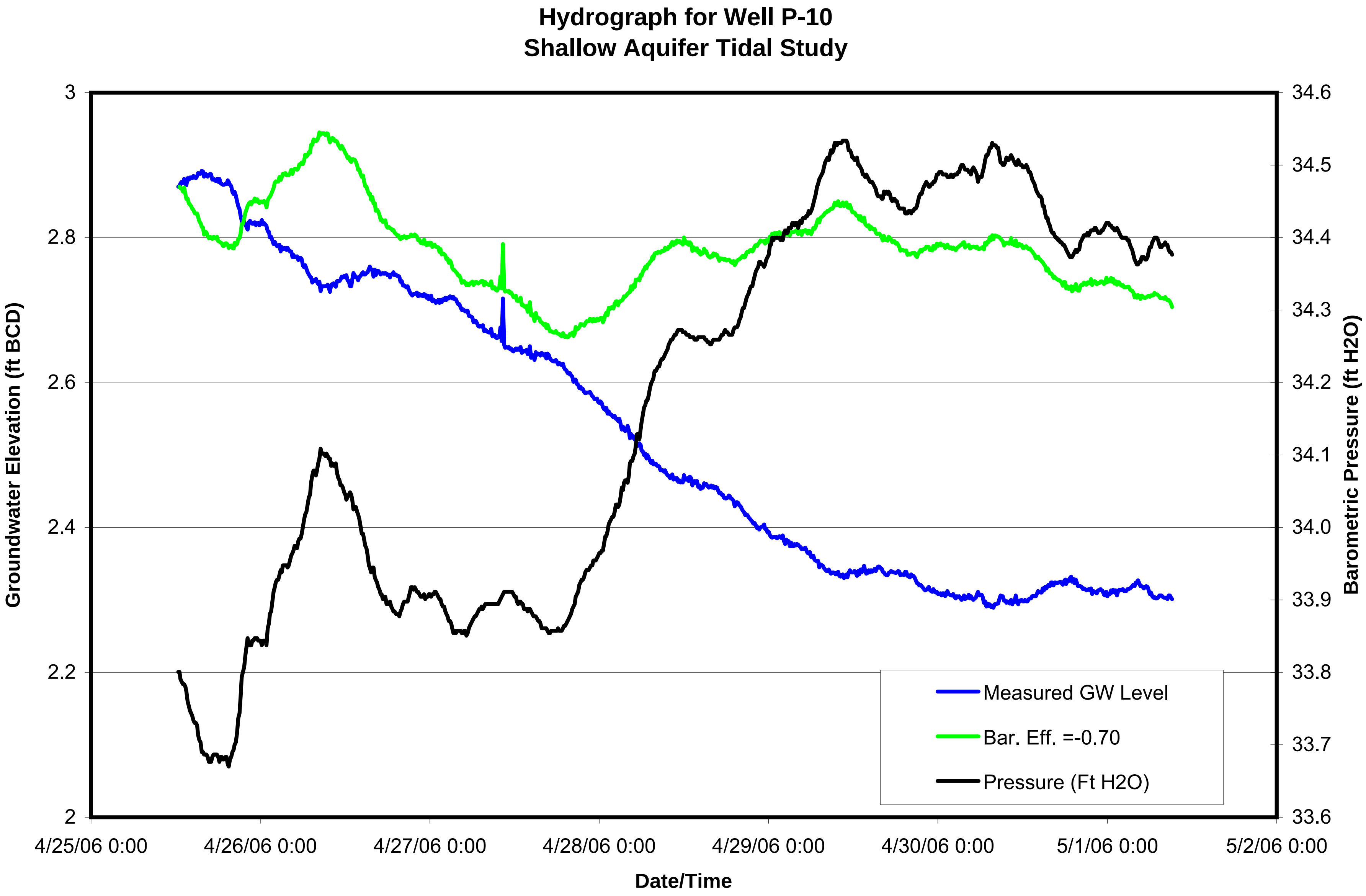


Hydrograph for Well EAC-03S
Shallow Aquifer Tidal Study

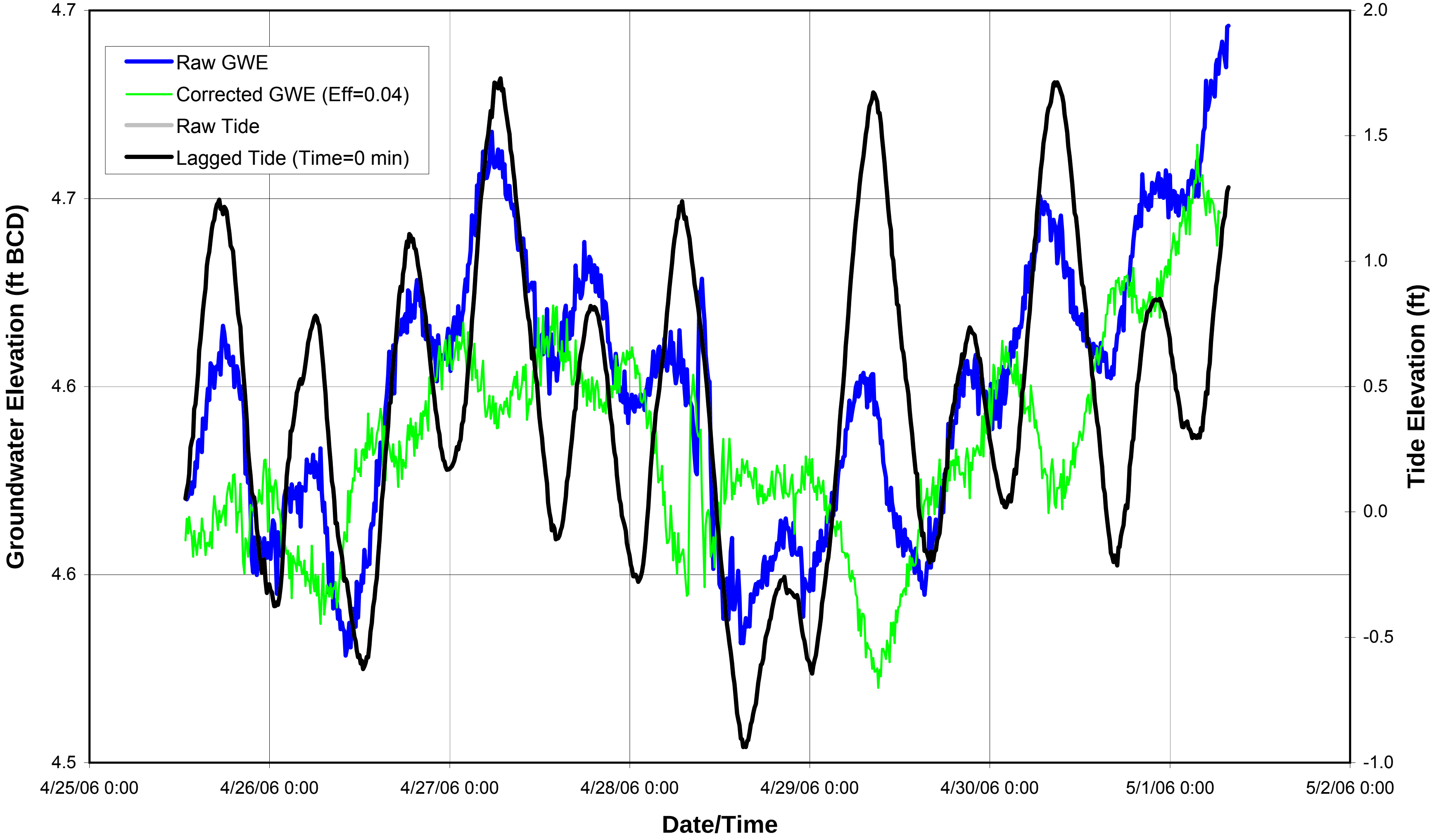


Hydrograph for Well EAC-04S
Shallow Aquifer Tidal Study

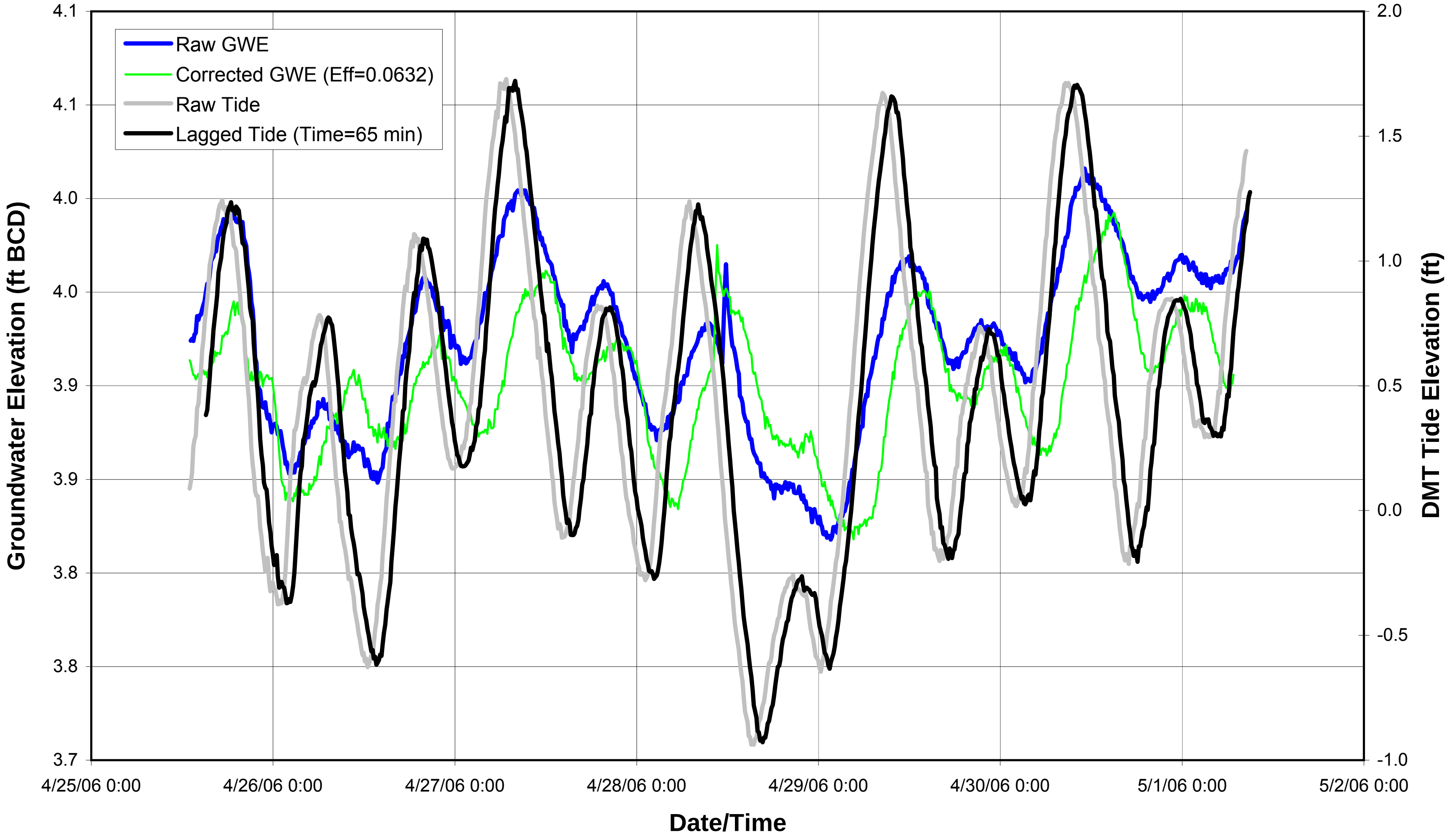


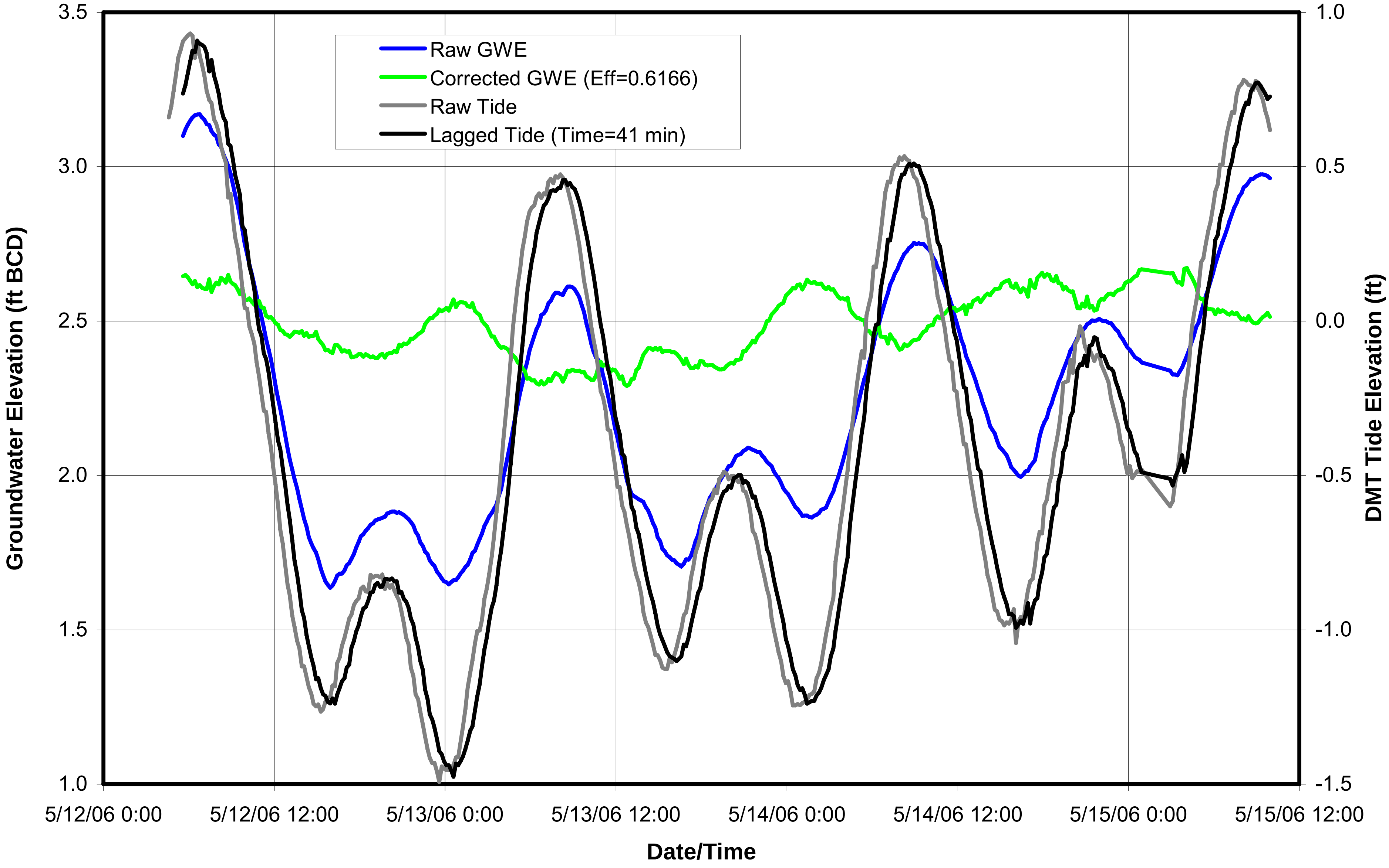

Hydrograph for Well P-10
Shallow Aquifer Tidal Study
Groundwater Elevation (ft BCD)
3
2.8
2.6
2.4
2.2
2
Barometric Pressure (ft H2O)
34.6
34.5
34.4
34.3
34.2
34.1
34.0
33.9
33.8
33.7
33.6
4/25/06 0:00
4/26/06 0:00
4/27/06 0:00
4/28/06 0:00
4/29/06 0:00
4/30/06 0:00
5/1/06 0:00
5/2/06 0:00
Date/Time
Measured GW Level
Bar. Eff. =-0.70
Pressure (Ft H2O)

Hydrograph of Groundwater Elevations
Corrected for Barometric and Tidal Effects for Well DMT-14S
Shallow Aquifer Tidal Study

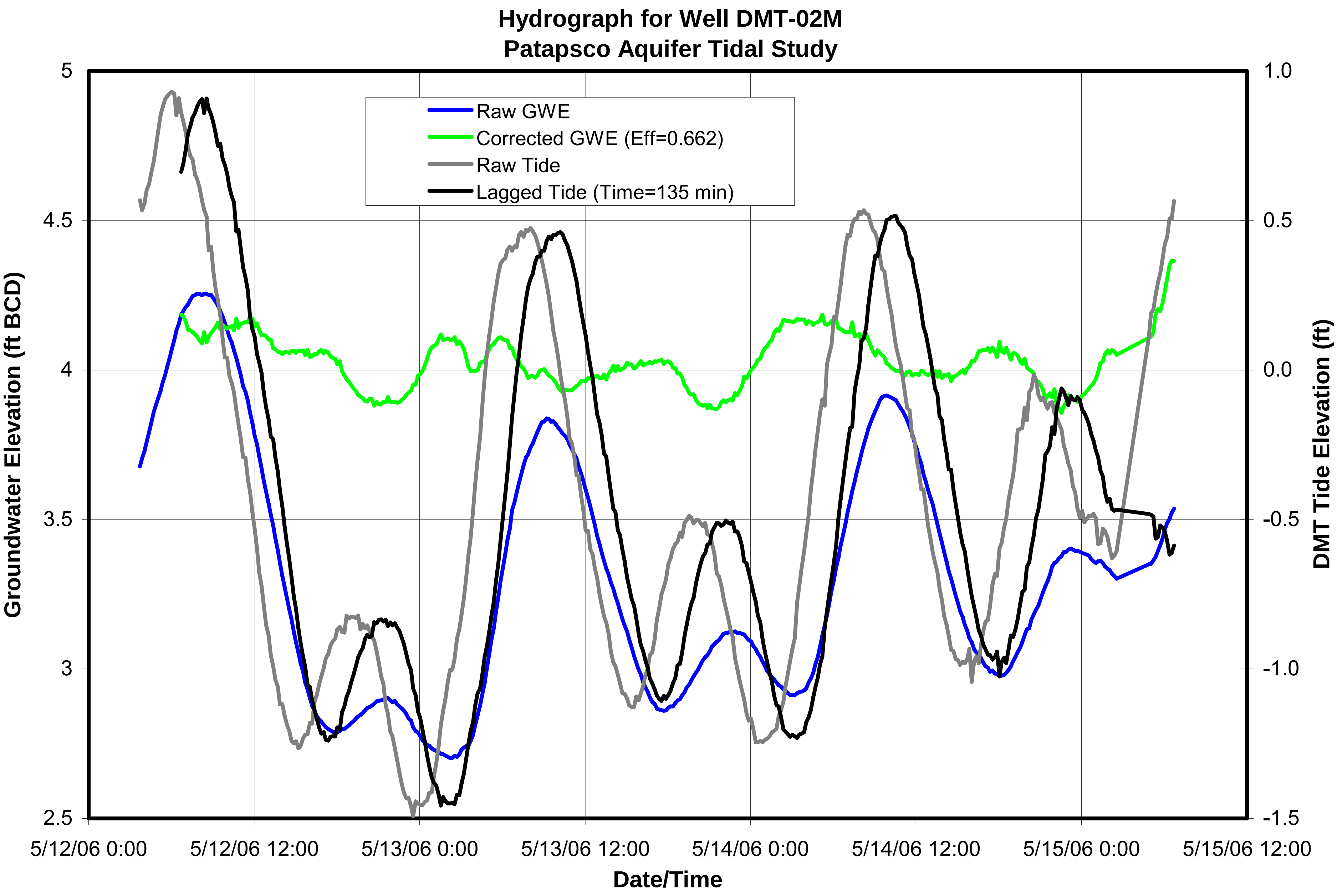


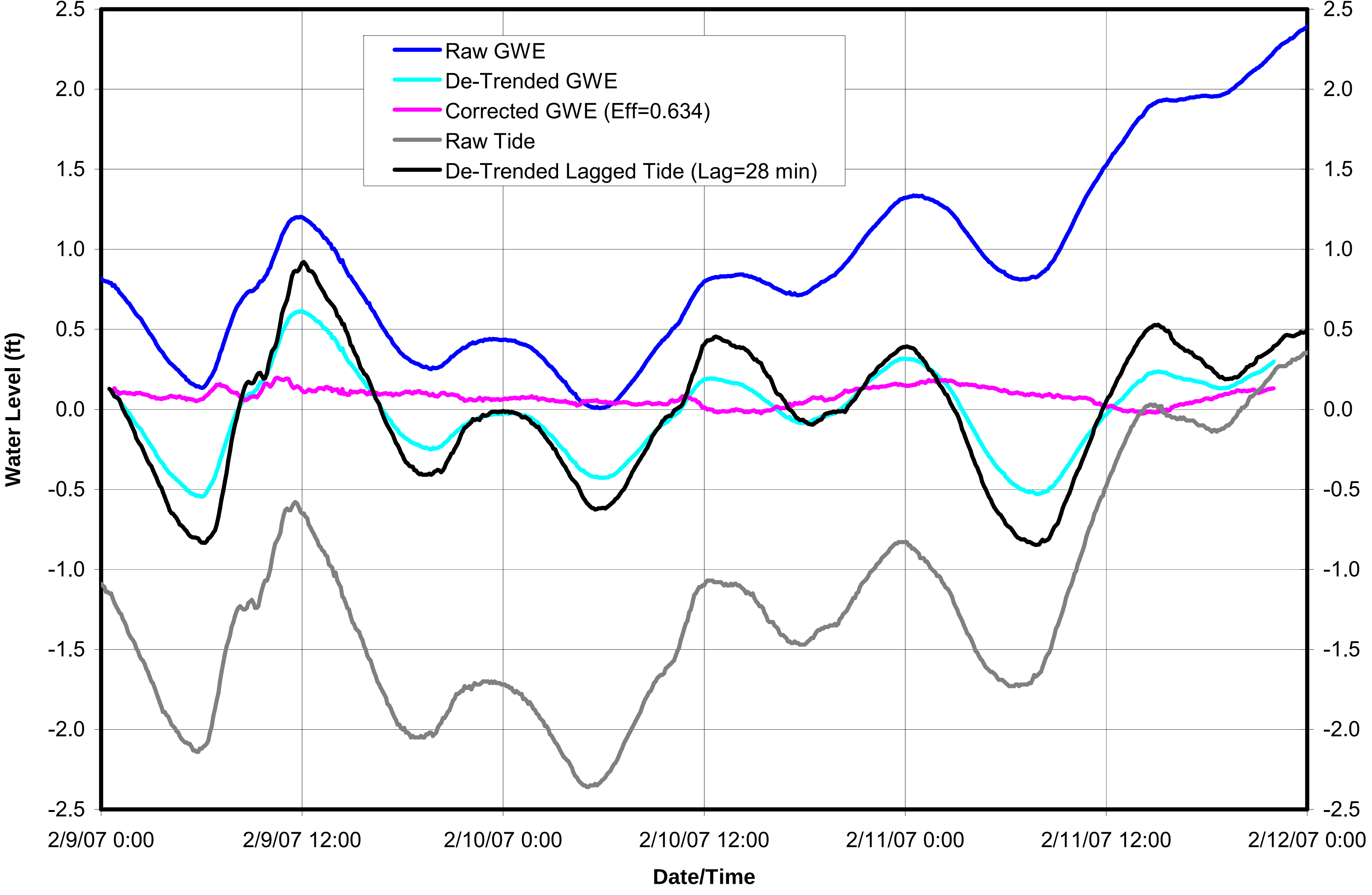
Hydrograph of Groundwater Elevations
Corrected for Barometric and Tidal Effects for Well EA-10S
Shallow Aquifer Tidal Study



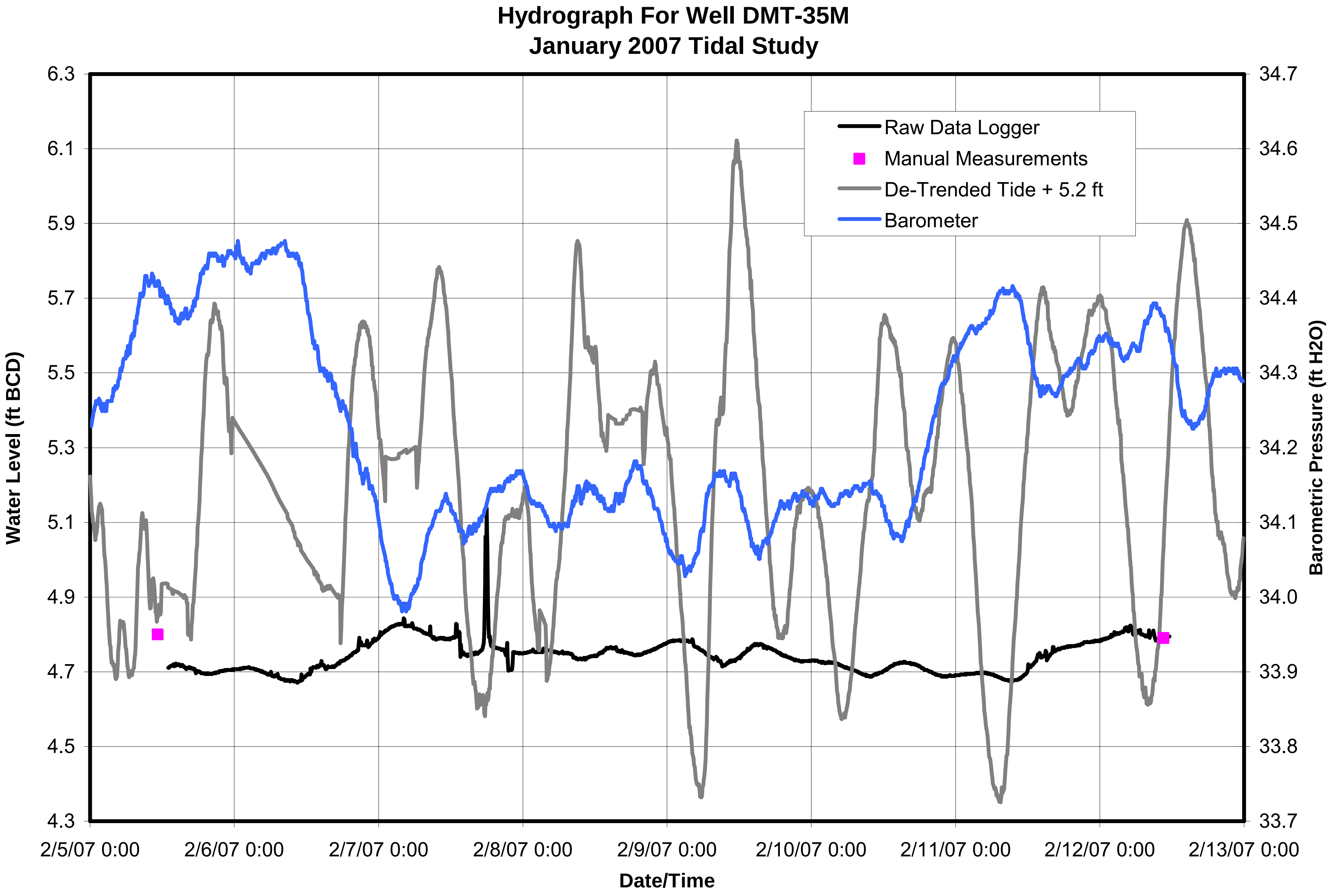


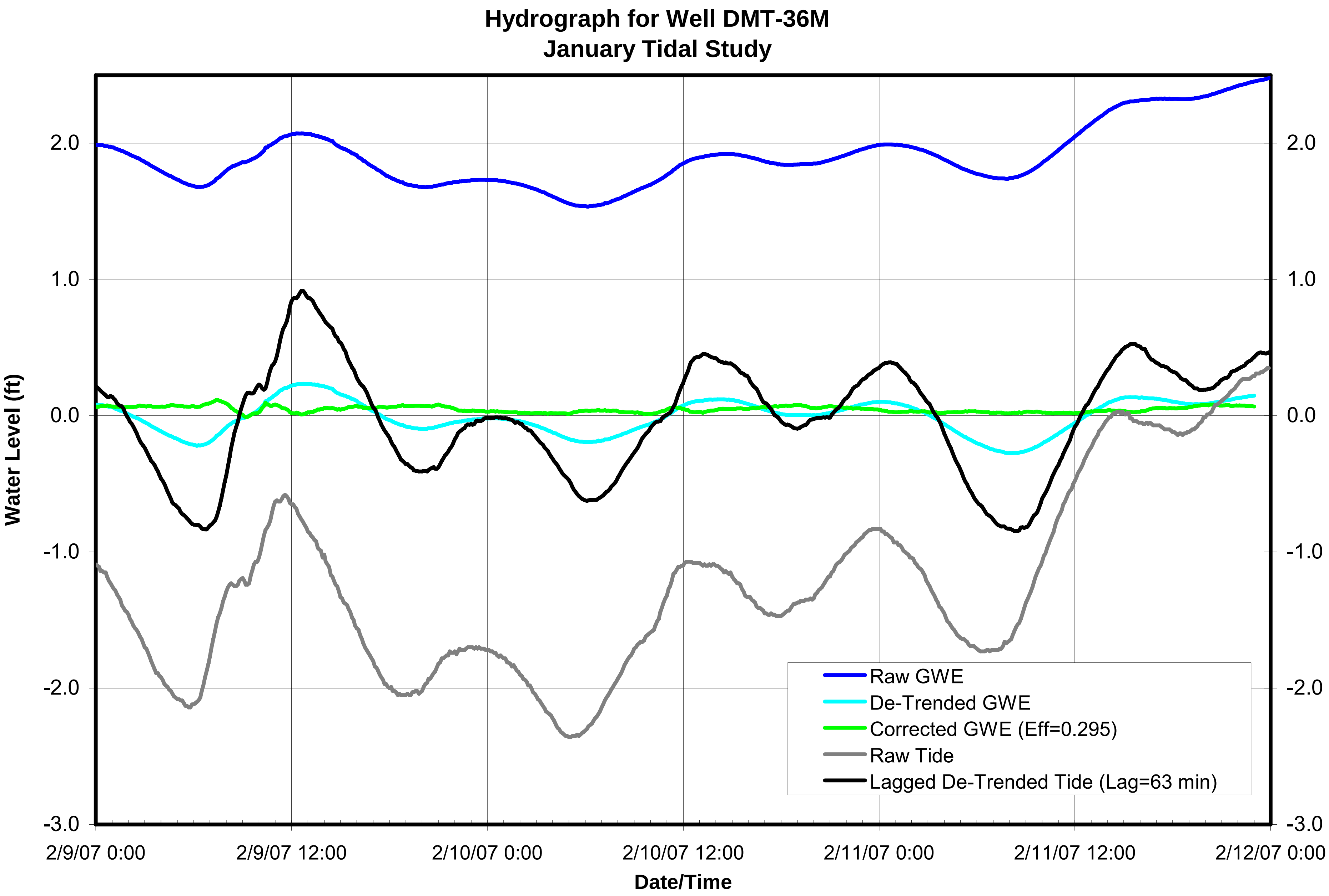
Hydrograph for Well DMT-01M
Patapsco Aquifer Tidal Study

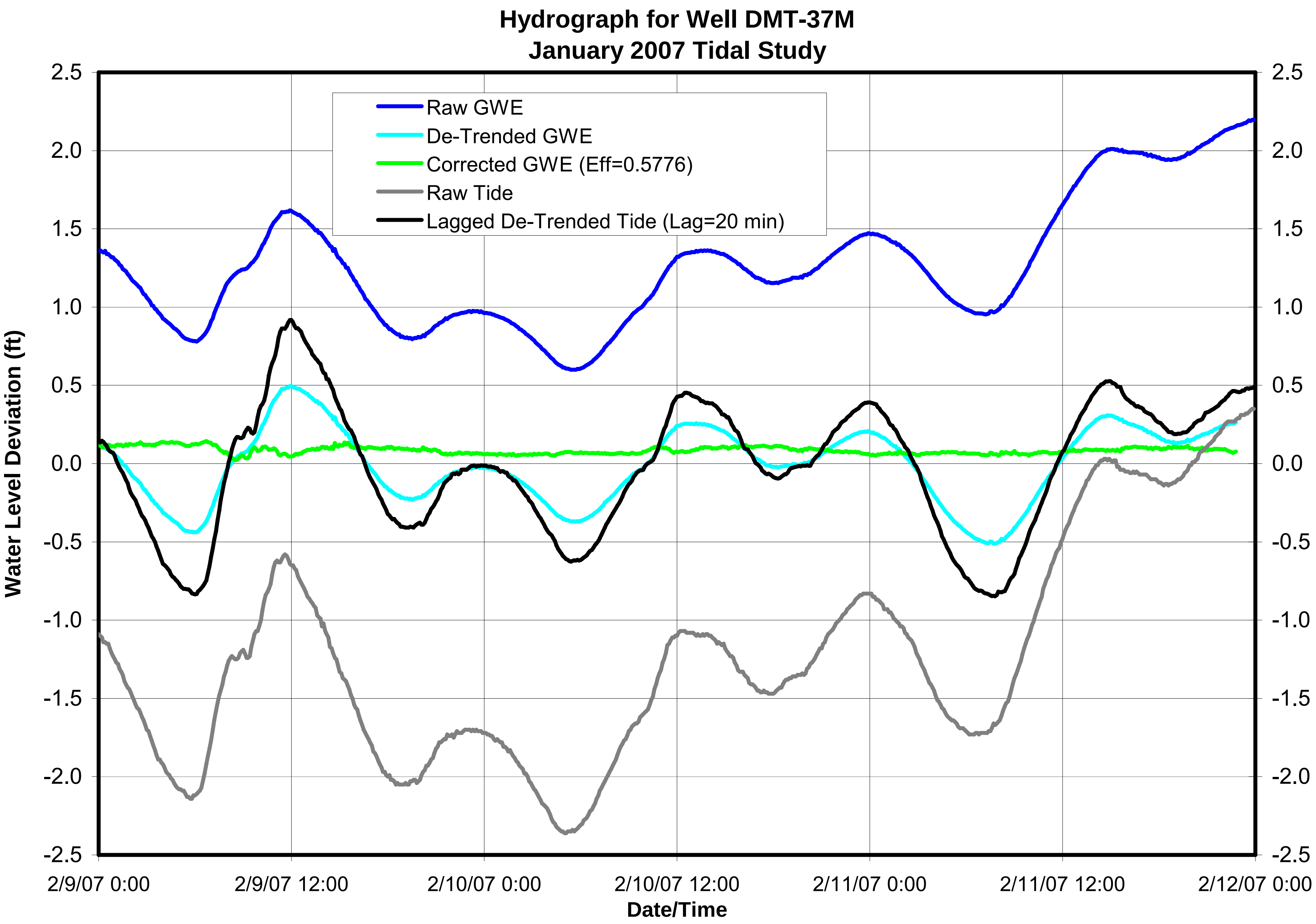

Hydrograph for Well DMT-02M
Patapsco Aquifer Tidal Study
Raw GWE
Corrected GWE (Eff=0.662)
Raw Tide
Lagged Tide (Time=135 min)
Groundwater Elevation (ft BCD)
DMT Tide Elevation (ft)
Date/Time
5
4.5
4
3.5
3
2.5
1.0
0.5
0.0
-0.5
-1.0
-1.5
5/12/06 0:00
5/12/06 12:00
5/13/06 0:00
5/13/06 12:00
5/14/06 0:00
5/14/06 12:00
5/15/06 0:00
5/15/06 12:00

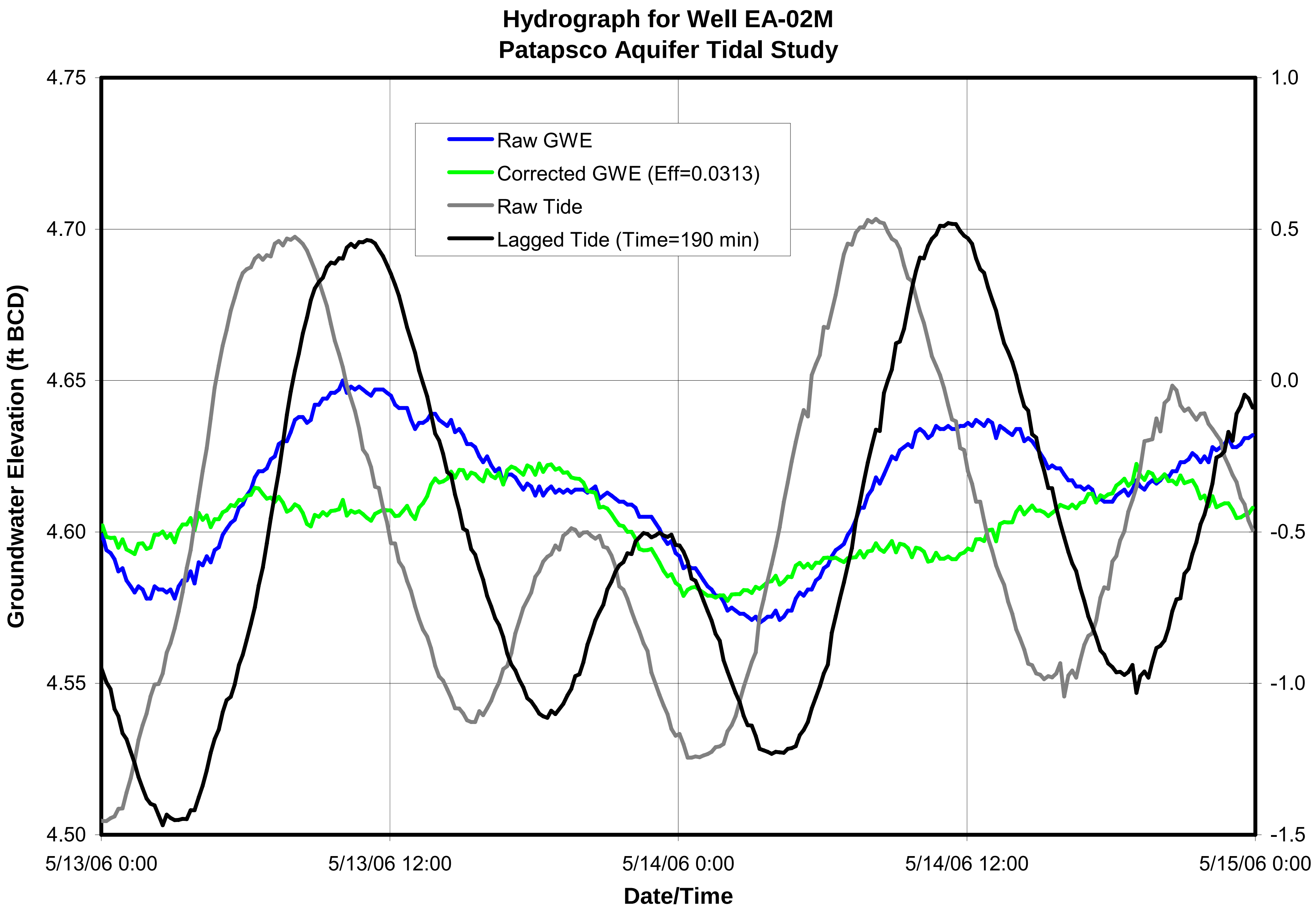


Hydrograph for Well DMT-34M
Patapsco Aquifer Tidal Study


Hydrograph For Well DMT-35M
January 2007 Tidal Study
Raw Data Logger
Manual Measurements
De-Trended Tide + 5.2 ft
Barometer
Water Level (ft BCD)
6.3
6.1
5.9
5.7
5.5
5.3
5.1
4.9
4.7
4.5
4.3
Barometric Pressure (ft H2O)
34.7
34.6
34.5
34.4
34.3
34.2
34.1
34.0
33.9
33.8
33.7
2/5/07 0:00
2/6/07 0:00
2/7/07 0:00
2/8/07 0:00
2/9/07 0:00
2/10/07 0:00
2/11/07 0:00
2/12/07 0:00
2/13/07 0:00
Date/Time

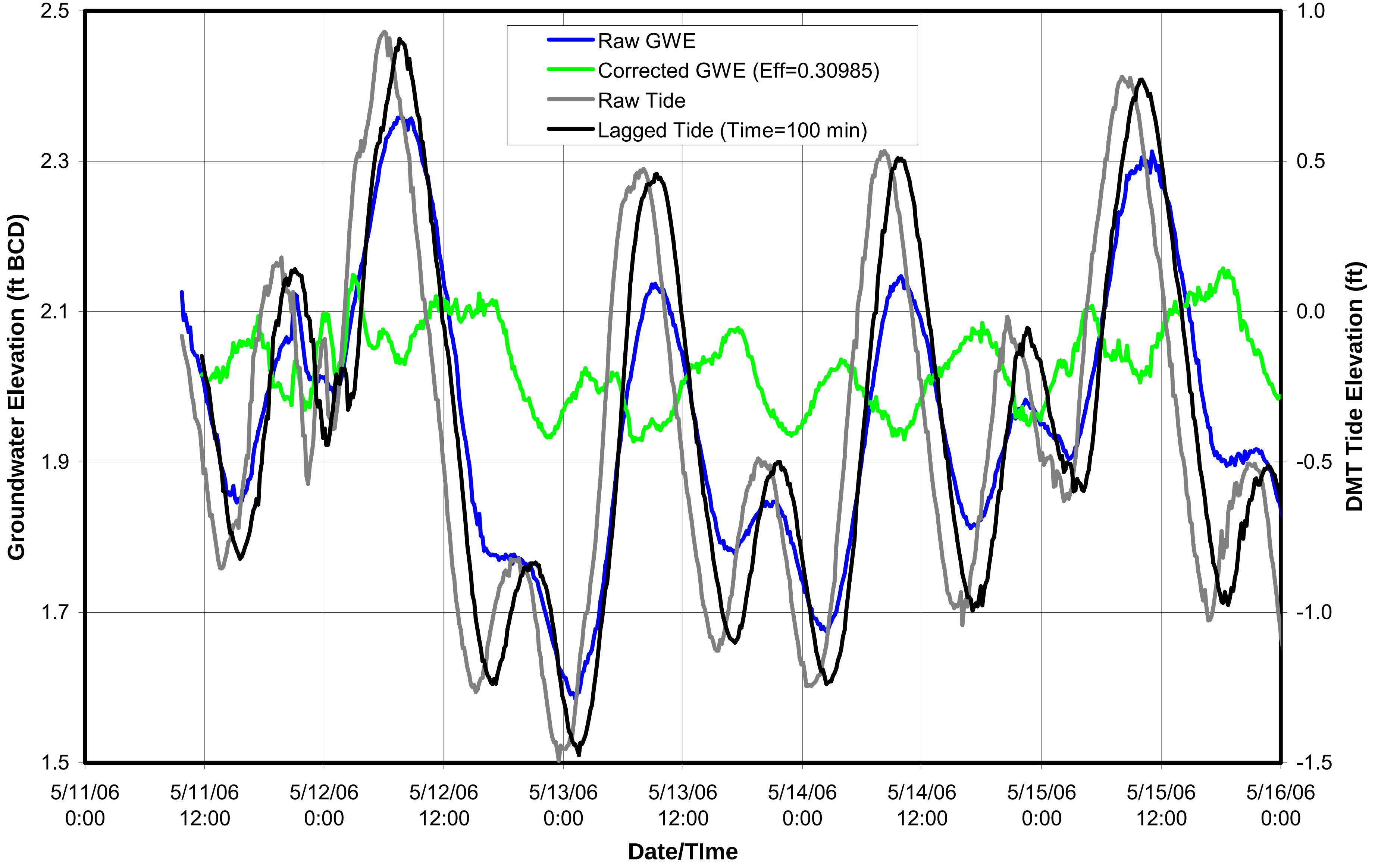

Hydrograph for Well DMT-36M
January Tidal Study
Water Level (ft)
2.0
1.0
0.0
-1.0
-2.0
-3.0
2/9/07 0:00
2/9/07 12:00
2/10/07 0:00
2/10/07 12:00
2/11/07 0:00
2/11/07 12:00
2/12/07 0:00
Date/Time
Raw GWE
De-Trended GWE
Corrected GWE (Eff=0.295)
Raw Tide
Lagged De-Trended Tide (Lag=63 min)

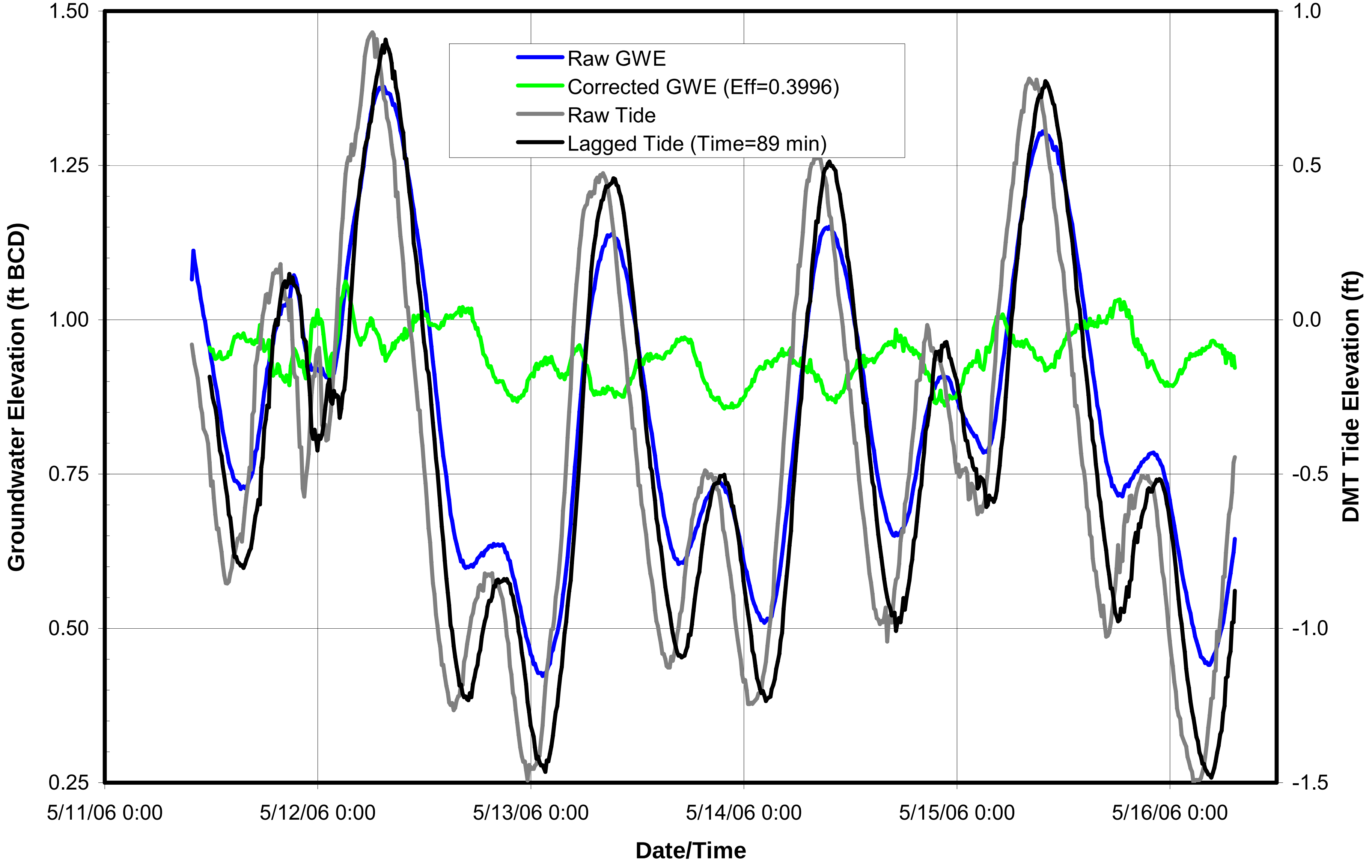

Hydrograph for Well DMT-37M
January 2007 Tidal Study
Raw GWE
De-Trended GWE
Corrected GWE (Eff=0.5776)
Raw Tide
Lagged De-Trended Tide (Lag=20 min)
Water Level Deviation (ft)
Tide Elevation (ft)
2.5
2.0
1.5
1.0
0.5
0.0
-0.5
-1.0
-1.5
-2.0
-2.5
2/9/07 0:00
2/9/07 12:00
2/10/07 0:00
2/10/07 12:00
2/11/07 0:00
2/11/07 12:00
2/12/07 0:00
Date/Time



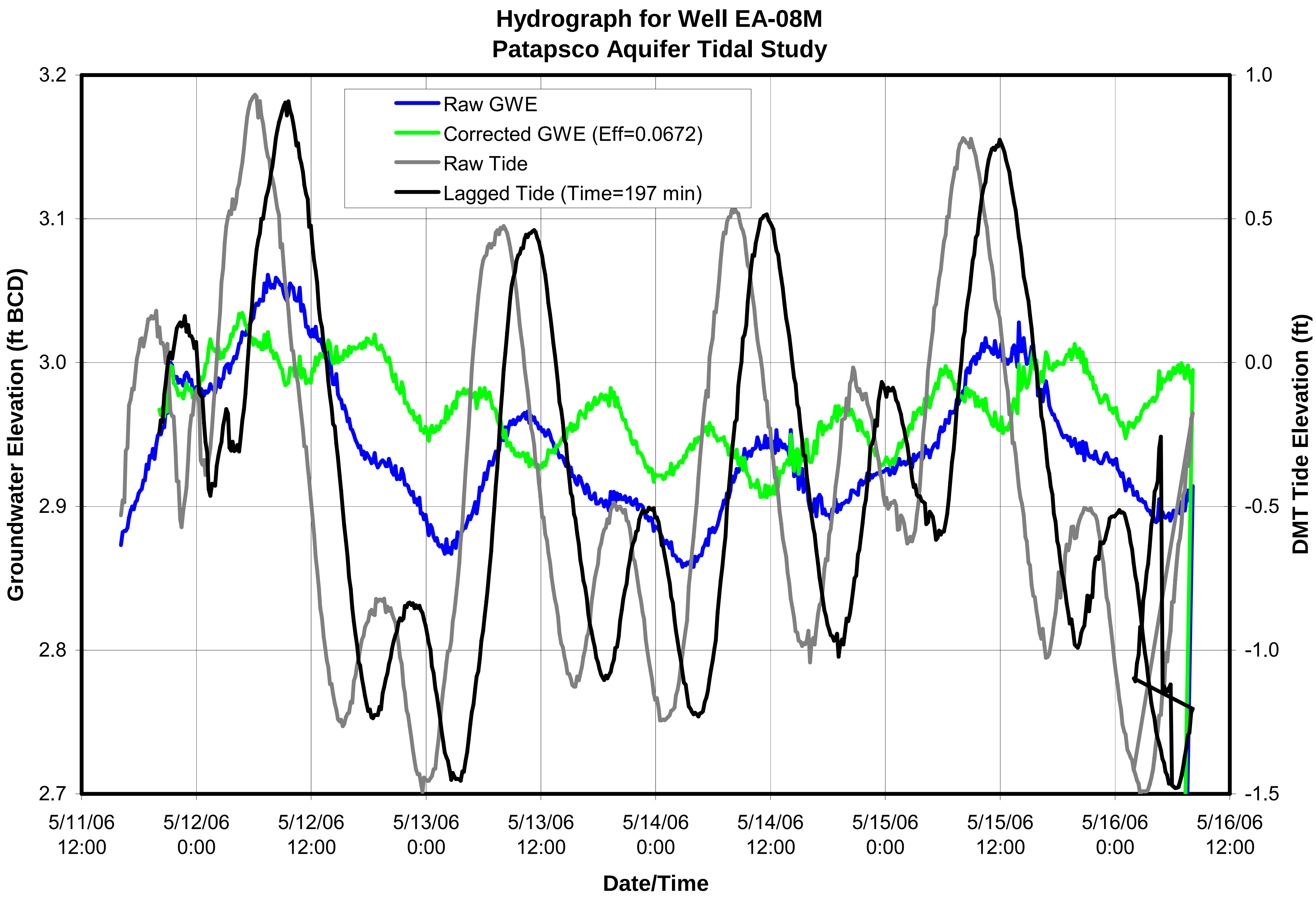
Hydrograph for Well EA-02M
Patapsco Aquifer Tidal Study
Raw GWE
Corrected GWE (Eff=0.0313)
Raw Tide
Lagged Tide (Time=190 min)
Groundwater Elevation (ft BCD)
4.75
4.70
4.65
4.60
4.55
4.50
DMT Tide Elevation (ft)
1.0
0.5
0.0
-0.5
-1.0
-1.5
5/13/06 0:00
5/13/06 12:00
5/14/06 0:00
5/14/06 12:00
5/15/06 0:00
Date/Time

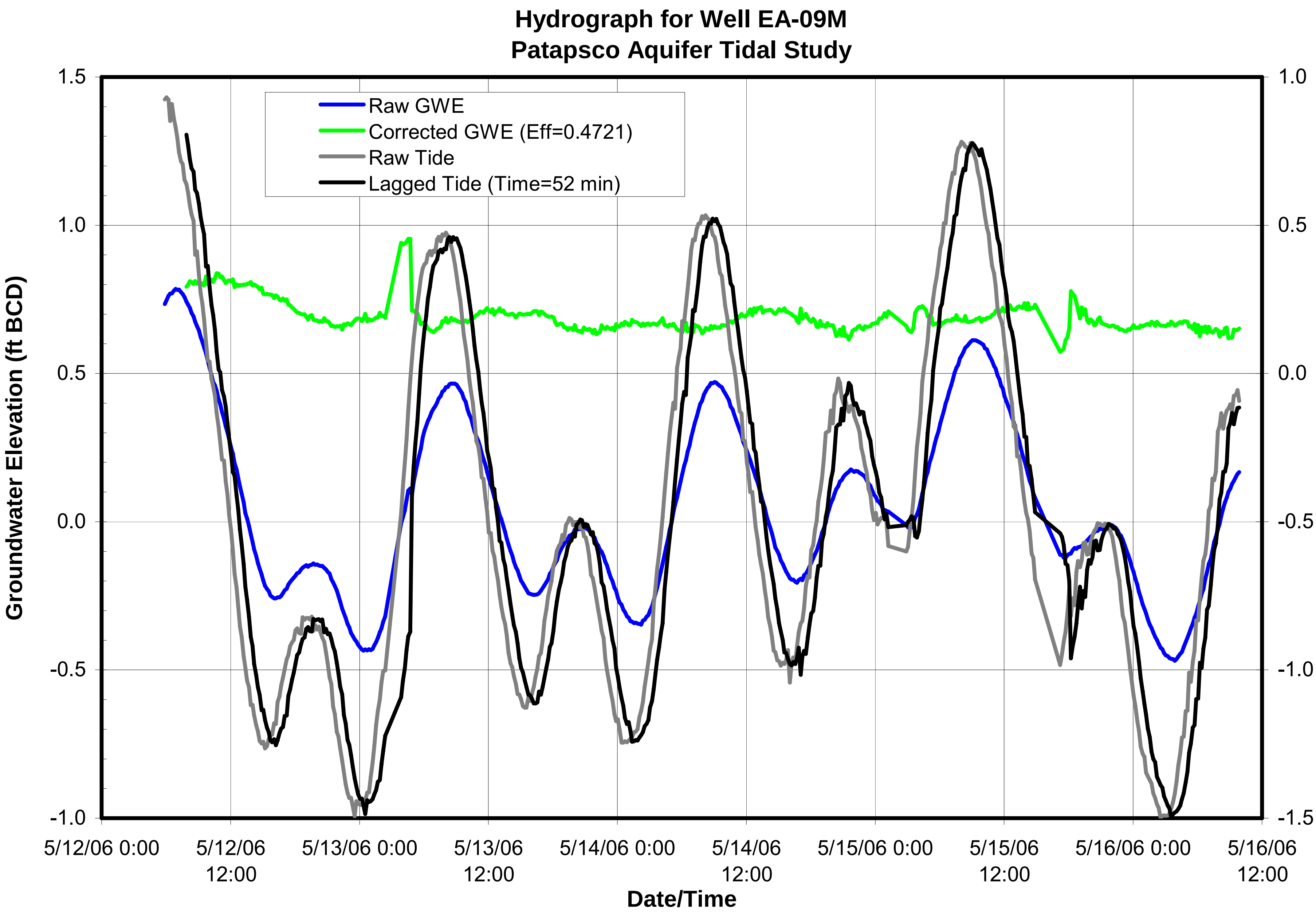
Hydrograph for Well EA-06M
Patapsco Aquifer Tidal Study

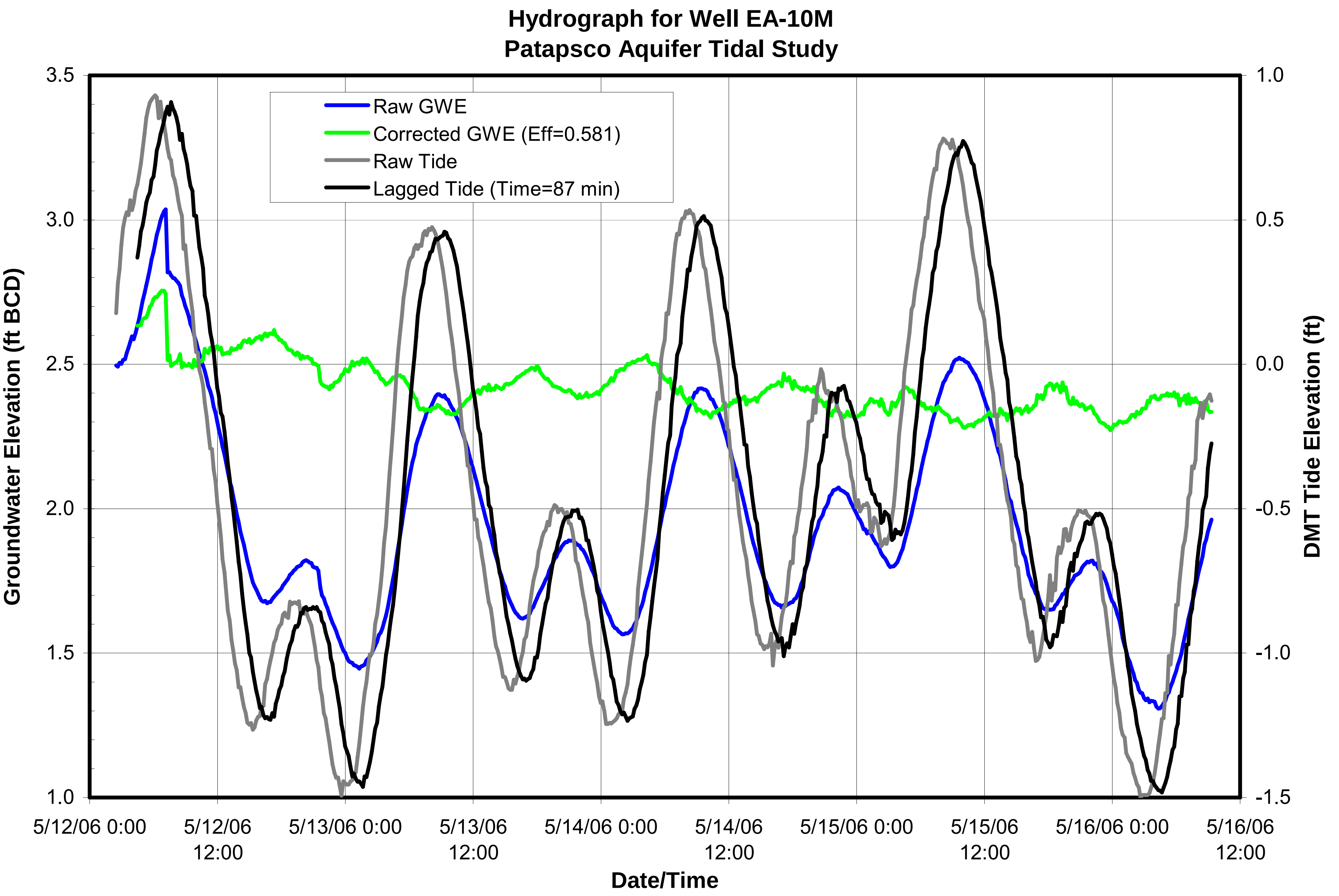


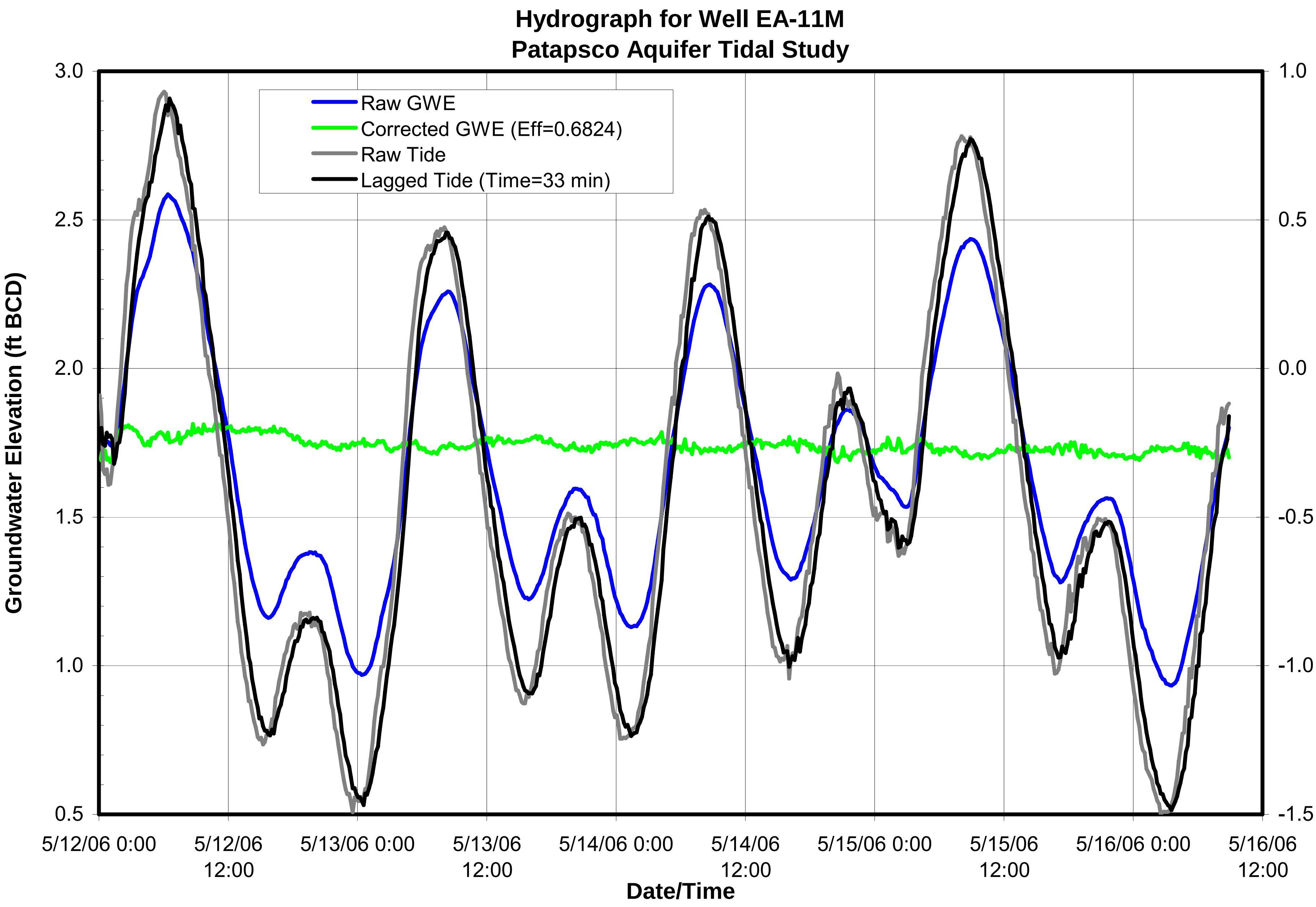


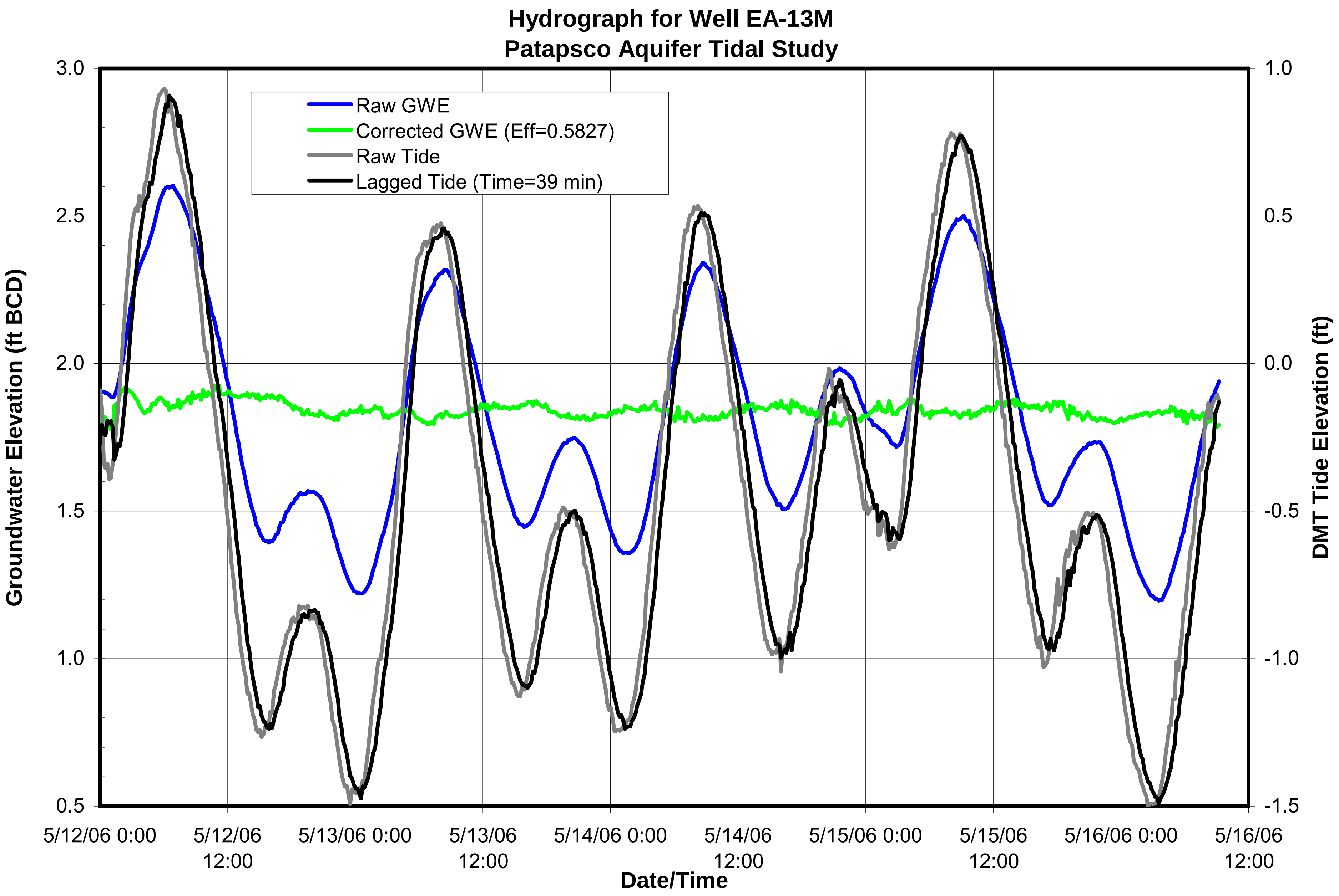
Hydrograph for Well EA-07M
Patapsco Aquifer Tidal Study


Hydrograph for Well EA-08M
Patapsco Aquifer Tidal Study
Raw GWE
Corrected GWE (Eff=0.0672)
Raw Tide
Lagged Tide (Time=197 min)
Groundwater Elevation (ft BCD)
3.2
3.1
3.0
2.9
2.8
2.7
DMT Tide Elevation (ft)
1.0
0.5
0.0
-0.5
-1.0
-1.5
5/11/06 12:00
5/12/06 0:00
5/12/06 12:00
5/13/06 0:00
5/13/06 12:00
5/14/06 0:00
5/14/06 12:00
5/15/06 0:00
5/15/06 12:00
5/16/06 0:00
5/16/06 12:00
Date/Time

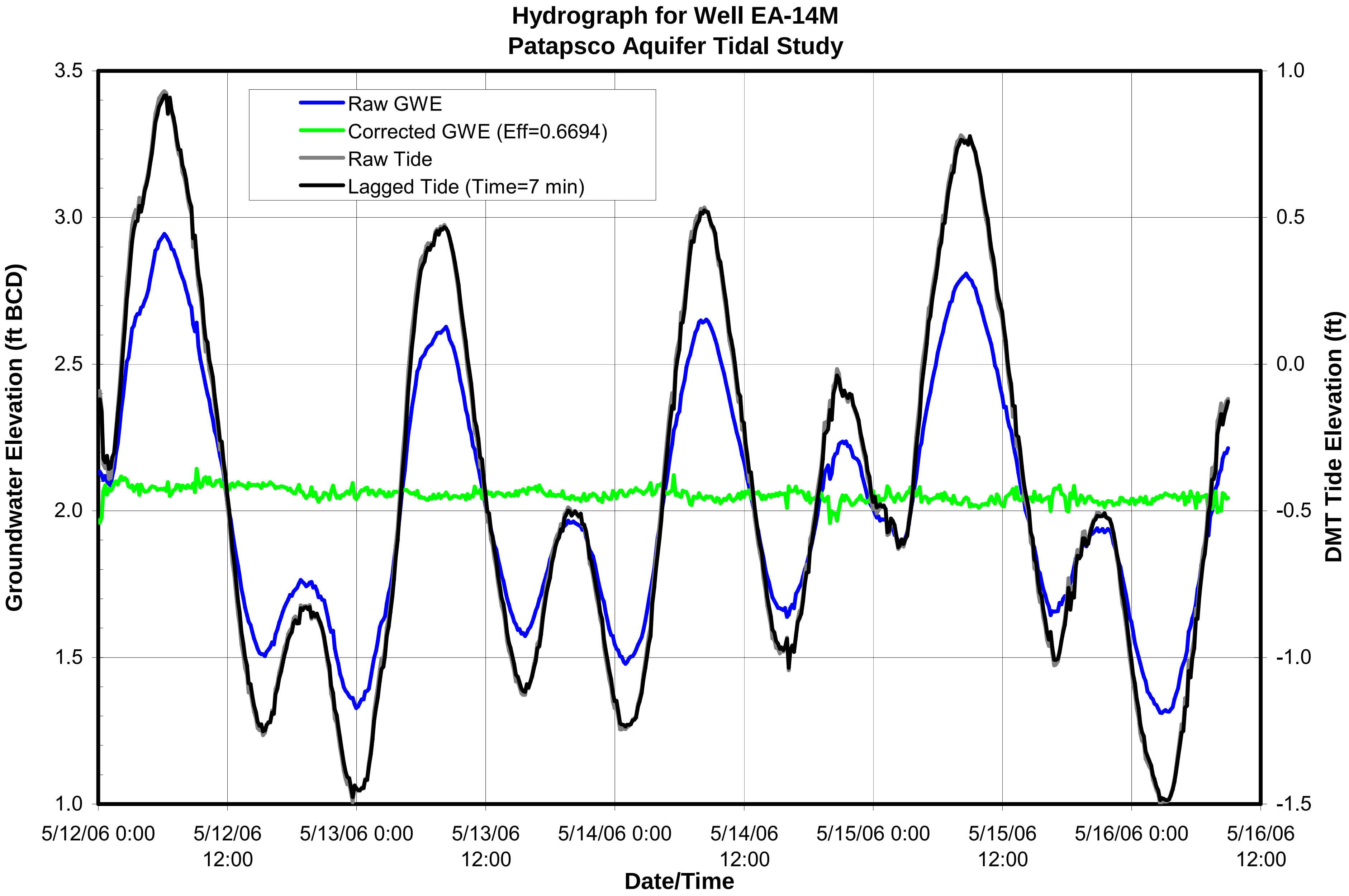

Hydrograph for Well EA-09M
Patapsco Aquifer Tidal Study
Raw GWE
Corrected GWE (Eff=0.4721)
Raw Tide
Lagged Tide (Time=52 min)
Groundwater Elevation (ft BCD)
1.5
1.0
0.5
0.0
-0.5
-1.0
DMT Tide Elevation (ft)
1.0
0.5
0.0
-0.5
-1.0
-1.5
5/12/06 0:00
5/12/06 12:00
5/13/06 0:00
5/13/06 12:00
5/14/06 0:00
5/14/06 12:00
5/15/06 0:00
5/15/06 12:00
5/16/06 0:00
5/16/06 12:00
Date/Time


Hydrograph for Well EA-10M
Patapsco Aquifer Tidal Study
Raw GWE
Corrected GWE (Eff=0.581)
Raw Tide
Lagged Tide (Time=87 min)
Groundwater Elevation (ft BCD)
3.5
3.0
2.5
2.0
1.5
1.0
DMT Tide Elevation (ft)
1.0
0.5
0.0
-0.5
-1.0
-1.5
5/12/06 0:00
5/12/06 12:00
5/13/06 0:00
5/13/06 12:00
5/14/06 0:00
5/14/06 12:00
5/15/06 0:00
5/15/06 12:00
5/16/06 0:00
5/16/06 12:00
Date/Time

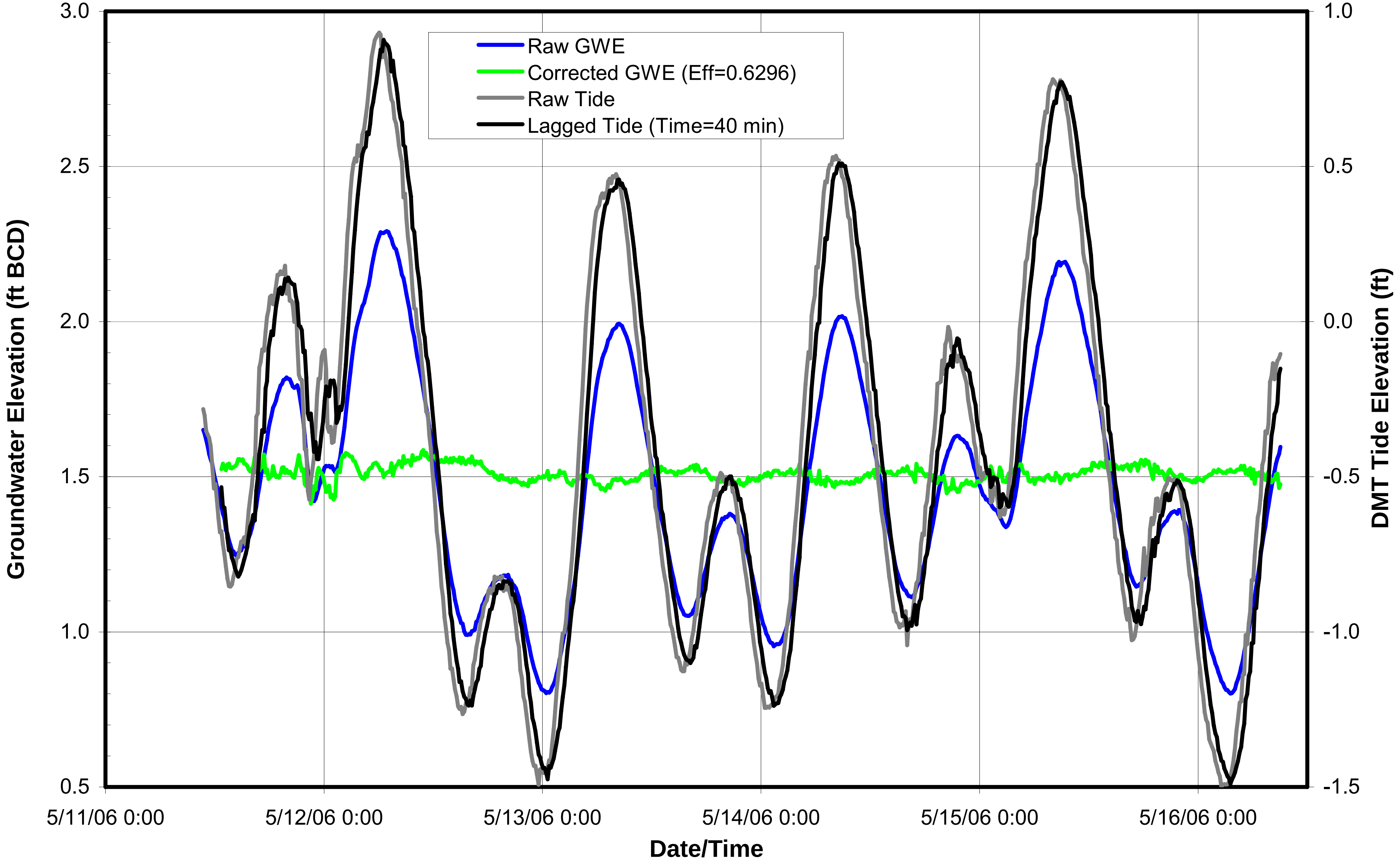

Hydrograph for Well EA-11M
Patapsco Aquifer Tidal Study
Raw GWE
Corrected GWE (Eff=0.6824)
Raw Tide
Lagged Tide (Time=33 min)
Groundwater Elevation (ft BCD)
3.0
2.5
2.0
1.5
1.0
0.5
DMT Tide Elevation (ft)
1.0
0.5
0.0
-0.5
-1.0
-1.5
5/12/06 0:00
5/12/06 12:00
5/13/06 0:00
5/13/06 12:00
5/14/06 0:00
5/14/06 12:00
5/15/06 0:00
5/15/06 12:00
5/16/06 0:00
5/16/06 12:00
Date/Time

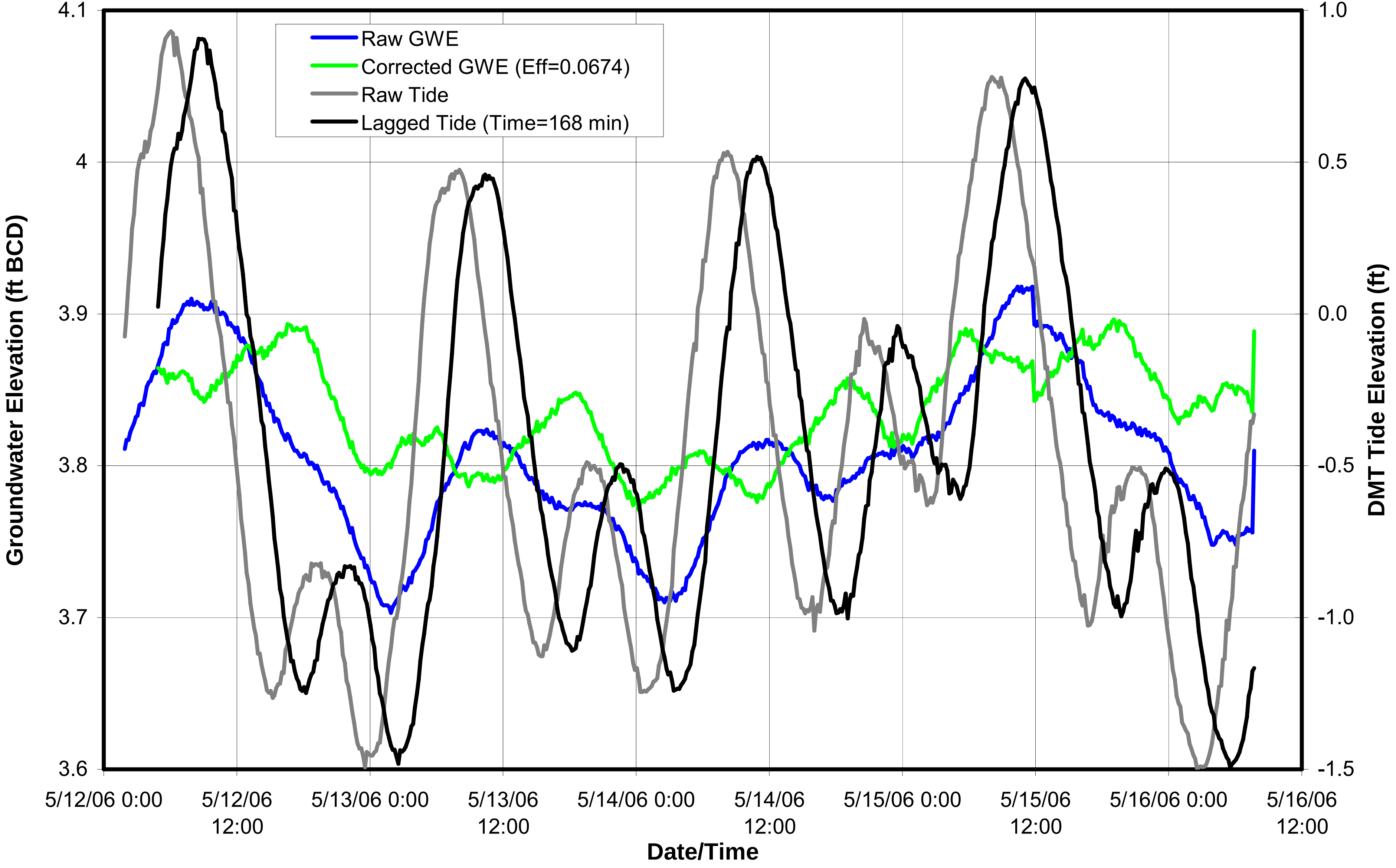


Hydrograph for Well EA-13M
Patapsco Aquifer Tidal Study

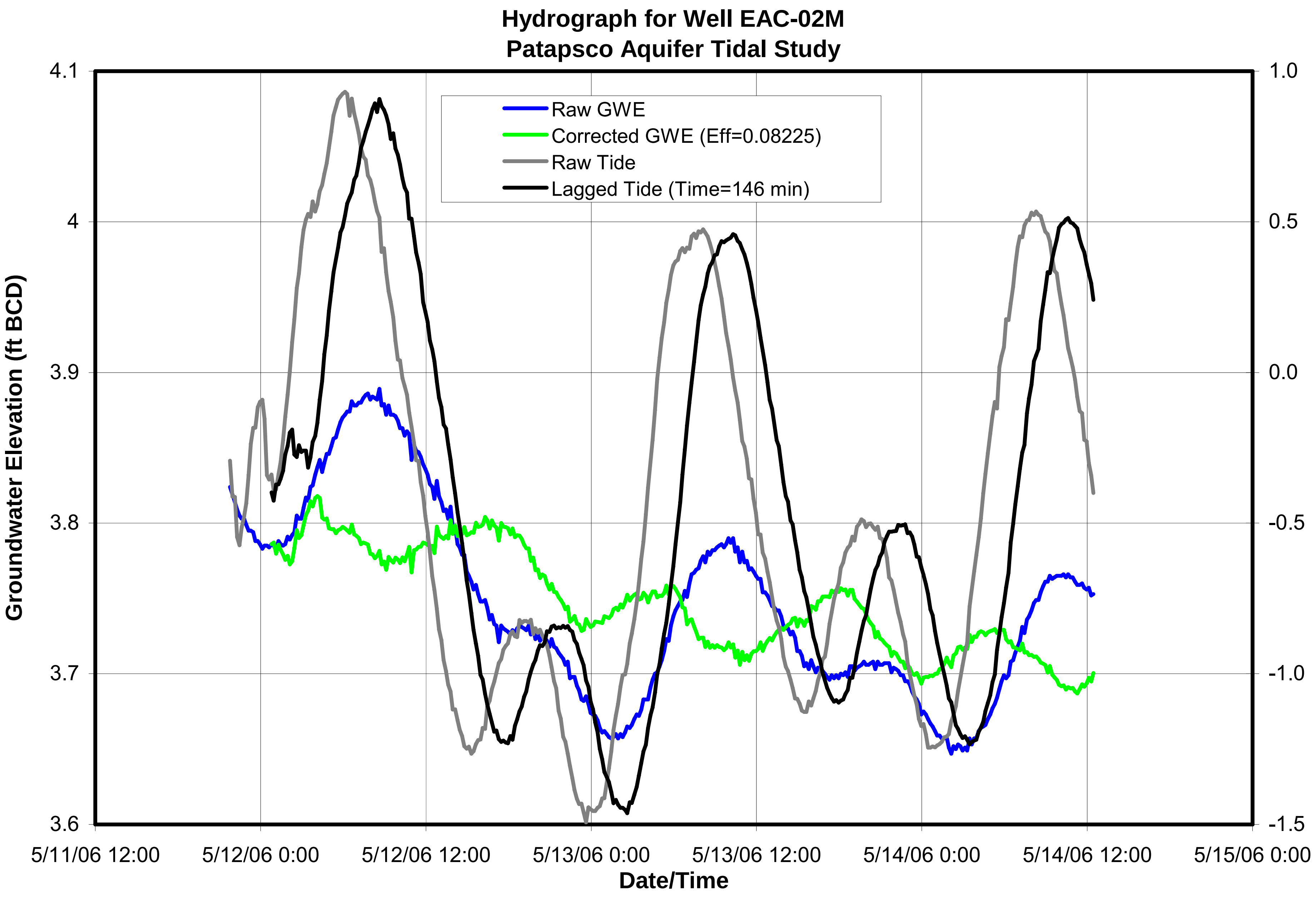

Hydrograph for Well EA-14M
Patapsco Aquifer Tidal Study
Raw GWE
Corrected GWE (Eff=0.6694)
Raw Tide
Lagged Tide (Time=7 min)
Groundwater Elevation (ft BCD)
DMT Tide Elevation (ft)
Date/Time
3.5
3.0
2.5
2.0
1.5
1.0
1.0
0.5
0.0
-0.5
-1.0
-1.5
5/12/06 0:00
5/12/06 12:00
5/13/06 0:00
5/13/06 12:00
5/14/06 0:00
5/14/06 12:00
5/15/06 0:00
5/15/06 12:00
5/16/06 0:00
5/16/06 12:00

Hydrograph for Well EA-15M
Patapsco Aquifer Tidal Study

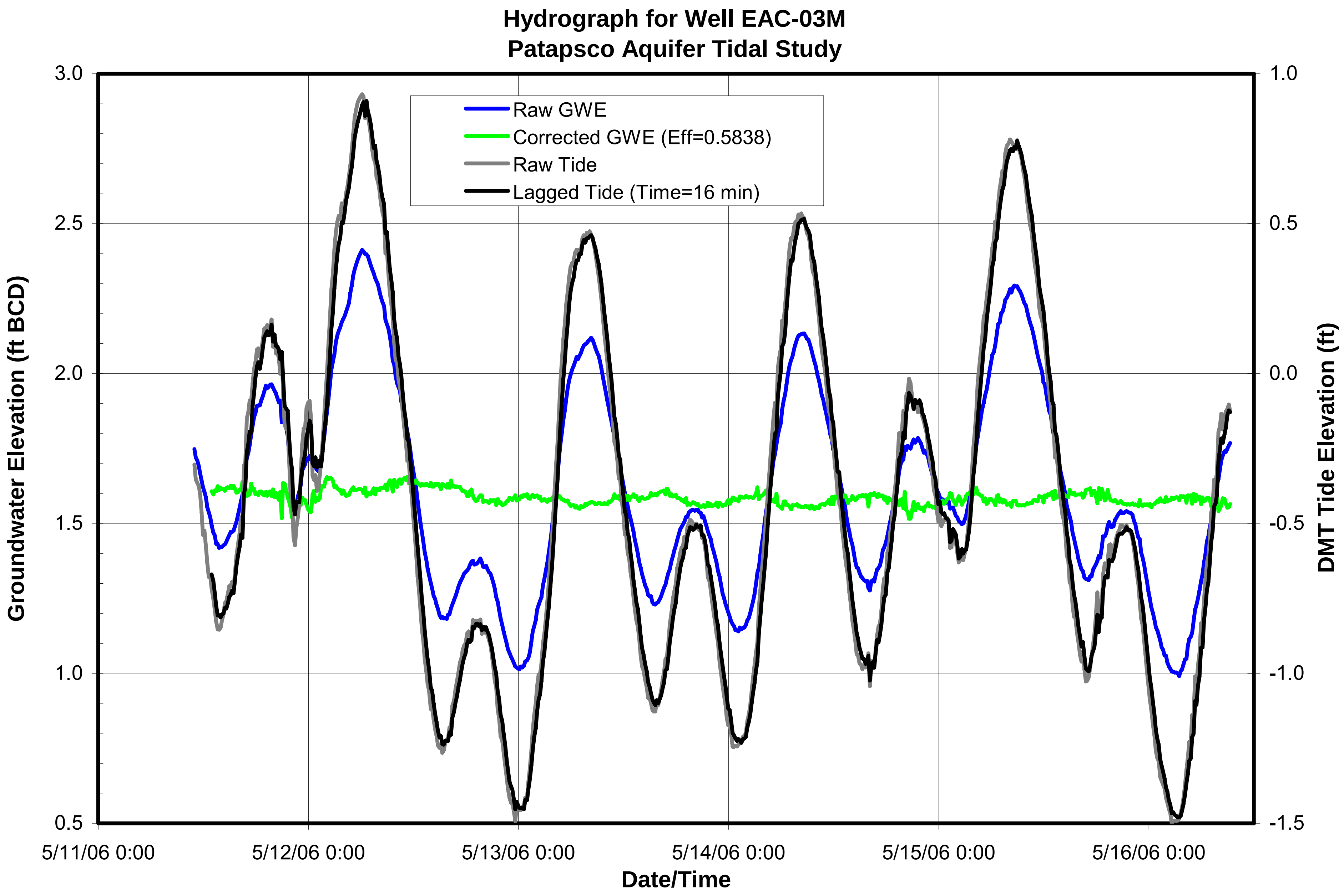




Hydrograph for Well EAC-01M
Patapsco Aquifer Tidal Study

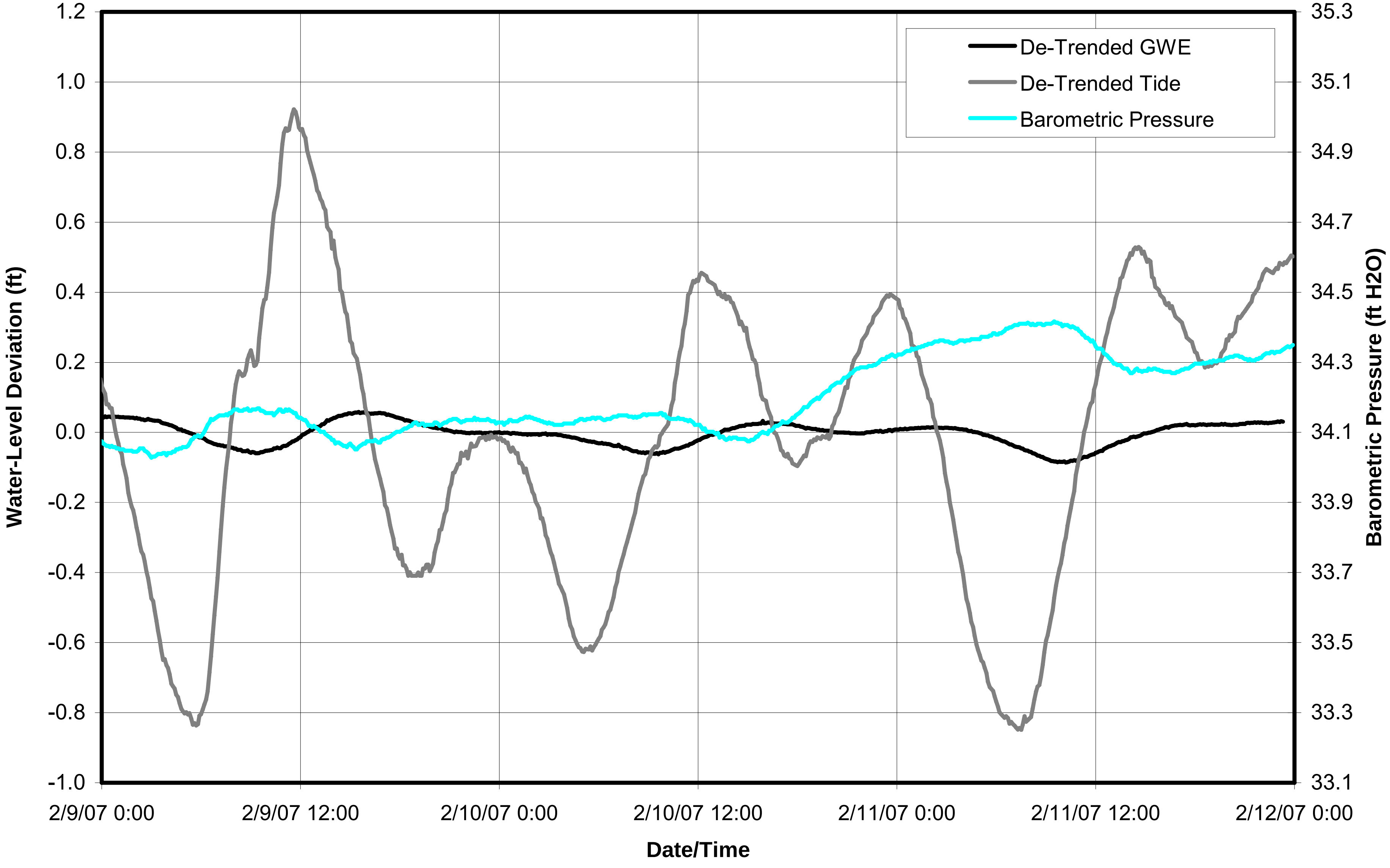


Hydrograph for Well EAC-02M
Patapsco Aquifer Tidal Study
Raw GWE
Corrected GWE (Eff=0.08225)
Raw Tide
Lagged Tide (Time=146 min)
Groundwater Elevation (ft BCD)
4.1
4
3.9
3.8
3.7
3.6
DMT Tide Elevation (ft)
1.0
0.5
0.0
-0.5
-1.0
-1.5
5/11/06 12:00
5/12/06 0:00
5/12/06 12:00
5/13/06 0:00
5/13/06 12:00
5/14/06 0:00
5/14/06 12:00
5/15/06 0:00
Date/Time

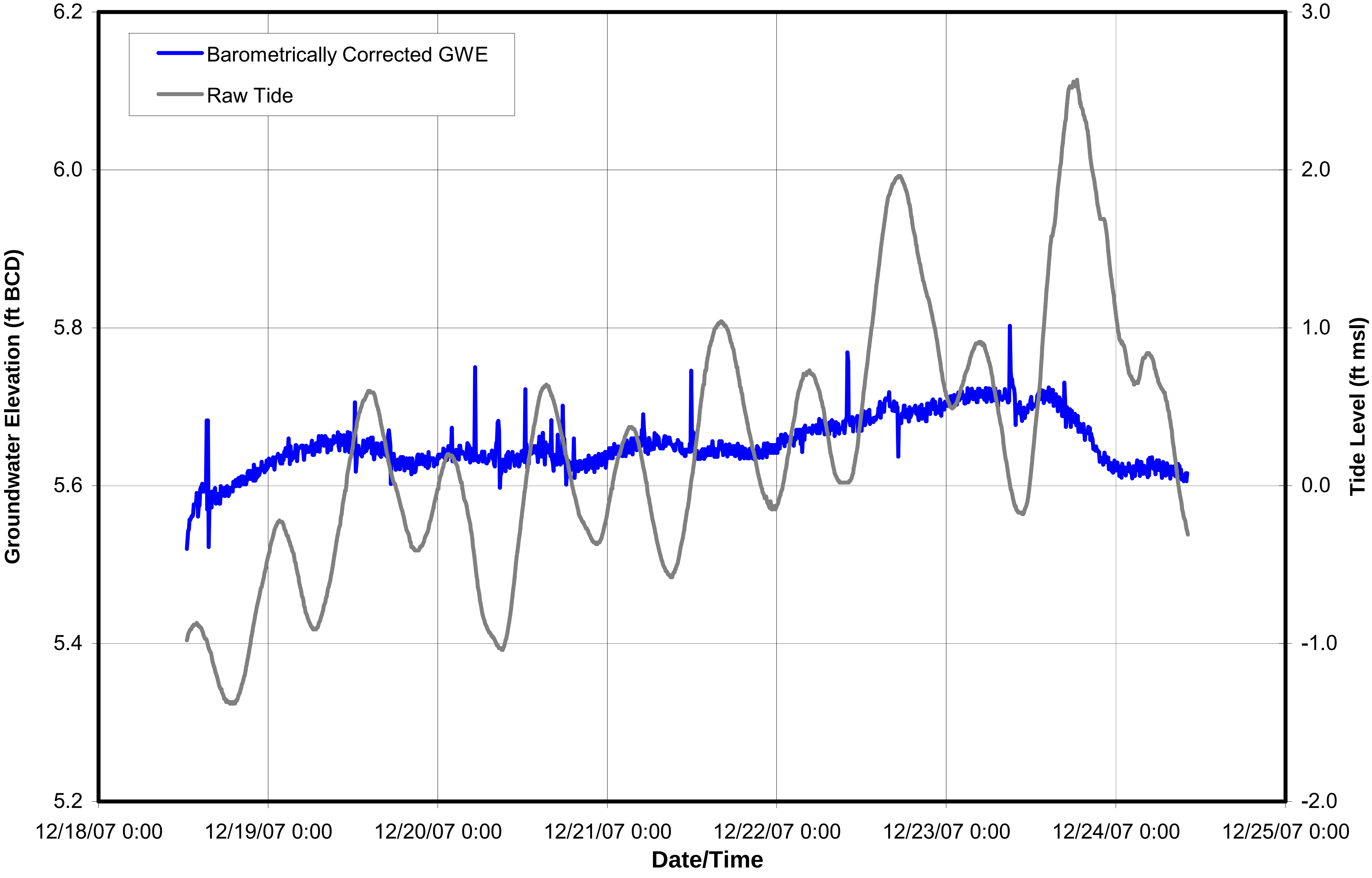


Hydrograph for Well EAC-03M
Patapsco Aquifer Tidal Study

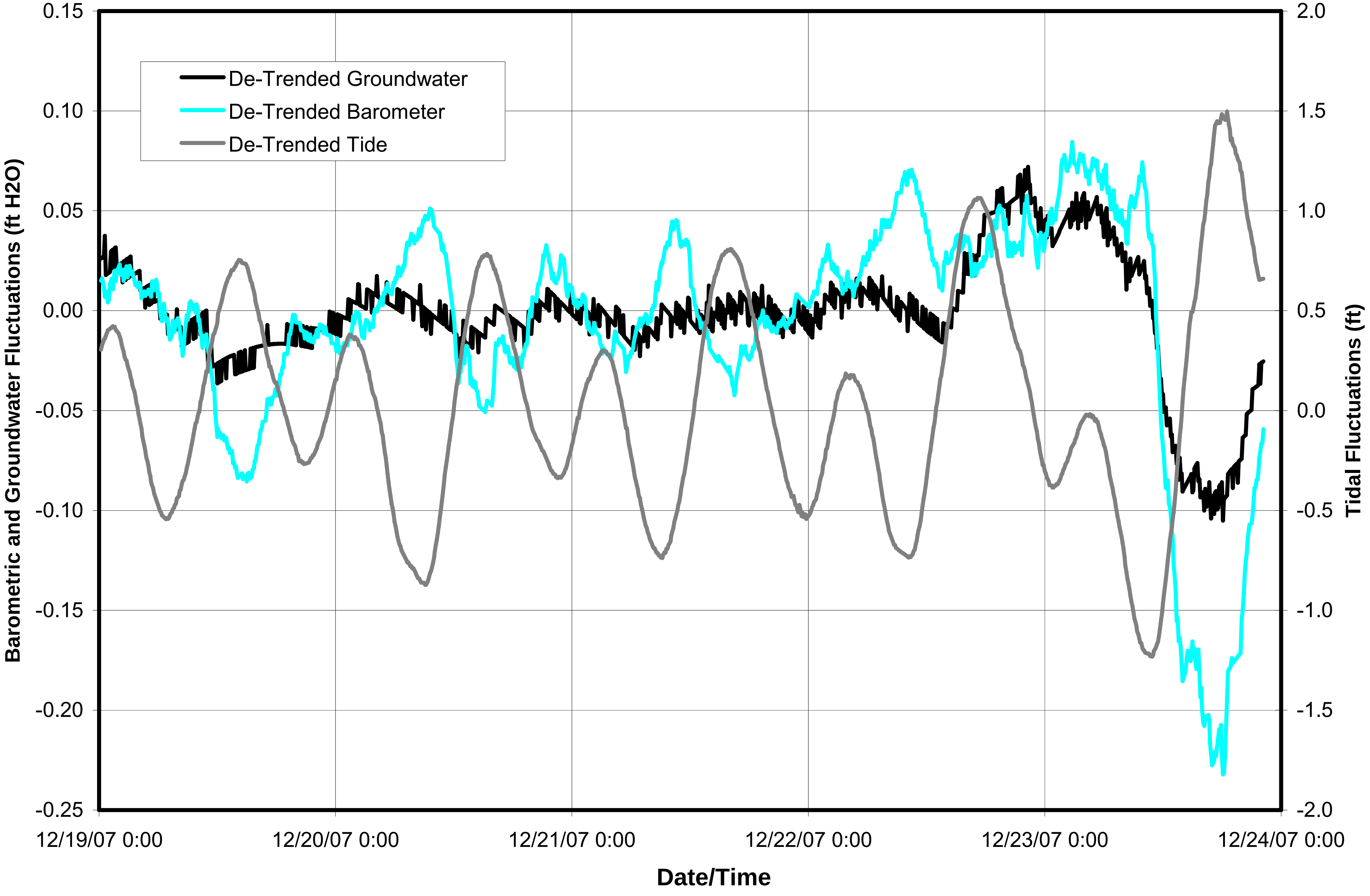
Hydrograph for Well DMT-38M
Patapsco Aquifer Tidal Study



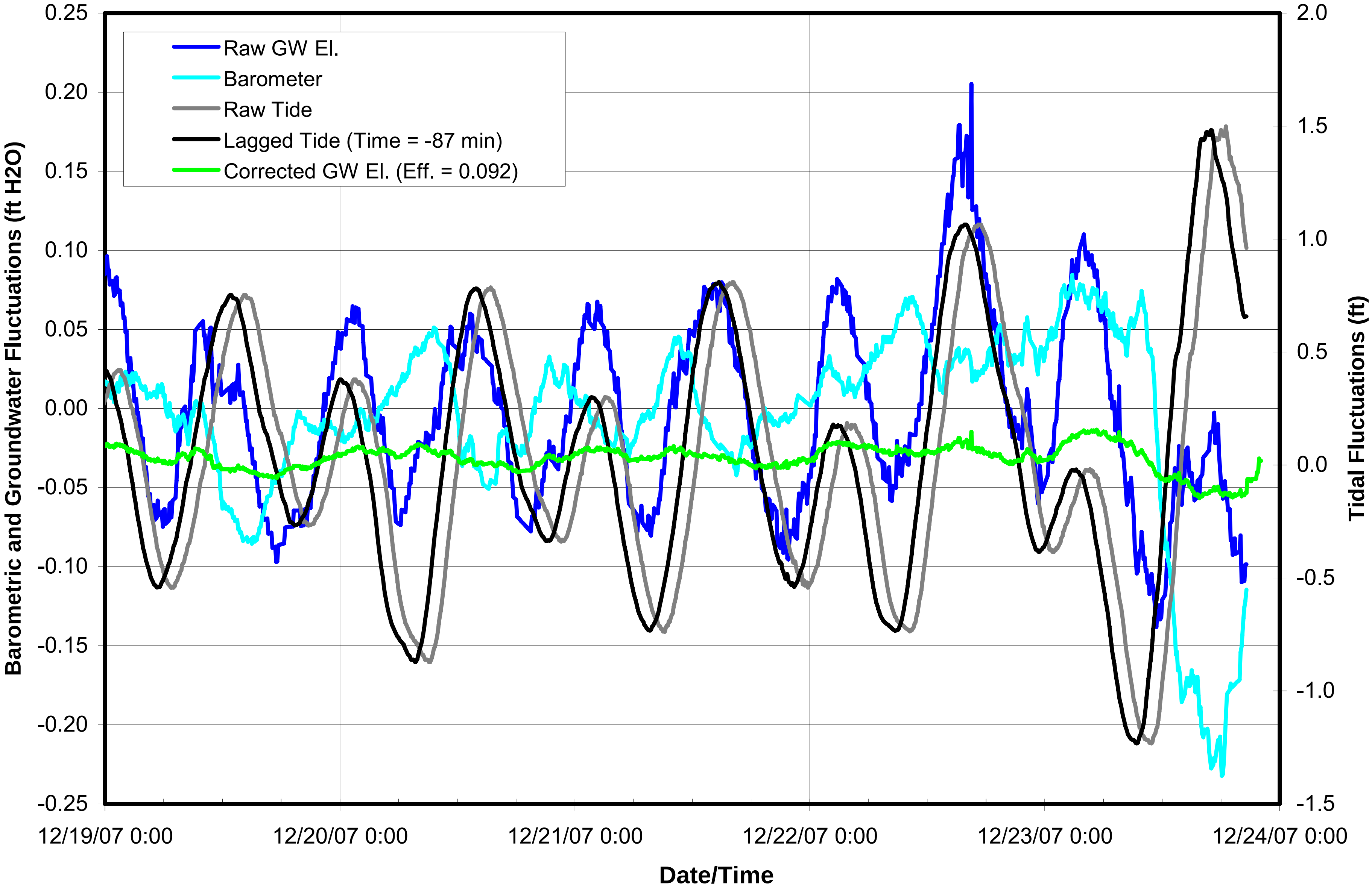
Hydrograph for Well DMT-60M
Patapsco Aquifer Tidal Study



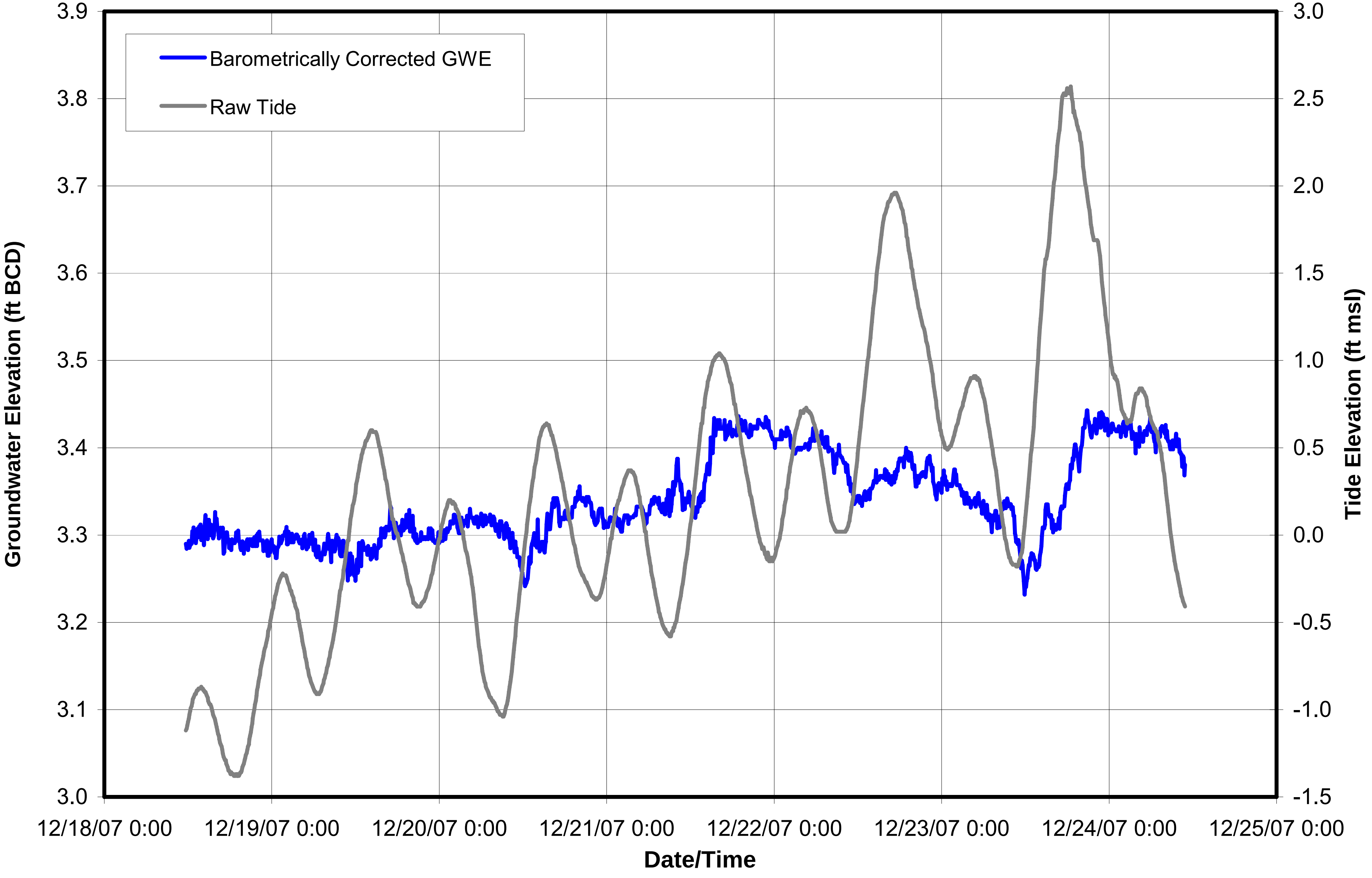
De-Trended Tidal, Barometric, and Groundwater Fluctuations for Well DMT-49US
Alluvial Sand Wells Tidal Study

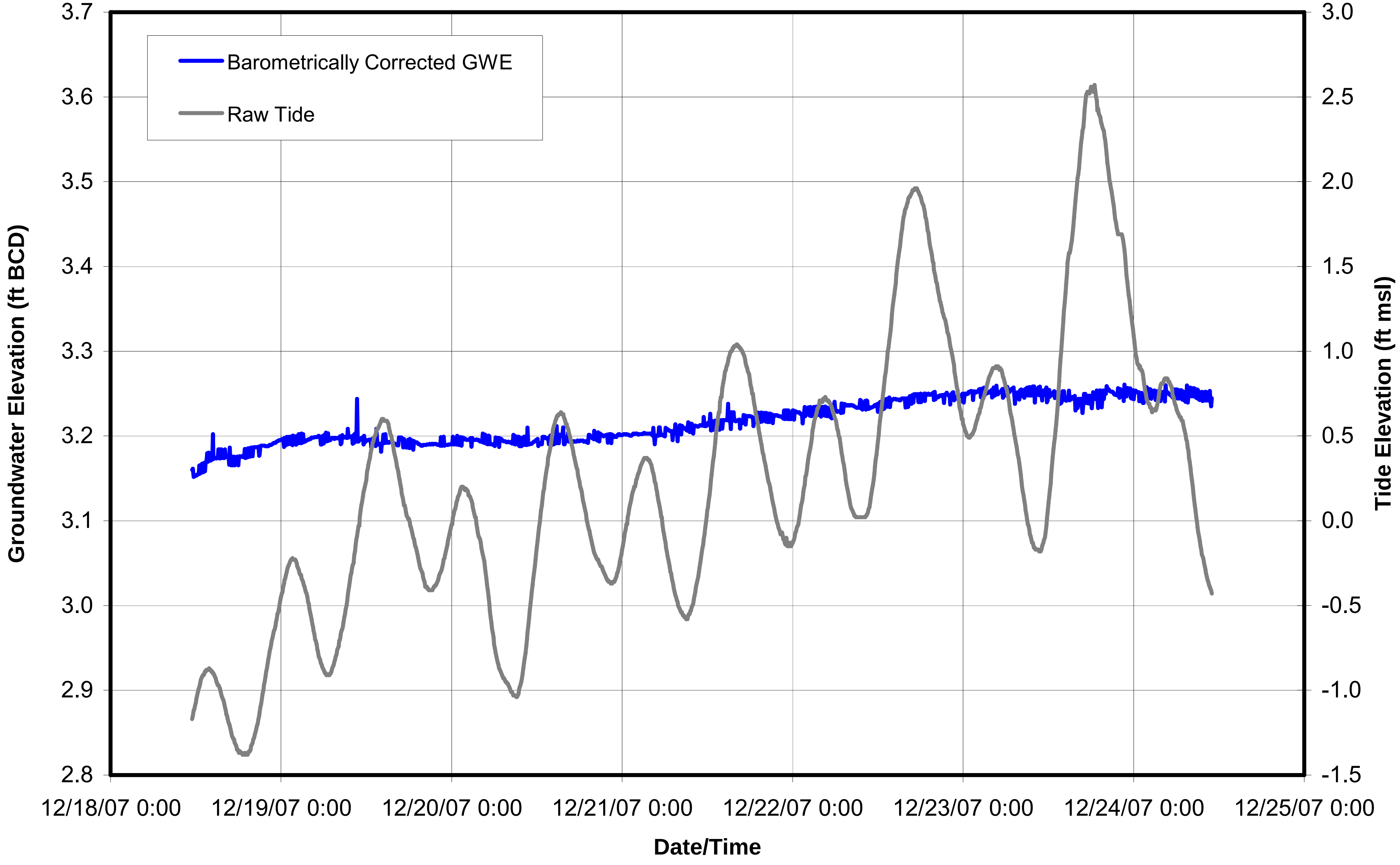


De-Trended Tidal, Barometric, and Groundwater Fluctuations for Well DMT-50US
Alluvial Sand Wells Tidal Study

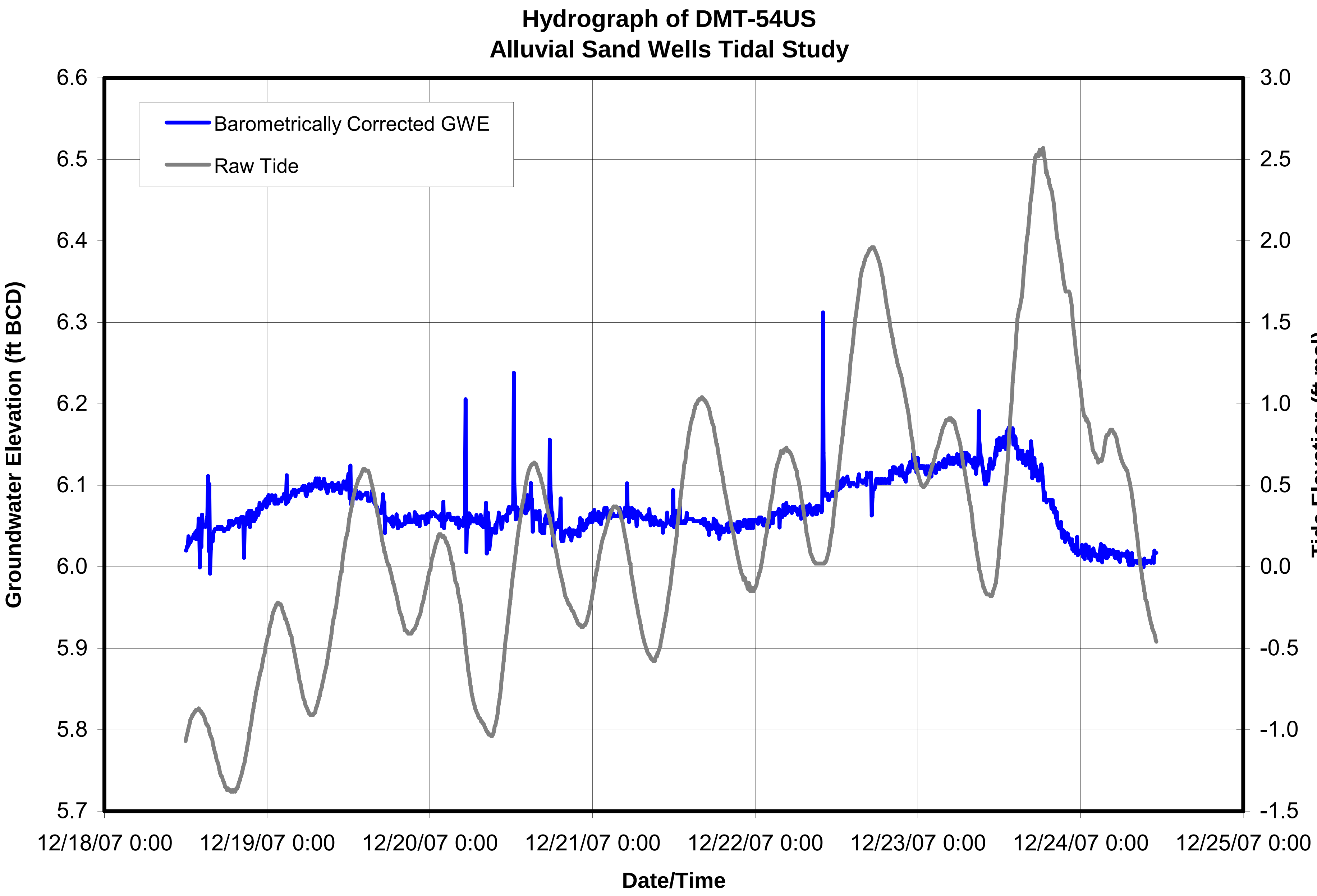


Hydrograph for DMT-51US
Alluvial Sand Wells Tidal Study



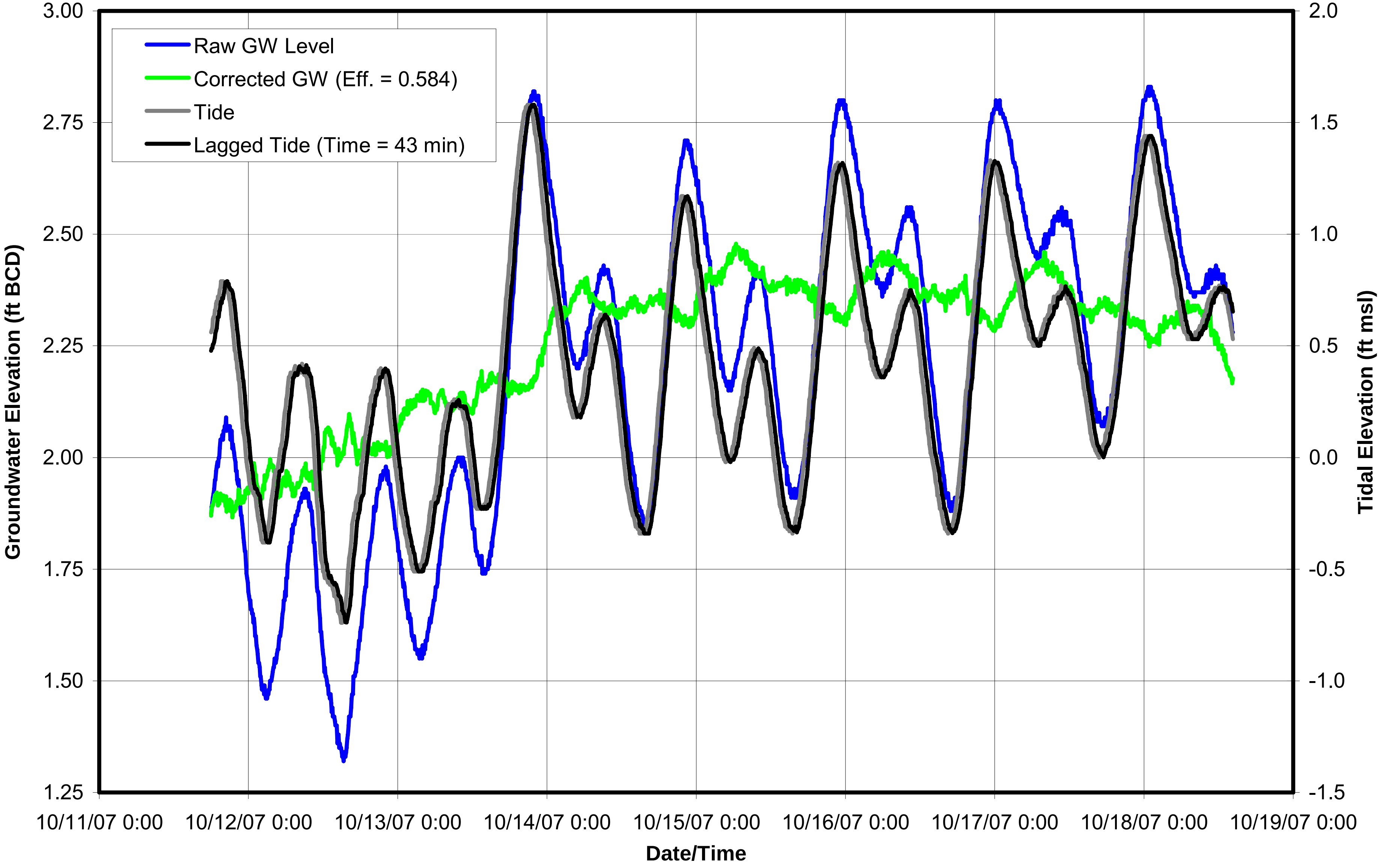


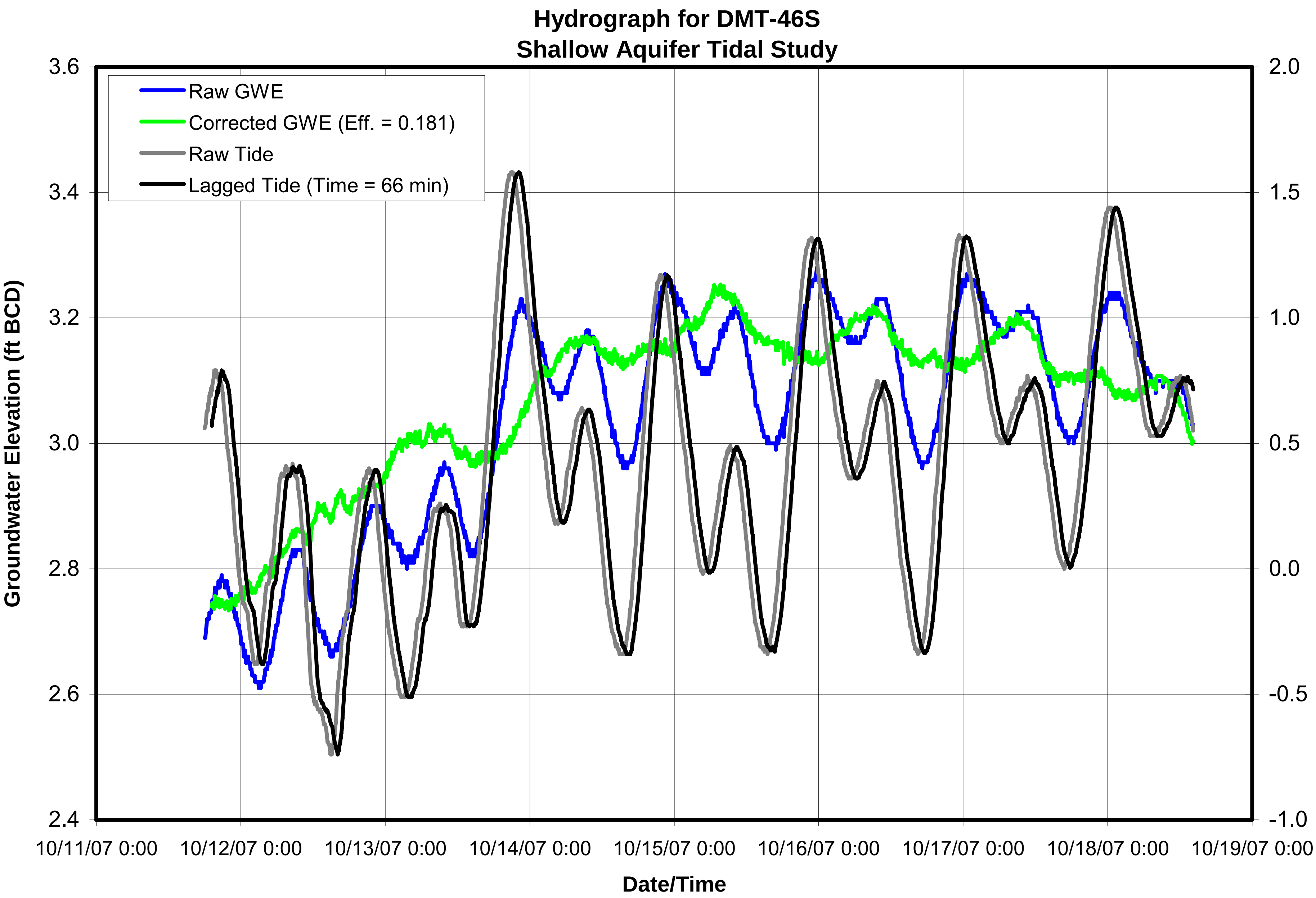
Hydrograph of DMT-52US
Alluvial Sand Wells Tidal Study



Hydrograph of DMT-54US
Alluvial Sand Wells Tidal Study
Barometrically Corrected GWE
Raw Tide
Groundwater Elevation (ft BCD)
Tide Elevation (ft msl)
Date/Time
6.6
6.5
6.4
6.3
6.2
6.1
6.0
5.9
5.8
5.7
3.0
2.5
2.0
1.5
1.0
0.5
0.0
-0.5
-1.0
-1.5
12/18/07 0:00
12/19/07 0:00
12/20/07 0:00
12/21/07 0:00
12/22/07 0:00
12/23/07 0:00
12/24/07 0:00
12/25/07 0:00

Hydrograph for Well DMT-45S
Shallow Aquifer Tidal Study




Hydrograph for DMT-46S
Shallow Aquifer Tidal Study
Raw GWE
Corrected GWE (Eff. = 0.181)
Raw Tide
Lagged Tide (Time = 66 min)
Groundwater Elevation (ft BCD)
Tidal Elevation (ft MSL)
Date/Time
3.6
3.4
3.2
3.0
2.8
2.6
2.4
2.0
1.5
1.0
0.5
0.0
-0.5
-1.0
10/11/07 0:00
10/12/07 0:00
10/13/07 0:00
10/14/07 0:00
10/15/07 0:00
10/16/07 0:00
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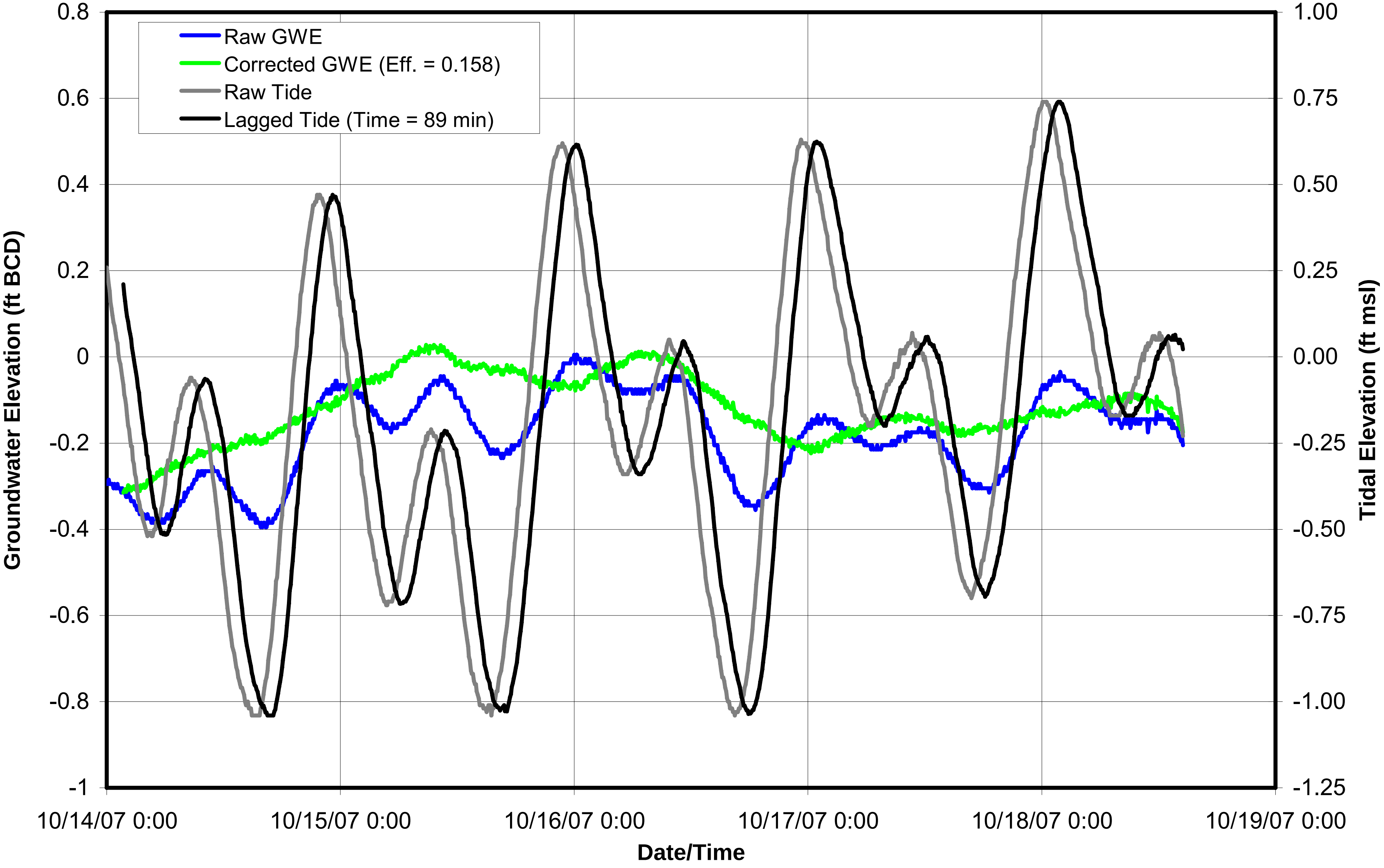
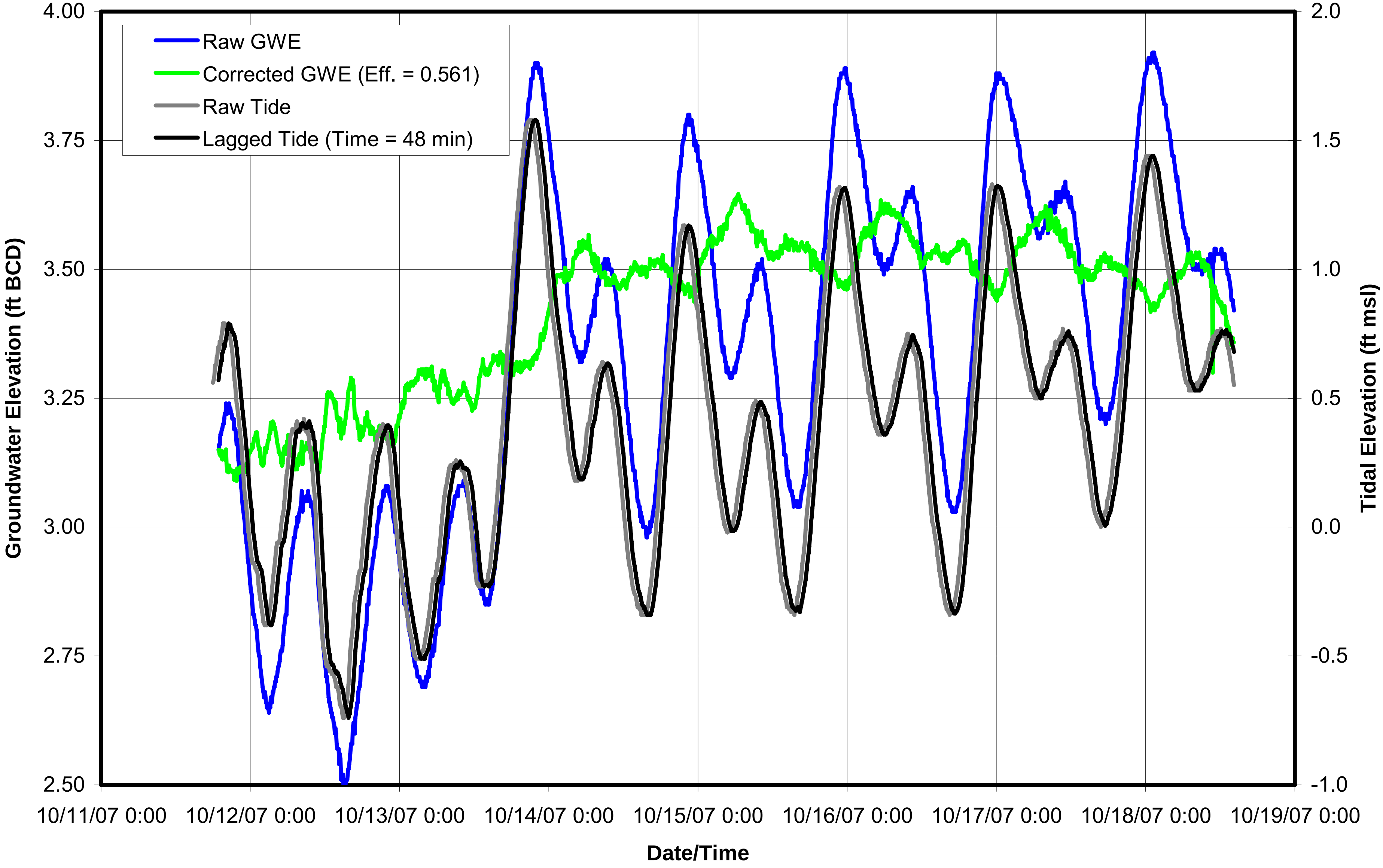
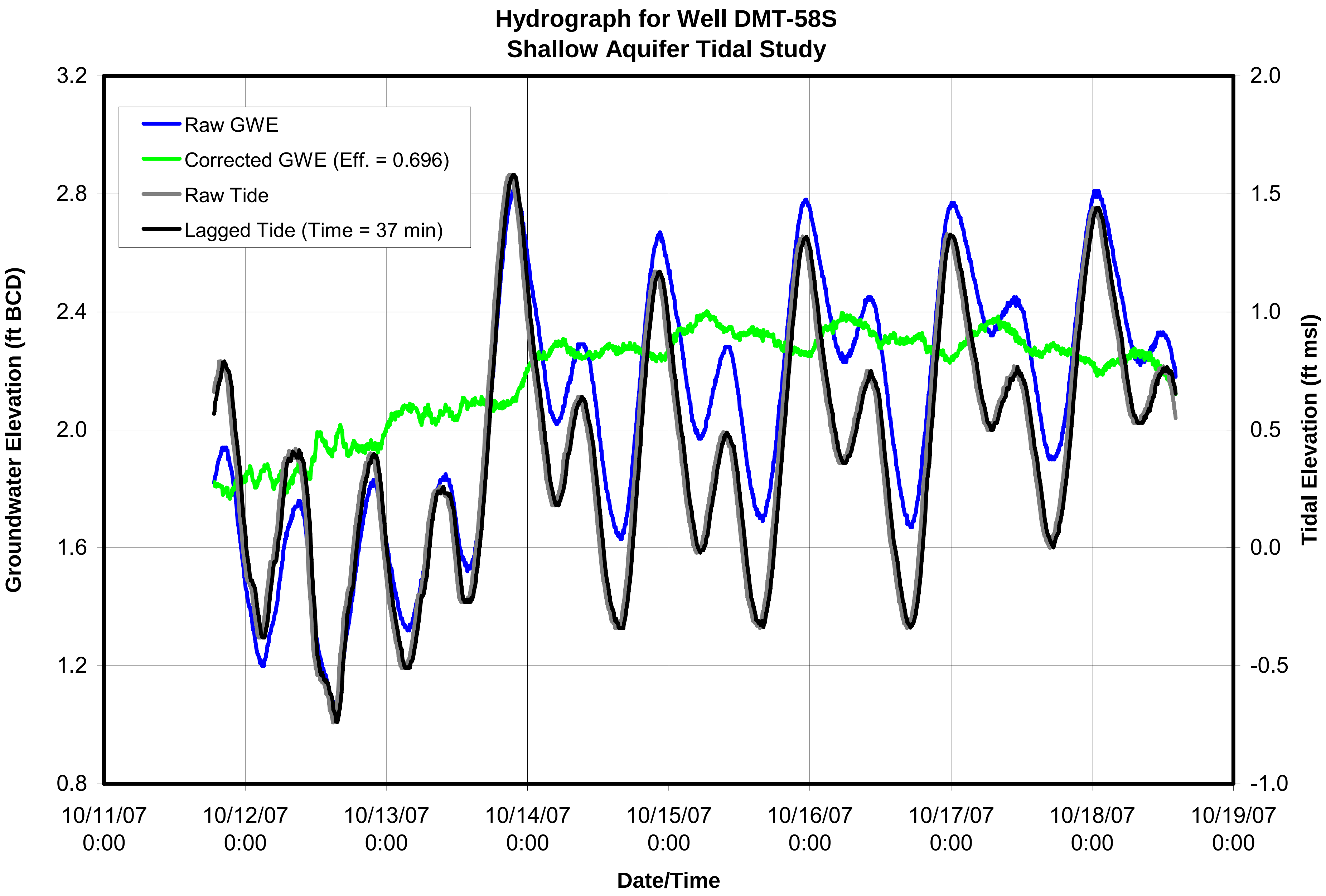
10/18/07 0:00
10/19/07 0:00

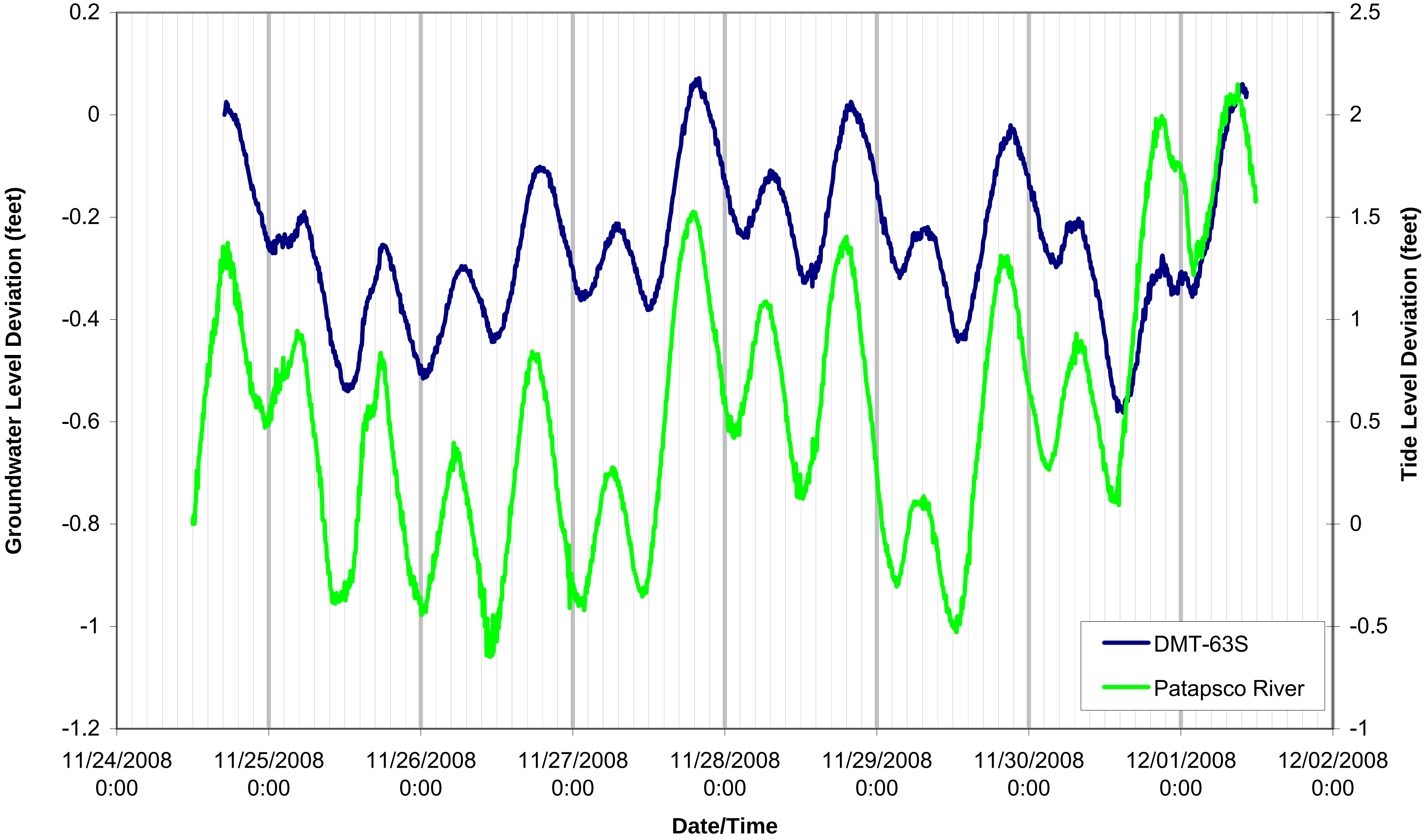


Hydrograph for Well DMT-56S
Shallow Aquifer Tidal Study

Hydrograph for DMT-57S
Shallow Aquifer Tidal Study




Hydrograph for Well DMT-58S
Shallow Aquifer Tidal Study
Raw GWE
Corrected GWE (Eff. = 0.696)
Raw Tide
Lagged Tide (Time = 37 min)
Groundwater Elevation (ft BCD)
3.2
2.8
2.4
2.0
1.6
1.2
0.8
Tidal Elevation (ft msl)
2.0
1.5
1.0
0.5
0.0
-0.5
-1.0
10/11/07 0:00
10/12/07 0:00
10/13/07 0:00
10/14/07 0:00
10/15/07 0:00
10/16/07 0:00
10/17/07 0:00
10/18/07 0:00
10/19/07 0:00
Date/Time



Hydrograph Comparison of DMT-63S and the Patapsco River Tide Gauge

Phase 3 Groundwater Investigation

Dundalk Marine Terminal

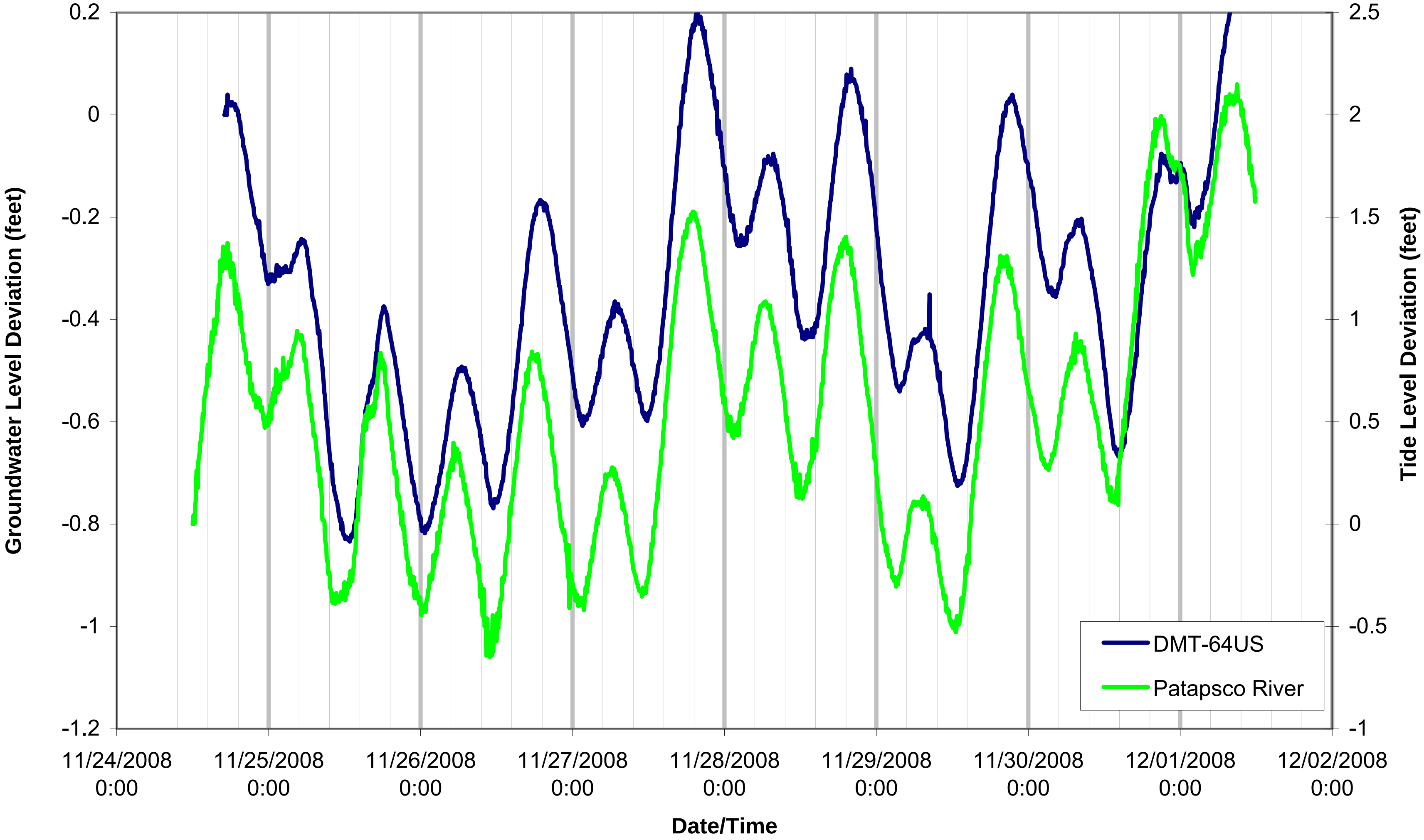
Baltimore, Maryland

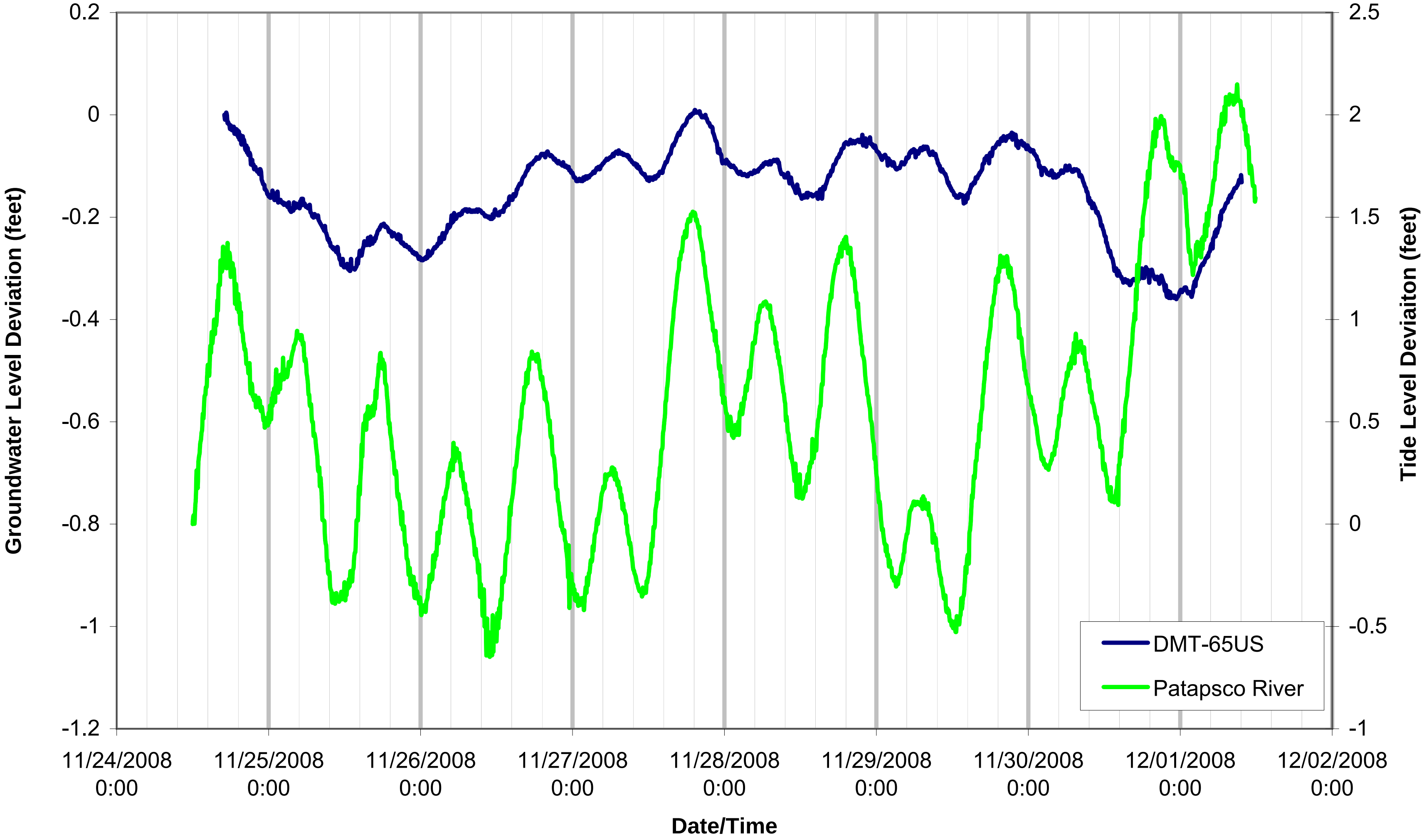
Hydrograph Comparison of DMT-64US and the Patapsco River Tide Gauge

Phase 3 Groundwater Investigation

Dundalk Marine Terminal

Baltimore, Maryland





Hydrograph Comparison of DMT-65US and the Patapsco River Tide Gauge

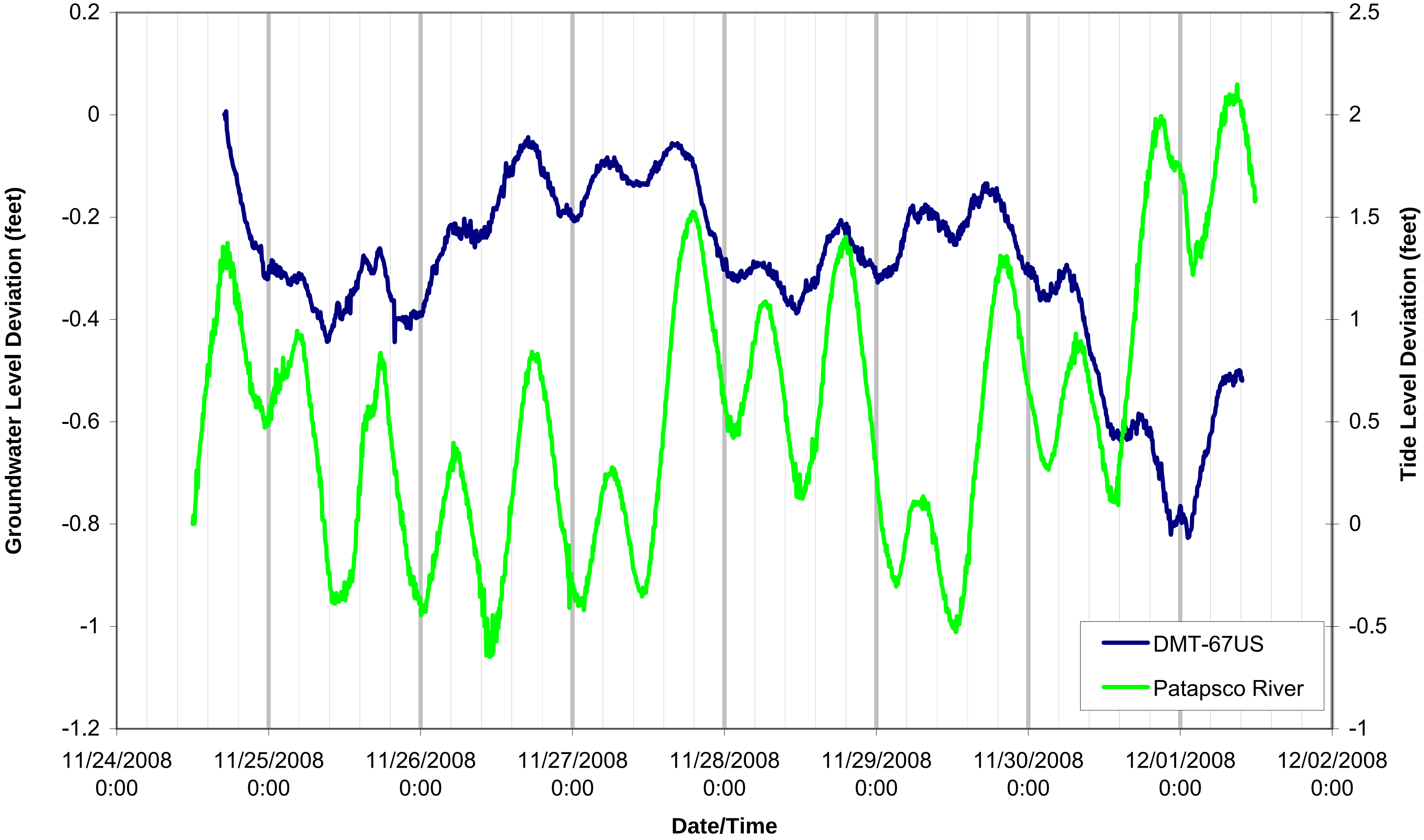
Phase 3 Groundwater Investigation

Dundalk Marine Terminal

Baltimore, Maryland

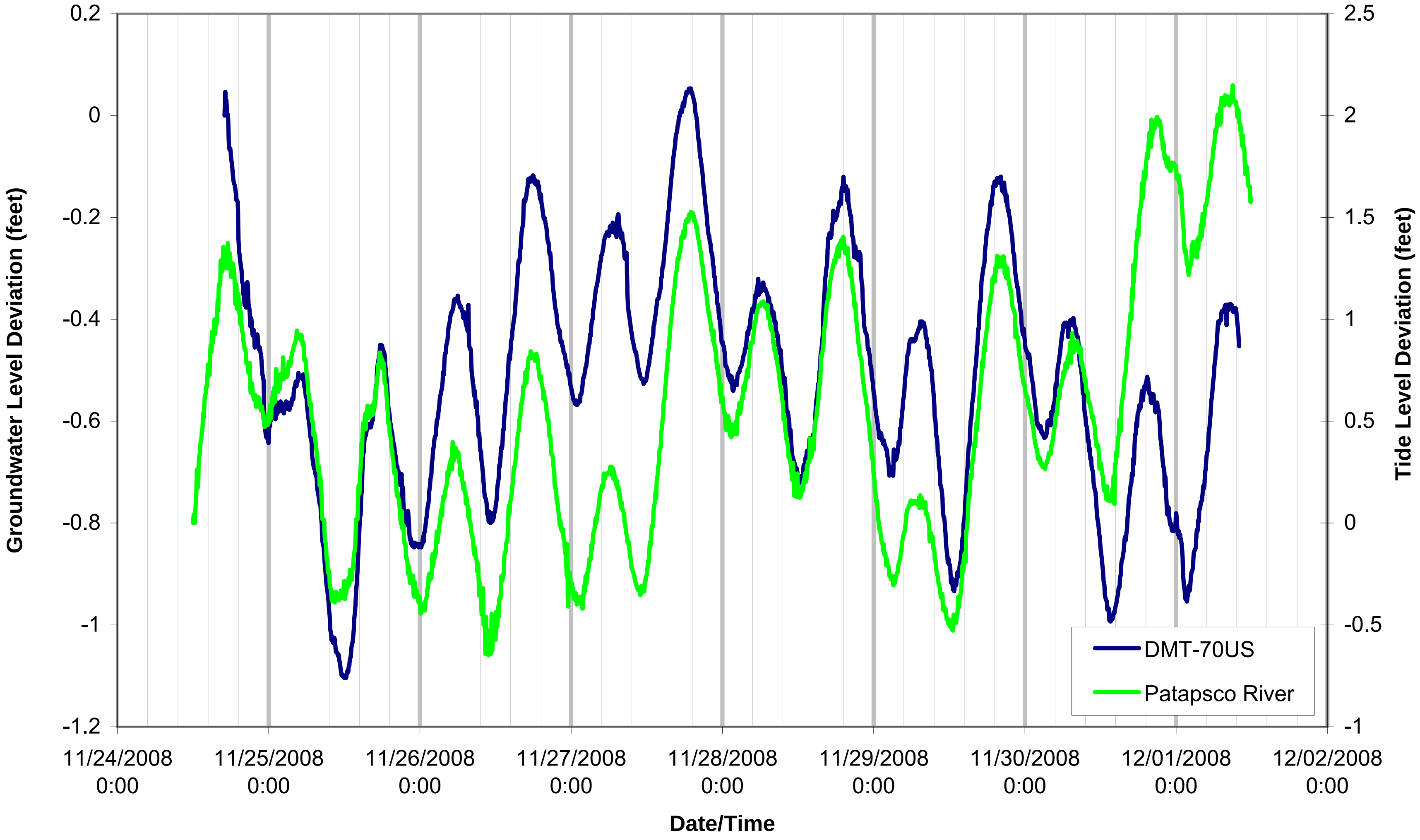
Hydrograph Comparison of DMT-67US and the Patapsco River Tide Gauge

Phase 3 Groundwater Investigation
Dundalk Marine Terminal
Baltimore, Maryland



Hydrograph Comparison of DMT-70US and the Patapsco River Tide Gauge

Phase 3 Groundwater Investigation
Dundalk Marine Terminal
Baltimore, Maryland

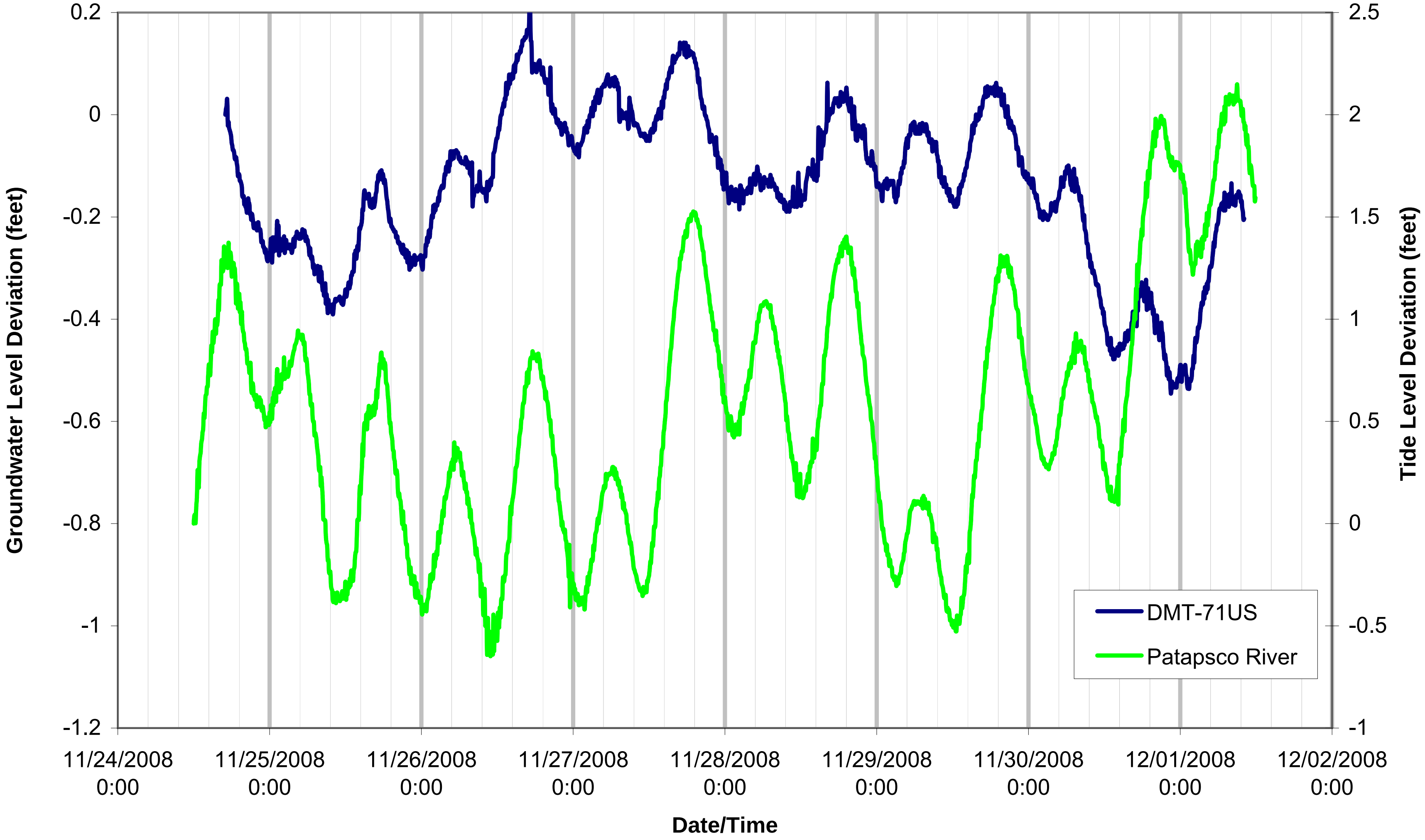


Hydrograph Comparison of DMT-71US and the Patapsco River Tide Gauge

Phase 3 Groundwater Investigation

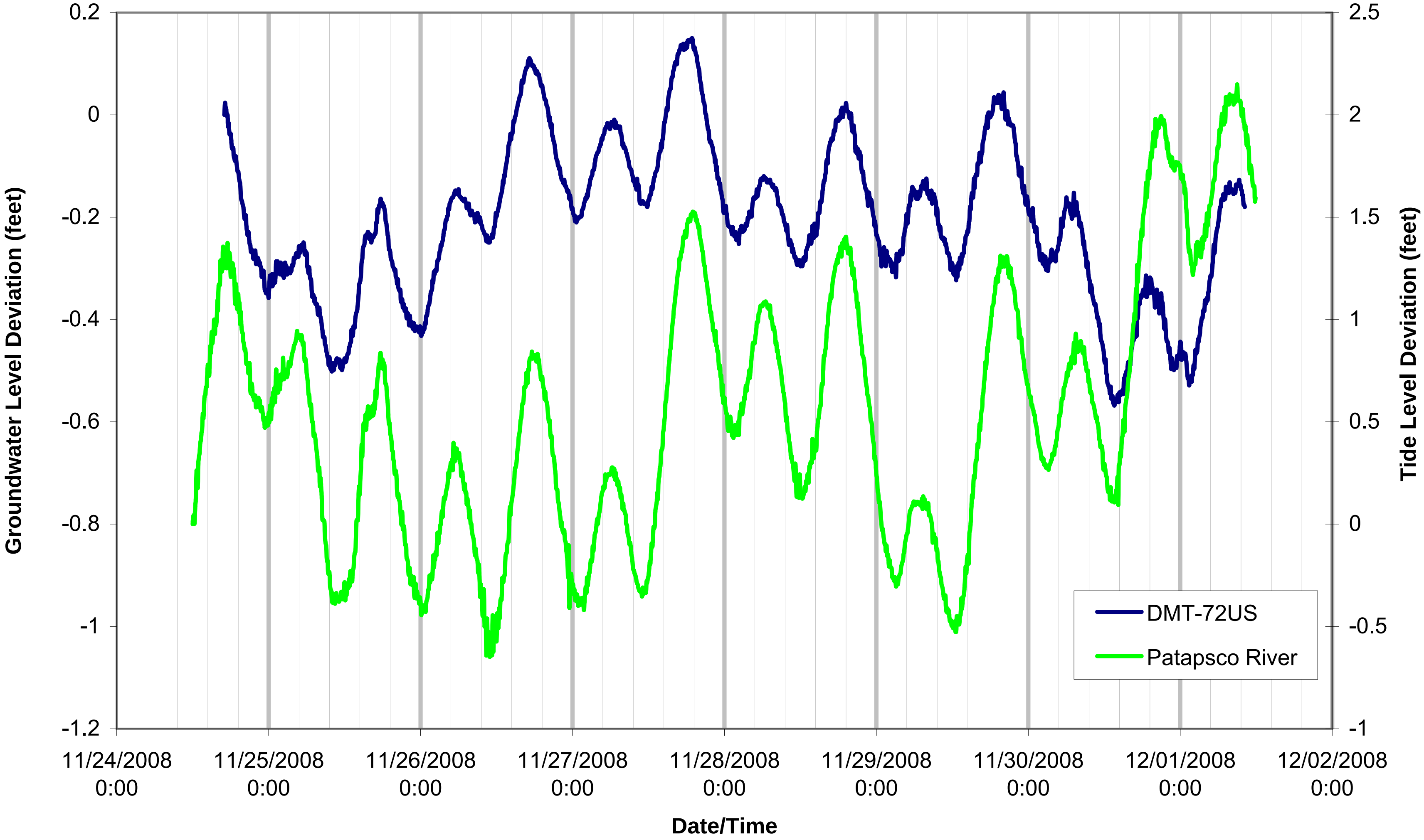
Dundalk Marine Terminal

Baltimore, Maryland



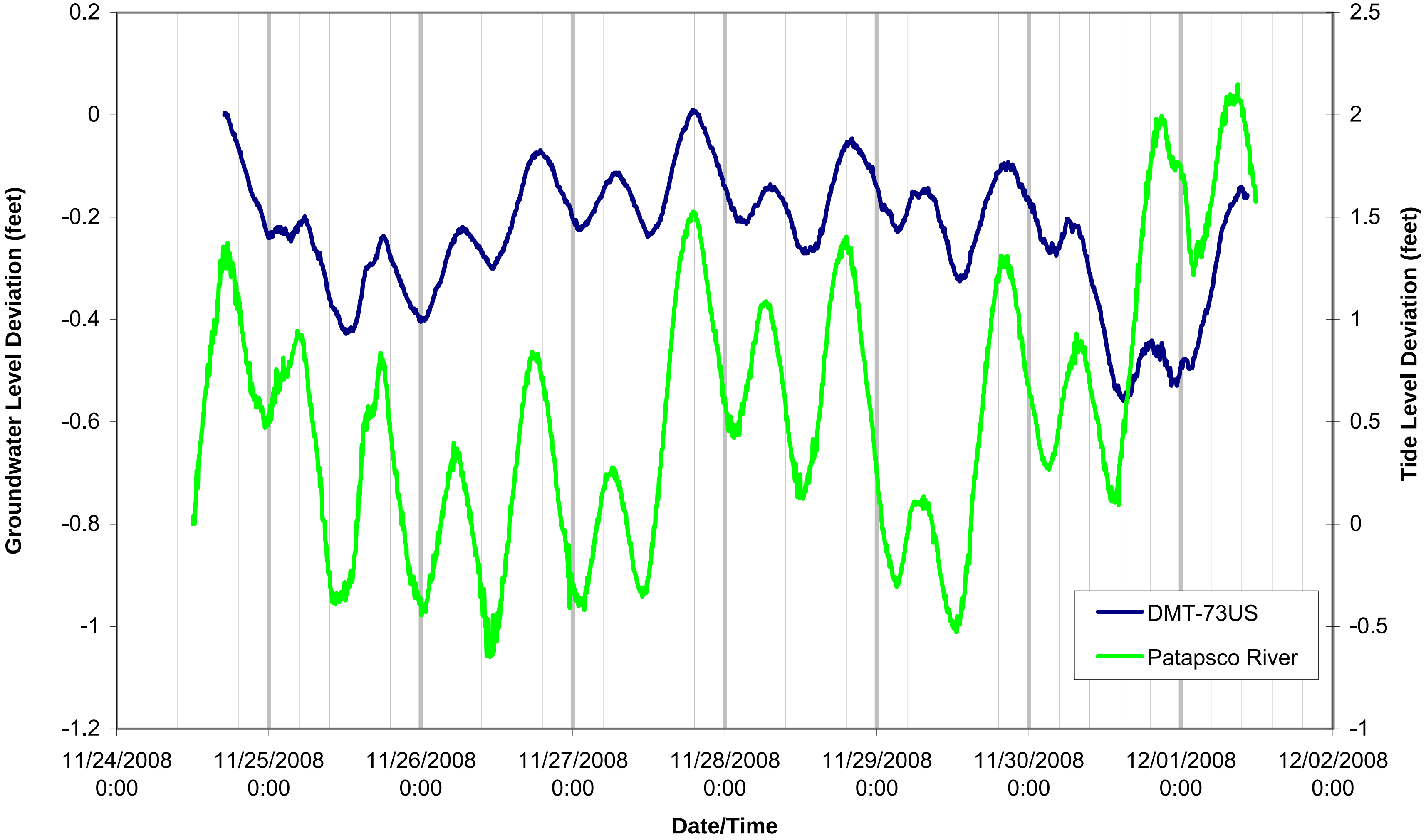
Hydrograph Comparison of DMT-72US and the Patapsco River Tide Gauge

Phase 3 Groundwater Investigation
Dundalk Marine Terminal
Baltimore, Maryland



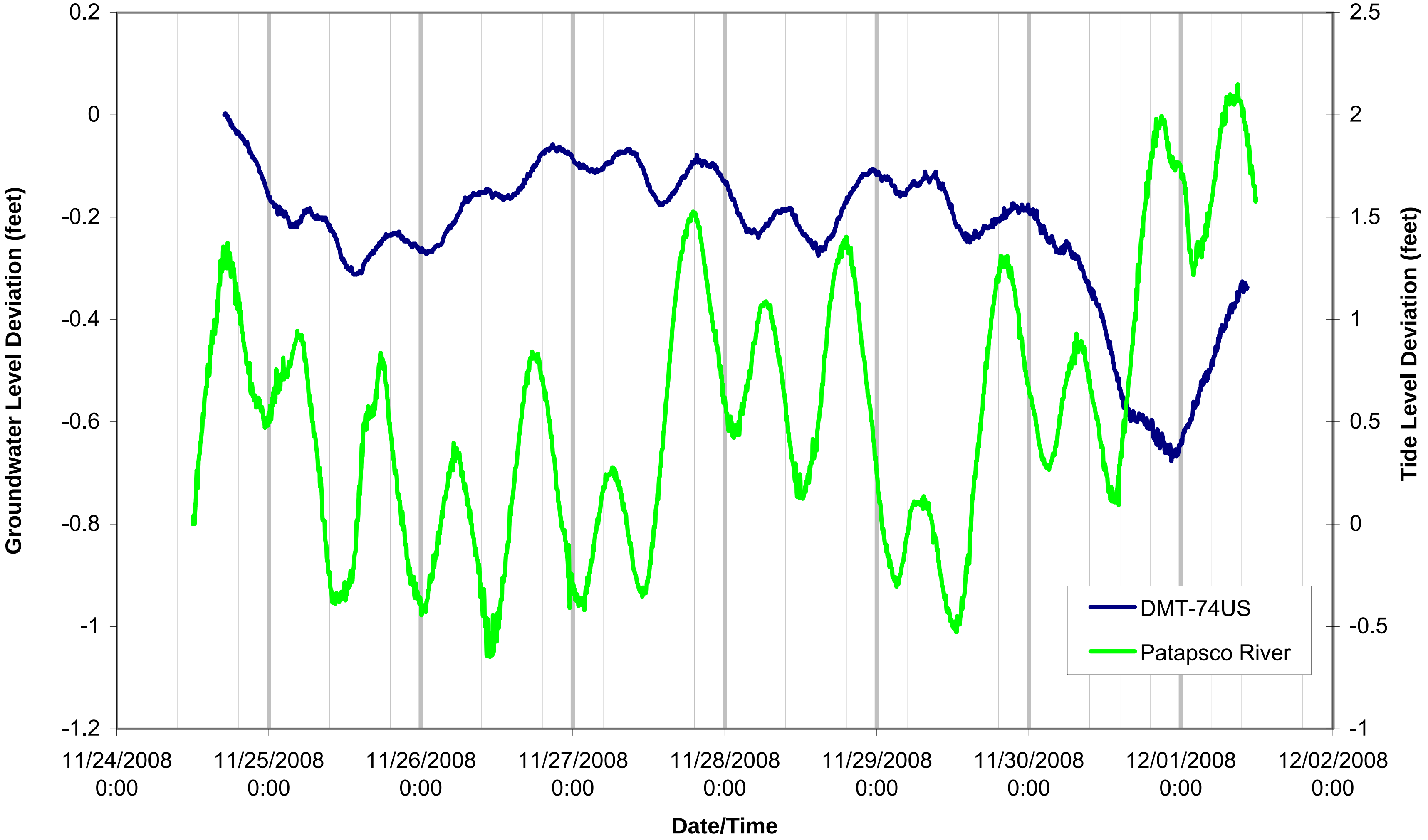
Hydrograph Comparison of DMT-73US and the Patapsco River Tide Gauge

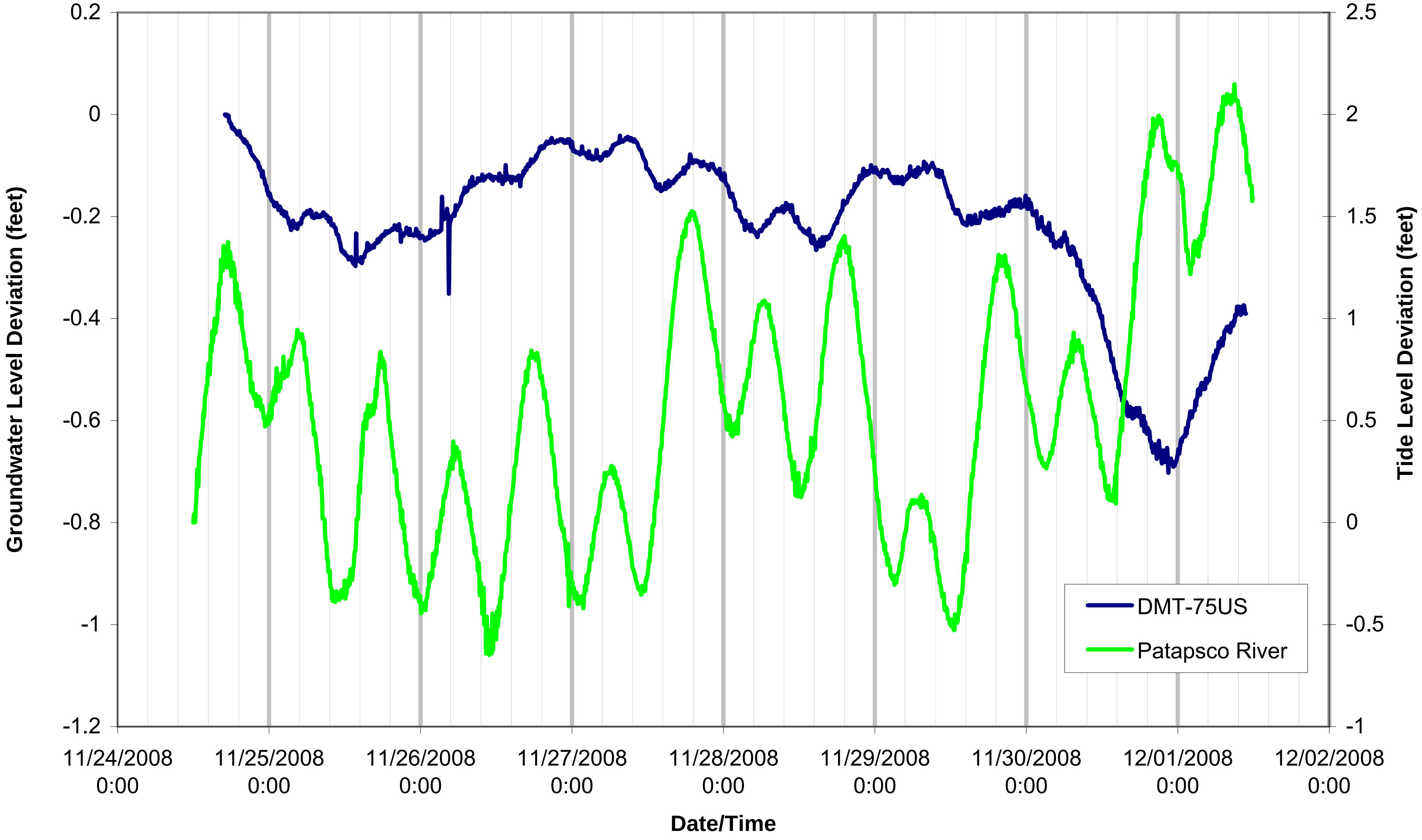
Phase 3 Groundwater Investigation
Dundalk Marine Terminal
Baltimore, Maryland



Hydrograph Comparison of DMT-74US and the Patapsco River Tide Gauge

Phase 3 Groundwater Investigation
Dundalk Marine Terminal
Baltimore, Maryland





Hydrograph Comparison of DMT-75US and the Patapsco River Tide Gauge

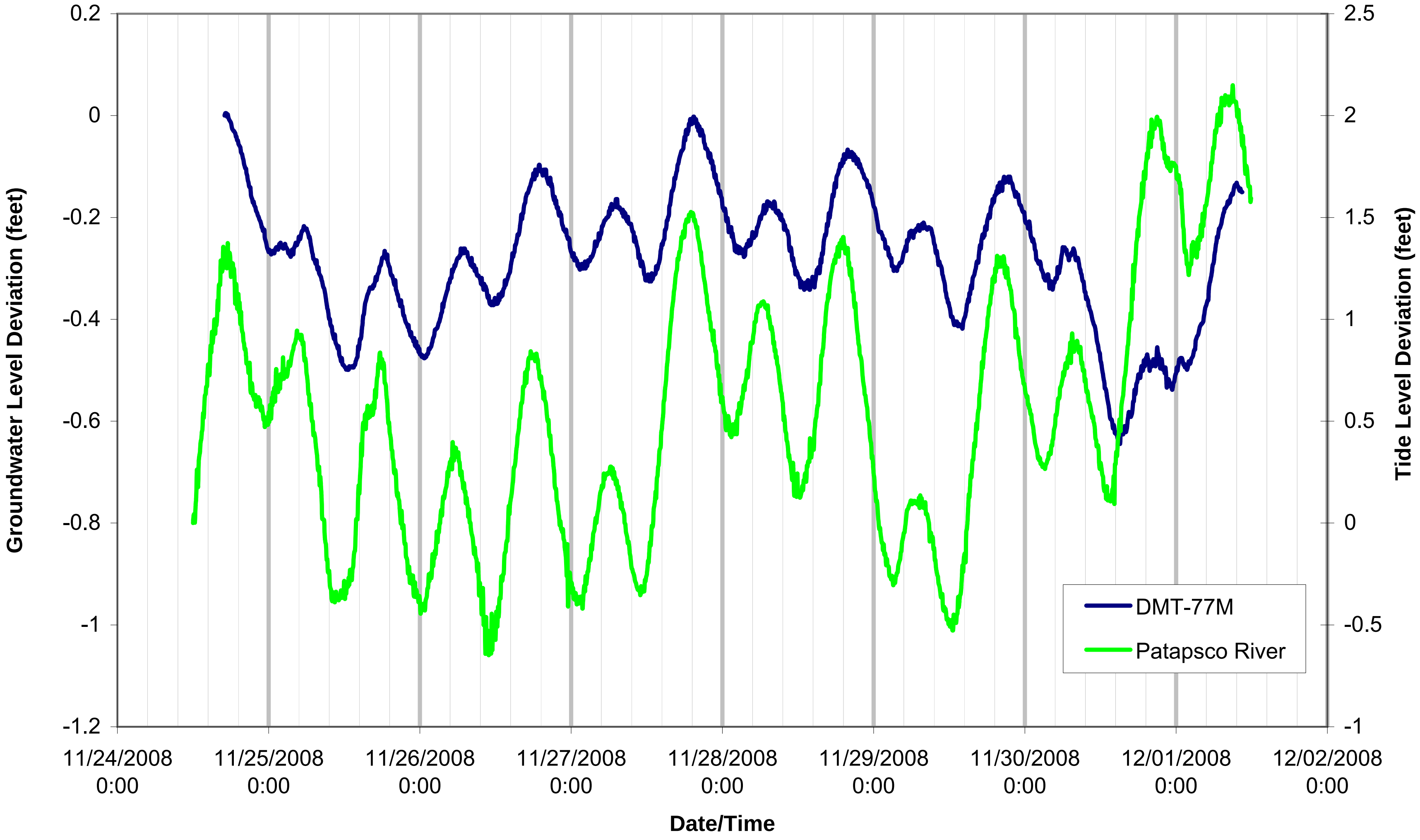
Phase 3 Groundwater Investigation

Dundalk Marine Terminal

Baltimore, Maryland

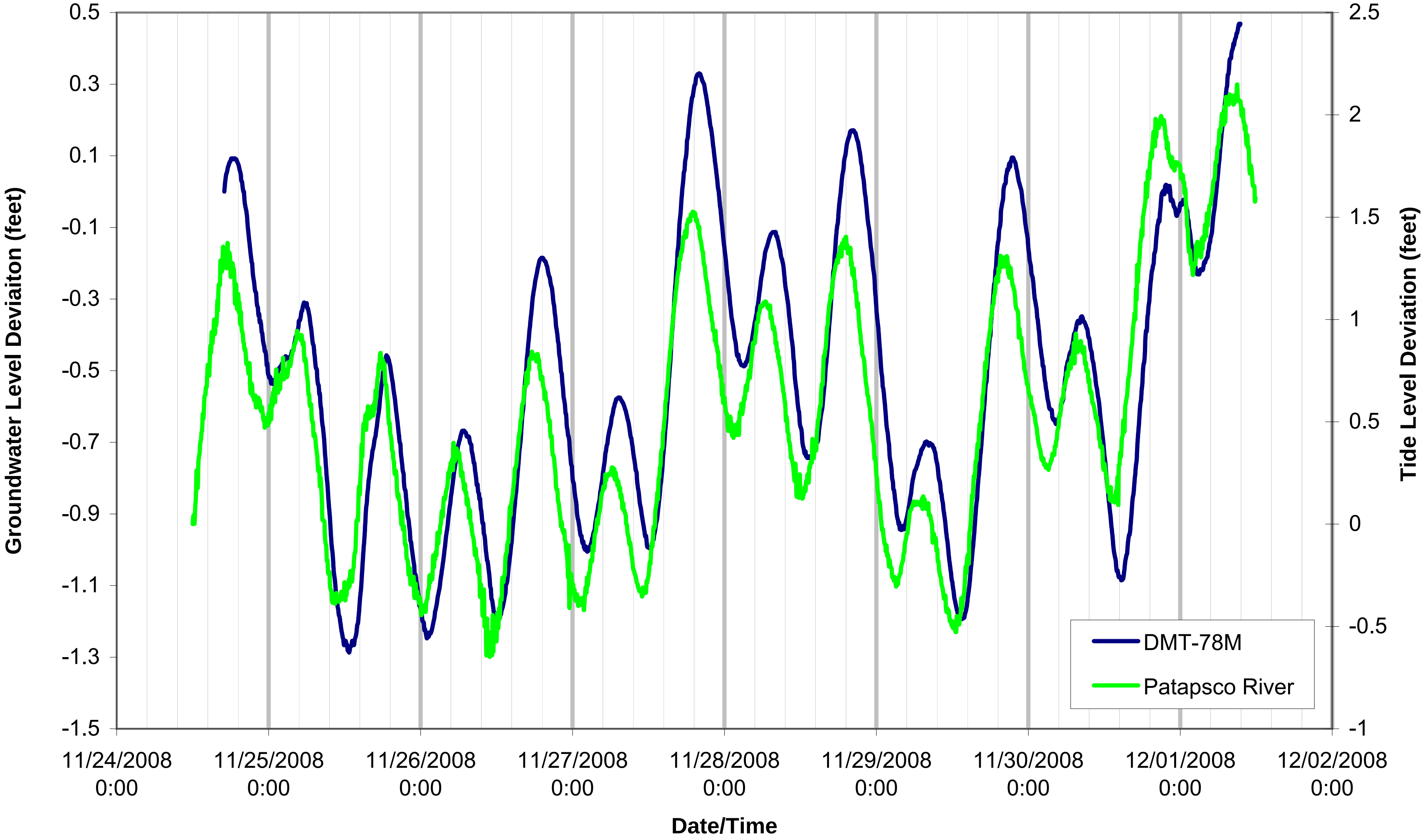
Hydrograph Comparison of DMT-77M and the Patapsco River Tide Gauge

Phase 3 Groundwater Investigation
Dundalk Marine Terminal
Baltimore, Maryland



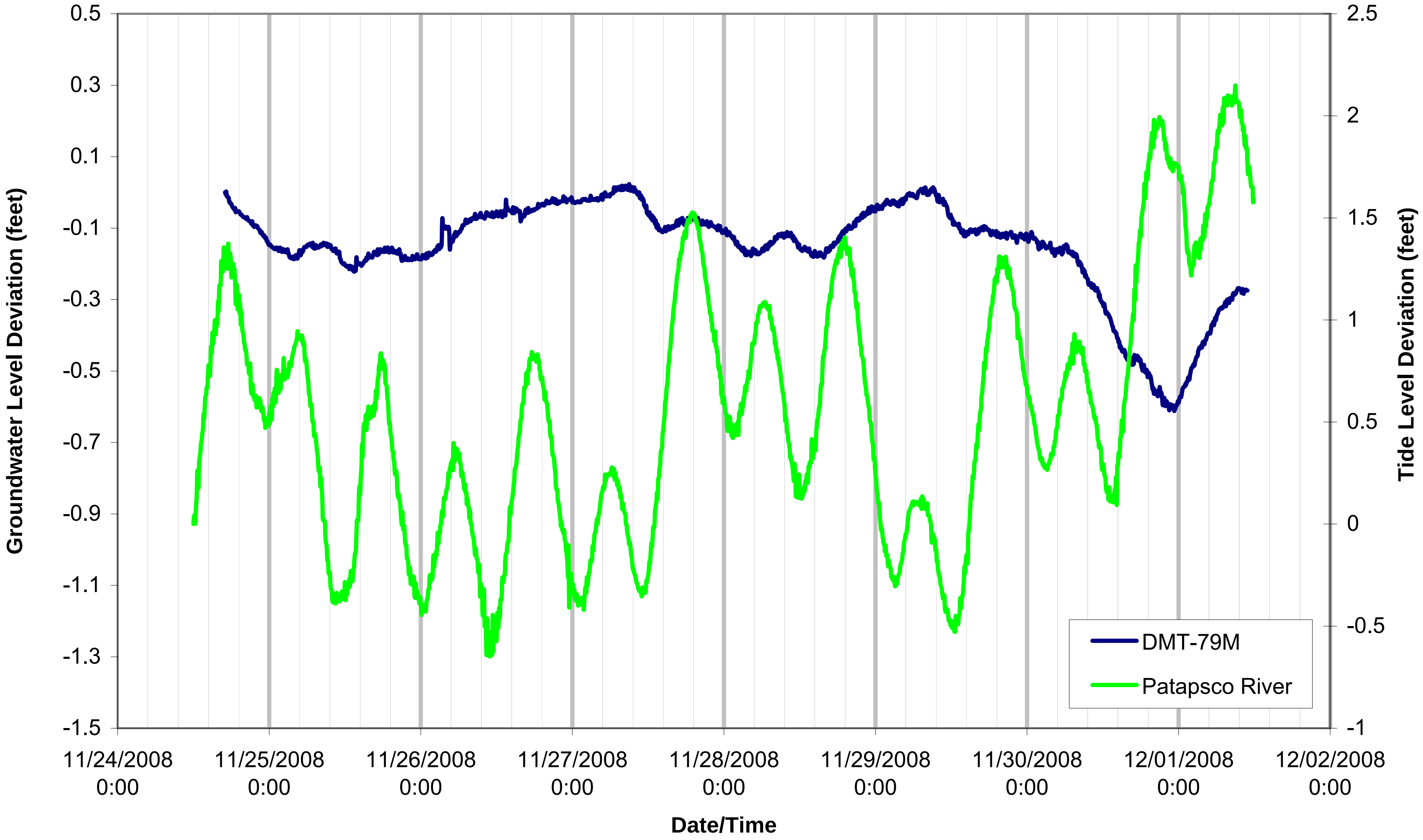
Hydrograph Comparison of DMT-78M and the Patapsco River Tide Gauge

Phase 3 Groundwater Investigation
Dundalk Marine Terminal
Baltimore, Maryland



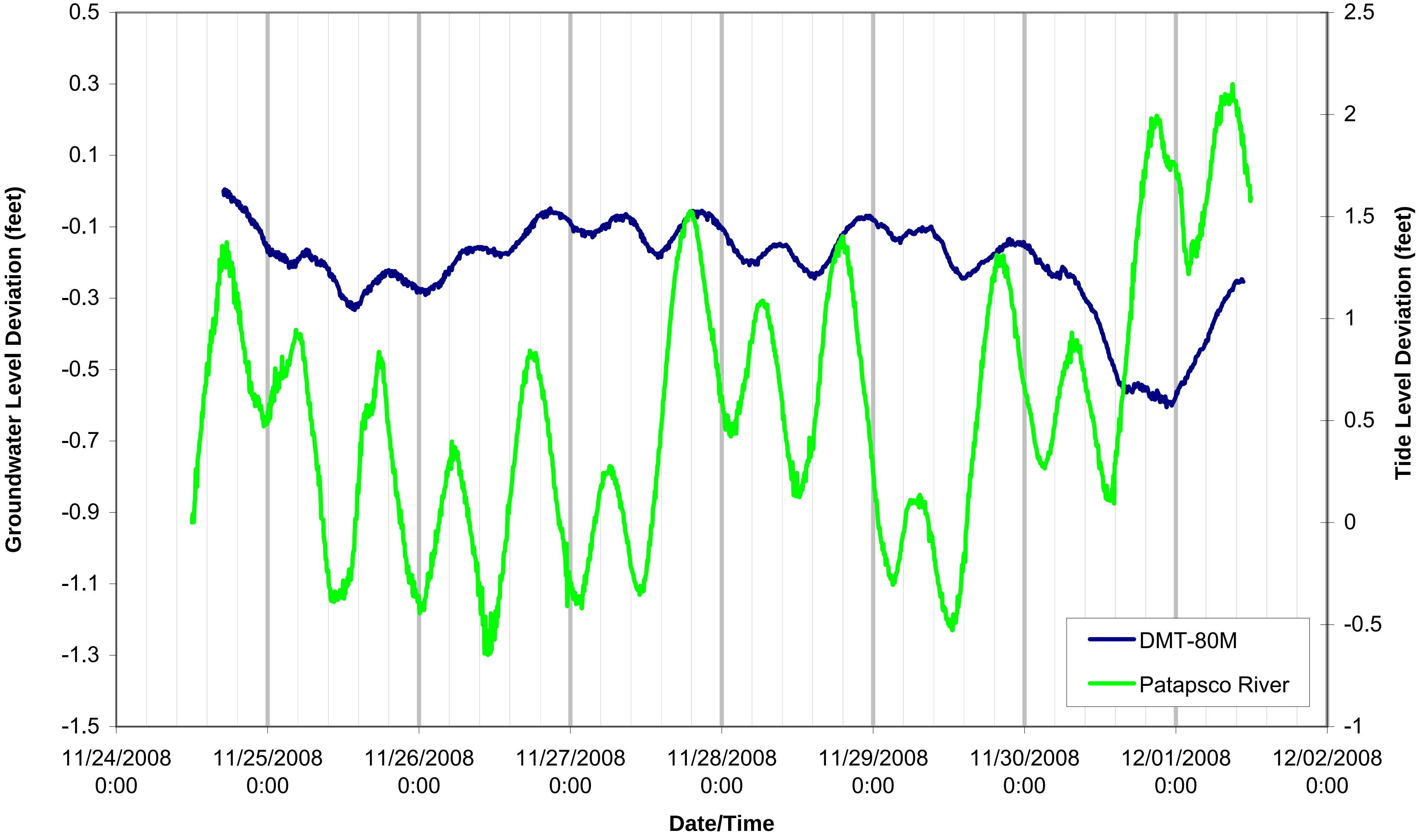
Hydrograph Comparison of DMT-79M and the Patapsco River Tide Gauge

Phase 3 Groundwater Investigation
Dundalk Marine Terminal
Baltimore, Maryland



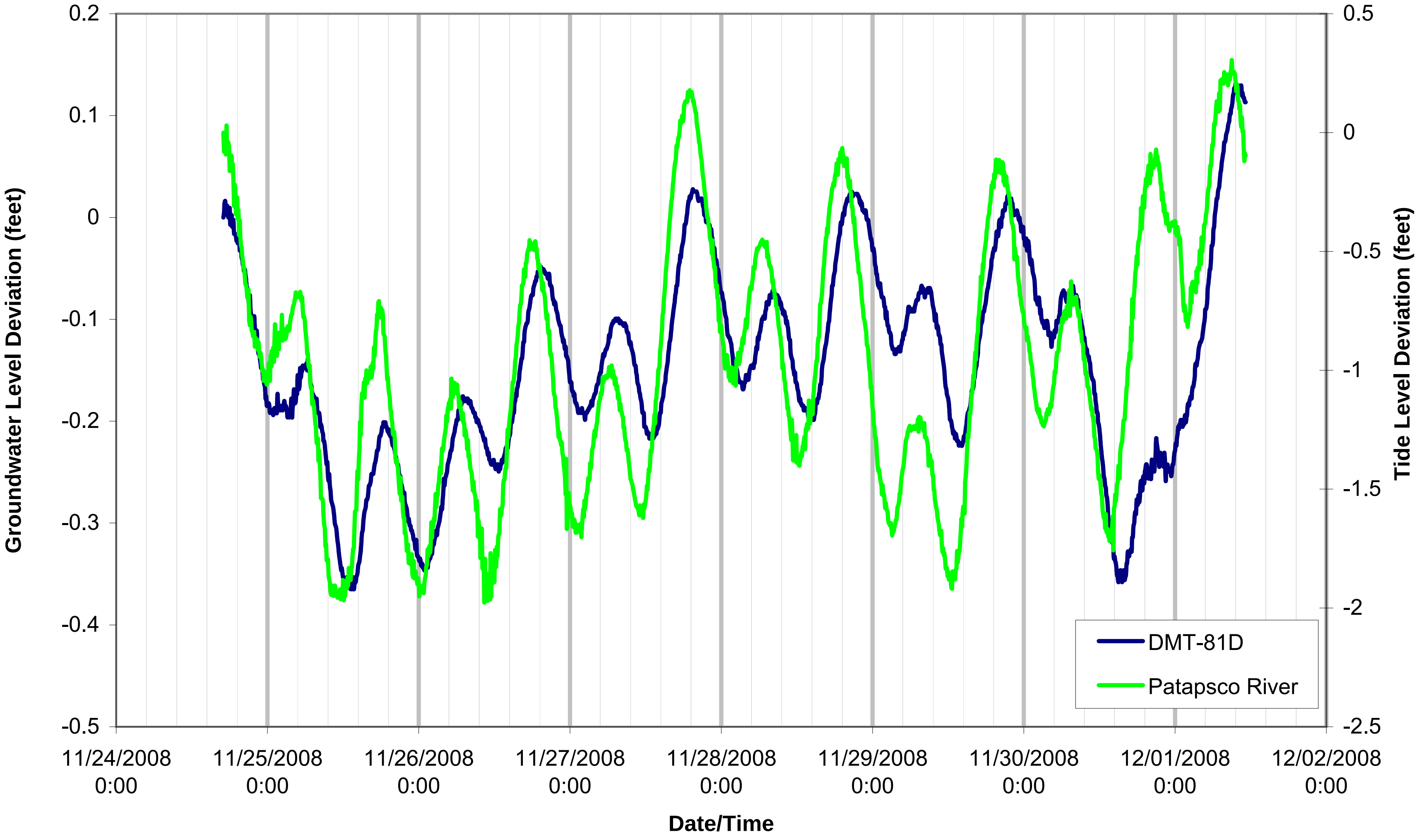
Hydrograph Comparison of DMT-80M and the Patapsco River Tide Gauge

Phase 3 Groundwater Investigation
Dundalk Marine Terminal
Baltimore, Maryland



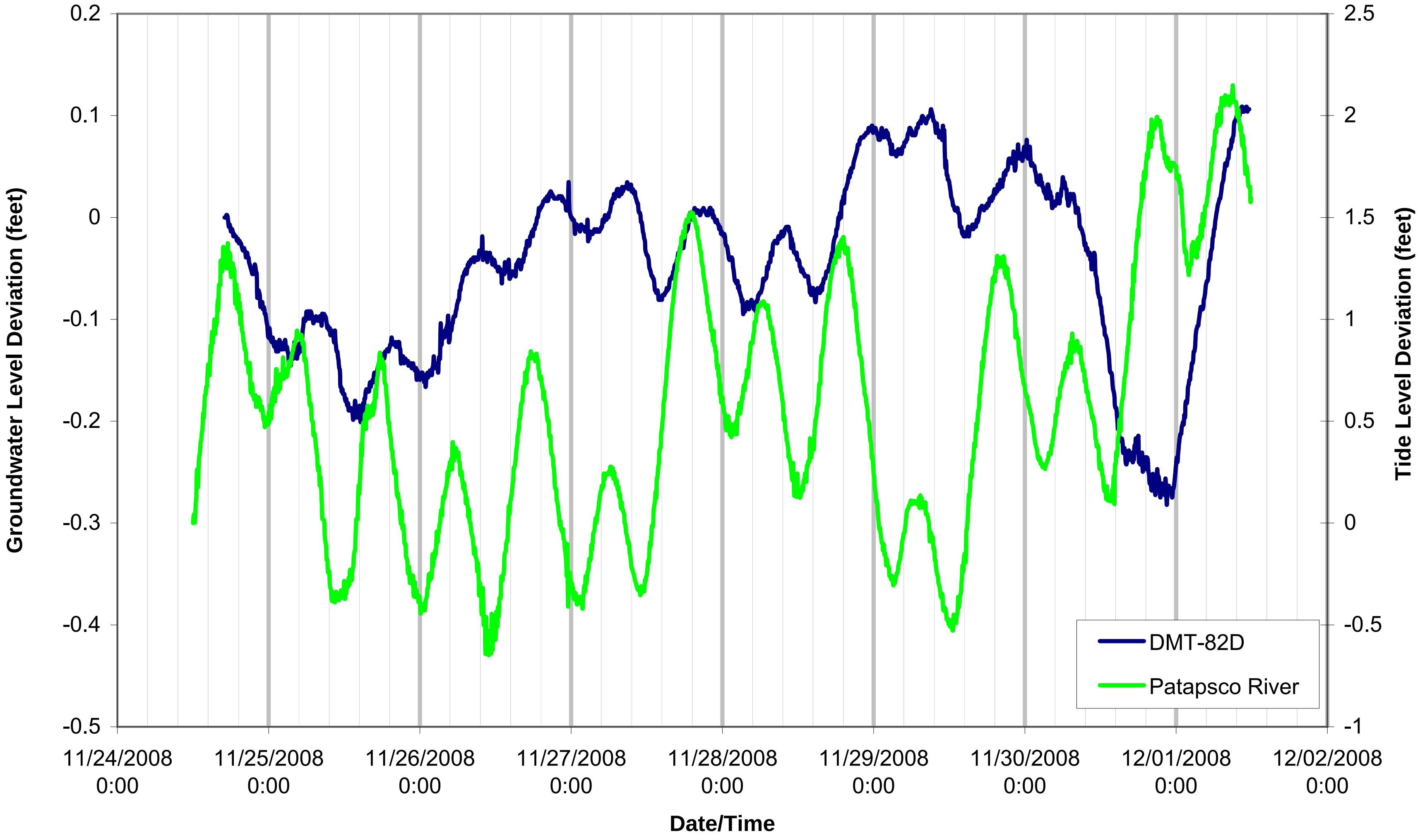
Hydrograph Comparison of DMT-81D and the Patapsco River Tide Gauge

Phase 3 Groundwater Investigation
Dundalk Marine Terminal
Baltimore, Maryland



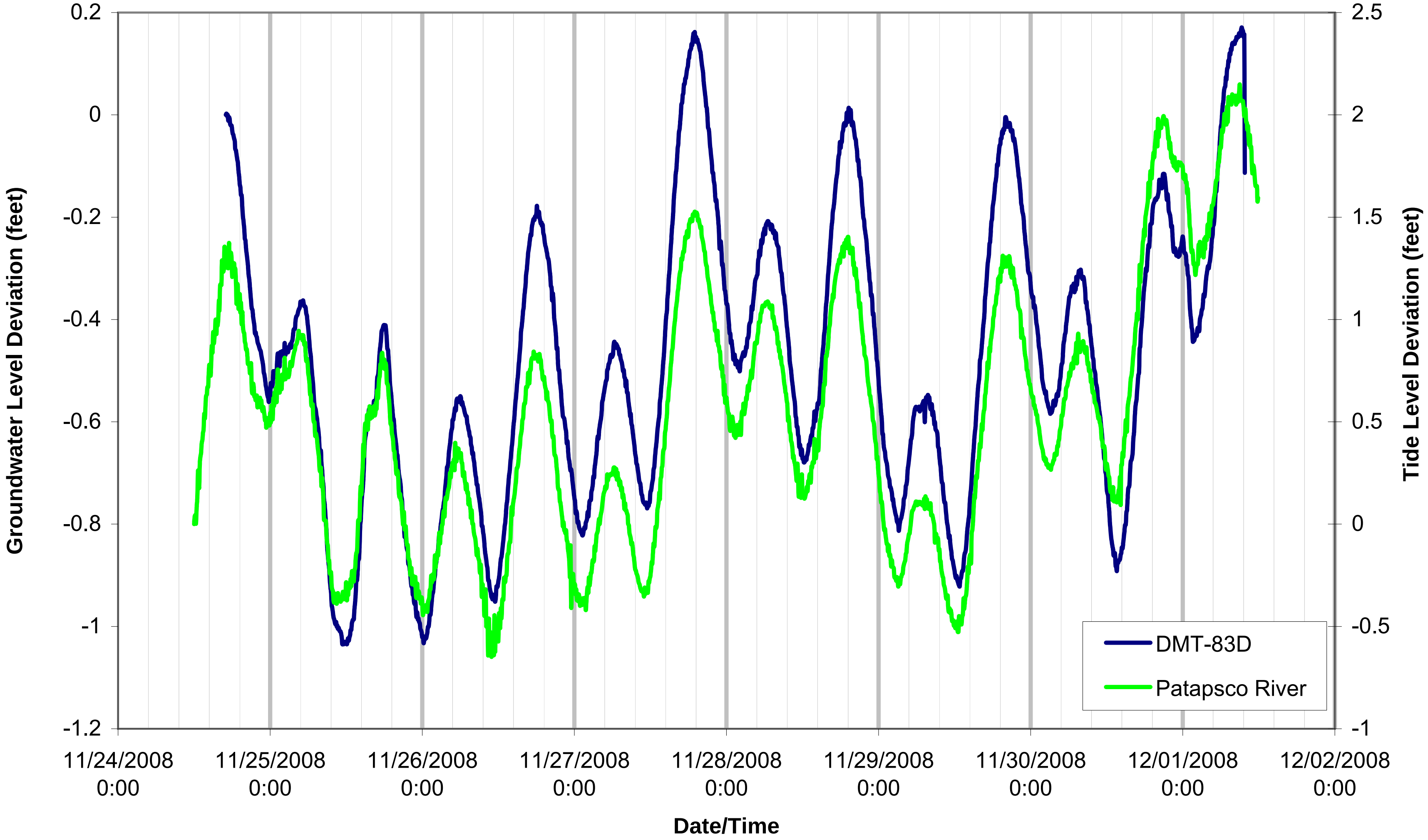
Hydrograph Comparison of DMT-82D and the Patapsco River Tide Gauge

Phase 3 Groundwater Investigation
Dundalk Marine Terminal
Baltimore, Maryland



Hydrograph Comparison of DMT-83D and the Patapsco River Tide Gauge

Phase 3 Groundwater Investigation
Dundalk Marine Terminal
Baltimore, Maryland

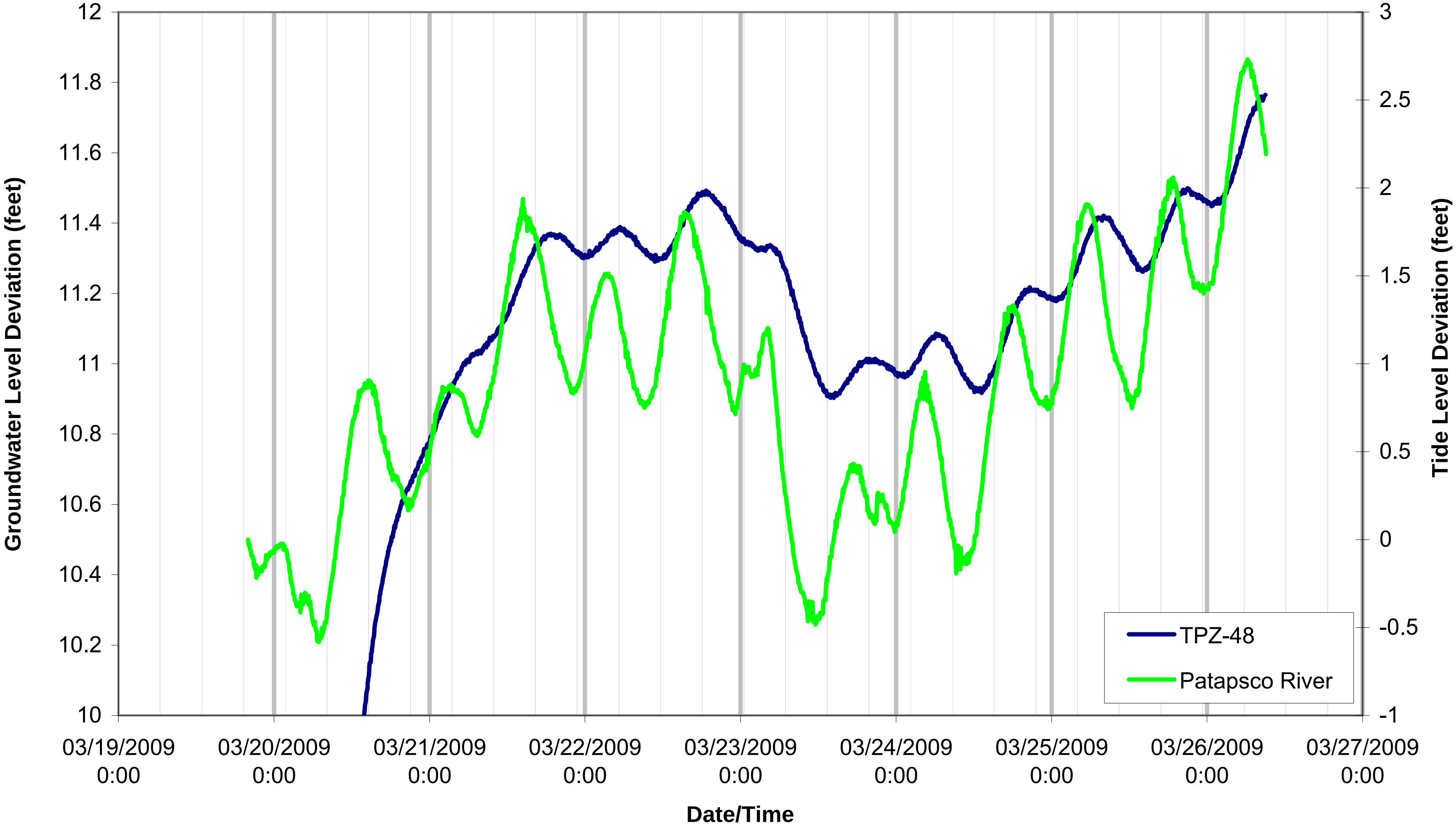


Hydrograph Comparison of TPZ-48 and the Patapsco River Tide Gauge

Phase 3 Groundwater Investigation

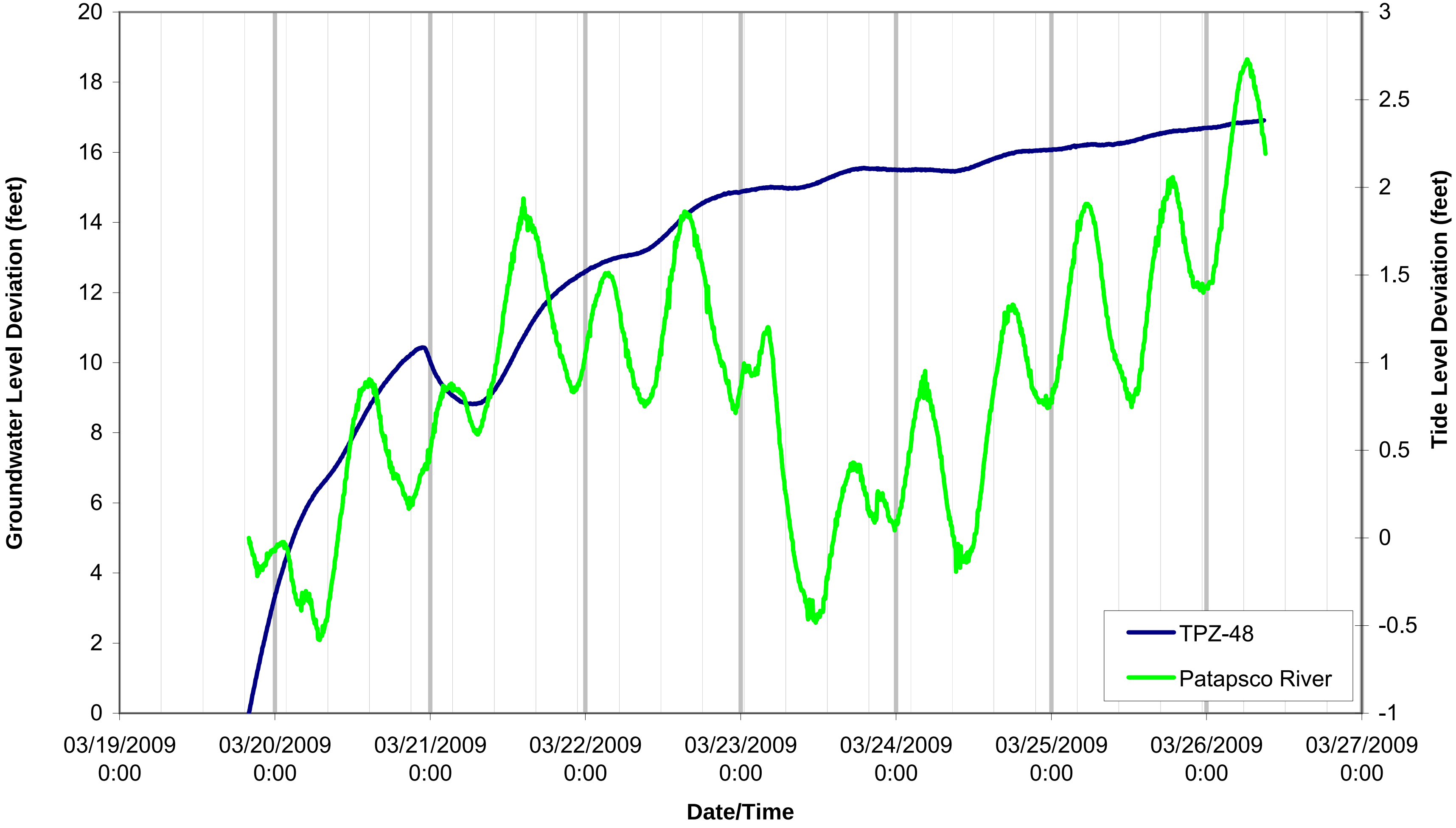
Dundalk Marine Terminal

Baltimore, Maryland



Hydrograph Comparison of TPZ-48 and the Patapsco River Tide Gauge

Phase 3 Groundwater Investigation
Dundalk Marine Terminal
Baltimore, Maryland



Attachment D

Attachment D - Table 1

Groundwater Elevations Measured in the Shallow and Upper Sand Wells

	28-Apr-06		15-May-06		18-Jan-07		23-Apr-07		24-Sep-07		19-Nov-07		24-Nov-08		02-Jun-09	
Well Identification	**Time**	**GWE* (ft BCD)**	**Time**	**GWE* (ft BCD)**	**TIME**	**GWE* (ft BCD)**	**TIME**	**GWE* (ft BCD)**	**Time**	**GWE* (ft BCD)**	**Time**	**GWE* (ft BCD)**	**Time**	**GWE* (ft BCD)**	**Time**	**GWE* (ft BCD)**
DMT-01S	8:14	3.91	8:03	4.11	10:51	3.82	12:28	4.25	11:22	3.93	12:03	3.55	11:57	2.80	11:22	3.43
DMT-02S	8:25	4.61	8:25	4.64	10:47	4.36	12:25	4.80	11:14	4.60	11:55	4.25	11:52	3.15	11:36	3.72
DMT-03S	8:40	4.62	8:37	4.73	10:34	4.63	12:24	5.02	11:16	4.58	11:16	4.21	11:48	3.28	11:58	3.88
DMT-04S	9:43	4.46	8:44	4.53	11:05	4.49	12:39	5.01	N. Meas.	N. Meas.	12:09	3.96	11:41	2.96	12:45	3.76
DMT-05S	9:39	3.94	9:06	4.10	11:08	3.93	11:58	4.30	10:21	3.98	12:22	3.40	10.55	2.71	12:42	3.51
DMT-06S	9:50	2.70	9:27	3.17	11:12	4.01	12:00	4.14	10:17	4.43	12:28	5.25	11:01	3.13	12:39	3.47
DMT-07S	9:57	4.08	9:02	4.24	11:14	4.16	12:02	4.06	10:15	3.36	11:33	3.11	10:58	2.71	12:38	3.41
DMT-08S	10:00	3.95	9:36	4.18	11:54	4.15	12:55	4.10	13:30	3.38	11:31	3.10	N. Meas.	N. Meas.	12:35	3.41
DMT-09S	10:15	3.78	10:05	3.91	11:58	4.08	14:04	4.74	11:38	3.03	11:50	2.87	11:41	4.61	12:32	3.53
DMT-10S	10:37	4.84	11:21	5.02	11:17	4.98	13:18	5.55	14:03	4.68	12:40	4.63	12:25	5.53	16:15	5.32
DMT-11S	12:20	2.69	11:08	3.63	10:58	2.25	13:12	2.60	12:43	2.19	N. Meas.	N. Meas.	13:22	2.00	15:15	2.56
DMT-12S	11:10	3.96	10:54	4.27	11:16	4.22	11:57	4.73	15:25	3.16	13:15	2.86	11:31	3.11	13:55	3.59
DMT-13S	10:11	4.62	9:46	4.64	11:11	5.02	14:26	4.47	14:48	3.21	12:06	3.06	N. Meas.	N. Meas.	N. Meas.	N. Meas.
DMT-14S	12:25	4.17	8:58	4.48	12:58	3.78	13:18	4.22	11:39	3.32	12:17	2.55	10:30	2.34	11:32	3.66
DMT-15S	8:55	3.52	8:56	4.12	11:42	3.29	12:46	4.04	11:52	3.76	12:19	2.99	11:39	2.70	12:10	3.91
DMT-16S	8:34	4.07	8:31	6.61	10:41	5.84	12:43	6.20	11:58	5.05	11:59	5.75	N. Meas.	N. Meas.	N. Meas.	N. Meas.
DMT-17S	7:52	3.50	7:54	3.76	10:47	3.51	12:06	3.85	11:34	3.55	11:43	3.23	11:03	2.73	10:25	3.27
DMT-18S	7:48	3.44	7:46	3.75	10:57	3.44	12:10	3.86	11:45	3.73	11:51	3.44	10:57	2.98	10:00	3.39
DMT-22S	8:04	3.69	7:51	3.89	10:48	3.65	12:19	4.02	11:37	3.70	11:45	3.34	11:10	2.75	10:34	3.26
DMT-23S	8:23	4.57	8:26	4.59	10:47	4.40	13:31	4.78	11:15	4.52	11:56	4.08	N. Meas.	N. Meas.	11:34	3.76
DMT-24S	10:02	3.99	9:31	4.19	11:53	4.34	14:23	4.13	13:33	3.19	11:30	2.87	N. Meas.	N. Meas.	12:36	3.23
DMT-25S	10:44	4.91	11:23	5.00	11:18	4.87	13:21	5.61	14:02	4.60	12:36	4.54	N. Meas.	N. Meas.	16:16	5.27
DMT-29S	N. Inst.	N. Inst.	N. Inst.	N. Inst.	10:54	6.36	12:31	6.62	12:53	5.86	11:47	4.99	11:27	4.11	13:15	4.53
DMT-30S	N. Inst.	N. Inst.	N. Inst.	N. Inst.	10:58	6.97	12:34	7.85	13:02	5.05	12:31	4.88	11:24	4.30	13:08	4.87
DMT-31S	N. Inst.	N. Inst.	N. Inst.	N. Inst.	10:42	3.89	11:59	4.31	11:18	3.99	11:20	3.65	11:31	2.88	11:38	3.51
DMT-32S	N. Inst.	N. Inst.	N. Inst.	N. Inst.	10:29	3.34	11:55	4.06	11:53	3.70	11:10	3.42	11:37	2.93	12:05	3.53
DMT-33S	N. Inst.	N. Inst.	N. Inst.	N. Inst.	10:42	4.17	13:17	3.91	13:41	3.76	12:43	2.74	11:36	3.59	12:20	3.91
DMT-39S	N. Inst.	N. Inst.	N. Inst.	N. Inst.	N. Inst.	N. Inst.	13:08	4.37	11:50	2.97	13:03	3.04	10:35	3.06	11:55	4.60
DMT-42S	N. Inst.	N. Inst.	N. Inst.	N. Inst.	N. Inst.	N. Inst.	N. Inst.	N. Inst.	11:49	3.19	11:36	2.90	12:36	2.56	10:17	2.99
DMT-43S	N. Inst.	N. Inst.	N. Inst.	N. Inst.	N. Inst.	N. Inst.	N. Inst.	N. Inst.	12:34	3.87	13:17	3.72	11:08	3.36	12:24	3.72
DMT-44S	N. Inst.	N. Inst.	N. Inst.	N. Inst.	N. Inst.	N. Inst.	N. Inst.	N. Inst.	14:22	3.01	N. Meas.	N. Meas.	N. Meas.	N. Meas.	12:28	3.41
DMT-45S	N. Inst.	N. Inst.	N. Inst.	N. Inst.	N. Inst.	N. Inst.	N. Inst.	N. Inst.	14:18	2.19	12:52	1.89	12:52	1.99	12:20	2.25
DMT-46S	N. Inst.	N. Inst.	N. Inst.	N. Inst.	N. Inst.	N. Inst.	N. Inst.	N. Inst.	14:22	2.98	12:55	2.96	12:05	14.00	N. Meas.	N. Meas.
DMT-47S	N. Inst.	N. Inst.	N. Inst.	N. Inst.	N. Inst.	N. Inst.	N. Inst.	N. Inst.	11:20	6.12	14:17	14.10	12:05	14.00	9:04	14.08
DMT-57S	N. Inst.	N. Inst.	N. Inst.	N. Inst.	N. Inst.	N. Inst.	N. Inst.	N. Inst.	14:15	1.93	11:10	1.74	12:37	1.86	12:54	2.12
DMT-58S	N. Inst.	N. Inst.	N. Inst.	N. Inst.	N. Inst.	N. Inst.	N. Inst.	N. Inst.	14:20	0.82	11:09	1.69	12:44	1.87	12:59	1.46
DMT-61S	N. Inst.	N. Inst.	N. Inst.	N. Inst.	N. Inst.	N. Inst.	N. Inst.	N. Inst.	N. Inst.	N. Inst.	13:54	6.52	12:20	7.09	13:55	9.13
DMT-62S	N. Inst.	N. Inst.	N. Inst.	N. Inst.	N. Inst.	N. Inst.	N. Inst.	N. Inst.	N. Inst.	N. Inst.	14:10	7.26	12:32	7.72	14:34	11.48
DMT-63S	N. Inst.	N. Inst.	N. Inst.	N. Inst.	N. Inst.	N. Inst.	N. Inst.	N. Inst.	N. Inst.	N. Inst.	N. Inst.	N. Inst.	13:03	2.68	12:07	3.37
EA-02S	12:48	5.73	12:45	5.98	11:09	6.25	12:31	6.38	11:30	5.98	12:11	5.71	11:47	5.72	9:32	6.08
EA-03S	12:44	9.16	12:42	9.11	10:31	9.5	12:40	10.11	11:24	7.43	12:03	9.43	11:57	9.22	9:27	9.97
EA-06S	11:03	3.96	10:48	4.21	11:07	4.40	11:55	5.85	13:04	3.10	12:10	2.96	11:43	3.24	11:56	3.68
EA-08S	12:51	7.29	12:50	7.27	11:13	7.53	12:44	8.43	13:44	7.22	11:48	7.37	N. Meas.	N. Meas.	13:19	8.41
EA-10S	8:53	3.85	8:54	4.17	11:36	3.78	12:15	4.25	10:33	3.73	11:21	3.15	10:48	2.45	12:34	3.29
EA-11S	8:06	3.64	7:59	3.85	10:44	3.37	12:04	3.82	11:27	3.26	11:33	3.06	11:24	2.32	11:13	3.22
EA-12S	8:43	4.72	8:41	4.77	10:31	4.91	12:27	5.37	11:12	5.28	11:14	4.51	11:46	3.46	12:01	4.31
EA-14S	8:36	3.96	8:34	4.26	10:38	3.84	12:19	4.45	10:42	4.05	11:07	3.80	11:27	2.94	11:54	3.60
EA-15S	8:27	5.88	8:20	5.91	10:44	6.02	12:23	6.28	10:46	5.53	11:12	4.72	N. Meas.	N. Meas.	11:29	4.23
EA-16S	8:18	4.28	8:13	4.35	12:04	4.12	12:21	4.53	N. Meas.	N. Meas.	11:25	3.82	12:00	3.02	11:25	3.54
EA-17S	11:08	3.67	10:53	4.02	11:13	4.04	12:04	4.41	12:04	3.36	12:07	3.06	11:34	3.21	13:56	3.98
EA-18S	13:55	3.97	14:01	4.14	11:22	4.08	12:54	4.16	N. Meas.	N. Meas.	N. Meas.	N. Meas.	N. Meas.	N. Meas.	N. Meas.	N. Meas.
EA-22S	13:19	6.72	13:25	6.80	N. Meas.	N. Meas.	N. Meas.	N. Meas.	N. Meas.	N. Meas.	N. Meas.	N. Meas.	N. Meas.	N. Meas.	N. Meas.	N. Meas.
EAC-01S	12:36	8.58	11:40	8.79	10:48	8.84	12:11	10.21	12:05	6.77	13:24	8.01	11:03	7.98	11:17	9.78
EAC-03S	9:29	4.76	9:38	4.93	10:56	5.29	12:44	4.14	11:52	2.84	11:08	2.88	10:54	1.57	11:40	2.53

Attachment D - Table 1
Groundwater Elevations Measured in the Shallow and Upper Sand Wells

	28-Apr-06		15-May-06		18-Jan-07		23-Apr-07		24-Sep-07		19-Nov-07		24-Nov-08		02-Jun-09	
Well Identification	**Time**	**GWE* (ft BCD)**	**Time**	**GWE* (ft BCD)**	**TIME**	**GWE* (ft BCD)**	**TIME**	**GWE* (ft BCD)**	**Time**	**GWE* (ft BCD)**	**Time**	**GWE* (ft BCD)**	**Time**	**GWE* (ft BCD)**	**Time**	**GWE* (ft BCD)**
EAC-04S	8:00	3.51	7:45	3.86	10:58	3.61	12:16	3.99	N. Meas.	N. Meas.	N. Meas.	N. Meas.	N. Meas.	N. Meas.	N. Meas.	N. Meas.
EAS-01A	10:48	3.33	10:36	4.14	11:24	3.92	13:53	4.65	11:44	2.73	12:20	2.34	N. Meas.	N. Meas.	12:02	3.37
EAS-01B	10:49	3.27	10:37	4.11	11:26	3.76	13:56	4.63	11:46	2.68	12:25	2.40	11:47	2.93	12:03	3.36
EAS-02A	10:31	0.40	10:31	4.32	11:35	2.26	13:39	3.06	11:35	2.53	12:29	2.16	N. Meas.	N. Meas.	N. Meas.	N. Meas.
EAS-02B	10:35	5.06	10:32	4.25	11:36	4.43	13:43	5.57	11:37	2.78	12:30	5.07	N. Meas.	N. Meas.	12:10	3.68
MW-23	13:39	5.56	13:11	7.00	11:35	5.20	13:07	5.68	N. Meas.	N. Meas.	N. Meas.	N. Meas.	N. Meas.	N. Meas.	N. Meas.	N. Meas.
P-03	8:58	4.04	10:13	4.13	10:50	4.43	14:20	4.27	N. Meas.	N. Meas.	11:36	2.89	N. Meas.	N. Meas.	N. Meas.	N. Meas.
P-04	8:48	3.60	8:49	3.92	10:37	3.92	12:50	4.57	12:24	4.12	12:11	3.51	12:08	3.12	12:57	3.75
P-05	10:20	4.60	10:17	4.98	11:44	4.79	13:22	5.19	11:20	4.74	11:37	4.59	12:00	4.84	12:55	5.16
P-06	10:24	3.91	10:18	4.17	11:41	4.21	13:26	3.03	11:17	3.78	11:39	3.75	11:56	3.40	12:19	3.72
P-07	10:25	4.13	10:23	4.64	11:39	4.34	13:31	4.45	11:30	3.85	11:42	3.82	11:54	3.89	12:16	4.20
P-08	10:27	2.99	10:25	3.56	11:37	3.55	13:36	3.77	11:33	3.05	13:35	2.80	11:50	2.70	12:13	3.06
P-09	10:53	3.66	10:41	3.98	11:23	3.78	13:49	4.45	11:40	3.21	12:18	2.41	N. Meas.	N. Meas.	12:08	3.30
P-10	10:55	4.09	10:44	4.39	11:20	4.94	12:12	5.87	11:55	3.07	12:48	3.62	N. Meas.	N. Meas.	11:53	3.62
P-11	12:54	5.33	11:33	5.24	11:35	5.50	13:25	6.07	13:55	4.84	12:45	5.62	12:23	6.44	10:49	5.82
TPZ-04	N. Inst.	N. Inst.	N. Inst.	N. Inst.	11:00	4.82	12:20	4.92	13:15	3.08	12:10	3.04	11:18	3.13	11:47	3.51
TPZ-05	N. Inst.	N. Inst.	N. Inst.	N. Inst.	11:03	4.88	12:24	5.05	13:51	4.09	12:12	2.92	N. Meas.	N. Meas.	11:48	3.54
TPZ-06	N. Inst.	N. Inst.	N. Inst.	N. Inst.	11:06	4.95	12:35	5.18	13:52	4.18	12:14	3.33	N. Meas.	N. Meas.	11:49	3.63
TPZ-07	N. Inst.	N. Inst.	N. Inst.	N. Inst.	11:09	5.19	12:15	5.46	13:53	3.08	11:57	3.12	N. Meas.	N. Meas.	11:51	3.65
TPZ-08	N. Inst.	N. Inst.	N. Inst.	N. Inst.	11:23	4.81	13:22	3.92	11:44	2.57	11:13	2.56	10:58	2.07	13:51	2.16
TPZ-09	N. Inst.	N. Inst.	N. Inst.	N. Inst.	11:20	4.83	13:23	3.93	11:45	2.55	11:15	2.41	N. Meas.	N. Meas.	13:50	2.28
TPZ-10	N. Inst.	N. Inst.	N. Inst.	N. Inst.	11:24	4.83	13:24	4.02	11:46	2.61	11:17	2.59	N. Meas.	N. Meas.	13:48	2.39
TPZ-11	N. Inst.	N. Inst.	N. Inst.	N. Inst.	11:27	4.81	13:25	4.20	12:18	2.90	11:19	2.70	11:04	2.55	13:45	2.78
TPZ-12	N. Inst.	N. Inst.	N. Inst.	N. Inst.	12:07	5.04	13:24	4.14	11:33	3.24	12:30	3.08	8:35	2.56	11:35	2.70
TPZ-13	N. Inst.	N. Inst.	N. Inst.	N. Inst.	12:04	5.07	13:22	4.19	11:34	3.22	12:26	3.53	N. Meas.	N. Meas.	N. Meas.	N. Meas.
TPZ-14	N. Inst.	N. Inst.	N. Inst.	N. Inst.	12:02	4.34	13:20	4.20	11:35	3.45	12:24	0.80	N. Meas.	N. Meas.	11:33	3.28
TPZ-15	N. Inst.	N. Inst.	N. Inst.	N. Inst.	11:56	4.35	13:16	4.51	11:36	3.97	12:21	3.94	10:34	2.70	11:30	3.83
TPZ-16	N. Inst.	N. Inst.	N. Inst.	N. Inst.	11:46	4.01	13:14	4.34	N. Meas.	N. Meas.	N. Meas.	N. Meas.	N. Meas.	N. Meas.	12:21	3.69
TPZ-17	N. Inst.	N. Inst.	N. Inst.	N. Inst.	11:47	4.01	13:12	4.36	12:10	4.31	13:32	4.43	N. Meas.	N. Meas.	12:19	3.64
TPZ-18	N. Inst.	N. Inst.	N. Inst.	N. Inst.	11:50	3.42	13:10	3.63	N. Meas.	N. Meas.	N. Meas.	N. Meas.	N. Meas.	N. Meas.	N. Meas.	N. Meas.
TPZ-19	N. Inst.	N. Inst.	N. Inst.	N. Inst.	11:45	3.93	13:08	4.31	12:07	4.14	13:23	3.49	10:44	2.87	12:14	3.67
TPZ-20	N. Inst.	N. Inst.	N. Inst.	N. Inst.	11:33	3.77	12:51	-1.49*	10:38	3.97	11:30	3.22	10:50	2.70	12:25	3.38
TPZ-21	N. Inst.	N. Inst.	N. Inst.	N. Inst.	11:31	3.76	12:49	4.21	10:37	3.94	11:28	3.26	N. Meas.	N. Meas.	12:28	3.39
TPZ-22	N. Inst.	N. Inst.	N. Inst.	N. Inst.	11:35	3.72	12:53	4.08	10:36	3.85	11:24	3.21	N. Meas.	N. Meas.	12:30	3.34
TPZ-23	N. Inst.	N. Inst.	N. Inst.	N. Inst.	11:39	3.92	N. Meas.	N. Meas.	13:06	4.76	11:19	3.96	10:52	2.66	N. Meas.	N. Meas.
TPZ-27A	N. Inst.	N. Inst.	N. Inst.	N. Inst.	N. Inst.	N. Inst.	12:19	7.92	12:24	5.93	13:48	6.33	11:22	6.32	10:15	7.42
TPZ-30A	N. Inst.	N. Inst.	N. Inst.	N. Inst.	N. Inst.	N. Inst.	13:03	8.54	11:56	4.90	13:08	4.71	14:46	4.96	11:39	8.36
TPZ-34	N. Inst.	N. Inst.	N. Inst.	N. Inst.	N. Inst.	N. Inst.	N. Inst.	N. Inst.	12:27	1.52	12:39	5.27	11:20	4.47	13:05	4.98
TPZ-35	N. Inst.	N. Inst.	N. Inst.	N. Inst.	N. Inst.	N. Inst.	N. Inst.	N. Inst.	13:39	0.68	13:06	3.77	11:11	3.24	12:51	3.83
TPZ-37	N. Inst.	N. Inst.	N. Inst.	N. Inst.	N. Inst.	N. Inst.	N. Inst.	N. Inst.	13:33	3.58	13:25	3.53	11:31	3.51	12:52	3.78
TPZ-44	N. Inst.	N. Inst.	N. Inst.	N. Inst.	N. Inst.	N. Inst.	N. Inst.	N. Inst.	11:40	3.86	12:20	4.11	10:53	3.60	15:38	4.21
TPZ-45	N. Inst.	N. Inst.	N. Inst.	N. Inst.	N. Inst.	N. Inst.	N. Inst.	N. Inst.	12:10	4.25	14:06	5.04	11:28	4.81	10:30	5.44
TPZ-46	N. Inst.	N. Inst.	N. Inst.	N. Inst.	N. Inst.	N. Inst.	N. Inst.	N. Inst.	13:09	6.39	12:34	4.66			15:49	5.49
TPZ-47	N. Inst.	N. Inst.	N. Inst.	N. Inst.	N. Inst.	N. Inst.	N. Inst.	N. Inst.	12:20	5.51	N. Meas.	N. Meas.	12:05	4.01	12:54	4.61
TPZ-A	N. Inst.	N. Inst.	N. Inst.	N. Inst.	N. Meas.	N. Meas.	12:08	3.85	13:56	3.10	12:52	3.05	11:38	3.47	12:25	3.54
TPZ-B	N. Inst.	N. Inst.	N. Inst.	N. Inst.	11:23	5.08	13:20	5.68	14:10	4.87	N. Meas.	N. Meas.	N. Meas.	N. Meas.	16:19	5.47

Attachment D - Table 1
Groundwater Elevations Measured in the Shallow and Upper Sand Wells

	28-Apr-06		15-May-06		18-Jan-07		23-Apr-07		24-Sep-07		19-Nov-07		24-Nov-08		02-Jun-09	
Well Identification	**Time**	**GWE* (ft BCD)**	**Time**	**GWE* (ft BCD)**	**TIME**	**GWE* (ft BCD)**	**TIME**	**GWE* (ft BCD)**	**Time**	**GWE* (ft BCD)**	**Time**	**GWE* (ft BCD)**	**Time**	**GWE* (ft BCD)**	**Time**	**GWE* (ft BCD)**
Wells Completed in Non-Aquifer Sediments																
DMT-48S	N. Inst.	N. Inst.	N. Inst.	N. Inst.	N. Inst.	N. Inst.	N. Inst.	N. Inst.	N. Inst.	N. Inst.	13:46	6.13	N. Meas.	N. Meas.	N. Meas.	N. Meas.
DMT-55S	N. Inst.	N. Inst.	N. Inst.	N. Inst.	N. Inst.	N. Inst.	N. Inst.	N. Inst.	N. Inst.	N. Inst.	13:50	10.16	N. Meas.	N. Meas.	N. Meas.	N. Meas.
DMT-56S	N. Inst.	N. Inst.	N. Inst.	N. Inst.	N. Inst.	N. Inst.	N. Inst.	N. Inst.	14:16	-1.78	11:14	-0.13	N. Meas.	N. Meas.	N. Meas.	N. Meas.
DMT-59S	N. Inst.	N. Inst.	N. Inst.	N. Inst.	N. Inst.	N. Inst.	N. Inst.	N. Inst.	N. Inst.	N. Inst.	13:41	6.02	12:15	6.08	13:34	6.60
EA-07S	12:07	7.27	10:56	7.62	10:54	7.57	12:01	8.14	12:50	7.00	11:57	7.64	N. Meas.	N. Meas.	N. Meas.	N. Meas.
P-01	12:41	11.16	12:38	11.14	10:38	11.3	12:53	11.82	11:33	10.79	11:55	11.27	N. Meas.	N. Meas.	N. Meas.	N. Meas.
P-12	12:13	11.80	11:03	11.77	10:38	11.3	12:53	11.82	11:45	11.63	12:26	11.58	N. Meas.	N. Meas.	N. Meas.	N. Meas.
TPZ-27B	N. Inst.	N. Inst.	N. Inst.	N. Inst.	N. Inst.	N. Inst.	12:20	11.88	12:25	9.65	13:49	10.78	11:23	9.87	10:18	7.30
TPZ-28	N. Inst.	N. Inst.	N. Inst.	N. Inst.	N. Inst.	N. Inst.	N. Meas.	N. Meas.	12:10	10.50	13:19	1.75	11:06	9.45	10:18	11.00
TPZ-29	N. Inst.	N. Inst.	N. Inst.	N. Inst.	N. Inst.	N. Inst.	13:00	11.63	12:17	9.69	13:14	11.16	10:58	9.48	11:32	11.62
TPZ-30B	N. Inst.	N. Inst.	N. Inst.	N. Inst.	N. Inst.	N. Inst.	13:04	16.33	11:58	14.56	13:09	15.54	10:45	15.04	11:41	16.09
TPZ-39	N. Inst.	N. Inst.	N. Inst.	N. Inst.	N. Inst.	N. Inst.	N. Inst.	N. Inst.	N. Meas.	N. Meas.	11:26	4.62	13:17	4.96	N. Meas.	N. Meas.
TPZ-40	N. Inst.	N. Inst.	N. Inst.	N. Inst.	N. Inst.	N. Inst.	N. Inst.	N. Inst.	14:32	6.49	11:21	6.24	13:20	6.63	15:13	5.80
TPZ-41	N. Inst.	N. Inst.	N. Inst.	N. Inst.	N. Inst.	N. Inst.	N. Inst.	N. Inst.	14:31	6.58	N. Meas.	N. Meas.	13:26	6.83	15:19	7.23
TPZ-42	N. Inst.	N. Inst.	N. Inst.	N. Inst.	N. Inst.	N. Inst.	N. Inst.	N. Inst.	14:50	7.17	N. Meas.	N. Meas.	N. Meas.	N. Meas.	N. Meas.	N. Meas.
TPZ-43	N. Inst.	N. Inst.	N. Inst.	N. Inst.	N. Inst.	N. Inst.	N. Inst.	N. Inst.	14:42	7.19	11:43	7.81	13:15	8.19	15:23	9.18
Wells in the Former Airport Area																
DMT-19S	13:31	3.33	13:42	3.61	11:56	3.21	13:20	3.55	13:29	3.64	12:04	3.36	N. Meas.	N. Meas.	9:38	3.80
DMT-20S	13:03	3.70	13:50	3.98	11:12	3.94	12:38	3.12	12:35	4.37	12:16	3.70	N. Meas.	N. Meas.	9:25	3.63
DMT-21S	13:02	3.85	13:52	3.04	N. Meas.	N. Meas.	12:36	3.75	12:36	4.03	12:18	3.05	N. Meas.	N. Meas.	9:28	4.19
DMT-26S	N. Inst.	N. Inst.	N. Inst.	N. Inst.	11:48	4.35	13:12	4.71	12:58	3.67	12:41	3.82	N. Meas.	N. Meas.	9:20	4.85
DMT-27S	N. Inst.	N. Inst.	N. Inst.	N. Inst.	11:03	2.67	12:16	3.10	12:18	2.88	11:58	2.94	N. Meas.	N. Meas.	10:02	2.88
DMT-28S	N. Inst.	N. Inst.	N. Inst.	N. Inst.	11:15	3.06	12:45	3.23	12:43	3.25	12:31	3.13	N. Meas.	N. Meas.	13:14	3.37
DMT-40S	N. Inst.	N. Inst.	N. Inst.	N. Inst.	N. Inst.	N. Inst.	N. Inst.	N. Inst.	12:00	2.27	11:53	1.80	10:45	1.63	10:07	2.33
DMT-41S	N. Inst.	N. Inst.	N. Inst.	N. Inst.	N. Inst.	N. Inst.	N. Inst.	N. Inst.	12:10	2.79	12:07	2.48	N. Meas.	N. Meas.	9:42	3.04
EA-21S	13:46	5.31	13:04	5.41	11:18	4.65	12:50	5.17	N. Meas.	N. Meas.	N. Meas.	N. Meas.	N. Meas.	N. Meas.	N. Meas.	N. Meas.
EAC-02S	12:59	4.49	12:55	4.72	10:35	4.50	12:48	4.89	13:58	4.84	11:22	4.60	12:12	4.66	13:08	5.05
TPZ-24	N. Inst.	N. Inst.	N. Inst.	N. Inst.	N. Meas.	N. Meas.	N. Meas.	N. Meas.	12:38	4.19	12:17	3.93	N. Meas.	N. Meas.	9:30	4.14
TPZ-33	N. Inst.	N. Inst.	N. Inst.	N. Inst.	N. Inst.	N. Inst.	N. Inst.	N. Inst.	12:30	3.29	12:09	2.91	11:18	2.95	13:11	3.10
TPZ-36	N. Inst.	N. Inst.	N. Inst.	N. Inst.	N. Inst.	N. Inst.	N. Inst.	N. Inst.	13:35	3.76	13:11	4.16	11:14	4.29	13:18	4.85
TPZ-38	N. Inst.	N. Inst.	N. Inst.	N. Inst.	N. Inst.	N. Inst.	N. Inst.	N. Inst.	13:29	4.09	11:12	4.11	12:06	4.19	12:57	4.56
Upper Sand Wells																
DMT-49US	N. Inst.	N. Inst.	N. Inst.	N. Inst.	N. Inst.	N. Inst.	N. Inst.	N. Inst.	11:24	3.17	11:30	3.19	11:58	2.66	11:20	2.83
DMT-50US	N. Inst.	N. Inst.	N. Inst.	N. Inst.	N. Inst.	N. Inst.	N. Inst.	N. Inst.	11:29	3.28	11:31	3.48	11:17	2.38	11:10	3.00
DMT-51US	N. Inst.	N. Inst.	N. Inst.	N. Inst.	N. Inst.	N. Inst.	N. Inst.	N. Inst.	12:32	3.50	13:32	2.73	11:06	3.21	12:23	3.52
DMT-52US	N. Inst.	N. Inst.	N. Inst.	N. Inst.	N. Inst.	N. Inst.	N. Inst.	N. Inst.	13:18	3.13	N. Meas.	N. Meas.	N. Meas.	N. Meas.	12:27	3.51
DMT-53US	N. Inst.	N. Inst.	N. Inst.	N. Inst.	N. Inst.	N. Inst.	N. Inst.	N. Inst.	11:34	5.63	N. Meas.	N. Meas.	11:49	5.52	9:38	5.82
DMT-54US	N. Inst.	N. Inst.	N. Inst.	N. Inst.	N. Inst.	N. Inst.	N. Inst.	N. Inst.	11:25	12.88	14:19	5.90	12:02	5.86	9:08	6.29
DMT-64US	N. Inst.	N. Inst.	N. Inst.	N. Inst.	N. Inst.	N. Inst.	N. Inst.	N. Inst.	N. Inst.	N. Inst.	N. Inst.	N. Inst.	12:38	2.36	10:14	2.44
DMT-65US	N. Inst.	N. Inst.	N. Inst.	N. Inst.	N. Inst.	N. Inst.	N. Inst.	N. Inst.	N. Inst.	N. Inst.	N. Inst.	N. Inst.	11:04	2.46	10:28	2.50
DMT-67US	N. Inst.	N. Inst.	N. Inst.	N. Inst.	N. Inst.	N. Inst.	N. Inst.	N. Inst.	N. Inst.	N. Inst.	N. Inst.	N. Inst.	11:34	2.99	11:49	3.34
DMT-70US	N. Inst.	N. Inst.	N. Inst.	N. Inst.	N. Inst.	N. Inst.	N. Inst.	N. Inst.	N. Inst.	N. Inst.	N. Inst.	N. Inst.	10:32	3.09	11:37	2.55
DMT-71US	N. Inst.	N. Inst.	N. Inst.	N. Inst.	N. Inst.	N. Inst.	N. Inst.	N. Inst.	N. Inst.	N. Inst.	N. Inst.	N. Inst.	11:11	3.14	11:44	3.31
DMT-72US	N. Inst.	N. Inst.	N. Inst.	N. Inst.	N. Inst.	N. Inst.	N. Inst.	N. Inst.	N. Inst.	N. Inst.	N. Inst.	N. Inst.	11:24	3.06	13:53	3.25
DMT-73US	N. Inst.	N. Inst.	N. Inst.	N. Inst.	N. Inst.	N. Inst.	N. Inst.	N. Inst.	N. Inst.	N. Inst.	N. Inst.	N. Inst.	10:33	2.32	11:47	4.74
DMT-74US	N. Inst.	N. Inst.	N. Inst.	N. Inst.	N. Inst.	N. Inst.	N. Inst.	N. Inst.	N. Inst.	N. Inst.	N. Inst.	N. Inst.	11:17	2.98	10:12	3.64
DMT-75US	N. Inst.	N. Inst.	N. Inst.	N. Inst.	N. Inst.	N. Inst.	N. Inst.	N. Inst.	N. Inst.	N. Inst.	N. Inst.	N. Inst.	11:31	3.71	10:02	4.31

* Groundwater elevation. Tidal corrections applied to wells DMT-45S, DMT-46S, DMT-56S, DMT-57S, and DMT-58S for adjustment to mean tide.

"N. Meas." means the water level was not measured.

"N. Inst." means the well was not yet installed.

Attachment D - Table 2

Groundwater Elevations Measured in the M-Series Wells

	28-Apr-06		15-May-06		18-Jan-07		23-Apr-07		24-Sep-07		19-Nov-07		24-Nov-08		02-Jun-09	
Well Identification	**Time**	**GWE* (ft BCD)**	**Time**	**GWE* (ft BCD)**	**TIME**	**GWE* (ft BCD)**	**TIME**	**GWE* (ft BCD)**	**Time**	**GWE* (ft BCD)**	**Time**	**GWE* (ft BCD)**	**Time**	**GWE* (ft BCD)**	**Time**	**GWE* (ft BCD)**
DMT-01M	9:10	1.80	9:51	1.89	12:49	2.11	13:12	2.04	14:23	1.75	N. Meas.	N. Meas.			12:26	2.24
DMT-02M	13:13	1.69	13:19	2.83	13:40	2.17	12:41	1.63	12:53	1.94	12:35	2.39	10:37	3.71	9:05	3.75
DMT-34M	N. Inst.	N. Inst.	N. Inst.	N. Inst.	10:56	1.90	12:13	2.00	11:47	2.17	11:48	2.19	10:58	2.24	11:40	2.09
DMT-35M	N. Inst.	N. Inst.	N. Inst.	N. Inst.	10:35	4.79	12:35	5.10	11:23	4.87	12:05	4.93	11:55	4.80	9:20	5.20
DMT-36M	N. Inst.	N. Inst.	N. Inst.	N. Inst.	11:02	2.35	12:07	2.60	14:16	2.20	12:30	2.23	N. Meas.	N. Meas.	15:54	2.68
DMT-37M	N. Inst.	N. Inst.	N. Inst.	N. Inst.	10:30	1.84	11:56	1.93	10:24	1.63	12:14	1.82	10:59	1.89	12:41	2.06
DMT-38M	N. Inst.	N. Inst.	N. Inst.	N. Inst.	10:43	3.22	12:24	3.71	12:20	2.93	13:55	2.97	11:27	2.95	10:35	3.66
DMT-60M	N. Inst.	N. Inst.	N. Inst.	N. Inst.	N. Inst.	N. Inst.	N. Inst.	N. Inst.	N. Inst.	N. Inst.	13:40	5.48	12:13	5.50	13:30	6.08
DMT-77M	N. Inst.	N. Inst.	N. Inst.	N. Inst.	N. Inst.	N. Inst.	N. Inst.	N. Inst.	N. Inst.	N. Inst.	N. Inst.	N. Inst.	10:34	2.19	11:53	3.00
DMT-78M	N. Inst.	N. Inst.	N. Inst.	N. Inst.	N. Inst.	N. Inst.	N. Inst.	N. Inst.	N. Inst.	N. Inst.	N. Inst.	N. Inst.	10:41	2.42	9:45	2.29
DMT-80M	N. Inst.	N. Inst.	N. Inst.	N. Inst.	N. Inst.	N. Inst.	N. Inst.	N. Inst.	N. Inst.	N. Inst.	N. Inst.	N. Inst.	11:00	2.60	11:21	3.29
EA-02M	12:49	3.71	12:46	3.97	11:08	3.42	12:29	4.41	11:32	3.73	12:14	3.72	11:43	3.70	9:34	4.19
EA-06M	11:02	1.91	10:47	2.16	11:06	2.23	11:54	2.43	13:03	2.10	12:12	2.26	11:41	2.18	11:55	2.66
EA-07M	12:08	1.72	10:57	2.01	10:53	2.04	12:00	2.17	12:51	1.83	11:55	1.97	12:48	2.01	12:35	2.39
EA-08M	12:52	4.02	12:49	4.18	11:12	4.14	12:43	4.49	13:43	4.13	11:50	4.09	N. Meas.	N. Meas.	13:18	4.53
EA-09M	9:04	1.78	9:50	2.08	10:48	2.06	13:03	2.21	N. Meas.	N. Meas.	N. Meas.	N. Meas.	N. Meas.	N. Meas.	N. Meas.	N. Meas.
EA-10M	8:52	1.76	8:53	1.78	10:30	1.69	12:13	1.74	10:32	1.64	11:22	1.79	10:47	1.93	N. Meas.	N. Meas.
EA-11M	8:10	1.23	7:58	1.30	10:45	1.39	12:02	1.38	11:26	1.14	11:35	1.39	11:21	1.38	11:15	1.70
EA-13M	8:47	1.50	14:25	1.69	10:36	1.71	12:31	1.77	12:22	1.40	12:12	1.58	12:08	1.69	12:59	1.85
EA-14M	8:36	1.29	8:32	1.45	10:37	1.52	12:18	1.56	N. Meas.	N. Meas.	11.08	1.43	11:27	1.44	11:52	1.64
EA-15M	8:28	1.20	8:18	1.21	10:43	1.44	12:22	1.48	10:45	1.15	11:11	0.80	N. Meas.	N. Meas.	11:31	1.63
EAC-01M	12:37	2.78	11:39	2.87	10:46	3.01	12:14	3.39	12:06	2.58	13:22	1.60	N. Meas.	N. Meas.	N. Meas.	N. Meas.
EAC-02M	13:00	3.85	12:57	3.84	10:33	3.94	12:49	4.18	14:00	4.11	11:21	4.07	12:11	4.05	13:07	4.39
EAC-03M	9:27	1.60	9:37	1.60	10:54	1.66	12:48	1.85	N. Meas.	N. Meas.	N. Meas.	N. Meas.	N. Meas.	N. Meas.	11:41	1.84

Groundwater Elevations Measured in in the D-Series Wells

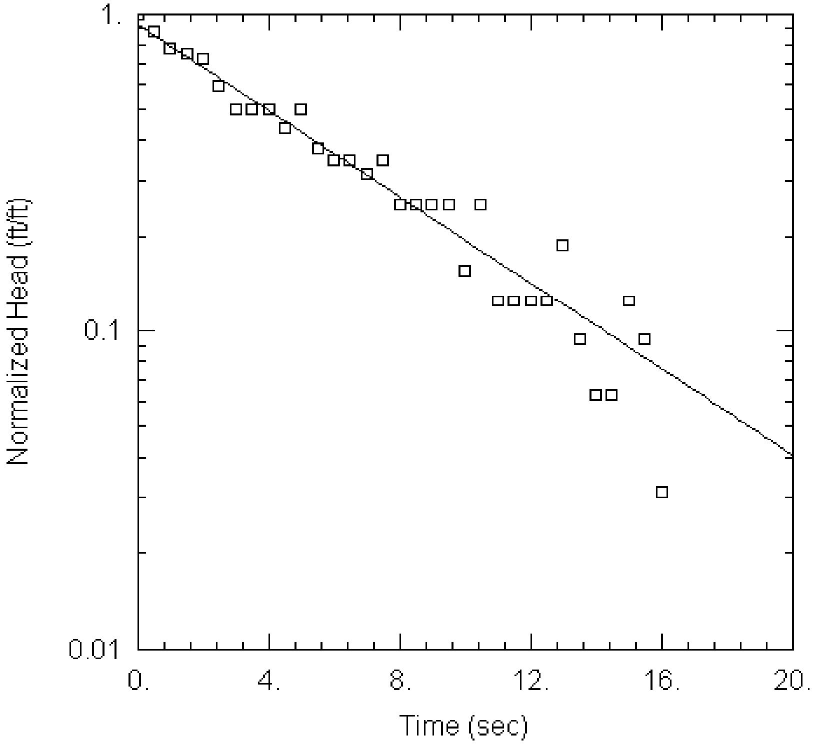
DMT-81D	N. Inst.	N. Inst.	N. Inst.	N. Inst.	N. Inst.	N. Inst.	N. Inst.	N. Inst.	N. Inst.	N. Inst.	N. Inst.	N. Inst.	12:30	-4.36	14:39	-3.66
DMT-82D	N. Inst.	N. Inst.	N. Inst.	N. Inst.	N. Inst.	N. Inst.	N. Inst.	N. Inst.	N. Inst.	N. Inst.	N. Inst.	N. Inst.	12:07	-3.49	13:37	-2.51
DMT-83D	N. Inst.	N. Inst.	N. Inst.	N. Inst.	N. Inst.	N. Inst.	N. Inst.	N. Inst.	N. Inst.	N. Inst.	N. Inst.	N. Inst.	11:18	-1.51	11:06	-1.06

* Groundwater elevation adjusted to mean tide by applying well-specific tidal correction.

"N. Meas." means the water level was not measured.

"N. Inst." means the well was not yet installed.

Attachment E



DMT-1S TEST 1

Data Set: C:\Dundalk\SlugTests-2\DMT-1S-R1.aqt
Date: 10/04/06 Time: 09:20:12

PROJECT INFORMATION

Company: CH2M HILL
Client: Honeywell
Location: DMT
Test Well: DMT-1S
Test Date: 1/13/2006

SOLUTION

Aquifer Model: Unconfined
Solution Method: Bouwer-Rice

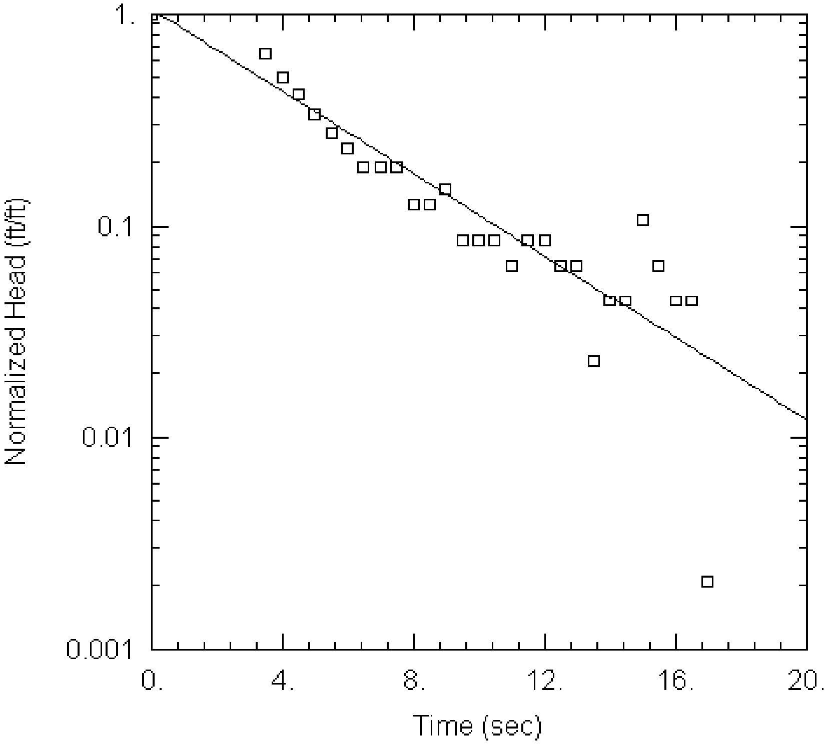
K = 39.82 ft/day
y0 = 0.2958 ft

AQUIFER DATA

Saturated Thickness: 18. ft
Anisotropy Ratio (Kz/Kr): 1.

WELL DATA (DMT-1S)

Initial Displacement: 0.32 ft
Total Well Penetration Depth: 18. ft
Casing Radius: 0.0861 ft
Static Water Column Height: 18. ft
Screen Length: 20. ft
Wellbore Radius: 0.333 ft
Gravel Pack Porosity: 0.3



DMT-1S TEST 2

Data Set: C:\Dundalk\SlugTests-2\DMT-1S-R2.aqt
Date: 10/04/06 Time: 09:29:35

PROJECT INFORMATION

Company: CH2M HILL
Client: Honeywell
Location: DMT
Test Well: DMT-1S
Test Date: 1/13/2006

SOLUTION

Aquifer Model: Unconfined
Solution Method: Bouwer-Rice

K = 57.02 ft/day
y0 = 0.5057 ft

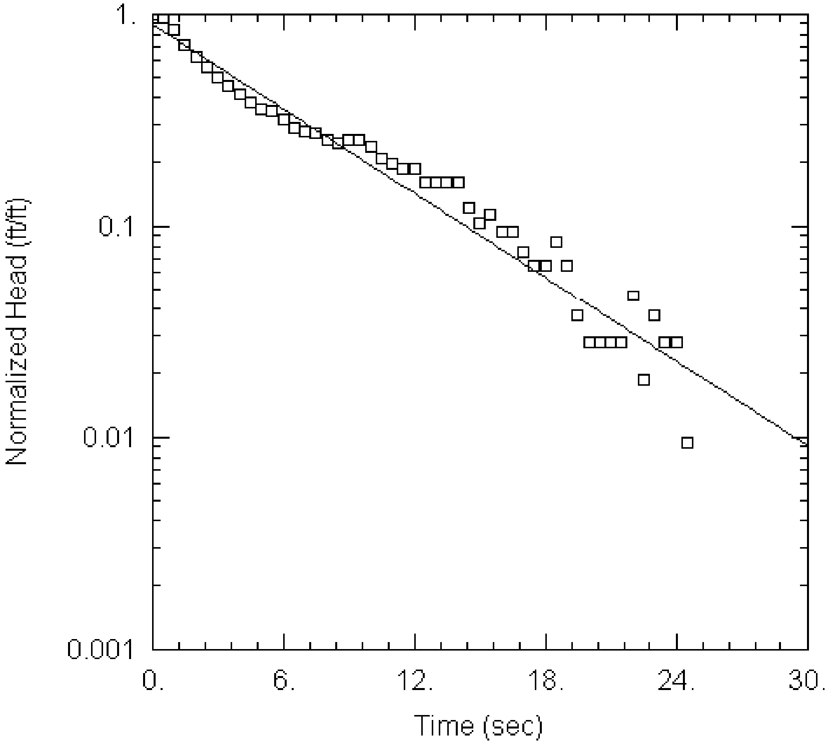
AQUIFER DATA

Saturated Thickness: 18. ft
Anisotropy Ratio (Kz/Kr): 1.

WELL DATA (DMT-1S)

Initial Displacement: 0.481 ft
Total Well Penetration Depth: 18. ft
Casing Radius: 0.0861 ft

Static Water Column Height: 18. ft
Screen Length: 20. ft
Wellbore Radius: 0.333 ft
Gravel Pack Porosity: 0.3



DMT-2S TEST 1

Data Set: C:\Dundalk\SlugTests-2\DMT-2S-R1.aqt
Date: 10/04/06 Time: 09:30:47

PROJECT INFORMATION

Company: CH2M HILL
Client: Honeywell
Location: DMT
Test Well: DMT-2S
Test Date: 1/13/2006

SOLUTION

Aquifer Model: Unconfined
Solution Method: Bouwer-Rice

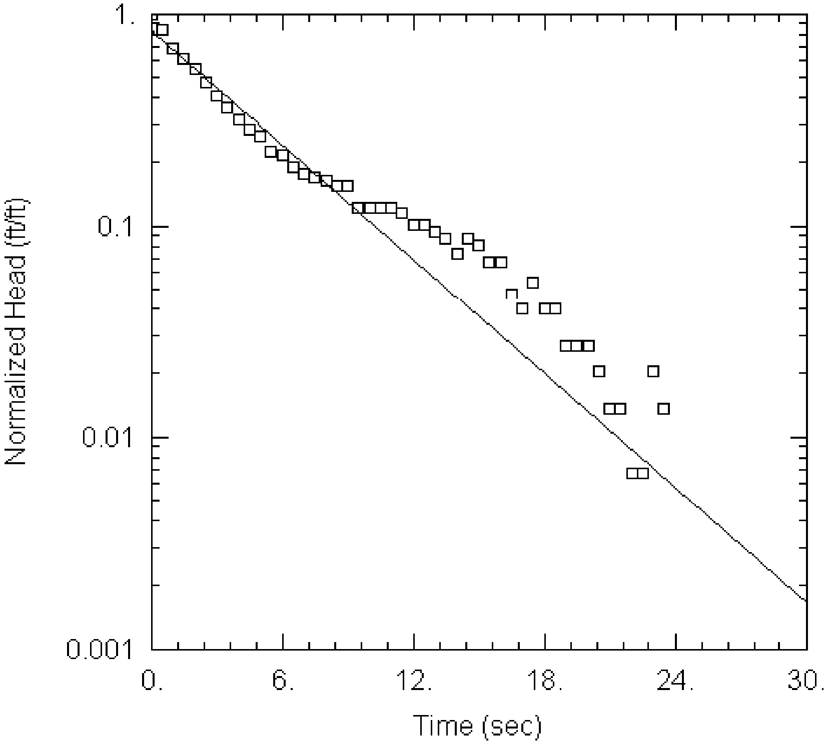
K = 39.45 ft/day
y0 = 0.9502 ft

AQUIFER DATA

Saturated Thickness: 19. ft
Anisotropy Ratio (Kz/Kr): 1.

WELL DATA (DMT-2S)

Initial Displacement: 1.07 ft
Total Well Penetration Depth: 19. ft
Casing Radius: 0.0861 ft
Static Water Column Height: 19. ft
Screen Length: 20. ft
Wellbore Radius: 0.333 ft
Gravel Pack Porosity: 0.3



DMT-2S TEST 2

Data Set: C:\Dundalk\SlugTests-2\DMT-2S-R2.aqt
Date: 10/04/06 Time: 09:31:54

PROJECT INFORMATION

Company: CH2M HILL
Client: Honeywell
Location: DMT
Test Well: DMT-2S
Test Date: 1/13/2005

SOLUTION

Aquifer Model: Unconfined
Solution Method: Bouwer-Rice

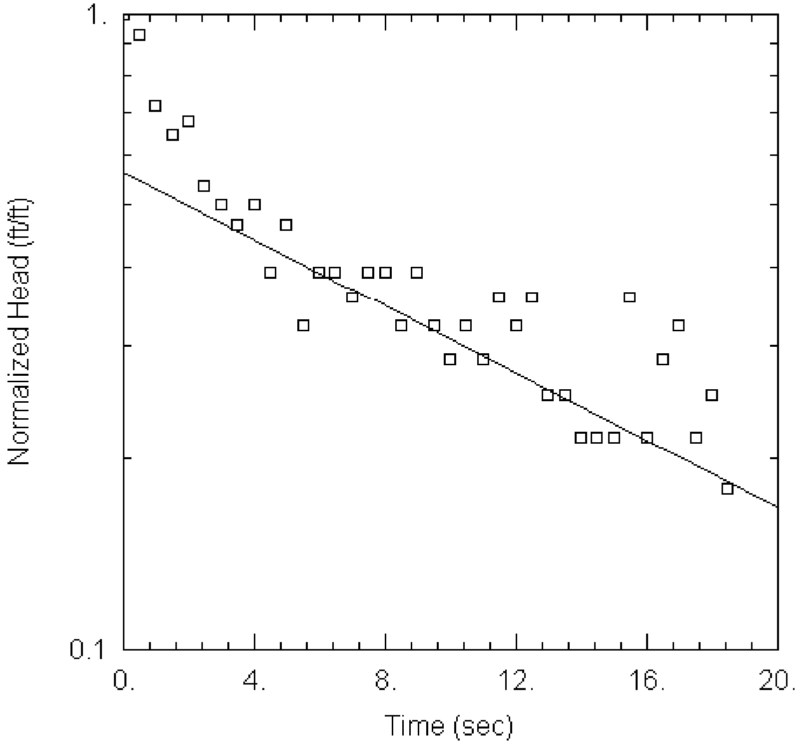
K = 53.5 ft/day
y0 = 1.231 ft

AQUIFER DATA

Saturated Thickness: 19. ft
Anisotropy Ratio (Kz/Kr): 1.

WELL DATA (DMT-2S)

Initial Displacement: 1.48 ft
Total Well Penetration Depth: 19. ft
Casing Radius: 0.0861 ft
Static Water Column Height: 19. ft
Screen Length: 20. ft
Wellbore Radius: 0.333 ft
Gravel Pack Porosity: 0.3



DMT-4S TEST 1

Data Set: C:\Dundalk\SlugTests-2\DMT-4S-R1.aqt
Date: 10/04/06 Time: 09:58:03

PROJECT INFORMATION

Company: CH2M HILL
Client: Honeywell
Location: DMT
Test Well: DMT-4S
Test Date: 1/13/2006

SOLUTION

Aquifer Model: Unconfined
Solution Method: Bouwer-Rice

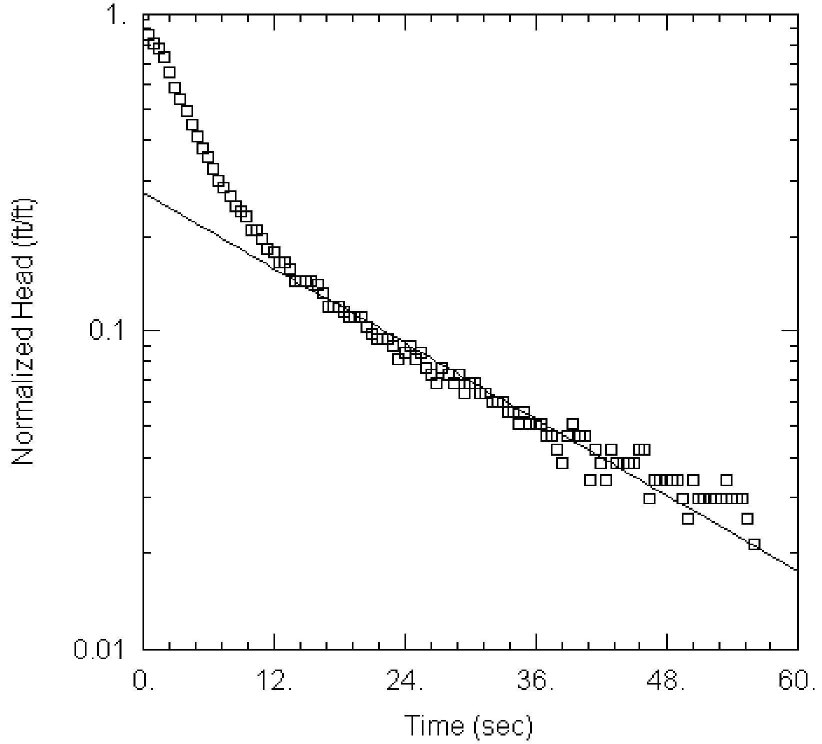
K = 19.86 ft/day
y0 = 0.1575 ft

AQUIFER DATA

Saturated Thickness: 16. ft
Anisotropy Ratio (Kz/Kr): 1.

WELL DATA (DMT-4S)

Initial Displacement: 0.28 ft
Total Well Penetration Depth: 16. ft
Casing Radius: 0.0861 ft
Static Water Column Height: 16. ft
Screen Length: 15. ft
Wellbore Radius: 0.333 ft
Gravel Pack Porosity: 0.3



DMT-5S TEST 1

Data Set: C:\Dundalk\SlugTests-2\DMT-5S-R1.aqt
Date: 10/04/06 Time: 10:02:21

PROJECT INFORMATION

Company: CH2M HILL
Client: Honeywell
Location: DMT
Test Well: DMT-5S
Test Date: 1/13/2006

SOLUTION

Aquifer Model: Unconfined
Solution Method: Bouwer-Rice

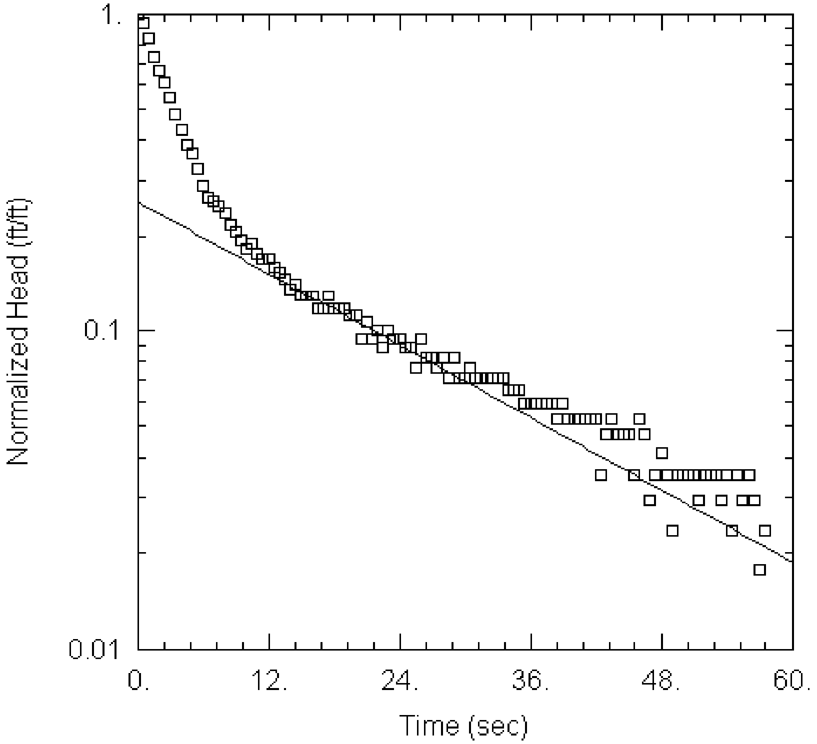
K = 20.37 ft/day
y0 = 0.6446 ft

AQUIFER DATA

Saturated Thickness: 8. ft
Anisotropy Ratio (Kz/Kr): 1.

WELL DATA (DMT-5S)

Initial Displacement: 2.35 ft
Total Well Penetration Depth: 8. ft
Casing Radius: 0.0861 ft
Static Water Column Height: 8. ft
Screen Length: 9. ft
Wellbore Radius: 0.333 ft
Gravel Pack Porosity: 0.3



DMT-5S TEST 2

Data Set: C:\Dundalk\SlugTests-2\DMT-5S-R2.aqt
Date: 10/04/06 Time: 10:05:06

PROJECT INFORMATION

Company: CH2M HILL
Client: Honeywell
Location: DMT
Test Well: DMT-5S
Test Date: 1/13/2006

SOLUTION

Aquifer Model: Unconfined
Solution Method: Bouwer-Rice

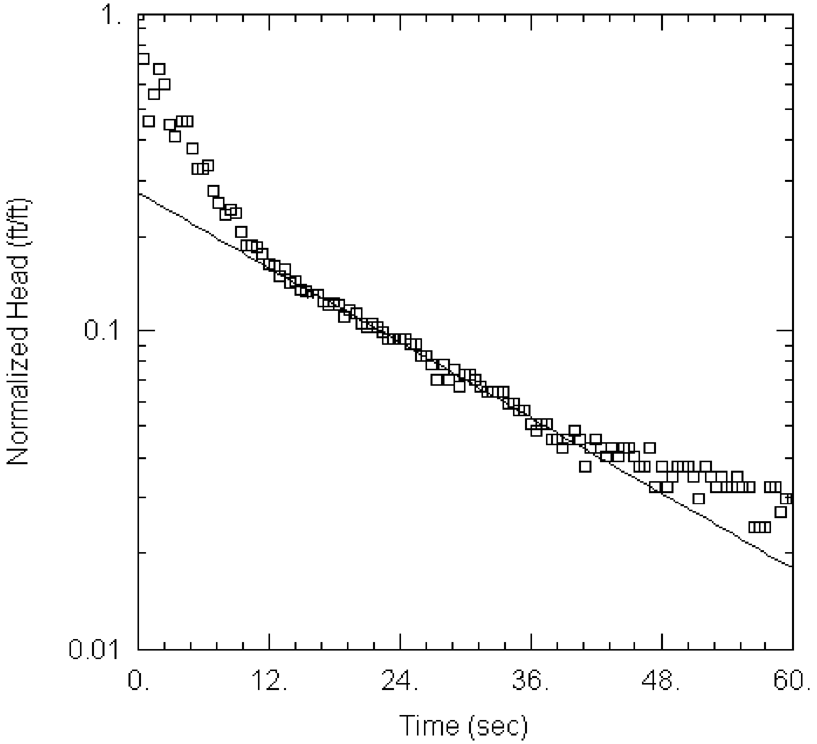
K = 19.4 ft/day
y0 = 0.4357 ft

AQUIFER DATA

Saturated Thickness: 8. ft
Anisotropy Ratio (Kz/Kr): 1.

WELL DATA (DMT-5S)

Initial Displacement: 1.7 ft
Total Well Penetration Depth: 8. ft
Casing Radius: 0.0861 ft
Static Water Column Height: 8. ft
Screen Length: 9. ft
Wellbore Radius: 0.333 ft
Gravel Pack Porosity: 0.3



DMT-6S TEST 1

Data Set: C:\Dundalk\SlugTests-2\DMT-6S-R1.aqt
Date: 10/04/06 Time: 10:07:04

PROJECT INFORMATION

Company: CH2M HILL
Client: Honeywell
Location: DMT
Test Well: DMT-6S
Test Date: 1/13/2006

SOLUTION

Aquifer Model: Unconfined
Solution Method: Bouwer-Rice

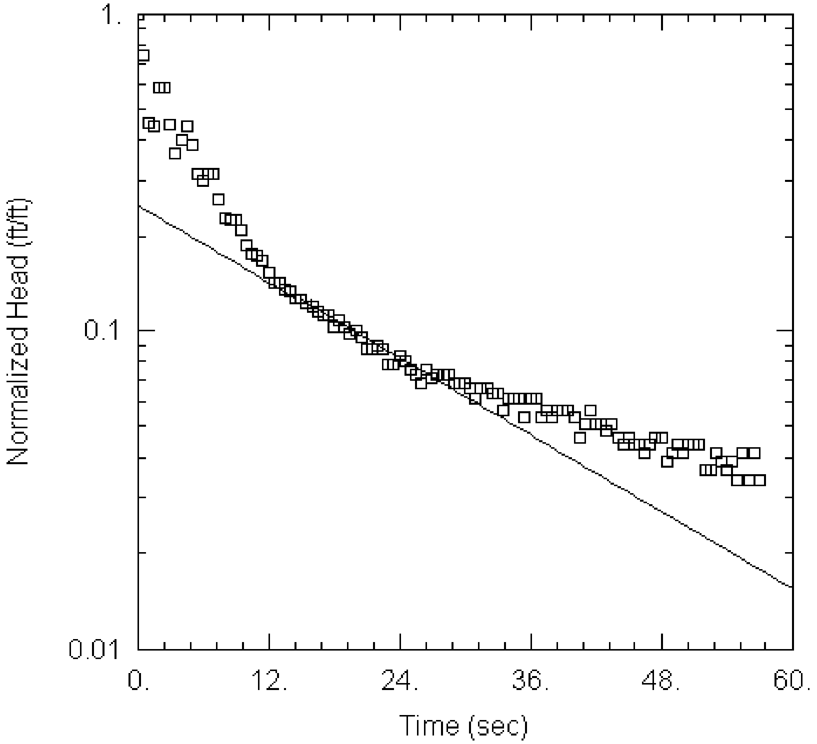
K = 9.961 ft/day
y0 = 1.023 ft

AQUIFER DATA

Saturated Thickness: 24. ft
Anisotropy Ratio (Kz/Kr): 1.

WELL DATA (DMT-6S)

Initial Displacement: 3.73 ft
Total Well Penetration Depth: 24. ft
Casing Radius: 0.0861 ft
Static Water Column Height: 24. ft
Screen Length: 25. ft
Wellbore Radius: 0.333 ft
Gravel Pack Porosity: 0.3



DMT-6S TEST 2

Data Set: C:\Dundalk\SlugTests-2\DMT-6S-R2.aqt
Date: 10/04/06 Time: 10:09:06

PROJECT INFORMATION

Company: CH2M HILL
Client: Honeywell
Location: DMT
Test Well: DMT-6S
Test Date: 1/13/2006

SOLUTION

Aquifer Model: Unconfined
Solution Method: Bouwer-Rice

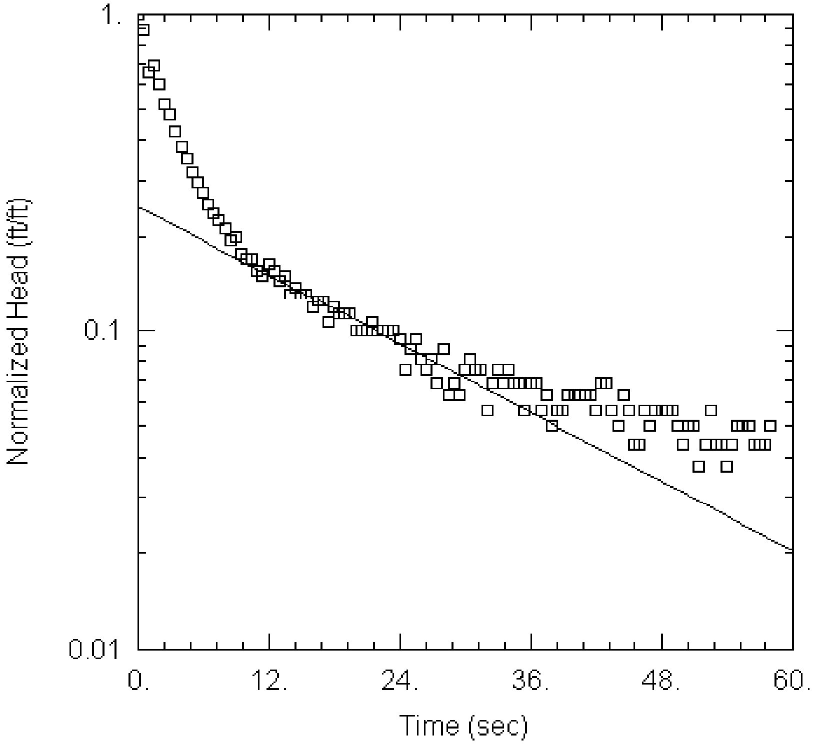
K = 10.15 ft/day
y0 = 1.026 ft

AQUIFER DATA

Saturated Thickness: 24. ft
Anisotropy Ratio (Kz/Kr): 1.

WELL DATA (DMT-6S)

Initial Displacement: 4.11 ft
Total Well Penetration Depth: 24. ft
Casing Radius: 0.0861 ft
Static Water Column Height: 24. ft
Screen Length: 25. ft
Wellbore Radius: 0.333 ft
Gravel Pack Porosity: 0.3



DMT-7S TEST 1

Data Set: C:\Dundalk\SlugTests-2\DMT-7S-R1.aqt
Date: 10/04/06
Time: 10:10:48

PROJECT INFORMATION

Company: CH2M HILL
Client: Honeywell
Location: DMT
Test Well: DMT-7S
Test Date: 1/13/2006

SOLUTION

Aquifer Model: Unconfined
Solution Method: Bouwer-Rice

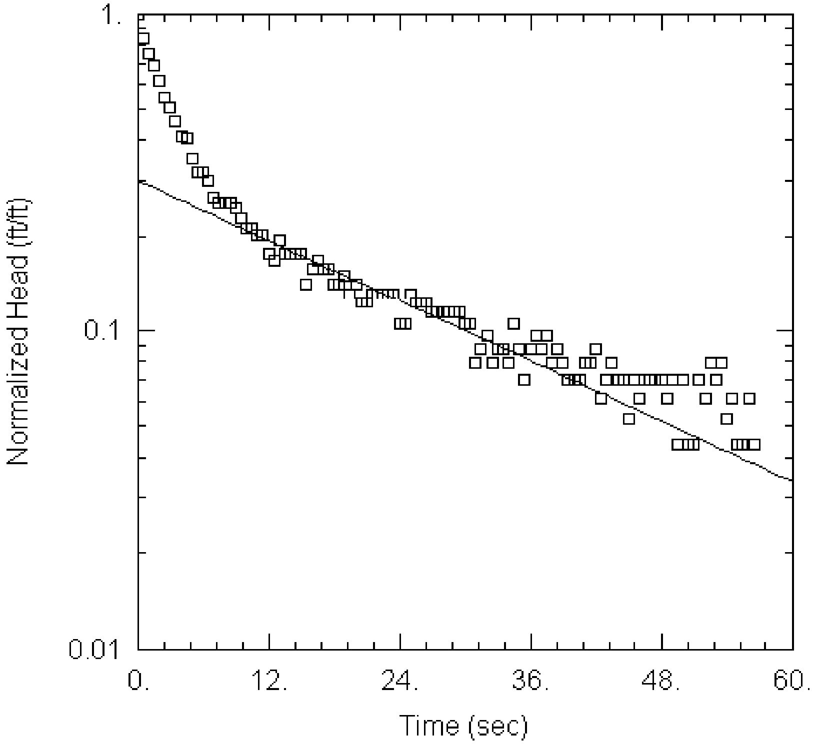
K = 9.042 ft/day
y0 = 0.3964 ft

AQUIFER DATA

Saturated Thickness: 23. ft
Anisotropy Ratio (Kz/Kr): 1.

WELL DATA (DMT-7S)

Initial Displacement: 1.6 ft
Total Well Penetration Depth: 23. ft
Casing Radius: 0.0861 ft
Static Water Column Height: 23. ft
Screen Length: 25. ft
Wellbore Radius: 0.333 ft
Gravel Pack Porosity: 0.3



DMT-7S TEST 2

Data Set: C:\Dundalk\SlugTests-2\DMT-7S-R2.aqt
Date: 10/04/06 Time: 10:14:06

PROJECT INFORMATION

Company: CH2M HILL
Client: Honeywell
Location: DMT
Test Well: DMT-7S
Test Date: 1/13/2006

SOLUTION

Aquifer Model: Unconfined
Solution Method: Bouwer-Rice

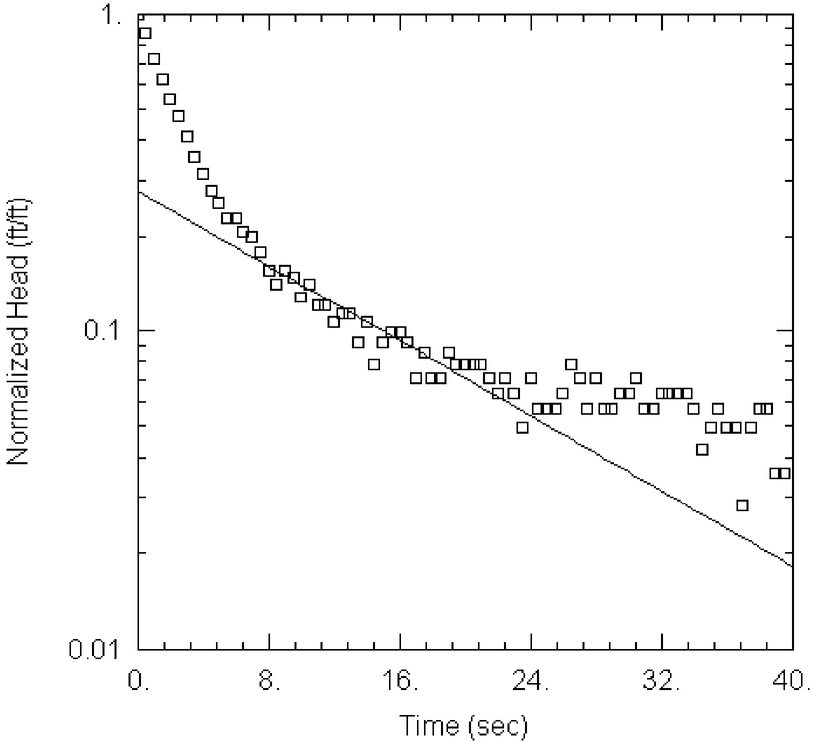
K = 7.913 ft/day
y0 = 0.3408 ft

AQUIFER DATA

Saturated Thickness: 23. ft
Anisotropy Ratio (Kz/Kr): 1.

WELL DATA (DMT-7S)

Initial Displacement: 1.14 ft
Total Well Penetration Depth: 23. ft
Casing Radius: 0.0861 ft
Static Water Column Height: 23. ft
Screen Length: 25. ft
Wellbore Radius: 0.333 ft
Gravel Pack Porosity: 0.3



DMT-8S TEST 1

Data Set: C:\Dundalk\SlugTests-2\DMT-8S-R1.aqt
Date: 10/04/06 Time: 10:16:03

PROJECT INFORMATION

Company: CH2M HILL
Client: Honeywell
Location: DMT
Test Well: DMT-8S
Test Date: 1/13/2006

SOLUTION

Aquifer Model: Unconfined
Solution Method: Bouwer-Rice

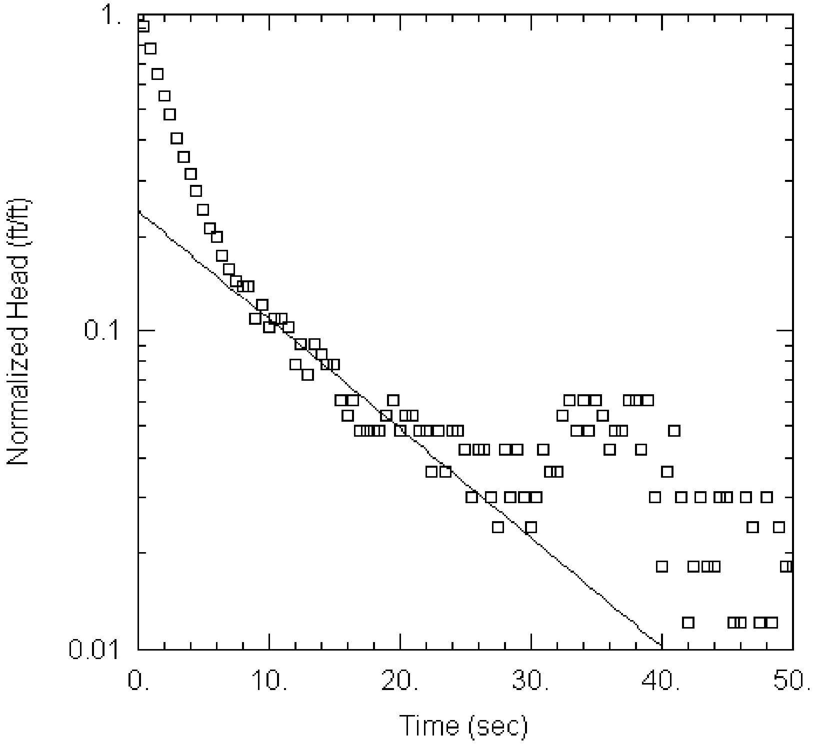
K = 12.96 ft/day
y0 = 0.3899 ft

AQUIFER DATA

Saturated Thickness: 29. ft
Anisotropy Ratio (Kz/Kr): 1.

WELL DATA (DMT-8S)

Initial Displacement: 1.41 ft
Total Well Penetration Depth: 29. ft
Casing Radius: 0.0861 ft
Static Water Column Height: 29. ft
Screen Length: 30. ft
Wellbore Radius: 0.333 ft
Gravel Pack Porosity: 0.3



DMT-8S TEST 2

Data Set: C:\Dundalk\SlugTests-2\DMT-8S-R2.aqt
Date: 10/04/06 Time: 10:19:04

PROJECT INFORMATION

Company: CH2M HILL
Client: Honeywell
Location: DMT
Test Well: DMT-8S
Test Date: 1/13/2006

SOLUTION

Aquifer Model: Unconfined
Solution Method: Bouwer-Rice

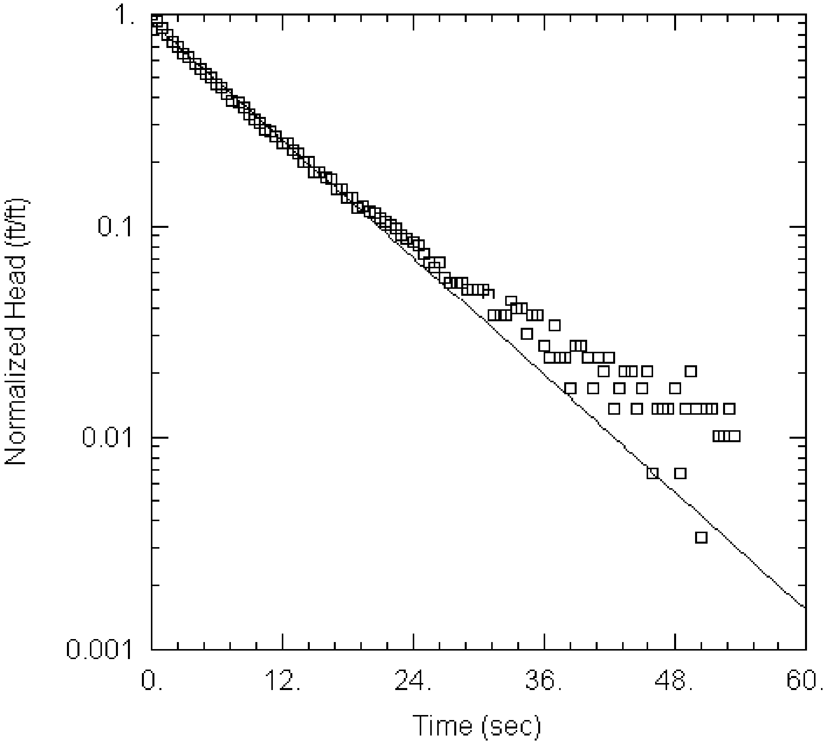
K = 15.08 ft/day
y0 = 0.3995 ft

AQUIFER DATA

Saturated Thickness: 29. ft
Anisotropy Ratio (Kz/Kr): 1.

WELL DATA (DMT-8S)

Initial Displacement: 1.66 ft
Total Well Penetration Depth: 29. ft
Casing Radius: 0.0861 ft
Static Water Column Height: 29. ft
Screen Length: 30. ft
Wellbore Radius: 0.333 ft
Gravel Pack Porosity: 0.3



DMT-9S TEST 1

Data Set: C:\Dundalk\SlugTests-2\DMT-9S-R1.aqt
Date: 10/04/06 Time: 10:20:49

PROJECT INFORMATION

Company: CH2M HILL
Client: Honeywell
Location: DMT
Test Well: DMT-9S
Test Date: 1/13/2006

SOLUTION

Aquifer Model: Unconfined
Solution Method: Bouwer-Rice

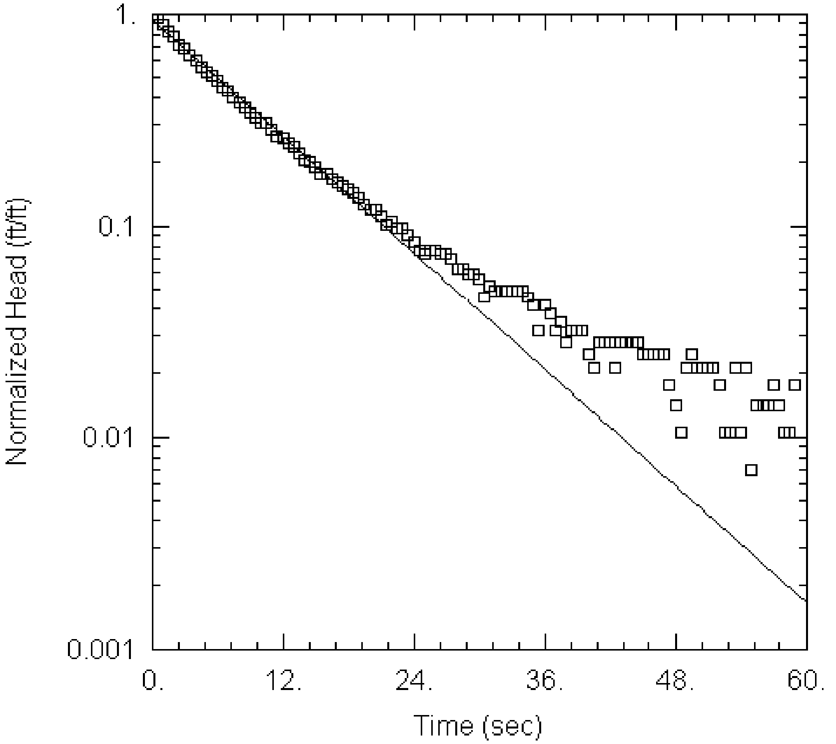
K = 16.58 ft/day
y0 = 2.721 ft

AQUIFER DATA

Saturated Thickness: 22. ft
Anisotropy Ratio (Kz/Kr): 1.

WELL DATA (DMT-9S)

Initial Displacement: 2.97 ft
Total Well Penetration Depth: 22. ft
Casing Radius: 0.0861 ft
Static Water Column Height: 22. ft
Screen Length: 35. ft
Wellbore Radius: 0.333 ft
Gravel Pack Porosity: 0.3



DMT-9S TEST 2

Data Set: C:\Dundalk\SlugTests-2\DMT-9S-R2.aqt
Date: 10/04/06 Time: 10:22:01

PROJECT INFORMATION

Company: CH2M HILL
Client: Honeywell
Location: DMT
Test Well: DMT-9S
Test Date: 1/13/2006

SOLUTION

Aquifer Model: Unconfined
Solution Method: Bouwer-Rice

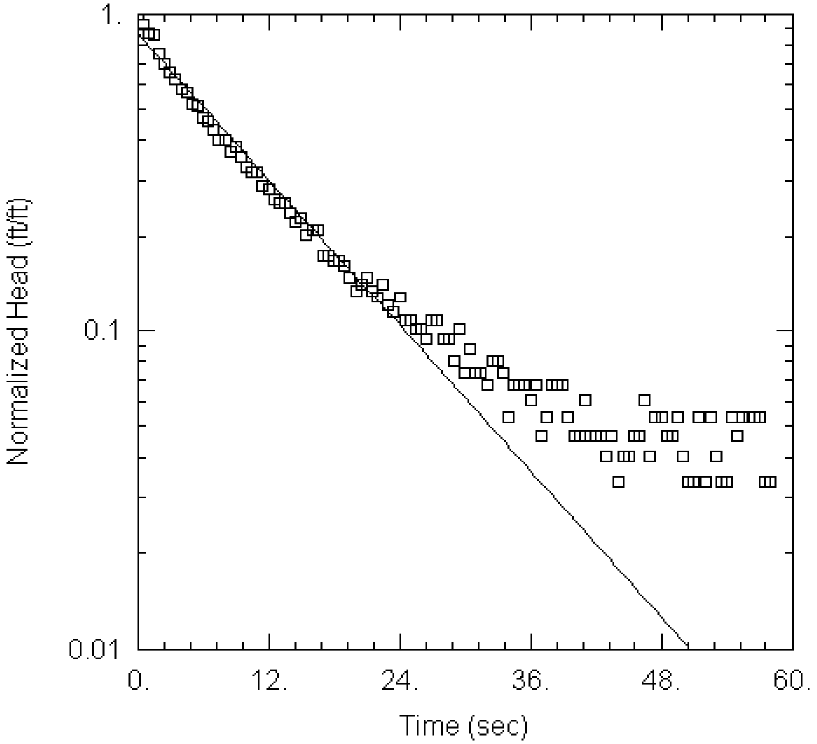
K = 16.45 ft/day
y0 = 2.695 ft

AQUIFER DATA

Saturated Thickness: 22. ft
Anisotropy Ratio (Kz/Kr): 1.

WELL DATA (DMT-9S)

Initial Displacement: 2.87 ft
Total Well Penetration Depth: 22. ft
Casing Radius: 0.0861 ft
Static Water Column Height: 22. ft
Screen Length: 35. ft
Wellbore Radius: 0.333 ft
Gravel Pack Porosity: 0.3



DMT-10S TEST 1

Data Set: C:\Dundalk\SlugTests-2\DMT-10S-R1.aqt
Date: 10/04/06 Time: 10:25:37

PROJECT INFORMATION

Company: CH2M HILL
Client: Honeywell
Location: DMT
Test Well: DMT-10S
Test Date: 1/13/2006

SOLUTION

Aquifer Model: Unconfined
Solution Method: Bouwer-Rice

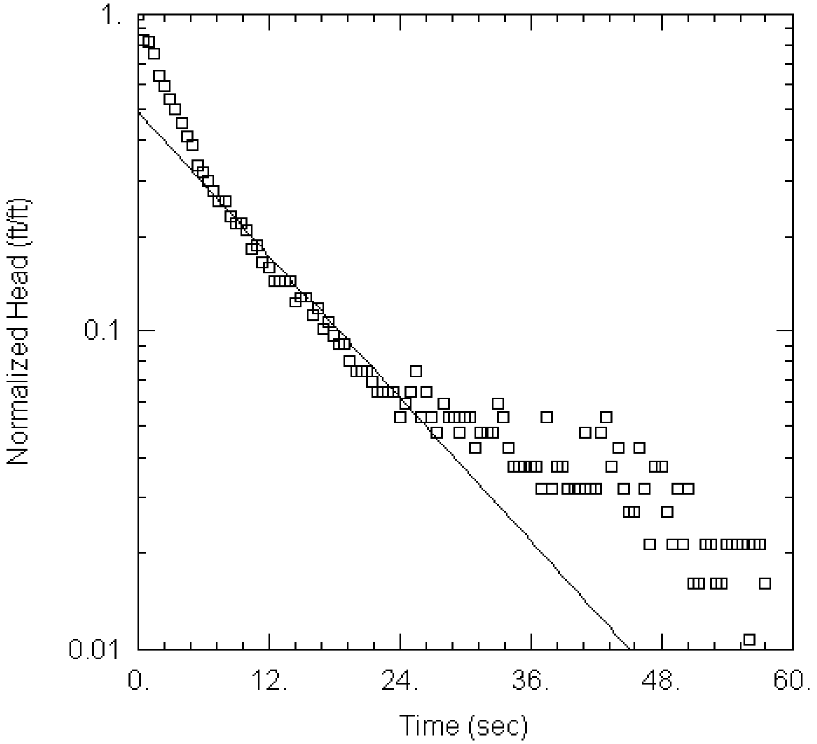
K = 16.05 ft/day
y0 = 1.293 ft

AQUIFER DATA

Saturated Thickness: 23. ft
Anisotropy Ratio (Kz/Kr): 1.

WELL DATA (DMT-10S)

Initial Displacement: 1.49 ft
Total Well Penetration Depth: 23. ft
Casing Radius: 0.0861 ft
Static Water Column Height: 23. ft
Screen Length: 30. ft
Wellbore Radius: 0.333 ft
Gravel Pack Porosity: 0.3



DMT-10S TEST 2

Data Set: C:\Dundalk\SlugTests-2\DMT-10S-R2.aqt
Date: 10/04/06 Time: 10:26:50

PROJECT INFORMATION

Company: CH2M HILL
Client: Honeywell
Location: DMT
Test Well: DMT-10S
Test Date: 1/13/2006

SOLUTION

Aquifer Model: Unconfined
Solution Method: Bouwer-Rice

K = 15.75 ft/day
y0 = 0.9222 ft

AQUIFER DATA

Saturated Thickness: 23. ft
Anisotropy Ratio (Kz/Kr): 1.

WELL DATA (DMT-100S)

Initial Displacement: 1.87 ft
Total Well Penetration Depth: 23. ft
Casing Radius: 0.0861 ft
Static Water Column Height: 23. ft
Screen Length: 30. ft
Wellbore Radius: 0.333 ft
Gravel Pack Porosity: 0.3

Attachment F

Aquifer Testing of Well DMT-01M at the Dundalk Marine Terminal

Introduction

Well DMT-01M was installed in December 2005 and January 2006 as the pumping well of an aquifer test cluster. The other wells in the test cluster were the existing monitoring well EA-09M and three small-diameter temporary piezometers, TPZ-1, TPZ-2, and TPZ-3. Figure 1 shows a stratigraphic column based on the lithologic log collected during installation of DMT-01M. The figure also shows the relative locations and screen elevations of the wells in the test cluster.

Wells DMT-01M and EA-09M are both screened in the Patapsco Aquifer, which corresponds to the sand and gravel layers shown in Figure 1 at elevations between -81.87 and -100.87 feet below the Baltimore City Datum (BCD). These two wells were used to test the hydraulic properties of the Patapsco Aquifer in two constant-rate aquifer tests performed in June and November, 2006. In these tests, DMT-01M was the pumping well and EA-09M was used as the primary drawdown observation well.

The three temporary piezometers were installed in clayey silt layers between elevations -43.87 and -79.87 feet (BCD). These silt units, together with the clays between -57.87 and -73.87 feet (BCD), comprise the Patapsco confining unit, which separates the Patapsco Aquifer from the overlying fill aquifer above -22.87 feet (BCD). The temporary piezometers were designed for observation of drawdown in the confining unit during the Patapsco aquifer test. It was intended that the drawdown records from the temporary piezometers would be analyzed by the ratio method of Neuman and Witherspoon (1972). However, for various reasons to be explained here, the data records obtained from them were not suitable for analysis by that method.

First Aquifer Test at Well DMT-01M

The first aquifer test was a 48-hour constant-rate test performed from June 19, to June 21, 2006. The test procedures are described in detail in Appendix C of the CTS. DMT-01M was pumped at an average rate of 26.7 gallons per minute (gpm) for 48 hours, and the resulting drawdown in the Patapsco Aquifer was recorded at observation wells EA-09M, EA-06M, EA-13M, EAC-02M, and EAC-03M. These drawdown records produced transmissivity estimates ranging from 1,541 square feet per day (ft^2/day) at EA-06M to 3,788 ft^2/day at EAC-02M. The estimate at well EA-09M was 2,659 ft^2/day.

Figure 2 shows the drawdown and recovery in observation well EA-09M during the Patapsco aquifer test. It shows that a clear and substantial hydraulic response was produced by the pumping of well DMT-01M. The drawdown exceeded 2 feet after approximately the first 7 hours of pumping and reached a maximum of about 2.4 feet early in the second 24 hours. Because the temporary piezometers are located at the same distance from the test well as EA-09M, it is probable that a similar magnitude of drawdown was produced in the Patapsco Aquifer directly below them, also. It was expected that this drawdown would propagate upward through the Patapsco confining layers and be detected in the shallow piezometers in the early stages of the 48-hour aquifer test. When the data records were examined, however, it was found that the piezometers were not sensitive enough for the intended purpose.

Figure 3 shows the water-level variations observed in TPZ-3 during the aquifer test. The continuous water-level record was obtained using an InSitu LevelTroll™ data logger. Before the data logger and its tethering cable were inserted into the piezometer, a water level of 2.68 feet (BCD) was measured manually. This occurred at 9:51 AM on June 19, 2006. The pumping test started 67 minutes later at 10:58. It was expected that any disturbance caused to the water levels in the piezometer would have dissipated in 67 minutes. As Figure 3 shows, however, the insertion of the data logger and its cable caused an increase of approximately 4.4 feet in the water level of the piezometer, which dissipated slowly over the 48 hours of the observation record. In effect, the installation of the monitoring equipment and the subsequent slow recovery of the water level was equivalent to a falling-head slug test. Analysis of the recovery data using the slug test method of Bouwer and Rice (1976) yielded a hydraulic conductivity estimate of 2.25 x 10^{-3} ft/day (7.94 x 10^{-7} cm/s), as shown in Figure 4. Because the flow of water out of the 3-foot screen was primarily horizontal, this is an estimate of the horizontal component of hydraulic conductivity of the silt unit in which TPZ-3 was screened.

Installation of the data logger in piezometer TPZ-2 produced a similar water-level increase and recovery that was analyzed as a slug test. Before installation of the data logger, the static water level was measured manually and recorded as 3.08 feet (BCD). Upon insertion of the logger and its cable, the water level rose by approximately 4.5 feet. After this initial displacement, the water level in this piezometer declined even more slowly than was seen in TPZ-03 (see Figure 5). Analysis of this recovery record, as shown in Figure 6, produced a hydraulic conductivity estimate of approximately 7.22 x 10^{-4} ft/day (2.55 x 10^{-7} cm/s).

Figure 7 shows the water level records from piezometer TPZ-1. In this piezometer, the initial displacement caused by installation of the data logger dissipated in less than 1 hour, and the subsequent measurements appear to be representative of the potentiometric head in the confining unit. In this sense, the piezometer functioned as intended. However, the water-level record does not show any detectable drawdown signal resulting from the drawdown produced in the Patapsco Aquifer by pumping at well DMT-01M. That is undoubtedly because of the low hydraulic conductivity of the silts and clays that separate this piezometer screen from the aquifer approximately 43 feet below. Piezometer TPZ-1 did register an apparent tidal signal with a period of about 12 hours and amplitude of approximately 0.1 foot. It is assumed that this tidal response propagated downward from the sand unit just above the screen of TPZ-1 (see Figure 1), but this cannot be confirmed, because there is no piezometer or monitoring well in that unit near the test cluster.

Second Aquifer Test at Well DMT-01M

After reviewing the records obtained from the temporary piezometers during the first Patapsco aquifer test, it was apparent that TPZ-2 and TPZ-3 were not sensitive enough to register any pressure variations that might be produced in the Patapsco confining unit by an aquifer test. Their insensitivity was caused by the volume of water that needed to be exchanged between the well bore and the porous matrix to produce a change in water level in the piezometer casing. Because of the low hydraulic conductivity of the sediments in which these piezometers were installed, they respond very slowly to pressure changes in the groundwater.

To overcome this obstacle to the usefulness of the piezometers, a set of packers was constructed so that the piezometer casings could be sealed above the data logger after it was installed. The packers were constructed using 10-foot joints of ¾-inch steel electrical conduit and 1-inch rubber stoppers. A length of 1/16-inch steel cable was threaded through the rubber stopper and attached to an eye-bolt with a wing nut at the upper end of the conduit so that the stopper could be compressed inside the piezometer casing after the data logger was installed. This packer isolated the data logger from the atmosphere and prevented any movement of the water surface in the piezometer, so that pressure variations in the porous matrix outside the piezometer screen would be registered directly by the transducer in the data logger. The only pressure-mitigating influence remaining after the packers were sealed was the compliance of the rubber stopper itself, which was minimal.

Using these packers to seal the piezometers, a second aquifer test was run in well DMT-01M from October 31 to November 2, 2006. Pumping started at 9:45 on October 31, and continued at 28 gpm until 10:03 on November 2. The hydrograph from well DMT-01M for the testing and recovery period is shown in Figure 8.

Figure 9 shows the water-level record for observation well EA-09M during the 48 hours of the second DMT-01M pumping test. Also shown are the tide record for that period and the tide-corrected water level record. A notable feature of the raw water-level record shown in Figure 9 is the sudden rise that occurred about 1:30 AM on November 2. Although the graph is truncated at elevation -0.5 ft (BCD) in the figure, the actual water level rose rapidly to the elevation of the ground surface and stayed there for approximately 5 hours before rapidly declining to the previous drawdown level just before termination of pumping. This evidently corresponds to a rainfall event in which runoff ponded on the ground surface and filled the well, with the well serving as an unintended storm drainage utility. The tide-corrected record shown in the figure for the period before the storm event reveals a maximum drawdown of approximately 2.3 feet, which is consistent with the results observed in the first aquifer test at DMT-01M.

Analysis of the tide-corrected time-drawdown record is illustrated in Figure 10. After the first 6 minutes of the record, the drawdown produced a close fit to the Theis curve, resulting in a transmissivity estimate of approximately 2,362 ft^2/day for the Patapsco Aquifer. This result agrees closely with that of the first DMT-01M aquifer test. The early time drawdown data shown in Figure 10 departs from the Theis curve by relatively small fractions of a foot. This could easily be due to small errors in the tide lag or tidal efficiency factor used in removing the tidal signal from the raw data record. It could also indicate a departure of the aquifer behavior from the assumptions of the Theis equation (i.e., complete confinement, radial flow, uniform homogeneous aquifer properties, etc.). Alternative hydraulic solutions for leaky aquifers with and without storage in the confining unit were tried, but did not provide a better fit to the early drawdown measurements.

Figures 11 and 12 show the pressure records collected in piezometers TPZ-1 and TPZ-3 before and during the second DMT-01M pumping test. These graphs show that the piezometers were very sensitive to pressure changes after the casings were sealed above the data loggers with the packers. The packer in TPZ-2 provided only a partial seal, so that piezometer produced a record that was not useful for interpretation.

Figures 11 and 12 illustrate a few notable features, one of which is the barometric influence in the records. Because the piezometers were to be isolated from the atmosphere, non-vented pressure transducers were used with the data loggers. The obvious barometric responses represent the loading efficiency of the porous medium rather than the usual barometric efficiency of wells. In these figures, an increase in barometric pressure corresponds to increasing pressure recorded by the sealed piezometers. This is because the increased atmospheric pressure applied to the ground surface causes axial compression of the porous matrix, which is reflected in increased pore pressure of the groundwater. The loading efficiency for both piezometer records was estimated as 87 percent. A second feature of these pressure records is a sharp increase in pressure that occurred at approximately 1:30 AM on November 2. That is the same time when the casing of well EA-09M was flooded, presumably by storm water on the ground surface. Both piezometers were also apparently flooded, but the increase in pressure registered by the sealed data loggers corresponded to 1 foot of water. Instead of receding after approximately 5 hours, the increased water levels persisted through the end of the record, although not at the high level of the initial pressure spike. It is theorized that the piezometers above the packers filled with water, and that the compliance of the compressed rubber stoppers was enough to transmit a small portion of the added load to the sealed portion of the piezometer as an increase in pressure. Another possible explanation is that pore pressure in the confining unit increased because of surface loading by the weight of ponded water.

Figure 13 shows the corrected pressure record from piezometer TPZ-1 for the period prior to the disturbances that occurred in the early morning of November 2. With the barometric signal removed, the pressure in TPZ-1 registered an apparent tidal fluctuation on the order of 0.1 ft or less. That is consistent with the findings from the first aquifer test.

Figure 14 shows the corrected pressure record for the deep piezometer, TPZ-3. Reference to Figure 1 shows that the screen of TPZ-3 is approximately 5 feet above the top of the transmissive portion of the Patapsco Aquifer. Water levels in the Patapsco were drawn down approximately 2.3 feet during the aquifer test, but the pressure record from TPZ-3 shows no detectable response to that drawdown. Propagation of the drawdown from the Patapsco Aquifer upward into the confining unit can be estimated from the following one-dimensional differential equation:

$$\frac{\partial h}{\partial t} = \frac{K_v}{S_s} \frac{\partial^2 h}{\partial z^2}$$

where,

$d = d(t,z)$, drawdown (ft)
t = time (days)
K_v = vertical component of hydraulic conductivity (ft/day)

S_s = specific storage of the silt (1/day)
z = vertical distance (ft)

The initial conditions for this problem are:

$d(0,z) = 0$ (initial drawdown is zero everywhere)
$d(t,0) = 2.3$ ft (drawdown at the bottom of the silt is 2.3 ft at all positive times)

The solution to this initial value problem is:

$$d(t,z) = 2.3 ercf\left(\frac{z}{2\sqrt{K_v t / S_s}}\right)$$

Where erfc(x) is the complimentary error function (Carslaw and Jaeger, 1959).

To evaluate this solution for the vertical component of hydraulic conductivity, K_v, an independent estimate of the specific storage, S_s, is needed. This can be obtained by referring to the results of the consolidation test that was run on the soil sample taken from the boring of well DMT-01M at the depth interval of the TPZ-3 well screen (87 to 89 feet). Figure 15 shows a plot of vertical strain versus vertical stress obtained from that consolidation test. The specific storage can be estimated from the following equation:

$$S_s = \rho g \frac{\Delta V / V_0}{\Delta \sigma}$$

Where:

ρg = unit weight of water (62.4 lb/ft^3)
$\Delta V/V_0$ = vertical strain (fraction)
σ = vertical stress (lb/ft^2)

Taking the portion of the stress-strain curve in Figure 15 that approximates the probable in-situ load at a depth of 87 to 89 feet, the estimated specific storage from the above equation is 4.9×10^{-4}/ft. Given this estimate, the error function solution to the governing equation was evaluated for a range of values of the vertical component of hydraulic conductivity at a location (z value) 5 feet above the top of the Patapsco Aquifer. This produced the family of curves shown in Figure 16 representing expected drawdown as a function of time at the location of the TPZ-3 piezometer screen. Referring to Figure 14, it is unlikely that a drawdown of more then 0.03 feet could have propagated to the elevation of TPZ-3 in 1.6 days without being obvious in the recorded pressure record. That suggests, from Figure 16, that the vertical component of hydraulic conductivity in the silt between the TPZ-3 screen and the Patapsco Aquifer must be less than about 6×10^{-4} ft/day (2.1×10^{-7} cm/s).

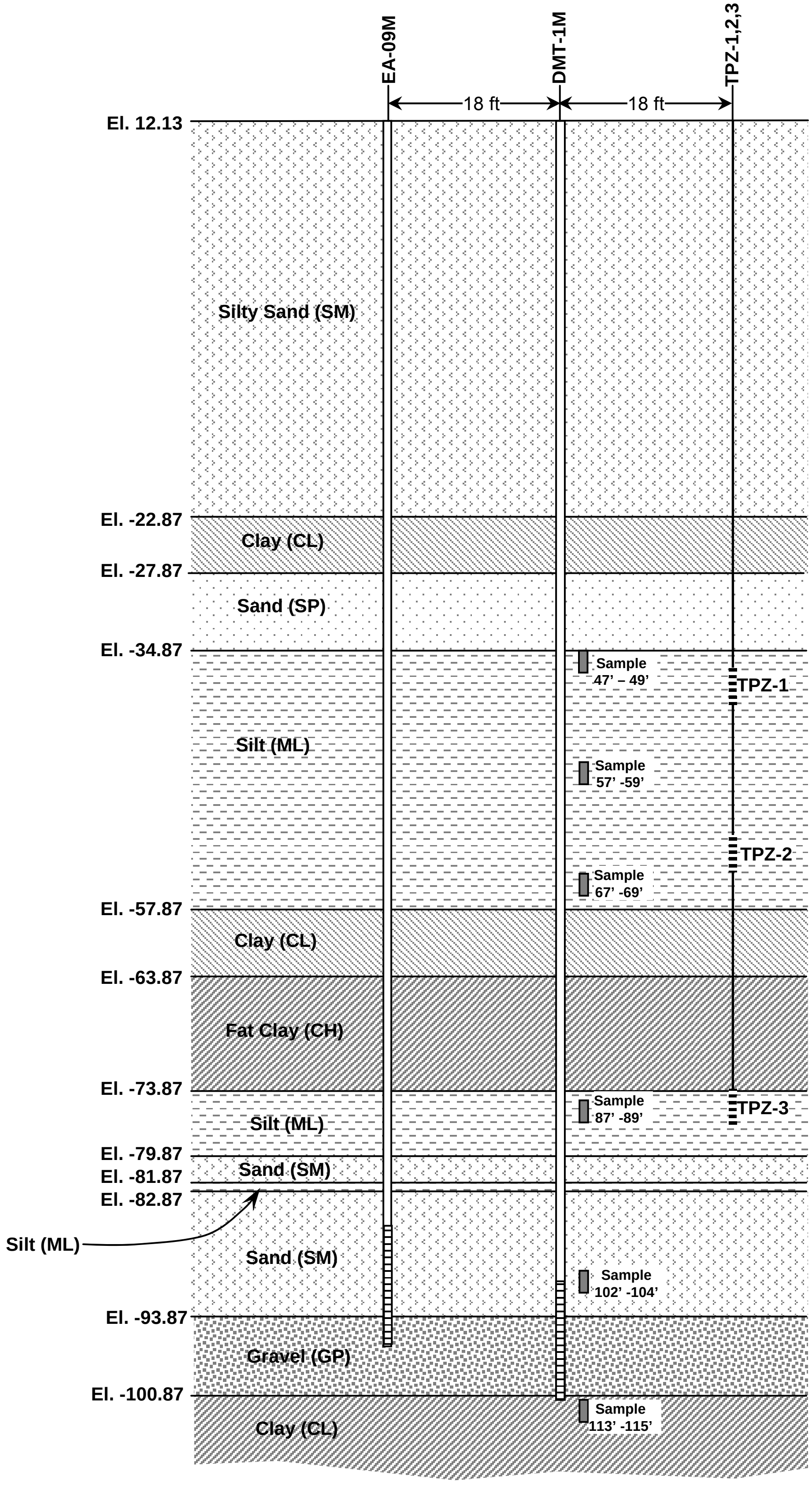


Figure 1
Stratigraphic Column and Well Configurations
at the DMT-01M Aquifer Test Cluster

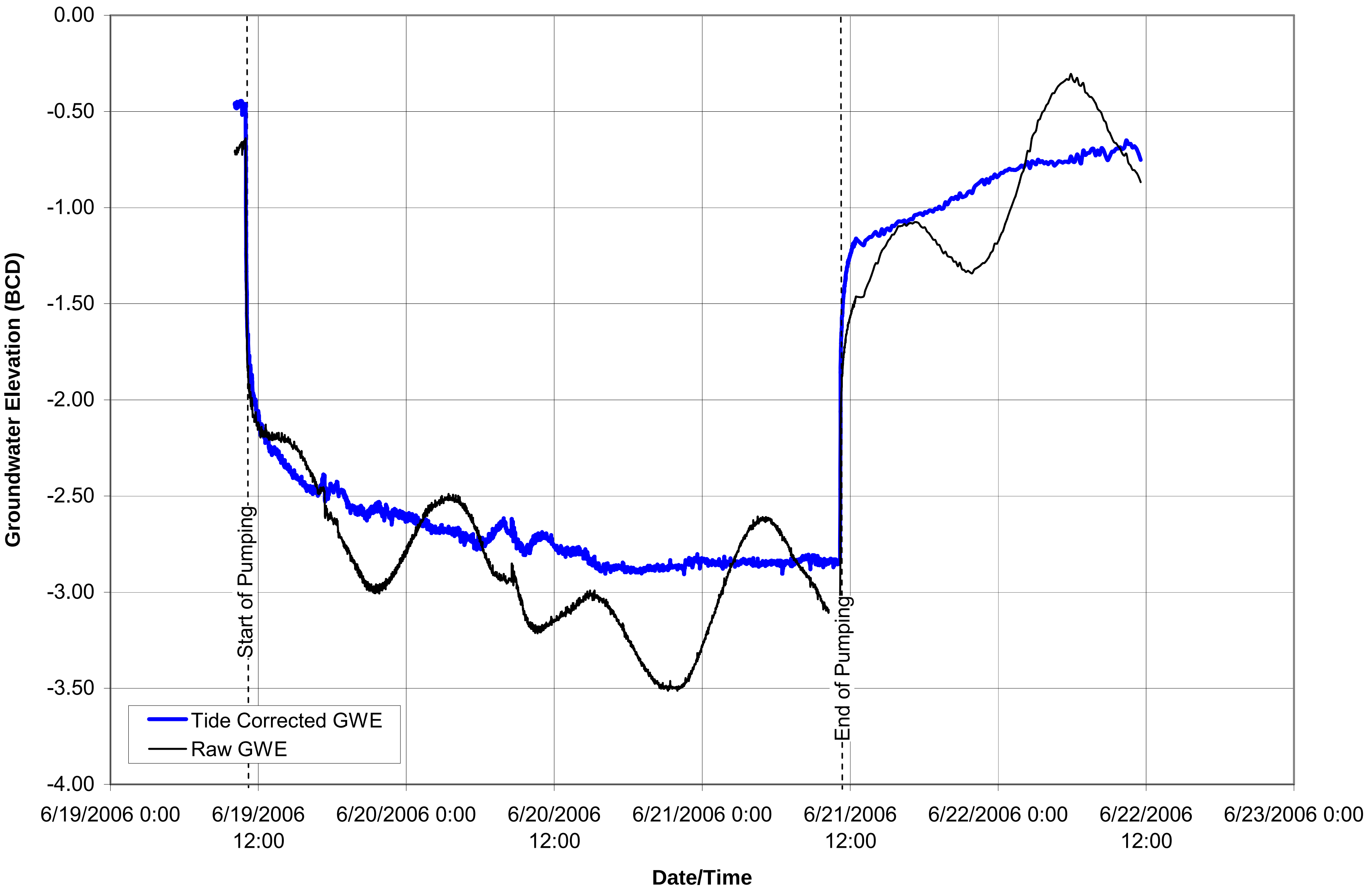


Figure 2
Raw and Tide-Corrected Drawdown and Recovery Records for Observation Well EA-09M, First DMT-01M Aquifer Test

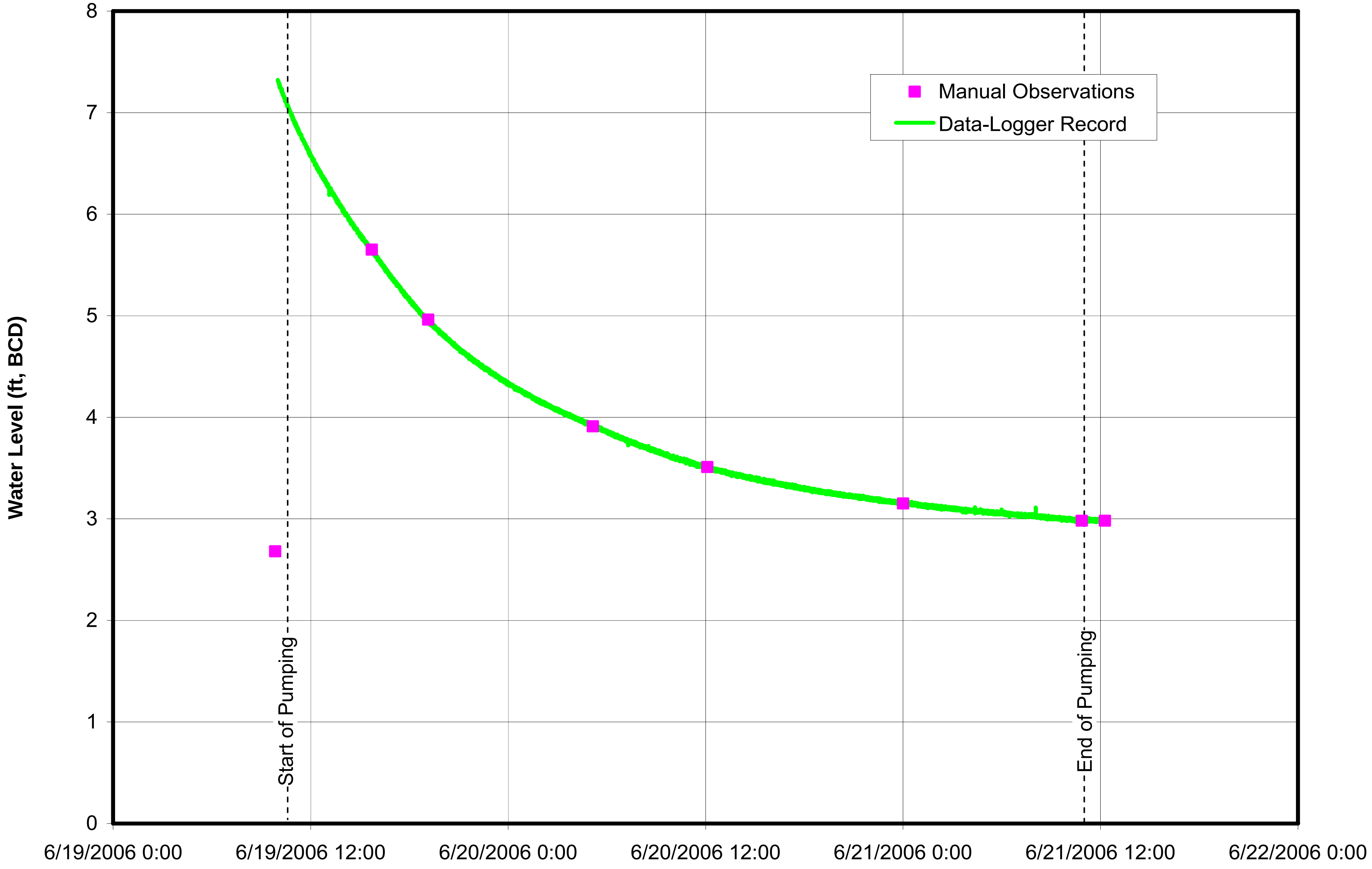
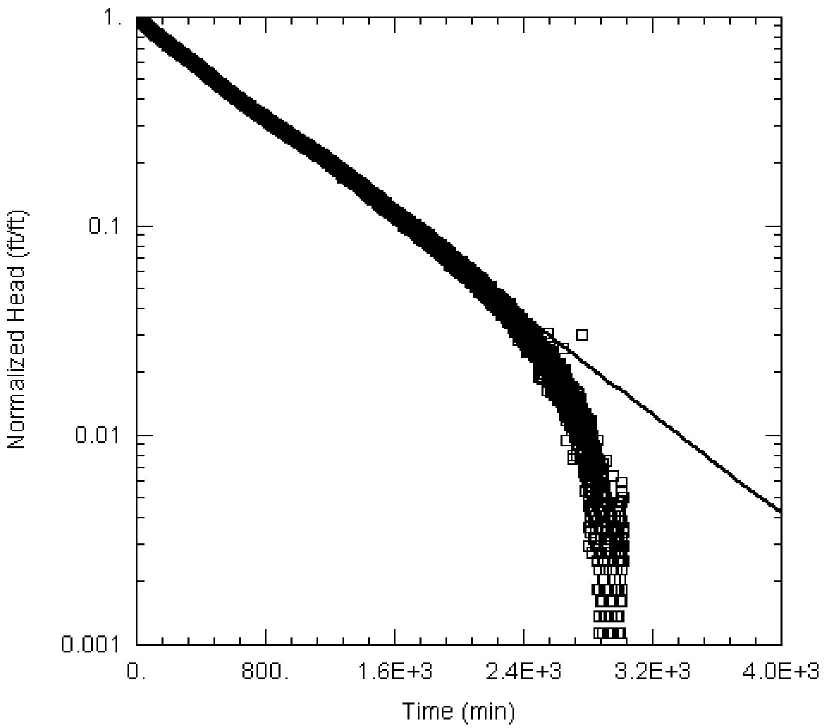


Figure 3
Water-Level Observations from Piezometer
TPZ-3, First DMT-01M Aquifer Test

CH2M HILL



TPZ-3 SLUG TEST

Data Set: C:\...\TPZ-3FirstTest.aqt
Date: 11/15/06 Time: 08:56:22

PROJECT INFORMATION

Company: CH2M HILL
Client: Honeywell
Location: DMT
Test Well: TPZ-3
Test Date: 6/19/06

SOLUTION

Aquifer Model: Confined
Solution Method: Bouwer-Rice

K = 0.002251 ft/day
y0 = 4.292 ft

AQUIFER DATA

Saturated Thickness: 50. ft
Anisotropy Ratio (Kz/Kr): 0.1

WELL DATA (TPZ-3)

Initial Displacement: 4.41 ft
Total Well Penetration Depth: 26.5 ft
Casing Radius: 0.04142 ft
Static Water Column Height: 50. ft
Screen Length: 3. ft
Wellbore Radius: 0.09375 ft

Figure 4
Slug Test Analysis of Data Logger Insertion and Water-Level Recovery in Piezometer TPZ-3

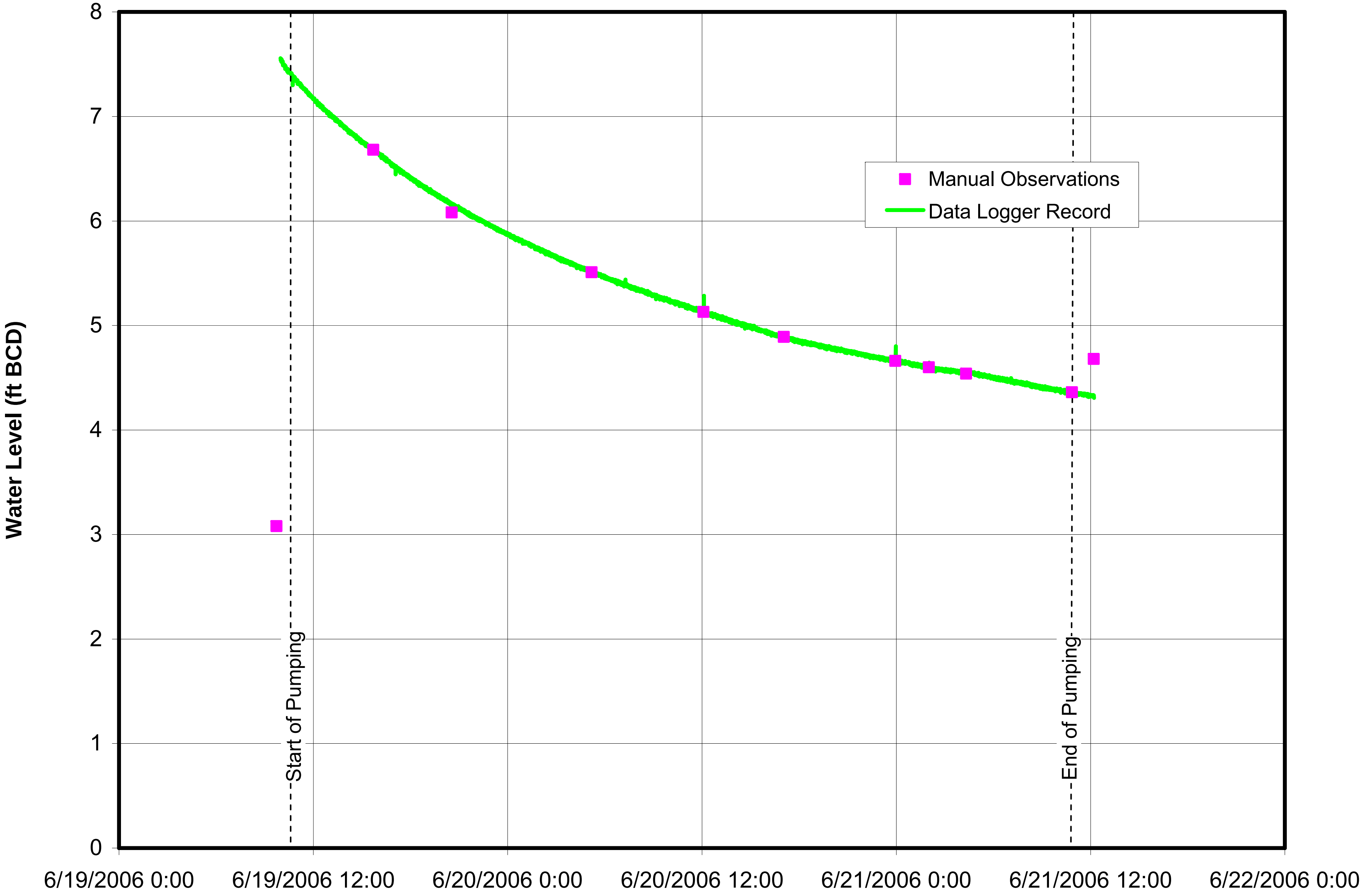
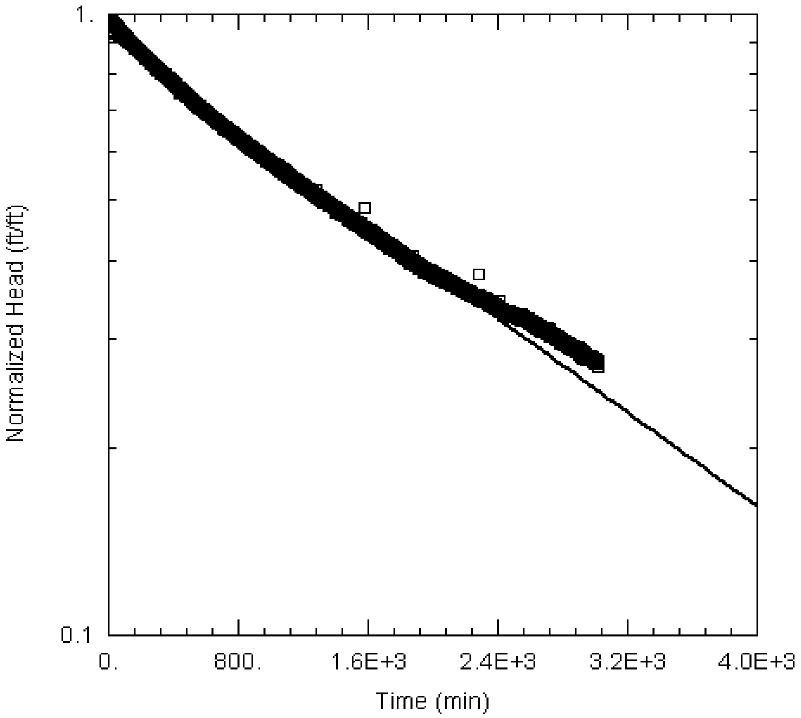


Figure 5
Water-Level Observations from Piezometer TPZ-2, First DMT-01M Aquifer Test



TPZ-2 SLUG TEST

Data Set: C:\...\TPZ-2FirstTest.aqt
Date: 11/15/06
Time: 08:59:13

PROJECT INFORMATION

Company: CH2M HILL
Client: Honeywell
Location: DMT
Test Well: TPZ-2
Test Date: 6/19/2006

SOLUTION

Aquifer Model: Confined
Solution Method: Bouwer-Rice

K = 0.0007224 ft/day
y0 = 4.187 ft

AQUIFER DATA

Saturated Thickness: 50. ft
Anisotropy Ratio (Kz/Kr): 0.1

WELL DATA (TPZ-2)

Initial Displacement: 4.538 ft
Total Well Penetration Depth: 26.5 ft
Casing Radius: 0.04142 ft
Static Water Column Height: 50. ft
Screen Length: 3. ft
Wellbore Radius: 0.09375 ft

Figure 5
Slug Test Analysis of Data Logger Insertion and Water-Level Recovery in Piezometer TPZ-2

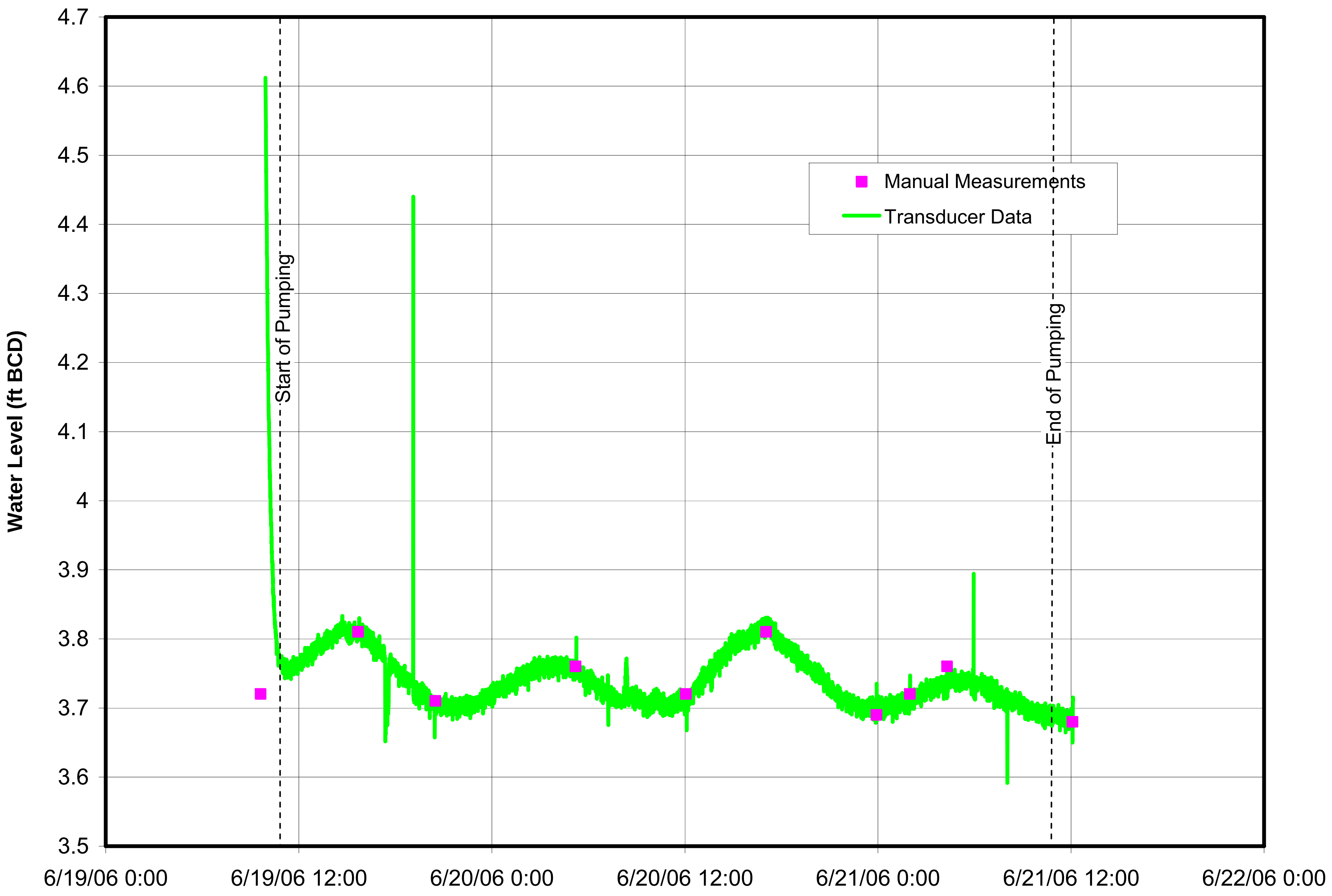


Figure 7
Water-Level Observations from Piezometer
TPZ-1, First DMT-01M Aquifer Test

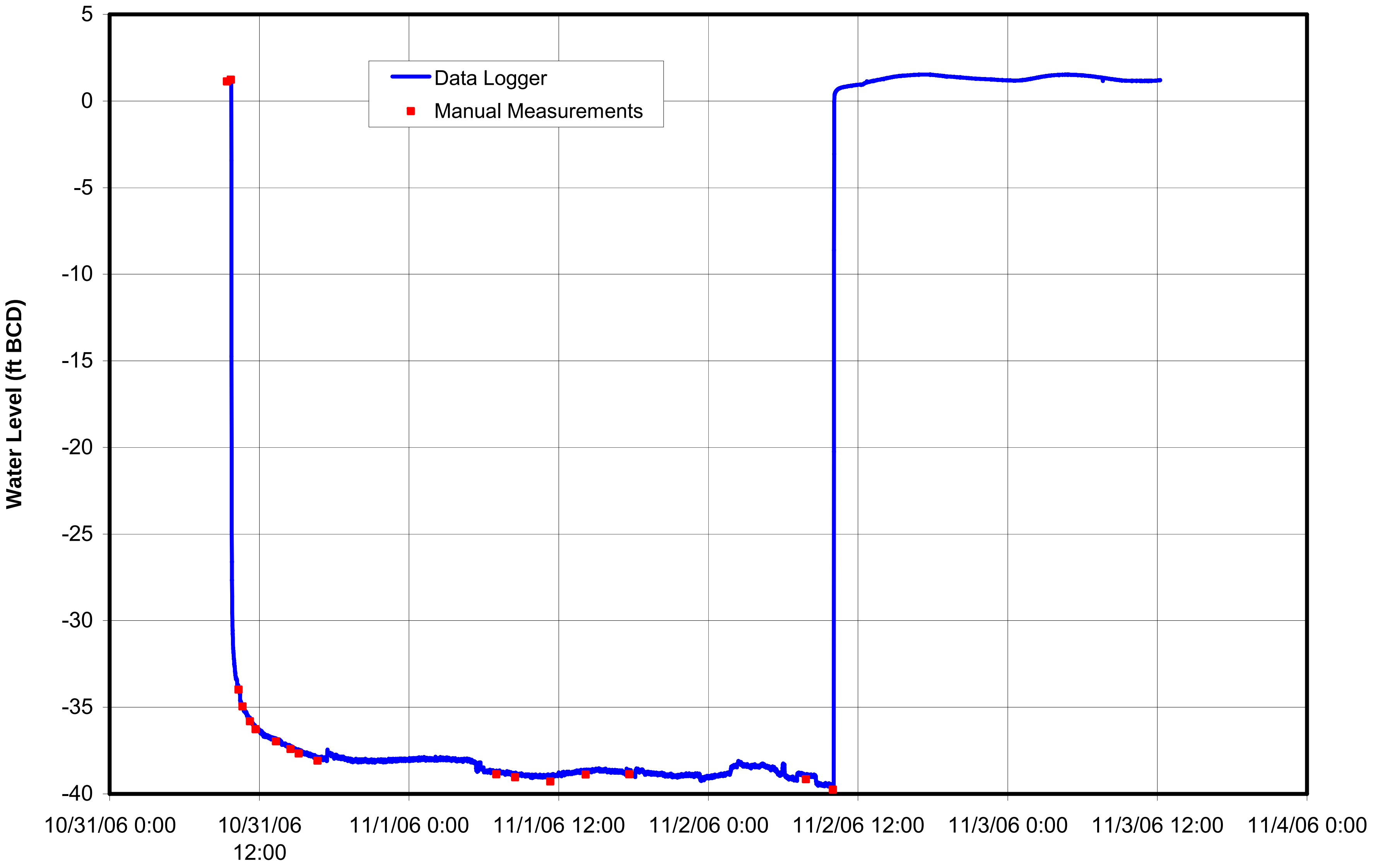


Figure 8
Water-Level Observations in Test Well
DMT-01M, Second Aquifer Test

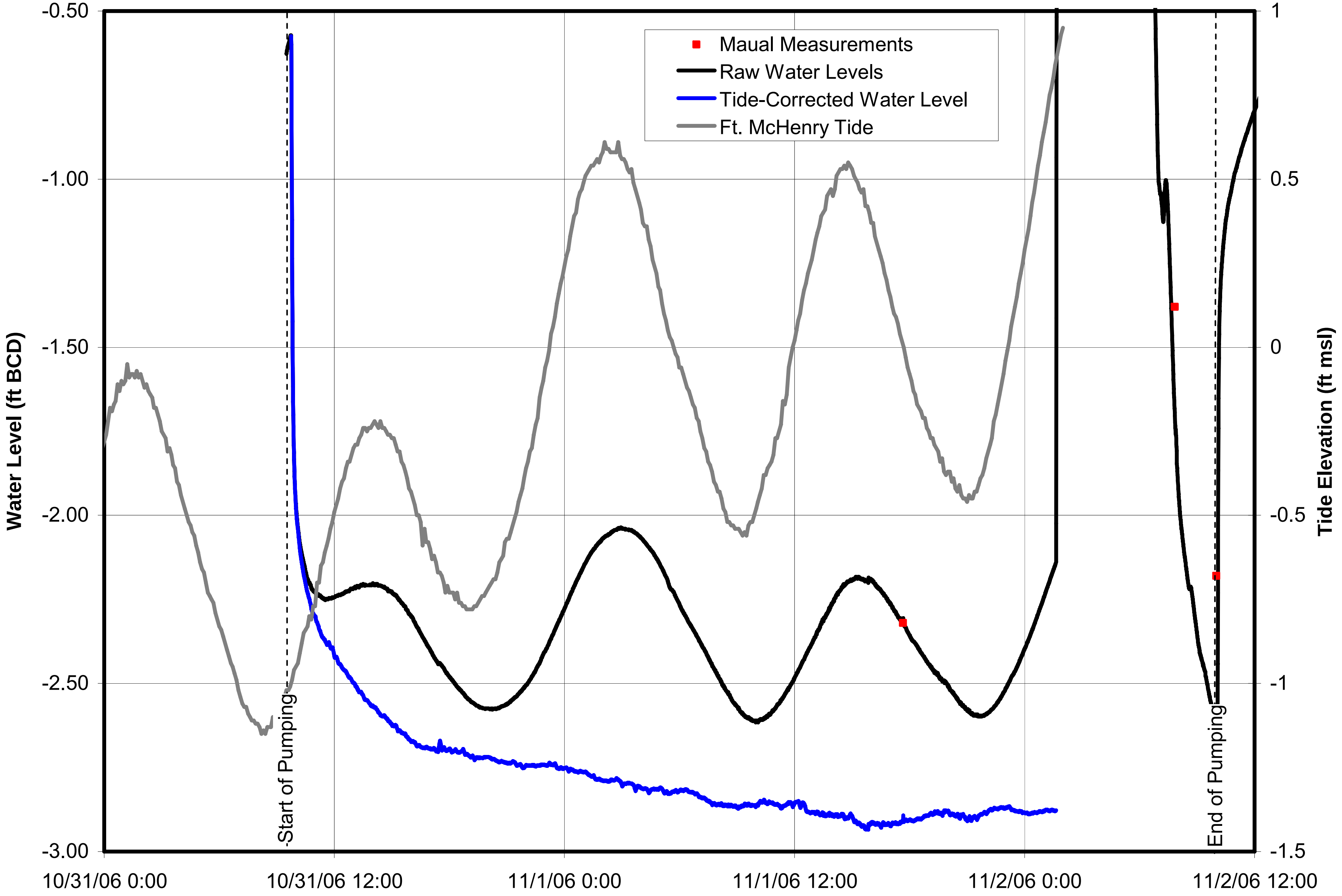
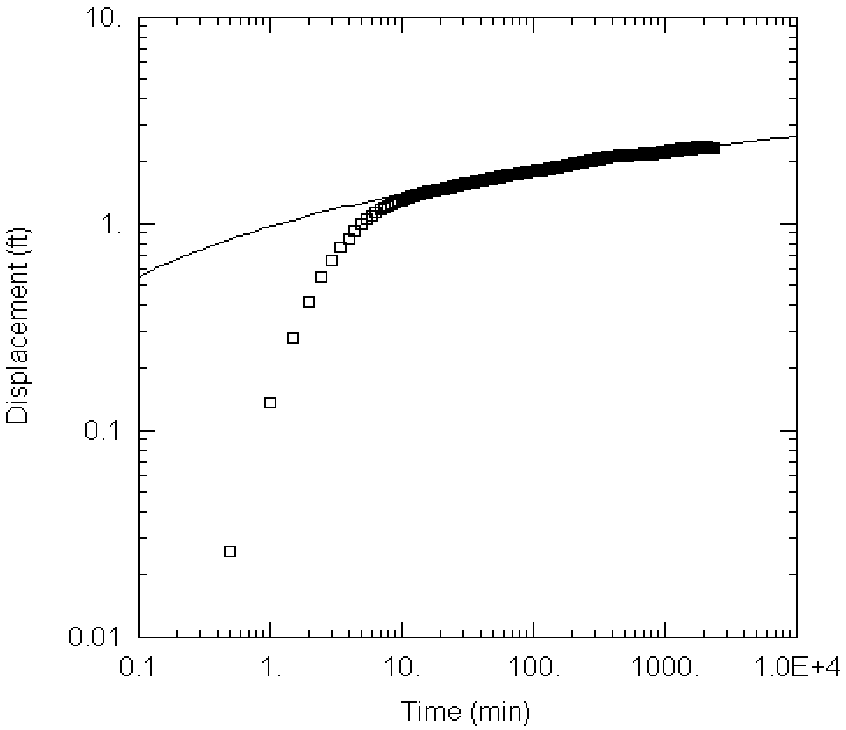


Figure 9
Raw and Tide-Corrected Water-Level Records from Observation Well EA-09M, Second DMT-01M Aquifer Test



SECOND DMT-1M TEST

Data Set:
Date: 11/08/06 Time: 10:24:10

PROJECT INFORMATION

Company: CH2M HILL
Client: Honeywell, Inc.
Location: DMT
Test Well: DMT-1M
Test Date: 10/31 - 11/2, 2006

SOLUTION

Aquifer Model: Confined
Solution Method: Theis

T = 2361.7 ft^2/day
S = 8.545E-7
Kz/Kr = 1.
b = 18. ft

WELL DATA

Pumping Wells

Well Name	X (ft)	Y (ft)
DMT-1M	1447036	574771

Observation Wells

Well Name	X (ft)	Y (ft)
□ EA-9M	1446902	574708

Figure 10
Analysis of the Tide-Corrected Drawdown Record from Well EA-09M, Second DMT-01M Aquifer Test

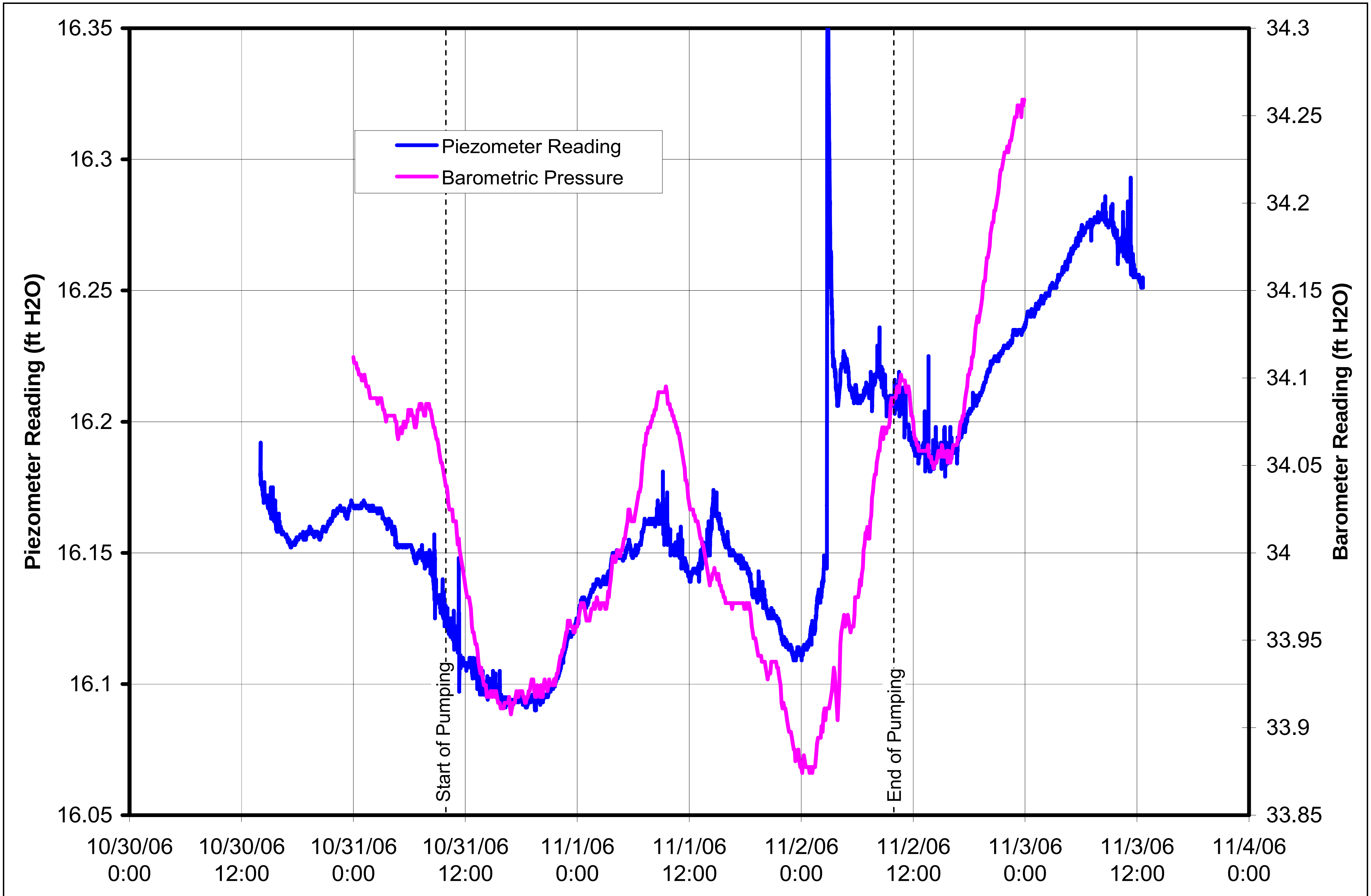


Figure 11
Raw Pressure Record from Piezometer TPZ-1 and Barometric Record from NOAA Francis Scott Key Bridge Station

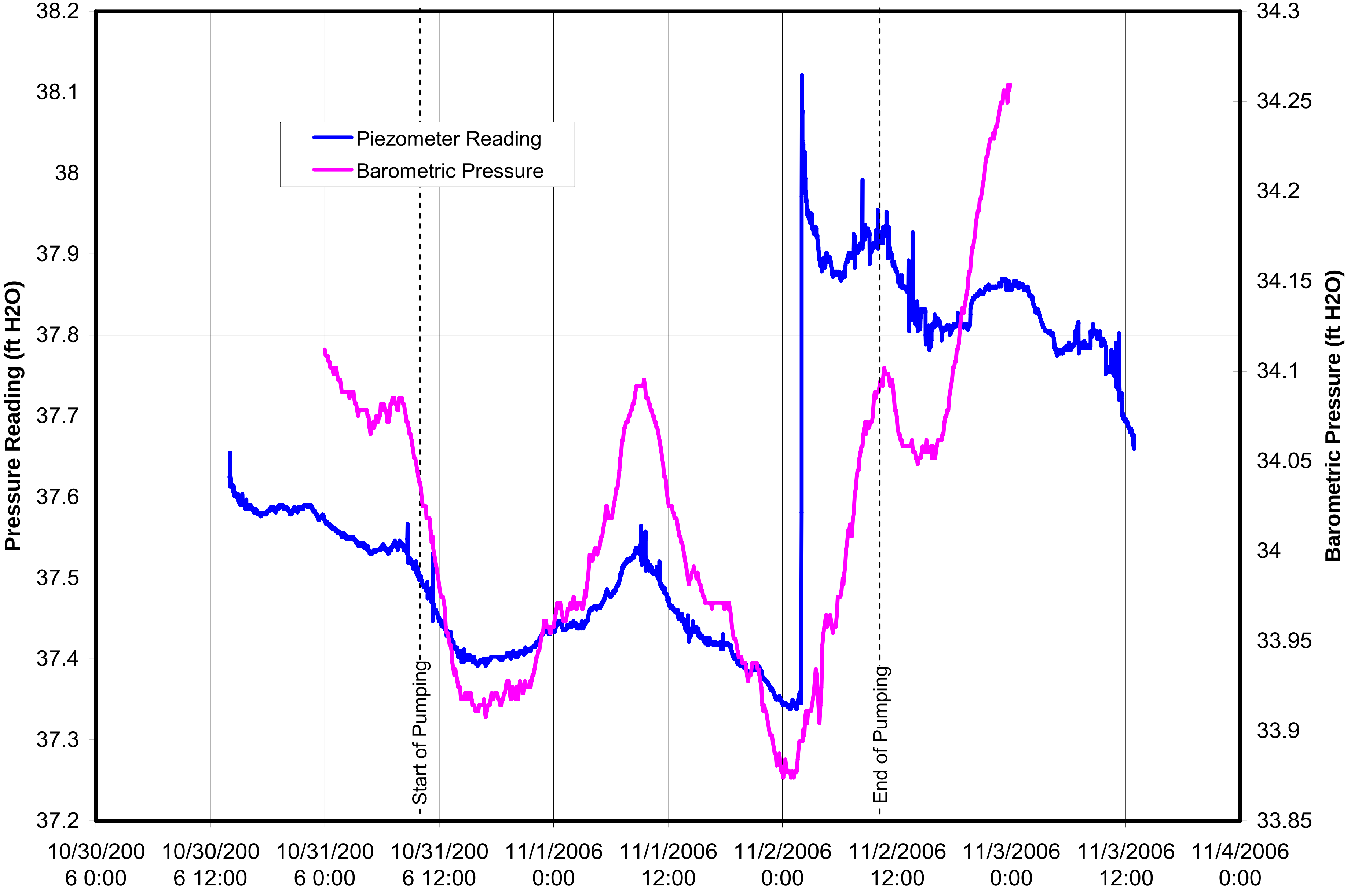


Figure 12
Raw Pressure Record from Piezometer TPZ-3 and Barometric Record from NOAA Francis Scott Key Bridge Station

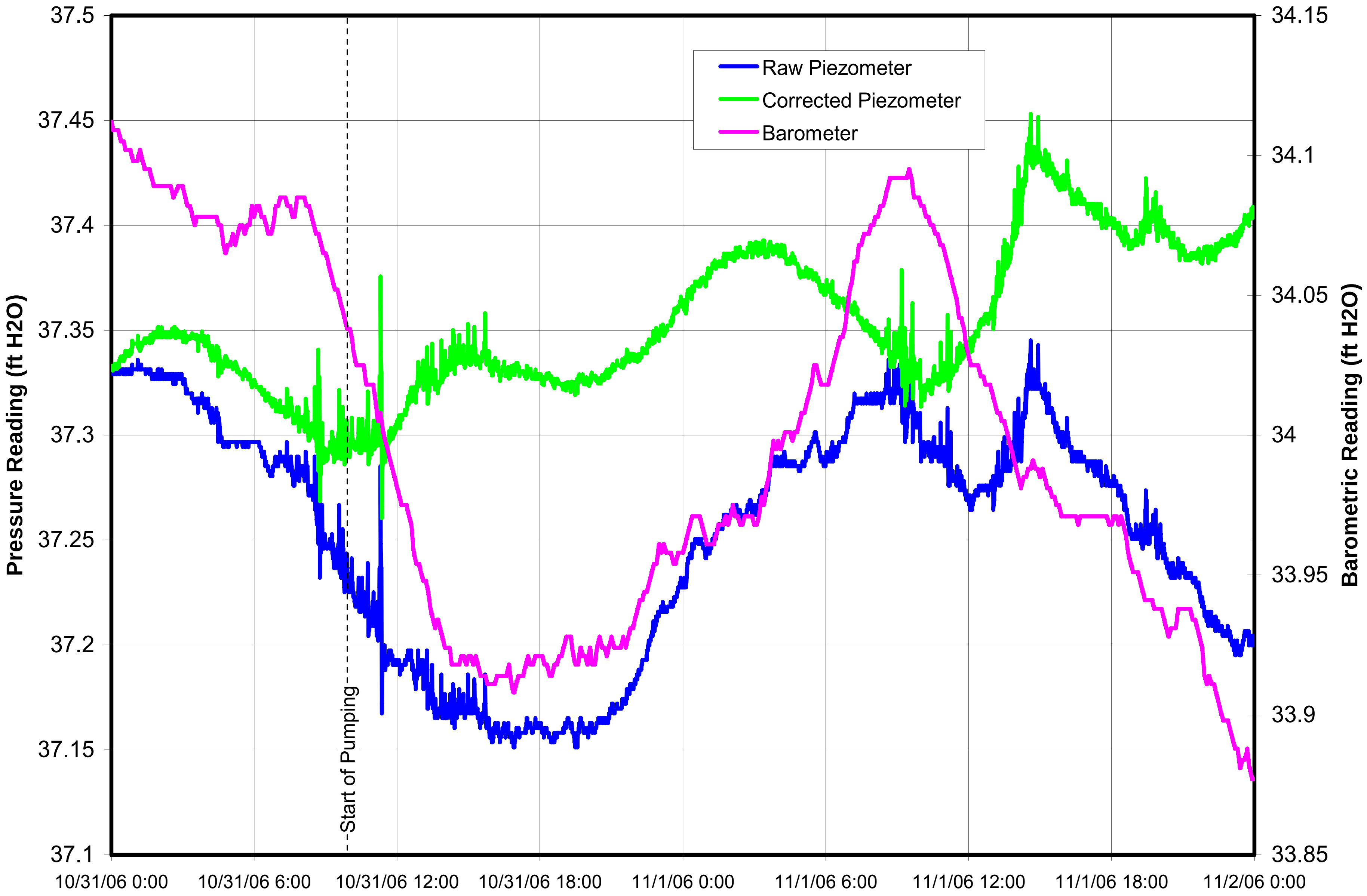


Figure 13
Raw and Barometrically-Corrected Pressure Records from Piezometer TPZ-1 Before and During the DMT-01M Pumping Test

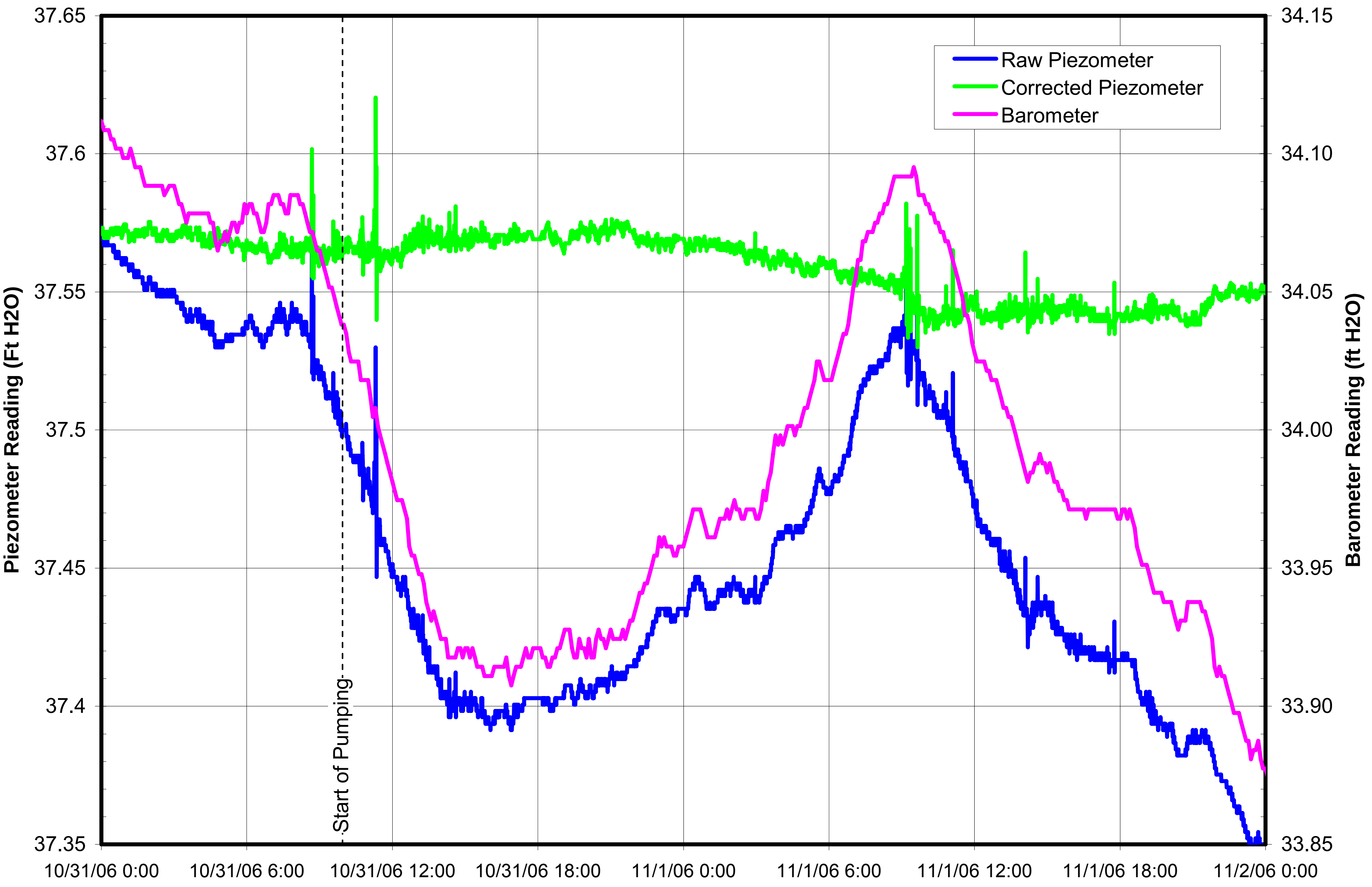
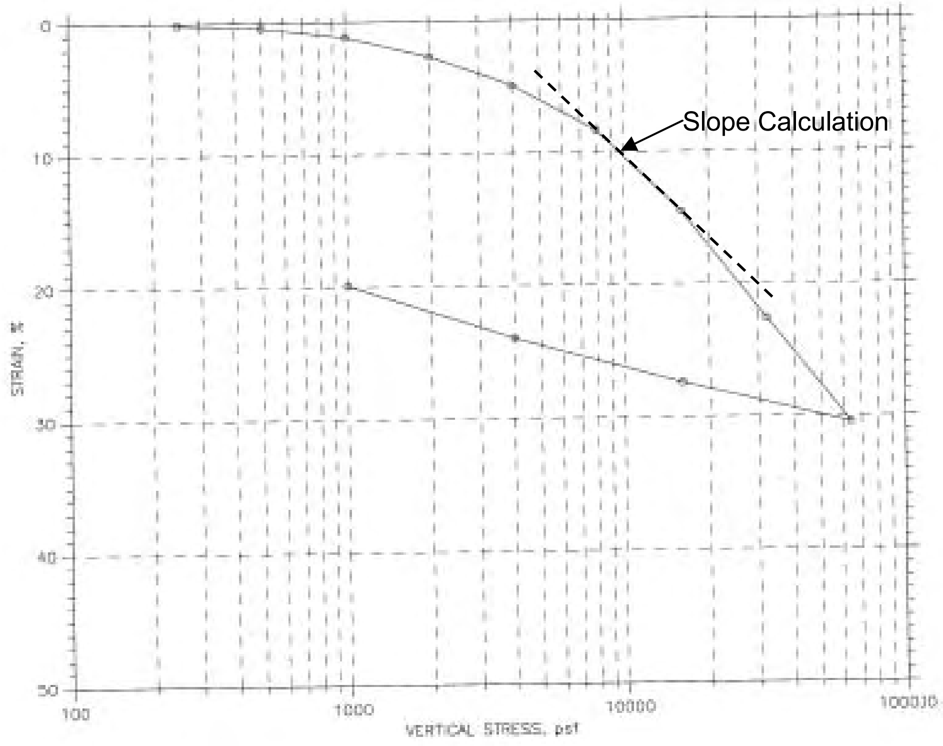


Figure 14
Raw and Barometrically-Corrected Pressure Records from Piezometer TPZ-3 Before and During the DMT-01M Pumping Test

CONSOLIDATION TEST DATA

SUMMARY REPORT



					Before Test	After Test
Overburden Pressure: 0 psf				Water Content, %	51.60	38.14
Preconsolidation Pressure: 0 psf				Dry Unit Weight, pcf	68.61	85.35
Compression Index: 0				Saturation, %	95.64	105.71
Diameter: 2.5 in		Height: 1 in		Void Ratio	1.46	0.97
LL: 80	PL: 46	PI: 34	GS: 2.70			

GeoTesting express the groundwork for success	Project: Dundalk Marine	Location: SODMT1M8789	Project No.: GTX-G0971
	Boring No.: DMT-1M	Tested By: md	Checked By: jdt
	Sample No.: UD	Test Date: 01/27/06	Depth: 87-89 ft
	Test No.: 13983	Sample Type: Shelby Tube	Elevation: N/A
	Description: Gray Elastic Silt		
	Remarks:		

Tue, 14-FEB-2006 11:41:08 Privileged and Confidential - Prepared at the Request of Counsel

Figure 15
Consolidation Test Results for DMT-01M Sample at 87 – 89 Foot Depth Used to Estimate Porous Matrix Specific Storage

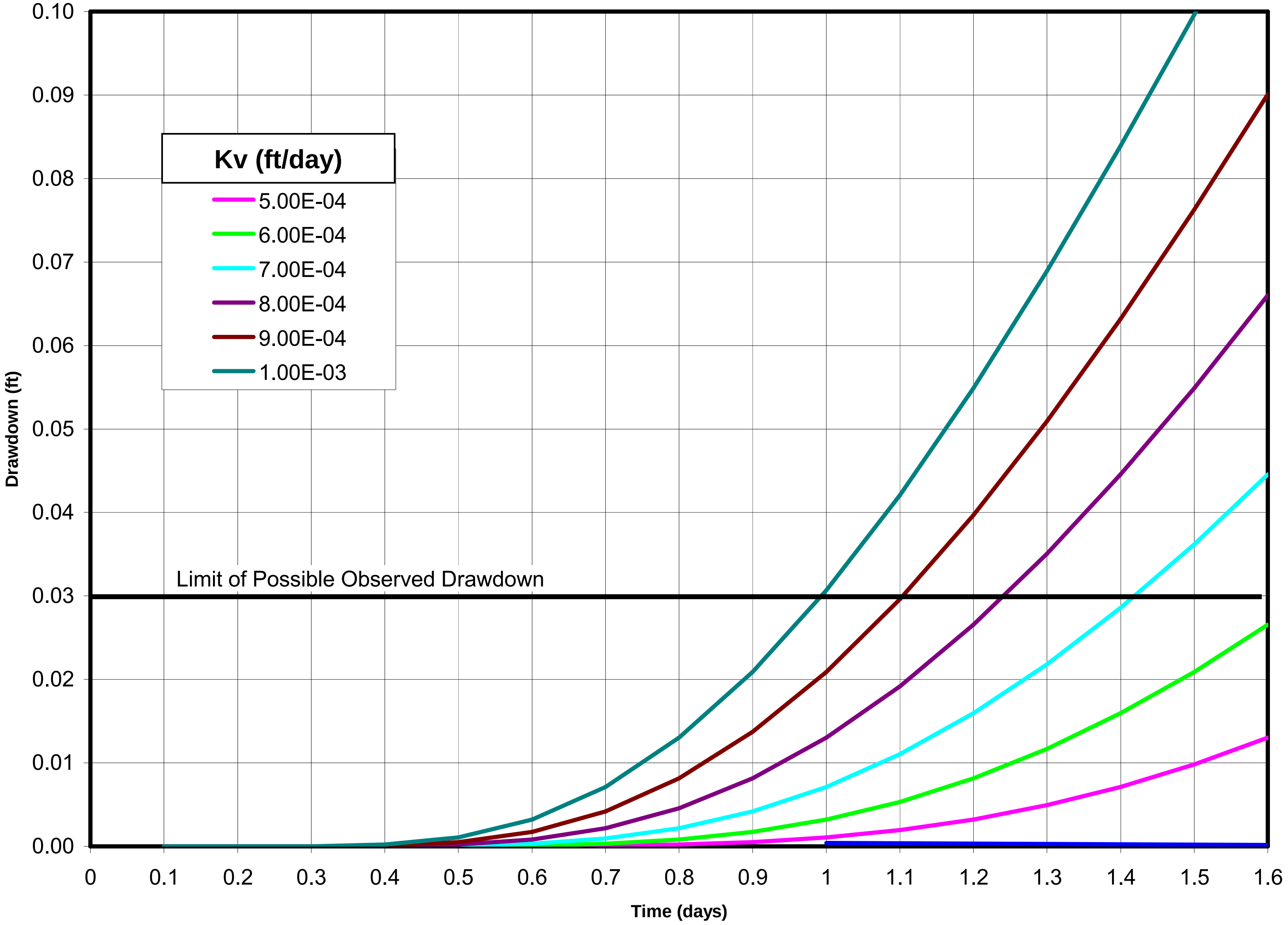
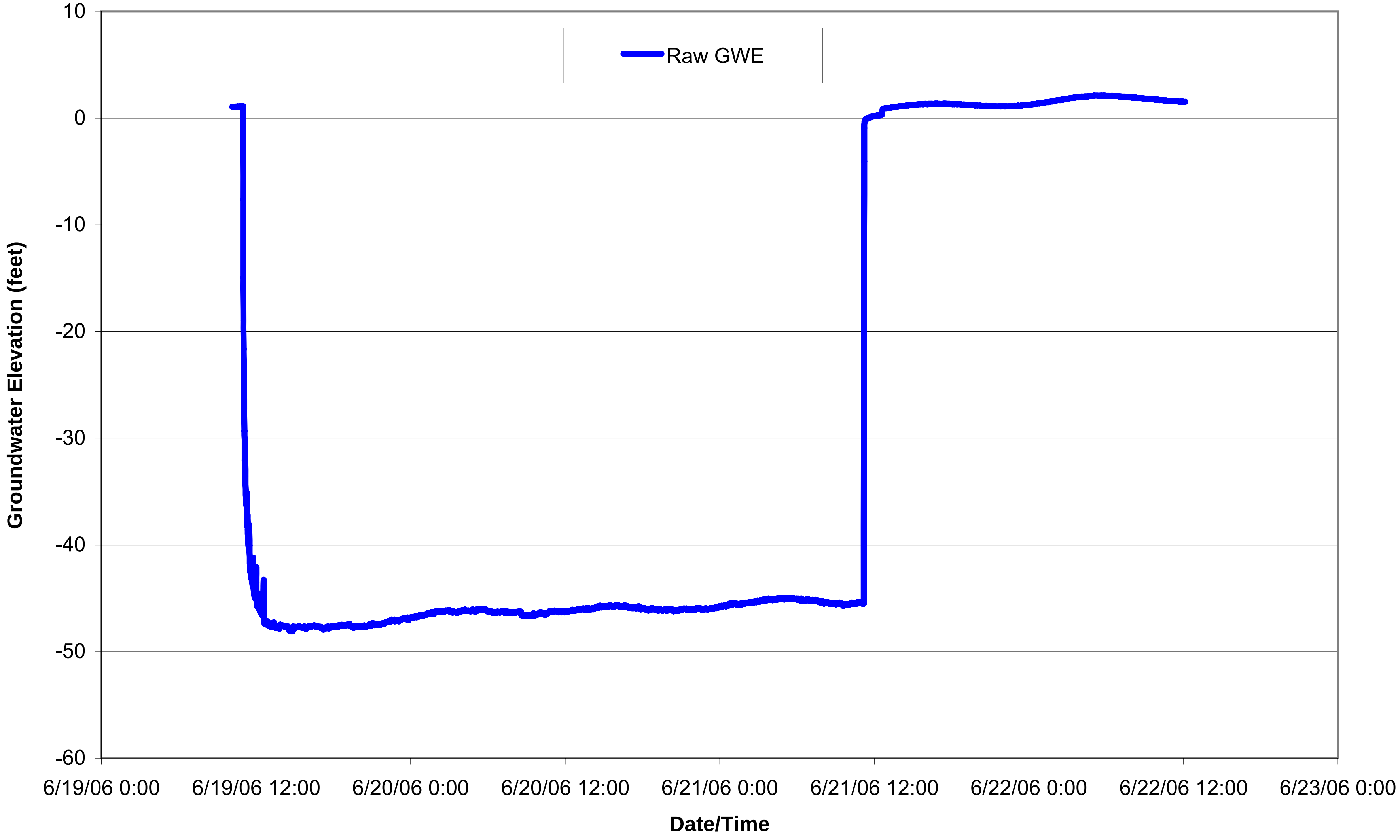
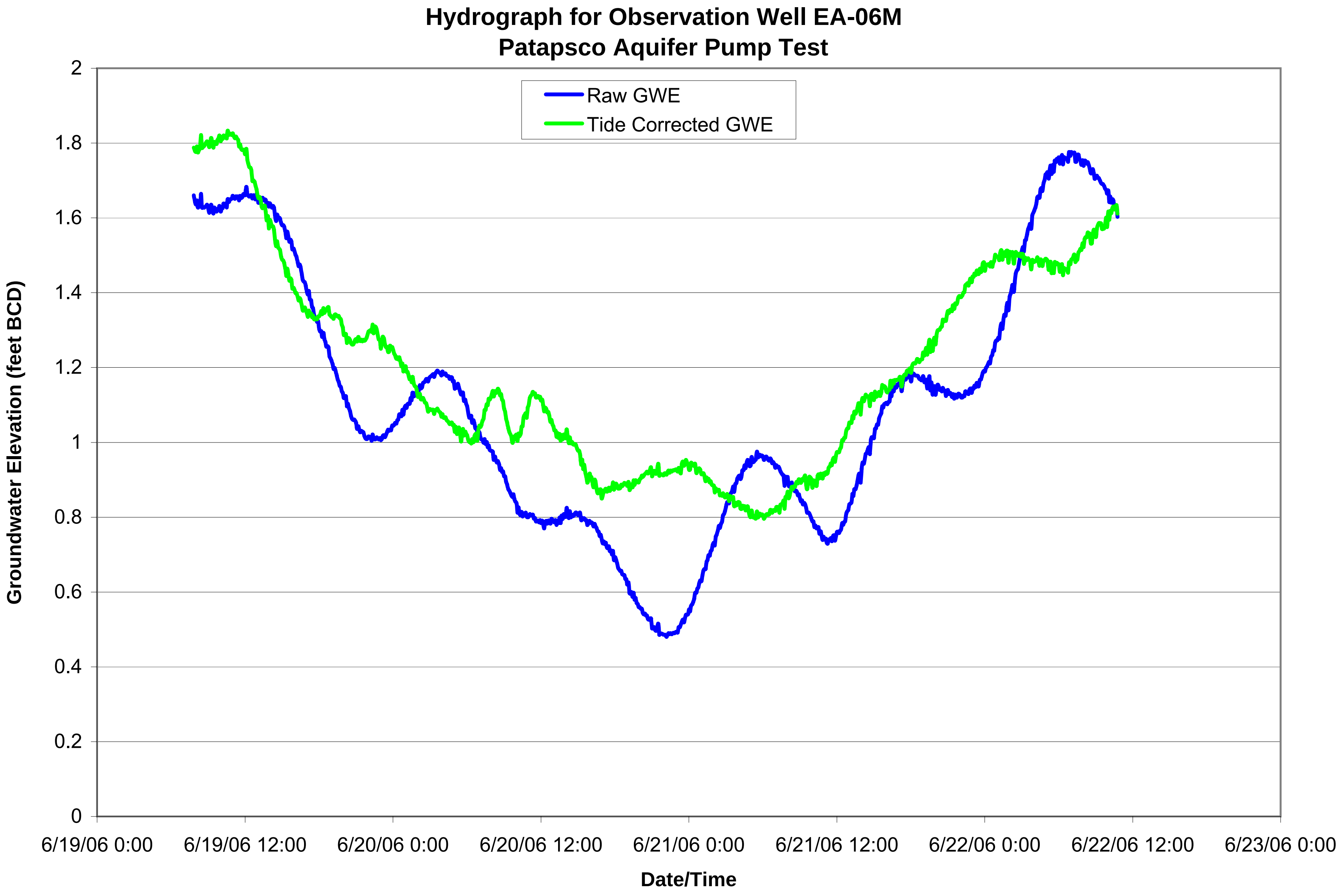


Figure 16
Curves of Calculated Drawdown Propagation to the Screen of Piezometer TPZ-3 for a Range of Vertical Hydraulic Conductivity Values

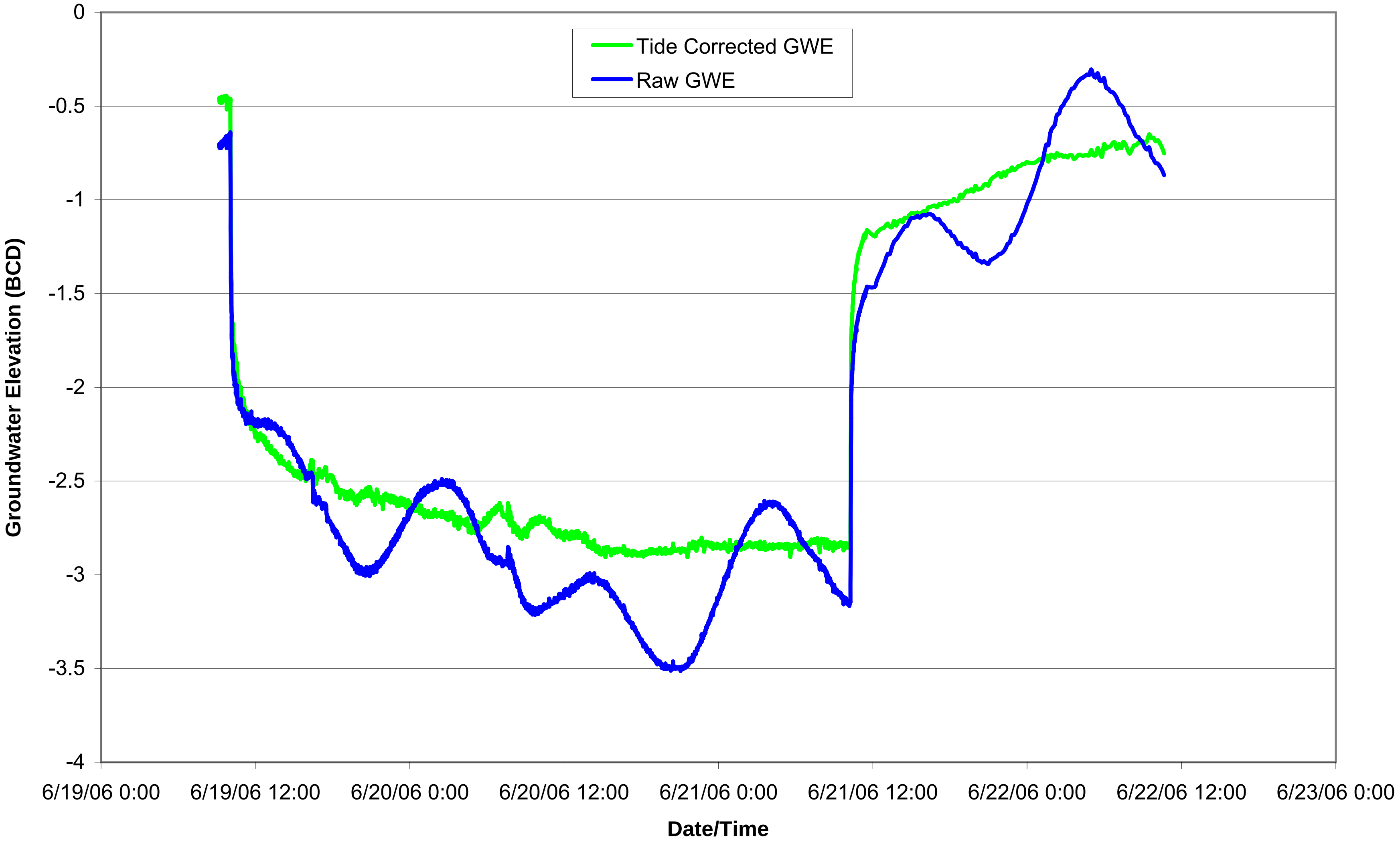
Hydrograph for Pumping Well DMT-01M
Patapsco Aquifer Pump Test



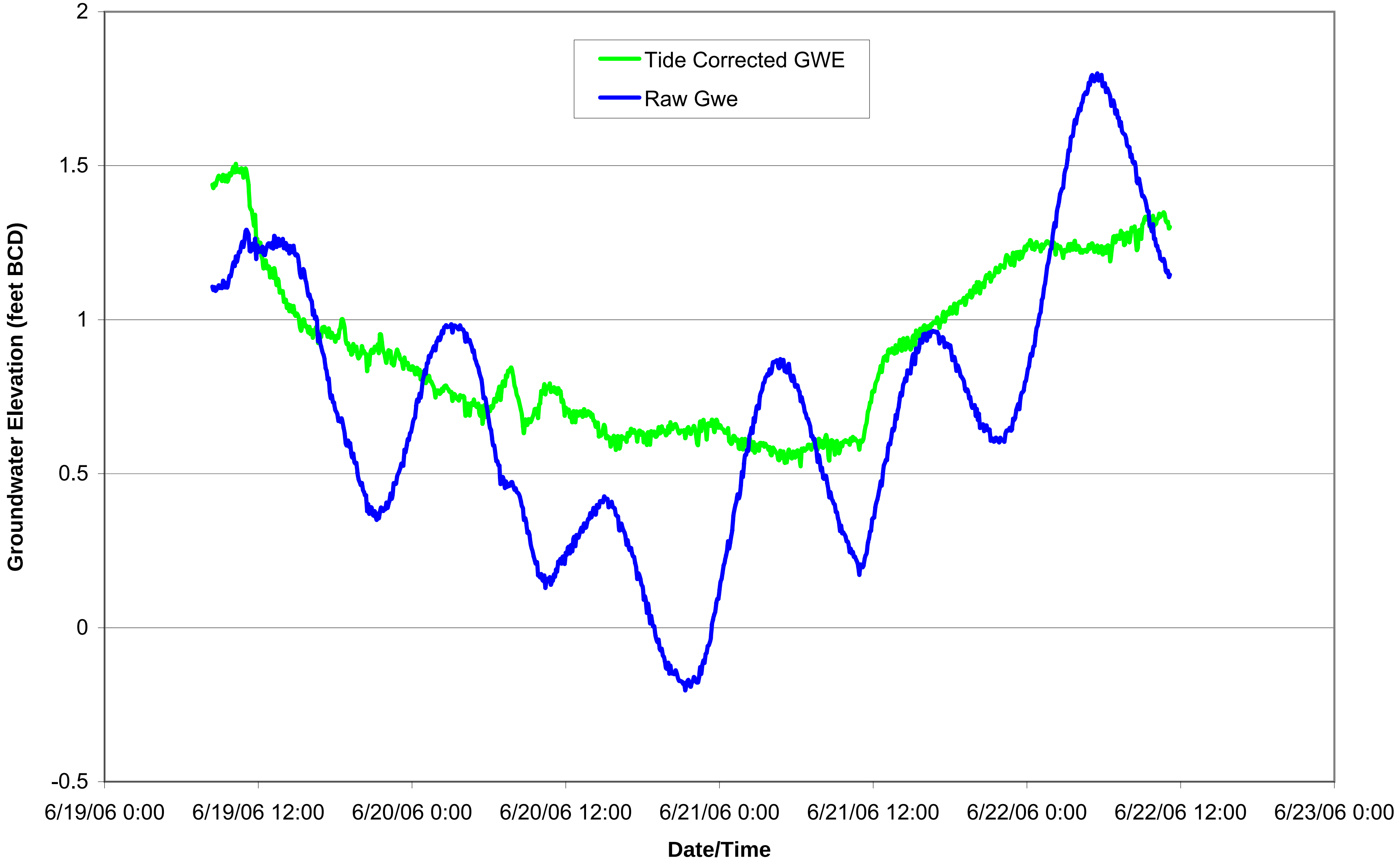


Hydrograph for Observation Well EA-06M
Patapsco Aquifer Pump Test

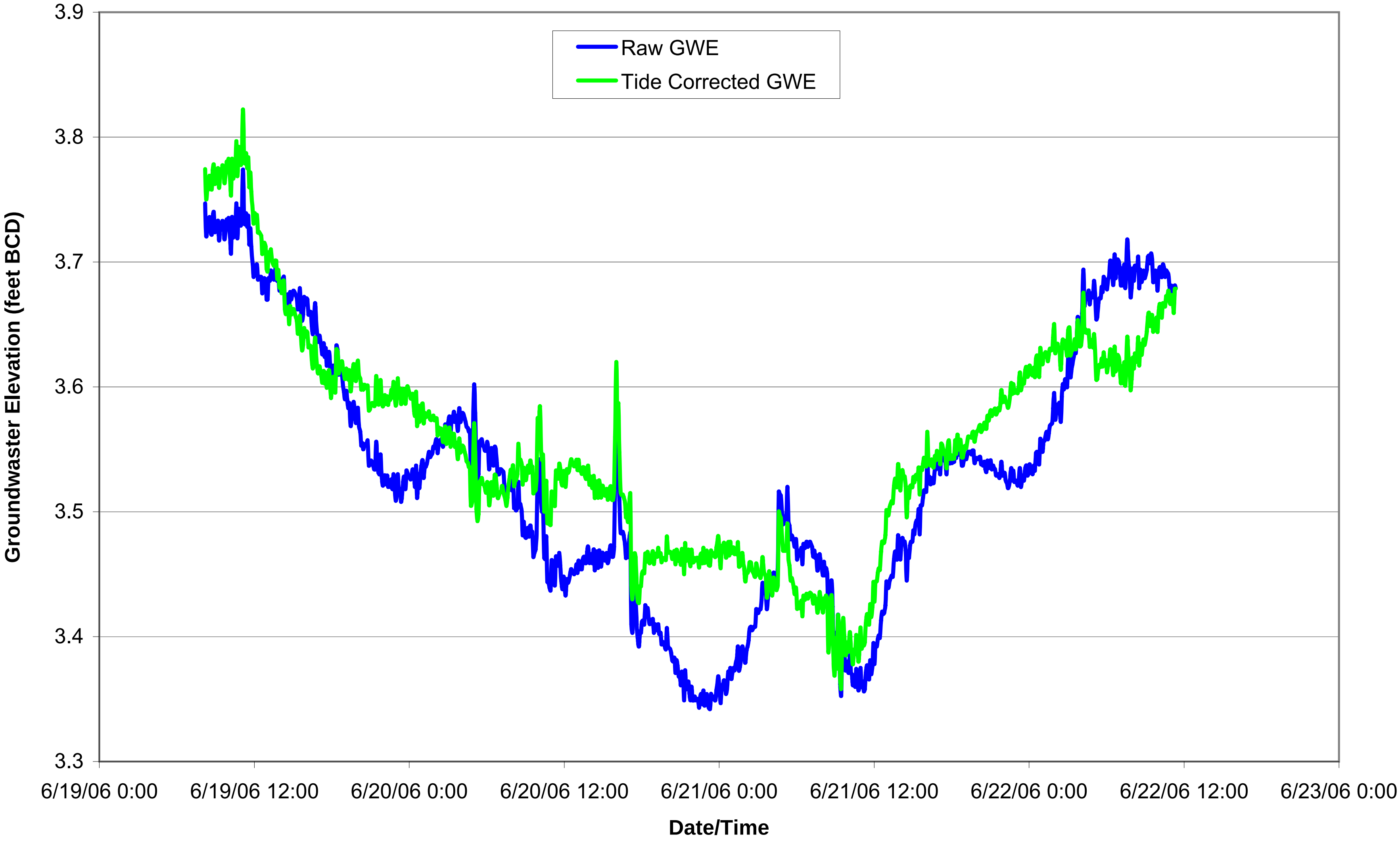
Hydrograph for Observation Well EA-09M
Patapsco Aquifer Pump Test



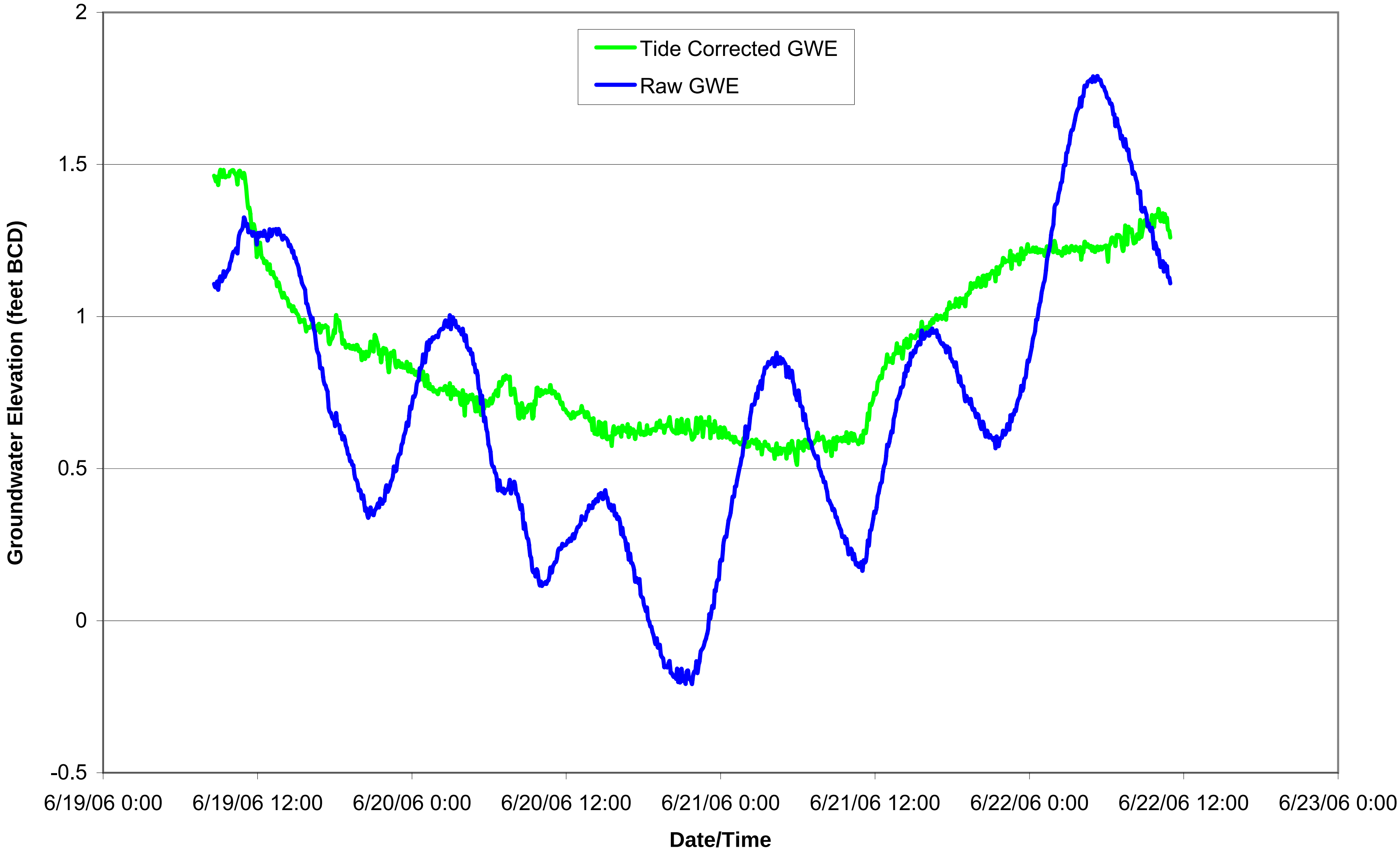
Hydrograph for Observation Well EA-13M
Patapsco Aquifer Pump Test

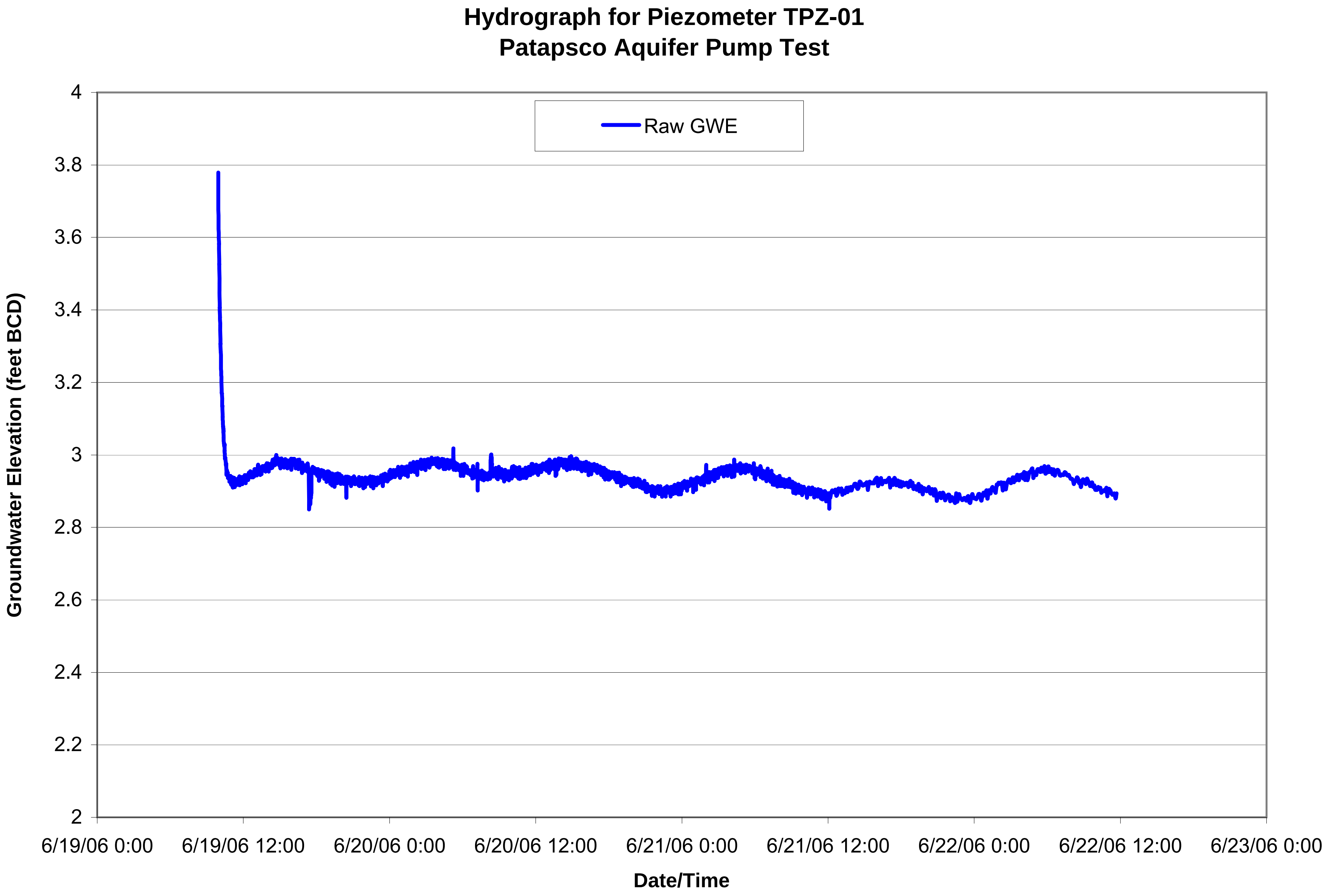


Hydrograph for Observation Well EAC-02M
Patapsco Aquifer Pump Test



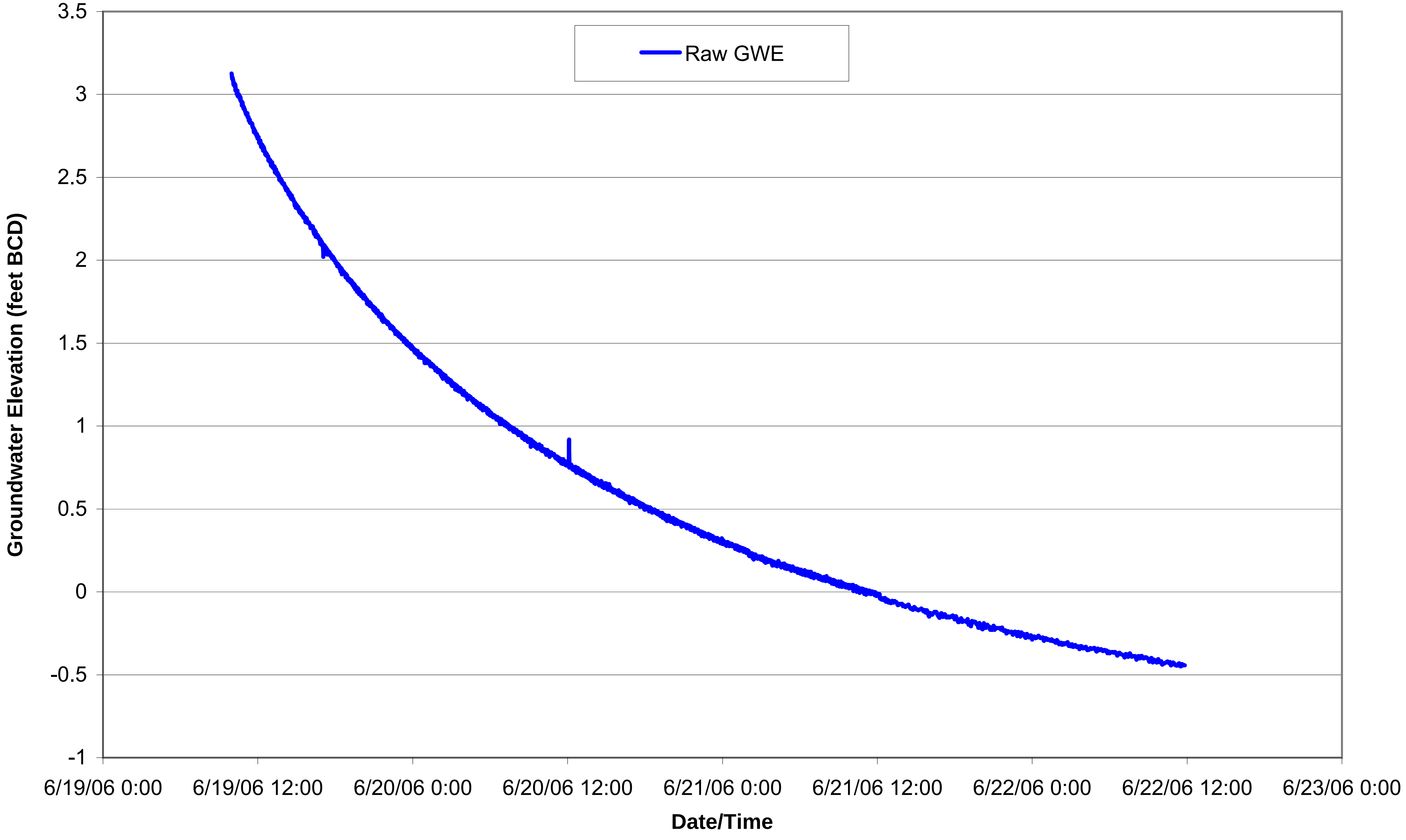
Hydrograph for Observation Well EAC-03M
Patapsco Aquifer Pump Test



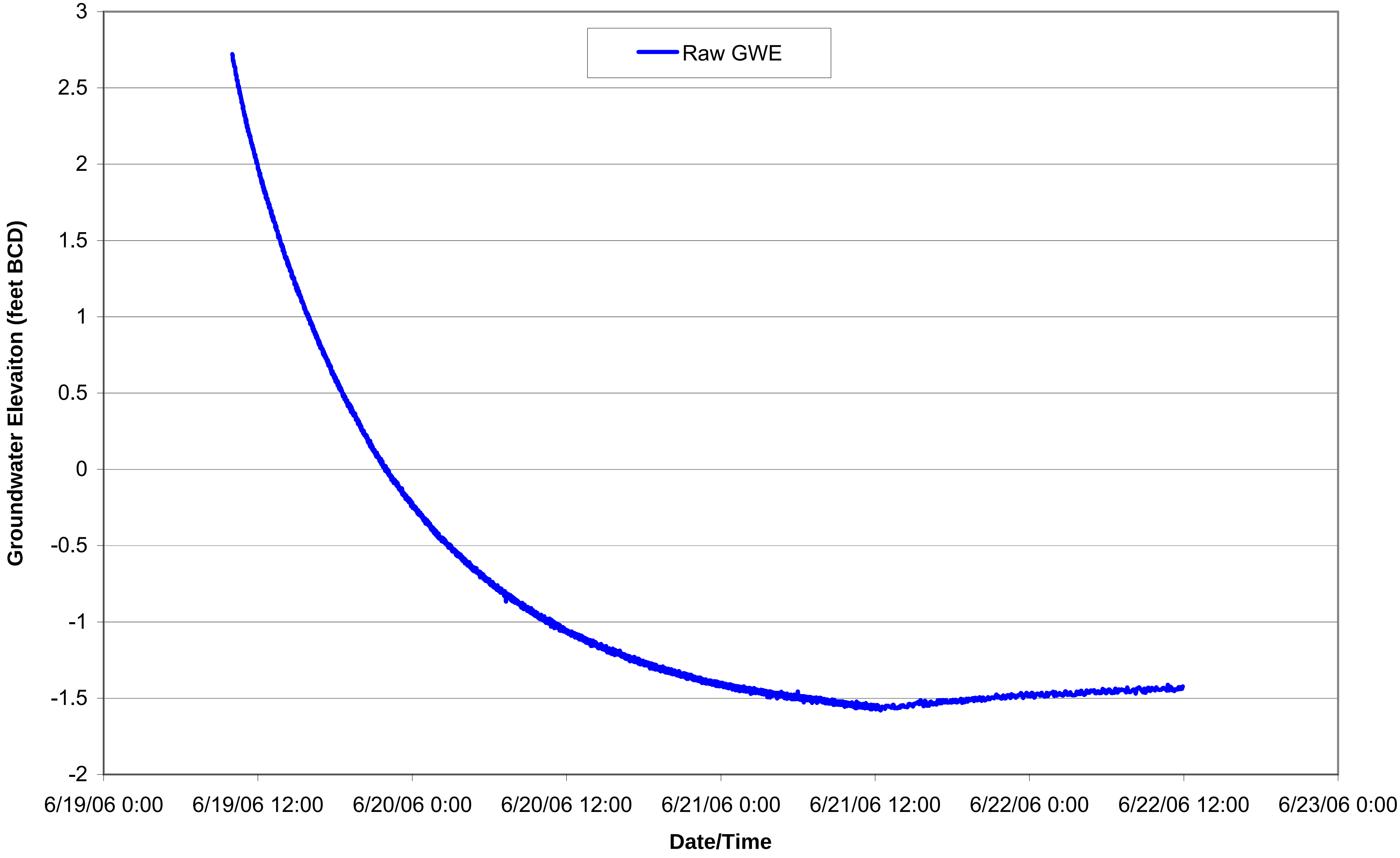


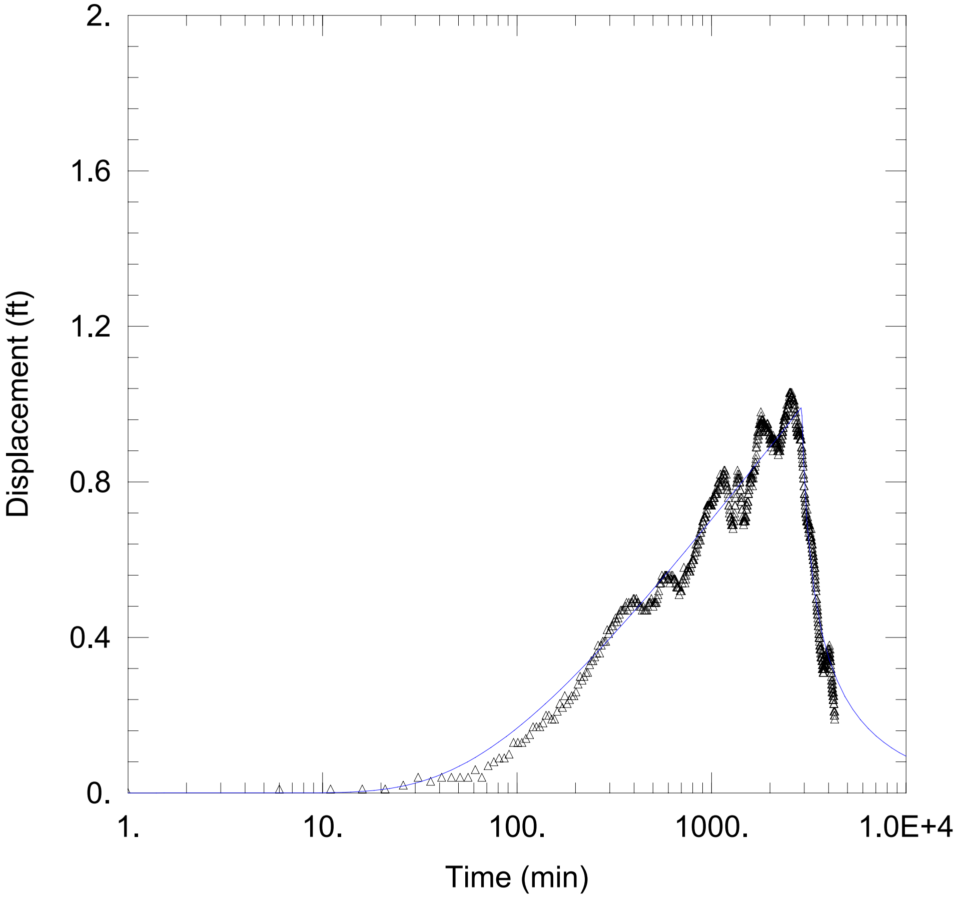
Hydrograph for Piezometer TPZ-01
Patapsco Aquifer Pump Test

Hydorgraph for Piezometer TPZ-02
Patapsco Aquifer PumpTest



Hydrograph for Piezometer TPZ-03
Patapsco Aquifer Pump Test





PATAPSCO AQUIFER TEST

Data Set: C:\...\EA06M.aqt
Date: 08/22/06 Time: 08:47:16

PROJECT INFORMATION

Company: CH2MHILL
Client: Honeywell
Location: DMT
Test Well: DMT-01M
Test Date: 6/19/06

SOLUTION

Aquifer Model: Confined
Solution Method: Theis

T = 1540.8 ft^2/day
S = 0.0004199
Kz/Kr = 1.
b = 21. ft

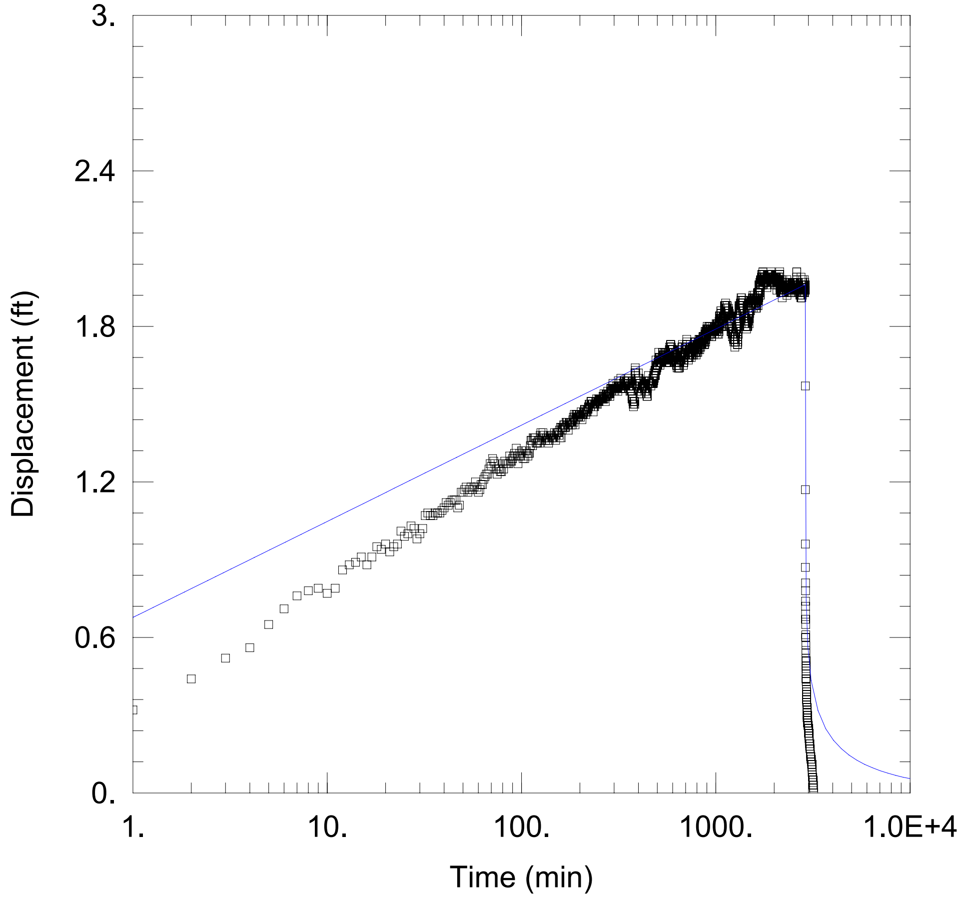
WELL DATA

Pumping Wells

Well Name	X (ft)	Y (ft)
DMT-01M	574770.85	1447035.85

Observation Wells

Well Name	X (ft)	Y (ft)
△ EA-06M	574466.068	1447657.263



PATAPSCO AQUIFER TEST

Data Set: C:\...\EA09M.aqt
Date: 08/22/06 Time: 08:46:32

PROJECT INFORMATION

Company: CH2MHILL
Client: Honeywell
Location: DMT
Test Well: DMT-01M
Test Date: 6/19/06

SOLUTION

Aquifer Model: Confined
Solution Method: Theis

T = 2658.8 ft^2/day
S = 0.0001711
Kz/Kr = 1.
b = 21. ft

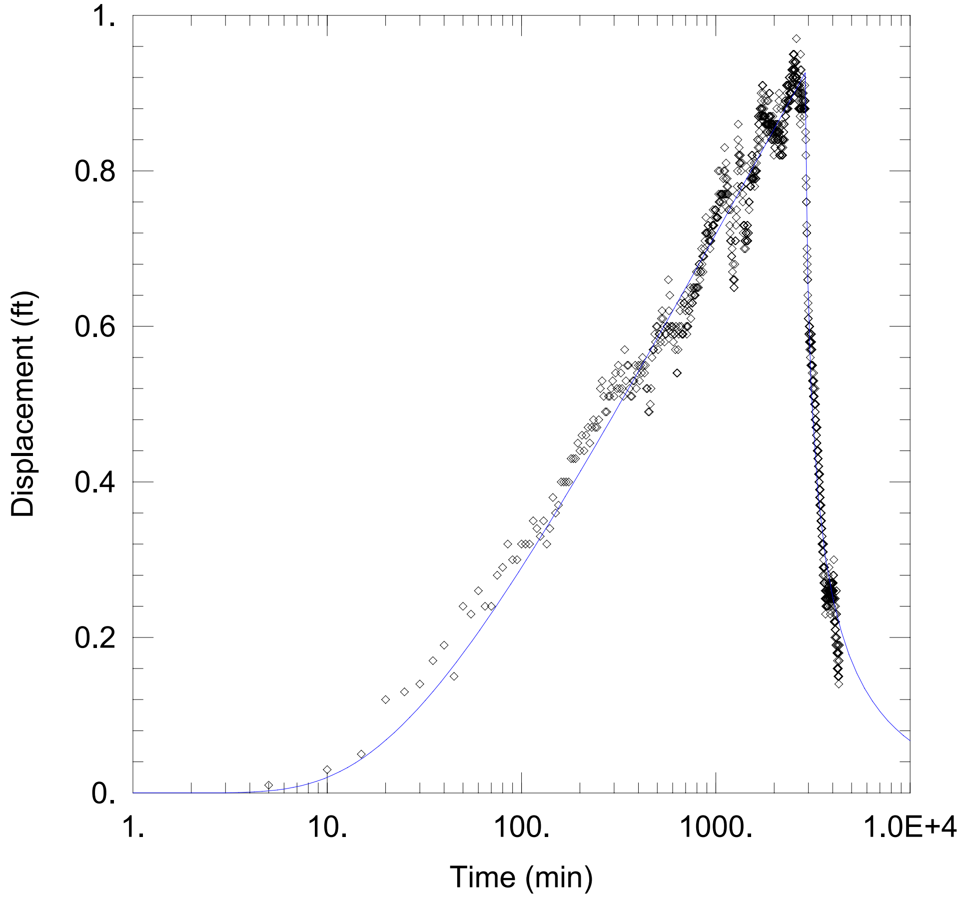
WELL DATA

Pumping Wells

Well Name	X (ft)	Y (ft)
DMT-01M	574770.85	1447035.85

Observation Wells

Well Name	X (ft)	Y (ft)
□ EA-09M	574767.47	1447017.01



PATAPSCO AQUIFER TEST

Data Set: C:\...\EA13M.aqt
Date: 08/22/06 Time: 08:47:46

PROJECT INFORMATION

Company: CH2MHILL
Client: Honeywell
Location: DMT
Test Well: DMT-01M
Test Date: 6/19/06

SOLUTION

Aquifer Model: Confined
Solution Method: Theis

T = 2173.9 ft^2/day
S = 9.032E-5
Kz/Kr = 1.
b = 21. ft

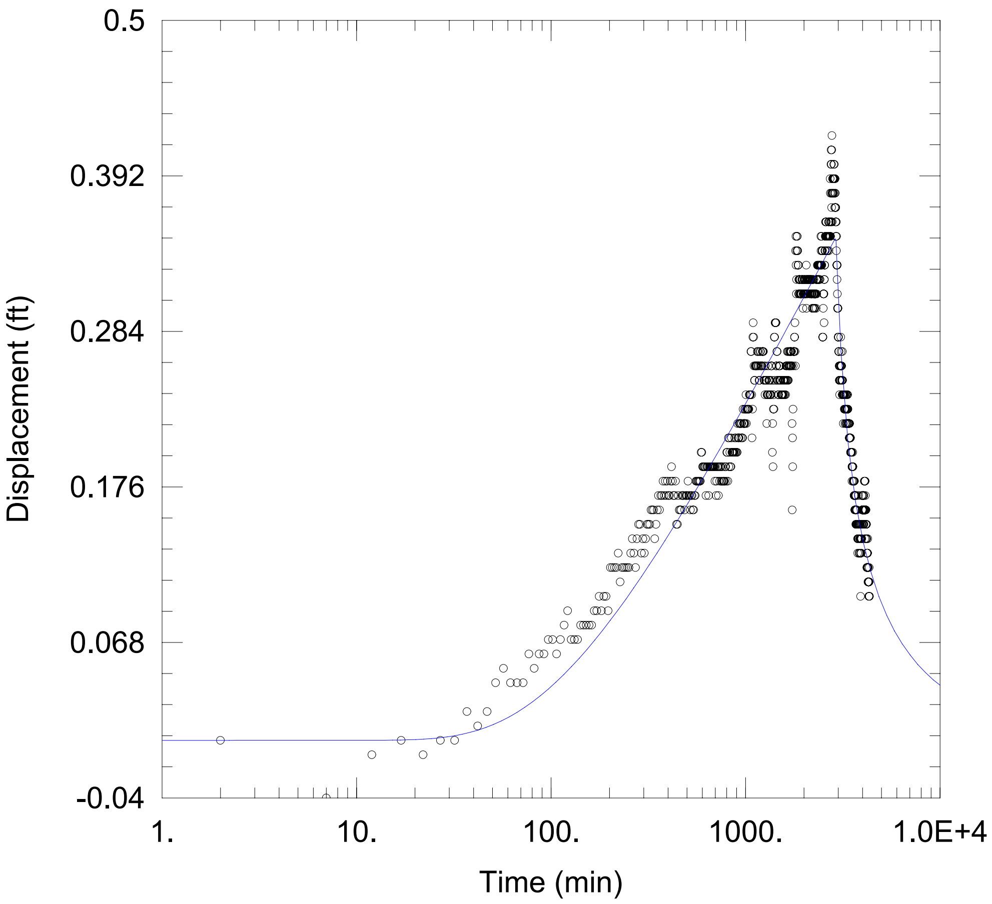
WELL DATA

Pumping Wells

Well Name	X (ft)	Y (ft)
DMT-01M	574770.85	1447035.85

Observation Wells

Well Name	X (ft)	Y (ft)
◇ EA-13M	574686.52	1446040.459



PATAPSCO AQUIFER TEST

Data Set: C:\...\EAC02M.aqt
Date: 08/22/06 Time: 08:48:27

PROJECT INFORMATION

Company: CH2MHILL
Client: Honeywell
Location: DMT
Test Well: DMT-01M
Test Date: 6/19/06

SOLUTION

Aquifer Model: Confined
Solution Method: Theis

T = 3788.2 ft^2/day
S = 0.001229
Kz/Kr = 1.
b = 21. ft

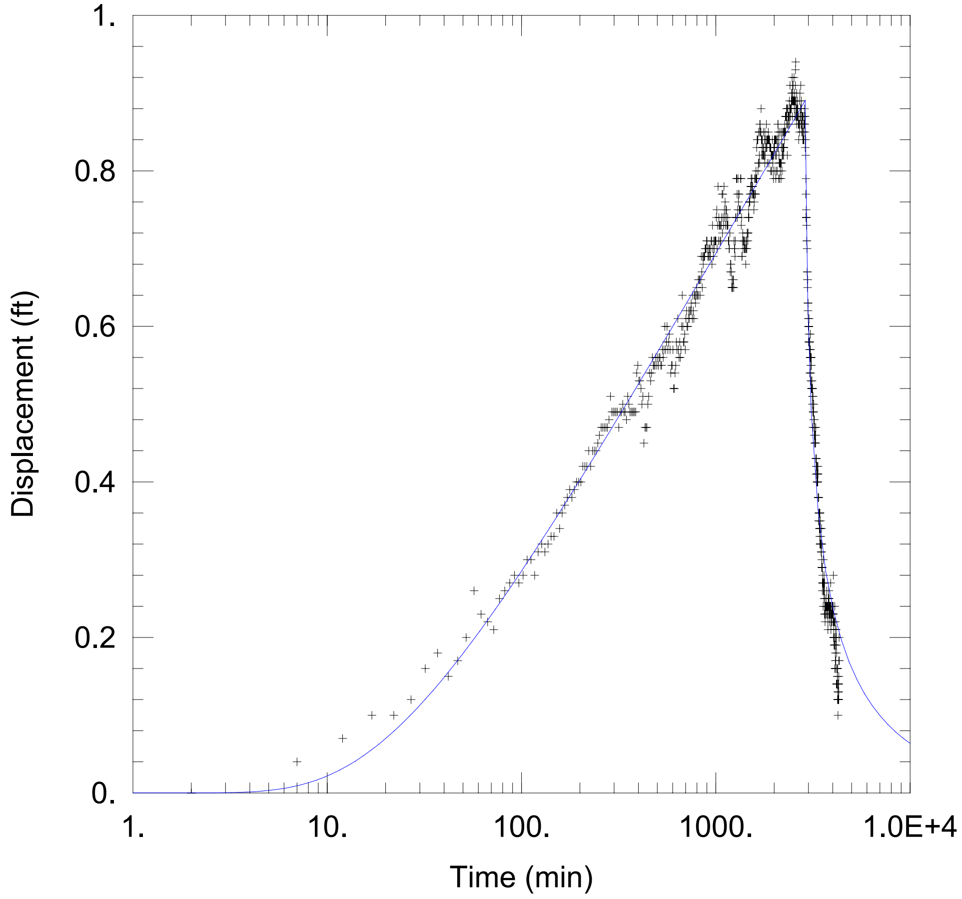
WELL DATA

Pumping Wells

Well Name	X (ft)	Y (ft)
DMT-01M	574770.85	1447035.85

Observation Wells

Well Name	X (ft)	Y (ft)
○ EAC-02M	575580.83	1446990.323



PATAPSCO AQUIFER TEST

Data Set: C:\...\EAC03M.aqt
Date: 08/22/06 Time: 08:45:42

PROJECT INFORMATION

Company: CH2MHILL
Client: Honeywell
Location: DMT
Test Well: DMT-01M
Test Date: 6/19/06

SOLUTION

Aquifer Model: Confined
Solution Method: Theis

T = 2291.4 ft^2/day
S = 0.0004249
Kz/Kr = 1.
b = 21. ft

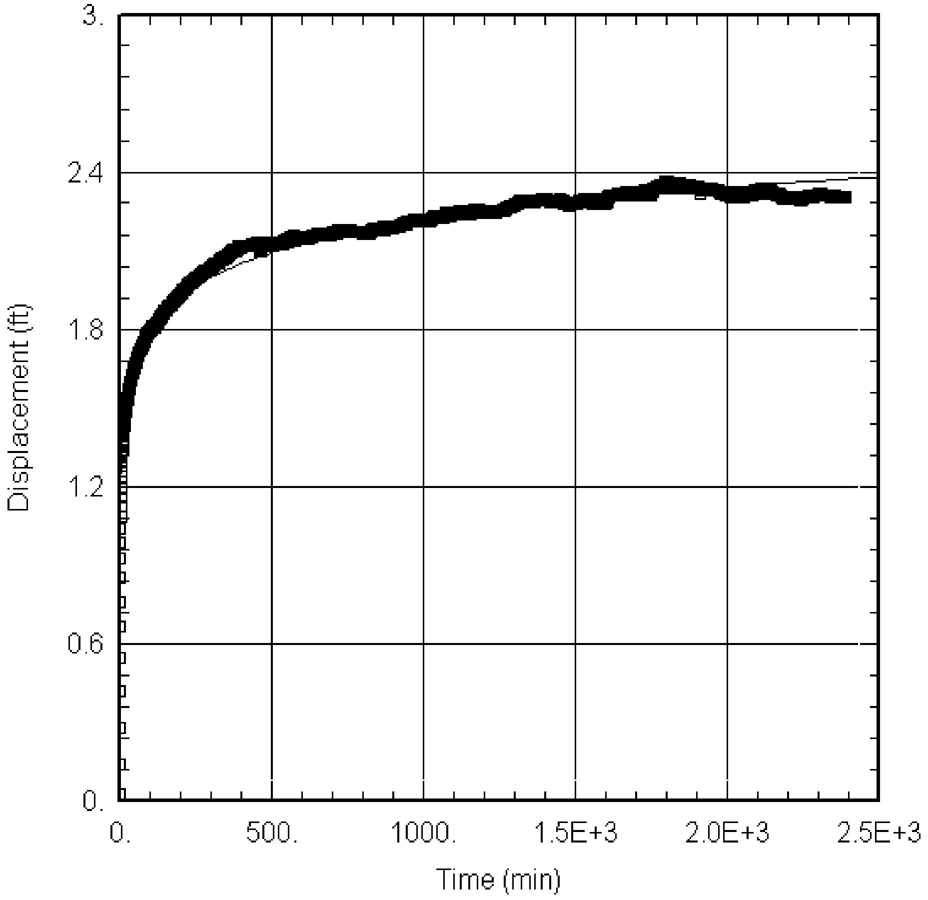
WELL DATA

Pumping Wells

Well Name	X (ft)	Y (ft)
DMT-01M	574770.85	1447035.85

Observation Wells

Well Name	X (ft)	Y (ft)
+ EAC-03M	574316.26	1446980.496



SECOND DMT-1M TEST

Data Set: C:\Dundalk\DeepAquiferTest\Test2\EA-9M.aqt
Date: 04/15/08 Time: 11:47:35

PROJECT INFORMATION

Company: CH2M HILL
Client: Honeywell, Inc.
Location: DMT
Test Well: DMT-1M
Test Date: 10/31 - 11/2, 2006

WELL DATA

Pumping Wells

Well Name	X (ft)	Y (ft)
DMT-1M	1447036	574771

Observation Wells

Well Name	X (ft)	Y (ft)
□ EA-9M	1447017	574767

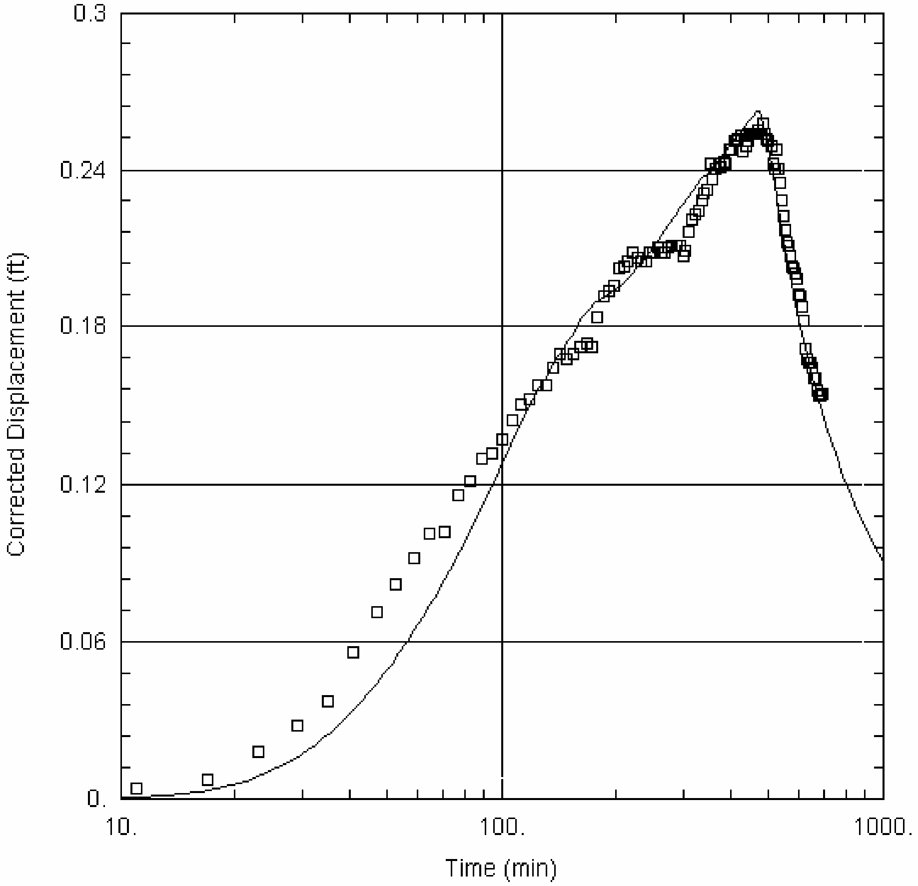
SOLUTION

Aquifer Model: Confined

Solution Method: Theis

T = 2361.7 ft^2/day
Kz/Kr = 1.

S = 4.97E-5
b = 18. ft



WELL TEST ANALYSIS

Data Set: C:\Dundalk\ShallowAquiferTests\Round2\DMT-21S\DMT-20SLoggerFit.aqt
Date: 05/02/07 Time: 09:02:37

PROJECT INFORMATION

Company: CH2M HILL
Client: Honeywell
Location: DMT
Test Well: DMT-21S
Test Date: 1/9/2007

WELL DATA

Pumping Wells

Well Name	X (ft)	Y (ft)
DMT-21S	1445388.78	575423.36

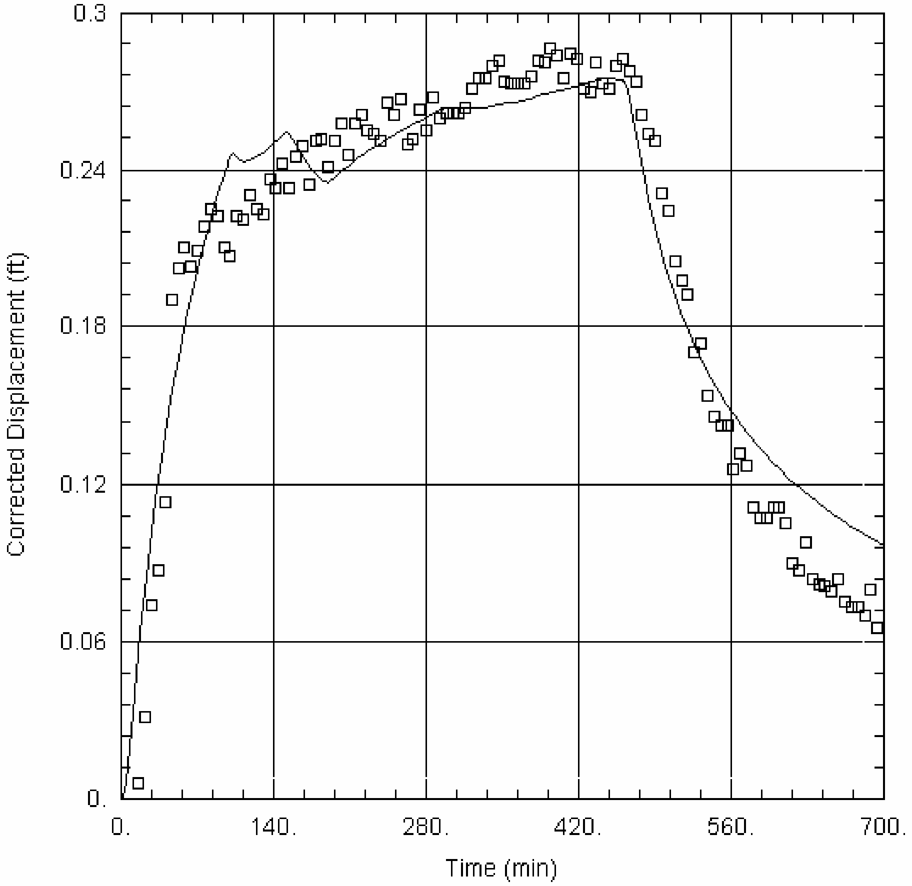
Observation Wells

Well Name	X (ft)	Y (ft)
□ DMT-20S	1445408.53	575421.83

SOLUTION

Aquifer Model: Unconfined
Solution Method: Theis

T = 64.72 ft^2/day
Kz/Kr = 1.
S = 0.02381
b = 30. ft



WELL TEST ANALYSIS

Data Set: C:\Dundalk\ShallowAquiferTests\Round2\DMT-21S\TPZ-24SLoggerFit.aqt
Date: 05/03/07 Time: 09:33:36

PROJECT INFORMATION

Company: CH2M HILL
Client: Honeywell
Location: DMT
Test Well: DMT-21S
Test Date: 1/9/2007

WELL DATA

Pumping Wells

Well Name	X (ft)	Y (ft)
DMT-21S	1445388.78	575423.36

Observation Wells

Well Name	X (ft)	Y (ft)
□ TPZ-24	1445408.53	575421.83

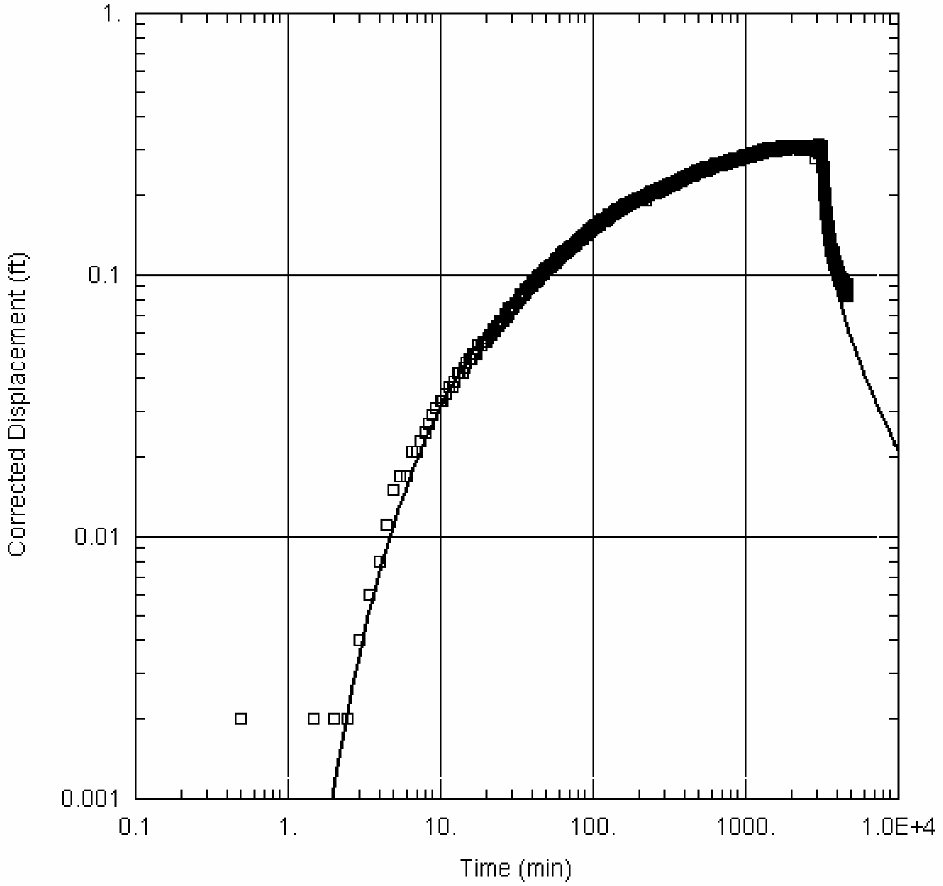
SOLUTION

Aquifer Model: Unconfined

Solution Method: Theis

T = 107.6 ft^2/day
Kz/Kr = 1.

S = 0.008567
b = 30. ft



WELL TEST ANALYSIS

Data Set: C:\Dundalk\ShallowAquiferTests\DMT-23S\DMT-2SAnalysis.aqt
Date: 05/01/07 Time: 15:48:50

PROJECT INFORMATION

Company: CH2M HILL
Client: Honeywell
Location: DMT
Test Well: DMT-23S
Test Date: Nov. 2-7, 2006

WELL DATA

Pumping Wells

Well Name	X (ft)	Y (ft)
DMT-23S	1445303.52	573823.28

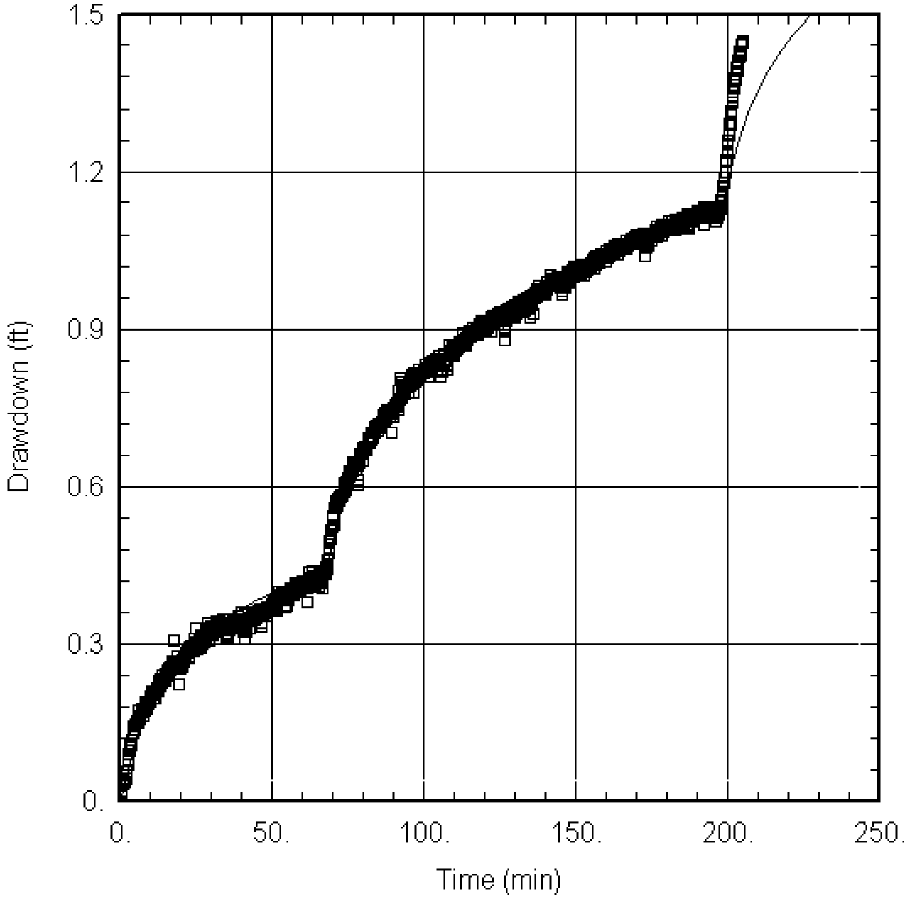
Observation Wells

Well Name	X (ft)	Y (ft)
□ DMT-2S	1445281.87	573811.64

SOLUTION

Aquifer Model: Unconfined
Solution Method: Theis

T = 1052.5 ft^2/day
S = 0.02733
Kz/Kr = 1.
b = 14. ft



STEP-DRAWDOWN TEST

Data Set: C:\Temp\DMT-08S.aqt
Date: 04/15/08 Time: 11:57:50

PROJECT INFORMATION

Company: CH2M HILL
Client: HoneyWell
Location: Dundalk Marine Terminal
Test Well: DMT-24S
Test Date: 6/2/2006

WELL DATA

Pumping Wells

Well Name	X (ft)	Y (ft)
DMT-24S	1446821	574550

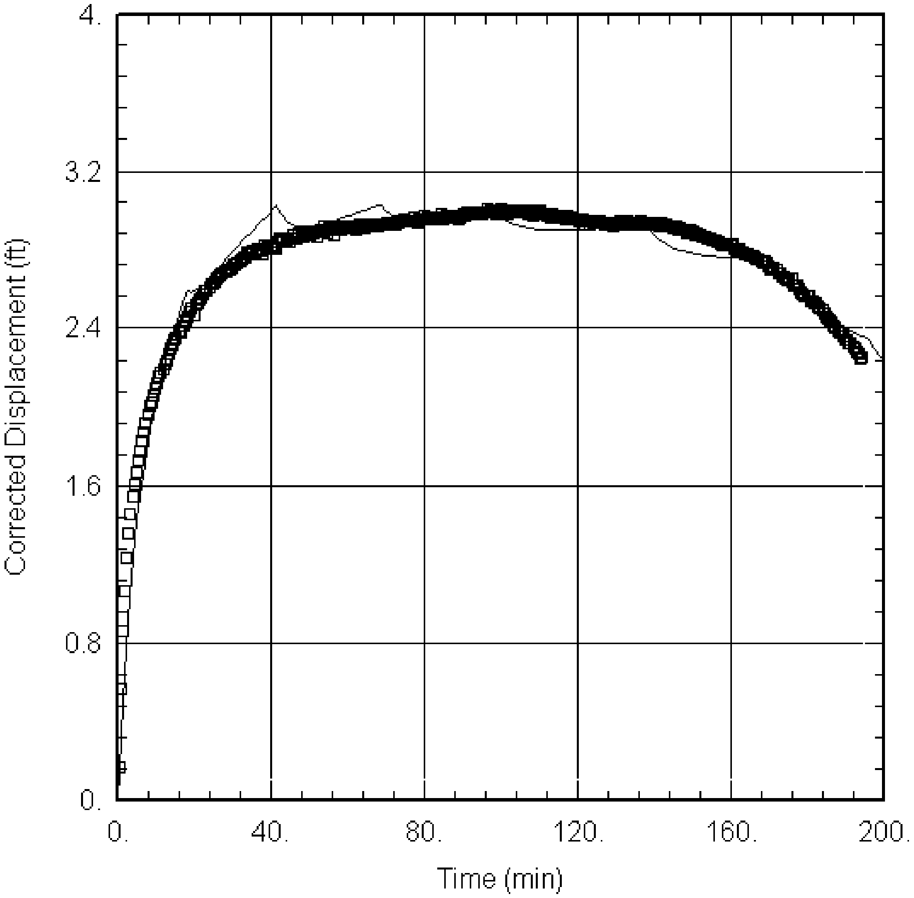
Observation Wells

Well Name	X (ft)	Y (ft)
□ DMT-08S	1446804	574543

SOLUTION

Aquifer Model: Unconfined
Solution Method: Theis

T = 520.9 ft^2/day
S = 0.008471
Kz/Kr = 1.
b = 25. ft



DMT-24S TEST NO. 4

Data Set: C:\Temp\DMT-08SAnalysis.aqt
Date: 04/15/08 Time: 13:20:04

PROJECT INFORMATION

Company: CH2M HILL
Client: Honeywell
Location: Dundalk Marine Terminal
Test Well: DMT-24S
Test Date: 6/29/2006

WELL DATA

Pumping Wells

Well Name	X (ft)	Y (ft)
DMT-24S	1446821.17	574549.68

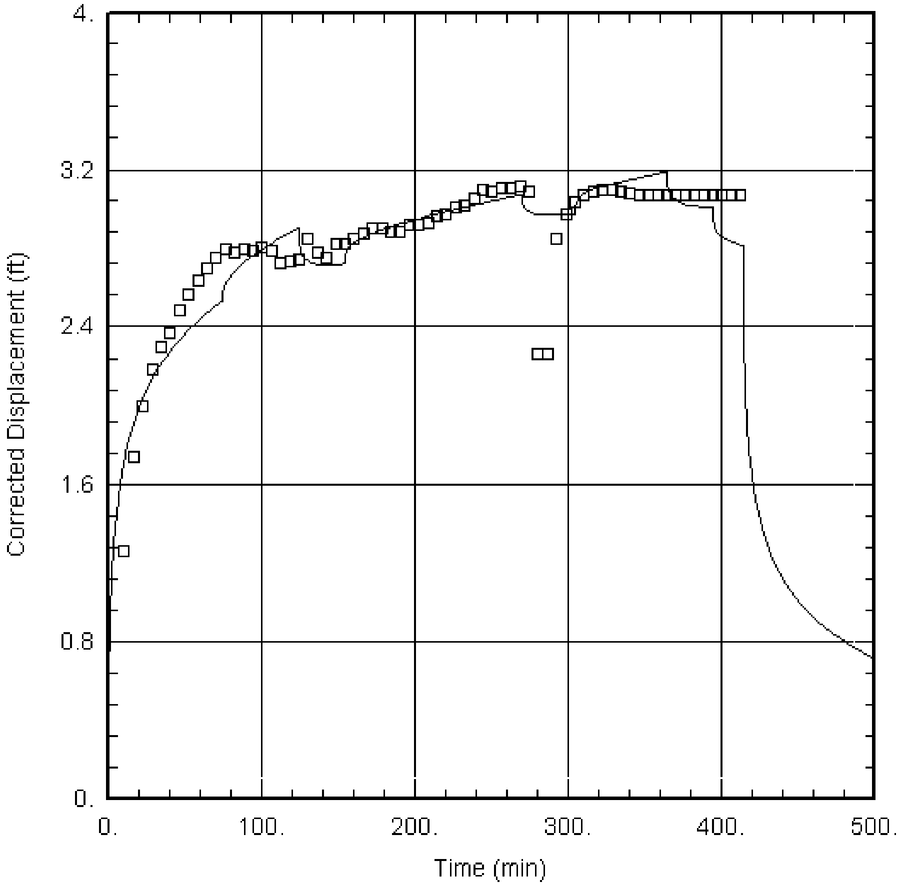
Observation Wells

Well Name	X (ft)	Y (ft)
□ DMT-08S	1446803.88	574542.69

SOLUTION

Aquifer Model: Unconfined
Solution Method: Theis

T = 393.7 ft^2/day
S = 0.002669
Kz/Kr = 1.
b = 25. ft



ANALYSIS OF FIRST 7 HOURS

Data Set: C:\Temp\DMT-8S_First7Hrs.aqt
Date: 04/15/08 Time: 13:32:57

PROJECT INFORMATION

Company: CH2M HILL
Client: Honeywell
Location: DMT
Test Well: DMT-24S
Test Date: 1/2/2007

WELL DATA

Pumping Wells

Well Name	X (ft)	Y (ft)
DMT-24S	1446821.17	574549.68

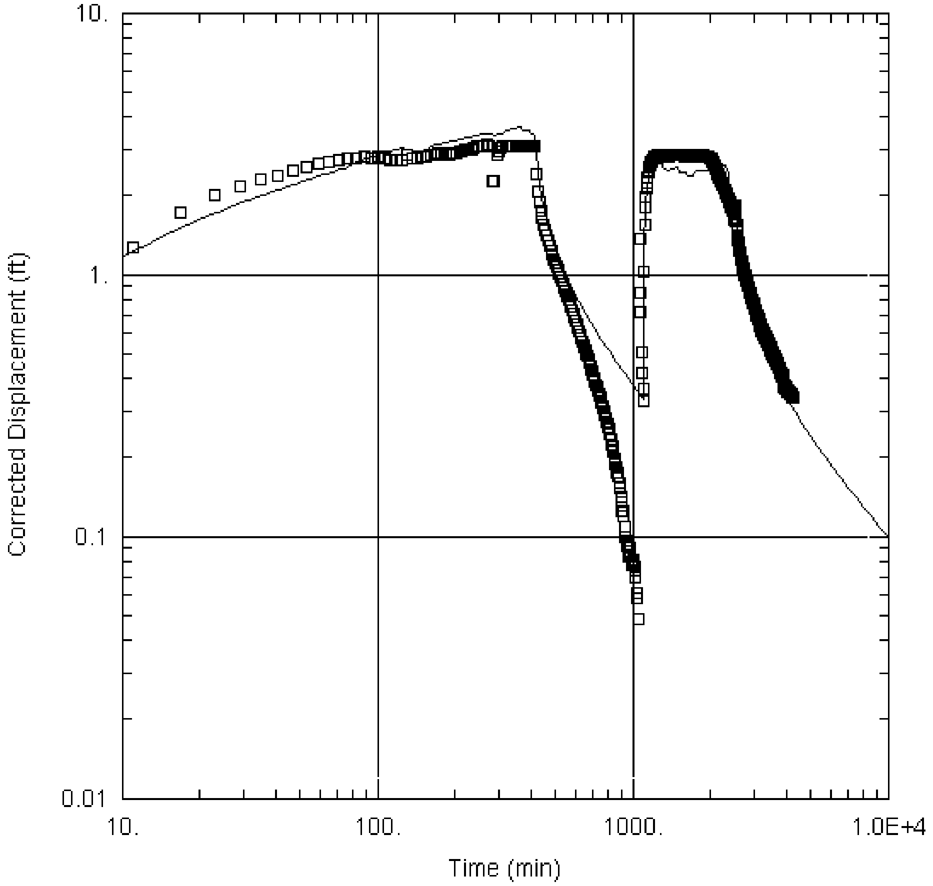
Observation Wells

Well Name	X (ft)	Y (ft)
□ DMT-08S	1446803.88	574542.69

SOLUTION

Aquifer Model: Unconfined
Solution Method: Theis

T = 546.6 ft^2/day
S = 0.0004457
Kz/Kr = 1.
b = 25. ft



WELL TEST ANALYSIS

Data Set: C:\Dundalk\ShallowAquiferTests\Round2\DMT-8S\DMT-8S_WholeCurve.aqt
Date: 01/11/07 Time: 16:44:08

PROJECT INFORMATION

Company: CH2M HILL
Client: Honeywell
Location: DMT
Test Well: DMT-24S
Test Date: 1/2/2007

WELL DATA

Pumping Wells

Well Name	X (ft)	Y (ft)
DMT-24S	1446821.17	574549.68

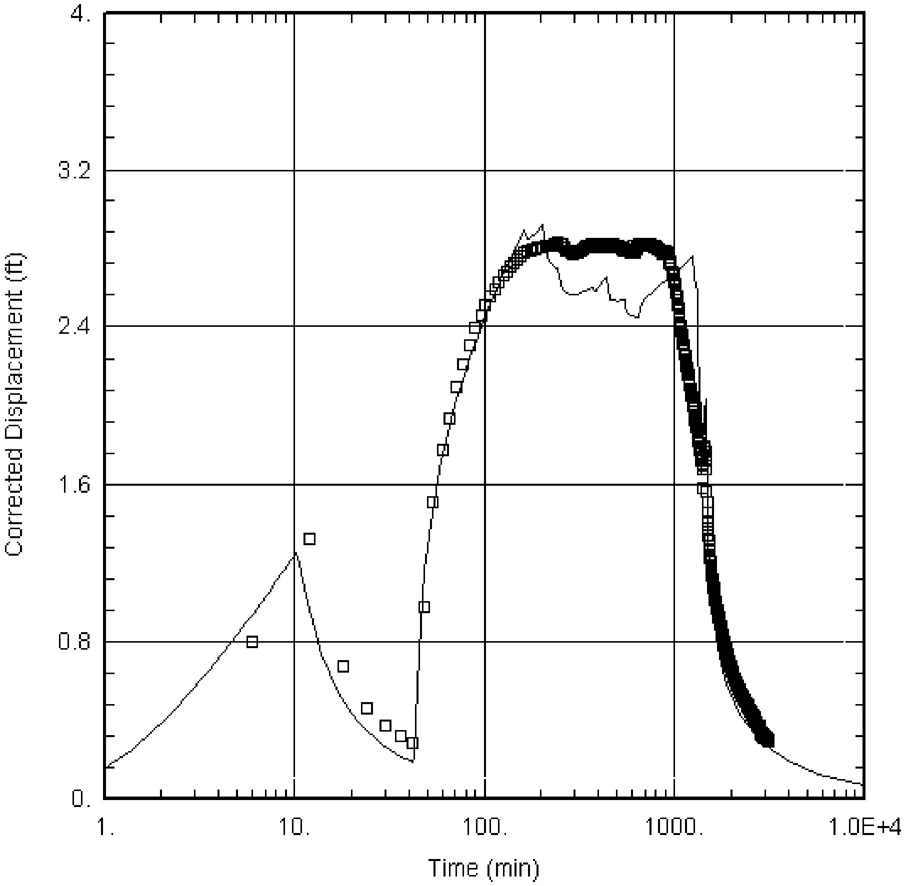
Observation Wells

Well Name	X (ft)	Y (ft)
□ DMT-08S	1446803.88	574542.69

SOLUTION

Aquifer Model: Unconfined
Solution Method: Theis

T = 316. ft^2/day
S = 0.003294
Kz/Kr = 0.1797
b = 25. ft



ANALYSIS OF RESTART

Data Set: C:\Temp\DMT-8S_Restart.aqt
Date: 04/15/08 Time: 13:32:07

PROJECT INFORMATION

Company: CH2M HILL
Client: Honeywell
Location: DMT
Test Well: DMT-24S
Test Date: 1/2/2007

WELL DATA

Pumping Wells

Well Name	X (ft)	Y (ft)
DMT-24S	1446821.17	574549.68

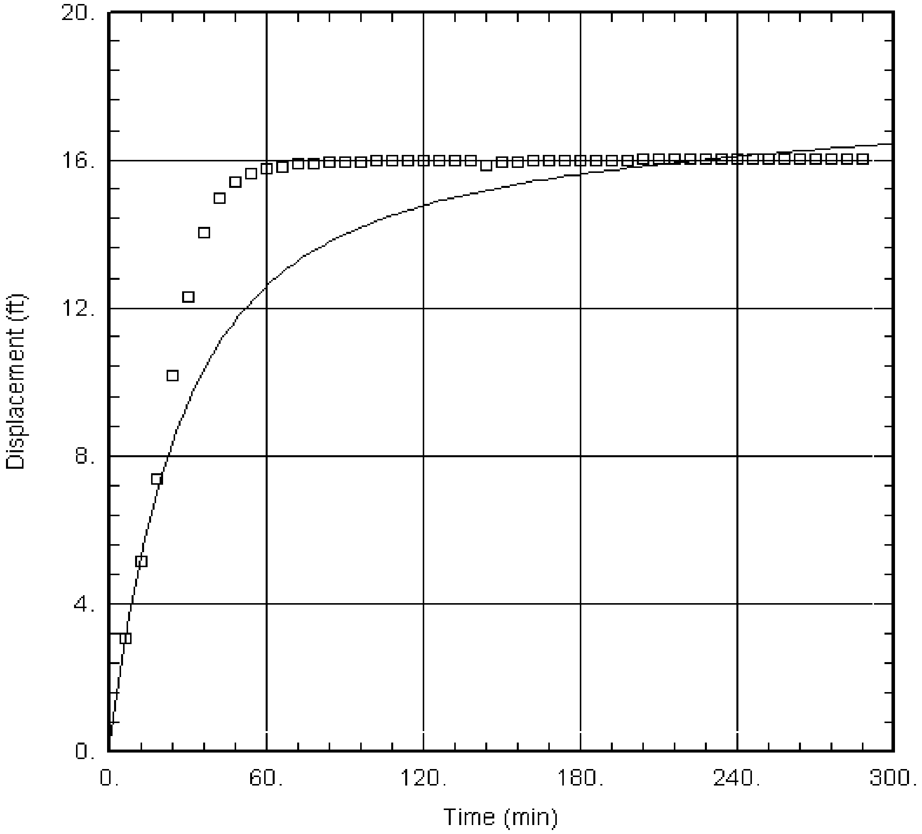
Observation Wells

Well Name	X (ft)	Y (ft)
□ DMT-08S	1446803.88	574542.69

SOLUTION

Aquifer Model: Unconfined
Solution Method: Theis

T = 296. ft^2/day
Kz/Kr = 1.
S = 0.002331
b = 25. ft



WELL TEST ANALYSIS

Data Set: C:\Temp\DMT-25S-Pap-Coop.aqt
Date: 04/15/08 Time: 13:53:20

PROJECT INFORMATION

Company: CH2M HILL
Client: Honeywell
Location: DMT
Test Well: DMT-25S
Test Date: 1/10-11/07

AQUIFER DATA

Saturated Thickness: 23. ft Anisotropy Ratio (Kz/Kr): 1.

WELL DATA

Pumping Wells

Well Name	X (ft)	Y (ft)
DMT-25S	0	0

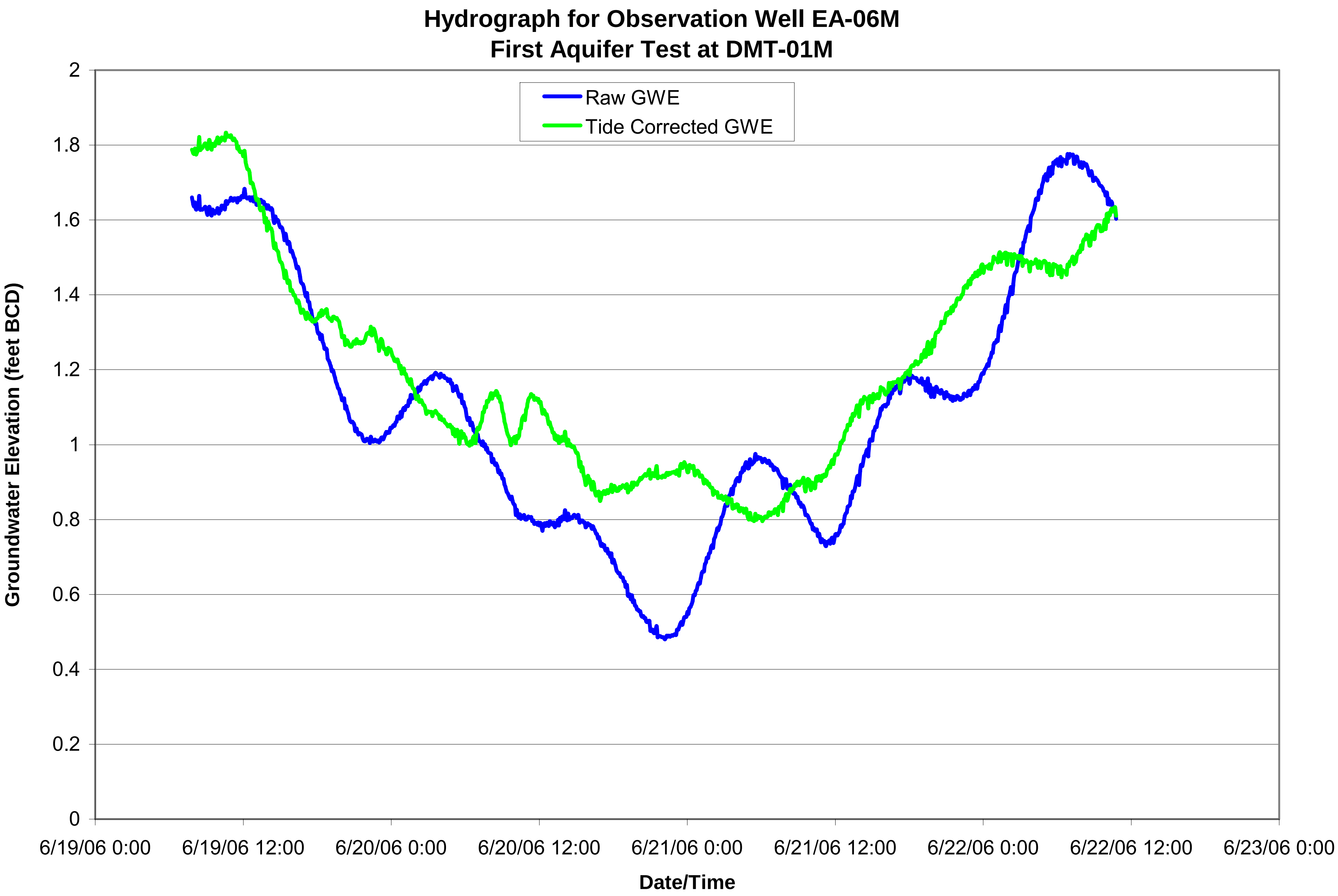
Observation Wells

Well Name	X (ft)	Y (ft)
□ DMT-25S	0	0

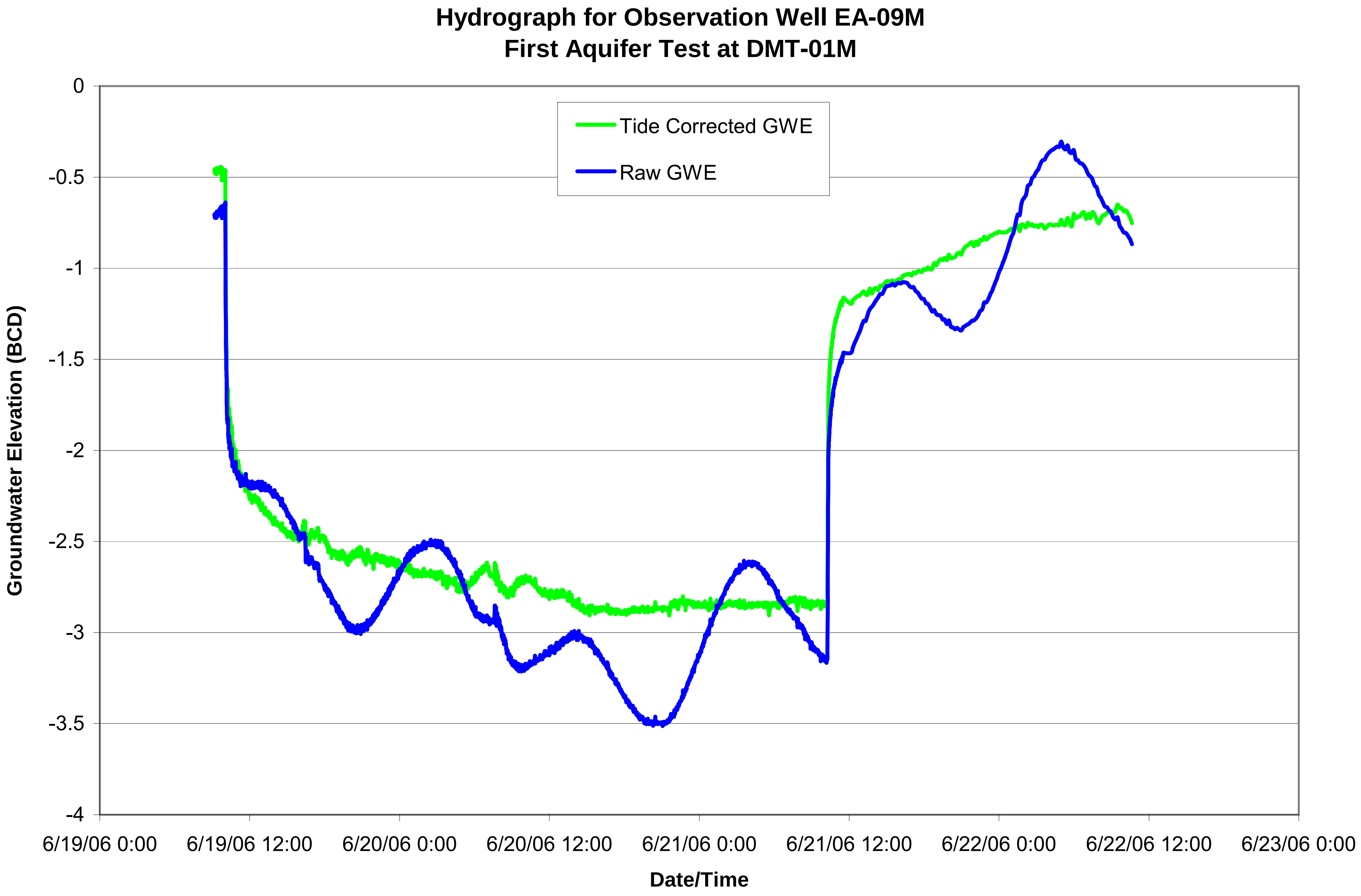
SOLUTION

Aquifer Model: Confined Solution Method: Papadopulos-Cooper

T = 4.795 ft^2/day S = 7.121E-5
r(w) = 0.167 ft r(c) = 0.167 ft

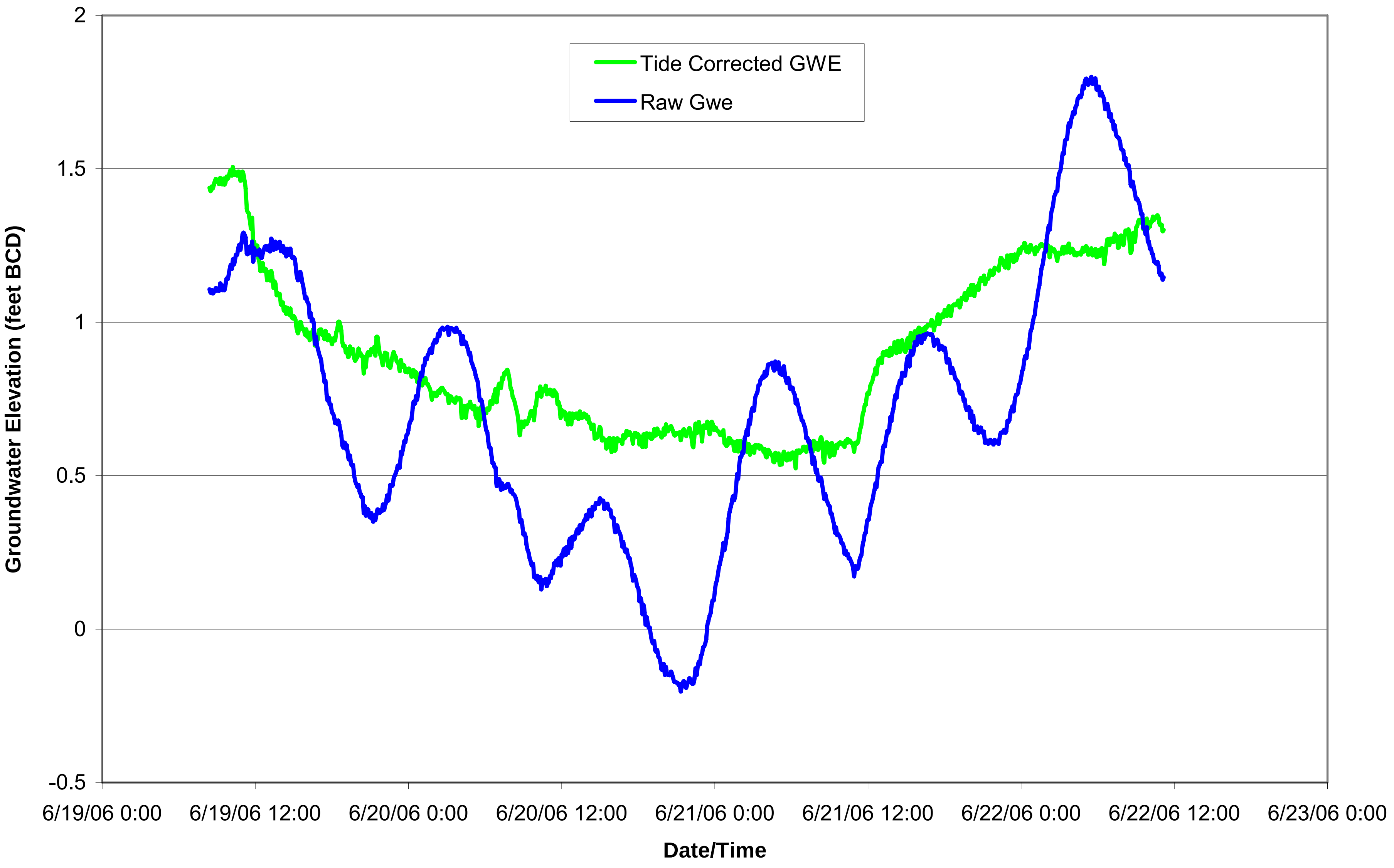


Hydrograph for Observation Well EA-06M
First Aquifer Test at DMT-01M

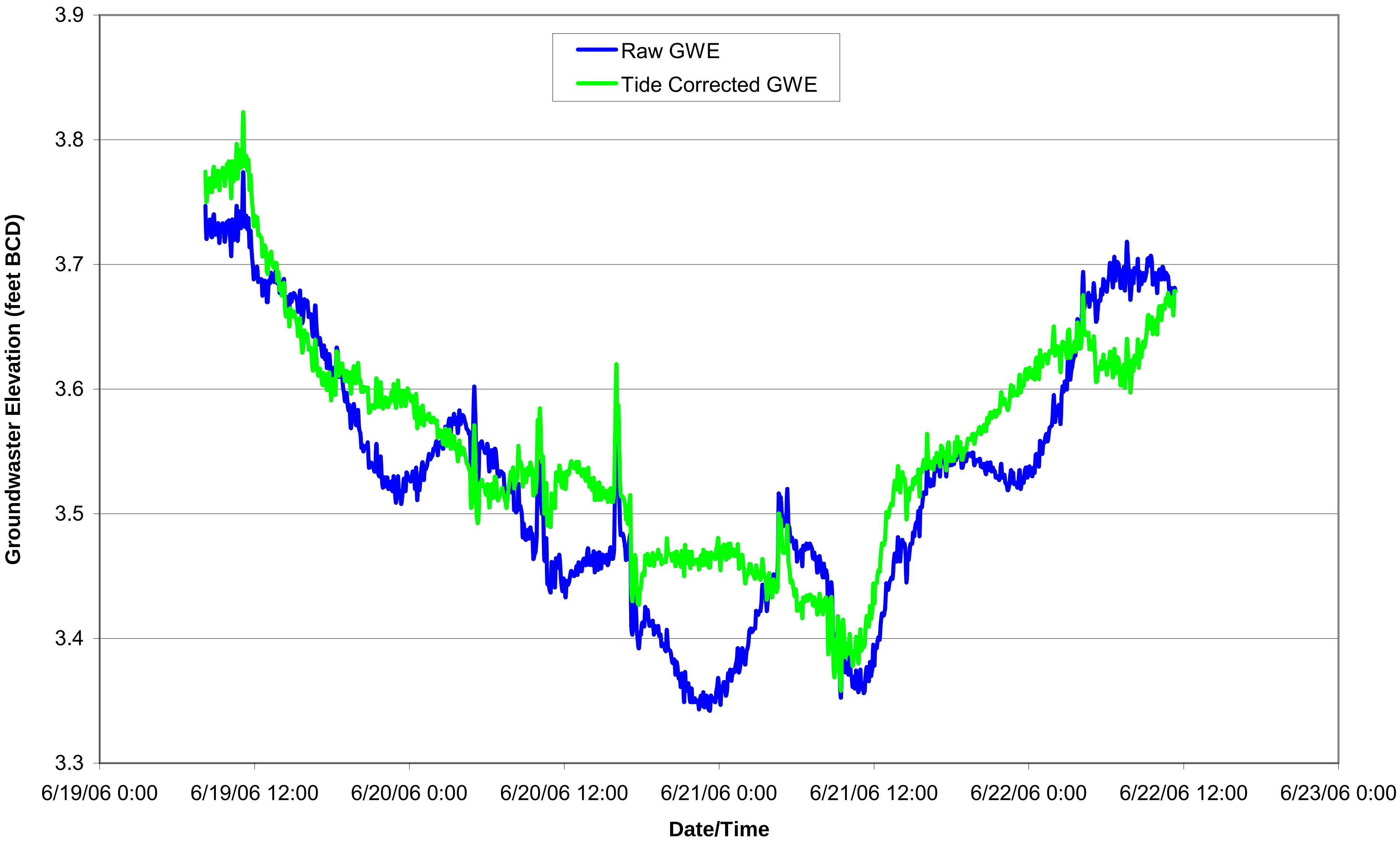


Hydrograph for Observation Well EA-09M
First Aquifer Test at DMT-01M
Tide Corrected GWE
Raw GWE
Groundwater Elevation (BCD)
0
-0.5
-1
-1.5
-2
-2.5
-3
-3.5
-4
6/19/06 0:00
6/19/06 12:00
6/20/06 0:00
6/20/06 12:00
6/21/06 0:00
6/21/06 12:00
6/22/06 0:00
6/22/06 12:00
6/23/06 0:00
Date/Time

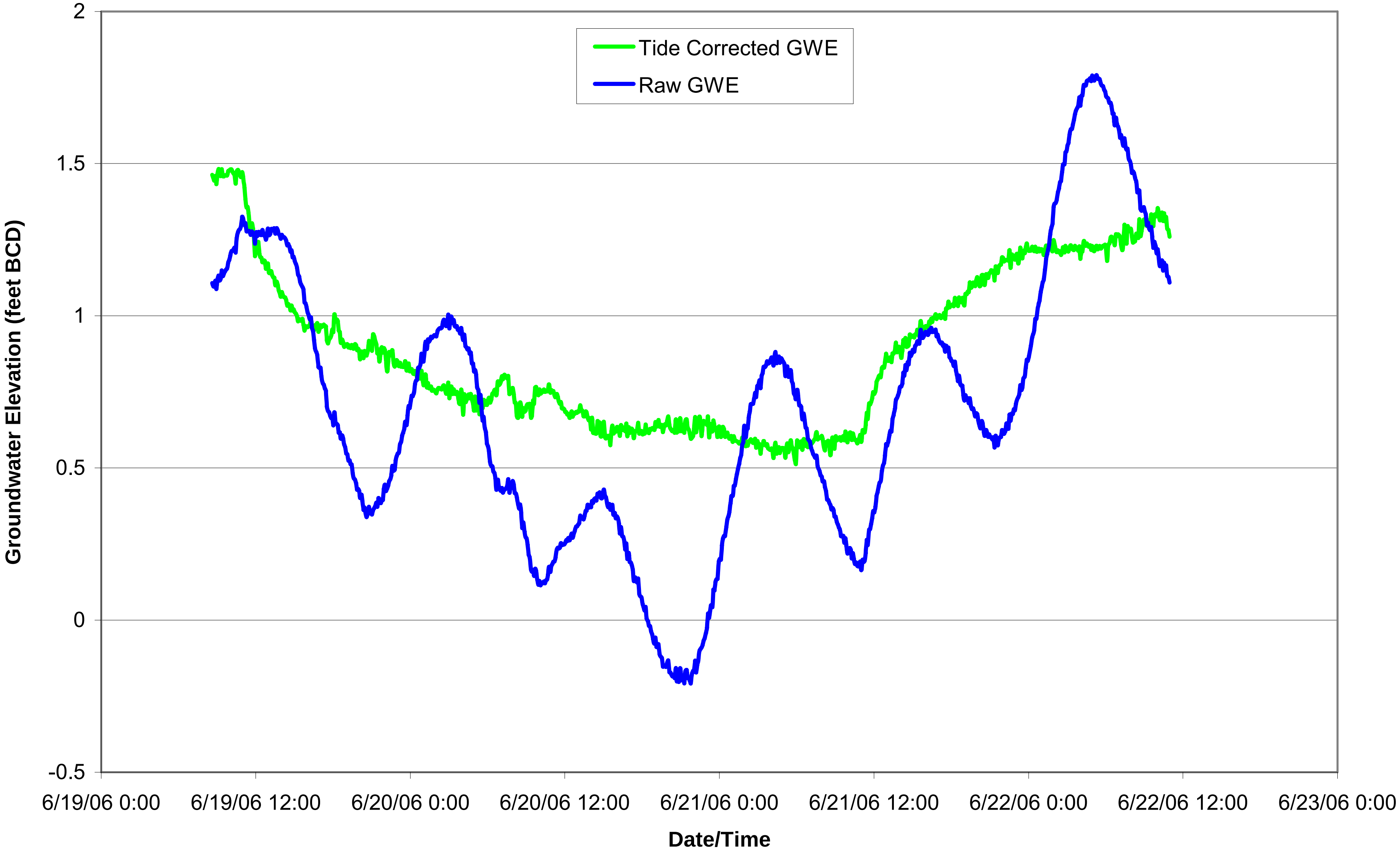
Hydrograph for Observation Well EA-13M
First Aquifer Test at DMT-01M

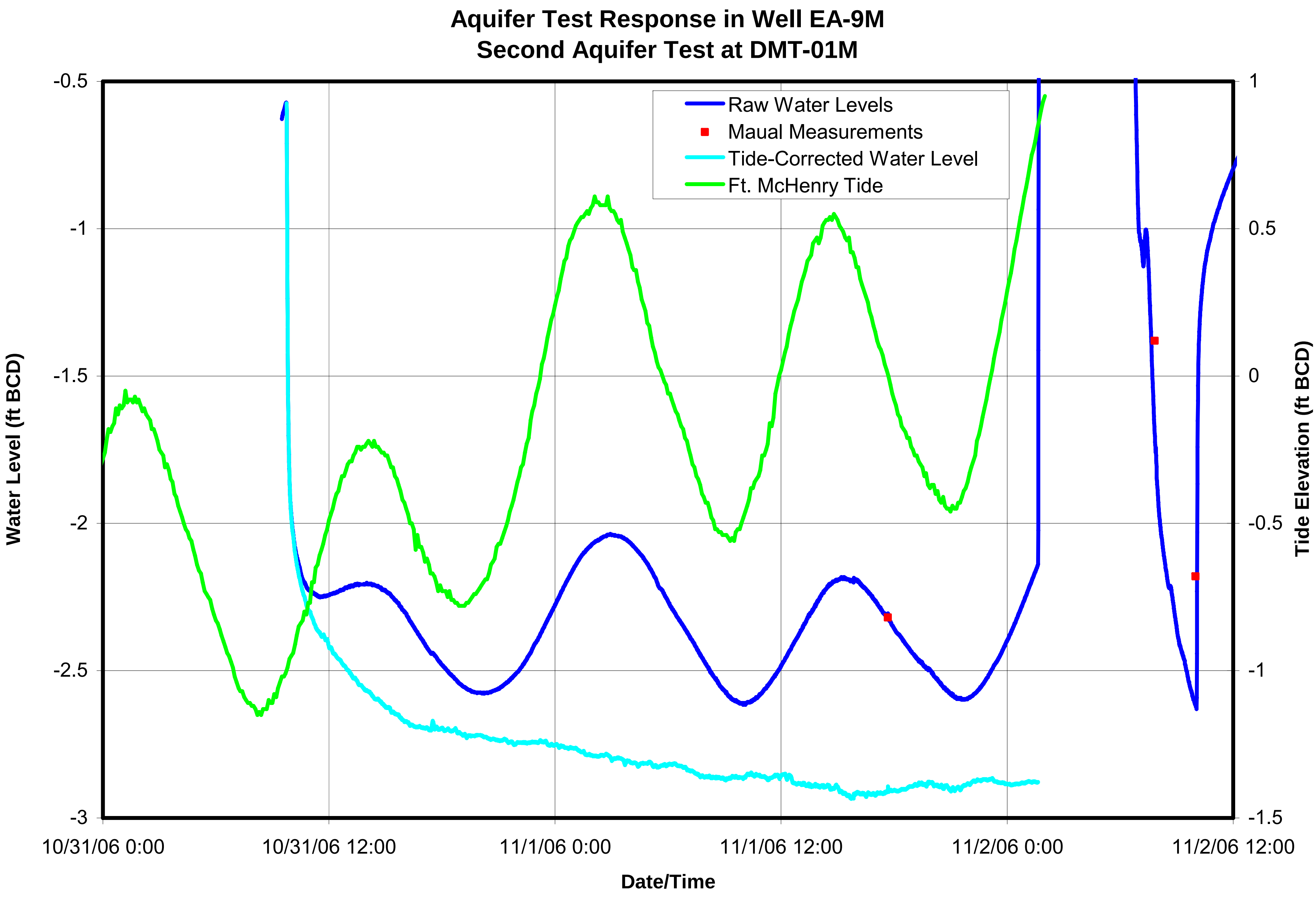


Hydrograph for Observation Well EAC-02M
First Aquifer Test at DMT-01M

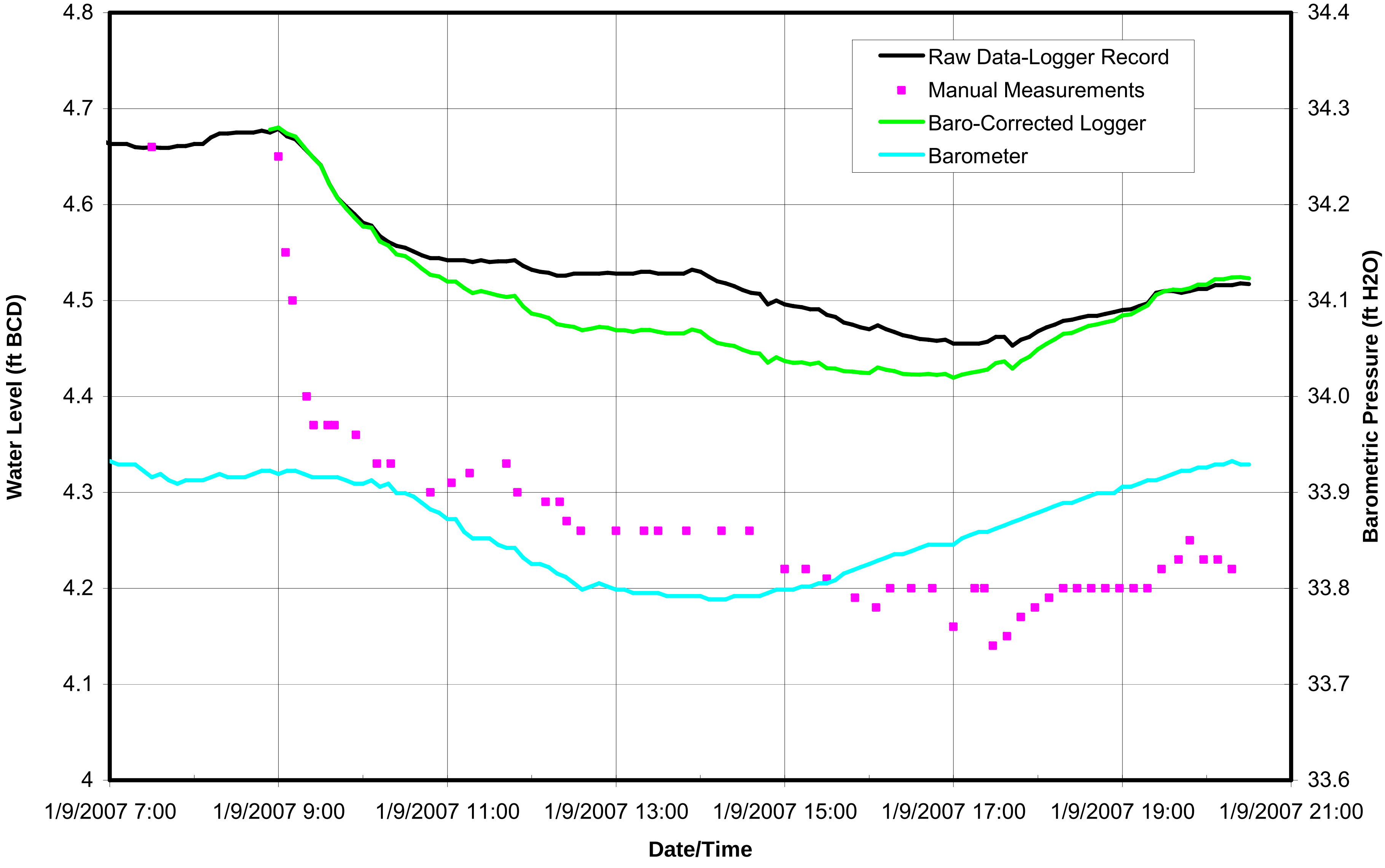


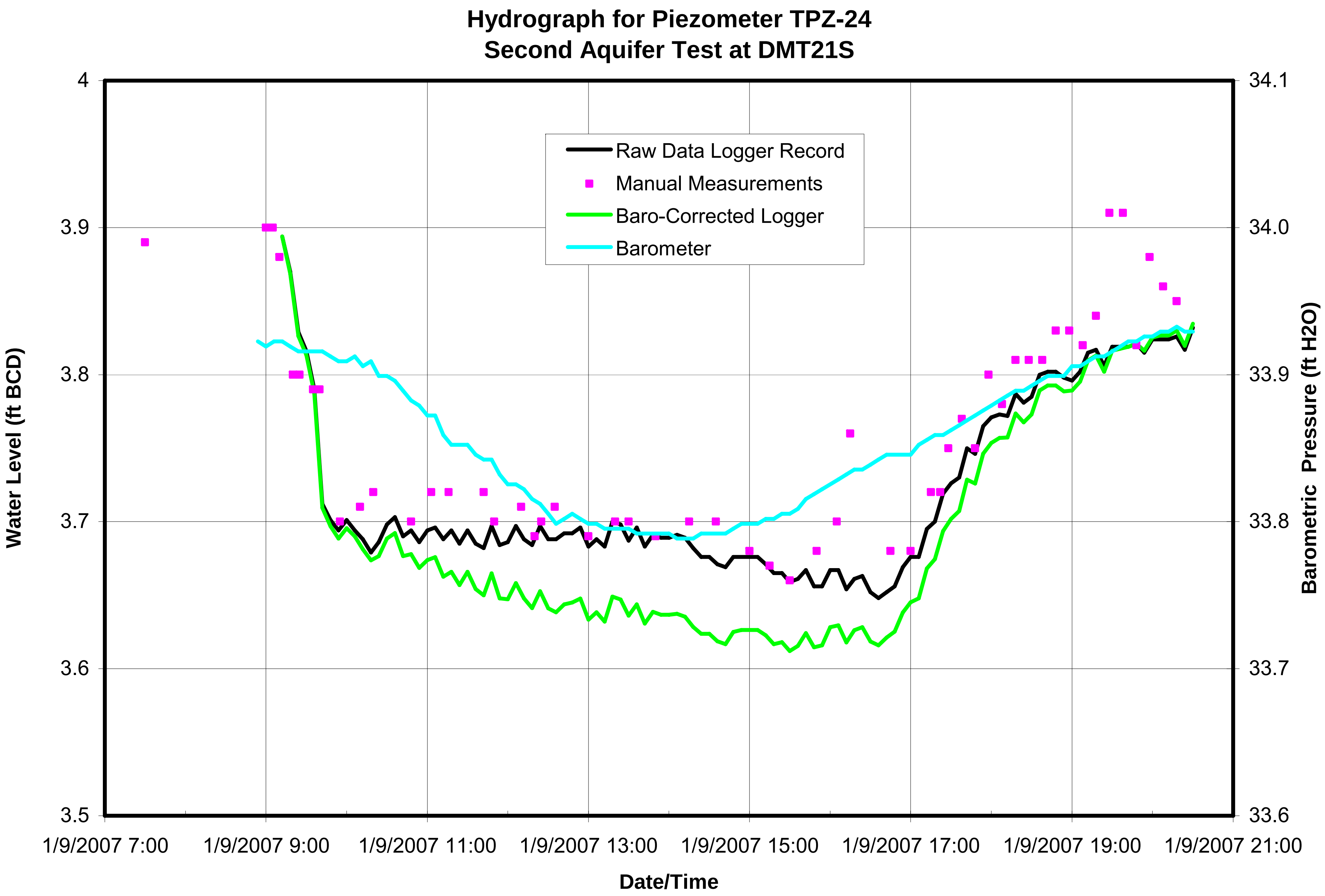
Hydrograph for Observation Well EAC-03M
First Aquifer Test at DMT-01M




Aquifer Test Response in Well EA-9M
Second Aquifer Test at DMT-01M
Raw Water Levels
Maual Measurements
Tide-Corrected Water Level
Ft. McHenry Tide
Water Level (ft BCD)
-0.5
-1
-1.5
-2
-2.5
-3
Tide Elevation (ft BCD)
1
0.5
0
-0.5
-1
-1.5
10/31/06 0:00
10/31/06 12:00
11/1/06 0:00
11/1/06 12:00
11/2/06 0:00
11/2/06 12:00
Date/Time

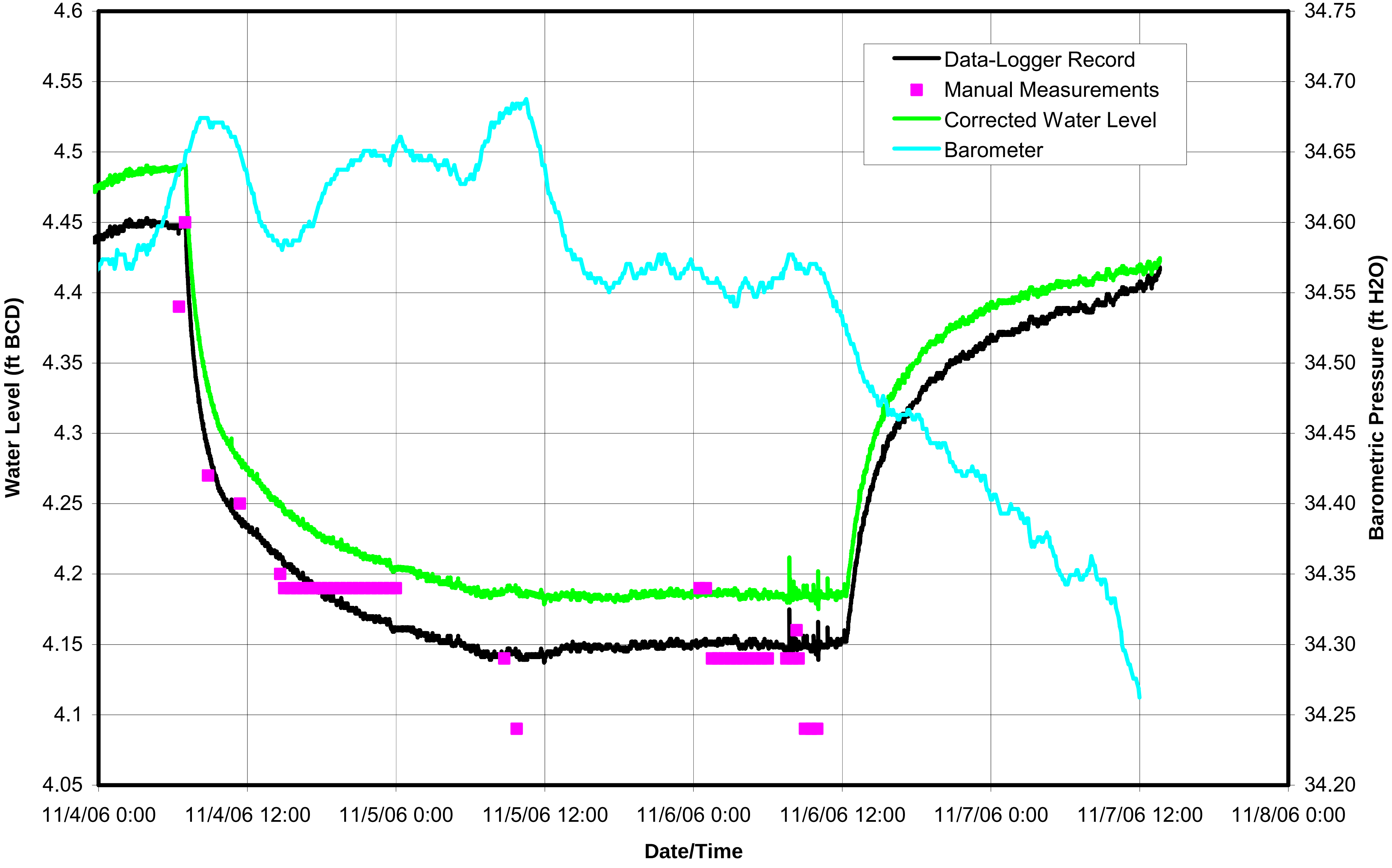
Hydrograph of Observation Well DMT-20S
Second Aquifer Test at DMT-21S



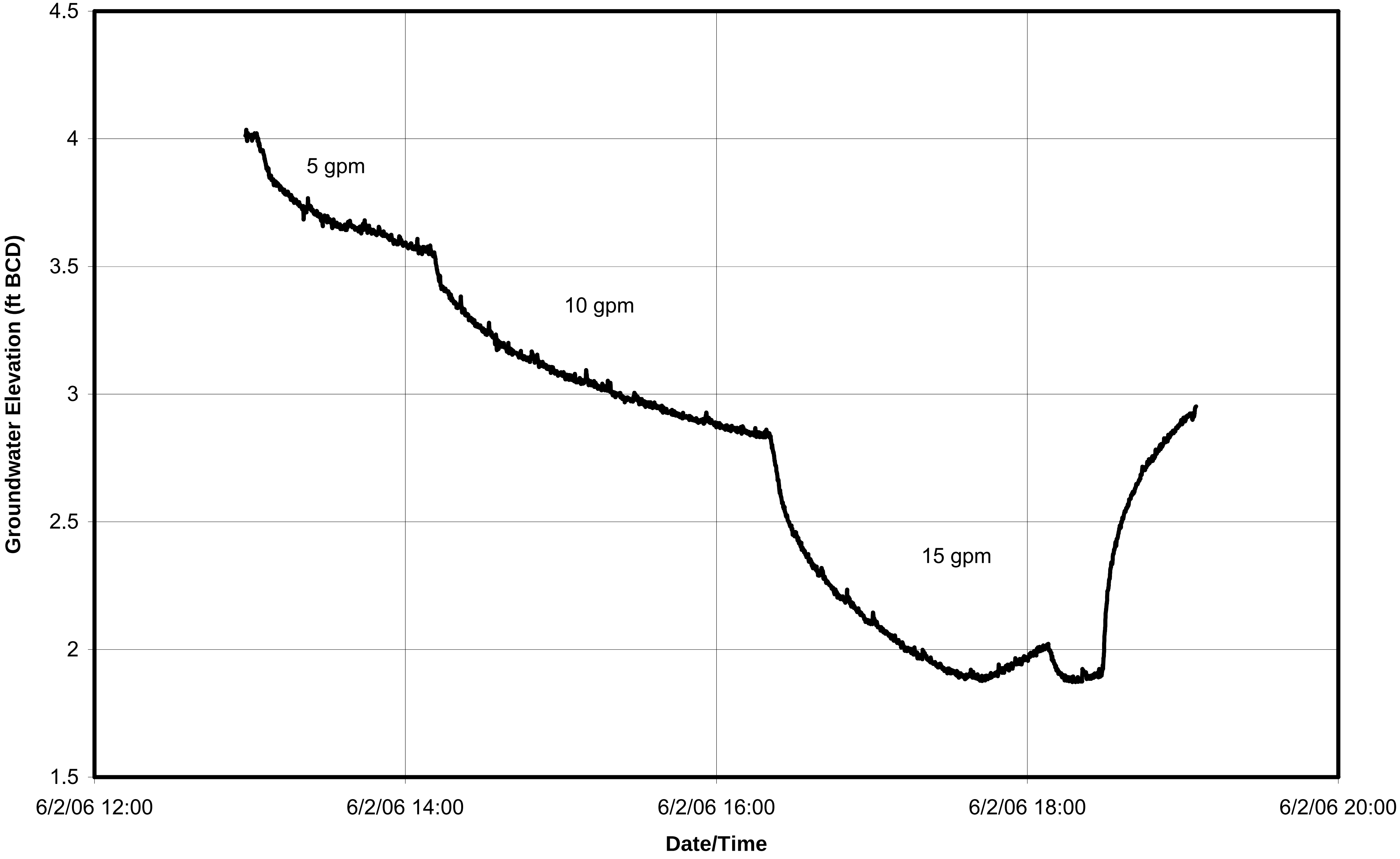


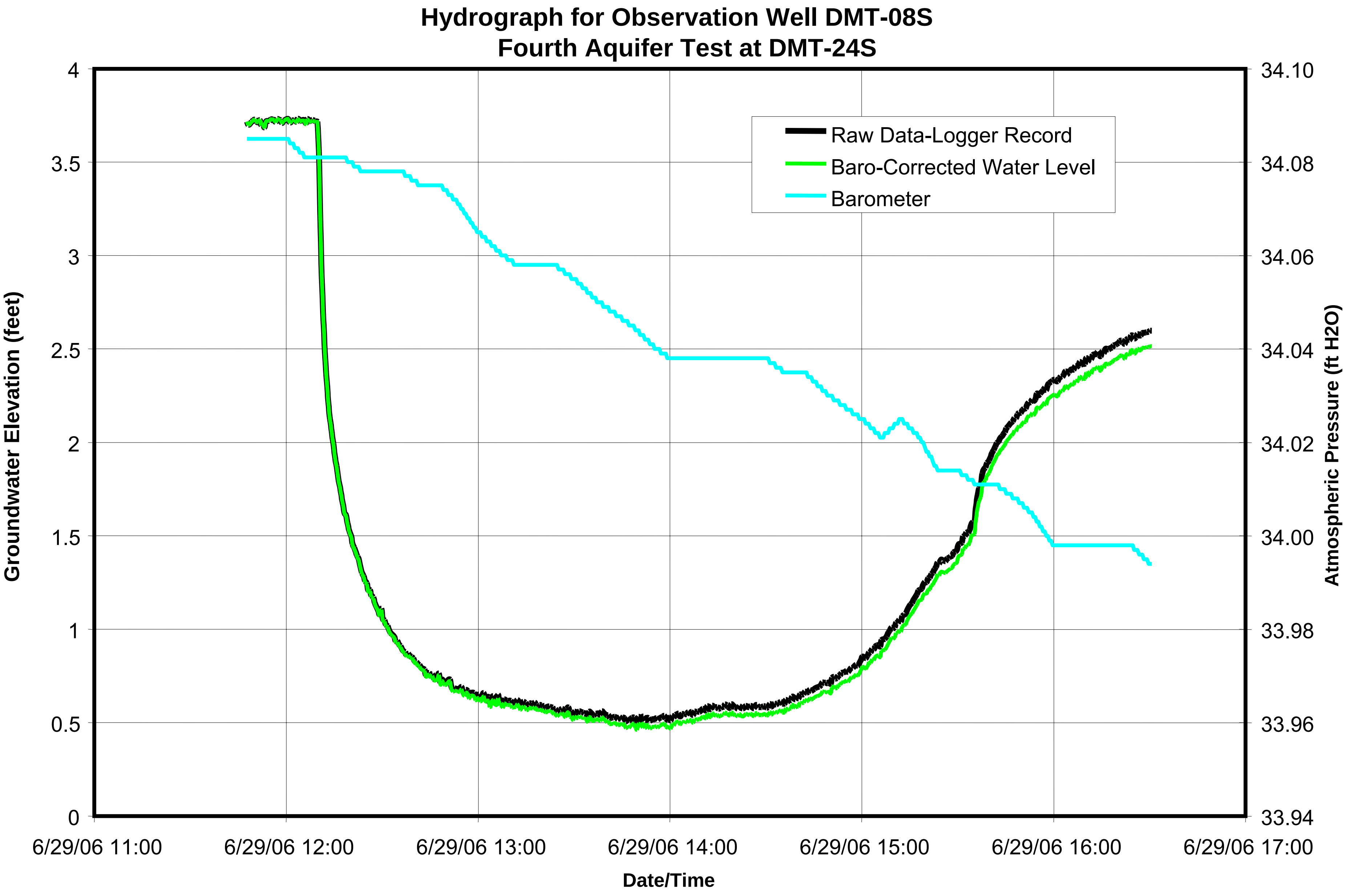
Hydrograph for Piezometer TPZ-24
Second Aquifer Test at DMT21S

Hydrograph for Well DMT-2S
Aquifer Test at DMT-23S

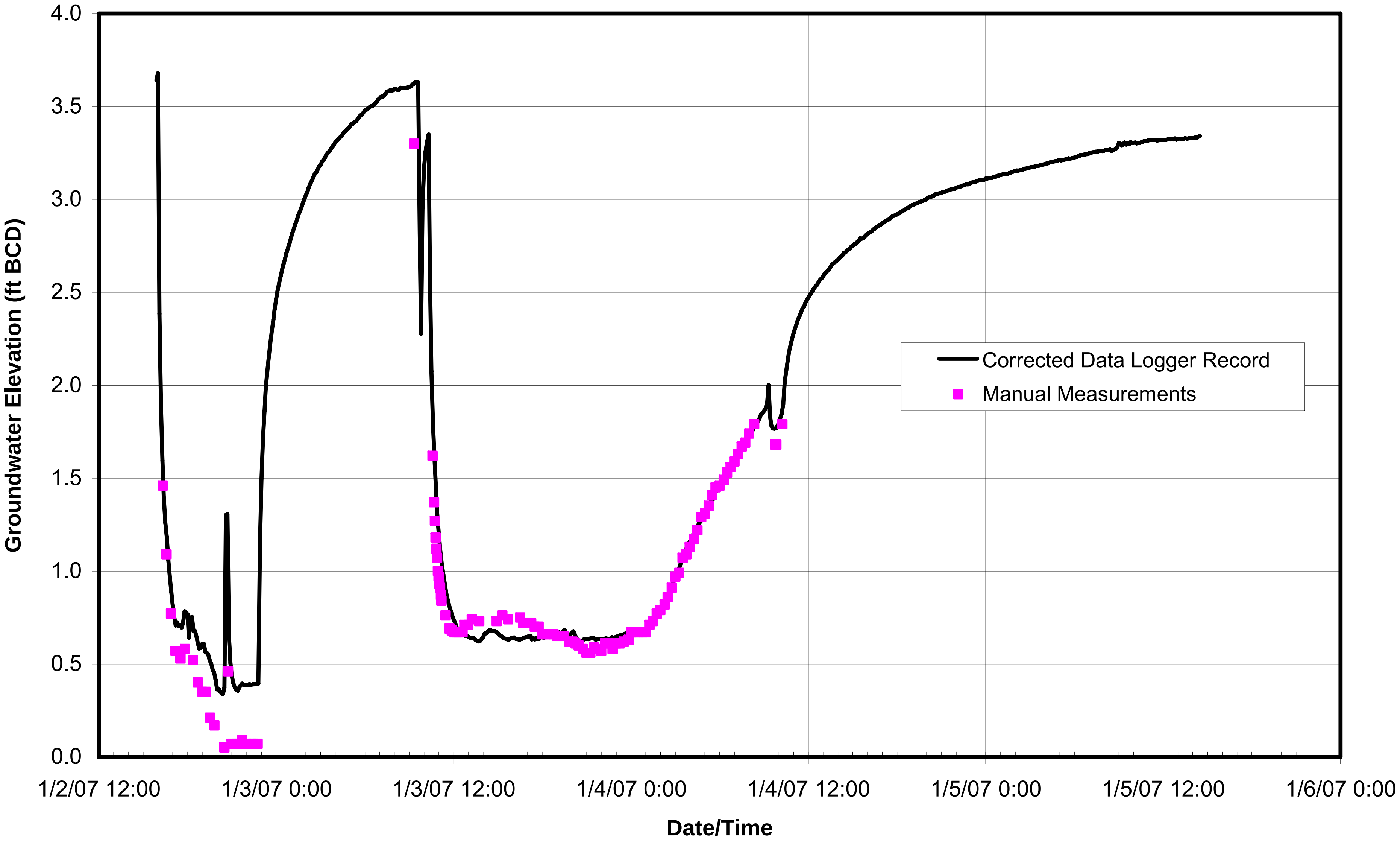


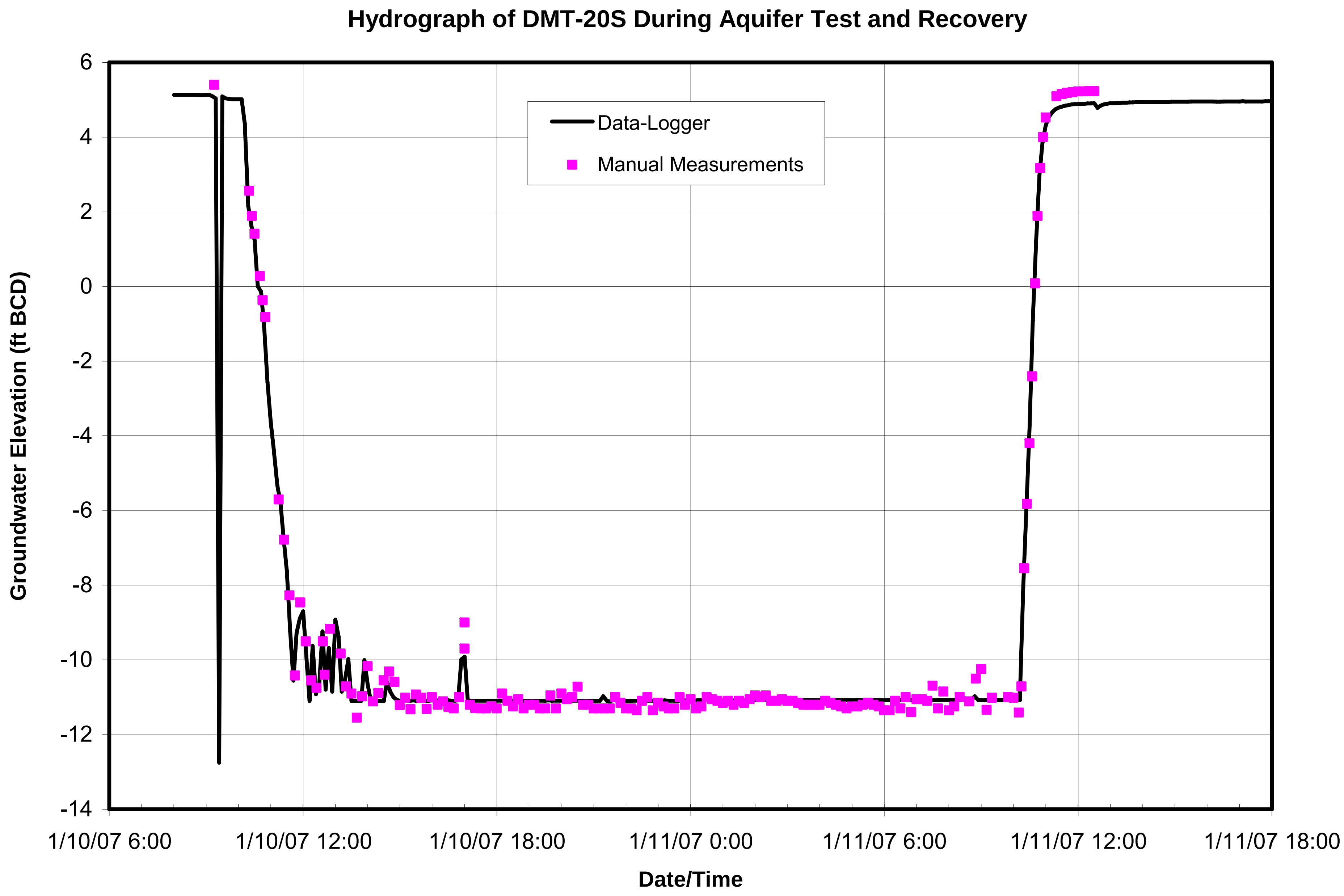
Hydrograph for Observation Well DMT-08S
Step-Drawdown Test at DMT-24S




Hydrograph for Observation Well DMT-08S
Fourth Aquifer Test at DMT-24S
Raw Data-Logger Record
Baro-Corrected Water Level
Barometer
Groundwater Elevation (feet)
4
3.5
3
2.5
2
1.5
1
0.5
0
Atmospheric Pressure (ft H2O)
34.10
34.08
34.06
34.04
34.02
34.00
33.98
33.96
33.94
6/29/06 11:00
6/29/06 12:00
6/29/06 13:00
6/29/06 14:00
6/29/06 15:00
6/29/06 16:00
6/29/06 17:00
Date/Time

Hydrograph for Observation Well DMT-08S
Fifth Aquifer Test at DMT-24S




Hydrograph of DMT-20S During Aquifer Test and Recovery
Data-Logger
Manual Measurements
Groundwater Elevation (ft BCD)
6
4
2
0
-2
-4
-6
-8
-10
-12
-14
1/10/07 6:00
1/10/07 12:00
1/10/07 18:00
1/11/07 0:00
1/11/07 6:00
1/11/07 12:00
1/11/07 18:00
Date/Time