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September 27, 2016

Maryland Department of the Environment
Oil Control Program
1800 Washington Blvd., Suite 620
Baltimore, MD 21230

Attn: Ms. Susan Bull

Re: Chester River Hospital Center
Subsurface Investigation Work Plan
Report of Findings
Project No: 14004.00

Dear Ms. Bull:

This is to advise the Maryland Department of the Environment (MDE) that the various conditions and requirements of MDE's May 9, 2016 Work Plan approval letter have been satisfied. This letter report presents the findings of these investigations and presents discussion regarding how these subsurface investigations relate to the ongoing remediation effort. As a general observation, it is important to note the findings substantiate the effectiveness of the pump and treat system, the Ivey-sol process, and comprehensive cleanup efforts. University of Maryland Shore Medical Center at Chestertown (SMCC) looks forward to continuing the case closure process in accordance with the MDE/SMCC Settlement Agreement and Consent Order.

Certification of Work Performance:

1. The six (6) new wells have been located consistent with the map provided by MDE and installed per specifications included in the approved Earth Data scope of services. This includes drilling methods, diameter of wells, depth of screens, identification of adjacent monitoring wells, average depth to water, total depth, screen intervals, etc.

2. No measurable liquid phase hydrocarbons (LPH) were detected.

3. All of the purge and development water was placed into 500 gallon poly tanks provided by Earth Data and disposed of into the Town's sanitary sewer system after being pumped through a portable granulated activated carbon unit as approved by the Town of Chestertown.

4. Earth Data, Inc. (Earth Data) acquired necessary drilling permits and have provided all driller/boring logs, field reports, well permit applications, well construction as-built summary table, and completion reports which are included as ***Attachment A***.

5. A revised monitoring plan/map is enclosed as ***Attachment B*** which identifies all of the existing and new monitoring wells. The map reflects the new monitoring wells as field located Davis, Bowen & Friedel, Inc. (DBF) surveyors. This plan/map also shows the direction of groundwater flow. It is important to note that the groundwater gradient and direction of flow has not changed from that reported in the past as the new wells did not indicate a need to modify the existing datum.

6. Continuous soils samples were collected as part of the drilling process using a discrete macro-core sampling device. To the extent needed small diameter hallow stem augers were used to enhance the drilling efficiency/effectiveness. All samples were screened visually and with a photo-ionization detector (PID) using consistent methodology to minimize volatizing prior to screening with the PID. Soils core logging of the formation stratigraphy and the collection of soil samples at intervals exhibiting the highest field reading at the soil/water interface were performed per MDE requirements. Consistent with MDE direction in the field, whenever positive PID readings were noted the continuous boring was advanced until such a time as the PID meter reading was zero. Soil samples collected were sent to the laboratory for analysis consistent with the protocols and procedures specified. The results of the core logging and soil samples are included in ***Attachment C***.

7. All of the drill cuttings were placed into fifty-five (55) gallon drums and BrightFields, Inc. disposed of this material at an approved waste disposal facility. Appropriate documentation can be found in ***Attachment D***.

8. The required sampling of the new wells was not initiated until more than fourteen (14) days had elapsed from the time the wells were developed utilizing active surging in addition to pumping/purging. The results of water samples collected to date are included in the tables in the **Well Drilling and Core Sample Results** section below. (These wells have been added to the regiment of monthly and quarterly sampling which is performed by BrightFields.)

Well Drilling and Core Sample Results:

The well drilling work was initiated by Earth Data on June 9, 2016. This followed extensive coordination with SMCC regarding logistics, property management, and vehicle/pedestrian safety. Ms. Susan Bull, with MDE was onsite to observe the well drilling, core sampling, and testing protocol as well as Mr. James Sines with EBA Engineering, Inc. (EBA). In accordance with the MDE March 23, 2016 approval letter, to complete the vertical delineation of petroleum impacts, the soil borings were field screened continuously from ground surface to at least ten feet (10') below the top of the water table, both visually and with a photo-ionization detector (PID).

Mr. Sines and Ms. Bull documented findings and reports were prepared by both which included visual observations as to presence of sheen observed in the smear zone along with results from the required PID testing results. These field reports have been included in ***Attachment E*** and the report PID meter readings can be found in ***Attachment C*** as noted above.

The most important of the findings is that some sheen was observed at different levels in the defined smear zone, but no free product was observed at any time during the subsurface investigation.

MW-51:

MW-51 is located in the courtyard in the general vicinity of existing MW-5, and approximately ten feet (10') from an active underground storage tank (UST) at UMSCC. An initial boring was advanced to a depth of approximately thirteen and one half feet (13.5') below ground surface (bgs), at which point refusal was encountered. The boring was abandoned and moved approximately five feet (5') south of the initial boring. Due to logistical issues with rig placement in the courtyard this well had to be drilled with a smaller (lower torque) rig and is constructed with two inch (2") PVC well casing and screen.

This well was completed by first collecting continuous direct-push soil samples (five foot (5') cores) to a total depth of seventy feet (70'). Organic Vapor Meter (OVM) readings were taken at regular intervals. In MW-51 OVM readings were zero from ground surface to a depth of thirty-eight feet (38'), where an initial reading of three and one half (3.5) parts per million (ppm) was noted. Maximum OVM reading was one hundred sixty (160) ppm at a depth of fifty-five feet (55'). Water and some minor evidence of Liquid Phase Hydrocarbons (LPH) were noted in the soil sample at that depth. Soil samples were collected for laboratory analysis from the depths of fifty to fifty-one feet (50'-51'); fifty-four to fifty-five feet (54'-55'); and sixty-nine to seventy feet (69'-70'). The well is constructed with two inch (2") diameter PVC casing and screen to a total depth of sixty-four feet (64'). The screen interval is from thirty-nine feet (39') to fifty-nine feet (59'). Well gravel is installed to approximately five feet (5') above the top of the screen. The annular space between the casing and the drilled hole is filled with bentonite grout from the top of the gravel pack to near ground surface. The static water level was measured at a depth of approximately fifty-one feet (51') bgs.

Analytical results associated with MW-51 are presented in the table below:

Location (bgs)	TPH-DRO (mg/kg)	Benzene (mg/kg)	Toluene (mg/kg)	Ethylbenzene (mg/kg)	Xylenes (mg/kg)	Naphthalene (mg/kg)
MDE Non-Residential Cleanup Standard	**620**	**52**	**8,200**	**10,000**	**20,000**	**2,000**
50-51'	240	<0.0053	<0.0053	<0.0053	<0.011	<0.0053
54-55'	**5,900**	<0.54	<0.54	<0.54	<1.1	1.4
69-70'	<13	<0.0051	<0.0051	<0.0051	<0.010	<0.0051

MW-52:

MW-52 is located south of the Emergency Room ambulance entrance at the UMSCC.

This well was completed by first collecting continuous direct-push soil samples (five foot (5') cores) to a total depth of fifty-eight feet (58'). Once the water table was encountered (approximately thirty-nine feet (39')) hollow-stem augers were advanced with the core barrel to ensure the hole remained open and maximum core retrieval was obtained. OVM readings were taken at regular intervals. In MW-52 OVM readings were zero from ground surface to a depth of twenty-eight feet (28'), where an initial reading of three to five (3-5) ppm was noted. Water and evidence of LPH were noted in the soil samples beginning at depth of approximately thirty-eight feet (38'). Maximum OVM reading was one hundred thirty to one hundred fifty (130-150) ppm at a depth of forty-three

feet (43'). Soil samples were collected for laboratory analysis from the depths of thirty-three to thirty-four feet (33'-34'); forty-two to forty-three feet (42'-43'); and fifty-seven to fifty-eight feet (57'-58'). The well is constructed with four inch (4") diameter PVC casing and screen to a total depth of fifty-five feet (55'). The screen interval is from thirty feet (30') to fifty feet (50'). Well gravel is installed to approximately five feet (5') above the top of the screen. The annular space between the casing and the drilled hole is filled with bentonite grout from the top of the gravel pack to near ground surface. The static water level was measured at a depth of approximately thirty-nine and one half feet (39.5') bgs.

Analytical results associated with MW-52 are presented in the table below:

Location (bgs)	**TPH-DRO (mg/kg)**	**Benzene (mg/kg)**	**Toluene (mg/kg)**	**Ethylbenzene (mg/kg)**	**Xylenes (mg/kg)**	**Naphthalene (mg/kg)**
MDE Non-Residential Cleanup Standard	**620**	**52**	**8,200**	**10,000**	**20,000**	**2,000**
33-34'	13	<0.0057	<0.0057	<0.0057	<0.011	<0.0057
42-43'	**11,000**	<0.47	<0.47	<0.47	<0.93	13
57-58'	<12	<0.0049	<0.0049	<0.0049	<0.0097	<0.006

MW-53:

MW-53 is located in the vicinity of existing MW-40 and RW-4, near the pedestrian entrance to the Emergency Room at UMSCC.

This well was completed by first collecting continuous direct-push soil samples (five foot (5') cores) to a total depth of fifty-five feet (55'). Once the water table was encountered (approximately thirty-nine feet (39')) hollow-stem augers were advanced with the core barrel to ensure the hole remained open and maximum core retrieval was obtained. OVM readings were taken at regular intervals. In MW-53 OVM readings were zero from ground surface to a depth of approximately thirty-nine feet (39'), where an initial reading of fourteen (14) ppm was noted. Water and some evidence of LPH were noted in the soil samples beginning at depth of approximately forty feet (40'). Maximum OVM reading was one hundred thirty (130) ppm at a depth of forty-two feet (42'). Soil samples were collected for laboratory analysis from the depths of forty to forty-one feet (40'-41') and fifty-four to fifty-five feet (54'-55'). The well is constructed with four inch (4") diameter PVC casing and screen to a total depth of fifty-five feet (55'). The screen interval is from thirty feet (30') to fifty feet (50'). Well gravel is installed to approximately five feet (5') above the top of the screen. The annular space between the casing and the drilled hole is filled with bentonite grout from the top of the gravel pack to near ground surface. The static water level was measured at a depth of approximately thirty-nine and one half feet (39.5') bgs.

Analytical results associated with MW-53 are presented in the table below:

Location (bgs)	TPH-DRO (mg/kg)	Benzene (mg/kg)	Toluene (mg/kg)	Ethylbenzene (mg/kg)	Xylenes (mg/kg)	Naphthalene (mg/kg)
MDE Non-Residential Cleanup Standard	**620**	**52**	**8,200**	**10,000**	**20,000**	**2,000**
40-41'	300	<0.0061	<0.0061	<0.0061	<0.012	0.026
54-55'	12	<0.0059	<0.0059	<0.0059	<0.012	0.011

MW-54:

MW-54 is located approximately four feet (4') south of the retaining wall in the Emergency Room parking lot, south of existing well RW-5 and northwest of existing MW-46 at UMSCC.

This well was completed by first collecting continuous direct-push soil samples (five foot (5') cores) to a total depth of fifty-five feet (55'). Once the water table was encountered (approximately thirty-six feet (36')) hollow-stem augers were advanced with the core barrel to ensure the hole remained open and maximum core retrieval was obtained. OVM readings were taken at regular intervals. In MW-54 OVM readings were zero from ground surface to a depth of twenty-seven (27) feet, where an initial reading of three (3) ppm was noted. Water and some evidence of LPH were noted in the soil samples beginning at depth of approximately thirty-six feet (36'). Maximum OVM reading was one hundred eighty-six (186) ppm at a depth of thirty-eight feet (38'). Soil samples were collected for laboratory analysis from the depths of thirty-six to thirty-seven feet (36'-37') and fifty-four to fifty-five feet (54'-55'). The well is constructed with four inch (4") diameter PVC casing and screen to a total depth of fifty-two feet (52'). The screen interval is from twenty-seven feet (27') to forty-seven feet (47'). Well gravel is installed to approximately five feet (5') above the top of the screen. The annular space between the casing and the drilled hole is filled with bentonite grout from the top of the gravel pack to near ground surface. The static water level was measured at a depth of approximately thirty-six feet (36') bgs.

Analytical results associated with MW-54 are presented in the table below:

Location (bgs)	TPH-DRO (mg/kg)	Benzene (mg/kg)	Toluene (mg/kg)	Ethylbenzene (mg/kg)	Xylenes (mg/kg)	Naphthalene (mg/kg)
MDE Non-Residential Cleanup Standard	**620**	**52**	**8,200**	**10,000**	**20,000**	**2,000**
36-37'	**1,400**	<0.47	<0.47	<0.47	<0.94	0.83
54-55'	<12	<0.0046	<0.0046	<0.0046	<0.0093	<0.0046

MW-55:

MW-55 is located approximately four feet (4') south of the retaining wall in the Emergency Room parking lot, approximately mid-way between existing wells MW-32 and MW-45 at UMSCC.

This well was completed by first collecting continuous direct-push soil samples (five foot (5') cores) to a total depth of forty-nine feet (49'). Once the water table was encountered (approximately thirty-seven feet (37')) hollow-stem augers were advanced with the core barrel to ensure the hole remained open and maximum core retrieval was obtained. OVM readings were taken at regular intervals. In MW-55 OVM readings were zero from ground surface to a depth of thirty-seven feet (37'), where an initial reading of one (1) ppm was noted. Water and evidence of LPH were noted in the soil samples beginning at depth of approximately thirty-eight feet (38'). Maximum OVM reading was two (2) ppm at a depth of thirty-nine feet (39'). A soil sample was collected for laboratory analysis from the depth of thirty-seven to thirty-eight feet (37'-38'). The well is constructed with four inch (4") diameter PVC casing and screen to a total depth of fifty feet (50'). The screen interval is from twenty-five feet (25') to forty-five feet (45'). Well gravel is installed to approximately five feet (5') above the top of the screen. The annular space between the casing and the drilled hole is filled with bentonite grout from the top of the gravel pack to near ground surface. The static water level was measured at a depth of approximately thirty-five feet (35.3') bgs.

Analytical results associated with MW-55 are presented in the table below:

Location (bgs)	TPH-DRO (mg/kg)	Benzene (mg/kg)	Toluene (mg/kg)	Ethylbenzene (mg/kg)	Xylenes (mg/kg)	Naphthalene (mg/kg)
MDE Non-Residential Cleanup Standard	**620**	**52**	**8,200**	**10,000**	**20,000**	**2,000**
37-38'	51	<0.0046	<0.0046	<0.0046	<0.0093	<0.0046

MW-56:

MW-56 is located approximately fifteen feet (15') south of existing MW-20, near the edge of the grassy median between Brown Street and the adjacent parking lot at the UMSCC.

This well was completed by first collecting continuous direct-push soil samples (five foot (5') cores) to a total depth of forty-five feet (45'). Once the water table was encountered (approximately thirty-five feet (35')) hollow-stem augers were advanced with the core barrel to ensure the hole remained open and maximum core retrieval was obtained. OVM readings were taken at regular intervals. In MW-56 OVM readings were zero from ground surface to the total depth of the boring, with no evidence of LPH at any point during drilling operations. A soil samples was collected for laboratory analysis from the depth of thirty-one and one half to thirty-two and one half feet (31.5'-32.5'). The well is constructed with four inch (4") diameter PVC casing and screen to a total depth of forty-seven feet (47'). The screen interval is from twenty-two feet (22') to forty-two feet (42'). Well gravel is installed to approximately five feet (5') above the top of the screen. The annular space between the casing and the drilled hole is filled with bentonite grout from the top of the gravel pack to near ground surface. The static water level was measured at a depth of approximately thirty-one feet (31') bgs.

Analytical results associated with MW-56 are presented in the table below:

Location (bgs)	TPH-DRO (mg/kg)	Benzene (mg/kg)	Toluene (mg/kg)	Ethylbenzene (mg/kg)	Xylenes (mg/kg)	Naphthalene (mg/kg)
MDE Non-Residential Cleanup Standard	**620**	**52**	**8,200**	**10,000**	**20,000**	**2,000**
31.5-32.5'	<12	<0.005	<0.005	<0.005	<0.01	<0.005

Water Quality Sampling:

Well No.	Date	Top of Casing Elevation (ft)	Depth to Water (ft)	GW Elevation (ft)	TPH-DRO (mg/L)	Surfactant (mg/L)
MDE GW Cleanup Standards for Type I and II Aquifers					**0.047**	**NA**
MW-51	28-Jul-16	60.55	50.05	10.50	**3.0**	<1.4
MW-51	24-Aug-16	60.55	0.00	60.55	**6.9**	NS
MW-52	28-Jul-16	47.25	39.05	8.20	**1.5**	<1.4
MW-52	24-Aug-16	47.25	0.00	47.25	**1.2**	NS
MW-53	28-Jul-16	47.69	40.13	7.56	**4.1**	<1.4
MW-53	24-Aug-16	47.69	0.00	47.69	**4.6**	NS
MW-54	28-Jul-16	42.99	36.13	6.86	**6.1**	<1.4
MW-54	24-Aug-16	42.99	0.00	42.99	**5.2**	NS
MW-55	28-Jul-16	42.78	35.80	6.98	**0.46**	<1.4
MW-55	24-Aug-16	42.78	0.00	42.78	**0.16**	NS
MW-56	27-Jul-16	37.82	30.22	7.60	<0.1	<1.4
MW-56	24-Aug-16	37.82	0.00	37.82	<0.1	NS

NS - Not Sampled

Discussion of Findings:

- Gauging results for the month of July shows GW table was within 0.5' of historic high. GW then dropped about a foot in August.
- At no time was free product or sheen observed in any of the 6 new wells during July/August sampling activities.
- Results from MW-51 ranged from 3.0 to 6.9 mg/L. Based upon the elevated groundwater table along with the presence of TPH-DRO in the soils at/near the groundwater interface,

the presence of TPH-DRO is not unanticipated. Results from MW-51 are consistent with nearby cross-gradient MW-37 for the same period.

- Results from MW-52 ranged from 1.2 to 1.5 mg/L. Based upon the elevated groundwater table along with the presence of TPH-DRO in the soils at/near the groundwater interface, the presence of TPH-DRO is not unanticipated. Furthermore, results are consistent with nearby cross-gradient wells MW-42 and MW-9 for the same period.

- Results from MW-53 ranged from 4.1 to 4.6 mg/L. Based upon the elevated groundwater table along with the presence of TPH-DRO in the soils at/near the groundwater interface, the presence of TPH-DRO is not unanticipated. Furthermore, results are consistent with nearby cross-gradient wells MW-10R for the same period.

- Results from MW-54 ranged from 5.2 to 6.1 mg/L. Based upon the presence of TPH-DRO in the soils at/near the groundwater interface, the presence of TPH-DRO is not unanticipated. Nearby down-gradient well MW-46 showed results slightly higher than MW-54, however this monitoring well was documented as still containing residual surfactant and said surfactant may still be releasing sorbed hydrocarbons.

- Results from MW-55 ranged from 0.16 to 0.46 mg/L. These low levels were not unexpected as there was minimal impact in the soil column above and that nearby cross-gradient well MW-32 was below detection limits. Nearby down-gradient wells (MW-13, MW-45, and MW-11) showed results slightly higher than MW-55, however these monitoring well were documented as still containing residual surfactant and said surfactant may still be releasing sorbed hydrocarbons.

- Results from MW-56 were below detection limits. This is not unexpected as there was no evidence of contaminated soils in the soil column above and that nearby cross-gradient and down-gradient wells (MW-33, MW-34, MW-35) were also below detection limits for the same period. Nearby well MW-20 showed results slightly higher than MW-56, however this monitoring well was documented as still containing residual surfactant and said surfactant may still be releasing sorbed hydrocarbons.

Summary:

The purpose of the subsurface investigation was to further document the presence and/or absence of free product, TPH-DRO, and other related compounds. The investigation also measured the levels (if any) of contaminants, and determined whether the results were consistent with previous findings from the other existing monitoring wells.

The following observations capture the substantive findings during these investigations.

1. As anticipated, subsurface investigation revealed no plume of free product in soils or groundwater.

2. As anticipated, subsurface investigation confirmed the absence of impacted soils in the upper soil column. Impacted soils were present at/near the groundwater interface at

select wells. This further supports the preferential pathway for the original source migration was primarily vertical in direction whereas upon reaching the groundwater, the petroleum then traveled horizontally via the groundwater.

3. As anticipated, water sampling results of the six (6) new wells are consistent with their nearby cross-gradient and down-gradient wells.

4. Water sample results from nearby wells indicate the presence of residual surfactant and said surfactant may still be releasing sorbed hydrocarbons.

The cumulative findings indicate that there are no pockets of free product which have not been appropriately addressed through the combined efforts of the pump and treat system coupled with the Ivey-sol® injection/extraction process. The results also indicate that the findings from the core samples and water testing results are comparable and quite consistent with the other monitoring wells in the immediate vicinity. Based on the 2015/2016 Summary Report, these subsurface investigation findings, and the ongoing quarterly and monthly sampling events, we believe as soon as the surfactant levels are below detection limits in all of the monitoring wells the results justify shutting down the pump and treat system and commencing with the required closeout process in accordance with the Settlement Agreement and Consent Order.

We look forward to your review and approval of the work plan so that we can initiate the scope outlined above and complete the effort consistent with the above referenced schedule.

Sincerely,

H&B Solutions, LLC

Dane S. Bauer
Member

Enclosures

Cc: Mayor Chris Cerino (Town of Chestertown) w/enclosures
Mr. Bill Ingersoll (Town of Chestertown) w/enclosures
Mr. Bob Sipes (Town of Chestertown) w/enclosures
Mr. Michael Forlini, Esq. (Funk & Bolton, PA) w/enclosures
Mr. John Beskid (Kent County Health Department) w/enclosures
Mr. Kenneth Kozel (SMCC) w/enclosures
Mr. James Sines (EBA Engineering, Inc.) w/enclosures
Mr. Michael Powell, Esq. (Gordon-Feinblatt, LLC) w/enclosures
Mr. Horacio Tablada (MDE) w/enclosures
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