CHESTER RIVER HOSPITAL CENTER

GROUNDWATER REMEDIATION
2013/2014 ACTION PLAN MODIFICATIONS
CASE NO. 1987-2534-KE

PILOT TEST EVALUATION REPORT
AND
PROPOSED 2015 ACTION PLAN

JANUARY 19, 2015

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1.0 EXECUTIVE SUMMARY

In August of 2014, the Chester River Hospital Center (CRHC) Technical Team implemented a "Pilot Study" for purposes of demonstrating the viability and effectiveness of the Ivey-sol® surfactant push-pull process. The objective was to use this soil cleansing process to safely liberate sorbed residual hydrocarbons from soils as the next logical progression in this multi-year groundwater remediation case.

For over twenty (20) years CRHC's focus was to remove liquid petroleum hydrocarbons (free product), and to remediate the groundwater using a "pump and treat" system consisting of six (6) recovery wells, four (4) pre-filters, and two (2) MyCelx® filtration units. Based on the success of the pump and treat system, and the nearly nonexistence of free petroleum sampling in recent years, this case moved into a closure status/process during 2012/2013. For the first ten (10) months of intensive sampling, down-gradient monitoring wells continued to show low near non–detect levels. Then, unexpectedly, increased in months eleven (11) and twelve (12). The pump and treat system was turned back on while investigations determined the cause and further remediation options were evaluated. The review of data and further investigation determined that a seasonal high water table came into contact with sorbed residual hydrocarbons in soils near the original spill in a "smear zone", which had not been documented by earlier assessments. Previous to this evidence indicated that the groundwater had been substantially cleaned. However, when the water table came into contact with soils that still had residual material embedded, the water once again showed higher levels of residuals.

Cross sections of the site were developed to define the limits and configuration of the smear zone. Following the development of the cross sections, the Technical Team shifted its efforts to determining which proven technology would most effectively extract sorbed residual hydrocarbons from the smear zone.

Through professional contacts and research the Technical Team concluded that a patented product and process owned by Ivey International, Inc. would provide the greatest opportunity to address the smear zone issue. A surfactant simply known as Ivey-sol® would be used in a "push-pull" process to inject this solution, cleanse the soil, and liberated sorbed residual hydrocarbons would be extracted and removed from the site. A Pilot Study was designed to demonstrate the efficacy of utilizing this process for removing sorbed residual hydrocarbons in this hydrogeological setting.

In July 2014, the Maryland Department of the Environment (MDE) approved the proposed Pilot Study based on specific conditions. Conditions included: 1) limiting the push-pull applications to four (4) wells within the hydraulic control of the pump and treat system; 2) keeping the pump and treat system in operation during the Pilot Study; 3) conducting extensive gauging and monitoring during and after a one (1) week push-pull process and for ninety (90) days thereafter; 4) testing for volatile organic compounds (VOC's), Non-Ionic Surfactant (surfactant), total petroleum hydrocarbons (TPH-DRO and TPH-GRO); 5) offsite and safe disposal of all liquid extracted from the four (4) wells; and 6) a requirement that a complete report of results including specific tables and charts be submitted to MDE forty-five (45) days after completion of the post-injection monitoring period.

The push-pull process was completed in August, 2014, the ninety (90) days post-injection gauging and monitoring was performed in September, October, and November; and the report of findings prepared for submittal by February 1, 2015. The results, findings, and conclusions exceeded all expectations. High levels of sorbed residual hydrocarbons were liberated, field testing combined with results confirmed that no liberated material migrated down-gradient, methods were identified to define Ivey-sol® "end point" indicators for use in future applications, and protocols were established for targeting future push-pulls within the smear zone. More importantly, the data indicates Ivey-sol® to be a safe and effective technology for completing the remediation of this site. In other words, once subsequent applications of Ivey-sol® are applied per the following plan, this site will be able to move to case closure.

Specifically, the surfactant (Ivey-sol® solution) quickly dissipated. After ten (10) days ninety-seven percent (97%) removal was reported, and after forty-five (45) days ninety-nine percent (99%) was removed. Mass recovery of liberated sorbed residual hydrocarbon was calculated from the four (4) extraction wells showing many logs of removal ranging from one thousand percent (1,000%) to eighteen thousand percent (18,000%). Results of VOC's, surfactant, TPH-GRO, and TPG-DRO showed no migration down-gradient with concentrations unchanged from pre-pilot conditions. The dispersion of Ivey-sol® was reported at ten feet (10') to twenty feet (20') in radius from each injection point, while the capture zones of the extraction wells extended over approximately one hundred feet (100') in radius associated with the four inch (4") diameter wells, indicating that Ivey-sol® was not released down-gradient.

The use of surface tension field tests as an indicator of the presence/absence of surfactant was confirmed by twenty-six (26) of twenty-seven (27) split sample laboratory tests. This demonstrates a ninety-seven percent (97%) confidence level in the surface tension field testing protocol. Also, TPH-DRO removals associated with the extraction process correlated well with the rapid dissipation/removal of surfactants. This establishes that the two (2) tests combined will be a good indicator of removal efficiencies during future push-pull applications in the target areas of the smear zone.

An equally important finding during the Pilot Study was that the pump and treat system was highly efficient as a hydraulic curtain around the push-pull area, and in removing residuals of liberated materials not fully recovered during the extraction process. Evidence of the biological residue on treatment filters indicated that when freed from the soil, sorbed residual hydrocarbon becomes available to microbial action which further hastens the remediation process through natural assimilation. The efficiency and effectiveness of the filter process is further evidenced by the increased frequency of replacing the bag filters and in examining the Discharge Monitoring Reports which demonstrated continuous conformance with effluent limitations of the Discharge Permit.

Building on the success of the Pilot Study, the CRHC Technical Team findings and conclusions strongly support the continued use of the Ivey-sol® process to liberate remaining sorbed residual hydrocarbon from the smear zone in order to complete the remediation effort. All of the collected data, analyses, and interpretations indicate a more than reasonable expectation that high removal efficiencies similar to those observed during the Pilot Study will result from a strategically designed and targeted approach to cleansing soils in the smear zone.

The keys to success will be to:

1. Target future push-pull applications to up-gradient areas most impacted by the original spill and to other areas that would benefit from additional Ivey-sol® applications.

2. Use of surface tension field tests and twenty-four (24) hour laboratory tests for TPH-DRO to establish Ivey-sol® "end point" indicators (indications that no more sorbed residual hydrocarbon is being liberated).

3. Perform push-pull applications during the wet season time of the year (under high water table conditions) from March, 2015 to June, 2015.

4. Utilize the existing treatment system for onsite treatment and disposal of extracted water. The curtain effect of the hydraulic pump and treat approach will continue to be used but the extraction wells connected to the treatment system will be modified to replace the existing recovery wells to include the push-pull wells located in the target areas.

5. Quarterly monitoring will include VOC's, TPH-DRO, and TPH-GRO at selected wells. Monthly sampling will include TPH-DRO only at select wells.

6. Perform post remediation gauging and monitoring required to demonstrate that the case can proceed to closure status including a report of findings which included assessment of the Seven (7) Risk Factors. It is

assumed during the twelve (12) months of sampling and assessment of the Seven (7) Risk Factors the pump and treat system would remain off.

2.0 INTRODUCTION

2.1 BACKGROUND INFORMATION

Several years ago, Chester River Hospital Center (CRHC) had pursued with the Maryland Department of the Environment (MDE) a twelve (12) month intensive monitoring program for purposes of demonstrating that the groundwater had been remediated to a point that the enforcement case might be closed. After ten (10) months of favorable sampling, monitoring in months eleven (11) and twelve (12) revealed higher contaminant levels which warranted further investigation. The outcome of these investigations supported the presence of residual hydrocarbons in the formation and groundwater of the source area. These residual hydrocarbons were sorbed (absorbed and/or adsorbed) to the soil particles and during periods of seasonal groundwater fluctuation, a smear zone, was subsequently formed. Due to the presence of a smear zone, the onsite pump and treat remediation system was no longer effective and new measures were necessary to cleanse the residual hydrocarbons from the formation and groundwater. With the technical information that was available, the Technical Team was able to prepare cross sections of the smear zone which defined its limits and configuration.

In July 2013, the CRHC Technical Team proposed an Action Plan for the utilization of Ivey-sol® surfactants to liberate the sorbed residual hydrocarbons in the formation of the source area followed by their removal. Through a significant collaboration effort between the Town, MDE, and the CRHC Technical Team, the 2013/2014 Action Plan was subsequently revised on June 26, 2014 and approved by MDE on July 25, 2014. This report follows the protocols and procedures outlined in the CRHC 2013/2014 Proposed Action Plan as modified by MDE in its July 25, 2014 approval letter included in Appendix A.

Essentially, with input from the Town and MDE, the Pilot Study reduced the total number of well injection and extraction points, required that the pump and treat system remain on to assure hydraulic control during the applications, expanded the laboratory testing requirements, and established detailed reporting requirements associated with the post injection "push" monitoring period. The MDE approval also stipulated that, "the collection of all materials purged during the "pull" portion of the procedure be collected in separate breakout tanks to ensure the system is not fouled with liberated material from the formation."

In the original 2013/2014 Action Plan, as modified, a detailed description was included on the number and location of applications and procedures to be followed for Days 1–5. MDE's approval letter of July 25, 2014 confirmed the Day 1–5 protocols and procedures on the basis that it had correctly incorporated MDE revisions suggested in their letter of March 25, 2014. (The Town of Chestertown through their attorney had raised certain questions regarding the protocols and procedures to be used during the Pilot Study which were incorporated into the approved Action Plan.)

With this information and with significant input from Ivey International, Inc. regarding their patented Ivey-sol® products and processes, the CRHC Technical Team was able to define for MDE's approval, the protocols for implementing a five (5) day Pilot Study which included MDE conditions regarding the number and location of wells to be used for the push-pull process; weekly and monthly gauging events; collection of depth-to-water measurements at intervals of once per every thirty (30) minutes; and to collect data associated with recoverability, radius of influence, the drawdown effect, the evaluation of liquid petroleum hydrocarbon rebound, etc. A sampling program was established and MDE specified a ninety (90) day post-injection monitoring period. This post-injection monitoring period also included the requirement to present results in the form of various tables and figures in addition to narrative discussion.

The push-pull process using Ivey-sol® was implemented from July 29, 2014 to August 6, 2014 and the ninety (90) day post-injection monitoring occurred in September, October, and November along with the necessary gauging and ongoing reporting. The results of the Pilot Study as presented in this report detail the successful findings and results from the Ivey-sol® application process. With these successful findings which included much higher levels of residual

hydrocarbon recovery than had been observed in recent years from the pump and treat system alone, the success of the hydraulic controls to contain the liberated material, no measured impact to down-gradient wells, the quick dissipation of the surfactant, and efficient/effective removal of the extracted material. We now believe that in 2015 a focused effort using the Ivey-sol® process to cleanse the soils in the smear zone area will produce a significant improvement over the previous groundwater remediation plan, leading to a determination that the remediation efforts can move expeditiously towards closure. We expect this would logically lead to twelve (12) months of monitoring, successful assessment of the Seven (7) Risk Factors, and case closure. In other words, as mentioned earlier, rinsing the soils with surfactant freed up residual hydrocarbons which we can more efficiently capture and extract through this push-pull process.

2.2 PURPOSE

2013 and 2014 have brought changes to the remediation approach that are logical progressions from a primary pump and treat system to one which includes the use of surfactants to liberate absorbed materials from soils and recover it through a push-pull extraction process. After discovering a smear zone effect in 2013/2014, as documented and characterized through narrative descriptions and cross sections prepared by EBA Engineering, Inc., the CRHC Technical Team proposed the use of a patented surfactant product and process (Ivey-sol®). Although Ivey International, Inc. produced documents which demonstrated the successful implementation of this process to clean up similar groundwater contamination sites in other parts of the world; MDE, the Town, and the Hospital agreed that a pilot scale study should be performed to establish the viability of using Ivey-sol® for this remediation case.

The CRHC Technical Team had thoroughly researched the use of surfactants to enhance ongoing groundwater remediation and continues to believe that concentrated efforts in the area of the original spill could safely liberate residual petroleum hydrocarbons and be safely recovered without exacerbating the ongoing efforts through the pump and treat system. The Pilot Study was designed to evaluate the efficiency and effectiveness of the patented Ivey-sol® product and push-pull process in order that the results could be used to guide the proposed larger scale application. With the approval letter of July 25, 2014, MDE agreed to the underlying purpose of the Pilot Study, further specified the conditions to be followed during the Study, and outlined requirements for ninety (90) days of post-injection monitoring and reporting.

2.3 WORK PLAN

The Day 1–5 detailed work plan was incorporated on page 3 and page 4 of the 2013/2014 Action Plan Modifications Letter dated June 26, 2014 and included the following detailed action items as restated below. (Note that Appendix 4 referenced below is included as Appendix B in this report.) This information has been extracted from the 2013/2014 approved Action Plan and restated in this report in order that readers can easily compare the approved conditions and protocols to the actual recorded events as described in Section 3.

Day 1

- A round of gauging and sampling data will be collected and recorded from select wells as indicated in Appendix 4.
- Although the CRHC Technical Team had a preference for turning the system off prior to initiating the Pilot Study, Mr. Ivey has indicated that he believes good results can still be achieved with the remediation system left on; therefore, we are now proposing to run the Pilot Study with the hydraulic controls remaining in place per the Town's request.
- At each well location, a mixture of the Ivey-sol® (approximately five (5) gallons) and potable water will be prepared in a 275 gallon tote (a total of 1,100 gallons of Ivey-sol® mixture across the four (4) wells).

- The injection or "Push" portion of the event will involve the Ivey-sol® mixtures being gravity fed into each well (i.e. not pumped under pressure). The gravity feeding of the surfactant mixture may take upwards of one (1) hour or longer depending on the specific well hydraulics.
- The injection wells and surrounding monitoring wells will be gauged periodically during the daily activities.
- Groundwater from the injection wells will also be assessed for surface tension by an approved field testing method. Surface tension results provide a near real time indication of the presence/absence of surfactants.

Day 2

- A round of gauging data will be collected and recorded from select wells as indicated in Appendix 4.
- Approximately twenty-four (24) hours after injection, a submersible pump will be placed into each injection well and approximately 1,100 gallons of liquids (i.e. groundwater, Ivey-sol®, and liquid petroleum hydrocarbons) will be extracted from each well as the "Pull" portion of the event. At an average pumping rate of nine (9) gallons per minute, which is the maximum rating for a typical submersible pump, the extraction portion of the event will take upwards of three (3) hours provided that pumping is done simultaneously from all four (4) wells. The extracted liquids will be pumped into two (2) 5,000-gallon poly tanks for temporary storage. The extracted liquids will be transported offsite for proper disposal prior to the next "Pull" event.
- Once the "Pull" event has been completed, a round of data will be collected and recorded from select wells as indicated in Appendix 4.
- The next round of Ivey-sol® mixtures will be prepared and injected into the four (4) wells for the second "Push" event.
- The injection wells and surrounding monitoring wells will be gauged periodically during the daily activities. Groundwater from the injection wells will also be assessed for surface tension throughout the day.

Day 3

- A round of gauging data will be collected and recorded from select wells as indicated in Appendix 4.
- If not completed on Day 2, the liquids extracted from the Day 2 "Pull" event will commence.
- Once the "Pull" event has been completed, a round of data will be collected and recorded from select wells as indicated in Appendix 4.
- The next round of Ivey-sol® mixtures will be prepared and injected into the four (4) wells for the third and final "Push" event of the pilot test.
- The injection wells and surrounding monitoring wells (MW) will be gauged periodically during the daily activities. Groundwater from the wells will also be assessed for surface tension throughout the day.

Day 4

- A round of gauging data will be collected and recorded from select wells as indicated in Appendix 4.
- The liquids extracted from the Day 3 "Pull" event will be transported offsite.
- Approximately twenty-four (24) hours after the Day 3 injection, the third and final "Pull" event will commence.
- Once the "Pull" event has been completed, a round of gauging data will be collected and recorded from select wells as indicated on the attached table. Groundwater from the injection wells will also be assessed for surface tension throughout the day.

Day 5

- Monitoring well gauging and sampling will be completed as indicated in Appendix 4.
- The liquids extracted from the Day 4 "Pull" event will be transported offsite.

For a minimum of three (3) months following the pilot test, monitoring wells will be gauged and sampled for the presence of volatile organic compounds (VOC's) (via EPA Method 8260), total petroleum hydrocarbons (TPH-DRO and TPH-GRO) (via EPA Method 8015), and surfactants (via EPA Method SM5540D). The particular wells to be sampled and the sampling frequencies are detailed in Appendix 4.

MDE provided conditional approval of the Day 1–5 work plan, contingent upon the following:

1. The Department understands that recovery well MW-22 will be utilized as a "push/pull" well during this pilot test. Following completion of the pilot test ≺ MW-22 will return to a recovery well.

2. In order to better evaluate recoverability, radius of influence, the drawdown effect, and to evaluate liquid phase hydrocarbons rebound, the Department requires more continuous monitoring during the injection event. The goal will be to collect depth-to-water measurements at intervals of once per every thirty (30) minutes. These monitoring readings must include those points already outlined on the Pilot Test Well Designations Table. Gauging of the monitoring well network should be conducted before, during, and post-injection until water levels return to pre-injection conditions.

3. The Department requires weekly gauging events to evaluate the potential of liquid petroleum hydrocarbons rebound for the first four (4) weeks post-injection. This will be followed by the proposed monthly gauging thereafter.

4. The Department concurs with the proposed post-injection sampling regime.

5. Following sample collection, gauging must return to a monthly schedule.

SECTION 3 – SITE ACTIVITIES

3.1 ACTIVITIES PRIOR TO THE PILOT STUDY

On Monday, July 28, 2014 an open-house kickoff meeting was performed at the site. The kickoff meeting included a presentation of the planned activities to Town and MDE representatives, followed by a walk-through of the site where participants had an opportunity to become familiar with the equipment to be utilized. Following the kickoff meeting, the Technical Team conducted an onsite health and safety meeting.

Baseline groundwater samples of the twenty-eight (28) Pilot Study Monitoring Wells (MW-10R, MW-13, MW-14, MW-15, MW-16, MW-17, MW-18, MW-19, MW-20, MW-22, MW-23, MW-24, MW-25, MW-28, MW-29, MW-33, MW-34, MW-35, MW-40, MW-41, MW-42, MW-43, MW-45, MW-46, MW-47, MW-48, MW-49, MW-50) were collected in accordance with MDE's Plan Approval letter dated July 25, 2014.

MDE's Plan Approval also identified sixteen (16) Pilot Study Monitoring Wells (MW-10R, MW-13, MW-14, MW-19, MW-20, MW-22, MW-33, MW-34, MW-35, MW-40, MW-41, MW-42, MW-43, MW-45, MW-46, MW-47) that were to be gauged and sampled during Pilot Study activities.

Throughout Day 1-5 the Technical Team coordinated with MDE on a daily basis. Appendix C includes copies of MDE's report of observations in regards to the actual daily site activities.

3.2 DAY 1 – INJECTION 1 (TUESDAY, JULY 29)

Activities performed by the Technical Team included the following:

- Gauged the twenty-eight (28) Pilot Study Monitoring Wells prior to injection.
- Injected 275 gallons of 0.11% Ivey-sol® solution into MW-22, MW-40, MW-41, and MW-42. Collectively, 1,100 gallons of 0.11% Ivey-sol® solution was injected into the groundwater.
- Periodic gauging of the sixteen (16) Pilot Study Monitoring Wells post injection until elevations returned to pre-injection conditions.
- Periodic visual inspections of the System Influent (wet well) of the pump and treat system for the presence of surfactant and/or liquid phase hydrocarbons.

3.3 DAY 2 – EXTRACTION 1 (WEDNESDAY, JULY 30)

Activities performed by the Technical Team included the following:

- Gauged the sixteen (16) Pilot Study Monitoring Wells prior to extraction activities.
- Collected samples from MW-13, MW-14, MW-46, and MW-47 (located along Brown Street) for surface tension field test.
- Collected samples from RW-4, RW-5, and from System Influent for surface tension field test.
- Commenced extraction activities utilizing submersible pumps positioned approximately two feet (2') from the bottom of well and discharged water into two (2) aboveground storage tanks. Extraction rates were measured in the field at MW-22 (5.0 GPM), MW-40 (5.0 GPM), MW-41 (3.5 GPM), and MW-42 (1.0 GPM).
- Periodic gauging of the sixteen (16) Pilot Study Monitoring Wells during extraction activities.
- Periodic visual inspections of the System Influent for the presence of surfactant and/or liquid phase hydrocarbons.
- Periodic sampling of four (4) Extraction Wells and perform surface tension field tests.
- Periodic sampling of four (4) Extraction Wells for subsequent analysis of TPH-DRO.

- Replaced bag filters (3 and 4) in pump and treat system.
- Ceased extraction activities based upon results of field surface tension tests from four (4) Extraction Wells.
- Gauged the sixteen (16) Pilot Study Monitoring Wells post extraction activities.
- Collected post extraction samples from four (4) Extraction Wells (MW-22, MW-40, MW-41, and MW-42) for TPH-DRO and surfactant and submit for laboratory analysis.
- Collected post extraction samples from MW-13, MW-14, MW-46, and MW-47 for TPH-DRO and surfactant and submit for laboratory analysis.

3.4 DAY 3 – INJECTION 2 (THURSDAY, JULY 31)

Activities performed by the Technical Team included the following:

- Transferred extracted water from aboveground storage tanks into Clean Harbors tanker truck.
- Gauged the sixteen (16) Pilot Study Monitoring Wells prior to injection.
- Collected samples from MW-13, MW-14, MW-46, and MW-47 (located along Brown Street) for surface tension field test.
- Collected samples from RW-4, RW-5, RW-6, and System Influent for surface tension field test.
- Injected of 275 gallons of 0.22% Ivey-sol® solution into MW-22, MW-40, MW-41, and MW-42. Collectively, 1,100 gallons of 0.22% Ivey-sol® solution was injected into the groundwater.
- Periodic gauging of the sixteen (16) Pilot Study Monitoring Wells post injection until elevations returned to pre-injection conditions.
- Periodic visual inspections of the System Influent for the presence of surfactant and/or liquid phase hydrocarbons.

3.5 DAY 4 – EXTRACTION 2 (FRIDAY, AUGUST 1)

Activities performed by the Technical Team include the following:

- Pump and Treat System Maintenance, replaced all four (4) bag filters and Mycelex® filter.
- Gauged the sixteen (16) Pilot Study Monitoring Wells prior to extraction activities.
- Collected samples from MW-13, MW-14, MW-46, and MW-47 (located along Brown Street) for surface tension field test.
- Collected samples from RW-4, RW-5, and from System Influent for surface tension field test.
- Commenced extraction activities utilizing submersible pumps positioned approximately two feet (2') from bottom of well and discharged water into two (2) aboveground storage tanks.
- Periodic gauging of the sixteen (16) Pilot Study Monitoring Wells during extraction activities.
- Periodic visual inspections of the System Influent for the presence of surfactant and/or liquid phase hydrocarbons.
- Periodic sampling of four (4) Extraction Wells and performed surface tension field tests.
- Periodic sampling of four (4) Extraction Wells for subsequent analysis of TPH-DRO.
- Ceased extraction activities based upon results of field surface tension tests from four (4) Extraction Wells.
- Gauged the sixteen (16) Pilot Study Monitoring Wells post extraction activities.
- Collected post extraction samples from four (4) Extraction Wells (MW-22, MW-40, MW-41, and MW-42) for TPH-DRO and surfactant and submit for laboratory analysis.
- Collected post extraction samples from MW-13, MW-14, MW-46, and MW-47 for TPH-DRO and surfactant and submit for laboratory analysis.
- Collected post extraction samples from RW-4, RW-5, and RW-6 for TPH-DRO and surfactant and submit for laboratory analysis.

3.6 DAY 5 – INJECTION 3 (MONDAY, AUGUST 4)

Activities performed by the Technical Team included the following:

- Transferred extracted water from aboveground storage tanks into Clean Harbors tanker truck.
- Gauged the sixteen (16) Pilot Study Monitoring Wells prior to injection.
- Collected samples from MW-13, MW-14, MW-46, and MW-47 (located along Brown Street) for surface tension field test.
- Collected samples from RW-4, RW-5, RW-6, and System Influent for surface tension field test.
- Injected of 275 gallons of 0.11% Ivey-sol® solution into MW-22, MW-40, MW-41, and MW-42. Collectively, 1,100 gallons of 0.11% Ivey-sol® solution was injected into the groundwater.
- Periodic gauging of the sixteen (16) Pilot Study Monitoring Wells post injection until elevations returned to pre-injection conditions.
- Periodic visual inspections of the System Influent for the presence of surfactant and/or liquid phase hydrocarbons.

3.7 DAY 6 – EXTRACTION 3 (TUESDAY, AUGUST 5)

Activities performed by the Technical Team included the following:

- Pump and Treat System Maintenance, replaced all four (4) bag filters and MyCelx® filter.
- Gauged the sixteen (16) Pilot Study Monitoring Wells prior to extraction activities.
- Collected samples from MW-13, MW-14, MW-46, and MW-47 (located along Brown Street) for surface tension field test.
- Collected samples from RW-4, RW-5, and from System Influent for surface tension field test.
- Commenced extraction activities utilizing submersible pumps positioned approximately two feet (2') from bottom of well and discharged water into two (2) aboveground storage tanks.
- Periodic gauging of the sixteen (16) Pilot Study Monitoring Wells during extraction activities.
- Periodic visual inspections of the System Influent for the presence of surfactant and/or liquid phase hydrocarbons.
- Periodic sampling of four (4) Extraction Wells and performed surface tension field tests.
- Periodic sampling of four (4) Extraction Wells for subsequent analysis of TPH-DRO.
- Ceased extraction activities at Extraction Wells MW-22, MW-40, and MW-41 based upon results of surface tension field tests. Continued extraction at MW-42.
- Ceased extraction activities at MW-42. Surface tension field test showed slight presence for surfactant. Team made plans for returning to site tomorrow and performing additional extraction measures at MW-42.

3.8 DAY 7 – EXTRACTION 4 (WEDNESDAY, AUGUST 6)

Activities performed by the Technical Team include the following:

- Pump and Treat System Maintenance, replaced all four (4) bag filters and MyCelx® filter.
- Gauged the sixteen (16) Pilot Study Monitoring Wells prior to extraction activities.
- Commenced extraction activities at MW-42 and MW-9. MW-9 was utilized due to its close proximity to MW-42 and was a four inch (4") diameter well. Extraction rates were measured in the field at MW-42 (1.0 GPM) and MW-9 (5.0 GPM).
- Ceased extraction activities based upon results of surface tension field tests from MW-42 and MW-9.
- Gauged the sixteen (16) Pilot Study Monitoring Wells post extraction activities.

- Collected post extraction samples from four (4) Extraction Wells (MW-22, MW-40, MW-41, and MW-42) for TPH-DRO and surfactant and submit for laboratory analysis.
- Collected post extraction samples from MW-13, MW-14, MW-46, and MW-47 for TPH-DRO and surfactant and submit for laboratory analysis.
- Collected post extraction samples from RW-4, RW-5, and RW-6 for TPH-DRO and surfactant and submit for laboratory analysis.

3.9 DISPOSAL OF EXTRACTED WASTE MATERIAL

During the Pilot Study, extracted groundwater was deposited into two (2) 5,000 gallon aboveground storage tanks located onsite and adjacent to the extraction wells. As directed by the Technical Team, Clean Harbors Environmental Services visited the site and transferred the contents of the aboveground storage tanks directly into their tanker trucks. These activities occurred as follows:

- July 31st – Removed approximately 3,378 gallons of extracted groundwater.
- August 4th – Removed approximately 4,884 gallons of extracted groundwater.
- August 11th – Truck 1, Removed approximately 5,000 gallons of extracted groundwater.
- August 11th – Truck 2, Removed approximately 1,797 gallons of extracted groundwater.

It was noted by the field technicians that for every gallon of diluted Ivey-sol® solution injected four and a half (4.5) gallons of liberated material and groundwater were extracted.

Extracted waste material was subsequently transported to Environ Recovery Corporation of PA (ERC), a waste processing facility located in Lancaster, Pennsylvania. The waste is then processed in accordance with Commonwealth of Pennsylvania Permit for Solid Waste Disposal and/or Processing Facility No. 301344 and their City of Lancaster Industrial Waste Discharge Permit No. 1072.

3.10 GENERAL OBSERVATIONS AND DISCUSSION

An important part of the push-pull protocol was to perform daily surface tension field tests after the application of Ivey-sol® during the extraction process, in order to determine the presence/absence of surfactant as a guide for field technicians to use in determining cutoff points for ceasing extraction activities. This test served to be a good tool in the field and these cutoff points were further substantiated by lab samples collected and analyzed to verify the exact amount of surfactant that remained in the water column. Even after the push-pull process had been completed during the Pilot Study, samples continued to be collected as part of the post-injection monitoring period. Summary tables were prepared which demonstrate that the surfactant completely dissipated over the period of time when post monitoring sampling was conducted. As a result the Technical Team was able to demonstrate both that the surface tension field testing was a good guide during the actual application process and secondly that the Ivey-sol® solution was a safe product which quickly dissipated and did not migrate downstream.

Additionally, as referenced in **Table 1**, the laboratory testing of surfactants correlated well with the surface tension field tests; twenty-six (26) of twenty-seven (27) split samples with the lab confirmed results of the surface tension field tests (ninety-six percent (96%)) correlation. Since we have been able to demonstrate a close correlation between laboratory testing and these surface tension field tests, it is concluded that performing both as part of the future push-pull applications would be redundant. (Using the surface tension field tests is a good indicator of the presence/absence of surfactant.)

Also, as reflected in the tables of information in this report, we do not feel that conducting TPH-GRO testing will add any significant data or information beyond what would be learned through the normally scheduled monitoring of TPH-DRO and VOC's. However, the TPH-GRO testing was useful since it proved that liberated sorbed residual hydrocarbons did not migrate down-gradient. We do believe that TPH-GRO will continue to be a useful test and provide the necessary continuity required as part of the quarterly monitoring. Also, the Technical Team has been able to confirm no observed liberated material at the closest down-gradient wells during or after the push-pull applications. Because the extraction process was so effective and four and a half (4.5) times as much groundwater was extracted compared to the amount injected it is suggested that less monitoring of down-gradient wells will be needed during future Ivey-sol® applications.

The team of professionals conducting the push-pull reported that they could have performed additional push-pull applications in a day. Moving forward, and applying the same process to a larger set of wells, the Technical Team envisions doing pushes in some wells and extractions from other wells within the same day. Being able to rotate between the field of wells in the same day would achieve three (3) or four (4) times as much total push-pull in a day as could be accomplished in the Pilot Study. The efficiencies of the push-pull and the use of the labor force could also be much more effective if the number of down-gradient wells that had to be monitored and gauged was significantly reduce from twenty-eight (28) to eleven (11). In other words the Technical Team believes that the location, number of down-gradient wells, frequency of monitoring, and type of monitoring can be reduced as supported by the findings.

As a result of the extensive gauging that was performed during the Pilot Study, it is important to note that there was no free product associated with the liberation of material from the soils. Not seeing any free product through the gauging process and monitoring the pump and treat system, the utilization of the treatment system for future activities is considered to be an appropriate technology to capture any residuals that might be associated with the process of liberating sorbed residual hydrocarbons. Extraction through tanks and offsite disposal is considered not to be cost-effective.

The Technical Team also observed that biological activity was significantly enhanced and noted during the inspection of the pump and treat system; specifically the presence of biological residue on the primary filters, and noting the increased frequency of having to change the bag filters. This biological activity is an added benefit of utilizing the Ivey-sol® product which increases biological activity in the groundwater and helps to enhance the natural attenuation capacity within this environment. Associated with these observations was a determination that during extraction the bag filters should be replaced more frequently in order to prevent this bio-fouling of the primary bag filters which is a very inexpensive process that provides significant benefit.

Previous studies of the site were able to determine that the rate of groundwater flow velocity was 0.4 feet per day. Earth Data, Inc. performed this analysis for MDE using two (2) different methods calculated 0.2 feet per day and 0.3 feet per day. Accounting for a margin of safety the groundwater flow velocity was reported at 0.4 feet per day. During the push-pull process and accounting for the differing properties for the surfactant as compare to water the Technical Team utilized a safety factor of twice the flow rate to be able to predict travel times. Based upon a residence time of only twenty-four (24) hours it would not be anticipated that the surfactant solution would migrate to the closest monitoring well and this was confirmed from the field and laboratory testing performed. Managing the injected Ivey-sol® and liberated material during future push-pull events would not present any significant risk of material migration outside the envelope of the subject applications.

SECTION 4 – PRESENTATION OF RESULTS

4.1 REFERRING TO TABLES AND FIGURES

Based upon the field data collected and results of the laboratory analysis, we offer the following attachments included in Appendix D for your review:

- Table 1 – Data Summary of 28 Pilot Study Monitoring Wells During Field Activities
- Table 2 – Data Summary of 28 Pilot Study Monitoring Wells Post Pilot Study
- Table 3 – Extraction Well Draw Down Data and Radius of Influence
- Figure 1 – Overview of Pilot Study Injection/Extraction Wells and Pilot Study Monitoring Wells
- Figure 2 – Pilot Study Area of Influence During Injection
- Figure 3 – Pilot Study Capture Zone During Extraction
- Figure 4 – Water Quality Maps of TPH-DRO and TPH-GRO for July, August, September, October, and November
- Figure 5 – Water Quality Maps of VOC's for July, August, September, October, and November
- Figure 6 - Water Quality Map of Non-Ionic Surfactants for July, August, September, October, and November
- Appendix 1 – Laboratory Analytical Reports

Table 1 shows a summary of all gauging, TPH-DRO results, and Non-Ionic Surfactant results collected during the field activities. This includes gauging data pre, during, and post injection (push) and extraction (pull) events. Dates, times, and comments associated with each gauging and/or sampling event are included. As shown in **Table 1**, mounding of the groundwater was observed during the injection events at approximately two feet (2') in MW-41, approximately five feet (5') in MW-40, approximately thirteen feet (13') in MW-42, and approximately sixteen feet (16') in MW-22. Also shown in **Table 1** are numerous samples collected for TPH-DRO during extraction activities. The sampling frequency was at the discretion of the Technical Team and was necessary for determining the efficiency of the Ivey-sol® application. During the extraction events, sheen was observed at MW-14, MW-22, MW-40, MW-41, and MW-42. At no time was liquid petroleum hydrocarbon detected during site activities. Finally, **Table 1** includes samples collected for surfactants. Again, the sampling frequency was at the discretion of the Technical Team and was necessary for demonstrating that at no time did the Ivey-sol® solution migrate down-gradient from the upper parking lot.

Table 2 shows a summary of all analytical results including, VOC's, TPH-DRO, TPH-GRO, and Non-Ionic Surfactants collected during the baseline and post-injection monitoring period. In reviewing the results of VOC's and TPH-DRO, the post-injection monitoring results are generally consistent with baseline results. Site maps showing concentrations of TPH-DRO are included in **Figures 4a-4e.** As shown in **Table 2**, TPH-GRO analysis was not included in the baseline sampling. In reviewing the results of TPH-GRO with historical data (Post June 2012), the post-injection monitoring results are generally consistent with the historical data where detectable levels of TPH-GRO are present at MW-14, MW-41, MW-46, and MW-47. Finally, **Table 2** shows detectable levels of surfactants were present only at the four (4) injection/extraction wells and at residual concentrations. The results confirm that at no time did the Ivey-sol® solution migrate down-gradient from the upper parking lot. The results further confirm that field testing measures implemented for determining the presence/absence of Ivey-sol® solution were effective.

Table 3 shows a summary of the drawdown data and radius of influence for each extraction well during the three (3) extraction events. Noting that MW-22, MW-40, and MW-41 were four inches (4") in diameter and MW-42 was two inches (2") in diameter the radius of influence was most noticeable utilizing the four inch (4") diameter wells. **Figure 3** in **Appendix D** shows the radius of influence associated with each extraction well. The two inch (2") well drawdowns demonstrated that extractions reached a radius of approximately fifty-five feet (55'), where the four inch (4") well extractions reached an average radius of approximately one hundred (100'). These observations further

demonstrate that the extraction radius overlap and that Ivey-sol® solution and liberated extractions produced highly efficient removal rates approaching complete recovery.

SECTION 5 – DISCUSSION OF REMEDIAL EFFECTIVENESS

5.1 DISCUSSION ON MASS RECOVERY FROM FOUR (4) INJECTION/EXTRACTION WELLS DURING THREE (3) INJECTION/EXTRACTION EVENTS

5.1.A PRELIMINARY TECHNICAL REVIEW

This section focuses on the TPH-DRO mass recovery at the four (4) push-pull wells (MW-22, MW-40, MW-41, and MW-42) and associated groundwater elevation observations, within the onsite smear zone. Baseline groundwater sampling, gauging for groundwater table elevation and liquid petroleum hydrocarbon presence, were completed at all push-pull and nearby monitoring well and recovery well locations to establish the baseline pre Ivey-sol® conditions onsite, for comparison of the post Ivey-sol® application findings.

The first Ivey-sol® push-pull injection was commenced at 13:00 on July 29, 2014, and allowed a residence time of approximately twenty-four (24) hours before the push-pull wells were equipped with submersible pumps for groundwater extraction, into an aboveground holding tank onsite. Time based groundwater samples, groundwater elevation, liquid petroleum hydrocarbon gauging, and surfactant surface tension field testing were completed. The field surface tension field tests were used to ensure adequate groundwater was extracted between events (indicated by absence of surfactant in field tests).

A similar two (2) day injection (push) followed by a twenty-four (24) hour residence period before extraction (pull) approach was employed during all three (3) Ivey-sol® push-pull events. MW-40 and MW-42 were the first two (2) wells injected and then MW-41 and MW-22 were injected in this order for each event. The associated monitoring around each event was amended and generally increased to allow enhanced data capture with the time-based sampling program employed.

5.1.B GROUNDWATER ELEVATION AND SMEAR ZONE

The groundwater table elevation correlated well with each Ivey-sol® injection event and was most apparent at all wells for the second and third Ivey-sol® injections. It seems the elevation data collected during the first injection appeared to have generally missed the rise at all monitoring well locations. By achieving a groundwater table mounding on the order of five feet (5') to ten feet (10') in the vicinity of each monitoring well indicates we can target residual TPH-DRO in the unsaturated (vadose) zone onsite if and as required. This is important to note as the TPH-DRO is present within the saturated and unsaturated geology onsite.

5.1.C TPH-DRO MASS RECOVERY AT MW-22, MW-40, MW-41, MW-42

The below calculations detail the observed mass recovery at each of the monitoring wells associated with the three (3) Ivey-sol® push-pull events. The mass recovery calculations provided below are based on the following:

Averaged TPH-DRO Concentration Pre Injection Event =

$$\frac{\text{[Pre Ivey-sol injection TPH-DRO (ppm) X Concentrations (ppm)]}}{\text{'}X\text{' Data Sample Points}}$$

Note: Take the 3 to 5 Pre Ivey-sol Injection TPH-DRO concentrations from the plots and average them to establish an 'Averaged' Baseline TPH-DRO concentration. 'X'=number if samples.

Averaged TPH-DRO Concentration Post Injection Event =

[Post Ivey-sol Injection TPH-DRO (ppm) X Concentrations (ppm)]
***'X'* Data Sample Points**

Note: Take the Post Ivey-sol® Injection TPH-DRO concentrations from the peaks and average them to establish an 'Averaged' Baseline TPH-DRO concentration. In our case this is usually one (1) data point. If there were more we would average them. 'X'=number if samples.

Mass Recovery = [Averaged TPH-DRO Concentration Post Injection Event] X 100%
[Averaged TPH-DRO Concentration Pre Injection Event]

= % Mass Recovery Increase For The Ivey-sol® Push-Pull Event

MW-22	Ivey-sol® Injection #1	426% Increase in **TPH-DRO**
	Ivey-sol® Injection #2	6,240% Increase in **TPH-DRO**
	Ivey-sol® Injection #3	6,846% Increase in **TPH-DRO**
MW-40	Ivey-sol® Injection #1	7,333% Increase in **TPH-DRO**
	Ivey-sol® Injection #2	5,133% Increase in **TPH-DRO**
	Ivey-sol® Injection #3	5,156% Increase in **TPH-DRO**
MW-41	Ivey-sol® Injection #1	*Not Calculated (Missed Sample)*
	Ivey-sol® Injection #2	18,966% Increase in **TPH-DRO**
	Ivey-sol® Injection #3	3,226% Increase in **TPH-DRO**
MW-42	Ivey-sol® Injection #1	948% Increase in **TPH-DRO**
	Ivey-sol® Injection #2	824% Increase in **TPH-DRO**
	Ivey-sol® Injection #3	3,737% Increase in **TPH-DRO**

In all above calculations, just one (1) pre-injection data point was used with the two (2) peak TPH-DRO for completing the mass recovery calculations. The observed increases in TPH-DRO correlate well with the observed rise and fall of the local groundwater table in the vicinity of each push-pull recovery well.

5.1.D POST IVEY-SOL® APPLICATION "ECHO" MASS RECOVERY EFFECTS

The associated increase in mass recovery at each of the monitoring well location for this "Echo" effect would be as follows:

- MW-22 739% (From 2.3 to 17 ppm)
- MW-40 1,980% (From 4.9 to 97 ppm)
- MW-41 9,500% (From 0.8 to 76 ppm)
- MW-42 8,545% (From 1.1 to 94 ppm)

An interpretation for this increase in mass recovery following the three (3) push-pull Ivey-sol® applications could be attributed to some residual Ivey-sol® injection (push) remaining in the smear zone due to the induced drawdown (pull) on the groundwater table across this zone.

5.1.E SUMMARY

As a result of the investigations, analysis, and calculations of mass recovery the Technical Team has been able to determine that in the push-pull wells recovery rates were significantly enhanced from one thousand percent (1,000%) to eighteen thousand percent (18,000%). Extrapolating from this information and planning for future applications it is expected that similar and more substantial results can be achieved from using these techniques when the push-pull Ivey-sol® process is targeted to the original up-gradient source area and the several mid to down-gradient areas that would benefit from addition Ivey-sol® applications which have been identified in previous reports.

By using the existing MyCelx® Filter Treatment System and based on the above observations identified in previous sections of this report, it is clear that this treatment facility has the capacity to achieve the necessary removal while continuing to stay in conformance with Discharge Permit effluent limitations. During the period that the Pilot Study was conducted and for the ninety (90) days of intensive post-injection monitoring that followed, the pump and treat system continued to successfully operate within the limits of the Discharge Permit.

In order to assure that there is sufficient capacity within this system to handle an increased frequency of push-pulls during future applications, the Technical Team has assessed the original Basis of Design for this facility and made the determination that with appropriate management of the bag filters and attention to the standard operating procedures of the MyCelx® Filter Treatment System, that there is more than adequate capacity within this treatment works to satisfy the project's needs. Appendix E provides the detailed technical assessment and capabilities of the MyCelx® Filter Treatment System.

In measuring the amount of Ivey-sol® product to use in each of the push-pull applications various concentrations were used. It was determined that doubling the concentration did not significantly increase the mass removal. This is significant because we are able to conclude that the lowest effective dose of Ivey-sol® was more than adequate to accomplish the objectives of this remediation process. Specifically, the doses using a concentration of 0.11 percent were as effective as twice that concentration at 0.22 percent. For these reasons all future applications would be limited to the 0.11 percent which we also believe contributed significantly to the very fast dissipation of the surfactant in the water table.

5.2 CAPTURE ZONE AND PUMP AND TREAT SYSTEM

5.2.A INFLUENCE OF THE CAPTURE ZONE IN RECOVERY OF LIBERATED MATERIAL

The data demonstrates that although the injected Ivey-sol® material moves out in very small distances from the point of application, the drawdown radius of influence extends out as far as approximately one hundred feet (100') to ninety feet (90') during the extraction process. These observations confirm that with the groundwater migration rates, the extraction drawdown radius, and the curtain effect of the hydraulic controls, that the push-pull applications and liberated materials are completely controlled within the immediate area of the injection/extraction wells. Referring to **Appendix D, Figure 3** on the following page, the capture zone represented by these extraction wells overlap each other which provides additional redundancy in the recovery of the Ivey-sol® solution and liberated materials.

5.2.B THE POSITIVE INFLUENCE OF THE PUMP AND TREAT SYSTEM

Laboratory results, from the recovery wells, all indicate that the mass removal was primarily the result of the four (4) extraction wells rather than the pump and treat system. However, using the MyCelx® Filter Treatment System, for extracting the liberated materials, the pumping to the treatment system would also provide a secondary benefit in future applications associated with the curtain effect as part of the drawdown radius of influence during extractions.

Although the pump and treat system was not primarily used for extracting and removing liberated material during the Pilot Study; based on the historic performance of the treatment system, its capacity rating, and the filter technology, the Technical Team believes that using the MyCelx® Filter Treatment System for recovery and treatment onsite will be the most efficient and cost-effective approach during future push-pull Ivey-sol® applications.

5.2.C SUMMARY

As mentioned above, the groundwater movement is exceedingly slow, the dispersion of the injected Ivey-sol® in these soils is typically limited to twenty feet (20') or thirty feet (30'), and extractions from four inch (4") wells typically overlap at an average distance of approximately one hundred feet (100'). For these reasons the Technical Team believes that liberated material and Ivey-sol® surfactant can be contained and recaptured within the immediate area of application. Also, the pumps used to extract water for treatment in the MyCelx® Filter Treatment System provides a degree of hydraulic control and curtain effect which will further limit liberated materials and surfactant from moving down-gradient. With groundwater movement at a conservative 0.4 feet per day and extractions being approximately twenty-four (24) hours after the application, the risk of down-gradient movement of liberated materials is de-minims.

SECTION 6 – RECOMMENDATIONS FOR ADDITIONAL IMPLEMENTATION

6.1 FIELD OBSERVATIONS

- Ivey-sol® solution demonstrated the ability to remove sorbed residual hydrocarbon from soil and dissolved phase hydrocarbons from groundwater. The Technical Team concludes the Ivey-sol® product and push-pull process is the appropriate remediation technology for this site.

- Post monitoring results for TPH-DRO were consistent with baseline sampling prior to the Pilot Study. This indicates the locations of the injection/extraction wells were down-gradient of the smear zone. Indicating the remediation strategy of the site will require efforts further up-gradient and within the smear zone.

- At no time did the Ivey-sol® solution migrate down-gradient of the upper parking lot. The results support that the extraction efforts captured over ninety-seven percent (97%) over ten (10) days and after forty-five (45) days ninety-nine percent (99%) was removed. Since elimination of the Ivey-sol® solution is a good indicator of the efficiency for removing of liberated material, the data correlation supports the conclusion that similar efficiencies were, and would be, achieved during extractions for the liberated sorbed residual hydrocarbons.

- Utilization of four inch (4") diameter wells provided the greatest area of influence during extraction activities. Monitoring wells located further up-gradient and within the 'source area' smear zone MW-1, MW-2, MW-3, MW-4, MW-5, and MW-37 are all four inches (4") in diameter. In addition, MW-14 is also four inches (4") in diameter, while MW-46 and MW-47 are two inches (2") in diameter.

- Keeping the pump and treat system in operation during the Pilot Study limited the diffusion radius associated with MW-41 due to the close proximity of RW-2D and RW-5. It is not anticipated the operation of onsite recovery wells would impact injection/extraction efforts located further up-gradient due to their physical proximity location.

While all attempts were made to utilize the extraction wells for removal of the groundwater, keeping the pump and treat system in operation during the Pilot Study inevitably resulted in an unknown quantity of groundwater being introduced into the remediation system. Monitoring of the remediation system during the Pilot Study demonstrated that Ivey-sol® solution did not pose any impacts to the effectiveness of remediation system. Due to the physical limitations of the site and the monitoring results of the remediation system, utilization of the remediation system is recommended for the treatment of extracted water during future extraction events.

6.2 IVEY-SOL® "END POINT" INDICATORS

6.2.A Liquid Phase Hydrocarbons

Encompassing the twenty (20) year period of the initial contaminant removal followed by Earth Data's pump and treat, it has been demonstrated that the vast majority of free product has been recovered. Measurable amount of free product was last recovered in April, 2014. Having documented the absence of liquid petroleum hydrocarbons the focus of the remediation case shifted to remediation associated with sorbed residual hydrocarbons and dissolved phase hydrocarbons.

6.2.B Sorbed Residual Hydrocarbons

At the end of 2012, following a year of intensive monitoring with the pump and treat system off, the data revealed ten (10) months of very low levels of dissolved phase hydrocarbons followed by two (2) months of elevated TPH-DRO. As part of the analysis of these findings, it was determined by the Technical Team that the cause of the spikes were associated with the seasonal high groundwater water table coming into contact with unsaturated soils in the smear zone that contained residual petroleum product materials. The Technical Team developed a cross section which clearly defined a smear zone interval that represented areas where sorbed contaminants could potentially be adhered to the soil matrix.

After discovering a smear zone and researching the industry for viable options to clean the soils in the area of contamination, the Technical Team assessed the viability of using Ivey-sol®. Subsequently the Technical Team submitted findings to MDE and obtained approval for a Pilot Study to demonstrate the effectiveness of this technique at the CRHC site. The results of the Pilot Study prove that the Ivey-sol® process was effective in liberating material from the soil and is the appropriate method to be used for full scale implementation.

During the Pilot Study a comprehensive set of samples and laboratory analysis were performed. These included the measurement of TPH-DRO and surfactants. The results from the samples taken during the extraction activities can be associated with the mass product recovery which was discussed above. With each extraction higher levels of petroleum hydrocarbon concentrations were reported by the laboratory results and in amounts indicating several logs of removal higher than had been experienced with the pump and treat system alone. For the proposed full scale push-pull application, with every extraction, conducting a follow-up TPH-DRO sample can be used as an indicator as to when “end points” have been achieved. In other words, continuous push-pull applications on any given well would continue until the measured amount of TPH-DRO was significantly reduced. At that point no further Ivey-sol® applications would be required as measurable amounts of liberated material would not be achieved.

In examining all of the laboratory data and correlating it with the span of time that the push-pull process was being conducted, the highest rate of liberated material was associated with samples taken within the first one (1) to two (2) hours of Ivey-sol® application. Therefore, the indicator sample should be those collected in the first two (2) hours for each of the push-pull applications and examined by the laboratory and reports received within twenty-four (24) to forty-eight (48) hours. This information will be used by the field team as the appropriate indicator information to determine whether additional push-pulls are necessary or if removal efficiencies have already been optimized and no more applications are indicated.

6.2.C Dissolved Phase Hydrocarbons

For years the pump and treat system has been removing dissolved phase hydrocarbons through the filter system and discharging clean water per MDE Discharge Permit requirements. The process of removing very small concentrations of dissolved phase hydrocarbon is an exceedingly slow process especially when concentrations are at levels measured in parts per million. Until the sorbed residual hydrocarbon is essentially removed and completely liberated from the smear zone, there continues to be the possibility during the seasonal high water table that some of the sorbed residual hydrocarbon becomes dissolved and reintroduced into the water table.

With this same technology employed to address the sorbed residual hydrocarbon (Ivey-sol® applications combined with the MyCelx® Filter Treatment System) we anticipate dissolved phase hydrocarbons to reach concentrations at levels acceptable to MDE for case closure consideration. In order to accomplish this and once the more concentrated Ivey-sol® applications are completed in the area of the original spill and other areas that would benefit from additional Ivey-sol® applications, the Technical Team will conduct several

minor applications of Ivey-sol® at the down-gradient wells in an effort to remove any remaining sorbed or dissolved residuals. This would likely include applications at select wells immediately south of Brown Street.

6.3 POST IVEY-SOL® MONITORING

The proposal to initiate a campaign of Ivey-sol® applications in the Spring of 2015 will be further discussed in the Section 7 of this report. However, once the Ivey-sol® application is completed there will need to be an extended period of monitoring and laboratory testing to determine if the site has been remediated to a level that an assessment of the Seven (7) Risk Factors can be performed and the project can be reconsidered for case closure. The indicators as to having satisfied all of the remediation requirements of the site to the maximum extent feasible would be the cumulative data gathered over a twelve (12) month period where levels of TPH-DRO approach laboratory reporting limits. With the sorbed residual hydrocarbon having been liberated and Ivey-sol® push-pull applications applied to down-gradient wells that show some level of dissolved phase hydrocarbon, it is reasonable to expect that safe levels of TPH-DRO will have been achieved by the end of this reporting period.

The monthly monitoring program that we are recommending following the application of Ivey-sol® would include TPH-DRO with quarterly sampling to include TPH-DRO, TPH-GRO, and VOC's. In the interim while Ivey-sol® push-pull applications are still being performed the appropriate level of monitoring would only include:

- Quarterly sampling for VOC's, TPH-DRO, and TPH-GRO at select wells.
- Monthly sampling for TPH-DRO only at select wells.
- Monthly gauging at select wells.

SECTION 7 – PROPOSED 2015 ACTION PLAN

7.1 INTRODUCTION

The following work plan, discussion of protocols, and remediation approach for 2015 will build on the results from the 2014 Pilot Study. A proposed ninety (90) to one-hundred twenty (120) day series of pre-planned sequencing of Ivey-sol® push-pull applications would demonstrate a high expectation that as much as ninety percent (90%) of the absorbed material could be liberated and extracted from the groundwater. The Technical Team believes the best time to implement this full scale push-pull process would be during periods of higher groundwater table (i.e. Spring) during the months of March, April, and May, and perhaps extending into part of June.

As detailed below, the results of the Pilot Study also indicate that benefits can be derived from modifying the protocols as follows:

- There would be a series of push-pull events in each of the Priority Zones over a ninety (90) to one hundred twenty (120) day period.
- The MyCelx® Filter Treatment System would remain on for the duration of the 2015 remediation efforts, in order to serve as the method to treat and discharge extracted water.
- As mentioned above the extraction would be treated through the MyCelx® Filter Treatment System and not collected in tanks and taken offsite.
- The 2015 Action Plan defines Ivey-sol® "end point" indicators through various measuring techniques which would control the number of push-pull applications at any well over this period of time and define when no more liberated material is being extracted from the formation.
- Since the addition of testing parameters during the Pilot Study revealed no measurement of substances which would in any way exacerbate the cleanup effort, or indicate that downstream water quality was impacted, the proposed 2015 Action Plan suggests a significantly reduced level of laboratory testing.
- Bag filters would be replaced Monday-Friday during the push-pull process.

With a concerted effort to liberate absorbed materials and remove them from the smear zone, we believe that the proposed 2015 Action Plan can produce results which significantly enhance the overall remediation effort. The new Action Plan moves from focusing on free product and removal of dissolved materials to concentrate efforts on liberating materials from the smear zone, much improved extraction/removal efficiencies, use of the Mycelx® Filter Treatment System, and moving quickly to a complete remediation result.

In the following sections the details of these proposals, the rationale, and the expected efficiencies and effectiveness will be reviewed thoroughly and organized in such a fashion so as to present the conclusion that implementing this new approach provides a "more than reasonable expectation" of achieving final cleanup and a move toward case closure.

7.2 PROTOCOL 1 – SERIES OF PUSH-PULL EVENTS

Summary of Protocol: Using the 2014 Pilot Study Conclusions and Recommendations, it is proposed that the Ivey-sol® push-pull applications be targeted in the area of the original spill (smear zone) as a first priority and then moving outward to encompass the entire smear zone within a ninety (90) to one-hundred twenty (120) day period during the seasonal high groundwater table time of the year. The number and frequency of push-pulls at any one (1) well would be determined in the field by measuring the amount of material liberated and making determinations when no more material is being recovered.

Discussion/Rationale: Targeting localized material recovery from smear zones at priority well locations would eliminate residual mass from rebounding at said wells and expedite local and site-wide remediation to achievable levels. (Further details and discussion of the Priority Zone Implementation Approach is discussed is Section 7.7 below.)

7.3 PROTOCOL 2 – HYDRAULIC CONTROLS TO REMAIN IN PLACE

Summary of Protocol: It is still critical to ensure that any liberated material does not move offsite. The success of the pump and treat system to minimize down-gradient movement of petroleum products has been carefully documented over the years. For future Ivey-sol® applications it is recommended that extraction pumps discharging to the treatment system will continue to provide a curtain effect that is a secondary benefit which will further limit migration of liberated material down-gradient.

Discussion/Rationale: During the Pilot Study none of the tested parameters increased in concentrations at the down-gradient wells. This was an important demonstration of the Pilot Study to be able to show that the Ivey-sol® push-pull process could be implemented upstream with no movement of liberated material downstream/offsite. By leaving hydraulic controls in place as defined above as part of the 2015 Action Plan, this also provides the opportunity to use the system for the treatment of extracted material removed as part of the Ivey-sol® push-pull process.

7.4 PROTOCOL 3 – EXTRACTIONS TO BE REMOVED THROUGH PUMP AND TREAT

Summary of Protocol: During the 2014 Pilot Study it was determined that the concentration of materials in the extraction of liberated material were within the design parameters of the existing Mycelx® Filter Treatment System. Certainly over the many years of its operation when product recovery and groundwater concentrations were much higher, the pump and treat system proved very efficient in removing petroleum chemicals without damage to the filter and while continuing to meet Discharge Permit requirements.

Discussion/Rationale: The cost of renting tanks to collect extracted material and disposing of it offsite through a licensed hauler with final disposal at an approved disposal facility is a costly and unwarranted expense. Neither the surfactant (Ivey-sol®) nor the liberated material poses any significant threat to the performance of the treatment system. Also, the wells to be used in the smear zone areas are close enough to the treatment system that small diameter plastic tubing can be used to connect the small pumps to the treatment building. This process would be the most cost-effective, least disruptive to the parking lot and hospital entrance areas, and assure that the extracted materials will be properly treated, while also limiting down-gradient migration by serving as a hydraulic control. For those monitoring wells further from the treatment building, portable containers shall be utilized and the extracted water transferred to the treatment system.

7.5 PROTOCOL 4 – CREATING TESTING PARAMETERS TO GAUGE EFFECTIVENESS OF PUSH-PULL

Summary of Protocol: The 2015 Action Plan approach is to undertake a concerted effort to conduct a series of push-pull applications at each well in the smear zone until there are no more significant amounts of liberated materials being extracted. Having demonstrated the efficiency, effectiveness, and safety of the Ivey-sol® push-pull process it is important to the overall groundwater remediation that we remove the sorbed materials which are the continued source of groundwater contamination. The combination of surface tension field tests and twenty-four (24) hour laboratory testing of TPH-DRO will be used to determine Ivey-sol® end point indicators; when application of Ivey-sol® no longer liberates sorbed residual hydrocarbon.

Discussion/Rationale: Although the surfactant dissipates quickly and the treatment system can safely remove liberated materials it is important to the overall effort to be able to predict when the remediation of soils has been achieved. The use of the proposed surface tension field tests has correlated well with laboratory tests and when combined with TPH-DRO results will be the best indicator that no more liberated material or surfactant remains in the groundwater at the extraction points.

7.6 PROTOCOL 5 – REDUCTION OF LABORATORY TESTING REQUIREMENTS

Summary of Protocol:

Monthly Monitoring and Reporting:
Sampling of eleven (11) targeted monitoring wells (MW-15, MW-16, MW-19, MW-20, MW-24, MW-33, MW-34, MW-35, MW-48, MW-49, and MW-50) for the presence of Total Petroleum Hydrocarbons – Diesel Rand Organics (TPH-DRO) using EPA Method 8015.

Quarterly Monitoring and Reporting:
For the first month of each quarter sample all monitoring and recovery wells for the presence of TPH-DRO using EPA Method 8015 and Volatile Organic Compounds (VOC's) including oxygenates, using EPA Method 8260B.

For the second and third months sample of eleven (11) targeted wells (MW-15, MW-16, MW-19, MW-20, MW-24, MW-33, MW-34, MW-35, MW-48, MW-49, and MW-50) for the presence of TPH-DRO using EPA Method 8015.

For each of the three (3) months gauge all monitoring and recovery wells.

Push-Pull Monitoring and Reporting:

- The injection wells and surrounding monitoring wells will be gauged periodically during daily push-pull events.
- Groundwater from the injection wells will be assessed for surface tension throughout the day.

Discussion/Rationale: The routine monthly and quarterly sampling, gauging, and reporting should continue as outlined above. The safety and efficacy of using Ivey-sol® to liberate materials from the smear zone has been demonstrated and additional sampling and gauging beyond what is described above would not be indicated or warranted.

7.7 PRIORITY ZONE IMPLEMENTATION PLAN

7.7.A Ivey-sol® In-situ Push-Pull Remediation Strategy For 2015

This section will detail a ninety (90) to one hundred and twenty (120) day in-situ Ivey-sol® surfactant remediation strategy for application in 2015.
The general approach would involve implementing remediation priority zones across the site based on the TPH-DRO groundwater concentrations observed at monitoring well locations over the last calendar year. Within each priority zone, the Ivey-sol® push-pull applications would occur at each individual monitoring well location, and modelled after the positive pilot-scale application results which yielded upwards of an eighteen thousand percent (18,000%) increases in TPH-DRO contaminant mass removal in the vicinity of the subject monitoring well locations.

For 2015 efforts, we are proposing three (3) modifications to the Pilot Study Application as follows:

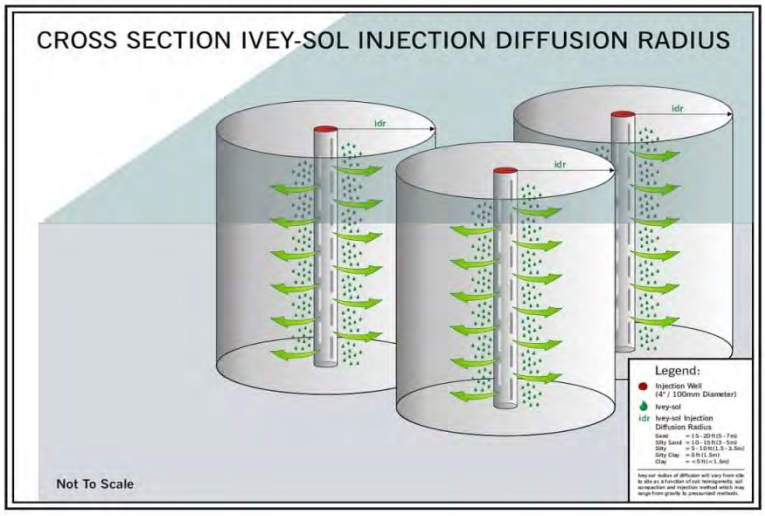
- Modification No.1 – Expand the post Ivey-sol® injection residence time, before groundwater extraction, from twenty-four (24) hours to forty-eight (48) hours. This will allow for greater contaminant mass removal per push-pull event.

- Modification No.2 – Discontinue operation of the recovery wells. As documented in the Pilot Study, localized hydraulic control exceeding approximately one hundred feet (100') in the vicinity of the four inch (4") diameter monitoring well locations, and over approximately fifty-five feet (55') in the vicinity of the two inch (2") diameter monitoring well locations was achieved.

- Modification No.3 – Utilize existing onsite MyCelx® Filter Treatment System for treatment and disposal of extracted groundwater. The Pilot Study has demonstrated that no adverse effects to the treatment system were encountered due to the presence of Ivey-sol® in the system influent.

The same Ivey-sol® push-pull application approach would be completed at all TPH-DRO impacted monitoring well locations where concentrations greater than 0.1 parts per million (ppm) have been observed. The only difference between the monitoring well locations in each priority zone would be the number of Ivey-sol® push-pull application events required. The Ivey-sol® push-pull approach would generally achieve contaminant mass removal within a twenty foot (20') to thirty foot (30') radius of each monitoring well location. (See **Exhibit 1** below.)

Exhibit 1: Cross Section Ivey-sol® Injection Diffusion Radius



7.7.B Priority Zones

To implement the proposed remediation strategy across the site, the monitoring locations were grouped into four (4) priority zones (highest to lowest), based on the observed groundwater TPH-DRO concentration trends over last calendar year (2014). Priority 1 monitoring well locations would be specified to receive the greatest remediation effort as these monitoring well locations exhibited the highest TPH-DRO concentrations. The remediation effort within each lower priority zone would proportionally scale down as a function of the lower TPH-DRO concentrations observed. Monitoring well locations that would not require any remediation efforts have also been identified as 'No Action' wells.

The four (4) priority zones are listed below, and color coded to match the priority zones and monitoring well locations falling within each, as shown in Appendix F. The monitoring well locations are depicted with a twenty foot (20') to twenty-five foot (25') radius of remediation influence indicated around each monitoring well. The relative TPH-DRO concentrations observed within each priority zone are also provided.

- **Priority #1** **MW-1, MW-2, MW-3, MW-4, MW-5, and MW-37** *(Up-gradient smear zone wells in vicinity of original spill site),* **MW-14** and **MW-47** *(Hot-spot localized high TPH-DRO concentrations)*
  Note: TPH-DRO >100 ppm over last year (2014)

- **Priority #2** **MW-40, MW-41, MW-42, MW-43, MW-46** (*Mid-plume down gradient of smear zone).*
  Note: TPH-DRO <100 to 10 ppm over last year (2014)

- **Priority #3** **MW-9, MW-10R, MW-11, MW-13, MW-20, MW-45** *(Mid to down gradient plume region)*
  Note: TPH-DRO >1 ppm and < 10 ppm over last year (2014)

- **Priority #4** **MW-12, MW-15, MW-16, MW-17, MW-18, MW-19, MW-22, MW-24, MW-25, MW-32, MW-33, and MW-50** *(Down-gradient frontal plume).*
  Note: TPH-DRO 0.1 to <1 ppm over last year (2014)

- **No Action** **MW-21, MW-23, MW-28*, MW-29, MW-31R, MW-34*, MW-44*, MW-48, and MW-49**

Note: TPH-DRO <0.1 ppm over last year (2014) * MW-28, MW-34, and MW-44 each had one exception for remaining below laboratory reporting limits in 2014. Based upon their one time result of 0.11 ppm and the sampling history at these monitoring wells, there is insufficient data to warrant remedial activities at these locations.

7.7.C Ivey-sol® Priority Zone Application

To expedite in-situ TPH-DRO mass remediation within each of the priority zones for reaching the Technical Team's objectives of <0.1 ppm, the following application strategy to be implemented sequentially by priority zone would apply over a concerted ninety (90) to one-hundred twenty (120) days (three (3) to four (4) month) effort onsite.

Priority #1 Ivey-sol® push-pull applications commencing with a maximum two (2) events per week, and could adjust down to one (1) per weeks as the observed TPH-DRO concentrations approach <0.1 ppm.
Eight (8) monitoring wells involved.

Priority #2 Ivey-sol® push-pull applications commencing with a maximum one (1) to two (2) events per week, and could adjust down to one (1) per week as the observed TPH-DRO concentrations approach <0.1 ppm.
Five (5) monitoring involved.

Priority #3 Ivey-sol® push-pull applications commencing with a maximum one (1) event per week, and could adjust down to one (1) bi-weekly as the observed TPH-DRO concentrations approach <0.1 ppm.
Six (6) monitoring wells involved.

Priority #4 Ivey-sol® push-pull applications commencing with a maximum one (1) bi-weekly as the observed TPH-DRO concentrations approach <0.1 ppm.
Twelve (12) monitoring wells involved.

The Ivey-sol® push-pull remediation events at each monitoring well location, within the four (4) priority zones, would generally follow a stepwise approach as listed below:

1. Preparation of a 0.11 % by volume Ivey-sol® 106 formulation for injection (i.e., mixing five (5) gallon pail of Ivey-sol® 106 into 275 gallons of clean water).

2. Inject this diluted Ivey-sol® into the subject monitoring well location(s).

3. Allow a post injection 'Residence Time' of forty-eight (48) hours to pass.

4. Commence extraction efforts. Collect sample within first hour of extraction for analysis by TPH-DRO. Extract the groundwater from the monitoring well location removing three (3) to five (5) times the volume injected, and/or when the Ivey-sol® field screening test indicates that the majority of Ivey-sol® surfactant from the injection has been removed.

5. The extracted groundwater is then treated and disposed via the onsite MyCelx® Filter Treatment System. (Filter bags to be changed Monday through Friday.)

6. Review the TPH-DRO extraction result collected in Step 4. If concentrations indicate, proceed with additional push-pull applications.

7. On a monthly basis, for each monitoring well that has undergone an Ivey-sol® application during that month, collect and analyze for TPH-DRO.

8. Based on a review of laboratory analysis during extraction activities, the frequency of Ivey-sol® push-pull application events can be increased or decreased accordingly.

7.8 POST INJECTION EXTRACTION MONITORING AND SAMPLING

The CRHC Technical Team is proposing the following monthly and quarterly sampling and testing after the ninety (90) to one hundred and twenty (120) day Ivey-sol® injection and extraction:

- Quarterly monitoring sampling, and testing of eleven (11) targeted wells (MW-15, MW-16, MW-19, MW-20, MW-24, MW-33, MW-34, MW-35, MW-48, MW-49, and MW-50) for the presence of TPH-DRO using EPA Method 8015.
- Monthly monitoring, sampling, and testing of eleven (11) targeted monitoring wells (MW-15, MW-16, MW-19, MW-20, MW-24, MW-33, MW-34, MW-35, MW-48, MW-49, and MW-50) for the presence of Total Petroleum Hydrocarbons – Diesel Rand Organics (TPH-DRO) using EPA Method 8015.

This will be performed while the pump and treat system is turned off for twelve (12) months. Based on the result of the results of 2014 Pilot Study the Technical Team is believes that "case closure" can be achieved after the twelve (12) month sampling and monitoring.

APPENDIX A

MDE July 25, 2014 Pilot Study Approval Letter

MDE

MARYLAND DEPARTMENT OF THE ENVIRONMENT

Oil Control Program, Suite 620, 1800 Washington Blvd., Baltimore MD 21230-1719
410-537-3442 410-537-3092 (fax) 1-800-633-6101, ext. 3442

Martin O'Malley
Governor

Anthony G. Brown
Lieutenant Governor

Robert M. Summers, Ph.D.
Secretary

July 25, 2014

Mr Kenneth D. Kozel
President and CEO
Shore Regional Health
219 S Washington Street
Easton MD 21601

RE: MODIFIED PILOT TEST APPROVAL
Case No. 1987-2534-KE
Chester River Hospital Center
100 Brown Street, Chestertown
Kent County, Maryland
Facility I.D. No. 3168

Dear Mr. Kozel:

The Maryland Department of the Environment's Oil Control Program, Underground Injection Control Program, and the Water Supply Program have completed a review of the *Groundwater Remediation 2013/2014 Action Plan Modifications*, dated June 26, 2014. The June 2014 *Action Plan* proposes modifications to the July 2013 *Action Plan* approved by the Department on October 17, 2013. The modifications were adopted after technical meetings with the Town of Chestertown, the Hospital, and the Department, and were discussed at a public meeting with the citizens of Chestertown. These modifications include: conducting injections in only four well locations (MW-22, MW-40, MW-41, and MW-42); continuing to operate the groundwater pump-and-treat system during the pilot test; and the collection of all materials purged during the "pull" portion of the procedure in separate breakout tanks to ensure the system is not fouled with liberated material from the formation.

The Underground Injection Control Program has reviewed the June 26, 2014 *Action Plan* and has determined that the modifications made to the approved plan have been instituted to improve groundwater quality and are not adding pollutants to the groundwater. In addition, leaving the pump-and-treat system on during the injection process will further decrease the possibility of migration of Ivey-sol (i.e. is more conservative than the previous plan); therefore, no changes will be made to the previous authorization.

The Oil Control Program has reviewed the *Action Plan Modifications*, dated June 26, 2014, and approves the proposed modifications, contingent upon the following:

1) The Department understands that recovery well MW-22 will be utilized as a "push/pull" well during this pilot test. Following completion of the pilot test, MW-22 will return to a recovery well.

2) In order to better evaluate recoverability, radius of influence, the draw-down effect, and to evaluate liquid phase hydrocarbons (LPH) rebound, the Department requires more continuous monitoring during the injection event. The goal will be to collect depth-to-water measurements at intervals of once per every 30 minutes. These monitoring reading must include those points already outlined on the *Pilot Test Well Designations Table*. Gauging of the monitoring well network should be conducted before, during, and post-injection until water levels return to pre-injection conditions.

3) The Department requires weekly gauging events to evaluate the potential of LPH rebound for the first four (4) weeks post-injection. This will be followed by the proposed monthly gauging thereafter.

4) The Department concurs with the proposed post-injection sampling regime.

5) Following sample collection, gauging must return to a monthly schedule.

6) **No later than 45 days following the three month post-injection monitoring period**, submit a *Pilot Test Evaluation Report*. This report must provide: tabulated gauging data; radius of influence calculations; post-injection groundwater sampling data; technical discussion(s) of the remedial effectiveness and efficiency of the injection event; and recommendations for additional implementation. The presentation of this data should, at a minimum, include:

   a) Independent tables depicting:
      i) Gauging data collected before, during, and after the *Pilot Test;*
      ii) Draw down data by well and a calculated area of influence per extraction well;
      iii) Time of surfactant break through to the nearest extraction well based on the surfactant field testing data (i.e. surface tension data);
      iv) Volume of surfactant solution accepted in each injection well vs. time; and
      v) Surfactant, total petroleum hydrocarbon (TPH), and volatile organic compound (VOC) analytical data per well.

   b) Independent figures depicting:
      i) Calculated area of influence per injection well;
      ii) Capture zones of the recovery wells;
      iii) Concentration maps depicting surfactant, TPH, VOC, and LPH concentrations; and
      iv) Updated cross section maps as follows: A-A' – add MW-22 and RW-3B; B-B' – add MW-16; C-C' – add RW-3B and RW-2D; D-D' – add RW-6; and create E-E' – include MW-1, MW-2, MW-42, RW-5, MW-41, MW-47, MW-33, MW-16, and MW-23.

If you have any questions, please contact me at 410-537-3499 (email: susan.bull@maryland.gov).

Sincerely,

FOR

Susan R. Bull, Eastern Region Section Head
Remediation and State-Lead Division
Oil Control Program

SRB/chr

cc: Mayor Chris Cerino (Town of Chestertown)
Mr. Bill Ingersoll (Town of Chestertown)
Mr. Bob Sipes (Town of Chestertown)
Mr. Michael Forlini, Esquire (Funk & Bolton, PA)
Mr. John Beskid (Kent County Health Dept.)
Mr. Dane Bauer (Diversified Building Solutions, LLC)
Mr. James Sines (EBA Engineering, Inc.)
Mr. Michael Powell, Esquire (Gordon-Feinblatt, LLC)
Dr. Ching-Tzone Tien, Ph. D, P.E.
Mr. John Grace
Mr. Saeid Kasraei
Ms. Priscilla Carroll, Esquire
Mr. Andrew B. Miller
Mr. Christopher H. Ralston
Mr. Horacio Tablada

APPENDIX B

MDE Chart for Gauging and Sampling Data

MDE Case No. 1987-2534-KE - Chester River Hospital Center

Pilot Test Well Designations

Well ID	TOC Elevation (ft)	Well Diameter (in)	Well Depth (ft)	Top of Screen Depth (ft)	Tag Number	Comments	Pilot Test Well Type	Gauging Frequency	Sampling Frequency	Analytes Sampled
RW-1B	46.71	6	60	35	KE-94-0592	abandoned Aug '13				
RW-2D	40.54	6	55	30	KE-94-0593					
RW-3B	39.45	6	55	30	KE-94-0594					
RW-4	48.15	6	54	29	KE-94-0796	raised TOC by 2.46 (18 Dec 12)				
RW-5	43.34	6	55	30	KE-94-0809	raised TOC by 0.42 (8 Apr 11)				
RW-6	47.22	6	57	32	KE-94-0797					
MW-1	57.05	4	60	40	KE-81-1375					
MW-2	56.37	4	60	40	KE-81-137_					
MW-3	50.55	4	58	38	KE-81-1444					
MW-3b										
MW-4	53.40	4	60	40	KE-81-1443	raised TOC by 0.75 (25 Jun 07)				
MW-5	61.08	4	65	45	KE-88-0093					
MW-6		4	54	34	KE-88-0094	abandoned Nov '00				
MW-7		4	48	38	KE-88-0167	abandoned Nov '00				
MW-8		4	47	37	KE-88-0168	abandoned Aug '13				
MW-9	46.10	4	47	37	KE-88-0169	lowered TOC by 0.85 (15 Oct 12)				
MW-10		4	50	30	KE-88-0185	abandoned Nov '12				
MW-10R	48.70	2	54	29	KE-95-1066		Monitoring Well	B, D, A	B, A	PT
MW-11	41.49	4	46	23	KE-88-0186					
MW-12	44.46	4	48	33	KE-88-0187					
MW-13	41.70	4	44	29	KE-88-0188	raised TOC by 0.88 (1 May 02)	Monitoring Well	B, D, A	B, A	PT
MW-14	41.38	4	43	23	KE-88-0189	raised TOC by 0.7 (8 Apr 02)	Monitoring Well	B, D, A	B, A	PT
MW-15	35.01	4	45	20	KE-88-0196		Monitoring Well	A	A	PT
MW-16	35.55	4	39	24	KE-88-0197		Monitoring Well	A	A	PT
MW-17	35.49	4	38	23	KE-88-0198		Monitoring Well	A	A	PT
MW-18	35.82	4	39	25	KE-88-0199		Monitoring Well	A	A	PT

Well ID	TOC Elevation (ft)	Well Diameter (in)	Well Depth (ft)	Top of Screen Depth (ft)	Tag Number	Comments	Pilot Test Well Type	Gauging Frequency	Sampling Frequency	Analytes Sampled
MW-19	38.85	4	46	23	KE-88-0209		Monitoring Well	B, D, A	B, A	PT
MW-20	38.72	4	43	23	KE-88-0213		Monitoring Well	B, D, A	B, A	PT
MW-21	38.55	4	43	23	KE-88-0214					
MW-22	47.04	4	56	26	KE-88-0207	raised TOC by 1.29 (18 Dec 12)	Injection Well	B, D, A	B, A	PT
MW-23	35.95	4	40	25	KE-88-0225		Monitoring Well	A	A	PT
MW-24	36.56	4	40	25	KE-88-0226		Monitoring Well	A	A	PT
MW-25	36.10	4	40	25	KE-88-0227		Monitoring Well	A	A	PT
MW-27		4	45	25	KE-88-0229	abandoned Nov '06				
MW-28	35.90	4	39	24	KE-88-0230		Monitoring Well	A	A	PT
MW-29	35.15	4	39	24	KE-88-0231		Monitoring Well	A	A	PT
MW-30		4	49	34	KE-88-023_	abandoned Nov '00				
MW-31		4	48	33	KE-88-0391	abandoned Nov '12				
MW-31R	47.40	2	54	29	KE-95-1067					
MW-32	47.41	4	47	32	KE-88-0392	raised TOC by 2.81 (18 Dec 12)				
MW-33	36.52	4	41	26	KE-88-0415		Monitoring Well	B, D, A	B, A	PT
MW-34	36.64	4	41	26	KE-88-0416		Monitoring Well	B, D, A	B, A	PT
MW-35	38.62	4	43	28	KE-88-0417		Monitoring Well	B, D, A	B, A	PT
MW-37	50.54	4	70	11	KE-88-0497	lowered TOC by 1.03 (28 Sep 10)				
MW-38		4	55	40	KE-92-0002	pump stuck in collapsed well				
MW-40	48.69	4	55	30	KE-94-0803	raised TOC by 0.46 (9 Jun 09); raised TOC by 2.13 (18 Dec 12); resurvey May '13	Injection Well	B, D, A	B, A	PT
MW-41	42.92	4	55	30	KE-94-0802		Injection Well	B, D, A	B, A	PT
RW-1A		6	56	36	KE-88-0190	abandoned Jan '01				
RW-2A		6	47	27	KE-88-0224	abandoned Mar '08				
RW-2B		6	60	30	KE-88-0425	abandoned Mar '08				
MP-2B		2	60	30	na					
RW-2C		6				abandoned Sep '03				
RW-3A		6	60	30	KE-88-0411	abandoned Sep '03				

Well ID	TOC Elevation (ft)	Well Diameter (in)	Well Depth (ft)	Top of Screen Depth (ft)	Tag Number	Comments	Pilot Test Well Type	Gauging Frequency	Sampling Frequency	Analytes Sampled
MP-3A		2	60	30	na					
MW-42	46.15	2	50	30	KE-95-0342	lowered TOC by 0.89 (15 Oct 12)	Injection Well	B, D, A	B, A	PT
MW-43	47.90	2	50	30	KE-95-0343	raised TOC by 1.48 (18 Dec 12); resurvey May '13	Monitoring Well	B, D, A	B, A	PT
MW-44	47.20	2	50	30	KE-95-0344	raised TOC by 0.8 (18 Dec 12); resurvey May '13				
MW-45	40.91	2	45	25	KE-95-0345		Monitoring Well	B, D, A	B, A	PT
MW-46	41.08	2	48	28	KE-95-0346		Monitoring Well	B, D, A	B, A	PT
MW-47	40.74	2	50	30	KE-95-0347		Monitoring Well	B, D, A	B, A	PT
IW-1		4	61	31	KE-95-0752	raised TOC by 1.64 (18 Dec 12)				
MW-48	36.22	2			KE-95-1113		Monitoring Well	A	A	PT
MW-49	35.49	2			KE-95-1114		Monitoring Well	A	A	PT
MW-50	35.64	2			KE-95-1115		Monitoring Well	A	A	PT

Notes

Indicates well to be used for injection of Ivey-sol during the pilot test
Indicates a well to be used for monitoring during the pilot test.

Frequency

B - Before Sampled and gauged prior to injection of Ivey-sol.
D - During Gauged during the Ivey-sol injection events.
A - After Sampled and gauged one week and monthly for at least three months after Ivey-sol injection events.

Analytes

PT - Pilot Test Sampled for VOCs via EPA Method 8260, TPH-DRO/TPH-GRO via EPA Method 8015, and surfactants via EPA Method SM5540D.

APPENDIX C

Copies of MDE's Daily Site Reports

MARYLAND DEPARTMENT OF THE ENVIRONMENT

1800 Washington Boulevard, Suite 620 • Baltimore Maryland 21230-1719
(410) 537-3442 • 1-800-633-6101 • http://www.mde.state.md.us
LAND MANAGEMENT ADMINISTRATION
Oil Control Program

Report of Observations

Type of Inspection/Observations: B-3	**Date:** July 28 – 30, 2014
Site/Facility Name: Chester River Hospital Center	**Facility ID #:**
Address: 100 Brown Street	**Case #:** 87-2534KE
City / County: Chestertown, MD	**Permit #:**

Remarks:

July 28, 2014 – On this date this writer met representatives of Brightfields, Inc. (Ken, Hannon, Mike Craskey, and Ronald Mortel) and Ivy Sol (Bud Ivy) to oversee the pre-injection site preparations.

A health and safety meeting was conducted, pre-Injection well gauging and sampling began for all of the target pilot testing monitoring wells, the injection totes were assembled adjacent to the injection wells and a 0.11% solution of *Ivy-Sol* © was mixed for addition to the injection totes on Tuesday.

July 29, 2014 – On this date, this writer arrived on-site. Representatives of MDE (Forest Arnold, Daniel Jester, and myself), Ivy-Sol (Bud Ivy and Rusty Hashimoto), Brightfields, Inc. (Ken, Hannon, Mike Craskey, and Ronald Mortel) and EBA Engineering (James Sines).

- The last of the pre-gauging and sampling was completed
- A pre-injection site walk was completed to visually locate all monitoring and recovery wells. Site conditions of the monitoring and recovery wells were documented following construction activities (see table 2 below).
- Extraction well MW-22 was shut-down at 12:10 hours, in preparation to become a pilot injection well.
- Injections of 275 gallons water and 0.11% *Ivy-Sol* © solution began into MW-40 and MW-42 at 13:00 hours.
- The injection was completed utilizing a transfer pump capable of pumping 25 gal/min and terminated in MW-40 and MW-42 at 13:25 hours.
- Injections of 275 gallons water and 0.11% Ivy-Sol solution began into MW-22 and MW-41 at 13:30 hours.
- The injection was completed in MW-41 and MW-22 at 14:00 hours.
- Gauging and surface tension monitoring/sampling began…
- The Department requested that remediation system influent tank be added to the 30 minute site walk/inspection.
- The Department observed the location of the Town of Chestertown Well field in conjunction with the site wells.
- The Department was not able to locate Town Well 8. Mr. Ingersol and Mr. Sipes will be contacted from the Town to assist in locating this well.
- Baseline samples were sent to the lab.

Table 1:

Point	Total Depth of Well	Screen interval	Length of Hose
MW-22	56 feet	26-56 feet	25 feet

MW-40	55 feet	30-55 feet	25 feet
MW-41	55 feet	30-55 feet	25 feet
MW-42	50 feet	30-50 feet	25 feet

Table 2

Monitoring Well:	Well Condition:	Requirements:
MW-1	Portable generator on well	Move generator to make accessible
MW-38	Pump stuck in well	All efforts should be make to make accessible
MW-11, 10R 42	Covered with asphalt	Uncover and properly complete well vault
MW-9,14,31R, 32, 40, 41, 42, 43, 44, 45, 46	Pads destroyed	Manways and pads to be replaced

July 30, 2014 – On this date, this writer arrived on-site. Representatives of MDE (Adam Corry, Daniel Jester, and myself), Ivy-Sol (Bud Ivy and Rusty Hashimoto), Brightfields, Inc. (Ken, Hannon, Mike Craskey, and Ronald Mortel) and EBA Engineering (James Sines). Dane Bower stopped by briefly.

- First morning gauging and field tests for surface tension and agitation testing were conducted.
- Field tests conducted on samples collected from Brown Street perimeter wells MW-14, MW-47, MW-46 and MW-13 did not exhibit decreased surface tension.
- Field testing was also conducted on samples collected from the injection wells, the recovery wells, and the system influent holding tank. Decreased surface tension was exhibited in samples collected from all of the injections wells & RW-4. No obvious decreased surface tension was noted in any of the other samples.
- Extraction pumps capable of pumping up to 10 gallons per minute were set approximately 2 feet off of the bottom of the wells and at 12:30 hours extraction began from all four injection wells (MW-22, MW-40, MW-41, and MW-42).
- The environmental team is prepared to collect regular interval samples to determine decreasing presence of surface tension until the total of 1,500 gallons of liquid is removed from each target well.
- The presence of potential liquid phase hydrocarbons (LPH), sedimentation, and high iron was noted in MW-42.
- MW-22, MW-40, MW-41, and MW-42 have been assessed during the extraction process. Visual agitation testing has revealed the presence of varying thicknesses of bubbles, indicating the continued presence of surfactants. Extraction continues
- Samples were sent to the lab today to verify the monitoring parameters at the start of the day.

MDE/LMA/OCP
Report of Observation

NOTES

- Report the following conditions to the Department immediately, but not later than 2 hours after the detection, at **410-537-3442** during normal business hours, or to the Emergency Response Division hotline at **1-866-633-4686**:
  - An oil spill or discharge
  - If a storage system fails a test for tightness,
  - A storage system is determined to be leaking,
  - There exists evidence of a discharge
  - Two consecutive inconclusive tests
  - Presence of liquid phase hydrocarbons
- Reports should **not** be made via voice messages to OCP case managers.
- Operating without a permit or in violation of a permit, regulation, or law may result in the assessment of civil or administrative penalties and or other legal sanctions.

MDE Representative: Susan R Bull	**Person Interviewed:** JAMES P. SINGH
Signature:	**Signature:**
MDE Representative:	**Person Interviewed:**
Signature:	**Signature:**

Revised: 5/1/2014

MARYLAND DEPARTMENT OF THE ENVIRONMENT

1800 Washington Boulevard, Suite 620 • Baltimore Maryland 21230-1719
(410) 537-3442 • 1-800-633-6101 • http://www.mde.state.md.us
LAND MANAGEMENT ADMINISTRATION
Oil Control Program

Memorandum to File

Type of Inspection/Observations: B-3	**Date:** July 31 – August 4, 2014
Site/Facility Name: Chester River Hospital Center	**Facility ID #:**
Address: 100 Brown Street	**Case #:** 87-2534KE
City / County: Chestertown, MD	**Permit #:**

Remarks:

July 31, 2014 – On this date this writer received verbal updates of site remediation progress over the telephone from Mike Craskey of BrightFields, Inc. First morning gauging of the pilot test area wells revealed the presence of a petroleum sheen in injection wells MW-22, MW-40, MW-42. No Ivy-Sol © was noted within the recovery system influent when field tests were performed. Field tests conducted on samples collected from Brown Street perimeter wells MW-14, MW-47, MW-46 and MW-13 did not exhibit decreased surface tension. The second injection of Ivy-Sol © was initiated at a concentration of 0.22%, double the strength of the first injection.

August 1, 2014 – On this date, this writer received verbal updates of site remediation progress over the telephone from Mike Craskey of BrightFields, Inc. First morning gauging of the pilot test area wells revealed the presence of a petroleum sheen in injection wells MW-22, MW-40, MW-42. No Ivy-Sol © was noted within the recovery system influent when field tests were performed. However, the presence of Ivy-Sol © was noted in the recovery wells. Field tests conducted on samples collected from Brown Street perimeter wells MW-14, MW-47, MW-46 and MW-13 did not exhibit decreased surface tension. The second extraction was conducted.

August 4, 2014 – On this date, this writer received verbal updates of site remediation progress over the telephone from Mike Craskey of BrightFields, Inc. First morning gauging of the pilot test area wells revealed the presence of a petroleum sheen in MW-47 was noted. No Ivy-Sol © was noted within the recovery system influent when field tests were performed. However, the presence of Ivy-Sol © was noted in the recovery wells. Field tests conducted on samples collected from Brown Street perimeter wells MW-14, MW-47, MW-46 and MW-13 did not exhibit decreased surface tension. The third injection of Ivy-Sol © was initiated at a concentration of 0.11%.

NOTES

- Report the following conditions to the Department immediately, but not later than 2 hours after the detection, at **410-537-3442** during normal business hours, or to the Emergency Response Division hotline at **1-866-633-4686**:
  - An oil spill or discharge
  - If a storage system fails a test for tightness,
  - A storage system is determined to be leaking,
  - There exists evidence of a discharge
  - Two consecutive inconclusive tests
  - Presence of liquid phase hydrocarbons
- Reports should **not** be made via voice messages to OCP case managers.
- Operating without a permit or in violation of a permit, regulation, or law may result in the assessment of civil or administrative penalties and or other legal sanctions.

MDE Representative: Susan R Bull	**Person Interviewed:** Mike Craskey
Signature:	**Signature:**
MDE Representative:	**Person Interviewed:**
Signature:	**Signature:**

Revised: 5/1/2014

MARYLAND DEPARTMENT OF THE ENVIRONMENT

1800 Washington Boulevard, Suite 620 • Baltimore Maryland 21230-1719
(410) 537-3442 • 1-800-633-6101 • http://www.mde.state.md.us
LAND MANAGEMENT ADMINISTRATION
Oil Control Program

Report of Observations

Type of Inspection/Observations: B-3	**Date:** August 5, 2014
Site/Facility Name: Chester River Hospital Center	**Facility ID #:**
Address: 100 Brown Street	**Case #:** 87-2534KE
City / County: Chestertown, MD	**Permit #:**

Remarks:

On this date, this writer arrived on-site. Representatives of Ivy-Sol (Bud Ivy and Rusty Hashimoto), Brightfields, Inc. (Ken, Hannon, Mike Craskey, and Ronald Mortel) and EBA Engineering (James Sines) were on-site. Dane Bauer and Melissa Hall stopped by briefly.

- First morning gauging, field tests for surface tension were conducted, and laboratory samples were collected.
- A sheen was noted on MW-40, MW-42, MW-47, MW-14, and in system influent bag filters 1, 2, and 3.
- Field tests conducted on samples collected from Brown Street perimeter wells MW-14, MW-47, MW-46 and MW-13 did not exhibit a visual decreased surface tension.
- Field testing was also conducted on samples collected from the injection wells, the recovery wells, and the system influent holding tank. Decreased surface tension was exhibited in samples collected from MW-40, MW-41, MW-42, MW-22, and RW-4.
- The final extraction began with required monitoring.
- I showed James Sines and Bud Ivy the physical locations of Town Well 8 and the Town well field.

NOTES

- Report the following conditions to the Department immediately, but not later than 2 hours after the detection, at **410-537-3442** during normal business hours, or to the Emergency Response Division hotline at **1-866-633-4686**:
  - An oil spill or discharge
  - If a storage system fails a test for tightness,
  - A storage system is determined to be leaking,
  - There exists evidence of a discharge
  - Two consecutive inconclusive tests
  - Presence of liquid phase hydrocarbons
- Reports should **not** be made via voice messages to OCP case managers.
- Operating without a permit or in violation of a permit, regulation, or law may result in the assessment of civil or administrative penalties and or other legal sanctions.

MDE Representative: SUSAN BULL	**Person Interviewed:** JAMES P. SINES
Signature:	**Signature:**
MDE Representative:	**Person Interviewed:**
Signature:	**Signature:**

Revised: 5/1/2014

APPENDIX D

Section 4 – Presentation of Results, Tables, and Figures

TABLE 1

Data Summary of 28 Pilot Study Monitoring Wells During Field Activities

Appendix D - Table 1 - Pilot Study Data Summary During Field Activities
Chester River Hospital Center
100 Brown Street
Chestertown, MD 21620

Well No.	Date	Time	Top of Casing Elevation (ft)	Depth to Water (ft)	GW Elevation (ft)	TPH-DRO (mg/L)	Surfactant (mg/L)	Comments
MW-9	6-Aug-14	9:30	46.10	37.70	8.40	NA	NA	During Extraction 3
	6-Aug-14	12:45	46.10	NA	NA	NA	Absent*	During Extraction 3
	6-Aug-14	13:15	46.10	NA	NA	NA	Absent*	During Extraction 3
	6-Aug-14	13:45	46.10	NA	NA	NA	Absent*	During Extraction 3
	6-Aug-14	14:06	46.10	37.90	8.20	NA	NA	Post Extraction 3

NA - Not Applicable
* - Surface Tension Field Test for Presence/Absence

Well No.	Date	Time	Top of Casing Elevation (ft)	Depth to Water (ft)	GW Elevation (ft)	TPH-DRO (mg/L)	Surfactant (mg/L)	Comments
MW-10R	29-Jul-14	9:00	48.70	38.16	10.54	NA	NA	Pre-Injection 1
	29-Jul-14	12:00	48.70	NA	NA	<0.1	1.57	Pre-Injection 1
	29-Jul-14	14:20	48.70	37.96	10.74	NA	NA	During Injection 1
	29-Jul-14	15:31	48.70	38.01	10.69	NA	NA	Post Injection 1
	29-Jul-14	15:55	48.70	38.01	10.69	NA	NA	Post Injection 1
	30-Jul-14	9:25	48.70	38.01	10.69	NA	NA	Pre-Extraction 1
	30-Jul-14	15:42	48.70	38.71	9.99	NA	NA	During Extraction 1
	30-Jul-14	16:24	48.70	38.92	9.78	NA	NA	Post Extraction 1
	31-Jul-14	9:12	48.70	39.26	9.44	NA	NA	Pre-Injection 2
	31-Jul-14	12:01	48.70	39.26	9.44	NA	NA	Post Injection 2
	31-Jul-14	12:35	48.70	39.27	9.43	NA	NA	Post Injection 2
	1-Aug-14	8:58	48.70	38.16	10.54	NA	NA	Pre-Extraction 2
	1-Aug-14	15:52	48.70	39.51	9.19	NA	NA	During Extraction 2
	1-Aug-14	16:48	48.70	39.35	9.35	NA	NA	Post Extraction 2
	4-Aug-14	9:24	48.70	38.79	9.91	NA	NA	Pre-Injection 3
	4-Aug-14	11:00	48.70	38.61	10.09	NA	NA	During Injection 3
	4-Aug-14	11:38	48.70	38.71	9.99	NA	NA	Post Injection 3
	4-Aug-14	12:23	48.70	38.71	9.99	NA	NA	Post Injection 3
	5-Aug-14	8:45	48.70	38.41	10.29	NA	NA	Pre-Extraction 3
	5-Aug-14	15:15	48.70	39.50	9.20	NA	NA	During Extraction 3
	6-Aug-14	9:21	48.70	39.53	9.17	NA	NA	During Extraction 3
	6-Aug-14	13:58	48.70	39.59	9.11	NA	NA	Post Extraction 3

NA - Not Applicable
* - Surface Tension Field Test for Presence/Absence

Appendix D - Table 1 - Pilot Study Data Summary During Field Activities
Chester River Hospital Center
100 Brown Street
Chestertown, MD 21620

Well No.	Date	Time	Top of Casing Elevation (ft)	Depth to Water (ft)	GW Elevation (ft)	TPH-DRO (mg/L)	Surfactant (mg/L)	Comments
MW-13	29-Jul-14	9:00	41.70	31.82	9.88	NA	NA	Pre-Injection 1
	29-Jul-14	11:35	41.70	NA	NA	0.46	<1.40	Pre-Injection 1
	29-Jul-14	14:45	41.70	31.47	10.23	NA	NA	During Injection 1
	29-Jul-14	15:43	41.70	31.69	10.01	NA	NA	Post Injection 1
	30-Jul-14	9:41	41.70	31.41	10.29	NA	NA	Pre-Extraction 1
	30-Jul-14	10:50	41.70	NA	NA	NA	<1.40	Pre-Extraction 1
	30-Jul-14	15:56	41.70	32.54	9.16	NA	NA	During Extraction 1
	30-Jul-14	16:33	41.70	32.81	8.89	NA	NA	Post Extraction 1
	31-Jul-14	9:20	41.70	33.47	8.23	NA	NA	Pre-Injection 2
	31-Jul-14	9:45	41.70	NA	NA	NA	Absent*	Pre-Injection 2
	31-Jul-14	11:48	41.70	33.47	8.23	NA	NA	Post Injection 2
	31-Jul-14	12:47	41.70	33.47	8.23	NA	NA	Post Injection 2
	31-Jul-14	13:05	41.70	NA	NA	NA	Absent*/<1.40	Post Injection 2
	1-Aug-14	9:33	41.70	32.51	9.19	NA	NA	Pre-Extraction 2
	1-Aug-14	10:00	41.70	NA	NA	NA	Absent*	During Extraction 2
	1-Aug-14	16:03	41.70	33.58	8.12	NA	NA	During Extraction 2
	1-Aug-14	16:25	41.70	NA	NA	NA	Absent*	Post Extraction 2
	1-Aug-14	16:56	41.70	33.55	8.15	NA	NA	Post Extraction 2
	1-Aug-14	17:10	41.70	NA	NA	1.8	<1.40	Post Extraction 2
	4-Aug-14	9:32	41.70	32.77	8.93	NA	NA	Pre-Injection 3
	4-Aug-14	9:45	41.70	NA	NA	1.0	Absent*	Pre-Injection 3
	4-Aug-14	11:09	41.70	32.54	9.16	NA	NA	Post Injection 3
	4-Aug-14	11:47	41.70	32.59	9.11	NA	NA	Post Injection 3
	4-Aug-14	12:12	41.70	32.59	9.11	NA	NA	Post Injection 3
	4-Aug-14	12:15	41.70	NA	NA	NA	Absent*/<1.40	Post Injection 3
	5-Aug-14	8:54	41.70	32.30	9.40	NA	NA	Pre-Extraction 3
	5-Aug-14	9:30	41.70	NA	NA	0.22	Absent*/<1.40	Pre-Extraction 3
	5-Aug-14	15:24	41.70	33.59	8.11	NA	NA	During Extraction 3
	6-Aug-14	9:32	41.70	33.79	7.91	NA	NA	During Extraction 3
	6-Aug-14	14:11	41.70	33.82	7.88	NA	NA	Post Extraction 3
	6-Aug-14	14:50	41.70	NA	NA	0.75	<1.40	Post Extraction 3

NA - Not Applicable
* - Surface Tension Field Test for Presence/Absence

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Chester River Hospital Center
100 Brown Street
Chestertown, MD 21620

Well No.	Date	Time	Top of Casing Elevation (ft)	Depth to Water (ft)	GW Elevation (ft)	TPH-DRO (mg/L)	Surfactant (mg/L)	Comments
MW-14	29-Jul-14	9:00	41.38	31.52	9.86	NA	NA	Pre-Injection 1
	29-Jul-14	11:10	41.38	NA	NA	9.8	<1.40	Pre-Injection 1
	29-Jul-14	14:36	41.38	31.30	10.08	NA	NA	During Injection 1
	29-Jul-14	15:47	41.38	31.36	10.02	NA	NA	Post Injection 1
	30-Jul-14	9:39	41.38	31.40	9.98	NA	NA	Pre-Extraction 1
	30-Jul-14	10:45	41.38	NA	NA	NA	<1.40	Pre-Extraction 1
	30-Jul-14	15:51	41.38	39.98	1.40	NA	NA	During Extraction 1
	30-Jul-14	16:30	41.38	34.20	7.18	NA	NA	Post Extraction 1
	31-Jul-14	9:16	41.38	34.62	6.76	NA	NA	Pre-Injection 2
	31-Jul-14	9:45	41.38	NA	NA	NA	Absent*	Pre-Injection 2
	31-Jul-14	11:51	41.38	34.53	6.85	NA	NA	Post Injection 2
	31-Jul-14	12:44	41.38	34.60	6.78	NA	NA	Post Injection 2
	31-Jul-14	13:05	41.38	NA	NA	NA	Absent*/<1.40	Post Injection 2
	1-Aug-14	9:30	41.38	33.96	7.42	NA	NA	Pre-Extraction 2
	1-Aug-14	10:00	41.38	NA	NA	NA	Absent*	During Extraction 2
	1-Aug-14	15:58	41.38	34.76	6.62	NA	NA	During Extraction 2
	1-Aug-14	16:25	41.38	NA	NA	NA	Absent*	Post Extraction 2
	1-Aug-14	16:54	41.38	34.71	6.67	NA	NA	Post Extraction 2
	1-Aug-14	17:10	41.38	NA	NA	53	<1.40	Post Extraction 2
	4-Aug-14	9:29	41.38	33.46	7.92	NA	NA	Pre-Injection 3
	4-Aug-14	9:45	41.38	NA	NA	17	Absent*	Pre-Injection 3
	4-Aug-14	11:06	41.38	33.24	8.14	NA	NA	Post Injection 3
	4-Aug-14	11:44	41.38	33.37	8.01	NA	NA	Post Injection 3
	4-Aug-14	12:09	41.38	33.62	7.76	NA	NA	Post Injection 3
	4-Aug-14	12:15	41.38	NA	NA	NA	Absent*/<1.40	Post Injection 3
	5-Aug-14	8:51	41.38	31.90	9.48	NA	NA	Pre-Extraction 3
	5-Aug-14	9:30	41.38	NA	NA	4.4	Absent*/<1.40	Pre-Extraction 3
	5-Aug-14	12:15	41.38	NA	NA	NA	NA	During Extraction 3/ Sheen
	5-Aug-14	15:21	41.38	34.81	6.57	NA	NA	During Extraction 3
	6-Aug-14	9:28	41.38	34.89	6.49	NA	NA	During Extraction 3
	6-Aug-14	14:08	41.38	34.95	6.43	NA	NA	Post Extraction 3
	6-Aug-14	14:50	41.38	NA	NA	34	<1.40	Post Extraction 3

NA - Not Applicable
* - Surface Tension Field Test for Presence/Absence

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Chester River Hospital Center
100 Brown Street
Chestertown, MD 21620

Well No.	Date	Time	Top of Casing Elevation (ft)	Depth to Water (ft)	GW Elevation (ft)	TPH-DRO (mg/L)	Surfactant (mg/L)	Comments
MW-19	29-Jul-14	9:00	38.85	29.33	9.52	NA	NA	Pre-Injection 1
	29-Jul-14	12:15	38.85	NA	NA	0.14	<1.40	Pre-Injection 1
	29-Jul-14	14:53	38.85	29.21	9.64	NA	NA	During Injection 1
	29-Jul-14	15:48	38.85	29.21	9.64	NA	NA	Post Injection 1
	30-Jul-14	9:51	38.85	29.22	9.63	NA	NA	Pre-Extraction 1
	30-Jul-14	16:01	38.85	29.70	9.15	NA	NA	During Extraction 1
	30-Jul-14	16:37	38.85	29.83	9.02	NA	NA	Post Extraction 1
	31-Jul-14	9:24	38.85	30.42	8.43	NA	NA	Pre-Injection 2
	31-Jul-14	11:44	38.85	30.42	8.43	NA	NA	Post Injection 2
	31-Jul-14	12:50	38.85	30.46	8.39	NA	NA	Post Injection 2
	1-Aug-14	9:36	38.85	29.84	9.01	NA	NA	Pre-Extraction 2
	1-Aug-14	16:06	38.85	30.48	8.37	NA	NA	During Extraction 2
	1-Aug-14	17:00	38.85	30.48	8.37	NA	NA	Post Extraction 2
	4-Aug-14	9:36	38.85	30.21	8.64	NA	NA	Pre-Injection 3
	4-Aug-14	11:13	38.85	30.11	8.74	NA	NA	Post Injection 3
	4-Aug-14	11:51	38.85	30.11	8.74	NA	NA	Post Injection 3
	4-Aug-14	12:15	38.85	30.19	8.66	NA	NA	Post Injection 3
	5-Aug-14	8:58	38.85	29.87	8.98	NA	NA	Pre-Extraction 3
	5-Aug-14	15:28	38.85	30.57	8.28	NA	NA	During Extraction 3
	6-Aug-14	9:36	38.85	30.81	8.04	NA	NA	During Extraction 3
	6-Aug-14	14:17	38.85	30.87	7.98	NA	NA	Post Extraction 3

NA - Not Applicable
* - Surface Tension Field Test for Presence/Absence

Appendix D - Table 1 - Pilot Study Data Summary During Field Activities
Chester River Hospital Center
100 Brown Street
Chestertown, MD 21620

Well No.	Date	Time	Top of Casing Elevation (ft)	Depth to Water (ft)	GW Elevation (ft)	TPH-DRO (mg/L)	Surfactant (mg/L)	Comments
MW-20	29-Jul-14	9:00	38.72	29.17	9.55	NA	NA	Pre-Injection 1
	29-Jul-14	12:45	38.72	NA	NA	0.33	<1.40	Pre-Injection 1
	29-Jul-14	14:52	38.72	29.05	9.67	NA	NA	During Injection 1
	29-Jul-14	15:49	38.72	29.04	9.68	NA	NA	Post Injection 1
	30-Jul-14	9:49	38.72	29.03	9.69	NA	NA	Pre-Extraction 1
	30-Jul-14	16:00	38.72	29.67	9.05	NA	NA	During Extraction 1
	30-Jul-14	16:36	38.72	29.86	8.86	NA	NA	Post Extraction 1
	31-Jul-14	9:23	38.72	30.48	8.24	NA	NA	Pre-Injection 2
	31-Jul-14	11:45	38.72	30.49	8.23	NA	NA	Post Injection 2
	31-Jul-14	12:49	38.72	30.49	8.23	NA	NA	Post Injection 2
	1-Aug-14	9:35	38.72	29.75	8.97	NA	NA	Pre-Extraction 2
	1-Aug-14	16:05	38.72	30.55	8.17	NA	NA	During Extraction 2
	1-Aug-14	16:59	38.72	30.53	8.19	NA	NA	Post Extraction 2
	4-Aug-14	9:35	38.72	30.03	8.69	NA	NA	Pre-Injection 3
	4-Aug-14	11:12	38.72	29.93	8.79	NA	NA	Post Injection 3
	4-Aug-14	11:50	38.72	29.94	8.78	NA	NA	Post Injection 3
	4-Aug-14	12:13	38.72	30.01	8.71	NA	NA	Post Injection 3
	5-Aug-14	8:57	38.72	29.69	9.03	NA	NA	Pre-Extraction 3
	5-Aug-14	15:27	38.72	30.60	8.12	NA	NA	During Extraction 3
	6-Aug-14	9:35	38.72	30.82	7.90	NA	NA	During Extraction 3
	6-Aug-14	14:16	38.72	30.87	7.85	NA	NA	Post Extraction 3

NA - Not Applicable
* - Surface Tension Field Test for Presence/Absence

Appendix D - Table 1 - Pilot Study Data Summary During Field Activities
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100 Brown Street
Chestertown, MD 21620

Well No.	Date	Time	Top of Casing Elevation (ft)	Depth to Water (ft)	GW Elevation (ft)	TPH-DRO (mg/L)	Surfactant (mg/L)	Comments
MW-22	29-Jul-14	9:00	47.04	36.54	10.50	NA	NA	Pre-Injection 1
	29-Jul-14	11:45	47.04	NA	NA	4.7	<1.40	Pre-Injection 1
	29-Jul-14	13:30	47.04	NA	NA	NA	NA	**Commence Injection 1**
	29-Jul-14	14:27	47.04	36.33	10.71	NA	NA	Post Injection 1
	29-Jul-14	15:35	47.04	36.47	10.57	NA	NA	Post Injection 1
	30-Jul-14	9:31	47.04	36.47	10.57	NA	NA	Pre-Extraction 1
	30-Jul-14	11:30	47.04	NA	NA	20	Present*/218	Pre-Extraction 1
	30-Jul-14	12:10	47.04	NA	NA	NA	NA	**Commence Extraction 1**
	30-Jul-14	12:30	47.04	NA	NA	1.9	NA	During Extraction 1
	30-Jul-14	12:32	47.04	39.96	7.08	NA	NA	During Extraction 1
	30-Jul-14	12:45	47.04	NA	NA	1.9	NA	During Extraction 1
	30-Jul-14	12:48	47.04	39.54	7.50	NA	NA	During Extraction 1
	30-Jul-14	13:06	47.04	39.56	7.48	NA	NA	During Extraction 1
	30-Jul-14	13:20	47.04	NA	NA	1.6	NA	During Extraction 1
	30-Jul-14	13:30	47.04	39.56	7.48	NA	NA	During Extraction 1
	30-Jul-14	13:50	47.04	NA	NA	1.1	NA	During Extraction 1
	30-Jul-14	14:20	47.04	NA	NA	2.2	Present*	During Extraction 1
	30-Jul-14	14:50	47.04	NA	NA	2.1	Present*	During Extraction 1
	30-Jul-14	15:20	47.04	NA	NA	3.3	Present*	During Extraction 1
	30-Jul-14	15:47	47.04	40.40	6.64	NA	NA	During Extraction 1
	30-Jul-14	15:50	47.04	NA	NA	2.6	Present*	During Extraction 1
	30-Jul-14	16:20	47.04	NA	NA	2.4	Absent*	During Extraction 1
	30-Jul-14	16:27	47.04	38.02	9.02	NA	NA	Post Extraction 1
	31-Jul-14	9:11	47.04	38.44	8.60	NA	NA	Pre-Injection 2
	31-Jul-14	10:46	47.04	38.12	8.92	NA	NA	Pre-Injection 2
	31-Jul-14	11:05	47.04	NA	NA	NA	NA	**Commence Injection 2**
	31-Jul-14	11:31	47.04	21.48	25.56	NA	NA	During Injection 2/ Mounding
	31-Jul-14	11:57	47.04	38.29	8.75	NA	NA	Post Injection 2
	31-Jul-14	12:39	47.04	38.39	8.65	NA	NA	Post Injection 2
	31-Jul-14	14:30	47.04	NA	NA	150	Present*	Post Injection 2
	1-Aug-14	9:01	47.04	36.64	10.40	NA	NA	Pre-Extraction 2
	1-Aug-14	9:10	47.04	NA	NA	25	Present*/170	Pre-Extraction 2/ Sheen
	1-Aug-14	10:20	47.04	NA	NA	NA	NA	**Commence Extraction 2**
	1-Aug-14	10:50	47.04	NA	NA	17	Present*	During Extraction 2
	1-Aug-14	10:58	47.04	42.03	5.01	NA	NA	During Extraction 2
	1-Aug-14	11:20	47.04	NA	NA	0.70	Present*	During Extraction 2
	1-Aug-14	11:50	47.04	NA	NA	0.59	Present*	During Extraction 2
	1-Aug-14	11:53	47.04	41.90	5.14	NA	NA	During Extraction 2
	1-Aug-14	12:20	47.04	NA	NA	1.2	Present*	During Extraction 2
	1-Aug-14	12:50	47.04	NA	NA	2.1	Present*	During Extraction 2
	1-Aug-14	13:20	47.04	NA	NA	1.6	Present*	During Extraction 2
	1-Aug-14	13:50	47.04	NA	NA	1.3	Present*	During Extraction 2
	1-Aug-14	14:20	47.04	NA	NA	NA	Present*	During Extraction 2
	1-Aug-14	14:50	47.04	NA	NA	NA	Present*	During Extraction 2
	1-Aug-14	15:20	47.04	NA	NA	NA	Present*	During Extraction 2
	1-Aug-14	15:50	47.04	NA	NA	NA	Absent*	Post Extraction 2
	1-Aug-14	15:54	47.04	38.72	8.32	NA	NA	Post Extraction 2
	1-Aug-14	16:50	47.04	38.51	8.53	NA	51.0	Post Extraction 2
	1-Aug-14	16:50	47.04	NA	NA	89	NA	Post Extraction 2
	4-Aug-14	9:26	47.04	37.61	9.43	NA	NA	Pre-Injection 3
	4-Aug-14	10:36	47.04	NA	NA	NA	NA	**Commence Injection 3**
	4-Aug-14	11:03	47.04	26.21	20.83	NA	NA	During Injection 3/ Mounding
	4-Aug-14	11:41	47.04	37.51	9.53	NA	NA	Post Injection 3
	4-Aug-14	12:28	47.04	37.29	9.75	NA	NA	Post Injection 3
	4-Aug-14	12:30	47.04	NA	NA	2.0	Present*	Post Injection 3
	5-Aug-14	8:48	47.04	36.88	10.16	NA	NA	Pre-Extraction 3
	5-Aug-14	9:40	47.04	NA	NA	1.1	Present*	Pre-Extraction 3
	5-Aug-14	10:10	47.04	NA	NA	NA	NA	**Commence Extraction 3**
	5-Aug-14	10:40	47.04	NA	NA	0.34	Present*	During Extraction 3

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	5-Aug-14	11:10	47.04	41.56	5.48	6.9	Present*	During Extraction 3
	5-Aug-14	11:40	47.04	NA	NA	4.9	Present*	During Extraction 3
	5-Aug-14	12:10	47.04	41.70	5.34	0.64	Present*	During Extraction 3
	5-Aug-14	12:40	47.04	NA	NA	0.59	Present*	During Extraction 3
	5-Aug-14	13:10	47.04	NA	NA	1.3	Present*	During Extraction 3
	5-Aug-14	13:40	47.04	NA	NA	1.4	Absent*	During Extraction 3
	5-Aug-14	14:10	47.04	41.72	5.32	NA	NA	During Extraction 3
	5-Aug-14	14:10	47.04	NA	NA	1.1	NA	During Extraction 3
	5-Aug-14	14:40	47.04	NA	NA	2.3	NA	During Extraction 3
	5-Aug-14	15:10	47.04	NA	NA	NA	Absent*	During Extraction 3
	5-Aug-14	15:17	47.04	38.67	8.37	NA	NA	During Extraction 3
	6-Aug-14	9:24	47.04	38.72	8.32	NA	NA	During Extraction 3
	6-Aug-14	14:01	47.04	38.81	8.23	NA	NA	Post Extraction 3
	6-Aug-14	14:35	47.04	NA	NA	17	75.8	Post Extraction 3

NA - Not Applicable
* - Surface Tension Field Test for Presence/Absence

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Well No.	Date	Time	Top of Casing Elevation (ft)	Depth to Water (ft)	GW Elevation (ft)	TPH-DRO (mg/L)	Surfactant (mg/L)	Comments
MW-33	29-Jul-14	9:00	36.52	27.17	9.35	NA	NA	Pre-Injection 1
	29-Jul-14	13:10	36.52	NA	NA	<0.1	<1.40	Pre-Injection 1
	29-Jul-14	14:55	36.52	27.08	9.44	NA	NA	During Injection 1
	29-Jul-14	15:52	36.52	27.09	9.43	NA	NA	Post Injection 1
	30-Jul-14	9:53	36.52	27.07	9.45	NA	NA	Pre-Extraction 1
	30-Jul-14	16:01	36.52	27.28	9.24	NA	NA	During Extraction 1
	30-Jul-14	16:38	36.52	27.35	9.17	NA	NA	Post Extraction 1
	31-Jul-14	9:25	36.52	27.83	8.69	NA	NA	Pre-Injection 2
	31-Jul-14	11:43	36.52	27.83	8.69	NA	NA	Post Injection 2
	31-Jul-14	12:52	36.52	27.88	8.64	NA	NA	Post Injection 2
	1-Aug-14	9:37	36.52	27.44	9.08	NA	NA	Pre-Extraction 2
	1-Aug-14	16:07	36.52	27.87	8.65	NA	NA	During Extraction 2
	1-Aug-14	17:01	36.52	27.87	8.65	NA	NA	Post Extraction 2
	4-Aug-14	9:37	36.52	27.88	8.64	NA	NA	Pre-Injection 3
	4-Aug-14	11:14	36.52	27.80	8.72	NA	NA	Post Injection 3
	4-Aug-14	11:52	36.52	27.81	8.71	NA	NA	Post Injection 3
	4-Aug-14	12:18	36.52	27.81	8.71	NA	NA	Post Injection 3
	5-Aug-14	8:59	36.52	27.55	8.97	NA	NA	Pre-Extraction 3
	5-Aug-14	15:29	36.52	27.93	8.59	NA	NA	During Extraction 3
	6-Aug-14	9:37	36.52	28.22	8.30	NA	NA	During Extraction 3
	6-Aug-14	14:18	36.52	28.21	8.31	NA	NA	Post Extraction 3

NA - Not Applicable
* - Surface Tension Field Test for Presence/Absence

Well No.	Date	Time	Top of Casing Elevation (ft)	Depth to Water (ft)	GW Elevation (ft)	TPH-DRO (mg/L)	Surfactant (mg/L)	Comments
MW-34	29-Jul-14	9:00	36.64	27.33	9.31	NA	NA	Pre-Injection 1
	29-Jul-14	13:05	36.64	NA	NA	<0.1	<1.40	Pre-Injection 1
	29-Jul-14	14:58	36.64	27.21	9.43	NA	NA	During Injection 1
	29-Jul-14	15:50	36.64	27.21	9.43	NA	NA	Post Injection 1
	30-Jul-14	9:55	36.64	27.21	9.43	NA	NA	Pre-Extraction 1
	30-Jul-14	16:02	36.64	27.45	9.19	NA	NA	During Extraction 1
	30-Jul-14	16:39	36.64	27.53	9.11	NA	NA	Post Extraction 1
	31-Jul-14	9:26	36.64	27.99	8.65	NA	NA	Pre-Injection 2
	31-Jul-14	11:42	36.64	27.99	8.65	NA	NA	Post Injection 2
	31-Jul-14	12:53	36.64	28.02	8.62	NA	NA	Post Injection 2
	1-Aug-14	9:38	36.64	27.61	9.03	NA	NA	Pre-Extraction 2
	1-Aug-14	16:08	36.64	28.00	8.64	NA	NA	During Extraction 2
	1-Aug-14	17:02	36.64	28.02	8.62	NA	NA	Post Extraction 2
	4-Aug-14	9:38	36.64	27.99	8.65	NA	NA	Pre-Injection 3
	4-Aug-14	11:15	36.64	27.91	8.73	NA	NA	Post Injection 3
	4-Aug-14	11:53	36.64	27.92	8.72	NA	NA	Post Injection 3
	4-Aug-14	12:20	36.64	27.91	8.73	NA	NA	Post Injection 3
	5-Aug-14	9:00	36.64	27.69	8.95	NA	NA	Pre-Extraction 3
	5-Aug-14	15:30	36.64	28.06	8.58	NA	NA	During Extraction 3
	6-Aug-14	9:38	36.64	28.32	8.32	NA	NA	During Extraction 3
	6-Aug-14	14:20	36.64	28.35	8.29	NA	NA	Post Extraction 3

NA - Not Applicable
* - Surface Tension Field Test for Presence/Absence

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Well No.	Date	Time	Top of Casing Elevation (ft)	Depth to Water (ft)	GW Elevation (ft)	TPH-DRO (mg/L)	Surfactant (mg/L)	Comments
MW-35	29-Jul-14	9:00	38.62	28.62	10.00	NA	NA	Pre-Injection 1
	29-Jul-14	12:45	NA	NA	NA	<0.1	<1.40	Pre-Injection 1
	29-Jul-14	13:00	NA	NA	NA	NA	NA	**Commence Injection 1**
	29-Jul-14	14:50	38.62	28.87	9.75	NA	NA	During Injection 1
	29-Jul-14	15:46	38.62	28.87	9.75	NA	NA	Post Injection 1
	30-Jul-14	9:47	38.62	28.87	9.75	NA	NA	Pre-Extraction 1
	30-Jul-14	15:59	38.62	29.17	9.45	NA	NA	During Extraction 1
	30-Jul-14	16:35	38.62	29.28	9.34	NA	NA	Post Extraction 1
	31-Jul-14	9:22	38.62	29.77	8.85	NA	NA	Pre-Injection 2
	31-Jul-14	11:46	38.62	29.77	8.85	NA	NA	Post Injection 2
	31-Jul-14	12:49	38.62	29.80	8.82	NA	NA	Post Injection 2
	1-Aug-14	9:35	38.62	29.31	9.31	NA	NA	Pre-Extraction 2
	1-Aug-14	16:04	38.62	29.82	8.80	NA	NA	During Extraction 2
	1-Aug-14	16:58	38.62	29.82	8.80	NA	NA	Post Extraction 2
	4-Aug-14	9:34	38.62	29.66	8.96	NA	NA	Pre-Injection 3
	4-Aug-14	11:11	38.62	29.87	8.75	NA	NA	Post Injection 3
	4-Aug-14	11:40	38.62	29.61	9.01	NA	NA	Post Injection 3
	4-Aug-14	12:12	38.62	29.63	8.99	NA	NA	Post Injection 3
	5-Aug-14	8:56	38.62	29.34	9.28	NA	NA	Pre-Extraction 3
	5-Aug-14	15:26	38.62	29.89	8.73	NA	NA	During Extraction 3
	6-Aug-14	9:34	38.62	30.11	8.51	NA	NA	During Extraction 3
	6-Aug-14	14:15	38.62	30.17	8.45	NA	NA	Post Extraction 3

NA - Not Applicable
* - Surface Tension Field Test for Presence/Absence

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Well No.	Date	Time	Top of Casing Elevation (ft)	Depth to Water (ft)	GW Elevation (ft)	TPH-DRO (mg/L)	Surfactant (mg/L)	Comments
MW-40	29-Jul-14	9:00	48.69	38.11	10.58	NA	NA	Pre-Injection 1
	29-Jul-14	12:15	48.69	NA	NA	15	<1.40	Pre-Injection 1
	29-Jul-14	13:00	48.69	NA	NA	NA	NA	**Commence Injection 1**
	29-Jul-14	14:22	48.69	37.94	10.75	NA	NA	Post Injection 1
	29-Jul-14	15:30	48.69	38.03	10.66	NA	NA	Post Injection 1
	30-Jul-14	9:27	48.69	38.00	10.69	NA	NA	Pre-Extraction 1/ Sheen
	30-Jul-14	11:30	48.69	NA	NA	1100	Present*/164	Pre-Extraction 1
	30-Jul-14	12:10	48.69	NA	NA	NA	NA	**Commence Extraction 1**
	30-Jul-14	12:30	48.69	NA	NA	1.8	NA	During Extraction 1
	30-Jul-14	12:30	48.69	40.86	7.83	NA	NA	During Extraction 1
	30-Jul-14	12:45	48.69	NA	NA	1.3	NA	During Extraction 1
	30-Jul-14	12:46	48.69	40.99	7.70	NA	NA	During Extraction 1
	30-Jul-14	13:05	48.69	41.00	7.69	NA	NA	During Extraction 1
	30-Jul-14	13:20	48.69	NA	NA	1.8	NA	During Extraction 1
	30-Jul-14	13:29	48.69	41.02	7.67	NA	NA	During Extraction 1
	30-Jul-14	13:50	48.69	NA	NA	2.5	NA	During Extraction 1
	30-Jul-14	14:20	48.69	NA	NA	1.8	Present*	During Extraction 1
	30-Jul-14	14:50	48.69	NA	NA	2.6	Present*	During Extraction 1
	30-Jul-14	15:20	48.69	NA	NA	1.7	Present*	During Extraction 1
	30-Jul-14	15:44	48.69	41.79	6.90	NA	NA	During Extraction 1
	30-Jul-14	15:50	48.69	NA	NA	1.5	Present*	During Extraction 1
	30-Jul-14	16:20	48.69	NA	NA	1.5	Absent*	During Extraction 1
	30-Jul-14	16:25	48.69	39.67	9.02	NA	NA	Post Extraction 1
	31-Jul-14	9:10	48.69	39.66	9.03	NA	NA	Pre-Injection 2/ Sheen
	31-Jul-14	10:32	48.69	NA	NA	NA	NA	**Commence Injection 2**
	31-Jul-14	10:43	48.69	34.32	14.37	NA	NA	During Injection 2/ Mounding
	31-Jul-14	11:32	48.69	39.46	9.23	NA	NA	Post Injection 2
	31-Jul-14	12:00	48.69	39.66	9.03	NA	NA	Post Injection 2
	31-Jul-14	12:37	48.69	39.66	9.03	NA	NA	Post Injection 2
	31-Jul-14	14:30	48.69	NA	NA	77	Present*	Post Injection 2
	1-Aug-14	9:00	48.69	38.17	10.52	NA	NA	Pre-Extraction 2
	1-Aug-14	9:10	48.69	NA	NA	26	Present*	Pre-Extraction 2/ Sheen
	1-Aug-14	10:20	48.69	NA	NA	NA	NA	**Commence Extraction 2**
	1-Aug-14	10:50	48.69	NA	NA	17	Present*	During Extraction 2
	1-Aug-14	10:57	48.69	42.22	6.47	NA	NA	During Extraction 2
	1-Aug-14	11:20	48.69	NA	NA	1	Present*	During Extraction 2
	1-Aug-14	11:50	48.69	NA	NA	0.89	Present*	During Extraction 2
	1-Aug-14	11:52	48.69	42.45	6.24	NA	NA	During Extraction 2
	1-Aug-14	12:20	48.69	NA	NA	1.3	Present*	During Extraction 2
	1-Aug-14	12:50	48.69	NA	NA	2.6	Present*	During Extraction 2
	1-Aug-14	13:20	48.69	NA	NA	2.5	Present*	During Extraction 2
	1-Aug-14	13:50	48.69	NA	NA	6.4	Present*	During Extraction 2
	1-Aug-14	14:20	48.69	NA	NA	NA	Present*	During Extraction 2
	1-Aug-14	14:50	48.69	NA	NA	NA	Present*	During Extraction 2
	1-Aug-14	15:20	48.69	NA	NA	NA	Present*	During Extraction 2
	1-Aug-14	15:50	48.69	NA	NA	NA	Absent*	Post Extraction 2
	1-Aug-14	15:53	48.69	40.27	8.42	NA	NA	Post Extraction 2
	1-Aug-14	16:48	48.69	39.75	8.94	NA	NA	Post Extraction 2
	1-Aug-14	16:50	48.69	NA	NA	330	38.2	Post Extraction 2
	4-Aug-14	9:25	48.69	38.93	9.76	NA	NA	Pre-Injection 3
	4-Aug-14	10:05	48.69	NA	NA	NA	NA	**Commence Injection 3**
	4-Aug-14	11:01	48.69	38.57	10.12	NA	NA	Post Injection 3
	4-Aug-14	11:39	48.69	38.87	9.82	NA	NA	Post Injection 3
	4-Aug-14	12:25	48.69	38.91	9.78	NA	NA	Post Injection 3
	4-Aug-14	12:30	48.69	NA	NA	1	Present*	Post Injection 3
	5-Aug-14	8:46	48.69	38.47	10.22	NA	NA	Pre-Extraction 3
	5-Aug-14	9:40	48.69	NA	NA	1.7	Present*	Pre-Extraction 3
	5-Aug-14	10:10	48.69	NA	NA	NA	NA	**Commence Extraction 3**
	5-Aug-14	10:40	48.69	NA	NA	24	Present*	During Extraction 3

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	5-Aug-14	11:10	48.69	42.40	6.29	8.9	Present*	During Extraction 3
	5-Aug-14	11:40	48.69	NA	NA	6.4	Present*	During Extraction 3
	5-Aug-14	12:10	48.69	42.57	6.12	1.1	Present*	During Extraction 3
	5-Aug-14	12:40	48.69	NA	NA	0.99	Present*	During Extraction 3
	5-Aug-14	13:10	48.69	NA	NA	1.8	Present*	During Extraction 3
	5-Aug-14	13:40	48.69	NA	NA	2.8	Absent*	During Extraction 3
	5-Aug-14	14:10	48.69	NA	NA	0.88	NA	During Extraction 3
	5-Aug-14	14:10	48.69	42.66	6.03	NA	NA	During Extraction 3
	5-Aug-14	14:40	48.69	NA	NA	4.9	NA	During Extraction 3
	5-Aug-14	15:10	48.69	NA	NA	NA	Absent*	During Extraction 3
	5-Aug-14	15:16	48.69	39.92	8.77	NA	NA	During Extraction 3
	6-Aug-14	9:22	48.69	39.97	8.72	NA	NA	During Extraction 3
	6-Aug-14	14:00	48.69	40.00	8.69	NA	NA	Post Extraction 3
	6-Aug-14	14:35	48.69	NA	NA	97	50.8	Post Extraction 3

NA - Not Applicable
* - Surface Tension Field Test for Presence/Absence

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Well No.	Date	Time	Top of Casing Elevation (ft)	Depth to Water (ft)	GW Elevation (ft)	TPH-DRO (mg/L)	Surfactant (mg/L)	Comments
MW-41	29-Jul-14	9:00	42.92	32.85	10.07	NA	NA	Pre-Injection 1
	29-Jul-14	12:40	42.92	NA	NA	9.5	2.80	Pre-Injection 1
	29-Jul-14	13:30	42.92	NA	NA	NA	NA	**Commence Injection 1**
	29-Jul-14	14:33	42.92	32.44	10.48	NA	NA	Post Injection 1
	29-Jul-14	15:37	42.92	32.62	10.30	NA	NA	Post Injection 1
	30-Jul-14	9:35	42.92	32.74	10.18	NA	NA	Pre-Extraction 1
	30-Jul-14	11:30	42.92	NA	NA	12	Present*/255	Pre-Extraction 1
	30-Jul-14	12:10	42.92	NA	NA	NA	NA	**Commence Extraction 1**
	30-Jul-14	12:30	42.92	NA	NA	4.5	NA	During Extraction 1
	30-Jul-14	12:36	42.92	34.86	8.06	NA	NA	During Extraction 1
	30-Jul-14	12:45	42.92	NA	NA	1.1	NA	During Extraction 1
	30-Jul-14	12:50	42.92	34.99	7.93	NA	NA	During Extraction 1
	30-Jul-14	13:08	42.92	35.05	7.87	NA	NA	During Extraction 1
	30-Jul-14	13:20	42.92	NA	NA	1.5	NA	During Extraction 1
	30-Jul-14	13:32	42.92	35.11	7.81	NA	NA	During Extraction 1
	30-Jul-14	13:50	42.92	NA	NA	1.4	NA	During Extraction 1
	30-Jul-14	14:20	42.92	NA	NA	2.0	Present*	During Extraction 1
	30-Jul-14	14:50	42.92	NA	NA	2.7	Present*	During Extraction 1
	30-Jul-14	15:20	42.92	NA	NA	1.6	Present*	During Extraction 1
	30-Jul-14	15:50	42.92	36.09	6.83	NA	NA	During Extraction 1
	30-Jul-14	15:50	42.92	NA	NA	2.3	Present*	During Extraction 1
	30-Jul-14	16:20	42.92	NA	NA	2.9	Absent*	During Extraction 1
	30-Jul-14	16:29	42.92	34.53	8.39	NA	NA	Post Extraction 1
	31-Jul-14	9:14	42.92	35.11	7.81	NA	NA	Pre-Injection 2
	31-Jul-14	10:47	42.92	35.01	7.91	NA	NA	Pre-Injection 2
	31-Jul-14	11:05	42.92	NA	NA	NA	NA	**Commence Injection 2**
	31-Jul-14	11:30	42.92	33.21	9.71	NA	NA	Post Injection 2
	31-Jul-14	11:54	42.92	34.85	8.07	NA	NA	Post Injection 2
	31-Jul-14	12:42	42.92	35.07	7.85	NA	NA	Post Injection 2
	31-Jul-14	14:30	42.92	NA	NA	550	Present*	Post Injection 2
	1-Aug-14	9:10	42.92	NA	NA	200	Present*/154	Pre-Extraction 2/ Sheen
	1-Aug-14	9:14	42.92	33.29	9.63	NA	NA	Pre-Extraction 2
	1-Aug-14	10:20	42.92	NA	NA	NA	NA	**Commence Extraction 2**
	1-Aug-14	10:50	42.92	NA	NA	0.78	Present*	During Extraction 2
	1-Aug-14	11:01	42.92	36.76	6.16	NA	NA	During Extraction 2
	1-Aug-14	11:20	42.92	NA	NA	0.68	Present*	During Extraction 2
	1-Aug-14	11:50	42.92	NA	NA	0.82	Present*	During Extraction 2
	1-Aug-14	11:55	42.92	37.15	5.77	NA	NA	During Extraction 2
	1-Aug-14	12:20	42.92	NA	NA	1.8	Present*	During Extraction 2
	1-Aug-14	12:50	42.92	NA	NA	1.1	Present*	During Extraction 2
	1-Aug-14	13:20	42.92	NA	NA	1.3	Present*	During Extraction 2
	1-Aug-14	13:50	42.92	NA	NA	3.1	Present*	During Extraction 2
	1-Aug-14	14:20	42.92	NA	NA	NA	Present*	During Extraction 2
	1-Aug-14	14:50	42.92	NA	NA	NA	Present*	During Extraction 2
	1-Aug-14	15:20	42.92	NA	NA	NA	Present*	During Extraction 2
	1-Aug-14	15:50	42.92	NA	NA	NA	Absent*	Post Extraction 2
	1-Aug-14	15:57	42.92	35.47	7.45	NA	NA	Post Extraction 2
	1-Aug-14	16:50	42.92	NA	NA	100	68.5	Post Extraction 2
	1-Aug-14	16:52	42.92	35.22	7.70	NA	NA	Post Extraction 2
	4-Aug-14	9:28	42.92	34.09	8.83	NA	NA	Pre-Injection 3
	4-Aug-14	10:36	42.92	NA	NA	NA	NA	**Commence Injection 3**
	4-Aug-14	11:05	42.92	33.30	9.62	NA	NA	Post Injection 3
	4-Aug-14	11:43	42.92	33.91	9.01	NA	NA	Post Injection 3
	4-Aug-14	12:30	42.92	33.80	9.12	NA	NA	Post Injection 3
	4-Aug-14	12:30	42.92	NA	NA	1.5	Present*	Post Injection 3
	5-Aug-14	8:50	42.92	33.22	9.70	NA	NA	Pre-Extraction 3
	5-Aug-14	9:40	42.92	NA	NA	0.56	Present*	Pre-Extraction 3
	5-Aug-14	10:10	42.92	NA	NA	NA	NA	**Commence Extraction 3**
	5-Aug-14	10:40	42.92	NA	NA	7.9	Present*	During Extraction 3

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	5-Aug-14	11:10	42.92	NA	NA	NA	Present*	During Extraction 3
	5-Aug-14	11:40	42.92	NA	NA	6.6	Present*	During Extraction 3
	5-Aug-14	12:10	42.92	37.80	5.12	7.3	Present*	During Extraction 3
	5-Aug-14	12:40	42.92	NA	NA	1.9	Present*	During Extraction 3
	5-Aug-14	13:10	42.92	NA	NA	3.2	Present*	During Extraction 3
	5-Aug-14	13:40	42.92	NA	NA	1.7	Absent*	During Extraction 3
	5-Aug-14	14:10	42.92	38.12	4.80	NA	NA	During Extraction 3
	5-Aug-14	14:10	42.92	NA	NA	0.81	NA	During Extraction 3
	5-Aug-14	14:40	42.92	NA	NA	0.80	NA	During Extraction 3
	5-Aug-14	15:10	42.92	NA	NA	NA	Absent*	During Extraction 3
	5-Aug-14	15:20	42.92	35.45	7.47	NA	NA	During Extraction 3
	6-Aug-14	9:25	42.92	35.40	7.52	NA	NA	During Extraction 3
	6-Aug-14	14:07	42.92	35.55	7.37	NA	NA	Post Extraction 3
	6-Aug-14	14:35	42.92	NA	NA	76	83.1	Post Extraction 3

NA - Not Applicable
* - Surface Tension Field Test for Presence/Absence

Appendix D - Table 1 - Pilot Study Data Summary During Field Activities
Chester River Hospital Center
100 Brown Street
Chestertown, MD 21620

Well No.	Date	Time	Top of Casing Elevation (ft)	Depth to Water (ft)	GW Elevation (ft)	TPH-DRO (mg/L)	Surfactant (mg/L)	Comments
MW-42	29-Jul-14	9:00	46.15	35.68	10.47	NA	NA	Pre-Injection 1
	29-Jul-14	11:15	46.15	NA	NA	96	<1.40	Pre-Injection 1
	29-Jul-14	13:00	46.15	NA	NA	NA	NA	**Commence Injection 1**
	29-Jul-14	14:30	46.15	35.41	10.74	NA	NA	Post Injection 1
	29-Jul-14	15:36	46.15	35.49	10.66	NA	NA	Post Injection 1
	30-Jul-14	9:33	46.15	35.55	10.60	NA	NA	Pre-Extraction 1/ Sheen
	30-Jul-14	11:30	46.15	NA	NA	910	Present*/127	Pre-Extraction 1
	30-Jul-14	12:10	46.15	NA	NA	NA	NA	**Commence Extraction 1**
	30-Jul-14	12:30	46.15	NA	NA	1.7	NA	During Extraction 1
	30-Jul-14	12:34	46.15	36.19	9.96	NA	NA	During Extraction 1
	30-Jul-14	12:45	46.15	NA	NA	1.5	NA	During Extraction 1
	30-Jul-14	12:50	46.15	36.26	9.89	NA	NA	During Extraction 1
	30-Jul-14	13:07	46.15	36.30	9.85	NA	NA	During Extraction 1
	30-Jul-14	13:20	46.15	NA	NA	1.2	NA	During Extraction 1
	30-Jul-14	13:31	46.15	36.30	9.85		NA	During Extraction 1
	30-Jul-14	13:50	46.15	NA	NA	1.1	NA	During Extraction 1
	30-Jul-14	14:20	46.15	NA	NA	1.3	Present*	During Extraction 1
	30-Jul-14	14:50	46.15	NA	NA	1.9	Present*	During Extraction 1
	30-Jul-14	15:20	46.15	NA	NA	0.83	Present*	During Extraction 1
	30-Jul-14	15:48	46.15	37.05	9.10	NA	NA	During Extraction 1
	30-Jul-14	15:50	46.15	NA	NA	1.7	Present*	During Extraction 1
	30-Jul-14	16:20	46.15	NA	NA	0.17	Absent*	During Extraction 1
	30-Jul-14	16:28	46.15	36.71	9.44	NA	NA	Post Extraction 1
	31-Jul-14	9:13	46.15	37.35	8.80	NA	NA	Pre-Injection 2/ Sheen
	31-Jul-14	10:32	46.15	NA	NA	NA	NA	**Commence Injection 2**
	31-Jul-14	10:45	46.15	24.73	21.42	NA	NA	During Injection 2/ Mounding
	31-Jul-14	11:33	46.15	37.05	9.10	NA	NA	Post Injection 2
	31-Jul-14	11:55	46.15	37.16	8.99	NA	NA	Post Injection 2
	31-Jul-14	12:40	46.15	37.30	8.85	NA	NA	Post Injection 2
	31-Jul-14	14:30	46.15	NA	NA	140	Present*	Post Injection 2
	1-Aug-14	9:10	46.15	NA	NA	80	Present*/179	Pre-Extraction 2/ Sheen
	1-Aug-14	9:11	46.15	35.91	10.24	NA	NA	Pre-Extraction 2
	1-Aug-14	10:20	46.15	NA	NA	NA	NA	**Commence Extraction 2**
	1-Aug-14	10:50	46.15	NA	NA	1.2	Present*	During Extraction 2
	1-Aug-14	11:00	46.15	38.17	7.98	NA	NA	During Extraction 2
	1-Aug-14	11:20	46.15	NA	NA	0.96	Present*	During Extraction 2
	1-Aug-14	11:50	46.15	NA	NA	0.83	Present*	During Extraction 2
	1-Aug-14	11:54	46.15	38.35	7.80	NA	NA	During Extraction 2
	1-Aug-14	12:20	46.15	NA	NA	3.1	Present*	During Extraction 2
	1-Aug-14	12:50	46.15	NA	NA	3.6	Present*	During Extraction 2
	1-Aug-14	13:20	46.15	NA	NA	1.6	Present*	During Extraction 2
	1-Aug-14	13:50	46.15	NA	NA	1.9	Present*	During Extraction 2
	1-Aug-14	14:20	46.15	NA	NA	NA	Present*	During Extraction 2
	1-Aug-14	14:50	46.15	NA	NA	NA	Present*	During Extraction 2
	1-Aug-14	15:20	46.15	NA	NA	NA	Present*	During Extraction 2
	1-Aug-14	15:50	46.15	NA	NA	NA	Absent*	During Extraction 2
	1-Aug-14	15:55	46.15	37.50	8.65	NA	NA	During Extraction 2
	1-Aug-14	16:50	46.15	NA	NA	71	90.8	Post Extraction 2
	1-Aug-14	16:51	46.15	37.39	8.76	NA	NA	Post Extraction 2
	4-Aug-14	9:27	46.15	36.62	9.53	NA	NA	Pre-Injection 3
	4-Aug-14	9:50	46.15	NA	NA	NA	NA	**Commence Injection 3**
	4-Aug-14	11:04	46.15	36.31	9.84	NA	NA	Post Injection 3
	4-Aug-14	11:42	46.15	36.51	9.64	NA	NA	Post Injection 3
	4-Aug-14	12:29	46.15	36.51	9.64	NA	NA	Post Injection 3
	4-Aug-14	12:30	46.15	NA	NA	2.2	Present*	Post Injection 3
	5-Aug-14	8:47	46.15	35.99	10.16	NA	NA	Pre-Extraction 3
	5-Aug-14	9:40	46.15	NA	NA	2.4	Present*	Pre-Extraction 3
	5-Aug-14	10:10	46.15	NA	NA	NA	NA	**Commence Extraction 3**
	5-Aug-14	10:40	46.15	NA	NA	13	Present*	During Extraction 3

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	5-Aug-14	11:10	46.15	38.17	7.98	1.1	Present*	During Extraction 3
	5-Aug-14	11:40	46.15	NA	NA	4.0	Present*	During Extraction 3
	5-Aug-14	12:10	46.15	38.29	7.86	0.81	Present*	During Extraction 3
	5-Aug-14	12:40	46.15	NA	NA	1.9	Present*	During Extraction 3
	5-Aug-14	13:10	46.15	NA	NA	1.8	Present*	During Extraction 3
	5-Aug-14	13:40	46.15	NA	NA	2.1	Absent*	During Extraction 3
	5-Aug-14	14:10	46.15	38.50	7.65	2.2	NA	During Extraction 3
	5-Aug-14	14:40	46.15	NA		1.1	NA	During Extraction 3
	5-Aug-14	15:10	46.15	NA	NA	NA	Present*	During Extraction 3
	5-Aug-14	15:19	46.15	37.51	8.64	NA	NA	During Extraction 3
	6-Aug-14	9:30	46.15	37.57	8.58	NA	NA	During Extraction 3
	6-Aug-14	11:45	46.15	NA	NA	NA	Present*	During Extraction 3
	6-Aug-14	12:15	46.15	NA	NA	NA	Present*	During Extraction 3
	6-Aug-14	12:45	46.15	NA	NA	NA	Present*	During Extraction 3
	6-Aug-14	13:15	46.15	NA	NA	NA	Absent*	During Extraction 3
	6-Aug-14	13:45	46.15	NA	NA	NA	Absent*	During Extraction 3
	6-Aug-14	14:05	46.15	37.75	8.40	NA	NA	Post Extraction 3
	6-Aug-14	14:35	46.15	NA	NA	94	77.9	Post Extraction 3

NA - Not Applicable
* - Surface Tension Field Test for Presence/Absence

Appendix D - Table 1 - Pilot Study Data Summary During Field Activities
Chester River Hospital Center
100 Brown Street
Chestertown, MD 21620

Well No.	Date	Time	Top of Casing Elevation (ft)	Depth to Water (ft)	GW Elevation (ft)	TPH-DRO (mg/L)	Surfactant (mg/L)	Comments
MW-43	29-Jul-14	9:00	47.90	37.44	10.46	NA	NA	Pre-Injection 1
	29-Jul-14	12:00	47.90	NA	NA	14	<1.40	Pre-Injection 1
	29-Jul-14	14:25	47.90	37.25	10.65	NA	NA	During Injection 1
	29-Jul-14	15:32	47.90	37.31	10.59	NA	NA	Post Injection 1
	30-Jul-14	9:29	47.90	37.31	10.59	NA	NA	Pre-Extraction 1
	30-Jul-14	15:45	47.90	38.82	9.08	NA	NA	During Extraction 1
	30-Jul-14	16:26	47.90	38.80	9.10	NA	NA	Post Extraction 1
	31-Jul-14	9:15	47.90	39.04	8.86	NA	NA	Pre-Injection 2
	31-Jul-14	11:59	47.90	38.97	8.93	NA	NA	Post Injection 2
	31-Jul-14	12:38	47.90	39.02	8.88	NA	NA	Post Injection 2
	1-Aug-14	9:40	47.90	38.36	9.54	NA	NA	Pre-Extraction 2
	1-Aug-14	15:56	47.90	39.29	8.61	NA	NA	During Extraction 2
	1-Aug-14	16:49	47.90	39.12	8.78	NA	NA	Post Extraction 2
	4-Aug-14	11:02	47.90	37.70	10.20	NA	NA	During Injection 3
	4-Aug-14	11:40	47.90	38.16	9.74	NA	NA	Post Injection 3
	4-Aug-14	12:27	47.90	38.17	9.73	NA	NA	Post Injection 3
	5-Aug-14	8:47	47.90	37.77	10.13	NA	NA	Pre-Extraction 3
	5-Aug-14	15:18	47.90	39.26	8.64	NA	NA	During Extraction 3
	6-Aug-14	9:23	47.90	39.30	8.60	NA	NA	During Extraction 3
	6-Aug-14	14:02	47.90	39.39	8.51	NA	NA	Post Extraction 3

NA - Not Applicable
* - Surface Tension Field Test for Presence/Absence

Well No.	Date	Time	Top of Casing Elevation (ft)	Depth to Water (ft)	GW Elevation (ft)	TPH-DRO (mg/L)	Surfactant (mg/L)	Comments
MW-45	29-Jul-14	9:00	40.70	30.79	9.91	NA	NA	Pre-Injection 1
	29-Jul-14	10:50	40.70	NA	NA	<0.1	<1.40	Pre-Injection 1
	29-Jul-14	14:47	40.70	30.66	10.04	NA	NA	During Injection 1
	29-Jul-14	15:49	40.70	30.67	10.03	NA	NA	Post Injection 1
	30-Jul-14	9:45	40.70	30.67	10.03	NA	NA	Pre-Extraction 1
	30-Jul-14	15:58	40.70	31.13	9.57	NA	NA	During Extraction 1
	30-Jul-14	16:34	40.70	31.30	9.40	NA	NA	Post Extraction 1
	31-Jul-14	9:21	40.70	31.81	8.89	NA	NA	Pre-Injection 2
	31-Jul-14	11:47	40.70	31.81	8.89	NA	NA	Post Injection 2
	31-Jul-14	12:48	40.70	31.81	8.89	NA	NA	Post Injection 2
	1-Aug-14	9:34	40.70	31.17	9.53	NA	NA	Pre-Extraction 2
	1-Aug-14	16:02	40.70	31.90	8.80	NA	NA	During Extraction 2
	1-Aug-14	16:57	40.70	31.87	8.83	NA	NA	Post Extraction 2
	4-Aug-14	9:33	40.70	31.53	9.17	NA	NA	Pre-Injection 3
	4-Aug-14	11:10	40.70	31.38	9.32	NA	NA	Post Injection 3
	4-Aug-14	11:48	40.70	31.43	9.27	NA	NA	Post Injection 3
	5-Aug-14	8:55	40.70	31.16	9.54	NA	NA	Pre-Extraction 3
	5-Aug-14	15:25	40.70	31.95	8.75	NA	NA	During Extraction 3
	6-Aug-14	9:32	40.70	32.10	8.60	NA	NA	During Extraction 3
	6-Aug-14	14:11	40.70	32.15	8.55	NA	NA	Post Extraction 3

NA - Not Applicable
* - Surface Tension Field Test for Presence/Absence

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Well No.	Date	Time	Top of Casing Elevation (ft)	Depth to Water (ft)	GW Elevation (ft)	TPH-DRO (mg/L)	Surfactant (mg/L)	Comments
MW-46	29-Jul-14	9:00	40.89	31.04	9.85	NA	NA	Pre-Injection 1
	29-Jul-14	10:55	40.89	NA	NA	5.6	<1.40	Pre-Injection 1
	29-Jul-14	14:43	40.89	30.82	10.07	NA	NA	During Injection 1
	29-Jul-14	15:40	40.89	30.85	10.04	NA	NA	Post Injection 1
	30-Jul-14	9:43	40.89	30.90	9.99	NA	NA	Pre-Extraction 1
	30-Jul-14	10:45	40.89	NA	NA	NA	<1.40	Pre-Extraction 1
	30-Jul-14	15:54	40.89	31.79	9.10	NA	NA	During Extraction 1
	30-Jul-14	16:32	40.89	32.20	8.69	NA	NA	Post Extraction 1
	31-Jul-14	9:19	40.89	33.08	7.81	NA	NA	Pre-Injection 2
	31-Jul-14	9:45	40.89	NA	NA	NA	Absent*	Pre-Injection 2
	31-Jul-14	11:49	40.89	33.03	7.86	NA	NA	Post Injection 2
	31-Jul-14	12:46	40.89	33.05	7.84	NA	NA	Post Injection 2
	31-Jul-14	13:05	40.89	NA	NA	NA	Absent*/<1.40	Post Injection 2
	1-Aug-14	9:32	40.89	31.68	9.21	NA	NA	Pre-Extraction 2
	1-Aug-14	10:00	40.89	NA	NA	NA	Absent*	During Extraction 2
	1-Aug-14	16:01	40.89	33.22	7.67	NA	NA	During Extraction 2
	1-Aug-14	16:25	40.89	NA	NA	NA	Absent*	Post Extraction 2
	1-Aug-14	16:55	40.89	33.23	7.66	NA	NA	Post Extraction 2
	1-Aug-14	17:10	40.89	NA	NA	71	<1.40	Post Extraction 2
	4-Aug-14	9:31	40.89	32.16	8.73	NA	NA	Pre-Injection 3
	4-Aug-14	9:45	40.89	NA	NA	33	Absent*	Pre-Injection 3
	4-Aug-14	11:08	40.89	31.88	9.01	NA	NA	Post Injection 3
	4-Aug-14	11:45	40.89	31.89	9.00	NA	NA	Post Injection 3
	4-Aug-14	12:11	40.89	31.90	8.99	NA	NA	Post Injection 3
	4-Aug-14	12:15	40.89	NA	NA	NA	Absent*/<1.40	Post Injection 3
	5-Aug-14	8:53	40.89	31.46	9.43	NA	NA	Pre-Extraction 3
	5-Aug-14	9:30	40.89	NA	NA	3.6	Absent*/<1.40	Pre-Extraction 3
	5-Aug-14	15:23	40.89	33.30	7.59	NA	NA	During Extraction 3
	6-Aug-14	9:31	40.89	33.43	7.46	NA	NA	During Extraction 3
	6-Aug-14	14:10	40.89	33.46	7.43	NA	NA	Post Extraction 3
	6-Aug-14	14:50	40.89	NA	NA	23	<1.40	Post Extraction 3

NA - Not Applicable
* - Surface Tension Field Test for Presence/Absence

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Well No.	Date	Time	Top of Casing Elevation (ft)	Depth to Water (ft)	GW Elevation (ft)	TPH-DRO (mg/L)	Surfactant (mg/L)	Comments
MW-47	29-Jul-14	9:00	40.74	30.92	9.82	NA	NA	Pre-Injection 1
	29-Jul-14	10:30	40.74	NA	NA	530	<1.40	Pre-Injection 1
	29-Jul-14	14:40	40.74	30.63	10.11	NA	NA	During Injection 1
	29-Jul-14	15:42	40.74	30.71	10.03	NA	NA	Post Injection 1
	30-Jul-14	9:37	40.74	30.78	9.96	NA	NA	Pre-Extraction 1
	30-Jul-14	10:50	40.74	NA	NA	NA	<1.40	Pre-Extraction 1
	30-Jul-14	15:53	40.74	32.36	8.38	NA	NA	During Extraction 1
	30-Jul-14	16:31	40.74	32.62	8.12	NA	NA	Post Extraction 1
	31-Jul-14	9:17	40.74	33.36	7.38	NA	NA	Pre-Injection 2
	31-Jul-14	9:45	40.74	NA	NA	NA	Absent*	Pre-Injection 2
	31-Jul-14	11:50	40.74	33.22	7.52	NA	NA	Post Injection 2
	31-Jul-14	12:45	40.74	33.36	7.38	NA	NA	Post Injection 2
	31-Jul-14	13:05	40.74	NA	NA	NA	Absent*/<1.40	Post Injection 2
	1-Aug-14	9:31	40.74	32.16	8.58	NA	NA	Pre-Extraction 2
	1-Aug-14	10:00	40.74	NA	NA	NA	Absent*	During Extraction 2
	1-Aug-14	15:59	40.74	33.60	7.14	NA	NA	During Extraction 2
	1-Aug-14	16:25	40.74	NA	NA	NA	Absent*	Post Extraction 2
	1-Aug-14	16:54	40.74	33.46	7.28	NA	NA	Post Extraction 2
	1-Aug-14	17:10	40.74	NA	NA	420	<1.40	Post Extraction 2
	4-Aug-14	9:30	40.74	32.17	8.57	NA	NA	Pre-Injection 3
	4-Aug-14	9:45	40.74	NA	NA	900	Absent*	Pre-Injection 3
	4-Aug-14	11:07	40.74	31.72	9.02	NA	NA	Post Injection 3
	4-Aug-14	11:46	40.74	31.86	8.88	NA	NA	Post Injection 3
	4-Aug-14	12:10	40.74	31.96	8.78	NA	NA	Post Injection 3
	4-Aug-14	12:15	40.74	NA	NA	NA	Absent*/<1.40	Post Injection 3
	5-Aug-14	8:52	40.74	31.28	9.46	NA	NA	Pre-Extraction 3
	5-Aug-14	9:30	40.74	NA	NA	90	Absent*/<1.40	Pre-Extraction 3
	5-Aug-14	15:22	40.74	33.59	7.15	NA	NA	During Extraction 3
	6-Aug-14	9:29	40.74	33.69	7.05	NA	NA	During Extraction 3
	6-Aug-14	14:09	40.74	33.81	6.93	NA	NA	Post Extraction 3
	6-Aug-14	14:50	40.74	NA	NA	670	<1.40	Post Extraction 3

NA - Not Applicable
* - Surface Tension Field Test for Presence/Absence

Well No.	Date	Time	Top of Casing Elevation (ft)	Depth to Water (ft)	GW Elevation (ft)	TPH-DRO (mg/L)	Surfactant (mg/L)	Comments
RW-2D	5-Aug-14	10:40	40.54	NA	NA	24	NA	During Extraction 3
	5-Aug-14	11:40	40.54	NA	NA	0.48	Present*	During Extraction 3
	5-Aug-14	12:40	40.54	NA	NA	0.59	NA	During Extraction 3
	5-Aug-14	13:40	40.54	NA	NA	0.54	Absent*	During Extraction 3
	5-Aug-14	14:40	40.54	NA	NA	0.28	NA	During Extraction 3
	6-Aug-14	14:30	40.54	NA	NA	0.51	<1.40	Post Extraction 3

NA - Not Applicable
* - Surface Tension Field Test for Presence/Absence

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Well No.	Date	Time	Top of Casing Elevation (ft)	Depth to Water (ft)	GW Elevation (ft)	TPH-DRO (mg/L)	Surfactant (mg/L)	Comments
RW-4	29-Jul-14	14:45	48.15	NA	NA	NA	Absent*	Post Injection 1
	29-Jul-14	15:30	48.15	NA	NA	NA	Absent*	Post Injection 1
	30-Jul-14	10:00	48.15	NA	NA	0.62	Absent*/<1.40	Pre-Extraction 1
	31-Jul-14	9:42	48.15	NA	NA	NA	Absent*	Pre-Injection 2
	31-Jul-14	12:50	48.15	NA	NA	0.36	Present*	Post Injection 2
	31-Jul-14	14:30	48.15	NA	NA	NA	Absent*	Post Injection 2
	1-Aug-14	9:30	48.15	NA	NA	0.37	Absent*/<1.40	Pre-Extraction 2
	1-Aug-14	17:00	48.15	NA	NA	0.55	<1.40	Post Extraction 2
	4-Aug-14	9:55	48.15	NA	NA	0.16	Absent*	During Injection 3
	4-Aug-14	12:00	48.15	NA	NA	<0.1	Absent*	Post Injection 3
	5-Aug-14	9:35	48.15	NA	NA	0.21	Absent*/<1.40	Pre-Extraction 3
	5-Aug-14	10:40	48.15	NA	NA	0.88	NA	During Extraction 3
	5-Aug-14	11:40	48.15	NA	NA	0.90	Present*	During Extraction 3
	5-Aug-14	12:40	48.15	NA	NA	0.62	NA	During Extraction 3
	5-Aug-14	13:40	48.15	NA	NA	0.71	Absent*	During Extraction 3
	5-Aug-14	14:40	48.15	NA	NA	0.43	NA	During Extraction 3
	6-Aug-14	14:30	48.15	NA	NA	0.51	<1.40	Post Extraction 3

NA - Not Applicable
* - Surface Tension Field Test for Presence/Absence

Well No.	Date	Time	Top of Casing Elevation (ft)	Depth to Water (ft)	GW Elevation (ft)	TPH-DRO (mg/L)	Surfactant (mg/L)	Comments
RW-5	29-Jul-14	14:30	43.34	NA	NA	NA	Absent*	Post Injection 1
	29-Jul-14	16:15	43.34	NA	NA	NA	Absent*	Post Injection 1
	30-Jul-14	10:00	43.34	NA	NA	5.0	Absent*/<1.40	Pre-Extraction 1
	31-Jul-14	9:42	43.34	NA	NA	NA	Absent*	Pre-Injection 2
	31-Jul-14	12:50	43.34	NA	NA	2.7	Present*	Post Injection 2
	31-Jul-14	14:30	43.34	NA	NA	NA	Absent*	Post Injection 2
	1-Aug-14	9:30	43.34	NA	NA	0.46	Absent*/<1.40	Pre-Extraction 2
	1-Aug-14	17:00	43.34	NA	NA	10	<1.40	Post Extraction 2
	4-Aug-14	9:55	43.34	NA	NA	0.17	Absent*	During Injection 3
	4-Aug-14	12:00	43.34	NA	NA	<0.1	Absent*	Post Injection 3
	5-Aug-14	9:35	43.34	NA	NA	0.25	Absent*/<1.40	Pre-Extraction 3
	5-Aug-14	10:40	43.34	NA	NA	0.6	NA	During Extraction 3
	5-Aug-14	11:40	43.34	NA	NA	0.25	Present*	During Extraction 3
	5-Aug-14	12:40	43.34	NA	NA	0.65	NA	During Extraction 3
	5-Aug-14	13:40	43.34	NA	NA	0.50	Absent*	During Extraction 3
	5-Aug-14	14:40	43.34	NA	NA	0.24	NA	During Extraction 3
	6-Aug-14	14:30	43.34	NA	NA	1.5	<1.40	Post Extraction 3

NA - Not Applicable
* - Surface Tension Field Test for Presence/Absence

Appendix D - Table 1 - Pilot Study Data Summary During Field Activities
Chester River Hospital Center
100 Brown Street
Chestertown, MD 21620

Well No.	Date	Time	Top of Casing Elevation (ft)	Depth to Water (ft)	GW Elevation (ft)	TPH-DRO (mg/L)	Surfactant (mg/L)	Comments
RW-6	31-Jul-14	9:42	47.22	NA	NA	NA	Absent*	Pre-Injection 2
	31-Jul-14	12:50	47.22	NA	NA	0.23	Present*	Post Injection 2
	31-Jul-14	14:30	47.22	NA	NA	NA	Absent*	Post Injection 2
	1-Aug-14	9:30	47.22	NA	NA	0.30	Absent*/<1.40	Pre-Extraction 2
	1-Aug-14	17:00	47.22	NA	NA	0.45	<1.40	Post Extraction 2
	4-Aug-14	9:55	47.22	NA	NA	<0.1	Absent*	During Injection 3
	4-Aug-14	12:00	47.22	NA	NA	<0.1	Absent*	Post Injection 3
	5-Aug-14	9:35	47.22	NA	NA	6.2	Absent*/<1.40	Pre-Extraction 3
	5-Aug-14	10:40	47.22	NA	NA	0.58	NA	During Extraction 3
	5-Aug-14	11:40	47.22	NA	NA	0.29	Present*	During Extraction 3
	5-Aug-14	12:40	47.22	NA	NA	0.50	NA	During Extraction 3
	5-Aug-14	13:40	47.22	NA	NA	0.57	Absent*	During Extraction 3
	5-Aug-14	14:40	47.22	NA	NA	0.36	NA	During Extraction 3
	6-Aug-14	14:30	47.22	NA	NA	0.22	<1.40	Post Extraction 3

NA - Not Applicable
* - Surface Tension Field Test for Presence/Absence

TABLE 2

Data Summary of 28 Pilot Study Monitoring Wells Post Pilot Study

Appendix D Table 2 - Pilot Study Data Summary Post Monitoring
Chester River Hospital Center
100 Brown Street
Chestertown, MD 21620

Well No.	Date	Top of Casing Elevation (ft)	Depth to Water (ft)	GW Elevation (ft)	Benzene (µg/L)	Toluene (µg/L)	Ethyl-benzene (µg/L)	Xylenes (µg/L)	Total BTEX (µg/L)	MTBE (µg/L)	TPH-DRO (mg/L)	TPH-GRO (mg/L)	Naphthalene (µg/L)	Surfactant (mg/L)
MDE GW Cleanup Standards for Type I and II Aquifers					**5**	**1,000**	**700**	**10,000**	**NA**	**20**	**0.047**	**0.047**	**NA**	**NA**
MW-10R	29-Jul-14	48.70	38.16	10.54	<1	<1	<1	<2	<2	<1	<0.1	<0.1	<1	1.57
	15-Aug-14	48.70	38.88	9.82	<1	<1	<1	<2	<2	<1	**0.87**	<0.1	1.2	<1.4
	19-Sep-14	48.70	38.93	9.77	<1	<1	<1	<2	<2	<1	**0.88**	<0.1	2.3	<1.4
	24-Oct-14	48.70	40.09	8.61	<1	<1	<1	<2	<2	<1	**0.20**	<0.1	<1	<1.4
	20-Nov-14	48.70	39.30	9.40	<1	<1	<1	<2	<2	<1	**0.35**	<0.1	<1	<1.4

NS - Not Sampled

Well No.	Date	Top of Casing Elevation (ft)	Depth to Water (ft)	GW Elevation (ft)	Benzene (µg/L)	Toluene (µg/L)	Ethyl-benzene (µg/L)	Xylenes (µg/L)	Total BTEX (µg/L)	MTBE (µg/L)	TPH-DRO (mg/L)	TPH-GRO (mg/L)	Naphthalene (µg/L)	Surfactant (mg/L)
MDE GW Cleanup Standards for Type I and II Aquifers					**5**	**1,000**	**700**	**10,000**	**NA**	**20**	**0.047**	**0.047**	**NA**	**NA**
MW-13	29-Jul-14	41.70	31.82	9.88	<1	<1	<1	<2	<2	<1	**0.46**	<0.1	<1	<1.4
	14-Aug-14	41.70	32.77	8.93	<1	<1	<1	<2	<2	<1	**0.54**	<0.1	<1	<1.4
	19-Sep-14	41.70	32.90	8.80	<1	<1	<1	<2	<2	<1	**2.10**	<0.1	<1	<1.4
	24-Oct-14	41.70	IA-NS											
	19-Nov-14	41.70	33.16	8.54	<1	<1	<1	<2	<2	<1	**0.42**	<0.1	<1	<1.4

NS - Not Sampled, IA-NS - Inaccessible Not Sampled

Well No.	Date	Top of Casing Elevation (ft)	Depth to Water (ft)	GW Elevation (ft)	Benzene (µg/L)	Toluene (µg/L)	Ethyl-benzene (µg/L)	Xylenes (µg/L)	Total BTEX (µg/L)	MTBE (µg/L)	TPH-DRO (mg/L)	TPH-GRO (mg/L)	Naphthalene (µg/L)	Surfactant (mg/L)
MDE GW Cleanup Standards for Type I and II Aquifers					**5**	**1,000**	**700**	**10,000**	**NA**	**20**	**0.047**	**0.047**	**NA**	**NA**
MW-14	29-Jul-14	41.38	31.52	9.86	<1	<1	<1	<2	<2	<1	**9.8**	<0.1	8.8	<1.4
	14-Aug-14	41.38	33.12	8.26	<1	<1	9	<2	9.0	<1	**23**	**0.17**	81	<1.4
	19-Sep-14	41.38	34.06	7.32	1.3	<1	22	3.1	26.4	<1	**210**	**0.39**	140	<1.4
	24-Oct-14	41.38			<1	<1	3	<2	3.0	<1	**38**	**0.13**	24	<1.4
	19-Nov-14	41.38	32.04	9.34	<1	<1	<1	<2	<2	<1	**42**	**0.2**	13	<1.4

NS - Not Sampled

EBA ENGINEERING

Appendix D Table 2 - Pilot Study Data Summary Post Monitoring
Chester River Hospital Center
100 Brown Street
Chestertown, MD 21620

Well No.	Date	Top of Casing Elevation (ft)	Depth to Water (ft)	GW Elevation (ft)	Benzene (µg/L)	Toluene (µg/L)	Ethyl-benzene (µg/L)	Xylenes (µg/L)	Total BTEX (µg/L)	MTBE (µg/L)	TPH-DRO (mg/L)	TPH-GRO (mg/L)	Naphthalene (µg/L)	Surfactant (mg/L)
MDE GW Cleanup Standards for Type I and II Aquifers					**5**	**1,000**	**700**	**10,000**	**NA**	**20**	**0.047**	**0.047**	**NA**	**NA**
MW-15	22-Jul-14	35.01	25.82	9.19	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS
	14-Aug-14	35.01	26.25	8.76	<1	<1	<1	<2	<2	<1	<0.1	<0.1	<1	<1.4
	19-Sep-14	35.01	25.9	9.11	<1	<1	<1	<2	<2	<1	<0.1	<0.1	<1	<1.4
	24-Oct-14	35.01	IA-NS											
	20-Nov-14	35.01	26.32	8.69	<1	<1	<1	<2	<2	<1	<0.1	<0.1	<1	<1.4

NS - Not Sampled, IA-NS - Inaccessible Not Sampled

Well No.	Date	Top of Casing Elevation (ft)	Depth to Water (ft)	GW Elevation (ft)	Benzene (µg/L)	Toluene (µg/L)	Ethyl-benzene (µg/L)	Xylenes (µg/L)	Total BTEX (µg/L)	MTBE (µg/L)	TPH-DRO (mg/L)	TPH-GRO (mg/L)	Naphthalene (µg/L)	Surfactant (mg/L)
MDE GW Cleanup Standards for Type I and II Aquifers					**5**	**1,000**	**700**	**10,000**	**NA**	**20**	**0.047**	**0.047**	**NA**	**NA**
MW-16	23-Jul-14	35.55	26.47	9.08	<1	<1	<1	<2	<2	<1	<0.1	NS	<1	NS
	14-Aug-14	35.55	27.07	8.48	<1	<1	<1	<2	<2	<1	<0.1	<0.1	<1	<1.4
	19-Sep-14	35.55	26.63	8.92	<1	<1	<1	<2	<2	<1	<0.1	<0.1	<1	<1.4
	24-Oct-14	35.55	IA-NS											
	20-Nov-14	35.55	27.40	8.15	<1	<1	<1	<2	<2	<1	<0.1	<0.1	<1	<1.4

NS - Not Sampled, IA-NS - Inaccessible Not Sampled

Well No.	Date	Top of Casing Elevation (ft)	Depth to Water (ft)	GW Elevation (ft)	Benzene (µg/L)	Toluene (µg/L)	Ethyl-benzene (µg/L)	Xylenes (µg/L)	Total BTEX (µg/L)	MTBE (µg/L)	TPH-DRO (mg/L)	TPH-GRO (mg/L)	Naphthalene (µg/L)	Surfactant (mg/L)
MDE GW Cleanup Standards for Type I and II Aquifers					**5**	**1,000**	**700**	**10,000**	**NA**	**20**	**0.047**	**0.047**	**NA**	**NA**
MW-17	23-Jul-14	35.49	26.23	9.26	<1	<1	<1	<2	<2	<1	**0.13**	NS	<1	NS
	14-Aug-14	35.49	26.51	8.98	<1	<1	<1	<2	<2	<1	<0.1	<0.1	<1	<1.4
	19-Sep-14	35.49	28.22	7.27	<1	<1	<1	<2	<2	<1	<0.1	<0.1	<1	<1.4
	24-Oct-14	35.49	IA-NS											
	20-Nov-14	35.49	26.87	8.62	<1	<1	<1	<2	<2	<1	<0.1	<0.1	<1	<1.4

NS - Not Sampled, IA-NS - Inaccessible Not Sampled

Appendix D Table 2 - Pilot Study Data Summary Post Monitoring
Chester River Hospital Center
100 Brown Street
Chestertown, MD 21620

Well No.	Date	Top of Casing Elevation (ft)	Depth to Water (ft)	GW Elevation (ft)	Benzene (µg/L)	Toluene (µg/L)	Ethyl-benzene (µg/L)	Xylenes (µg/L)	Total BTEX (µg/L)	MTBE (µg/L)	TPH-DRO (mg/L)	TPH-GRO (mg/L)	Naphthalene (µg/L)	Surfactant (mg/L)
MDE GW Cleanup Standards for Type I and II Aquifers					**5**	**1,000**	**700**	**10,000**	**NA**	**20**	**0.047**	**0.047**	**NA**	**NA**
MW-18	23-Jul-14	35.82	27.34	8.48	<1	<1	<1	<2	<2	<1	<0.1	NS	<1	NS
	14-Aug-14	35.82	27.56	8.26	<1	<1	<1	<2	<2	<1	<0.1	<0.1	<1	<1.4
	19-Sep-14	35.82	27.36	8.46	<1	<1	<1	<2	<2	<1	<0.1	<0.1	<1	<1.4
	23-Oct-14	35.82	27.83	7.99	<1	<1	<1	<2	<2	<1	<0.1	<0.1	<1	<1.4
	20-Nov-14	35.82	27.91	7.91	<1	<1	<1	<2	<2	<1	<0.1	<0.1	<1	<1.4

NS - Not Sampled

Well No.	Date	Top of Casing Elevation (ft)	Depth to Water (ft)	GW Elevation (ft)	Benzene (µg/L)	Toluene (µg/L)	Ethyl-benzene (µg/L)	Xylenes (µg/L)	Total BTEX (µg/L)	MTBE (µg/L)	TPH-DRO (mg/L)	TPH-GRO (mg/L)	Naphthalene (µg/L)	Surfactant (mg/L)
MDE GW Cleanup Standards for Type I and II Aquifers					**5**	**1,000**	**700**	**10,000**	**NA**	**20**	**0.047**	**0.047**	**NA**	**NA**
MW-19	29-Jul-14	38.85	29.33	9.52	<1	<1	<1	<2	<2	<1	**0.14**	<0.1	<1	<1.4
	14-Aug-14	38.85	30.24	8.61	<1	<1	<1	<2	<2	<1	<0.1	<0.1	<1	<1.4
	19-Sep-14	38.85	29.98	8.87	<1	<1	<1	<2	<2	<1	<0.1	<0.1	<1	<1.4
	23-Oct-14	38.85	31.32	7.53	<1	<1	<1	<2	<2	<1	<0.1	<0.1	<1	<1.4
	21-Nov-14	38.85	30.58	8.27	<1	<1	<1	<2	<2	<1	<0.1	<0.1	<1	<1.4

NS - Not Sampled

Well No.	Date	Top of Casing Elevation (ft)	Depth to Water (ft)	GW Elevation (ft)	Benzene (µg/L)	Toluene (µg/L)	Ethyl-benzene (µg/L)	Xylenes (µg/L)	Total BTEX (µg/L)	MTBE (µg/L)	TPH-DRO (mg/L)	TPH-GRO (mg/L)	Naphthalene (µg/L)	Surfactant (mg/L)
MDE GW Cleanup Standards for Type I and II Aquifers					**5**	**1,000**	**700**	**10,000**	**NA**	**20**	**0.047**	**0.047**	**NA**	**NA**
MW-20	29-Jul-14	38.72	29.17	9.55	<1	<1	<1	<2	<2	<1	**0.33**	<0.1	<1	<1.4
	14-Aug-14	38.72	30.08	8.64	<1	<1	<1	<2	<2	<1	<0.1	<0.1	<1	<1.4
	19-Sep-14	38.72	29.95	8.77	<1	<1	<1	<2	<2	<1	**0.94**	<0.1	<1	<1.4
	24-Oct-14	38.72	31.32	7.40	<1	<1	<1	<2	<2	<1	**0.22**	<0.1	<1	<1.4
	21-Nov-14	38.72	30.43	8.29	<1	<1	<1	<2	<2	<1	**0.30**	<0.1	<1	<1.4

NS - Not Sampled

Appendix D Table 2 - Pilot Study Data Summary Post Monitoring
Chester River Hospital Center
100 Brown Street
Chestertown, MD 21620

Well No.	Date	Top of Casing Elevation (ft)	Depth to Water (ft)	GW Elevation (ft)	Benzene (µg/L)	Toluene (µg/L)	Ethyl-benzene (µg/L)	Xylenes (µg/L)	Total BTEX (µg/L)	MTBE (µg/L)	TPH-DRO (mg/L)	TPH-GRO (mg/L)	Naphthalene (µg/L)	Surfactant (mg/L)
MDE GW Cleanup Standards for Type I and II Aquifers					**5**	**1,000**	**700**	**10,000**	**NA**	**20**	**0.047**	**0.047**	**NA**	**NA**
MW-22	25-Jul-14	47.04	36.59	10.45	<1	<1	<1	<2	<2	<1	**0.25**	<0.1	1.1	<1.4
	15-Aug-14	47.04	37.54	9.50	<1	<1	<1	<2	<2	<1	**0.41**	<0.1	2.0	<1.4
	19-Sep-14	47.04	42.72	4.32	<1	<1	<1	<2	<2	<1	**0.35**	<0.1	2.0	<2.34
	24-Oct-14	47.04	43.68	3.36	<1	<1	<1	<2	<2	<1	<0.1	<0.1	2.4	<1.4
	21-Nov-14	47.04	36.15	10.89	<1	<1	<1	<2	<2	<1	**0.62**	<0.1	2.8	<1.4

NS - Not Sampled

Well No.	Date	Top of Casing Elevation (ft)	Depth to Water (ft)	GW Elevation (ft)	Benzene (µg/L)	Toluene (µg/L)	Ethyl-benzene (µg/L)	Xylenes (µg/L)	Total BTEX (µg/L)	MTBE (µg/L)	TPH-DRO (mg/L)	TPH-GRO (mg/L)	Naphthalene (µg/L)	Surfactant (mg/L)
MDE GW Cleanup Standards for Type I and II Aquifers					**5**	**1,000**	**700**	**10,000**	**NA**	**20**	**0.047**	**0.047**	**NA**	**NA**
MW-23	23-Jul-14	35.95	27.53	8.42	<1	<1	<1	<2	<2	<1	<0.1	NS	<1	NS
	14-Aug-14	35.95	27.78	8.17	<1	<1	<1	<2	<2	<1	<0.1	<0.1	<1	<1.4
	19-Sep-14	35.95	27.66	8.29	<1	<1	<1	<2	<2	<1	<0.1	<0.1	<1	<1.4
	23-Oct-14	35.95	28.06	7.89	<1	<1	<1	<2	<2	<1	<0.1	<0.1	<1	<1.4
	20-Nov-14	35.95	28.10	7.85	<1	<1	<1	<2	<2	<1	<0.1	<0.1	<1	<1.4

NS - Not Sampled

Well No.	Date	Top of Casing Elevation (ft)	Depth to Water (ft)	GW Elevation (ft)	Benzene (µg/L)	Toluene (µg/L)	Ethyl-benzene (µg/L)	Xylenes (µg/L)	Total BTEX (µg/L)	MTBE (µg/L)	TPH-DRO (mg/L)	TPH-GRO (mg/L)	Naphthalene (µg/L)	Surfactant (mg/L)
MDE GW Cleanup Standards for Type I and II Aquifers					**5**	**1,000**	**700**	**10,000**	**NA**	**20**	**0.047**	**0.047**	**NA**	**NA**
MW-24	23-Jul-14	36.56	27.57	8.99	<1	<1	<1	<2	<2	<1	<0.1	NS	<1	NS
	14-Aug-14	36.56	28.12	8.44	<1	<1	<1	<2	<2	<1	<0.1	<0.1	<1	<1.4
	19-Sep-14	36.56	27.67	8.89	<1	<1	<1	<2	<2	<1	<0.1	<0.1	<1	<1.4
	23-Oct-14	36.56	28.51	8.05	<1	<1	<1	<2	<2	<1	<0.1	<0.1	<1	<1.4
	20-Nov-14	36.56	28.43	8.13	<1	<1	<1	<2	<2	<1	**0.47**	<0.1	<1	<1.4

NS - Not Sampled

Appendix D Table 2 - Pilot Study Data Summary Post Monitoring
Chester River Hospital Center
100 Brown Street
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Well No.	Date	Top of Casing Elevation (ft)	Depth to Water (ft)	GW Elevation (ft)	Benzene (µg/L)	Toluene (µg/L)	Ethyl-benzene (µg/L)	Xylenes (µg/L)	Total BTEX (µg/L)	MTBE (µg/L)	TPH-DRO (mg/L)	TPH-GRO (mg/L)	Naphthalene (µg/L)	Surfactant (mg/L)
MDE GW Cleanup Standards for Type I and II Aquifers					**5**	**1,000**	**700**	**10,000**	**NA**	**20**	**0.047**	**0.047**	**NA**	**NA**
MW-25	23-Jul-14	36.10	27.20	8.90	<1	<1	<1	<2	<2	<1	<0.1	NS	<1	NS
	14-Aug-14	36.10	27.54	8.56	<1	<1	<1	<2	<2	<1	<0.1	<0.1	<1	<1.4
	19-Sep-14	36.10	27.23	8.87	<1	<1	<1	<2	<2	<1	<0.1	<0.1	<1	<1.4
	23-Oct-14	36.10	27.95	8.15	<1	<1	<1	<2	<2	<1	<0.1	<0.1	<1	<1.4
	21-Nov-14	36.10	27.88	8.22	<1	<1	<1	<2	<2	<1	<0.1	<0.1	<1	<1.4

NS - Not Sampled

Well No.	Date	Top of Casing Elevation (ft)	Depth to Water (ft)	GW Elevation (ft)	Benzene (µg/L)	Toluene (µg/L)	Ethyl-benzene (µg/L)	Xylenes (µg/L)	Total BTEX (µg/L)	MTBE (µg/L)	TPH-DRO (mg/L)	TPH-GRO (mg/L)	Naphthalene (µg/L)	Surfactant (mg/L)
MDE GW Cleanup Standards for Type I and II Aquifers					**5**	**1,000**	**700**	**10,000**	**NA**	**20**	**0.047**	**0.047**	**NA**	**NA**
MW-28	23-Jul-14	35.90	26.98	8.92	<1	<1	<1	<2	<2	<1	<0.1	NS	<1	NS
	14-Aug-14	35.90	27.43	8.47	<1	<1	<1	<2	<2	<1	<0.1	<0.1	<1	<1.4
	19-Sep-14	35.90	27.01	8.89	<1	<1	<1	<2	<2	<1	<0.1	<0.1	<1	<1.4
	23-Oct-14	35.90	27.39	8.51	<1	<1	<1	<2	<2	<1	<0.1	<0.1	<1	<1.4
	20-Nov-14	35.90	27.46	8.44	<1	<1	<1	<2	<2	<1	**0.11**	<0.1	<1	<1.4

NS - Not Sampled

Well No.	Date	Top of Casing Elevation (ft)	Depth to Water (ft)	GW Elevation (ft)	Benzene (µg/L)	Toluene (µg/L)	Ethyl-benzene (µg/L)	Xylenes (µg/L)	Total BTEX (µg/L)	MTBE (µg/L)	TPH-DRO (mg/L)	TPH-GRO (mg/L)	Naphthalene (µg/L)	Surfactant (mg/L)
MDE GW Cleanup Standards for Type I and II Aquifers					**5**	**1,000**	**700**	**10,000**	**NA**	**20**	**0.047**	**0.047**	**NA**	**NA**
MW-29	22-Jul-14	35.15	26.92	8.23	<1	<1	<1	<2	<2	<1	<0.1	NS	<1	NS
	14-Aug-14	35.15	27.04	8.11	<1	<1	<1	<2	<2	<1	<0.1	<0.1	<1	<1.4
	19-Sep-14	35.15	26.93	8.22	<1	<1	<1	<2	<2	<1	<0.1	<0.1	<1	<3.5
	23-Oct-14	35.15	27.29	7.86	<1	<1	<1	<2	<2	<1	<0.1	<0.1	<1	<1.4
	20-Nov-14	35.15	27.35	7.80	<1	<1	<1	<2	<2	<1	<0.1	<0.1	<1	<1.4

NS - Not Sampled

Appendix D Table 2 - Pilot Study Data Summary Post Monitoring
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Well No.	Date	Top of Casing Elevation (ft)	Depth to Water (ft)	GW Elevation (ft)	Benzene (µg/L)	Toluene (µg/L)	Ethyl-benzene (µg/L)	Xylenes (µg/L)	Total BTEX (µg/L)	MTBE (µg/L)	TPH-DRO (mg/L)	TPH-GRO (mg/L)	Naphthalene (µg/L)	Surfactant (mg/L)
MDE GW Cleanup Standards for Type I and II Aquifers					**5**	**1,000**	**700**	**10,000**	**NA**	**20**	**0.047**	**0.047**	**NA**	**NA**
MW-33	29-Jul-14	36.52	27.17	9.35	<1	<1	<1	<2	<2	<1	<0.1	NS	<1	<1.4
	14-Aug-14	36.52	27.96	8.56	<1	<1	<1	<2	<2	<1	<0.1	<0.1	<1	<1.4
	19-Sep-14	36.52	27.49	9.03	<1	<1	<1	<2	<2	<1	<0.1	<0.1	<1	<1.4
	23-Oct-14	36.52	28.68	7.84	<1	<1	<1	<2	<2	<1	<0.1	<0.1	<1	<1.4
	21-Nov-14	36.52	28.27	8.25	<1	<1	<1	<2	<2	<1	**0.11**	<0.1	<1	<1.4

NS - Not Sampled

Well No.	Date	Top of Casing Elevation (ft)	Depth to Water (ft)	GW Elevation (ft)	Benzene (µg/L)	Toluene (µg/L)	Ethyl-benzene (µg/L)	Xylenes (µg/L)	Total BTEX (µg/L)	MTBE (µg/L)	TPH-DRO (mg/L)	TPH-GRO (mg/L)	Naphthalene (µg/L)	Surfactant (mg/L)
MDE GW Cleanup Standards for Type I and II Aquifers					**5**	**1,000**	**700**	**10,000**	**NA**	**20**	**0.047**	**0.047**	**NA**	**NA**
MW-34	29-Jul-14	36.64	27.33	9.31	<1	<1	<1	<2	<2	<1	<0.1	<0.1	<1	<1.4
	14-Aug-14	36.64	28.06	8.58	<1	<1	<1	<2	<2	<1	<0.1	<0.1	<1	<1.4
	19-Sep-14	36.64	27.76	8.88	<1	<1	<1	<2	<2	<1	<0.1	<0.1	<1	<1.4
	23-Oct-14	36.64	28.76	7.88	<1	<1	<1	<2	<2	<1	**0.11**	<0.1	<1	<1.4
	21-Nov-14	36.64	28.41	8.23	<1	<1	<1	<2	<2	<1	<0.1	<0.1	<1	<1.4

NS - Not Sampled

Well No.	Date	Top of Casing Elevation (ft)	Depth to Water (ft)	GW Elevation (ft)	Benzene (µg/L)	Toluene (µg/L)	Ethyl-benzene (µg/L)	Xylenes (µg/L)	Total BTEX (µg/L)	MTBE (µg/L)	TPH-DRO (mg/L)	TPH-GRO (mg/L)	Naphthalene (µg/L)	Surfactant (mg/L)
MDE GW Cleanup Standards for Type I and II Aquifers					**5**	**1,000**	**700**	**10,000**	**NA**	**20**	**0.047**	**0.047**	**NA**	**NA**
MW-35	29-Jul-14	38.62	28.98	9.64	<1	<1	<1	<2	<2	<1	<0.1	<0.1	<1	<1.4
	14-Aug-14	38.62	29.77	8.85	<1	<1	<1	<2	<2	<1	<0.1	<0.1	<1	<1.4
	19-Sep-14	38.62	29.38	9.24	<1	<1	<1	<2	<2	<1	<0.1	<0.1	<1	<2.34
	24-Oct-14	38.62	30.57	8.05	<1	<1	<1	<2	<2	<1	<0.1	<0.1	<1	<1.4
	21-Nov-14	38.62	30.11	8.51	<1	<1	<1	<2	<2	<1	<0.1	<0.1	<1	<1.4

NS - Not Sampled

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Well No.	Date	Top of Casing Elevation (ft)	Depth to Water (ft)	GW Elevation (ft)	Benzene (µg/L)	Toluene (µg/L)	Ethyl-benzene (µg/L)	Xylenes (µg/L)	Total BTEX (µg/L)	MTBE (µg/L)	TPH-DRO (mg/L)	TPH-GRO (mg/L)	Naphthalene (µg/L)	Surfactant (mg/L)
MDE GW Cleanup Standards for Type I and II Aquifers					**5**	**1,000**	**700**	**10,000**	**NA**	**20**	**0.047**	**0.047**	**NA**	**NA**
MW-40	29-Jul-14	48.69	38.11	10.58	<1	<1	<1	<2	<2	<1	**15**	<0.1	<1	<1.4
	15-Aug-14	48.69	38.99	9.70	<100	<100	<100	<200	<200	<100	**9.1**	<0.1	<100	28.3
	19-Sep-14	48.88	39.61	9.27	<1	<1	<1	<2	<2	<1	**3.6**	<0.1	1.7	2.38
	24-Oct-14	48.88	40.80	8.08	<1	<1	<1	<2	<2	<1	**7.6**	<0.1	2.5	<1.4
	19-Nov-14	48.88	39.78	9.10	<1	<1	<1	<2	<2	<1	**2.1**	<0.1	<1	<1.4

NS - Not Sampled

Well No.	Date	Top of Casing Elevation (ft)	Depth to Water (ft)	GW Elevation (ft)	Benzene (µg/L)	Toluene (µg/L)	Ethyl-benzene (µg/L)	Xylenes (µg/L)	Total BTEX (µg/L)	MTBE (µg/L)	TPH-DRO (mg/L)	TPH-GRO (mg/L)	Naphthalene (µg/L)	Surfactant (mg/L)
MDE GW Cleanup Standards for Type I and II Aquifers					**5**	**1,000**	**700**	**10,000**	**NA**	**20**	**0.047**	**0.047**	**NA**	**NA**
MW-41	29-Jul-14	42.92	32.85	10.07	<1	<1	<1	<2	<2	<1	**9.5**	<0.1	5.7	2.80
	15-Aug-14	42.92	34.00	8.92	<100	<100	<100	<200	<200	<100	**28**	**0.12**	<100	36.2
	19-Sep-14	43.15	34.84	8.31	<1	<1	<1	1.3	1.3	<1	**3.9**	<0.1	11	9.56
	24-Oct-14	43.15	36.03	7.12	<1	<1	<1	<2	<2	<1	**1.6**	<0.1	<1	<1.4
	19-Nov-14	43.15	34.60	8.55	<1	<1	<1	<2	<2	<1	**3.1**	<0.1	4.0	2.77

NS - Not Sampled

Well No.	Date	Top of Casing Elevation (ft)	Depth to Water (ft)	GW Elevation (ft)	Benzene (µg/L)	Toluene (µg/L)	Ethyl-benzene (µg/L)	Xylenes (µg/L)	Total BTEX (µg/L)	MTBE (µg/L)	TPH-DRO (mg/L)	TPH-GRO (mg/L)	Naphthalene (µg/L)	Surfactant (mg/L)
MDE GW Cleanup Standards for Type I and II Aquifers					**5**	**1,000**	**700**	**10,000**	**NA**	**20**	**0.047**	**0.047**	**NA**	**NA**
MW-42	29-Jul-14	46.15	35.68	10.47	<1	<1	<1	<2	<2	<1	**96**	NS	2.3	<1.4
	15-Aug-14	46.15	36.67	9.48	<1	<1	<1	<2	<2	<1	**9.1**	<0.1	2.7	20.2
	19-Sep-14	47.11	37.83	9.28	<1	<1	<1	<2	<2	<1	**1.0**	<0.1	<1	4.80
	24-Oct-14	47.11	39.14	7.97	<1	<1	<1	<2	<2	<1	**1.4**	<0.1	<1	2.62
	20-Nov-14	47.11	37.81	9.30	<1	<1	<1	<2	<2	<1	**1.2**	<0.1	1.1	<1.4

NS - Not Sampled

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Well No.	Date	Top of Casing Elevation (ft)	Depth to Water (ft)	GW Elevation (ft)	Benzene (µg/L)	Toluene (µg/L)	Ethyl-benzene (µg/L)	Xylenes (µg/L)	Total BTEX (µg/L)	MTBE (µg/L)	TPH-DRO (mg/L)	TPH-GRO (mg/L)	Naphthalene (µg/L)	Surfactant (mg/L)
MDE GW Cleanup Standards for Type I and II Aquifers					**5**	**1,000**	**700**	**10,000**	**NA**	**20**	**0.047**	**0.047**	**NA**	**NA**
MW-43	29-Jul-14	47.90	37.44	10.46	<1	<1	<1	<2	<2	<1	**14**	<0.1	<1	<1.4
	15-Aug-14	47.90	38.28	9.62	<1	<1	<1	<2	<2	<1	**0.23**	<0.1	<1	<1.4
	19-Sep-14	47.90	39.09	8.81	<1	<1	<1	<2	<2	<1	**0.21**	<0.1	<1	<2.69
	24-Oct-14	47.90	40.24	7.66	<1	<1	<1	<2	<2	<1	**0.32**	<0.1	<1	<1.4
	19-Nov-14	47.90	38.68	9.22	<1	<1	<1	<2	<2	<1	**0.33**	<0.1	<1	<1.4

NS - Not Sampled

Well No.	Date	Top of Casing Elevation (ft)	Depth to Water (ft)	GW Elevation (ft)	Benzene (µg/L)	Toluene (µg/L)	Ethyl-benzene (µg/L)	Xylenes (µg/L)	Total BTEX (µg/L)	MTBE (µg/L)	TPH-DRO (mg/L)	TPH-GRO (mg/L)	Naphthalene (µg/L)	Surfactant (mg/L)
MDE GW Cleanup Standards for Type I and II Aquifers					**5**	**1,000**	**700**	**10,000**	**NA**	**20**	**0.047**	**0.047**	**NA**	**NA**
MW-45	29-Jul-14	40.70	30.79	9.91	<1	<1	<1	<2	<2	<1	<0.1	<0.1	<1	<1.4
	15-Aug-14	40.70	31.56	9.14	<1	<1	<1	<2	<2	<1	**0.24**	<0.1	<1	<1.4
	19-Sep-14	40.70	31.41	9.29	<1	<1	<1	<2	<2	<1	**1.8**	<0.1	<1	<1.4
	24-Oct-14	40.70	IA-NS											
	19-Nov-14	40.70	31.47	9.23	<1	<1	<1	<2	<2	<1	<0.1	<0.1	<1	<1.4

NS - Not Sampled, IA-NS - Inaccessible Not Sampled

Well No.	Date	Top of Casing Elevation (ft)	Depth to Water (ft)	GW Elevation (ft)	Benzene (µg/L)	Toluene (µg/L)	Ethyl-benzene (µg/L)	Xylenes (µg/L)	Total BTEX (µg/L)	MTBE (µg/L)	TPH-DRO (mg/L)	TPH-GRO (mg/L)	Naphthalene (µg/L)	Surfactant (mg/L)
MDE GW Cleanup Standards for Type I and II Aquifers					**5**	**1,000**	**700**	**10,000**	**NA**	**20**	**0.047**	**0.047**	**NA**	**NA**
MW-46	29-Jul-14	40.89	31.04	9.85	<1	<1	<1	1.7	<2	<1	**5.6**	<0.1	9.0	<1.4
	15-Aug-14	40.89	32.14	8.75	<1	<1	<1	3.5	3.5	<1	**29**	**0.13**	16	<1.4
	19-Sep-14	40.89	32.41	8.48	<1	<1	<1	5.2	5.2	<1	**36**	**0.14**	21	<1.4
	24-Oct-14	40.89	IA-NS											
	19-Nov-14	40.89	32.56	8.33	<1	<1	<1	<2	<2	<1	**28**	**0.2**	34	<1.4

NS - Not Sampled, IA-NS - Inaccessible Not Sampled

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Well No.	Date	Top of Casing Elevation (ft)	Depth to Water (ft)	GW Elevation (ft)	Benzene (µg/L)	Toluene (µg/L)	Ethyl-benzene (µg/L)	Xylenes (µg/L)	Total BTEX (µg/L)	MTBE (µg/L)	TPH-DRO (mg/L)	TPH-GRO (mg/L)	Naphthalene (µg/L)	Surfactant (mg/L)
MDE GW Cleanup Standards for Type I and II Aquifers					**5**	**1,000**	**700**	**10,000**	**NA**	**20**	**0.047**	**0.047**	**NA**	**NA**
MW-47	29-Jul-14	40.74	30.92	9.82	2.3	<1	11	23.3	36.6	<1	**530**	**1.2**	110	<1.4
	15-Aug-14	40.74	31.95	8.79	3.7	<1	7.2	15.4	26.3	<1	**260**	**0.43**	74	<1.4
	19-Sep-14	40.74	33.10	7.64	3.6	<1	8.3	19.4	31.3	<1	**210**	**0.39**	76	<1.4
	24-Oct-14	40.74	IA-NS											
	19-Nov-14	40.74	32.21	8.53	6.5	<1	14	<2	20.5	<1	**260**	**2.4**	160	<1.4

NS - Not Sampled, IA-NS - Inaccessible Not Sampled

Well No.	Date	Top of Casing Elevation (ft)	Depth to Water (ft)	GW Elevation (ft)	Benzene (µg/L)	Toluene (µg/L)	Ethyl-benzene (µg/L)	Xylenes (µg/L)	Total BTEX (µg/L)	MTBE (µg/L)	TPH-DRO (mg/L)	TPH-GRO (mg/L)	Naphthalene (µg/L)	Surfactant (mg/L)
MDE GW Cleanup Standards for Type I and II Aquifers					**5**	**1,000**	**700**	**10,000**	**NA**	**20**	**0.047**	**0.047**	**NA**	**NA**
MW-48	24-Jul-14	36.22	26.87	9.35	<1	<1	<1	<2	<2	<1	<0.1	NS	<1	NS
	14-Aug-14	36.22	27.48	8.74	<1	<1	<1	<2	<2	<1	<0.1	<0.1	<1	<1.4
	19-Sep-14	36.22	27.11	9.11	<1	<1	<1	<2	<2	<1	<0.1	<0.1	<1	<1.4
	24-Oct-14	36.22	IA-NS											
	20-Nov-14	36.22	27.76	8.46	<1	<1	<1	<2	<2	<1	<0.1	<0.1	<1	<1.4

NS - Not Sampled, IA-NS - Inaccessible Not Sampled

Well No.	Date	Top of Casing Elevation (ft)	Depth to Water (ft)	GW Elevation (ft)	Benzene (µg/L)	Toluene (µg/L)	Ethyl-benzene (µg/L)	Xylenes (µg/L)	Total BTEX (µg/L)	MTBE (µg/L)	TPH-DRO (mg/L)	TPH-GRO (mg/L)	Naphthalene (µg/L)	Surfactant (mg/L)
MDE GW Cleanup Standards for Type I and II Aquifers					**5**	**1,000**	**700**	**10,000**	**NA**	**20**	**0.047**	**0.047**	**NA**	**NA**
MW-49	24-Jul-14	35.49	27.40	8.09	<1	<1	<1	<2	<2	<1	<0.1	NS	<1	NS
	14-Aug-14	35.49	26.90	8.59	<1	<1	<1	<2	<2	<1	<0.1	<0.1	<1	<1.4
	19-Sep-14	35.49	26.53	8.96	<1	<1	<1	<2	<2	<1	<0.1	<0.1	<1	<1.4
	24-Oct-14	35.49	IA-NS											
	20-Nov-14	35.49	27.22	8.27	<1	<1	<1	<2	<2	<1	<0.1	<0.1	<1	<1.4

NS - Not Sampled, IA-NS - Inaccessible Not Sampled

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Well No.	Date	Top of Casing Elevation (ft)	Depth to Water (ft)	GW Elevation (ft)	Benzene (µg/L)	Toluene (µg/L)	Ethyl-benzene (µg/L)	Xylenes (µg/L)	Total BTEX (µg/L)	MTBE (µg/L)	TPH-DRO (mg/L)	TPH-GRO (mg/L)	Naphthalene (µg/L)	Surfactant (mg/L)
MDE GW Cleanup Standards for Type I and II Aquifers					**5**	**1,000**	**700**	**10,000**	**NA**	**20**	**0.047**	**0.047**	**NA**	**NA**
MW-50	24-Jul-14	35.64	26.51	9.13	<1	<1	<1	<2	<2	<1	<0.1	NS	<1	NS
	14-Aug-14	35.64	27.07	8.57	<1	<1	<1	<2	<2	<1	<0.1	<0.1	<1	<1.4
	19-Sep-14	35.64	26.69	8.95	<1	<1	<1	<2	<2	<1	<0.1	<0.1	<1	<1.4
	24-Oct-14	35.64	27.62	8.02	<1	<1	<1	<2	<2	<1	**0.58**	<0.1	<1	<1.4
	21-Nov-14	35.64	27.39	8.25	<1	<1	<1	<2	<2	<1	<0.1	<0.1	<1	<1.4

NS - Not Sampled

TABLE 3

Extraction Well Draw Down Data and Radius of Influence

Appendix D Table 3 - Extraction Well Draw Down Data Radius of Influence
Chester River Hospital Center
100 Brown Street
Chestertown, MD 21620

Radius of Influence = 3000(H-h)√k

Reference

Powers, J. Patrick, P.E. Construction Dewatering: New Methods and Applications - Second Edition. New York, New York: John Wiley & Sons, 1992

	MW-22 - Ext 1				
R	Radius of Influence (m)	31.33625	Convert to (ft)	100.275986	**Average R**
H	Total Head of Water Table (ft)	19.83	Convert to (m)	6.196875	**120**
h	Total Head of Dewatered Table (ft)	15.9	Convert to (m)	4.96875	
k	Permeability (ft/day)	20	Convert to (m/sec)	7.2338E-05	
	GW Elev Prior Ext (ft)	10.57			
	GW Elev During Ext (ft)	6.64			
	Bottom of MW Elev (ft)	-9.26			
	MW-22 - Ext 2				
R	Radius of Influence (m)	42.9777	Convert to (ft)	137.528643	
H	Total Head of Water Table (ft)	19.66	Convert to (m)	6.14375	
h	Total Head of Dewatered Table (ft)	14.27	Convert to (m)	4.459375	
k	Permeability (ft/day)	20	Convert to (m/sec)	7.2338E-05	
	GW Elev Prior Ext (ft)	10.4			
	GW Elev During Ext (ft)	5.01			
	Bottom of MW Elev (ft)	-9.26			
	MW-22 - Ext 3				
R	Radius of Influence (m)	38.59222	Convert to (ft)	123.495108	
H	Total Head of Water Table (ft)	19.42	Convert to (m)	6.06875	
h	Total Head of Dewatered Table (ft)	14.58	Convert to (m)	4.55625	
k	Permeability (ft/day)	20	Convert to (m/sec)	7.2338E-05	
	GW Elev Prior Ext (ft)	10.16			
	GW Elev During Ext (ft)	5.32			
	Bottom of MW Elev (ft)	-9.26			
	MW-40 - Ext 1				**Average R**
R	Radius of Influence (m)	30.21994	Convert to (ft)	96.7038138	**104**
H	Total Head of Water Table (ft)	18.1	Convert to (m)	5.65625	
h	Total Head of Dewatered Table (ft)	14.31	Convert to (m)	4.471875	
k	Permeability (ft/day)	20	Convert to (m/sec)	7.2338E-05	
	GW Elev Prior Ext (ft)	10.69			
	GW Elev During Ext (ft)	6.9			
	Bottom of MW Elev (ft)	-7.41			
	MW-40 - Ext 2				
R	Radius of Influence (m)	34.12701	Convert to (ft)	109.206418	
H	Total Head of Water Table (ft)	17.93	Convert to (m)	5.603125	
h	Total Head of Dewatered Table (ft)	13.65	Convert to (m)	4.265625	
k	Permeability (ft/day)	20	Convert to (m/sec)	7.2338E-05	
	GW Elev Prior Ext (ft)	10.52			
	GW Elev During Ext (ft)	6.24			
	Bottom of MW Elev (ft)	-7.41			
	MW-40 - Ext 3				
R	Radius of Influence (m)	33.40938	Convert to (ft)	106.910021	
H	Total Head of Water Table (ft)	17.63	Convert to (m)	5.509375	
h	Total Head of Dewatered Table (ft)	13.44	Convert to (m)	4.2	
k	Permeability (ft/day)	20	Convert to (m/sec)	7.2338E-05	
	GW Elev Prior Ext (ft)	10.22			
	GW Elev During Ext (ft)	6.03			
	Bottom of MW Elev (ft)	-7.41			

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Appendix D Table 3 - Extraction Well Draw Down Data Radius of Influence
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	MW-41 - Ext 1				
R	Radius of Influence (m)	26.71156	Convert to (ft)	85.4769858	**Average R**
H	Total Head of Water Table (ft)	19.16	Convert to (m)	5.9875	**103**
h	Total Head of Dewatered Table (ft)	15.81	Convert to (m)	4.940625	
k	Permeability (ft/day)	20	Convert to (m/sec)	7.2338E-05	
	GW Elev Prior Ext (ft)	10.18			
	GW Elev During Ext (ft)	6.83			
	Bottom of MW Elev (ft)	-8.98			
	MW-41 - Ext 2				
R	Radius of Influence (m)	30.77809	Convert to (ft)	98.4899001	
H	Total Head of Water Table (ft)	18.61	Convert to (m)	5.815625	
h	Total Head of Dewatered Table (ft)	14.75	Convert to (m)	4.609375	
k	Permeability (ft/day)	20	Convert to (m/sec)	7.2338E-05	
	GW Elev Prior Ext (ft)	9.63			
	GW Elev During Ext (ft)	5.77			
	Bottom of MW Elev (ft)	-8.98			
	MW-41 - Ext 3				
R	Radius of Influence (m)	39.07064	Convert to (ft)	125.026039	
H	Total Head of Water Table (ft)	18.68	Convert to (m)	5.8375	
h	Total Head of Dewatered Table (ft)	13.78	Convert to (m)	4.30625	
k	Permeability (ft/day)	20	Convert to (m/sec)	7.2338E-05	
	GW Elev Prior Ext (ft)	9.70			
	GW Elev During Ext (ft)	4.80			
	Bottom of MW Elev (ft)	-8.98			
	MW-42 - Ext 1				**Average R**
R	Radius of Influence (m)	11.9604	Convert to (ft)	38.2732772	**55**
H	Total Head of Water Table (ft)	13.45	Convert to (m)	4.203125	
h	Total Head of Dewatered Table (ft)	11.95	Convert to (m)	3.734375	
k	Permeability (ft/day)	20	Convert to (m/sec)	7.2338E-05	
	GW Elev Prior Ext (ft)	10.60			
	GW Elev During Ext (ft)	9.10			
	Bottom of MW Elev (ft)	-2.85			
	MW-42 - Ext 2				
R	Radius of Influence (m)	19.45558	Convert to (ft)	62.2578643	
H	Total Head of Water Table (ft)	13.09	Convert to (m)	4.090625	
h	Total Head of Dewatered Table (ft)	10.65	Convert to (m)	3.328125	
k	Permeability (ft/day)	20	Convert to (m/sec)	7.2338E-05	
	GW Elev Prior Ext (ft)	10.24			
	GW Elev During Ext (ft)	7.80			
	Bottom of MW Elev (ft)	-2.85			
	MW-42 - Ext 3				
R	Radius of Influence (m)	20.01373	Convert to (ft)	64.0439506	
H	Total Head of Water Table (ft)	13.01	Convert to (m)	4.065625	
h	Total Head of Dewatered Table (ft)	10.5	Convert to (m)	3.28125	
k	Permeability (ft/day)	20	Convert to (m/sec)	7.2338E-05	
	GW Elev Prior Ext (ft)	10.16			
	GW Elev During Ext (ft)	7.65			
	Bottom of MW Elev (ft)	-2.85			

FIGURE 1

Overview of Pilot Study Injection/Extraction Wells and Pilot Study Monitoring Wells

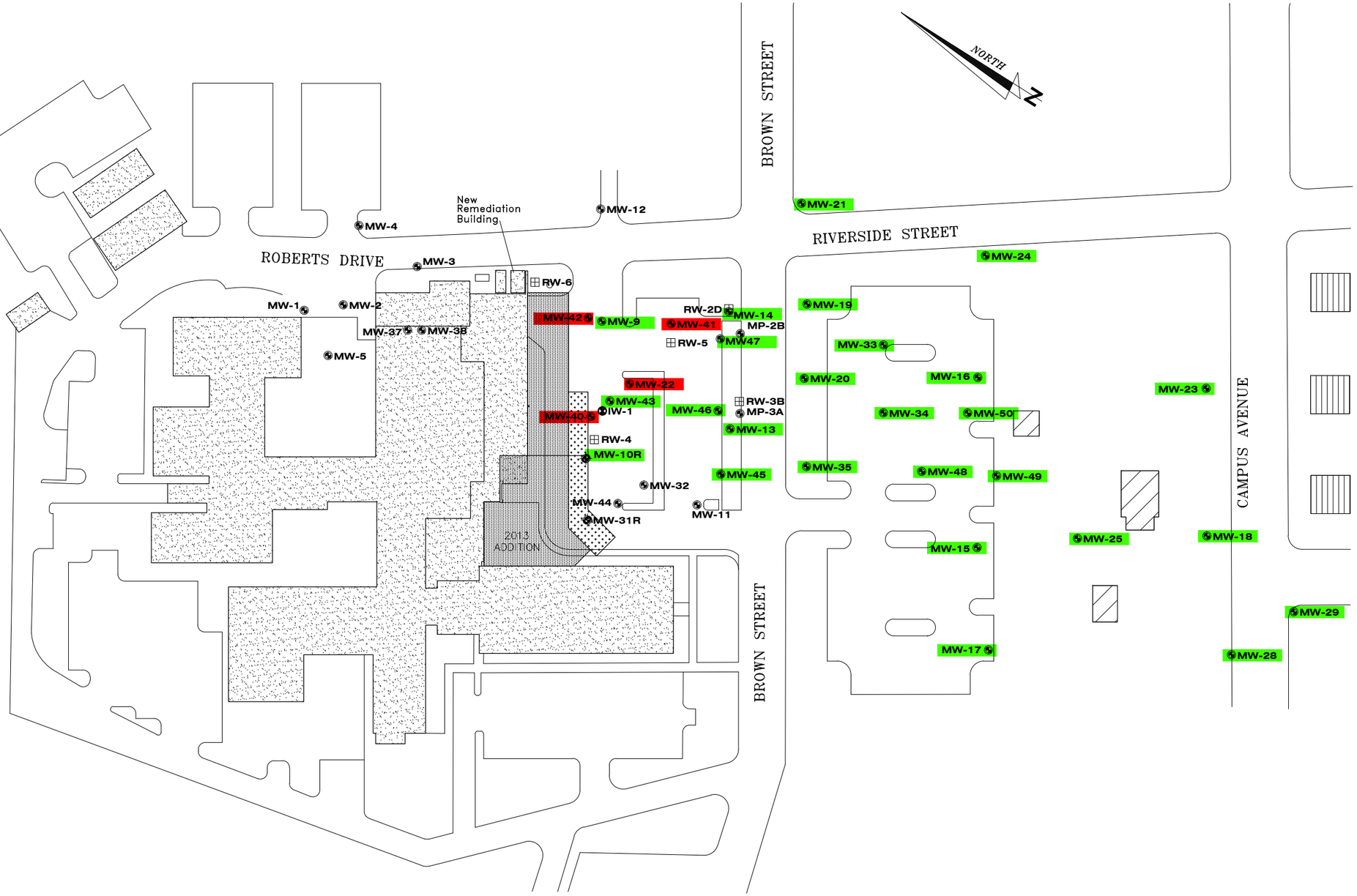

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FIGURE 1

2014 PILOT STUDY
FOR
CHESTER RIVER HOSPITAL CENTER
CHESTERTOWN, MARYLAND

PROJECT:	SCALE:
4070-00	AS SHOWN
DRAWN BY:	DATE:
DK	01/02/2015

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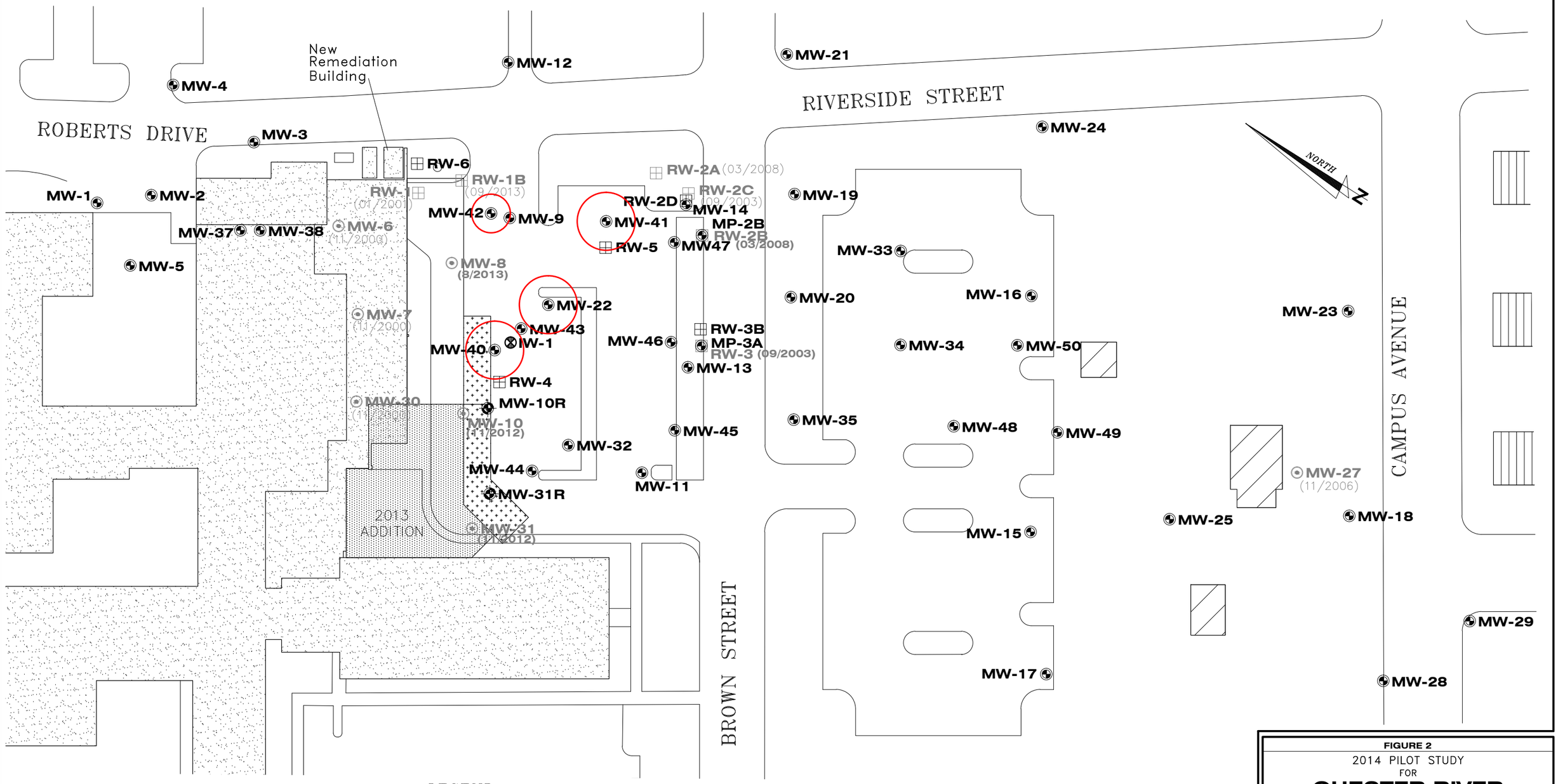
Appendix D Figure 1– Overview of Pilot Study Injection/Extraction Wells and Pilot Study Monitoring Wells

FIGURE 2

Pilot Study Area of Influence During Injection



LEGEND

MW-40	MONITORING WELL
RW-3B	RECOVERY WELL
IW-1	INJECTION WELL
MW-30	ABANDONED MONITORING WELL
(09/2003)	DATE OF ABANDONMENT
RW-3	ABANDONED RECOVERY WELL
(09/2003)	DATE OF ABANDONMENT

AREA OF INFLUENCE DURING INJECTION
24 HOUR RESIDENCE TIME

50 0 25 50
GRAPHIC SCALE (FEET)

FIGURE 2
2014 PILOT STUDY
FOR
CHESTER RIVER HOSPITAL CENTER
CHESTERTOWN, MARYLAND

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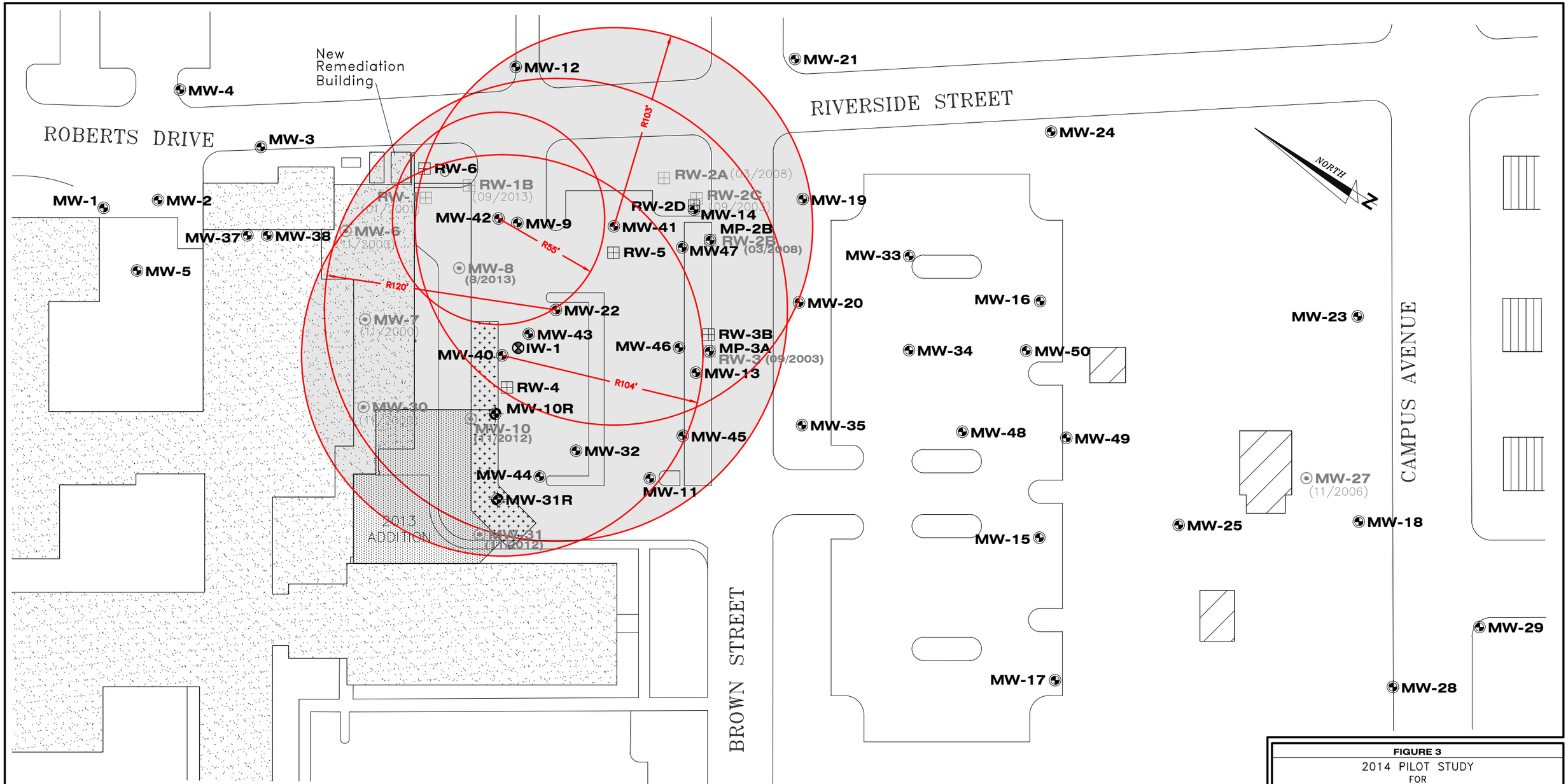
Appendix D Figure 2– Pilot Study Area of Influence During Injection

FIGURE 3

Pilot Study Capture Zone During Extraction



LEGEND

MW-40	MONITORING WELL
RW-3B	RECOVERY WELL
IW-1	INJECTION WELL
MW-30	ABANDONED MONITORING WELL
(09/2003)	DATE OF ABANDONMENT
RW-3	ABANDONED RECOVERY WELL
(09/2003)	DATE OF ABANDONMENT

CAPTURE ZONE DURING EXTRACTION

50 0 25 50

GRAPHIC SCALE (FEET)

FIGURE 3

2014 PILOT STUDY FOR

CHESTER RIVER HOSPITAL CENTER

CHESTERTOWN, MARYLAND

PROJECT: 2781	SCALE: AS SHOWN
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Appendix D Figure 3– Pilot Study Capture Zone During Extraction

FIGURES 4a – 4e

Water Quality Maps of TPH-DRO and TPH-GRO for July, August, September, October, and November

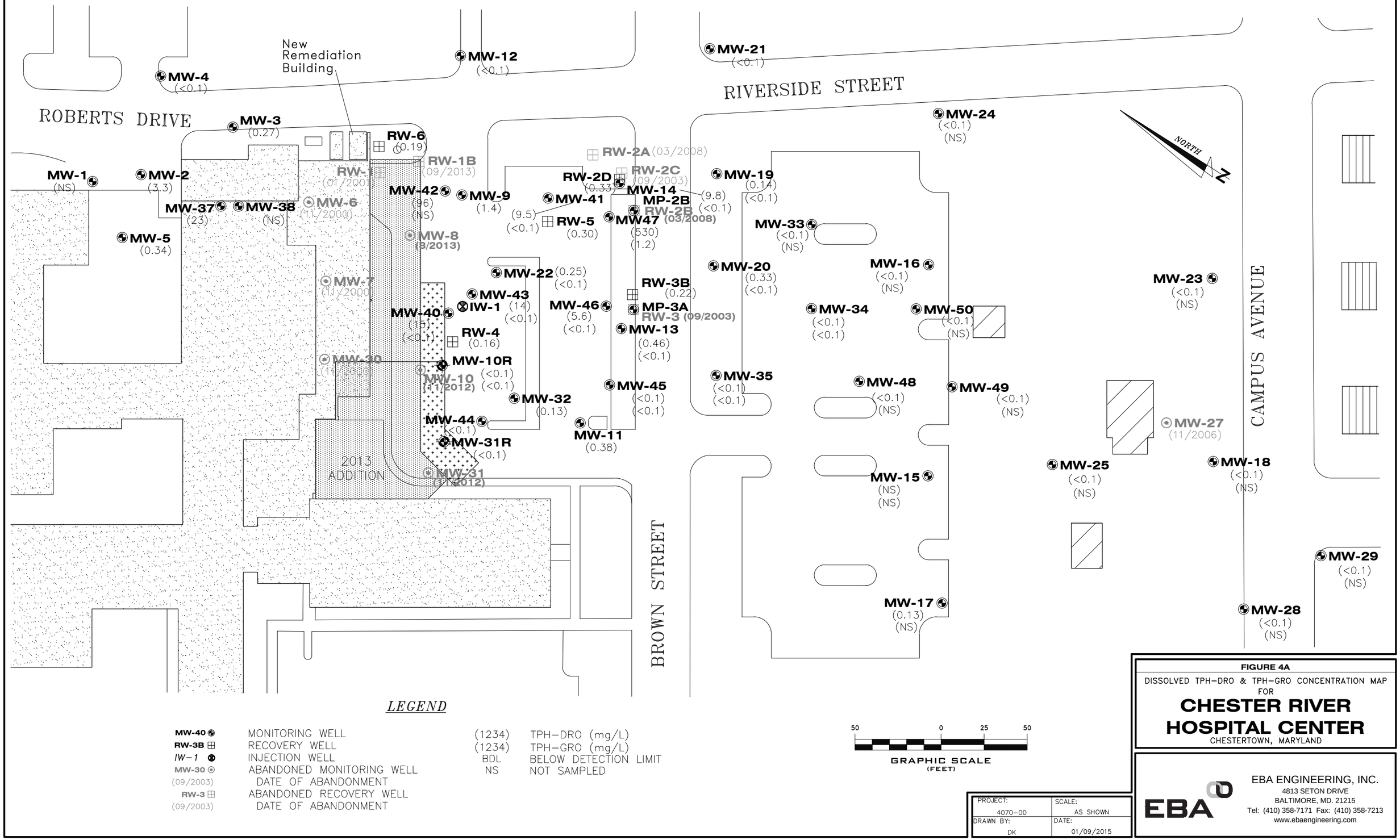

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FIGURE 4A

DISSOLVED TPH-DRO & TPH-GRO CONCENTRATION MAP FOR

CHESTER RIVER HOSPITAL CENTER

CHESTERTOWN, MARYLAND

PROJECT:	SCALE:
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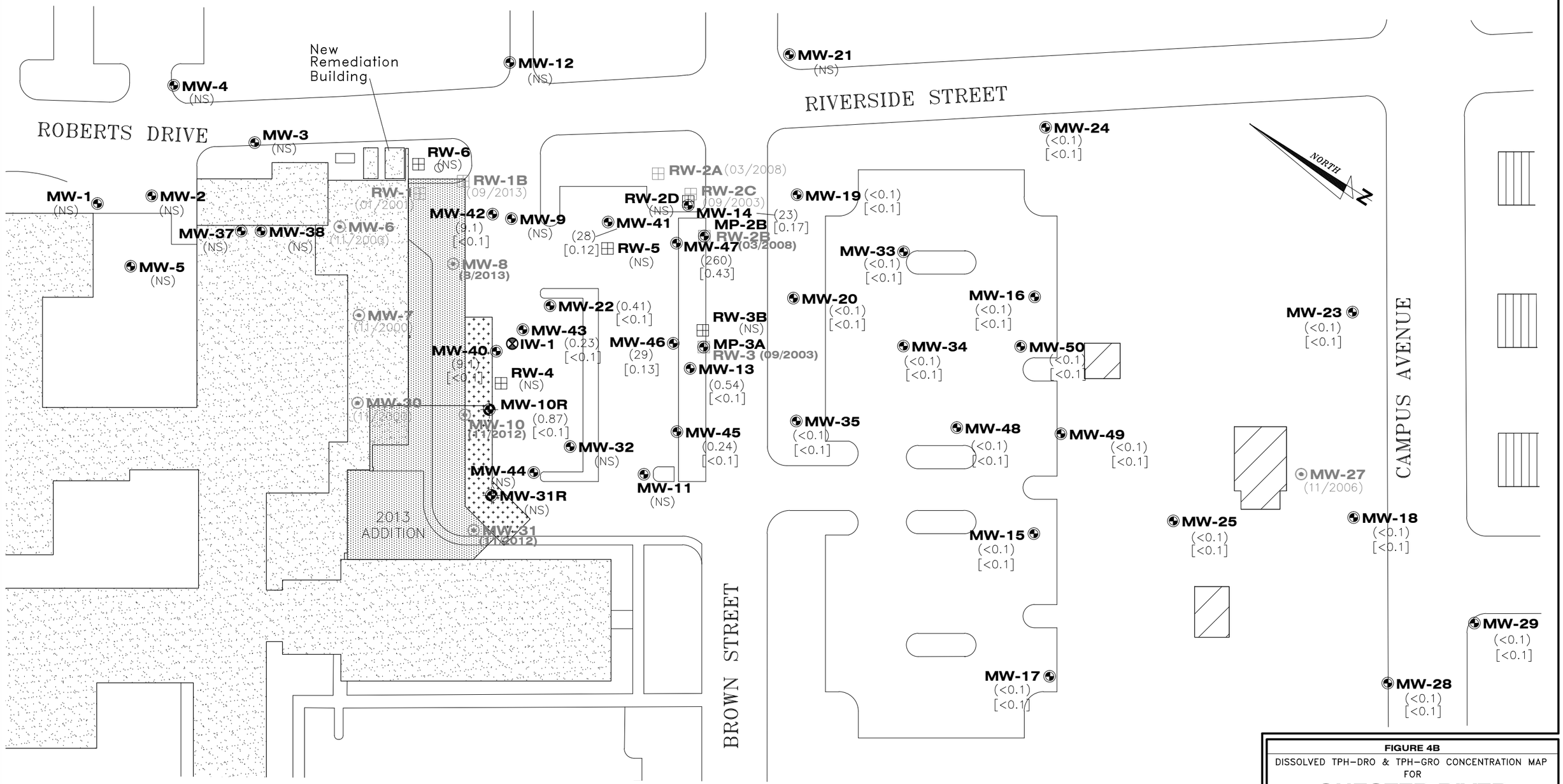
Appendix D Figure 4A- Water Quality Maps of TPH-DRO & TPH-GRO July 22-29, 2014 Chester River Hospital Center, Chestertown, Maryland.



LEGEND

MW-40	MONITORING WELL	(1234)	TPH–DRO (mg/L)
RW-3B	RECOVERY WELL	[1234]	TPH–GRO (mg/L)
IW–1	INJECTION WELL	BDL	BELOW DETECTION LIMIT
MW-30 (09/2003)	ABANDONED MONITORING WELL DATE OF ABANDONMENT	NS	NOT SAMPLED
RW-3 (09/2003)	ABANDONED RECOVERY WELL DATE OF ABANDONMENT		

FIGURE 4B

DISSOLVED TPH–DRO & TPH–GRO CONCENTRATION MAP FOR

CHESTER RIVER HOSPITAL CENTER

CHESTERTOWN, MARYLAND

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Appendix D Figure 4B– Water Quality Maps of TPH–DRO & TPH–GRO for August 14–15, 2014 Chester River Hospital Center, Chestertown, Maryland.

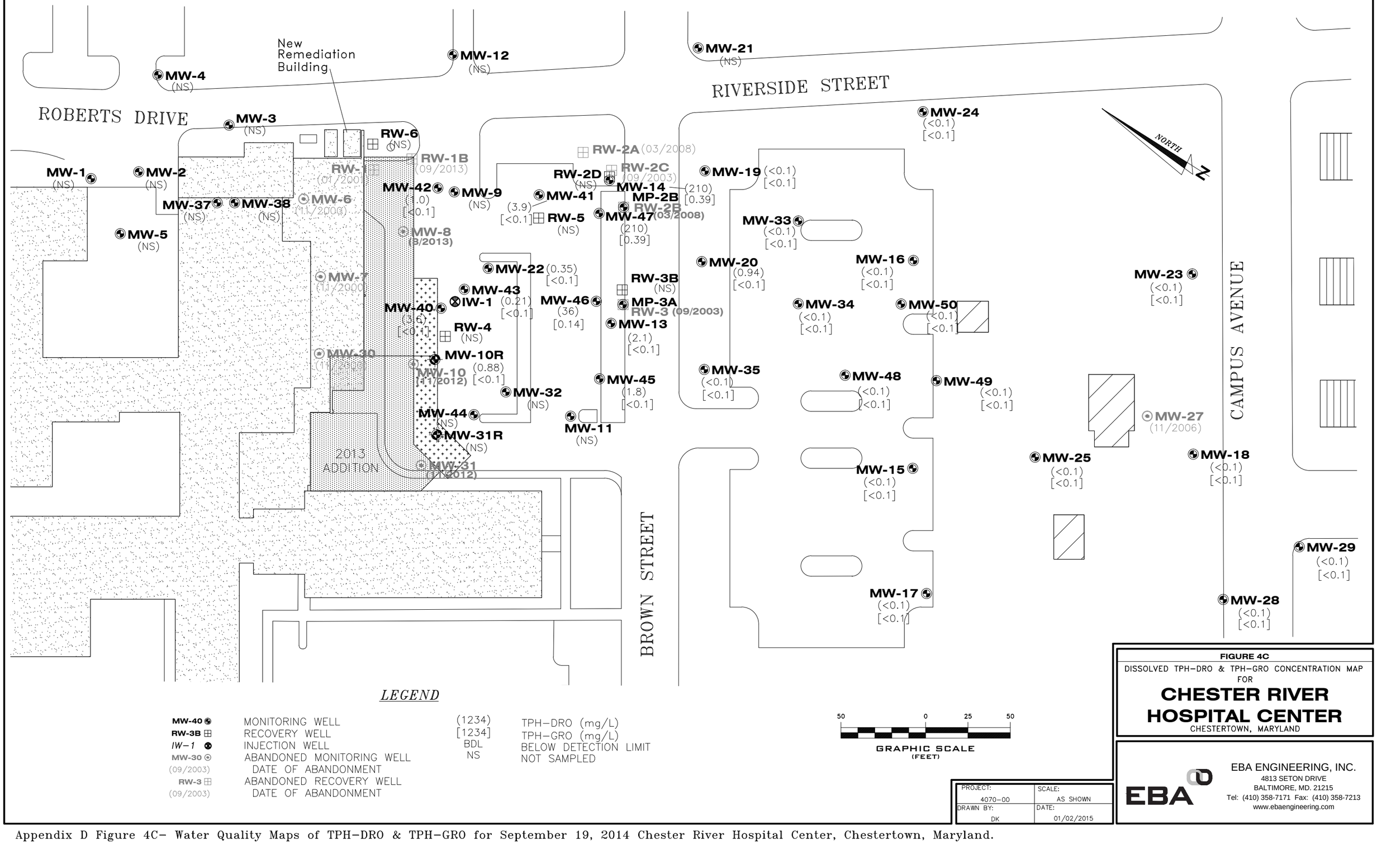

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FIGURE 4C

DISSOLVED TPH-DRO & TPH-GRO CONCENTRATION MAP FOR

CHESTER RIVER HOSPITAL CENTER

CHESTERTOWN, MARYLAND

PROJECT:	SCALE:
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DK	01/02/2015

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Appendix D Figure 4C- Water Quality Maps of TPH-DRO & TPH-GRO for September 19, 2014 Chester River Hospital Center, Chestertown, Maryland.

ROBERTS DRIVE

RIVERSIDE STREET

CAMPUS AVENUE

BROWN STREET

New Remediation Building

2013 ADDITION

NORTH

MW-1 (1.2) [NS]
MW-2 (<0.1) [NS]
MW-3 (<0.1) [NS]
MW-4 (0.15) [NS]
MW-5 (2.7) [NS]
MW-6 (11/2006)
MW-7 (11/2006)
MW-8 (3/2013)
MW-9 (1.2) [NS]
MW-10 (11/2012)
MW-10R (0.20) [<0.1]
MW-11 (0.15) [NS]
MW-12 (0.38) [NS]
MW-13 (NS) [NS]
MW-14 (38) [0.13]
MW-15 (NS) [NS]
MW-16 (NS) [NS]
MW-17 (NS) [NS]
MW-18 (<0.1) [<0.1]
MW-19 (<0.1) [<0.1]
MW-20 (0.22) [<0.1]
MW-21 (<0.1) [NS]
MW-22 (<0.1) [<0.1]
MW-23 (<0.1) [<0.1]
MW-24 (<0.1) [<0.1]
MW-25 (<0.1) [<0.1]
MW-27 (11/2006)
MW-28 (<0.1) [<0.1]
MW-29 (<0.1) [<0.1]
MW-30 (11/2006)
MW-31 (11/2012)
MW-31R (<0.1) [NS]
MW-32 (NS) [NS]
MW-33 (<0.1) [<0.1]
MW-34 (0.11) [<0.1]
MW-35 (<0.1) [<0.1]
MW-37 (0.13) [NS]
MW-38 (NS)
MW-40 (7.6) [<0.1]
MW-41 (1.6) [<0.1]
MW-42 (1.4) [<0.1]
MW-43
MW-44
MW-45 (NS) [NS]
MW-46 (NS) [NS]
MW-47 (03/2008) (NS) [NS]
MW-48 (NS) [NS]
MW-49 (NS) [NS]
MW-50 (0.58) [<0.1]
IW-1 (0.32) [<0.1]
RW-1 (01/2000)
RW-1B (09/2013)
RW-2A (03/2008)
RW-2B
RW-2C (09/2003)
RW-2D (0.18) [NS]
RW-3 (09/2003)
RW-3B (<0.1) [NS]
RW-4 (<0.1) [NS]
RW-5 (0.13) [NS]
RW-6 (<0.1) [NS]
MP-2B [0.13]
MP-3A

LEGEND

MW-40	MONITORING WELL	(1234)	TPH–DRO (mg/L)
RW-3B	RECOVERY WELL	[1234]	TPH–GRO (mg/L)
IW–1	INJECTION WELL	BDL	BELOW DETECTION LIMIT
MW-30 (09/2003)	ABANDONED MONITORING WELL DATE OF ABANDONMENT	NS	NOT SAMPLED
RW-3 (09/2003)	ABANDONED RECOVERY WELL DATE OF ABANDONMENT		

50 0 25 50
GRAPHIC SCALE (FEET)

FIGURE 4D

DISSOLVED TPH–DRO & TPH–GRO CONCENTRATION MAP FOR

CHESTER RIVER HOSPITAL CENTER

CHESTERTOWN, MARYLAND

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Appendix D Figure 4D– Water Quality Maps of TPH–DRO & TPH–GRO for October 23–24, 2014 Chester River Hospital Center, Chestertown, Maryland.

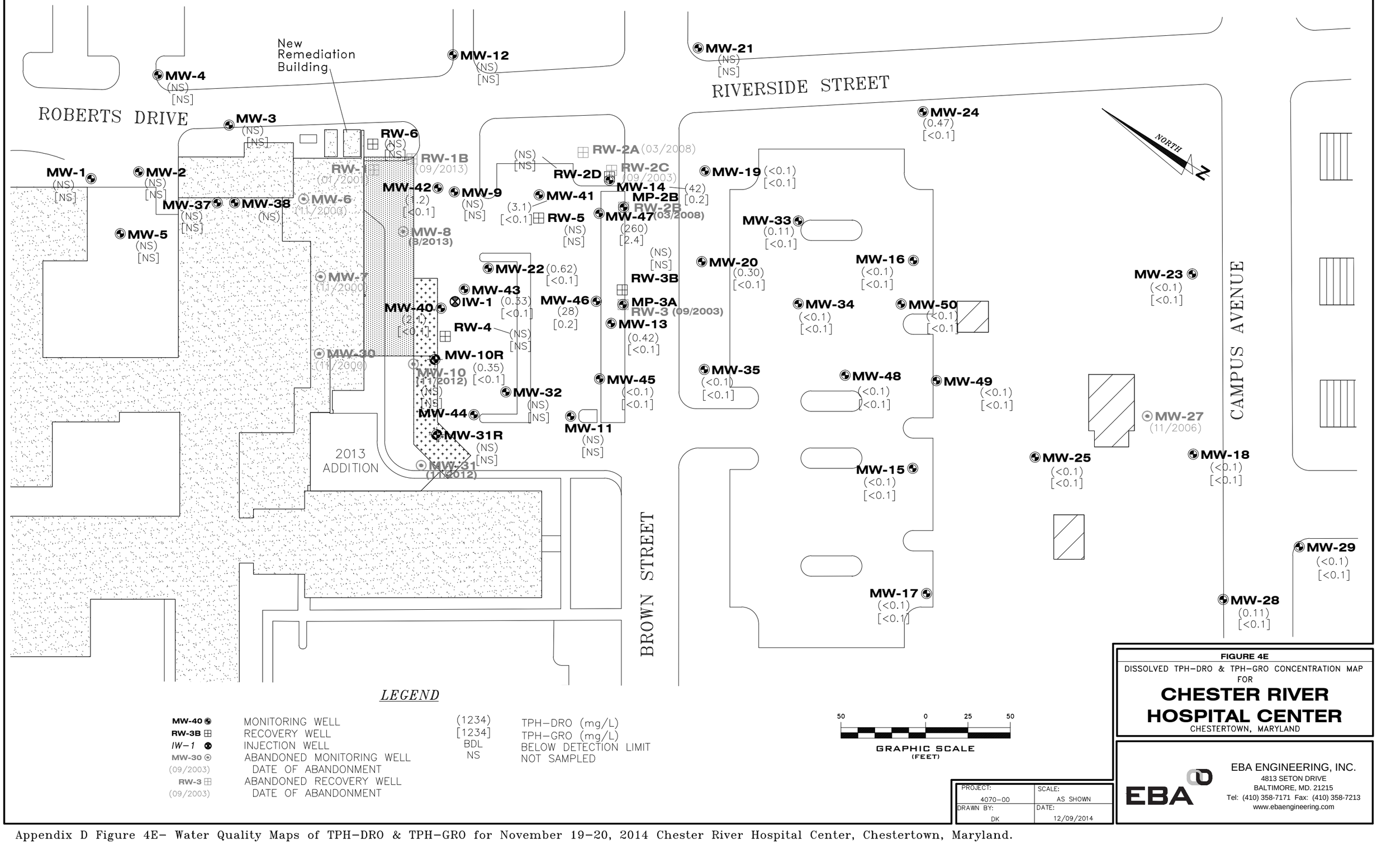

FIGURE 4E

DISSOLVED TPH-DRO & TPH-GRO CONCENTRATION MAP FOR

CHESTER RIVER HOSPITAL CENTER

CHESTERTOWN, MARYLAND

PROJECT:	SCALE:
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Appendix D Figure 4E- Water Quality Maps of TPH-DRO & TPH-GRO for November 19-20, 2014 Chester River Hospital Center, Chestertown, Maryland.

FIGURES 5a – 5e

Water Quality Maps of VOC's for
July, August, September, October, and November

ROBERTS DRIVE

RIVERSIDE STREET

CAMPUS AVENUE

BROWN STREET

New Remediation Building

2013 ADDITION

NORTH

MW-1 (NS) [NS] [[NS]] <NS> {NS}

MW-2 (BDL) [BDL] [[BDL]] <BDL> {BDL}

MW-3 (BDL) [BDL] [[BDL]] <BDL> {BDL}

MW-4 (BDL) [BDL] [[BDL]] <BDL> {BDL}

MW-5 (BDL) [BDL] [[BDL]] <BDL> {BDL}

MW-6 (11/2006)

MW-7 (11/2006)

MW-8 (3/2013)

MW-9 (BDL) [BDL] [[BDL]] <BDL> {4.5}

MW-10 (11/2012)

MW-11 (BDL) [BDL] [[BDL]] <BDL> {BDL}

MW-12 (BDL) [BDL] [[BDL]] <BDL> {BDL}

MW-13 (BDL) [BDL] [[BDL]] <BDL> {BDL}

MW-14 (BDL) [BDL] [[BDL]] <BDL> {8.8}

MW-15 (NS) [NS] [[NS]] <NS> {NS}

MW-16 (BDL) [BDL] [[BDL]] <BDL> {BDL}

MW-17 (BDL) [BDL] [[BDL]] <BDL> {BDL}

MW-18 (BDL) [BDL] [[BDL]] <BDL> {BDL}

MW-19 (BDL) [BDL] [[BDL]] <BDL> {BDL}

MW-20 (BDL) [BDL] [[BDL]] <BDL> {BDL}

MW-21 (BDL) [BDL] [[BDL]] <BDL> {BDL}

MW-22 (BDL) [BDL] [[BDL]] <BDL> {1.1}

MW-23 (BDL) [BDL] [[BDL]] <BDL> {BDL}

MW-24 (BDL) [BDL] [[BDL]] <BDL> {BDL}

MW-25 (BDL) [BDL] [[BDL]] <BDL> {BDL}

MW-27 (11/2006)

MW-28 (BDL) [BDL] [[BDL]] <BDL> {BDL}

MW-29 (BDL) [BDL] [[BDL]] <BDL> {BDL}

MW-30 (11/2006)

MW-31 (11/2012)

MW-31R (BDL) [BDL] [[BDL]] <BDL> {BDL}

MW-32 (BDL) [BDL] [[BDL]] <BDL> {BDL}

MW-33 (BDL) [BDL] [[BDL]] <BDL> {BDL}

MW-34 (BDL) [BDL] [[BDL]] <BDL> {BDL}

MW-35 (BDL) [BDL] [[BDL]] <BDL> {BDL}

MW-36 (BDL) [BDL] [[BDL]] <BDL> {BDL}

MW-37 (BDL) [BDL] [[BDL]] <BDL> {5.3}

MW-38 (NS)

MW-40 (BDL) [BDL] [[BDL]] <BDL> {2.3}

MW-41 (BDL) [BDL] [[BDL]] <BDL> {1.2}

MW-42 (BDL) [BDL] [[BDL]] <BDL> {1.1}

MW-43 (BDL) [BDL] [[BDL]] <BDL> {BDL}

MW-44 (BDL) [BDL] [[BDL]] <BDL> {BDL}

MW-45 (BDL) [BDL] [[BDL]] <BDL> {BDL}

MW-46 (BDL) [BDL] [[BDL]] <1.7> {9.0}

MW-47 (03/2008) (2.3) [BDL] [[11]] <23.3> {110}

MW-48 (BDL) [BDL] [[BDL]] <BDL> {BDL}

MW-49 (BDL) [BDL] [[BDL]] <BDL> {BDL}

MW-50 (BDL) [BDL] [[BDL]] <BDL> {BDL}

IW-1 (BDL) [BDL] [[BDL]] <BDL> {BDL}

RW-1 (01/2000)

RW-1B (09/2013)

RW-2A (03/2008) (BDL) [BDL] [[BDL]] <BDL> {5.7}

RW-2B

RW-2C (09/2003)

RW-2D

RW-3 (09/2003)

RW-3B (BDL) [BDL] [[BDL]] <BDL> {BDL}

RW-4 (BDL) [BDL] [[BDL]] <BDL> {1.0}

RW-5 (BDL) [BDL] [[BDL]] <BDL> {BDL}

RW-6 (BDL) [BDL] [[BDL]] <BDL> {1.1}

MP-2B

MP-3A

LEGEND

MW-40	MONITORING WELL	(1234)	BENZENE (ug/L)
RW-3B	RECOVERY WELL	[1234]	TOLULENE (ug/L)
IW-1	INJECTION WELL	[[1234]]	ETHYLBENZENE (ug/L)
MW-30	ABANDONED MONITORING WELL	<1234>	XYLENES (ug/L)
(09/2003)	DATE OF ABANDONMENT	{1234}	NAPHTHALENE (ug/L)
RW-3	ABANDONED RECOVERY WELL	BDL	BELOW DETECTION LIMIT
(09/2003)	DATE OF ABANDONMENT	NS	NOT SAMPLED

50 0 25 50

GRAPHIC SCALE (FEET)

FIGURE 5A

DISSOLVED VOC CONCENTRATION MAP FOR

CHESTER RIVER HOSPITAL CENTER

CHESTERTOWN, MARYLAND

PROJECT:	SCALE:
4070-00	AS SHOWN
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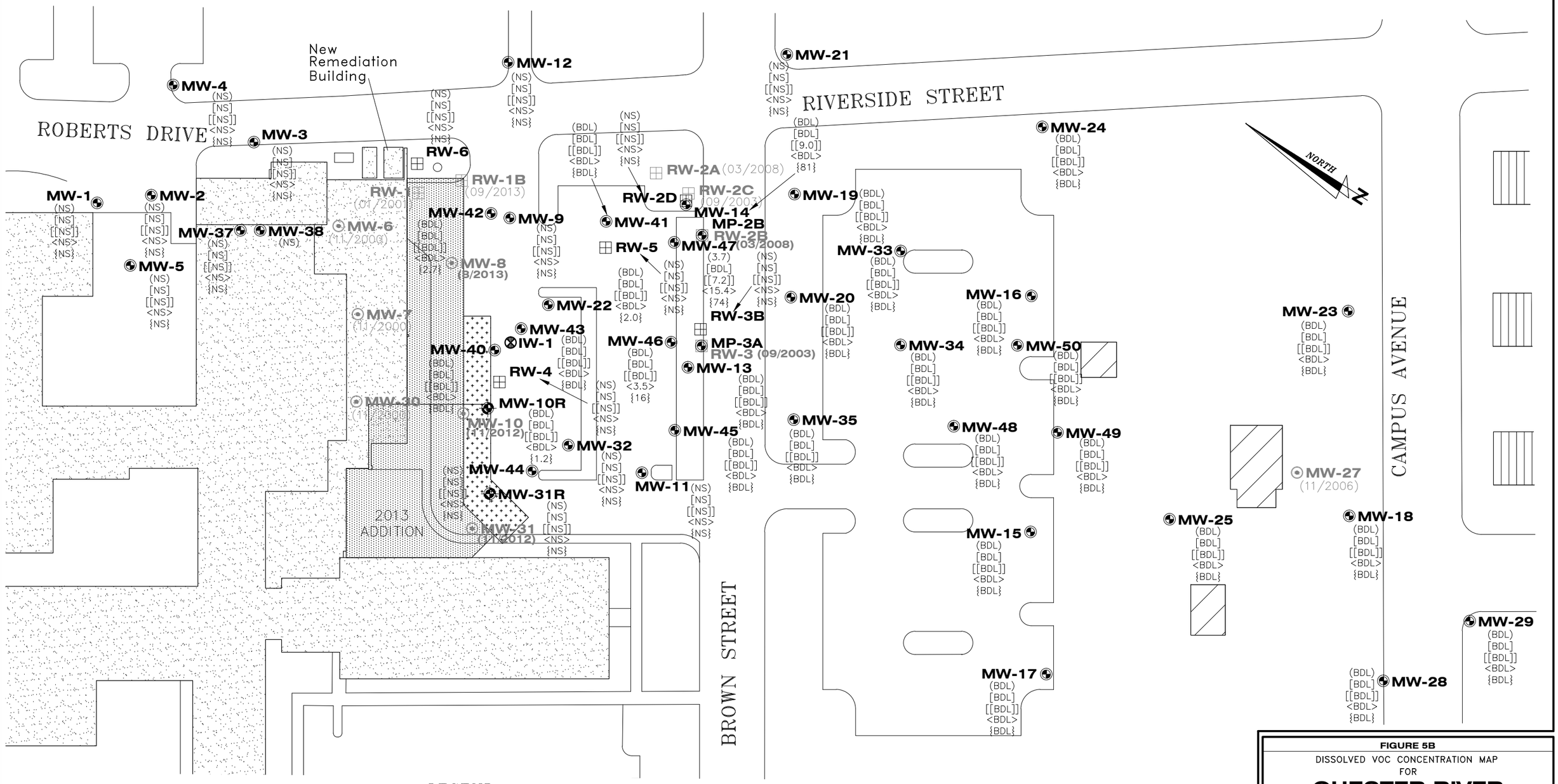
Appendix D Figure 5A– Water Quality Maps of VOCs for July 22–29, 2014 Chester River Hospital Center, Chestertown, Maryland.



LEGEND

MW-40	MONITORING WELL
RW-3B	RECOVERY WELL
IW-1	INJECTION WELL
MW-30 (09/2003)	ABANDONED MONITORING WELL DATE OF ABANDONMENT
RW-3 (09/2003)	ABANDONED RECOVERY WELL DATE OF ABANDONMENT

(1234)	BENZENE (ug/L)
[1234]	TOLULENE (ug/L)
[[1234]]	ETHYLBENZENE (ug/L)
<1234>	XYLENES (ug/L)
{1234}	NAPHTHALENE (ug/L)
BDL	BELOW DETECTION LIMIT
NS	NOT SAMPLED

50 0 25 50

GRAPHIC SCALE (FEET)

FIGURE 5B

DISSOLVED VOC CONCENTRATION MAP FOR

CHESTER RIVER HOSPITAL CENTER

CHESTERTOWN, MARYLAND

PROJECT:	SCALE:
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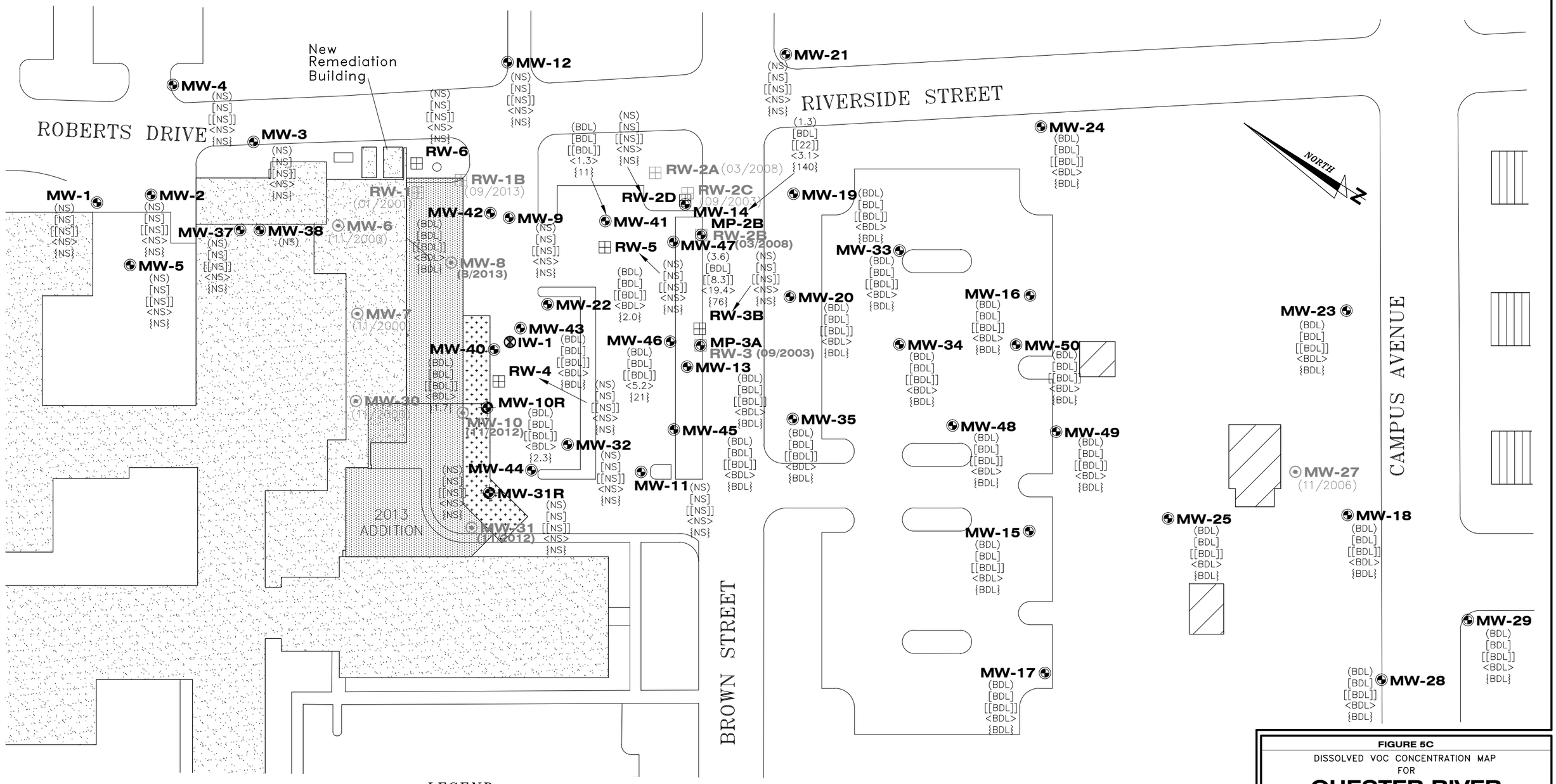
Appendix D Figure 5B– Water Quality Maps of VOCs August 14–15, 2014 Chester River Hospital Center, Chestertown, Maryland.



LEGEND

MW-40	MONITORING WELL
RW-3B	RECOVERY WELL
IW-1	INJECTION WELL
MW-30 (09/2003)	ABANDONED MONITORING WELL DATE OF ABANDONMENT
RW-3 (09/2003)	ABANDONED RECOVERY WELL DATE OF ABANDONMENT

(1234)	BENZENE (ug/L)
[1234]	TOLULENE (ug/L)
[[1234]]	ETHYLBENZENE (ug/L)
<1234>	XYLENES (ug/L)
{1234}	NAPHTHALENE (ug/L)
BDL	BELOW DETECTION LIMIT
NS	NOT SAMPLED

FIGURE 5C

DISSOLVED VOC CONCENTRATION MAP FOR

CHESTER RIVER HOSPITAL CENTER

CHESTERTOWN, MARYLAND

PROJECT: 4070-00	SCALE: AS SHOWN
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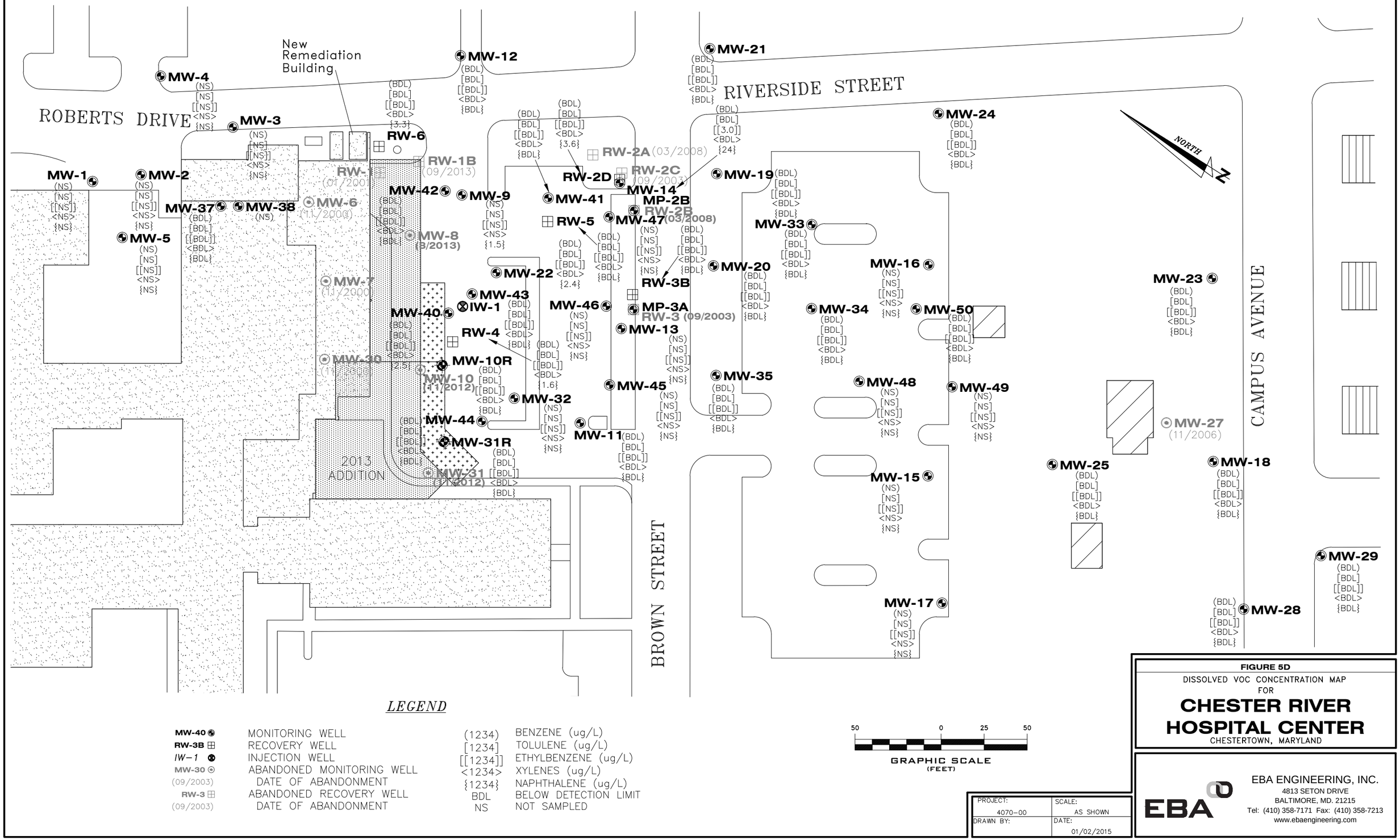
Appendix D Figure 5C- Water Quality Maps of VOCs September 19, 2014 Chester River Hospital Center, Chestertown, Maryland.



LEGEND

MW-40	MONITORING WELL	(1234)	BENZENE (ug/L)
RW-3B	RECOVERY WELL	[1234]	TOLULENE (ug/L)
IW-1	INJECTION WELL	[[1234]]	ETHYLBENZENE (ug/L)
MW-30	ABANDONED MONITORING WELL	<1234>	XYLENES (ug/L)
(09/2003)	DATE OF ABANDONMENT	{1234}	NAPHTHALENE (ug/L)
RW-3	ABANDONED RECOVERY WELL	BDL	BELOW DETECTION LIMIT
(09/2003)	DATE OF ABANDONMENT	NS	NOT SAMPLED

FIGURE 5D

DISSOLVED VOC CONCENTRATION MAP
FOR

CHESTER RIVER HOSPITAL CENTER

CHESTERTOWN, MARYLAND

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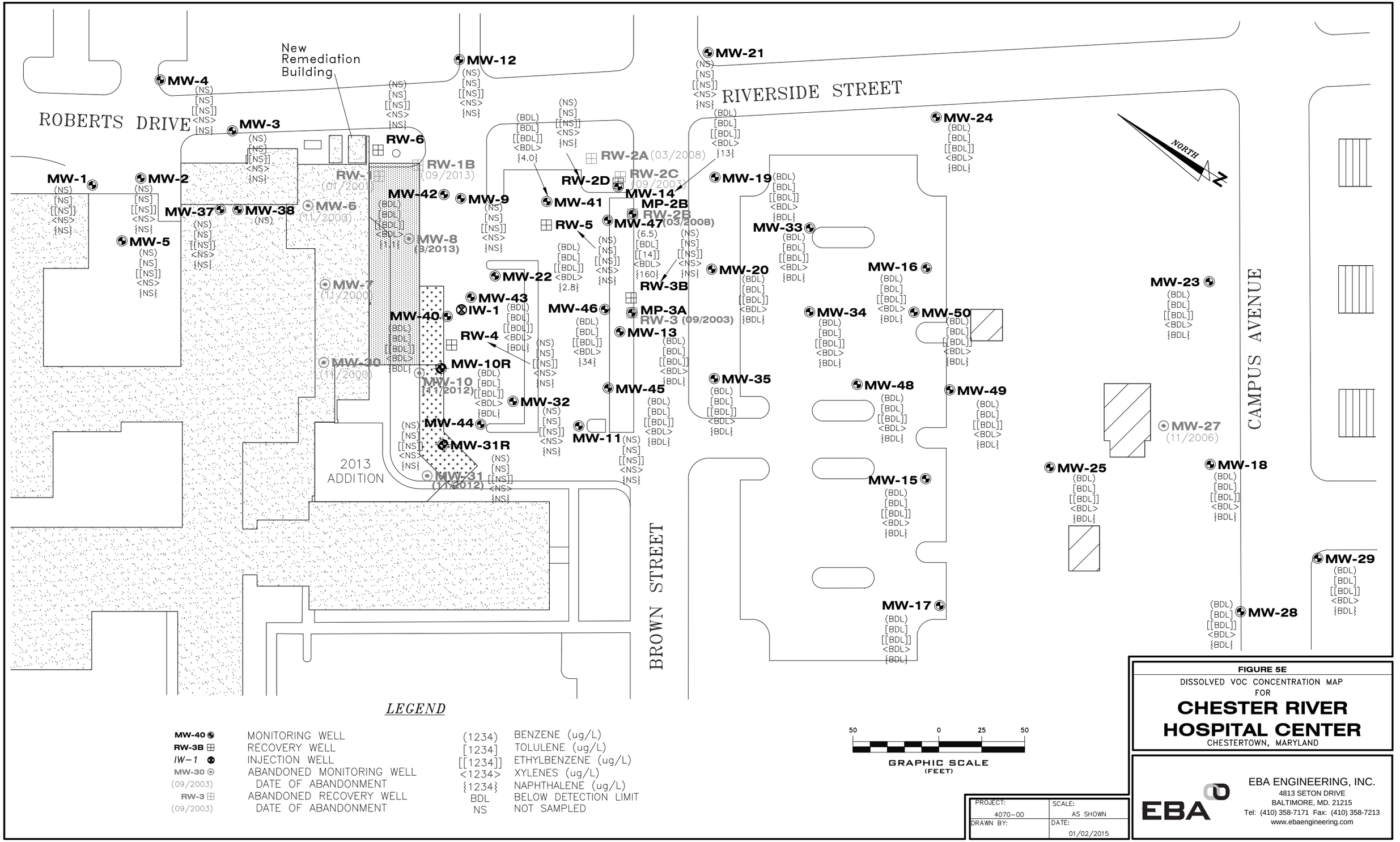
Appendix D Figure 5D– Water Quality Maps of VOCs for October 23–24, 2014 Chester River Hospital Center, Chestertown, Maryland.



LEGEND

MW-40	MONITORING WELL
RW-3B	RECOVERY WELL
IW-1	INJECTION WELL
MW-30	ABANDONED MONITORING WELL
(09/2003)	DATE OF ABANDONMENT
RW-3	ABANDONED RECOVERY WELL
(09/2003)	DATE OF ABANDONMENT

(1234)	BENZENE (ug/L)
[1234]	TOLULENE (ug/L)
[[1234]]	ETHYLBENZENE (ug/L)
<1234>	XYLENES (ug/L)
{1234}	NAPHTHALENE (ug/L)
BDL	BELOW DETECTION LIMIT
NS	NOT SAMPLED

50 0 25 50

GRAPHIC SCALE (FEET)

FIGURE 5E

DISSOLVED VOC CONCENTRATION MAP FOR

CHESTER RIVER HOSPITAL CENTER

CHESTERTOWN, MARYLAND

PROJECT: 4070-00	SCALE: AS SHOWN
DRAWN BY:	DATE: 01/02/2015

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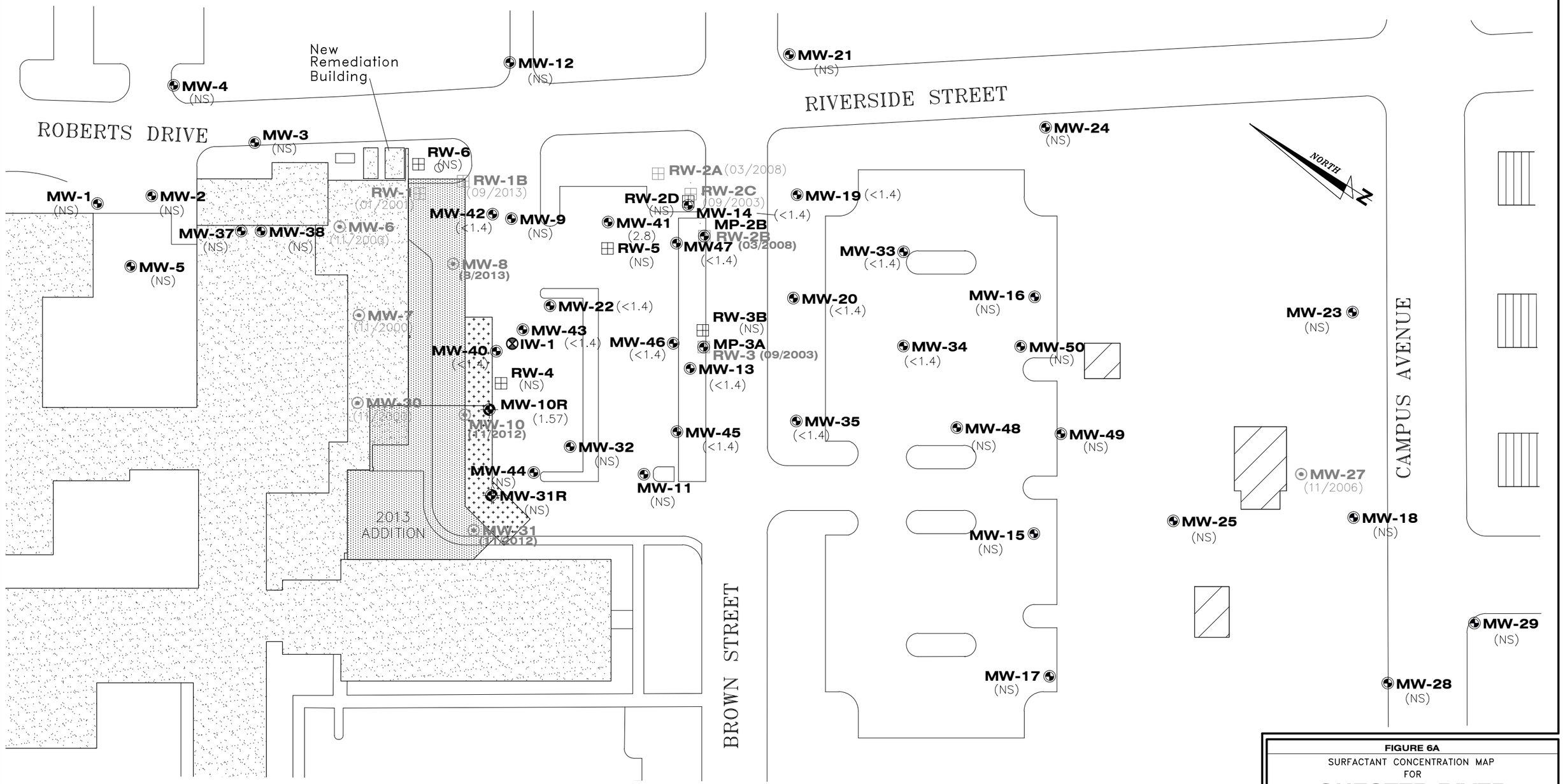
Appendix D Figure 5E- Water Quality Maps of VOCs for November 19-20, 2014 Chester River Hospital Center, Chestertown, Maryland.

FIGURES 6a – 6e

Water Quality Map of Non-Ionic Surfactants for July, August, September, October, and November



LEGEND

MW-40	MONITORING WELL
RW-3B	RECOVERY WELL
IW-1	INJECTION WELL
MW-30	ABANDONED MONITORING WELL
(09/2003)	DATE OF ABANDONMENT
RW-3	ABANDONED RECOVERY WELL
(09/2003)	DATE OF ABANDONMENT

(1234) SURFACANTS (mg/L)
NS NOT SAMPLED

50 0 25 50
GRAPHIC SCALE (FEET)

FIGURE 6A
SURFACTANT CONCENTRATION MAP
FOR
CHESTER RIVER HOSPITAL CENTER
CHESTERTOWN, MARYLAND

PROJECT:	SCALE:
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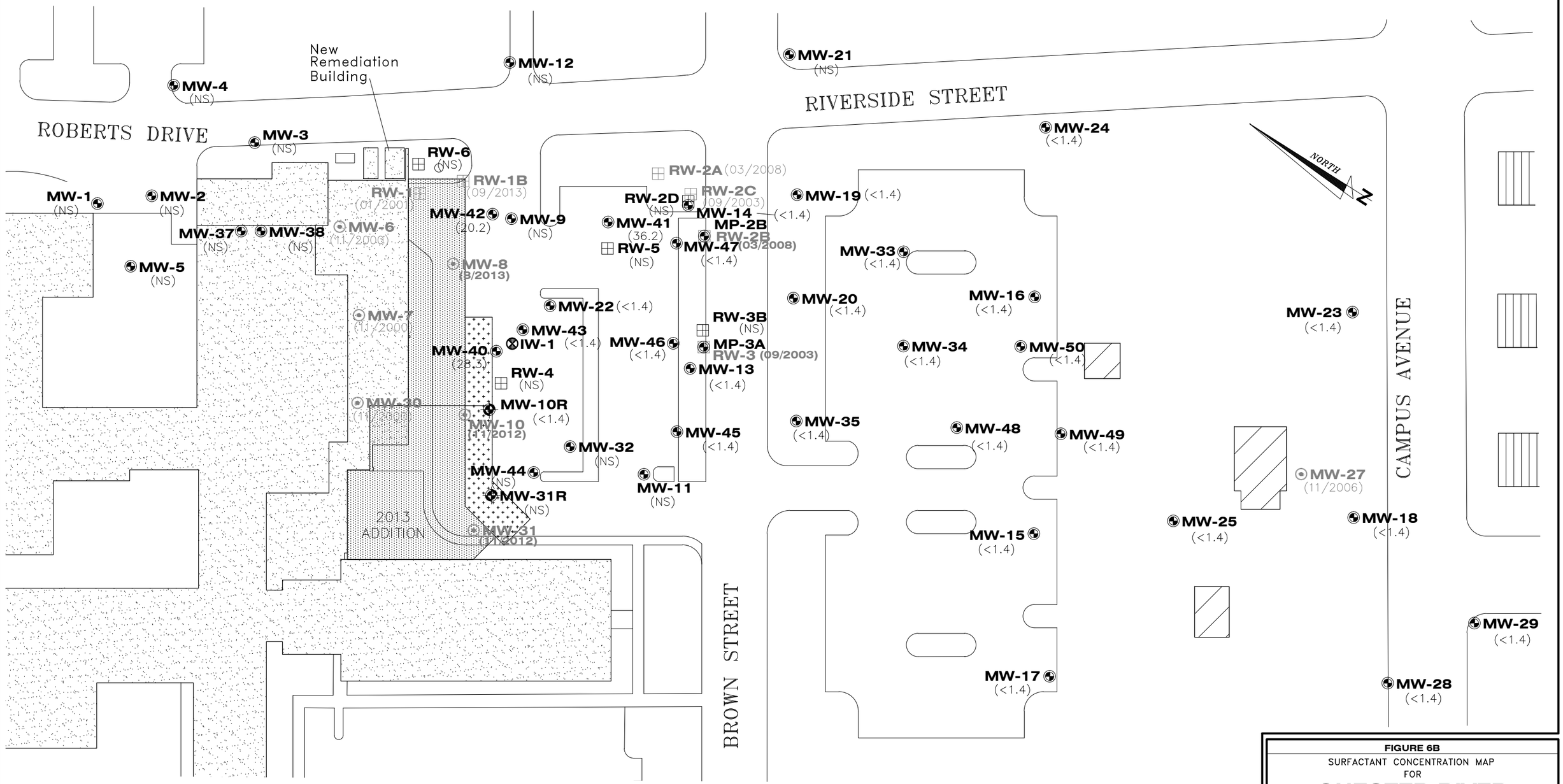
Appendix D Figure 6A Water Quality Map of Non-Ionic Surfactants for July 29, 2014 Chester River Hospital Center, Chestertown, Maryland.



LEGEND

MW-40	MONITORING WELL	(1234)	SURFACANTS (mg/L)
RW-3B	RECOVERY WELL	NS	NOT SAMPLED
IW-1	INJECTION WELL		
MW-30	ABANDONED MONITORING WELL		
(09/2003)	DATE OF ABANDONMENT		
RW-3	ABANDONED RECOVERY WELL		
(09/2003)	DATE OF ABANDONMENT		

50 0 25 50

GRAPHIC SCALE (FEET)

FIGURE 6B

SURFACTANT CONCENTRATION MAP FOR

CHESTER RIVER HOSPITAL CENTER

CHESTERTOWN, MARYLAND

PROJECT:	SCALE:
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	01/02/2015

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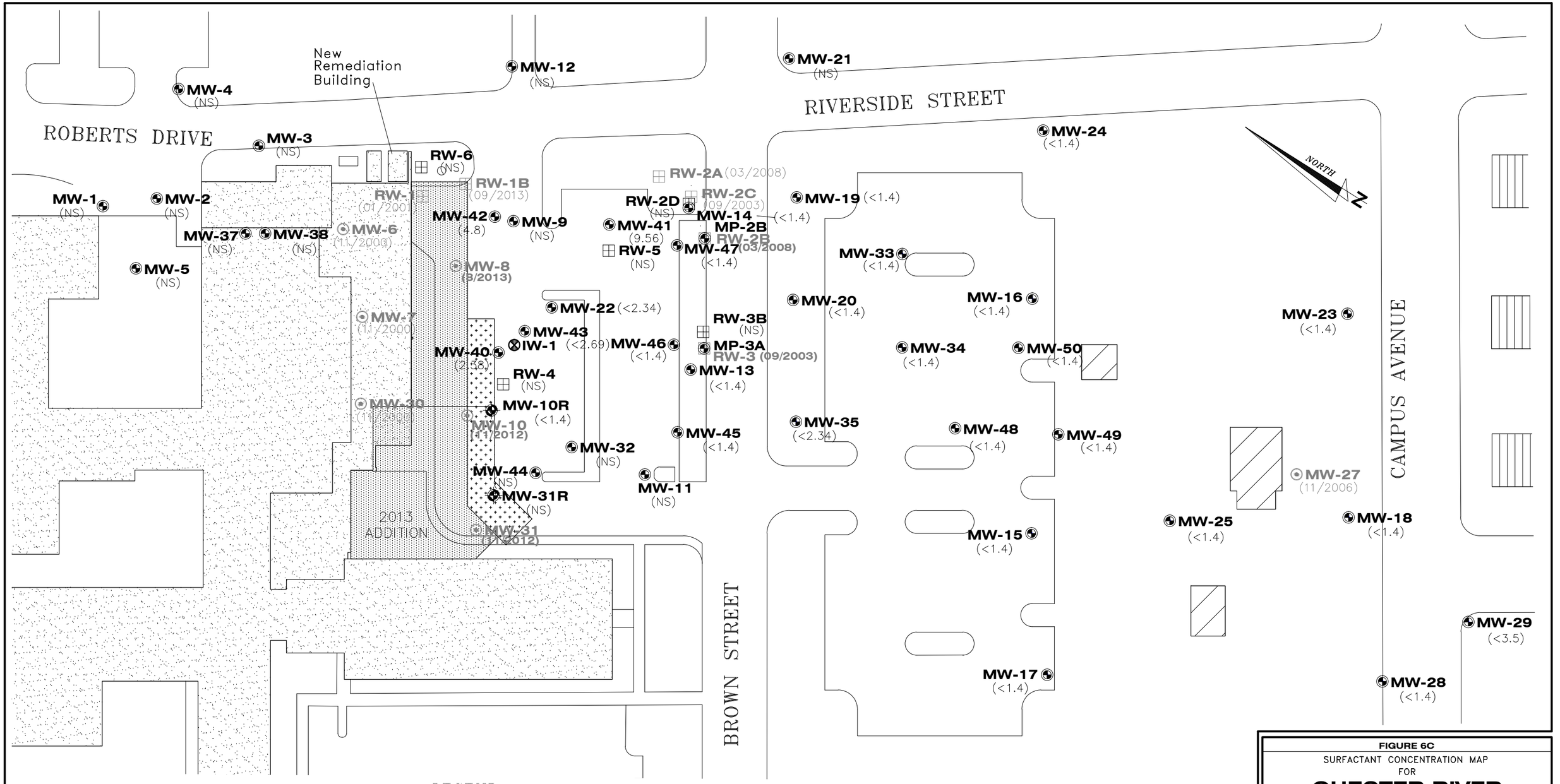
Appendix D Figure 6B- Water Quality Map of Non-Ionic Surfactants for August 14, 2014 Chester River Hospital Center, Chestertown, Maryland.



LEGEND

MW-40	MONITORING WELL	(1234)	SURFACANTS (mg/L)
RW-3B	RECOVERY WELL	NS	NOT SAMPLED
IW-1	INJECTION WELL		
MW-30	ABANDONED MONITORING WELL		
(09/2003)	DATE OF ABANDONMENT		
RW-3	ABANDONED RECOVERY WELL		
(09/2003)	DATE OF ABANDONMENT		

FIGURE 6C

SURFACTANT CONCENTRATION MAP
FOR

CHESTER RIVER HOSPITAL CENTER

CHESTERTOWN, MARYLAND

PROJECT:	SCALE:
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DRAWN BY:	DATE:
DK	01/02/2015

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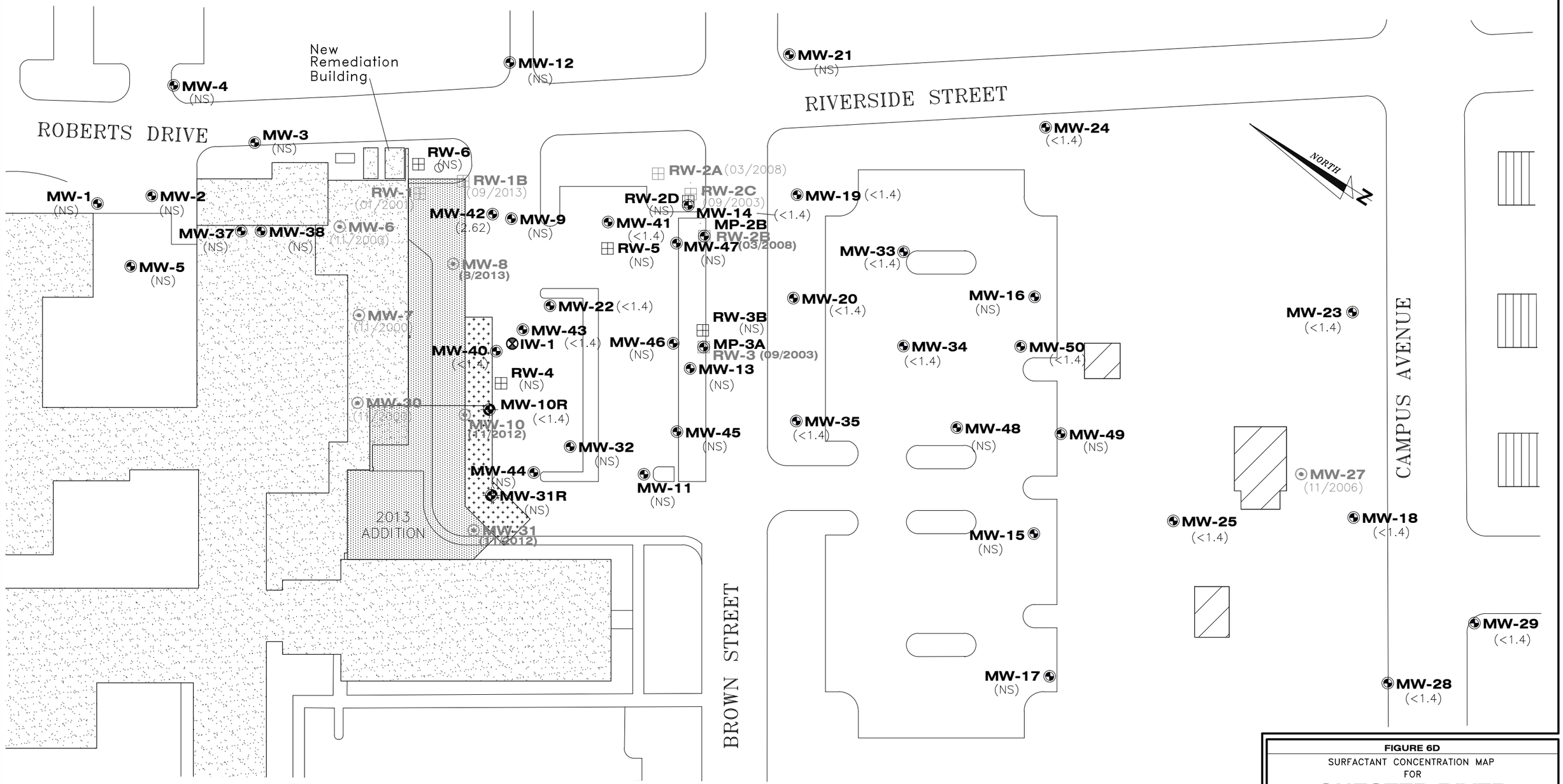
Appendix D Figure 6C Water Quality Map of Non-Ionic Surfactants for September 19, 2014 Chester River Hospital Center, Chestertown, Maryland.



LEGEND

MW-40	MONITORING WELL	(1234)	SURFACANTS (mg/L)
RW-3B	RECOVERY WELL	NS	NOT SAMPLED
IW-1	INJECTION WELL		
MW-30	ABANDONED MONITORING WELL		
(09/2003)	DATE OF ABANDONMENT		
RW-3	ABANDONED RECOVERY WELL		
(09/2003)	DATE OF ABANDONMENT		

FIGURE 6D

SURFACTANT CONCENTRATION MAP
FOR

CHESTER RIVER HOSPITAL CENTER

CHESTERTOWN, MARYLAND

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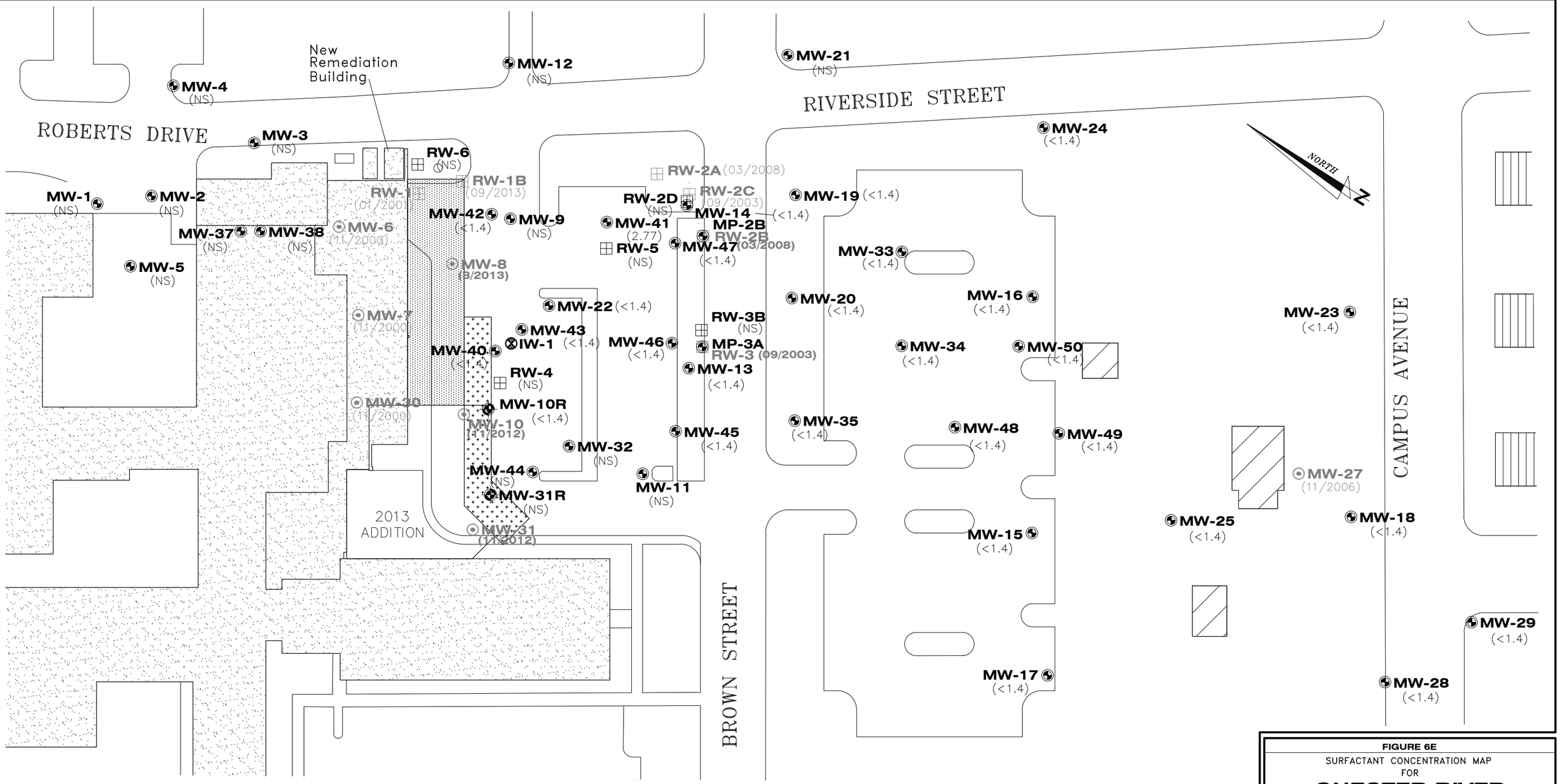
Appendix D Figure 6D- Water Quality MAp of Non-Ionic Surfactants for October 24, 2014 Chester River AppendixHospital Center, Chestertown, Maryland.



LEGEND

MW-40	MONITORING WELL	(1234)	SURFACANTS (mg/L)
RW-3B	RECOVERY WELL	NS	NOT SAMPLED
IW-1	INJECTION WELL		
MW-30	ABANDONED MONITORING WELL		
(09/2003)	DATE OF ABANDONMENT		
RW-3	ABANDONED RECOVERY WELL		
(09/2003)	DATE OF ABANDONMENT		

FIGURE 6E

SURFACTANT CONCENTRATION MAP
FOR

CHESTER RIVER HOSPITAL CENTER

CHESTERTOWN, MARYLAND

PROJECT:	SCALE:
4070-00	AS SHOWN
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	01/12/2015

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Appendix D Figure 6E- Water Quality Map of Non-Ionic Surfactants for November 19-20, 2014 Chester River Hospital Center, Chestertown, Maryland.

APPENDIX 1

Laboratory Analytical Reports

APPENDIX E

MyCelx® Filter Treatment System Technical Assessment

MyCelx® Filter Treatment System Technical Assessment

BrightFields, Inc.
Environmental Services

The CRHC remediation system employs four bag filters and two MyCelx® (model MX-12) filter units to treat contaminated groundwater. The MyCelx® filter cartridges are constructed of spun polypropylene which capture hydrocarbons and other contaminants to their surface. The MyCelx® filters are designed to effectively remove hydrocarbons, organically bound metals, surfactants and other organic contaminants greater than 5 microns in diameter.

The two MyCelx® MX-12 filters in the CRHC remediation system are operated in parallel; captured groundwater is divided into two separate flow trains with each MX-12 filter treating one flow train. Each MX-12 filter is capable of treating up to 180 gallons per minute (gpm) for a combined treatment capacity of 360 gpm. A MX-12 filter holds 12 filter cartridges which are capable of holding up to 360 grams of oil each; the combined loading capacity of both filters is over 19 pounds of oil. Once loaded (i.e. through visual inspection and pressure differential), the filter cartridges can be easily changed so that the filters continue to effectively remove hydrocarbons and surfactants from extracted groundwater.

The average combined groundwater extraction rate from all system recovery wells from June through December 2014 was approximately 55 gpm. The highest instantaneous groundwater extraction rate from all system recovery wells during that period was just below 99 gpm. During the proposed 2015 remedial action, a maximum of 12 monitoring wells would be used as "push-pull" wells at any one time. The extraction rate from each well is expected to be up to 5 gpm for a combined extraction rate of 60 gpm. Should the remediation system operate at the highest instantaneous rate (99 gpm) while up to 60 gpm of additional extraction water is added to the system, the combined influent flow to the system would be approximately 160 gpm, well below the treatment capacity of one MyCelx® MX-12 filter.

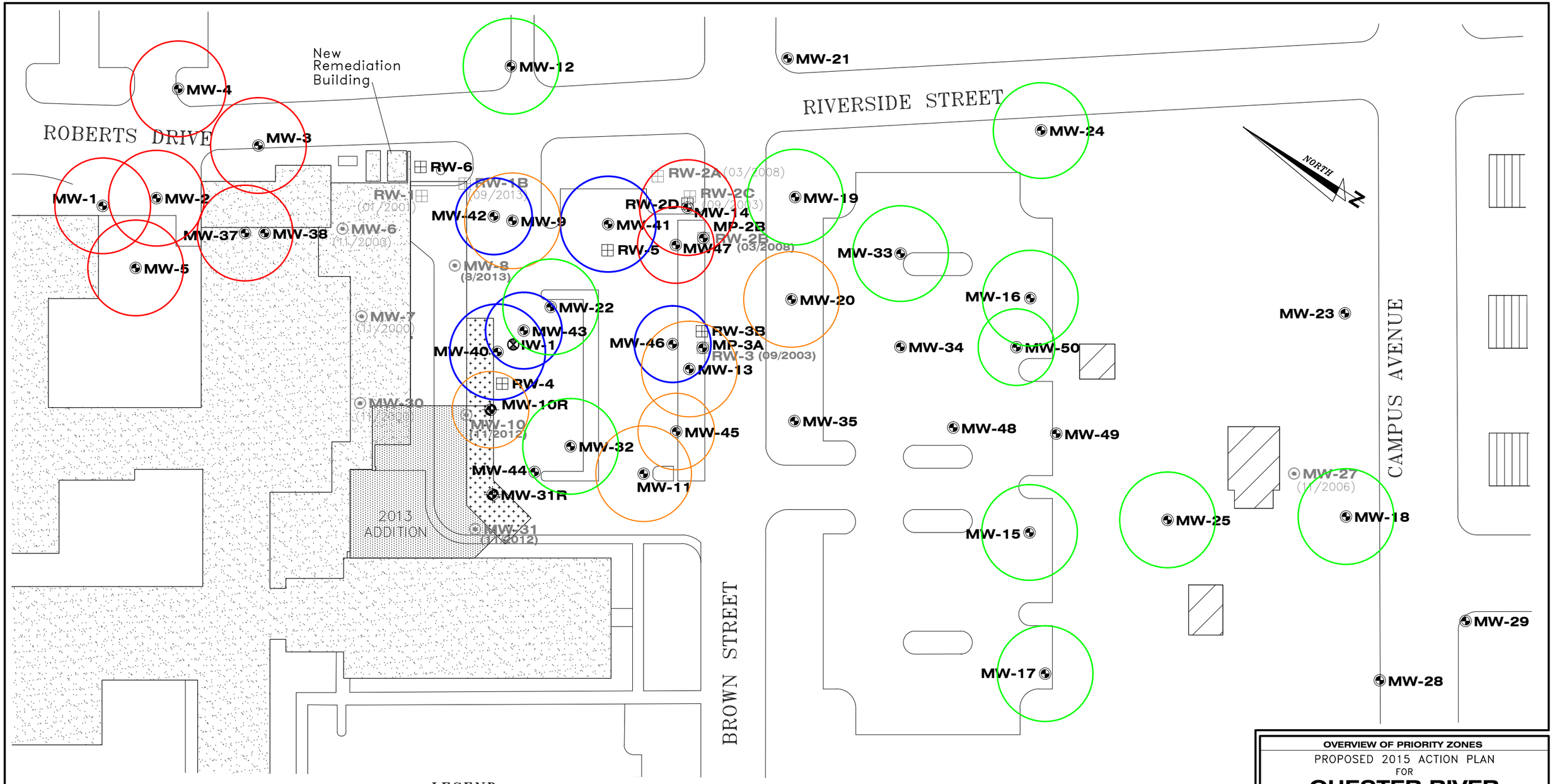
The MyCelx® filters have operated at the site for an extended period effectively removing hydrocarbons from extracted groundwater. The filter media has significant hydrocarbon loading capacity and is designed to capture hydrocarbons and surfactants during treatment. Finally, the design flow capacity of the filters is more than two times the theoretical maximum flow that will be encountered during the proposed 2015 remedial action. The MyCelx® filters are an effective option for treating groundwater to meet effluent limitations.

Kenneth Hannon, P.E.

801 Industrial Street, Suite 1 • Wilmington, DE 19801 • (302) 656-9600 • Fax (302) 656-9700

APPENDIX F

Priority Zones and Monitoring Well Locations



LEGEND

MW-40	MONITORING WELL
RW-3B	RECOVERY WELL
IW-1	INJECTION WELL
MW-30	ABANDONED MONITORING WELL
(09/2003)	DATE OF ABANDONMENT
RW-3	ABANDONED RECOVERY WELL
(09/2003)	DATE OF ABANDONMENT

- PRIORITY ZONE 1 INJECTION DIFFUSION RADIUS
- PRIORITY ZONE 2 INJECTION DIFFUSION RADIUS
- PRIORITY ZONE 3 INJECTION DIFFUSION RADIUS
- PRIORITY ZONE 4 INJECTION DIFFUSION RADIUS

50 0 25 50
GRAPHIC SCALE (FEET)

OVERVIEW OF PRIORITY ZONES
PROPOSED 2015 ACTION PLAN
FOR
CHESTER RIVER HOSPITAL CENTER
CHESTERTOWN, MARYLAND

PROJECT: 2781	SCALE: AS SHOWN
DRAWN BY:	DATE: 03/12/2014

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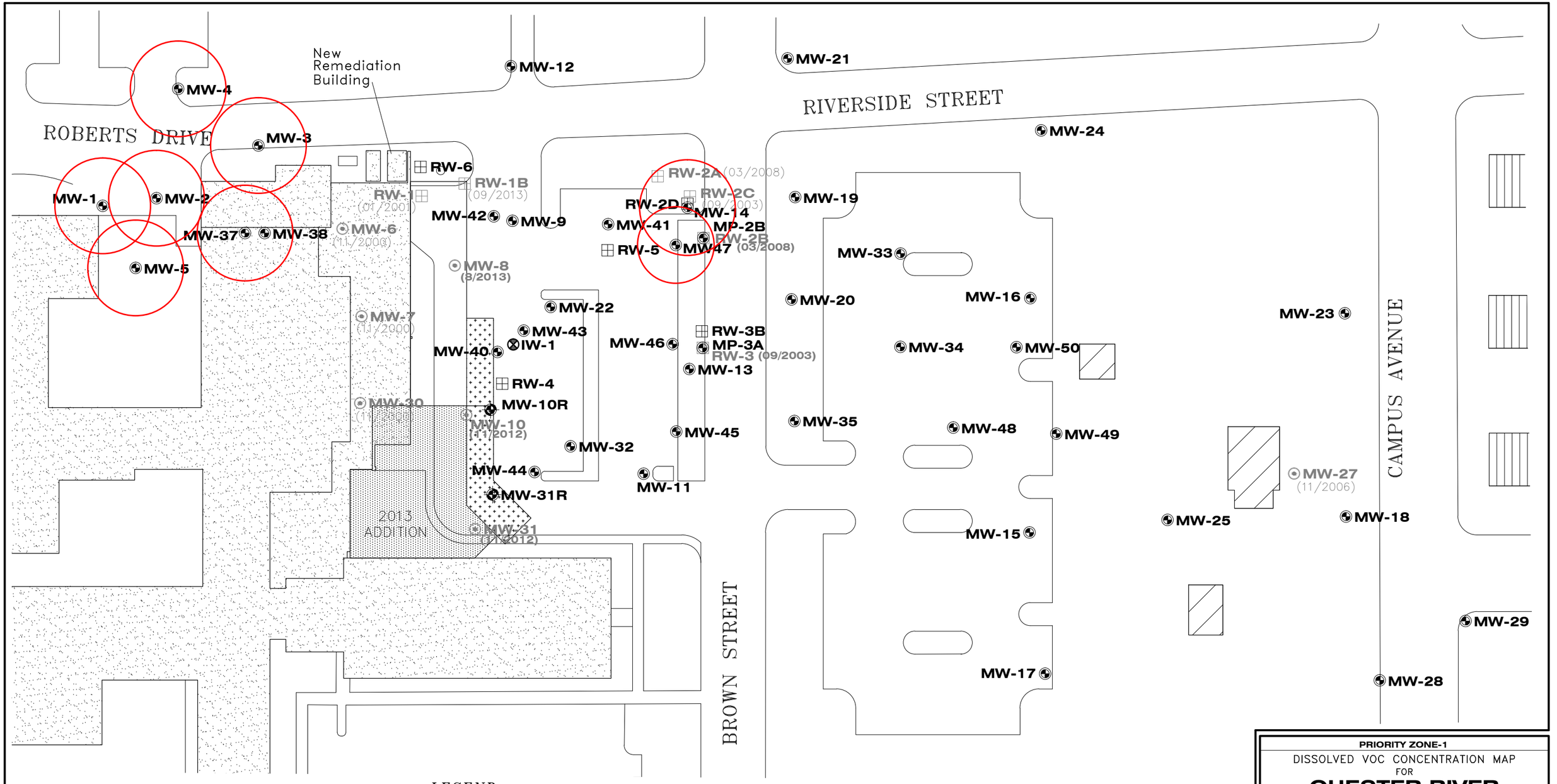
Appendix F – Figure 1 – Site map showing overview of priority zones 1–4 injection diffusion radius



LEGEND

MW-40	MONITORING WELL
RW-3B	RECOVERY WELL
IW-1	INJECTION WELL
MW-30	ABANDONED MONITORING WELL
(09/2003)	DATE OF ABANDONMENT
RW-3	ABANDONED RECOVERY WELL
(09/2003)	DATE OF ABANDONMENT

PRIORITY ZONE 1 INJECTION DIFFUSION RADIUS

50 0 25 50

GRAPHIC SCALE (FEET)

PRIORITY ZONE-1

DISSOLVED VOC CONCENTRATION MAP FOR

CHESTER RIVER HOSPITAL CENTER

CHESTERTOWN, MARYLAND

PROJECT: 2781	SCALE: AS SHOWN
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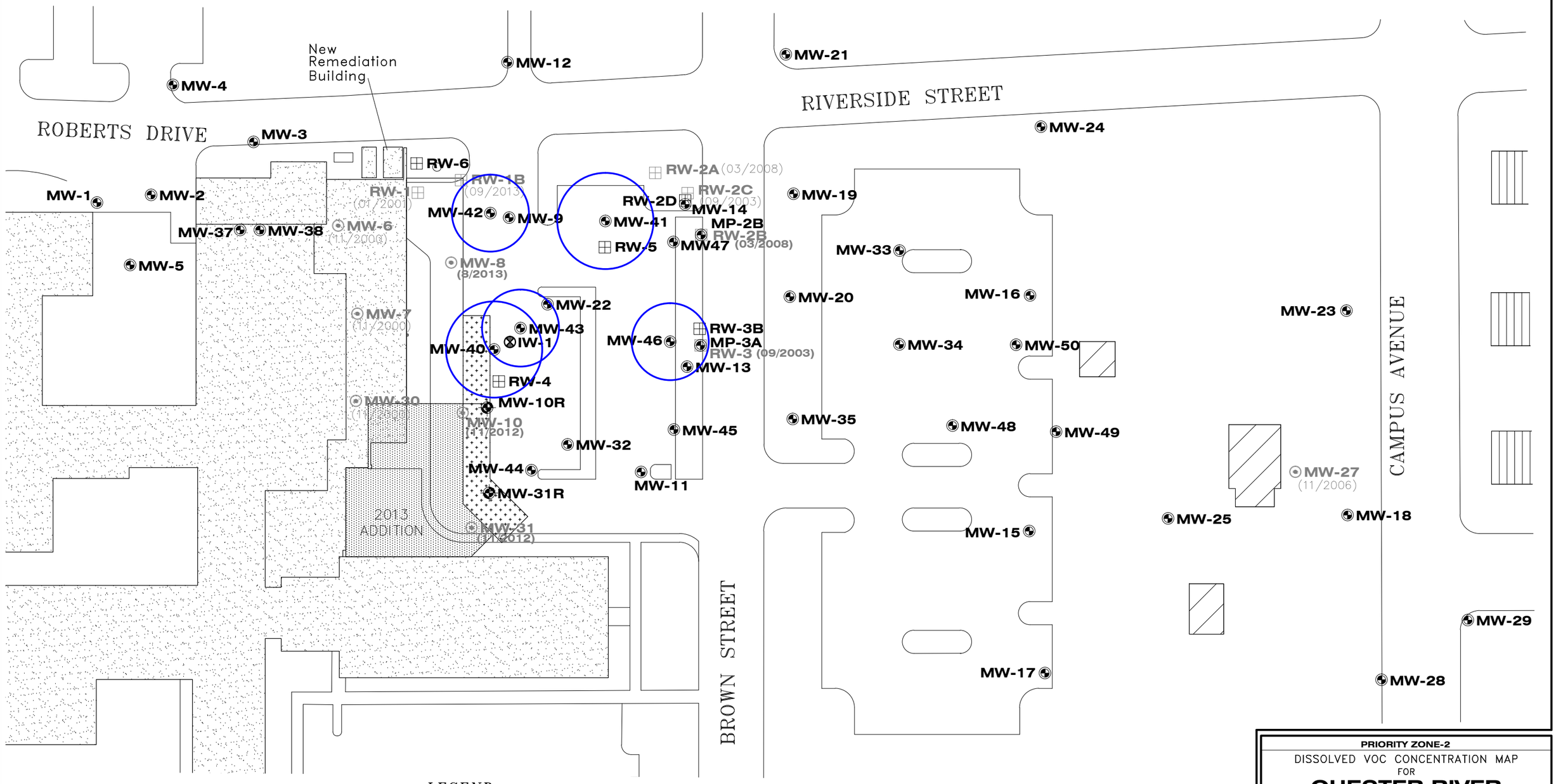
Appendix F – Figure 2 – Site map showing overview of priority zone 1 injection diffusion radius



LEGEND

MW-40	MONITORING WELL
RW-3B	RECOVERY WELL
IW-1	INJECTION WELL
MW-30	ABANDONED MONITORING WELL
(09/2003)	DATE OF ABANDONMENT
RW-3	ABANDONED RECOVERY WELL
(09/2003)	DATE OF ABANDONMENT

PRIORITY ZONE 2 INJECTION DIFFUSION RADIUS

50 0 25 50

GRAPHIC SCALE (FEET)

PRIORITY ZONE-2

DISSOLVED VOC CONCENTRATION MAP FOR

CHESTER RIVER HOSPITAL CENTER

CHESTERTOWN, MARYLAND

PROJECT: 2781	SCALE: AS SHOWN
DRAWN BY:	DATE: 03/12/2014

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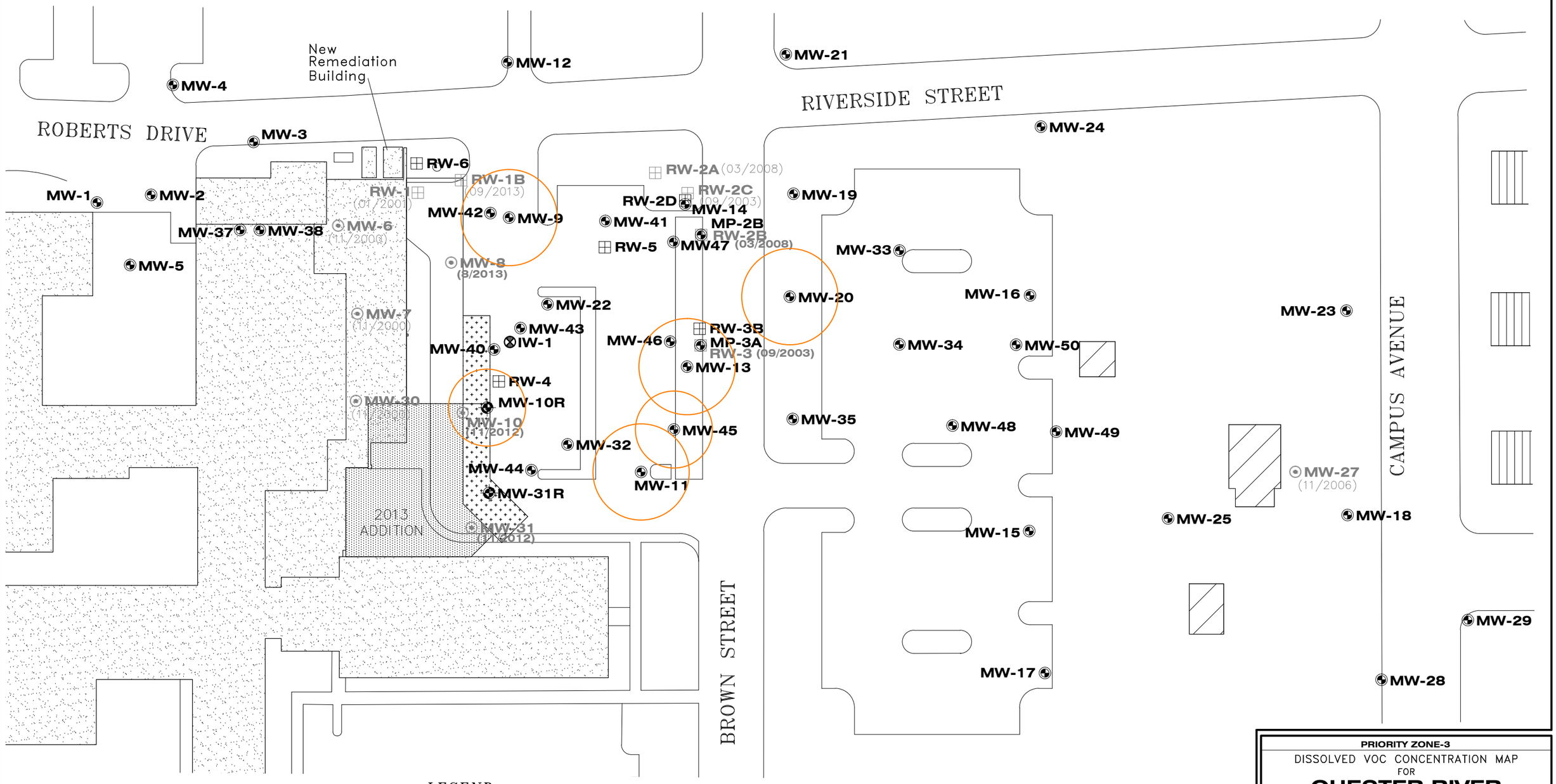
Appendix F – Figure 3 – Site map showing overview of priority zone 2 injection diffusion radius



LEGEND

MW-40	MONITORING WELL
RW-3B	RECOVERY WELL
IW-1	INJECTION WELL
MW-30 (09/2003)	ABANDONED MONITORING WELL DATE OF ABANDONMENT
RW-3 (09/2003)	ABANDONED RECOVERY WELL DATE OF ABANDONMENT

PRIORITY ZONE 3 INJECTION DIFFUSION RADIUS

50 0 25 50

GRAPHIC SCALE (FEET)

PRIORITY ZONE-3

DISSOLVED VOC CONCENTRATION MAP FOR

CHESTER RIVER HOSPITAL CENTER

CHESTERTOWN, MARYLAND

PROJECT: 2781	SCALE: AS SHOWN
DRAWN BY:	DATE: 03/12/2014

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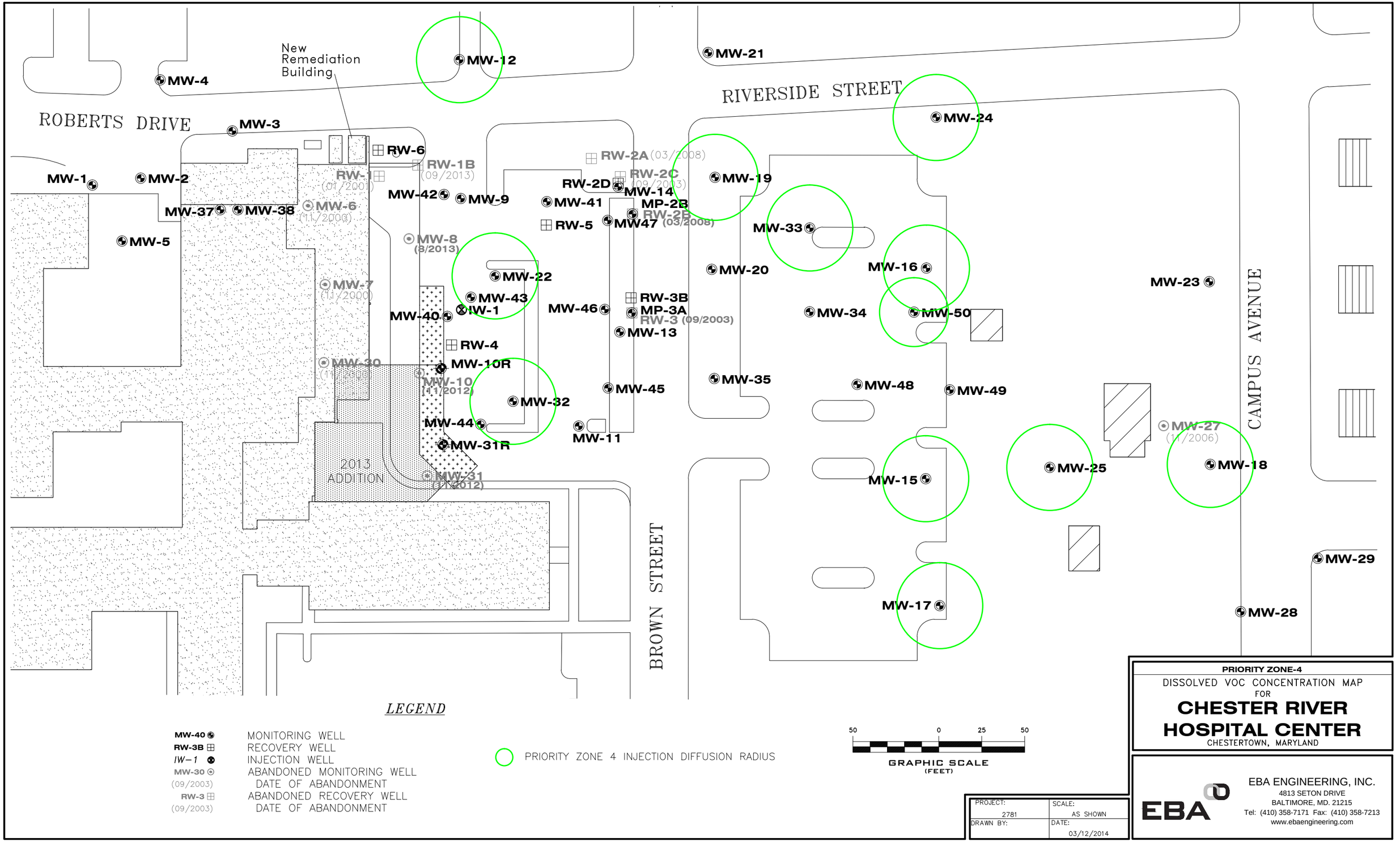
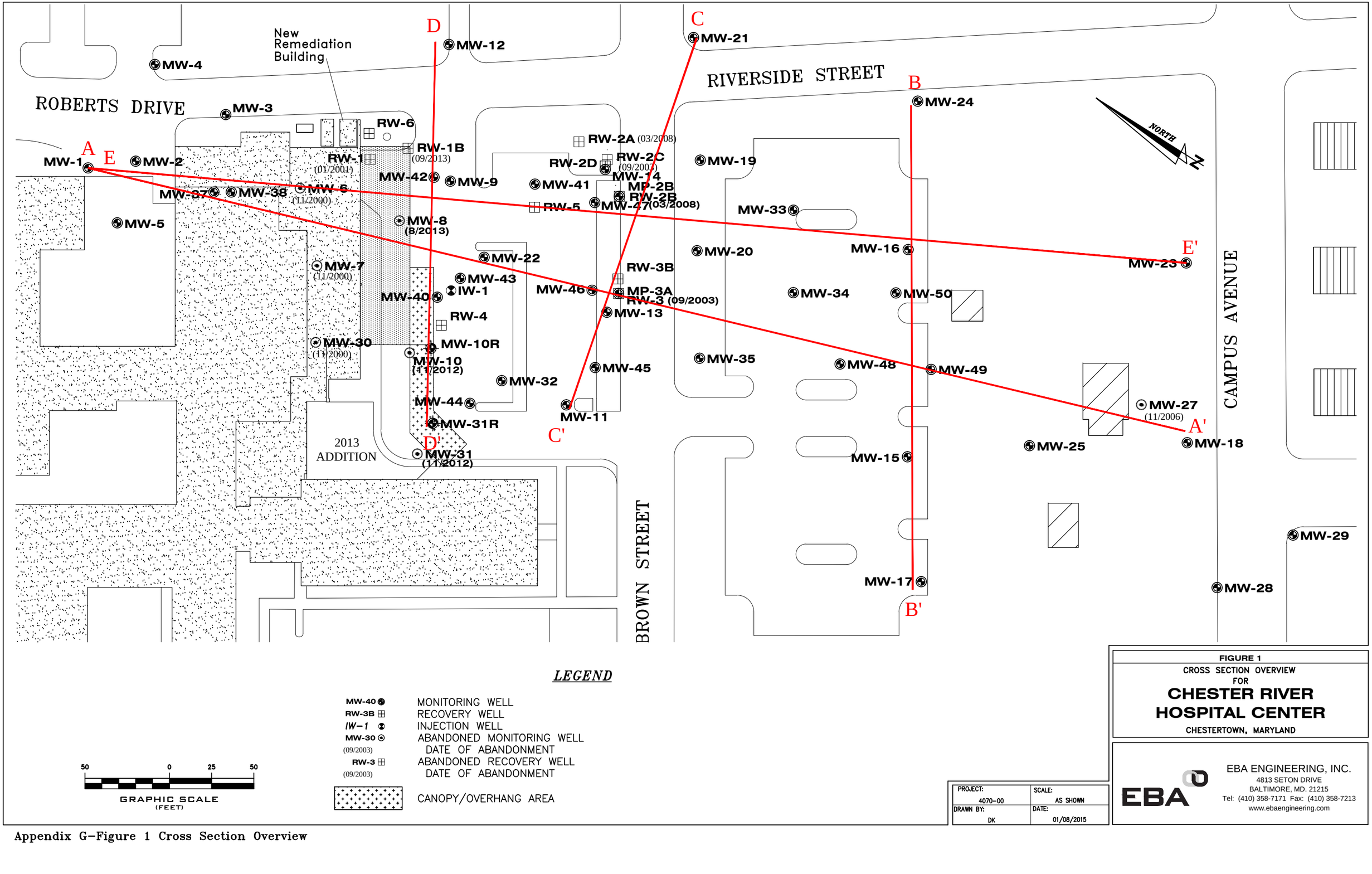
Appendix F – Figure 4 – Site map showing overview of priority zone 3 injection diffusion radius



Appendix F – Figure 5 – Site map showing overview of priority zone 4 injection diffusion radius

APPENDIX G

Figure 1 - Cross Section Overview



LEGEND

MW-40	MONITORING WELL
RW-3B	RECOVERY WELL
IW-1	INJECTION WELL
MW-30 (09/2003)	ABANDONED MONITORING WELL DATE OF ABANDONMENT
RW-3 (09/2003)	ABANDONED RECOVERY WELL DATE OF ABANDONMENT
	CANOPY/OVERHANG AREA

50 0 25 50

GRAPHIC SCALE (FEET)

PROJECT: 4070-00	SCALE: AS SHOWN
DRAWN BY: DK	DATE: 01/08/2015

FIGURE 1

CROSS SECTION OVERVIEW FOR

CHESTER RIVER HOSPITAL CENTER

CHESTERTOWN, MARYLAND

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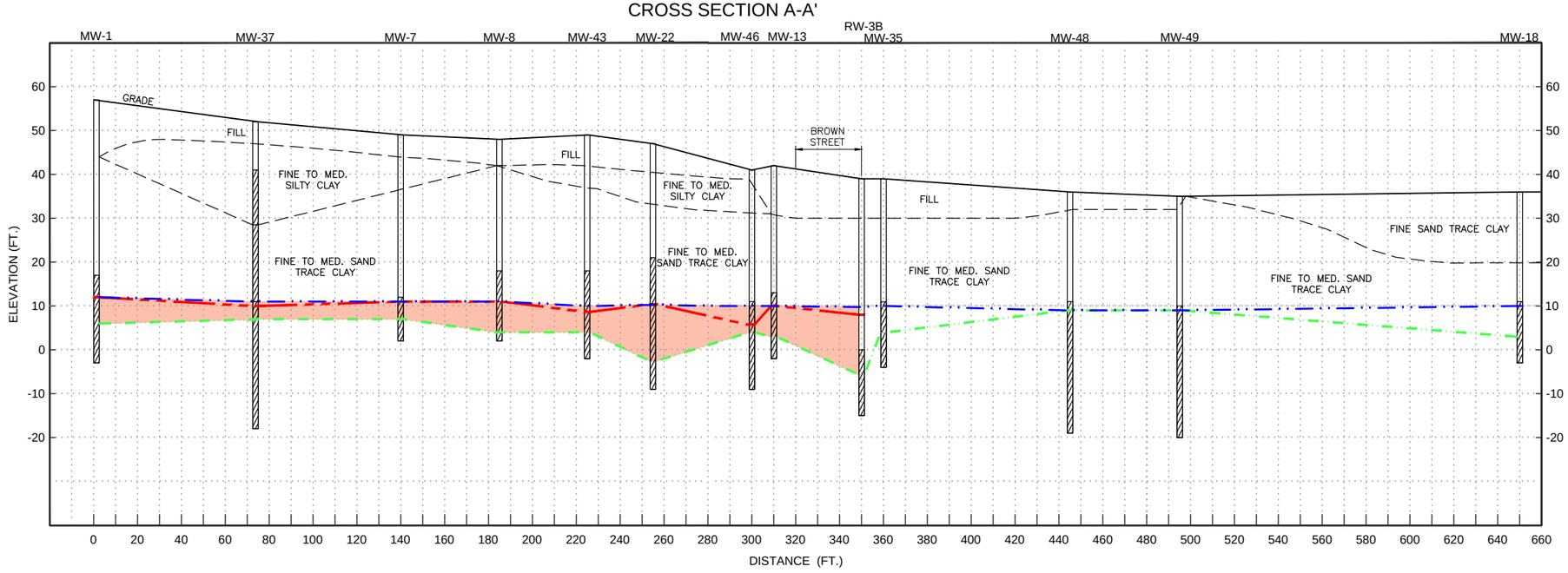
Appendix G–Figure 1 Cross Section Overview

APPENDIX G

Figure 2 - Cross Section A-A'

CROSS SECTION A-A'



SCALE: HORIZONTAL: 1'=60'
VERTICAL: 1'=30'

LEGEND

- SCREEN
- HIGH WATER ELEVATION
- LOW WATER ELEVATION
- HISTORIC PRODUCT
- SMEAR ZONE

FIGURE 2

CROSS SECTION A–A'
FOR

CHESTER RIVER HOSPITAL CENTER

CHESTERTOWN, MARYLAND

PROJECT:	SCALE:
4070–00	AS SHOWN
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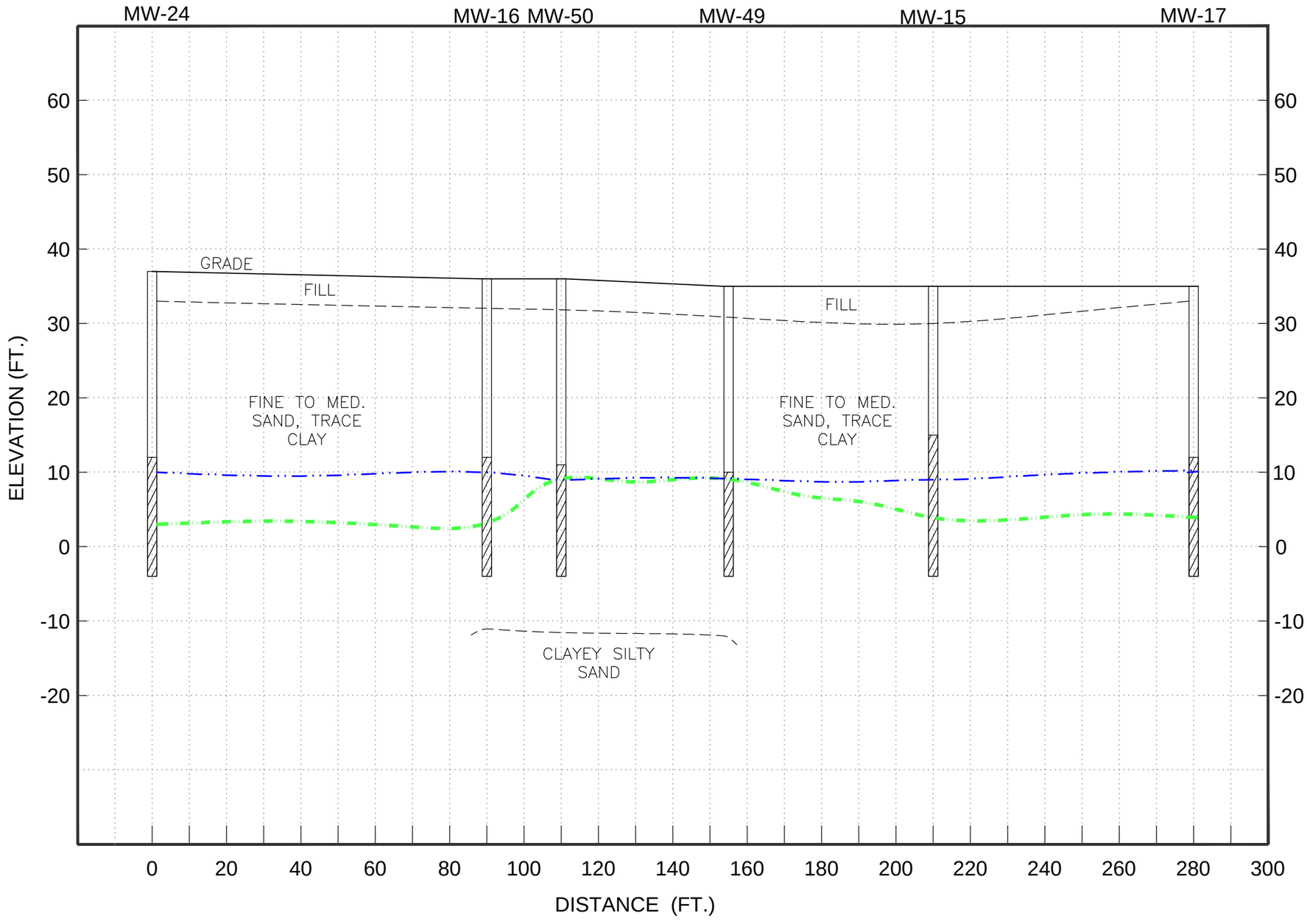
Appendix G–Figure 2 Cross Section A–A'

APPENDIX G

Figure 3 - Cross Section B-B'

CROSS SECTION B-B'



LEGEND

- SCREEN
- HIGH WATER ELEVATION
- LOW WATER ELEVATION
- HISTORIC PRODUCT
- SMEAR ZONE

FIGURE 3

CROSS SECTION B–B'
FOR
CHESTER RIVER HOSPITAL CENTER
CHESTERTOWN, MARYLAND

PROJECT:	SCALE:
4070–00	AS SHOWN
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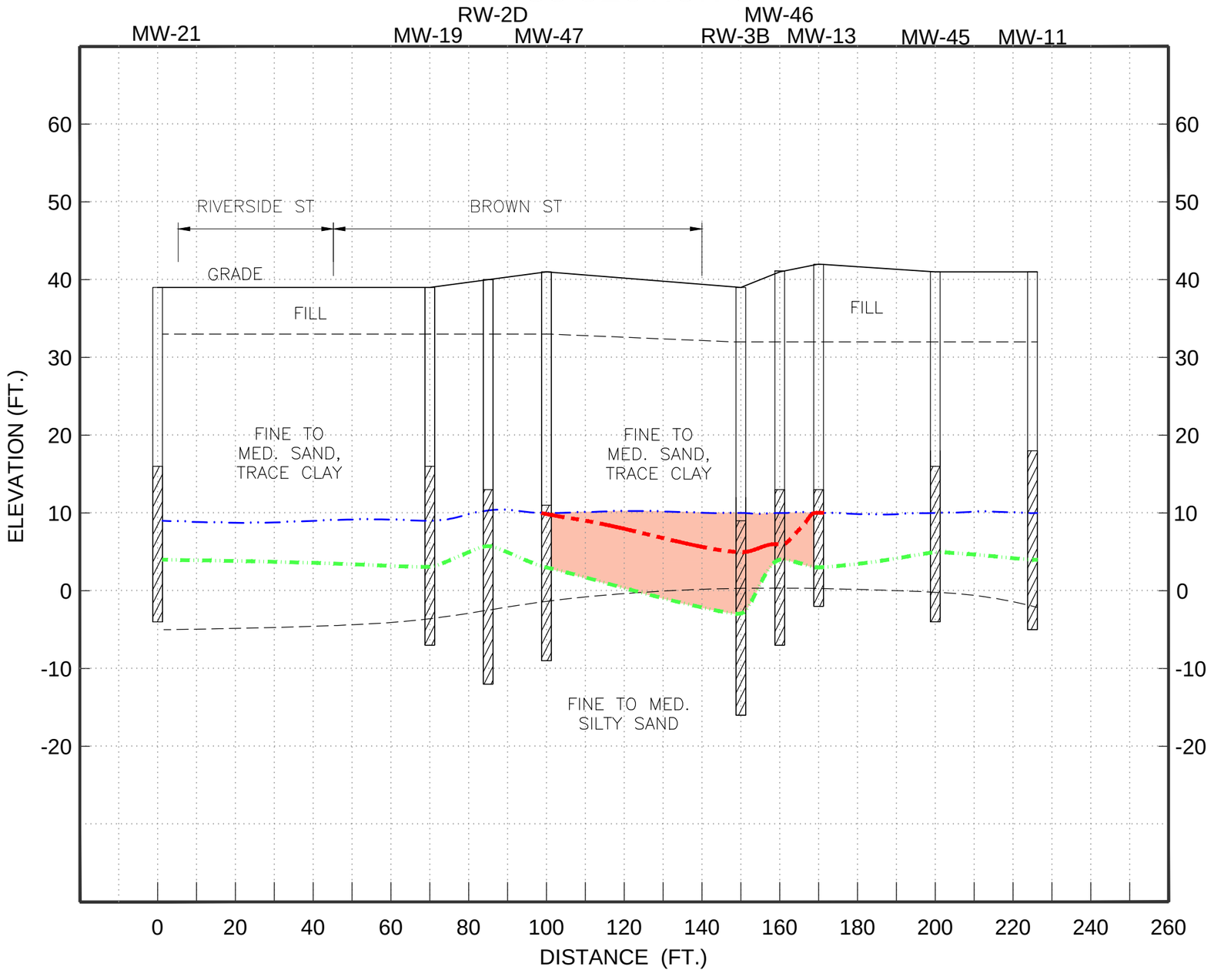
Appendix G–Figure 3 Cross Section B–B'

APPENDIX G

Figure 4 - Cross Section C-C'

CROSS SECTION C-C'



LEGEND

- SCREEN
- HIGH WATER ELEVATION
- LOW WATER ELEVATION
- HISTORIC PRODUCT
- SMEAR ZONE

FIGURE 4

CROSS SECTION C–C'
FOR
CHESTER RIVER HOSPITAL CENTER
CHESTERTOWN, MARYLAND

PROJECT:	SCALE:
4070-00	AS SHOWN
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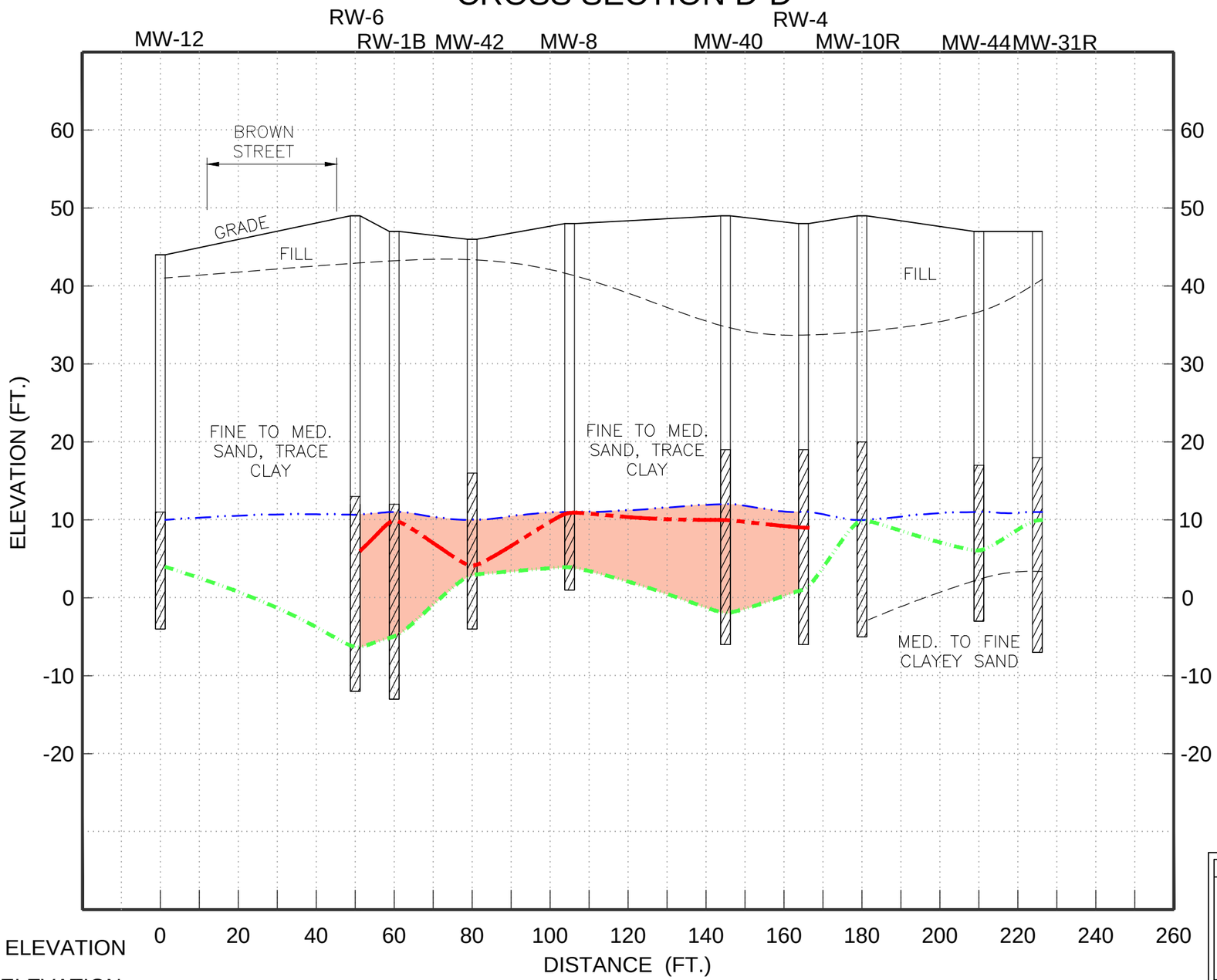
Appendix G–Figure 4 Cross Section C–C'

APPENDIX G

Figure 5 - Cross Section D-D'

CROSS SECTION D-D'



LEGEND

- SCREEN
- HIGH WATER ELEVATION
- LOW WATER ELEVATION
- HISTORIC PRODUCT
- SMEAR ZONE

FIGURE 5

CROSS SECTION D–D'
FOR
CHESTER RIVER HOSPITAL CENTER
CHESTERTOWN, MARYLAND

PROJECT:	SCALE:
4070-00	AS SHOWN
DRAWN BY:	DATE:
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Appendix G–Figure 5 Cross Section D–D'

APPENDIX G

Figure 6 - Cross Section E-E'

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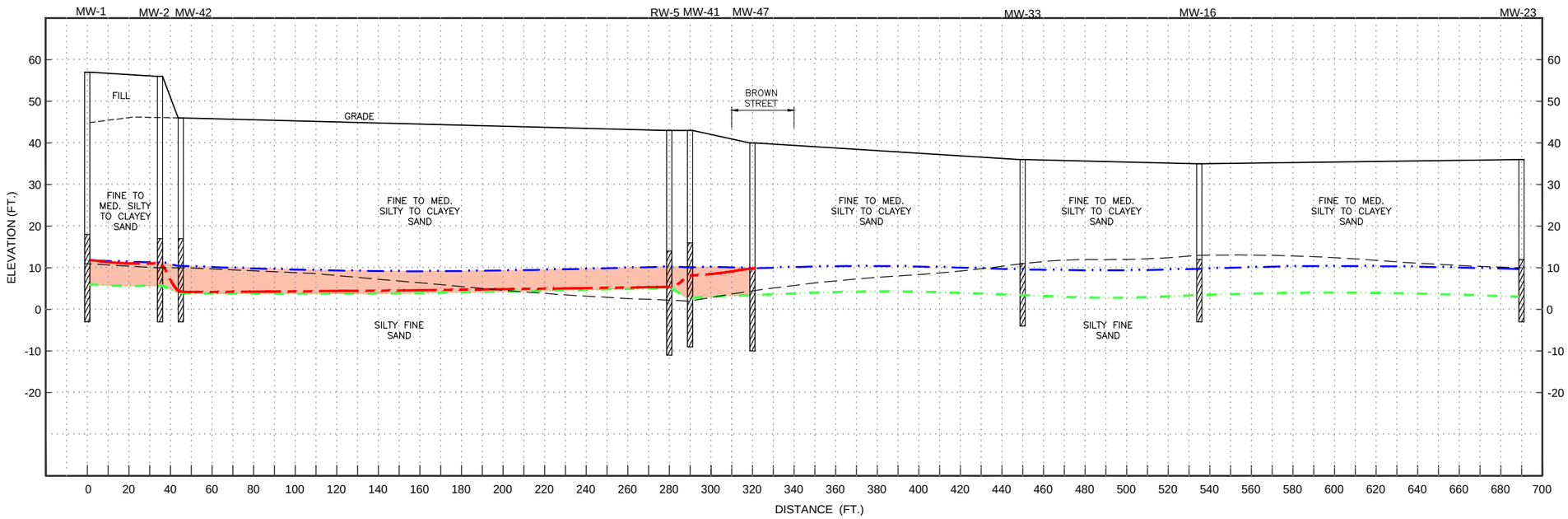
CROSS SECTION E-E'



SCALE: HORIZONTAL: 1'=60'
VERTICAL: 1'=30'

LEGEND

- SCREEN
- HIGH WATER ELEVATION
- LOW WATER ELEVATION
- HISTORIC PRODUCT
- SMEAR ZONE

FIGURE 6

CROSS SECTION E-E'
FOR
CHESTER RIVER HOSPITAL CENTER
CHESTERTOWN, MARYLAND

PROJECT:	SCALE:
4070-00	AS SHOWN
DRAWN BY:	DATE:
DK	01/08/2015

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Appendix G-Figure 6 Cross Section E-E'