

Draft Final Closure Report  
*Sykesville Oil Site*  
*Sykesville, Maryland*

01 July 2014

EPA Docket No.: CWA-03-2005-0150CW

MDE Case No.: 2004-1496CL

**Environmental Resources Management, Inc.**  
200 Harry S Truman Parkway  
Suite 400  
Annapolis, MD 21401

## TABLE OF CONTENTS

<b>LIST OF ACRONYMS</b>		<b><i>iii</i></b>
<b>1.0</b>	<b>INTRODUCTION AND BACKGROUND</b>	<b>1</b>
<b>1.1</b>	<b>BACKGROUN</b>	<b>1</b>
<b>2.0</b>	<b>IMPLEMENTATION OF REMEDIAL ACTIONS PLAN</b>	<b>5</b>
<b>2.1</b>	<b>INTERIM MEASURES</b>	<b>5</b>
<b>2.2</b>	<b>SITE SECURITY AND FIRE PROTECTION</b>	<b>5</b>
<b>2.3</b>	<b>EXTENT OF CONTAMINATION STUDY PLAN</b>	<b>5</b>
<b>2.4</b>	<b>ABATEMENT PLAN</b>	<b>7</b>
<b>2.5</b>	<b>SITE RECOVERY/RESTORATION PLAN</b>	<b>7</b>
<b>2.6</b>	<b>HEALTH AND SAFETY PLAN</b>	<b>8</b>
<b>2.7</b>	<b>PROGRESS REPORTS</b>	<b>8</b>
<b>3.0</b>	<b>FARM CLOSURE</b>	<b>9</b>
<b>4.0</b>	<b>SEEP AREA CLOSURE</b>	<b>11</b>
<b>4.1</b>	<b>PRODUCT MONITORING AND RECOVERY</b>	<b>11</b>
<b>4.2</b>	<b>REPLANTING</b>	<b>12</b>
<b>5.0</b>	<b>FACILITY BIOVENTING AREA CLOSURE</b>	<b>13</b>
<b>5.1</b>	<i>Assessment of Current Conditions</i>	<b>13</b>
<b>5.3</b>	<i>Proposed Actions</i>	<b>14</b>
<b>6.0</b>	<b>ASSESSMENT OF SEVEN RISK FACTORS</b>	<b>16</b>
<b>7.0</b>	<b>SUMMARY AND CONCLUSIONS</b>	<b>19</b>

## LIST OF FIGURES

<b>1</b>	<b><i>Site Location Map - 580 Obrecht Road and Adjacent Property</i></b>
----------	--

- 2      *Site Topographic Map - 1711 Dennings Road*
- 3      *Facility Area and Seep Area Monitoring Well Location Map*
- 4      *Conceptual Cross Section*
- 5      *Seep and Facility Area Product Thickness Hydrographs*
- 6      *Replanting Plan*
- 7      *Bioventing System Soil Sampling Locations – August 2013*
- 8      *TPH-GRO Concentrations in Soil – Bioventing System Sample Locations*

#### **LIST OF TABLES**

- 1      *Summary of Well Locations*
- 2      *Cumulative Product and Water Recovered*
- 3      *Summary of Performance Sample Results for Bioventing System Through August 2013*

#### **APPENDICES**

- A      *Referenced Progress Reports*
- B      *Construction Completion Report Removal of Petroleum-Impacted Soils at the Fogle's Farm*
- C      *Supporting Information for Product Monitoring Case Closure*
- D      *Construction Completion Report for Abandonment of Monitoring Wells, Sumps, and the Underflow Dam*
- E      *Tree Planting Photographic Log*

## *LIST OF ACRONYMS*

AOC	Administrative Order of Consent
AST	Above-ground Storage Tank
bgs	Below Ground Surface
COMAR	Code of Maryland Regulations
DRO	Diesel Range Organics
EMA	Episcopal Ministries to the Aging, Inc.
EOCS	Extent of Contamination Study
EPA	U.S. Environmental Protection Agency
ERM	Environmental Resources Management, Inc.
Fogle's	Fogle's Septic Clean, Inc.
GRO	Gasoline Range Organics
HASP	Health and Safety Plan
LPH	Liquid Phase Hydrocarbons
LUST	Leaking Underground Storage Tanks
MDE	Maryland Department of the Environment
MEAT	Maryland Environmental Assessment Technology
MOSH	Maryland Occupational Safety and Health
NRC	National Response Center
OCP	Oil Control Program
ppm	Parts per Million
PRFA	Pollutant Removal Funding Authorization
RAP	Response Action Plan
TPH	Total Petroleum Hydrocarbon
USACE	United States Army Corps of Engineers

Environmental Resources Management (ERM) has prepared this Final Closure Report on behalf of Fogle's Septic Clean, Inc. (Fogle's), to summarize activities associated with the implementation of the Response Action Plan (RAP) for the Fogle's Facility located at 580 Obrecht Road, Sykesville, Maryland (Figure 1) as part of the U.S. Environmental Protection Agency (EPA) led cleanup action for the Sykesville Oil Site (the Site).

Collectively, the Site consists of three separate areas. The main location is the Fogle's property (the "Facility") which is located in a residential/rural area just north of the intersection of Wimmer Lane and Obrecht Road in the town of Sykesville, Carroll County, Maryland (mailing address 580 Obrecht Road) (Figure 1). Fogle's business operations at and from the Facility include septic service, waste collection, excavating, well drilling, and pump services. Additionally, the Site includes two areas outside of the Facility. The first is a wooded area containing an unnamed creek adjacent to and downgradient from the Facility, which is owned by Episcopal Ministries for the Aging (EMA) and is referred to as the Hill Slope and Seep Areas, or simply the Seep Area (Figure 1). The second area is a portion of a farm (the Fogle's Farm or the Farm) owned by Fogle's and located at 1711 Dennings Rd., New Windsor, Maryland, where soils excavated from the Facility were placed (Figure 2).

EPA approved closure of the Farm area of the Site via its notice dated 24 September 2012. Upon the Maryland Department of the Environment's (MDE's) acceptance of the Seep Area Closure report, on 12 March 2014, the EPA requested Fogle's proceed with the overall Final Report as per Section 9.11 of the 28 April 2005 Administrative Order by Consent (AOC) (Docket No. CWA-03-2005-0150CW).

## 1.1

### BACKGROUND

On 28 January 2004, National Response Center (NRC) spill report #711788 was referred by EPA to the MDE Emergency Response Division. This report identified an oil seep emanating from the ground and impacting the unnamed creek at the base of the steep slope located adjacent to and north of the Fogle's Facility.

In early 2004, Maryland Occupational Safety and Health (MOSH) conducted a site inspection and suggested to Fogle's that they provide secondary containment for a 10,000-gallon above-ground storage tank (AST) used to store #2 diesel fuel, located at the northern edge of the Facility. Following this recommendation, in early 2004, Fogle's relocated the 10,000-gallon AST on the Facility and installed secondary containment around the tank. During the relocation, fuel-impacted soils observed

beneath the tank were reportedly excavated to 15 feet below ground surface (bgs) and transported to the Fogle's Farm.

In early March 2004, MDE's environmental cleanup contractor began to mitigate the oil release to the unnamed creek by placing sorbent pads and booms at the seep location and in the creek. On 30 March 2004, MDE requested assistance from EPA Region III's Removal Response Section. The EPA issued a Pollutant Removal Funding Authorization (PRFA) to the United States Army Corps of Engineers (USACE), Baltimore District. Under the PRFA, the USACE hired a cleanup contractor (Plexus Scientific) to perform the seep mitigation activities. In December 2004, initial investigations conducted by EPA confirmed the presence of oil on the water table in three monitoring wells located adjacent to the oil seep area. The USACE also identified petroleum hydrocarbons in soils and on the water table in the area and immediately down gradient of the former 10,000-gallon AST.

An AOC (Docket No. CWA-03-2005-0150CW) was agreed to by Fogle's and the EPA on 28 April 2005. The stated purpose of the AOC was "to abate, mitigate, and/or eliminate any threat to public health and welfare and the environment" posed by the oil. As part of the AOC, as identified in Section 9.3, the following should be accomplished for the Site:

- a. Provide site security sufficient to preclude access by persons not conducting or overseeing the response action required by this Consent Order;
- b. Provide fire protection appropriate to the conditions at the Site;
- c. Develop and submit for approval an extent-of-contamination study which will characterize the nature, concentration, extent and depth of oil contamination at the Site;
- d. Implement the approved extent-of-contamination study identified in subparagraph 9.3(c);
- e. Provide a work plan/remedy for removal/mitigation of contaminated soils. Plan/remedy can include excavation and proper disposal of and/or treatment of soils identified as a result of the approved extent-of-contamination study identified in subparagraph 9.3(c) with a total petroleum hydrocarbons (TPH) concentration greater than 5 parts per million (ppm);
- f. Conduct post-excavation and/or treatment sampling to ensure that soil TPH levels at the Site are below 5 ppm after completion of the work described in subparagraph 9.3 (e);
- g. Transport all contaminated soils and other materials designated for off-site disposal to an EPA-approved disposal facility in accordance with U.S.

Department of Transportation requirements, and assure their proper disposal in accordance with applicable laws and regulations;

- h. Restore excavated area to original conditions by performing site restoration and re-vegetation;
- i. Treat and/or remove and properly dispose of offsite contaminated water generated as a result of the above items (e.g. equipment and sampling-related fluids) in accordance with promulgated requirements and standards;
- j. Provide site specific health and safety measures, including preparation and implementation of a Health and Safety Plan (HASP) for actions to be performed at the Site, to protect the health and safety of workers, other personnel and the public from the oil and/or hazardous substances and work-related health and safety hazards during performance of the response action specified herein. The HASP shall, as appropriate, provide for proper decontamination of personnel and equipment, monitoring and control of offsite migration of oil and/or hazardous substances during the performance of activities at the Site and protection of public health from exposure to hazardous substances during the conduct of activities at the Site pursuant to this Consent Order. Health and safety requirements in the HASP shall be at least as stringent as those set forth in Occupational Safety and Health Administration and EPA requirements, including but not limited to, requirements contained in 29 C.F.R. § 1910.120 and/or EPA Standard Operating Safety Guides (July 5, 1988); and
- k. Develop and follow an expeditious schedule for implementation of the Response Action Plan (RAP).

On 11 May 2005, on behalf of Fogle's, ERM replaced the USACE contractor and commenced the performance of fluid recovery at the sumps and maintenance of the sumps. ERM prepared a RAP dated 27 May 2005 for the Site, which was submitted to EPA and subsequently approved on 31 May 2005.

This report summarizes cleanup and closure activities performed under and subsequent to the EPA-approved RAP and the AOC as documented in the following submittals:

- Extent of Contamination Study Report, Sykesville Oil Site, Sykesville, MD dated 3 April 2006;
- Abatement Plan, Sykesville Oil Site, Sykesville, MD dated 5 January 2007;
- Supporting Information for Product Monitoring Case Closure, Sykesville Oil Site, Sykesville, MD dated 12 September 2011;

- Construction Completion Report, Removal of Petroleum-Impacted Soils at the Fogle's Farm, Sykesville Oil Site, Sykesville, Maryland dated 14 September 2012 (approved by EPA on 24 September 2012); and
- Construction Completion Report for Abandonment of Monitoring Wells, Sumps, and the Underflow Dam, Sykesville Oil Site, Sykesville, MD dated 20 February 2014 (approved by EPA on 12 March 2014).



## **2.0            *IMPLEMENTATION OF REMEDIAL ACTION PLAN***

### **2.1            *INTERIM MEASURES***

Pursuant to Section II of the AOC, interim measures were required to contain and prevent any existing discharge of oil to shorelines and navigable waters until final abatement, mitigation and/or elimination of the discharge or threat of discharge of oil from the Site was approved by the EPA. Section 3.1 of the RAP details the interim measures to be performed and maintained at the Site. ERM maintained these measures until their removal was approved by notification from EPA on 24 September 2012. Maintenance of interim measures was documented in weekly and monthly Progress Reports. Milestone Progress Reports (Progress Reports 106 and 107, documenting the final weekly monitoring and product recovery events, and the conclusion of interim measures, respectively) are included as Appendix A.

### **2.2            *SITE SECURITY AND FIRE PROTECTION***

Items 9.3 (a) and (b) of Section IX of the AOC required Fogle's to provide site security to preclude access by persons not conducting or overseeing the response actions and fire protection appropriate to the conditions of the Site. Section 3.2 of the RAP details the security and fire prevention measures to be taken at the Site. Work activities performed at the Site complied with the measures specified in the RAP.

### **2.3            *EXTENT OF CONTAMINATION STUDY***

Item 9.3 (c) of Section IX of the AOC required the development and submission to EPA of an Extent of Contamination Study (EOCS) Plan for the Site. The EOCS Plan was prepared and submitted to EPA for approval on 7 June 2005.

The EOCS Plan was implemented in late 2005 and early 2006. Investigation tasks undertaken included:

- Document review;
- Geophysical study of the Facility;
- Passive soil gas survey of the Facility and Hill Slope and Seep Areas;

- Collection and analysis of soil samples from the Facility, Hill Slope and Seep Areas, and the Fogle's Farm;
- Installation and monitoring of 5 new monitoring wells at the Facility and the Hill Slope and Seep areas; and
- Pumping tests to assess the recovery of free product as well as the hydraulic conductivity of the impacted soils to aid in the design of any necessary oil recovery systems.

The methods and results of the EOCS were presented to the EPA in the Extent of Contamination Study Report, dated 3 April 2006. Significant findings included the following:

- Soil Contamination
  - Elevated concentrations of TPH (gasoline range organics [GRO] and diesel range organics [DRO]) present in soil below 15 feet at the Facility in the area of the former 10,000-gallon AST. The average TPH concentration detected was 20,000 mg/kg.
  - Downgradient of the Facility at the Seep Area, residual TPH contamination was present along the water table, as a result of free product migration along the water table surface. The maximum concentration detected was 2,970 mg/kg total TPH.
  - Surface soils at the Fogle's Farm had a maximum concentration of 1,000 mg/kg TPH. No petroleum hydrocarbons were detected in the soils underlying those placed at the farm from the Facility in 2004.
- Presence and Migration of Free Product
  - Free product was not detected in well MW-FG01 (near the former AST), but was detected in wells MW-A01, MW-A02S and MW-A03S, which were located just north of the Facility at the top of the Hill Slope Area. The average thickness of free product detected at the wells was 0.55 feet. The estimated width of the Facility impacted by free product was estimated to be about 25 feet.
  - A conceptual model for subsurface stratigraphy and free product migration was developed (Figure 4). Free product at MW-A02S was pooled behind a ridge in the bedrock. The free product moved downgradient from the Facility along the water table and was retarded as the water table passed through the soil into the bedrock.

Once in the bedrock, the free product most likely traveled down gradient along bedding planes and thin fractures.

- In the Seep Area, free product was present in sumps A, B, C, and D and in monitoring wells TMW-B1, B2, and C1. The estimated area impacted by free product was about 90 feet wide and extended from the seep up the slope to the Facility.
- As of February 2006, a total of 3,626 gallons of free product had been recovered from the wells and sumps in the Seep Area. While the aerial extent of the free product impact had not changed in this time the thickness of free product present had decreased significantly.

## **2.4 ABATEMENT PLAN**

As required by Item 9.3 (e) of Section IX of the AOC and Section 3.4 of the RAP, an Abatement Plan was prepared to address the areas of contamination identified and delineated in the EOCS. The Abatement Plan was completed and submitted to EPA for approval on 5 January 2007. The Abatement Plan detailed remedial activities for three areas of the Site:

- Fogle's Farm - Monitored Natural Attenuation and engineering controls;
- Hill Slope and Seep Areas - Free product recovery from sumps and recovery wells and re-vegetation; and
- Facility Area - Bioventing to facilitate and expedite microbial degradation of petroleum compounds.

Details of the implementation and completion of abatement activities for each area are presented in subsequent sections 3.0, 4.0, and 5.0, respectively.

## **2.5 SITE RECOVERY/RESTORATION PLAN**

As required by Item 9.3 (h) of the AOC and Section 3.5 of the RAP, all excavated areas of the Site were restored to original conditions through re-grading and re-vegetation of the land surface, as needed. All restoration activities that occurred on the portion of the Site owned by EMA, including areas adjacent to the unnamed creek were fully coordinated with EMA representatives. Provisions for site restoration were included in the Abatement Plan. Work associated with the abandonment of wells, sumps, and other structures associated with free product recovery is discussed in Section 4.0.

**HEALTH AND SAFETY PLAN**

As required by Item 9.3 (j) of the AOC and Section 3.6 of the RAP, all onsite work activities were performed in accordance with a site-specific HASP. The initial HASP was prepared in 2005, prior to the initiation of the EOCS Plan, and was updated over time as conditions and activities changed on site. As an example, subsequent and/or separate revisions of the HASP were created in conjunction with Abatement Plan activities and soil sampling activities associated with the bioventing system. Subcontractors were provided with ERM's site-specific HASP for review and use on the project site, but were also advised to prepare their own activity-specific HASPs.

**PROGRESS REPORTS**

As required by AOC Section IX, 9.7 and Section 3.7 of the RAP, weekly Progress Reports were provided to EPA beginning 15 June 2005 through 30 September 2005. After this point, with EPA's approval, Progress Reports were submitted on a monthly basis. Progress Report #107 included information documenting the initiation of closure activities, specifically summarizing well and sump abandonment activities. The final Progress Report (#114) covered work performed through 30 November 2013. Milestone Progress Reports documenting particular events are included in Appendix A.

The Fogle's Farm area (the Farm) is a plot of agricultural land where soils excavated during the removal of the former 10,000-gallon AST in 2004 were reportedly disposed. It was reasoned that the soils disposed at the Farm site initially contained levels of TPH comparable to those detected by EPA in 2005 at depths of 16 to 28 feet below the former AST (i.e. depths below the excavation depth). These levels ranged as high as 25,000 mg/kg. The AOC stipulated a cleanup concentration of 5 mg/kg total TPH for the Farm area.

The Farm area was investigated during the EOCS and surface soils contained concentrations of TPH DRO as high as 1,000 mg/kg and TPH GRO as high as 15 mg/kg, suggesting a 24-fold decrease in contaminant concentration since placement of the impacted soils at the Farm. Furthermore, TPH levels were non-detect below and downgradient of the placement area, indicating that there had been no migration of contaminants into surrounding soils.

As such, Section 2.3 of the 2005 Abatement Plan specified monitored natural attenuation as the remedial approach to the TPH at the Farm area. Twelve grid locations were identified for semi-annual sampling to confirm the attenuation of TPH in the Farm Area. Analytical data were reported to EPA in Progress Reports. Monitoring of the Farm area began in January 2007 and continued through November 2010.

On 28 May 2011, Fogle's requested closure of the Farm area as all TPH GRO levels had decreased to below detection limits and TPH DRO levels had fallen below the MDE residential cleanup standard of 230 mg/kg. A table documenting analytical results for all samples collected during the monitoring period was included with the request for closure letter.

On 27 September 2011, in consultation with MDE and Carroll County, the EPA required that work continue to abate the TPH levels in soil at the Farm and that Fogle's provide a work plan for approval that provides for enhanced bioremediation or removal of impacted soils from the property. On 10 April 2012, Fogle's submitted to EPA the Soil Removal Work Plan for the Farm area. EPA approved the work plan on 10 April 2012.

Soil removal was performed over the period of 6 and 7 June 2012. Excavated soils were transported to Clean Earth of Maryland, Inc. for treatment. The methods for the soil removal, as well as details of permits required and obtained, confirmation sampling results, photographs, and waste manifests are included in the Construction Completion Report Removal of Petroleum-Soils at the Fogle's Farm, dated 12 September 2012 (Appendix B). Although the results for some confirmation

samples were marginally above the 5 mg/kg total TPH cleanup standard, Fogle's requested closure of the Farm area portion of the Site based on the following:

- The area is not and will not be in the future used for cultivation;
- At least one structure (a storage shed) was to be constructed over the former area of impacted soils; and
- Screening and analysis of these soils did not indicate the presence of any volatile compounds.

EPA approved closure of the Farm area of the Site via its notice dated 24 September 2012 (see Attachment B).

The Seep Area is located in the wooded area on the southern portion of the EMA property where the seep impacting the unnamed creek was first identified in 2004, and also includes the hill slope to the south. This portion of the Site remediation also includes monitoring and recovery of free product from monitoring wells at the Fogle's Facility. During the investigations completed by EPA and ERM from 2005 through 2006, a total of 19 wells and 9 sump monitoring points were installed in the seep and facility areas to monitor the presence of free product and, when necessary, recovered free product via pumps, bailers, and/or absorbent socks. A summary of well details is given in Table 1 and well locations are shown on Figure 3. Additional measures used to control the migration of free product to the unnamed creek included an underflow dam, constructed under the direction of the EPA contractor, and the use of absorbent booms and pads in the seep area. Based on the results of the EOCS, the area of impact was estimated to be approximately 25 feet wide in the facility area and 90 feet wide at the hill slope and seep areas.

Section 2.2 of The Abatement Plan described the remedial approach for the Seep Area at the Site. The selected remedies included continued recovery of free product from the sumps and wells already in place and re-planting the hill slope with hybrid poplars and native plants that are known to enhance phytoremediation. The completion of these remedial activities is described in the Supporting Information for Product Monitoring Case Closure dated 12 September 2011 (Appendix C). The activities are described briefly below.

#### 4.1

#### PRODUCT MONITORING AND RECOVERY

Product monitoring and recovery began under the direction of EPA in March 2005 and continued through June 2011. The results of monitoring and the quantities of product recovered were reported in the weekly and monthly Progress Reports. Initial product recovery was performed using a combination of various pumps and bailers; over time, as the quantity of free product recovered decreased, recovery methods changed to absorbent socks only. Progress Report 106 (Appendix A) was the last Progress Report in which product monitoring and recovery was reported. Table 2 presents the cumulative recovery of product from all wells and sumps at the Site. Figure 5 presents hydrographs illustrating graphically the asymptotic decrease in the amount of oil recovered at the Site. A total volume of 4,561 gallons of free product was recovered.

The Supporting Information for Product Monitoring Case Closure (Appendix C) assessed conditions at the Seep Area with respect to the "Seven Risk Factors" outlined in the *Maryland Environmental Assessment Technology* (MEAT) for Leaking

Underground Storage Tanks (LUST) guidance document. The MDE Oil Control Program (OCP) uses this guidance document to support the closure of oil release cases in Maryland. Based on this assessment, ERM, on behalf of Fogle's, requested case closure allowing the cessation of product monitoring.

The MDE OCP authorized Fogle's to begin abandonment of the wells, sumps, and underflow dam in its Site Status Letter dated 18 March 2013 (included in Appendix C). EPA approved the termination of monitoring and product removal and the beginning of closure activities via an email dated 12 April 2013 (Progress Report #107 in Appendix A). The abandonment of wells, sumps, and the underflow dam was initiated on 29 April 2013. These activities are documented in Progress Report 107 (Appendix A) and in the report titled *Construction Completion Report for Abandonment of Monitoring Wells, Sumps, and the Underflow Dam* dated 20 February 2014 (Appendix D). A summary of the abandonment activities is as follows:

- Wells, piezometers, and sumps listed in Table 1 were removed and abandonment reports completed and filed with MDE (photos and abandonment reports are included in Appendix D);
- PVC associated with the recovery trench and sumps was removed (photographs included with Appendix D); and
- The underflow dam was demolished and removed under the supervision of MDE (photos and MDE's letter report of observations included with Appendix D).

## 4.2

### REPLANTING

The Abatement Plan proposed re-vegetation of the Seep Area, to the extent possible, with hybrid poplar trees and a mixture of native trees. The replanting occurred in two phases; initial planting of hybrid poplar trees to enhance a biological barrier to TPH in the groundwater from entering the stream, followed by the planting of native trees following remedial activities. The replanting plan is shown in Figure 6. As documented in the Supporting Information for Product Monitoring Case Closure (Appendix C) initial planting occurred in May 2007 with the planting of 36 hybrid poplar trees downgradient of Sump A to enhance attenuation of hydrocarbons in the shallow groundwater and an additional four hybrid poplar trees planted upgradient of Sump D.

The second phase of re-vegetation included replanting of native trees consisting of a mix of red maple, yellow poplar, and black cherry. Fogle's coordinated the replanting with EMA, as necessary. Final replanting of the native trees was completed on 14 May 2014. A photographic log of replanting activities is included in Appendix E.



Based on the results of the EOCS, an area of elevated petroleum concentrations was identified in the location of the former 10,000-gallon AST. The investigation data indicate that impacted soils extend to a depth of about 30 feet beneath the ground surface and encompass an area to the south and east of approximately 8,600 square feet. The area where the former AST was located was reported by Fogle's personnel to have been a ravine, brought to its current grade by backfilling with a combination of construction debris, waste vegetation, and soils by a previous owner to create a usable lot. Observations of concrete and asphalt debris along the slope and in soil borings during the EOCS support this report. As such, the soils in the vicinity of the former 10,000-gallon AST are highly heterogeneous and contamination is likely concentrated in pockets, rather than distributed evenly across the area.

Section 2.1 of the Abatement Plan identified bioventing as the remedial approach for the Facility soils in the area of the former AST. Bioventing was selected over excavation due to the need for extensive shoring to protect the office buildings and work areas, which was determined to be infeasible to construct due to the shallow bedrock in the area. The goal of bioventing was to introduce air (oxygen) into the subsurface to enhance the microbial degradation of petroleum compounds. As documented in Progress Reports 30 and 32, installation of the system was completed between 6 December 2006 and 30 January 2007 (Appendix A). Baseline sampling was completed on 27 and 28 December 2006, as documented in Progress Report 31 (Appendix A).

The locations for performance monitoring sample collection are shown on Figure 7. The bioventing system has been monitored by collection of soil samples for analysis of TPH GRO and DRO. Monitoring was performed twice annually from 2007 through 2009 and annually beginning in 2010 due to the established trends observed with concentrations. Progress Report #111 documents the most recent monitoring results (Appendix A). The results for all monitoring events are presented in Table 3.

## 5.1

### ASSESSMENT OF CURRENT CONDITIONS

As summarized in Table 3 and shown on Figure 8, concentrations of TPH GRO have decreased in the Facility area soils over time. The highest concentration detected during the baseline sampling in 2006 was 1,600 mg/kg at grid location B3, while the highest concentration detected during the most recent sampling in August 2013 was 140 mg/kg.

Concentrations of TPH DRO have displayed variability over time, and have shown very slow improvement overall. The highest concentration of TPH DRO detected during the baseline monitoring was 13,000 mg/kg, and historically EPA had reported concentrations of TPH DRO as high as 25,000 mg/kg. During the August 2013 sampling event, the highest concentration reported for TPH DRO was 48,000 mg/kg. Grid location C2 reported total TPH concentrations of 20,350 mg/kg during February 2008 at a sample depth of 21-22. At the same sample location, total TPH concentrations were reported as 6,975 mg/kg during February 2009 at the same sample depth.

Per the example above, the reported concentrations show high variability within each sample grid. This variability, in part, is a result of the fill materials in the impacted area and the heterogeneous nature of the native soils. Both contribute to a pattern of TPH where specific trends may not be able to be evaluated for the entire sample grid.

Of the eleven grid squares included in the bioventing system monitoring, two (A1 and D1) have been closed because the level of total TPH has fallen below the cleanup goal of 5 mg/kg. Data supporting the closure of grids A1 and D1 and suspension of sampling at A3 are documented in progress reports 45, 55, and 57 (Appendix A). Of the remaining grids, two show an overall decreasing trend in total TPH levels (B1 and D2). The remaining six grids (A2, B2, B3, C1, C2, and C3) show variability in total TPH concentration; however, prior lab reports have indicated that TPH is detected in the heavier range, meaning that lighter fractions have already been removed.

In general, the greatest effects of the bioventing system appear to have been realized primarily at the perimeter of the treatment area. Conditions at three perimeter grids (A1, A3, and D1) have improved enough to close them or suspend sampling, while other perimeter cells have shown improvements in TPH levels. Thus, attenuation is occurring but at a relatively slow rate. Residual TPH is primarily located in grids in the center of the treatment area (B3 and C2), where TPH appears to break down more slowly.

### 5.3

#### ***PROPOSED ACTIONS***

Excavation with offsite treatment and disposal of the remaining impacted soils in the Facility area is not feasible because soils would have to be removed to a depth of nearly 30 feet, and there are concerns as to the effect this would have on the stability of the nearby slope. Fogle's proposes to continue operation and maintenance of the bioventing system and work in cooperation with MDE to further reduce these residual levels. Although elevated levels of residual TPH remain in the subsurface in this area, they do not appear to pose a significant risk to human health or the environment. Section 6.0 presents a detailed assessment of the risks posed by this

material. In brief: the soils are too deep to come into direct contact with Site workers, and no sheens have reappeared at the Seep Area after heavy rain and snow events following the abandonment of all wells, sumps, and other oil mitigation structures. As such, the actions taken at the Site to date have met the AOC directive “to abate, mitigate, and/or eliminate any threat to public health and welfare and the environment.”

The MDE OCP has adopted the goals outlined in the MEAT Guidance document to remediate sites with confirmed releases of petroleum products. An examination of the potential risk from the site to human health and the environment was performed by using the “Seven Risk Factors” process, as outlined in the MEAT Guidance. The risk factors are examined and discussed below as they relate to current site conditions at the Facility and the Seep areas. The Fogle’s Farm is not included in this assessment, as it is not contiguous with the Facility and Seep Areas and all impacted soils were removed from that portion of the Site.

A re-assessment of the Seven Risk Factors included in the document *Supporting Information for Product Monitoring Case Closure*, dated September 12, 2011, was performed. The seven risk factors as incorporated into the referenced document include:

1. Liquid Phase Hydrocarbons (LPH)
2. Current and Future Use of Impacted Groundwater
3. Migration of Contamination
4. Human Exposure
5. Environmental Ecological Exposure
6. Impact to Utilities and Other Buried Services
7. Other Sensitive Receptors

Each of the seven risk factors have been re-visited and re-assessed for changes as compared to the initial evaluation in the September 2011 report *Supporting Information for Product Monitoring Case Closure*. The conditions of the Site and evaluation of the risk factors has remained unchanged since evaluated in the September 2011 report, with the exception of Human Exposure (in regards to the bioventing system area of the Facility):

1. As documented in the Supporting Information for Product Monitoring Case Closure Report, dated 12 September 2011, by June 2011 the amount of LPH (herein referred to as free product) had decreased to nearly immeasurable thicknesses and product recoveries had decreased to less than 0.2 gallons per month. As of March 2013, in both the Fogle’s Facility and the Seep Area, the amount of free product has decreased to nearly immeasurable thicknesses in all wells and sumps, as noted in the submittal of Progress Report #106. Both MDE (via its Site Status letter dated 18 March 2013) and EPA (by its notification dated 12 April 2013) approved the cessation of product monitoring and recovery and the abandonment of all wells and sumps at the Facility and the Seep Area. Abandonment of the wells and sumps was completed in early 2014. Free product was not encountered during well

abandonments. Free product has never been observed in wells or soil borings in the area of the Former AST, therefore no recovery or mitigation of free product was necessary for this area;

2. There are no groundwater users between the suspected release area and Piney run and therefore, there are no receptors of impacted groundwater. The property north of the Fogle's Facility is owned by EMA and is not planned for future use of the land that would require installation of a drinking water well. However, in the event that a drinking water well would be installed on either property, the Carroll County Environmental Health Department would be contacted for permit review and approval before installation of the proposed well. Carroll County Environmental Health Department maintains a database of properties and in consultation with the MDE would assess the proposed well location to determine the need for specific analytical data in addition to the primary testing for regulated contaminants;
3. The threat of the potential for petroleum to migrate to the unnamed stream (i.e., the primary receptor) has been mitigated via the pumping of free product out of wells and sumps since 2005. Since 2005, the migration of free product has been controlled preventing the threat of discharge to the unnamed tributary to Piney Run. Furthermore, free-product has been removed from the subsurface to the extent practicable. The absence of free product in deep monitoring wells (i.e., MW-A02 and MW-A03) confirms that free product has not impacted the shallow bedrock groundwater.

As described in the EOCS (ERM, 2006) the maximum extent of free product at the groundwater table was estimated as 90 feet wide in the Seep Area and 25 feet wide at the Facility. The area of soil impacted by high TPH is limited to the area immediately surrounding the former AST, as shown in Figure 7, and depths of 15 to 30 feet. The extent of contamination was determined using empirical data collected from soil gas monitoring points, soil borings, piezometers, groundwater wells and sumps.

The history of monitoring of the bioventing system at the Facility shows that the areas of highest TPH impacts have not changed over time. This indicates that these impacts are not mobile. In addition, the absence of free product at wells MW-A02 and MW-A03 indicates that the residual TPH in this area is not contributing LPH to the groundwater. Furthermore, the example of the soils at the Fogle's Farm (which had been formerly excavated from the 0-15 foot interval in the area of the former 10,000-gallon AST) shows that no TPH compounds had migrated from the placed soils into underlying soils. This suggests that the residual TPH materials in these soils (which are expected to be identical to those remaining in the bioventing area) are not very mobile and are not likely to migrate in precipitation as it percolates through the soil column;

4. As measurable amounts of LPH at the site are negligible (i.e., LPH has been recovered to the extent practicable) and there are no users on Site, the risk of human exposure to LPH in groundwater is minimal. Human exposure via

direct contact with any residual product that may still be present in the subsurface can be managed through the implementation of engineering controls such as health and safety awareness plans and personal protective equipment. Human exposure to the TPH-impacted soils in the area of the former AST is unlikely due to the depth of the impacted soils (greater than 15 feet). Excavations at greater depths are unlikely, due to the potential disruption of the nearby slope. In the event that deep excavations are unavoidable in this area, an appropriate soil management plan with proper monitoring and PPE will be prepared and followed;

5. The TPH impacted soils in the bioventing area are located at depths of 15-30 feet bgs, and are situated on a property that is utilized for commercial/industrial work; thus, there is no potential for direct contact with ecological receptors. The only potential impact to ecological receptors would be through contaminant migration to groundwater, which discharges to the unnamed creek; however, as indicated under Risk Factor 3: Migration of Contaminants, the residual TPH in these deep soils does not appear to be highly mobile thus the threat of this exposure pathway is not considered to be significant.

Removal of free product from the sumps and wells in the seep and hill slope area have eliminated the threat of discharge of free product to the stream. Free product was not observed in the stream during the dam removal;

6. There are no known underground utilities in the vicinity of the historical release of product in the Facility Area, or in the Hill Slope and Seep Areas. Furthermore, no underground utilities were encountered during installation of the bioventing system. Further, if utilities were present or installed in the future, they would be placed well above the water table and the residual TPH impacts based on the depths shown on the conceptual cross section (Figure 4). Therefore, the potential presence of any trace oil remaining in the subsurface would not cause any adverse effects to hypothetical underground utilities; and
7. Other than the unnamed stream, there are no sensitive receptors present at the site. The threat of petroleum migration to the unnamed stream has been mitigated, as discussed in the above sections; and the migration of residual TPH is considered unlikely.

The following remedial goals have been achieved at the Sykesville Oil Site and have received acknowledgement/closure from EPA and MDE:

- Free product/LPH has been recovered to the extent practicable;
- Discharge of free product to the unnamed creek has been eliminated;
- All wells and sumps as well as the underflow dam installed to mitigate the discharge of free product to the unnamed creek have been removed; and
- TPH-impacted soils have been removed from the Fogle's Farm and the area has been capped with pavement and new storage buildings.

In addition to the above activities, re-vegetation of the hill slope on the EMA property to the north of the Fogle's Facility was performed in 2014.

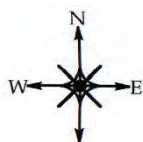
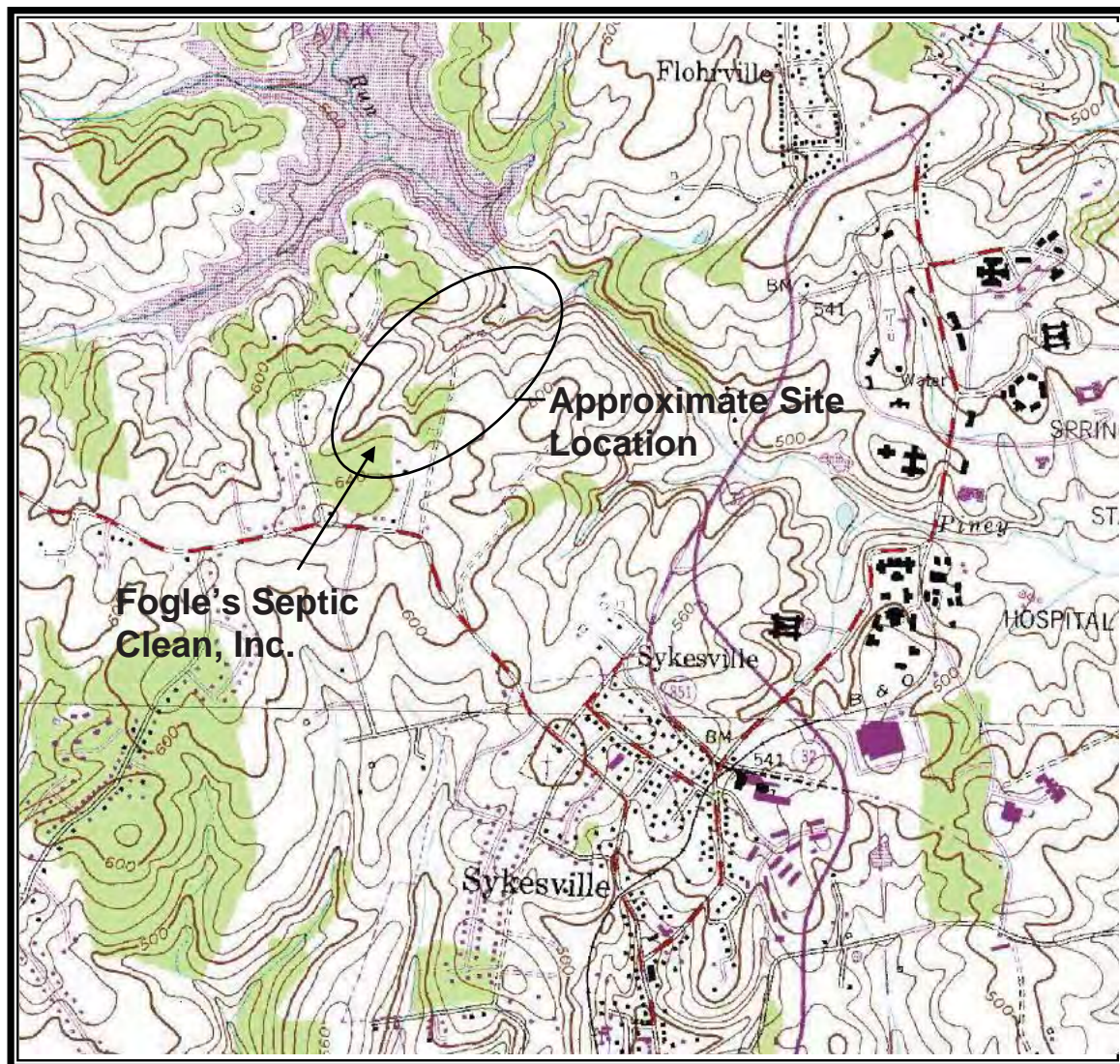
The final remaining area of concern at the Site is the residual TPH in deep (15 to 30 feet bgs) soils in the area of the former 10,000-gallon AST. After 7 years of operation of the bioventing system, TPH GRO concentrations in these soils have been reduced significantly if not eliminated, however the TPH DRO levels remain elevated. Laboratory analysis of the TPH continues to indicate a heavy fraction (i.e., higher carbon and hydrogen content) of petroleum hydrocarbons present in the samples. These heavier fraction hydrocarbons are more resistant to degradation, but also present significantly lower risk to human health and the environment. Further, the depth of the impacted soils minimizes the risk of direct contact by site workers or trespassers. No excavations or installations of utilities are planned for this area; if such excavations do occur, they are likely to terminate above the 15-foot depth at which impacts are concentrated. If for any reason deeper excavations occur, any risks posed by the residual TPH can be managed by the implementation of appropriate soil management practices and PPE. Based on data from monitoring wells in this area as well as the fact that similar soils that were placed at the Fogle's Farm did not leach TPH into underlying clean soils, it is believed that the residual TPH (i.e., the longer carbon-chain hydrocarbons) in these deep soils at the Facility is not mobile and poses little, if any, risk to groundwater or the unnamed creek.

As current conditions do not pose a risk to human health and the area does not provide ecologically sensitive habitat that may warrant a more conservative cleanup goal, ERM and Fogle's are requesting the EPA accept this report as documentation of successful implementation of the RAP in accordance with the AOC.

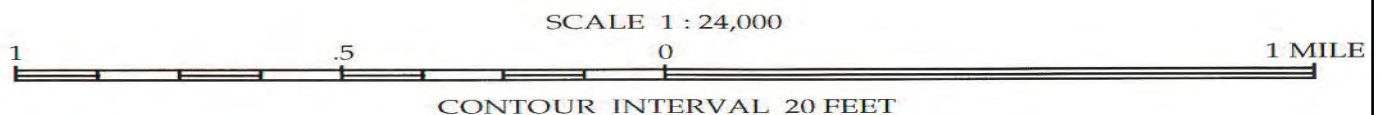
## *Figures*



**Figure 1**  
**Site Location Map**  
**580 Obrecht Road and Adjacent Properties**  
**Sykesville Oil Site**  
**Sykesville, Maryland**

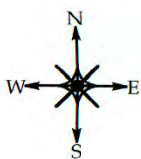
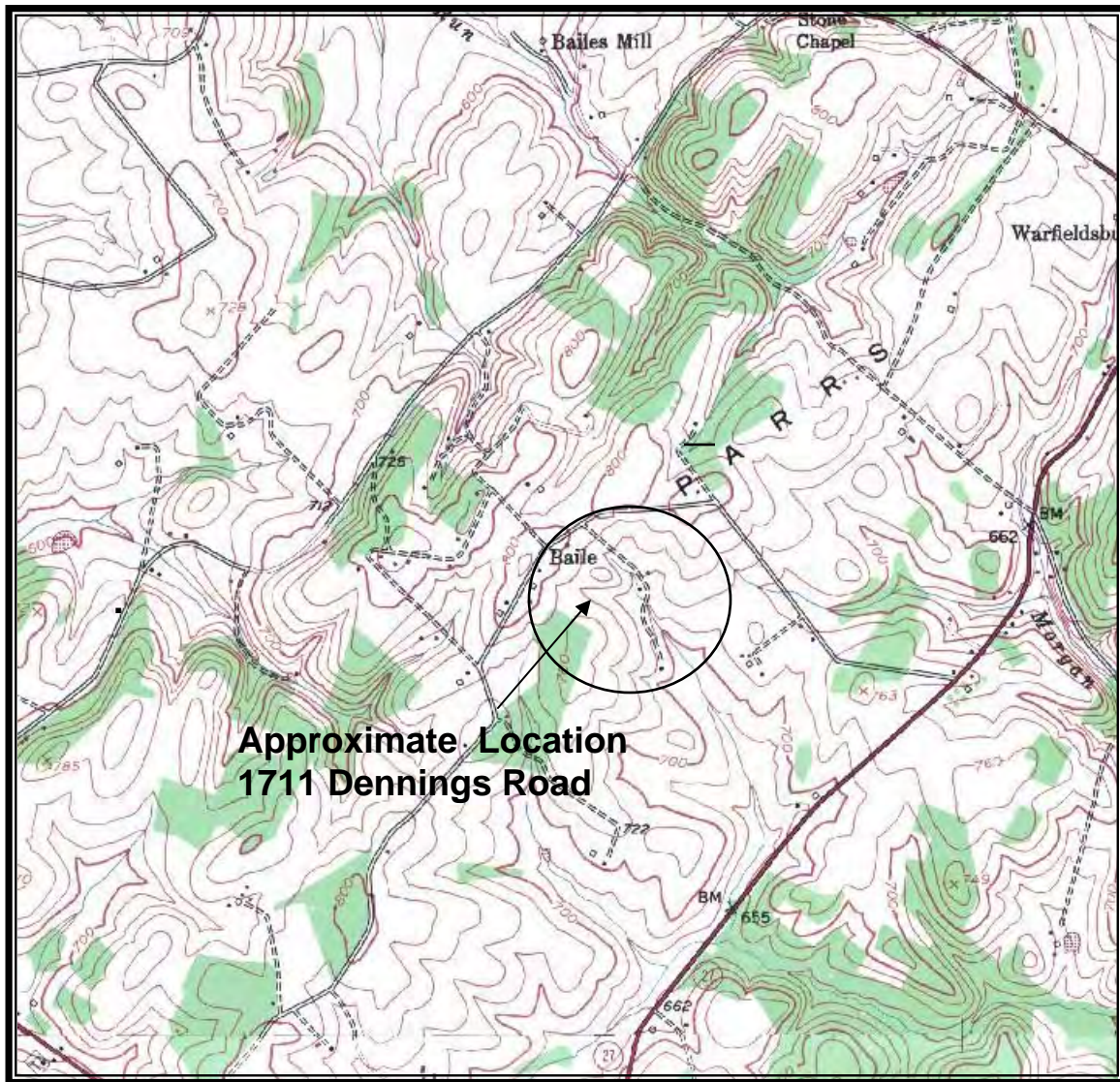


*Sykesville Quadrangle*  
*Maryland*  
*7.5 Minute Series*

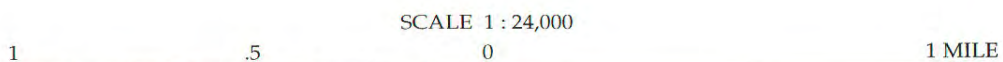




**Figure 2**  
**Site Topographic Map –**  
**1711 Dennings Road**  
**Sykesville Oil Site**  
**Sykesville, Maryland**



*New Windsor Quadrangle*  
*Maryland*  
*7.5 Minute Series*



CONTOUR INTERVAL 20 FEET



**FIGURE 3**  
**FACILITY AREA AND SEEP AREA**  
**MONITORING WELL LOCATION MAP**  
**SYKESVILLE OIL SITE**  
**SYKESVILLE, MARYLAND**

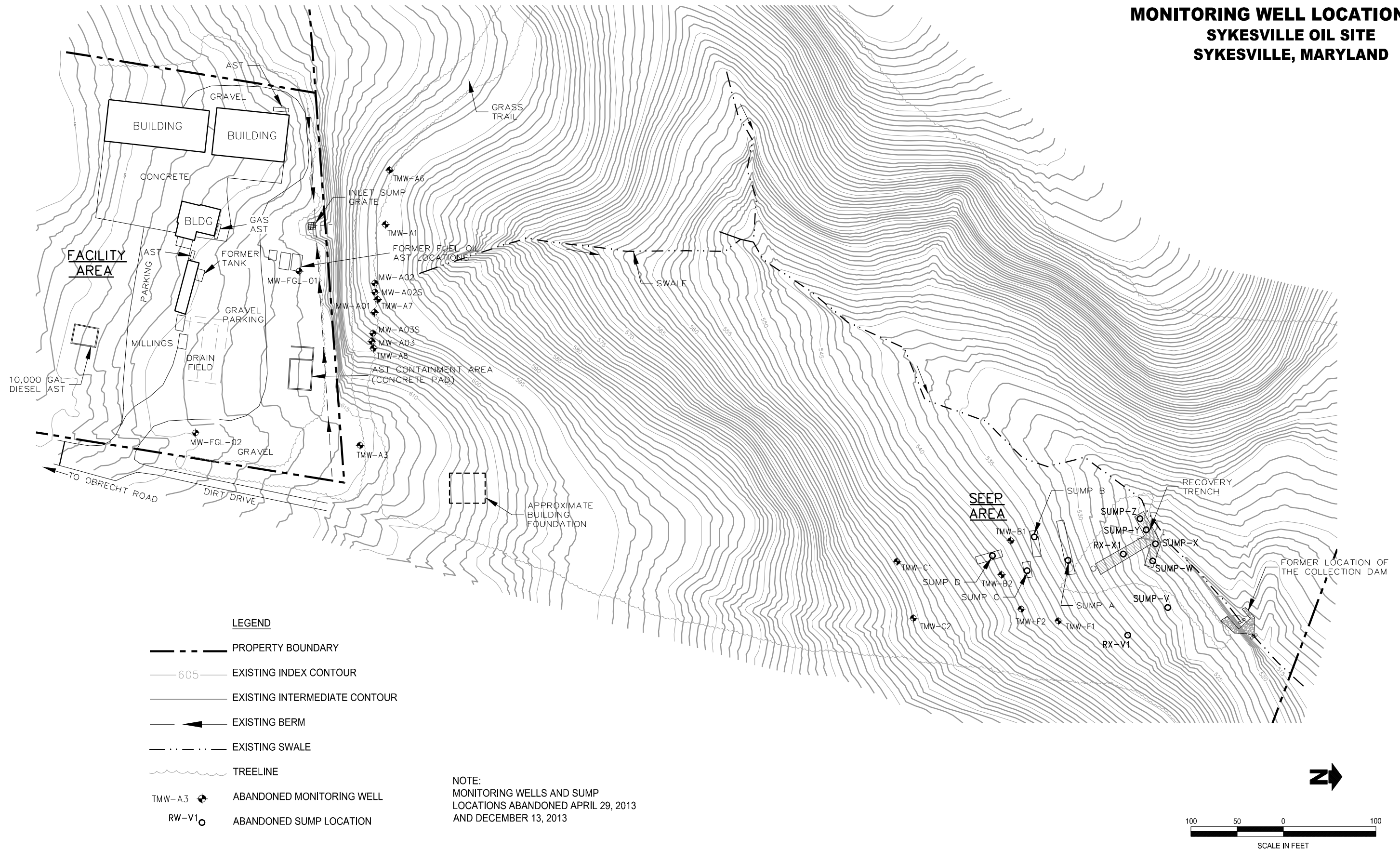
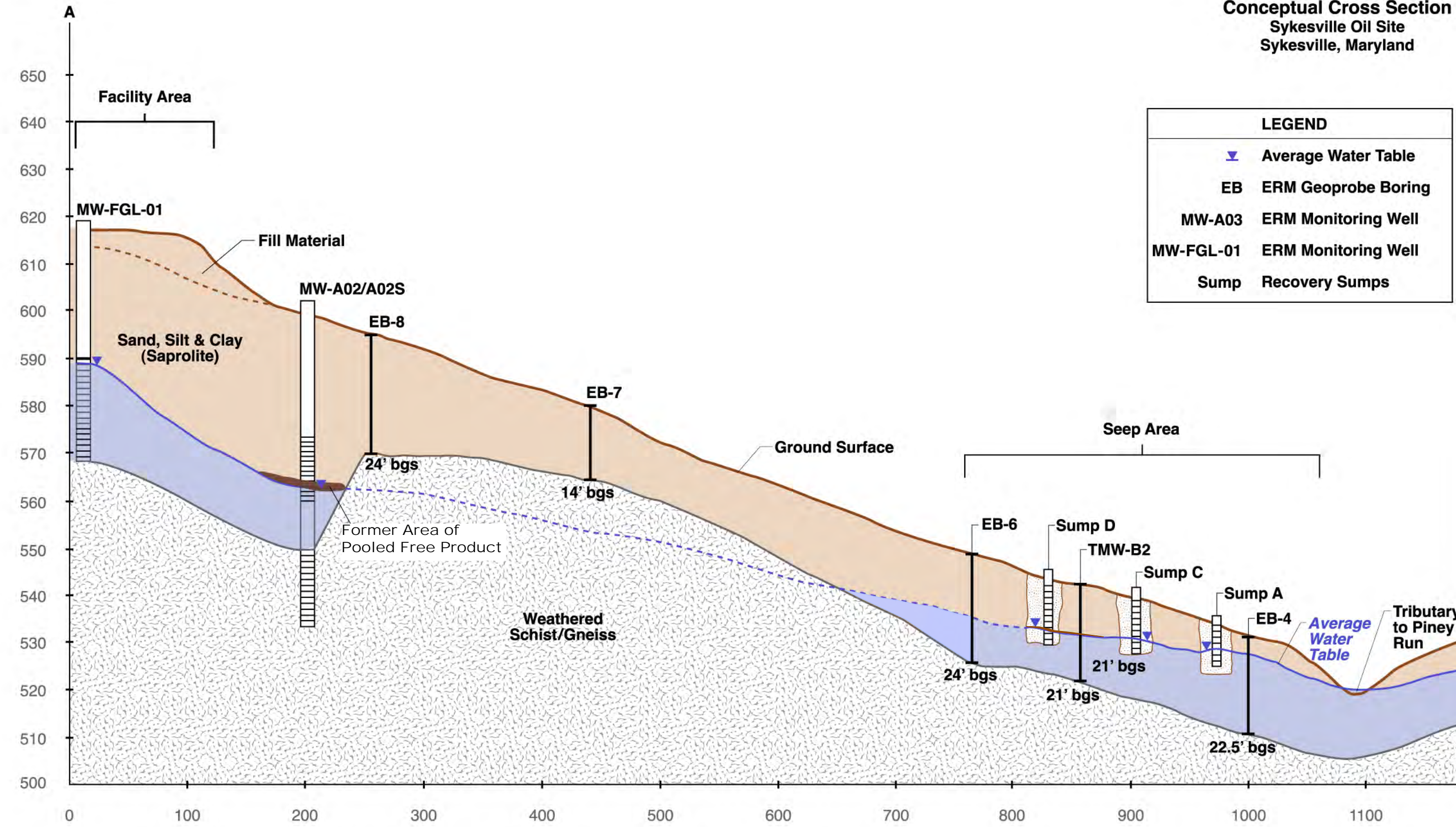


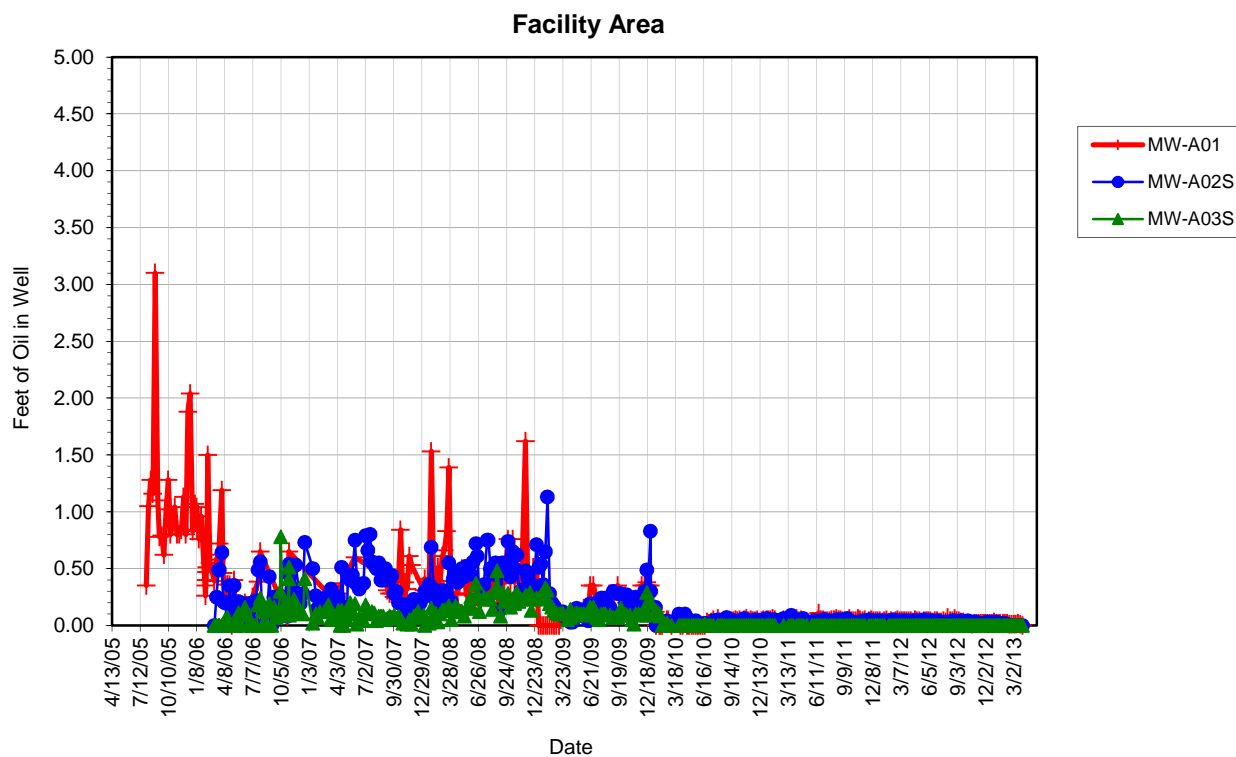
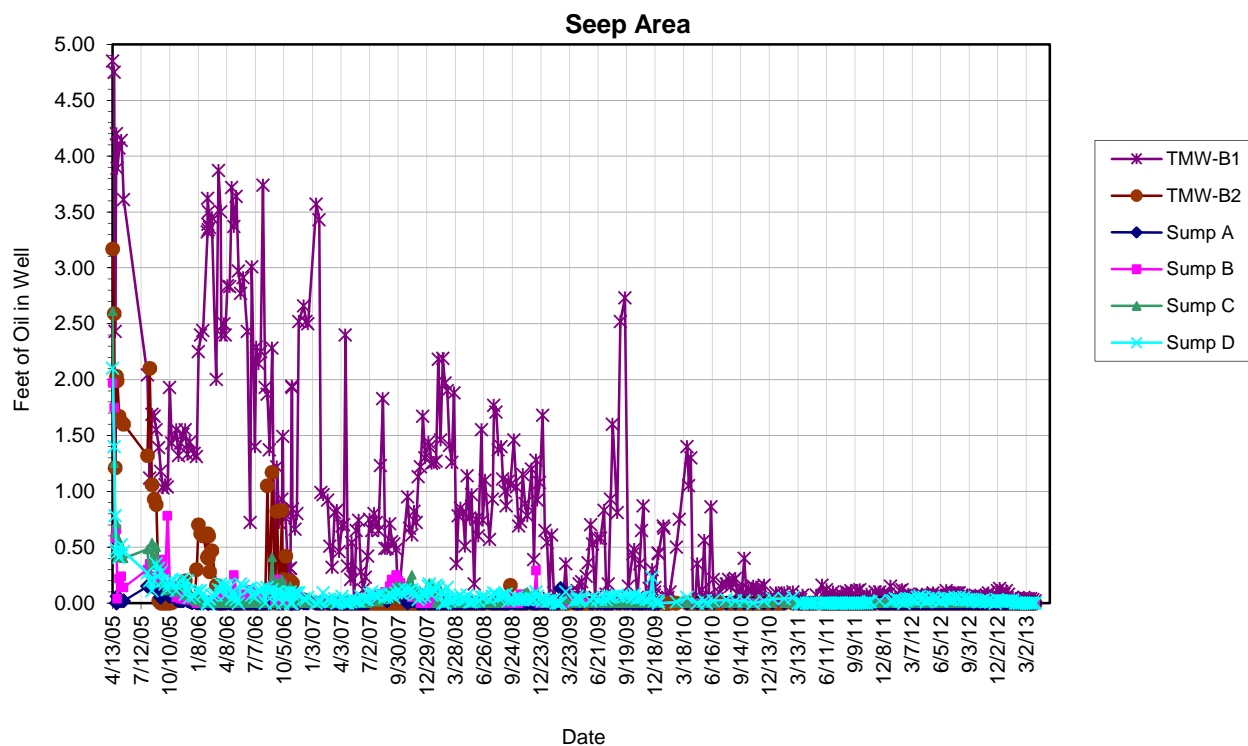


Figure 4  
**Conceptual Cross Section**  
 Sykesville Oil Site  
 Sykesville, Maryland



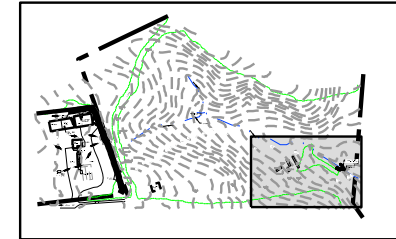
**Note:** Schist/Gneiss elevation inferred from Geoprobe refusal at EB locations and observation of cuttings at MW locations.  
 Wells and recovery sumps abandoned April 29, 2013 and December 13, 2013

**Figure 5**  
**Free Product Thickness Hydrographs**  
**April 2005 thru March 2013**  
**Sykesville Oil Site**  
**Sykesville, Maryland**

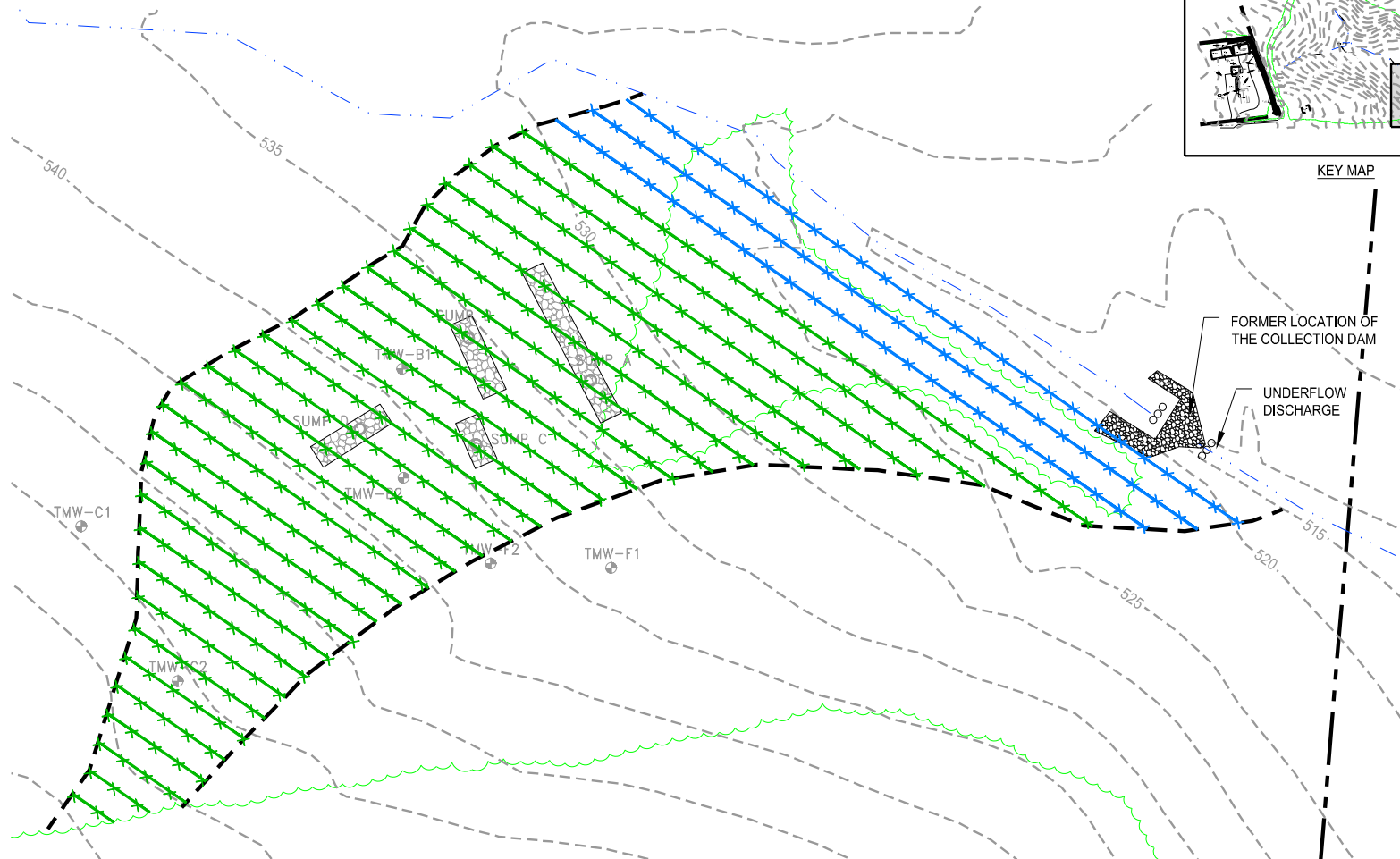


Note:  
 Free product recovery ceased March 2013.

# **FIGURE 6** **REPLANTING PLAN COMPLETED MAY 14, 2014** **SYKESVILLE OIL SITE** **SYKESVILLE, MARYLAND**



KEY MAP

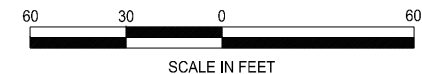


**LEGEND**

	PROPERTY LINE		APPROXIMATE CLEARING BOUNDARY
	CONTOUR (5 FT)		HYBRID POPLAR ROWS - 77 TREES
	STREAM		NATIVE SPECIES ROWS - 328 TREES EVEN MIX OF RED MAPLE, YELLOW POPLAR, AND BLACK CHERRY
	ABANDONED MONITORING WELL		
	ABANDONED SUMP		

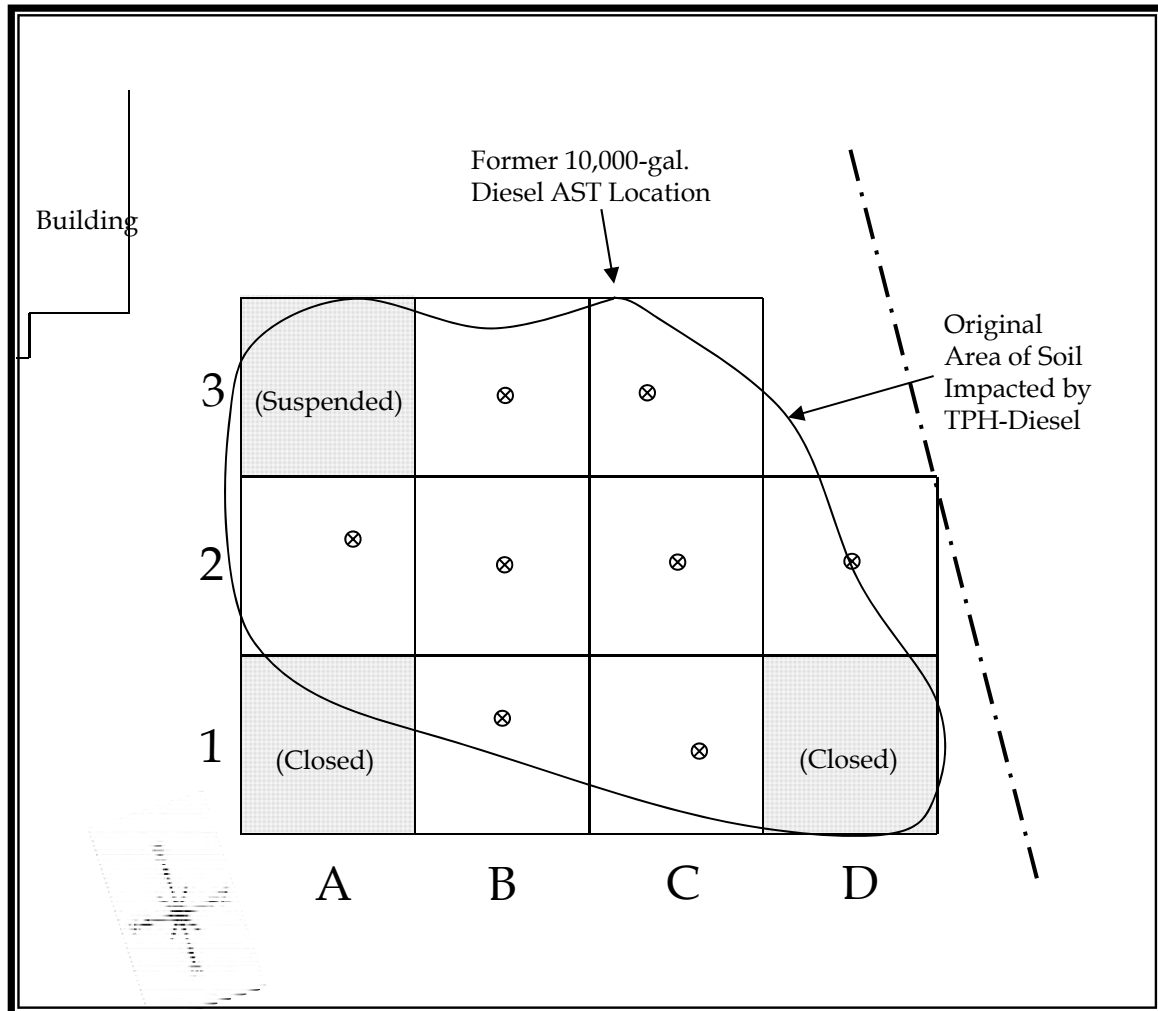
**NOTES:**

1. REPLANTING WILL OCCUR IN TWO PHASES.
2. PHASE 1, HYBRID POPLARS: HYBRID POPLAR REPLANTING PLAN BASED ON 5-7 FOOT BARE-ROOT TREES.
3. PHASE 2, NATIVE TREES: NATIVE TREES SPECIES WILL BE PLANTED FOLLOWING REMEDIATION ACTIVITIES. REPLANTING BASED ON THE USE OF CONTAINER GROWN SEEDLING TUBES. REPLANTING SPACING AND DENSITIES BASED ON REQUIREMENTS OF THE MARYLAND STATE FOREST CONSERVATION TECHNICAL MANUAL. 1997.





**Figure 7**  
**Bioventing System Soil Sample Locations**  
**Sykesville Oil Site**  
**Sykesville, Maryland**

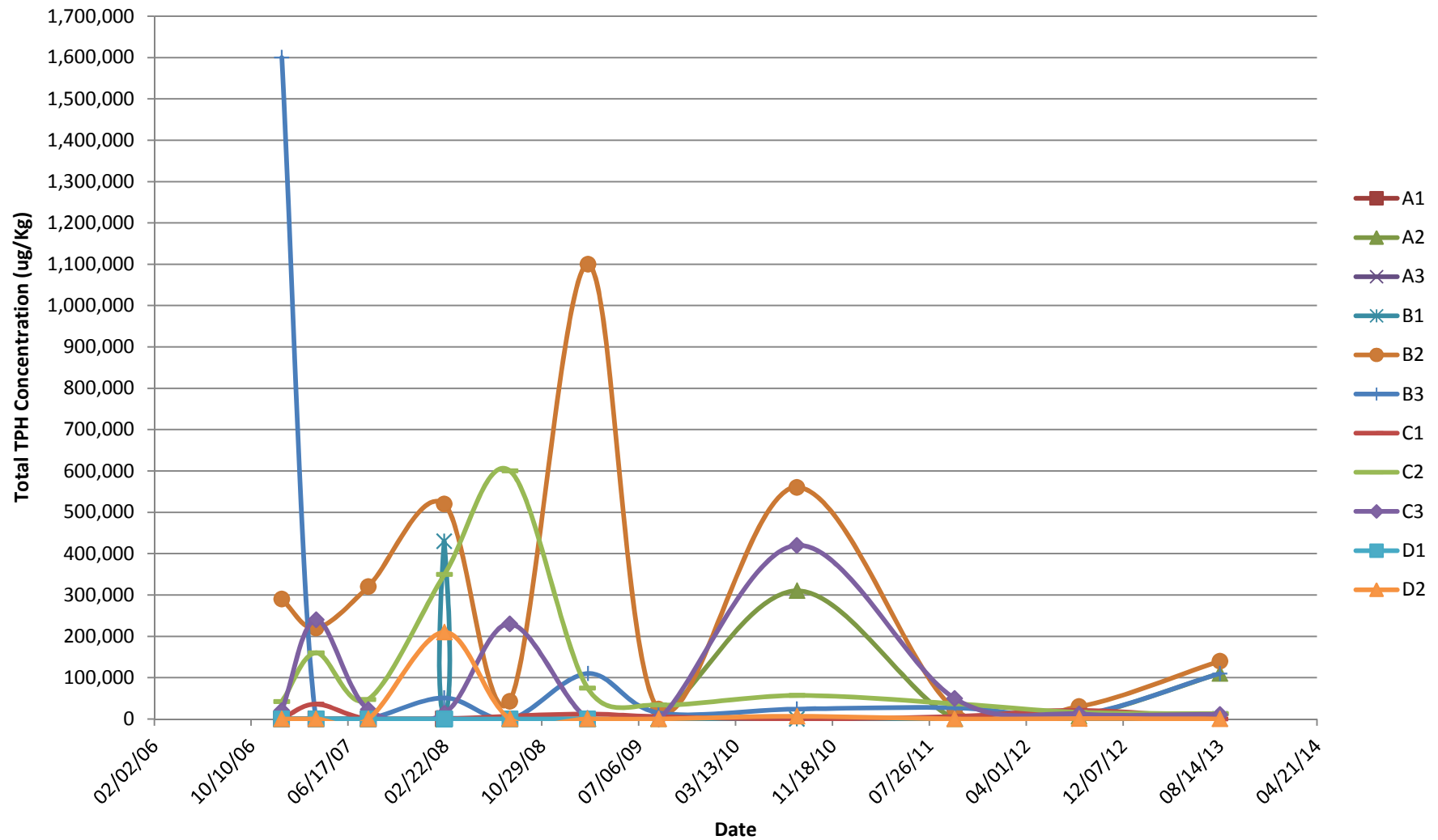


WO# 0032112

- ⊗ Soil Boring Location
- · - Property Line

Not to Scale: Grids are roughly 30 ft x 30 ft.

## Sykesville, Maryland





## *Tables*

**Table 1. Summary of Well Locations**  
**Sykesville Oil Site, Sykesville, Maryland**

Monitoring Point ID	Permit Number	Date Installed	Installed By	Total Depth (feet bgs)	Screen Interval (feet bgs)
MW-FGL-01	NA	Apr-05	USACE	46	30 - 50
MW-FGL-02	CL-95-0203	Jan-06	ERM	60	40 - 60
MW-A01	NA	Feb-05	USACE	38	~ 30 - 50
MW-A02	CL-95-0205	Jan-06	ERM	60	50 - 60
MW-A02S	CL-95-0315	Mar-06	ERM	40	25 - 40
MW-A03	CL-95-0204	Jan-06	ERM	80	70 - 80
MW-A03S	CL-95-0316	Mar-06	ERM	43	23 - 43
SUMP - A	NA	Mar-05	USACE	13.0	~ 2 - 12
SUMP - B	NA	Mar-05	USACE	13.0	~ 2 - 12
SUMP - C	NA	Mar-05	USACE	12.2	~ 2 - 12
SUMP - D	NA	Mar-05	USACE	14.9	~ 2 - 12
Sump - V	NA	Mar-05	USACE	8	NA
Sump - W	NA	Mar-05	USACE	8	NA
Sump - X	NA	Mar-05	USACE	8	NA
Sump - Y	NA	Mar-05	USACE	8	NA
Sump - Z	NA	Mar-05	USACE	8	NA
RX - V1	NA	Mar-05	USACE	8	NA
RX - X1	NA	Mar-05	USACE	8	NA
TMW - A1	NA	NA	USACE	NA	NA
TMW - A3	NA	NA	USACE	NA	NA
TMW - A7	NA	NA	USACE	NA	NA
TMW - A8	NA	NA	USACE	NA	NA
TMW - B1	NA	NA	USACE	16	NA
TMW - B2	NA	NA	USACE	21	NA
TMW - C1	NA	NA	USACE	NA	NA
TMW - C2	NA	NA	USACE	NA	NA
TMW - F1	NA	NA	USACE	NA	NA
TMW - F2	NA	NA	USACE	NA	NA

Notes:

bgs - below ground surface

ERM - Environmental Resources Management

USACE - United States Army Corps of Engineers

NA - Not Available.

~ - Approximate based on field measurement. Construction records not available.

**Table 2. Cumulative Product and Water Recovered  
Sykesville Oil Site, Sykesville, Maryland**

Date	Event Volume of Product (gallons)	Cumulative Volume of Product (gallons)	Event Volume of Water (gallons)	Cumulative Volume of Water (gallons)
24-Mar-05	55	55	0	0
7-Apr-05	110	165	0	0
13-Apr-05	674	839	788	788
18-Apr-05	475	1,314	2,060	2,848
21-Apr-05	274	1,588	2,184	5,032
25-Apr-05	259	1,847	3,016	8,048
28-Apr-05	170	2,017	2,244	10,292
4-May-05	120	2,137	1,313	11,605
11-May-05	94	2,231	752	12,357
18-May-05	55	2,286	368	12,725
25-May-05	59	2,345	316	13,041
1-Jun-05	95	2,440	715	13,756
9-Jun-05	49	2,489	158	13,914
15-Jun-05	39	2,528	48	13,962
23-Jun-05	57	2,585	160	14,122
27-Jun-05	68	2,653	284	14,406
29-Jun-05	45	2,698	245	14,651
5-Jul-05	75	2,773	170	14,821
11-Jul-05	50	2,823	150	14,971
13-Jul-05	12	2,835	12	14,983
14-Jul-05	5	2,840	5	14,988
18-Jul-05	45	2,885	190	15,178
20-Jul-05	0.06	2,885	0	15,178
22-Jul-05	20	2,905	20	15,198
25-Jul-05	10	2,915	10	15,208
27-Jul-05	45	2,960	140	15,348
29-Jul-05	0.06	2,960	0	15,348
16-Jan-06	3	2,963	155	15,503
23-Jan-06	2	2,965	1,915	17,418
3-Feb-06	2	2,967	30	17,448
13-Feb-06	1	2,968	1	17,449
20-Feb-06	2	2,970	2	17,451
6-Mar-06	2	2,972	350	17,801
13-Mar-06	1	2,973	9	17,810
22-Mar-06	2	2,975	500	18,310
27-Mar-06	1	2,976	40	18,350
30-Mar-06	12	2,988	240	18,590
3-Apr-06	0	2,989	3	18,593
10-Apr-06	14	3,003	161	18,754
17-Apr-06	10	3,013	220	18,974
24-Apr-06	10	3,023	200	19,174
1-May-06	3	3,026	204	19,378
8-May-06	7	3,033	175	19,553
15-May-06	5	3,038	350	19,903
22-May-06	10	3,048	157	20,060

**Table 2. Cumulative Product and Water Recovered  
Sykesville Oil Site, Sykesville, Maryland**

Date	Event Volume of Product (gallons)	Cumulative Volume of Product (gallons)	Event Volume of Water (gallons)	Cumulative Volume of Water (gallons)
30-May-06	11	3,059	140	20,200
31-May-06	4	3,063	#N/A	20,204
5-Jun-06	5	3,068	180	20,384
12-Jun-06	5	3,073	175	20,559
21-Jun-06	10	3,083	3,350	23,909
26-Jun-06	8	3,091	325	24,234
30-Jun-06	3	3,093	#N/A	24,237
6-Jul-06	4	3,097	115	24,352
10-Jul-06	4	3,101	262	24,614
17-Jul-06	7	3,108	315	24,929
24-Jul-06	2	3,110	150	25,079
31-Jul-06	3	3,113	165	25,244
31-Jul-06	4	3,117	#N/A	25,248
7-Aug-06	3	3,120	313	25,561
14-Aug-06	10	3,130	210	25,771
21-Aug-06	12	3,142	222	25,993
29-Aug-06	40	3,182	355	26,348
31-Aug-06	5	3,187	26	26,374
6-Sep-06	26	3,213	175	26,549
13-Sep-06	25	3,238	200	26,749
20-Sep-06	12	3,250	245	26,994
29-Sep-06	14	3,264	200	27,194
30-Sep-06	7	3,271	#N/A	34,089
4-Oct-06	12	3,283	425	34,514
11-Oct-06	8	3,291	220	34,734
18-Oct-06	10	3,301	440	35,174
25-Oct-06	10	3,311	350	35,524
31-Oct-06	6	3,317	31	35,555
1-Nov-06	8	3,325	400	35,955
9-Nov-06	4	3,329	375	36,330
15-Nov-06	4	3,333	400	36,730
21-Nov-06	3	3,336	375	37,105
30-Nov-06	1	3,337	375	37,480
30-Nov-06	4	3,340	31	37,511
6-Dec-06	1	3,341	350	37,861
14 Dec-06*	1	3,342	100	37,961
20 Dec-06*	2	3,344	45	38,006
27 Dec-06*	2	3,346	5	38,011
1-31 Dec-06**	2	3,348	17	38,028
3-Jan-07	1	3,349	4	38,032
8-Jan-07	1	3,351	4	38,036
15-Jan-07	1	3,351	1	38,037
24-Jan-07	0	3,352	5	38,042
30-Jan-07	0	3,352	4	38,046
1-31 Jan-07**	4	3,356	50	38,096

**Table 2. Cumulative Product and Water Recovered  
Sykesville Oil Site, Sykesville, Maryland**

Date	Event Volume of Product (gallons)	Cumulative Volume of Product (gallons)	Event Volume of Water (gallons)	Cumulative Volume of Water (gallons)
6-Feb-07	0.3	3,356	5	38,101
12-Feb-07	0.6	3,357	260	38,361
20-Feb-07	0.3	3,357	5	38,366
27-Feb-07	0.3	3,358	5	38,371
1-28 Feb-07**	6	3,363	75	38,446
21-Mar-07	10.0	3,373	400	38,846
1-31 Mar-07**	6.8	3,380	90	38,936
3-Apr-07	0.4	3,381	54	38,990
12-Apr-07	3.0	3,384	425	39,415
Apr-07**	5.4	3,389	67	39,482
7-May-07	2.0	3,391	342	39,824
May-07**	5.5	3,396	114	39,938
5-Jun-07	0.3	3,397	4	39,942
12-Jun-07	1.6	3,398	250	40,192
19-Jun-07	0.3	3,399	4	40,196
25-Jun-07	1.2	3,400	306	40,502
June-07**	5.7	3,406	71	40,573
9-Jul-07	10.8	3,416	200	40,773
23-Jul-07	7.7	3,424	150	40,923
July-07**	8.7	3,433	85	41,008
6-Aug-07	14.0	3,447	250	41,258
13-Aug-07	10.0	3,457	300	41,558
27-Aug-07	12.0	3,469	375	41,933
August-07**	5.9	3,475	45	41,978
4-Sep-07	14.0	3,489	350	42,328
10-Sep-07	13.0	3,502	375	42,703
17-Sep-04	18.0	3,520	300	43,003
24-Sep-07	15.0	3,535	300	43,303
September-07**	4.7	3,539	59	43,362
1-Oct-07	12.0	3,551	250	43,612
8-Oct-07	12.0	3,563	260	43,872
15-Oct-07	10.0	3,573	250	44,122
22-Oct-07	10.0	3,583	350	44,472
30-Oct-07	15.0	3,598	250	44,722
October-07**	4.0	3,602	58	44,780
5-Nov-07	12.0	3,614	375	45,155
12-Nov-07	11.0	3,625	250	45,405
19-Nov-07	10.0	3,635	325	45,730
26-Nov-07	8.0	3,643	275	46,005
November-07**	3.1	3,647	58	46,063
3-Dec-07	10.0	3,657	250	46,313
10-Dec-07	6.0	3,663	250	46,563
17-Dec-07	8.0	3,671	200	46,763
24-Dec-07	0.5	3,671	5	46,768
December-07**	3.4	3,674	56	46,824

**Table 2. Cumulative Product and Water Recovered  
Sykesville Oil Site, Sykesville, Maryland**

Date	Event Volume of Product (gallons)	Cumulative Volume of Product (gallons)	Event Volume of Water (gallons)	Cumulative Volume of Water (gallons)
4-Feb-08	25.0	4,372	350	47,600
February-08**	6.1	4,378	74	47,674
3-Mar-08	12.0	4,390	325	47,999
March 2008**	6.6	4,397	78	48,077
7-Apr-08	10.0	4,407	200	48,277
April 2008**	6.9	4,414	82	48,359
5-May-08	1.0	4,415	300	48,659
May 2008**	5.6	4,420	65	48,724
2-Jun-08	1.6	4,422	255	48,979
June 2008**	5.6	4,427	62	49,041
7-Jul-08	5.0	4,432	250	49,291
July 2008**	8.4	4,441	62	49,353
4-Aug-08	4.0	4,445	250	49,603
August 2008**	8.0	4,453	62	49,665
5-Sep-08	5.0	4,458	350	50,015
September 2008**	5.0	4,463	31	50,046
6-Oct-08	7.0	4,470	255	50,301
October 2008**	6.5	4,476	41	50,342
3-Nov-08	5.0	4,481	357	50,699
November-08**	5.2	4,487	37	50,736
12-Dec-08	7.0	4,494	400	51,136
December-08**	5.1	4,499	37	51,173
5-Jan-09	1.0	4,500	267	51,440
January-09**	2.6	4,503	13	51,453
2-Feb-09	2.2	4,505	221	51,674
February-09**	1.0	4,507	23.5	51,698
11-Mar-09	0.2	4,508	0	51,698
March-09**	3.7	4,513	43	51,741
7-Apr-09	0.2	4,513	2	51,743
April-09**	2.2	4,515	30	51,773
5-May-09	0.2	4,516	4	51,777
May-09**	4.3	4,520	27.5	51,804
9-Jun-09	0.4	4,520	2	51,806
June-09**	4.7	4,525	35	51,841
10-Jul-09	0.3	4,525	2	51,843
July-09**	5.9	4,531	26	51,869
6-Aug-09	0.3	4,532	3	51,872
Aug-09**	6.1	4,538	29	51,901
14-Sep-09	0.6	4,538	4	51,905
Sep-09**	5.1	4,543	14.5	51,920
13-Oct-09	0.4	4,544	3	51,923
Oct-09**	6.3	4,550	22.5	51,945
11-Nov-09	0.35	4,550	4	51,949
Nov-09**	3.7	4,554	17.5	51,967

**Table 2. Cumulative Product and Water Recovered  
Sykesville Oil Site, Sykesville, Maryland**

Date	Event Volume of Product (gallons)	Cumulative Volume of Product (gallons)	Event Volume of Water (gallons)	Cumulative Volume of Water (gallons)
09-Dec-09	0.52	4,555	6	51,973
Dec-09**	2.3	4,557	10.5	51,983
Jan-10**	0.5	4,557	6.5	51,990
Feb-10**	1.1	4,558	3.5	51,993
Mar-10**	0.2	4,559	3	51,996
April-10**	0.2	4,559	6	52,002
May-10**	0.1	4,559	3	52,005
June-10**	0.1	4,559	6	52,011
July-10**	0.2	4,559	8	52,019
August-10**	0.1	4,559	7	52,026
September-10**	0.2	4,559	12	52,038
October-10**	0.2	4,560	17	52,055
November-10**	0.1	4,560	14	52,069
December-10**	0.1	4,560	9	52,078
January-11**	0.2	4,560	13	52,091
February-11**	0.1	4,560	4	52,095
March-11**	0.1	4,560	9	52,104
April-11**	0.2	4,561	12	52,116
May-11**	0.04	4,561	7	52,123
June-11**	0.15	4,561	15	52,138
July-11**	0.24	4,561	16	52,154
August-11**	0.21	4,561	14	52,168
September-11**	0.25	4,561	15	52,183
October-11**	0.18	4,562	16	52,199
November-11**	0.14	4,562	9	52,208
December-11**	0.22	4,562	13	52,221
January-12**	0.17	4,562	14	52,235
February-12**	0.20	4,562	9	52,244
March-12**	0.30	4,563	17	52,261
April-12**	0.22	4,563	12	52,273
May-12**	0.23	4,563	10	52,283
June-12**	0.20	4,563	8	52,291
July-12**	0.17	4,563	10	52,301
August-12**	0.21	4,564	10	52,311
September-12**	0.15	4,564	8	52,319
October-12**	0.10	4,564	8	52,327
November-12**	0.10	4,564	6	52,333
December-12**	0.18	4,564	12	52,345
January-13**	0.12	4,564	8	52,353
February-13**	0.05	4,564	6	52,359
March-13**	0.04	4,564	6	52,365

\*\* - Sum of daily recovery events from wells.

Table 3. Summary of Performance Sample Results for Bioventing System Through August 2013  
 Sykesville Oil Site  
 Sykesville, Maryland

Event	SAMPLE INFORMATION	GRID LOCATION IDENTIFICATION												
1		A1	A2	A3	B1	B2	B3	C1	C2	C3	D1	D2	B3 (Dup)	
	DATE:	12/27/06	12/27/06	12/28/06	12/27/06	12/28/06	12/28/06	12/27/06	12/28/06	12/28/06	12/27/06	12/28/06	12/28/06	
	DEPTH (ft):	28	29	29	24	29	29.5	30	19	28	29	28	29.5	
	TPH-GRO (ug/kg):	ND<130	ND<120	ND<130	ND<110	290,000	1,600,000	ND<110	42,000	20,000	ND<130	ND<110	1,500,000	
	TPH-DRO (mg/kg):	ND<4.3	5	ND<4.3	ND<3.7	9,000	13,000	ND<3.7	7,100	2,400	ND<4.2	ND<3.8	9,200	
Total TPH (mg/kg):		ND<4.43	5	ND<4.43	ND<3.81	9,290	14,600	ND<3.81	7,142	2,420	ND<4.33	ND<3.91	10,700	
2		A1	A2	A3	B1	B2	B3	C1	C2	C3	D1	D2	B3 (Dup)	
	DATE:	03/26/07	03/26/07	03/26/07	03/26/07	03/26/07	03/26/07	03/26/07	03/27/07	03/27/07	03/27/07	03/26/07	03/26/07	
	DEPTH (ft):	---	---	---	---	---	19	---	---	23	---	---	---	
	TPH-GRO (ug/kg):	---	---	---	---	---	57	---	---	240,000	---	---	---	
	TPH-DRO (mg/kg):	---	---	---	---	---	2,600	---	---	9,400	---	---	---	
Total TPH (mg/kg):		---	---	---	---	---	2,657	---	---	9,640	---	---	---	
	DEPTH (ft):	28	29	29	24	29	29.5	19	19	28	29	28	29.5	
	TPH-GRO (ug/kg):	ND<57	ND<60	ND<55	ND<54	220,000	ND<53	36,000	160,000	23,000	ND<53	ND<68	ND<51	
	TPH-DRO (mg/kg):	ND<6	ND<6	ND<5	ND<5	13,000	370	7,300	8,600	ND<5	55	ND<6	ND<5	
	Total TPH (mg/kg):	ND<6.06	ND<6.06	ND<5.06	ND<5.05	13,220	370	7,336	8,760	23	55	ND<6.07	ND<5.05	
3		A1	A2	A3	B1	B2	B3	C1	C2	C3	D1	D2	C3 (Dup)	
	DATE:	08/08/07	08/07/07	08/07/07	08/07/07	08/08/07	08/07/07	08/07/07	08/07/07	08/08/07	08/08/07	08/08/07	08/08/07	
	DEPTH (ft):	29	29	31	29	27	26	26	30	28	23	29	28	
	TPH-GRO (ug/kg):	ND<63	ND<62	ND<57	ND<56	320,000	ND<54	ND<52	47,000	14,000	ND<53	ND<61	1,600,000	
	TPH-DRO (mg/kg):	ND<4	5	ND<4	ND<4	8,100	ND<4	6.3	16,000	2,300	ND<4	14	33,000	
Total TPH (mg/kg):		ND<4.06	5	ND<4.06	ND<4.06	8,420	ND<4.05	6.3	16,047	2,314	ND<4.05	14	34,600	
4		A1-1	A2-1	A3-1	B1-1	B2	B3	C1	C2	C3	D1-1	D2	D2 (Dup)	
	DATE:	02/19/08	02/19/08	02/19/08	02/20/08	02/20/08	02/20/08	02/21/08	02/21/08	02/21/08	02/21/08	02/21/08	02/21/08	
	DEPTH (ft):	24-25	19-20	25-26	18-19	26-27	23-24	25-26	21-22	11-12	26-27	27-29	27-29	
	TPH-GRO (ug/kg):	ND<60	ND<51	ND<58	ND<62	520,000	51,000	ND<56	350,000	230,000	ND<58	210,000	53,000	
	TPH-DRO (mg/kg):	ND<5	ND<4	ND<5	6.5	5,300	10,000	8.5	20,000	8,400	ND<5	11,000	9,500	
	Total TPH (mg/kg):		ND<5.06	ND<5.05	ND<5.06	6.5	5,820	10,051	8.5	20,350	8,630	ND<5.06	11,210	9,553
		A1-2	A2-2	A3-2	B1-2	---	---	---	---	---	D1-2	---	---	
	DATE:	02/19/08	02/19/08	02/20/08	02/20/08	---	---	---	---	---	02/21/08	---	---	
	DEPTH (ft):	20-21	22-23	20-21	26-27	---	---	---	---	---	22-23	---	---	
	TPH-GRO (ug/kg):	ND<58	ND<60	ND<52	430,000	---	---	---	---	---	ND<61	---	---	
	TPH-DRO (mg/kg):	ND<5	ND<5	8.3 HF	8,000	---	---	---	---	---	ND<5	---	---	
	Total TPH (mg/kg):		ND<5.06	ND<5.06	8.3	8,430	---	---	---	---	---	ND<5.06	---	---
		A1-3	A2-3	A3-3	B1-3	---	---	---	---	---	D1-3	---	---	
	DATE:	02/19/08	02/19/08	02/20/08	02/20/08	---	---	---	---	---	02/21/08	---	---	
	DEPTH (ft):	27-28	27-28	7-9	22-23	---	---	---	---	---	18-19	---	---	
TPH-GRO (ug/kg):	ND<65	ND<55	1,800	ND<57	---	---	---	---	---	ND<55	---	---		
TPH-DRO (mg/kg):	ND<5	7.9	140	ND<5	---	---	---	---	---	ND<5	---	---		
Total TPH (mg/kg):		ND<5.06	7.9	141.8	ND<5.06	---	---	---	---	---	ND<5.06	---	---	
5		A1 (Closed)	A2	A3 (A3-2)	B1	B2	B3	C1	C2	C3	D1	D2*	D2 (Dup)*	
	DATE:	---	08/07/08	08/07/08	08/07/08	08/07/08	08/07/08	08/08/08	08/08/08	08/07/08	08/08/08	08/08/08	08/08/08	
	DEPTH (ft):	---	27	20	26	29	21	19	21	18	29	25	25	
	TPH-GRO (ug/kg):	---	ND<57	ND<54	ND<63	43,000	ND<55	6,900	600,000	1,600	ND<60	ND<60	69	
	TPH-DRO (mg/kg):	---	13	ND<4	18	8,900	16	3,100	14,000	2,700	ND<4	ND<4	26	
Total TPH (mg/kg):		---	13	ND<4.05	18	8,943	16	3,107	14,600	2,702	ND<4.06	ND<4.06	26.07	



**Table 3. Summary of Performance Sample Results for Bioventing System Through August 2013**  
**Sykesville Oil Site**  
**Sykesville, Maryland**

Event	SAMPLE INFORMATION	GRID LOCATION IDENTIFICATION											
6		A1 (Closed)	A2	A3 (Suspended)	B1	B2	B3	C1	C2	C3	D1	D2	D2 (Dup)
	DATE:	---	02/25/09	---	02/25/09	02/25/09	02/25/09	02/24/09	02/24/09	02/24/09	02/24/09	02/24/09	02/24/09
	DEPTH (ft):	---	27	---	25	29	23	19	21	18	29	28	28
	TPH-GRO (ug/kg):	---	76	---	ND<55	1,100,000	110,000	12,000	75,000	69	ND<57	ND<57	ND<55
	TPH-DRO (mg/kg):	---	13	---	110	2,500	8,200	9,500	6,900	8.9	ND<4	ND<4	ND<4
	Total TPH (mg/kg):	---	13.08	---	110	3,600	8,310	9,512	6,975	8.97	ND<4.06	ND<4.06	ND<4.06
7		A1 (Closed)	A2	A3 (Suspended)	B1	B2	B3	C1	C2	C3	D1 (Closed)	D2	D2 (Dup)
	DATE:	---	08/26/09	---	08/26/09	08/26/09	08/26/09	08/26/09	08/27/09	08/27/09	---	08/27/09	08/27/09
	DEPTH (ft):	---	27	---	26	29	23	19	21	23	---	27	27
	TPH-GRO (ug/kg):	---	ND<56	---	ND<60	24,000	15,000	5,700	34,000	420,000	---	ND<56	ND<300
	TPH-DRO (mg/kg):	---	ND<4	---	38	6,500	15,000	4,500	40,000	19,000	---	15	ND<4
	Total TPH (mg/kg):	---	ND<4.06	---	38	6,524	15,015	4,557	40,034	19,420	---	15	ND<4.3
8		A1 (Closed)	A2	A3 (Suspended)	B1	B2	B3	C1	C2	C3	D1 (Closed)	D2	D2 (Dup)
	DATE:	---	08/19/10	---	08/18/10	08/18/10	08/18/10	08/19/10	08/19/10	08/18/10	---	08/19/10	08/19/10
	DEPTH (ft):	---	20	---	25	29	26	19	25	15	---	28	28
	TPH-GRO (ug/kg):	---	310,000	---	ND<110	560,000	24,000	ND<110	57,000	50,000	---	6,700	6,400
	TPH-DRO (mg/kg):	---	18,000	---	ND<4	14,000	15,000	3.6	10,000	7,200	---	1,200	2,100
	Total TPH (mg/kg):	---	18,310	---	ND<4.11	14,560	15,024	3.6	10,057	7,250	---	1,267	2,164
9		A1 (Closed)	A2	A3 (Suspended)	B1	B2	B3	C1	C2	C3	D1 (Closed)	D2	D2 (Dup)
	DATE:	---	09/30/11	---	09/30/11	09/29/11	09/30/11	09/29/11	09/29/11	09/29/11	---	09/29/11	09/29/11
	DEPTH (ft):	---	27	---	25	25	20	19	26	11	---	28	28
	TPH-GRO (ug/kg):	---	ND<120	---	ND<110	24,000	27,000	6,000	37,000	12,000	---	ND<120	ND<120
	TPH-DRO (mg/kg):	---	7.7	---	6.6	5,800	15,000	8,500	11,000	12,000	---	ND<5	ND<5
	Total TPH (mg/kg):	---	7.7	---	6.6	5,824	15,027	8,506	11,037	12,012	---	ND<5.12	ND<5.12
10		A1 (Closed)	A2	A3 (Suspended)	B1	B2	B3	C1	C2	C3	D1 (Closed)	D2	D2 (Dup)
	DATE:	---	08/15/12	---	08/15/12	08/15/12	08/15/12	08/16/12	08/16/12	08/15/12	---	08/16/12	08/16/12
	DEPTH (ft):	---	24	---	24	25	25	13.5	25	25	---	21	21
	TPH-GRO (ug/kg):	---	6,600	---	ND<100	30,000	9,900	21,000	16,000	11,000	---	940	ND<110
	TPH-DRO (mg/kg):	---	20,000	---	8.1	10,000	16,000	18,000	9,800	8,600	---	310	ND<4.5
	Total TPH (mg/kg):	---	20,007	---	8.1	10,030	16,010	18,021	9,816	8,611	---	311	ND<4.6
11		A1 (Closed)	A2	A3 (Suspended)	B1	B2	B3	C1	C2	C3	D1 (Closed)	D2	D2 (Dup)
	DATE:	---	08/14/13	---	08/14/13	08/14/13	08/14/13	08/14/13	08/15/13	08/14/13	---	08/14/13	08/14/13
	DEPTH (ft):	---	24.3	---	24.3	24.5	25	19	25	28.5	---	21	21
	TPH-GRO (ug/kg):	---	110,000	---	240	140,000	110,000	ND<120	13,000	42,000	---	ND<110	ND<110
	TPH-DRO (mg/kg):	---	23,000	---	ND<4.4	15,000	48,000	20	8,100	14,000	---	11	ND<4.7
	Total TPH (mg/kg):	---	23,110	---	0.24	15,140	48,110	20	8,113	14,042	---	11	ND<4.81

The bioventing system was started in January 2007.

All samples were collected from the center of the grid except as noted

Event 3 samples were collected randomly in the grid.

Event 4 samples from grids A1, A2, A3, B1 and D1 were collected from three random locations within each respective grid.

Event 5 sample A3 was collected at the location of Event 4 sample A3-2 as requested by EPA.

Event 7 sample B2 was moved 6' east due to refusal. Sample C3 was moved 6' southwest of center due to refusal.

\* - Sample was collected at 25' since 25-30' section was compacted in sample tube and could not be retrieved. No FID readings in any samples at this location.

*Appendices A, B, C, D, and E*  
*(Provided on CD)*