



Groundwater & Environmental Services, Inc.

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Odenton, MD 21113

T. 800.220.3606

April 19, 2019

Susan Bull

Maryland Department of the Environment

Oil Control Program

1800 Washington Blvd.

Baltimore, MD 21230

**Re: Horizontal and Vertical Delineation Work Plan  
Bel Air Xtra Fuels No. 7805  
2476 East Churchville Road, Bel Air, Maryland  
MDE Case #2011-0112-HA and 2013-0007-HA  
Facility I.D. No. 12391**

Dear Ms. Bull:

Groundwater & Environmental Services, Inc. (GES), on behalf of Drake Petroleum Company, Inc. (Drake), is submitting this *Horizontal and Vertical Delineation Work Plan* to address the requested activities included within the *Modification to Sampling Frequency and Request for Work Plan*, Maryland Department of the Environment (MDE) directive, dated February 15, 2019. The MDE directive included a Work Plan submittal due date of March 29, 2019, but due to public information act (PIA) requests and historical document review an extension to April 19, 2019 was requested by GES and approved by MDE on March 21, 2019. This Work Plan covers investigation and sampling activities to complete the delineation of the source contaminants towards the west of the Site – 2476 East Churchville Road, Bel Air, MD (**Figure 1**). Concentrations of benzene, ethylbenzene, methyl-tert-butyl-ether (MTBE), total petroleum hydrocarbons – diesel ranges organics (TPH-DRO) and total petroleum hydrocarbons – gasoline range organics (TPH-GRO) remain in groundwater at the Site above MDE Groundwater Cleanup Standards as detected in monitoring wells MW-7R, MW-16S and MW-16I during the First Quarter 2019 event and RW-18 and RW-19 when they were last sampled during the fourth quarter 2019 sampling event.

Based on historical groundwater sampling results impacted groundwater remains in the overburden and shallow bedrock with predominant flow to the southwest. As a result, further assessment of the overburden (shallow), shallow bedrock (intermediate) and competent bedrock (deep) will be conducted to vertically and horizontally delineate each of the three water bearing zones to the west of the source area as detected within the Site monitoring well MW-7R.

#### Historical Document Review –

Evaluation of existing boring and geophysical logs for monitoring well clusters MW-16S/I/D and MW-17S/I/D provided critical information to the planning and design of the installation of proposed monitoring well cluster MW-21S, MW-21I and MW-21D (MW-21S/I/D). The site is underlain by a highly weathered gneiss bedrock with steeply dipping fracture planes striking in the N40°E to N60°E range. These bedrock fracture planes act as groundwater pathways and are consistent with regional structural trends of the Appalachian Mountain System. The in-situ weathering of this rock has



resulted in interbedded sand and clay with abundant mica minerals extending to depths of approximately 30 feet below grade (fbg) where competent, but highly fractured bedrock is encountered. Fracture density decreases at deeper intervals such that protective steel casings were set at depths of 58 fbg and 38 fbg in monitoring wells MW-16D and MW-17D; respectively. Evidence of fracturing and groundwater infiltration exist in both wells in the 80 – 85 fbg range and again at the 172 fbg range in monitoring well MW-16D.

Analysis of relative heads and vertical gradients using the Environmental Protection Agency (EPA) “center point to center point” method, indicates limited head differential across the three water bearing zones with slight downward vertical gradient as determined from the monitoring well clusters MW-16S/I/D and MW-17S/I/D. This data suggests an integrated hydraulic system, which is typical of the Appalachian Piedmont Region. Water supply wells or domestic potable wells installed in the Piedmont often encounter the best production at or immediately beneath the transition from overburden (saprolite regolith) to the underlying crystalline parent rock (gneiss). As noted above and evident upon examination of the geophysical logs for MW-16S/I/D and MW-17S/I/D this transition zone is where fracture density is the greatest. However, this groundwater is also closely interrelated with storage in the overburden and offers a migration pathways for groundwater from the shallow water bearing zone, which is most likely to be affected by potential sources. For this reason, it is sometimes necessary to case off the first productive water bearing zone in bedrock and evaluate deeper zones for sustained production. A quality geologic and geophysical evaluation completed to a depth of 200 feet as recommended by the MDE will allow for further evaluation of the different water bearing zones and potential pathways.

### Well Installation –

As requested within the February 15, 2019 MDE directive, GES on behalf of Drake, will vertically and horizontally delineate dissolved phase impacts of the shallow, intermediate and deep water bearing zones to the west of the Site on or near the La Tolteca Mexican Restaurant property (La Tolteca) located at 2350 East Churchville Road, Bel Air, MD. Previous attempts have been made to gain access to La Tolteca with no success. If access is not granted for the La Tolteca, GES on behalf of Drake, will attempt to gain access to the further downgradient properties 2308 or 2310 East Churchville Road for the installation of the delineation monitoring well cluster MW-21S/I/D. The proposed monitoring well cluster locations are shown attached on **Figure 1**, as well as the potential back-up locations if access is not successfully obtained for La Tolteca.

Based on the successful installation of monitoring well clusters MW-16S/I/D and MW-17S/I/D, monitoring well cluster MW-21S/I/D is proposed to assess the shallow, intermediate and deep water bearing zones to the west of the Site utilizing three separate boring locations. The use of three separate borings to assess the different water bearing zones is recommended as this will restrict the potential for cross contamination from the potentially impacted shallow and intermediate zones into the deeper water bearing zones. In addition, this will eliminate the potential for short circuiting as a result of annulus construction issues, which can occur in nested monitoring well locations. The proposed potential locations are shown on the attached **Figure 1**, but the final locations will be confirmed following completion of utility mark-out and access agreement execution. Well installation specifications will follow Code of Maryland (COMAR) regulations as outlined in COMAR 26.04.04.

Following the MDE approval of the Work Plan, execution of an access agreement and permit approval, a private utility mark-out (PUMO) will be completed utilizing ground penetrating radar (GPR) and electromagnetic (EM) to locate subsurface utilities. Following the completion of a PUMO event, utility clearance will be conducted as verification including air knife technology to a minimum depth of 5 fbg. Once the borehole locations are cleared, each will be installed to termination depths as detailed below:

- **MW-21S** – will be installed utilizing hollow stem augers to refusal or an approximate termination depth of 30 fbg. Soils will be field screened continuously for volatile organic compounds (VOCs) utilizing a calibrated photoionization detector (PID) and lithology documented. One soil sample will be submitted for laboratory analysis from the highest PID interval or just above the water interface if no readings are detected for analysis of



- full-suite VOCs via EPA Method 8260, TPH-DRO and TPH-GRO via EPA Method 8015. The soil sample will be submitted to SGS-Accutest of Dayton, NJ (Accutest);
- MW-21I – will be installed within close proximity to monitoring well MW-21S utilizing air rotary from the surface. Soil cuttings will be screened using a PID and logged as applicable, but these capabilities are limited with air rotary drilling methodology. Air rotary will be continued 5 feet into competent bed rock, assumed to be at an approximate depth of 40 fbg, prior to setting and grouting a 6-inch polyvinyl chloride (PVC) casing in place. The casing will be allowed to set for a minimum of 24-hours and will seal off the upper shallow water bearing zone. Once the casing has set completely, drilling will commence with air rotary methodologies through the casing to an approximate termination depth of 80 fbg. Soil sampling is not expected as this well will be set in rock; and
  - MW-21D – will be installed within close proximity to monitoring wells MW-21S and MW-21I utilizing air rotary from the surface. Soil cuttings will be screened using a PID and logged as applicable, but these capabilities are limited with air rotary drilling methodology. Air rotary will be continued 5 feet into competent bedrock, assumed to be at an approximate depth of 40 fbg, prior to setting and grouting an 10-inch PVC casing in place. The casing will be allowed to set for a minimum of 24-hours and will seal off the upper shallow water bearing zone. Once this 8-inch casing is set drilling will commence with air rotary methodologies through the casing to an approximate depth of 100 fbg where a second 6-inch casing will be set and grouted to seal off the intermediate water bearing zone. Following a 24-hour period once the grout has set completely on the second casing monitoring well MWE-21D will be drilled utilizing air rotary methodology to an approximate depth of 200 fbg. Soil samples will not be collected.

The depths included above for casing and termination depths are assumed based on review of the Brown & Caldwell logs for the monitoring well clusters MW-16S/I/D and MW-17S/I/D, but the final termination depths of MW-21S/I/D will be made in consultation with the Maryland licensed well driller. As geophysical investigations are not suited for evaluating shallow overburden, monitoring well MW-21S will be installed to an approximate depth of 30 fbg and will be constructed of 2-inch schedule 40 PVC with a 20 foot machine slotted 0.020-inch well screen from 10 fbg to 30 fbg. Within the borehole annulus #2 sand pack will be inserted to 2 feet above the top of well screen to an approximate depth of 8 fbg and followed by approximately 2 feet of clay bentonite seal to 6 fbg. Once the bentonite seal is applied, the annulus will be grouted from 2 fbg to 6 fbg with the surface finished as a concrete 2 foot by 2 foot flush mount manhole with a locking gripper plug. The final construction of monitoring wells MW-21I and MW-21D will be completed in a separate mobilization following the completion of subsurface geophysics. As such, these locations will be left as open boreholes below the cased off depths to allow for evaluation of the competent rock and potential fracture pathways.

Once monitoring wells MW-21I and MW-21D have been drilled to termination depths a subsurface geophysical investigation will be coordinated to be completed in each location. The geophysical investigation within monitoring well MW-21I will be completed from approximate depths of 40 fbg to 80 fbg and within monitoring well MW-21D from approximate depths of 100 fbg to 200 fbg. Geophysics will be completed from the first exposed borehole depth to borehole termination. The geophysical investigation will consist of the following data collection methods:

- caliper;
- natural gamma;
- fluid temperature;
- electrical logs – fluid resistivity and single point resistance;
- optical or acoustic televiewer; and
- heat pulse flowmeter – both ambient and pumping at finite number of selected intervals.

Once the geophysical investigation is complete, the geophysical data in conjunction with the monitoring well MW-21I and MW-21D boring logs will be evaluated to formulate the construction parameters for the intermediate and deep locations.

Upon completion of the geophysical investigation and data evaluation, 2-inch PVC monitoring wells MW-21I and MW-21D will be installed to depths corresponding to potential fractures and water bearing zones. Each monitoring well, MW-21I



and MW-21D, will be installed to assess separate water bearing zones while sealing off other zones. The 0.020 machine slotted well screens for each will be approximately 10 feet in length as to only allow infiltration from discrete selected zones that have the greatest capability of water production and the most likely preferential pathways. Upon completion of installation activities, the monitoring wells will be developed and water contained for proper off-site disposal. In addition, each top of casing will be surveyed into the existing monitoring well network to allow for inclusion in the assessment of groundwater elevations and groundwater contouring.

### Identified Derived Waste–

Soil cuttings produced from drilling activities will be containerized in either drums or a covered roll-off and excess waste water produced during drilling activities will be containerized in plastic totes or drums. The totes/drums will be disposed off-site at an approved facility. The roll-off/drums of soil will also be hauled off-site for proper disposal. Prior to off-site disposal the waste containers will be staged on-Site. Upon completion of waste disposal, waste manifest documentation will be included within the Subsurface Investigation Report (SIR) submitted to the MDE.

### Groundwater Sampling –

As requested within the February 15, 2019 MDE directive, groundwater samples from the monitoring well cluster MW-17S/I/D will be collected on a semi-annual basis, increasing from the current annual schedule. The semi-annual samples will be collected during the Second and Fourth Quarter sampling events. As a result, the breakdown of samples per quarter is detailed below:

- First Quarter – MW-7R, MW-14, MW-16S and MW-16I;
- Second Quarter – MW-7R, MW-14, MW-16S, MW-16I, MW-17S, MW-17I and MW-17D;
- Third Quarter – MW-7R, MW-14, MW-16S and MW-16I; and
- Fourth Quarter – MW-7R, MW-8, MW-9, MW-14, MW-15S, MW-15D, MW-16S, MW-16I, MW-16D, MW-17S, MW-17I, MW-17D, RW-18 and RW-19.

Sampling of the newly installed monitoring wells MW-21S, MW-21I and MW-21D will occur following installation with a minimum of two weeks allowed for equilibration and will be included within the quarterly events for a minimum of one year to assess groundwater trends. Groundwater samples will be submitted to Accutest for laboratory analysis of full-suite VOCs including fuel oxygenates and naphthalene via EPA Method 8260, and TPH-DRO and TPH-GRO via EPA Method 8015. Furthermore, to understand the origin of TPH-DRO concentrations detected historically in monitoring wells across the site including down-gradient monitoring wells MW-17S, MW-17I and MW-17D; silica gel cleanup (SGC) analysis is recommended. This analysis will allow GES to understand if the concentrations detected are representative of petroleum originated constituents or other potential polar metabolites not associated with the petroleum releases at the Site. SGC analysis will be conducted utilizing the “cartridge” method as it provides a more accurate evaluation of the TPH-DRO concentration origins. Additionally, a surrogate sample will be run as quality control to ensure the accuracy of the method.

### Potable Well Sampling –

As TPH-DRO concentrations have been detected in downgradient monitoring wells MW-17S, MW-17I and MW-17D, prior to the recent precipitation driven water table elevation increase, semi-annual sampling will be conducted on the 2303 E Churchville Road potable well. Sample collection will occur during the Second and Fourth Quarters for the analysis of full suite VOCs via EPA Method 524.2. Copies of the sampling results will be supplied to the property owner, the MDE and the Harford County Health Department (HCHD). Point of entry treatment (POET) sampling will continue on a quarterly basis for the domestic potable well located at 1 Meadow Springs Drive for analysis of full suite VOCs via EPA Method 524.2. The sampling results for this location are supplied to the home owner, MDE and HCHD quarterly.

### Schedule –



The project schedule is subject to change depending on various potential delays, but will be planned as follows:

- submit access agreement to La Tolteca property owner within 10 business days of MDE Work Plan approval;
- submit well construction permit applications within 10 business days of access agreement execution;
- drill three boreholes to termination depths and install monitoring well MW-21S within 30 business days of well permit approval;
- conduct geophysical investigation within open boreholes for monitoring wells MW-21I and MW-21D within 10 business days of borehole installation;
- supply summary of findings of geophysical investigation and recommendations for MW-21I and MW-21D well construction specifications to MDE within 15 business days of receiving data package from geophysics subcontractor;
- return to site to install MW-21I and MW-21D in the open boreholes within 15 business days of MDE well specification approval;
- collect groundwater samples from the new well locations during the next sampling period at least greater than two weeks following final monitoring well installation; and
- submit SIR to MDE within 45 days of groundwater sampling data receipt from MW-21S/I/D.

Should you have any questions or require further information, please contact either of the undersigned at (800) 220-3606 extension 3725 or 3703, respectively.

Sincerely,

**GROUNDWATER & ENVIRONMENTAL SERVICES, INC.**

A handwritten signature in blue ink, appearing to read 'Timothy Boswell'.

Timothy Boswell  
Case Manager – Geologist





A handwritten signature in blue ink, appearing to read 'Andrea Taylorson-Collins'.

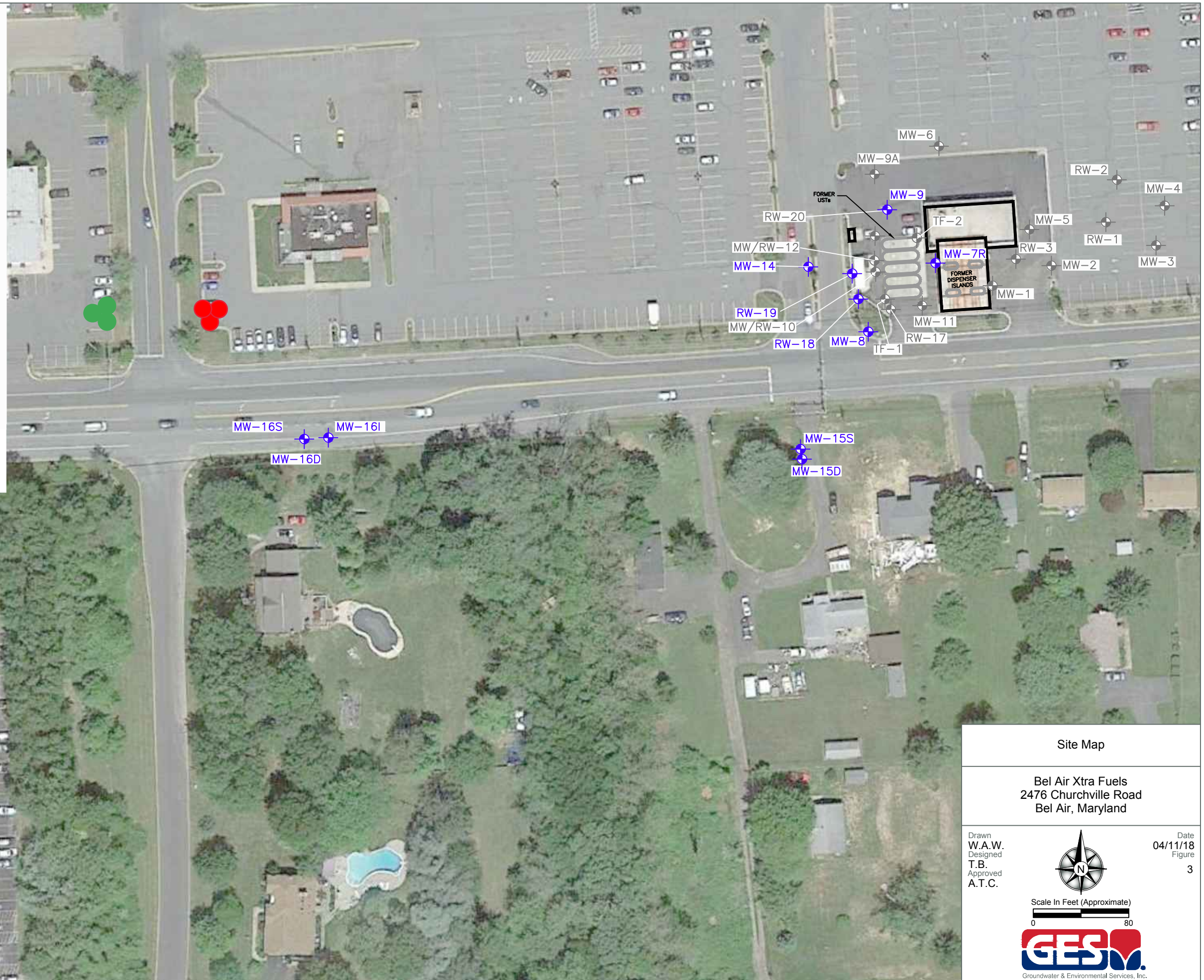
Andrea Taylorson-Collins  
Senior Project Manager – Environmental Scientist

Attachment

C: Eric Harvey, Drake Petroleum – via email  
GES PSID# - 775186

**LEGEND**

-  MONITORING WELL
-  ABANDONED MONITORING WELL
-  Proposed MW-21S/I/D
-  Potential back-up well locations at 2310 or further downgradient property (not visible) 2308 E Churchville Road



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