ADVANTAGE ENVIRONMENTAL CONSULTANTS, LLC

Bedrock Well Installation Work Plan
Gasoline Fueling Station – Royal Farms #96
500 Mechanics Valley Road
North East, Cecil County, Maryland 21901

OCP Case No. 2011-0729-CE
MDE Facility No. 13326

AEC Project Number: 05-056 RF096

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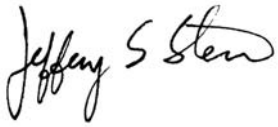

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TABLE OF CONTENTS

APPENDICES

FIGURES

1.0 INTRODUCTION

This Bedrock Well Installation Work Plan has been developed for Royal Farms Gasoline Fueling Station No. 96 located at 500 Mechanics Valley Road, North East, Cecil County, Maryland (hereinafter referred to as the "Site"). A Site Vicinity and Site Features Map are included in Attachment A as Figures 1 and 2, respectively. This work plan is intended to satisfy certain requirements outlined in a Maryland Department of the Environment (MDE) correspondence dated October 6, 2011.

The Site is located southeast of the intersection of Mechanics Valley Road and Pulaski Highway in a commercial/residential area in North East, Cecil County, Maryland. The Site is developed with a convenience store/gasoline fueling station and associated landscaped, asphalt- and concrete-paved areas. The surrounding properties include single family residences to the west, and commercial properties to the south, east and north. A Site Area Map is included as Figure 3 in Appendix A.

The purpose of the bedrock well installation will be to further assess contaminant migration to private off-site drinking water supply wells. Specifically, this will entail the installation of three bedrock monitoring wells located between the known contaminant plume and three off-site bedrock supply wells.

On June 8, 2011, AEC was performing an annual groundwater sampling event in accordance with Code of Maryland Regulations (COMAR) 26.10.02.03-04, when approximately two-inches of LPH were detected in groundwater monitoring well MW-3. The LPH was observed to be golden in color, indicating 'un-weathered' gasoline. AEC inspected the submersible turbine pump (STP) containment sumps, which were observed to be free of LPH. Royal Farms was informed of the field observations made by AEC and a suspected release of petroleum was reported to the MDE Oil Control Program (OCP) on June 8, 2011. On June 13, 2011 the MDE opened a case in response to a report of evidence of a petroleum spill at the Site. Based on LPH plume configuration, laboratory analytical data and field observations during UST system piping removal, the source of the release is likely in the vicinity of dispensers 3/4 and 7/8 (see Figure 2 in Appendix A).

The Site recently underwent an underground storage tank (UST) system replacement. The Site formerly operated three double-walled, composite (steel with fiberglass reinforced plastic (FRP)) USTs which distributed fuel to 12 product dispensers, including two satellite diesel dispensers. The former system was installed in 1999 and consisted of the following: a 20,000 gallon unleaded regular UST, a 12,000 gallon super unleaded UST, and a 12,000 gallon diesel UST. The replacement USTs consist of one 20,000-gallon and one 30,000-gallon double walled FRP USTs. The 20,000-gallon UST is split into a 12,000-gallon compartment for diesel and an 8,000-gallon compartment for premium unleaded gasoline. The entire 30,000-gallon UST contains regular unleaded gasoline. Product piping consists of double-walled flexible plastic within plastic chase pipes, and stage II vapor recovery piping consists of double-walled FRP.

According to the Maryland Geological Survey's Geologic Map of Maryland (1968); the Site is located in the Atlantic Coastal Plain physiographic province, which is situated east of the fall line that separates the unconsolidated sediments of the Atlantic Coastal Plain province from the metamorphic units of the Piedmont. According to the map, the Site is underlain by Quaternary (Pleistocene to present) Lowland Deposits. This formation consists of irregularly distributed beds of sand, gravel, sandy clay, and clay. The sandy components are medium- to course-grained quartz sand with cobbles and boulders near the base. Most beds are lenticular and change rapidly in character over short distances. The finer grained materials consist of varicolored silts and clays and brown to dark gray lignitic silty clay. This formation lies unconformably on the Port Deposit Gneiss which is a moderately to strongly deformed intrusive complex composed of gneissic biotite quartz diorite, hornblende-biotite quartz diorite, and biotite granodiorite. These rocks are reportedly foliated and some strongly sheared. The Port Deposit Gneiss formation outcrops to the west of the Site along the North East Creek alignment.

The offsite potable well locations are shown on Figure 3 in Attachment A. Also shown on this map and the table below are the well completion characteristics such as total depth and casing depth as described in the various MDE well completion reports. The well completion information for 487 Mechanics Valley Road was verbally relayed to AEC by the MDE. No permit or well completion information has been found for 513 Mechanics Valley Road. Based on visual observation, water from the potable well at 505 Mechanics Valley Road also services the business at 513 Mechanics Valley Road.

Address	**Well Depth (ft)**	**Casing Depth (ft)**	**Sand/Gravel Interval (ft)**	**Depth to Bedrock (ft)**
463 Mechanic Valley Road	400	60	10-30	53
475 Mechanic Valley Road	400	64	30-45	60
487 Mechanic Valley Road	25	No data	No data	No data
493 Mechanic Valley Road	165	55	3-45	50
500 Mechanic Valley Road	350	63	26-60	60
505 Mechanic Valley Road	147	40	0-10	38
513 Mechanic Valley Road	No data	No data	No data	No data
10 Montgomery Drive	360	60	26-60	55

Based on the well construction information all but one of the wells (487 Mechanic Valley Road) uses the Port Deposit Gneiss as a water source. The 487 Mechanic Valley Road well is reportedly hand dug and draws water from the surficial material.

2.0 WELL INSTALLATION PROCEDURES

2.1 Bedrock Well Location Selection

Three bedrock wells will be installed between the known contaminant plume and three off-site bedrock supply wells. Figures 2 and 3 in Appendix A illustrate these locations. The bedrock wells will be part of three nested well couplings and be installed within 8 feet of the previously placed shallow monitoring wells (MW-10, MW-12, and MW-13). The locations may be adjusted in the field based on the locations of site utilities and subsurface structures. The bedrock wells will be installed to a maximum depth of 100 feet below ground surface (bgs). This depth was selected based on a review of the offsite potable well logs and dissolved phase plume configuration.

2.2 Procedure

Public utility clearances will be obtained prior to the initiation of the sampling program. This will entail contacting Miss Utility at least 72 hours prior to drilling activities. All drilling work will be performed by a State of Maryland-licensed well driller and appropriate well permits will be obtained from Cecil County.

In order to properly seal off the top portion of the overburden, to prevent caving, the upper portion of the well will be constructed using steel or PVC casing. Specifically, an air rotary or hollow stem auger drill rig will first advance a nominal 10-inch diameter drill string to a depth between 40 and 60 feet bgs depending on depth to competent bedrock. Seven-inch diameter steel or PVC casing will be fitted with a drive shoe and installed to the total depth of the initial borehole. The annular space between the seven-inch casing and the borehole will be positive pressure grouted to the ground surface.

After allowing the grout to set at least 24-hours, a six inch diameter drill bit will be used to drill to 100 feet bgs. The monitoring well will be left as an open borehole within the bedrock. The wells will be completed with a flush mounted housing secured in a 2’ x 2’ concrete pad. Locking well caps will be placed on each of the wells and locked with padlocks.

The soil cuttings will be evaluated through out the drilling process and involve the inspection of the material at 5-feet intervals. Soils will be logged for grain size, texture, color, odor, hydrocarbon staining, and field screened using for volatile organic compounds (VOCs) using a photoionization detector (PID).

Approximately one week after well installation over-pumping via the air rotary rig will initially be used to develop the wells and remove potential suspended material from the water column. Should the wells produce significant water the wells will be developed by a combination of pumping with a submersible pump and surging with a surge block. The development water will be containerized in 55-gallon drums and handled as discussed below.

Prior to arriving at the Site all augers, core barrels, cutting shoes, rods, tips, samplers, tools, and other down-hole equipment will be power washed with clean water. Fuel, lubricants, and other similar substances will be handled in a manner consistent with accepted standard operating practices and be stored away from the well construction materials.

The relative elevation of the new well's top of casing will be determined to within 0.01 feet using a rod and transit. This measurement will be taken relative to an existing monitoring well. Groundwater levels within each monitoring well associated with the Site will be measured using an electronic water level indicator accurate to 0.01 feet. The groundwater levels will be correlated with the well head elevations for use in developing a groundwater gradient map and determining vertical gradients.

2.3 Waste Management Procedures

Investigation-derived water and soil will be containerized in 55-gallon drums, labeled (date of generation, site name/address, source, and contents), and, staged on the Site. The soil drums will be composite sampled and analyzed for benzene, toluene, ethylbenzene, and total xylenes (BTEX) via EPA Analytical Method 8021, and TPH DRO and GRO via EPA Analytical Method 8015. These materials will be staged no longer than 90 days before they are characterized, transported and disposed according to applicable United States Department of Transportation (USDOT), EPA, and MDE regulations. AEC will retain copies of all bills of lading, manifests, receipts and/or waivers that were signed prior to transport. Copies of these documents will be included in the Work Plan Implementation Report.

3.0 SCHEDULING

All field and reporting activities associated with this work plan are anticipated to be completed within 25 days after authorization by the MDE and the client. The MDE will be notified of AEC's field schedule at least five business days prior to the start of work plan implementation. The following is a summary of major project milestones and associated estimated times of completion:

Event	Approximate Schedule (days)
MDE approves Work Plan	Day X
Procure Necessary Permits	X + 4
Complete Well Installation	X + 12
Complete Well Development	X + 20
Submit Work Plan Implementation Report to MDE	X + 25

4.0 REPORTING

Information developed from the investigation will be assembled into a report including the following information: report summary; physical site description; site vicinity map; well location map; description of the sampling program; and soil-boring and well construction logs. Four hard copies and an electronic copy of the report will be submitted to the MDE.

APPENDIX A

FIGURES